Turbulence Measurements by Interferometry and Far-forward Scattering on the HSX Stellarator. C.B. DENG, D.L. BROWER, University of California, Los Angeles, D.T. ANDERSON, F.S.B. ANDERSON, K.M. LIKIN, J.N. TALMADGE, University of Wisconsin-Madison — After neo-classical transport was reduced by restoring symmetry along the helical axis, a primary physics goal for HSX is to study how 3-D shaping can reduce turbulence thereby requiring measurement of turbulence with $k_y \rho_s$ up to 1. For characteristic HSX parameters ($T_e \sim 200$ eV at $r/a \sim 0.5$ where the density gradient peaks), this condition corresponds to $k_y$ up to $7 \text{ cm}^{-1}$. To accommodate this goal, a new 9-chord HSX interferometer/far-forward scattering system has been designed to measure density turbulence at higher $k$. The new system employing two high-power (30 mW each, 320 GHz), solid-state sources with frequency offset up to 6 MHz. This will permit true heterodyne detection, thereby realizing faster measurement time response, increased bandwidth and reduced noise. High power sources and high sensitivity planar-diode mixers will allow us to reduce the aperture of the receiver optics to a few mm thereby increasing the maximum wavenumber to $k \sim 15 \text{ cm}^{-1}$. Reconfiguring the interferometer system into a finite-angle collective scattering arrangement is also planned as it will increase the measured $k$-spectrum up to $18 \text{ cm}^{-1}$ with some spatial resolution (core or edge).

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