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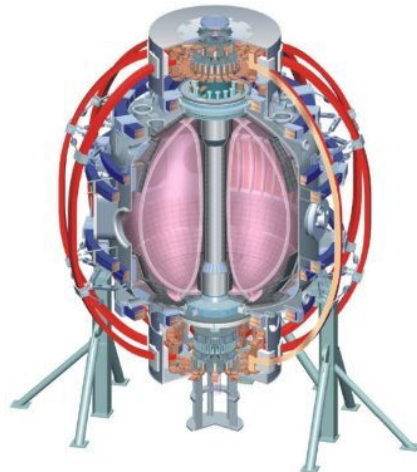
Effects of 3D Fields on Impurity Transport in the NSTX Plasma Edge

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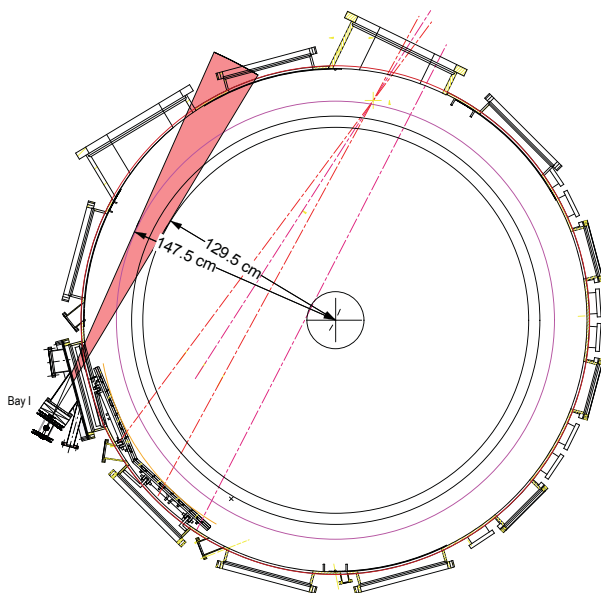
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Proposal: Use the New ME-SXR Diagnostic to Measure Impurity Transport with and without Applied 3D Fields

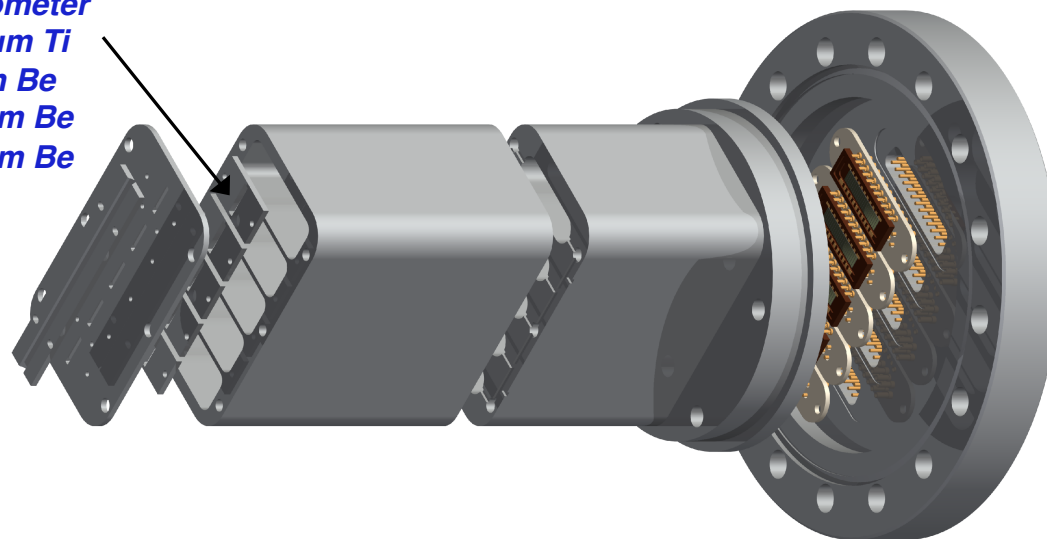
- An impurity transport XP would help accomplish the NSTX FY11 research milestone R(11-4): H-mode pedestal transport, turbulence, and stability response to 3D fields
 - “Edge particle transport will be measured using improved Thomson scattering, impurity injection, and edge SXR.”
- Soft-x-ray emission from impurity gas puffs can be used to determine the impurity transport coefficients D and v
 - ME-SXR provides high spatial (1 cm) and time (0.1 ms) resolution multi-color measurement from $r/a \sim 0.6$ to 1.0
 - Impurity transport modeling (STRAHL) used to determine D and v
- Turbulence diagnostics will be used in conjunction with transport measurements to look for correlations

The ME-SXR Diagnostic Measures X-Ray Emission with 1 cm and >10 kHz Resolution from $r/a \sim 0.6$ to 1.0

- 5 photodiode arrays, each with a different filter ($0.3\ \mu\text{m}$ Ti, 5, 15, and $50\ \mu\text{m}$ Be, and one without a filter for bolometry)
- 20 spatial channels provide ~ 1 cm resolution from $r/a \sim 0.6$ to SOL ($R = 127$ - 147 cm) with a time resolution >10 kHz
- Digitally-controlled variable gain amplifiers provide excellent signal-to-noise for low intensities measured in the edge

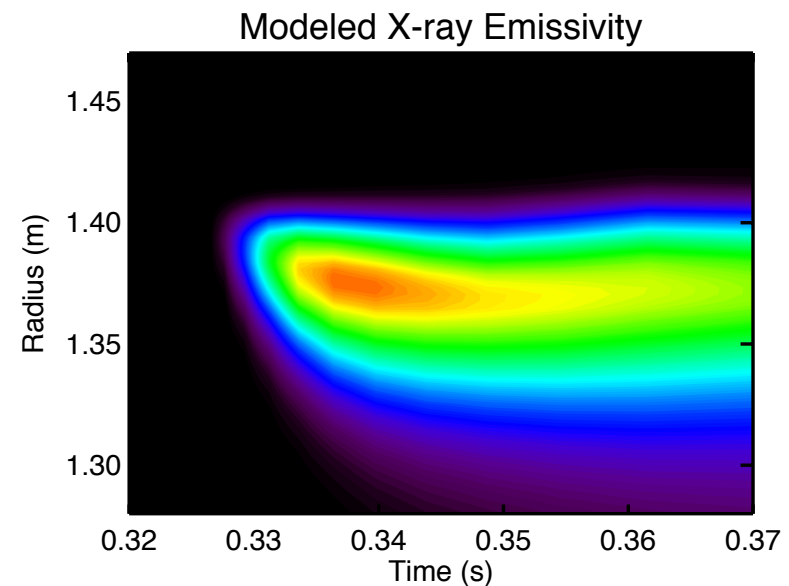
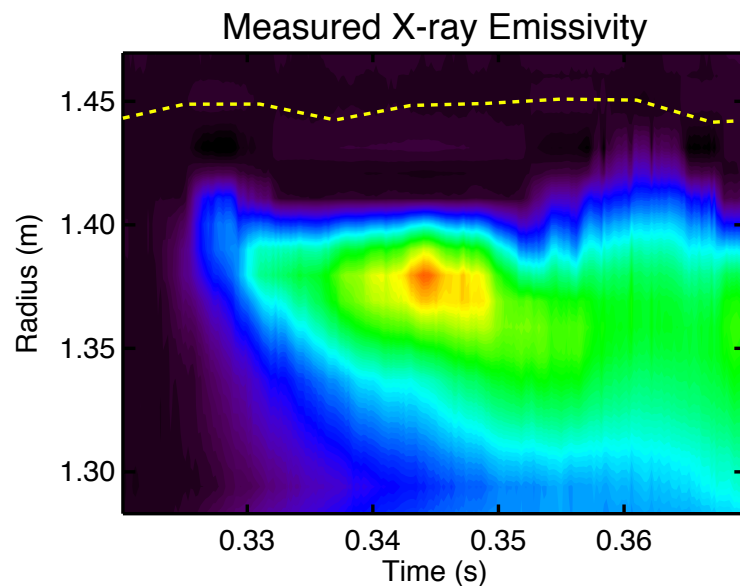


Bolometer
 $0.3\ \mu\text{m}$ Ti
 $5\ \mu\text{m}$ Be
 $15\ \mu\text{m}$ Be
 $50\ \mu\text{m}$ Be



The Impurity Transport Code STRAHL is being Used to Determine the Transport Coefficients

- The STRAHL impurity transport code, with ADAS atomic rates and emission coefficients, can be used to model emission for a given source, diffusion, and convection, which are varied to find the best fit to the data
- Example of emissivity measured/modeled with 5 μm Be filter with initial guesses of $D = 3 \text{ m}^2/\text{s}$, $v = -4 \text{ m/s}$ in the edge:



Run Plan: One Day to Perform RMP Coil Current Scan and Z Scan

- Impurity puffing technique was established last year (XP1073) with limited diagnostic capabilities
- Baseline discharge: H-mode plasma with 4 MW beam power, MHD and ELM-free (with Li)
- Shots with and without impurities for background reference
- RMP coil current scan to study effects of 3D fields
- Neon was used previously; additional gases would provide Z scaling of transport (CD_4 , Ar, Kr are possibilities)
- Correlate measurements with turbulence diagnostics
 - BES, high- k scattering, reflectometry