Beitrag ID: **19** Typ: **Invited Talk**

Ionoacoustic Dose-Monitor for Laser Accelerated Ion-Bunches

Freitag, 23. Januar 2026 11:30 (20 Minuten)

State-of-the-art laser-driven plasma accelerators are entering the Hz repetition-rate regime, delivering ion beams with cut-off energies of multiple tens of MeV. For many applications, this creates an urgent need for a precise online dose monitor that can cope with the challenges of these sources and is capable of reconstructing the full dynamic range of the exponential dose distribution.

Ionoacoustic measurements provide a promising route to such a device. By detecting and reconstructing the acoustic wave emitted from the energy density deposited by the ions, the spatial dose distribution can be recovered for sub-nanosecond ion bunches. However, conventional ionoacoustic detection relies on the presence of a pronounced dose gradient, which limits its applicability to broad energy distributions.

To overcome this limitation, we introduce specially designed modulator foils into the ionoacoustic detector to artificially shape the dose deposition region. This forms the basis of the TIMBRE detector (Tracing Ionoacoustic Modulations of Broad Energy Distributions). Depending on the modulator material choice, the resulting acoustic wave is compressed in dynamic range and emitted at a characteristic resonance frequency, which strongly increases the signal-to-noise ratio. Consequently, single-shot measurements can recover the full energy density distribution, typically spanning more than four orders of magnitude in dose.

Here, we present experimental results from recent ATLAS and PHELIX campaigns benchmarked against simulation work, providing promising insights into the device performance. We demonstrate a robust, high-repetition-rate online readout, even under harsh electromagnetic pulse (EMP) conditions. This represents an important step toward meeting the diagnostic demands of next-generation laser-driven accelerators for future applications.

Autoren: PRASSELSPERGER, Alexander (LMU Munich); Prof. SCHREIBER, Jörg (LMU Munich)

Vortragende(r): PRASSELSPERGER, Alexander (LMU Munich)

Sitzung Einordnung: Session 4