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Measurements of electron temperature profiles on Alcator C-Mod using a novel energy-resolving x-ray camera J. MADDOX, L. DELGADO, N. PABLANT, K.W. HILL, M. BITTER, P. EFTHIMION, Princeton Plasma Physics Lab, J. RICE, MIT Plasma Science Fusion Center — The most common electron temperature diagnostics, Thomson Scattering (TS) and Electron Cyclotron Emission (ECE), both require large diagnostic footprints and expensive optics. Another electron temperature diagnostic is the Pulse-Height-Analysis (PHA) system, which derives the electron temperature from the x-ray bremsstrahlung continuum. However, the main disadvantage of the PHA method is poor temporal resolution of the Si(Li) diode detectors. This paper presents a novel x-ray pinhole camera, which uses a pixilated Pilatus detector that allows single photon counting at a rate 2MHz per pixel and the setting of energy thresholds. The detector configuration is optimized by Shannon-sampling theory, such that spatial profiles of the x-ray continuum intensity can be obtained simultaneously for different energies, in the range from 4 to 16 keV. The exponential-like dependence of the x-ray intensity with photon energies is compared with a model describing the Be filter, attenuation in air, and detector efficiency, as well as different sets of energy thresholds. Electron temperature measurements are compared with TS and ECE measurements. This work was supported by the US DOE Contract No.DE-AC02-09CH11466 and the DoE Summer Undergraduate Laboratory Internship (SULI) program.

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