

Status of NSTX Diagnostics



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Outline



- I. Diagnostics Available in January 2002
- II. Ultrasoft X-Ray Array Status
- III. Diagnostics Available Later in Spring
FY02 Run Period
- IV. Diagnostics Still Under Development in
FY02
- V. Summary

Diagnostics Available in January 2002 for Confinement Studies



- * Magnetics for equilibrium reconstruction (new “bare wire” sensors for improved sensitivity and reliability)
- * Diamagnetic flux measurement
- * Thomson scattering (10 ch., 60Hz)
- * VB detector (single chord)
- * Midplane tangential bolometer array
- * X-ray crystal spectrometer
- * X-ray pulse height analyzer
- * “Proto-CHERS”: T_i and v_ϕ (16 ch.)
- * Electron Bernstein wave radiometer
- * Neutral particle analyzer (horizontally scanning NPA)
- * FIRETIP interferometer/polarimeter (2 ch.) [UCD]

Diagnostics Available in January 2002 for MHD/Fluctuations



- * High-n and high-frequency Mirnov arrays (more sensors added)
- * Locked mode coil array
- * Edge reflectometer [UCLA]
- * Visible edge fluctuation imaging [LANL]
- * Fast ion loss probe
- * Ultrasoft x-ray arrays [JHU]

Ultrasoft X-Ray Diagnostic Status in January 2002



USXR system upgrades (D. Stutman)

- **Four filtered diode arrays:** 3 at Bay G + 1 at Bay J
- **Improved core coverage** for Bay G vertical array
- **Lower cutoff filters** ($E > 0.4$ keV) for extended core coverage
- Pinholes + baffles for **poloidal P_{rad}** imaging
- Laser calibrated lines-of-sight
- Improved vignetting estimate for vertical array
- New re-entrant (*non-vignetted*) vertical array for next run

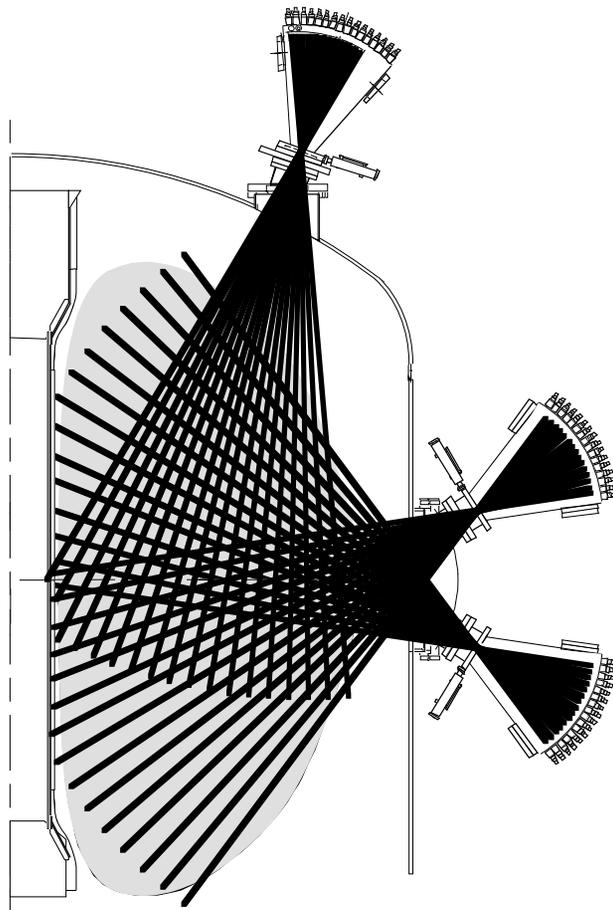
New capabilities

- Low resolution tomography
- P_{rad} imaging for edge MHD/turbulence
- Toroidal MHD measurements (G and J chords not yet identical)

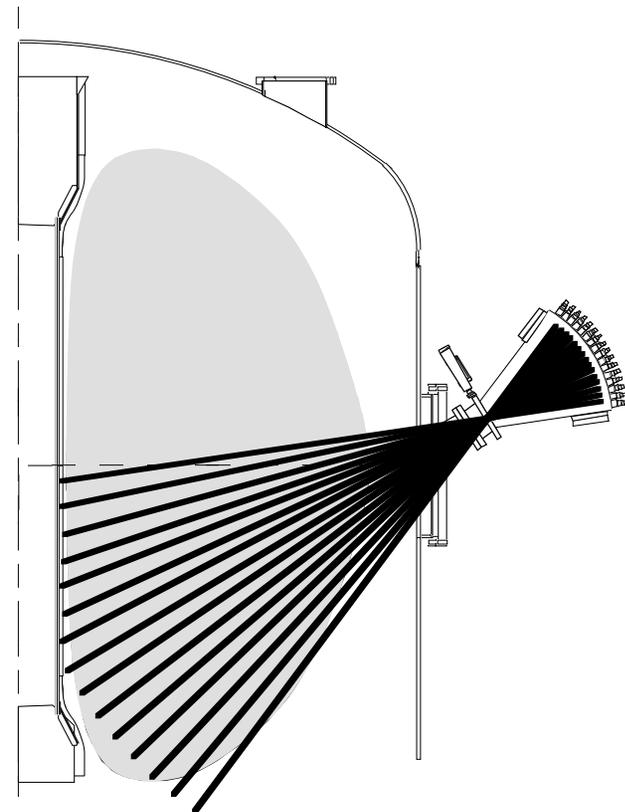
Ultrasoft X-Ray Diagnostic Layout in January 2002



Bay G



Bay J



Diagnostics Available in January 2002 for Plasma Monitoring



- * Fast visible camera [LANL]
- * VIPS-1: Visible survey spectrometer with reticon array
- * Fission chamber neutron measurement
- * Fast neutron measurement
- * 1-D CCD camera H_{α} monitor
- * Visible filterscopes [ORNL]
- * Scrape-off layer reflectometer [ORNL]
- * GRITS: VUV spectrometer [JHU]
- * IR cameras (two locations)
- * VIPS-2: Visible survey spectrometer with CCD detector
- * SPRED: UV spectrometer with CCD detector
- * Langmuir probe and thermocouple arrays in plasma facing components
- * Fast pressure gauge [University of Washington]

Diagnostics to be Available Later in Spring FY02 Run Period



- * Fast reciprocating probe [UCSD]
- * FIRETIP interferometer/polarimeter (2 additional channels for total of 4 channels) [UCD]
- * 1 mm microwave interferometer [UCLA]
- * X-ray pinhole camera for internal flux surface shapes [with U. Wisconsin]
- * Multipoint Thomson scattering (10 additional channels for a total of 20 channels)
- * Diamond fast ion detector (to be mounted on rear of horizontally-scanning NPA) [TRINITI]
- * Gas electron multiplier (GEM) X-ray detector [ENEA/Frascati]
- * Divertor imaging with fast visible camera [Hiroshima U.]
- * Divertor bolometer array

Diagnostic Capabilities Still Under Development in FY02



- * Scintillator fast loss ion probe (sFLIP) - requires vent and in-vessel access to install components still under fabrication
- * CHERS (~75 channels) - requires vent and in-vessel access for calibration in conjunction with MSE collection optics (Sep.)
- * MSE polarimeter (collisionally-induced fluorescence) - will not be ready before end of run in May [Nova]
- * X-ray crystal spectrometer for astrophysics studies - requires modifications to divertor plates [LLNL]
- * Fast (MHz) tangential X-ray camera - delivery of camera uncertain due to ongoing difficulties with chip fabrication [PSI]

Summary



- NSTX will conduct its second year of physics operations with ~36 diagnostic systems.
- Modifications have been made to increase performance and reliability of diagnostics for studies of confinement and MHD/fluctuations and plasma modeling
- Improvements to spatial resolution for profile diagnostics have been limited
- Current profile measurements remain an issue for spring FY02 run period