Contribution ID: **523** Type: **Oral Presentation**

ITR/1-3: Design of the MITICA Neutral Beam Injector: From Physics Analysis to Engineering Design

Monday, 8 October 2012 17:40 (20 minutes)

For ITER heating and current drive, two neutral beam injectors (NBIs) are planned, delivering a total of 33 MW in stationary conditions up to one hour; each injector will accelerate a 40 A negative deuterium ion current up to 1 MV. Such requirements have never been achieved simultaneously. Hence the PRIMA (Padova Research on ITER Megavolt Accelerator) facility is under construction at Consorzio RFX in Padua, Italy. PRIMA will include a test bed named MITICA (Megavolt ITer Injector and Concept Advancement), with the aim of meeting the ITER beam requirements in terms of negative ion yield, beam uniformity, high voltage holding, operation of beam line components and power supplies, overall reliability of the NBI.
The present contribution describes the current status of numerical simulations, devoted to the optimisation of MITICA, providing the main inputs for the design of accelerator, beam line components, diagnostics and power supplies. Physics and engineering aspects include: beam optics, dumping of co-extracted and stripped electrons, thermo-mechanical behaviour of grids and beam line components during long pulse operation, voltage holding capabilities. The optimised geometry of the accelerator is characterised by equal acceleration gaps (increased voltage holding capability) and a combination of horizontal and vertical magnetic fields in the accelerator (reducing heat loads and electrons exiting the accelerator); the gas pressure profile is also simulated in the accelerator and in the injector.
The design of the accelerator power supplies has been supported by simulations of static and dynamic performances, including the investigation of overvoltages by a sophisticated fast transient model and the modelling of matching network and RF systems.
Moreover the signals expected from the diagnostic systems have been simulated, with realistic beam features, providing prescriptions for the design of diagnostics, like beam emission spectroscopy, beam tomography and neutron diagnostic.
Most of the design of MITICA plants and components are well developed and close to finalisation.

Country or International Organization of Primary Author

Italy

Primary author: Mr SONATO, Piergiorgio (Italy)

Co-authors: Dr CHAKRABORTY, Arun (Iter India); Prof. DAY, Christian (Karlsruhe Institute of Technology); Dr BOILSON, Deirdre (ITER Organization); Dr PETER, Franzen (IPP-Garching); Prof. GORINI, Giuseppe (Università di MIlano Bicocca); Dr MILNES, Joseph (Culham Centre for Fusion Energy); Dr INOUE, Takashi (JAEA Naka); Prof. MINEA, Tiberiu (Université de Paris XI); Dr BONICELLI, Tullio (Fusion for Energy)

Presenter: Mr SONATO, Piergiorgio (Italy)

Session Classification: ITER Physics, Scenarios and Heating & Current Drive Technology

Track Classification: ITR - ITER Activities