Contribution ID: **27** Type: **In-person talk**

Synthetic μwave tomograph based on DEMO Plasma Positioning Reflectometer

Thursday 16 May 2024 14:00 (30 minutes)

Under the framework of an enabling research EUROfusion project, it was possible to explore the concept of μwave tomograph based on the Plasma Positioning Reflectometers (PPR) system planned to measure the plasma shape in a DEMO poloidal cross section from the early start-up phase to flat top and then the ramp-down phase. The possibility to do it in real-time is also considered based on the use of AI tools, but it requires a database of learning cases. Here the focus is put on how to build the needed database. The only possibility to build it at this moment is by using a raytracing code, considering the DEMO size. However, the synthetic tomograph elaboration requires the knowledge of the radiation patterns of each reflectometer antenna. According to the typical antenna structure, a full-wave simulation is needed to determine it and use it as an input parameter describing the launching beam in the ray tracing code at the emitter antenna mouth. After running the ray tracing code, the lightening reflectometers are identified for computing the electric field map at the receiver antenna mouth. This reconstruction of the electric map at the receiver is mandatory for determining the electric field and phase reaching the detector placed in a waveguide, assuming that only fundamental mode propagates. All the used procedure will be presented in details. Then a comparison in academic cases between full-wave code results and our synthetic model based on raytracing code was performed showing that the amplitude and phase have enough accordance to be used to describe the behavior of the DEMO microwave tomograph. Other information will be provided on the feasibility of such DEMO μwave tomograph such as the required source power, among others. Few words on a foreseen experimental on SPEKTRE device dedicated to the validation of the methodology in the case of the density profile reconstruction using oblique incidence will be also given.

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Session Classification: Talks

Track Classification: Day 4 - Scientific Contributions: Plasma position reflectometry (PPR)