Plans for the Motional Stark Effect Diagnostic on NSTX

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Presented at the NSTX Five Year Planning Workshop

June 24-26, 2002

Princeton, NJ

Motional Stark Effect (MSE)

Polarimetry Diagnostic: MSE-CIF

Nova Photonics, Inc.

- **MSE via collisionally induced fluorescence (MSE-CIF).**
  - **Tangential view of the heating beam.**
- **Characteristics:**
  - **Time resolution: ∼5 msec.**
  - **Spatial resolution: 2-3 cm.**
  - **Pitch angle uncertainty: ∼0.2 degrees.**
- **Schedule:**
  - **Installation on NSTX this summer.**
  - **Begin shakedown of 2-4 channels when heating beams begin injection into plasma.**
  - **10 channels in early 2003.**
  - **Goal – Calibrated data before end of next run.**
  - **Increase number of channels to 19 in early FY04.**
- **Future option: high resolution edge MSE.**

Scientific Topics with MSE-CIF

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- **MSE-CIF: Measure magnetic field pitch angle ⇒ q(r) and j(r).**
  - **Reversed shear scenario.**
  - **MHD stability.**
  - **Non-inductive current drive using RF(HHFW, EBW).**
  - **Bootstrap current and effects on stability and transport.**
  - **Real-time equilibrium.**

Motional Stark Effect (MSE)

Polarimetry Diagnostic: MSE-LIF

Nova Photonics, Inc.

- **MSE via laser-induced fluorescence (MSE-LIF).**
  - **New approach under development; using a diagnostic neutral beam and laser-induced fluorescence (LIF).**
- **Design goals:**
  - **Time resolution: ∼5 msec.**
  - **Spatial resolution: 2-3 cm.**
  - **Pitch angle uncertainty: ∼0.2 degrees.**
  - **E_r (combined with MSE-CIF) uncertainty: ∼1 kV/m.**
  - **$|B|$ uncertainty: $< 0.1\%$.**
- **Installation on NSTX is expected to be FY04-05.**

Scientific Topics with MSE-LIF

Nova Photonics, Inc.

- **New approach under development; using a diagnostic neutral beam and laser-induced fluorescence (LIF).**
  - **Radial electric field $\Rightarrow$ $E \times B$ shear, micro-stability, transport.**
  - **Current profiles without heating beams $\Rightarrow$ plasma startup (both inductive and non-inductive), CHI, RF.**
  - **P(r) – independent of numerical calculation of non-thermal contribution from beams or RF $\Rightarrow$ MHD stability, advanced feedback and control, fast particle physics.**