Title

User: B. Badger

Facilitator: U.W. Scientist

Device: MST

Date: November 5, 2019

Proposal Number: To be assigned

# 1 Abstract

Please provide a brief description of the proposed research to let your operator, diagnosticians, and the rest of the scientific team know what it is you’re trying to accomplish. This is an excellent opportunity to make a first draft of an abstract for a proposed presentation or publication.

# 2 Objectives of Experiment

1. A list of objectives that will give you and the WiPPL team an idea ofthe scope of the experimental study.
2. This list should help you determine what constitutes a complete dataset to address the big picture described in the Abstract.

# 3 Run Plan

Describe the range of plasma conditions and measurements that are required to complete the listed objectives. WiPPL staff will help translate the desired plasma conditions into operational scenarios as part of the collaborative development of this document. They will help you consider contingency planning such as required conditioning, anticipation of non-ideal shot conditions, *etc.*

You can also help by specifying any prioritization you may have among different planned plasma conditions. You could indicate your priorities in a table like Table 1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Priority | Shots | Fueling | *I*P [kA] | *n*¯e [1019 m−3] | mode |
| Critical | 100 | D | 400 | 0.60 | PPCD |
| Desired | 100 | D | 500 | 0.60 | PPCD |
| Critical | 100 | H | 500 | 1.00 | *F* = 0 |
| Desired | 100 | He | 300 | 1.00 | *F* = 0 |

Table 1: Summary of run plan. Try to quantify the number of shots needed in each run condition based on statistical uncertainty considerations. Typical operation of MST anticipates reproducible plasma conditions to facilitate ensemble averaging over many plasma discharges (or shots).

After determining the requisite number of shots, estimate the number of run days required to acquire the shots. Indicate a separate planned number of contingency days if machine conditions warrant it.

# 4 Auxiliary Heating & Control systems

## 4.1 Ohmic

There are a few different power supply considerations for MST operation. The legacy system uses a pulse-forming network to generate discharges with flattop conditions ranging between a few milliseconds to about 30 msec. A new programmable power supply (PPS) can be used with feedback on the toroidal field or on the reversal parameter *F* = *B*tor(*r* = *a*)*/*h*B*tori to program the field line pitch.

## 4.2 Neutral Beam Injection

For research involving a fast ion population, a 25 kV 50 amp hydrogen neutral beam is available. Different fuels can be used at reduced parameters, *e.g.* a hydrogen/deuterium mix can be used to provide a neutron signal from beamtarget fusion reactions.

**4.3 Plasma Control System**

To indicate that feedback control of the heating systems is desired.

## 4.4 Resonant Magnetic Perturbation System

To provide a controlled magnetic perturbation with a particular *m* harmonic. Here you would specify the timing and amplitude requirements. This provision is useful for locking the orientation of stationary 3D structures in the plasma.

# 5 Diagnostics

MST has a well-established set of fusion-grade diagnostics. Operation of some of the more advanced diagnostics, like Thomson Scattering and beambased spectroscopy, require additional personnel for the run campaign. This section helps to identify diagnostics needs for the proposed experiment.

To help convey the level of interest in having a diagnostic available for the experiment, there are three categories Table 2:

* **Essential**: I will not be able to complete my objectives if these diagnostics are unavailable. Do not schedule the run until they are available.
* **Desired**: My post-shot analysis will make use of data from these diagnostics, but I won’t postpone the run if they are not available.
* **Non-essential**: I have no plans to use data from these diagnostics. If others can make use of data from these diagnostics they will be responsible for coordinating support.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Diagnostic | Needs operator? | Essential | Desired | Non-essential |
| CO2 interferometry | No | X |  |  |
| Toroidal coil array | No | X |  |  |
| *Dα* array | No |  |  |  |
| Thomson scattering | Yes |  |  |  |
| FIR interferometry | Yes |  |  |  |
| Rutherford scattering | Yes |  |  |  |
| SXR tomography | Yes |  |  |  |
| Fast x-ray detector | Yes |  |  |  |
| HXR array | Yes |  |  |  |
| Other (please specify) |  |  |  |  |

Table 2: Diagnostic needs

# 6 Preparatory Work

Describe any work in the machine area that must be performed before shots dedicated to the objectives listed can begin.

* List any machine modifications
* or equipment installation
* or calibration and alignment needs

# 7 Post-shot Analysis

Data will be stored on standard MST MDSplus nodes.

If you are adding a diagnostic, do we need to add additional nodes to the MDSplus tree for this work?

If there is any post-shot analysis like magnetic equilibrium reconstructions using MSTFIT or neutral profile modeling using DEGAS2, where will the resulting output files be stored? This could be in a user directory on one of our servers.

# 8 Clean up

List any steps that need to be taken to return the machine to normal operation. List any equipment that needs to be removed from the machine area and specify where it is supposed to go.