GA–A26394

DIII–D YEAR 2009 EXPERIMENT PLAN

by
DIII–D RESEARCH TEAM

APRIL 2009

GENERAL ATOMICS

DISCLAIMER

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GENERAL ATOMICS PROJECT 30200
APRIL 2009

GENERAL ATOMICS

FOREWORD

This document presents the planned experimental activities for the DIII-D National Fusion Facility for the fiscal year 2009. This plan is part of a five-year cooperative agreement between General Atomics and the Department of Energy. The Experiment Plan advances on the objectives described in the DIII-D National Fusion Program Five-Year Plan 2009–2013 (GA-A25889). The Experiment Plan is developed yearly with the advice of the DIII-D Research Council, approved by the Director of the DIII-D National Fusion Program, and approved by DOE. DIII-D research progress is reviewed quarterly against this plan. The 2009 plan is for 13 weeks of tokamak research operations.

APPROVALS

Approved:

T.S. Taylor
DIII–D Program Director
General Atomics

16-Mar 09
Date

M.S. Foster
On-site Program Representative
DOE Office of Fusion Energy Sciences

8 Apr 09
Date

E. Oktay
DIII–D Program Manager
DOE Office of Fusion Energy Sciences

22-April 2009
Date

DIII–D RESEARCH COUNCIL MEMBERS

2009 Campaign — February 2009 to July 2009

D.N. Hill (LLNL) (Chair)
C.M. Greenfield (Vice Chair)
M.E. Fenstermacher (LLNL) (Experiment Coordinator)
J.S. deGrassie (Deputy Experiment Coordinator)

M.E. Austin (U Texas)
K.H. Burrell (GA)
J.R. Ferron (GA)
M. Groth (LLNL)
E.M. Hollmann (UCSD)
D.A. Humphreys (GA)
T.C. Jernigan (ORNL)
A.G. Kellman (GA)
L.L. Lao (GA)
T.C. Luce (GA)
G.R. McKee (U. Wisc.)
M. Murakami (ORNL)
R. Nazikian (PPPL)
P.I. Petersen (GA)
C.C. Petty (GA)
R. Prater (GA)
H. Reimerdes (Col. U.)
T.L. Rhodes (UCLA)
M.J. Schaffer (GA)
P.B. Snyder (GA)
W.M. Solomon (PPPL)
E.J. Strait (GA)
M.R. Wade (GA)
M.A. Van Zeeland (GA)

Ex officio members:

V.S. Chan (GA)
R.D. Stambaugh (GA)
T.S. Taylor (GA)

2009 DIII–D PROGRAM ADVISORY COMMITTEE MEMBERS (Meeting: February 10-12, 2009)

Dr. Valery Chuyanov (ITER, Caderache)
Dr. Claude Gormezano (retired)
Dr. Troy Carter (UCLA)
Dr. Steve Cowley (UKAEA-Culham)
Dr. Rich Hawryluk (PPPL)
Prof. Chris Hegna (Univ. Wisconsin)
Dr. Guenter Janeschitz (ITER, Cadarache)
Dr. Yutaka Kamada (JAEA, Japan)
Dr. Stan Kaye (PPPL)
Dr. Rajesh Maingi (ORNL)
Dr. Tom Rognlien (LLNL)
Dr. Francesco Romanelli (EFDA/JET)
Dr. John Rice (MIT)
Dr. Nermin Uckan (ORNL)
Prof. James Van Dam (U Texas) (Chair)

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1. SYNOPSIS OF THE 2009 DIII-D RESEARCH PLAN

The research campaign for 2009 is organized into six Physics Groups making up the Experimental Science Division, with three additional Task Forces coordinated independently of that management structure (Fig. 1). Approximately 70% (35 days) of the time allocated in the 13-week experimental plan has been allocated to the Physics Groups, and their associated Working Groups. This reflects the broad base and scientific depth of the DIII-D experimental program. The remaining 30% (15 days) is allocated to the Task Forces, which are more narrowly focused on critical, shorter term, issues, and to the Torkil Jensen Award experiments. The Torkil Jensen Award, up to one day of experimental run time per proposal, was established for the 2009 campaign to encourage submission of proposals for experiments that are focused on new research topics with the potential for exploring transformational physics using very innovative techniques.

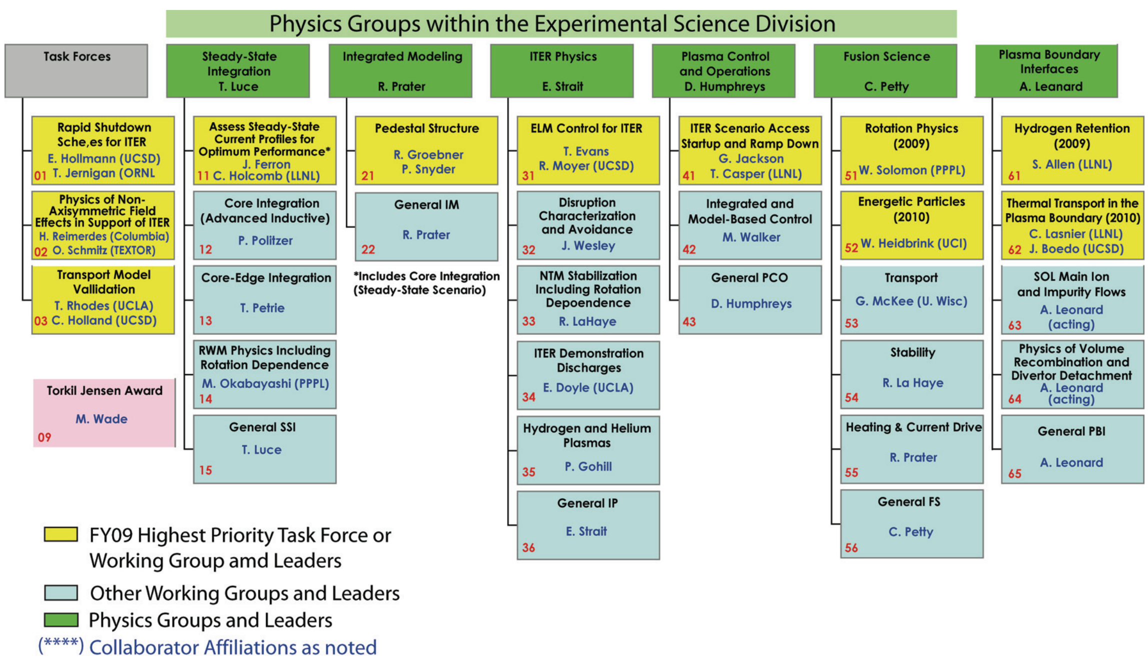

Fig. 1. The 2009 Experimental Campaign is organized into three Task Forces, the Torkil Jensen Award category, and 27 Working Groups within the Physics Groups of the Experimental Science Division. The Task Forces and Working Groups highlighted in yellow are considered high priority areas for the DIII-D program.

The three Task Forces and eight Working Groups highlighted in yellow in Fig. 1 were identified by the Research Council as high priority research areas for the DIII-D program for the 2009–2010 run campaigns. The other Working Groups, shown in blue, were added in "bottom up" fashion through discussions within the Physics Groups. The high priority research areas are as follows

- **Rapid Shutdown Schemes for ITER**. Reliable techniques for rapid and safe discharge termination would be of great benefit to ITER, especially over the next year during the licensing process. Research on this topic seeks to demonstrate methods for disruption mitigation (e.g., magnetic perturbations, shell pellets, shattered pellets, and massive gas injection) and support disruption modeling. This effort is organized as a Task Force under the Director of Experimental Science and directly supports DIII-D 2009 Milestone 169.

- **Physics of Non-Axisymmetric Field Effects in Support of ITER**. Resonant and non-resonant 3D magnetic fields are observed to have large effects on global plasma stability, edge localized modes, plasma rotation and confinement, and plasma-wall interactions in DIII-D and other tokamaks. There may be a common physical basis for many of these observations that could lead to better predictive capability (e.g. neoclassical tordoidal viscosity). Experiments will seek improved understanding by comparing theoretical models (e.g., IPEC, MARS-F) to the measured response of the plasma to non-axisymmetric fields. This effort is organized as a Task Force under the Director of Experimental Science.

- **Transport Model Validation**. Continued improvements to simulation tools (e.g. TGLF and synthetic diagnostics for GYRO), plasma diagnostics (e.g., BES, PCI, and ECEI), and tokamak capabilities (e.g. ECH) enable better experiments aimed at the validation of theory-based transport and turbulence models. Work in this area seeks to build upon recent success by varying key plasma parameters (e.g., κ, ρ^*, ∇T_e) expected to affect local plasma turbulence. These experiments will be coordinated as a Task Force reporting to the Director of Experimental Science.

- **Hydrogenic Retention**. Tritium retention is a major driver for the choice of plasma facing components in ITER, and DIII-D is uniquely positioned to evaluate plasma-wall interactions with all-carbon PFCs. Topics of interest include quantifying carbon migration pathways, developing methods for mitigating carbon co-deposits, and testing techniques for removal of hydrogen species from co-deposits (e.g. oxygen bake). Activity for this topic directly supports the OFES FY09 Joint Facilities JOULE milestone and DIII-D 2009 Milestone 168, and is organized within the Plasma Boundary Interfaces group now being formed within the Experimental Science Division.

- **Assess Steady-State Current Profiles for Optimum Performance**. The primary focus of these experiments will be the exploration of the effect of the q-profile on the bootstrap current and fully non-inductive high-β operation utilizing the full complement of six gyrotrons available in 2009. Other topics may include extending the duration of fully noninductive operation, examining H-mode confinement, and extending high-ℓ_i operation. This research will be organized as a Working Group within Steady-State Integration and is in direct support of FY09 DIII-D Milestone 170. In FY10, the scope of the research could be expanded to include Fast Wave heating and current drive in support of a new DIII-D milestone.

- **ELM Control for ITER**. Critical issues related to robust ELM control in ITER remain to be resolved. DIII-D is uniquely capable for this line of research due to its flexible set of perturbation coils, mix of co/counter NBI, and comprehensive diagnostics and analysis tools. Experiments will address specific issues in support of ITER design activities, with more fundamental physics experiments organized by the 3D field-effects task force. Topics of interest include (but are not necessarily limited to) RMP ELM suppression, pellet ELM pacing, QH-mode, and small ELM regimes. This working group is managed within ITER Physics.

- **ITER Scenario Access, Startup and Ramp Down**. DIII-D experiments in FY08 successfully simulated all four ITER reference discharge scenarios and examined startup issues using appropriately scaled parameters, but more work remains related to access to these scenarios. Experiments in FY09 seek to address access-related issues such as L-H and H-L power thresholds, shape control and vertical stability limits during ramp-up and ramp down, ELM control, MHD stability, and current profile evolution. Research here is organized as a Working Group in Plasma Control and Operations.

- **Rotation Physics**. A number of new results came out of the Rotation Physics Task Force in FY08 and from work on the OFES joint facilities JOULE milestone. Work should continue in FY09 to improve understanding of intrinsic rotation, momentum transport, and their relation to neoclassical toroidal viscosity and other effects, building on the results of the FY08 activities. This effort remains extremely ITER-relevant, since ITER performance projections and system requirements are sensitive to the assumed plasma rotation. This effort is organized as a working group within Fusion Science. The effect of rotation on NTMs and RWMs will be studied within the Steady-State Integration group.

- **Pedestal Structure**. The edge-pedestal remains one of the largest unknowns for predicting ITER performance and ELM behavior. Experiments here will seek to test physics elements related to building models of the edge pedestal (e.g., EPED1, TEMPEST, or XGC0) through systematic parameter scans in plasmas optimized for edge-pedestal measurements, both with and without RMP ELM control. Topics of interest include shape variations, ρ*, EHO physics, dRsep, and edge bootstrap current. Experiments are organized as a working group within Integrated Modeling. We anticipate a 2010 DIII-D milestone on this subject.

- **Thermal Transport in the Plasma Boundary**. This topic will replace Hydrogenic Retention as a high-priority research topic in FY10 to support the FY10 OFES Joint Facilities JOULE milestone. Divertor heat and particle flux have long been recognized as an important design driver for tokamak reactors, though the physics of 2D and 3D thermal transport in the scrape-off layer is not well established. DIII-D has extensive edge/divertor diagnostic and control capabilities, which enables experiments to compare edge data with physics models and data from other tokamaks. Activities here are organized as a Working Group within the Plasma Boundary Interfaces group. In addition, a DIII-D milestone on SOL Thermal Transport Physics is planned for FY2010.

- **Energetic Particles**. This 2010 high priority research topic will build on results from FY08 experiments coupled with significant new diagnostic improvements implemented in FY09, including new views for FIDA, a Fast-ion Loss Detector (FILD), and continued improvements to the BES system for density fluctuation measurements. These efforts lay the preparatory groundwork for increased run time in FY10 dedicated to study of fast ion stability and transport with the aim of validating theoretical models such as the NOVA and NOVA-K codes. The work proposed for the FY10 DIII-D milestone on energetic particles will be done by a working group within Fusion Science.

Below we convey the essential content of the various Task Force and Physics Groups and their goals and anticipated results. The research described is based on a 13-week experimental campaign. To allow for contingency, experimental time has been allocated for 48 run days out of a possible 65 run days, with 13 days of contingency, 2 days of Torkil Jensen Award experiments and 2 days director's reserve. Additional detailed information can be found on the web, and related links: https://diii-d.gat.com/diii-d/Exp09.

The 2009 campaign follows a very successful 2008 campaign in which 19.0 weeks of operation were completed. The 2008 campaign was the third experimental campaign following the one-year long Long Torus Opening Activity (LTOA), in which several significant upgrades were made to the DIII-D facility. Experiments in 2008 continued to exploit the new capabilities added during the 2005-06 LTOA, including: 1) reorientation of the 210-degree neutral beam line to provide 5 MW of neutral beam power directed opposite from the remaining five sources, allowing balanced neutral beam injection up to 10 MW input power; 2) installation of an extended shelf in the lower divertor to allow pumping of high triangularity single-null and double-null plasmas; and 3) additional ECH power and pulse length (~5 s, still in progress). In addition for 2008 several significant diagnostic upgrades were implemented including: 1) a new high framing rate IRTV in the lower divertor, 2) 2D imaging of fast phenomena in the core (sawteeth, fast ion instabilities using FIDA, ELM effects) by combining the tangentially viewing fast visible emission camera with advanced signal processing, 3) a new thermocouple array in the lower divertor tiles, and 4) initial data from a fast MSE prototype.

During the 2008 campaign, many experiments were conducted in support of physics areas identified by the International Tokamak Physics Activity (ITPA) working groups (Table I). Although these experiments continued to support long-term physics needs of ITER, direct support of the ITER Design Review follow-on issues continued to be a major consideration in setting priorities for the 2008 campaign. While the Design Review has been formally completed, many issues remain open and studies continue under the guidance of the ITER Science and Technology Advisory Committee (STAC). These, as well as other high priority physics issues for ITER, are given the highest priority in the 2009 experimental campaign (Table II). In 2009, DIII-D will also continue to actively support the ITPA through taking part in joint experiments (Table III).

To enable the success of ITER by providing physics solutions to key physics issues is the highest priority of three overarching goals for DIII-D research. The 13-week program plan for 2009 provides adequate experimental time for DIII-D to continue its leading roles in development of a physics basis for steady-state operation in ITER and beyond, and to advance the fundamental understanding of fusion plasmas along a broad front.

Table I
DIII-D Conducted a Number of Experiments in 2008 in Support of the International Tokamak Physics Activity (ITPA)

ID No	Title	DIII-D Experiment
CDB-10	Power ratio – hysteresis and access to H-mode with H~1	H-mode power threshold for EC and NBI leaked discharges and their dependence on input torque
DIAG-2	First mirror activity	ITER mirror performance test: Active control over mirror deposition by a local gas injection
DSOL-9	^{13}C injection experiments to understand C migration	^{13}C injection experiments to understand C migration
DSOL-11	Disruption mitigation experiments	Disruption mitigation with mixed species; enhanced disruption mitigation effectiveness with I-coil field; runaway electron diagnosis with pellets; low-Z pellet ablation
DSOL-12	Oxygen wall cleaning	Possible oxygen or air bake (under study)
DSOL-13	Deuterium co-deposition with carbon in gaps of plasma facing components	C deposition, D co-deposition in tile gaps
DSOL-19	Impurity generation mechanism and transport during ELMs for comparable ELMs across devices	Inter-machine comparisons for heat flux scaling and ELM heat; heat transport profiles and poloidal asymmetries
MDC-1	Disruption mitigation by massive gas jets	Same as DSOL-11 (above)
MDC-2	Joint experiments on resistive wall mode physics	RWM stability in slowly rotating high beta plasmas
MDC-5	Comparison of sawtooth control methods for neoclassical tearing mode suppression	Effects of rotation and fast ions on sawteeth
MDC-8	Current drive prevention/stabilization of NTMs	NTM detection and control by oblique ECE; stabilization of rotating 2/1 modes — modulated ECCD
MDC-11	Fast ion losses and redistribution from ocalized AEs	Low-NBI power NCS plasmas and BAAE investigation (high field NCS target plasmas); low field plasmas
MDC-12	Non-resonant magnetic braking	Non-resonant braking (normal and reversed I_P)
MDC-13	Vertical stability physics and performance limits in tokamaks with highly elongated plasmas	Vertical stability control limit assessment for ITER
MDC-14	Rotation effects on neoclassical tearing modes	Effect of rotation on NTM beta limits
PEP-2	Pedestal gradients in dimensionally similar discharges and their dimensionless scaling	DIII-D/JET pedestal width scaling with ρ* (depends on JET readiness)
PEP-17	Small ELM regimes at low pedestal collisionality	Obtain small ELMs at low collisionality to test pedestal structure models (if JET ρ* experiment not done)
PEP-19	Edge transport under the influence of resonant magnetic perturbations in DIII-D and TEXTOR	3D transport pattern in RMP ELM suppressed H-modes and their dependence on edge safety factor and collisionality; effect of RMP ELM suppression on pedestal particle sources and sinks
SSO-1	Document performance boundaries for steady state target *q*-profile	Fully noninductive operation
SSO-2.1	Qualifying hybrid scenario at ITER-relevant parameters	ITER demonstration discharges — AT + hybrid; ITER startup and hybrid discharges
SSO-3	Modulation of actuators to qualify real-time profile control methods for hybrid and steady-state scenarios	Profile control Part I: open loop trajectory control

Table I
DIII-D Conducted a Number of Experiments in 2008 in Support of the International Tokamak Physics Activity (ITPA) (Continued)

ID No	Title	DIII-D Experiment
SSO-5	Simulation and validation of ITER startup to achieve advanced scenarios	ITER startup and hybrid discharges
SSO-6	Ability to obtain and predict off-axis NBCD	Off-axis NBCD using vertically shifted, small plasmas
TP-4.2	Low momentum input operation effects on E×B shear and reduced transport	E×B shear vs magnetic shear effects on core barrier formation at q_{min}=2
TP-5	QH/QDB plasma studies	QH-mode at balanced input torque; QH-mode experiments with co-NBI
TP-6.1	Scaling of spontaneous rotation with no external momentum input	Balanced NBI studies of intrinsic rotation; effect of shape, density and temperature on intrinsic rotation

Table II
ITER Urgent Design Issues are a Major Focus for the DIII-D 2009 Campaign

STAC Topic	Topic Title	DIII-D experiment(s)
01.a	Vertical stability	<u>ITER Startup and Ramp down high priority WG</u> • Vertical stability during ramp down • ECH startup assist
01.b	Shape control/poloidal field coils	
04	ELM control	<u>ELM Control for ITER high priority WG</u> • Width of the q_{95} operating window for ELM suppression by RMPs • Collisionality dependence of RMP ELM suppression • Impact of RMP on core and edge transport

Additional topics	DIII-D effort
Disruption mitigation and avoidance	Rapid shutdown TF and disruption characterization and avoidance WG
Hydrogenic retention	Hydrogenic retention high priority WG
Developing ITER reference discharges in each ITER operating scenario	ITER demonstration discharges WG Baseline demonstration discharges at low collisionality and low torque
NTM stabilization	NTM stabilization WG
Performance during non-activation phase	Hydrogen and helium plasmas WG

Table III
Many Experiments Planned During 2009 will Support the International Tokamak Physics Activity (ITPA)

ID No.	Title	DIII-D Experiment
TC-7	ITG/TEM transport dependence on T_i/T_e, q profile and rotation in L-mode	Correlation between core density and temperature fluctuations
TC-10	Experimental identification of ITG, TEM and ETG turbulence and comparison with codes	Multi-scale turbulence measurements in transport model validation TF experiments
TC-11	He profiles and transport coefficients	He transport in advance regimes (piggyback experiment in 2009)
TC-13	ITG critical gradient and profile stiffness	Turbulence studies with ∇T_e modulation
TC-15	RF driven rotation	Generation mechanism and size scaling of intrinsic rotation
PEP-2	Pedestal gradients in dimensionally similar discharges and dimensionless scaling	DIII-D JET pedestal similarity experiments and dependence on ρ^*
PEP-17	Rotation effect on high β_p small ELM regimes	Dependence of pedestal structure and ELM size on collisionality and rotation
PEP-19	Basic mechanisms of edge transport with RMP in toroidal plasma confinement	Impact of RMP on core and edge transport during ELM suppression
PEP-20	Documentation of the edge pedestal in advanced scenarios	Optimization of the bootstrap current through variations in q_{min} and q_{95}
DSOL-2	Injection to quantify chemical erosion	Argon detached divertor erosion studies, helium plasma chemical erosion comparisons
DSOL-9	^{13}C injection experiments to understand C migration	^{13}C methane injection and follow-up oxygen bake for removal of hydrogenic co-deposits
DSOL-12	Reactive wall cleaning	^{13}C methane injection and follow-up oxygen bake for removal of hydrogenic co-deposits
DSOL-13	Deuterium co-deposition with carbon in gaps of plasma facing components	^{13}C methane injection and follow-up oxygen bake for removal of hydrogenic co-deposits
DSOL-14	Multi-code, multi-machine edge modeling and code benchmarking	Inboard/outboard ITER startup SOL widths
EP-2	Fast ion losses and redistribution from localized AEs	Energetic particle transport by plasma turbulence in L-mode
MDC-1	Disruption mitigation by massive gas injection	Optimize MGI pulse length and radiation asymmetry during MGI
MDC-2	Joint experiments on resistive wall mode physics	RMW feedback stabilization in Ohmic plasmas
MDC-4	Neoclassical tearing mode physics – aspect ratio comparison	DIII-D and NSTX aspect ratio comparison of NTM physics

Table III
Many Experiments Planned During 2009 will Support the International Tokamak Physics Activity (ITPA) (Continued)

ID No.	Title	DIII-D Experiment
MDC-8	Current drive prevention/stabilization of NTMs	m/n=2/1 NTM suppression in ITER baseline demonstration discharges
MHD-12	Non-resonant magnetic braking	Test link between toroidal torque and radial particle flux
MDC-14	Rotation effects on neoclassical tearing modes	DIII-D and NSTX aspect ratio comparison of NTM physics
MDC-15	Disruption database development	Characterize VDEs and disruptions with vertical instability
MDC-16	Runaway electron generation, confinement and loss	Characterize runaway generation, confinement and loss
MDC-17	Active disruption avoidance	Characterize VDEs and disruptions with vertical instability
IOS-2.2	Ramp-down from q_{95}=3	ITER ramp down studies
IOS-3.2	Define access conditions to get to SS scenario	Optimization of the bootstrap current through variations in q_{min} and q_{95}
IOS-4.2	ρ* dependence on transport and stability in hybrid scenarios	Scaling of transport with ρ*
IOS-5.2	ICRH local gas fueling requirements for coupling	Long distance fast wave antenna coupling

The experimental plan was compiled based on input and prioritization provided by the 2009 DIII-D Research Council. The Research Council develops a research plan on an annual basis based on the “DIII-D Five-Year Program Plan 2009-2013,” January 2009, GA-A25889, with adjustments made for scientific and programmatic issues identified since that plan was written. As already stated, these deliberations consider the needs of ITER and ITPA, as well as input from the US Burning Plasma Organization.

The experimental plan is also influenced by three programmatic and one joint facility JOULE milestones:

Milestone 165: Particle control and hydrogenic retention with carbon in-vessel components; Understanding and controlling tritium inventory in co-deposited layers. Level 1 FY09 joint facility research target (September, 2009).

Milestone 169: Evaluate fast shutdown schemes for ITER (August, 2009).

Milestone 170: Assess candidate current profiles for steady state operation (August, 2009).

Joint facility research target (GG 3.1/2.49.1): Conduct experiments on major fusion facilities to develop understanding of particle control and hydrogenic fuel retention in tokamaks. (September, 2009).

In November 2008, a call for experimental research proposals towards the DIII-D objectives was issued and 553 proposals (Table IV and Appendix A) were received and presented at a community-wide Research Opportunities Forum (ROF; http://fusion.gat.com/global/Rof2009) on December 16–18, 2008. The overall interest of the general fusion community in research on DIII-D is exemplified by the large number of proposal submissions that were received from universities (165) and foreign labs (136), including 18 proposals received directly from the ITER International Orgnaization (IO) in Cadarache, France. Remote participation, using H.323 video, was used in the plenary and most of the breakout sessions to allow participation by scientists at many remote locations in the US, including Princeton Plasma Physics Laboratory, Massachusetts Institute of Technology, and Oak Ridge National Laboratory, and internationally, including JET, ASDEX-Upgrade, JAEA, MAST, TEXTOR and the ITER IO. The interest shown in the DIII-D program is partly a result of DIII-D's commitment to domestic and international collaborations as well as its participation in the ITPA process and ITER Design Review. A listing of the proposals received at the ROF is included as Appendix A of this report and can be viewed at http://fusion.gat.com/global/Rof2009.

Table IV
Proposal Statistics for the 2009 Campaign

Area	Proposals Received	Unique Proposals	Proposals in 13-week Plan for 2009	Backlog of Proposals Post 2009
Task Forces and Torkil Jensen Award (reporting to Director of Experimental Science Division)				
Rapid shutdown schemes for ITER	15	14	9	5
Physics of non-axisymmetric fields in support of ITER	53	48	9	39
Transport model validation	25	14	3	11
Torkil Jensen award	16	16	2	14
Physics Groups (reporting to Physics Group Leaders)				
Steady-state integration	65	55	6	49
Integrated modeling	21	17	3	14
ITER physics	159	118	8	110
Plasma control and operations	28	24	3	21
Fusion science	122	106	27	79
Plasma boundary interfaces	49	32	7	25
Totals	**553**	**444**	**77 (50 days)**	**367**

From these proposals, the various Task Force and Physics Group Leaders met with their groups and developed a proposal for experimental time. This plan was then presented to the Research Council. Subsequently, the Research Council provided advice to the Director on the relative allocation of experimental time amongst the various areas. Based on this input, the Director established the experimental allocation for each program area.

The final run plan (Table V and Fig. 2) reflects the DIII-D Team's commitment to support the ITER Design Review process, as embodied by issues identified by the ITPA, US BPO, the ITER Design Review Working Groups, and the ITER STAC. The plan is highlighted by experiments in support of urgent issues, where our research results may have an immediate impact on the ITER design itself. Experiments where DIII-D has unique capabilities to address these issues have been given highest priority.

The experimental plan was presented to the DIII-D Program Advisory Committee, February 10–12, 2009. The DIII-D PAC endorsed the priorities and the program plan.

Table V
Run Time Allocations for the 2009 Experiment Campaign

Area	Description	Plan (Days)	ITPA/IEA Experiments	Area Leaders
Task Forces (reporting to Director of Experimental Science Division)				
Rapid shutdown for ITER	Develop a recommendation for ITER on the best rapid shutdown scheme (Milestone 169)	5	1	**E. Hollmann** T. Jernigan
Physics of non-axisymmetric fields in support of ITER	Investigate the common physical basis of the effects on global stability, ELMs, plasma rotation and confinement due to non-axisymmetric fields	4	0	**H. Reimerdes** O. Schmitz
Transport model validation	Validate computational tools to predict core plasma transport in future devices	4	3	**T. Rhodes** C. Holland
Torkil Jensen Award	Support experiments investigating potentially transformational physics using innovative techniques	2	0	**M. Wade**
Physics Groups (reporting to Physics Group Leaders)				
Steady-state integration	Develop the physics basis for steady-state operation in ITER and future devices	9	2	**T. Luce**
Integrated modeling	Experimental validation of complex theoretical models	3	2	**R. Prater**
ITER physics	Provide physics solutions to key design and operational issues for ITER	8	5	**E. Strait**
Plasma control and operations	Develop and deploy state-of-the-art plasma control systems for DIII-D	3	1	**D. Humphreys**
Fusion science	Advance basic fusion plasma science on DIII-D through test of basic theories, development of new measurement capabilities, and novel ideas	7	7	**C. Petty**
Plasma boundary interfaces	Develop an improved understanding of energy and particle transport in the plasma boundary region through tests with applicable theories/models, characterization of the interaction of the plasma with material surfaces, the migration and retention of eroded materials and fuel in those surfaces, and the development of new measurement capabilities for boundary plasma research	5	4	**T. Leonard**
	Total allocated days	**50**	**27**	
	Director's reserve	**2**		
	Contingency	**13**		
	Available days	**65**		

Area/Task Force	Days in 13 weeks	ITER	AT	Fusion Science
Torkil Jensen Award	2			
Rapid Shutdown	5	5		
Non-Axisymmetric Fields	4			4
Transport Model Validation	4	2		2
ITER Physics	8	8		
Steady State Integration	9		9	
Fusion Science	7	2		5
Integrated Modeling	3			3
Plasma Control	3	2.3	0.3	0.3
Plasma Boundary Interfaces	5	5		
Directors Reserve	2			
Totals	48 (+4)	24.3	9.3	14.3

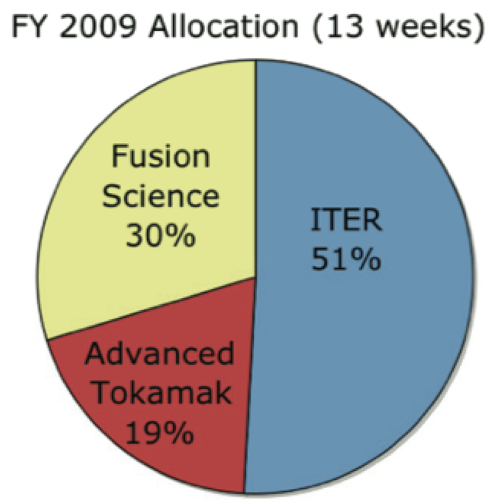

Fig. 2. The fractional allocation of 2009 Experimental Campaign run time into the three primary areas of the DIII-D program shows continuation of DIII-D's strong commitment to ITER related physics research.

DIII-D continues to have a large research backlog as is shown in Table IV. A measure of this backlog is obtained from comparing the number of proposals that the area leaders expect can be reasonably completed in a 13-week campaign during 2009 (77) compared to the total number of unique proposals (444). This leaves a proposal backlog of 367 proposals. The 2009 campaign, therefore, will only allow 17% of the proposed research to be conducted.

The 13 run week experimental plan for 2009, summarized in Tables V and VI, consists of efforts in three Task Forces and six Physics Groups. The Physics Groups themselves are in turn made up of a total of 27 Working Groups (Fig. 1).

- **Torkil Jensen Award**

  Torkil was an extremely productive physicist whose long career was marked by innovative work on a wide variety of fusion-related subjects brought forward with a strong sense of optimism and enthusiasm. The Torkil Jensen Award was created to inspire proposals from the broader fusion community for experiments with potential for transformational new results with high visibility or scientific impact. This year, 16 proposals were submitted and two were selected based on the recommendation of the award committee consisting of Keith Burrell of General Atomics, Prof. Ray Fonck of the U. Wisconsin, and Prof. Mike Mauel of Columbia U. The winners are:

  Solenoid-free Startup by Geoff Cunningham (MAST); Dennis Mueller and David Gates (NSTX); Jim Leuer, Nick Eidietis, Dave Humphreys, Al Hyatt, Gary Jackson, Peter Politzer, Ron Prater, and Phil West (GA). (1 day)

  Super H-mode by Phil Snyder (GA) (1 day).

- **Task Forces**

Task Force on Rapid Shutdown for ITER (5 days in support of Milestone 169). Disruptions are an important issue for ITER and this new task force was created to develop methods to minimize the effects of disruptions in tokamaks. Five days are allocated for this task force under both the 13 and 15 week plans. Research on disruption avoidance and characterization will be carried out within the ITER Physics Topical Area. Experiments this year should focus on successful completion of Milestone 169, with the goal of providing a first recommendation on which shutdown scheme (or combination of schemes) we believe would be most effective for avoiding disruption wall damage in ITER. Therefore, experiments should balance effort to further optimize Massive Gas Injection (MGI) and effort to evaluate alternative or complementary schemes such as large cryogenic pellets (both shattered D_2 and neon), shell pellets, and the use of resonant magnetic perturbations to enhance the suppression of runaway electrons.

Task Force on the Physics of 3D Fields for ITER (4 days). This new task force combines several research elements previously organized under separate working groups or task forces in order to bring a common perspective to issues related to non-axisymmetric field effects. Four days are allocated under the 13 week plan and five days under the 15 week plan. High priority should be given to understanding how 3D fields affect the magnetic topology going from the vacuum region to the highly conductive core plasma dominated by ideal MHD effects, comparing theoretical models (e.g. IPEC, MARS-F, and NIMROD) to the measured plasma response to non-axisymmetric fields.

Task Force on Transport Model Validation (4 days). A total of four days is allocated to this task force for both the 13 and 15 week plans. The combination of new diagnostics providing high resolution broad spectrum fluctuation measurements, coupled with the development of synthetic diagnostics allow comparison between theory and experiment with unprecedented detail in the core of high temperature plasmas. Priority should be given to study of plasma turbulence relevant to electron thermal transport, and this work will need close coordination with theorists to provide the requisite supporting simulations.

- **Physics Groups**

ITER Physics Group (8 days). The DIII-D ITER Physics Group has identified a number of near-term important research needs to support ITER. A total of 8 days is allocated in this area; highest priority should be given to RMP ELM control experiments. A large part of the efforts and plan organized under the 2008 ELM Control Task Force will continue under the ELM-control working group here. Since evaluation of helium plasma operation is best accomplished with several contiguous run days, these experiments should be reserved for the 15 week plan, which provides 4 additional days to accomplish this work. Evaluation of the L-H transition and characterization of H-mode plasmas with ECH should be included as part of the helium work.

Steady State Integration Group (includes support for Milestone 170) (9 days). A total of 9 days is allocated for research in this area under both the 13 week and 15 week plans. Work in support of completing milestone 170 should receive the highest priority in this area, with studies of core-edge integration, advanced inductive, and RWM feedback stabilization also receiving attention.

Fusion Science (7 days). Fusion Science spans a very wide range of topics; virtually all research on DIII-D contains a strong fusion science component. This year, a separate task force on Transport model validation has been created and work in boundary science has been moved to its own Physics Research Area within the Experimental Science Division. This year, 7 days are allocated to Fusion Science under the 13 week plan and 8 days under the 15 week plan. Work on the physics of plasma rotation, organized as a separate task force 2008, will receive high priority within Fusion Science. It is anticipated that Energetic Particle research will be an important focus for fusion science experiments in 2010, with work this year concentrating on diagnostic development. Experiments seeking to gain understanding of the coupling of Fast Wave power to high performance plasmas are planned.

Integrated Modeling (including pedestal structure) (3 days). Work on integrated modeling complements the activities of the Fusion Science area by seeking to validate specific theory, codes, and models against experiment. Three days are allocated for study of the pedestal structure in the 13 week plan, including testing the EPED1 model. A fourth day is allocated in the 15 week plan.

Plasma Control (3 days plus unspecified number of 2-hour shifts). Three days are allocated to plasma control experiments in 2009, primarily to support research examining ITER ramp down scenarios and completing remaining startup work, with some attention given to plasma control in support of operations. The ITER Startup and Rampdown (ISAR) working group will collaborate with the Plasma Boundary

Interfaces Topical Science to include measurements of the interactions between the plasma and inner/outer limiter during startup and ramp down to meet specific ITER needs. Additional time for plasma control development will be made available in the form of specific 2-hour extensions to run days subject to the Director's approval. Under the 15 week plan, an additional day is allocated to allow for more ISAR-related experiments, including examination of vertical stability with simultaneous use of fast (internal) and slow (external) coils in support of ITER.

The plans and goals for the various science areas are detailed below.

1.1. TASK FORCES FOR 2009

1.1.1. TASK FORCE ON RAPID SHUTDOWN SCHEMES FOR ITER (includes milestone 169) (Leader: E.M. Hollmann Deputy: T.C. Jernigan)

1.1.1.1. Mission. Make recommendations to ITER on best rapid shutdown scheme or combination of schemes.

1.1.1.2. Importance and Urgency. Unmitigated disruptions are a significant concern for ITER because of possible wall damage due to localized heat loads, vessel forces and runaway electron beams. Solutions to these issues will impact hardware decisions for ITER. This task force is also charged with fulfilling DIII-D Milestone 169.

1.1.1.3. Research Areas for 2009. This Task Force will focus on the following areas:

- Optimization of massive gas injection for rapid shutdown and runaway electron minimization.
- Exploration of the use of shell pellets for triggering controlled rapid shutdown though ablation and dispersal studies.
- Exploration of the use of large shattered cryogenic deuterium pellets for rapid shutdown without runaway electrons.
- Techniques for deconfining runaway electrons to prevent localized heat loads.

1.1.1.4. New and/or unique Tools.

- New, unique large shattered cryogenic deuterium pellet injector.
- Fabrication and injection of customized shell pellets for rapid shutdown.
- Multi-valve (Medusa) system for massive gas injection.

1.1.2. TASK FORCE ON PHYSICS OF NON-AXISYMMETRIC FIELD EFFECT FOR ITER (Leader: H. Reimerdes Deputy: O. Schmitz)

1.1.2.1. Mission. Improve our physics understanding of the plasma response to non-axisymmetric magnetic field perturbations.

1.1.2.2. Importance and Urgency. Non-axisymmetric magnetic field perturbations can have both positive effects (e.g. ELM suppression, RMW feedback control) and negative effects (e.g. Rotation braking and locked mode triggering, confinement degradation, enhanced fast particle loss) on the plasma performance. Many of these effects will affect the performance (transport and stability) of the ITER plasma and physics understanding of these responses by the plasma will impact ITER design decisions.

1.1.2.3. Research Areas for 2009. This Task Force will focus on the following areas:

- Determine the magnetic topology in the plasma in the presence of non-axisymmetric fields.
- Investigate how external and internal non-axisymmetric fields change plasma transport (particle, energy and momentum).
- Explore how non-axisymmetric fields modify plasma stability.
- Develop techniques to optimize correction of error fields.

1.1.2.4. New and/or Unique Tools.

- Combination of upper and lower internal perturbation coils (I-coils) capable of high frequency or high current operation with external error field correction coils (C-coils).
- Unique diagnostics to measure plasma response including resonant field amplification methods.

1.1.3. TASK FORCE ON TRANSPORT MODEL VALIDATION (Leader: T.L. Rhodes Deputy: C. Holland)

1.1.3.1. Mission. Validation of both theory-based transport models and turbulence models including but not limited to GYRO, TGLF, XPTOR/TGYRO etc.

1.1.3.2. Importance and Urgency of Research.

1.1.3.3. Research Areas for 2009.

- Parametric Variations including dependence of transport on elongations, T_e/T_i, ion mass, safety factor, Mach number, collisionality, and beta.
- Basic turbulence mode properties including phase between density and temperature fluctuations.

1.1.3.4. New and/or Unique Tools

- Flexible shape control, heating-rotation control (Co and Counter NBI), localized heating (ECH), multiple confinement regimes (QH-mode, core barriers, hybrid etc.).

- Unique diagnostics including fluctuation measurements at the ITG, TEM and ETG scales, $\tilde{n}$, $\tilde{T}_e$, turbulence flows, radial and poloidal correlations lengths, density-temperature phase angle, and zonal flows.
- Close coordination with theoreticians at GA and in the broader international community.

1.2. PHYSICS GROUPS

These groups parallel the organization of the DIII-D Experimental Science Division. Each consists of one or more working groups, reporting to the physics group leader.

1.2.1. ITER PHYSICS (Leader: E.J. Strait)

The ITER Physics group provides a home for several issues of importance to ITER, as well as a point of contact for future ITER physics needs. ELM Control for ITER is the high priority physics topic in this area.

1.2.1.1. Mission. Provide physics solutions to key design and operational issues for ITER.

1.2.1.2. Importance and Urgency

- Short-term research is needed to address short-deadline urgent issues, identified during the ITER design review.
- Several other issues have been identified that can be addressed in the medium-term and still have impact on the ITER design.

1.2.1.3. Research Areas for 2009. This physics group is organized into the following working groups:

- **ELM Control for ITER (high priority research topic)**. Develop the physics basis for ELM control techniques in particular for ELM Suppression by resonant magnetic perturbations (RMPs). Explore alternate means of ELM control such as pellet ELM pacing, RMP ELM pacing and QH-mode operation.

- **Disruption Characterization and Avoidance**. Develop a physics understanding of causes and consequences of disruptions, strategies toward disruption-free operation. Characterize vertical displacement events (VDEs), vertically unstabile disruptions (VUDs) and runaway electron generation, confinement and loss.

- **NTM Stabilization**. Establish a physics basis for NTM stabilization in ITER. Validate model predictions for NTM stabilization by modulated and continuous ECCD. Develop methods for control of locked tearing modes.

- **ITER Demonstration Discharges**. Develop improved basis for projections to ITER through direct comparison of the four primary ITER scenarios on a single present device. Explore performance optimization methods for ITER scenarios.

- **Hydrogen and Helium Discharges**. Work toward a physics basis to predict ITER performance during the initial non-deuterium operation phase. Revisit, and in many cases study for the first time, isotope scaling of L-H transition, energy confinement, pedestal width, ELM characteristics, ELM avoidance, and ELM suppression.

1.2.2. STEADY-STATE INTEGRATION (Leader: T.C. Luce)

Assessment of steady-state current profiles for optimum performance in support of Milestone 170 is the high priority research topic in this physics area.

1.2.2.1. Mission: Develop the Physics Basis for Steady-state Operation in ITER and Future Devices. Demonstrate stationary high-performance inductive and non-inductive solutions that would satisfy the objectives of future fusion devices. Develop sufficient physics understanding for projection and optimization of similar scenarios for existing and future tokamaks.

1.2.2.2. Importance and Urgency. Steady-state scenarios will likely be required in a future fusion-based power plant. In a shorter term, this effort should build a basis for steady-state scenarios in ITER, FDF, and DEMO. The urgency comes from a need to specify appropriate actuators to achieve steady-state ITER operation.

1.2.2.3. Research Areas for 2009. This physics group is organized into the following working groups:

- **Fully Noninductive High Beta Operation (high priority)**. Optimization of existing steady state scenario with the goal of fully noninductive operation for τ_R. Exploration of higher β scenarios, with a target β_N=5. Explore new approaches to steady state. This work is complementary with experiments studying the ITER SS scenario in the ITER Physics Research Area.

- **Core Integration (Advanced Inductive).** Clarify the role of the m=3/n=2 tearing mode in hybrid scenario performance. Establish a physics basis for extrapolation. Explore scaling of transport with ρ^* and understand access conditions for hybrid scenarios.

- **Core-Edge Integration**. Optimize particle inventory control for steady-state scenarios. Explore combination of ELM Suppression by RMPs from the I-coil and radiative divertor operation in standard H-mode.

- **RWM Physics**. Assess RWM feedback stabilization methods at low rotation using current driven RWM in collaboration with the RFX group (Padua, Italy). Establish a physics basis for rotational stabilization.

1.2.2.4. Unique Tools.

- High power ECH/ECCD (five gyrotrons at start of campaign, possible sixth gyrotron available later in the year) for off-axis current drive.
- Lower pumped divertor facilitates particle control in plasma shapes optimized for high β.
- The internal I-coil and external C-coil for simultaneous error field and RWM control.
- Counter-NBI, provided by the rotated 210º beamline, allows control of applied torque decoupled from heating power, facilitating low-rotation studies.

1.2.3. FUSION SCIENCE (Leader: C.C. Petty)

1.2.3.1. Mission: Advance the fundamental science understanding of fusion plasmas, especially in areas where DIII-D has unique capabilities or high leverage.

1.2.3.2. Importance and Urgency. Understanding of the physics underlying the behavior of fusion plasmas is critical in building a predictive capability for the design and operation of future devices.

1.2.3.3. Research Areas for 2009. This physics group is organized into the following working groups. Although the topical science areas of previous years are each represented by a working group within Fusion Science, much of the work that would have previously been in these areas is now done elsewhere in the program. The overall emphasis on science in the DIII-D program is not diminished, rather it permeates the entire DIII-D research program.

- **Rotation Physics (high priority research topic for 2009)**. Develop a predictive understanding of rotation by conducting experiments aimed at improving our knowledge of intrinsic rotation, momentum transport, and rotation damping.
- **Energetic Particles (high priority for 2010)**. Study fast ion stability and transport with the goal of validating theoretical models such as the NOVA and NOVA-K codes. Utilize improved diagnostic capabilities implemented in 2009 including: new views for FIDA and FIDA-I, fast FIDA, and Fast Ion Loss Detector (FILD).
- **Transport**. The goal of the DIII-D Transport Topical Area is to develop a fundamental and comprehensive understanding of turbulence and transport behavior in magnetically confined plasmas, with a long-term goal of developing a predictive capability for turbulent transport. Progress in this area is closely

coupled with development of theory-based turbulent transport models in the Integrated Modeling Physics Research Area and in the Transport Model Validation Task Force.

- **Stability**. The goal of the DIII-D Stability Topical Area is to establish the scientific basis to predict and control macroscopic instabilities.
- **Heating and Current Drive**. The goal of the DIII-D Heating and Current Drive Topical Area is to develop comprehensive, predictive models for NBCD, ECCD, and FWCD. In addition, research on the self-generated bootstrap current is in this topical area.

1.2.3.4. New and/or Unique Tools.

- DIII-D's uniquely comprehensive diagnostic set facilitates detailed fusion science studies.
- Unique capabilities to vary shape, heating location and mix, density, …

1.2.4. INTEGRATED MODELING (Leader: R. Prater)

1.2.4.1. Mission. This group is responsible for the experimental validation of complex theoretical models.

1.2.4.2. Importance and Urgency. Understanding of the physics underlying the behavior of fusion plasmas is critical in building a predictive capability for the design and operation of future devices. This understanding will be embodied in codes representing complex physical models. Experimental validation is a critical step in preparing these codes for use as predictive tools.

1.2.4.3. Research Areas for 2009. This physics group for 2009 has two working groups because the work on pedestal structure physics previously done in a task force is now handled by this physics area:

- **Pedestal Structure Physics**. Develop validated model of pedestal height icluding tests of EPED1 predictive model. Explore techniques to optimize pedestal for ITER and beyond.
- **Integrated Modeling**. Integrated modeling of simulated alpha heating in an ITER demonstration discharge.

1.2.4.4. Unique Tools.

- All of the tools listed for Fusion Science are applicable.
- In addition, close collaboration with the GA Theory Group and other modelers is important for this effort.

1.2.5. PLASMA CONTROL AND OPERATIONS (Leader: D. Humphreys)

1.2.5.1. Mission. Develop and deploy state-of-the-art plasma control systems for DIII-D. Study control issues for ITER.

1.2.5.2. Importance and Urgency. Studies of the ITER startup and shutdown, as well as vertical stability, are of critical short-term importance to ITER and may have impact on the design of that device. The work in model-based control should have impact on the DIII-D program within the next year, and should improve our ability to develop and control new sets of plasma conditions.

1.2.5.3. Research Areas for 2009. This physics group is organized into the following working groups:

- **ITER Startup, Shutdown, and Vertical Stability (high priority research topic**). Develop and demonstrate ITER startup/ramp down scenarios and study access to flattop operating scenarios including also vertical stability assessment and control, L-H access for ITER and real-time locked mode control.
- Model-based Control. Develop MIMO based plasma control for routine operation in DIII-D. Develop model-based profile control.

1.2.5.4. New and/or Unique Tools.

- Unique DIII-D Plasma Control System

1.2.6. PLASMA BOUNDARY INTERFACES — NEW PHYSICS AREA FOR 2009 (Leader: T. Leonard)

1.2.6.1. Mission. Provide physics understanding of SOL plasma, divertor plasma and plasma materials interaction toward solutions of steady state and transient heat and particle flux issues for ITER and future high power tokamaks.

1.2.6.3. Research Areas for 2009. This physics group is organized into the following working groups:

- **Hydrogen Retention (2009 high priority research topic in support of 2009 DOE Joint Facilities Research Target)** is being led by Dr. S.L. Allen (LLNL). Improve extrapolation of tritium control for ITER operation by understanding physics mechanisms of tritium (hydrogenic species) retention in material surfaces. Work will include measurement and modeling of the edge plasma and transport, particle balance measurements and evaluation of the changing properties of the material walls.

- **Thermal Transport in the Plasma Boundary (2010 high priority research topic)**. Develop understanding of the heat transport in the plasma SOL and divertor toward predictive capability for ITER including fluctuation driven transport in the SOL, PFC energy characteristics during rampup and ramp down, and power widths in rf-heated discharges.

- **SOL Main Ion and Impurity Flows**. Establish physics mechanisms leading to measured strong plasma flows in the SOL toward the inner divertor target.

- **Physics of Volume Recombination and Divertor Detachment**. Explore detachment and radiative divertor models, characteristics of the secondary X-point and novel divertor configurations with potential for enhanced divertor detachment and heat flux spreading control.

1.3. RESEARCH PROPOSALS RECEIVED

A detailed list of research proposals received during the 2009–2010 ROF is given in Appendix A. These proposals formed the basis for the 2009 campaign.

1.4. DETAILED LIST OF SCHEDULED EXPERIMENTS

Table VI lists the experiments scheduled during the 2009 experimental campaign.

Table VI
Detailed list of scheduled experiments for the 2009 Experiment Campaign

Date	Title	Area	SL
2/13/09	Plasma startup	Plasma startup	Hyatt
2/17/09	Plasma startup	Plasma startup	Hyatt
2/18/09	Optimize co-NBI QH-mode	ELM control	Burrell
2/19/09	Ideal MHD response in rotating H-mode	3D fields	Lanctot
2/20/09	Optimize MGI pulse length	Rapid shutdown	Wesley
2/23/09	Ideal MHD response in rotating H-mode	3D fields	Lanctot
2/23/09	RWM feedback stabilization in Ohmic	RWM	In
2/24/09	DIII-D and NSTX aspect ratio comparison of NTM physics	NTM physics	La Haye
2/24/09	Powered VFI	General PCO	Hyatt
2/25/09	DIII-D and NSTX aspect ratio comparison of NTM physics	NTM physics	La Haye
2/25/09	RWM feedback stabilization in Ohmic	RWM	In
2/26/09	Powered VFI	General PCO	Walker
2/26/09	ITER startup	ITER startup-ramp down	Jackson
2/27/09	RMP ELM suppression plus RadDiv Day 1	Core-edge integration	Petrie
2/27/09	Secondary divertor characterization	General PBI	Leonard
3/6/09	Plasma startup	Plasma startup	Hyatt
3/9/09	ITER baseline demo at low collisionality	ITER Demo	Doyle
3/09/09	Contingency		
3/10/09	DIII-D/JET pedestal similarity scans	Pedestal	Osborne
3/11/09	Contingency		
3/12/09	RWM feedback stabilization in Ohmic	RWM	In
3/12/09	RMP half day 2	RWM	In
3/13/09	MGI radiation asymmetry in ECH plasmas	Rapid shutdown	Hollmann
3/16/09	Assess steady-state current profiles day 1	Steady state	Ferron
3/17/09	q_{95} dependence of RMP ELM suppression	ELM control	Evans
3/18/09	Test field penetration in L-mode and compare to H-mode	3D fields	Schmitz
3/19/09	Ramp down for ITER day 1	ITER startup-ramp down	Jackson
3/20/09	Contingency	Contingency	Fenstermacher
4/3/09	Plasma startup	Plasma startup	Hyatt
4/6/09	Test kinetic ballooning modes and EPED1	Pedestal	Groebner
4/7/09	Turbulence studies with ∇T_e modulation	Transport model validation	DeBoo
4/8/09	Turbulence Studies with ∇T_e modulation	Transport Model Validation	DeBoo

Table VI
Detailed list of scheduled experiments for the 2009 Experiment Campaign (Continued)

Date	Title	Area	SL
4/8/09	Validation of elongation and shaping scans of transport	Transport model validation	Holland
4/9/09	Collisionality effects on RMP ELM control	Steady state	Evans
4/10/09	Large cryogenic D_2 pellet injection	Rapid shutdown	Hollmann
4/13/09	Solenoidless startup and current rampup TJA	TJA Award	Cunningham
4/13/09	Diamond PFC DiMES exposure	Hydrogen Retention	Rudakov
4/14/09	Contingency		
4/15/09	Validation of elongation and shaping scans of transport	Transport model validation	Holland
4/16/09	Assess steady-state current profiles day 2	Steady state	Ferron
4/17/09	Solenoidless startup and current rampup TJA	TJA Award	Cunningham
4/17/09	DiMES heated sample	General PBI	Rudakov
4/20/09	RWM studies full day	RWM	Okabayashi
4/20/09	Energetic particle transport by plasma turbulence in L-mode	Energetic particles	Heidbrink
4/21/09	Ramp down for ITER day 2	ITER startup-ramp down	Jackson
4/22/09	Inboard/outboard ITER startup SOL widths	SOL transport	Boedo
4/23/09	Contingency		
4/24/09	Small shell pellet ablation	Rapid shutdown	Hollmann
5/8/09	Plasma startup	Plasma startup	Hyatt
5/11/09	Hybrid scenario access/JET ρ* comparison	Advanced inductive	Joffrin
5/12/09	Correlation between core density and temperature fluctuations	Transport model validation	White
5/13/09	Assess steady-state current profiles day 3	Steady state	Ferron
5/14/09	Contingency		
5/15/09	Test of collisionality dependence of momentum and particle pinch	Rotation physics	Solomon
5/18/09	Test link between toroidal torque and radial particle flux	3D fields	Garofalo
5/19/09	Validation of theory of magnetic field driven torques	Rotation physics	Cole
5/20/09	Super H-mode TJA	TJA Award	Snyder
5/21/09	Validation of B-Stark and an atomic model for MSE spectrum	General fusion science	Antoniuk
5/22/09	Dependence of pedestal structure and ELM size on collisionality and rotation	Pedestal	Groebner
5/26/09	Contingency		
5/27/09	Core-edge integration day 2	Core-edge Integration	Petrie
5/28/09	Secondary divertor characterization	General PBI	Watkins
5/29/09	Characterize runaway electron generation, confinement, and loss	Rapid shutdown	Wesley
6/12/09	Plasma startup	Plasma startup	Hyatt
6/15/09	Generation mechanism and size scaling of intrinsic rotation	Rotation physics	deGrassie
6/16/09	Particle balance	Hydrogen retention	Whyte

Table VI
Detailed list of scheduled experiments for the 2009 Experiment Campaign (Continued)

Date	Title	Area	SL
6/17/09	Measure 3D structures with slowly rotating n=2 fields	3D fields	Reimerdes
6/18/09	Deconfinement of REs with RMP	Rapid shutdown	Hollmann
6/19/09	Characterize VDEs and disruptions with vertical instability	Disruption characterization	Wesley
6/22/09	Contingency		
6/22/09	m/n=2/1 NTM suppression in ITER baseline demonstration discharges	NTM physics	La Haye
6/23/09	ITER baseline demonstration discharges with low torque	ITER Demo	Doyle
6/24/09	Ion and electron heat transport, heat pinch, and turbulence spreading via ECH modulation	Transport physics	Austin
6/25/09	General SSI half day	General SSI	Luce
6/25/09	Contingency		
6/26/09	Contingency		
6/29/09	General SSI full day	General SSI	Luce
6/30/09	Impact of RMP on core and edge transport	ELM control	Evans
7/1/09	Long distance FW antenna coupling	Heating and CD	Pinsker
7/2/09	Contingency		
7/6/09	Contingency		
7/7/09	Director's Reserve	Director's Reserve	Taylor
7/8/09	Director's Reserve	Director's Reserve	Taylor
7/9/09	^{1}3C injection followed by air bake	Hydrogen retention	Allen

1.5. THE 2009 OPERATIONS SCHEDULE

The operations schedule is designed for efficient and safe use of the DIII-D facility. Thirteen calendar weeks of plasma physics operations is scheduled for the fiscal year 2009. The operations schedule is shown in Fig. 3. The schedule was adjusted to accommodate the ReNew Workshops as much as possible, especially those held March 2–6, 2009, Joint Workshop [Plasma Materials Interface (Theme III) and Harnessing Fusion Power (Theme IV)] and March 23–27, 2009, Joint Workshop [Burning Plasmas in ITER (Theme I) and High Performance Steady-State Plasmas (II)]. Operations are carried out 5 days per week for 8.5 hours. The 2009 operations schedule can be viewed at http://d3dnff.gat.com/Schedules/fy2009Sch.htm.

In addition to operating the tokamak, maintenance has to be performed and new hardware is being installed to enhance DIII-D capabilities. The schedule calls for these maintenance activities to be carried out during the weeks that the tokamak is not operating.

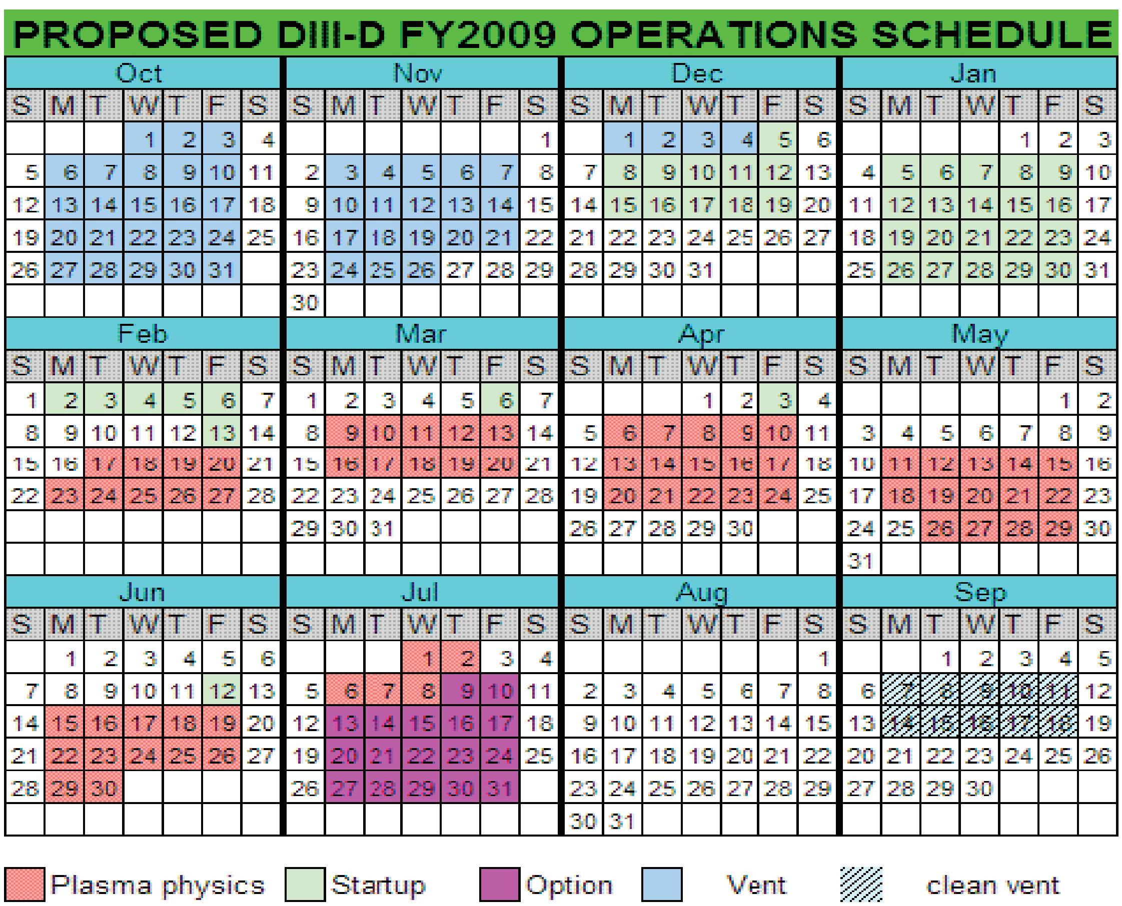

Fig. 3. DIII–D master schedule FY2009 (13-week plan).

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APPENDIX A
RESEARCH PROPOSALS RECEIVED

ID	Title	Research Area	Name	Affiliation
1	Physics of safety factor resonance for n=3 RMP ELM suppression	ELM control for ITER	Fenstermacher	LLNL
2	NTV versus intrinsic rotation	Physics of non-axisymmetric field effects in support of ITER	deGrassie	GA
3	RMP ELM suppression in ECH H-mode	ELM control for ITER	deGrassie	GA
4	The effect of collisionality on RMP ELM suppression	ELM control for ITER	deGrassie	GA
5	Understand ECH density pumpout	Transport	deGrassie	GA
6	Heat pulse transport in the RMP perturbed boundary	Physics of non-axisymmetric field effects in support of ITER	Schmitz	Juelich
7	RMP effects on boundary plasma potentials, transport and turbulence	ELM control for ITER	Boedo	UCSD
8	ELM velocity and size scaling	General plasma boundary interfaces	Boedo	UCSD
9	ELM characterization and dynamics under RMP	ELM control for ITER	Boedo	UCSD
10	Test q_{95} resonance window for ELM suppression with single I-coil row	ELM control for ITER	Fenstermacher	LLNL
11	Optimized attempt at ELM control with n=3 C-coil	ELM control for ITER	Fenstermacher	LLNL
12	Intrinsic rotation scaling; get the highest β_N possible in an ECH H-mode	Rotation physics (2009)	deGrassie	GA
13	Measure intrinsic rotation size scaling in DIII-D alone	Rotation physics (2009)	deGrassie	GA
14	Measure intrinsic rotation profiles for the bulk ion (He), especially poloidal intrinsic velocity.	Rotation physics (2009)	deGrassie	GA
15	Sensitivity of one vs two I-coils to input torque variation	ELM control for ITER	Fenstermacher	LLNL
16	T_e gradient modulation experiments	Transport model validation	DeBoo	GA
17	High collisionless NBI torque drive for GAMs, aka the VH-mode path?	Transport	deGrassie	GA
18	Impact of rotation on incremental diffusivity in hybrid discharges	Rotation physics (2009)	DeBoo	GA
19	Ion response to T_e heat pulses	Transport	DeBoo	GA
20	Momentum transfer across LCFS	SOL main ion and impurity flows	Boedo	UCSD
21	More SOL flows	SOL main ion and impurity flows	Boedo	UCSD
22	Heat transport in boundary	Thermal transport in the boundary (2010)	Boedo	UCSD
23	Helium transport in advanced operating regimes	Core integration (advanced inductive)	Weisen	CRPP - EPFL

ID	Title	Research Area	Name	Affiliation
24	Powered VFI operation	General plasma control/operations	Hyatt	GA
25	Screening effect on recycling impurities of RMP-induced flows	Physics of non-axisymmetric field effects in support of ITER	Brooks	GA
26	Inboard divertor detachment characterization	Physics of volume recombination and divertor plasma detachment	Leonard	GA
27	Poloidal asymmetry of heat transport in H-mode	Thermal transport in the boundary (2010)	Leonard	GA
28	In/out ELM heat flux asymmetry with counter injection	Thermal transport in the boundary (2010)	Leonard	GA
29	Effect of elongation on disruption runaways	Rapid shutdown schemes for ITER	Granetz	MIT
30	Why don't we see evidence for RMP impact on transport in L-mode?	Physics of non-axisymmetric field effects in support of ITER	Schmitz	Juelich
31	Real-time magnetic and kinetic profile control for advanced tokamak operation on DIII-D	Integrated and model-based control	Moreau	Cadarache
32	Structure of the plasma response to kink resonant perturbations in LSN H-mode	Physics of non-axisymmetric field effects in support of ITER	Lanctot	Columbia U
33	Scaling of the q_{95} ELM suppression window with β_N	ELM control for ITER	Evans	GA
34	RMP coil pattern variation to investigate ELM and pump-out physics	ELM control for ITER	Mordijck	UCSD
35	Test and verify safety factor dependence of turb./transp. simulations via multi-scale turb. meas.	Transport model validation	Rhodes	UCLA
36	Data collection for validation of current and temperature profile evolution models	Integrated and model-based control	Walker	GA
37	VFI-less operation	General plasma control/operations	Walker	GA
38	Operations development time	General plasma control/operations	Walker	GA
41	Poloidal asymmetry of SOL flows in DN plasmas	Thermal transport in the boundary (2010)	Brooks	GA
42	Exposure of BW sample	General plasma boundary interfaces	Wong	GA
43	Real time boronization	General plasma boundary interfaces	Wong	GA
44	Nonlinearity of thermal conductivity	Transport model validation	Gentle	U of Texas
45	High-resolution heat flux measurement at the strikepoint	Thermal transport in the boundary (2010)	Lasnier	LLNL
46	Plasma exposure of tungsten nano-scopic “fuzz” layers on DIMES	General plasma boundary interfaces	Baldwin	UCSD

ID	Title	Research Area	Name	Affiliation
47	ECCD triggered 4/3 NTM for predictable high performance Hybrid access	Core integration (advanced inductive)	Hyatt	GA
48	Pellet pacing of ELMs in low toroidally rotating plasmas	ELM control for ITER	Gohil	GA
49	Dependence of the H-L transition on toroidal rotation	Transport	Gohil	GA
50	The scaling of the low density limit for threshold power	Transport	Gohil	GA
51	Confinement and H factors at input powers close to threshold power	Transport	Gohil	GA
52	FW-only L/H transition power study	General ITER physics	Pinsker	GA
53	FW coupling and electron heating in ELM-stabilized H-modes with RMPs - continued	ELM control for ITER	Pinsker	GA
54	4th and 6th harmonic FW synergy studies	Heating and current drive	Pinsker	GA
55	Heat transport in the tokamak SOL – FY10 Joule Milestone	Thermal transport in the boundary (2010)	Maingi	ORNL
56	Exposure of tungsten nano-scopic “fuzz” on DIMES	General plasma boundary interfaces	Baldwin	UCSD
57	Access to H-mode during ramp up/down phases	ITER scenario access, startup and ramp down	Gohil	GA
58	Direct measurement of E_rad corrugation at rational surfaces	Transport	Petty	GA
59	Core transport barriers and "bat-eared" T_e profiles in EC-heated discharges	Transport	Austin	U of Texas
60	High beta, steady-state hybrids	Assess steady-state current profiles for optimum performance	Petty	GA
61	Measurement of particle transport coefficients in L-mode and RMP plasmas	Physics of non-axisymmetric field effects in support of ITER	Gentle	U of Texas
62	Runaway electron strikepoint determination	Disruption characterization	James	UCSD
63	H-mode power threshold in helium plasmas	Hydrogen and helium plasmas	Gohil	GA
64	Fueling in helium plasmas	Hydrogen and helium plasmas	Gohil	GA
65	Use of ECCD to create non-thermal seed for runaway generation studies	Disruption characterization	James	UCSD
66	Pellet induced H-mode in hydrogen or helium plasmas	Hydrogen and helium plasmas	Gohil	GA
67	RMP ELM-control in hydrogen or helium plasmas	Hydrogen and helium plasmas	Gohil	GA
68	QH-mode in hydrogen or helium plasmas	Hydrogen and helium plasmas	Gohil	GA
69	Higher β ELM-suppressed hybrids	Core-edge integration	Petty	GA
70	Hybrid β limit at low rotation	Core integration (advanced inductive)	Petty	GA

ID	Title	Research Area	Name	Affiliation
71	ECCD in high β poloidal plasmas	Heating and current drive	Petty	GA
72	Dependence of stiffness on elongation	Transport model validation	Petty	GA
73	Measurement of inductive poloidal current	Heating and current drive	Petty	GA
74	Extreme off-axis ECCD	Heating and current drive	Petty	GA
75	Sustained monster sawteeth	Energetic particles (2010)	Petty	GA
76	Simulation of alpha channeling current drive	Energetic particles (2010)	Petty	GA
77	Reducing the power loads to the divertor in ELM-supressed phase	Physics of non-axisymmetric field effects in support of ITER	Jakubowski	Juelich
78	Separating rotational shear and ρ* scaling effects on transport	Transport model validation	Petty	GA
79	Modulation of bootstrap current	Heating and current drive	Petty	GA
80	Electron heat pinch	Transport	Petty	GA
81	Pedestal width scaling with toroidal field direction	Pedestal structure	Leonard	GA
82	ITER pedestal dependence on separatrix shape	ITER demonstration discharges	Leonard	GA
83	RMP enhanced particle transport threshold dependence on collisionality	ELM control for ITER	Leonard	GA
84	Density dependence of pedestal width scaling	Pedestal structure	Leonard	GA
85	Wide density pedestal beyond the neutral penetration depth	Pedestal structure	Leonard	GA
86	L-H transition dependence on divertor detachment	Pedestal structure	Leonard	GA
87	Test of neoclassical toroidal viscosity theory using modulated I-coil currents	Rotation physics (2009)	Burrell	GA
88	Feedback control of q_{min} using B_T ramping	Core integration (steady state)	Petty	GA
89	Main ion poloidal rotation measurements in helium plasmas	Rotation physics (2009)	Burrell	GA
90	Simultaneous suppression of 3/2 and 4/3 NTM with ECCD	Core integration (advanced inductive)	Petty	GA
91	Prompt torque and zonal flow damping	Rotation physics (2009)	Burrell	GA
92	Test neoclassical poloidal rotation prediction as a function of toroidal rotation speed	Rotation physics (2009)	Burrell	GA
93	Diagnostic spatial cross calibration using edge sweeps in QH-mode	ELM control for ITER	Burrell	GA
94	Dependence of intrinsic rotation on density/safety factor	Rotation physics (2009)	Petty	GA
95	T_e/T_i scaling of electron heat transport in ETG-dominated H-mode plasmas	Transport model validation	Schmitz	UCLA
96	Divertor ELM energy deficit and first wall ELM energy fluxes	General plasma boundary interfaces	Pitts	ITER Cadarache

ID	Title	Research Area	Name	Affiliation
97	Initial development of an integrated approach for rapid shutdown	Rapid Shutdown Schemes for ITER	Walker	GA
98	Determination of stochastic heat transport by RMP in a non-rotating plasma	ELM control for ITER	Hudson	Oak Ridge Associated Universities
99	Effect of magnetic stocasticity on bootstrap current	ELM control for ITER	Hudson	Oak Ridge Associated Universities
100	Effect of plasma rotation on RMP	ELM control for ITER	Hudson	Oak Ridge Associated Universities
101	Dependence of ITER shape on effectiveness of RMP ELM suppression.	ELM control for ITER	Hudson	Oak Ridge Associated Universities
102	Fuel ion mass scaling of turbulence and transport	Transport model validation	McKee	U of Wisconsin
103	Pure ECH divertor power widths	Thermal transport in the boundary (2010)	Pitts	ITER Cadarache
104	Physics of NRMF torque	Physics of non-axisymmetric field effects in support of ITER	Garofalo	GA
105	Enhanced erosion from deuterium saturated materials during ELMs	Hydrogenic retention (2009)	Umstadter	UCSD
106	ECCD within magnetic islands	Heating and current drive	Prater	GA
107	Introduction of pre-characterized dust in divertor and SOL	General plasma boundary interfaces	Rudakov	UCSD
108	RMP particle sources and sinks with helium discharges	Physics of non-axisymmetric field effects in support of ITER	Unterberg	ORISE
109	Improving long-distance FW coupling to H-mode plasmas with gas puffing	Heating and current drive	Pinsker	GA
110	Dependence of high-k Turbulence on ExB Shear	Transport	Petty	GA
111	Develop hybrid QH-mode	ELM control for ITER	Burrell	GA
112	How do zonal flow-induced shear layers affect electron transport?	Transport	Schmitz	UCLA
113	Optimized plasma shape for RMP ELM suppression	ELM control for ITER	Petty	GA
114	Imaging the RMP stochastic boundary	Physics of non-axisymmetric field effects in support of ITER	Unterberg	ORISE
115	RMP ELM suppression at the NTV offset rotation	ELM control for ITER	Petty	GA
116	Quanitification of the requirements for ELM suppression by RMP from off midplane coils	ELM control for ITER	Kirk	UKAEA
117	Study transient neutral particle burst transport in RMP perturbed boundary	ELM control for ITER	Schmitz	Juelich
118	Stabilization of ICRF-induced giant sawteeth by suppressing core-localized TAE activity	Energetic particles (2010)	Kramer	PPPL

ID	Title	Research Area	Name	Affiliation
119	Exploration of He gas puff imaging for measurement of 2D electron density and temperature fields	General plasma boundary interfaces	Schmitz	Juelich
120	Disruption statistics and prediction	Disruption characterization	Wesley	GA
121	Optimized low-Z and mixed tas MGI	Rapid shutdown schemes for ITER	Wesley	GA
122	Dust generation from deposited layers and leading edges	General plasma boundary interfaces	Rudakov	UCSD
123	Thermal energy scan for low-Z MGI	Rapid shutdown schemes for ITER	Wesley	GA
124	2/1 NTM stab by ECCD in ITER Demo discharges	NTM stabilization including rotation dependence	La Haye	GA
125	Dependence of C deposition and D co-deposition rates on the surface temperature	Hydrogenic retention (2009)	Rudakov	UCSD
126	Transient divertor reattachment and detachment control	ITER demonstration discharges	Pitts	ITER Cadarache
127	Effect of islands on ECCD	Heating and current drive	Petty	GA
128	ELM filament propagation through SOL and interaction with main chamber wall	General plasma boundary interfaces	Rudakov	UCSD
129	Testing the sensitivity of GYRO-calculated turbulence to non-Maxwellian distribution functions	General integrated modeling	White	UCLA
130	Investigate disagreements between Thomson scattering and ECE measurements in high T_e discharges	Heating and current Drive	White	UCLA
131	DiMES erosion measurements with detached plasmas induced by argon injection	Hydrogenic retention (2009)	Rudakov	UCSD
132	New optimal plasma shape for AT scenario?	Core integration (steady state)	Petty	GA
133	Comparison of phase between density and electron temperature fluctuations with GYRO predictions	Transport model validation	White	UCLA
134	Fast pellet mass drift physics experiment	General ITER physics	Commaux	Oak Ridge Associated Universities
135	Influence of the density on the RMP ELM suppression	ELM control for ITER	Commaux	Oak Ridge Associated Universities
136	Pellet fueling in high density ITER-like discharges	General ITER physics	Commaux	Oak Ridge Associated Universities
137	Determination of particle transport using pellet injection	Transport	Commaux	Oak Ridge Associated Universities
138	Validation of an atomic model for the motional Stark effect spectrum.	Heating and current drive	Antoniuk	ORISE
139	B-Stark validation	Heating and current drive	Antoniuk	ORISE

ID	Title	Research Area	Name	Affiliation
140	ELM pacing using the new pellet dropper configuration	ELM control for ITER	Baylor	ORNL
141	Pellet ELM triggering physics study	ELM control for ITER	Baylor	ORNL
142	RMP-pellet compatibility	ELM control for ITER	Baylor	ORNL
143	β scaling of multi-field, multi-scale turbulence on DIII-D	Transport model validation	White	UCLA
144	Can the RMP coils eliminate ELMs from SNs with $B\times\nabla B$ out of the divertor?	ELM control for ITER	Petrie	GA
145	Comparison of impurity screening between ELMing and ELM-suppressed plasmas	ELM control for ITER	Petrie	GA
146	Is the radiating divertor scenario compatible with ELM suppression?	ELM control for ITER	Petrie	GA
147	Compatibility of ELM suppression with the radiating divertor in the hybrids	ELM control for ITER	Petrie	GA
148	What is the nature of the heat flux outside a slot divertor and are particle drifts important?	Thermal transport in the boundary (2010)	Petrie	GA
149	Realistic test of the compatibility of radiative divertor with AT plasma operation with RMP	Core-edge integration	Petrie	GA
150	Further development of co-NBI QH-mode	ELM control for ITER	Burrell	GA
151	Optimal location for fueling pumped DN plasmas	SOL main ion and impurity flows	Petrie	GA
152	Effect of particle drifts on deuteron and impurity exhaust in an ITER-like configuration	ITER demonstration discharges	Petrie	GA
153	Heat flux reduction in double-null plasmas	Thermal transport in the boundary (2010)	Petrie	GA
154	Active impurity removal from the core plasma	Core-edge integration	Petrie	GA
155	Investigate QH-mode without EHO	ELM control for ITER	Burrell	GA
156	Joint NSTX/DIII-D poloidal rotation experiment	Rotation physics (2009)	Burrell	GA
157	Measuring the structure of tearing modes	Stability	Petty	GA
158	FW coupling and electron heating in QH mode	ELM control for ITER	Pinsker	GA
159	Expand the high ℓ_i, β_N>4 operating regime through instability avoidance and higher heating power	Core integration (steady state)	Ferron	GA
160	Maintaining high ℓ_i at high β_N using RMP and near-axis current drive	Core integration (steady state)	Ferron	GA
161	Cross-cutting experiment to address LH transition physics and formation of edge shear layer	ITER scenario access, startup and ramp down	Rhodes	UCLA

ID	Title	Research Area	Name	Affiliation
162	Dependence of confinement and stability on toroidal rotation in high ℓ_i discharges	Core integration (steady state)	Ferron	GA
163	Extend the f_{NI} = 1 phase in the steady-state scenario and maintain q_{min} above 1.5	Core integration (steady state)	Ferron	GA
164	Routinely use feedback control of q_{min} during the I_p ramp up	Core integration (steady state)	Ferron	GA
165	Addressing the physics of ECH density pump-out via multi-scale/field turbulence measurements	Transport	Rhodes	UCLA
166	Clarification of minimum EC-driven current for complete NTM stabilization	NTM stabilization including rotation dependence	Isayama	JAERI
167	Assess the bootstrap current fraction as a function of the *q* profile in steady-state discharges	Assess steady-state current profiles for optimum performance	Ferron	GA
168	Detailed measurement of NTM island structure	Stability	Isayama	JAERI
169	Multi-scale, multi-field turbulence in reversed shear and ITB plasmas	Transport	Rhodes	UCLA
170	Beta limit and bootstrap current fraction in ITER steady-state scenario discharges	ITER demonstration discharges	Ferron	GA
171	Improve the ability to produce the exact, scaled ITER discharge shape in DIII-D	ITER demonstration discharges	Ferron	GA
172	Establish the requirements for 2/1 tearing mode stabilization by broadly deposited ECCD	Core integration (steady state)	Ferron	GA
173	Turbulence and transport dependence on ρ_* utilizing working gas species	Transport model validation	Rhodes	UCLA
174	Maximize the high noninductive fraction duration in the ITER shape discharges	ITER demonstration discharges	Ferron	GA
175	High-power modulated ECH to assess power deposition and heat transport models	Transport	Austin	U of Texas
176	Turbulence reduction via nonresonant magnetic field-driven velocity shear	Rotation physics (2009)	McKee	U of Wisconsin
177	Integrated diagnostics tool for non-axisymmetric MHD mode internal structure	Physics of non-axisymmetric field effects in support of ITER	Bogatu	FAR-TECH, Inc.
178	Test neutral penetration model for pedestal density width	Pedestal structure	Groebner	GA
179	Test EPED1 pedestal model at high density	Pedestal structure	Groebner	GA
180	ELM pacing with n=0 I-coil configuration	ELM control for ITER	West	GA

ID	Title	Research Area	Name	Affiliation
181	Turbulence and transport scaling with T_e/T_i in low rotation L&H modes	Transport model validation	McKee	U of Wisconsin
182	Dynamic error field correction for ITER	Physics of non-axisymmetric field effects in support of ITER	Strait	GA
183	Comparison of resonant and non-resonant n=1 error fields	Physics of non-axisymmetric field effects in support of ITER	Strait	GA
184	Dependence of halo currents on plasma current and q_{95}	Disruption characterization	Strait	GA
185	Study of edge plasma turbulence with RMP	Thermal transport in the boundary (2010)	Krasheninnikov	UCSD
186	Physics of sawtooth suppression in hybrid discharge	Core integration (advanced inductive)	Suzuki	JAEA
187	SOL and divertor behavior in hydrogen	Hydrogen and helium plasmas	Pitts	ITER Cadarache
188	Rotation effect on high β_p small ELM regimes	ELM control for ITER	Oyama	Japan Atomic Energy Agency
189	Controllability of pedestal and ELM characteristics by edge ECH/ECCD	ELM control for ITER	Oyama	Japan Atomic Energy Agency
190	Edge FW power loss versus edge density	Heating and current drive	Hosea	Princeton U
191	DIII-D/JET steady-state scenario comparison	Core integration (steady state)	Challis	UKAEA
192	Comparison of rotation effects on Type I ELMing H-mode in JT-60U and DIII-D	ELM control for ITER	Kamada	JAEA
193	Rotation and beta effects on ELM suppression/control by RMPs	ELM control for ITER	Loarte	ITER
194	Requirements of resonance window for ELM suppression with consant I_p	ELM control for ITER	Loarte	ITER
195	Fast-ion driven MHD instabilities and fast-ion transport in ASDEX Upgrade similar plasmas	Energetic particles (2010)	Garcia-Munoz	IPP
196	FILD commissioning	Energetic particles (2010)	Garcia-Munoz	IPP
197	Fast-ion driven MHD instabilities and fast-ion transport in ASDEX Upgrade similar plasmas	Energetic particles (2010)	Garcia-Munoz	IPP
198	Stability and electron thermal transport effects of high-n modes in QH plasmas	Energetic particles (2010)	Nazikian	PPPL
199	Effect of low-n RSAEs, TAEs on electron thermal transport	Energetic particles (2010)	Nazikian	PPPL
200	stability and structure of the E-GAM	Energetic particles (2010)	Nazikian	PPPL
201	Validation of integrated modeling	General integrated modeling	Budny	PPPL
202	Validation of integrated modeling	General integrated modeling	Budny	PPPL
203	Input power requirements for access to H-mode, Type III ELMy H-mode and high confinement H-modes	General ITER physics	Alberto	ITER

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204	Pedestal scaling for discharges dominated by pellet fueling	Pedestal structure	Loarte	ITER
205	Effect of TF ripple on pedestal plasma studied by radial shifts	Pedestal structure	Loarte	ITER
206	H-mode/pedestal physics and particle transport ECRH heated Type I ELMy H-modes	General ITER physics	Loarte	ITER
207	Comparison of rotation in ECCD plasmas to C-Mod LHCD	Rotation physics (2009)	Rice	MIT PSFC
208	Generation of current hole by ECCD alone and its conversion to AT plasma	Torkil Jensen Award for innovative research	Shiraiwa	PSFC, MIT
209	Effects of mixed plasma exposure on D retention and surface damage of tungsten	Hydrogen and helium plasmas	Ueda	Osaka U, Japan
210	Comparison of rotation effects on Type I ELMing H-mode in JT-60U and DIII-D	Pedestal structure	Kamada	Japan Atomic Energy Agency
211	Role of ECRF on toroidal rotation profile	Rotation physics (2009)	Yoshida	JAEA
212	Transport during transients in ITER	Transport model validation	Alberto	ITER
213	NSTX/DIII-D TAE avalanche and RSAE simularity experiment	Energetic particles (2010)	Fredrickson	PPPL
214	Model-based current profile control during the ramp-up phase in DIII-D	Integrated and model-based control	Schuster	Lehigh U
215	Model-based current and kinetic profile control during the flattop phase in DIII-D	Integrated and model-based control	Schuster	Lehigh U
216	Shape effects on ℓ_i during ITER-like current ramp down	ITER scenario access, startup and ramp down	Casper	LLNL
217	Heating, H-to-L transition and limited plasma effects on ℓ_i during ITER-like current ramp down	ITER scenario access, startup and ramp down	Casper	LLNL
218	Generation of ring of relativistic electrons	Torkil Jensen Award for innovative research	Prater	GA
219	Rotation dependence of hybrid tearing β limit and ECRH control requirements	NTM stabilization including rotation dependence	Buttery	UKAEA
220	Rotation dependence of hybrid tearing β limit and ECRH control requirements	Core integration (advanced inductive)	Buttery	UKAEA
221	Two point *q*=3.1 "ITER Reference" scans for baseline scenario β and error field limits	ITER demonstration discharges	Buttery	UKAEA
222	Two point *q*=3.1 "ITER Reference" scans for baseline scenario β and error field limits	Physics of non-axisymmetric field effects in support of ITER	Buttery	UKAEA
223	Two point *q*=3.1 "ITER Reference" scans for baseline scenario β and error field limits	Stability	Buttery	UKAEA
224	ITB torque scan	Transport	Greenfield	GA

ID	Title	Research Area	Name	Affiliation
225	Error field sensitivity of low torque intermediate β_N plasmas	Physics of non-axisymmetric field effects in support of ITER	Buttery	UKAEA
226	ITB dynamics while changing between pressure gradient and rotation dominated ExB shear	Transport	Greenfield	GA
227	Scaling of baseline scenario error field sensitivity towards ITER	Physics of non-axisymmetric field effects in support of ITER	Buttery	UKAEA
228	One shot 2/1 island size dependence on rotation	Stability	Buttery	UKAEA
229	Disruption forces	Disruption characterization	Greenfield	GA
230	Looking for the upturn of NTM thresholds with strong counter rotation to test NTM physics	Stability	Buttery	UKAEA
231	ELM suppression by RMPs at ITER-like additional heating level	ELM control for ITER	Loarte	ITER
232	ELM suppression by RMPs at low and high densities and associated pedestal/divertor behavior	ELM control for ITER	Loarte	ITER
233	ELM suppression by RMPs during transient phases of discharges	ELM control for ITER	Loarte	ITER
234	Localization of ripple-field induced fast-ion losses	Physics of non-axisymmetric field effects in support of ITER	Kramer	PPPL
235	Impact of a mock-up ferromagnetic test blanket module on plasma operations in DIII-D	Physics of non-axisymmetric field effects in support of ITER	Snipes	ITER Organization
236	Characterization of H-to-L and L-to-H transitions and control in ITER shape	ITER scenario access, startup and ramp down	Casper	LLNL
237	Destabilization of fast particle stabilized sawteeth in ITER-like baselines for NTM avoidance	Energetic particles (2010)	Buttery	UKAEA
238	Quantify effects of test blanket module on performance	Physics of non-axisymmetric field effects in support of ITER	Greenfield	GA
239	Quantify effects of test blanket module on performance	Energetic particles (2010)	Greenfield	GA
240	Disruption mitigation by real time control of locked modes	ITER scenario access, startup and ramp down	Buttery	UKAEA
242	Disruption mitigation by real time control of locked modes	Torkil Jensen Award for innovative research	Buttery	UKAEA
243	Evaluation of diamond as a plasma facing material	General plasma boundary interfaces	Lisgo	UKAEA
244	Characterization of heat loads due to Type-I ELMs	ELM control for ITER	Jakubowski	Juelich
245	Aspect ratio scaling of Alfvén eigenmode structure and avalanche transport	Energetic particles (2010)	Crocker	UCLA
246	Validation of code predictions for the sensitivity of turbulence and transport to T_e/T_i ratio	Transport model validation	White	UCLA

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247	Impurity and radiation asymmetry during massive gas injection disruption mitigation	Disruption characterization	Whyte	Massachusetts Institute of Technology
248	Study of sawtooth physics by ECEI	Stability	Park	Pohang U of Science and Technology
249	O-bake of DIII-D + $^{13}CH_4$-trace experiment re tritium recovery in ITER	Hydrogenic retention (2009)	Stangeby	U of Toronto
250	VDE and VUD characterization for ITER	Disruption characterization	Wesley	GA
251	Snowflake divertor	Core-edge integration	Umansky	LLNL
252	Characterization of power fluxes to PFCs during VDEs, ITER-relevant disruptions	Disruption characterization	Loarte	ITER
253	Beam-ion transport by plasma turbulence	Energetic particles (2010)	Heidbrink	UC, Irvine
254	Pitch resonant vs non-resonant perturbation effects on pedestal and ELM	ELM control for ITER	Moyer	UCSD
255	Runaway discharge position control and controlled loss of runaway electrons	Rapid shutdown schemes for ITER	Loarte	ITER
256	Revisiting the current limit at q_{95}~2 in RWM perspective	Torkil Jensen Award for innovative research	In	FAR-TECH, Inc.
257	Beam-ion transport by plasma turbulence	Energetic particles (2010)	Heidbrink	UC, Irvine
258	Investigate the relative roles of density and collisionality in RMP ELM control response	ELM control for ITER	Moyer	UCSD
259	Giant sawteeth that never crash	Energetic particles (2010)	Heidbrink	UC, Irvine
260	Study of NTM physics by ECEI system	NTM stabilization including rotation dependence	Park	Pohang U of Science and Technology
261	RMP field penetration studies	Physics of non-axisymmetric field effects in support of ITER	Moyer	UCSD
262	Fast-ion transport by sawteeth	Energetic particles (2010)	Heidbrink	UC, Irvine
263	POP test of a low-Z gas IRD	Rapid shutdown schemes for ITER	Wesley	GA
264	Measurement of structure, flows, and turbulence associated with tearing mode islands	Stability	Carter	UCLA
265	Image 3D structure in RMP H-modes	ELM control for ITER	Moyer	UCSD
266	Validate Wingen magnetic field model using pedestal ECH	ELM control for ITER	Moyer	UCSD
267	Deep pellet fueling of RMP H-modes	ELM control for ITER	Moyer	UCSD
268	Deep core fueling in ELM suppressed RMP H-modes using D_2 filled hollow shell pellets	Torkil Jensen Award for innovative research	Evans	GA

ID	Title	Research Area	Name	Affiliation
269	Low rotation ITER scenarios — impact on confinement and fusion performance	ITER demonstration discharges	Doyle	UCLA
270	Solenoidless startup studies in DIII-D	Torkil Jensen Award for innovative research	Cunningham	MAST
271	SOL characteristics and PFC energy loads during ramp-up/down	Thermal transport in the boundary (2010)	Pitts	ITER Cadarache
272	Effect of plasma rotation upon MGI impurity assimilation	Rapid shutdown schemes for ITER	Eidietis	GA
273	Study of runaway beam loss into wall	Disruption characterization	Yu	UCSD
274	Ion gyroradius scaling of the coupled turbulence/zonal flow system at the LH transition	Transport	Yan	UCSD
275	Effect of NTMs upon shell pellet deposition	Rapid shutdown schemes for ITER	Eidietis	GA
276	Image NTM structure during ECCD growth and suppression	Stability	Yu	UCSD
277	Benchmark measurements of NTM island structure using fast camera and ECE	Stability	Yu	UCSD
278	Effect of mode coupling on NTM dynamics	Stability	Yu	UCSD
279	Real-time β control via NTM width modulation	General plasma control/operations	Eidietis	GA
280	Sawtooth instability studies with gas puffing for imaging	Stability	Yu	UCSD
281	Measurements of spiral MHD structure induce by pellet injection	Stability	Yu	UCSD
282	He Startup in DIII-D with transition to D/H plasma in I_p ramp	Hydrogen and helium plasmas	Leuer	GA
283	Confirm that flow shear acts to reduce NTM island size	Stability	La Haye	GA
284	Structure of the plasma response to kink resonant perturbations in AT steady-state scenario	Physics of non-axisymmetric field effects in support of ITER	Lanctot	Columbia U
285	Fast shutdown with shell pellets	Rapid shutdown schemes for ITER	Hollmann	UCSD
287	Current-driven RWM mode structure time evolution and IPEC analysis	RWM physics including rotation dependence	Okabayashi	Princeton U
288	Measurements of hydrogenic retention and isotope exchange using H_2 vs D_2 fueling.	Hydrogenic retention (2009)	Hollmann	UCSD
289	Effect of hot ions on RWM stability	RWM physics including rotation dependence	Reimerdes	Columbia U
290	Comparison of RWM stability in DIII-D and NSTX	RWM physics including rotation dependence	Reimerdes	Columbia U
291	Prep-101: current-driven RWM tool refinements of C- and I-coil dynamic error field correction	RWM physics including rotation dependence	Okabayashi	Princeton U

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292	Real-time stability measurement using active MHD spectroscopy	RWM physics including rotation dependence	Reimerdes	Columbia U
293	DIII-D and NSTX m/n=2/1 NTM comparison allows testing aspect ratio physics (including rotation)	Stability	La Haye	GA
294	Identification, extraction, and reallocation of DEFC in RWM stabilization at q_{95}~4	RWM physics including rotation dependence	In	FAR-TECH, Inc.
295	ITER startup studies in DIII-D	ITER scenario access, startup and ramp down	Jackson	GA
296	Feedback stabilization and mode helicity of current-driven RWM at q_{95}~3	RWM physics including rotation dependence	In	FAR-TECH, Inc.
297	Development of ITER ramp down scenarios without VDEs or disruptions	ITER scenario access, startup and ramp down	Jackson	GA
298	Particle pinch in H-Mode pedestal?	Pedestal structure	Callen	U of Wisconsin
299	Fast-ion effects on intrinsic rotation (combined rf exp. on rotation, core TAEs and sawtooth stabilization)	Rotation physics (2009)	Nave	Instituto Superior Tecnico
300	Investigate scaling of residual stress/effective intrinsic torque with edge pressure gradient	Rotation physics (2009)	Solomon	Princeton U
301	Fully integrated ITER operational scenarios	ITER scenario access, startup and ramp down	Doyle	UCLA
302	Relationship between momentum and particle pinch and dependence on collisionality	Rotation physics (2009)	Solomon	Princeton U
303	Measurement of enhanced jxb torque driven by enhanced fast ion transport	Energetic particles (2010)	Solomon	Princeton U
304	Hybrid operation with electron heating and T_e~T_i	Core integration (advanced inductive)	Doyle	UCLA
305	Active MHD spectroscopy for unstable RWM using feedback with complex gains	RWM physics including rotation dependence	In	FAR-TECH, Inc.
306	Sawtooth crash flow generation, damping, and multiscale, multifield turbulence response	Torkil Jensen Award for innovative research	Hillesheim	UCLA
307	Maintenance of high β reverse shear discharges with ITBs	Assess steady-state current profiles for optimum performance	Doyle	UCLA
308	Pedestal scaling in hydrogen plasmas	Hydrogen and helium plasmas	Snyder	GA
309	Physics of the super X divertor	General plasma boundary interfaces	Garofalo	GA
310	Fast ion instability validation plasmas	Energetic particles (2010)	Van Zeeland	GA
311	Pedestal studies in helium plasmas	Hydrogen and helium plasmas	Snyder	GA

ID	Title	Research Area	Name	Affiliation
312	Energetic-particle driven RWM: comparison DIII-D/JT60-U with the emphasis of residual error field	RWM physics including rotation dependence	Matsunaga	Japan Atomic Energy Agency
313	Test ELM suppression by RMPs in counter-rotating plasmas	ELM control for ITER	Nardon	UKAEA
314	Investigate the effect of a slow I-coils ramp down after a fast initial ramp up	ELM control for ITER	Nardon	UKAEA
315	MHD induced fast ion transport	Energetic particles (2010)	Van Zeeland	GA
317	β induced Alfvén acoustic eigenmode (BAAE) studies	Energetic particles (2010)	Van Zeeland	GA
318	ρ_* scaling of Alfvénic activity using hydrogen discharge	Energetic particles (2010)	Van Zeeland	GA
319	L-H transition mechanism study through comparison of different triggers: NBI, ECH, and sawtooth	Transport	Wang	UCLA
320	Edge low-density locked mode (LDLM) I. mode penetration at electron velocity-reversal surface	Physics of non-axisymmetric field effects in support of ITER	Waelbroeck	IFS, U. Texas
321	RWM stability with zero neutral beam torque	RWM physics including rotation dependence	Strait	GA
322	Study of high temperature pedestals in JET	ELM control for ITER	Solano	JET and Ciemat, Spain
323	Edge low-density locked mode (LDLM) II: locked EHO	Physics of non-axisymmetric field effects in support of ITER	Waelbroeck	IFS, U. Texas
324	Modification of plasma rotation using NTV torque	Rotation physics (2009)	Sabbagh	Columbia and NSTX
325	Super H-Mode	Torkil Jensen Award for innovative research	Snyder	GA
326	ITER baseline H-mode access	ITER scenario access, startup and ramp down	Wang	UCLA
327	Hyper-velocity high-density ^{60}C-Fullerene plasma jet for disruption mitigation	Rapid shutdown schemes for ITER	Bogatu	FAR-TECH, Inc.
328	Power hysteresis in ITER baseline scenario	ITER demonstration discharges	Wang	UCLA
329	ELM-driven RWM: comparison between DIII-D and JT-60U	RWM physics including rotation dependence	Okabayashi	Princeton U
330	Scaling of conventional H-mode power hysteresis in DIII-D	Transport	Wang	UCLA
331	Multiple low-n RWM identification and feedback control	RWM physics including rotation dependence	In	FAR-TECH, Inc.
332	Pedestal variation with collisionality	Pedestal structure	Snyder	GA
333	Low radial electric field For maximum NTV	Physics of non-axisymmetric field effects in support of ITER	Cole	U of Wisconsin
334	Taking ITER baseline demonstration discharges to more reactor relevant conditions	ITER demonstration discharges	Doyle	UCLA

ID	Title	Research Area	Name	Affiliation
335	Eigenmode model-based n=1 RWM feedback control with Kalman filter	Integrated and model-based control	In	FAR-TECH, Inc.
336	ELM pacing driven by non-resonant magnetic fields	ELM control for ITER	Solomon	Princeton U
337	n_e and T_e fluctuation level and radial correlation length in both low and high field side of L-mode	Transport model validation	Wang	UCLA
338	Test of kinetic ballooning mode constrained pedestal	Pedestal structure	Snyder	GA
339	Can we prevent locked mode from being locked?	Physics of non-axisymmetric field effects in support of ITER	In	FAR-TECH, Inc.
340	Catastrophic MHD-affiliated non-axisymmetric fields	Physics of non-axisymmetric field effects in support of ITER	In	FAR-TECH, Inc.
341	n=1 braking in counter rotation	Physics of non-axisymmetric field effects in support of ITER	Reimerdes	Columbia U
342	Pedestal optimization with ELM suppression	Pedestal structure	Snyder	GA
343	Validation of FIDA upgrade in quiet plasma	Energetic particles (2010)	Muscatello	UC, Irvine
344	Validation of transport elongation scalings	Transport model validation	Holland	UCSD
345	RWM stability above no-wall limit in AT plasmas with q~2 and near zero rotation	RWM physics including rotation dependence	Okabayashi	Princeton U
346	Tungsten surface treatments for thermography	General plasma boundary interfaces	Lasnier	LLNL
347	Rotate RMP perturbation to spread the divertor heat flux	Physics of non-axisymmetric field effects in support of ITER	Lasnier	LLNL
348	Dependence of pedestal on heating method	Pedestal structure	Groebner	GA
349	Feedback from t=0: developing DEFC from t=0	RWM physics including rotation dependence	Okabayashi	Princeton U
350	Validation of R/L_{Te} Transport scalings	Transport model validation	Holland	UCSD
351	Rotation dependence of the LH power threshold in ITER & C-Mod like configurations	Rotation physics (2009)	McKee	U of Wisconsin
352	Particle Exhaust from RMP ELM suppressed LSN discharges vs X-point height	ELM control for ITER	Unterberg	ORISE
353	Measurement of error field penetration/shielding with slowly rotating n=2 fields	Physics of non-axisymmetric field effects in support of ITER	Reimerdes	Columbia U
354	Kink mode-resonant windows in q_{95} for n=3 fields with even and odd parity	Physics of non-axisymmetric field effects in support of ITER	Reimerdes	Columbia U
355	Target plate profiles during ELM suppression	ELM control for ITER	Watkins	Sandia National Lab
356	Type III ELM heat flux profile and scaling	Thermal transport in the boundary (2010)	Lasnier	LLNL

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357	Effect if RMP strength on pedestal height	ELM control for ITER	Groebner	GA
358	Burning plasma simulator with control via pedestal	Integrated and model-based control	Snyder	GA
359	Critical ν* for density pumpout in ITER	Physics of non-axisymmetric field effects in support of ITER	Joseph	UCSD
360	The RMP plasma edge and impurity control	ELM control for ITER	Watkins	Sandia National Lab
361	Compatibility of RMP ELM suppression with large NRMF torque	Physics of non-axisymmetric field effects in support of ITER	Garofalo	GA
362	Target plate heat flux, sheath power transmission factor, and power accounting	General plasma boundary interfaces	Watkins	Sandia National Lab
363	Sheath factor measurement in unbalanced double null	General plasma boundary interfaces	Watkins	Sandia National Lab
364	Secondary divertor and SOL	General plasma boundary interfaces	Watkins	Sandia National Lab
365	Suppression of first ELM following the L-H transition	ELM control for ITER	Evans	GA
366	Target plate Vf evolution as an indicator of ELM suppression	Torkil Jensen Award for innovative research	Watkins	Sandia National Lab
367	Electron heat transport in 3rd harmonic-ECH-heated hybrid plasmas	Transport	Schmitz	UCLA
368	Dynamic D retention studies	Hydrogenic retention (2009)	Pigarov	UCSD
369	Investigations of ITER-like castellation: castellation shaping to reduce fuel inventory in the gaps	Hydrogenic retention (2009)	Litnovsky	Juelich
370	Mirror tests for ITER diagnostics: impact of wall conditioning by oxidation on mirror properties	Hydrogenic retention (2009)	Litnovsky	Juelich
371	Mirror tests for ITER diagnostics: active control over the deposition on mirrors by the gas feed	General ITER physics	Litnovsky	Juelich
372	Measurement of in-plasma neutral beam atom excited state lifetime	Transport model validation	McKee	U of Wisconsin
373	Excitation of the geodesic acoustic mode via radial field oscillation	Transport	McKee	U of Wisconsin
374	Exploration of better feedback toward q=3, 2 and usage of hybrid current-/pressure-driven RWM	RWM physics including rotation dependence	Okabayashi	Princeton U
375	Error field threshold in counter rotation	Physics of non-axisymmetric field effects in support of ITER	Garofalo	GA
376	Steady-state high β with NCS and q_{min}>2	Assess steady-state current profiles for optimum performance	Garofalo	GA

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377	Baffled-probe measurements of plasma properties at the divertor	General plasma boundary interfaces	Raitses	PPPL
378	He/D_2 plasma exposure of VPS-W for EAST	General plasma boundary interfaces	Luo	ASIPP
379	Investigation of hybrid scenario access conditions with similar ν*, ρ*, β, *q* and rotation	Core integration (advanced inductive)	Joffrin	JET-EFDA-CSU
380	Driven open loop stabilization of vertical instability	Torkil Jensen Award for innovative research	Humphreys	GA
381	Role of MHD in disruption mitigation	Rapid shutdown schemes for ITER	Humphreys	GA
382	Role of κ and growth rate in RE suppression	Disruption characterization	Humphreys	GA
383	Demonstrate integrated active control methods for optimal rapid shutdown	Rapid shutdown schemes for ITER	Humphreys	GA
384	Vertical stability controllability physics for ITER	ITER scenario access, startup and ramp down	Humphreys	GA
385	Improved gas jet disruption mitigation by I-coil-enhanced impurity transport	Rapid shutdown schemes for ITER	Humphreys	GA
386	Vertical stability control using C-coil and I-coil	General plasma control/operations	Humphreys	GA
387	Application of DEFC from t=0, considering the application to ITER Ohmic period	Physics of non-axisymmetric field effects in support of ITER	Okabayashi	Princeton U
388	Resolve interior of separatirx lobes by very slow q_{95} sweeps	Physics of non-axisymmetric field effects in support of ITER	Schmitz	Juelich
389	A possibility of modifying the VDE process by the DEFC application	Physics of non-axisymmetric field effects in support of ITER	Okabayashi	Princeton U
390	Study of high temperature pedestals in VH-mode	ELM control for ITER	Solano	Ciemat
391	Coupling between peering mode driven RWM and ELM and possible issues of non-helicity-preferred DEFC	Physics of non-axisymmetric field effects in support of ITER	Okabayashi	Princeton U
392	Investigate physics of rotation modification of EHO-induced edge transport	ELM control for ITER	Burrell	GA
393	Study of non-axisymmetric field coupling with rotating magnetic perturbation fields	Torkil Jensen Award for innovative research	Stoschus	Juelich
394	Deposition and erosion studies with the DiMES PPI sample in detachment	Hydrogenic retention (2009)	McLean	U of Toronto
395	Tearing mode stability of high-β discharges	Core integration (steady state)	Turco	Oak Ridge Associated Universities
396	Tearing mode stability in presence of pellet fueling	Core integration (steady state)	Turco	Oak Ridge Associated Universities

ID	Title	Research Area	Name	Affiliation
397	ITER Demo steady state target scenario development	ITER demonstration discharges	Murakami	ORNL
398	Extend fully noninductive high-β operation	Core integration (steady state)	Murakami	ORNL
399	Complete prototype off-axis NBCD	Heating and current drive	Murakami	ORNL
400	ITER accessibility to hybrid regime using rf	ITER demonstration discharges	Murakami	ORNL
401	The role of fast ion loss in ELM-free plasmas	ELM control for ITER	Zhu	UC, Irvine
402	Fast wave heating and current drive in AT plasmas	Heating and current drive	Murakami	ORNL
403	Modulation of ECCD for 2/1 NTM suppression	NTM stabilization including rotation dependence	Welander	GA
404	Effect of rotation, nonresonant field perturbation, β_p, and triangularity on ELM size	ELM control for ITER	Osborne	GA
405	Experimental investigations on current driven RWM feedback control	RWM physics including rotation dependence	Marrelli	Consorzio RFX
406	ECRH at the 3rd Harmonic	Heating and current drive	Volpe	Max-Planck Institute for Plasma Physics
407	Electron Bernstein wave studies	Heating and current drive	Volpe	Max-Planck Institute for Plasma Physics
408	ECH effects on pedestal and ELMs	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
409	Oblique ECE for radial alignment during NTM suppression	NTM stabilization including rotation dependence	Welander	GA
410	ECCD and Ohkawa CD stabilization of marginally peeling-unstable ELMs	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
411	Filling with ECCD an unstable ELM current-hole	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
412	ELM-pacing by modulated ECH/ECCD	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
413	ECH/ECCD modulated in the rotating ELM filament	Torkil Jensen Award for innovative research	Volpe	Max-Planck Institute for Plasma Physics
414	The full Monty: A complete ITER Ohmic discharge	ITER scenario access, startup and ramp down	Jackson	GA
415	H-mode pedestal width in ITER demonstration discharges	ITER demonstration discharges	Osborne	GA
416	Reynolds stress peak in momentum counter-injection H-modes	Rotation physics (2009)	Muller	UCSD
417	ECE imaging of ELM-NTM coupling	Core integration (advanced inductive)	Petty	GA

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418	Dimensionless parameter scaling of the H-mode edge transport barrier width.	Pedestal structure	Osborne	GA
419	Effect of ECH/ECCD on H-mode Pedestal Characteristics and ELMs	Pedestal structure	Osborne	GA
420	Use of non-axisymmetric fields to reduce requirements for access to H-mode	Transport	Solomon	Princeton U
421	Invariance of SOL flows of plasma rotation in H-mode	Rotation physics (2009)	Muller	UCSD
422	Control of the heat and particle flux in radiative divertors	General plasma control/operations	Welander	GA
423	Study of termination event of pure co-injected QH-mode	ELM control for ITER	Osborne	GA
424	Role of flows and multi-scale fluctuations in RMP induced ELM-free operation	ELM control for ITER	Zeng	UCLA
425	Transition from drift to BAAE instabilities	Energetic particles (2010)	Gorelenkov	Princeton U, PPPL
426	Reynolds stress measurements deep inside LCFS in rotation experiments in L-mode	Rotation physics (2009)	Muller	UCSD
427	Investigation of ZMF zonal flows in plasmas with and without RMP	Physics of non-axisymmetric field effects in support of ITER	Krämer-Flecken	Juelich
428	Transition from drift to BAAE instabilities	Energetic particles (2010)	Gorelenkov	PPPL, Princeton U
429	Active disruption avoidance	Disruption characterization	Strait	GA
430	Reynolds stress and flow evolution during an L-H transition	Transport	Muller	UCSD
431	Multi-experiment validation of edge-turbulence codes against basic experiments and DIII-D	Transport model validation	Muller	UCSD
432	Preferential locking — complete stabilization and avoidance of locked modes	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
433	Locked mode AVOIDANCE by "catching" its precursor with a rotating field	Torkil Jensen Award for innovative research	Volpe	Max-Planck Institute for Plasma Physics
434	Pellet in a locked-mode	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
435	NBCD in a locked mode	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
436	Unlocking by NBI torque and locking/unlocking hysteresis	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics

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437	Modulate I-coils to induce edge currents and affect/study ELMs	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
438	Modulate I_p to modulate edge current above/below peeling limit	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
439	NTMs "on demand", by ECH	Core integration (advanced inductive)	Volpe	Max-Planck Institute for Plasma Physics
440	NTMs "on demand", by modulated ECCD	Core integration (advanced inductive)	Volpe	Max-Planck Institute for Plasma Physics
441	Test of causality: mode rotation vs. plasma rotation	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
442	Disruption mitigation with large, shattered pellets	Rapid shutdown schemes for ITER	Jernigan	ORNL
443	Effect of impurities and wall conditioning on NTMs	Stability	Volpe	Max-Planck Institute for Plasma Physics
444	ECH target development for disruption mitigation experiments	Rapid shutdown schemes for ITER	Jernigan	ORNL
445	Onset condition on anomaly in off-axis NBCD	Heating and current drive	Myung Park	ORNL
446	Fully noninductive operation using off-axis NBCD	General SSI	Myung Park	ORNL
447	Simultaneous control of ELMs and RWMs	RWM physics including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
448	Hot electron target plasma for runaway experiments	Disruption characterization	Jernigan	ORNL
449	Impact of RMP on L-H Transition Power Threshold	ELM control for ITER	Moyer	UCSD
450	Poloidal asymmetry of density profile in core region due to large poloidal rotation	Heating and current drive	Myung Park	ORNL
451	The q<1 regime	Torkil Jensen Award for innovative research	Politzer	GA
452	Quantify transport changes during RMP in H-modes	Physics of non-axisymmetric field effects in support of ITER	Moyer	UCSD
453	Collisionality effect of RMP on ELM control and density pump-out in 2 collisionality regimes	ELM control for ITER	Mordijck	UCSD
454	Assess optimal error field correction by modulating I-coils at incommensurable frequencies	Physics of non-axisymmetric field effects in support of ITER	Volpe	Max-Planck Institute for Plasma Physics
455	Pair formation during disruptions	Torkil Jensen Award for innovative research	Volpe	Max-Planck Institute for Plasma Physics
456	Study of resonant window for ELM suppression in q_{95} at I_p=const	ELM control for ITER	Marina	Cadarache

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457	Hybrid confinement and m/n=3/2 MHD	Core integration (advanced inductive)	Crisanti	Euratom-ENEA Fusion Association
458	ELM suppression at counter low plasma rotation	ELM control for ITER	Marina	Cadarache
459	Pedestal scaling between DIII-D, AUG and JET (ITPA-PEP-2)	Pedestal structure	Beurskens	UKAEA
460	Characteristics of m/n=2/1 modes at high β	Stability	Buratti	Euratom-ENEA Fusion Association
461	Summary of ORNL proposals on diagnostics for rf	Heating and current drive	Hillis	ORNL
462	ELM suppression with RMP in high performance AI plasmas	Physics of non-axisymmetric field effects in support of ITER	Politzer	GA
463	ELM suppression with RMP in high performance AI plasmas	ELM control for ITER	Politzer	GA
464	Transport of current and poloidal flux with voltage modulation	Heating and current Drive	Politzer	GA
465	Comparison of rotation in ECCD plasmas to C-Mod LHCD	Rotation physics (2009)	Rice	MIT PSFC
466	MHD and confinement in fully noninductive high β_p plasmas	Core integration (steady state)	Politzer	GA
467	Fast ions, NTMs, and the current profile in AI plasmas	Energetic particles (2010)	Politzer	GA
468	Fast ions, NTMs, and the current profile in AI plasmas	Core integration (advanced inductive)	Politzer	GA
469	Density dependence of n=1 error field tolerance in NBI heated H-modes	Physics of non-axisymmetric field effects in support of ITER	Reimerdes	Columbia U
470	AI and hybrid plasmas rotating in the counter-I_p direction	Core integration (advanced inductive)	Politzer	GA
471	Optimized AI operation for ITER (low rotation, T_e=T_i)	ITER demonstration discharges	Politzer	GA
472	Optimized AI operation for ITER (low rotation, T_e=T_i)	Core integration (advanced inductive)	Politzer	GA
473	Oblique-ECE-assisted MECCD suppression of 2/1 NTM	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
474	Compare co-/ctr-ECCD in O-/X-point (4 cases)	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
475	Search for core plasma H-mode trigger	Transport	Schmitz	UCLA
476	ITG-scale and intermediate-scale H-mode core turbulence vs shear	Transport	Schmitz	UCLA
477	Outer PF only startup on DIII-D	Torkil Jensen Award for innovative research	Mueller	PPPL
478	High bootstrap fraction noninductive operation at high G	Core integration (steady state)	Politzer	GA
479	Burn control simulation	General plasma control/operations	Politzer	GA

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480	Control requirements for self-organized, high β_p, noninductive plasma operation	General plasma control/operations	Politzer	GA
481	Pedestal modification and ELM effects via loop voltage (E_ϕ) variation	ELM control for ITER	Politzer	GA
482	Pedestal modification and ELM effects via loop voltage (E_ϕ) variation	Pedestal structure	Politzer	GA
483	ELM synchronization (pacing) via pulsed ECH	ELM control for ITER	Politzer	GA
484	Advanced inductive performance comparison in H and He plasmas	Hydrogen and helium plasmas	Politzer	GA
485	Elimination of ELMs from SNs using the RMP coils with $B \times \nabla B$ away from the divertor	Core-edge integration	Petrie	GA
486	Impurity screening comparison between ELMing and ELM-suppressed plasmas	Core-edge integration	Petrie	GA
487	Compatibility of ELM suppression with radiating divertor scenarios	Core-edge integration	Petrie	GA
488	Compatibility of ELM suppression with the radiating divertor in hybrid mode	Core-edge integration	Petrie	GA
489	Aerogel targets to study velocity, size and composition of dust particles in DIII-D SOL	General plasma boundary interfaces	Rudakov	UCSD
490	Compare AI and hybrid discharges with fishbones and with 3/2 NTMs	Core integration (advanced inductive)	Politzer	GA
491	Possible control of NTM mode in AI plasmas by shaping	Core integration (advanced inductive)	Politzer	GA
492	Access to advanced inductive and hybrid scenario plasmas in ITER	ITER Demonstration Discharges	Politzer	GA
493	Access to advanced inductive and hybrid scenario plasmas in ITER	ITER scenario access, startup and ramp down	Politzer	GA
494	Performance optimization of steady-state plasmas with ITER shape and low torque	ITER demonstration discharges	Challis	UKAEA
495	Lower-B ELM-control target plasma	ELM control for ITER	Schaffer	GA
496	Reproducibility of q_{95} RMP ELM suppression widow	ELM control for ITER	Evans	GA
497	The co- and counter- neutral beam switching experiment	Rotation physics (2009)	Ida	National Institute for Fusion Science
498	High central fast wave current drive efficiency at high electron β with ECH preheating	Heating and current drive	Pinsker	GA
499	Where are the &%$#! antenna arcs occurring?	General ITER physics	Pinsker	GA
500	QH mode with NRMF driven rotation	Physics of non-axisymmetric field effects in support of ITER	Garofalo	GA

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501	Characterize non-resonant magnetic torque offset rotation	Physics of non-axisymmetric field effects in support of ITER	Solomon	Princeton U
502	RMP ELM suppression dependencies	Physics of non-axisymmetric field effects in support of ITER	Schaffer	GA
503	Single-row ELM suppression vs q_{95}	Physics of non-axisymmetric field effects in support of ITER	Schaffer	GA
504	Phirsch-Schluter current in spiral footprints	Physics of non-axisymmetric field effects in support of ITER	Schaffer	GA
505	Suppression of first ELM at zero net torque	ELM control for ITER	Evans	GA
506	D injection for quantification of the recycling flux in the detached outer divertor of DIII-D	Hydrogenic retention (2009)	Brezinsek	FZJ/Germany
507	Measurement of thermo-electrically driven scrape-off-layer current (SOLC) in DIII-D discharges	General Plasma Boundary Interfaces	Takahashi	Princeton U
508	Core turbulence evolution and transport in RMP H-modes	Physics of non-axisymmetric field effects in support of ITER	Schmitz	UCLA
509	ETG turbulence scaling in RMP H-modes	Transport model validation	Schmitz	UCLA
510	Avoidance of disruptions due to the NTM-locking with feedback application	NTM stabilization including rotation dependence	Okabayashi	Princeton U
511	Active MHD spectroscopy under feedback stabilized plasmas	RWM physics including rotation dependence	Okabayashi	Princeton U
512	Determination of the intrinsic turbulence dispersion properties in the plasma reference frame	Transport model validation	Hillesheim	UCLA
513	Flow damping in response to transient momentum input	Rotation physics (2009)	Hillesheim	UCLA
514	Measurement of neoclassical edge current by lithium beam spectroscopy	Heating and current drive	Hudson	Oak Ridge Associated Universities
515	DiMES test of in situ carbon coating for FDF, reactor PFCs	Hydrogenic retention (2009)	Stangeby	U of Toronto
516	4/3 NTM as an n=3 RMP suppressing ELMs	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
517	ECH/ECCD modulated in the rotating ELM filament	ELM control for ITER	Volpe	Max-Planck Institute for Plasma Physics
518	Improved entrainment, with diagnostic applications	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
519	Easier modulated ECCD on forcefully rotated mode	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
520	Benefits of ECCD modulation as functions of phase, deposition width, misalignment and duty-cycle	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics

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521	ECCD modulated by horizontal ECE	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
522	Analogue approach to Mirnov modulation of ECCD, with phase scan	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
523	Torque waves	Rotation physics (2009)	Volpe	Max-Planck Institute for Plasma Physics
524	Current diffusion measured by MECCD and MSE	Heating and current drive	Volpe	Max-Planck Institute for Plasma Physics
525	Magnetic transport barriers from coalescing islands	Physics of non-axisymmetric field effects in support of ITER	Volpe	Max-Planck Institute for Plasma Physics
526	NTM stabilization by RMP stochastization of X-point	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
527	Offset velocity of NTMs	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
528	Imaging island formation for various NTM triggers	Stability	Volpe	Max-Planck Institute for Plasma Physics
529	Locked mode AVOIDANCE by "catching" its precursor with a rotating field	Disruption characterization	Volpe	Max-Planck Institute for Plasma Physics
530	Improved front end for RMP H-mode shots	ELM control for ITER	Fenstermacher	LLNL
531	Validation of TokSys a priori simulation of DIII-D plasma control	Integrated and model-based control	Humphreys	GA
532	Comparing static and dynamic particle balance	Hydrogenic retention (2009)	Whyte	Massachusetts Institute of Technology
533	Sawtooth control	Stability	Sauter	CRPP-EPFL
534	ECCD and hybrid scenario control	Core integration (advanced inductive)	Sauter	CRPP-EPFL
535	He pumping in AT-class plasmas	Core-edge integration	Petrie	GA
536	Triangularity impact on transport	Transport model validation	Staebler	GA
537	TEM dominated transport	Transport model validation	Staebler	GA
538	Low collision transport	Transport model validation	Staebler	GA
539	Dependence of momentum and particle pinch on collisionality	Rotation physics (2009)	Tala	Euratom-Tekes, VTT, Finland
540	Experimentally relevant benchmarks for gyrokinetic microstability codes	Transport model validation	Bravenec	Self-Employed
541	Carbon erosion in impurity seeded plasmas	General plasma boundary interfaces	Brezinsek	FZJ/Germany
542	Pair formation during disruptions	Disruption characterization	Volpe	Max-Planck Institute for Plasma Physics

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543	Compare ECCD+RMP with ECH-only control of disruptions	Disruption characterization	Volpe	Max-Planck Institute for Plasma Physics
544	Spiraling RMPs to find EFC	Physics of non-axisymmetric field effects in support of ITER	Volpe	Max-Planck Institute for Plasma Physics
545	Integrated disruption control	Disruption characterization	Volpe	Max-Planck Institute for Plasma Physics
546	Scaling of transport, turbulence and zonal flow/GAM damping with collisionality	Transport model validation	McKee	U of Wisconsin
547	Database of quasi-vacuum shots, plasma-response at low-beta and AA and SPA limits	Physics of non-axisymmetric field effects in support of ITER	Volpe	Max-Planck Institute for Plasma Physics
548	Locked mode avoidance by magnetic f/back on the saddle loops	NTM stabilization including rotation dependence	Volpe	Max-Planck Institute for Plasma Physics
549	ELM-driven RWM onset and the transport properties with/without suppressing ELM-driven RWM	Physics of non-axisymmetric field effects in support of ITER	Okabayashi	Princeton U
550	Scan to find (q_{min}, q_{95}) that maximize f_{BS} and evaluate the steady-state potential of this profile	Assess steady-state current profiles for optimum performance	Holcomb	LLNL
551	High pedestal density/collisionality RMP ELM suppressed discharges in helium	Hydrogen and helium plasmas	Schmitz	Juelich
552	H-mode core turbulence and transport scaling with RMP ELM suppression	ELM control for ITER	Schmitz	UCLA
553	Investigate field effects on stability versus profile evolution	Physics of non-axisymmetric field effects in support of ITER	Moyer	UCSD
554	Toroidal phase convergence on the DEFC iterations	Physics of non-axisymmetric field effects in support of ITER	Okabayashi	Princeton U
555	Investigate field effects on stability versus profile evolution	ELM control for ITER	Moyer	UCSD
556	Simulating ITER startup, scenario access, and ramp down in H_2 and He	Hydrogen and helium plasmas	Jackson	GA
557	Turbulence and transport dependence on Mach number in hybrid discharges	Transport	McKee	U of Wisconsin
558	I_p scan: Testing whether TGLF and GYRO results are consistent with multi-machine scaling laws	Transport model validation	White	UCLA
559	Test of turbulence spreading using turbulence propagation	Transport	Petty	GA
560	Toroidal/poloidal mapping of zonal flows and GAMs	Transport	Schmitz	UCLA
561	κ/κ' scaling	Transport model validation	Rhodes	UCLA