

Recent DIII-D Edge Studies

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Recent DIII-D Edge Experiments Relevant to ITER

- **Measure and characterize ELMs**
- **Eliminate ELMs with “ergodic” coils**
- **Study carbon transport and co-deposition to allow control of ITER tritium inventory**

DIII-D Boundary Topical Science Area Working Groups

- **Power and particle control (T. Petrie)**
 - Measure and model density control
 - Radiative divertor experiments in hybrid (2005)
 - Fewer edges in new divertor
- **SOL dynamics, radial transport (J. Boedo)**
 - Poloidal distribution of turbulence comparison with BOUT
 - Measure and model data, and compare with other machines — C-Mod picture frame
- **ELMs in the SOL and boundary (M. Fenstermacher, with Thrust 1)**
 - Some new measurements, also comparison with NSTX
 - Closely tied to pedestal issues
- **Impurity sources and transport (P. Stangeby)**
 - ^{13}C migration, ex-vessel oxygen bake — coordination with ITER central team
 - Measure 2-D sources — spectroscopy, DiMES, porous plug injector
 - Compare with codes — DIVIMP, OEDGE, UEDGE

Recent Boundary Experiments Completed

- “Porous Plug” methane source on DiMES probe (grad student)
- DiMES erosion in argon
- Carbon source experiment
- Reverse B_T flow experiment
- ^{13}C setup and DIMES cold mirror exposure
- ^{13}C injection (last run day) and DIMES hot mirror exposure
 - Mirror reflectivity and porization effects: Litovsky and Julich (ITER)
- Radiative divertor in hybrid mode

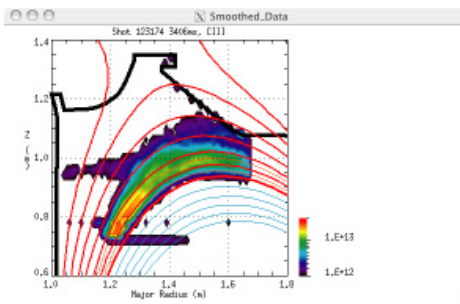
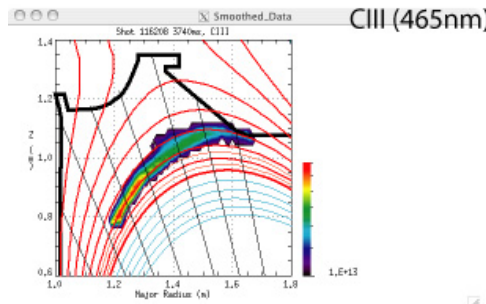
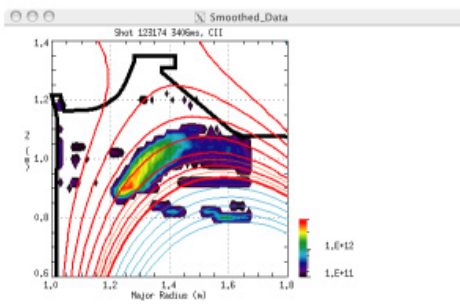
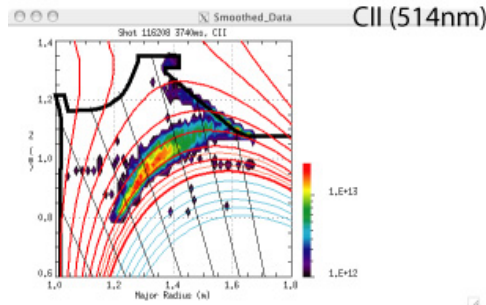
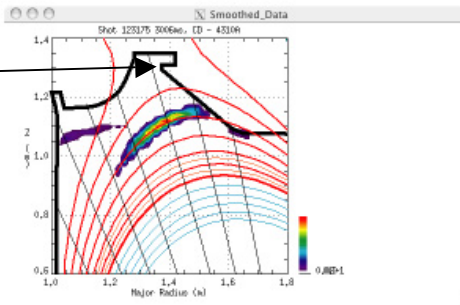
Carbon Transport: Forward and Reverse Toroidal Field — Carbon Emission Data is Similar

$^{13}\text{CH}_4$ puffed from baffle
(Toroidally symmetric source)

BT forward

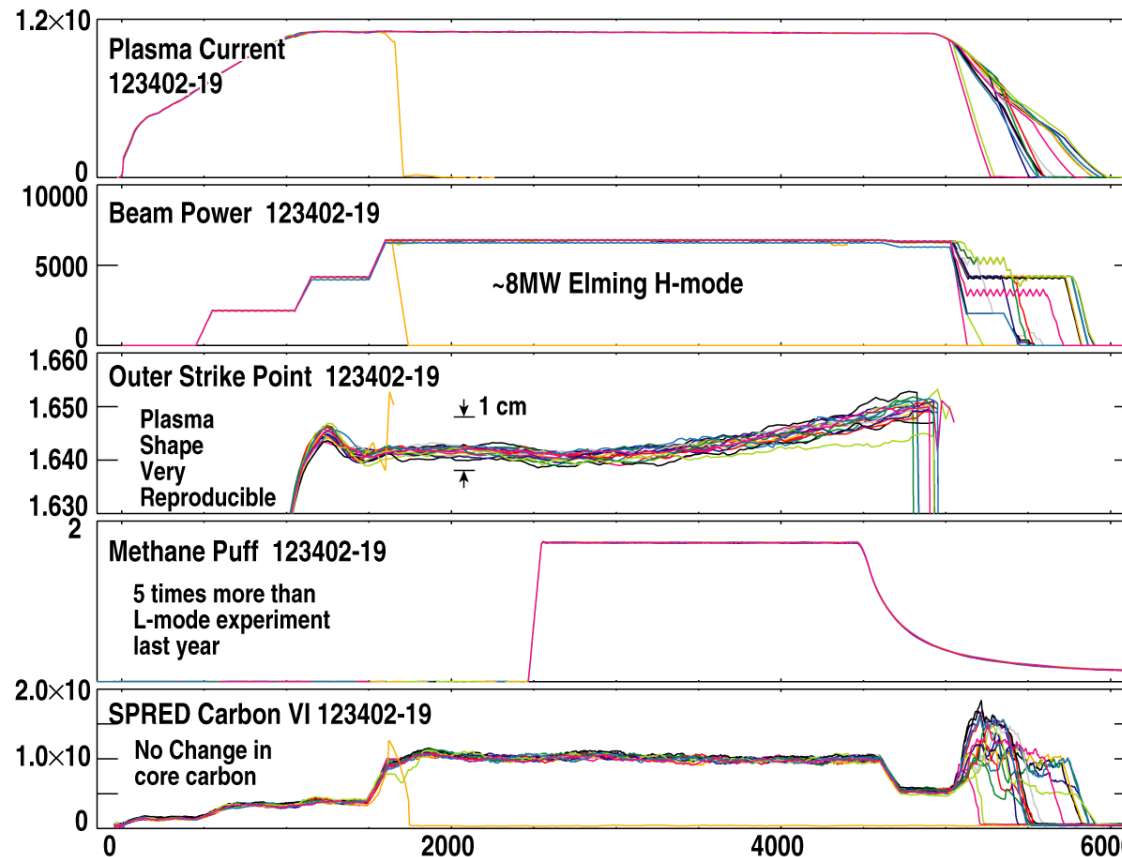
BT reversed

CD (431nm)



Investigate ITER Tritium co-deposition in ELMing H-mode via $^{13}\text{CH}_4$ Puffing and Tile Analysis

- Significant international involvement in planning and interpretation
- Collaborative effort LLNL, U. Toronto, U. Wisc., UCSD, SNL, PPPL, GA



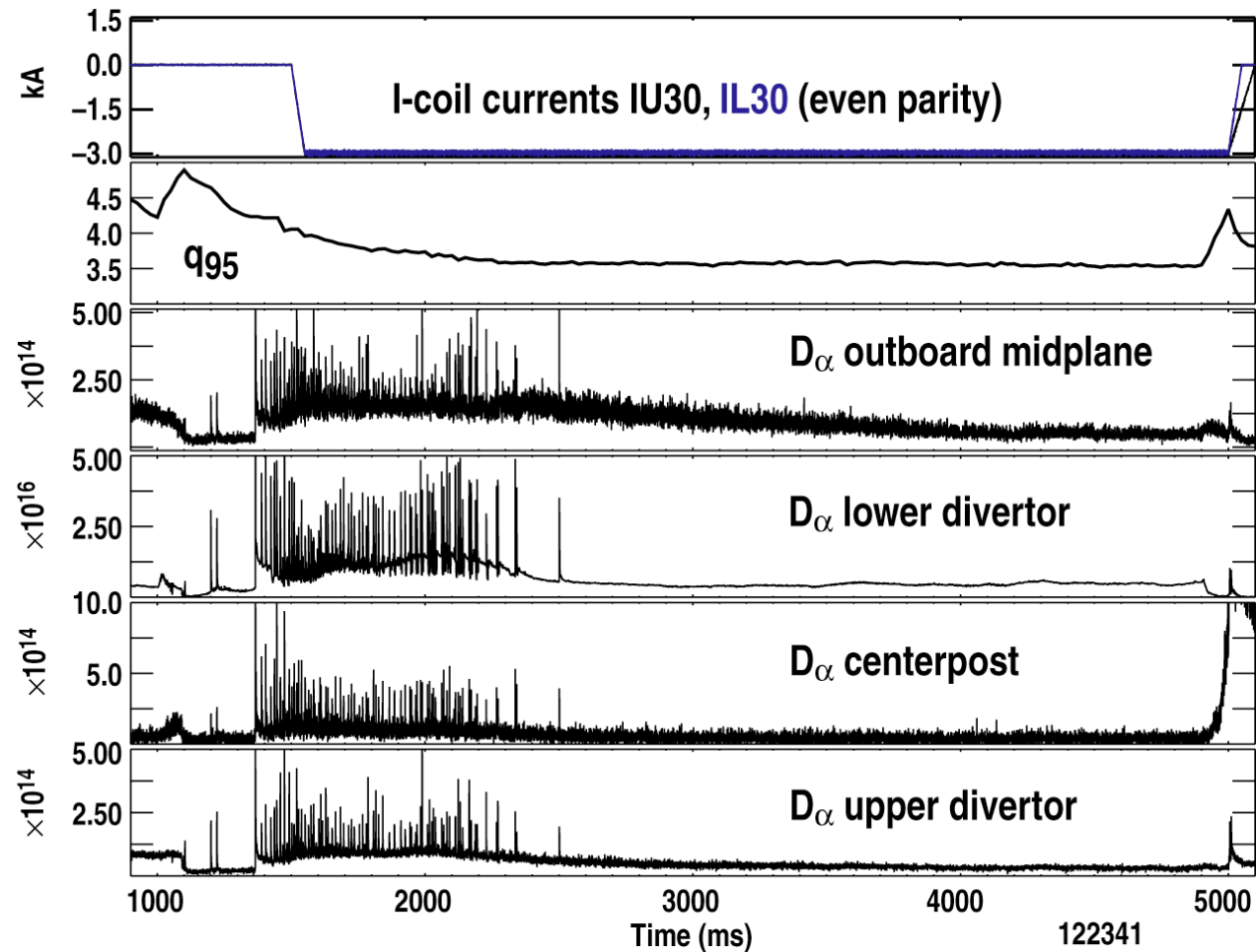
May 16 extract files
First send to Wampler,
Sandia NL, Albuquerque

(L-mode last year)

Oxygen bake,
U. Toronto

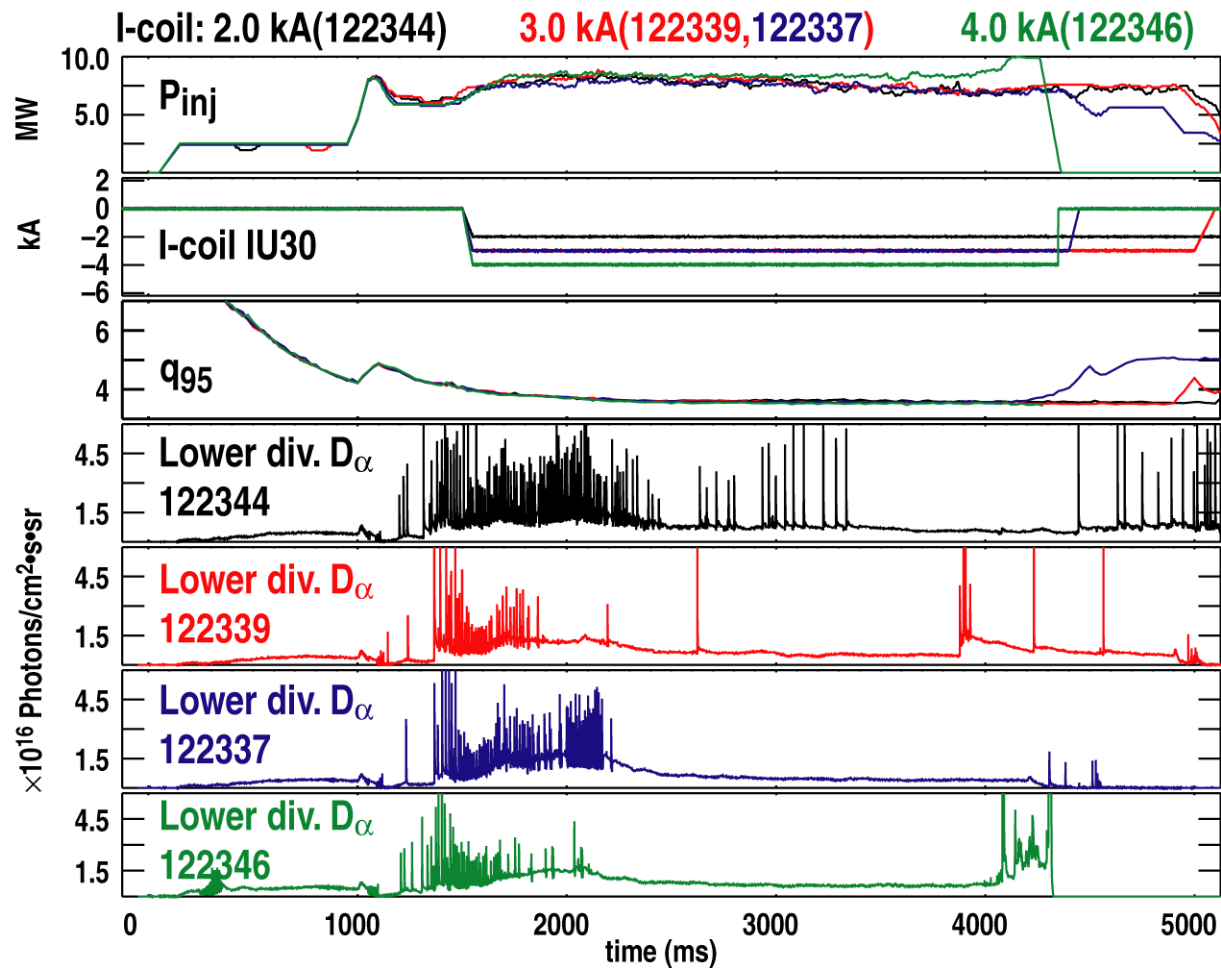
At $\nu_e^* \sim 0.04$ and Low δ , ELMs are Completely Suppressed After Initial ELMing Phase

- Similar to Quiescent H-modes
- q_{95} range appears to be narrower than at $n_e^* \approx 1$
- I-coil configured for even parity
 - More stochastic

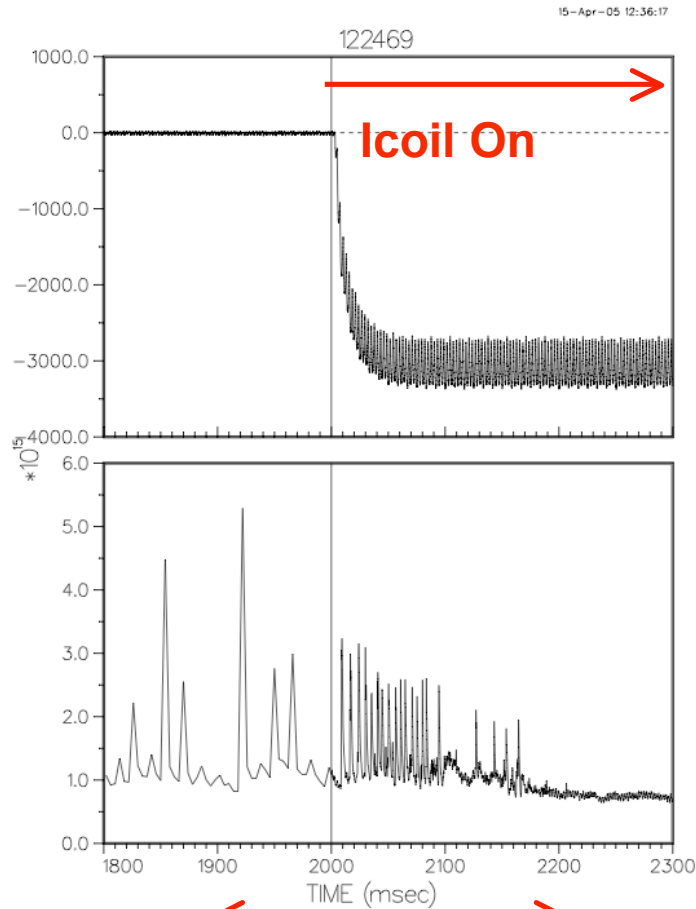


ELM Suppression Requires I-coil Current ≥ 3 kA

- At 2 kA, isolated ELMs appear; occasionally also at 3 kA

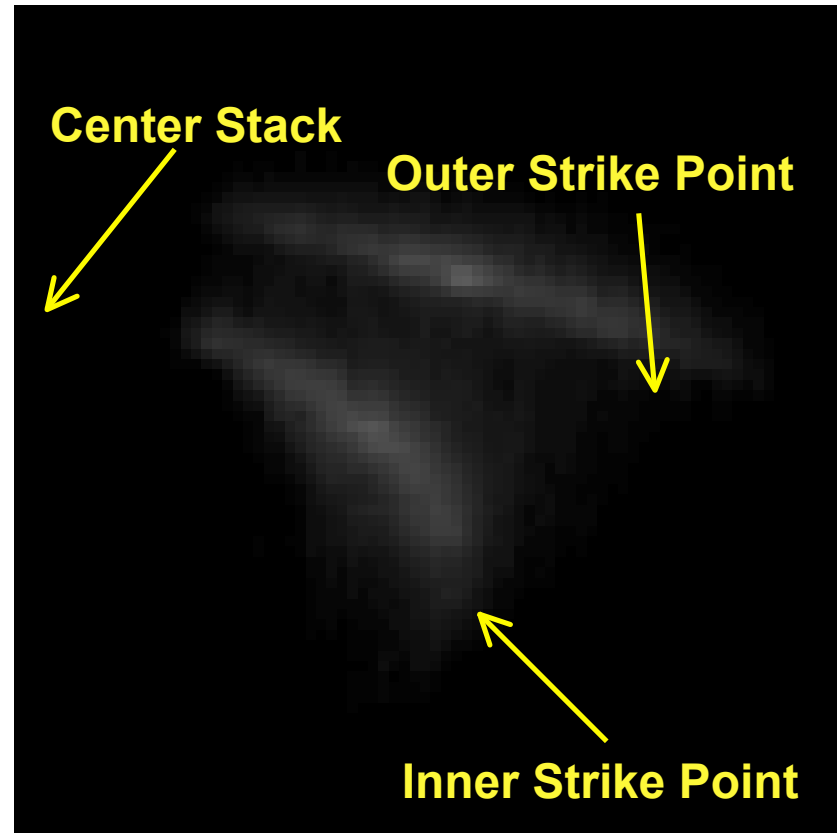


Suppression of ELMs with I-coil Observed with Lower Divertor Fast Camera Tangential View



←→
Movie window

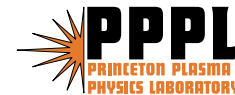
13,500 fps (75 μ s/frame), D_{α} filter



HIROSHIMA UNIVERSITY



ORNL
OAK RIDGE
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058-05/RLB/rs

* US-JAPAN COLLABORATION

Plans

- **Long torus opening (LTOA) through April 2006**
- **New lower divertor (high triangularity)**
- **Midplane version of DiMES (UCSD, SNL)**
- **More Langmuir probes (SNL)**
- **Quartz Microbalance (U. Wisconsin, GA)**
- **Curved tiles on lower inner wall**

Planned 2005 Modification of DIII-D Lower Divertor

