

Summary of follow-on work from the FY11 JRT

R.J. Groebner

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Summary of Physics Status

- **We have improved quantitative understanding of several physics processes**
 - Peeling-ballooning stability, bootstrap current, width scaling
- **EPED model predicts pressure pedestal height in moderate aspect ratio tokamaks to ~20% accuracy**
 - Enabled by improved quantitative understanding of the above processes
- **A number of physics processes may be operative in the pedestal**
 - Neoclassical, paleoclassical, neutrals may all play a role in concert with other physics
 - Have models/codes – need to apply them
 - KBM: simple model explains many observations
 - gyro-kinetic studies needed and some in progress
 - ETG, ITG, TEM, micro-tearing modes remain as possibilities – not well studied
 - Need modeling studies (and advances) to help interpret experiments

On-going research since official end of JRT

1) Electromagnetic gyro-kinetic code studies (LLNL, UC, UCI)

- 1) analyze more JRT discharges for linear stabilities
- 2) conduct global EM GK simulations for JRT discharges
- 3) start nonlinear EM GK simulations for JRT discharges.

2) Analysis of experimental data (DIII-D)

- 1) Analysis of opaque SOL experiment in progress
- 2) Analysis of BES data from KBM experiment has been initiated
- 3) Analysis plan for ETG experiments has been developed

3) Analysis of experimental data (C-Mod)

- 1) Have begun analyzing time-dependent pedestal behavior during ELM-cycle
- 2) Generating non-linear simulations of EDA H-mode with BOUT++, M3D
- 3) Developing new experiments to study pedestal fluctuations in ELMy H-mode, pedestal structure in I-mode

Some issues in experiment/theory comparisons

- **How do we compare fluctuation measurements in pedestal to theory/models?**
 - Seems that we cannot really do this for quite a while. Need to wait for experts to understand how to use GK or GF codes to study linear (non-linear?) simulations
 - Exception might be ETG turbulence – maybe we can use existing codes
 - What codes can be used?
 - And, who can do the work?
- **How do we compare fluctuation measurements on pedestal top to theory/models?**
 - Is TGLF the right tool? Other codes?
 - What can we compare? Correlation lengths? What else?
 - Who can do the work?
- **How do we evaluate role of neutrals versus transport in density pedestal?**
 - We probably need to obtain ionization rates in pedestal in which we have good confidence
 - And, these probably have to be made with 2D/edge analysis, constrained by measurements
 - How can we reduce uncertainty in this procedure?
- **What data would help modelers?**
 - Consistent parameter scans, such as beta scans, have been suggested
 - What constitutes the required consistency? Equilibria which are consistent with experimental pressure profiles?

What are the important pedestal issues? Where do we go from here?

- **What questions should we be addressing?**
- **Pressure to predict ITER pedestal height has dissipated to a large degree**
- **Many physics issues for pedestal structure remain**
 - Further studies of KBM
 - Physics of individual profiles (n , T_e , T_i , E_r , v_{tor} , v_{pol})
 - Role of fuelling vs transport in density pedestal (an ITER concern)
 - Timescales for pedestal growth (an ITER concern)
 - Transport mechanism(s) at pedestal top, which presumably limits pedestal growth
- **Need modeling work/advances to help answer these questions**
 - What models/codes can we use now?
 - What theoretical/modeling advances are needed?
 - What experimental advances are needed?