

Proton Beam Self-Modulation Instability in a DC Discharge Plasma Source at AWAKE

Monday, 18 September 2023 19:00 (1h 30m)

The Advanced Proton Driven Plasma Wakefield Acceleration Experiment (AWAKE) explores plasma wakefield acceleration of electrons, using a proton bunches as driver. AWAKE requires plasma sources capable of reaching densities of 1 to $10 \times 10^{14} \text{ cm}^{-3}$, and that allow extending the acceleration length from tens to hundreds of meters, beyond the achievable length with the present laser-ionised, rubidium vapor plasma source. As a possible candidate, a DC discharge plasma source (DPS) was qualified and installed in the AWAKE experiment. The target densities were achieved in three different gases of increasing ion mass: He, Ar and Xe. The applicability of the DPS was assessed by sending the 400 GeV proton bunch through the plasma and observing the development of the self-modulation instability (SMI). The frequency of the micro bunching imposed on the proton bunch by the SMI was measured for three different plasma lengths (3.5, 6.5 and 10 m). The plasma density integrated along the DPS, inferred from that frequency, matches that previously measured by longitudinal interferometry. We discuss the use of the DPS in future runs of the AWAKE experiment.

Primary author: AMOEDO, Carolina (CERN)

Co-authors: LOPES, Nelson; TORRADO, Nuno (Instituto Superior Técnico); MUGGLI, Patric (Max-Planck-Institut für Physik); VERRA, Livio (CERN); TURNER, Marlene (CERN); ZEVIDELLA PORTA, Giovanni; PUCEK, Jan (Max-Planck Institute for Physics); BERGAMASCHI, Michele (Max-Planck-Institut für Physik/CERN); CLAIREMBAUD, Arthur; MEZGER, Jan; PANNELL, Fern; VAN GILS, Nikita (CERN); GSCHWENDTNER, Edda (CERN); TABBORELLI, Mauro (CERN); SUBLET, Alban (CERN)

Presenter: AMOEDO, Carolina (CERN)

Session Classification: Poster session

Track Classification: WG8: Plasma sources and related diagnostics