

A new facility for Accelerator R&D at CERN

Aim of the facility:

- keep beam test capability for CLIC locally at CERN after the CTF3 stop (Dec. 2017)
- Keep experimental **electron expertise** alive at CERN, including **laser and photo-cathodes** – link with **AWAKE**
- Possibility of **beam tests during CERN long shut-downs**
- Complement **high-gradient X-band activities** for **X-FELs**, **medical** application, etc.
- Provide **training ground** for young accelerator physicists

Time frame and experiments planning:

- CLEAR was approved as a **2 + 2 years program**, with a review after the second year
- Already **many proposals** for experiments for 2018 and later
 - **Scientific Board** and the **Technical Board** being put in place
 - Experiment proposal module available on our website (cern.ch/clear)
- Thoughts on long-term upgrade (additional gun, new beam lines, ...)

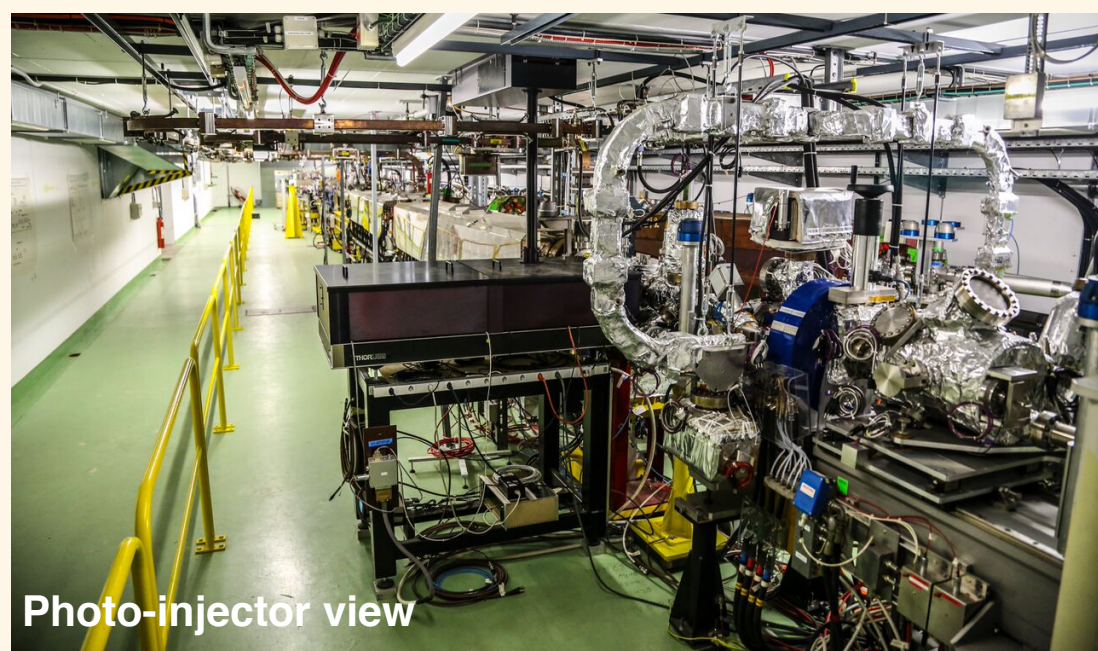


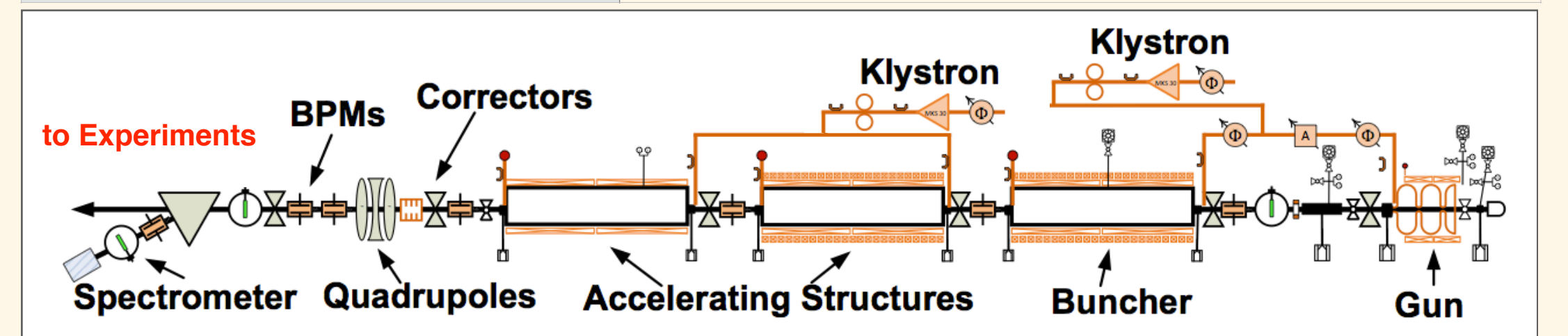
Photo-injector view



Dump view

Beam specifications and status

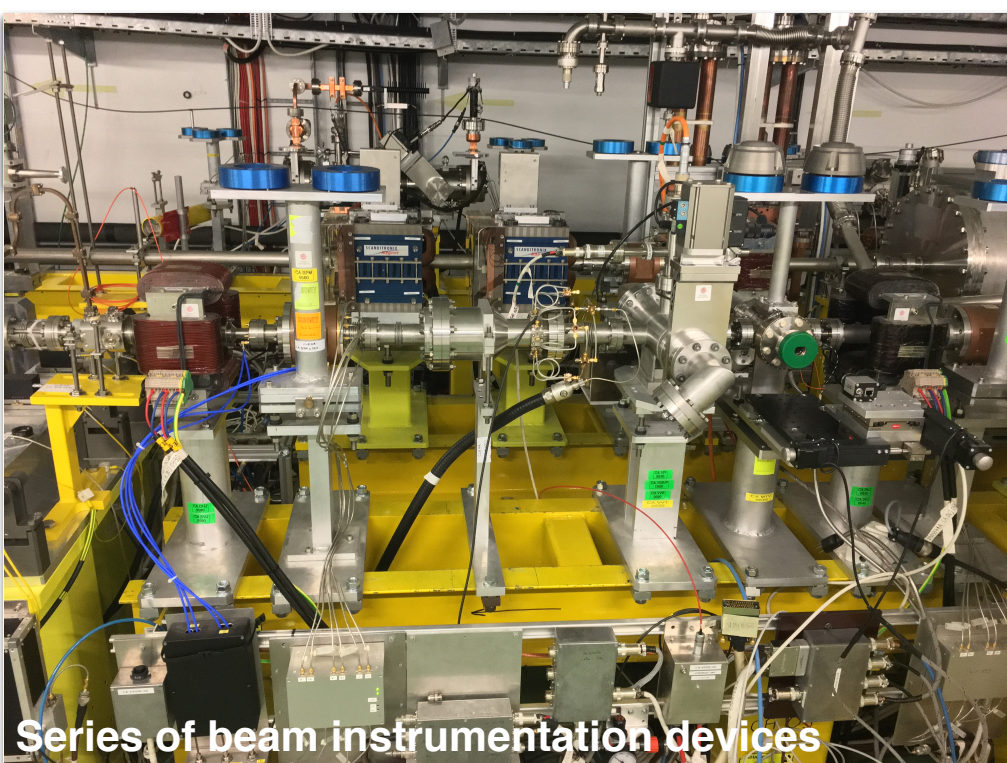
Beam parameter	Value range
Energy	60 - 220 MeV
Bunch charge	0.01 - 1.5 nC
Bunch length	c.a. 500 μ m - 1.2 mm
Normalized emittance	3 μ m for 0.05 nC per bunch, 20 μ m for 0.4 nC per bunch (in both planes)
Relative energy spread	< 0.2 % r.m.s (< 1 MeV FWHM)
Bunching frequency	1.5 GHz
RF frequency	3 GHz
Number of bunches	Selectable between 1 and >100
Repetition rate	1 - 5 Hz (25 Hz with upgrade)



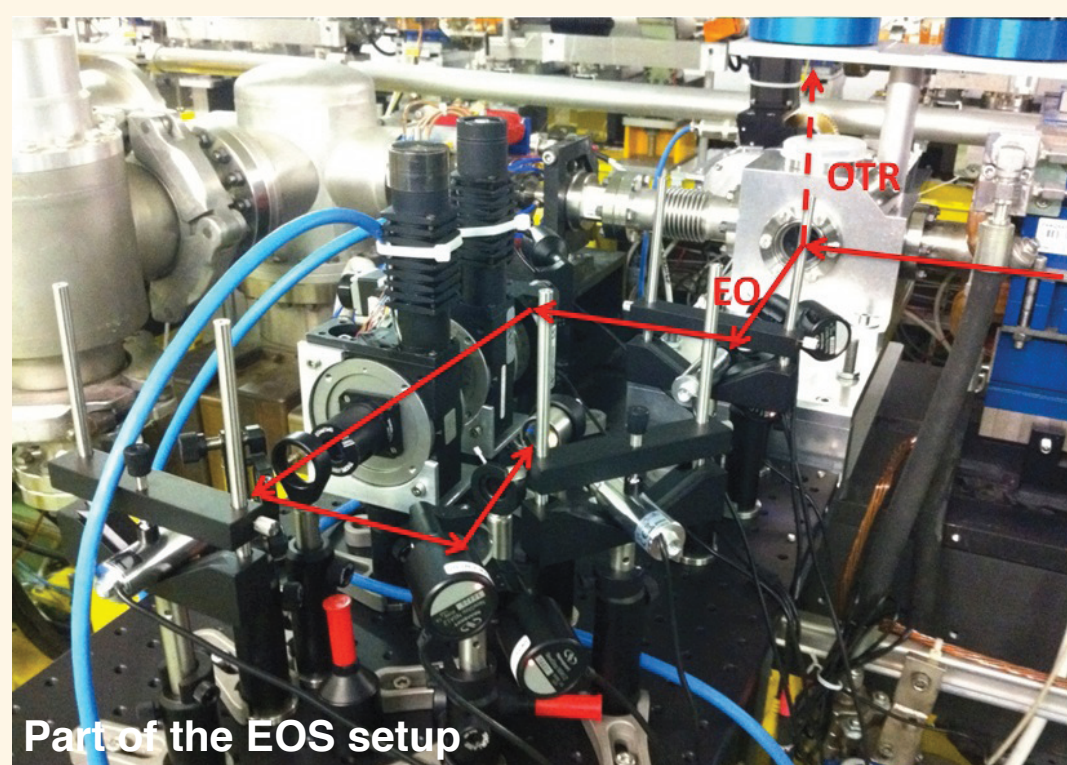
- **BEAM COMMISSIONING STARTED IN AUGUST 2017**
- **NOW SENDING BEAM TO FIRST EXPERIMENTS!**

Beam Inst. R&D

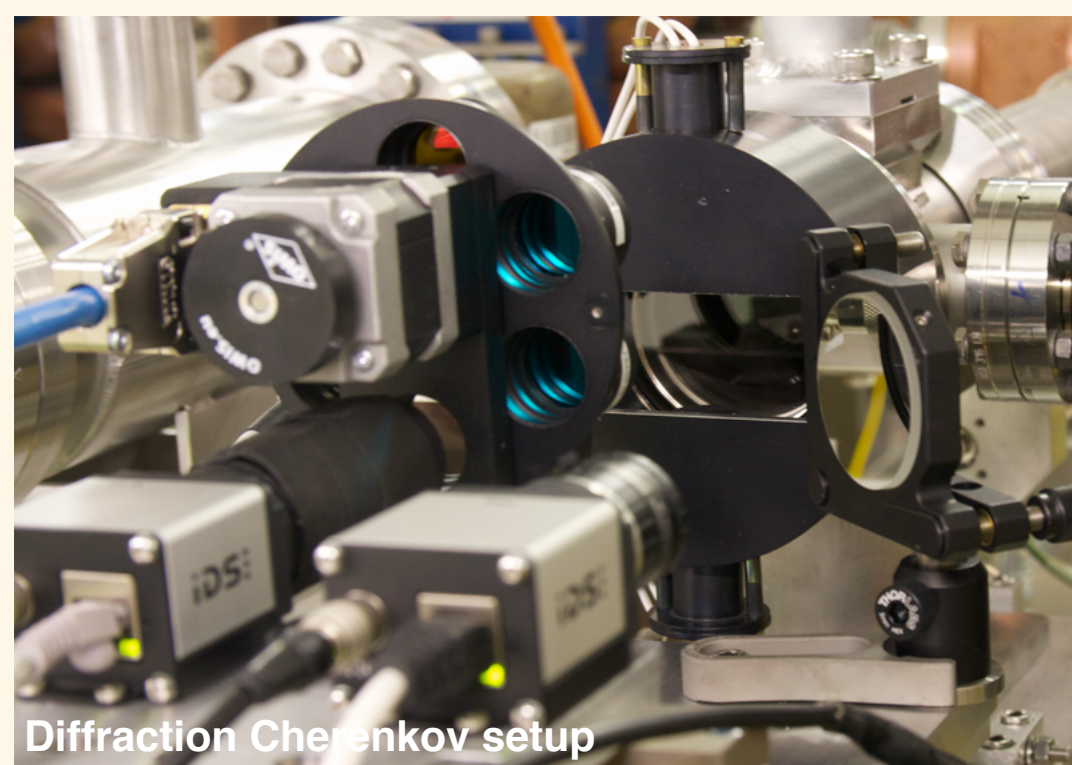
- CLIC inductive BPMs
- High bandwidth Wall Current Monitor
- Cavity BPMs
- Electro-optical system for bunch length measurements
- Diffraction Cherenkov Radiation tests



Series of beam instrumentation devices



Part of the EOS setup



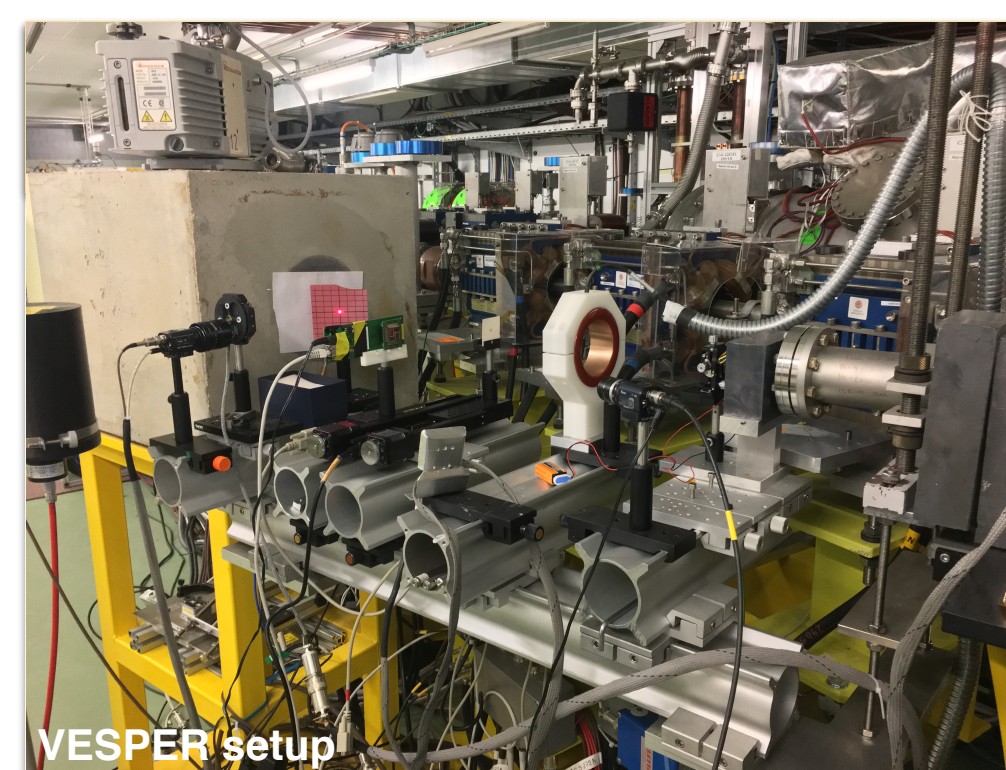
Diffraction Cherenkov setup

Irradiation facility **vesper**

- Movable stages, laser alignment
- Dedicated dosimetry
- Beam charge calibrated with a Faraday cup and another BCT

Measurements done in 2016:

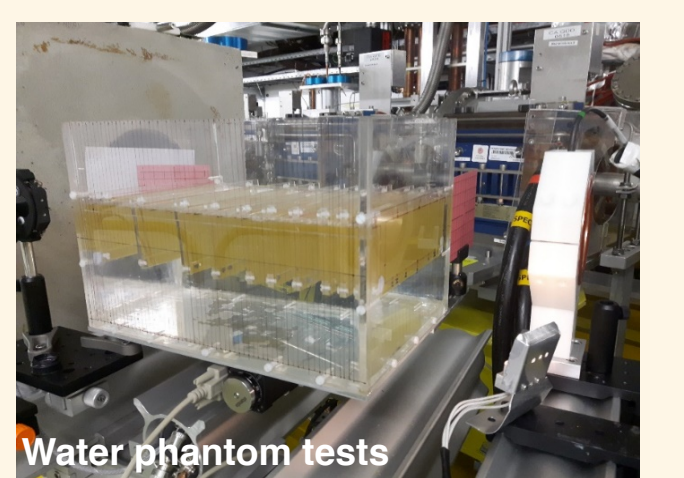
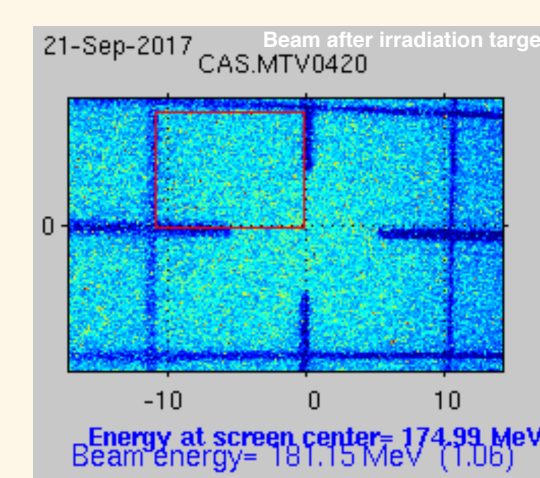
- Electron induced radiation effects
- Very High Energy Electrons for radiotherapy



VESPER setup

Operations resumed last week:

- Using dark current only
- 9 pC total charge
- 5Hz repetition rate
- Energy 175 MeV

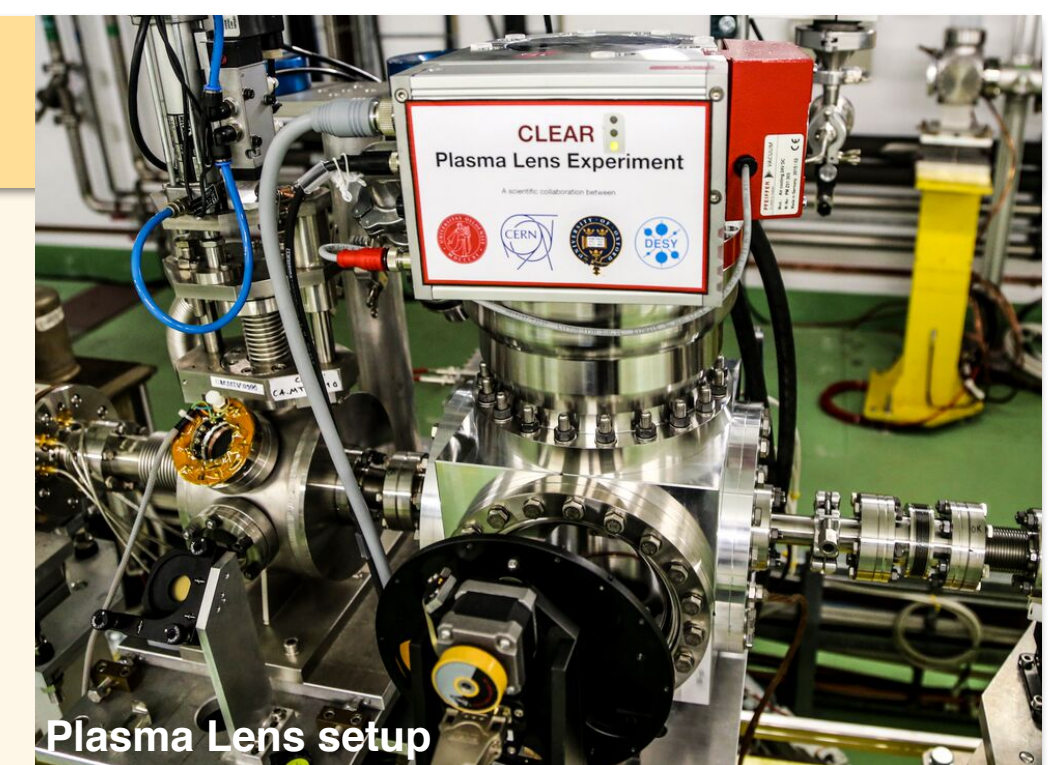


Water phantom tests

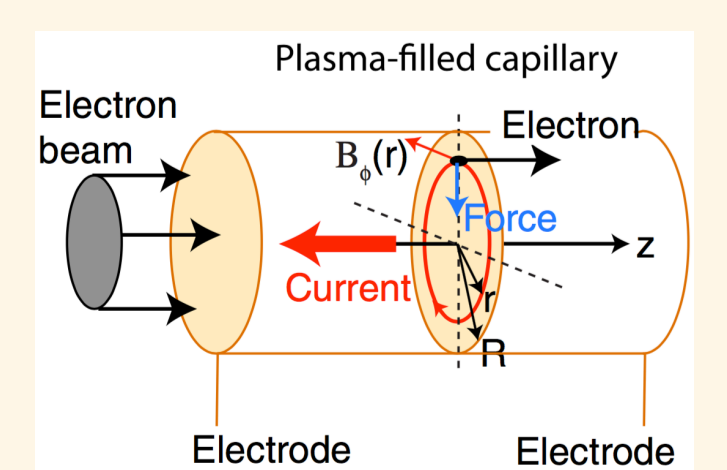
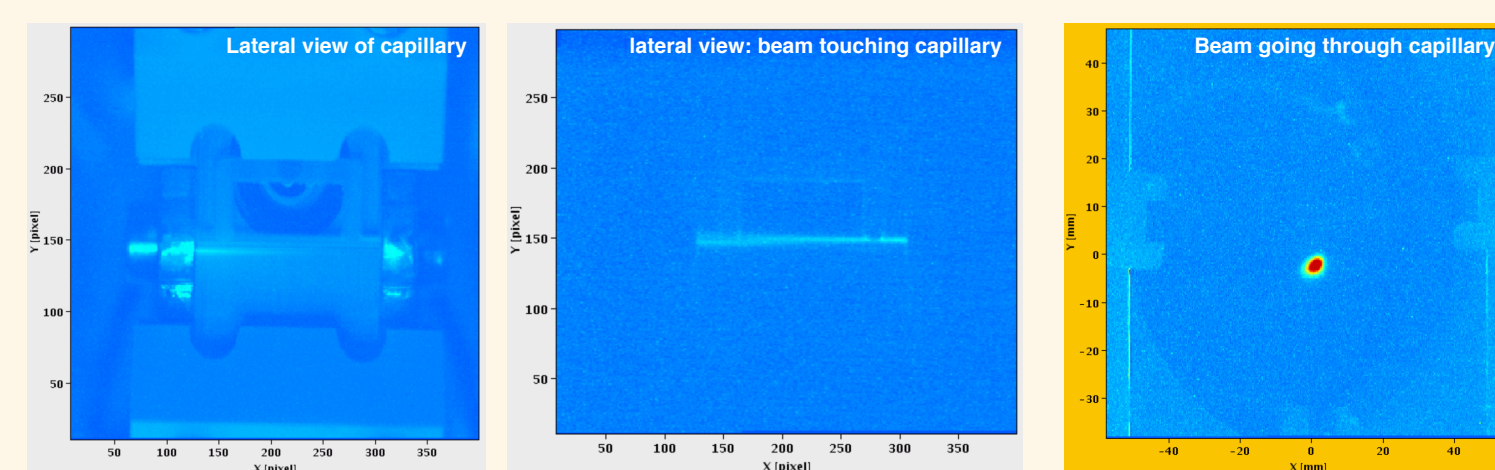
Plasma Lens Experiment

- Beam focusing by high-current discharge
- capillary for (transverse) gas confinement
- gas delivery system (approx. 1 – 50 mbar)
- HV discharge unit (order 10 kV, few 100 A)
- active alignment system

- **First beam delivered last week!**

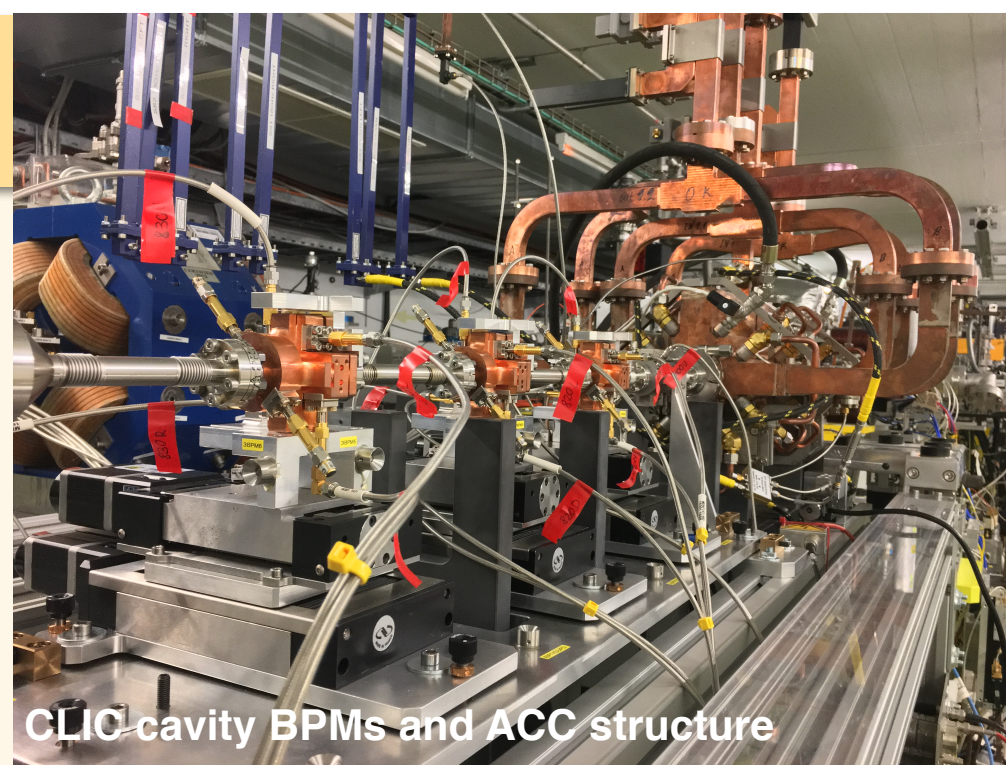


Plasma Lens setup

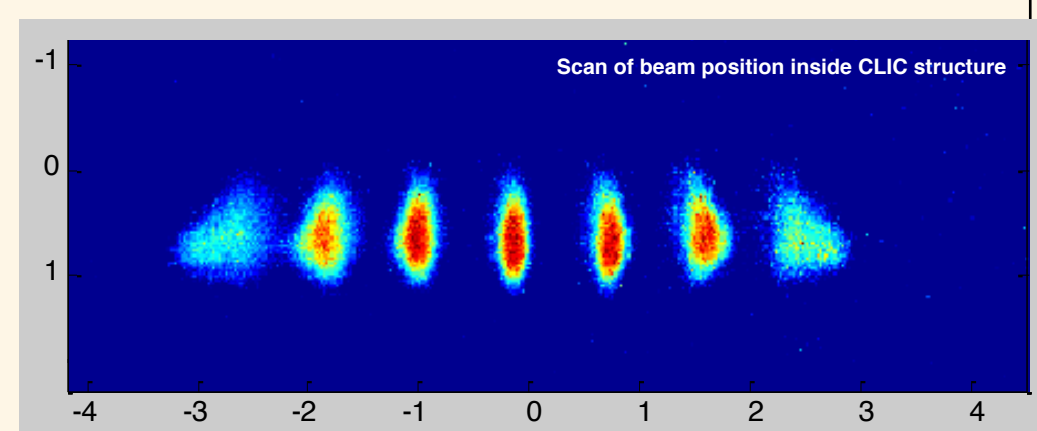
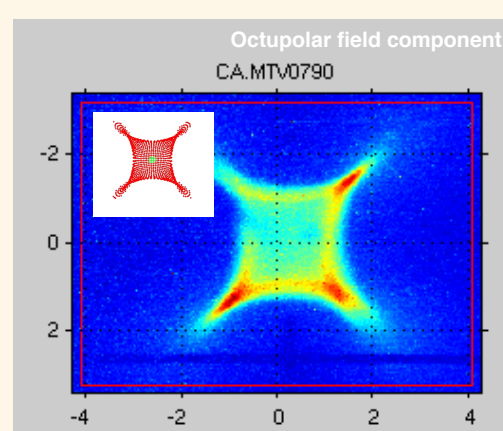
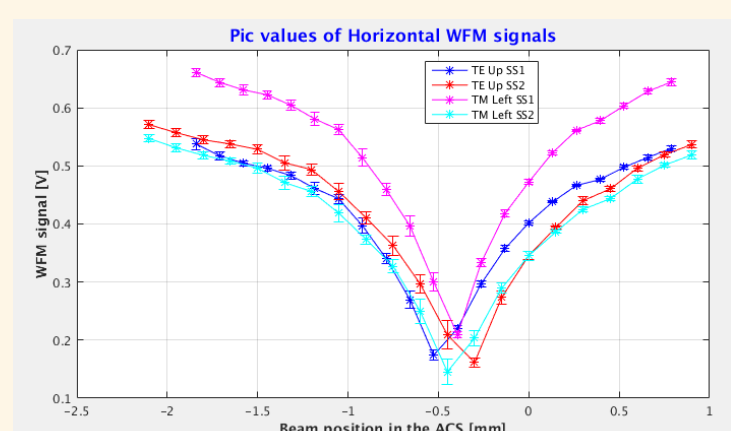


CLIC R&D

- CLIC cavity BPMS
- Toward 50 nm and 50 ns resolution
- CLIC structure Wake Field Monitor
- Field characterisation inside structure
- Higher order mode kicks studies

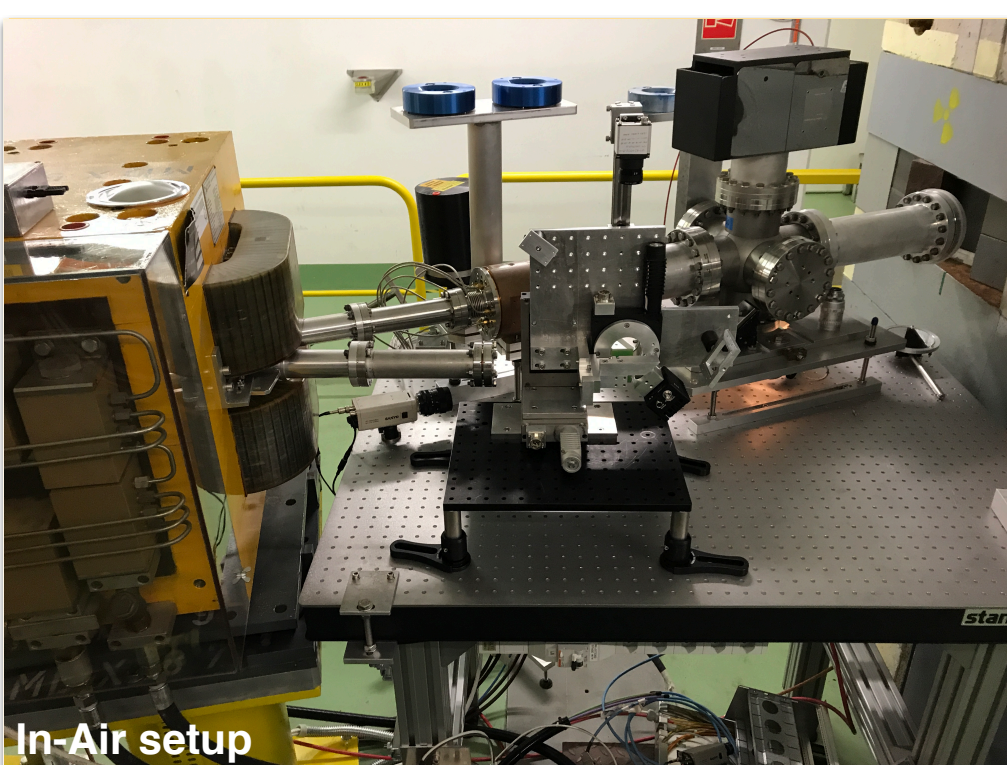


CLIC cavity BPMS and ACC structure



In-Air Test Stand

- Versatile space for in-air diagnostic studies
- About 1 m long, 0.4 m wide available space
- Foreseen experiments:
 - Transition/Cherenkov radiation comparison
 - Electro-optical BPM tests for HL-LHC
 - THz radiation studies



In-Air setup

CLEAR for education

- About 80 students have had accelerator hands-on experience at CTF3
- We will continue CTF3 tradition with CERN Summer, Technical, Doctoral students.
- Collaboration with JUAS accelerator school



JUAS students operating the beam

LOOKING FORWARD TO HOST YOUR NEXT EXPERIMENT!

For more info contact us at CLEAR-Info@cern.ch and visit us on <http://cern.ch/clear> or at CERN!