Contribution ID: **24** Type: **Short oral in replacement of poster**

Short_Oral_24: Assessment of long-term stability of the plasma current measurement at JET using fibre optics current sensor

Thursday, 9 September 2021 17:10 (10 minutes)

The Fibre Optic Current Sensor (FOCS) is a system that will perform plasma current measurements at ITER during long plasma discharges under intense nuclear radiation. Plasma current measurements are important for safe machine operation. The FOCS must perform measurements is harsh tokamak environment, which include strong magnetic fields, high temperatures, and also significant levels of neurons and high energy photons. JET is a unique machine where the impact of such conditions on the sensor performance can be investigated experimentally. In particular, DT operation is fully ITER-representative in terms of 14 MeV neutron fluxes.

Considering assessment of the FOCS performance in a tokamak environment, polarisation detection based FOCS systems were installed at JET and performed measurements in various machine operating scenarios at currents up to 3.5 MA. The FOCS 1 system installed in 2015 uses the Fibrecore Ge-doped core spun fibre SLB 1250 with a 10 mm spun period, and the FOCS 2 operational since 2018 is based on the Crystal Techno pure silica core LB1300 from with a 5 mm spun.

FOCS at ITER is a unique diagnostics, which consider the possibility of the sensing head replacement. However, it is preferable to use this possibility for the system upgrade and not as a maintenance procedure. The sensing optical fibre must remian mechanically stable and preserve optical properties during several years in service. The JET vacuum vessel temperatures during operation and backing are 200℃ and 300-320℃, which is higher than the corresponding temperatures in ITER, 100℃ and 200-220℃, respectively. Therefore operation at JET means that FOCS will sustain the ITER temperature conditions.

To address the radiation effect on the FOCS operating in a tokamak environment operating with hydrogen, which is relevant for the ITER first phase operation, analysis of the performance of FOCSs during DD and H operation provides necessary information. Analysis of data accumulated during more than five years of operation is presented. Rogowski system, which measures the same current as FOCS is used as a reference to assess the performance and the stability. The neutron radiation dose is estimated based on the KN1 absolute calibration system. Possible transient effect have been observed, but on a long term the performance variation are within measurement uncertainties.

Primary author: Dr GUSAROV, Andrei (SCK CEN)

Co-authors: Mr DANDU, Prasad (UMons); Dr BOBOC, Alex (UK AEA); Dr CROFT, David (UK AEA); Mr BERKIS, Nicolas (EuroFusion); Prof. BATISTONI, Paola (ENEA); Mr LEYSEN, Willem (SCK CEN); Mr BEAUMONT, Perry (UK AEA); Prof. WUILPART, Marc (UMons)

Presenter: Dr GUSAROV, Andrei (SCK CEN)