Proposal Submission for NSTX Research Forum 2001

Title	Ultrafast X ray imaging system based on GEM detector
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An innovative ultrafast system for X ray imaging has been developed at ENEA Frascati (Italy) by the plasma spectroscopy group and discussed in the paper accepted for publication in Rev. Sci. Instrum., October 2000. This device is based on a detector Gas Electron Multiplier (GEM) developed at CERN in 1998, modified for this aim in fusion

plasma physics.

This system, whose detector (2.5×2.5 cm active area) is equipped with a true 2-D read-out printed circuit board, is able to produce an X-ray image of the plasma (pinhole camera) with 128 pixels at very high sampling rate (up to one image in 10 μs) in a selectable X-ray energy range from 0.3 to 15 keV, with different magnifications or views of the plasma. These very attractive performances are due to the features of the GEM as X-ray detector: very high gain and sensitivity, photon energy proportionality, 2-D spatial resolution, flexible read-out (strips, pixels, ad hoc patterns), good time resolution and extremely high counting rates.

The system has been tested in a preliminary version on the Frascati Tokamak Upgrade (FTU) during the summer 2000, and it will be set up there in its final version with 128 electronic channels of amplification and acquisition in spring – summer 2001 . Since FTU has only perpendicular views (1-D), a full validation (2-D) is proposed to be carried out at NSTX (Princeton), with the diagnostic mounted with a tangential view. After the experimental set-up, this diagnostic will be used at NSTX also to study the spatial distribution of the X-ray emissions in presence of additional heating and MHD instabilities. A configuration with the highest time resolution will be tested to have indications about fluctuations and turbulence. These experiments at NSTX will be performed in collaboration with the plasma spectroscopy group of Johns Hopkins University.

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