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A Fast CCD Detector for Charge Exchange Recombination Spectroscopy on the DIII–D Tokamak,* D.M. Thomas, K.H. Burrell, C.C. Makariou, R.J. Groebner, P. Gohil, D. Kaplan, *General Atomics* — Charge Exchange Recombination (CER) spectroscopy has become a standard diagnostic for tokamaks. CER measurements have been used to determine spatially and temporally resolved ion temperature, toroidal and poloidal ion rotation speed, impurity density and radial electric field. Knowledge of the spatial profile and temporal evolution of the electric field shear in the plasma edge is crucial to understanding the physics of the L to H transition.[1] High speed CER measurements are also valuable for Edge Localized Mode (ELM) studies. Since the 0.52 ms minimum time resolution of our present system is barely adequate to study the time evolution of these phenomena, we have developed a new CCD detector system with about a factor of two better time resolution. In addition, our existing system detects sufficient photons to utilize the shortest time resolution only under exceptional conditions. The new CCD detector has a quantum efficiency of about 0.65, which is a factor of 7 better than our previous image intensifier - silicon photodiode detector systems.[2] We have also equipped the new system with spectrometers of lower f/number. This combination should allow more routine operation at the minimum integration time, as well as improving data quality for measurements in the divertor-relevant region outside of the separatrix. Construction details, benchmark data and initial tokamak measurements for the new system will be presented.

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[1]K.H. Burrell et al, Phys. Plasmas 1, 1536 (1994).

[2]P. Gohil et al, Proc. 14th IEEE/NPSS Symposium on Fusion Technology, (IEEE, Princeton, 1992) Vol. II, p. 1199.