Contribution ID: **33** Type: **In-person talk**

Bayesian O-mode profile inversion with dynamic initialisation

Monday 13 May 2024 12:00 (30 minutes)

The ASDEX Upgrade tokamak has a swept O-mode reflectometer for measuring density profiles, which is used as a stand-alone diagnostic and as part of the Integrated Data Analysis framework. This contribution presents developments for the stand-alone analysis using Bayesian methods for initialisation and inversion, with uncertainty quantification for both.
Stand-alone analyses using techniques such as Abel inversion rely on an initialisation for densities below the first probed cutoff density. A common choice is a linear interpolation of two group delays, representing a parabolic density profile. Often, the starting point of the profile along the line of sight is set a priori, so that the first measured group delay can be used to fully define the initialisation profile. However, discrepancies with the actual profile in that region can affect significant parts of the remaining profile and its gradients.
The proposed alternative is compatible with more general initialisation profiles with more degrees of freedom, allows their uncertainties to be quantified, incorporates prior knowledge of profile shape, and propagates all of this to the profile error bars.
Part of the approach is to extend the information for the initialisation by exploiting the trend of the measured group delays of the first measurement frequencies, as they contain information about the density gradient. Additionally, this reduces the susceptibility for outliers. This information is used to infer the free parameters of the initialisation model and their uncertainties including correlations. Prior knowledge about the initialisation profile, e.g. about the gradients or the decay length, from theory or other measurements is easily incorporated.
The subsequent inversion of the observed densities is based on posterior samples of the initialisation model. The result can be used to determine profiles with asymmetric error bars as, in general, the initialisation does not have a linear effect on the inversion.

Primary author: STIEGLITZ, Dirk (IPP Garching)

Co-authors: Dr FISCHER, Rainer (Max-Planck Institut für Plasmaphysik); SANTOS, Jorge (Instituto de Plasmas e Fusão Nuclear - Instituto Superior Técnico)

Presenter: STIEGLITZ, Dirk (IPP Garching)

Session Classification: Talks

Track Classification: Day 1 - Scientific Contributions: Real-time systems and profile inversion