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

Mini-proposal 480 (Topology Effect on SOL Total Flow Vector) has given us a fairly complete data set of the transport characteristics of the SOL including flows, radial temperature, density and potential profiles, and fluctuations up to and slightly inside the LCFS. We have observed a region of high shear in the cross-field flows and radial electric field which roughly corresponds to the region of steep pressure gradient. Flows and profiles change asymmetrically with topology reversal, consistent with previous observations of a dependence of transport physics on the direction of BxVB (towards or away from the active divertor) [1]. We would like to investigate the symmetry of these measurements to a field & current reversal. This will verify that we are seeing an effect of particle drifts rather than an effect of asymmetries in the probes, their poloidal location or the divertor structures. This will be the purpose of these experiments: To revisit the density and topology scan from MP 480 in a reversed field configuration.

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

The parallel flow structure seen during the experiments of MP 480 has the same near-sonic flow velocity observed by the ISP, which is consistently directed towards the active divertor. Coupled with the low fluctuation levels in the high field side and the lack of HFS plasma during double null, these data paint a compelling picture of sonic flows driven by ballooning like transport which give the SOL a volume averaged toroidal velocity that is topology dependant. This could interact with an intrinsic core rotation to set the flow shear in the vicinity of the separatrix and thereby affect the L-H transition power threshold. However, the high-field side flows do not reverse symmetrically when topology is changed from upper null to lower null. In particular, parallel flows tend to
approach zero near the separatrix in LSN but remain high near the separatrix in USN. Low-field side flows are modulated by topology, but seem to be largely driven by another mechanism.

Since we believe these asymmetries to be indicative of the underlying transport physics, they should be reproduced in the reversed field case. However, it is possible that some component of the asymmetry is caused by physical asymmetries of the machine. These could include divertor shape, poloidal probe location and irregularities in the probe’s electrode geometry. By repeating the measurements of MP 480 in a reversed field configuration, we can identify any such effects and remove them as possible explanations for the observed flow asymmetries.

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.

We will essentially repeat the density and topology scan carried out in MP 480 but with reversed field. These would be standard 0.8 MA, 5.4 T L-Mode discharges in upper single null, lower single null and double null topologies. The density would be scanned over the range of 0.4-1.4x10^20 since flow velocities have been observed to vary with n/n_G. This expanded density range would make contact with the entire space explored in previous campaigns, and fill in new points in the reversed-field case. While performing this scan, we would like at least one discharge in each configuration, but will add a second any time we switch topology to adjust the probe targeting. We may on occasion add another shot to scan the probes in fluctuation mode to measure fluctuation-induced fluxes.

We will not revisit the s-sep scan of MP 480 because the effect of reversed field would be minor. This should allow this MP to be completed in one run day.

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: D2
- Density: 0.6 – 1.2 x10^20

Equilibrium configuration:

Use the following reference equilibria: 1070511005 (LSN) 1070511008 (USN) 1070627021 (DN).

4.2 Auxiliary Systems

RF: none
Li Pellet Injection allowed at the end of some shots
DNB as necessary for CXRS
NINJA puffing as necessary for CXRS, Argon as necessary for HIREX

4.3 Diagnostics:

WASP, FSP and ASP scanning probes, Divertor Probe arrays, HIREX Sr., CXRS

5. Experimental Plan
Both sections must be filled in.

5.1 Run sequence Plan:
One run day should be sufficient if all goes well.

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.

All shots 0.8 MA 5.3 Tesla
The shot sequence is carried out in an order that takes the most important data first to reduce the impact of a failure of one of the probes. There are extra shots at low density for targeting and fluctuation mode plunges.

Shots #1-4
NL04=0.4 x10^{20} \, m^{-2}, LSN
Reference Shot: 1070511005

Shots #5-8
NL04=0.4x10^{20} \, m^{-2}, USN
Reference Shot: 1070511008

Shot #9
NL04=0.6x10^{20} \, m^{-2}, USN

Shots #10-11
NL04=0.8x10^{20} \, m^{-2}, USN

Shots #12-13
NL04=0.6x10^{20} \, m^{-2}, LSN

Shots #14-15
NL04=0.8x10^{20} \, m^{-2}, LSN

Shot #16
NL04=1.0x10^{20} \, m^{-2}, LSN
Shot #17
NL04=1.2x10^{20} \text{ m}^{-2}, \text{ LSN}

Shot #18
NL04=1.4x10^{20} \text{ m}^{-2}, \text{ LSN}

Shots #19-20
NL04=1.0x10^{20} \text{ m}^{-2}, \text{ USN}

Shot #21
NL04=1.2x10^{20} \text{ m}^{-2}, \text{ USN}

Shot #22
NL04=1.4x10^{20} \text{ m}^{-2}, \text{ USN}

Move to balanced Double Null and repeat density scan

Shots #23-25
NL04=0.4x10^{20} \text{ m}^{-2}, \text{ DN}

Shots #26-27
NL04=0.9x10^{20} \text{ m}^{-2}, \text{ DN}

Shots #28-29
NL04=1.4x10^{20} \text{ m}^{-2}, \text{ DN}

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.

We hope to identify what (if any) component of the USN-LSN flow asymmetries can be attributed to machine structures, such as divertors or the probes themselves. We will also be able to present a more robust theory as gaps in our previous data set are filled in. We believe these results will shed light on the mechanisms behind L-H transition power threshold dependence on topology and the transport physics behind this effect.

The results obtained from these experiments will form the basis for the doctoral thesis of N. Smick.
7. References
Include references both to external and internal literature or communications which bear on this proposal. See Section 2.

