



CTF3 Brief Summary

W. Farabolini
on behalf of the CTF3 team



Summary



- Installation of the CLIC Module
 - Schedule, Pre-Work (holes and shelters (new CTF3 buildings), removal of TBTS lines, reinstallation of the lines, care to the alignments, problems with vacuum leaks (structures, waveguides, strip-line BPMs), module ready.
- First beams through
 - First results
- Other experiments
 - Cooling and thermal control
 - Strip-line BPMs
 - BLM
 - WFM
 - OTRI
 - Phase Feed Forward

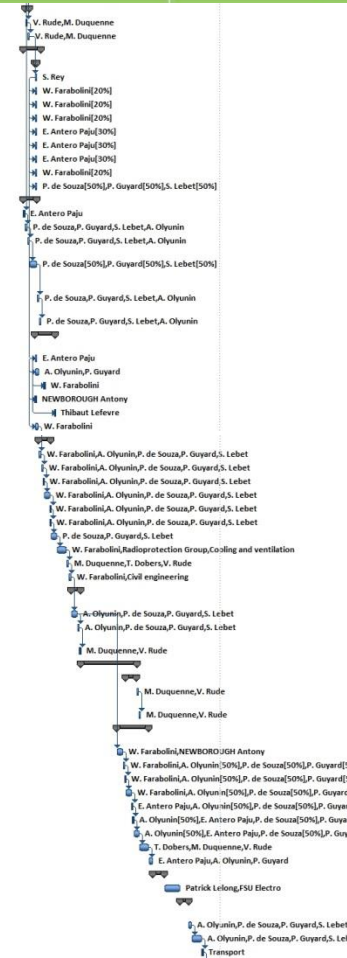
CLIC 19th of June 2014: the TBTS passed away

External shelter (Planning under way)	25 days	Mon 24/09/14	Fri 25/04/14
Installation of the shelter	20 days	Mon 24/09/14	Fri 25/04/14
Installation of the racks for electronics	5 days	Mon 22/06/14	Fri 20/04/14
Cavity BPM Metrology (x2) (Planning under way)	3 days	Fri 04/07/14	Wed 09/07/14
COOLING TBM (Planning under way)	63.5 days	Mon 02/06/14	Fri 29/08/14



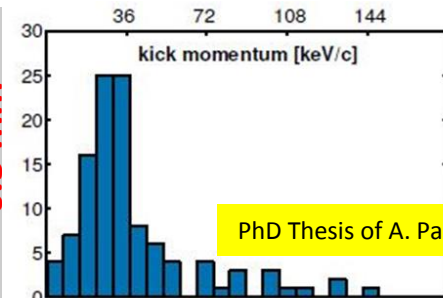
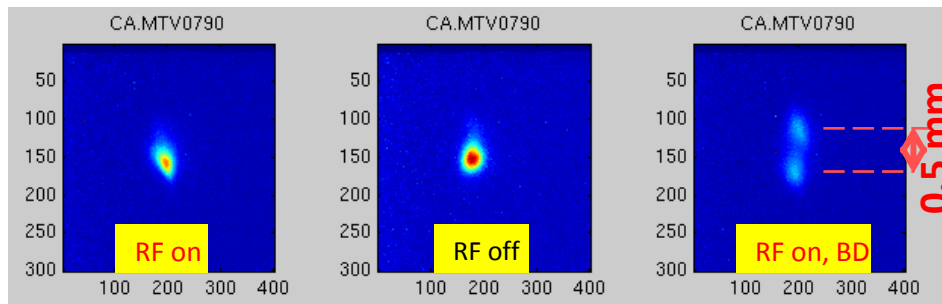
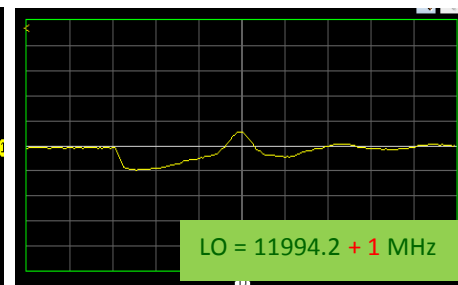
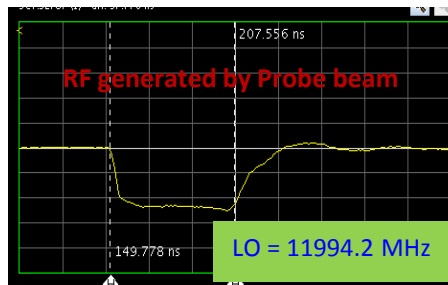
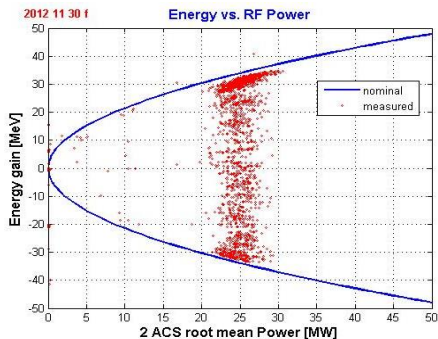
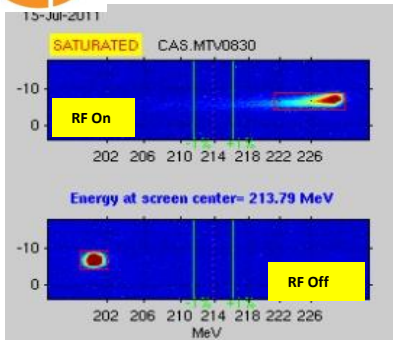
Dismantling of safety barriers 0.5 days Mon 23/06/14 Mon 23/06/14

Initial measurements of CLEX	2 days	Wed 25/06/14	Thu 26/06/14
Measurement of the existing references	1 day	Wed 25/06/14	Wed 25/06/14
Determination of the theoretical beam	1 day	Thu 26/06/14	Thu 26/06/14
Dismantling of the TBTS PB and the TBM	7 days	Tue 24/06/14	Wed 03/07/14
Disconnection of electrical cables and water pipes	1 day	Mon 30/06/14	Mon 30/06/14
RF cables (x12)	1 day	Mon 30/06/14	Mon 30/06/14
Photomultipliers (x2)	1 day	Mon 30/06/14	Mon 30/06/14
WFM (x16)	1 day	Mon 30/06/14	Mon 30/06/14
Thermal probes (x5)	1 day	Mon 30/06/14	Mon 30/06/14
Ion pumps (x6)	1 day	Mon 30/06/14	Mon 30/06/14
Vacuum gauges (x4)	1 day	Mon 30/06/14	Mon 30/06/14
Vacuum valves (x4)	1 day	Mon 30/06/14	Mon 30/06/14
RF phase shifter (x2)	1 day	Mon 30/06/14	Mon 30/06/14
Water pipes (x4)	1 day	Mon 30/06/14	Mon 30/06/14
Disconnection and dismantling of RF network	5 days	Tue 24/06/14	Mon 30/06/14
Vacuum break	0.5 days	Tue 24/06/14	Tue 24/06/14
Disconnection and dismantling of RF network	1.6 days	Tue 24/06/14	Wed 25/06/14
Storage of non-reusable equipment in buffer zone	1 day	Thu 26/06/14	Thu 26/06/14
Storage of equipment which will be used for TBM phase shifter, RF PP, RF pads, land packing under N	2 days	Fri 27/06/14	Mon 30/06/14
dismantling and transport of the TBTS PB Tank to the buffer zone	1 day	Tue 01/07/14	Tue 01/07/14
displacement of the TBTS PB TANK	1 day	Wed 02/07/14	Wed 02/07/14
Disconnection of all cables (labelling and pipes in the working area)	8.25 days	Mon 30/06/14	Mon 30/06/14
Vacuum equipment cables	1 day	Mon 30/06/14	Mon 30/06/14
Vacuum chambers removal and storage under N	1 day	Mon 30/06/14	Mon 30/06/14
Flomaster and thermal probes for magnets	0.5 days	Fri 04/07/14	Fri 04/07/14
Magnets power cables and cooling pipes	0.5 days	Mon 30/06/14	Mon 30/06/14
BPMs cables	0.25 days	Thu 10/07/14	Thu 10/07/14
Disconnection of the patch panels	1.5 days	Mon 30/06/14	Tue 01/07/14
Removal of the equipment in the working area	4.5 days	Tue 01/07/14	Mon 07/07/14
Quadrupoles and correctors	1.5 days	Tue 01/07/14	Wed 02/07/14
BPMs and diagnostics chambers	1 day	Thu 03/07/14	Thu 03/07/14
Flashbox	0.25 days	Fri 04/07/14	Fri 04/07/14
Supports	1.25 days	Fri 04/07/14	Mon 07/07/14
Vacuum valves	0.25 days	Mon 07/07/14	Mon 07/07/14
Pumping ports	0.25 days	Mon 07/07/14	Mon 07/07/14
Dismantling of the yellow grinders and feet (TBTS)	3 days	Tue 08/07/14	Thu 10/07/14
Removal of the cooling distribution (central line)	3 days	Fri 11/07/14	Tue 15/07/14
Process floor marking	1 day	Wed 16/07/14	Wed 16/07/14
Closing of the floor for all the supporting equipment	1.5 days	Thu 17/07/14	Fri 18/07/14
Installation of the supporting elements of the TBM and CLEX components	3 days	Fri 18/07/14	Wed 23/07/14
Installation of the new yellow supporting grinders	1 day	Fri 18/07/14	Mon 21/07/14
Transport and installation of the TBM extremity benches	1 day	Mon 21/07/14	Tue 22/07/14
Geometrical control of the extremity benches	1 day	Tue 22/07/14	Wed 23/07/14
TBM installation and assembly	21 days	Wed 23/07/14	Thu 21/08/14
Primary RF Network installation	3.5 days	Fri 15/08/14	Wed 20/08/14
Test of actuators displacement on 3 mm range (grid load)	1 day	Thu 21/08/14	Thu 21/08/14
Test of the Articulation Point (grid loaded)	1 day	Fri 22/08/14	Fri 22/08/14
Installation of CLEX components according to new configuration	12.5 days	Mon 11/08/14	Wed 27/08/14
Quadrupoles and correctors	3 days	Mon 11/08/14	Wed 13/08/14
BPMs and diagnostics chambers	1 day	Thu 14/08/14	Thu 14/08/14
Flashbox	0.25 days	Fri 15/08/14	Fri 15/08/14
Supports	1.25 days	Fri 15/08/14	Mon 18/08/14
Vacuum valves	0.5 days	Mon 18/08/14	Mon 18/08/14
Pumping ports	0.5 days	Tue 19/08/14	Tue 19/08/14
Installation of vacuum chambers	3 days	Tue 19/08/14	Fri 22/08/14
Alignment of the components	3 days	Fri 22/08/14	Wed 27/08/14
Leaktightness test	2 days	Wed 27/08/14	Fri 29/08/14
Final alignment tests	4 days	Fri 29/08/14	Thu 04/09/14
Reconstruction of cable trays and cables pulling	5 days	Thu 04/09/14	Fri 12/09/14
Reconnection of all cables (according to labelling) and pipes in the working area	2.5 days	Fri 12/09/14	Tue 16/09/14
Cooling system test	2 days	Tue 16/09/14	Thu 18/09/14
Cleaning the area	3 days	Thu 18/09/14	Tue 23/09/14
Closing the shielding	1 day	Tue 23/09/14	Wed 24/09/14

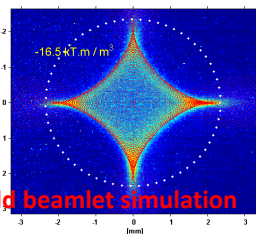
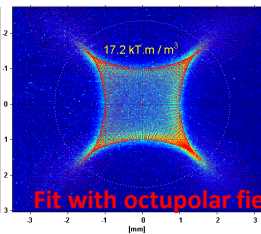
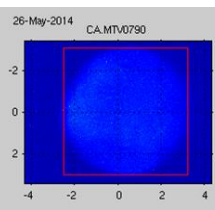
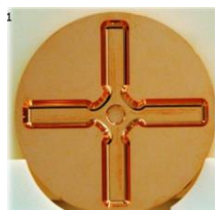
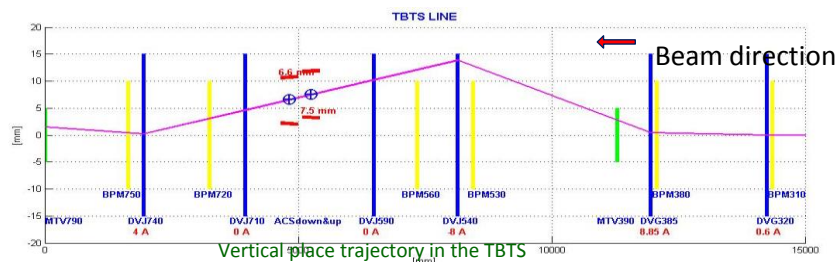
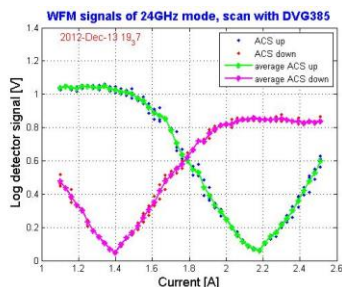
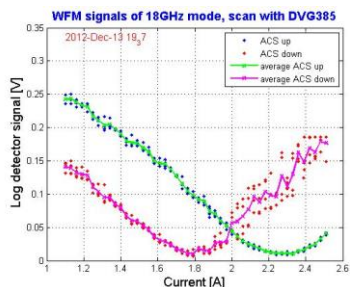
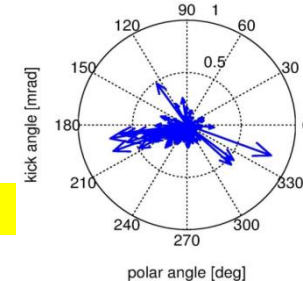


- Event preceded by an intense planning activity (D. Gudkov weekly CLIC Module WGM)
- Important issue: the summer holidays, to be included or not to be included ?
- Allocated time: 3 months

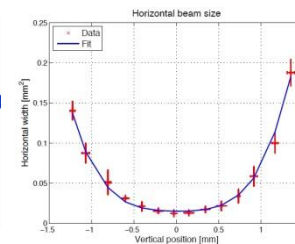
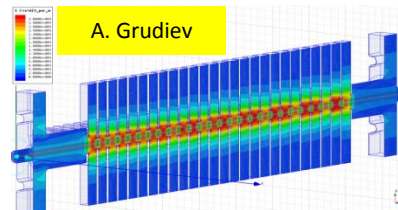
Commissioning 5 days Thu 25/09/14 Thu 02/10/14



Kicks to the beam measured on screen CA.MTV0790

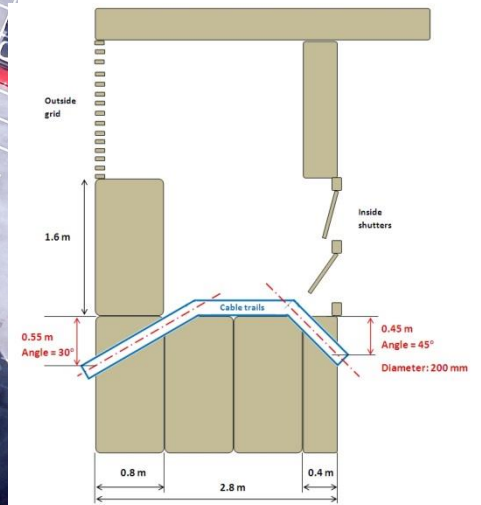
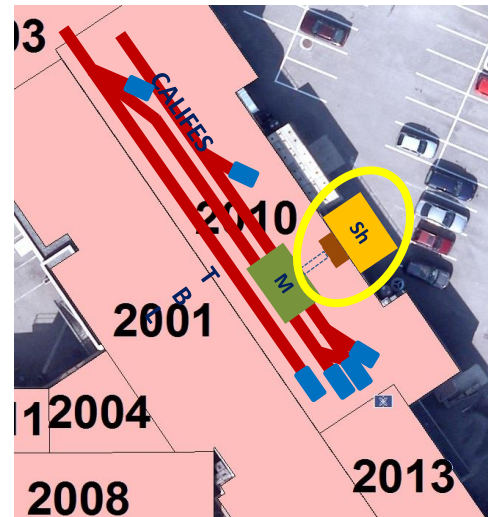


Fit with octupole field beamlet simulation





January 2014: Trench cut on the floor and holes drillings through the external wall (2.8 m)



New CTF3 buildings



CLEX construction



Klystron servicing hall



CLIC Module electronic shelter

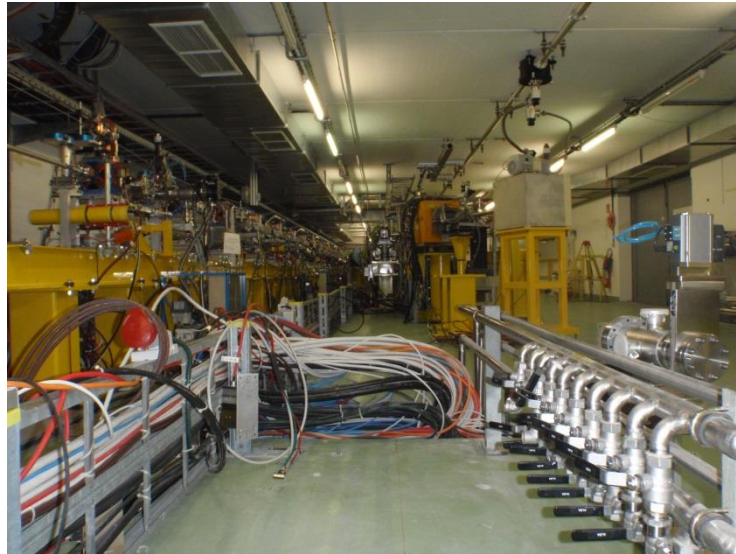


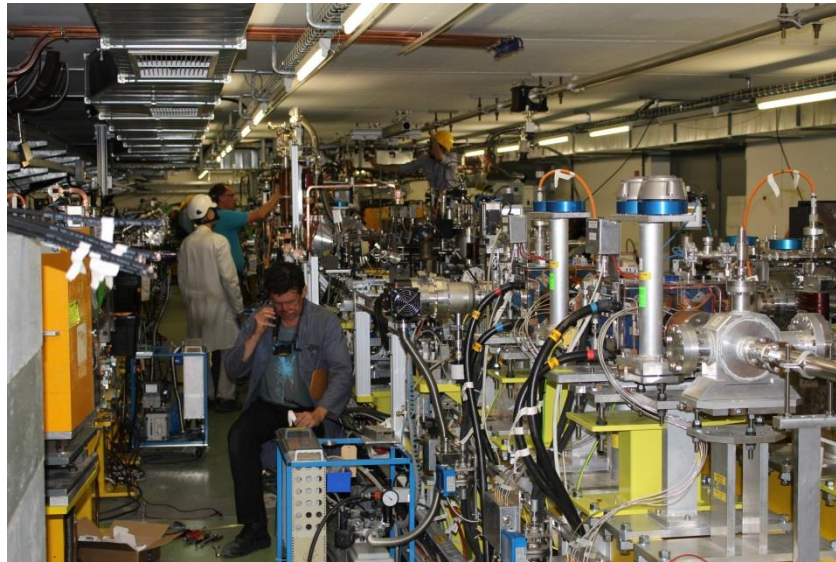
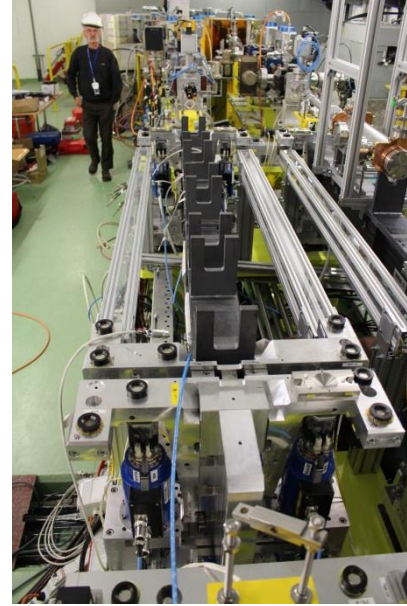
Nuclear buffer zone

TBTS lines removal (start)



TBTS lines removal (finished)



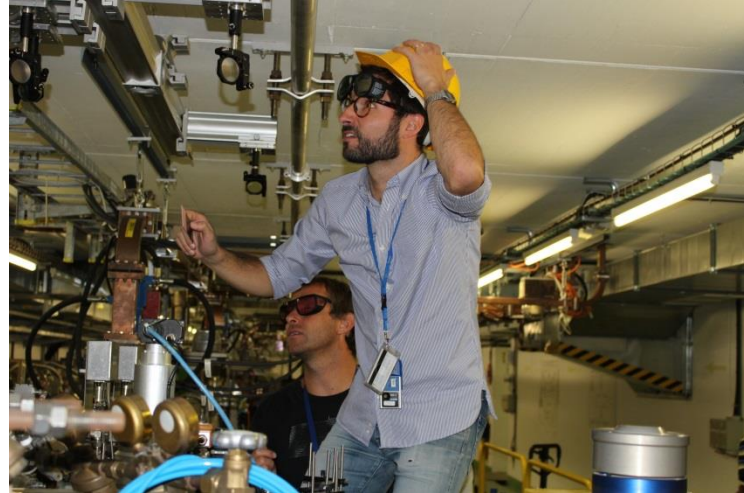
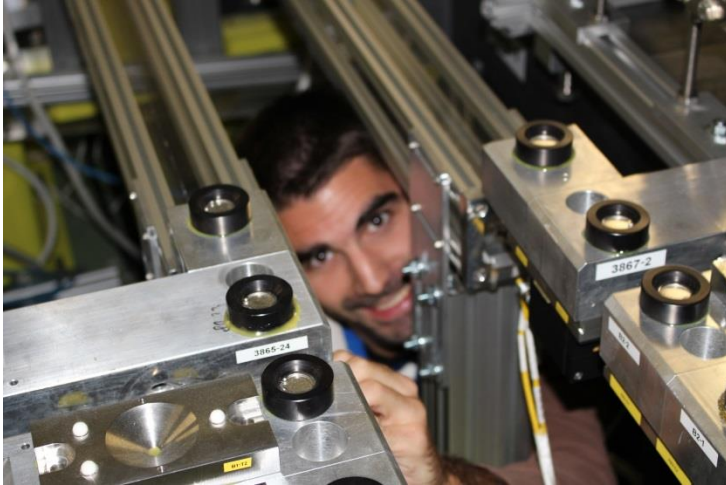


The vacuum leaks battle

- Leaks were detected on the superstructures and waveguide network just before installation and even on Strip-line BPMs after installation.
- 4 additional brazing were necessary to obtain a good vacuum quality on 1 of them (the second one will be installed during the winter shutdown).
- Some suggestions to improve the conception have emerged.



Easiness of the installation





Construction effort

Activity	Number of people
Civil Engineering	6
Drawings	2
Planning	5
Magnetic measures	2
Survey	6
Cabling	7
Transport	4
Disassembling	3
Vacuum	4
Beam diagnostics	13
Mechanics	7
Thermal control	1
RF	3
RP	4
Cleaning	2
Shelter and Buffer Zone construction	10
Total:	79

And also:

- 120 cables pulled (2400 m)
- 12 girders moved
- 12 quadrupoles magnetically measured and fiducialized
- Quasi-permanent survey of the equipment by 2 different teams

CLIC Module installed

Drive beam:

2 PETS

2 Quads

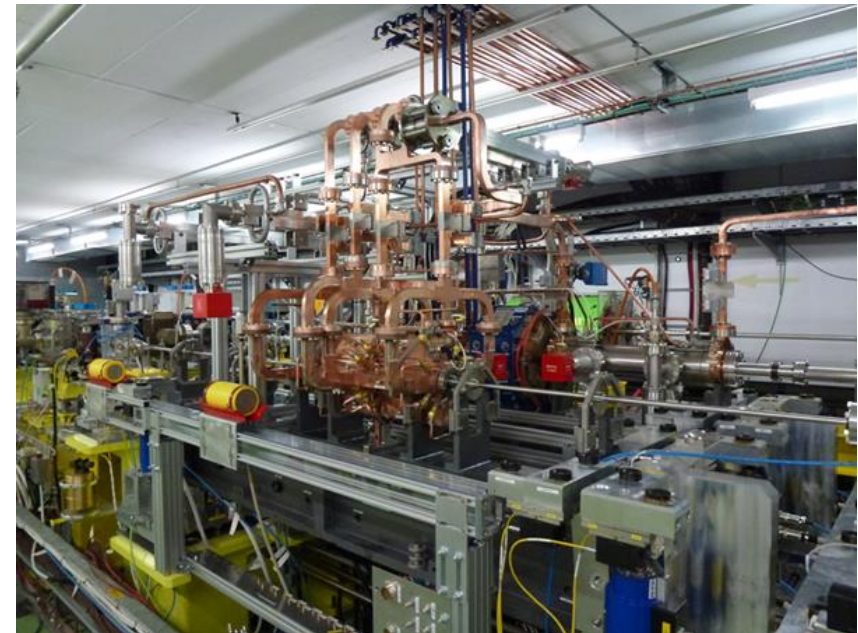
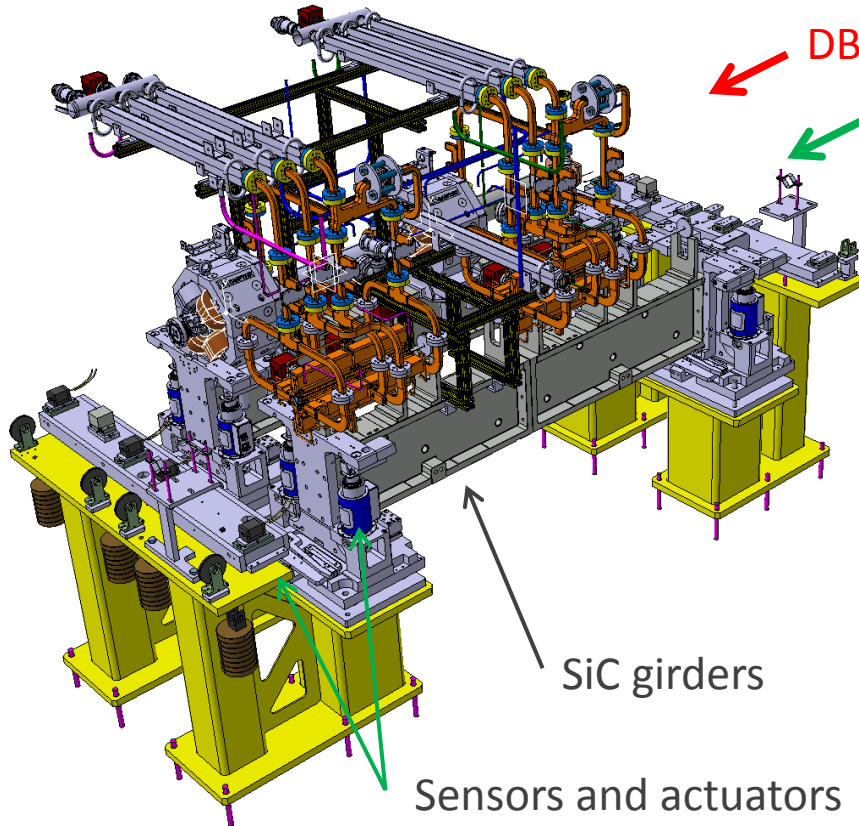
PB 2 Stripline BPMs

Probe beam:

2 superstructures

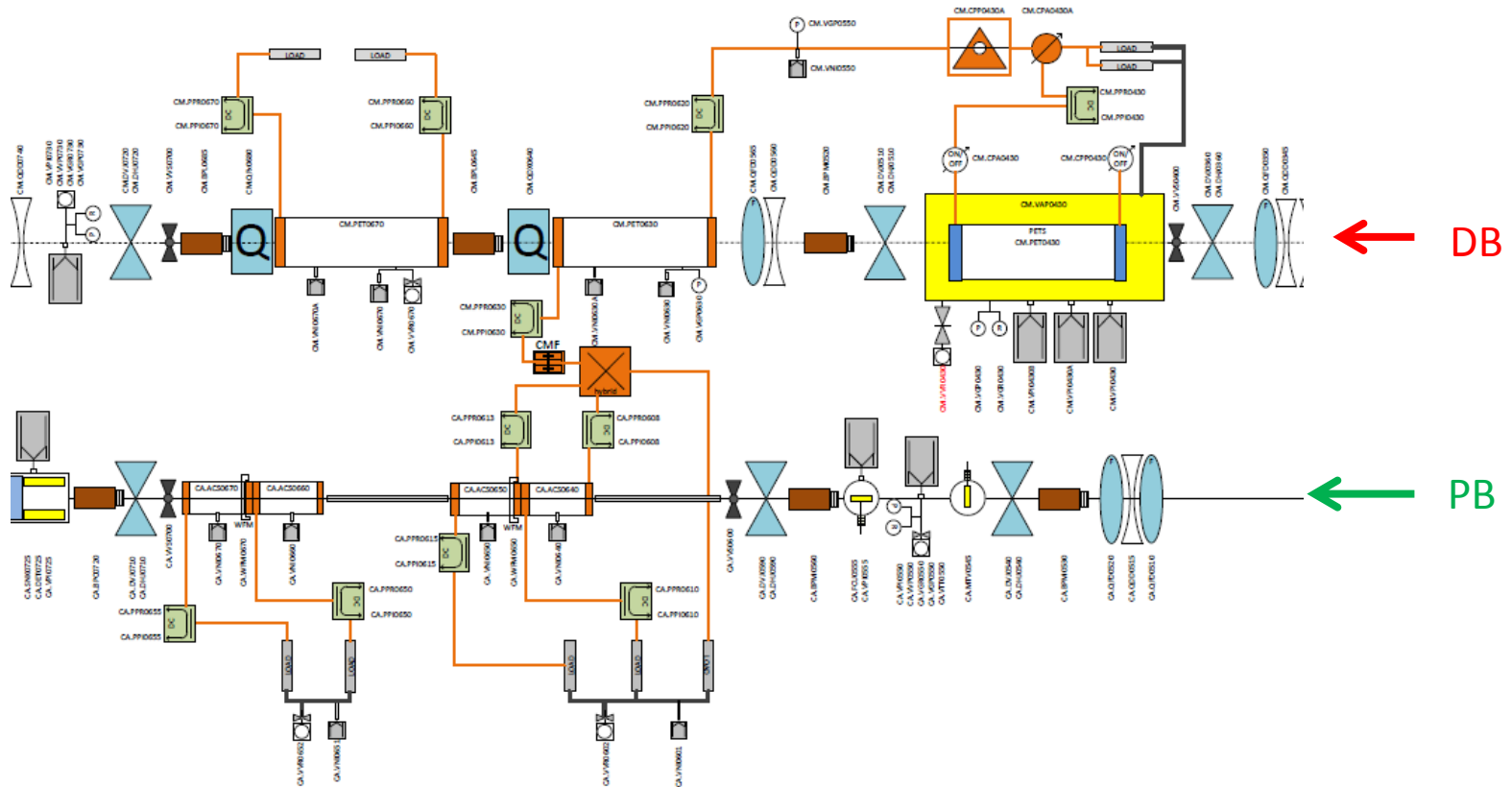
(4 ACSs)

2 WFMs



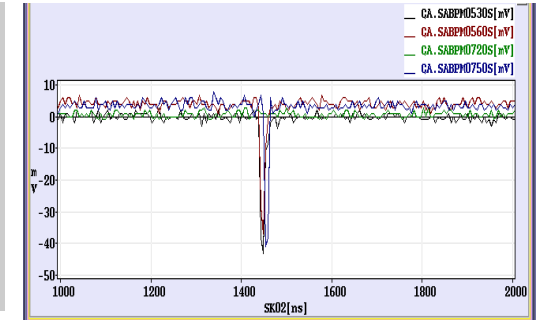
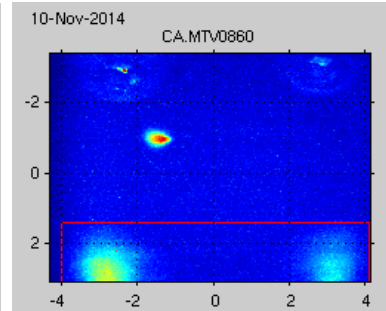
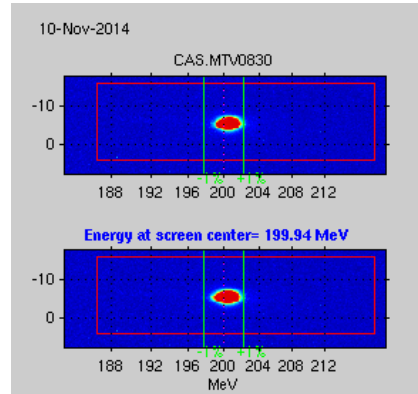
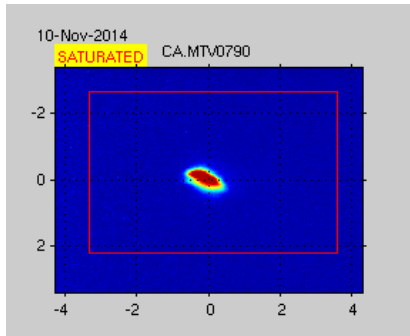
D. Gudkov

CLIC TBM INTEGRATION IN CLEX. COMPONENTS

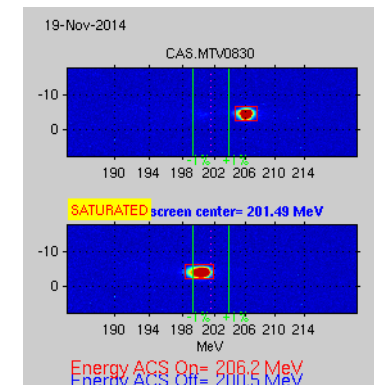
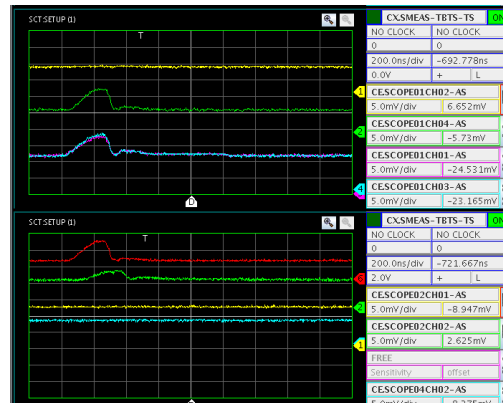
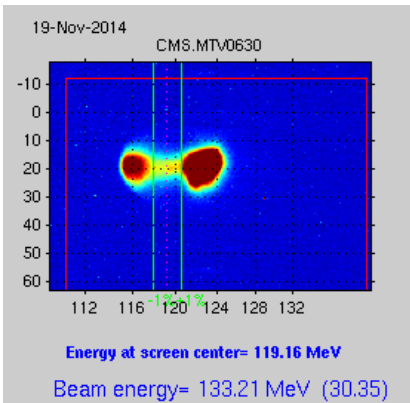
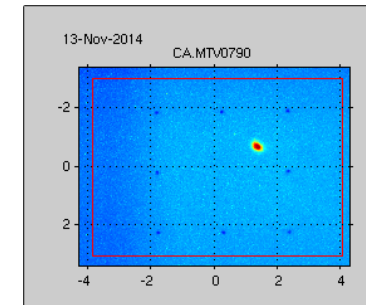


- 11 bidirectional RF Couplers (12 GHz)
- 4 RF controls (phase shifters and attenuators)
- 9 RF loads
- 11 additional pumps (ions and getter)

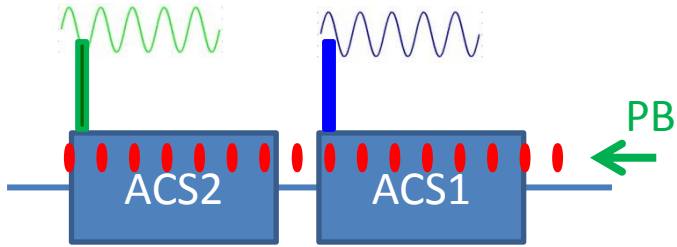
- 10 girder actuators
- 8 stretch wire position monitors
- 16 Wakefield monitors signals (18 and 24 GHz)
- Many beam loss monitors



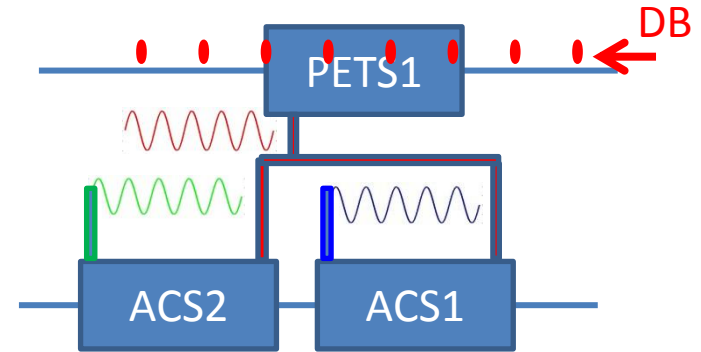
10 November: Less than 2 hours were necessary to send CALIFES beam through the superstructure. The equipment are very well aligned (no more need of the correctors).



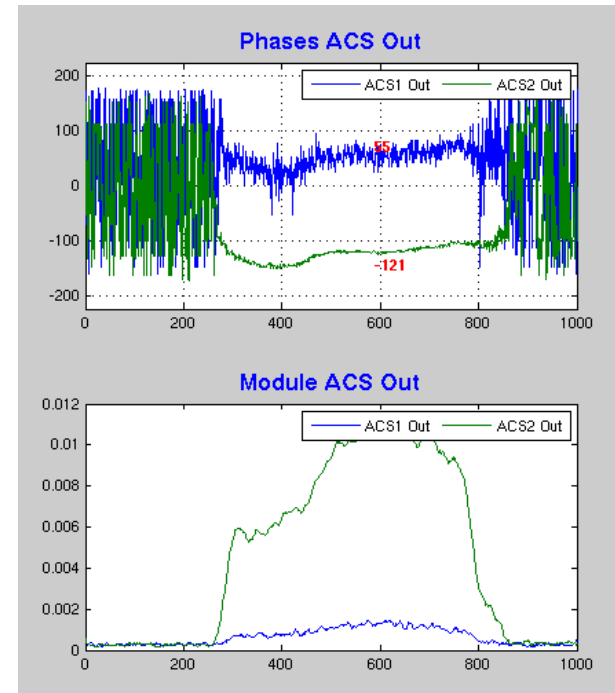
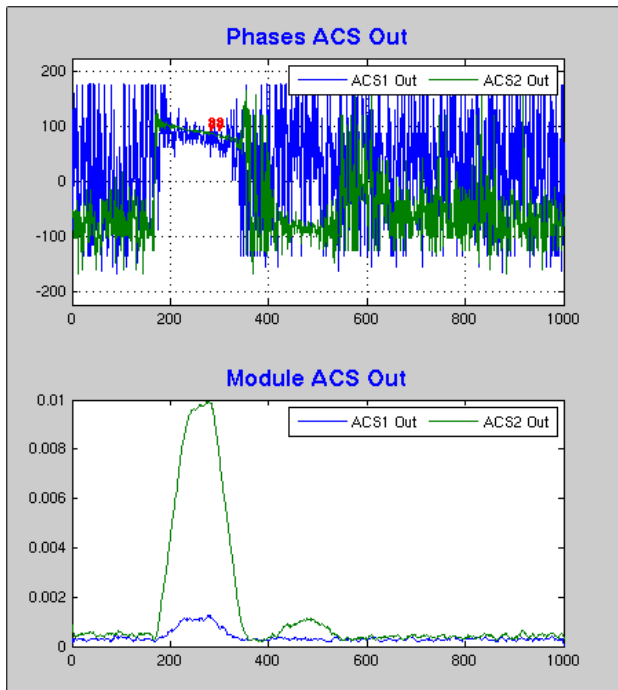
19 November: The drive beam is ready to go through the PETS and generates some RF power. However the energy gain of the PB is weak (less than 6 MeV) and the RF chains are not yet calibrated



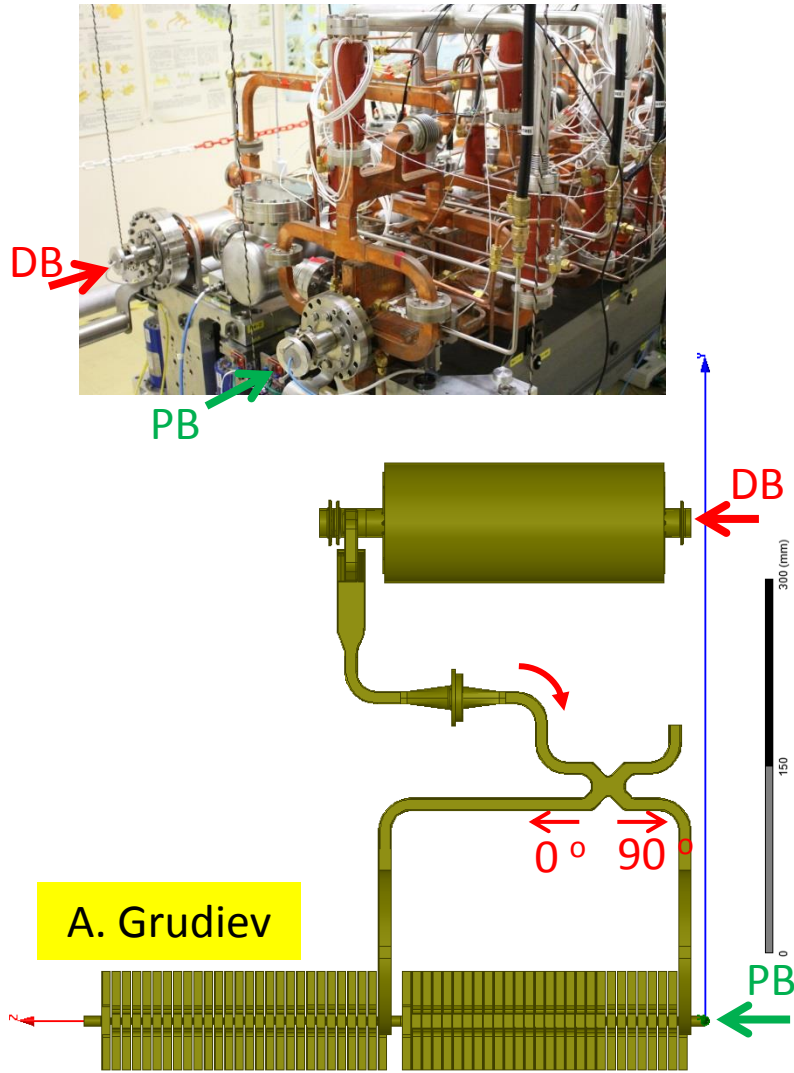
When generated by Probe Beam, RF phase difference between the 2 ACS measured on their output ports is 5 degrees.

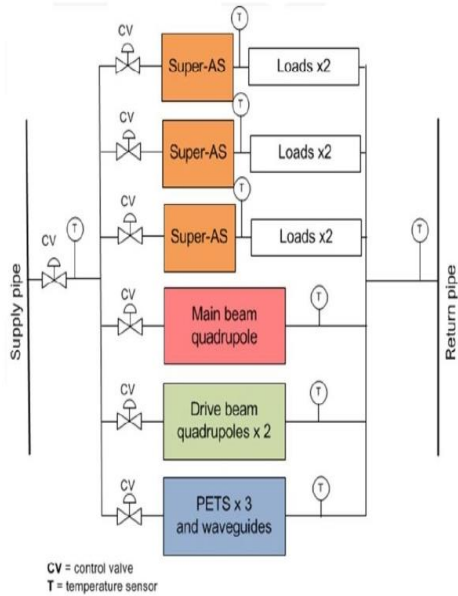


But when RF power comes from the PETS the phase difference is -175 degrees

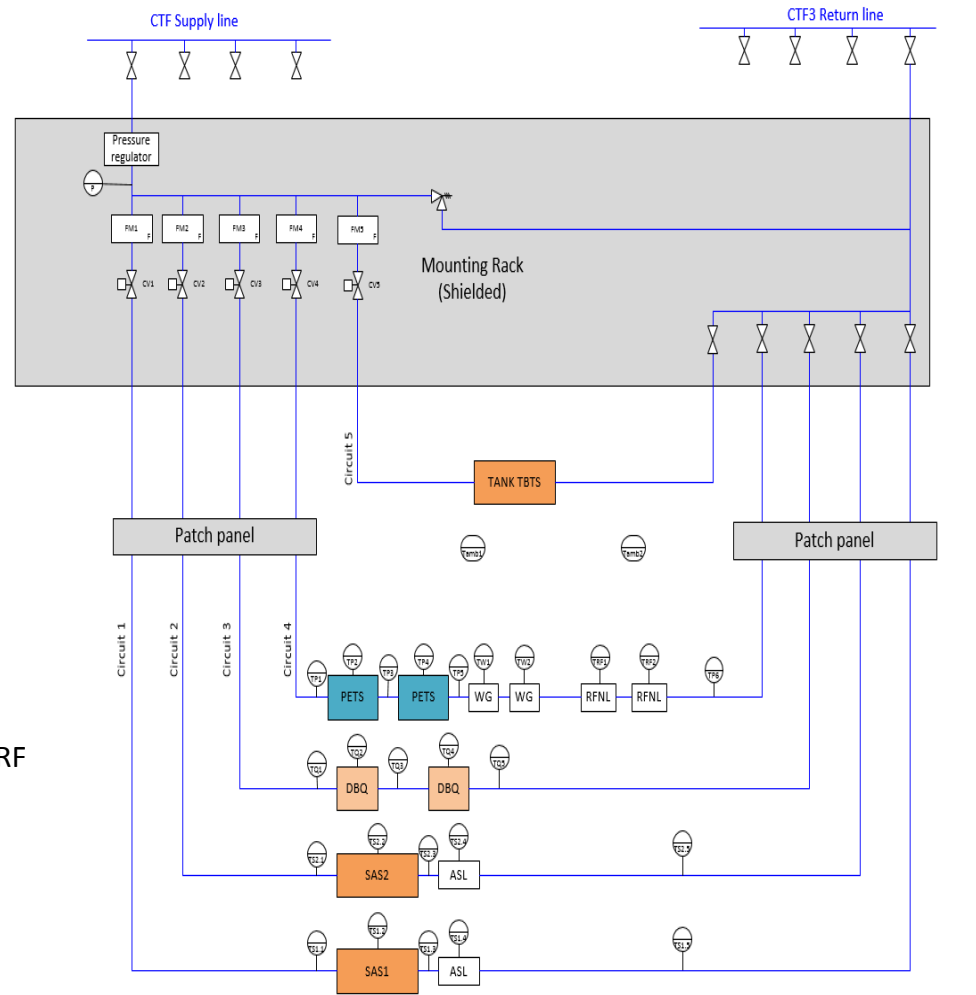


RF network (spot the difference)





CDR cooling layout (Fig. 5.144)

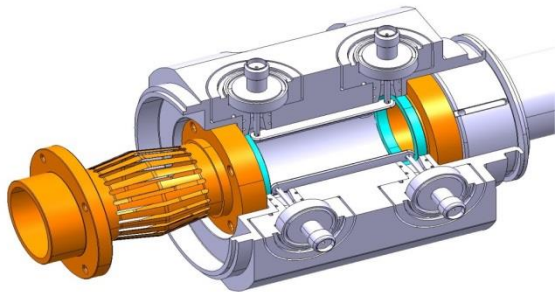
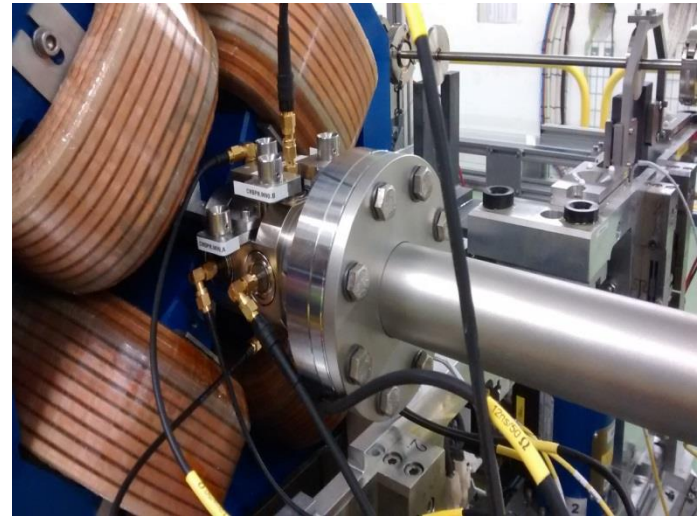


CLEX cooling layout

- Micron level stability requires accurate thermal control of the RF components
- 6200W to be dissipated
- Electronic control valves to regulate the cooling of each line separately
- Flow meters on each line to monitor the cooling capacity
- Multiple temperature sensors to monitor the temperature distribution over the module
- Provision for future upgrades

19 Dec 2014 W. Farabolini CLIC Project Meeting #19
 Testing of the TBM thermal behaviour will take place with RF power for the first time

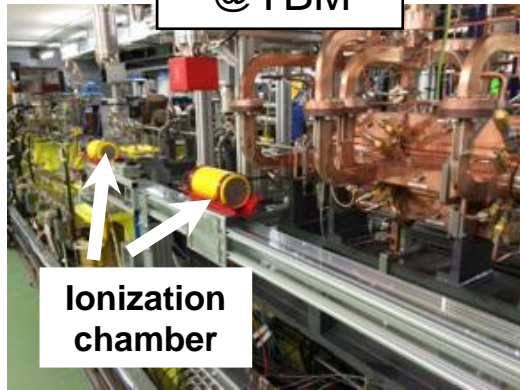
Parameter	Shorted BPM	Terminated BPM
Stripline length	25 mm	37.5 mm
Angular coverage	12.5% (45°)	5.55% (20°)
Electrode thickness	3.1 mm	1 mm
Outer radius	17 mm	13.54 mm
Ch. Impedance	37 Ω	50 Ω
Duct aperture	23 mm	23 mm
Resolution	2 μm	2 μm
Accuracy	20 μm	20 μm
Time Resolution	10 ns	10 ns



D. Gudkov BE-RF

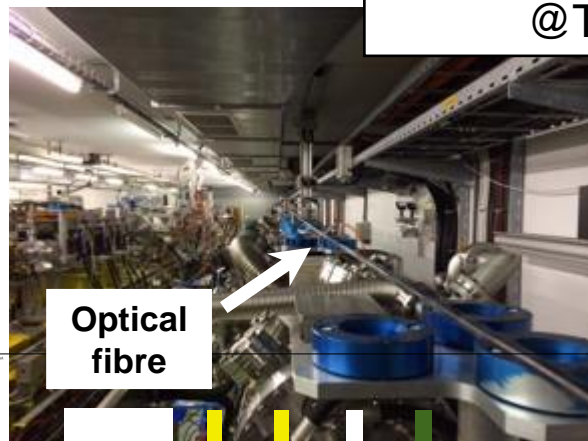
- Two units installed: CM.BPL0645, CM.BPL0685
- New FESA class developed for BPM control and data acquisition (TBM and TBL): CLEXBPM.

@TBM

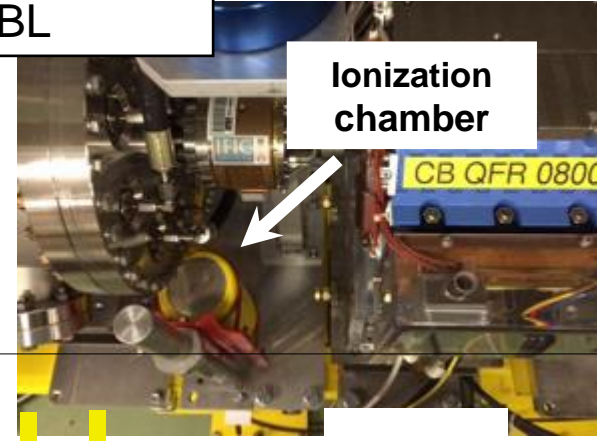


Ionization chamber

@TBL

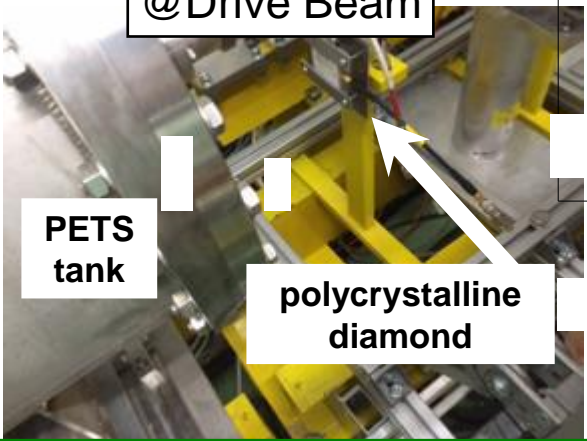


Optical fibre



Ionization chamber

@Drive Beam



PETS tank

polycrystalline diamond



■ Ionization Chambers
 ■ PEP-II
 ■ Optical Fibre

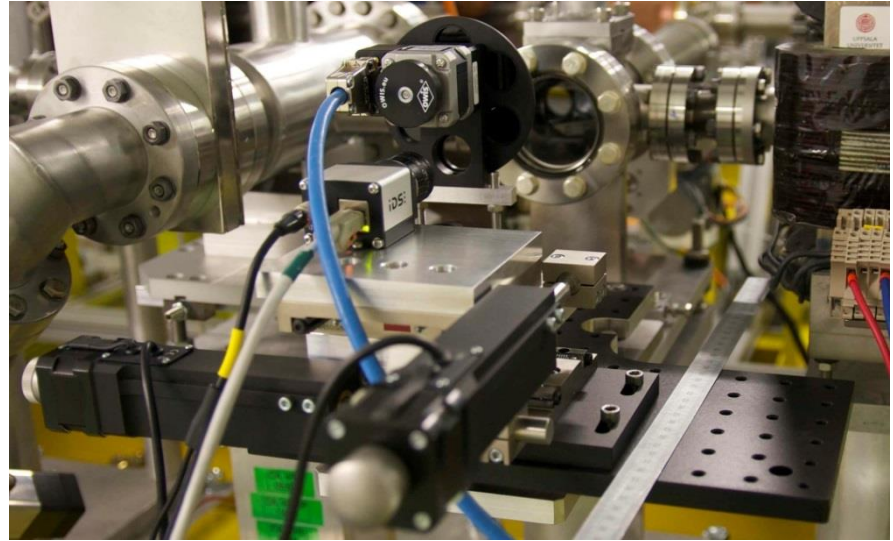
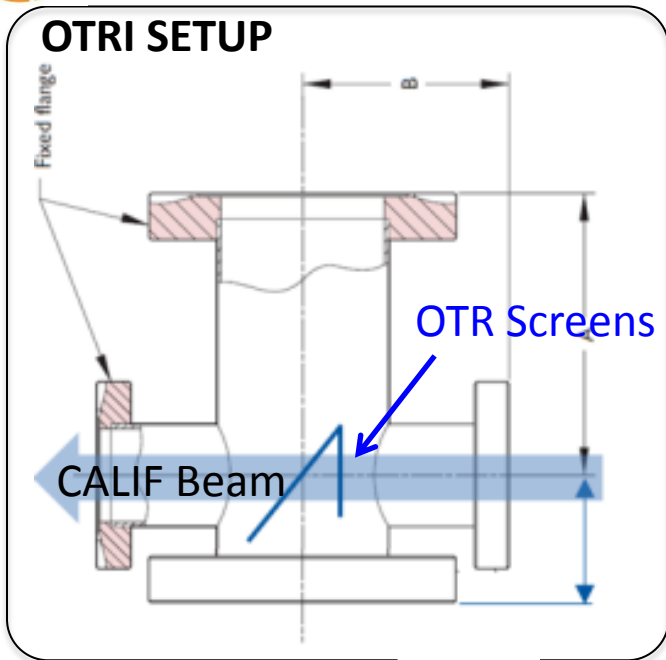
BLMs accessible via:
 OASIS
 Generic Sampler
 MATLAS scripts (preliminary)

Four technologies under investigation:

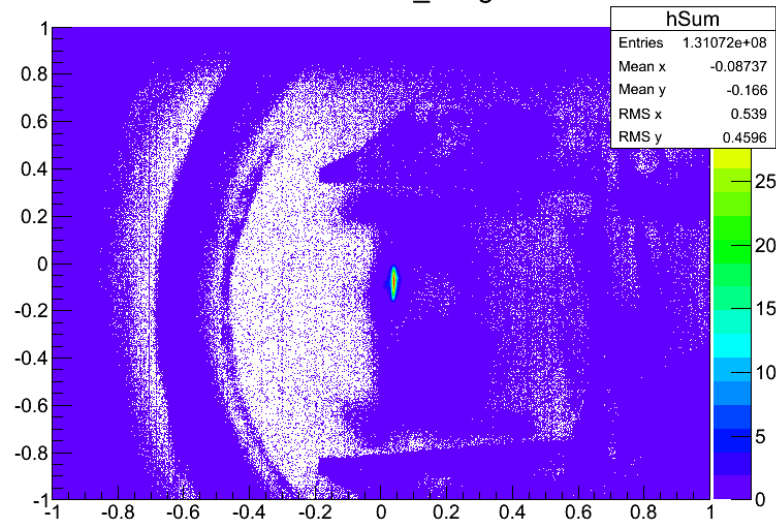
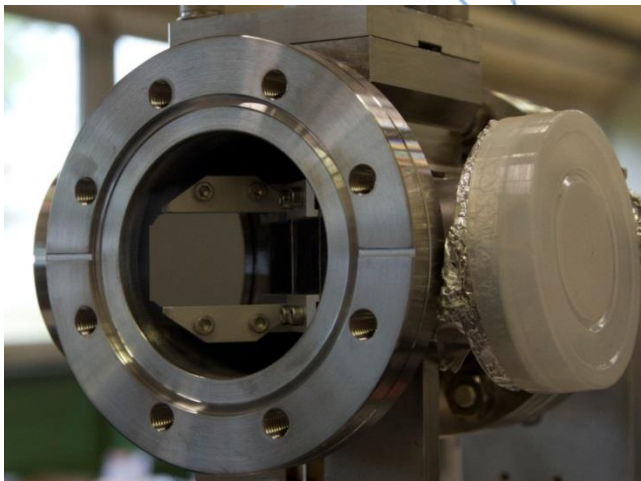
- **Ionization chambers**
nominal BLMs (as specified in CDR)
- **Quartz crystal (PEP -II) and optical fiber**
Cherenkov light based: Fast (PEP-II ~ 1 ns) and distributed (optical fibre)
- **Diamonds**
Fast (~ 1ns)
- **ACEMs** (for cross calibration)

CLIC OTRI (BI) experiment on CALIFES

R. Kieffer, S. Mazzoni, E. Bravin T. Lefevre

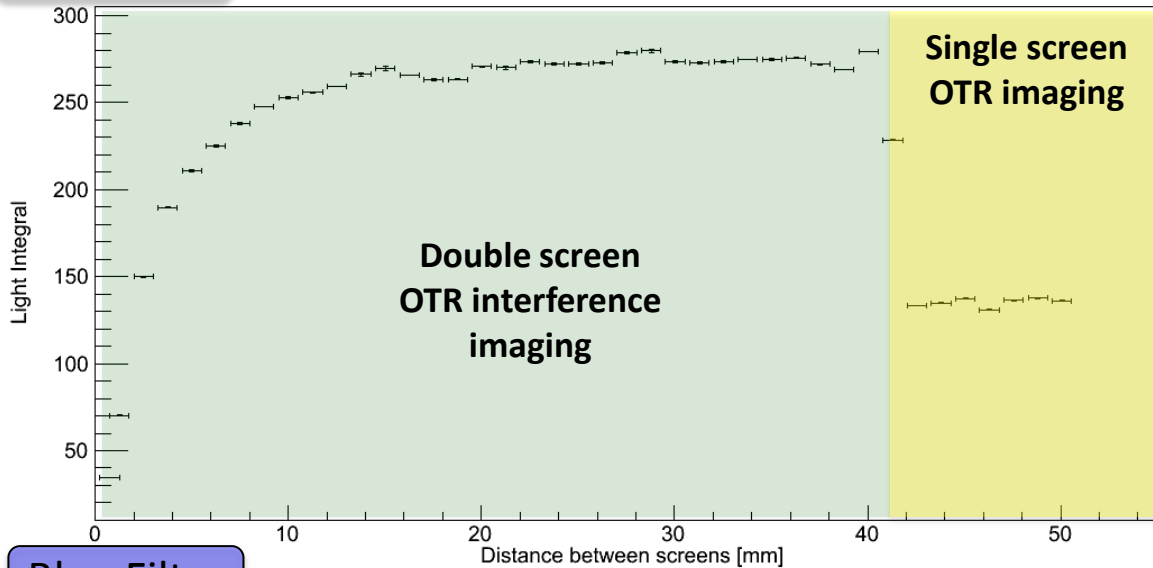


SumedOTRI_Image

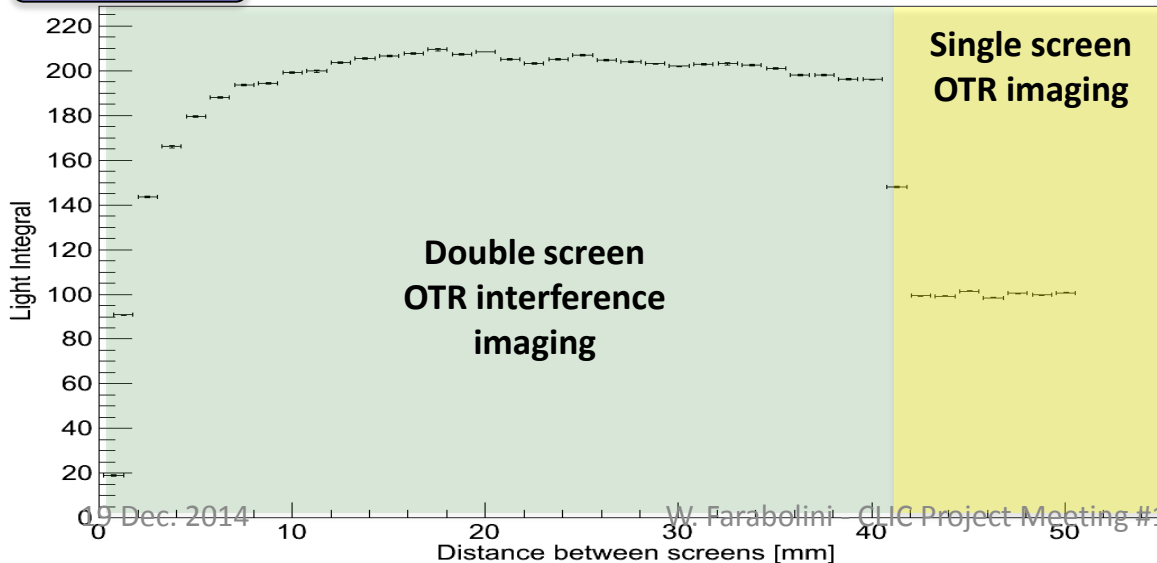


Red Filter

R. Kieffer, S. Mazzoni, E. Bravin T. Lefevre



Blue Filter



Purpose:

- Measure the shadowing effect of OTR.
- The effect depend on:
 - Distance between screens
 - Wavelength
 - Beam energy
- The light is integrated over 100 images for each point.
- Light data was compensated according to the beam charge measurement of BPMs.

Next step: Angular distribution

=>Add a lens and put the camera on the focal plane (2015).

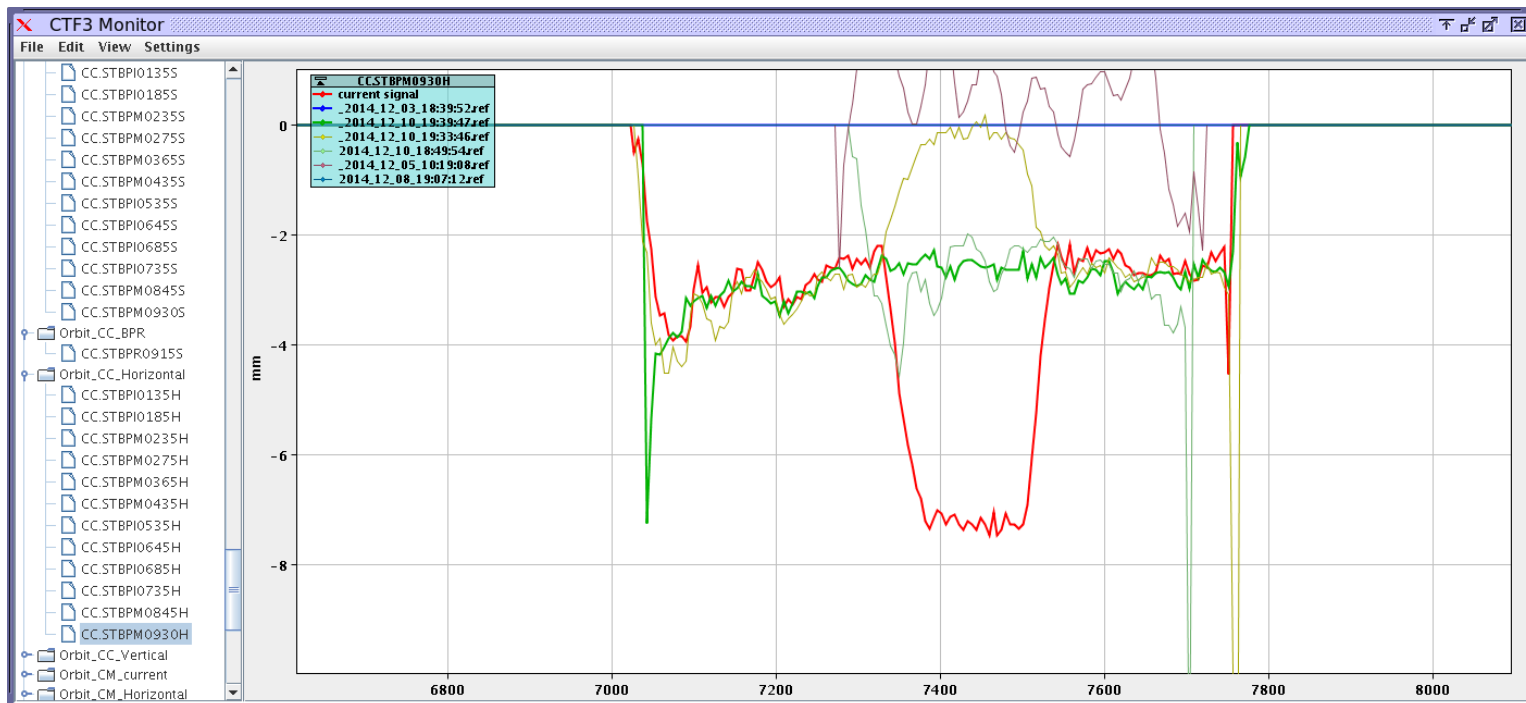


Phase Feed-Forward

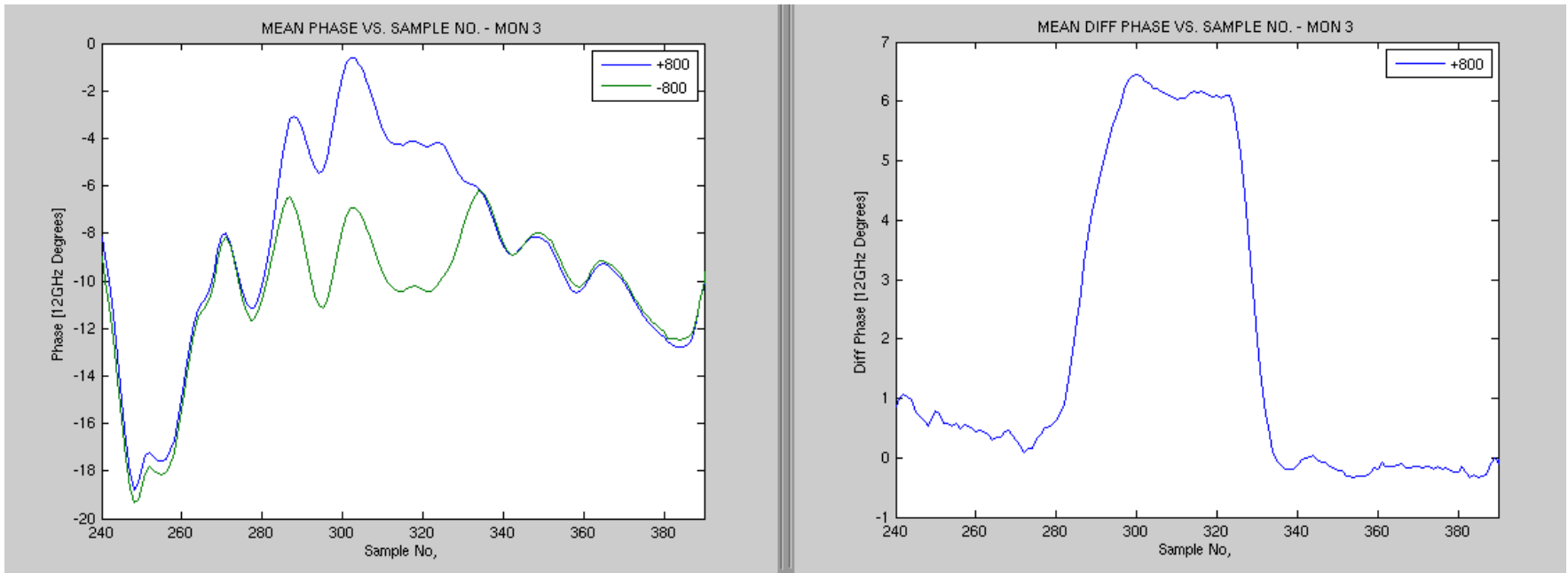
P. Skowronski



- In October the first amplifier prototype arrived from Oxford, making the PFF system complete
 - This version delivers $\frac{1}{4}$ of the target power, i.e. 16 kW, what corresponds to ± 3 deg. range (at 12GHz)
- **Initial tests are very successful:** kicks clearly visible on beam position (response to a square pulse)



- In October the first amplifier prototype arrived from Oxford, making the PFF system complete
 - This version delivers $\frac{1}{4}$ of the target power, i.e. 16 kW, what corresponds to ± 3 deg. range (at 12GHz)
- **Initial tests are very successful:** and on beam phase



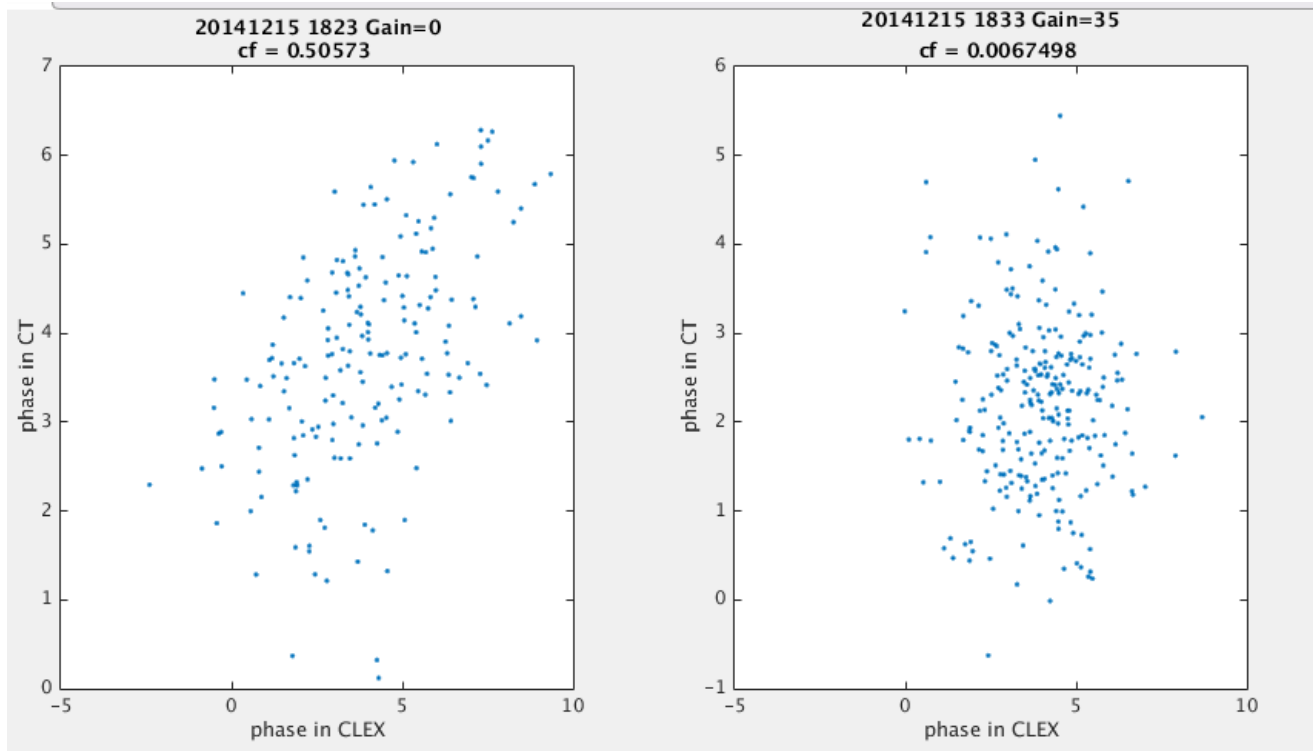


Phase Feed-Forward

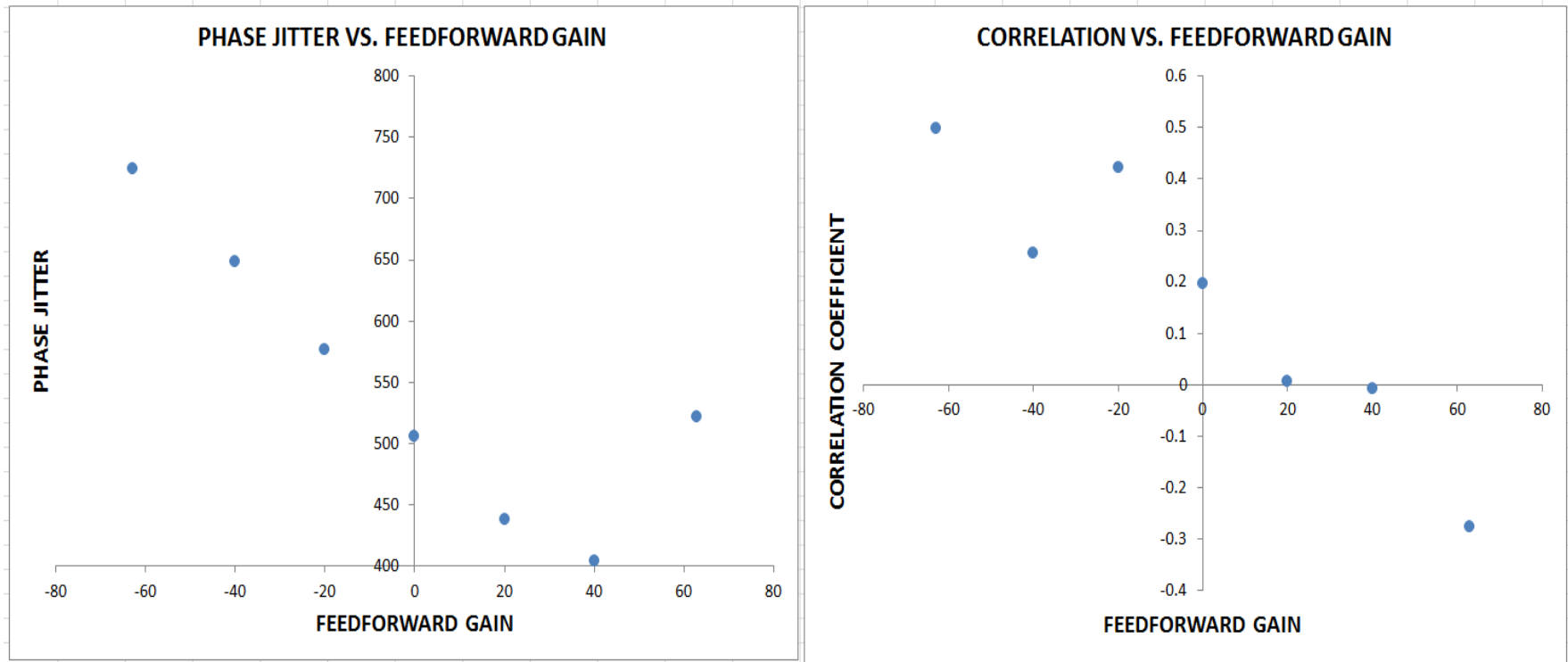
P. Skowronski



- In October the first amplifier prototype arrived from Oxford, making the PFF system complete
 - This version delivers $\frac{1}{4}$ of the target power, i.e. 16 kW, what corresponds to ± 3 deg. range (at 12GHz)
- **Initial tests are very successful:** the phase jitter observed behind the Stretching Chicane is removed



- The correlation Gain scan
 - The jitter is minimized and the correlation removed at the same value of gain





Phase Feed-Forward

P. Skowronski



- Unfortunately, the phase error in CLEX is not 1 to 1 with the one from the linac
 - Only 50 – 60 percent of correlation
 - The source of the additional error not yet understood, it seems it is related to the gun current ripple
 - There are 2 independent monitors in CLEX and their readings are 90% correlated → it is not the monitor problem
 - Data for analyses were collected and hopefully we will be able to improve the situation for the next run
- In order to test the system we induced phase errors in the injector, both pulse to pulse and intra-pulse
- Detailed results to be presented during the workshop



Conclusion

- TBM has been successfully installed during summer shutdown. The difficulties encountered will drive some improvements in the conception of the module. Great care was paid to the alignment of all the equipment.
- TBM is fit with many diagnostics and controls that promise a lot of exciting experiments.
 - Long life to TBM ! – Long life to CTF3 !

And than you for your attention