P 9: Codes and Modelling (Methods)

Time: Wednesday 16:30–17:30 Location: H5

P 9.1 Wed 16:30 H5

Determination of 2D Plasma Parameters with Filtered Cameras - An Application to the X-Point Radiator — •Emanuel Huett[1,2], Matthias Bernert[1], Alexander Bock[1], Marco Cavedon[1,2], Pierre David[1], Tilmann Lunt[1], Korbinian Moser[1], Takashi Nishizawa[1], Ou Pan[1], Ulrich Stroth[1,2], and The ASDEX Upgrade Team[1] — [1]Max-Plack-Institut für Plasmaphysik, Garching, Germany — [2]Technische Universität München, Munich, Germany

A method for the determination of 2D plasma parameters with filtered cameras has been developed. Major advantages are a high spatial resolution, 2D electron temperature, electron density and neutral density. The camera system at the ASDEX Upgrade Tokamak was upgraded to measure the deuterium balmer alpha, beta, gamma spectral lines and a nitrogen II multiplett simultaneously. Reflections are taken into account and can make a substantial contribution. The method's application is of interest in divertor physics, but also for more exotic studies like plasma production for wall conditioning. The method has been successfully applied to discharges with a well developed X-point radiator, one of the most promising scenarios for power exhaust control in a fusion reactor. First results show that the X-point radiator successfully cools the plasma to a point where recombination dominates. This is supported by simulations. A first verification with the new divertor Thomson scattering and divertor spectroscopy shows a reasonable agreement.

P 9.2 Wed 16:45 H5

Full-wave simulations of measurements of the perpendicular velocity of density fluctuations with Doppler reflectometry at ASDEX Upgrade — •Antonia Frank[1,2], Klara Höfler[1,2], Tim Happel[2], Carsten Lechte[3], Tobias Görler[2], Ulrich Stroth[2,1], and the ASDEX Upgrade Team[2] — [1]Technische Universität München, Munich, Germany — [2]Max-Planck-Institut für Plasma Physik, Garching, Germany — [3]Institut für Grenzflächenverfahrenstechnik und Plasmatechnologie IGVP, Stuttgart, Germany

The perpendicular propagation velocity of turbulent density fluctuations $v_\perp$ is an important quantity in fusion plasmas since sheared plasma flows are crucial for the reduction of turbulence and thus a relevant input parameter for simulations of turbulent transport. In the recent past, poloidal asymmetries have been observed in various fusion devices using Doppler reflectometry and correlation reflectometry. An explanation of these asymmetries may lie in the diagnostic response. Hence, numerical investigation using synthetic diagnostics is of great interest. The IPF-FD3D full-wave code is used as a synthetic Doppler reflectometry diagnostic, simulating microwave propagation and scattering. Turbulence flows are studied in several geometries with different synthetic turbulence spectra. The influence of the measurement's poloidal location on the diagnostic response is investigated. Full-wave simulations are also applied to turbulence from the gyro-kinetic code GENE in ASDEX Upgrade geometry on basis of selected experimental data for direct comparison with measurements.

P 9.3 Wed 17:00 H5

Two-part simulation approach of the source plasma of the KATRIN experiment — •Jonas Kellerer[1] and Felix Spanier[2] — [1]Institut für Astroteilchenphysik, KIT, Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany — [2]Institut für Theoretische Astrophysik, Universität Heidelberg, Albert-Überle-Str. 2 und Philosophenweg 12, 69120 Heidelberg, Germany

The **Ka**rlsruhe **Tri**tium **N**eutrino (KATRIN) experiment aims to determine the effective neutrino mass through spectroscopy of gaseous Tritium β-decay. Those high energy β-decay electrons ionize the surrounding gas in the source and thus create a partly ionized plasma. The exterior experimental conditions generate unconventional plasma conditions resulting in a highly magnetized, partly collisional, multi-species, non-thermal (with thermal components), bound plasma. The combination of these properties make a self-contained analytical description impossible. Thus, we decided on a two-part iterative simulation approach: the slow ion physics will be covered by the newly developed Monte Carlo code KARL, which produces electron energy distributions and ion currents. The results of KARL will be used by a modified version of the well tested ACRONYM Particle in Cell code to resolve the fast electron-field interactions. The modifications include cylindrical boundaries and position dependent background currents and fields. The derived fields will in turn be used as input for the KARL code. In this presentation, key concepts and challenges of the iterative approach and the underlying codes will be presented.

P 9.4 Wed 17:15 H5

Effects of laterally shifted bunch collisions on QED processes — •Marko Filipovic[1], Christoph Baumann[1], Alexander Pukhov[1], Alexander Samsonov[2], and Igor Kostyukov[2] — [1]Heinrich-Heine-Universität, Düsseldorf, Germany — [2]Institute of Applied RAS, Nizhny Novgorod, Russia

The collision of ultrarelativsitic electron bunches is a promising opportunity to study quantum electrodynamic effects in extreme fields and densities, this includes quantum photon emission and pair production. It was even conjectured that the interaction of light and matter can become fully non-perturbative. In this talk, the results of three-dimensional particle-in-simulations will be presented. First, the basic idea of the fully non-perturbative particle collider [1] will be recalled. Subsequently the configuration will be modified by considering the collision of two laterally shifted bunches. In detail, the impact on photon and pair yields through the modification will be compared and assessed by previous Beam-Beam collision estimates. Finally, the influence of longer bunches in the collider configurations will be considered.

[1] V. Yakimenko et al., Phys. Rev. Lett. **122**, 190404 (2019)