

LEDS2023

Longitudinal Electron beam Dynamics for coherent light Sources

3 – 5 October 2023, ENEA (Frascati, Rome)

In-person only. Chairs: S. Di Mitri (Elettra) and F. Nguyen (ENEA)

Organizers:



Sponsors:



Aim: Share know-how, provide mutual update and offer solutions to challenges, related to **most recent advancements in the generation of high brightness electron beams from photo-injectors** for coherent light sources. These include in particular seeded X-ray free-electron lasers and multi-THz superradiant sources.

Contents:

1. **Examples** of successful **applications** to EU funds in accelerators for light sources
2. **New** coherent and cost-effective light sources in the THz and X-ray range
3. **Energy spread and intrabeam scattering** in high brightness electron photo-injectors
4. **Diagnostics** for electron beam longitudinal phase space
5. Electron beam **longitudinal compression** and related collective instabilities

Numbers:

3 days, lunch-to-lunch
39 participants from 16 Institutions and 7 EU Countries + Switzerland, UK & China
22 contributions + 6 round tables

Outcomes:

- ❑ **CompactLight** resulted a successful project by virtue of wide collaboration effort, shared know-how at state-of-the-art level between all members, production of a conceptual design report with technical specification for new hardware production, involvement of industry on specific items.
- ❑ The unprecedented electron beam brightness available nowadays and the need of large degree of full coherence of radiation at higher photon energies moves the attention to previously **neglected** (and so far negligible) **challenges**:
 - **1-to-1 particle modelling** from cathode emission to MeV energy range including long- and short-range space-charge forces, intrabeam scattering, RF nonlinearities, and geometric wakefields;
 - electron beam modulation and/or RF **compression at < 100 MeV energy**;
 - magnetic **control** of time-compression, transverse emittance and beam stability at **>100 MeV energy**;
 - **sub-keV energy resolution at photo-injectors**, and sub-fs temporal accuracy at linac end.
- ❑ **Proposal** of a benchmarking study:
 - **semi-analytical vs. numerical** modelling of an existing photo-injector, inclusive of IBS;
 - **self-consistent validation** and sharing of the semi-analytical and numerical tool(s);
 - **experimental program to benchmark** the theoretical predictions, with special attention to beam energy spread in the low energy regime.