



Contribution ID: 87

Type: **not specified**

Metrology for integration and installation activities at the PRIMA Test Facility

Monday, 17 September 2018 11:00 (2 hours)

The ITER project requires at least two Neutral Beam Injectors, each accelerating up to 1MV a 40A beam of negative deuterium ions, so as to deliver to the plasma a power of about 33 MW for one hour.

Since these requirements have never been experimentally met, it was recognized necessary to build-up a test facility, named PRIMA, that is in an advanced state of realization and which includes both a full-size negative ion source (SPIDER) and a prototype of the whole ITER injector (MITICA).

The paper describes the main metrology activities performed in the last three years devoted to the integration and installation of the large number of items and plant units composing the facility. Particular emphasis is given to the propaedeutic activities consisting mainly in the definition of the metrology network (the so called Unified Spatial Metrology Network - USMN) by using technologically advanced laser trackers. The USMN is a feature of the Spatial Analyzer software (SA) compliant with the ISO standard that using the motecarlo method is capable to reduce the global measurement uncertainty. The method is based on the installation and measurement of a large number of fiducial points (approximately two hundreds targets). For PRIMA, some local USMN networks have been built up at different locations resulting eventually in the definition of the PRIMA USMN network. This approach allowed the definition of the global reference frame to be used for the positioning of all items, while respecting the uncertainty requirements of each component. In the paper some instances will be given like the positioning of the transmission line (uncertainty of 0.2mm over more than 100m between first and last tank) and the high voltage bushing support structure for MITICA, the vacuum vessel and the beam source for SPIDER (uncertainty better than 0.01mm of the grid apertures).

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Session Classification: P1

Track Classification: Plasma Heating and Current Drive