1. Purpose of Experiments
Include immediate goal of the experiments, scientific importance and/or programmatic relevance. Refer to any relevant program milestones.

To measure the properties of edge turbulence in the outer SOL of limited C-Mod plasmas and to compare the results to diverted plasmas and to the results from a turbulence simulation code written by Bruce Scott of Garching.

2. Background
Discuss Physics Basis of the proposed research. Prior results at Alcator or elsewhere, and any related work being carried out separately.

There have been few serious attempts to compare measurements of edge turbulence with first-principles simulation codes. Bruce Scott has a code which he thinks would be suitable for comparisons with turbulence measurements in the SOL of near-circular, limited plasmas in C-Mod. This experiment is designed to match the capabilities of this code and to exploit the available edge turbulence diagnostics on C-Mod. The results can also be compared with measurements in normal diverted plasmas, and with results from other devices.

3. Approach
Describe the methodology to be employed; explain the rationale for the choice of parameters, etc. Describe the analysis techniques to be employed in interpreting the data, if applicable. If the approach is standard or otherwise self-evident, this section may be absorbed into the Experimental Plan.

A near-circular, inner wall limited Ohmic plasma will be used. The outer SOL gap will be adjusted to 3 cm ± 1 cm to optimize the quality of the GPI imaging, fast diode, and probe measurements of edge turbulence. The density will be scanned to obtain the
highest possible edge density for improved comparison with the simulation code. All other available edge diagnostics will be used.

After the run, the time-averaged edge density and temperature profiles and EFIT magnetics will be sent to Bruce Scott to use as input to his simulation code. The turbulence field outputs of his code will then be compared with the imaging and probe data; for example, to compare the fluctuation levels and spectra, correlation lengths, and velocities.

4. Resources

4.1 Machine and Plasma Parameters

Give values or range for:

Toroidal Field: 5.4 T
Plasma Current: 0.8 MA
Working Gas Species: D
Density: nL = 0.8-1.2 cm-2
Equilibrium configuration (if possible, refer to database equilibria):
   near-circular, inner wall limited, similar to 1050615… but with kappa ≈ 1

4.2 Auxiliary Systems

RF Power, pulse length, phasing: none
Pellet Injection (species): none
Impurity blow-off injection: none
Diagnostic Neutral Beam: if available
Special gas puffing: GPI, either D or He
Non-axisymmetric Coils (Connections, Current): none
Other:

4.3 Diagnostics

List required diagnostics, and any special setup or configuration, e.g. non-standard digitization rate.

GPI imaging with PSI-5 camera (top) and PSI-4 camera (side)
Fast diode arrays (outer and inner SOL)
A-port probe (also F-port probe if possible)
edge spectroscopy and rotation (if available)
edge TS, ECE
all other standard diagnostics

5. Experimental Plan

Both sections must be filled in.

5.1 Run sequence Plan
Specify total number of runs required, and any special requirements, such as consecutive days, no Monday runs, extended run period – 10 hours maximum – etc.
one 1/2 day run for baseline case
additional 1/2 day run for additional scans

5.2 Shot sequence plan
For each run day, give detailed specification for proposed shot sequence: number of shots at each condition, specific parameters and auxiliary systems requirements, etc. Include contingency plans, if appropriate.

Baseline case (1/2 day):
shots 1-3: establish near-circular, inner wall limited plasma and check diagnostics
shots 4-7: scan outer gap from 2 cm to 4 cm to find optimum imaging condition
shots 8-11: increase density as much as possible (avoiding MARFES, MHD)
shots 12-15: repeat several times at optimum outer gap and density, vary GPI puff size

Additional scans (1/2 day):
shots 1-3: re-establish optimal baseline condition
shots 4-8: scan elongation from circular to elongated, still inner wall limited
shots 9-12: scan from elongated inner wall limited to normal diverted plasma
shots 13-15: try outer wall limited with inner wall probe

6. Anticipated Results
Discuss possible experimental outcomes and implications. Indicate if the program may be expected to lead to publications, milestone completions, improved operating techniques, etc. Indicate if the experiments are intended to contribute to a joint research effort, or an external database.

1) edge turbulence data in a new regime (inner wall limited)
2) comparison of edge turbulence with simulation code
3) comparison of limited vs. diverted edge turbulence (from “Phase Space MP”)
4) comparison with NSTX and other tokamaks
5) if Mp is successful, a paper will be written

7. References
Include references both to external and internal literature or communications which bear on this proposal. See Section 2.

GEM -- An Energy Conserving Electromagnetic Gyrofluid Model

Authors: Bruce D. Scott
Comments: RevTeX 4, 27 pages, 3 figures, submitted to Physics of Plasmas
Subj-class: Plasma Physics