CALIFES past experience as a user facility

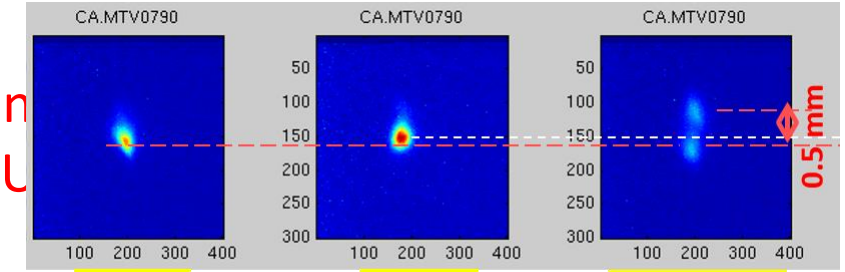
W. Farabolini on behalf of the Califes users

Initial scope of CALIFES

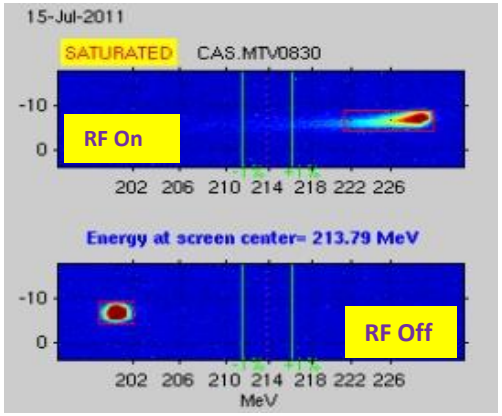
Concept d' **A**ccélérateur **Li**néaire pour **F**aisceaux d' **E**lectrons **S**onde

CALIFES was built in 2008 principally to test the high gradient accelerating structures:

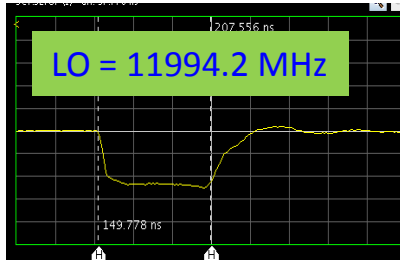
- Validation of the accelerating gradient as function of the input power
- Frequency tuning of the structures
- Statistics about transverse kicks due to breakdowns (A. Palaia thesis, Uppsala Univ.)
- Structure transverse alignment checking
- Wakefield Monitors resolution (F. Peauger CEA, R. Lillestol Oslo Un
- Octupolar component of the accelerating field (J Ogren, Uppsala U
- RF phase adjustment between structures in the CLIC module
- Beam kick due to transverse wakefields (my talk, Mon. 17:30)



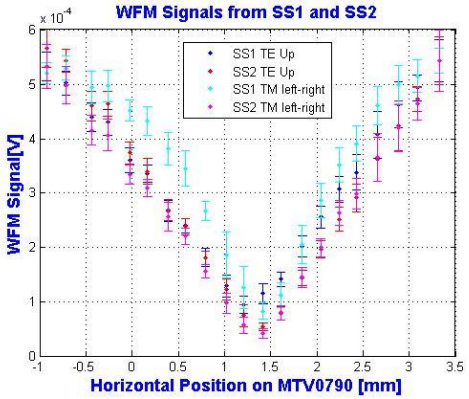
Kick during breakdown



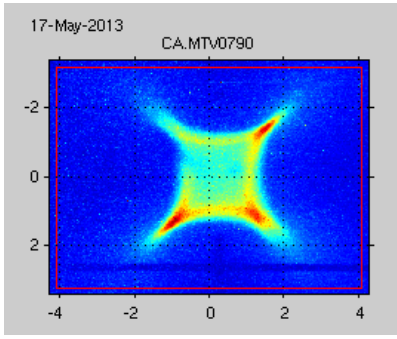
Measure of energy gain



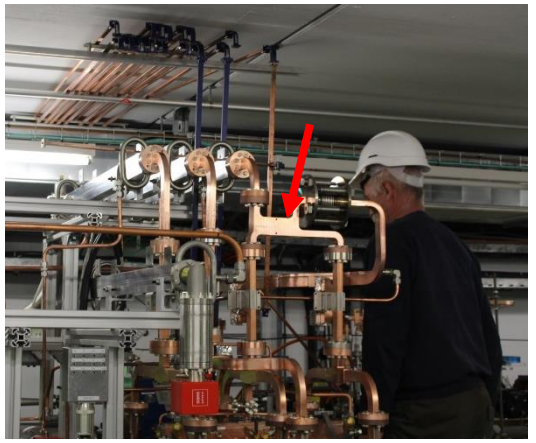
Frequency downmix of the beam generated power



Beam position scan in WFM



Octupolar beam shape

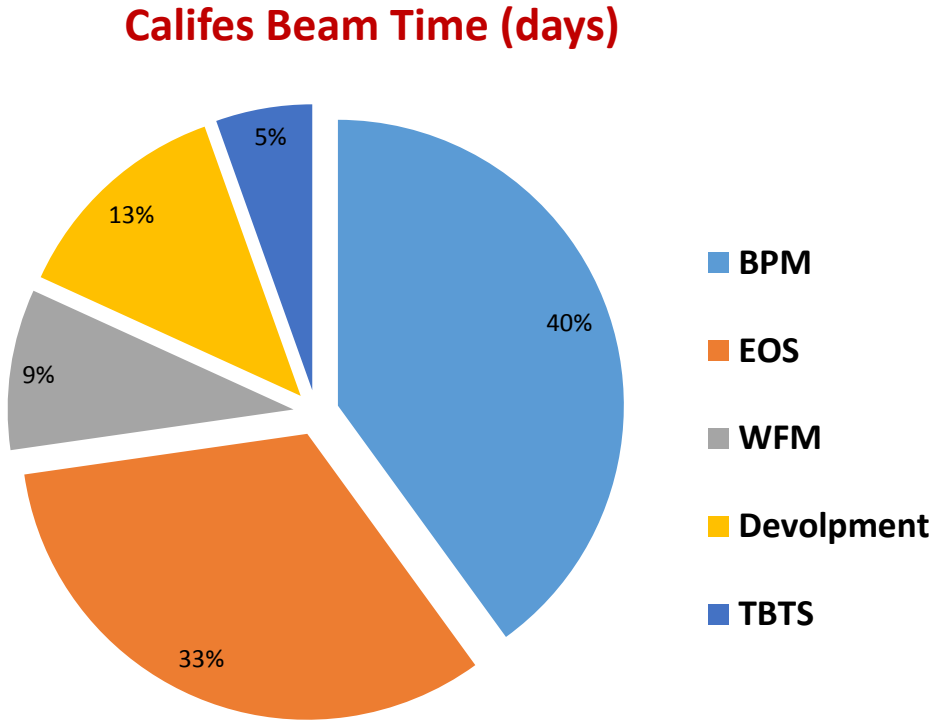


Waveguide phase problems

But rapidly many other users came

- Most of them related to the CLIC study
  - Various types of BPMs (cavity, strip-line [F. Cullinan, J. Towler RHUL, A. Benot Morell])
  - Beam transverse profile diagnostics (OTR, ODR, Diffraction Cherenkov [S. Mazzoni talk Mon. 15:45, T. Lefevre talk, Tues. 11:00])
  - Beam loss monitors (optic fibres, diamond detector, ionisation chambers [S. Mallow, M. Kastriotou, E. Del Busto])
  - Longitudinal beam profile (Electro-Optical System [R. Pan PhD])
  - Magnetic survey of the environment [B. Heilig, Geological and Geophysical Institute of Hungary]
- But now also from outside of the community
  - Irradiation test bench for ESA Jupiter mission [R. Garcia and M. Tali talks, Mon. 18:00]
  - Strip line BPM for AWAKE (S. Lui, TRIUMF)
  - JUAS for students practical training (my talk, Wed 9:35)

In 2014

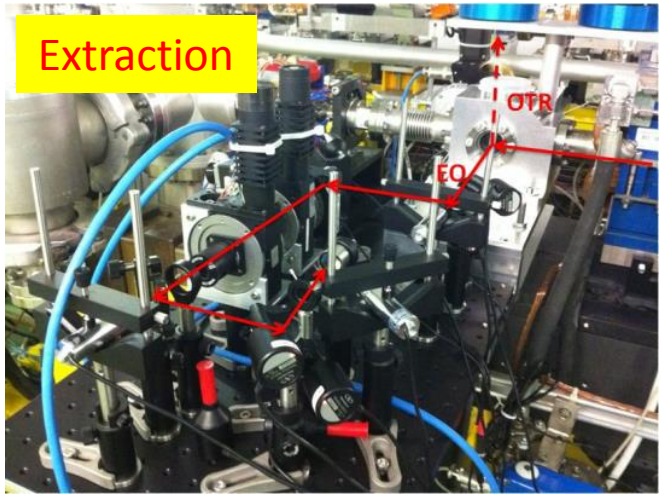


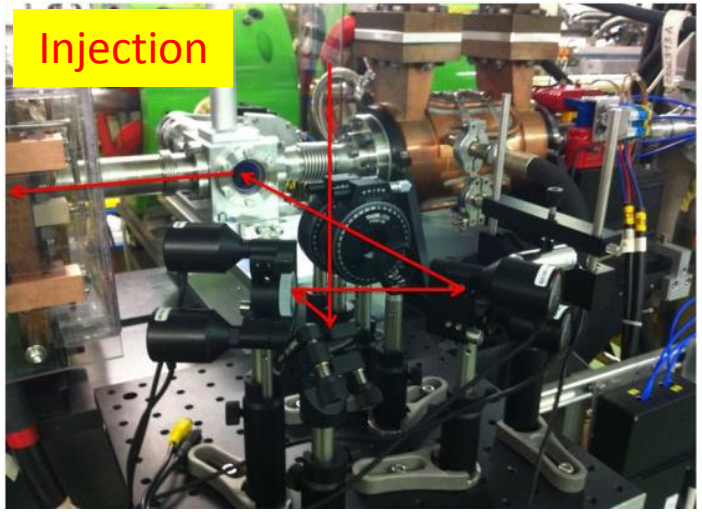
Rui Pan (PhD student), Electro-Optical Bunch Profile Measurement at CTF3 IPAC'13 MOPME077.

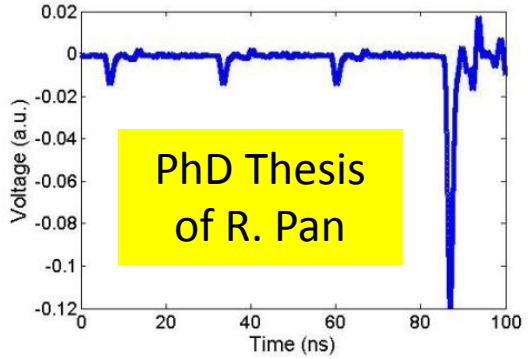
F. Cullinan (PhD student), *J. Towler* A Prototype Cavity Beam Position Monitor for the CLIC Main Beam, IBIC'12 MOPA18

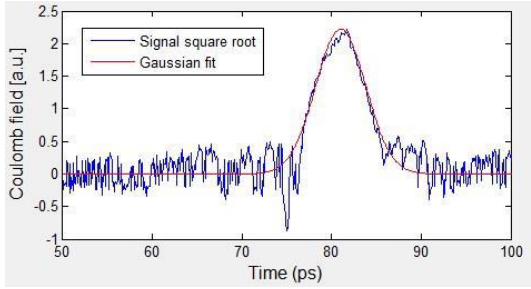
Sophie Mallows(PhD student), A fiber Based BLM System Research and Development at CERN, HB2012 THO3C05

Some diagnostics test in 2014

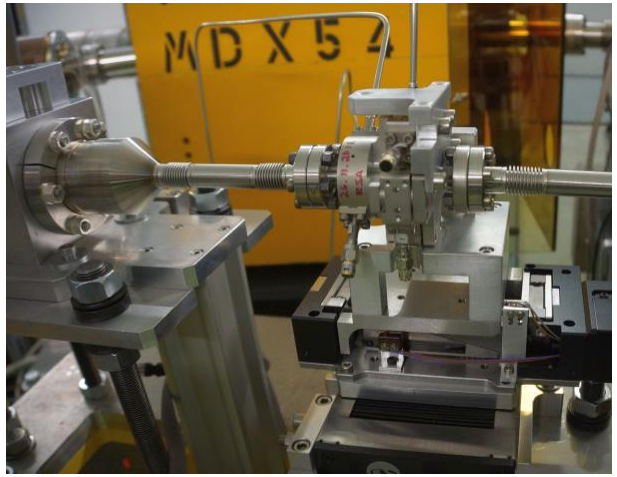






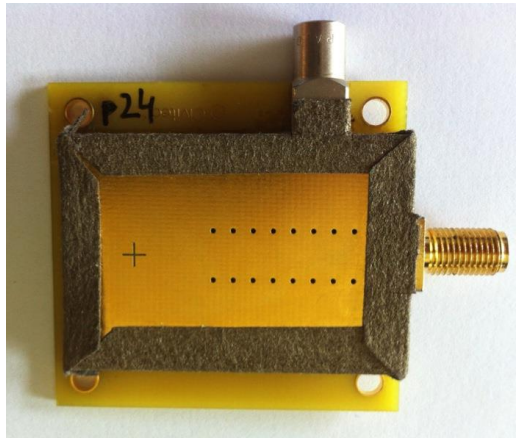


Electro Optical Sampling (EOS) for bunch length measurement

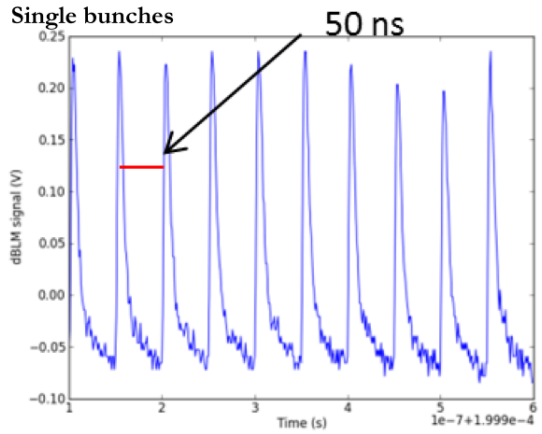


High resolution cavity BPM

F. Cullingam
J. Towler



Diamond beam loss detectors



F. Burkart, O. Stein,
E. Nebot Del Busto

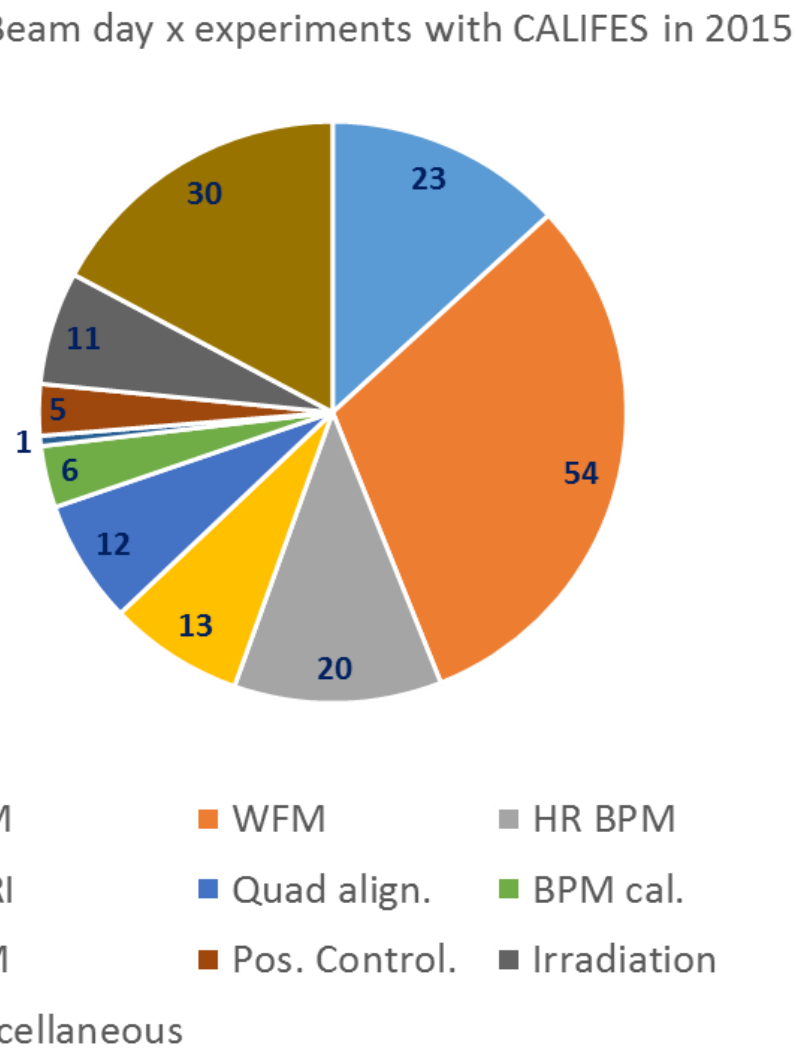
Experiments with CALIFES in 2015

- Test Beam Module : 23 days W. Farabolini & Drive Beam Team
- Wake Field Monitors : 54 days R. Lillestol et al.
- High Resolution Cavity BPMs : 20 days J. Towler
- Interferometric OTR : 13 days R. Kieffer
- Beam alignment in Quadrupoles : 12 days N. Aftab, S. Javeed
- Califes Cavity BPMs calibration : 6 days N. Aftab, S. Javeed
- Beam Loss Monitor: 1 day M. Kastriotou
- Girders positions control : 5 days V. Rude, M. Duquenne
- Irradiation Test Bench : 11 days R. Alia et al.
- Strip Line BPMs A. Benot Morell
- Miscellaneous : 30 days
  (beam preparation, development, studies non referenced in the log-book…)

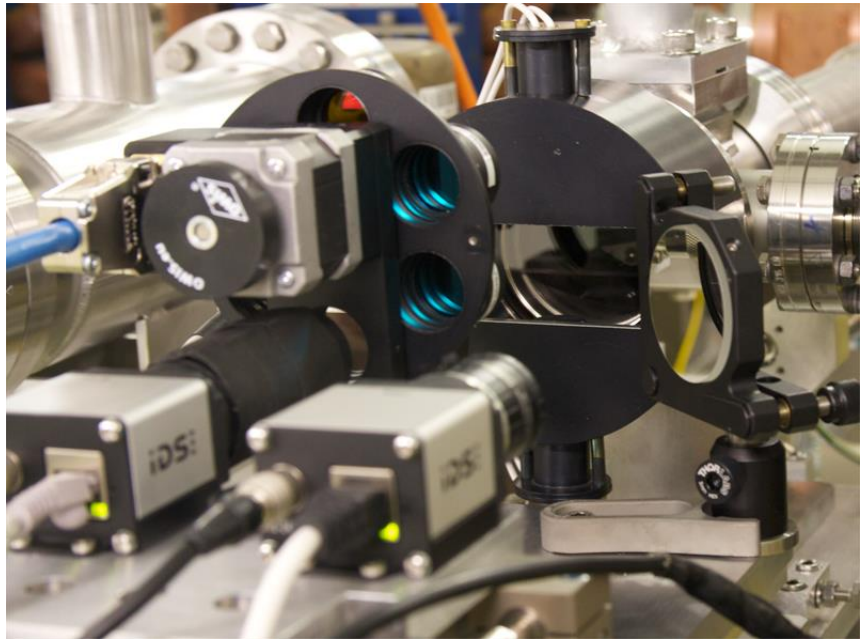
Total: **175 days** (users x days)

Klystron MKS30 for PHIN : 5 weeks

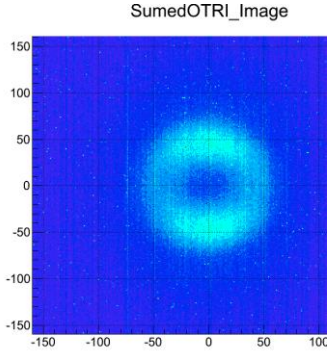
Very high beam reliability (almost no non-programmed unavailable day)

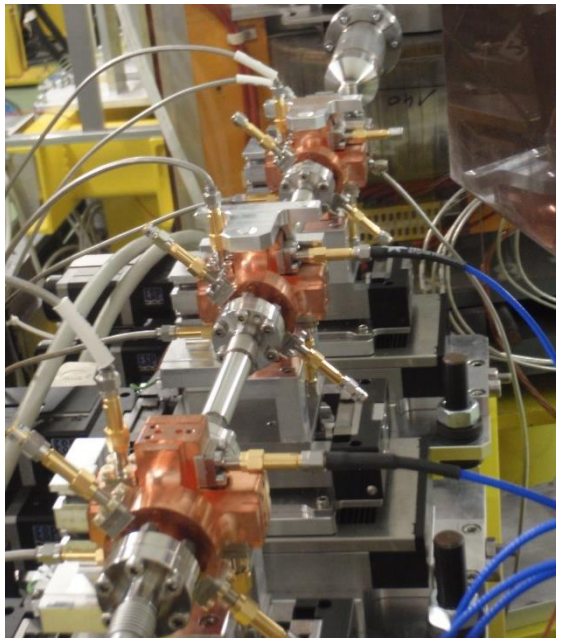


Some installed experiments in 2015

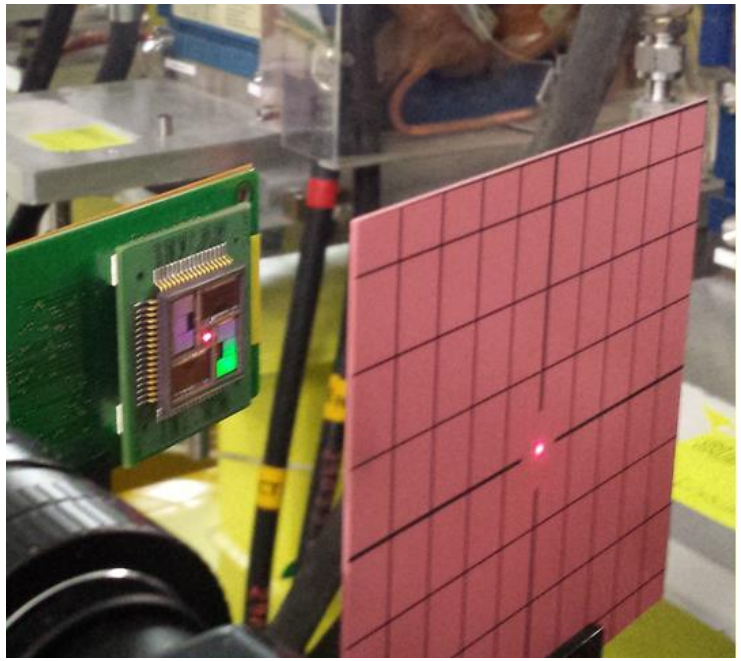


Optical Transition Radiation Interferences (R. Kieffer, T. Lefevre)





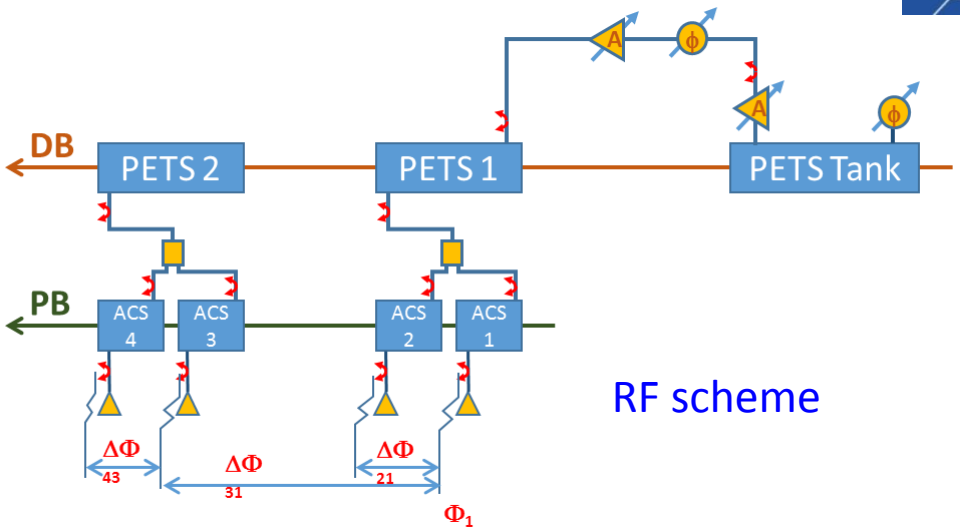
3 High Resolution Cavity BPMs on motorized stages (J. Towler, M. Wendt, A. Lyapin, S. Boogert)



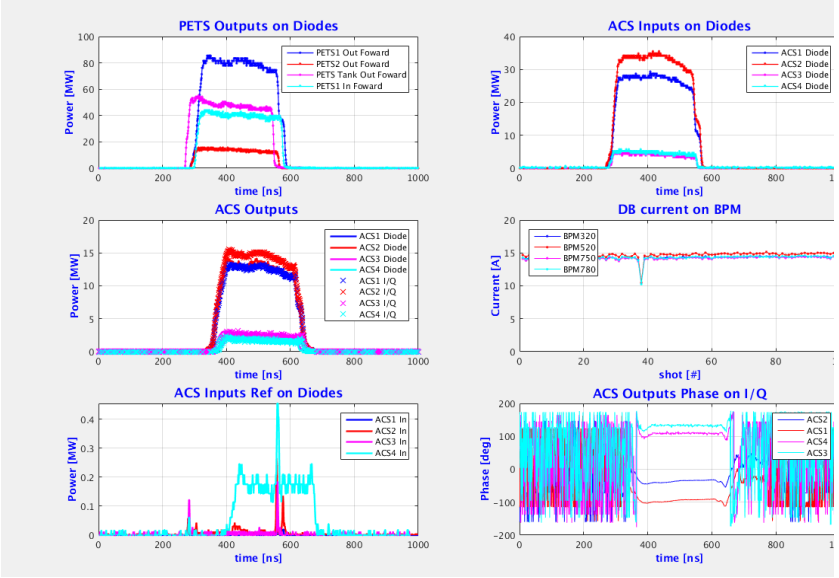
The ESA monitor aligned before test (M. Tali, R. Garcia Alia)

And for 2016

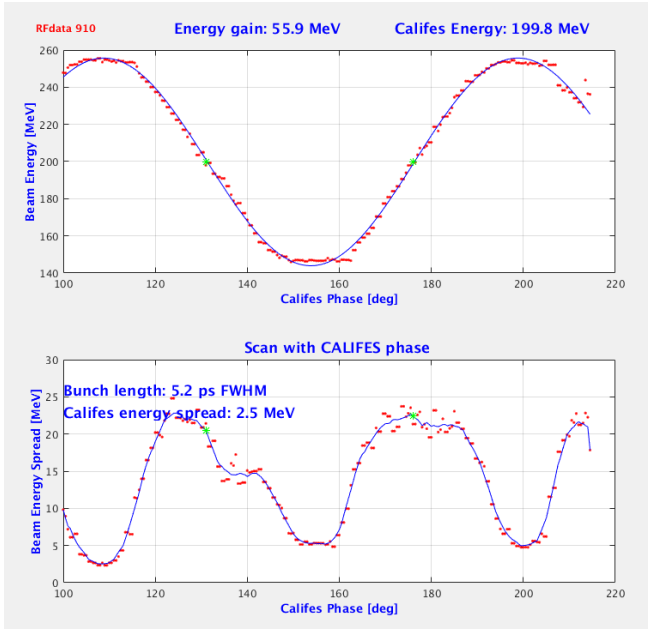
- Intense activity on the CLIC Module before shutdown
  - High gradient performances with DB factor 4, and now 8
  - Use of the octupolar component for structures alignment
  - Wake Field Monitor resolution
  - Wakefield transverse kicks
  - Use of the 12 GHz cavities to measure bunch length



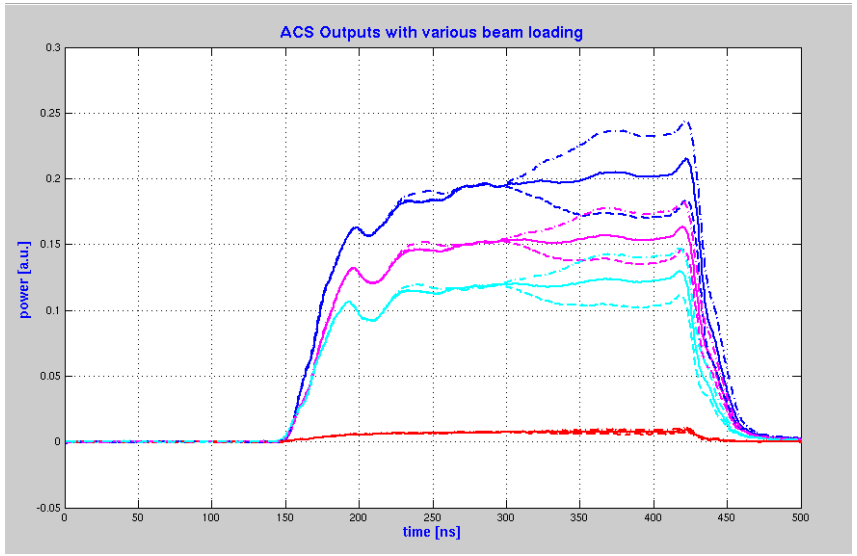
RF scheme



RF control panel

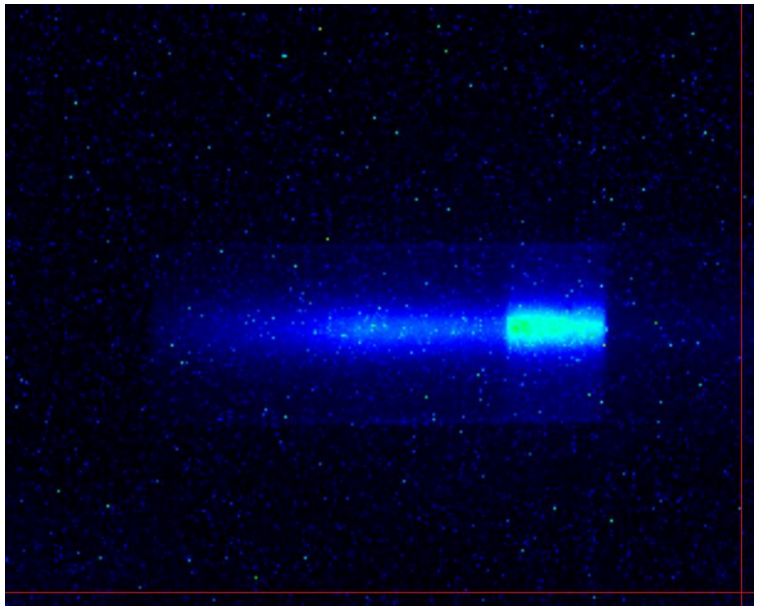


Energy and energy spread as function of CALIFES phase

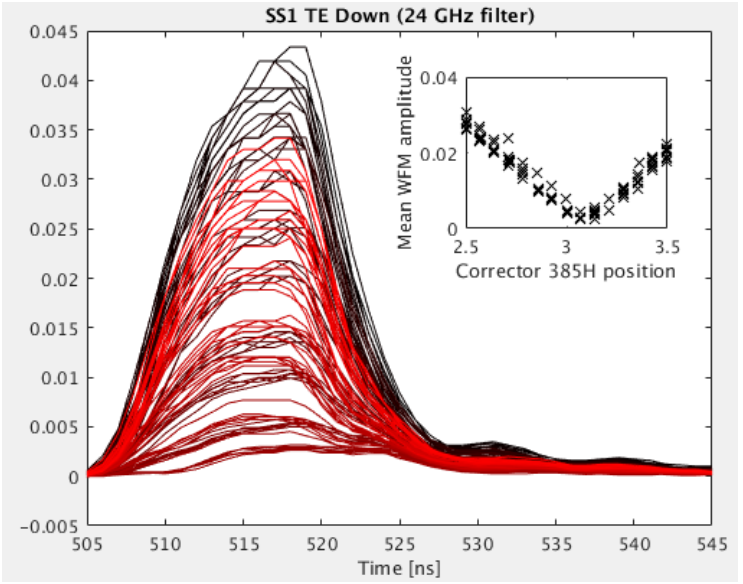


Beam loading (and anti-loading) with CALIFES long train visible on ACSs output coupler

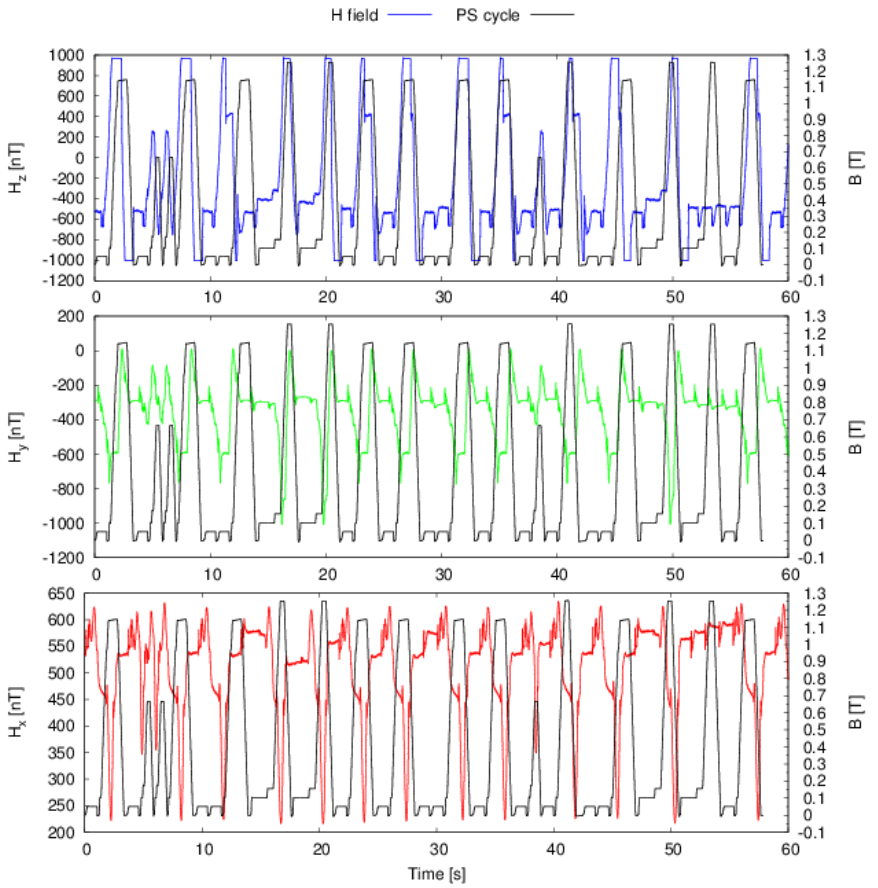
And still ‘external’ user experiments



Cherenkov radiation
(R. Kieffer, T. Lefevre)

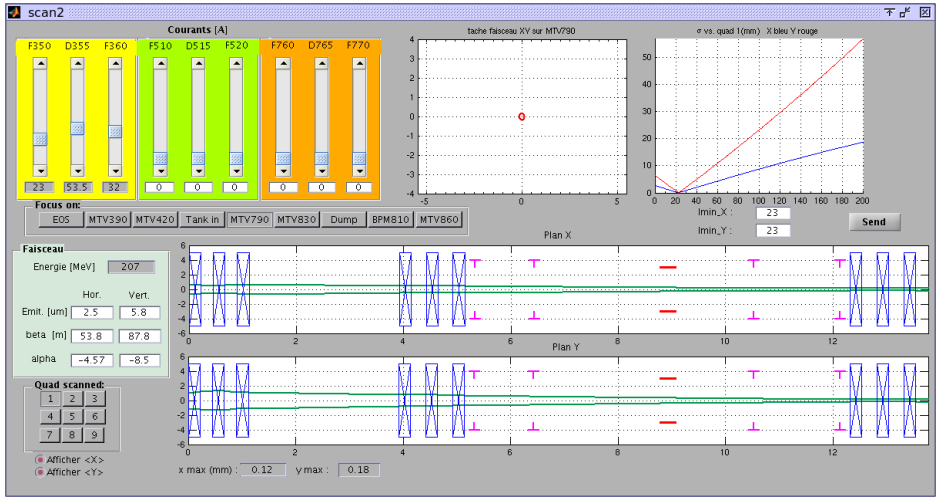


Wakefield monitors
scan (R. Lillestol)

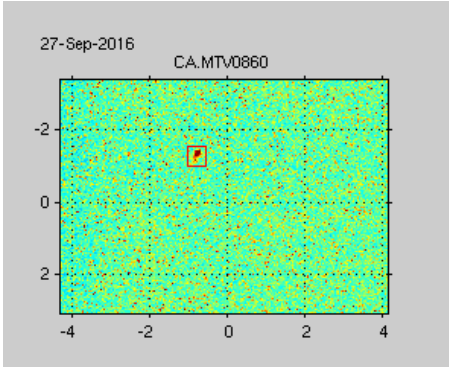


Magnetic stray field
measurements
(E. Marin Lacoma)

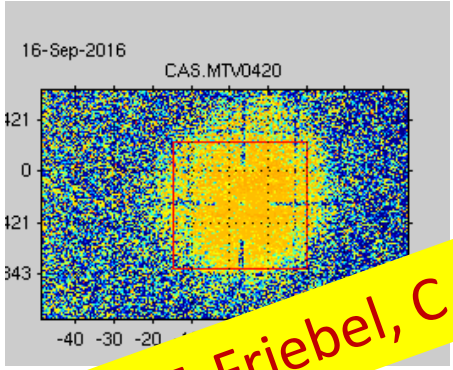
A flexible and pretty well controlled beam



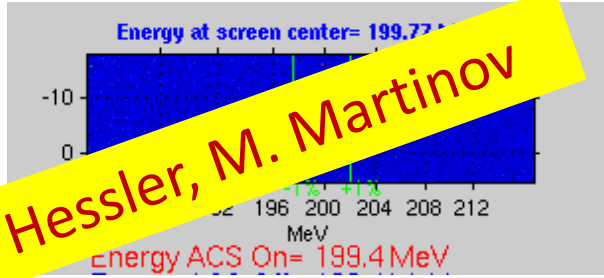
Current in quadrupoles -> beam envelope



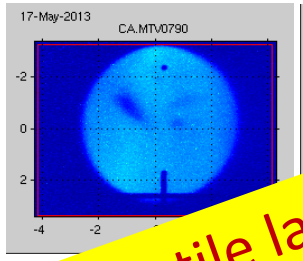
Single bunch beam
for high reso
cavit



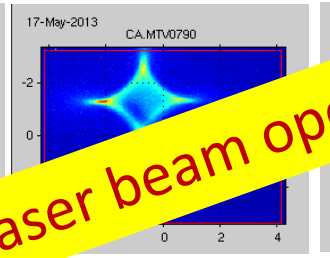
nt beam for
adiation 34 mm FWHM



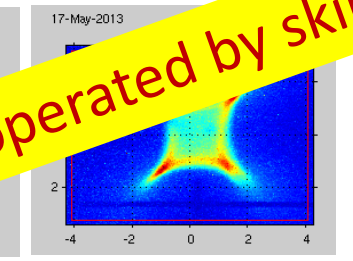
Low energy spread: 0.7 MeV



power

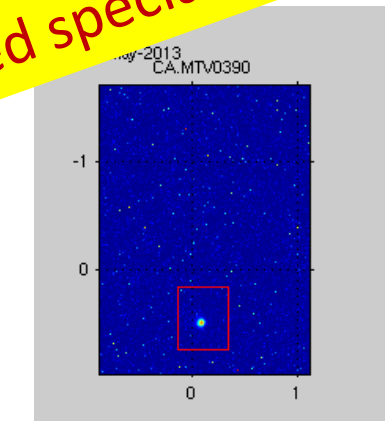


At zero-crossing
(rising RF power
side)

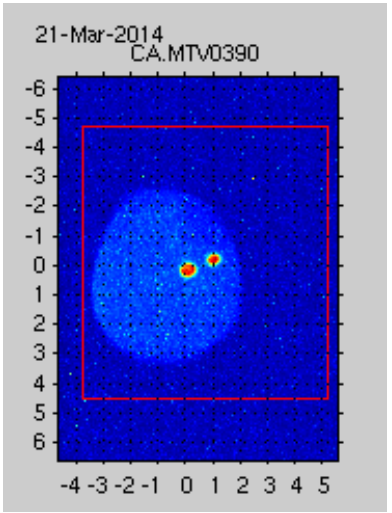


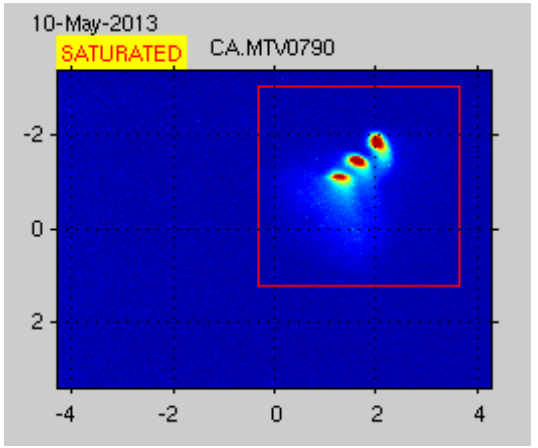
At zero-crossing
(falling RF power
side)

Large flat beam for octupolar component study



30 μm 1σ beam





Separated bunches

A versatile laser beam operated by skilled specialists helps a lot: F. Friebel, C. Hessler, M. Martinov

Conclusions

- CALIFES has proven to be capable to reliably provide an electron beam with a large range of parameters to various users.
- We are already operating with a user facility spirit
  - flexibility
  - assistance to the teams
- And above all: enthusiasm for novel experiments

Thank you for your attention