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The GEM soft x-ray diagnostics on RFX-mod2

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A novel soft X-ray (SXR) diagnostics system employing Gas Electron Multiplier (GEM) technology is under development for the RFX-mod2 device, the upgraded reversed field pinch (RFP) experiment aimed at advancing magnetic confinement fusion research. The GEM-based system is designed to provide energy-resolved, high-temporal-resolution measurements of SXR emissivity, enabling detailed studies of core MHD activity, impurity transport, and thermal structures in high-performance plasma scenarios.

Compared to conventional SXR detectors, GEM detectors offer coarse energy discrimination, imaging capability, radiation hardness and MHz counting rate capability —features that are particularly advantageous in the harsh environment of fusion devices. The system architecture includes two GEMs with segmented anode installed in pin-hole configuration on two vertical lines of sight to capture the poloidal cross-section of the plasma. Integration with synthetic diagnostics and modeling tools will further support interpretation and validation.

This contribution will outline the diagnostic concept, key design choices, integration strategy within the RFX-mod2 vessel, based on the experience gained from the installation of a similar diagnostic on the MAST-U tokamak. The GEM-SXR system is expected to play a critical role in characterizing MHD dynamics and impurity behavior, and more broadly in supporting the development of advanced confinement regimes in the RFP configuration.

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