1. Purpose of Experiments

The primary purpose of these experiments is to explore the radial and poloidal variation in the statistics of edge plasma fluctuations. In particular, plasma fluctuations will be recorded in the ‘near’ and ‘far SOL’ locations and on the high and low-field sides of the torus in a series of ohmic L-mode discharges. The experiments are also designed to accomplish a number of secondary goals in a ‘piggy-back’ mode: compare the SOL density, Te, and parallel flow profiles on the high-field and low-field sides, and to explore the influence (if any) of the new inner divertor configuration on the conditions in the SOL and divertor.

2. Background

Previous experiments showed a clear change in fluctuation character and SOL profiles in the ‘near’ and ‘far’ SOL regions (Gaussian vs. bursty, steep gradient vs. shallow) [1-3]. Time-series measurements have been performed with probes and with fast-diode systems looking at D-alpha light. Long-time samples obtain in the far SOL with probes have been analyzed, showing intermittent transport behavior, suggestive of a SOC system [4]. It is of great interest to extend these measurements to different radial locations in the SOL and to perform similar measurements on the high-field side of the torus where the instability drive is expected to be greatly reduced. It is also of interest to explore the dependence on high-field vs. low-field side fluctuations and profiles in a variety of single-null versus double-null discharges. However, owing to the lack of allocated run time, this proposal focuses on at least obtaining some high quality data in the standard lower x-point configuration. The effect of magnetic equilibrium may be the subject of a follow-on miniproposal.
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.

The approach is straightforward. We will run a series of plain ‘vanilla’ 0.8 MA, 5.3 tesla ohmic L-mode discharges, with fluctuation diagnostics trained on the high- and low-field side SOLs. A simple density scan will be performed, allowing contact to be made with data from previous runs which indicated that SOL collisionality is a parameter that correlates with the level of transport in the SOL. Ionization profiles will be inferred with data from the Lyman-alpha array in combination with profiles from Thomson scattering and Langmuir probes.

4.1 **Machine and Plasma Parameters**

Give values or range for:

- **Toroidal Field:** 5.3 tesla
- **Plasma Current:** 0.8 MA
- **Working gas species:** D₂
- **Density:** NL04 = 0.6 - 1.4x10²⁰ m⁻²

**Equilibrium configuration** (if possible, refer to database equilibria): - standard lower divertor with strikepoints on the vertical sections of the divertor plates. We may want to tweak the x-point programming to adjust the ever-present slow-sweep of the strike point across divertor probes so that it remains more or less the same for each discharge condition.

**Pulse length, typical current & density waveforms, etc.** Refer to database or sketch desired waveforms: current flat-top lasting to 1.1 seconds

4.2 **Auxiliary Systems**

- **RF Power, pulse length, phasing:** none (RF guys: take a break!)
- **Pellet Injection (species):** none
- **Impurity blow-off injection:** none
- **Special gas puffing:** Deuterium from A-B limiter capillary and inner wall, midplane
- **Other:**

4.3 **Diagnostics**

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

The key diagnostics which must be operational for this study are: (a) A-port and F-port scanning probes operated in a fluctuation mode (The A-port probe will be used in both a spatially scanning and a fixed position mode.), (b) inner wall scanning probe
(ISP) alternating between swept voltage mode and floating voltage mode, (c) outer fast-diodes viewing deuterium puffed from the A/B limiter capillary and inner fast-diodes viewing deuterium puffed from the midplane inner-wall capillary, (d) tangential Lyman-alpha diode array viewing outer SOL, (e) tangential D-alpha diode array viewing inner SOL (the converted Lyman-alpha2 system), (f) limiter particle flux probes, (g) edge thomson scattering, and (h) outer divertor probes (locations 9 and 10) recording fluctuations.

In preparation for this run, reliable operation of the inner wall scanning probe (ISP) must be demonstrated. If it turns out that the ISP can not be made to work, then it may be decided to proceed with the run without this diagnostic. When the A-port probe is at a fixed location in the SOL, it will be operated with two probes in ion-saturation mode (Isat) and two probes in floating mode. It may take a bit of tweaking of the probe position in order to get it deep enough to sample the ‘near’ SOL but not so deep as to overheat the probe.

4.4 Neutron Budget

Estimate the neutron dose rate at the site boundary. Give basis for estimate. (Once some experience has been gained a standard formula will be provided for estimating dose rates.)

Less than $10^{14}$ per shot

5. Experimental Plan

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 good full run day is requested to complete a density scan.

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.

Shot #1-3

$NL04 = 1.0 \times 10^{20} m^{-2}$

Setup equilibrium and FSP/ASP target.

Begin density scan with three shots at each density. Operate A-port probe (ASP) in three successive modes: scanning, fixed in far SOL, and fixed in near SOL. When ASP is in scanning mode, operate the ISP in swept-voltage mode. Otherwise, operate ISP in floating mode. Also, when the ASP is in scanning mode, the outer divertor probes will be operated in swept voltage mode. Otherwise they will be set to fluctuation mode.

Shot #4,5,6 - $NL04 = 1.0$

$7,8,9 - NL04 = 0.9$

$10,11,12 - NL04 = 0.8$
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.

From these data we should be able to compare the behavior of high-field versus low-field side turbulence (statistics, relative intensity, relationship to profiles). This information will be useful not only to expand our intuitive understanding but also in providing important constraints for numerical simulations of the edge turbulence. The behaviour of the plasma flow profiles on the high- and low-field sides is also of fundamental interest.

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