PPPL PRINCETON PLASMA PHYSICS LABORATORY

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Integrated Modeling of RMP ELM Suppression

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DIII-D ELM Thrust Meeting

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Goals

- **Develop validated, physics-based, predictive model of RMP ELM suppression**
- Develop methods for coupling 3D equilibrium calculations with 3D transport calculations
- Assemble database of shots with applied RMPs across multiple devices
- Apply integrated models to database to understand RPM ELM suppression over broad range of conditions

Integrated Model Will Consider Various Effects

- Various models for RMP ELM suppression have been proposed, we need to quantify them!

- 3D fields affect neoclassical transport, gyrokinetic transport, field-line stochasticity, fast-ion transport, etc.
  - 3D NEO, GYRO / GENE / GTS / GTC / XGC, TRIP3D, EMC3-EIRENE
  - Nonlinear M3D-C1 (error field penetration)
  - Coupling achieved using Fusion-IO library where appropriate

- There are conflicting ideas about what effects are important – need to treat these in a uniform way on equal footing

Breadth is Important

- Models developed under narrow range of conditions are unlikely to extrapolate well
- Want to consider discharges from multiple devices
  - DIII-D, NSTX, MAST, KSTAR, AUG(?)
- Cases that fail to suppress ELMs are just as interesting as those that succeed!
  - Need to understand the distinction

Uniformity is Important

- Treating cases non-uniformly will introduce spurious correlations
  - Kinetic EFITs are made differently among and within different devices
  - Choices need to be consistent (e.g. averaging over ELM period)

- Can we automate & standardize equilibrium reconstruction across devices?
  - This will be a huge challenge!
  - If anything can do this, OMFIT can.