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10.35 Integrated 2D Beam Emission Spectroscopy for the HL-2A/2M Tokamaks

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The Beam Emission Spectroscopy (BES) diagnostic measures long wavelength density fluctuations by measuring Doppler shifted H-alpha/D-alpha emission arising from collisions between heating neutral beam particles and background plasma electrons, ions and impurities. A novel integrated compact 2D BES system is currently being designed, tested and built for HL-2A and future HL-2M tokamak. A high throughput optical lens and optical fiber bundles collect light for two 8-channel 2D detector systems. A set of five plano-convex lenses and interference filter collimates, filters and focuses beam emission light onto a circular array of in-vacuum thermoelectrically cooled photodiode detectors. Eight high-gain and low-noise preamplifier circuits are integrated on a single circuit board for a compact design. External amplifiers and 16-bit simultaneously sampling 2 MHz digitizers record the signal. Low noise is achieved with a TEC cooling system that maintains detectors at -20º C with air-cooling. Testing and initial plasma data from the HL-2A tokamak will be presented. The new integrated system is designed to simplify operation, detector size, and reduce per-channel costs. Performance will be compared with that obtained with a more conventional individual modular detector system.

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