GA–A24617

DIII–D YEAR 2004 EXPERIMENT PLAN

by
DIII–D RESEARCH TEAM

MARCH 2004

DISCLAIMER

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GENERAL ATOMICS PROJECT 30200
MARCH 2004

FOREWORD

This document presents the planned experimental activities for the DIII–D National Tokamak Facility for the fiscal year 2004. 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 Tokamak Long Range Plan (GA–A23927). The Experiment Plan is developed yearly by the DIII–D Research Council and approved by DOE. DIII–D research progress is reviewed quarterly against this plan. The original 2004 plan, using the presidential budget, called for 21 weeks of tokamak operations. The present 2004 plan is based on a $56.0M DIII–D program funding for FY04, with $44.1M to GA, which allows for 18 weeks of tokamak operations. Other major collaborators include PPPL ($4.4M) LLNL ($3.1M), and ORNL ($2.6M). Funding of university collaborators are provided by DOE grants and GA subcontracts. In the event of other significant budgetary, technical, or programmatic changes this plan will be revised as necessary.

APPROVALS

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1. SYNOPSIS OF THE 2004 DIII–D RESEARCH PLAN

The research campaign for 2004 has been organized into five research thrusts and the ongoing four Topical Science Areas. Approximately 55% of the experimental time has been allocated to the research thrusts, since these activities are aimed directly at critical objectives for the DIII–D Program and for the tokamak research program generally. Additional experimental time in the topical areas maintains the breadth and scientific depth of the DIII–D Program. Below we convey the essential content of the various research thrust and topical science experiments and their goals and anticipated and hoped for results. The research described has been allocated to 65 run days out of a possible 90 run days, with 25 days of contingency and director's reserve. The original planning was performed for a 21 run week campaign. The recent budget rescission resulted in an 18 run week campaign for DIII-D in FY2004. The 18 run week campaign was arrived at by deferring one thrust (Thrust 6 – High ℓ_i scenarios) and six other experiments from a variety of areas. These experiments are expected to be conducted in FY2005. Additional detailed information can be found on the web, and related links: http://fusion.gat.com/exp/2004/.

The experiment plan was put together with input and prioritization by the year 2004 Research Council. Based on the "DIII–D Five-Year Program Plan 2003–2008," January 2003, GA–A23927, the Research Council develops a research plan which is annually updated. A summary of progress on DIII-D research for the 2003 experiment campaign is posted on the web (http://web.gat.com/exp/2004/review.html). With input from that review and considering the five-year plan, and advice from the Research Council, year 2004 research thrusts were identified. DIII-D experimental campaigns are planned to provide strong support for the physics needs of ITER as identified by the International Tokamak Physics Activity groups. Table 1 shows the support that DIII-D has provided for the ITPA proposed experiments.

Table 1
ITPA Topical Physics Group Proposals, November 2002 - Meeting Recommendations (Revised June 2003)

ID No	Proposal Title	DIII-D Progress in 2003	DIII-D Planned Experiments in 2004
CDB-2	β scaling of confinement in ELMy H-modes: β degradation	Completed factor-of-3 scan in beta (4 discharges) with Type-I and Type-III ELMs, including a factor-of-2 scan in β with Type-I ELMs only. Compared results with related experiments on JET.	
CDB-3	Improving the condition of Global ELMy H-mode and pedestal databases	DIII-D good confinement discharges are available in the global H-mode database, DB3V10 and later versions.	Exp. # 2004-01-02 ITPA pedestal similarity (DIII-D/JET ρ_*)
TP-1	Investigation of transport properties of candidate hybrid scenarios	Extended operating space of hybrid scenario to q_{95} ~ 3. Found two distinct regimes of hybrid operation: (a) $q_{95} > 4$ with small m=3/n=2 mode, no sawteeth, $\beta_N > 3$; and (b) $q_{95} < 4$ with very small m=3/n=2 mode, sawteeth, $\beta_N < 3$	Hybrid thrust has over 1 1/2 run weeks in 2004
TP-2	Investigation of transport properties of candidate steady-state scenarios	Extended operating space of hybrid scenario to q_{95} ~ 3. Found two distinct regimes of hybrid operation: (a) $q_{95} > 4$ with small m=3/n=2 mode, no sawteeth, $\beta_N > 3$; and (b) $q_{95} < 4$ with very small m=3/n=2 mode, sawteeth, $\beta_N < 3$	One of the major goals of the Hybrid thrust is to develop steady state discharges. Aproximately 1/2 of the AT thrust is directed towards sustained discharges.
TP-3	High performance operation with $T_e \sim T_i$	No progress in 2003 due to scheduling	One of the experiments of the Hybrid thrust will be directed towards $T_i = T_e$.
TP-4	Enhanced confinement operation with low external momentum input	No progress in 2003 due to scheduling	
TP-5	Improved physics understanding of QDB/ QH-mode operation	Strong shaping in the form of high triangularity and high elongation allows QH mode operation at edge densities close to 30% of Greenwald.	The QBD/QH-mode Thrust has more than one week of run time in 2004.
TP-6	Improved understanding of β-limits with ITB operation	Used EC power in heating and current drive modes to study the control of density, current and temperature profiles in QDB type ITBs.	
TP-7	Development of real-time profile control capabilities	Real time equilibrium reconstruction using MSE data is now functional in the DIII-D plasma control system. This provides values of q(0) and q_{min} in real time at intervals of ~6 ms.	Initial experiments on control of q(0) are planned using ECCd. Extending these initial results to control of other aspects of the q profile should be possible.
PEP-2	JET/DIII-D pedestal similarity studies	First phase of this experiment completed. The ETB width scaled as minor radius when dimensionless parameters were matched at the top of the H-mode pedestal. The DIII-D results alone showed no obvious ρ_* dependence in the ETB width. We would like to revisit the ρ_* scaling this year in the DOC-U JET shape to complete the ρ_* scaling.	Exp. # 2004-01-02 ITPA pedestal similarity (DIII-D/JET ρ_*)

Table 1 (Continued)
ITPA Topical Physics Group Proposals, November 2002 - Meeting Recommendations (Revised June 2003)

ID No	Proposal Title	DIII-D Progress in 2003	DIII-D Planned Experiments in 2004
PEP-4	Stability analysis with improved edge treatment	JT-60U current ramp discharges analyzed, compared to DIII-D. AUG grassy ELM data received, being analyzed	
PEP-5	Dimensionless identity experiments with JT-60U Type II ELMy H-modes in DIII-D		
PEP-8	Parameter similarity studies Quiescent H-mode regimes)	DIII-D achieved ITER pedestal ν_* and β_N values simulaneously. We also demonstarated pedestal density control using shaping. Similarity studies between machines has not yet begun.	The QBD/QH-mode thrust has more than one week of run time in 2004.
PEP-6	Impact of ELMs on the pedestal and SOL (effect of aspect ratio)	No Progress in 2003 due to scheduling	Exp. 2004-22-11 will study the aspect ratio scaling of pedestal and core confinement between DIII-D and NSTX (in 2005?)
PEP-14	QH-mode and QDB study using NBI and shape (JT-60U and DIII-D)		Approved US/Japan collaboration on this topic.
DSOL-1	Scaling of Type I ELM energy loss	A non-dimensional comparison of pedestal characteristics in DIII-D and JET was made. An initial analysis indicates the ELM size is a similar fraction of the pedestal energy in both cases.	Future experimental work will be to complete a ρ_* scan between JET and DIII-D. Modeling of the JET and DIII-D data will be performed.
DSOL-2	Tritium codeposition	An experiment was done to characterize the spatial deposition of C^{13} using injected C^{13}-methane in DIII-D. C^{13}-methane was injected toroidally uniformly from the top of the vessel through the upper baffle plenum entrance for 22 identical repeat shots. This was the last day of the 2003 run campaign, 29 tiles were removed prior to any other in-vessel work. Surface analysis to map the poloidal deposition pattern of C^{13} using these tiles is in progress at Sandia Laboratory.	A continuation of the C^{13} experiment is planned for 2004. #2004-23-05.
DSOL-3	Scaling of radial transport		The DIII-D boundary topical science area will contribute data to this research topic.
DSOL-4	Disruptions and effect on materials choices	No progress was made in this area this year.	Exp. 2004-21-03 will address disruption mitigation.
DSOL-3	Scaling of radial transport		The DIII-D boundary topical science area will contribute data to this research topic.

Table 1 (Continued)
ITPA Topical Physics Group Proposals, November 2002 - Meeting Recommendations (Revised June 2003)

ID No	Proposal Title	DIII-D Progress in 2003	DIII-D Planned Experiments in 2004
DSOL-6	Parallel transport in the SOL	UEDGE modeling of JET parallel mach numbers at the top of the plasma yields values somewhat less than measured, Compared SOLPS and UEDGE.	Exp. 2004-21-04 will compare SOL measurements withthe BOUT code.
MDC-1	Pressure and size scaling of gas jet penetration for disruption mitigation	Scaling of disruption mitigation efficiency vs gas jet pressure for both neon and argon was obtained on DIII-D. Machine size scaling on other devices is being discussed.	Exp. 2004-21-03 will address disruption mitigation.
MDC-2	Joint experiments on resistive wall mode physics	DIII-D personnel will participate in JET RWM experiments to be conducted on November 24.	Exp. 2004-04-10 is a cross machine comparison with JET on RWMs.
MDC-3	Joint experiments on neoclassical tearing modes (including error field effects)	β rampdown with m/n=3/2 NTM with different parameters yielded data for marginal conditions, i.e., re-stabilization to study threshold physics without complication of seeding physics.	NTM Exp. 2004-21-09 will involve strong collaboration with JET and TCV personnel.
MDC-4	Neoclassical tearing mode physics – aspect ratio comparison	None.	Under consideration.
MDC-5	Comparison of sawtooth control methods for neoclassical tearing mode suppression	ECCD (co) and ECRH was used in DIII-D to control sawteeth in L-mode discharges. Fine tuning the resonance by adjusting B_T allows destabilizing the sawteeth. i.e., making the period short and the amplitude small which are desirable for NTM avoidance.	Exp. 2004-21-04 is aimed at studying sawteeth.
MDC-6	Error field sideband effects for ITER	Experiments in DIII-D were run in ohmic discharges to induce locked modes with either the C-coil alone, several different phasings of the I-coil alone or combinations. Results show more that the m/n=2/1 error field component along determines locking. Experiments to match in JET will be run in January.	The 2004 campaign includes several experiments on error field studies.
SSEP-1	Preparation of ITER steady-state scenario	Extended operating space of hybrid scenario to $q_{95} \sim 3$. Found two distinct regimes of hybrid operation: (a) $q_{95} > 4$ with small m=3/n=2 mode, no sawteeth, $\beta_N > 3$; and (b) $q_{95} < 4$ with very small m=3/n=2 mode, sawteeth, $\beta_N < 3$.	One of the major goals of the Hybrid thrust is to develop steady-state discharges. Approximately 1/2 of the AT thrust is directed towards sustained discharges.
SSEP-2	Preparation of ITER hybrid scenario	Extended operating space of hybrid scenario to $q_{95} \sim 3$. Found two distinct regimes of hybrid operation: (a) $q_{95} > 4$ with small m=3/n=2 mode, no sawteeth, $\beta_N > 3$; and (b) $q_{95} < 4$ with very small m=3/n=2 mode, sawteeth, $\beta_N < 3$.	One of the major goals of the Hybrid thrust is to develop steady-state discharges. Approximately 1/2 of the AT thrust is directed towards sustained discharges.

A call for experimental research proposals towards those objectives was issued and over 450 proposals were presented at a community-wide Research Opportunities Forum (ROF) on December 9–11, 2003, which had significant remote participation. DIII-D was an active participant in the International Tokamak Physics Activity (ITPA) process conducted in 2002–2003, through which a number of joint international experiments were identified as high priority for the development of a database for burning plasma research. As a result of both these initiatives, we received 41 proposals from foreign laboratories. There were video conference, or at least telephone presentations, of the majority of these from outside the U.S. There was also Access Grid remote participation for proposals from Princeton Plasma Physics Laboratory (PPPL), Massachusetts Institute of Technology (MIT), and Oak Ridge National Laboratory (ORNL). All 2004 proposals can be viewed on the internet at http://d3dnff.gat.com/opportunity/2004/review.asp/. The thrust and topical science area (TSA) groups prioritized, combined, and otherwise sifted these ideas. The plans so arrived at were presented to the Research Council in January, 2004 and the advice of the Research Council was used to set the final allocations of run time for the year 2004 campaign.

DIII–D continues to have a large research backlog as shown in Table 2. A very good measure of this backlog is obtained from the run day requests from the research groups for the original 21 week option. The total requested by all of the thrusts and TSAs is 188 days for the 21 week operation. These 188 days are made up of experiments carefully considered, culled, combined, and optimized by run time from the total ROF submission list. All are high priority experiments. A 50-week run plan would be needed to reasonably expect to execute this 188 days of high priority experiments, that is, requiring nearly three years at a reasonable rate of 18 run weeks per year.

Table 2
Accounting of Run Day Requests for the 2004 Campaign

	Days Requested		Days Allocated		
Area	21 Week	18 Week	21 Week	18 Week	Proposals Received
Stability TSA	15		8	8	54
Boundary TSA	16.5		9	8	57
Confinement TSA	18		11	10	71
H&CD TSA	10		4	4	29
T1 edge pedestal	17		8	7	57
T4 RWM	21		9	8	60
T6 Hi ℓ_i	11		4	0	13
T8 AT scenarios	26.5		12	11	59
T9 QH	10.5		4	3	30
T10 Hybrid	12		6	6	22
Totals	187.5		75	65	452

The 18 run week 2004 experiment plan, summarized in Table 3, consists of efforts in five thrust areas and four topical areas.

Table 3
Run Time Allocations for the 2004 Experiment Campaign

#	Acronym	Description	18 wk Plan (Days)	Area Leaders
1	Edge pedestal	Determine the pedestal height and ELM size dependence on plasma parameters and atomic physics	7	**M. Fenstermacher** P. Snyder
4	RWM	Advance the physics understanding of resistive wall mode stabilization and validate effectiveness of internal coils	8	**M. Okabayashi** H.Reimerdes, E. Strait
8	AT scenario	Continue high beta full noninductive scenario development with new tools	11	**C. Greenfield** A. Garofalo
9	QH–mode	Develop an understanding of the QH–mode for ELM-free scenario projection to burning plasmas	3	**P. West** D. Doyle
10	Hybrid scenarios	Integrated, long-pulse scenario development for burning plasmas	6	**M. Wade** J. Jayakumar
		Thrust totals	35	
		Stability topical area	8	**E. Strait**
		Confinement topical area	10	**K. Burrell**
		Boundary topical area	8	**S. Allen**
		Heating and current drive topical area	4	**R. Prater**
		Total allocated days	65	
		Director’s reserve	3	
		Contingency	22	
		Available days	90	

- Thrust #1 edge pedestal (7-days, in the 18 week plan)

  Significant effort will be devoted this year to exploring the feasibility of mitigating and suppressing Type-I ELMs using edge stochastic magnetic field perturbations. Experiments and modeling in 2004 will also carry on the 3–5 year plan established in 2003 to understand the physics mechanisms setting the width/ height of the density and temperature pedestals in ELMing H-mode. Other experiments this year will focus on understanding the physics of Type-I ELM onset. Exploration of the VH-mode pedestal evolution and techniques for steady operation of VH-mode will be performed.

- Thrust #4 RWM (8-days)

  The ultimate goal of thrust 4 is the development of experimental methods to stabilize the resistive wall mode (RWM), which is a prerequisite for operation above the no-wall beta limit. One possibility is the stabilization of the RWM by sufficient toroidal plasma rotation, which has been demonstrated in DIII-D. In 2004 we will investigate the underlying dissipative process, whose understanding is essential in order to reliably predict the required plasma rotation in ITER. In accordance with these objectives we plan to develop a target plasma with rotation below the critical value. We also try to improve our understanding of rotational stabilization of the RWM.

- Thrust #8 advanced scenario development (11-days)

  The goal of the Advanced Scenario Development Thrust is fulfillment of the primary goal of the DIII–D program. To serve this end, Thrust 8 is carried out as a set of closely coupled experimental and modeling efforts. The goal of this multi-year effort is to yield a comprehensive scientific understanding that can transfer to future devices (ITER, FIRE, KSTAR,…). Occasional performance demonstrations in DIII–D serve to demonstrate our increased understanding as well as hardware developments in support of the *AT* research. Efforts at optimization of NCS plasmas with $f_{NI} \approx 100\%$ and $\beta_N \leq 3.5$ will continue. Alternative approaches to the AT scenario such as “current hole” and “flat q profile” will be evaluated.

- Thrust #9 QH–mode (3-days)

  The quiescent H-mode provides a solution to a major issue for fusion reactors, namely the pulsed divertor heat load due to ELMs. ELM impulsive heat loading is a critical issue for both ITER and FIRE. Maintenance of a high pedestal pressure is critical for ITER and FIRE. The fusion community is very interested in extending ELM-free H-mode regimes to show promise for use in future burning plasmas. The key issues for QH mode research during 2004 are: 1) understanding the ELM suppression in QH mode, 2) extend the working density in QH-mode and the achievable plasma beta in QDB mode to higher values, 3) work with JT-60U on experiments to vary rotation and edge radial electric field and 4) understand the edge particle transport in the absence of ELMs. The key issue for QDB during 2004 is the use of profile control tools to investigate and optimize the β limit.

- Thrust #10 hybrid scenarios (6-days)

  The long-term goal of Thrust 10 is to develop and assess the viability of robust, stationary plasma scenarios that offer significant normalized performance advantage over conventional, ELMing H-mode discharges. Demonstration of such a scenario would allow next-step burning devices to achieve their desired fusion performance while operating well away from the engineering limits of the device. The near-term goal of Thrust 10 is to evaluate the operating space and assess the viability of stationary, high performance discharges developed on DIII-D in recent years. An important issue is to understand how the magnetic flux is transported by the low level MHD and why the energy confinement is somewhat better than in conventional ELMy H-modes.

- Topical science areas

  Stability Topical Area (8 days). In addition to advancing basic MHD physics and stability control, this area will continue to take responsibility for the development of general plasma control. NTM studies will also be part of the area. Error field experiments will be coordinated with Thrust 4 (with a focus upon high toroidal rotation). In 2004 stability experiments will be performed in the areas of neoclassical tearing mode physics, disruption mitigation, sawtooth physics, error fields, fast ion physics, and advanced plasma control.

  Confinement Topical Area (10 days). The overarching goal for this area is to develop a predictive understanding of transport. A large number of well-formulated experimental proposals were submitted to the five subgroups. The limited number of run days available this year required that these be severely reduced and combined into the nominal ten days allocated.

  Boundary Topical Area (8 days). Many good experiments are proposed in four subgroups. The larger effort should be in the Impurities and PSI group that is more focused on the longer-range goal of mass transport.

  Heating and Current Drive Topical Area (4 days). The objectives of the Heating and Current Drive Topical Science Area are (1) to develop and validate predictive models of heating and current drive for the systems available on DIII-D: electron cyclotron, fast wave, and neutral beam power; (2) to improve the quantitative understanding of the bootstrap current; and (3) to improve our understanding of the long-term evolution and stability of discharges with the current supported fully noninductively.

Each of the efforts has a <u>responsible leader</u> and deputy leaders. The plans and goals for the various thrusts and topical science areas are detailed below.

1.1. RESEARCH THRUSTS FOR 2004

1.1.1. RESEARCH THRUST 1, H–MODE PEDESTAL AND ELMS (Leader: M.E. Fenstermacher, Deputy: P.B. Snyder)

1.1.1.1. Focus of Thrust 1.

Predict and control the pedestal width/height and ELM particle and energy losses.

Importance to DIII-D, Fusion Science and Next Step Experiments:

- The Snowmass and ITER design processes have identified the pedestal height, and the size of the associated Type-I ELMs, as some of the largest uncertainties in the design of a burning plasma tokamak. Predictions of the confinement in a BPX are critically dependent on the predicted pressure pedestal height while design of the plasma facing components is very dependent on the predicted ELM characteristics. The uncertainty in scaling these parameters from present devices to BPX conditions is very large due to lack of understanding of the physics mechanisms that control the density pedestal, temperature pedestal and ELM trigger and duration.

- Scaling of the pedestal is also important for evaluating the performance of different AT reactor scenarios that are currently under study at DIII-D. Many of these scenarios rely on an H-mode-like edge pedestal to allow high core stored energy and some type of transient phenomena at the edge to control impurity influx to the core plasma.

- Understanding the physics that controls the pedestal profiles and ELMs requires coupling of transport physics, stability physics and a host of boundary physics processes (neutral penetration and ionization, impurity sources and radiation, and parallel vs. perpendicular transport on open field lines). Understanding how these coupled processes interact will advance fusion and plasma science.

The design of the next step tokamak, ITER, is nearing completion. Confinement projections are based on our knowledge of pedestal scaling. If modifications to the operating scenario for ITER are required because of increased understanding of pedestal physics, then this must be known as soon as possible. In particular, the present ITER design is widely thought to be incompatible with large Type-I ELMs. The physics and scaling of smaller Type-I ELMs regimes with good core confinement must be understood soon to have confidence that the ITER divertor and first wall design are adequate.

Studies of pedestal physics require a tight integration of transport, MHD stability and boundary physics expertise. Recent advances in understanding of the pedestal profiles indicates that the temperature pedestal may be set by plasma energy transport while the density pedestal may be dominated by neutral sources from the boundary region. Predicting the scaling of ELM onset appears to involve coupled peeling/ballooning modes that are driven in part by the pedestal pressure gradient and edge current gradients from pressure driven bootstrap current. Expertise from at least three of the DIII-D topical science areas is critical to understanding pedestal physics.

Proposed Work

- Significant effort (37.5% of Thrust 1 experimental time) will be devoted this year to exploring the feasibility of mitigating and suppressing Type-I ELMs using edge stochastic magnetic field perturbations. The primary tool for this work is the I-coil. Tests of n=3 and other perturbation configurations of the I- and C-coils on ELM behavior will be done and compared with available 3D field models. The aim of this work will be to understand the mechanisms that allow these field perturbations to suppress ELMs in ITER relevant plasmas during experiments in 2004 and to propose additional ELM control experiments in 2005.

- Experiments (25% of Thrust 1 run time) and modeling in 2004 will also carry on the 3–5 year plan established in 2003 to understand the physics mechanisms setting the width/height of the density and temperature pedestals in ELMing H-mode. This will be done primarily by focused dimensionless similarity experiments between DIII-D and other tokamaks. The first priority will be to establish the ρ_* scaling of the temperature pedestal width and to verify that the current neutral penetration model correctly predicts the density pedestal width and height for multiple machines.

- Other experiments this year (12.5% of the run time) will focus on understanding the physics of Type-I ELM onset. A comprehensive model that includes measurement of the current in the pedestal region, theoretical predictions of the edge bootstrap current contribution to the total edge current, and the implications of the edge current on the coupled peeling/ballooning linear stability trigger for Type-I ELMs will be formulated. This will include work to automate these ELM stability calculations. This linear theory of ELM onset and new nonlinear theories for the saturation of the ELM instability will also be tested against experimental measurements in ELMing H- and VH-modes.

- Exploration of the VH-mode pedestal evolution and techniques for steady operation of VH-mode (25% of Thrust 1 run time) will be done in 2004.

VH-mode is a promising ELM-free plasma with very high pedestal pressure and core confinement. Studies this year will focus on the mechanisms that cause the evolution of the pedestal and techniques to prevent the X-event that typically terminates VH-mode.

Expected Highlights

- A verified model of the density pedestal width/height based on neutral penetration physics for the pedestal temperature range found in current experiments.
- The dependence of the temperature pedestal width/height on ρ_* allowing increased confidence in extrapolations to ITER.
- A consistent model of ELM stability thresholds based on linear coupled peeling/ ballooning modes incorporating the measured edge current density.
- A model to predict the edge current based on pressure driven bootstrap currents.
- Physics understanding of the effect of edge stochastic magnetic field perturbations on the ELM instability threshold for a range of plasma shapes, edge safety factors and other configuration parameters.
- Detailed understanding of the VH-mode pedestal evolution and the X-event in terms of edge current and fuelling profile evolution and edge stability calculations.

Where We Want to be Next Year

We want to know if the density pedestal is set by neutral penetration physics and if the temperature pedestal is set by dimensionless scaling of plasma energy transport. We also want to know if the application of edge magnetic field perturbations for suppression of ELMs has broad enough applicability to advance to a major thrust of the DIII-D program. Finally we want to have a verified model of ELM instability onset including the effect of pressure driven edge bootstrap currents.

1.1.2. RESEARCH THRUST 4 — ADVANCE THE PHYSICS UNDERSTANDING OF RWM STABILITY, INCLUDING THE DEPENDENCE ON PLASMA ROTATION, WALL/PLASMA DISTANCE, AND ACTIVE FEEDBACK STABILIZATION (Leader: M. Okabayashi, Deputies: H. Reimerdes, T. Strait)

The ultimate goal of thrust 4 is the development of experimental methods to stabilize the resistive wall mode (RWM), which is a prerequisite for operation above the no-wall beta limit. One possibility is the stabilization of the RWM by sufficient toroidal plasma rotation, which has been demonstrated in DIII-D. In 2004 we will investigate the underlying dissipative process, whose understanding is essential in order to reliably predict the required plasma rotation in ITER. Since a burning plasma experiment will most likely not have sufficient angular momentum input, the main focus in 2004 will be the direct feedback control of the RWM in discharges where the plasma rotation is not sufficient to stabilize the RWM. We, in particular, want to assess the advantages of internal control coils (I-coils) over external control coils (C-coils) in order to provide input into the ITER design. This requires the experimental verification of models, which predict that the current ITER design with external coils only is not suitable for operation significantly above the no-wall beta limit.

In accordance with these objectives we plan to develop a target plasma with rotation below the critical value:

1. The most promising and, hence, first approach is non-resonant magnetic braking using the internal coils. We will refine the target using rf heating to substitute NBI heating and decrease the momentum input and confinement.

2. At the same time we closely collaborate with Thrust 8 in order to assess the potential of alternative q-profiles as low-rotation targets.

3. The feedback system will be improved by using recently installed off-midplane poloidal field sensors.

4. The optimization of n=1 error field correction using the I-coils increases the available current for feedback.

5. The low-rotation target together with the feedback and error field correction improvements will be then used to compare the feedback performance of internal and external coils and verify RWM feedback modeling predictions.

We also try to improve our understanding of rotational stabilization of the RWM:

1. The main tool will be active measurements using resonant perturbation generated by the control coils. A measurement of the spectrum at high beta is necessary to validate the single mode approach with is the basis of the active measurement. We will then measure the RWM damping rate and rotation frequency for different plasma rotation frequencies and as a function of the radial electric field (counter-NBI) in order to test dissipation models.

2. We collaborate with JET and NSTX in order to generalize RWM characteristics and analyze aspect ratio dependence of rotational stabilization.

1.1.3. THRUST 8 — ADVANCED TOKAMAK SCENARIO DEVELOPMENT (Leader: C. Greenfield; Deputy: A. Garofalo)

1.1.3.1. Description of Thrust 8

The goal of the Advanced Scenario Development Thrust is fulfillment of the primary goal of the DIII–D program: *The DIII–D Program's primary focus is the Advanced Tokamak (AT) Thrust that seeks to find the ultimate potential of the tokamak as a magnetic confinement system*. To serve this end, Thrust 8 is carried out as a set of closely coupled experimental and modeling efforts. The goal of this multi-year effort [*DIII–D National Fusion Program Five Year Plan 2003–2008*, Chapter 2] is to yield a comprehensive scientific understanding that can transfer to future devices (ITER, FIRE, KSTAR,…). Occasional performance demonstrations in DIII–D serve to demonstrate our increased understanding as well as hardware developments in support of the *AT* research.

The plan for Thrust 8 in 2004 serves this long-term goal, in particular with respect to DIII–D Milestones 153 (*Evaluating the Physics Basis for Steady-State Advanced Tokamak Operation,* August, 2004) and 154 (*Controlling the Spatial Distribution of Electrical Current in Tokamak Plasmas*, September, 2005). Efforts to produce an integrated demonstration of in-principle steady-state high β conditions have begun, and will continue in 2004. These experiments demonstrate current profile control in our highest β target plasma, but do not address all elements included in the five-year plan.

1.1.3.2. 11 Day Experimental Program in 2004

Increase β and Pulse Length With 100% Noninductive in the High Bootstrap NCS Regime (4 days: 3 with $q_{min} > 1.5$, 1 with $q_{min} > 2$)

NCS plasmas with $f_{NI} \approx 100\%$ and $\beta_N \leq 3.5$ were obtained in 2004. Performance was limited mainly by confinement: All available NBI power was needed to reach these levels, leaving little power for long sustainment. Efforts at optimization of this regime will continue, including:

- Improve reproducibility of the current ramp phase
- Variation of current profile, dynamic error field correction, density,…
- Evaluate effect of small shape changes (consistent with existing divertor)

Goal for 2004: $f_{NI} \approx 100\%$ for > 2 seconds with $\beta_N \approx 3.5$-4.

Alternative Approaches to *AT* Development (4 days)

We have not definitively shown that the NCS regime is the "best" family of q profiles. These variations are part of a long-term effort to identify the optimal q profile family:

- Formation of "current hole" regimes (1 day)
- Formation, optimization and sustainment of the "flat q profile" regime. Major goal is to obtain $\beta_N \approx 4$ for > 2 sec. A key question is whether we can make and sustain these in a way that leads to steady-state.

Tool Development (3 days)

- Develop new tools for application to AT discharges

Current Profile Control Tool Development (2 days)

- Continue development of FW to heat and drive current near the magnetic axis (1 day)
- Develop real-time control of the current profile (1 day)

MHD Stability: Tune the I-coil for Application to NCS and Flat *q* Profile Discharges (2 × 0.5 days)

TABLE 4. Thrust 8 17 (proposed) and 11 day (reduced) experimental plans for 2004

	Min	11 Day Plan
Optimize $q_{min} > 1.5$ (“LOW q”) NCS for $f_{NI} \approx 100\%$ with long duration and high β_N	3	3
Maximize β limits	1	1
Demonstrate long sustainment of $f_{NI} \approx 100\%$ at high β_N	2	2
Transport documentation	0	0
Optimize $q_{min} > 2$ (“HIGH q”) NCS for $f_{NI} \approx 100\%$ with long duration and high β_N	1	1
Maximize β limits	0	0
Demonstrate long sustainment of $f_{NI} \approx 100\%$ at high β_N	1	1
Current hole scenario	1	1
Formation	1	1
Current hole as an *AT* scenario	0	0
Physics studies	0	0
Flat q profile scenario	3	3
Extension toward higher β	2	2
Extension toward noninductive sustainment	1	1
Tools: Current profile	2	2
Fast wave coupling and current profile control	1	1
Feedback control	1	1
Tools: Kinetic profiles	1	0
Pressure profile control	1	0
Reactor burn control	0	0
Tools: MHD stability	2	1
RWM / I-coil optimization	2	1
Pedestal / pressure profile shape	0	0
Obtain $\beta_N \geq 4$ for ≥ 2 seconds (campaign)	3	0
Reactor / burning plasma relevance	1	1
High performance with $T_e \approx T_i$	1	0
AT divertor power handling	0	0
High normalized density operation	0	0
Total Thrust 8 2004	17	11

1.1.4. THRUST 9 — QH–MODE UNDERSTANDING AND PROJECTION (Leader: W.P. West; Deputy: E. Doyle)

1.1.4.1. Goals of the QH–Mode Thrust: Develop an Understanding of QH–Mode so that ELM-Free Scenarios Can Be Achieved in Burning Plasmas.

- Importance: the quiescent H-mode provides a solution to a major issue for fusion reactors: Pulsed divertor heat load due to ELMs
  - ELM impulsive heat loading is a critical issue for both ITER and FIRE.
  - Maintenance of a high pedestal pressure is critical for ITER and FIRE.
  - The fusion community is very interested in extending ELM-free H-mode regimes to show promise for use in future burning plasmas.
- What must we accomplish to achieve our long term goal?
  - Understand ELM suppression.
  - Understand the scaling of QH pedestal parameters to larger devices.
  - Achieve QH at higher density.

1.1.4.2. Summary of Past Work on the QH–Mode

The quiescent H-mode provides a solution to a major issue for fusion reactors, pulsed divertor heat load due to ELMs. ELM impulsive heat loading is a critical issue for the ITER divertor, while maintenance of a high pedestal pressure is critical for ITER core confinement. QH mode is the only mode of operation which maintains a high edge pedestal and H-mode level confinement without ELMs. The fusion community is very interested in QH mode, witnessed by the fact that the other three major tokamaks in the world, ASDEX-Upgrade, JT-60U and JET, have initiated QH research efforts.

QDB is most advanced DIII-D regime with an ITB, achieving sustained, high performance, $\beta_N H_{89} \sim 7$, $\beta_N \sim 3$, $H_{89} \sim 2.5$. It reaches a performance level near that of the ELMing hybrid scenario without the debilitating effects of ELMs. In addition it is an excellent test-bed for development of active profile/transport control tools.

The key issues for QH mode research during 2004 are: 1) understanding the ELM suppression in QH mode, 2) extend the working density in QH-mode and the achievable plasma beta in QDB mode to higher values, 3) work with JT-60U on experiments to vary rotation and edge radial electric field and 4) understand the edge particle transport in the absence of ELMs. The key issue for QDB during 2004 is the use of profile control tools to investigate and optimize the β limit.

1.1.5. THRUST 10 — INTEGRATED (HYBRID), LONG-PULSE SCENARIO DEVELOPMENT FOR BURNING PLASMAS (Leader: M.R. Wade, Deputy: J. Jayakumar)

The long-term goal of Thrust 10 is to develop and assess the viability of robust, stationary plasma scenarios that offer significant normalized performance advantage over conventional, ELMing H-mode discharges. Demonstration of such a scenario would allow next-step burning devices to achieve their desired fusion performance while operating well away from the engineering limits of the device.

The near-term goal of Thrust 10 is to evaluate the operating space and assess the viability of stationary, high performance discharges developed on DIII-D in recent years. In particular, experiments will emphasize expanding the range in density and q_{95} in which these discharges can be achieved. In addition, comparisons will be made between these discharges and similar scenarios developed on ASDEX-Upgrade, JT-60U, and JET.

The 2004 DIII-D Thrust 10 experimental plan has been developed with the long-term goal of providing the next generation fusion devices with a robust and reliable operating regime which offers the potential for a substantial increase in performance and/or pulse duration over the conventional, sawtoothing, ELMing H-mode regime. The operating scenario utilizes the recently discovered hybrid regime of stationary discharges with low consumption of inductive flux. Thrust 10 also aims to convince the worldwide community to adopt the hybrid scenario as the new benchmark for pulsed tokamak performance in ITER. In order to achieve this aim, it is also necessary to develop the detailed understanding of the tokamak physics underlying the development of this hybrid regime.

The issues being addressed in the 2004 Thrust 10 experimental plans are the following:

- Expanding the DIII-D hybrid experiments to higher density/collisionality.
- Verifying and understanding the confinement improvement in hybrid discharges.
- Determining if the sawteeth are smaller in low q_{95} cases compared to conventional ELMing H-mode case?
- Verifying that the performance enhancement with good confinement is obtained in the reactor conditions of $T_i \sim T_e$.
- Establishing the existence of and parametric study of the dynamo/hyper-resistivity due to the m=3/n=2 tearing mode which affects the current profile evolution

leading to a stationary current profile. Model calculations will be carried out to assist this study.

- Obtaining a 10 second long hybrid discharge to demonstrate that the current profile is indeed stationary.
- Scaling of requisite physics phenomena — do they scale favorably/unfavorably to ITER?

Three run days will be devoted to experiments on extending the operating regime for broader (e.g. ITER) applications and 1 day for obtaining and investigating the $T_e = T_i$ regime. Two days will be devoted to the relationship of current profile evolution with tearing mode amplitude and plasma conditions, and 1 day will be used in attempts to obtain a hybrid discharge with 10 second duration.

1.2. PHYSICS TOPICAL AREAS

1.2.1. STABILITY (Leader: E.J. Strait)

1.2.1.1. Goals

The long-term objective of MHD stability research in DIII-D is to establish the scientific basis for understanding and predicting limits to macroscopic stability of toroidal plasmas. In addition to the more focused research carried out in the Research Thrusts, the role of the Stability Topical Science area is to provide a broad range of good MHD stability science, investigate instability control in regimes relevant to ITER and other burning plasmas, and explore stability physics in new regimes beyond the scope of the advanced tokamak program.

1.2.1.2. Plans for 2004

Under an 18-week operating schedule, 8 days have been allocated to the Stability Topical Science area. This time will be used for experiments in neoclassical tearing mode physics, disruption mitigation, sawtooth physics, error fields, fast ion physics, and advanced plasma control. This year the work of the former thrust on neoclassical tearing mode stabilization has been incorporated into the Stability Topical Science area.

The planned experiments are as follows. Each is planned for one day unless otherwise noted.

1. **ECCD Stabilization of the 2/ 1 Mode.** The goal of this experiment is to advance our techniques for stabilization of the m/n=2/1 neoclassical tearing mode by localized electron cyclotron current drive. The experiment will focus on pre-emptive injection of current drive to prevent the onset of the mode, and raising beta in the stabilized plasma. NTM stabilization is a key issue for ITER.

2. **ECCD Stabilization of the 3/ 2 Mode**. The goal of this experiment is to advance our techniques for stabilization of the m/n=3/2 neoclassical tearing mode by localized electron cyclotron current drive. The experiment will focus on pre-emptive injection of current drive to prevent the onset of the mode. We will also vary the width of the current drive layer to test theoretical predictions regarding the ratio of the current drive to the threshold island size. NTM stabilization is a key issue for ITER.

3. **Physics of Gas Jet Penetration and Jet Imaging**. This experiment will make use of a new fast camera and upgraded gas injection system to investigate the physics

of high-pressure gas jet penetration into the plasma. Disruption mitigation by noble gas injection is a key issue for ITER. This is a joint ITPA experiment with JET and C-Mod.

4. **m=1 Stability vs. Internal Flux Surface Shape**. This continuing experiment will test the roles of Mercier stability and resistive interchange in the sawtooth crash. The shaping of the internal flux surfaces is changed to vary the relative stability limits at the q=1 surface. This experiment is aimed at increasing our understanding of the basic MHD physics of the m=1 instability.

5. **Locked Mode Threshold and Size Scaling (1.5 day)**. The goal of this experiment is to measure the error field threshold for the onset of locked modes at low beta, by varying the error field applied with the I-coil and C-coil. As part of an ITPA joint experiment with JET, C-Mod, and other machines, it will provide a size scaling to ITER for tolerable error fields in the startup phase. A second part of the experiment is aimed at optimizing DIII-D error correction using the new I-coils, and understanding the relation of error correction to the measured error fields.

6. **MIMO Control of Plasma Shape (0.5 day).** This experiment will test model-based multivariable control of the plasma shape and position, and demonstrate solutions to nonlinear operating limit problems. This is a key element to improving the accuracy and reliability of DIII- D shape control, and a first step toward simulating the ITER control system

7. **NSTX/DIII- D Comparison of Alfvén Eigenmodes**. The goal of this experiment is to validate theoretical models of fast ion stability. The focus is on the role of aspect ratio, through similarity experiments with NSTX. Understanding the thresholds of fast ion-driven instabilities, and their effect on fast ion transport, is a key issue for predicting alpha particle confinement in ITER.

8. **Basic NTM Physics**. This experiment will investigate the threshold island size as a function of beta, for comparison with theory. If time permits, we will also measure the dependence on the threshold island size of the current drive power required for stabilization. This is a joint ITPA experiment with JET, ASDEX-U, and JT-60U.

1.2.2. CONFINEMENT AND TRANSPORT — (Leader: K.H. Burrell)

The long-term goal of the confinement and transport topical science area is to develop a predictive understanding of transport. As part of this work, we investigate the fundamental transport physics issues that are raised by the DIII-D advanced tokamak research. In addition, as a topical science area, we have the responsibility to foster investigations of novel transport ideas and to develop new discoveries.

For the 2004 campaign, the focus areas for confinement and transport research are:

1. Short wavelength turbulence and electron temperature gradient modes
2. Zonal flows and geodesic acoustic modes
3. Internal transport barrier physics--especially negative magnetic shear and Shafranov shift (alpha) stabilization
4. Rotation studies
5. Reynold's stress and the L to H transition.

The confinement and transport topical science area is divided into four working groups for the 2004 campaign: 1) Fundamental Turbulence, 2) Test of Theory-Based Models, 3) Core Transport and 4) H-mode Physics.

The scientific questions considered in the fundamental turbulence experiments are: 1) What is the role of short wavelength turbulence? 2) How do the short wavelength turbulence results compare with theoretical models? and 3) What are the role of zonal flows and the geodesic acoustic modes in controlling turbulence?

The scientific questions confronted in testing theory based models include: 1) Does Shafranov shift affect transport as predicted theoretically? 2) Do predicted ITG/ETG critical gradients agree with experiment? 3) Does particle pinch predicted by GLF23 agree with experiment? And 4) How does aspect ratio affect transport?

In the core transport area, we consider these scientific questions: 1) Do the main ions rotate in H-mode plasmas without torque input? 2) How does the rotation scale with plasma parameters in H-mode plasmas without torque input? and 3) How does turbulence vary when plasma goes through q_{min} = integer values?

Finally, the H-mode physics area will consider whether turbulence changes and turbulent transport changes across the L to H transition consistent with the Reynold's stress model.

1.2.3. BOUNDARY PHYSICS (Leader: S.L. Allen)

1.2.3.1. Boundary Working Groups' Experiments for 2004.

- The boundary TSA is organized into four working groups.
  — ELMs in the SOL and divertor.
  — Power and particle handling.
  — SOL dynamics.
  — Impurity and tritium mass transport.

1.2.3.2._Boundary TSA Experiments in 2004

- We are uniquely positioned to address critical ITER issues
- DIII-D AT program is interested in density control in high triangularity plasmas — so does database justify new lower divertor?
- Likewise, the DIII-D programmatic focus on "mass transport in the boundary'' will be carried out in the Boundary Topical Science Area.
- National and international collaboration will significantly improve this effort and the IEA/ITPA joint experiments should be given high priority.
- In particular, proposed carbon 13 experiments should be coordinated with those planned on JET.

1.2.3.3. Research Topics for 2004

ELMs 1 — Working Group 1.

- Understand the effect of B-dependent particle drifts on SOL/divertor ELM behavior as a function of plasma density at high q_{95}.
- Key Question: Dependence of ELM asymmetries on drifts because of pre-ELM divertor conditions or because drifts affect behavior during ELM pulse?

  — Expt: Characterize Type-I ELM SOL/divertor dynamics with all fast diagnostics, LSN, density scan, Forward vs. Rev. B_T, N_e trace.

  — Analysis: Compare with 2003 data at q_{95} ~ 3.1 for connection length dependence. Time dependent simulations with BOUT/UEDGE and SOLPS5.

ELMs 2.

- Understand the effect of divertor SOL flux expansion on ELM heat and particle flux profiles.

- Key Question: Can target energy density during ELMs be reduced by increasing flux expansion; i.e. does ELM particle and energy flux follow pre-ELM SOL field lines?

  — Expt: Characterize Type-I ELM divertor target heat and particle flux profiles vs flux expansion at fixed q_{95} and δ, LSN, flux expansion and density scans, Forward vs. Rev. B_T, N_e trace.

  — Analysis: Time dependent simulations with BOUT/UEDGE and SOLPS5.

ELMs 3.

- Understand the effect of particle reflux across the PF region after large Type-I ELMs on DN fueling.

- Key Question: Is particle reflux in PF region an important factor in setting the core plasma fueling in DN?

  — Expt: Characterize the reflux of particles from one divertor strikepoint to the other after a Type-I ELM and determine if E×B drift sets the magnitude of the reflux, DND, B_T scans 1.4–2.1 T, Forward vs. Reversed B_T, N_e trace.

Power and Particle 1 — Working Group 2.

- Quantify particle control capability of current DIII-D.

- Quantify pumping for AT plasma shapes —- complete this work.

- Is it necessary to have high field side pumping to maintain adequate density control of AT-like plasmas?
  — drsep scan with forward B_T

- How much density control can be provided by coupling to all threeexisting pumps? (Up/down asymmetric shape)
  — AT not interested because shape not expected to be high ?
  — Best diagnostic set to look at three pumps.

Power and Particle 2.

- Radiative divertor in high performance plasmas.

- Key questions:
  - How well are trace impurities entrained in the divertor in high performance ("hybrid"), lower density plasmas?
  - How well can a perturbing amount of an injected impurity be confined to the DIII-D divertor.

Power and Particle 3.

- Heat flux (or detachment) control with the I-Coil

- Key Questions:
  - Is the I-coil a useful knob in controlling detachment?
  - Can the I-coil broaden the operating space of detachment?
  - Based on previous DN I-coil bifurcation of heat flux peak — is this detachment?
  - (speculative that double heat pulse is detachment)

Power and Particle 4.

- Tungsten and lithium — tokamak tests.

- Key Question: Test tungsten brush in a tokamak
  - How do the thermomechanical and erosion response properties of tungsten change in a DIII-D divertor environment?

- Lithium DiMES — needs more discussion of priority
  - How do large transient surface currents affect thin melt layers that result from impulsive heat loading?

SOL Dynamics 1 — Working Group 3.

- Are ELMs or "Blobs" more important for SOL particle and heat transport?

- Relative flux to walls (far SOL anomalous transport) due to intermittency and ELMs
  - Modification with ergodic fields
  - Experiments mostly in H-mode (i.e. ELMing)

- Diagnose ELM transport and fluxes to wall (window frame, etc).
  - — Compare intermittency (inter ELM) flux to ELM-induced flux
  - — Then change parameters:
    - ★ Density scan, shape scan — windows frame
    - ★ Apply ergodic fields
    - ★ Helium plasma — try to discern collisionality vs density effects.

SOL Dynamics 2.

- Test BOUT prediction of transport poloidal asymmetry and variation with pedestal density and collisionallity.

- Fundamental understanding. Poloidal/toroidal asymmetries, code validation, and code improvement

- Why?
  - — Is poloidal dependence important — challenge UEDGE, OEDGE and BOUT.
  - — Study how ergodic fields affect edge transport (intermittent and Elm-induced).

Tritium and Impurity Mass Transport — Working Group 4

- Campaign focused around carbon → ITER tritium inventory: Campaign focused around carbon → ITER tritium inventory:

  - — What is the source of carbon which ends up in co-deposits? Where does the C come from? What mechanism?

  - — What transports C to the inner divertor? Nature of the large-scale, “anomalous” parallel SOL transport?

  - — What controls deposition pattern of C? Nature of the local transport within inner divertor?

  - — How to maximize recovery of the tritium?

- Common basis of physics for the divertor and SOL.

- Oxygen baking still under discussion — want to do a C13 experiment again this year.
  - — Wampler at Sandia is working on techniques to speed up analysis.
  - — Possible to use “camera” for in-vessel measurements.

1.2.4. HEATING AND CURRENT DRIVE PHYSICS (Leader: R. Prater)

The objectives of the Heating and Current Drive Topical Science Area are (1) to develop and validate predictive models of heating and current drive for the systems available on DIII-D: electron cyclotron, fast wave, and neutral beam power; (2) to improve the quantitative understanding of the bootstrap current; and (3) to improve our understanding of the long-term evolution and stability of discharges with the current supported fully noninductively.

In pursuance of these goals and in view of the allocation of experiment time, the priority of experiments in this area is first to advance the experiments on discharges with very high bootstrap fraction, approaching or exceeding unity. This experiment does not require high rf power so it is suitable for performance early in the campaign. The goal is to make use of the progress made in the past year to generate discharges with $\beta_N > 3$ but at low plasma current and with the Ohmic heating transformer open circuited. The existence of true steady states will be sought.

A key need for validating the computational model for electron cyclotron current drive (ECCD) is to measure ECCD in the temperature range needed for a burning plasma experiment. Electron temperatures above 15 keV can be generated in DIII-D by applying ECH power near the plasma center at low density. Adding modest ECCD power will allow the current drive efficiency to be determined at the high electron temperature. The effects of modestly nonthermal electron distribution functions and the action of transport on the distribution function will be studied for comparison with the calculations of the Fokker-Planck code CQL3D.

Modeling of high performance Advanced Tokamak discharges in DIII=D has identified the value of adding Fast Wave Current Drive (FWCD) for controlling the central safety factor. The fast wave systems are being brought into improved operability. The key scientific issues regarding FWCD which will be addressed are the absorption waves by the electrons and the parasitic absorption by the fast beam ions. By using ECH to vary the electron temperature, the dependence on T_e of the wave absorption and the efficiency of FWCD can be compared to models. By using two of the FW systems with different frequency (60 and 117 MHz) the effect of different frequency and $n_{||}$ can also be determined. These measurements can be compared with code calculations using CURRAY or a full wave code as a means of validating the codes. Similarly, absorption of the waves by fast ions, which is an important problem for ITER due to the presence of energetic alpha particles, will be studied and compared with code calculations.

1.2.4.1. Tools for 2004.

- ECH
  - 3 CPI gyrotrons, which operate at 1 MW for 5 s pulses.
    - ✯ One of these will become available in mid campaign
  - 2 Gycom gyrotrons, which operate at 0.7 MW for 2 s pulses.
- ICRF
  - FMIT transmitter for 60 MHz operation.
  - Possibly one ABB transmitter for 120 MHz operation.
  - Four-strap antennas for each transmitter.

1.3. RESEARCH PROPOSALS RECEIVED

A detailed list of research proposals received is given in Appendix A.

1.4. DETAILED LIST OF SCHEDULED EXPERIMENTS

These scheduled experiments represent the present plan for campaign 2004. There will be a mid-year reassessment of the 18-week 2004 plan in order to combine it with the 14-week 2005 plan. The 2005 campaign may start early in FY2005.

Date	Exyear Exp2004ID	Description	Session leader
3/15/04 0:00	2004 23-02	ELMs - forward Bt (after Boronization)	Fenstermacher
3/16/04 0:00	2004 23-01	Pumping and exhaust in AT shapes	Petrie
3/17/04 0:00	2004 01-02	ITPA Pedestal Similarity (DIII-D/JET rho*)	Osbourne
3/18/04 0:00	2004 22-05	4 Gyros - Rotation studies - Deuterium studies	deGrassie
3/19/04 0:00	2004 21-03	Disruption Mitigation	Hollmann
3/29/04 0:00	2004 10-01A	Hybrid existence domain 1st Day	Wade
3/30/04 0:00	2004 01-04	I-coil suppression of ELMs - International	Evans
3/31/04 0:00	2004 08-01A	1/2 Day Flat q profile at higher beta #1	Garofalo
3/31/04 0:00	2004 08-11A	Forward Bt 1/2 - RWM / I-coil optimization	Greenfield
4/1/04 0:00	2004 24-01	2 Gyros - High bootstrap fraction	Politzer
4/2/04 0:00	2004 99-01	Contingency	
4/5/04 0:00	2004 21-02	4 Gyros - ECCD stabilization of 3/2 mode	La Haye
4/7/04 0:00	2004 21-09	International - NTM physics	Buttery
4/8/04 0:00	2004 04-01A	1/2 Day- Target devel. I-coil n=3 non-resonant braking #1	Jackson
4/8/04 0:00	2004 04-06	1/2 Day - RWM physics: RFA at low rotation	Garofalo
4/9/04 0:00	2004 99-02	Contingency	
4/12/04 0:00	2004 04-04	1/2 Day- Error field correction using the I-coils	Garofalo
4/12/04 0:00	2004 04-01B	1/2 Day- Target devel. I-coil n=3 non-resonant braking #2	Jackson
4/13/04 0:00	2004 22-03	Reverse shear and electron heating	Kinsey
4/14/04 0:00	2004 24-02	4 Gyros - ECCD at high ITER like Te	Petty
4/15/04 0:00	2004 22-01	Measure high k turbulence	Rhodes
4/16/04 0:00	2004 99-03	Contingency	
5/3/04 0:00	2004 23-03	Rev Bt (after Boron) ELMs	tbd
5/4/04 0:00	2004 23-04	Rev Bt - SOL comparison with BOUT	tbd
5/5/04 0:00	2004 04-10	1/2 Day - Joint experiments: Cross machine scaling with JET	Lahaye
5/5/04 0:00	2004 21-05	1/2 Day - Error field size scaling	Howell
5/6/04 0:00	2004 10-01B	Hybrid existence domain 2nd Day	
5/7/04 0:00	2004 99-04	Contingency	
5/10/04 0:00	2004 08-05A	1/2,5 Gyros, Rev Bt- Maximize beta limits-low q NCS-via shape	Ferron
5/10/04 0:00	2004 08-11B	Rev Bt 1/2 - RWM / I-coil optimization	
5/11/04 0:00	2004 08-06	5 Gyros, Rev Bt Sustain fNI=100% @ high betaN(low q NCS)#1	tbd
5/12/04 0:00	2004 10-02A	Hybrid scenario current profile evolution #1	Wade
5/13/04 0:00	2004 22-07	Critical Gradient	DeBoo
5/14/04 0:00	2004 99-10	Contingency	
5/17/04 0:00	2004 22-06	Tests of high k models	Rhodes
5/18/04 0:00	2004 04-02	4 Gyros, FW- Target devel. RF heating & magnetic braking	Strait
5/19/04 0:00	2004 24-03	FW and FWCD at high Te	Pinsker
5/20/04 0:00	2004 24-05	FW absorbtion by beam ions	Luce
5/21/04 0:00	2004 99-06	Contingency	
6/7/04 0:00	2004 09-01	Counter - Role of edge current in QH Stability	West
6/8/04 0:00	2004 09-02	Counter - Role of Er and rotation in QH(JT-60U collab)	Burrell
6/9/04 0:00	2004 09-03	Counter - Increased density and betaN in QH	Doyle
6/10/04 0:00	2004 04-09	Counter - RWM: Test of models (Betti/Bondeson)	Strait
6/11/04 0:00	2004 99-07	Contingency	
6/14/04 0:00	2004 22-10	5 Gyros - Particle transport	Baker
6/16/04 0:00	2004 04-05A	Feedback demonstration Day #1	Garofalo
6/18/04 0:00	2004 99-08	Contingency	
6/21/04 0:00	2004 01-01	Pedestal stability - Ip ramps and localized fueling	Leonard
6/22/04 0:00	2004 08-09	FW coupling and profile control	tbd
6/23/04 0:00	2004 04-07	1/2 Day - RWM physics: n=2, n=3 RFA	Navratil
6/23/04 0:00	2004 04-08	1/2 Day - RWM physics: RFA spectrum at high beta	Reimerdes
6/24/04 0:00	2004 01-03	Pedestal turbulence & transport simulations	Groebner

Date	Exyear Exp2004ID	Description	Session leader
6/24/04 0:00	2004 21-06	DIII-D Error field correction	Scoville
6/25/04 0:00	2004 99-09	Contingency	
7/12/04 0:00	2004 09-04	Counter - EHO & Impurity Transport in QH	Gohil
7/13/04 0:00	2004 22-08	Counter injection combination	Nazikian
7/15/04 0:00	2004 22-02	H-mode physics	Moyer
7/15/04 0:00	2004 04-11	1/2 Day - Joint experiment aspect ratio scaling with NSTX	Reimerdes
7/15/04 0:00	2004 21-07	1/2 Day - Advanced plasma control	Walker
7/16/04 0:00	2004 04-03	Feedback tool development	Okabayashi
7/19/04 0:00	2004 08-02	Flat q profile at higher beta Day 2	Garofalo
7/20/04 0:00	2004 21-04	Sawtooth Studies	Lazarus
7/21/04 0:00	2004 22-09	Parametric scaling of GAM	McKee
7/22/04 0:00	2004 10-03	Hybrid scebario Te=Ti	Wade
7/23/04 0:00	2004 99-11	Contingency	
7/26/04 0:00	2004 01-05	Plasma response to I-coil & TRIP3D validation	Evans
7/27/04 0:00	2004 23-06A	1/2 Day - Inner Strike point	tbd
7/27/04 0:00	2004 23-06B	1/2 Day - Porous plug	tbd
7/28/04 0:00	2004 01-06	Expand ELM control operation space with (AC) I-coil	Moyer
7/30/04 0:00	2004 99-12	Contingency	
8/2/04 0:00	2004 08-04	International - Current hole formation	Jayakumar
8/3/04 0:00	2004 10-02B	Hybrid scenario current profile evolution #2	Wade
8/4/04 0:00	2004 23-07	Carbon heated tile gap - DiMES	tbd
8/6/04 0:00	2004 99-13	Contingency	
8/23/04 0:00	2004 08-07	5 Gyros, Rev Bt Sustain fNI=100% @ high betaN(low q NCS)#2	tbd
8/24/04 0:00	2004 08-08	5 Gyros, Rev Bt Sustain fNI=100% @ high betaN(high q NCS)	tbd
8/25/04 0:00	2004 21-08	NSTX/DIII-D Comparison of Alfven modes	Fredrickson
8/26/04 0:00	2004 23-09	Forward Bt - SOL comparison with BOUT	tbd
8/27/04 0:00	2004 99-14	Contingency	
8/30/04 0:00	2004 21-01	5 Gyros - ECCD stabilization of 2/1 mode	La Haye
8/31/04 0:00	2004 01-07	Characterization of VH-mode pedestal with new tools	Leonard
9/1/04 0:00	2004 08-03	5 Gyros - Flat q noninductive sustainment	Doyle
9/3/04 0:00	2004 99-15	Contingency	
9/7/04 0:00	2004 22-04	Rotation studies - Helium plasmas	Burrell
9/8/04 0:00	2004 08-10	5 Gyros - Feedback control of current profile	Ferron
9/10/04 0:00	2004 99-16	Contingency	
9/14/04 0:00	2004 23-08	Particle and Impurity control	tbd
9/15/04 0:00	2004 08-01B	1/2 Day Flat q profile at higher beta #2	Garofalo
9/15/04 0:00	2004 08-05B	1/2,5 Gyros, Rev Bt- Maximize beta limits-low q NCS-via shape	Ferron
10/18/04 0:00	2004 22-11	Aspect ratio scaling (NSTX)	Synakowski
10/19/04 0:00	2004 99-05	Contingency	
10/20/04 0:00	2004 08-12	5 Gyros, FW - High performance with Te = Ti	tbd
10/21/04 0:00	2004 10-05	5 Gyros - Hybrid scenario long pulse demo	Wade
10/25/04 0:00	2004 04-05B	Feedback demonstration Day #2	Okabayashi
10/26/04 0:00	2004 24-04	High bootstrap Day #2	Politzer
10/27/04 0:00	2004 01-08	Extend VH-mode with shaping or n=3 I-coil	Jackson
10/28/04 0:00	2004 24-06	Neutral beam CD	Petty
11/1/04 0:00	2004 24-07	Bootstrap physics	Politzer
11/2/04 0:00	2004 23-05	C13 injection - ITERTritium retention	Allen

1.5. THE 2004 OPERATIONS SCHEDULE

The operations schedule is designed for efficient and safe use of the DIII–D facility. Eighteen calendar weeks of plasma physics operations is scheduled for the calendar year 2004. The plan is to have five 2- or 3-week run periods. The operations schedule is shown in Fig. 1. Operations are carried out 5 days per week for 8.5 hours. The 2004 operations schedule can be viewed at http://d3dnff.gat.com/Schedules/fy2004Sch.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 for these activities is for the maintenance to be done when the tokamak is not operating.

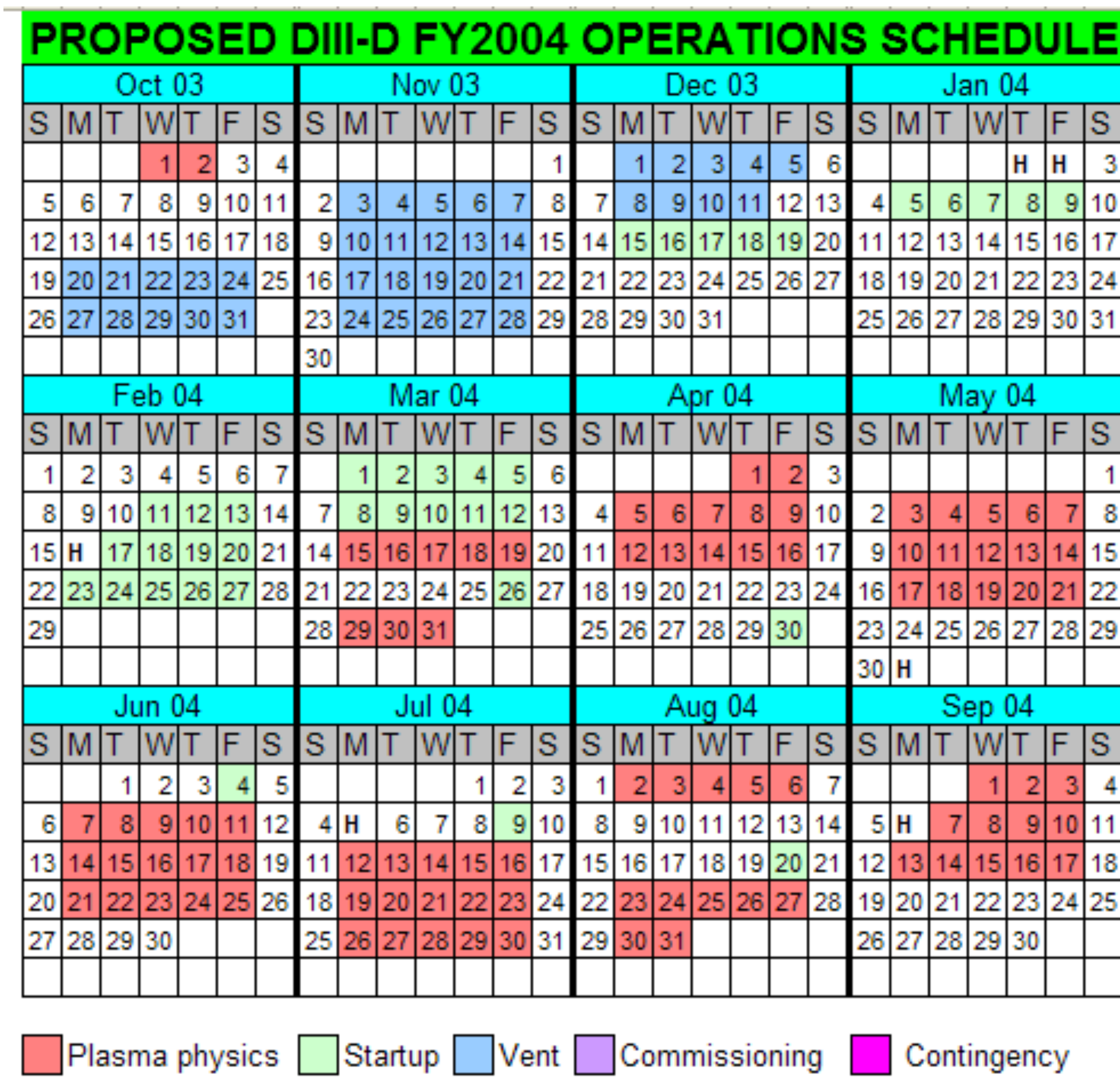

Fig. 1. DIII–D master schedule FY2004 (18 week plan).

ACKNOWLEDGMENT

This is a report of work supported by the U.S. Department of Energy under Cooperative Agreement No. DE-FC02-04ER54698.

APPENDIX A
RESEARCH PROPOSALS RECEIVED

Submitted Proposals

Go To: Detail Text of Proposals Proposal Homepage Research Forum Homepage

To sort by each column, please click on the title. Click on the ID# to see the details of that proposal.

ID#	Name	Affiliation	Title	Research Area
1	Dan R Baker	General Atomics	Dependence of electron density profile on Te and q profiles	Confinement and Transport
2	John S. deGrassie	General Atomics	Toroidal Rotation in ECH and Ohmic H-modes	Confinement and Transport
3	John S. deGrassie	General Atomics	Dimensional Similarity on Toroidal Rotation w/o Torque	Confinement and Transport
4	John S. deGrassie	General Atomics	Toroidal Momentum Confinement Scaling With Input NBI Torque	Confinement and Transport
5	John S. deGrassie	General Atomics	Magnetic Error Fields and Toroidal Momentum Confinement	Confinement and Transport
6	R.Jay Jayakumar	Lawrence Livermore National Laboratory	Generation and Maintenance of Current Hole	Advanced Scenario Development
7	R.Jay Jayakumar	Lawrence Livermore National Laboratory	Current Hole in counter Ip discharge	Advanced Scenario Development
8	R.Jay Jayakumar	Lawrence Livermore National Laboratory	Current profile modification by tearing modes in stationary (hybrid) discharges	Hybrid Scenarios
9	Anthony W Leonard	General Atomics	Edge current modification for ELM studies	Pedestal and ELMs
10	Anthony W Leonard	General Atomics	Outer wall fluxes due to ELMs	Divertor and Edge Physics
11	R.Jay Jayakumar	Lawrence Livermore National Laboratory	Measurement of local oscillating magnetic field associated with RWM, using MSE.	Resistive Wall Modes

13	R.Jay Jayakumar	Lawrence Livermore National Laboratory	High performance discharges with flat q profile	Scenario Development
14	Hiro Takahashi	Princeton Plasma Physics Laboratory	Controlling ELMs and SOL Current in High betaN RWM Discharges Using Externally Applied Field	Pedestal and ELMs
15	Hiro Takahashi	Princeton Plasma Physics Laboratory	Sustain RWM Plasma Rotation through Entraining by Traveling I-coil Current	Resistive Wall Modes
16	Hiro Takahashi	Princeton Plasma Physics Laboratory	Measure Radial Profile of SOL Current during RWM	Resistive Wall Modes
17	Michio Okabayashi	Princeton Plasma Physics Laboratory	Exploration of RWM control near the ideal wall limit with voltage control board	Resistive Wall Modes
18	Hiro Takahashi	Princeton Plasma Physics Laboratory	Extend High betaN RWM Discharge by Countering Control Signal Contamination by SOL Current	Resistive Wall Modes
19	Hiro Takahashi	Princeton Plasma Physics Laboratory	Determine Causality Relationship between Scrape-Off Layer Current and MHD activity	Stability
22	Hiro Takahashi	Princeton Plasma Physics Laboratory	Feedback Control of Non-axisymmetric MHD Instability Using Actively Driven Scrape-Off-Layer Current	Stability
37	Hiro Takahashi	Princeton Plasma Physics Laboratory	Suppress SOL Current in High betaN RWM Discharges by Gas Puffing	Resistive Wall Modes
41	Hiro Takahashi	Princeton Plasma Physics Laboratory	Drive Scrape-Off Layer Current to Interact with MHD Activity	Stability
42	Hiro Takahashi	Princeton Plasma Physics Laboratory	Feedback Control of Vertical Instability Using Actively Driven Scrape-Off-Layer Current	Stability
44	Michio Okabayashi	Princeton Plasma Physics Laboratory	ITER RWM/FFA control simulation with C-coil, using I-coils as rotation profile control tools	Resistive Wall Modes
46	Michio Okabayashi	Princeton Plasma Physics Laboratory	Study of feedback challenge near the ideal wall limit using fake rotation shell logic	Resistive Wall Modes
47	Jim C. DeBoo	General Atomics	Transport barrier studies in QDB discharges	Confinement and Transport

48	Anthony W Leonard	General Atomics	Edge Current Measurement in VH-mode	Pedestal and ELMs
56	Anthony W Leonard	General Atomics	LIthium Beam Diagnostic Calibration Validation	Pedestal and ELMs
57	Charles J. Lasnier	Lawrence Livermore National Laboratory	The role of stochasticity and fast ion orbit loss in QH mode boundaries	QH Mode and QDB
59	Charles J. Lasnier	Lawrence Livermore National Laboratory	Stochastic threshold for ELM suppression	Pedestal and ELMs
60	Garrard D Conway	IPP Garching	Doppler reflectometry for Geodesic Acoustic Mode studies	Confinement and Transport
61	Richard Moyer	University of California, San Diego	Fast Te and turbulent heat flux measurements in L and H modes andacross the L-H transition	Confinement and Transport
62	Richard Moyer	University of California, San Diego	Effect of error fields, islands, and stochasticity on the L-H transition	Confinement and Transport
63	Jose A Boedo	University of California, San Diego	Poloidal asymmetry of Turbulence	Divertor and Edge Physics
64	Jose A Boedo	University of California, San Diego	Influence of ergodic fields on Intermittency	Divertor and Edge Physics
65	Jose A Boedo	University of California, San Diego	ELM dynamics in the edge and SOL	Pedestal and ELMs
66	Dmitry Rudakov	University of California, San Diego	Role of coherent modes on edge pedestal and ELM behavior	Pedestal and ELMs
67	Janardhan Manickam	Princeton Plasma Physics Laboratory	Investigation of feedback stabilization in low-shear systems	Stability
68	Keith H. Burrell	General Atomics	Main ion toroidal rotation studies in ECH and Ohmic H-mode using helium plasmas	Confinement and Transport
69	Punit Gohil	General Atomics	Increased density operation in QH-mode plasmas	QH Mode and QDB
70	Michio Okabayashi	Princeton Plasma Physics Laboratory	Active RFA measurement up to no wall beta limit using feedback	Resistive Wall Modes

71	Charles Greenfield	General Atomics	Optimize fully noninductive AT plasmas at high beta	Advanced Scenario Development
72	Charles Greenfield	General Atomics	Fluctuation documentation of AT plasmas	Advanced Scenario Development
73	Max E Fenstermacher	Lawrence Livermore National Laboratory	SOL Poloidal Flow by Carbon Imaging	Divertor and Edge Physics
75	Charles Greenfield	General Atomics	Demonstrate fast wave control of magnetic shear near magnetic axis	Advanced Scenario Development
76	Michio Okabayashi	Princeton Plasma Physics Laboratory	ELM rejection filter with wave-pocket model	Resistive Wall Modes
77	Keith H. Burrell	General Atomics	Test of neoclassical poloidal rotation theory in helium plasmas	Confinement and Transport
78	Janardhan Manickam	Princeton Plasma Physics Laboratory	Investigation of eigenmode rigidity using the RWM feedback system	Resistive Wall Modes
79	Max E Fenstermacher	Lawrence Livermore National Laboratory	Upper Puff and Pump Radiative Divertor with Impurity Injection	Divertor and Edge Physics
80	Michio Okabayashi	Princeton Plasma Physics Laboratory	Revisit of Psuedo-shell with Internal coil and internal radial sensors	Resistive Wall Modes
81	Jonathan E Menard	Princeton Plasma Physics Laboratory	Profile and stability modifications in high beta-N AT discharges using an I-coil ergodized edge	Advanced Scenario Development
82	T. C. Luce	General Atomics	100% Non-inductive High Performance	Advanced Scenario Development
83	T. C. Luce	General Atomics	Impact of Temperature Ratio on Transport in High Performance Discharges	Advanced Scenario Development
84	Jonathan E Menard	Princeton Plasma Physics Laboratory	Dependence of RWM stability on q(min) in high beta-N AT discharges	Resistive Wall Modes
85	Pete Politzer	General Atomics	Stationary, fully noninductive plasmas	Advanced Scenario Development

86	Pete Politzer	General Atomics	Stationary, fully noninductive plasmas	Heating and Current Drive
87	Pete Politzer	General Atomics	Tearing modes and regulation of the q-profile in the hybrid scenario	Hybrid Scenarios
88	T. C. Luce	General Atomics	Complete Mapping of the Hybrid Scenario Domain	Hybrid Scenarios
89	Pete Politzer	General Atomics	Tearing modes and regulation of the q-profile in the hybrid scenario	Stability
90	T. C. Luce	General Atomics	High Fusion Performance for 10 s	Hybrid Scenarios
91	Pete Politzer	General Atomics	Fusion ignition and burn simulation	Advanced Scenario Development
93	Pete Politzer	General Atomics	Fusion ignition and burn simulation	Hybrid Scenarios
94	T. C. Luce	General Atomics	Importance of Temperature Ratio and Rotation in Hybrid Scenarios	Hybrid Scenarios
95	Pete Politzer	General Atomics	Fusion ignition and burn simulation	Heating and Current Drive
96	Keith H. Burrell	General Atomics	and ECH H-mode reverse sign when the plasma current is reversed?	and Transport
97	Pete Politzer	General Atomics	Bootstrap current physics near the axis	Heating and Current Drive
98	Pete Politzer	General Atomics	Bootstrap current physics near the axis	Advanced Scenario Development
99	T. C. Luce	General Atomics	Ideal Beta Limits at High l_i	HiLi-High Inductance Scenario
100	Pete Politzer	General Atomics	Experiments on the physics of the bootstrap current	Heating and Current Drive
101	Kenneth Gentle	University of Texas	Modulated ECH as a Test of Models of Electron Thermal Transport	Confinement and Transport
102	Jose A Boedo	University of California, San Diego	Test of TRIP3D	Divertor and Edge Physics

103	T. C. Luce	General Atomics	Sawtooth Suppression by EC and FW	HiLi-High Inductance Scenario
104	Neil H Brooks	General Atomics	Radiative Divertor with Helium Plasma and Impurity Injection	Divertor and Edge Physics
105	Richard Moyer	University of California, San Diego	Plasma contact with main chamber wall during ELMs with and without the I-coil	Pedestal and ELMs
106	Robert I. Pinsker	General Atomics	Using edge ergodization to achieve good FW coupling to H-modes	Heating and Current Drive
107	Tim Scoville	General Atomics	Low density locked mode threshold using I-coil	Stability
108	Richard Moyer	University of California, San Diego	Extend ELM suppression with the I-coil to lower density, higher power, and lower triangularity	Pedestal and ELMs
109	Neil H Brooks	General Atomics	SOL Poloidal Flow by Doppler shift measurement	Divertor and Edge Physics
110	Robert I. Pinsker	General Atomics	Study of preionization with FW power - relevant to NSTX CS-free breakdown/rampup scenarios	Heating and Current Drive
111	Keith H. Burrell	General Atomics	Test of neoclassical prediction of toroidal rotation differences of ions as a function of grad P	Confinement and Transport
112	Masanori Murakami	Oak Ridge National Laboratory	Central magnetic shear control using fast wave current drive in AT plasmas	Scenario Development
113	Karl H. Finken	Forschungszentrum Juelich	Impurity transport and He exhaust during stochastic ELM suppression	Pedestal and ELMs
114	Emilia R. Solano	CIEMAT, Spain	Study of ELMs, strike point movements, peeling.	Pedestal and ELMs
115	Emilia R. Solano	CIEMAT, Spain	Driving negative toroidal current in current hole plasmas	Advanced Scenario Development
116	Max E Fenstermacher	Lawrence Livermore National Laboratory	ELMs in the Boundary Plasma vs. q and Bt	Divertor and Edge Physics
117	Peter C. Stangeby	GA ,LLNL and U of Toronto	Interpretation of the 13C deposition expt: DTS + spectroscopy measurements of detached plasmas	Divertor and Edge Physics
119	Ed Synakowski	Princeton Plasma Physics Laboratory	Comparison of Confinement of DIII-D and NSTX Plasmas	Confinement and Transport

120	Dan R Baker	General Atomics	Central Heating without Central Particle Source	Confinement and Transport
121	Neil H Brooks	General Atomics	Helium SAPP (Simple-As-Possible Plasmas) Experiments For Understanding Carbon Sputtering and Redepos	Divertor and Edge Physics
122	James R Wilson	Princeton Plasma Physics Laboratory	Investigation of Parametric Decay during ICRF	Heating and Current Drive
123	Buzhinskij Oleg Igorevich	TRINITI	Investigation of graphite samples exposed to divertor plasma using DiMES system	Divertor and Edge Physics
124	Punit Gohil	General Atomics	Examination of high k fluctuations with increased electron heating	Confinement and Transport
125	Thomas W. Petrie	General Atomics	Can Heat Flux Outside the Slot Divertor Be Reduced?	Divertor and Edge Physics
126	Dennis L. Youchison	Sandia National Laboratories	Tungsten Rod Armor Plasma Exposure	Divertor and Edge Physics
127	Jim C. DeBoo	General Atomics	Determine chie_inc and chie_pb in L-mode discharges	Confinement and Transport
128	Thomas W. Petrie	General Atomics	Variation in Pumping Due to Changes in Magnetic Balance in High Performance Plasmas in ìNormalî BT	Divertor and Edge Physics
129	Neil H Brooks	General Atomics	ELM Characterization with an Improved Temporal Fiducial	Divertor and Edge Physics
130	Punit Gohil	General Atomics	Real time control of plasma profiles	Advanced Scenario Development
131	Robert J La Haye	General Atomics	Low rotation plasma testbed for RWM feedback	Resistive Wall Modes
132	Thomas W. Petrie	General Atomics	Compatibility of the Radiative Divertor Concept With High Performance (ìATî) Operation	Advanced Scenario Development
133	Thomas W. Petrie	General Atomics	Particle Control in a Non-Symmetric Double-null Divertor	Divertor and Edge Physics

134	Thomas W. Petrie	General Atomics	Best Fueling Location For DN Plasmas: High-Field Side vs Low-Field Side	Divertor and Edge Physics
135	Thomas W. Petrie	General Atomics	The Effect of Divertor SOL Flux Expansion on ELM Pulse Intensity	Divertor and Edge Physics
136	Thomas W. Petrie	General Atomics	Evaluation of Transient Particle Flow Across the Divertor Private Flux Region Following an ELM	Divertor and Edge Physics
137	Dmitry Rudakov	University of California, San Diego	Contribution of SOL intermittent transport to main wall interaction in L and H mode	Divertor and Edge Physics
138	Ed Lazarus	Oak Ridge National Laboratory	Beans & Ovals	Stability
139	Robert J La Haye	General Atomics	Higher beta plasmas with 3/2 NTM avoided by ECCD	Stability
140	Todd E. Evans	General Atomics	Testing of the High Resolution DiMES Current Array (HRDCA) in LSN plasmas	Divertor and Edge Physics
141	Tim Scoville	General Atomics	Test models of error field amplification and rotation change hysteresis using I-coil	Stability
142	Robert I. Pinsker	General Atomics	Is direct electron damping of FWs correctly modelled? Comparison of NSTX and DIII-D	Heating and Current Drive
143	C. Craig Petty	General Atomics	Current Drive in the Current Hole	Advanced Scenario Development
144	C. Craig Petty	General Atomics	Higher Beta With High qmin Using Pressure Profile Control	Advanced Scenario Development
145	C. Craig Petty	General Atomics	Higher Beta with ECCD Suppression of 2/1 NTM	Stability
146	C. Craig Petty	General Atomics	ECCD in Long Pulse, High Performance Discharges	Hybrid Scenarios
147	C. Craig Petty	General Atomics	Electron Heat Pinch	Confinement and Transport
148	C. Craig Petty	General Atomics	Electron Transport in ITB Plasmas	Confinement and Transport

149	C. Craig Petty	General Atomics	ECCD in High Beta Poloidal Plasmas	Heating and Current Drive
150	King-Lap K.L. Wong	Princeton Plasma Physics Laboratory	Investigation of density pump-out and Er asymmetry induced by high power ECH with counter beams	Heating and Current Drive
151	C. Craig Petty	General Atomics	ITB Physics: Rotation and Ti/Te	Confinement and Transport
152	C. Craig Petty	General Atomics	Extreme Off-Axis ECCD	Heating and Current Drive
153	C. Craig Petty	General Atomics	High Performance Operation With Te=Ti	Advanced Scenario Development
154	C. Craig Petty	General Atomics	Pulsed ECCD for 3/2 NTM stabilization using PCS	Stability
155	C. Craig Petty	General Atomics	Direct Measurement of ECCD Width from Modulated ECCD	Heating and Current Drive
156	C. Craig Petty	General Atomics	Fiducial Discharges For Comparison With Hybrid Scenario	Hybrid Scenarios
157	C. Craig Petty	General Atomics	Te=Ti With Electron Heating in Hybrid Scenarios	Hybrid Scenarios
158	C. Craig Petty	General Atomics	Rho* Scaling of Hybrid Scenario	Hybrid Scenarios
159	Masanori Murakami	Oak Ridge National Laboratory	Demonstration of full noninductive AT operation using off-axis ECCD	Advanced Scenario Development
160	King-Lap K.L. Wong	Princeton Plasma Physics Laboratory	Modification of plasma rotation profile and angular momentum transport studies by RF waves	Confinement and Transport
161	John Ferron	General Atomics	Feedback control of q during Ip ramp	Advanced Scenario Development
162	C. Craig Petty	General Atomics	ECCD at high electron temperature	Heating and Current Drive
163	C. Craig Petty	General Atomics	Modulation of Bootstrap Current in QBD Regime	QH Mode and QDB

164	C. Craig Petty	General Atomics	Hybrid Scenario in QH-mode	QH Mode and QDB
165	Paul B. Parks	General Atomics	ìSurpassing GW density limit in RS plasma while avoiding NTMsî	Advanced Scenario Development
166	T. C. Luce	General Atomics	MHD Stability with q < 1	HiLi-High Inductance Scenario
167	T. C. Luce	General Atomics	Reduction of edge current density in high l_i plasmas with the I coil	HiLi-High Inductance Scenario
168	T. C. Luce	General Atomics	Mass scaling of confinement and L-H threshold	Confinement and Transport
169	T. C. Luce	General Atomics	Is Degradation of Confinement near the Greenwald Limit Just Low P/P_LH	Confinement and Transport
170	T. C. Luce	General Atomics	How Close to the L_H Threshold Is Gyro-Bohm Scaling Maintained?	Confinement and Transport
171	T. C. Luce	General Atomics	Stiffness in the Electron and Ion Channels	Confinement and Transport
172	T. C. Luce	General Atomics	Increase Beta with 2/1 Tearing Mode Suppression	Stability
173	T. C. Luce	General Atomics	Preventative ECCD for Avoidance of the 2/1 Tearing Mode	Stability
174	Masanori Murakami	Oak Ridge National Laboratory	Sustainment of hybrid discharges using central CD	Hybrid Scenarios
177	didier mazon	CEA Cadarache	Feedback control of the current profile and ITBs	Advanced Scenario Development
178	Wolfgang Jacob	Max-Planck-Institut fuer Plasmaphysik	DiMES heated tile gap experiments (tritium-retention)	Divertor and Edge Physics
179	Volker Philipps	Forschungszentrum Juelich	13C-Methane Injection followed by Oxygen-Baking (T-retention issue)	Divertor and Edge Physics
180	Neil H Brooks	General Atomics	Feasibility Studies for a Divertor CER Diagnostic	Divertor and Edge Physics
181	Buzhinskij Oleg Igorevich	TRINITI	"Real time" boronization on DIII-D	Divertor and Edge Physics

182	Dana H. Edgell	FAR-TECH, Inc.	Simple ELM Characterization and Discrimination for RWM Active Control Signals in DIII-D	Resistive Wall Modes
183	Edgell	FAR-TECH, Inc.	Model-based RWM Control	Wall Modes
184	Masanori Murakami	Oak Ridge National Laboratory	Sustained high q_min NCS discharges using off-axis ECCD	Advanced Scenario Development
185	Joel C. Hosea	Princeton Plasma Physics Laboratory	Compare loading/VMAX of the ABB antennas for several AT regimes	Heating and Current Drive
186	T. C. Luce	General Atomics	Are Small, Growing Tearing Modes Easier to Suppress than Saturated Modes	Stability
187	Eric M Hollmann	University of California, San Diego	Imaging noble gas jet penetration during disruption mitigation	Stability
188	T. C. Luce	General Atomics	Is Suppressing the 3/2 Tearing Mode Worth the Trouble?	Stability
189	T. C. Luce	General Atomics	Suppression of sawteeth with EC power	Stability
190	Dennis Whyte	University of Wisconsin, Madison	Disruption mitigation with higher pressure gas jet	Stability
191	James W. Davis	U of Toronto	Hydrocarbon dissociation and transport studies using a porous plug injector	Divertor and Edge Physics
192	T. C. Luce	General Atomics	Tearing Mode as a Voltage Source Due to Modulation of the Amplitude	Stability
193	Keith H. Burrell	General Atomics	Modulated transport studies of all four transport channels	Confinement and Transport
195	Wayne M Solomon	Princeton Plasma Physics Laboratory	Study of toroidal rotation with varying momentum input	Confinement and Transport
196	Ron Prater	General Atomics	Effect of radial transport on ECCD profile	Heating and Current Drive
197	Wayne M Solomon	Princeton Plasma Physics Laboratory	Detailed comparison of measured poloidal velocity profiles with neoclassical prediction	Confinement and Transport
198	Wayne M Solomon	Princeton Plasma Physics Laboratory	Onset of turbulence with increasing momentum input	Confinement and Transport

199	Dennis Whyte	University of Wisconsin, Madison	Identifying carbon source locations using the window-frame technique	Divertor and Edge Physics
200	Richard Moyer	University of California, San Diego	Can the I-coil provide a co-injected QH mode?	QH Mode and QDB
201	Ron Prater	General Atomics	Compare effectiveness of large ECCD current vs large current density in stabilizing the 3/2 NTM	Stability
202	Jon Kinsey	Lehigh University	Transport in TEM dominated plasmas	Confinement and Transport
204	Richard Moyer	University of California, San Diego	Can the I-coil be used to produce a quasi-stationary VH mode?	Pedestal and ELMs
205	Larry W. Owen	Oak Ridge National Laboratory	Pedestal particle source in H-mode plasmas	Pedestal and ELMs
206	Anthony W Leonard	General Atomics	Small pellets for impurity entrainment in radiative divertors	Divertor and Edge Physics
207	Jon Kinsey	Lehigh University	Shafranov shift stabilization in H-mode discharges	Confinement and Transport
208	John Ferron	General Atomics	Tune the I-coil setup for minimum rotation drag for q_min > 2	Advanced Scenario Development
209	John Ferron	General Atomics	Test the achievable beta with q(0) closer to q_min	Advanced Scenario Development
210	John Ferron	General Atomics	Test I-coil stabilization of low rotation AT, q_min > 2 discharges	Advanced Scenario Development
211	Dmitri A. Mossessian	Mass. Inst. of Technology	DIII-D/C-Mod similarity with RF heating and lower upper triangularity	Pedestal and ELMs
212	Alberto Loarte	EFDA-CSU Garching	JET/DIII-D similarity experiments	Pedestal and ELMs
213	Ronald V. Bravenec	University of Texas	Benchmarking gyrokinetic simulations (GYRO, GS2) against DIII-D discharges	Confinement and Transport
214	Maxim V Umansky	Lawrence Livermore National Laboratory	Studies of effects of induced edge stochasticity on intermittent edge transport	Divertor and Edge Physics
215	Dmitry Rudakov	University of California, San Diego	Study erosion of ITER-relevant first wall materials in USN and IWL discharges	Divertor and Edge Physics

216	Maxim V Umansky	Lawrence Livermore National Laboratory	Intermittent edge transport in helium plasmas	Divertor and Edge Physics
217	Michio Okabayashi	Princeton Plasma Physics Laboratory	Study of ideal MHD stability status between ELMs with ìactive RFA measurementî	Resistive Wall Modes
218	Eric Fredrickson	Princeton Plasma Physics Laboratory	NTM threshold comparison	Stability
		University of Wisconsin, Madison	Scaling of global hydrogenic retention with plasma parameters	Divertor and Edge Physics
220	Eric Fredrickson	Princeton Plasma Physics Laboratory	NSTX/DIII-D CAE/TAE comparison	Stability
221	T. C. Luce	General Atomics	Test of ECCD Efficiency at ITER-like Temperatures	Heating and Current Drive
222	T. C. Luce	General Atomics	Test Models of Fast Ion Absorption of High Harmonic FW	Heating and Current Drive
223	Rajesh Maingi	Oak Ridge National Laboratory	Dependence of H-mode Pedestal Structure on Aspect Ratio	Pedestal and ELMs
224	T. C. Luce	General Atomics	Verification of Neutral Beam Current Drive Profile	Heating and Current Drive
225	Leonid Rudakov	Naval Research Laboratory	Rotation waves in Fusion Plasma	Heating and Current Drive
226	T. C. Luce	General Atomics	Validation of Bootstrap Current Models	Heating and Current Drive
227	T. C. Luce	General Atomics	Test of Edge Bootstrap Models	Confinement and Transport
228	Steven Lisgo	U of Toronto	"Window-frame" experiments on main chamber recycling	Divertor and Edge Physics
229	William R. Wampler	Sandia National Laboratories	Carbon erosion with argon-induced detached plasma	Divertor and Edge Physics
230	Dmitry Rudakov	University of California, San Diego	Effect of the secondary electron emission on the Langmuir probe measurements	Divertor and Edge Physics
231	R.Jay Jayakumar	Lawrence Livermore National Laboratory	Effect of rotation on qmin in hybrid discharges	Hybrid Scenarios
233	W. Phil West	General Atomics	Plasma Startup without the central solenoid or central pf coils using induction from outer pf coils	Stability

235	Peter C. Stangeby	GA ,LLNL and U of Toronto	ITER Critical Issue: Tritium-Retention Studies	Divertor and Edge Physics
236	C. Craig Petty	General Atomics	Fast Wave Damping on Ions and Electrons	Advanced Scenario Development
237	Todd E. Evans	General Atomics	Evaluate level of boundary toroidal asymmetry with I-coil perturbation	Divertor and Edge Physics
238	C. Craig Petty	General Atomics	ECCD Profile Width in QBD Mode	QH Mode and QDB
239	Garofalo	Columbia University	Induce plasma rotation using n=1 RFA	Wall Modes
240	Andrea M Garofalo	Columbia University	Develop target with low plasma-rotation using RF heating	Resistive Wall Modes
241	Morrell S. Chance	Princeton Plasma Physics Laboratory	Negative Helicity RWM n=1 braking	Resistive Wall Modes
242	Andrea M Garofalo	Columbia University	Measurement of the RFA vs. plasma rotation	Resistive Wall Modes
243	Andrea M Garofalo	Columbia University	Improvement of dynamic error field correction near the ideal-wall limit	Resistive Wall Modes
244	T. C. Luce	General Atomics	Electron Bernstein Wave Heating and Current Drive in DIII-D	Heating and Current Drive
245	T. C. Luce	General Atomics	Density Limit: Transport Increase or X-Point MARFE	Divertor and Edge Physics
246	T. C. Luce	General Atomics	Study of Radiative Divertor Solutions in Low Recycling Divertor Plasmas	Divertor and Edge Physics
247	W. Phil West	General Atomics	Thin melt layer dynamics in the divertor during disruptions	Divertor and Edge Physics
248	Bruce Lipschultz	MIT Plasma Science and Fusion Center	Extend SOL radial transport analysis to H-mode plasmas	Divertor and Edge Physics
249	Andrea M Garofalo	Columbia University	Optimization w.r.t. plasma rotation of the error field correction from I-coil	Resistive Wall Modes
250	Andrea M Garofalo	Columbia University	Develop low-rotation target using the flat q-profile scenario	Resistive Wall Modes
251	Andrea M Garofalo	Columbia University	Develop low-rotation target by varying the plasma density	Resistive Wall Modes
252	Andrea M Garofalo	Columbia University	Large rho_qmin and qmin AT scenario development	Advanced Scenario Development

253	Todd E. Evans	General Atomics	Validation of the TRIP3D field line integration code	Pedestal and ELMs
254	Andrea M Garofalo	Columbia University	Large rho_qmin using toroidal field ramp-down	Advanced Scenario Development
255	Raffi Nazikian	Princeton Plasma Physics Laboratory	ITB formation and turbulence suppression at rational q values	Confinement and Transport
256	Raffi Nazikian	Princeton Plasma Physics Laboratory	Direct measurement of core AE damping rates	Stability
257	Michael J Schaffer	GA/ORISE	First Principles Error Correction	Stability
258	David Rasmussen	Oak Ridge National Laboratory	Long pulse FW heating and current drive	Heating and Current Drive
259	Larry R. Baylor	Oak Ridge National Laboratory	High Density ELM suppresssion with pellets and a stochastic boundary	Pedestal and ELMs
260	Larry R. Baylor	Oak Ridge National Laboratory	Poloidal rotation from parallel neutral beam injection force	Confinement and Transport
261	Larry R. Baylor	Oak Ridge National Laboratory	Pellet Injection as a Pedestal Modification and ELM control tool	Pedestal and ELMs
262	Larry R. Baylor	Oak Ridge National Laboratory	Test of HFS Pellet Fueling Fast Transport Theory	Divertor and Edge Physics
263	George Tynan	University of California, San Diego	Evolution of turbulence-shear flow interactions as L-H transition is approached	Confinement and Transport
264	Larry R. Baylor	Oak Ridge National Laboratory	High Density Operation Compatible with Burning Plasma Scenario	Divertor and Edge Physics
265	Larry R. Baylor	Oak Ridge National Laboratory	Higher Density Operation of the QH-mode and compatibility with pellet injection	QH Mode and QDB
266	Larry R. Baylor	Oak Ridge National Laboratory	Pellet cloud diagnostic comparison with theory	Divertor and Edge Physics
267	Alexander Pigarov	University of California, San Diego	Impurity convective transport in SAPP and L-H shots	Divertor and Edge Physics
268	Gerald A Navratil	Columbia University	Preliminary Test of Audio Amplifiers for RWM Control	Resistive Wall Modes
269	Gerald A Navratil	Columbia University	Current Hole Plasma for RWM Studies	Resistive Wall Modes

270	Gerald A Navratil	Columbia University	Twelve independent channels for I-coil feedback	Resistive Wall Modes
271	Gerald A Navratil	Columbia University	MHD Spectroscopic Study of RWM Damping Rate with Feedback	Resistive Wall Modes
272	George Sips	IPP Garching	Density variation in Hybrid scenarios	Hybrid Scenarios
273	Larry R. Baylor	Oak Ridge National Laboratory	High density operation with long pulse pellet fueling	Hybrid Scenarios
274	Charles E. Kessel	Princeton Plasma Physics Laboratory	Beta Limitations from n=2 and 3 Linear Ideal Instabilities	Stability
275	Charles E. Kessel	Princeton Plasma Physics Laboratory	Interpolation of Plasma Shape and Density Operating Points	Advanced Scenario Development
276	Paul R THOMAS	CEA Cadarache	AC Edge Ergodisation using I-coils	Pedestal and ELMs
277	Charles E. Kessel	Princeton Plasma Physics Laboratory	Production of Sustainable ITBís Outside of Rho=0.5	Advanced Scenario Development
278	Martin Valovic	EURATOM/UKAEA FUSION ASSOCIATION	Aspect ratio scan of heat transport with MAST and DIII-D	Confinement and Transport
280	Gerald A Navratil	Columbia University	Study of n=2 and n=3 RWMs	Resistive Wall Modes
281	Clive D Challis	UKAEA Culham	Wide ITBs with negative shear and q-minimum=integer trigger	Confinement and Transport
282	Olivier Sauter	CRPP - EPFL	NTM Avoidance Using Sawtooth Control	Stability
283	Jef P.H.E Ongena	ERM-KMS, Lab Plasmaphysics, 1000 Brussel	JET / DIII-D similarity experiments at high delta with impurity seeding	Pedestal and ELMs
284	David F Howell	UKAEA Culham	Size scaling for error field locked mode thresholds	Stability
285	Sibylle Guenter	IPP Garching	Dependence of rotation damping on m-numbers of external error fields	Stability
286	Amanda E Hubbard	Mass. Inst. of Technology	Dimensionless Comparison of L-H threshold conditions on C-Mod and DIIID	Confinement and Transport
288	Sibylle Guenter	IPP Garching	Triggering of the transition of (3,2) NTMs into the FIR regime	Stability
289	Paul R THOMAS	CEA Cadarache	Does ELM suppression seen with n=3 coil change continuously with perturbation amplitude?	Pedestal and ELMs

290	gabriella Saibene	EFDA Close Support Unit - GArching	Type II ELMs at high density and/or high beta	Pedestal and ELMs
291	Punit Gohil	General Atomics	Affect of plasma size on ITB formation	Confinement and Transport
292	James R Wilson	Princeton Plasma Physics Laboratory	Stabilization of Sawteeth by freezing the q profile	HiLi-High Inductance Scenario
293	Olivier Sauter	CRPP - EPFL	ECCD Contribution To NTM Modified Rutherford Equation	Stability
294	Dale M Meade	Princeton Plasma Physics Laboratory	Determine Effect of Triangularity on Pedestal and Elms	Pedestal and ELMs
295	Dale M Meade	Princeton Plasma Physics Laboratory	Determine Effect of SN/DN Topology on Pedestal and Elms	Pedestal and ELMs
296	Dale M Meade	Princeton Plasma Physics Laboratory	Develop High Performance NCS AT modes for Next Step BPX and ARIES-RS/AT.	Advanced Scenario Development
297	Olivier Sauter	CRPP - EPFL	Electron vs ion transport with reverse shear profiles	Confinement and Transport
298	Dale M Meade	Princeton Plasma Physics Laboratory	Evaluate Double Null and Single Null on NCS AT Performance	Advanced Scenario Development
299	Dale M Meade	Princeton Plasma Physics Laboratory	Optimizing the Plasma Shape and Divertor Topology for the QH and QDB Modes	QH Mode and QDB
300	Dale M Meade	Princeton Plasma Physics Laboratory	Optimizing the Plasma Shape and Divertor Topology for Hybrid Scenarios	Hybrid Scenarios
301	John Ferron	General Atomics	Improve on high beta_N discharges with pressure profile broadening	Advanced Scenario Development
302	Nick C Hawkes	UKAEA Culham	Study heating mechanisms within the current hole	Advanced Scenario Development
303	John Ferron	General Atomics	Feedback control of the steady-state current profile	Advanced Scenario Development
304	Igor Semenov	Kurchatov Institute, Russia	The feedback effect between resonance surfaces and applied perturbations including SOL halo currents	Stability
305	John Ferron	General Atomics	Test a smaller outer gap in AT scenarios for higher achievable beta_N	Advanced Scenario Development

306	John Ferron	General Atomics	Steady-state in high beta, high kappa/delta discharges	Advanced Scenario Development
307	Simon D Pinches	Max-Planck-Intistitut fuer Plasmaphysik	Cross-Machine Scaling of RWMs	Resistive Wall Modes
308	Michio Okabayashi	Princeton Plasma Physics Laboratory	"Ergodic rotating limiter with n=1"	Pedestal and ELMs
309	Manabu Takechi	JAERI	Extend High betaN discharge by reduction of RWM and NTM in ITB plasmas (International remote exp.)	Resistive Wall Modes
310	Michael J Schaffer	GA/ORISE	L-H Transition vs. X-Point Potential	Divertor and Edge Physics
311	Michio Okabayashi	Princeton Plasma Physics Laboratory	Ideal MHD status of RWM, NTM, ELMs and I-coil optimization in AT plasma	Advanced Scenario Development
312	Emmanuel H Joffrin	CEA Cadarache	Investigation of the role of q profile in the hybrid scenario	Hybrid Scenarios
313	Richard J Buttery	EURATOM/UKAEA FUSION ASSOCIATION	2/1 NTM physics	Stability
314	David Mikkelsen	Princeton Plasma Physics Laboratory	Search for ETG modes with Central Electron Cyclotron Heating	and Transport
316	Richard H. Goulding	Oak Ridge National Laboratory	High Harmonic Fast Wave Studies: Comparison with NSTX Power Deposition and 117 MHz Performance	Heating and Current Drive
317	Richard J Buttery	EURATOM/UKAEA FUSION ASSOCIATION	RWM feedback after plasma stops	Resistive Wall Modes
318	Robert Budny	Princeton Plasma Physics Laboratory	Determining angular momentum transport using two extremely different rotation profiles	Resistive Wall Modes
320	Richard J Buttery	EURATOM/UKAEA FUSION ASSOCIATION	ELM control with n=1 fields	Pedestal and ELMs
321	C. Craig Petty	General Atomics	Sustained Monster Sawteeth	HiLi-High Inductance Scenario
322	Robert I. Pinsker	General Atomics	Moderate harmonic (3rd and 4th) ECH	Heating and Current Drive

323	Robert Budny	Princeton Plasma Physics Laboratory	Transport barriers with small applied torque	Confinement and Transport
324	Richard Groebner	General Atomics	Characterization of Turbulence in Pedestal	Pedestal and ELMs
325	M. F. F. Nave	Associacao EURATOM/IST	NTM triggering by magnetic mode coupling	Stability
326	Robert Budny	Princeton Plasma Physics Laboratory	Multi-species transport in steady state plasmas	QH Mode and QDB
327	Robert I. Pinsker	General Atomics	High central fast wave current drive efficiency at high electon beta with 110 GHz ECH	Heating and Current Drive
328	Gerrit Kramer	Princeton Plasma Physics Laboratory	Momentum and energy transport induced by error fields	Confinement and Transport
329	C. Craig Petty	General Atomics	Sustainment of High Li with Central Current Drive	HiLi-High Inductance Scenario
330	Gerrit Kramer	Princeton Plasma Physics Laboratory	The relation between Alfv?en cascades and BAEs in DIII-D	Stability
331	Gerrit Kramer	Princeton Plasma Physics Laboratory	Accurate benchmarking of ExB rotation from correlation reflectometry, BES and CER	Confinement and Transport
332	Francis W. Perkins	Princeton DIII-D	Evaluation of RWM Feedback Connections based on MHD Eigenfunctions	Resistive
333	clement wong	General Atomics	Heated and wetted Li-DiMES	Divertor and Edge Physics
334	Gerrit Kramer	Princeton Plasma Physics Laboratory	Toroidal turbulence velocity measurements from correlation reflectometry	Confinement and Transport
335	C. Craig Petty	General Atomics	Effect of Magnetic Shear on Transport	HiLi-High Inductance Scenario
336	Tom Osborne	General Atomics	Steady State VH-mode	Pedestal and ELMs
337	Tom Osborne	General Atomics	Scaling of ETB width with rho*	Pedestal and ELMs
338	Donald B. Batchelor	Oak Ridge National Laboratory	RF Modeling fot AT and high li discharges	Heating and Current Drive

339	Donald L. Hillis	Oak Ridge National Laboratory	Effects of High Recycling Impurities on Advanced Operating Scenarios	Hybrid Scenarios
340	Mickey R Wade	Oak Ridge National Laboratory	Low Squareness, High li Scenario Development	HiLi-High Inductance Scenario
341	Tom Osborne	General Atomics	Effect of Edge Current Density on ETB Width	Pedestal and ELMs
342	Mickey R Wade	Oak Ridge National Laboratory	Te=Ti, Low Rotation AT Target Development	Advanced Scenario Development
343	Mickey R Wade	Oak Ridge National Laboratory	Third Harmonic ECH and ECCD	Heating and Current Drive
344	Mickey R Wade	Oak Ridge National Laboratory	10-s High Performance Hybrid Scenario	Hybrid Scenarios
345	Andrea M Garofalo	Columbia University	Develop low-rotation target using magnetic braking	Resistive Wall Modes
346	Mickey R Wade	Oak Ridge National Laboratory	Te=Ti, Low Rotation Hybrid Scenario Development	Hybrid Scenarios
347	C. Craig Petty	General Atomics	Dependence of Stiffness on Elongation	Confinement and Transport
348	Mickey R Wade	Oak Ridge National Laboratory	Test of Conductivity Models	Heating and Current Drive
349	W. Phil West	General Atomics	Modification of Edge Current and Stability in QH and ELMing H modes using current ramps.	QH Mode and QDB
350	Wade	Laboratory	Reduced Toroidal Field	Wall Modes
351	C. Craig Petty	General Atomics	PEP Mode to Alternate Between Turbulence Modes	Confinement and Transport
352	Andrea M Garofalo	Columbia University	Test RWM stabilization by trapped particles model	Resistive Wall Modes
353	Mickey R Wade	Oak Ridge National Laboratory	Quantify effect of Tearing Modes on Particle and Energy Transport	Confinement and Transport
354	Michio Okabayashi	Princeton Plasma Physics Laboratory	Optimization of direct feedback RWM stabilization	Resistive Wall Modes
355	R.Jay Jayakumar	Lawrence Livermore National Laboratory	Effect of error field on the Dynamo action in Hybrid discharges	Hybrid Scenarios
356	Mickey R Wade	Oak Ridge National Laboratory	Edge Impurity Dynamics during ELMs	Pedestal and ELMs

357	Michio Okabayashi	Princeton Plasma Physics Laboratory	Application of feedback technique at AT plasmas like current hole	Resistive Wall Modes
358	Mickey R Wade	Oak Ridge National Laboratory	Helium Transport and Exhaust in Hybrid Scenario	Hybrid Scenarios
359	Andrea M Garofalo	Columbia University	RWM feedback tests in low rotation target	Resistive Wall Modes
360	Mickey R Wade	Oak Ridge National Laboratory	Effect of ECH on Impurity Transport in QDB	QH Mode and QDB
361	Mickey R Wade	Oak Ridge National Laboratory	Low Squareness, High Beta Discharges	Stability
362	Mickey R Wade	Oak Ridge National Laboratory	Direct Measurement of the Edge Bootstrap Current	Pedestal and ELMs
363	John Ferron	General Atomics	Development of high li scenarios and tests of the beta limit	HiLi-High Inductance Scenario
364	Mickey R Wade	Oak Ridge National Laboratory	Impurity Transport in High Non-Inductive Fraction Discharge	Advanced Scenario Development
365	Tom Osborne	General Atomics	Small, Type II, ELMs at High Density with Large ETB Width	Pedestal and ELMs
366	Andrea M Garofalo	Columbia University	High betaN sustainment using flat q-profile scenario	Advanced Scenario Development
367	Michio Okabayashi	Princeton Plasma Physics Laboratory	First attempt of Audio amplifier for RWM feedback	Resistive Wall Modes
368	Mickey R Wade	Oak Ridge National Laboratory	Measurement of Plasma Spin-Up Dynamics	Confinement and Transport
369	Wade	Laboratory	Plasma Response to Pellet Injection	Confinement and Transport
370	John Ferron	General Atomics	Reproduce a previous beta_N=5.2, li=1.1 discharge	HiLi-High Inductance Scenario
371	Mickey R Wade	Oak Ridge National Laboratory	Simultaneous Measurement of Electron and Ion Response to ELM	Pedestal and ELMs
372	clement wong	General Atomics	Three piggyback DiMES experiments	Divertor and Edge Physics
373	John Ferron	General Atomics	Steady-state VH-mode through controlled impurity radiation	Pedestal and ELMs

374	John Ferron	General Atomics	n=1 beta limit versus edge pedestal height	Advanced Scenario Development
375	Keith H. Burrell	General Atomics	Effect of Ip ramps on edge parameters at the L-H transition	Confinement and Transport
376	Keith H. Burrell	General Atomics	Investigate high triangularity QH-mode	QH Mode and QDB
377	Keith H. Burrell	General Atomics	Parametric dependence of edge Er well in QH-mode plasmas	QH Mode and QDB
378	Keith H. Burrell	General Atomics	Expand the QH-mode density range by utilizing increased current and a different shape	QH Mode and QDB
379	Keith H. Burrell	General Atomics	Does transport set edge gradients in QH-mode?	QH Mode and QDB
380	Michio Okabayashi	Princeton Plasma Physics Laboratory	Systematic study of critical rotation profile of RWM by using I-coil and comparison with MARS	Resistive Wall Modes
381	Keith H. Burrell	General Atomics	Effect of error field minimization on QH-mode plasmas	QH Mode and QDB
382	Keith H. Burrell	General Atomics	Does the EHO enhance edge impurity loss?	QH Mode and QDB
383	Keith H. Burrell	General Atomics	Improved startup phase for quiescent H-mode	QH Mode and QDB
384	Keith H. Burrell	General Atomics	Investigate effect of fast wave heating on quiescent H-mode	QH Mode and QDB
385	Keith H. Burrell	General Atomics	RF sustained QH-mode	QH Mode and QDB
386	Keith H. Burrell	General Atomics	Do all ions have the same T_i in the SOL of QH-mode plasmas?	QH Mode and QDB
387	Keith H. Burrell	General Atomics	Demonstrate an ITER hybrid scenario using QDB plasmas	QH Mode and QDB
388	Jonathan G. Watkins	Sandia National Laboratories	Stochastic Boundary q95 scan at constant density	Pedestal and ELMs
389	George R McKee	University of Wisconsin, Madison	Parametric scaling of Geodesic Acoustic Modes characteristics	Confinement and Transport
390	Wojciech Fundamenski	JET, UK	Near-SOL Energy Transport in ELMy H-modes	Pedestal and ELMs
391	Mathias Groth	Lawrence Livermore National Laboratory	Fuel and impurity sources: Is the divertor region the primary source?	Divertor and Edge Physics
392	Mathias Groth	Lawrence Livermore National Laboratory	Poloidal distribution of the neutral density in the pedestal / SOL region	Divertor and Edge Physics

393	Mathias Groth	Lawrence Livermore National Laboratory	Midplane Da and CIII emission profiles in the low-field side pedestal region during ELMs	Divertor and Edge Physics
394	Mathias Groth	Lawrence Livermore National Laboratory	Dependence of the gas jet penetration depth on the plasma pressure during disruption mitigation exp	Stability
395	Andrea M Garofalo	Columbia University	Continuos measurement of RFA vs betaN and vs plasma rotation	Resistive Wall Modes
396	Andrea M Garofalo	Columbia University	Test wall stabilization vs. wall distance	Resistive Wall Modes
397	Michio Okabayashi	Princeton Plasma Physics Laboratory	RWM stabilization by forced rotation with synchronizing the rotating field	Resistive Wall Modes
398	Lang L Lao	General Atomics	Exploration of Error Field Effects on Magnetic Surfaces to Guide Modeling Efforts	Stability
399	Dave Humphreys	General Atomics	3/2 NTM Suppression Using Feedback on Realtime Measurement of q-surface location	Stability
400	Dave Humphreys	General Atomics	Comparison of Vertical Position Variation and Mirror Steering Control for NTM Suppression	Stability
401	Dave Humphreys	General Atomics	Study MIMO Controller Effects on Plasma Shape/Stability Regulation	Stability
402	Dave Humphreys	General Atomics	Study of ITER Control Issues	Stability
403	Edward Doyle	UCLA	Generate co-NBI QDB plasma using I-coil for ELM suppression	QH Mode and QDB
405	Michio Okabayashi	Princeton Plasma Physics Laboratory	Active MHD spectroscopy around 400 Hz and Improvement of RWM feedback in 2.4Li and AT plasmas	Resistive Wall Modes
406	Edward Doyle	UCLA	Control of ITB radius with ECCD in flat q-profile discharges	Advanced Scenario Development
			Obtaining high performance operation with Te~Ti	Advanced Development
408	Edward Doyle	UCLA	Obtaining QDB operation with Te~Ti	QH Mode and QDB
409	Edward Doyle	UCLA	Investigate and optimize beta limits in QDB plasmas	QH Mode and QDB
410	Michio Okabayashi	Princeton Plasma Physics Laboratory	Possibility of Feedback parameter selection leading to ELM free operation	Resistive Wall Modes

411	Edward Doyle	UCLA	Investigation of current hole discharges in DIII-D	Advanced Scenario Development
412	Holger Reimerdes	Columbia University	Measurement of coil-plasma coupling for different helicities	Resistive Wall Modes
413	Holger Reimerdes	Columbia University	Develop standard use of MHD spectroscopy in high performance plasmas	Advanced Scenario Development
414	Holger Reimerdes	Columbia University	q- and rotation-profile dependence of the critical rotation for RWM stabilization	Resistive Wall Modes
415	Holger Reimerdes	Columbia University	Develop low-rotation target using active magnetic braking and real-time rotation measurements	Resistive Wall Modes
416	Holger Reimerdes	Columbia University	Early non-resonant braking	Resistive Wall Modes
417	Holger Reimerdes	Columbia University	Complete frequency scan at high betaN	Resistive Wall Modes
418	Holger Reimerdes	Columbia University	RWM scenario with counter injection	Resistive Wall Modes
419	Holger Reimerdes	Columbia University	Aspect ratio effects on RWM stability (joint DIII-D / NSTX experiment)	Resistive Wall Modes
420	Terry L. Rhodes	UCLA	Next step towards predictive transport capability: Detailed comparison of expt. to turb. simulations	Confinement and Transport
421	Terry L. Rhodes	UCLA	Existence of high-k turbulence and tests of theoretical predictions	Confinement and Transport
422	Terry L. Rhodes	UCLA	Continue tests and validation of intermediate-k FIR scattering system	Confinement and Transport
423	Ioan N. Bogatu	Non-affiliated	RWM Internal Structure Evolution Identification by SXR Contrast Enhancing Technique on DIII-D	Resistive Wall Modes
424	Thomas A. Casper	Lawrence Livermore National Laboratory	Edge current and collisionality modification with EC power	Pedestal and ELMs
425	Thomas A. Casper	Lawrence Livermore National Laboratory	Transport scaling using EC injection into ITB discharge	Confinement and Transport
426	Thomas A. Casper	Lawrence Livermore National Laboratory	Performance scaling and control in QDB discharges.	QH Mode and QDB

427	Ali Mahdavi	General Atomics	Test of the peeling-ballooning mode theory of the pedestal pressure limit and understanding of the o	Pedestal and ELMs
428	Ali Mahdavi	General Atomics	PEDESTAL AND CONFINEMENT ENHANCEMENT AND DESNITY INCREASE WITH PELLET FUELING	Pedestal and ELMs
429	George R McKee	University of Wisconsin, Madison	Test of electron thermal transport mechanisms	Confinement and Transport
430	Jonathan G. Watkins	Sandia National Laboratories	ELM control using xpt fueling	Pedestal and ELMs
431	gary jackson	General Atomics	Sustained VH-mode with a Stochastic Edge	Pedestal and ELMs
432	Jonathan G. Watkins	Sandia National Laboratories	density control with xpt fueling	Divertor and Edge Physics
433	Jonathan G. Watkins	Sandia National Laboratories	drsep scan with stochastic boundary	Pedestal and ELMs
434	Jonathan G. Watkins	Sandia National Laboratories	Very Narrow Target Heat Flux in H mode	Divertor and Edge Physics
435	Jonathan G. Watkins	Sandia National Laboratories	Target Plate ELM measurements	Pedestal and ELMs
436	Paul B. Parks	General Atomics	Towards a high-density continuous gas jet fueling approach	Divertor and Edge Physics
437	Max Austin	University of Texas	Electron-ITB's dependence on magnetic shear and rational q	Confinement and Transport
438	Jonathan G. Watkins	Sandia National Laboratories	Test trip3D with detailed target plate profiles during stochastic boundary operation	Pedestal and ELMs
439	Akihiko Isayama	JAERI	Suppression of 2/1 Neoclassical Tearing Mode by Early EC Wave Injection	Stability
440	Edward Doyle	UCLA	Test of profile control using ECH	Advanced Scenario Development
441	R. Coelho	Associacao EURATOM/IST	NTM excitation and plasma momentum braking by resonant error-fields	Stability
442	Deepak Gupta	University of Wisconsin, Madison	Direct Comparison of Growth and Shearing Rates of Turbulence	and Transport

443	gary jackson	General Atomics	Low Toroidal Rotation RWM stabilization with n=3 Stochastic Fields	Resistive Wall Modes
444	Charles Greenfield	General Atomics	Feedback control of current profile	Advanced Scenario Development
445	Ronald V. Bravenec	University of Texas	Benchmarking turbulence codes against ETG-free discharges	Confinement and Transport
446	Charles Greenfield	General Atomics	Kinetic profile control tool development	Advanced Scenario Development
447	Charles Greenfield	General Atomics	Search for ETG Streamers	Confinement and Transport
448	Charles Greenfield	General Atomics	Initial studies of current holes	Advanced Scenario Development
449	Charles Greenfield	General Atomics	AT plasmas with Te~Ti	Advanced Scenario Development
450	John Ferron	General Atomics	Return to 1.6 T to apply what we have learned for increasing beta	Advanced Scenario Development
452	Charles Greenfield	General Atomics	Internal Transport Barriers with Te~Ti	Confinement and Transport
453	John S. deGrassie	General Atomics	RFCD Sustainment of Hi-Li post kappa ramp	HiLi-High Inductance Scenario
454	M. F. F. Nave	Associacao EURATOM/IST	RWM/RFA excitation and relation to the ELM mode structure	Resistive Wall Modes
455	Guiding Wang	UCLA	The edge pedestal formation in different types of H-mode plasmas	Pedestal and ELMs
456	Mickey R Wade	Oak Ridge National Laboratory	Dynamics of the EQ Transition in QH-mode	QH Mode and QDB
457	Guiding Wang	UCLA	Characterize L-H transitions with NBI power close to power threshold with high resolution diagnostic	Confinement and Transport
458	Mickey R Wade	Oak Ridge National Laboratory	Current Hole H-mode Discharges	Advanced Scenario Development

459	gary jackson	General Atomics	An I-coil ELM trigger	ELMs
460	Mickey R Wade	Oak Ridge National Laboratory	Impurity Enrichment Using Puff and Pump in Hybrid Scenario	Hybrid Scenarios
461	Francis W. Perkins	Princeton DIII-D Collaboration	Neoclassical Tearing Modes: Stabilization Requirements at Small Amplitude and Mode Locking	Stability
462	Phil Snyder	General Atomics	Toroidal Asymmetry of the ELM Crash	Pedestal and ELMs
463	Jeffery Harris	Australian National University	I-Coil & ELMs: cross correlation between MHD and edge/divertor probes	Pedestal and ELMs
464	gary jackson	General Atomics	I-coil Induced Plasma Rotation	Resistive Wall Modes
465	Mickey R Wade	Oak Ridge National Laboratory	Effect of Loop Voltage on L-H Transition	Confinement and Transport
466	Michael Makowski	Lawrence Livermore National Laboratory	Using ECH Density Control to Broaden Pressure Profile and Increase the Beta Limit	Advanced Scenario Development
467	Phil Snyder	General Atomics	Pedestal Studies Using Small Pellets	Pedestal and ELMs
468	Dylan P. Brennan	GA/ORISE	Poles in Delta-Prime on Approach to a Sawtooth Crash	Stability
469	Dylan P. Brennan	GA/ORISE	A Study of Tearing Evolution to NTMs at Slow Beta Ramp Rates	Stability
470	Punit Gohil	General Atomics	Collaborative ITB studies on DIII-D and JT-60U	Confinement and Transport
471	William W Heidbrink	UC Irvine	Monster sawteeth that never crash	HiLi-High Inductance Scenario
472	Mickey R Wade	Oak Ridge National Laboratory	Sensitivity of Particle Transport to Electron/Ion Heating Balance	Confinement and Transport
473	Phil Snyder	General Atomics	VH Mode Edge Characterization	Pedestal and ELMs
474	Mickey R Wade	Oak Ridge National Laboratory	Effect of Magnetic Shear on Particle Transport	Confinement and Transport

475	Francis W. Perkins	Princeton DIII-D Collaboration	Does the plasma spin the pedestal or does the pedestal spin the plasma?	Pedestal and ELMs
476	William W Heidbrink	UC Irvine	Beam-ion profile diagnostic using Dalpha light	Stability
477	Mickey R Wade	Oak Ridge National Laboratory	ELM Refueling Dynamics of Recycling/Non-Recyling Impurities	Divertor and Edge Physics
478	Michael J Schaffer	GA/ORISE	Reduce B-coil Feed Error	Stability
479	Michael Makowski	Lawrence Livermore National Laboratory	Broad Pressure Profiles in high-kappa Discharges	Advanced Scenario Development
480	Phil Snyder	General Atomics	VH Mode Edge Control	Pedestal and ELMs
481	John Ferron	General Atomics	ECCD stabilization of NTMs in AT discharges	Advanced Scenario Development
482	Holger Reimerdes	Columbia University	Test of neoclassical ripple viscosity in co- and counter-injection discharges	Stability
483	Guiding Wang	UCLA	Modulated electron particle transport studies in QDB/QH discharges	Confinement and Transport
484	Guiding Wang	UCLA	Modulated electron particle transport studies in QDB/QH discharges	QH Mode and QDB
485	Jose A Boedo	University of California, San Diego	Multi-diagnostic Transport Studies in the SOL	Divertor and Edge Physics
486	Robert I. Pinsker	General Atomics	Continuation of ECH/ECCD Sawtooth Effects Experiments	Stability
487	lei zeng	UCLA	SOL and Pedestal Evolution in DIII-D Stochastic Magnetic Boundary	Pedestal and ELMs
488	Dan M. Thomas	General Atomics	I-Coil perturbation effects on the edge current during ELM modification	Pedestal and ELMs
489	Massimo De Benedetti	ENEA-Euratom Association, Frascati, Italy	Rotation braking, intermediate rotation regime and momentum transport barriers	Stability
490	Ted Strait	General Atomics	Low-rotation target for RWM feedback experiments using feedback-controlled resonant magnetic braking	Resistive Wall Modes
491	Ted Strait	General Atomics	Tests of RWM feedback control in rotation-stabilized plasmas	Resistive Wall Modes
492	Francis W. Perkins	Princeton DIII-D Collaboration	ECCD/ECH Requirements for 100% Non-Inductive Discharges	Heating and Current Drive

494	Francis W. Perkins	Princeton DIII-D Collaboration	Observation of Ballooning Mode Turbulence	Confinement and Transport
495	Lang L Lao	General Atomics	QH-Mode Similarity Experiments in DIII-D and JT-60U	QH Mode and QDB
496	lei zeng	UCLA	Dynamics of pedestal perturbation during ELM	Pedestal and ELMs
498	Charles Greenfield	General Atomics	NCS AT scenario with qmin>2	Advanced Scenario Development
499	lei zeng	UCLA	Measurement of EHO Characteristics - Location and Amplitude	QH Mode and QDB