



Contribution ID: 485

Type: **Oral contribution**

## Mainstreaming Start-to-End Realistic Simulations in Plasma Accelerator Research

*Tuesday 23 September 2025 17:00 (20 minutes)*

As plasma accelerators continue to mature, comprehensive simulations of all system components are increasingly essential for interpreting experimental results and designing credible concepts. Capturing the wide range of relevant physical mechanisms—including complex 3D effects—requires state-of-the-art simulation tools and seamless integration between them. In this contribution, we present a consistent set of simulation tools developed and employed at DESY to model the full plasma accelerator chain. This includes the formation and evolution of hydrodynamic optical-field-ionized (HOFI) waveguides, discharge capillaries, beam trapping and acceleration in plasma wakefields, as well as downstream RF and magnetic beamline transport. Our toolkit spans open-source codes capable of scaling from laptops to supercomputers—such as HYQUP, Wake-T and HiPACE++ and emphasizes their interoperability through shared data standards and interfaces. In particular, we highlight the adoption of the openPMD standard and LASYS, a collaborative open-source Python library for handling laser pulses. We will also showcase production-level studies leveraging start-to-end simulations and discuss strategies for integrating simulations with experimental data.

**Author:** THEVENET, Maxence (DESY)

**Presenter:** THEVENET, Maxence (DESY)

**Session Classification:** PS4: Theory and simulations

**Track Classification:** PS4: Theory and simulations