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Progress in HXR diagnostics at GOLEM and COMPASS tokamaks

J. Cerovsky[1,2], O. Ficker[1,2], V. Svoboda[2], E. Macusova[1], J. Mlynar[1,2], J. Caloud[1,2], V. Weinzettl[1], M. Hron[1], the COMPASS team & the EUROfusion MST1 team*

1) Institute of Plasma Physics of the CAS, Prague, Czech Republic

E-mail : cerovsky@ipp.cas.cz

2) FNSPE, Czech Technical University in Prague, Prague, Czech Republic

**See author list B. Labit el. al., 2019 Nucl. Fusion 59 086020*

Scintillation detectors are widely used for hard X-ray spectroscopy and allow to investigate dynamics of runaway electrons in tokamaks. This diagnostic tool proved to be able to provide information about energy or a number of runaway electrons. In past it was used for runaway studies at GOLEM and COMPASS tokamaks [1,2]. In recent years hard X-ray spectroscopy at GOLEM and COMPASS tokamaks have mainly relied on NaI(Tl) based detectors, which represent a standard solution. The set of detectors and also their type was significantly extended and improved. Besides NaI(Tl) (2x2 inch) scintillation detectors, YAP(Ce) and $CeBr_3$ were employed. Particularly, usage of $CeBr_3$ (1x1 inch) enhanced diagnostic capabilities, because of its of short decay time (compared to NaI(Tl)) and good energy resolution. Also, the data acquisition system was accordingly improved and Tektornix MSO64 oscilloscope is now dedicated to collect the data from scintillation detectors at GOLEM with appropriate sampling rate (≈ 300 MHz) and sufficient bandwidth (≈ 100 MHz) to allow pulse analysis.
Up to five detectors can currently simultaneously monitor hard X-ray radiation at GOLEM and were implemented into GOLEM environment. The same scintillation detectors were also installed during runaway electron campaign at the COMPASS tokamak in order to provide estimate of runaway electron energy. The aim of this contribution is to report progress in diagnostic of HXR radiation induced by runaway electrons at GOLEM and COMPASS tokamaks. The data collected during 12th runaway (2020) electron campaign at COMPASS shows that count rates during typical low-density runaway electrons discharges are in a range of hundreds of kHz and detected photon energies go up to 10 MeV (measured outside tokamak hall). Acquired data from experimental campaigns from both machines will be discussed and put into context of runaway electron research on these two machines [3].

References

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