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A Poloidal High-k Scattering System for NSTX-U

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A previous 280 GHz tangential High-k Scattering system [1, 2] is being replaced by a 693 GHz poloidal High-k Scattering system [3] on the National Spherical Tokamak Experiment Upgrade (NSTX-U), thereby considerably enhancing planned turbulence physics studies by providing a measurement of the k_θ-spectrum of both electron temperature gradient (ETG) and ion temperature gradient (ITG) modes. The far-infrared probe beam is launched from Bay G towards Bay L, where large aperture optics collect radiation at 8 simultaneous scattering angles ranging from 2 to 15°. This yields measurement of poloidal wavenumbers from 7 cm^{-1} to > 40 cm^{-1}.

The high power scattering source is an optically-pumped FIR laser, generating 50 mW at 432 µm (693 GHz). The CO_2 and FIR lasers sit outside the NSTX-U test cell, and are coupled to the launch optics through 20 m of low loss corrugated waveguide. The launching optics are remote control steerable and can aim the beam ±2.25° up/down and right/left. The scattering volume, defined as the plasma volume in which the scattering region (as determined by the receiver optics) intersects the probe beam, can be translated vertically by ±15 cm with respect to the plasma mid-plane, translated radially between r/a = 0.3 out to the pedestal region (r/a ~ 0.99), and translated horizontally as needed to satisfy wavenumber matching.

Details of the poloidal High-k Scattering system design and testing will be provided. Work supported in part by U.S. DOE Grants DE-FG02-99ER54518 and DE-AC02-09CH1146.

References

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