DIII-D Contributions & Plans for JRT-16

Presented by
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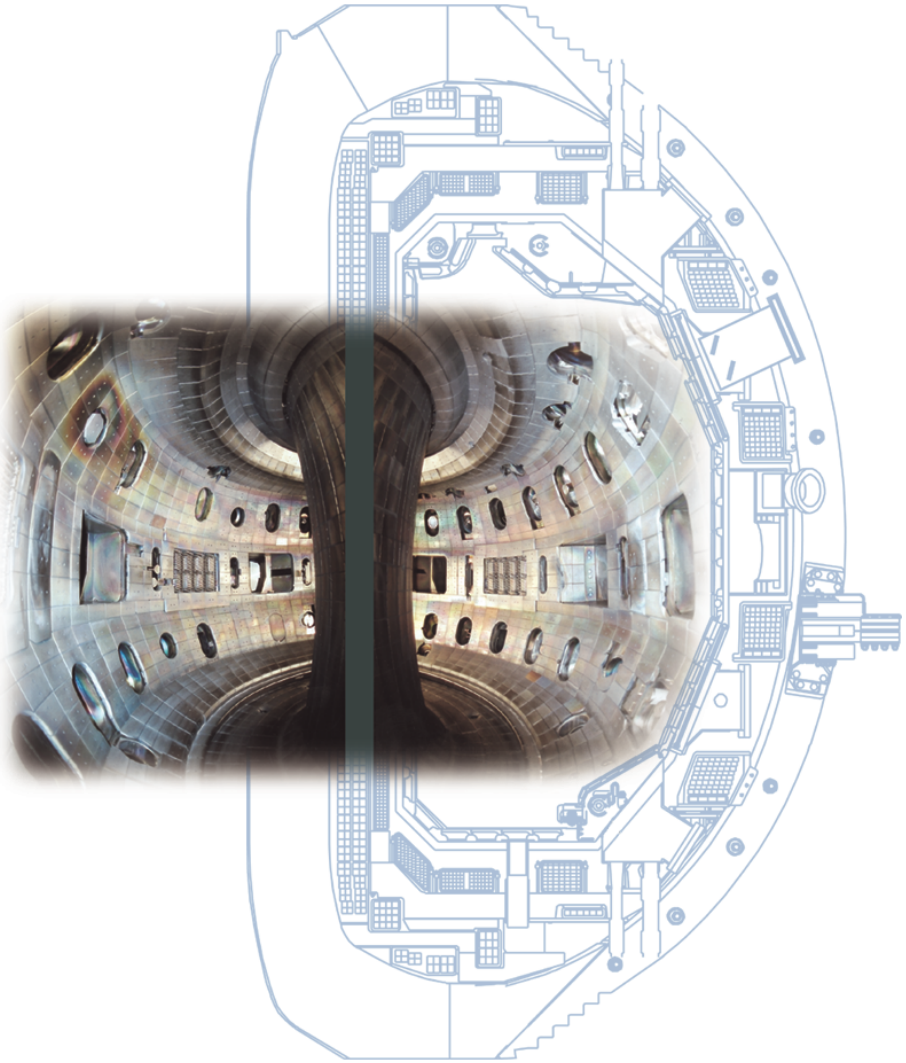
with thanks to **E. Strait**

for the
DIII-D 3D & Stability Physics Group
& Disruption Mitigation Task Force

Presented at the
IEA Workshop: Theory & Modeling of Disruptions Workshop

PPPL

July 13-15, 2015

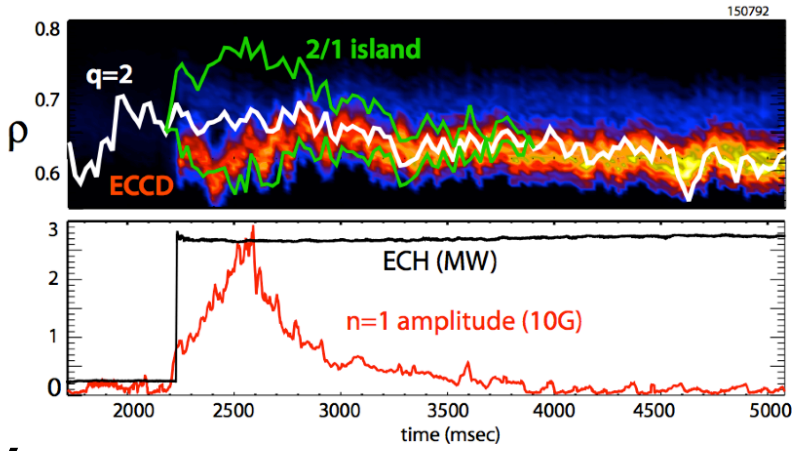


Disruption avoidance & detection

- ***Conduct research to detect** and minimize the consequences of disruptions in present and future tokamaks, including ITER. Coordinated research will deploy a **disruption prediction/ warning algorithm on existing tokamaks, assess approaches to avoid disruptions**, and quantify plasma and radiation asymmetries resulting from disruption mitigation measures, including both pre-existing and resulting MHD activity, as well as the localized nature of the disruption mitigation system. The research will employ new disruption mitigation systems, **control algorithms and hardware to help avoid disruptions, and measurements to detect disruption precursors** and quantify the effects of disruptions.*

DIII-D Research on Instability Control and Sensing Will Contribute to the FY 16 Joint Research Target

- **Experiments will work toward improving tearing mode stability in low-torque scenarios**
  - Improved stability by current profile modification
  - Active suppression by localized ECCD
  - Physics of rotation shear in NTM stability



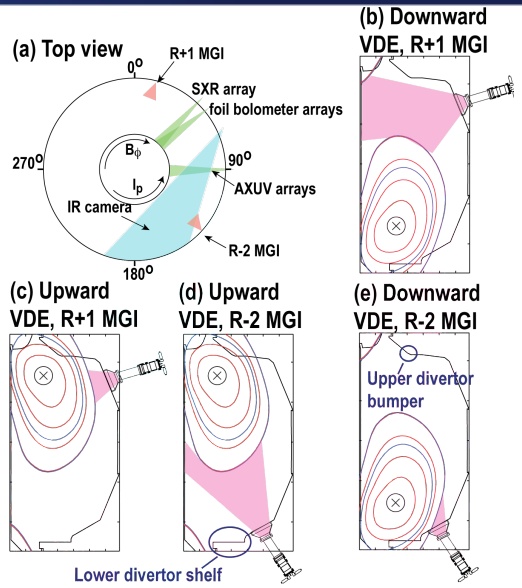
- **Planned research will address other key issues for stability physics and disruption avoidance:**
  - Test novel schemes for real-time sensing of tearing stability limits
  - Develop disruption avoidance by active control of locked modes
  - Assess the impact of n=2 error field in low-torque scenarios
  - Analyze existing data to characterize causes of disruptions in different operating conditions
  - Develop and test improved real-time disruption warning algorithms

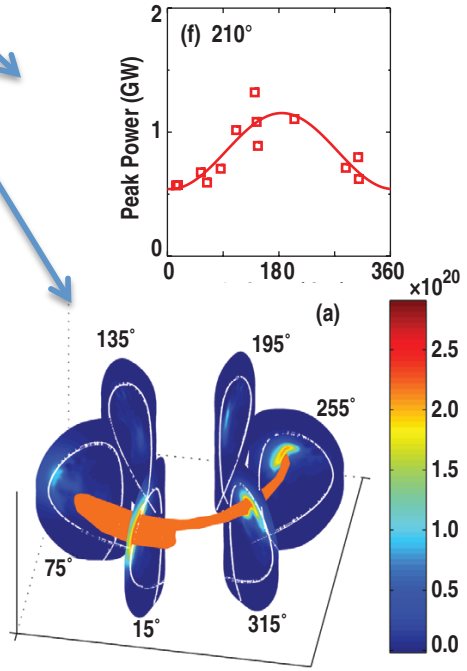
Disruption mitigation

- ***Conduct research to detect and minimize the consequences of disruptions in present and future tokamaks, including ITER. Coordinated research will deploy a disruption prediction/ warning algorithm on existing tokamaks, assess approaches to avoid disruptions, and quantify plasma and radiation asymmetries resulting from disruption mitigation measures, including both pre-existing and resulting MHD activity, as well as the localized nature of the disruption mitigation system. The research will employ new disruption mitigation systems, control algorithms and hardware to help avoid disruptions, and measurements to detect disruption precursors and quantify the effects of disruptions.***

DIII-D has been actively studying sources of asymmetry during thermal quench mitigation

- **Effect of injector poloidal mitigation upon effectiveness of VDE mitigation ✔**
  - Hollman et al, submitted to PoP
- **Effect of MHD upon toroidal radiation asymmetries using MGI ✔**
  - D. Shiraki *et al* 2015 *NF* **55** 073029
  - V.A. Izzo *et al* 2015 *NF* **55** 073032
- **Localized heating at MGI site & MGI superposition ✔**
  - Commaux et al., PoP **21**, 102510 (2014)
- **SPI toroidal asymmetry, MGI/SPI poloidal asymmetries in progress**
- **Local heating & superposition of SPI in FY17**





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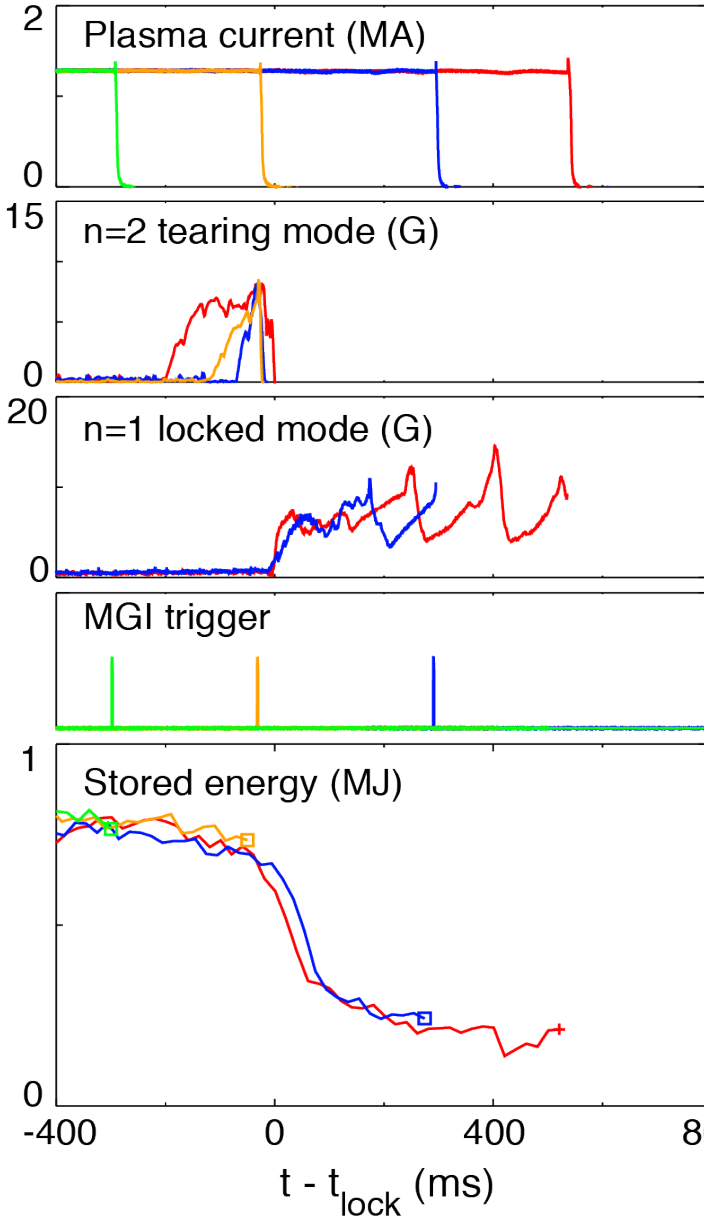
DIII-D also exploring interaction of impurity injection with unstable plasmas

- **Effect of pre-existing MHD upon MGI mitigation ✔**
  - Shiraki invited at 2015 APS
- **Effect of pre-existing MHD upon SPI mitigation ✔**
  - XP completed last Friday



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