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14.25 In-situ wavelength calibration system for the X-ray Imaging Crystal Spectrometer (XICS) on W7-X

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An in-situ wavelength calibration system for the X-ray Imaging Crystal Spectrometer (XICS) on W7-X has been developed to provide routine calibration between plasma shots. XICS is able to determine plasma flow profiles by measuring the Doppler shift of x-ray line emission from high charged impurity species. A novel design is described that uses an x-ray tube with a cadmium anode placed in front of the diffracting spherically bent crystal. This arrangement provides calibration lines over the full detector extent for both the Ar16+ and Ar17+/Fe24+ spectrometer channels. This calibration system can provide wavelength accuracy of 5×10^{-6} Å, which corresponds to a plasma flow velocity of 500 m/s in the W7-X system. This calibration system can be used to independently calibrate XICS systems on both stellarators and tokamaks, without the need for special plasma conditions often used for calibration, such as locked modes on tokamaks. Experimental and simulated results are shown along with expected results and complete design of the calibration hardware to be installed in W7-X XICS system.

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