

NSTX-U Diagnostic Plan Meeting

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Status in FY11 Prior to Upgrade

- 18 Channels magnetic field pitch angle data.
- 5 ms time resolution
- ~3 cm spatial resolution
- Accurate q-profiles using LRDFIT has supported many NSTX topical groups.

Plan for NSTX-U

- Existing MSE-CIF system will remain the same, with rtMSE operating in parallel.
- Real-time MSE (rtMSE) will be available when NSTX-U begins operation.
 - NSTX-U will make use of rtMSE for feedback control of the off-axis beam.
 - High performance real-time computer operating system.
 - High throughput digitizer and real-time driver.
 - Digital lock-in software.
 - Low latency propagation of MSE calibrated pitch angles to NSTX-U PCS computer (goal is <10 ms).
- Status: All hardware has been ordered and received. Setting up hardware and software for testing.

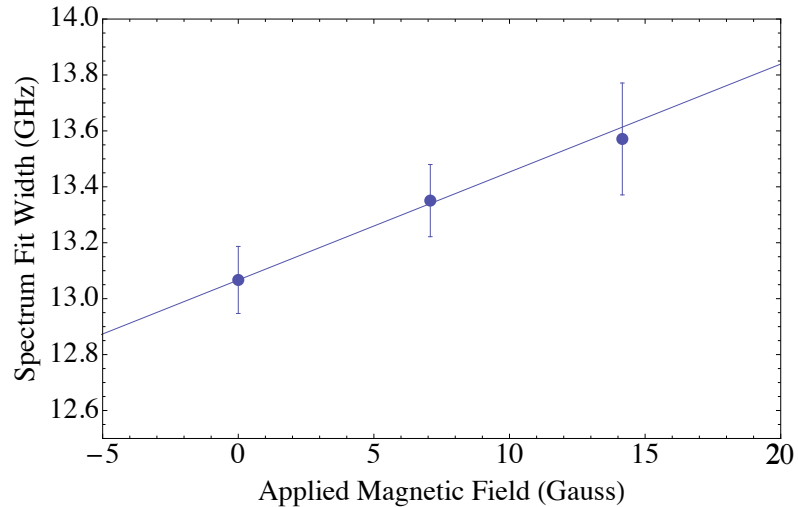
Hardware Modifications

- With higher magnetic field we plan to re-optimize the optical aperture to increase the throughput. This will result in more light and better time resolution.
- Filter switching for different sources/ beam energy. This may be delayed due to budget cuts.
- **Concern:** With additional heating beam the neutron/gamma radiation increase to our detectors will degrade system performance. Additional shielding is required.

Internal Magnetic Fluctuation Profile

- Utilizes MSE-CIF system. Coherent magnetic pitch angle fluctuation measurement has 5–10 ms time interval with ~100 kHz frequency bandwidth.
- Capability presently installed - completed filter upgrade in 2010 - initial analysis underway.
- Simultaneously measure density fluctuation profile, and phase angle between density and magnetic field fluctuations.
- Can identify magnetic island locations, MHD internal modes in core and edge.

MSE with Laser-Induced Fluorescence



Installed for first operation in 2011. Data taken with gas-filled torus in low field.

Diagnostic neutral beam and laser.

Measurements of magnetic field magnitude and pitch angle.

Can operate during startup and for RF studies without heating beams.

$|B|$ can be used to reconstruct the total plasma pressure, - use for MHD studies, and for fast ion pressure.

With MSE-CIF system, determine radial electric fields of interest for transport.

Time resolution ~ 5 ms, spatial resolution 1–3 cm, 38 channels planned

