GA–A23608

# DIII–D YEAR 2001 EXPERIMENT PLAN

by
DIII–D RESEARCH STAFF

MARCH 2001

# DISCLAIMER

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# FOREWORD

This document presents the planned experimental activities for the DIII–D National Tokamak Facility for the calendar year 2001. This plan is part of a five-year contract 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–A23607). The Experiment Plan is developed yearly by the DIII–D Research Council, reviewed by the DIII–D Program Advisory Committee, and approved by DOE. DIII–D research progress is reviewed quarterly against this plan. The 2001 plan is based on a $52.1M DIII–D program funding for FY01, with $41.0M to GA, which allows for 17 weeks of tokamak operations. Other major collaborators include PPPL ($3.99 M), LLNL ($3.1M), and ORNL ($2.3M). Funding of university collaborators are provided by DOE grants and GA subcontracts. In the event of significant budgetary, technical, or programmatic changes this plan will be revised.

# APPROVALS

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# 1. SYNOPSIS OF THE 2001 DIII–D RESEARCH PLAN

The research campaign for 2001 has been organized into six research thrusts and a broader selection of experiments in four Topical Science Areas. Significant blocks of experimental time have 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 60 run days out of a possible 75 run days, with 15 days of contingency. Additional detailed information can be found on the Web, and related links: http://fusion.gat.com/exp/2001/

The experiment plan was put together with input and prioritization by the year 2001 Research Council. Based on the "DIII–D Five-Year Program Plan 1999–2003," August 1998, GA–A22950, the Research Council develops a three-year plan which is annually updated. The first of these Three Year Plans was made in 1999. Progress on the research thrusts and topical areas in the 2000 experiment campaign was reviewed at the Year End Review (http://fusion.gat.com/exp/2001/review.shtml, also broadcast on the internet) September 7–8, 2000. With input from that review and considering the three-year objectives, year 2001 research thrusts were identified. A call for ideas towards those objectives was issued and over 200 ideas were presented at a community-wide Research Opportunities Forum on November 8-10, 2000 which was broadcast on the internet. Several proposals were presented remotely, including presentations from PPPL and MIT. The various thrust and topical area groups prioritized, combined, and otherwise sifted these ideas. The plans so arrived at were presented to the Research Council in December and the advice of the Research Council was used to set the final allocations of run time for the year 2001 campaign.

The 2001 experiment plan, summarized in Table 1, consists of efforts in six thrust areas and four topical areas. Thrust 1, which did not receive any run-time allocation last year (edge stability), has been slightly rescoped to focus on the edge pedestal. Thrust 5 was a data analysis task last year, and has been completed. Thrust 8 was successfully completed last year, and the operation of the new upper divertor pump and baffle was demonstrated in AT plasmas. Thrust 9, ECH/ECCD validation, was nearly completed, and the remaining tasks will be handled this year in the Heating and Current Drive

## Table 1
## Run Time Allocations for the 2001 Experiment Campaign

| No. | Acronym | Description | 75 Day Plan | Area Leader |
|---|---|---|---|---|
| T1 | Edge pedestal | Understand what determines the structure of the edge pedestal in H-mode and the edge localized modes | 4.5 | R. Groebner (GA)<br>T. Osborne (GA) |
| T2 | AT scenario | Develop the existence proof and the scientific basis for future exploration of high performance, steady-state Advanced Tokamak operation. | 8 | M. Wade (ORNL)<br>T. Luce (GA)<br>J. Ferron (GA) |
| T3 | NTM | Advance the physics understanding of neoclassical tearing modes, including the thresholds and means of stabilization. | 4.5 | R. LaHaye (GA)<br>C. Petty (GA) |
| T4 | RWM | Advance the physics understanding of RWM stability, including the dependence on plasma rotation, wall/plasma distance, and active feedback stabilization. | 9 | A. Garofalo (Col. )<br>L. Johnson (PPPL) |
| T6 | High $\ell_i$ | Exploration of the high li AT plasma scenario | | Deferred |
| T7 | ITB | Develop the ability to create and sustain optimized pressure profiles that are simultaneously consistent with high performance, improved stability, and high bootstrap fraction. | 6 | E. Doyle (UCLA)<br>C. Greenfield (GA) |
| | | Thrust totals | 32 | |
| | | Stability topical area | 4 | T. Strait (GA) |
| | | Confinement topical area | 11 | K. Burrell (GA) |
| | | Boundary topical area | 7 | S. Allen (LLNL)<br>P. West (GA) |
| | | Heating and current drive topical area | 6 | R. Prater (GA) |
| | | Topical area sum | 28 | |
| | | Percentage of total days | 47 | |
| | | Total allocated days | 60 | |
| | | Contingency | 15 | |
| | | Sum | 75 | |
| | | Available days | 75 | |

Topical Science areas. Each of the ten efforts has a responsible leader and deputy leaders. A brief synopsis of progress in the various thrusts in 2000 followed by year 2001 plans is given below.

DIII–D continues to have a large research backlog as shown in Fig. 1 and Tables 2 and 3 which itemize the research proposals and run time in the backlog. The “A” list proposals from the Research Forum were proposed to the Research Council. The 75 day allocation was drawn from this “A” list. The “B” list was proposals not even brought forward by the Thrust and Topical Area groups to the Research Council. The backlog is the “B” list plus the “A” list minus the 75 day allocation.

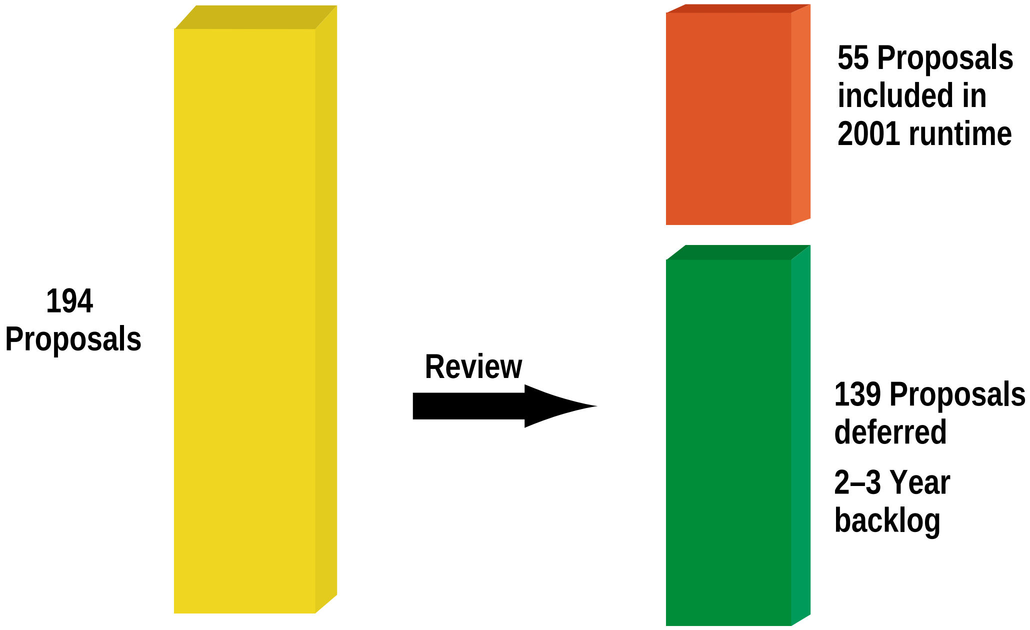

Fig. 1. Research backlog on DIII–D remains high.

## 1.1. RESEARCH THRUSTS FOR 2001

### 1.1.1. RESEARCH THRUST 1, H–MODE PEDESTAL AND ELMS (Leader: R.J. Groebner, Deputy: T.H. Osborne)

Thrust 1 seeks an understanding of the basic physics of pedestal formation and of energy losses due to ELMs.

Two experiments will be conducted to study the physics that sets the width of the H–mode transport barrier. The goal of the first experiment, conducted in cooperation with the edge/divertor topical science group, is to determine if the shape of the edge electron density profile in H–mode is determined purely by neutral fueling. This experiment will test a model that relates the shape of the density profile to both the amount and location of neutral fueling. This model predicts that there is a relation between the width and height of the density barrier and this will be tested. In addition, measurements of the neutral deuterium density, which can now be made at the midplane and in the divertor, will be used to see if the width of the density barrier qualitatively tracks the penetration depth of the neutrals.

A second experiment will address this issue in a different way and seeks to determine if the barrier width is set purely by physics parameters or if atomic processes are also important. This test will be done by performing an edge similarity comparison with

### TABLE 2
### PROPOSAL ALLOCATIONS FOR THE 2001 EXPERIMENT CAMPAIGN

| No. | Acronym | Description | Total Proposals Recieved | 75 Day Proposals | A List Proposals | B List Proposals |
|---|---|---|---|---|---|---|
| 1 | Edge pedestal | Understand what determines the structure of the edge pedestal in H-mode and the edge localized modes | 13 | 7 | 8 | 5 |
| 2 | AT scenario | Develop the existence proof and the scientific basis for future exploration of high performance, steady-state Advanced Tokamak operation | 11 | 8 | 8 | 3 |
| 3 | NTM | Advance the physics understanding of neoclassical tearing modes, including the thresholds and means of stabilization | 13 | 5 | 8 | 5 |
| 4 | RWM | Advance the physics understanding of RWM stability, including the dependence on plasma rotation, wall/plasma distance, and active feedback stabilization | 8 | 4 | 5 | 3 |
| 6 | High $\ell$ | Exploration of the high $\ell$ AT plasma scenario | | | | |
| 7 | ITB | Develop the ability to create and sustain optimized pressure profiles that are simultaneously consistent with high performance, improved stability, and high bootstrap fraction | 20 | 5 | 6 | 14 |
| | | Thrust Totals | 65 | 29 | 35 | 30 |
| | | Stability Topical Area | 12 | 3 | 7 | 5 |
| | | Confinement Topical Area | 50 | 11 | 16 | 34 |
| | | Boundary Topical Area | 48 | 7 | 11 | 37 |
| | | Heating and Current Drive Topical Area | 19 | 5 | 6 | 13 |
| | | Topical Area Sum | 129 | 26 | 40 | 89 |
| | | Percentage of Total Proposals | 67 | 47 | 53 | 75 |
| | | Total Proposals | 194 | 55 | 75 | 119 |

## TABLE 3
## RUNTIME ALLOCATION FOR THE 2001 EXPERIMENT CAMPAIGN

| No. | Acronym | Description | Total Run Days Proposed | 75 Day Plan | A List Days | B List Days |
|---|---|---|---|---|---|---|
| 1 | Edge pedestal | Understand what determines the structure of the edge pedestal in H–mode and the edge localized modes | 18 | 4.5 | 9 | 9 |
| 2 | AT scenario | Develop the existence proof and the scientific basis for future exploration of high performance, steady-state Advanced Tokamak operation | 13 | 8 | 11 | 2 |
| 3 | NTM | Advance the physics understanding of neoclassical tearing modes, including the thresholds and means of stabilization | 13.5 | 4.5 | 6.5 | 6 |
| 4 | RWM | Advance the physics understanding of RWM stability, including the dependence on plasma rotation, wall/plasma distance, and active feedback stabilization | 21 | 9 | 13 | 1 |
| 6 | High $\ell_i$ | Exploration of the high $\ell_i$ AT plasma scenario | | | | |
| 7 | ITB | Develop the ability to create and sustain optimized pressure profiles that are simultaneously consistent with high performance, improved stability, and high bootstrap fraction | 24 | 6 | 9 | 15 |
| | | Thrust Totals | 90 | 32 | 49 | 41 |
| | | Stability Topical Area | 16 | 4 | 10 | 6 |
| | | Confinement Topical Area | 50 | 11 | 16 | 34 |
| | | Boundary Topical Area | 48 | 7 | 12 | 36 |
| | | Heating and Current Drive Topical Area | 22 | 6 | 9 | 13 |
| | | Topical Area Sum | 136 | 28 | 47 | 89 |
| | | Percentage of Total Days | 60 | 47 | 49 | 69 |
| | | Total Allocated Days | 226 | 60 | 96 | 130 |
| | | Contingency | | 15 | | |
| | | Sum | | 75 | | |
| | | Available Days | | 75 | | |

C–Mod. The execution of the experiment is to make plasmas that have pedestals whose non-dimensional parameters are identical to those of reference C–Mod discharges. The scale lengths in the density and temperature transport barriers will then be compared to see if they are the same. If so, the result would be evidence that purely physics parameters control the pedestal width; if not, the result would suggest that atomic physics, such as neutral fueling, plays a role in setting the pedestal width.

An experiment will be performed to study the mechanism by which ELMs couple to the core of the plasma. Specifically, the experiment will seek to determine if the eigenfunction of an ELM couples to the core via the q-profile. If so, it is expected that the penetration depth and energy loss of ELMs will substantially increase as lower order rational surfaces are introduced into the plasma. Thus, plasmas will be made to reduce the minimum q from above 2 to less than 1 in order to search for these effects.

In collaboration with Thrust 7, experiments will be run to determine what the parameters are that are required to produce the QH–mode. These will be determined by attempting to make the QH–mode over a wide range of parameters. Some of the important parameters include plasma current, toroidal magnetic field, plasma shape (such as triangularity) and density. Heating power will be an important variable for each discharge condition.

The structure of the EHO will be studied in an experiment that will attempt to first determine where the mode is located and then to determine what the mode is. There are two primary ideas about the location of the mode. One is that the mode is located at or very near the separatrix and the other is that it is a resistive tearing mode at the q=3 surface. The experiment will seek to distinguish between these ideas by using fluctuation diagnostics to search for a phase reversal of a fluctuation signal. The BES and reflectometer systems will be particularly important in this study. In addition, a slow variation of the edge q will be attempted during a discharge. It is expected that if the mode has an island-like structure, then a dramatic change in the signatures of the mode should be observed as the edge q is changed.

### 1.1.2. AT SCENARIO, RESEARCH THRUST 2 — PREPARATION FOR AN NCS AT PLASMA DEMONSTRATION

**(Leader: M. Wade, Deputies: T. Luce, J. Ferron)**

The short-term (i.e., CY2000) research program within Scientific Research Thrust 2 will be focussed on addressing immediate physics issues that presently stand as obstacles to the achievement of the AT existence proof. These issues are: (1) can $\beta_N \sim 4$ be achieved in an optimized pumping configuration? and (2) can ECCD can be used effectively to modify/control the current density profile in a high performance plasma without having deleterious effects on other aspects of the developed scenario?

As discussed previously, attaining $\beta_N \sim 4$ and $\beta \sim 5\%$ in quasi-steady-state is a general requirement for fully non-inductive, high performance tokamak operation. Although this level of performance has been obtained in optimized magnetic configurations with $\kappa \sim 2.0$ and $\delta \sim 0.9$, experiments in 2000 showed that the $\beta$ limit in plasma shapes compatible with adequate density control via divertor exhaust (with $\kappa \sim 1.8$ and $\delta \sim 0.65$) to be 10%–15% lower. Detailed follow-up experiments in 2000 showed that this $\beta$ limit scaled roughly linearly with the shape parameter $S = (I/aB)\ q_{95}$. However, because the entire scan was done at fixed (I/aB), the dataset does not preclude a simple dependence on $q_{95}$. Experiments this year will seek to break this correlation by operating plasmas with the same shape (i.e., S = constant) but with different $q_{95}$ by varying plasma current and toroidal field. Further studies will be carried out to investigate the role of plasma shape in achievable $\beta_N$ with a view toward a possible future divertor modification. Also, the first use of resistive wall mode stabilization in these high performance plasmas will be made in hopes of gaining access to higher $\beta_N$ states.

ECCD studies will focus on understanding current drive efficiency in plasmas operating near the marginal stability limit for both MHD and turbulence-driven transport. In particular, one would like to know if ECCD will have deleterious effects on MHD and transport. Although initial studies in this area are independent of the outcome of the search for higher $\beta_N$ solutions, these studies will ultimately be affected by constraints imposed by such a solution. For example, if it's found that the observed $\beta_N$ scaling is simply a $q_{95}$ scaling, then to recover $\beta_N \sim 3.8$ in an optimized pumping configuration, the toroidal field will have to be increased to $B_T \sim 2.1$ T. The lower ECCD efficiency with the resonance further outboard will mean higher EC power will be required to achieve the scenario.

Upon successful resolution of these issues, it is envisioned that this research thrust will move aggressively towards integrating the essential ingredients (resistive wall mode stabilization, density control, and ECCD) into a combined scenario. Although we do not expect to have sufficient ECCD in the CY2001 to achieve a fully non-inductive existence proof, success at all steps of the plan should allow the demonstration of a plasma state that, although slowly evolving, has all of the essential ingredients of a steady-state, high performance advanced tokamak plasma.

### 1.1.3. RESEARCH THRUST 3 — VALIDATE NEOCLASSICAL TEARING MODEL AND INVESTIGATE STABILIZATION WITH ECCD

**(Leaders: R.J. La Haye, C.C. Petty)**

**(4-1/2 days)**

After the resistive wall mode instabilities that are the subject of Thrust 4, the next largest immediate stability concern for the AT work are the neoclassical tearing modes (NTMs). These modes have been seen to limit the performance in all our approaches to AT plasmas. Even in plasmas in which $q_{min}$ has been raised above 2, NTMs (m/n=5/2) have been observed. The purpose of this thrust is to gain further physics understanding of the neoclassical tearing modes and continue to develop means of avoiding or stabilizing them.

This thrust has four highest priority tasks: (1) finishing the multi-device dimensionless scaling of the onset of m/n=2/1 NTMs, particularly compared to JET-EFDA, (2) finishing the suppression of m/n=3/2 NTMs by rad. loc. off-axis ECCD in presence of sawteeth instabilities, (3) doing a proof of principle of whether sub-resonant static externally applied helical field can suppress a rotating m/n=3/2 NTM and (4) trying ECCD suppression of an m/n=2/1 NTM in a $q_{min} > 1$ discharge.

Two principal research lines are foreseen in a three year plan: (1) studies in H–mode with sawteeth present and (2) studies in an AT mode with raised $q_{min}$.

#### H–Mode With Sawteeth

Work in 2001 will continue on our ongoing collaboration with JET, ASDEX Upgrade, JT–60U, and Alcator C–Mod on the scaling of NTMs. Particularly, the dependence of the m/n=2/1 critical beta dependence or dimensionless parameters $\rho_{i*}$ and $(\nu_{ii}/\varepsilon)/\omega_{e*}$. Work will continue to follow up the successful complete suppression of a m/n=3/2 NTM by ECCD. This will include PCS real time position adjustment optimization. An alternate means of mode suppression will be given a proof of principle test; static sub-resonant helical fields (as can be produced with the C–coil such as m/n=1/3) of sufficient amplitude are predicted to reduce the rotating NTM helical pressure perturbation which sustains the mode.

#### AT–Mode Line

In 2001, we will make the first investigation of ECCD suppression of a m/n=2/1 NTM. This will be done in a discharge without sawteeth (but with $q_{min} \geq 1$) in which peak performance and/or duration is limited by the NTM.

In the year 2002, we expect to have developed the understanding and PCS control of NTM suppression to use it in a true $q_{min}$ ~ 2 AT plasma, keeping non-resonant field suppression as an alternate if the PoP is successful.

**Principal Goals for 2001**

1. Finish study of ECCD suppression of m/n=3/2 NTM in presence of sawteeth instabilities.
2. Do PoP of non-resonant static helical field suppression.
3. Start study of ECCD suppression of m/n=2/1 NTM in discharges without sawteeth.

### 1.1.4. RESEARCH THRUST 4 — ESTABLISH LIMITS OF PASSIVE WALL STABILIZATION, BENCHMARK QUANTITATIVELY FEEDBACK MODELS AND OPTIMIZE CONTROL WITH IMPROVED SENSORS

**(Leader: A.M. Garofalo,**
**Deputy: L.C. Johnson)**

The AT Program on DIII–D has shown that the growth of $n$=1 resistive wall modes limits the maximum steady-state value of $\beta_N$ to the $\beta_N^{\text{no wall}}$ stability boundary, even in presence of plasma rotation. Over the past two years, work in the DIII–D Research Thrust #4 has demonstrated that feedback using the existing C–coil with external saddle loops as mode sensors can stabilize the RWM at $\beta_N$ just above $\beta_N^{\text{no wall}}$.

Guided by calculations performed using the three-dimensional feedback simulation code VALEN, new RWM sensors have been designed and installed in DIII–D, and will be available for feedback experiments in 2001. New saddle loops mounted inside the vessel are shorter and measure the radial field closer to the plasma than the external saddle loops. They are predicted to improve the stable beta limit up to 30% of the incremental gain achieved with an ideal wall.

Newly installed Mirnov probes increase to four the number of diametrically opposed measurements of the poloidal field inside the vessel. These sensors are predicted to increase RWM stability by 50% towards the ideal wall $\beta_N$ limit.

Among the most important outstanding scientific questions that Thrust #4 intends to answer during the 2001 experimental campaign are:

- What are the limits of passive wall stabilization? Can we develop an optimized plasma regime able to maintain indefinitely the toroidal rotation?

- Do the new sensors improve feedback stabilization?
- Do new beta limiting phenomena intervene if we are successful at increasing the steady state beta value above the n=1 no-wall limit?
- Do experimental results on RWM stabilization agree with the VALEN predictions, to the extent that we can confidently use VALEN for designing an optimized feedback system (and feedback systems in future devices)?

The proposed experimental plan developed by the Research Thrust #4 to address these issues is shown below.

### Experimental Plan for 2001

Wall Stabilization Physics: validate models of plasma rotation slowdown and RWM stability (2 days)

- Recent theory (Boozer, submitted to PRL) predicts the damping of toroidal rotation in a plasma near marginal stability. A systematic, controlled investigation of error field amplification will be conducted to determine the importance of error field correction in plasmas near or above the beta limit and to compare with theoretical predictions
- Systematic study of q-profile effects to compare with theoretical predictions of wall stabilization dependence on the number and location of resonant surfaces present in the plasma.
- Systematic study of plasma/wall separation to compare with theoretical predictions of wall stabilization dependence on the distance and location (inboard/outboard) of the wall.

RWM Feedback: demonstrate improved steady-state $\beta_N$ limit through feedback stabilization of the RWM (7 days)

- Using SND target plasma with current ramp technique for reproducible RWM onset, test feedback system with new sensors and algorithms (internal saddle loops and internal, integrated Mirnov loops).
- Use feedback control of the neutral beam power to maintain a desired constant $\beta_N$ in a steady state-like high performance AT target and establish $\beta_N$ limit without RWM feedback.

- Using feedback control of the RWM amplitude, increase $\beta_N$ in small steps from shot to shot, to test and measure the improvement in maximum stable beta.
- Compare performance of different RWM feedback algorithms (smart shell, mode control, fake rotating shell).
- Compare performance of different sensors (external saddle loops, internal saddle loops, internal, integrated Mirnov loops).
- Demonstrate real-time identification of RWM using multi-sensors, that is simultaneous use of toroidally and poloidally distributed Mirnov probes and midplane and off-midplane saddle loops inside the vessel.
- Identify the characteristic of new beta limiting phenomena that might intervene in the n=1 feedback stabilized steady state plasma above the n=1 no-wall limit (higher n external kinks and their RWMs, and NTMs).
- Compare experimental results with predictions of 3-D electromagnetics code VALEN and other feedback models.

### 1.1.5. THRUST 7 — INTERNAL TRANSPORT BARRIER CONTROL
(Leader: E.J. Doyle;
Deputy: C.M. Greenfield)

#### Goals and Background

The ultimate goal of Thrust 7 is to develop both the scientific basis for, and practical implementation of, transport control in the plasma core, so as to optimize AT pressure profiles for simultaneous high performance, improved stability and high bootstrap fraction. On a shorter three-year time scale, the goals are to develop profile control tools with a well understood scientific foundation so as to modify the spatial extent of internal transport barriers (ITBs), and explore potential ITB based high performance AT scenarios, such as the new QDB regime

As discussed previously in Section 1**,** the DIII–D AT physics program seeks to explore the ultimate potential of the tokamak. The Thrust 7 goals directly relate to exploring that ultimate potential in the following ways:

— Expanding the spatial extent of the ITB increases the plasma volume with suppressed anomalous transport, hence increasing fusion performance

— Broad pressure profiles with transport barriers near the plasma edge (ρ~0.7-0.8) are required in order to achieve large, well aligned bootstrap currents, and

— MHD stability modeling indicates that the maximum stable normalized beta increases with increasing ITB radius and half-width.

— In addition, increased understanding and control of core plasma transport will be required in order to successfully design and realize integrated, high performance AT plasmas.

Illustrated in Fig. 2 are the scientific issues and practical applications addressed by Thrust 7, along with their inter-relationships. The basis of the thrust is the scientific challenge posed by understanding and controlling core plasma transport. Such an understanding leads directly to general profile control applications. However, in higher performance plasmas integration issues become apparent – sustained transport control cannot be achieved without also considering MHD stability limits and q profile control. A compatible pressure profile, q profile and stability solution is required for sustainable high performance AT scenarios. Understanding and controlling plasma transport is an active and rich field of scientific inquiry. To illustrate this, the following transport control techniques are under development at DIII-D, all of which have a firm basis in theory and theory-based modeling: (1) Modification of the ExB shearing rate via toroidal momentum injection by neutral beams; (2) modification of turbulence growth rates via changes in magnetic shear (q profile), impurity dilution, pellet injection or localized heating (e.g. ECH), and (3) turbulence stabilization via large Shafranov shift ($\alpha$-stabilization).

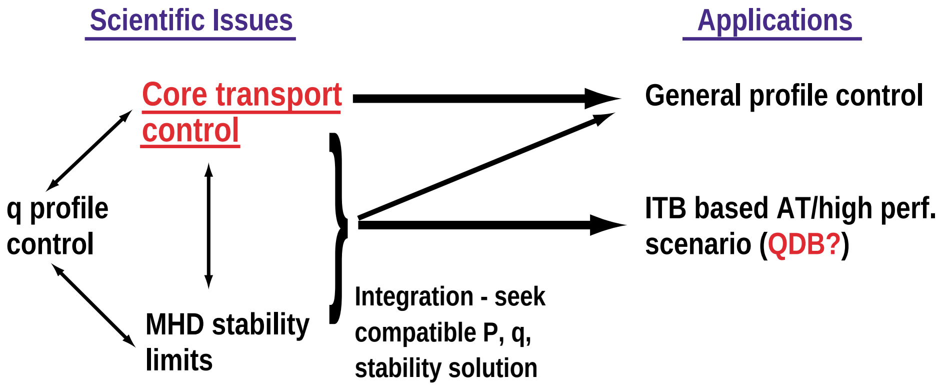

Fig. 2. Scientific issues and practical applications addressed by Thrust 7, and their inter-relationships.

## Results Obtained in 2000

Thrust 7 controlled 4.5 run days in 2000. In addition, several related experiments were run in the Confinement and Transport Topical Science area. Highlights of results obtained in 2000 include the following:

- A new long-pulse, high performance operating regime, dubbed the Quiescent Double Barrier (QDB) regime, was discovered. The discovery of the QDB regime arose directly from theory-based work using counter-NBI discharges to expand the ITB radius, by modifying the interplay of terms in the expression for the E×B shearing rate. The QDB regime features a quiescent, ELM-free QH–mode edge, and the edge and core transport barriers are compatible. Although ELM-free, the QH–mode edge still provides density and impurity control, due to the presence of a continuous Edge Harmonic Oscillation (EHO). To date, the QDB regime has only been obtained in counter-injection discharges with divertor pumping. Compared to previous ITB discharges with L-mode edges, performance in QDB plasmas is higher because of the higher temperatures associated with the QH–mode edge.

- Impurity injection into pre-existing ITBs with an L–mode edge expanded the ITB radius and improved plasma performance. The physics of this improvement is understood in terms of a synergism of decreased turbulence growth rates and increased E×B shear.
- Modeling of electron thermal ITBs (eITBs) created with ECH indicates that the $T_e$ gradient within the ITB is at marginal stability to the ETG mode, and that *$\alpha$-stabilization* effects are essential to eITB formation. (The experimental time for this work was carried out in the Confinement and Transport TS area).

These results are more fully described in the Thrust 7 DIII–D Year End Review document available on the web at http://fusion.gat.com/exp/2001/agenda.html as well as in papers from the 2000 IAEA and APS conferences.

## Planned 2001 Experiments

The success of the 2000 experiments has accelerated consideration of both ITB based scenario development and integration issues. Here, integration refers to both the integration of multiple ITB control tools within a single discharge, and also the integration of transport, MHD stability and q profile issues. Shown in Fig. 3 is a flow chart illustrating the issues addressed by the planned six days of Thrust 7 experiments in 2001, and their inter-relationship. Investigation of the QH/QDB regimes will be shared with Thrust 1.

In more detail these experiments and issues are:

1. Investigate the physics, scaling and operational robustness of the new QDB regime. Should finish year with deeper physics understanding of the QDB and QH–mode regimes. (Two days Thrust 7, one day Thrust 1 allocation).

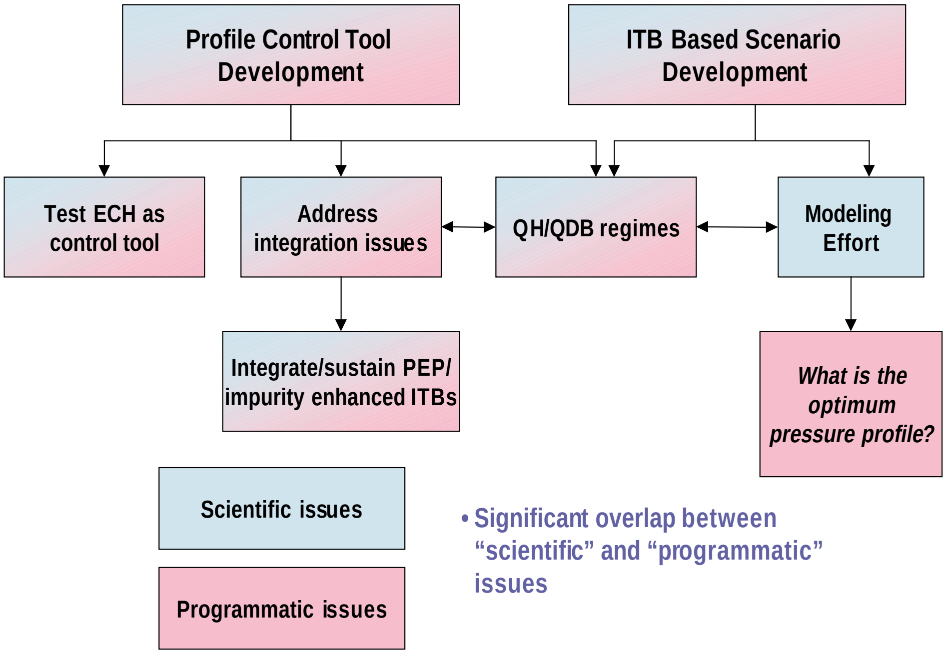

Fig. 3. Flow chart showing an outline of the issues addressed by planned Thrust 7 experiments in 2001.

2. Determine impurity transport in QDB plasmas and in particular assess role of density peaking. Is impurity transport and rotation neoclassical? Distinguish impurity source and transport effects. (One day).

3. Continue control tool development in QDB plasmas, which provide a long-pulse target plasma for integration of multiple control techniques and slow barrier expansion. Use control tools to decrease density peaking. (One day).

4. Initiate use of off-axis ECH as an ITB control tool. May provide precision control capability lacking in tools tested to date. (One day).

5. Integrate and sustain PEP and Impurity Enhanced ITBs. (One day).

6. Initiate modeling effort to determine optimal target pressure profile for future Thrust 7 efforts. In particular, assess the prospects for non-inductive sustainment of the QDB regime.

### Issues for 2002 and Beyond

Depending upon both the experimental and modeling results obtain in 2001, there is a major decision point as to whether to continue to pursue the QDB regime as a potential high performance AT regime in 2002. Whatever the outcome of this decision, the QDB regime may still be useful in providing a long-pulse, quasi-steady state target plasma for profile control tool development. As further progress is made in benchmarking and understanding the various control tools available, emphasis on integration and “closed loop” profile control experiments will increase relative to the initial investigation of these issues planned for 2001. In addition, we expect the modeling effort initiated in 2001 to produce more concrete target pressure profiles, as well as guidance on what combination of our available control tools could be used to create and sustain these profiles. At all stages the experimental results will be used to both test and benchmark the transport analysis and modeling codes. By 2003, we anticipate having demonstrated and benchmarked a suite of profile control tools, and that the operation and understanding of each of these tools will rest on a firm scientific foundation.

## 1.2. PHYSICS TOPICAL AREAS

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

In 2001, most of the stability experiments will be carried out under the research thrusts, and those plans will be described in more detail in the corresponding sections of this report. For example, neoclassical tearing mode stability experiments, which last year were part of the stability topical science area, will be carried out in 2001 under research Thrust 3. Here the primary goals include continuation of the control of instabilities with localized electron cyclotron current drive, and the first experimental test of the predicted stabilizing effect of non-resonant magnetic perturbations. Resistive wall mode stability experiments will be carried out under research Thrust 4. Here the primary goals are investigation of rotational stabilization physics including the possible role of error field amplification, and exploitation of a new set of internal magnetic diagnostics which are predicted to improve the feedback-controlled stability limits. Investigation of edge-driven instabilities is a strong element of research Thrusts 1 and 7, including the role of MHD stability in the newly discovered quiescent H–mode regime.

Experiments within the stability topical science area in 2001 will focus on validation of basic MHD stability physics, development of disruption mitigation, and exploration of new regimes. These experiments make use of DIII–D's extensive set of diagnostics for precise, detailed measurements of the pressure and current density profiles and the internal structure of MHD modes.

Disruptions are in principle predictable, occurring when a stability boundary is crossed, and much of the DIII–D stability program can be viewed as learning how to predict and avoid disruptions. However, some disruptions are inevitable due to unforeseen causes such as control system failure or unexpected impurity influx. The experiment planned for this year continues to develop methods of mitigating the effects of disruptions using strong gas puffing. Important physics issues to be investigated include the transport of impurity ions and neutral atoms, physics of non-axisymmetric halo currents, and the role of avalanche processes in runaway electron generation.

Validation of resistive interchange mode theory in regions of negative magnetic shear will provide a test of basic stability physics that is also important to the stability of stellarator plasmas. Resistive interchange modes have previously been observed in DIII–D discharges in a central region of negative magnetic shear. The planned experiment will obtain detailed measurements of the internal mode structure for comparison with theoretical predictions, using the full range of fluctuation diagnostics, and make a systematic study of the dependence of the stability threshold on the local pressure gradient and magnetic shear, again for comparison to theory.

Investigation of the physics of the sawtooth crash will be continued, including the role of the Mercier stability criterion. The primary goal is to compare a bean-shaped plasma that remains Mercier stable in the core because of the strong shaping, and a plasma with an elliptical cross-section that is Mercier unstable at the core. The expected result is a Kadomtsev-type full reconnection at the sawtooth crash in the first case, and short-wavelength instabilities and only a partial reconnection in the second case. If time permits, the central current density profile will be modified using ECCD.

The stability properties of discharges with very low global magnetic shear will be explored. This represents a possible new operating regime for high fusion performance. It is well known that both the energy confinement and the beta limit increase with plasma current. However, many previous experiments have found a strong degradation of confinement relative to this scaling as the safety factor $q_{95}$ decreases below about 4. On the other hand, more recent experiments with negative central shear showed no degradation down to $q_{95} \sim 3$, perhaps because of the absence of sawteeth. The planned experiment will explore the possibility of high absolute beta and energy confinement in configurations with $q_{95} < 3$ and $q(0) > 1$; if the central q can be increased above 2, there is also the possibility of a significant fraction of bootstrap current.

### 1.2.2. CONFINEMENT AND TRANSPORT — 11 DAYS (Leader: K.H. Burrell)

This topical area has experiments under various working group headings: in the area of fundamental turbulence studies, we will perform two experiments. In the first, we will change the ratio of poloidal to toroidal field while holding all other nondimensional paramters fixed in order to investigate whether the radial correlation length of the plasma turbulence scales with the poloidal or toroidal gyroradius. Different theories contain different predictions; this experiment is designed to test which of these are correct. The second experiment will be a first attempt to directly measure the properties of the zonal flows. These are stable, poloidally and toroidally symmetric perturbations which couple to the unstable turbulent modes and regulate the turbulence by extracting energy from it. There are possbile techniques with beam emission spectroscopy in the plasma core and with Langmuir probes at the plasma edge which may allow us to directly measure the zonal flows; these will be explored in this experiment. This experiment will also obtain information on local transport scaling with safety factor q; this latter experiment was originally proposed in the nondimensional transport area.

In the H–mode physics area, two days of experiments are planned. First, we will take half a day to investigate the effects of scrape-off layer flows on the power threshold for the L to H transition. There are theoretical predictions that these flows can have an effect and we want to test these. On the second half day of this experiment, we will make further investigations of the physics of pellet-triggered L to H transitions. The emphasis in this year's experiment will be on detailed, high time resolution measurements of the changes in the edge conditions across the pellet-triggered transition. On the second experimental day,we will investigate further the effect of the ion ∇B drift on the edge plasma prior to the transition. We wish to extend last years observation of a turbulence velocity shear layer to a wider parameter range. We especially want to study the shear layer for the case with unfavorable ∇B drift for heating powers just below the threshold. Last year's work was done with the same heating power for both directions of the ∇B drift, which meant that the input power was well below threshold for the case with ∇B drift away from the X-point. We expect the shear layer to develop in both cases when the input power is close to threshold power; the experiment will test this expectation.

In the area of test of transport models, an experiment will be done to demonstrate the existence of a heat pinch with outside launch, second-harmonic ECH and to determine if the heat pinch is dependent on the sign of the magnetic shear as predicted. The inward transport effect seen with the 60 GHz system remains a sever challenge to the theoretical community. One remaining mechanism could explain the observed profiles without requiring transport up the temperature gradient: the conversion of the fraction of ECH power which is not absorbed at the resonance to electron Bernstein waves at the upper hybrid layer. This mode conversion is not possible with second harmonic outside launch. The superior diagnostic set now available and the higher power densities possible with the 110 GHz ECH system could provide clear evidence of the mechanism responsible for the inward transport. Furthermore, the theoretical heat pinch model of coupled transport between ∇-J and ∇-T can be tested by comparing the non-diffusive electron transport for positive and negative shear plasmas.

A second test of transport models experiment is planned to provide tests of turbulence simulations, tests of transport models with modulated ECH, a test of the predictive capability of turbulent transport models and a demonstration of marginal stability in the electrons (L–mode part only).

Two days of experiments are planning in the nondimensional transport area The first will complete the experiment on the elongation scaling of transport which was begun last year. As a part of this work, we will also investigate the effect of Shafranov shift stabilization of turbulence. This latter experiment was originally proposed in the core transport physics area but it combines almost perfectly with this elongation experiment. The second experiment in the nondimensional transport area will investigate the changes in radial correlation length and decorrelation time as the electron to ion temperature ratio is varied. The analogous experiment last year in this area investigated the same changes with normalized gyroradius.

The core transport physics area will have three days of experiments. First, we have decided to increase the empahsis on angular momentum transport work this year because an ability to predict the toroidal rotation is central to our ability to predict the E×B shear which is important for turbulence reduction. The issue to be confronted in this experiment is to test whether the difference in toroidal rotation amoung the various ion species in the plasma agrees with the predictions of neoclassical theory. If it does, then we can use the theory to determine the main ion toroidal rotation from the measurements of impurity rotation. A variety of plasma conditions will be used here to test the theory as completely as possible. In addition, we will use measurements taken in Thrust 7 to expand this parameter range to counter injection.

Second, we will test our understanding of turbulence stabilization at various length scales by attempting to create plasmas with simultaneous electron and ion core transport barriers. Theory suggests that E×B shear stabilization is useful for stabilizing fairly long wavelength turbulence such as that seen with ion temperature gradient modes. Shafranov shift or alpha stabilization is predicted to be effective in stabilizing electron temperature gradient modes. Experiments last year created electron transport barriers with localized ECH. We have a long history of making transport barriers with neutral beam heating; in the best shots, we have transport barriers in all four transport channels. The goal this year will be to utilize combined heating to see if our theortical understanding is correct.

Third, we will perform a series of experiments to make detailed tests of electron thermal transport. Most of these will utilize modulated ECH in various fashions to probe the electron transport both inside and outside the core transpor barrier.

### 1.2.3. EDGE AND DIVERTOR PHYSICS (Leader: S.L. Allen)

We have six experiments planned for the upcoming 2001 campaign, listed below with a brief description.

1. Measurements of turbulence and the effects of drifts in near double-null operation. Measure SOL turbulence and heat and particle flux profiles and asymmetries as dRsep is varied about a double-null configuration (–2 cm < dRsep < +2 cm). Compare with BOUT and UEDGE. (Approximately 1 day led by Tom Petrie, GA).

2. Far SOL transport and recycling. measure non-diffusive transport mechanisms in the far SOL and main chamber recycling and fueling in L&H mode LSN plasmas, compare with C-Mod results and SOL transport theories. (Approximately 1 day led by Dennis Whyte, UCSD).

3. Measurement of potentials and drifts in single-null operation. Document SOL, X-point, and divertor plasma potentials, pressures, and drifts in USN and LSN and in forward and reverse $B_T$ across an L to H transition. Compare to UEDGE. (Approximately 2 days led by Mike Schaffer, GA).

4. Experimental documentation of a simple plasma and exposure of a DiMES Li sample. Document an L–mode plasma (no ELMs) using our spectroscopic, visible and UV TV, IRTV, fixed and plunging probes, IRTV, and bolometric diagnostics for detailed comparison to UEDGE and onion skin models. Expose a DiMES lithium sample to this weel documented and modeled plasma. (0.5 day, led by Dennis Whyte, UCSD).

5. Test of pedestal density theories and postulates. Investigate the role of fueling efficiency and particle loss in the achievement of high pedestal density. Compare to theoretical predictions and determine a path to high density at high confinement. (Approximately 1.5 days led by M.A. Mahdavi).

6. Carbon sources, flat vs contoured tiles. Measure the local carbon source and the core carbon contamination as the inner strike point is moved across the division on the inner wall between the new, well engineered, contoured tiles and the old flat tiles. Also measure carbon penetration from methane puffing at several poloidal locations. Compare to UEDGE and Monte Carlo models. (Approximately 1 day led by C. Lasnier).

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

The three year goals of this topical science area are described in Section 3.2 of the three-year plan (GA–A23598). The two key goals of highest priority for the 2001 campaign are development of a predictive model for ECCD and development of discharges with high bootstrap fraction.

For ECH physics, three experiment-days are planned. The key objectives of the experiments are:

1, Complete the ECCD scans from last year. The analysis of those scans will surely provide some surprises and suggest some new studies which will be necessary for development of a complete model of ECCD. At the least, some data points will need to be revisited to validate previous results.

2, Extend the previous scans of ECCD to larger minor radius. This goal is motivated by the fact that ECCD is needed by the AT program at minor radii around 0.5 to 0.7. We don’t yet have direct measurements of ECCD at such large minor radii.

3, Determine the dependence of ECCD on electron beta. It is believed from theory models that ECCD at high electron beta will reduce the deleterious effects of trapping, resulting in strongly improved current drive efficiency even for large minor radius. This concept needs to be tested since it is key for the AT applications. The electron beta will be increased by adding heating power (ECH plus NBI) and by operating in the H–mode.

The first objective can be carried out using two gyrotrons, since only two antennas (in the P1999 launcher) have the flexibility to perform such scans. The second and third objectives will require higher power from three or four gyrotrons operating with nearly the design power.

For bootstrap studies three days are planned. The objectives include:

1. Develop discharges with high bootstrap fraction (2 days). A steady-state reactor will have bootstrap fraction near unity. This links the profiles of pressure and current in a new way which we need to understand. The urgency is that high bootstrap fraction is one leg of the DIII–D AT program (high beta, high confinement, and high bootstrap fraction), and it has not been addressed in the present fusion program. The approach is to use low current discharges with high density (to minimize the NBCD and the flux diffusion time) and to maximize the ratio of rf heating to NB heating.

2, Measure the dependence of the edge bootstrap current on collisionality and shape. The urgency is that the edge bootstrap current is known to have a strong effect on plasma stability, but the models for edge bootstrap have not been validated. The edge bootstrap current may be directly measurable by operating the discharge without current feedback in order to reduce the effect of ohmic flux on the edge current. The concept is to measure edge bootstrap current for a range of triangularity and collisionality and compare with calculations.

## 1.3. RESEARCH PROPOSALS RECEIVED

### Submitted ideas for DIII-D Experimental Proposals 2001

**Click on the ID to see the corresponding idea. Click on the buttons on the title row to sort on the corresponding column.**

| ID | Author | Institution | Title | Topic Group |
|---|---|---|---|---|
| 6 | Porter, Gary D. | LLNL | Recycling characteristics vs gaps | Divertor and Edge Physics |
| 7 | deGrassie, John S. | General Atomics | Prompt Er change with EC power injection? | Heating and Current Drive |
| 8 | Greenfield, Charles M. | General Atomics | Simultaneous electron and ion internal transport barriers | Confinement and Transport |
| 9 | Greenfield, Charles M. | General Atomics | Determine parameter space for the Quiescent Double Barrier r | Internal Transport Barriers |
| 10 | Colchin, Richard J. | ORNL | L-H Transition Oscillations | Confinement and Transport |
| 12 | Ross, David W. | Fusion Research Center, The University o | Comparing Turbulence Simulation with Experiment in DIII-D | Confinement and Transport |
| 13 | Staebler, Gary M. | General Atomics | The role of SOL flow on the L/H transition | Divertor and Edge Physics |
| 14 | Evans, Todd E. | General Atomics | Experimental Test of Runaway Electron Avalanche Theories | Stability |
| 15 | Staebler, Gary M. | General Atomics | Test of Shafranov shift suppression of transport | High Bootstrap AT Scenario |
| 16 | Evans, Todd E. | General Atomics | AT Stability and performance during C+n=1 Coil Br Perturbati | Stability |
| 17 | Staebler, Gary M. | General Atomics | High performance RI-mode | Internal Transport Barriers |
| 18 | Mossessian, Dmitri | MIT, PSFC | Edge similarity experiments on C-Mod and DIII-D | Edge Pressure Pedestal Control |
| 19 | Greenfield, Charles M. | General Atomics | Internal transport barrier modification with off-axis ECH | Internal Transport Barriers |
| 20 | Greenfield, Charles M. | General Atomics | Argon puffing in Quiescent Double Barrier discharges | Internal Transport Barriers |
| 21 | Greenfield, Charles M. | General Atomics | Density profile modification in Quiescent Double Barrier dis | Internal Transport Barriers |
| 22 | Brooks, Jeffrey N. | Argonne National Laboratory | DiMES Tin Sample Exposure Experiment | Divertor and Edge Physics |
| 23 | Baker, Dan R | General Atomics | Temperature Perturbation to Measure Energy Transport in ITBs | Confinement and Transport |
| 24 | Baker, Dan R. | General Atomics | Density Perturbation to Measure Particle Transport in ITBs | Confinement and Transport |
| 25 | Baker, Dan R. | General Atomics | Scan plasma current to study Edge Harmonic Mode in QDB | Internal Transport Barriers |
| 26 | Synakowski, Edmund J. | Princeton Plasma Physics Laboratory | DIII-D and NSTX Aspect Ratio Confinement Study | Confinement and Transport |
| 27 | DeBoo, Jim C. | GA | Tests of Transport Models with Modulated ECH | Confinement and Transport |
| 28 | Wong, Clement | General Atomics | DiMES Piggyback experiments | Divertor and Edge Physics |
| 29 | Hubbard, Amanda E | MIT Plasma Science and Fusion Center | Investigating Edge Fluctuations during Type II ELM regime | Edge Pressure Pedestal Control |
| 30 | Luce, Tim | General Atomics | High performance at higher q_min | High Bootstrap AT Scenario |
| 31 | Luce, Tim | General Atomics | Off-Axis ECH/ECCD in High Normalized Performance Discharges | High Bootstrap AT Scenario |
| 32 | Luce, Tim | General Atomics | Determination of beta Limit as a function of q_95 | High Bootstrap AT Scenario |
| 33 | Bernabei, Stefano | Princeton Plasma Physics laboratory | q-dependence of EPM, TAE and sawtooth stabilization on DIII- | Heating and Current Drive |
| 34 | Luce, Tim | General Atomics | Enhanced Performance in ELMing H mode with q_min ~ 1 | Stabilization of NTM |
| 35 | Luce, Tim | General Atomics | What are the conditions for optimizing gain in ELMing H Mode | Stability |
| 36 | Burrell, Keith H. | General Atomics | Quiescent H-mode Studies | Edge Pressure Pedestal Control |

http://physics.gat.com/2001/REVIEW.asp

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| 37 | Luce, Tim | General Atomics | A Possible Route to High Bootstrap Current and High Gain | Stability |
| 38 | Burrell, Keith H. | General Atomics | Study Edge Harmonic Oscillation in Co-Injected Plasmas | Edge Pressure Pedestal Control |
| 39 | Burrell, Keith H. | General Atomics | Search for signatures of zonal flows | Confinement and Transport |
| 40 | Walker, Mike | GA | Develop Operational MIMO Plasma Control | Stability |
| 41 | Luce, Tim | General Atomics | Test of Electron Bernstein Wave Heating | Heating and Current Drive |
| 42 | Wong, King-Lap | Princeton Plasma Physics Laboratory | Expand duration of electron internal transport barrier | Heating and Current Drive |
| 43 | Luce, Tim | General Atomics | Development of Stationary q_min > 1 Discharges with ECCD | Heating and Current Drive |
| 44 | Luce, Tim | General Atomics | Understanding of Sawtooth Stabilization with ECH/ECCD | Heating and Current Drive |
| 45 | Greenwald, Martin | MIT-PSFC | Study the role of turbulent transport in the density limit | Divertor and Edge Physics |
| 46 | McKee, George R | U. Wisconsin-Madison | Dependence of Turbulence on Te/Ti in L-mode plasma | Confinement and Transport |
| 47 | Burrell, Keith H. | General Atomics | Effect of Current Ramping L-H Transition Edge Parameters | Confinement and Transport |
| 48 | Luce, Tim | General Atomics | Elongation Scaling at Fixed Dimensionless Parameters | Confinement and Transport |
| 49 | deGrassie, John S. | General Atomics | Rotation in Ohmic and rf-heated H-mode | Confinement and Transport |
| 50 | Luce, Tim | General Atomics | Mass Scaling at Fixed Dimensionless Parameters | Confinement and Transport |
| 51 | Luce, Tim | General Atomics | Test of Stiffness of the Electron Temperature Profile | Confinement and Transport |
| 52 | McKee, George R | U. Wisconsin-Madison | Shear Flow & Growth Rates in RI-mode Turbulence Suppression | Confinement and Transport |
| 53 | Wade, Mickey R. | Oak Ridge National Lab | High Triangulariy, High Elongation Pumped AT Discharges | High Bootstrap AT Scenario |
| 54 | McKee, George R. | U. Wisconsin-Madison | Neon-Enhanced Internal Transport Barrier Plasmas | Internal Transport Barriers |
| 55 | West, W. Philip | General Atomics | Argon radiative divertor in the RDP | Divertor and Edge Physics |
| 56 | Wade, Mickey R | | Low-Z Impurity Transport in QDB Plasmas | Internal Transport Barriers |
| 57 | Luce, Tim | General Atomics | Electron Energy Transport Inside the Transport Barrier | Confinement and Transport |
| 58 | Ferron, John | General Atomics | ELM pressure gradient threshold vs. pedestal width | Edge Pressure Pedestal Control |
| 59 | Wade, Mickey R | | "Direct" Measurement of Bootstrap Current and Theory Validat | Heating and Current Drive |
| 60 | Luce, Tim | General Atomics | Heat Pinch Studies | Confinement and Transport |
| 61 | Luce, Tim | General Atomics | Role of Electron and Ion Heat Flux in the L-H Transition | Confinement and Transport |
| 62 | Jakubowski, Marcin | U. Wisconsin-Madison | Turbulent Transport Measurements & Search for Zonal Flows | Confinement and Transport |
| 63 | Krasheninnikov, Sergei | University California San Diego | Turbulence and transport in the SOL plasmas | Divertor and Edge Physics |
| 64 | Evans, Todd E. | General Atomics | How do changes in the SOL topology stabilize chaotic bursts? | Divertor and Edge Physics |
| 65 | Youchison, Dennis L. | Sandia National Laboratories | Tungsten Rod Armor DiMES Sample Exposure to DIII-D Plasma | Divertor and Edge Physics |
| 66 | Whyte, Dennis | UCSD | Divertor Erosion during Detachment with Argon Injection | Divertor and Edge Physics |
| 67 | Whyte, Dennis | UCSD | Erosion and Transport of Lithium in the Divertor | Divertor and Edge Physics |
| 68 | Whyte, Dennis | UCSD | Disruption mitigation using high-pressure gas injection | Stability |
| 69 | Whyte, Dennis | UCSD | Evolution of carbon sources after boronizations | Divertor and Edge Physics |
| 70 | Petty, C. Craig | General Atomics | Wave-Induced Particle Pinch Using Toroidally Asymmetric ICRH | Heating and Current Drive |

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| 71 | Petty, C. Craig | General Atomics | Relative Gyroradius Scaling Between DIII-D and JET | Confinement and Transport |
| 72 | Petty, C. Craig | General Atomics | ITB Physics: Rotation and Ti/Te | Confinement and Transport |
| 73 | Petty, C. Craig | General Atomics | Safety Factor Scaling of L-mode Plasmas | Confinement and Transport |
| 74 | Krasheninnikov, Sergei | University California San Diego | Divertor detachment and SOL crossfield transport | Divertor and Edge Physics |
| 75 | Takahashi, Hiro | Princeton Plasma Physics Laboratory | Verify/Refute: Edge Harm. Modes Are Oscillating SOL Current. | Edge Pressure Pedestal Control |
| 76 | Takahashi, Hiro | Princeton Plasma Physics Laboratory | Magnetic Field by SOL Current Intrudes into Plasma Control | Stability |
| 77 | Petty, C. Craig | General Atomics | Extreme off-axis ECCD | Heating and Current Drive |
| 78 | Petty, C. Craig | General Atomics | ECCD Mysteries and Scandals | Heating and Current Drive |
| 79 | Petty, C. Craig | General Atomics | Electron Transport Physics I: Evidence for Critical Gradient | Confinement and Transport |
| 80 | Petty, C. Craig | General Atomics | Electron Transport Physics II: Heat Pinch | Confinement and Transport |
| 81 | Petty, C. Craig | General Atomics | Electron Transport Physics III: ETG vs. ITG | Confinement and Transport |
| 82 | Petty, C. Craig | General Atomics | Electron Transport Physics IV: Modulated ECH in ITB Plasmas | Confinement and Transport |
| 83 | Petty, C. Craig | General Atomics | Electron Transport Physics V: Isotope effect | Confinement and Transport |
| 84 | Schaffer, Michael J. | GA | Structure of Edge Harmonic Oscillation | Edge Pressure Pedestal Control |
| 85 | Leonard, Anthony W | General Atomics | Maximize Pedestal Density | Divertor and Edge Physics |
| 86 | Leonard, Anthony W. | General Atomics | Pedestal and ELM Scaling | Edge Pressure Pedestal Control |
| 87 | Schaffer, Michael J. | GA | X-point Pressure Hill and L-to-H Transition | Divertor and Edge Physics |
| 88 | Leonard, Anthony W. | General Atomics | Edge Current Density, Pedestal and ELM Energy | Edge Pressure Pedestal Control |
| 90 | Leonard, Anthony W. | General Atomics | Documentation of Drift Effects on Divertor Solution | Divertor and Edge Physics |
| 91 | Schaffer, Michael J. | GA | Edge Poloidal Nonuniformity | Divertor and Edge Physics |
| 92 | Leonard, Anthony W | General Atomics | Symmetrization of Double Null Heat Flux | Divertor and Edge Physics |
| 94 | Garofalo, Andrea M. | Columbia University | Higher plasma performance with improved error field correcti | High Bootstrap AT Scenario |
| 97 | Garofalo, Andrea M. | Columbia University | RWM rotation threshold vs plasma-wall separation and bN | Stabilization of RWM |
| 98 | Strait, Ted | GA | Expanding the Transport Barrier at Low q95 | Stability |
| 99 | Strait, Ted | GA | Wall stabilization physics: dependence on rational surfaces | Stabilization of RWM |
| 100 | Strait, Ted | GAMotivation: | Wall stabilization physics: dependence on wall distance | Stabilization of RWM |
| 101 | Strait, Ted | GAMotivation: | Wall stabilization physics: dependence on wall distance | Stabilization of RWM |
| 102 | Strait, Ted | GA | Error field optimization in AT plasmas | High Bootstrap AT Scenario |
| 103 | Guenter, Sibylle | IPP Garching | Stabilization of NTMs by external helical fields | Stabilization of NTM |
| 104 | Baylor, Larry R. | ORNL | PEP-mode with ECCD for Extended ITB Duration | Internal Transport Barriers |
| 105 | Baylor, Larry R. | ORNL | Test of HFS Pellet Fueling Deposition Theory | Confinement and Transport |
| 106 | Baylor, Larry R. | ORNL | Impurity Toroidal Rotation Comparison with Neoclassical Theo | Confinement and Transport |
| 107 | Baylor, Larry R. | ORNL | Determination of the Density Limit in H-mode with High Field | Divertor and Edge Physics |
| 108 | La Haye, Robert J | GA | ECCD SUPPRESSION OF NTM IN SAWTEETHING DISCHARGES | Stabilization of NTM |
| 109 | La Haye, Robert J | GA | RAISE BETA LIMIT TO NTM BY ECCD SUPPRESSION | Stabilization of NTM |
| 110 | West, W. Phil | General Atomics | Methane Penetration Factor | Divertor and Edge Physics |

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| 111 | Prater, Ron | GA | Test of model of electron ITB | Internal Transport Barriers |
| 112 | Mahdavi, Ali | GA | Test of the neutral penetration model and its impact on dens | Divertor and Edge Physics |
| 113 | Mahdavi, Ali | GA | Determination of boundaries of high density operating windo | Divertor and Edge Physics |
| 114 | Mahdavi, Ali | GA | Determine the radiative density limit within the separatrix | Divertor and Edge Physics |
| 115 | Burrell, Keith H. | General Atomics | Evolution of core Er in Ohmic and ECH H-mode | Confinement and Transport |
| 116 | Gohil, Punit | GA | Investigations of Pellet Induced H-mode Transitions | Confinement and Transport |
| 117 | Ferron, John | General Atomics | Scaling with discharge shape of AT scenario beta limits | High Bootstrap AT Scenario |
| 118 | Gohil, Punit | GA | Off-axis Pellet Injection to expand the ITB radius | Internal Transport Barriers |
| 119 | Gohil, Punit | GA | Control of Internal Transport Barriers using modulated ECH | Internal Transport Barriers |
| 120 | McKee, George R | U. Wisconsin-Madison | Isotope Scaling of Turbulence/Transport | Confinement and Transport |
| 121 | Lasnier, Charles J. | LLNL | Compare contoured and flat tiles | Divertor and Edge Physics |
| 122 | Doyle, Edward | UCLA | Continued Direct Experimental Tests of Predicted Turbulence | Confinement and Transport |
| 123 | Ferron, John | General Atomics | Scaling of ELM effect with plasma current | High Bootstrap AT Scenario |
| 124 | Ferron, John | General Atomics | Scaling of ELM effect with plasma current | Edge Pressure Pedestal Control |
| 129 | Rhodes, T. | UCLA | Establishing edge and SOL turbulence and transport character | Confinement and Transport |
| 130 | Whyte, Dennis | UCSD | Study of Far-SOL plasma and neutrals | Divertor and Edge Physics |
| 131 | Prater, Ron | GA | Alternate ECCD locations for suppression of NTMs | Stabilization of NTM |
| 132 | Boedo, Jose A | UCSD | Fluctuations in the DIII-D divertor | Divertor and Edge Physics |
| 133 | West, W. Phil | | DiMES leading edge experiments | Divertor and Edge Physics |
| 134 | Groebner, Richard J. | General Atomics | Width of H-mode Barrier for Electron Density | Edge Pressure Pedestal Control |
| 135 | Petrie, Thomas W. | General Atomics | Role of the "Dome" in Reducing Divertor Asymmetries in DN | Divertor and Edge Physics |
| 136 | West, W. Phil | General Atomics | Impurity Transport in QH and QDB discharges | Internal Transport Barriers |
| 138 | Lazarus, Ed | | Sawtooth Physics | Stability |
| 139 | Boedo, Jose A | UCSD | Convective cells and ExB structures in DIII-D SOL | Divertor and Edge Physics |
| 140 | Ferron, John | General Atomics | Benchmarking of stability calculations with new edge J measu | Edge Pressure Pedestal Control |
| 141 | Petrie, Thomas W. | General Atomics | Changes in SOL Behavior Between SN and DN Configurations | Divertor and Edge Physics |
| 142 | Casper, Thomas A. | LLNL | ECH/ECCD modifications of QDB | Internal Transport Barriers |
| 143 | Boedo, Jose A | UCSD | Fast Imaging of ELMS in the DIII-D boundary and divertor | Divertor and Edge Physics |
| 144 | Rudakov, Dmitry L | UCSD | Role of Turbulent Heat Convection versus Conduction in L and | Confinement and Transport |
| 145 | Moyer, Rick | University of California, San Diego | How important are avalanches to overall transport? | Confinement and Transport |
| 146 | Boedo, Jose A | UCSD | Influence of X-point convection on the L-H transition thresh | Divertor and Edge Physics |
| 147 | Petrie, Thomas W. | General Atomics | Does the Radiating Divertor Concept Make Sense For DN? | Divertor and Edge Physics |
| 148 | Rhodes, T. | UCLA | Establishing Core Turbulence Scale Lengths: Larmor vs Banana | Confinement and Transport |
| 149 | Zarnstorff, Michael C. | PPPL, Princeton U. | Direct Search for Zonal Flows | Confinement and Transport |
| 150 | Carlstrom, Tom | GA | Grad B effect on edge velocity shear and the L-H transition | Confinement and Transport |

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| | | | | |
|---|---|---|---|---|
| 151 | Jackson, Gary L. | GA | Enhnaced lithium conditioning with Dimes for lower recycling | Divertor and Edge Physics |
| 152 | Boedo, Jose A | UCSD | High resolution Te measurements in the DIII-D divertor | Divertor and Edge Physics |
| 153 | Petrie, Thomas W. | General Atomics | Why Is the HL Transition Sensitive to Mag Balance Near DN? | Divertor and Edge Physics |
| 154 | Stangeby, Peter C. | University of Toronto | Well-Diagnosed Shots for Edge Modeling | Divertor and Edge Physics |
| 155 | Boedo, Jose A | UCSD | Bifurcated divertor plasmas | Divertor and Edge Physics |
| 156 | Doyle, Edward | UCLA | Transport Barrier Expansion in QDB plasmas | Internal Transport Barriers |
| 157 | Greenfield, Charles M. | General Atomics | Perturbative transport study of the ETG mode | Confinement and Transport |
| 158 | Boedo, Jose A | UCSD | Modification of X-point ExB convection by divertor biasing | Divertor and Edge Physics |
| 159 | Luce, Tim | General Atomics | How Close to the L-H Threshold Can Good Confinement Be Had? | Confinement and Transport |
| 160 | Moyer, Rick | University of California, San Diego | Search for evidence for Reynolds Stress driven (zonal) flows | Confinement and Transport |
| 161 | Jackson, Gary L. | GA | Edge pressure profile modification with Kr injection | Edge Pressure Pedestal Control |
| 162 | Luce, Tim | General Atomics | Radiative Divertor in Low-Density Steady ELMing H modes | Divertor and Edge Physics |
| 163 | Doyle, Edward | UCLA | Improved Plasma Shaping for QDB plasmas | Internal Transport Barriers |
| 164 | Fredrickson, Eric | PPPL | Investigation of the Resistive Interchange Mode | Stability |
| 165 | Luce, Tim | General Atomics | Control of MARFEs with ECH | Divertor and Edge Physics |
| 166 | Ferron, John | General Atomics | Real time control of ECCD NTM suppression by PCS | Stabilization of NTM |
| 168 | Murakami, Masanori | ORNL | ECCD m/n=2/1 mode suppression with q_min>1 | Stabilization of NTM |
| 169 | Doyle, Edward J. | UCLA | Transport and Turbulence in Thrust 2 plasmas | High Bootstrap AT Scenario |
| 170 | Watkins, Jonathan | | Narrow target plate heat profile | Divertor and Edge Physics |
| 171 | Kim, Jin-Soo | FARTECH, Inc. | Multi-Sensor Resistive-Wall-Mode Identification | Stabilization of RWM |
| 172 | Watkins, Jonathan | SNL | ExB effect on pumping | Divertor and Edge Physics |
| 174 | Watkins, Jonathan | SNL | Steady State high Density | Divertor and Edge Physics |
| 175 | Watkins, Jonathan | | Optimize high density discharges | Divertor and Edge Physics |
| 176 | Okabayashi, Michio | PPPL | The excitation of N=2 external kink modes and the RWM | Stabilization of RWM |
| 177 | ONGENA, Jef P.H.E | TEC team Julich | Impurity seeded discharges with a nearly circular shape | Confinement and Transport |
| 178 | Okabayashi, Michio | PPPL | Comparison of Current Driven External Kinks in DIIID & NSTX | Stabilization of RWM |
| 179 | Krasheninnikov, Sergei | University California San Diego | Plasma in private region | Divertor and Edge Physics |
| 180 | Scoville, J. Timothy | General Atomics | Error field amplification above the no-wall beta limit | Stabilization of RWM |
| 183 | Jackson, Gary L. | GA | High density, JET-like, afterpuff impurity seeded discharges | Divertor and Edge Physics |
| 184 | Perkins, Francis W. | Priceton - DIII-D Collaboration | High Bootstrap Fraction Plasmas: Thermal and Magetic Diffusi | Heating and Current Drive |
| 185 | Petty, C. Craig | General Atomics | Increase in ECCD Efficiency with Electron Beta | Heating and Current Drive |
| 186 | Jayakumar, R. Jay | Lawrence Livermore National Lab | Dependence of Edge Bootstrap Current on plasma shape and col | Divertor and Edge Physics |
| 187 | Jackson, Gary L. | GA | ECCD supression of Neoclassical Tearing Modes in L-mode disc | Stabilization of NTM |
| 188 | Porkolab, Miklos | MIT | ITB Formation with off-Axis ECH | Internal Transport Barriers |
| 189 | Pinsker, Robert I. | GA | High Harmonic Electron Cyclotron Heating | Heating and Current Drive |
| 190 | Pinsker, Robert I. | GA | Modification of Sawteeth by High Power 110 GHz ECH and ECCD | Heating and Current Drive |

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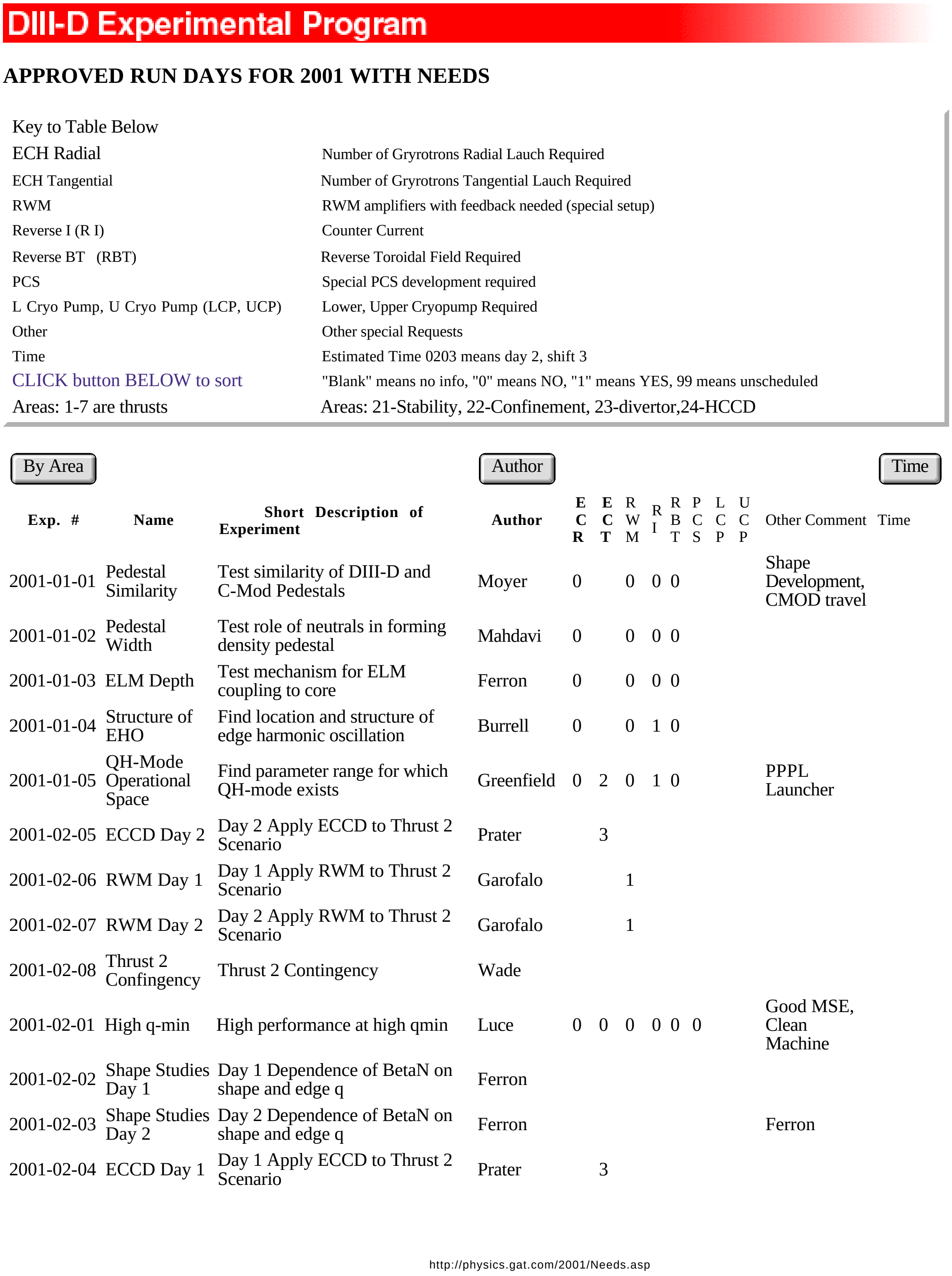
| | | | | |
|---|---|---|---|---|
| 191 | Prater, Ron | General Atomics | Nonlinear ECH effects | Heating and Current Drive |
| 192 | Prater, Ron | General Atomics | Effect of transport on ECCD for nonthermal distributions | Heating and Current Drive |
| 193 | Murakami, Masanori | ORNL | Momentum and Particle Transport in Helium RI-Mode Plasmas | Confinement and Transport |
| 194 | SEN, AMIYA K. | COLUMBIA UNIVERSITY | NOVEL ECH FEEDBACK CONTROL OF MHD MODES IN DIII-D | Stabilization of NTM |
| 195 | Buttery, Richard | UKAEA | Triggering NTMs with error field spin up modes, + others | Stabilization of NTM |
| 196 | Hender, Tim | JET-EFDA | (2,1) NTM DIII-D - JET comparison | Stabilization of NTM |
| 197 | Ernst, D. R. | PPPL | Magnetic braking of neon improved plasmas | Confinement and Transport |
| 198 | Ernst, D. R. | PPPL | Tests of Neoclassical Parallel Momentum Exchange | Confinement and Transport |
| 199 | Ernst, D. R. | PPPL | Hysteresis of ITB Plasmas using Modulated NBI | Internal Transport Barriers |
| 200 | Garofalo, Andrea M. | Columbia University | Benchmark VALEN | Stabilization of RWM |
| 201 | Garofalo, Andrea M. | Columbia University | Survey of feedback logics in SND plasmas | Stabilization of RWM |
| 202 | Garofalo, Andrea M. | Columbia University | Begin integration of RWM feedback in AT scenario | High Bootstrap AT Scenario |
| 203 | Fenstermacher, Max E. | LLNL @ DIII-D | Argon Radiative Divertor in a Helium Puff and Pump Plasma | Divertor and Edge Physics |
| 204 | Fenstermacher, Max | LLNL @ DIII-D | Div. Carbon and Deuterium Transport, Charge Bal. During ELMs | Divertor and Edge Physics |
| 205 | Sauter, Olivier | CRPP-EPFL | Stabilisation and Destabilisation of sawteeth with ECH/ECCD | Heating and Current Drive |
| 206 | Sauter, Olivier | JET-EFDA | Sawteeth destabilisation for NTM avoidance | Stabilization of NTM |
| 207 | Kinsey, Jon E. | Lehigh University | Cold edge pulse piggyback exeriments with Ti measurements | Confinement and Transport |
| 208 | DeBoo, Jim C. | GA | Summary of Transport Studies with Modulated ECH | Confinement and Transport |
| 209 | Petrie, Thomas | General Atomics | Why Cant the heat flux outside the slot be reduced | Divertor and Edge Physics |
| 210 | Lazarus, Ed | | Classical 2/1 Tearing | Stabilization of NTM |
| 211 | Moyer, Rick | University of California, San Diego | Characterization of fluctuations and transport in far SOL | Confinement and Transport |
| 212 | Politzer, Pete | GA | Flux and Current Transport by MHD Activity | Stability |
| 213 | Lazarus, Ed | | Stabilization of ITG turbulence by the Shafranov Shift | Confinement and Transport |

**Entry page for Research Proposals 2001** | **Fusion Educational Server** | **Fusion Technical Server**

**Last updated October 30, 2000**
**Email questions or comments to Steve Allen**

## 1.4. DETAILED SCHEDULE OF EXPERIMENTS



# DIII-D Experimental Program

### APPROVED RUN DAYS FOR 2001 WITH NEEDS

Key to Table Below

| | |
|---|---|
| ECH Radial | Number of Gryrotrons Radial Lauch Required |
| ECH Tangential | Number of Gryrotrons Tangential Lauch Required |
| RWM | RWM amplifiers with feedback needed (special setup) |
| Reverse I (R I) | Counter Current |
| Reverse BT (RBT) | Reverse Toroidal Field Required |
| PCS | Special PCS development required |
| L Cryo Pump, U Cryo Pump (LCP, UCP) | Lower, Upper Cryopump Required |
| Other | Other special Requests |
| Time | Estimated Time 0203 means day 2, shift 3 |
| CLICK button BELOW to sort | "Blank" means no info, "0" means NO, "1" means YES, 99 means unscheduled |
| Areas: 1-7 are thrusts | Areas: 21-Stability, 22-Confinement, 23-divertor,24-HCCD |

By Area  Author  Time

| **Exp. #** | **Name** | **Short Description of Experiment** | **Author** | **ECR** | **ECT** | RWM | RI | RBT | PCS | LCP | UCP | Other Comment | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001-01-01 | Pedestal Similarity | Test similarity of DIII-D and C-Mod Pedestals | Moyer | 0 | | 0 | 0 | 0 | | | | Shape Development, CMOD travel | |
| 2001-01-02 | Pedestal Width | Test role of neutrals in forming density pedestal | Mahdavi | 0 | | 0 | 0 | 0 | | | | | |
| 2001-01-03 | ELM Depth | Test mechanism for ELM coupling to core | Ferron | 0 | | 0 | 0 | 0 | | | | | |
| 2001-01-04 | Structure of EHO | Find location and structure of edge harmonic oscillation | Burrell | 0 | | 0 | 1 | 0 | | | | | |
| 2001-01-05 | QH-Mode Operational Space | Find parameter range for which QH-mode exists | Greenfield | 0 | 2 | 0 | 1 | 0 | | | | PPPL Launcher | |
| 2001-02-05 | ECCD Day 2 | Day 2 Apply ECCD to Thrust 2 Scenario | Prater | | 3 | | | | | | | | |
| 2001-02-06 | RWM Day 1 | Day 1 Apply RWM to Thrust 2 Scenario | Garofalo | | | 1 | | | | | | | |
| 2001-02-07 | RWM Day 2 | Day 2 Apply RWM to Thrust 2 Scenario | Garofalo | | | 1 | | | | | | | |
| 2001-02-08 | Thrust 2 Confingency | Thrust 2 Contingency | Wade | | | | | | | | | | |
| 2001-02-01 | High q-min | High performance at high qmin | Luce | 0 | 0 | 0 | 0 | 0 | 0 | | | Good MSE, Clean Machine | |
| 2001-02-02 | Shape Studies Day 1 | Day 1 Dependence of BetaN on shape and edge q | Ferron | | | | | | | | | | |
| 2001-02-03 | Shape Studies Day 2 | Day 2 Dependence of BetaN on shape and edge q | Ferron | | | | | | | | | Ferron | |
| 2001-02-04 | ECCD Day 1 | Day 1 Apply ECCD to Thrust 2 Scenario | Prater | | 3 | | | | | | | | |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2001-03-01 | NTM Stabilization Helical Fields | Proof of Principle stabilization of NTMs by non-resonant helical fields | LaHaye | | | | | | | Request March 1 or later for S. Guenther |
| 2001-03-02 | NTM Stabilization ECCD Day 1 | Day 1 Suppression of an NTM by radially localized off-axis ECCD in the presence of sawteeth instabilities | LaHaye | 0 | 4 | | | | | BT Control Slower Sweeps |
| 2001-03-03 | NTM Stabilization ECCD Day 2 | Day 2 Suppression of an NTM by radially localized off-axis ECCD in the presence of sawteeth instabilities | LaHaye | 0 | 4 | | | | | |
| 2001-03-04 | 2/1 NTM Stabilization ECCD | Enhanced performance in ELMing H-mode with qmin about 1 by ECCD suppression of 2/1 NTM | Luce | 0 | 4 | | | | | |
| 2001-04-01 | EFA Investigation | Investigation of error field amplification above no-wall limit | Scoville | 0 | 0 | 1 | 0 | 0 | 0 | Nav. only<br>Here Feb. 12 |
| 2001-04-02 | RWM vs q-profile | Study dependence of RWM stability on q-profile | Strait | 0 | 0 | 1 | 0 | 0 | 0 | Need Minipro |
| 2001-04-03 | Test of new sensors | Test new inernal saddle and Mirnov loops and new RWM feedback | Okabayashi | 0 | 0 | 1 | 0 | 0 | 1 | New PCS |
| 2001-04-04 | RWM FB in Steady-State Day 1 | Day 1 Test new internal saddle and Mirnov loops and new RWM feedback | Garofalo | 0 | 0 | 1 | 0 | 0 | 1 | New PCS |
| 2001-04-05 | RWM FB in Steady-State Day 2 | Day 2 Test new internal saddle and Mirnov loops and new RWM feedback | Garofalo | 0 | 0 | 1 | 0 | 0 | 0 | |
| 2001-04-06 | Smart Shell with ISLs | Optimize smart shell algorithm using internal saddle loops | Okabayashi | 0 | 0 | 1 | 0 | 0 | 1 | New PCS |
| 2001-04-07 | Mode Control with ISLs | Optimize mode control algorithm using internal saddle loops | Okabayashi | 0 | 0 | 1 | 0 | 0 | 1 | New PCS |
| 2001-04-08 | Mode Control with IMPs Day 1 | Day 1 Optimize mode control algorithm using Internal Magnetic Probes | Strait | 0 | 0 | 1 | 0 | 0 | 1 | New PCS |
| 2001-04-09 | Mode Control with IMPs Day 2 | Day 2 Optimize mode control algorithm using Internal Magnetic Probes | Strait | 0 | 0 | 1 | 0 | 0 | 1 | New PCS |
| 2001-07-01 | Investigate QDB Regime Day 1 | Day 1 Investigate physics, scaling, robustness of QDB regime | Greenfield | | 2 | | 1 | | | PPPL Launcher |
| 2001-07-02 | Investigate QDB Regime Day 2 | Day 2 Investigate physics, scaling, robustness of QDB regime | Greenfield | | 2 | | 1 | | | PPPL Launcher |
| 2001-07-03 | Impurity Transport in QDB | Examine High-Z transport and accumulation in QDB | West | | | | 1 | | | |
| 2001-07-04 | QDB Tool Development | Attempt to reduce density peaking using variety of tools | Doyle | | | | 1 | | | ?ECH |
| 2001-07-05 | Off-Axis ECH for ITB Control | Attempt at ITB control using off-axis ECH | Gohil | 3 | | | 1 | | | Radial ECH desired |
| 2001-07-06 | Integrate PEP and Impurity Induced ITB | Attempt integration of PEP and impurity ITB | McKee | 3 | | | 0 | | | Which ECH |
| 2001-21-01 | Disruption Mitigation | Disruption mitigation with high pressure gas injection | Whyte | | | | | | | |
| 2001-21-02 | Resistive Interchange Mode | Mode structure of resistive interchange mode physics | | | | | | | | |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2001-21-03 | Sawtooth physics | Reconnection dynamics in Mercier-stable bean, unstable ellipse | Lazarus | | | | | | | |
| 2001-21-04 | Low q95 | Exploration of enhanced performance at low q95 | | | | | | | | |
| 2001-22-01 | Core Turbulence Scale Lengths | Establish core turbulence scale lengths, Larmor vs Banana and safety factor scaling of L-mode plasmas | Rhodes | 2 | | | | | | Need Probe |
| 2001-22-02 | Renolds stress and zonal flow | Search for evidence of Reynolds stress(edge) and zonal flow (core) physics | McKee | | | | | | | |
| 2001-22-03 | SOL Flow on L/H Transition and Pellet Induced H-mode | The role of SOL Flow on the L/H Transition (1/2 day), Pellet Induced H-mode (1/2 day) | Gohil | | | | | | | |
| 2001-22-04 | Grad-B effect on shear and L-H transition | The effect of Grad-B on edge velocity shear and the L-H transition | Rhodes | 0 | 0 | 0 | 0 | 0 | 0 | Need Probe |
| 2001-22-05 | Heat Pinch Physics | Electron transport physics and heat pinch | Petty | 3 | | | | | | Need ECH |
| 2001-22-06 | Test Transport Models | Profile stiffness and tests of transport models with ECH | DeBoo | 3 | | | | | | Need ECH |
| 2001-22-07 | Elongation Scaling | Elongation scaling at fixed dimensionless parameters | Petty | | | | | | | Ready |
| 2001-22-08 | Dependence of Tubulence on Te/Ti ratio | Dependence of turbulence on Te/Ti ratio in L-mode plasma | McKee | | | | | | | |
| 2001-22-09 | Momentum and Particle Transport | Momentum and particle transport with and without impurity injection | Murakami | | | | | | | Baylor Gone Until Feb. 12 |
| 2001-22-10 | Simultaneous electron and ion ITB | Simultaneous electron and ion transport barriers | Greenfield | 2 | 2 | | | | | Need ECH |
| 2001-22-11 | Detailed Electron ITB | Detailed electron transport physics | Petty | 3 | 0 | | | | | |
| 2001-23-01 | DN Turbulence and Drifts | Near double null turbulence and drifts | Petrie | | | | | | | Probe Desired |
| 2001-23-02 | Test Pedestal Theories | Test of pedestal density theories and postulates | Mahdavi | | | | | | | |
| 2001-23-03 | L-Mode Far SOL Transport | L-mode far SOL transport | Whyte | | | | | | | Probes, Stangeby Travel |
| 2001-23-04 | Drifts and Potentials in LSN, Forward BT | Measure and change drifts and potentials in LSN in Forward BT | Schaffer | | | | | | | Probe Required |
| 2001-23-05 | Drifts and Potentials in LSN, Reverse BT | Measure and change drifts and potentials in LSN in Reverse BT | Schaffer | | | | | 1 | | |
| 2001-23-06 | Lithium DiMES exposure | Expose Lithium to a very simple plasma (1/2 day) | Whyte | | | | | | | Need 1 wk notice for sample |
| 2001-23-07 | Carbon Source | Carbon source, flat vs contoured tiles and methane puff | Lasnier | | | | | | | West until Feb. 7 |

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| | | | | | |
|---|---|---|---|---|---|
| 2001-24-01 | ECCD Physics | Complete ECCD Scans from last year | Prater | 2 | Complete last year |
| 2001-24-02 | Far Off-Axis ECCD | ECCD at Rho > 0.6 | | 3 | |
| 2001-24-03 | ECCD at High Electron Beta | ECCD at High Electron Beta | | 3 | |
| 2001-24-04 | High Bootstrap Fraction | Generate discharges with Bootstrap Fraction | | 3 | |
| 2001-24-05 | High Bootstrap Fraction Day 2 | DAy 2 Generate discharges with high bootstrap fraction | Petty | 3 | |
| 2001-24-06 | Edge Bootstrap current | Measure Edge Bootstrap Current | | 0 | |
| 2001-98-01 | Startup | Start | | | |
| 2001-99-01 | Contingency | Contingency | Schedule later | | Needed for Schedule Flexibility |
| 2001-99-02 | MSE/CER CAlibration | MSE/CER Calibration | | | |
| 2001-99-03 | RWM Checkout | RWM Checkout | | | |

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## 1.5. THE 2001 OPERATIONS SCHEDULE

The operations schedule is designed for efficient and safe use of the DIII–D facility. Seventeen weeks of plasma physics operations is scheduled for the calendar year 2001. The plan is to have four 4- or 5-week run periods. The operations schedule is shown in Fig. 4. Operations are carried out on either 4 or 5 days per week for 8.5 hours. Typically on four-day weeks, on one day operations are extended for 10.5 hours to allow longer experiments to reach completion.

The plan takes into consideration factors such as efficient matching of the machine run time with the availability of hardware and data analysis capabilities. Above all, the DIII–D program is carried out to keep radiation exposure to employees and to the general public. As Low As Reasonably Achievable (ALARA) and still carry out the research program.

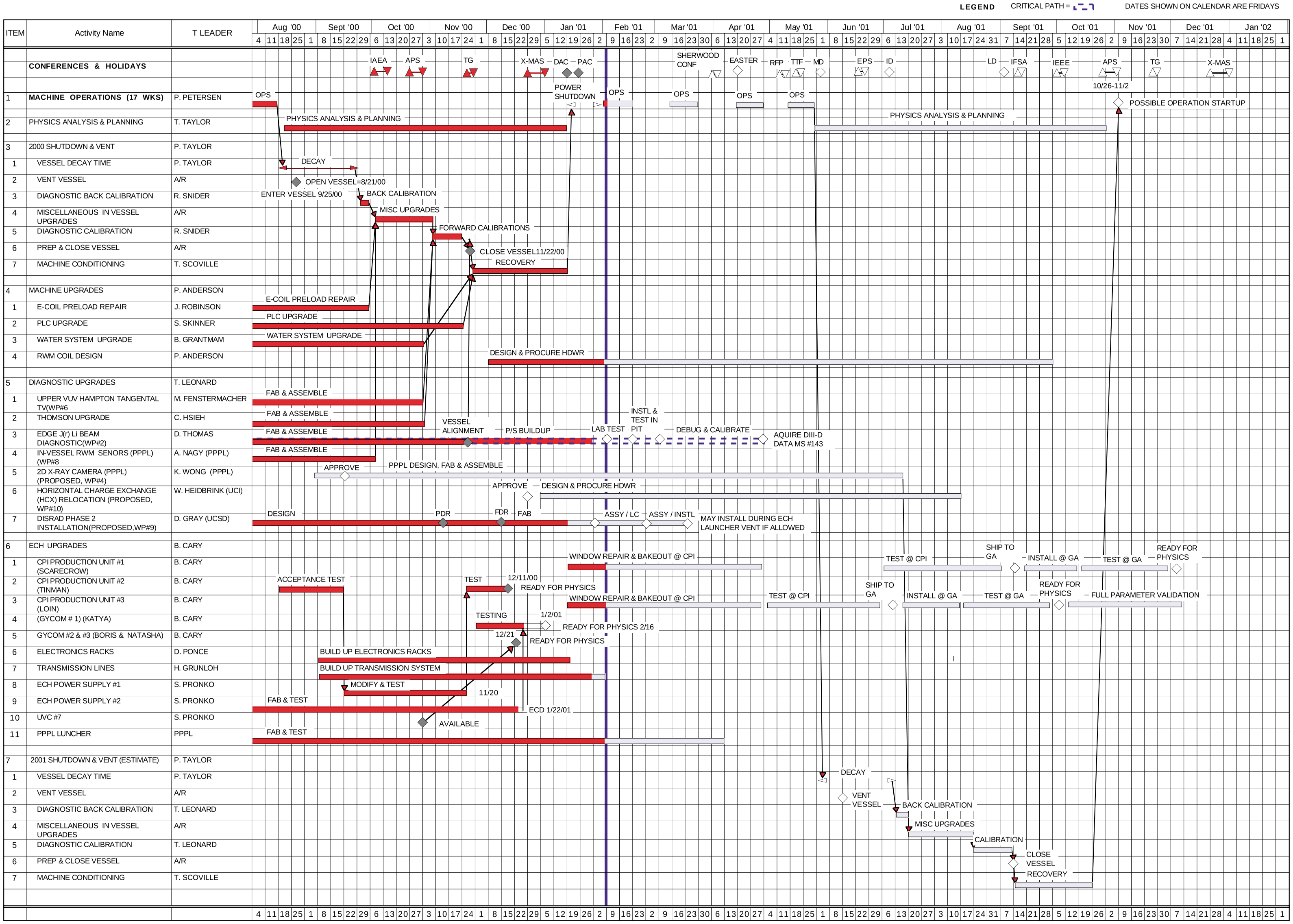

Fig. 4. DIII–D Master Schedule CY2001 17 Week Plan

# ACKNOWLEDGMENT

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