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5' Oral Poster Presentation

BEAM DYNAMICS STUDIES AND INSTRUMENTATION TESTS FOR BUNCH LENGTH MEASUREMENTS AT CLEAR

L.Garolfi on behalf of CLEAR team & collaborations
luca.garolfi@cern.ch

European Organization for Nuclear Research (CERN)

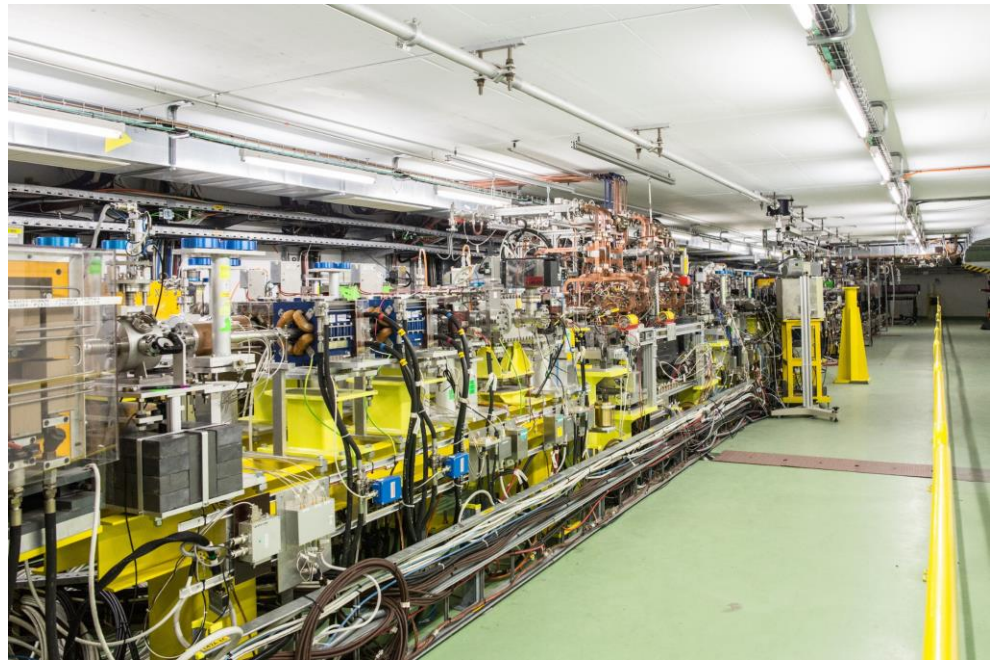
The CERN Linear Electron Accelerator for Research, CLEAR

- CLEAR is a general purpose facility aiming at accelerator R&D and component studies for existing and possible future machines at CERN, based on a broad internal and external user community.

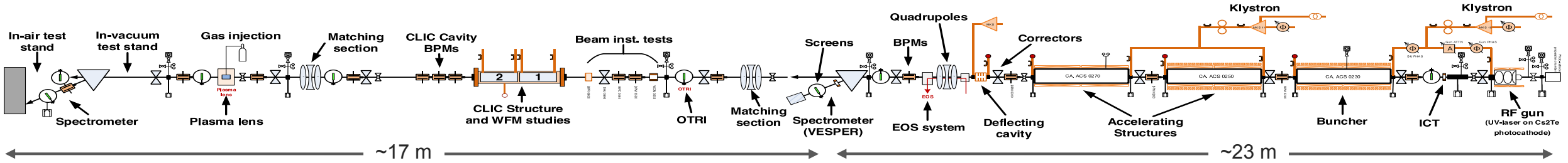
- The program covers two of the top priorities identified by the European Strategy for Particle Physics:
  - prototyping and validation of accelerator components for the upgrade of the Large Hadron Collider and its injector chain,
  - studies of high-gradient acceleration methods.

- The latter cover X-band studies for linear accelerators and also novel concepts as plasma and THz acceleration.

- CLEAR also provides unique training infrastructure for the next generation of accelerator scientists and engineers.



CLEAR: the machine, beam parameters, diagnostics & experiments

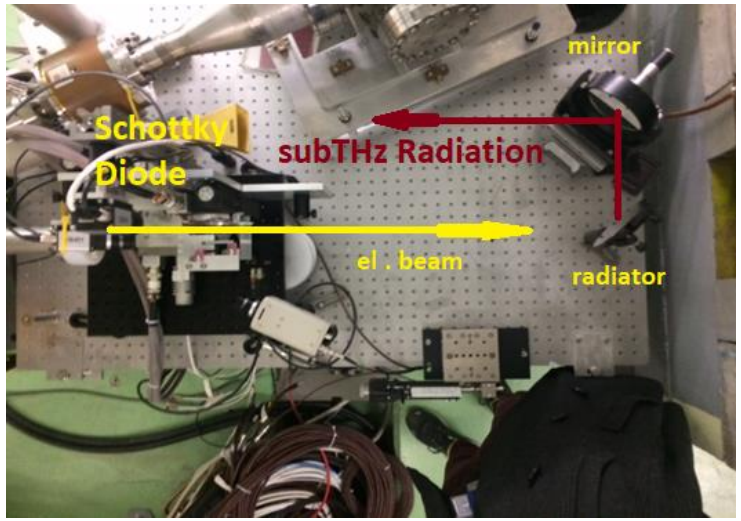


beam parameters	value range
Energy	60 – 220 MeV
Charge per bunch	0.01 – 1.5 nC
Normalised emittance (per bunch, both planes)	3 um for 0.05 nC 20 um for 0.4 nC
Relative energy spread	< 0.2% r.m.s
Bunching frequency	1.5 GHz
Number of bunches	between 1 and >100
Repetition rate	1 - 5 Hz (25 Hz with upgrade)

Diagnostics + Experiments
Optical Transition/Diffraction Radiation Interferometry (OTRI/OTDRI)
1 CLIC structure (12 GHz) + 3 CLIC Beam Position Monitors (12 GHz BPMs)
Streak camera
Plasma lens experiments
12 ×0.9 m^2 optical table: Cherenkov & THz radiation

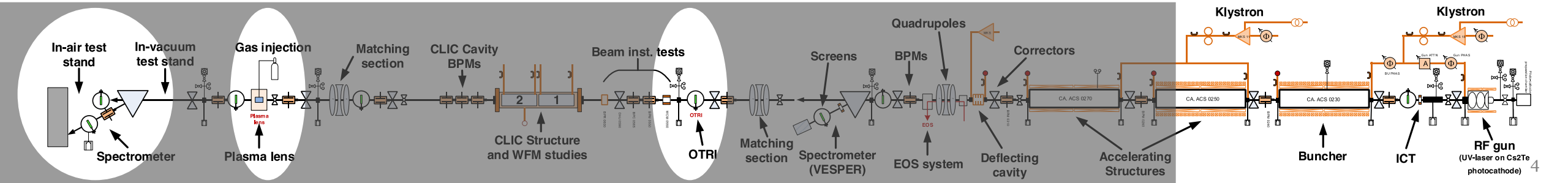
OTR/Cherenkov radiation as GHz/THz source

- GHz/THz production from:
  - **Transition** Radiation
  - (Diffraction) **Cherenkov** radiation
- Requires single high charge (>100 pC), short length (< 1 ps) bunches
- Collaboration **RHUL, Tomsk University, INFN – La Sapienza, Daresbury lab**
- **Investigation ongoing** by **Alessandro Curcio**
  - Proposal to use it as beam diagnostic
  - Could be used as plasma diagnostic



- Contact person:
  Thibaut Lefevre – CERN

See also:
- **Experiment application form #0002 (link)**
- **Presentation Jan 2018**: THz@CLEAR: source and diagnostics for the electron acceleration **(indico)**
- **Workshop Nov 2017:** THz@CLEAR Workshop 2017 **(indico)**



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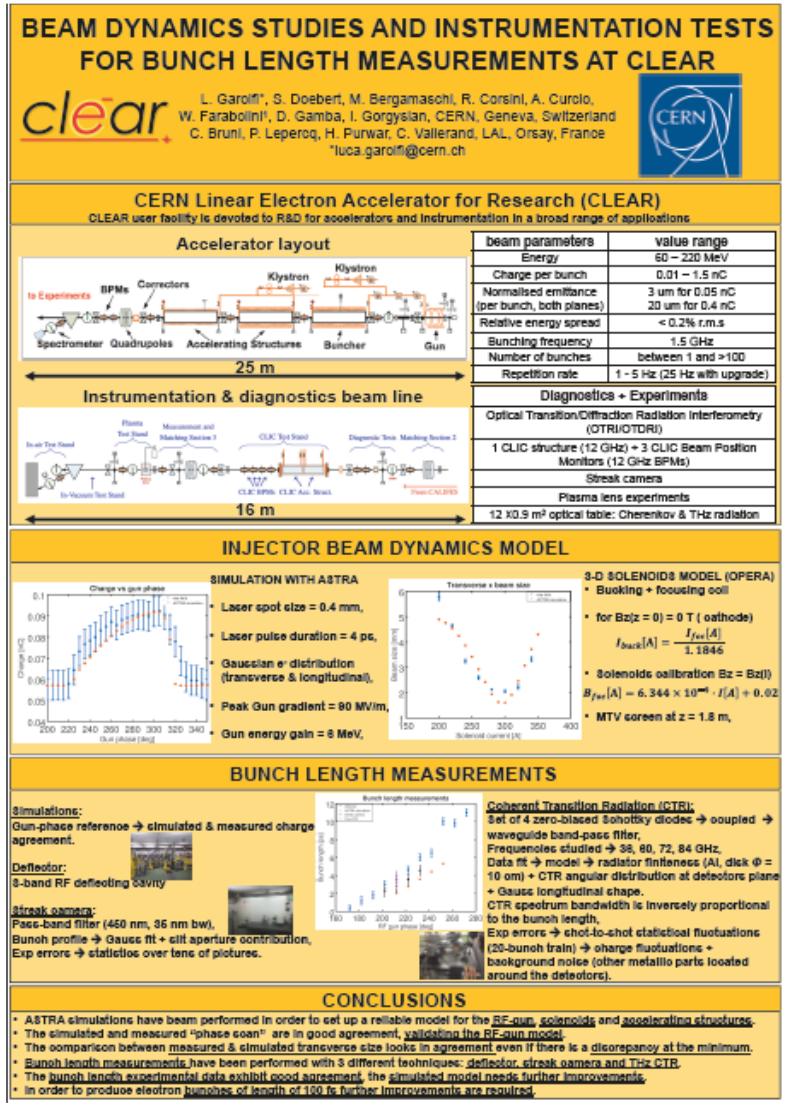
- CLEAR is user facility devoted to R&D for accelerators and i nstrumentation in a broad range of applications.
- **Beam dynamics studies**, **bunch length measurements** and i nstrumentation tests have been carried out.
- **ASTRA simulations** have been **compared** with **experimental data** and demonstrated a promising starting point toward a solid tool for predicting the best configuration for very short electron bunches.
- **Bunch length measures** have been performed with: **RF defle cting cavity**, **streak camera** and **THz Coherent Transition Ra diation (CTR).**
- The **experimental data exhibit good agreement** but for bun ches of length of 100 fs further improvements are required.



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Thank you for your attention