**TALIF diagnostic for atomic hydrogen density in divertor-relevant plasmas**

K. J. Loring1,2,3, K. Schutjes1, H.J. van der Meiden1, J.W.M Vernimmen1, I.G.J. Classen1, and the Magnum-PSI team1

*1 Dutch Institute for Fundamental Energy Research, Eindhoven, Netherlands*

*2 SLAC National Accelerator Laboratory, Menlo Park, CA, USA*

*3 Stanford University, Stanford, CA, USA*

Detachment is a mandatory operating condition to maintain power loads well below 20 MW/m2 in the ITER divertor. However, experimental data for validation of the SOLPS-ITER fluid-kinetic code is missing. Namely, atomic density and the ro-vibrational distribution during detachment are not known. For this reason, a Two-photon Absorption Laser Induced Fluorescence (TALIF) diagnostic has been developed for measuring spatially-resolved atomic density profiles of ground-state hydrogen in Magnum-PSI; a linear device uniquely capable of producing ITER-divertor relevant plasma conditions.

The TALIF diagnostic is based on a Sirah Cobra-Stretch dye laser (10 Hz, pulse width 8 ns), pumped by an Nd:YAG, which generates ~205 nm light (8 mW) by third-harmonic generation. Using the two-photon transition, ground-state atoms are excited to the n=3 level. The fluorescence (Hα) from n=3 to n=2 is detected by a gated ICCD camera and is a measure for the atomic density. The diagnostic has been successfully implemented on the Upgraded Pilot PSI (UPP) linear plasma device, where density measurements were made over a range of plasma parameters (ne ≤ 8x1019 m-2, Te ≤ 3.5 eV). Both the diagnostic design and density measurements from UPP are discussed. The diagnostic will be subsequently installed on Magnum-PSI in early 2023 and thereafter experiment-code benchmarking will take place.