Contribution ID: **178** Type: **Poster**

Conceptual design of the Radial Gamma Ray Spectrometers system for alpha particle and runaway electron measurements at ITER

Wednesday 19 October 2016 14:00 (4h 45m)

Among the key goals of ITER are the investigation of alpha particle physics in a burning plasma as well as the demonstration of the control of runaway electrons born in disruptions. The diagnostic needs to meet these goals are the determination of the alpha particle profile with a time resolution of < 0.1 s and the evaluation of the runaway electron beam current and end point energy with an estimated accuracy of 20%.
Spontaneous gamma-ray emission from nuclear reactions in the plasma can be exploited to satisfy both demands. Alpha particle studies rely on the observation of 4.44 MeV gamma-rays born in 9Be(alpha,n\gamma)12C reactions. Spectral measurements of bremsstrahlung emission from runaway electrons, colliding either with plasma impurities during massive gas injection or with the machine first wall, are instead the way to determine properties of suprathermal electrons with projected energies up to 100 MeV.
Building on the successful experience of the Joint European Torus (JET), we here present the principles, requirements and corresponding solutions that have shaped the conceptual design of the ITER Radial Gamma Ray Spectrometers (RGRS) system. The project aims at enabling gamma-ray measurements along a few of the collimated channels of the Radial Neutron Camera by the design of a suitable set of detectors, collimators and attenuators. The grand challenge is to perform gamma-ray measurements in a neutron field of unprecedented intensity and to ensure the stability and reliability of the detectors. We show that we can combine the high energy resolution, fast time response and resilience to neutron damage of the most advanced, up to date gamma-ray spectrometers with the need of a multi sightline system allowing for a spatial reconstruction of the alpha particle profile in the core plasma. The design starts from the calculated gamma-ray emission in the 15 MA Q=10 ITER deuterium-tritium scenario delivering a projected fusion power of 500 MW, as well as bremsstrahlung emission from runaway electrons born in a disruption phase. By merging the most successful solutions adopted for similar measurements at JET and benefitting from cutting edge developments in nuclear detector technology, we demonstrate that RGRS successfully meets ITER requirements. Implications of our design for alpha particle and runaway electron physics investigations are finally discussed

Paper Number

FIP/P4-2

Country or International Organization

Italy

Author: Dr NOCENTE, Massimo (Department of Physics, ItUMiB)

Co-authors: Dr FERNANDES, Ana (PtIPFN); Dr MURARO, Andrea (ItIFP); Dr BRICHARD, Benoit (EuFforE); Mr RIGAMONTI, Davide (Department of Physics, ItUMiB); Dr PERELLI CIPPO, Enrico (ItIFP); Dr CROCI, Gabriele (Department of Physics, ItUMiB); Dr BROLATTI, Giorgio (ItENEAUTF); Prof. GORINI, Giuseppe (Department of Physics, ItUMiB); Dr LENGAR, Igor (SkJSI); Prof. ZYCHOR, Izabella (PoNCBJ); Dr RZADKIEWICZ, Jacek (PoNCBJ); Dr SOUSA, Jorge (PtIPFN); Dr GIACOMELLI, Luca (ItIFP); Dr BERTALOT, Luciano (ITERFr); Dr DI PACE, Luigi (ItENEAUTF); Dr TARDOCCHI, Marco (ItIFP); Dr REBAI, Marica (Department of Physics, ItUMiB); Dr SANTOSH, Pandya (ITERFr); Dr PEREIRA, Rita Costa (PtIPFN); Dr BARNSLEY, Robin (ITERFr); Dr KRASILNIKOV, Vitaly (ITERFr)

Presenter: Dr NOCENTE, Massimo (Department of Physics, ItUMiB)

Session Classification: Poster 4

Track Classification: FIP - Fusion Engineering, Integration and Power Plant Design