Instrumentation at CTF3 and relevance to CLIC

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On behalf of the CTF3 Instrumentation Team

CTF3 Instrumentation & CLIC

Adapted for **use in CLIC**

necessary to **test CLIC beam dynamics / RF issues**

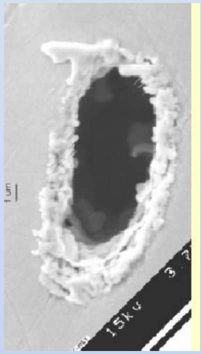
- Highlight difference between CTF3 and CLIC
  - Energy, single bunch charge, pulse length

- Review instrumentation along the CTF3 complex
  - Drive Beam, CR, DL
    - Longitudinal Diagnostics
    - Phase measurements
    - BPM development & rad hard electronics (details talk Lar's Soby)
  - Instrumentation TBL - new 2009
  - Two Beam Test Stand (TBTS) - new 2009
  - PHIN photo-injector (for CTF3 drive beam) – new 2009

CLIC drive beam vs CTF3

	CTF3	CLIC
Beam Energy (GeV)	0.15	2.4
RF Frequency (GHz)	3	1
Multiplication Factor	8	24
Initial Beam Current (A)	3.75	4.2
Final Beam Current (A)	30	100
Initial Pulse length (us)	**1.2**	**140**
Final Pulse Length (ns)	140	240
Total Beam Energy (kJ)	**0.7**	**1400**
Repetition Rate (Hz)	5	50
Average Beam Power (MW)	**0.0034**	**70**
Charge density (nC/cm^2)	**$0.4\ 10^6$**	**$2.3\ 10^{10}$**

Slide T. Lefevre



The thermal limit for 'best' material (C, Be, SiC) is $10^6\ nC/cm^2$

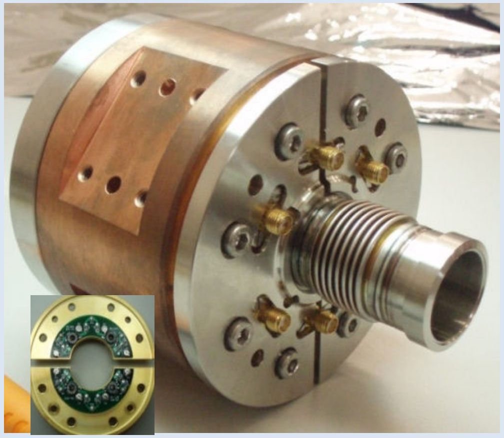
- Still considerable extrapolation to CLIC parameters
- Especially total beam power (loss management, machine protection)
- Development of non-destructive instruments
- Stability and reliability
- Resolution requirements stronger in all CLIC instruments compared to CTF3

Position Monitors - CLIC

CTF3 Sept. 2009, Operation

2 BPE's + 54 BPI's + 46 BPM's + 6 Re-Cavity BPM + 12 (+4) BPS + 5 WCM's

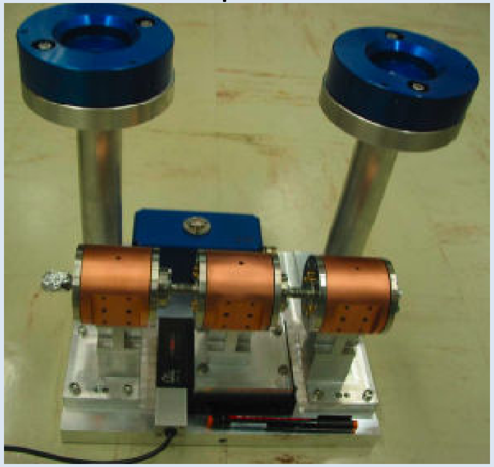
Inductive Pickup (BPS) - TBL



Juanjo Garrigós et al .Valencia Univ.

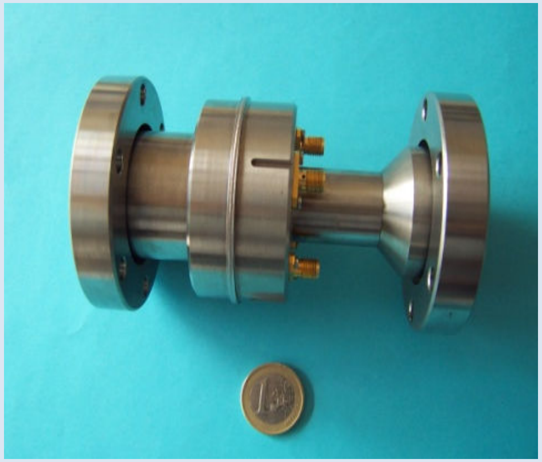
(based on M. Gasior BPM, scaled for reduced aperture – 24 mm)
16 units

Inductive Pickup - EuroTev BPM



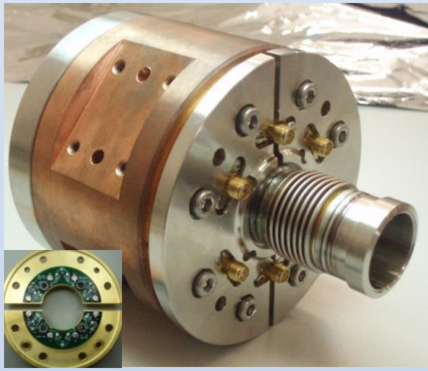
Lars Soby et al. @ CERN
3 units

Reentrant Cavity BPM - Califes

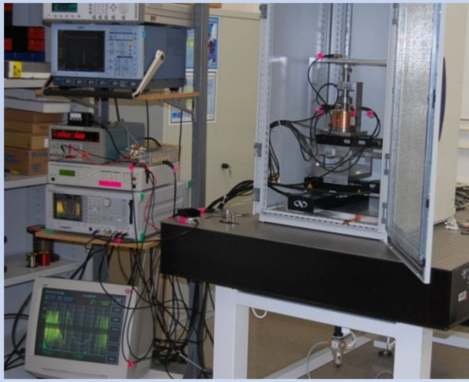


C. Simon, CEA Saclay
6 units

Beam Position Monitors for TBL (BPS)

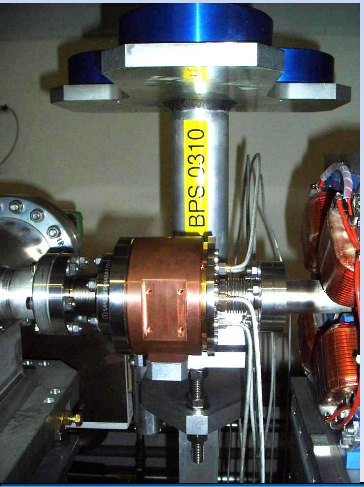


- **Beam Position Spanish** (BPS)
- Inductive BPM (Based on M. Gasior BPM's)
- **Univ Valencia,** Built and tested at IFIC.
- **16 BPS units** with alignment **supports**
- **Last units** are being installed in TBL.
- First **characterization test results** shows BPS performances under specifications (Accuracy ~30um).
- **Characterization Test-bench, last 12 BPS units delivered so far to TBL**



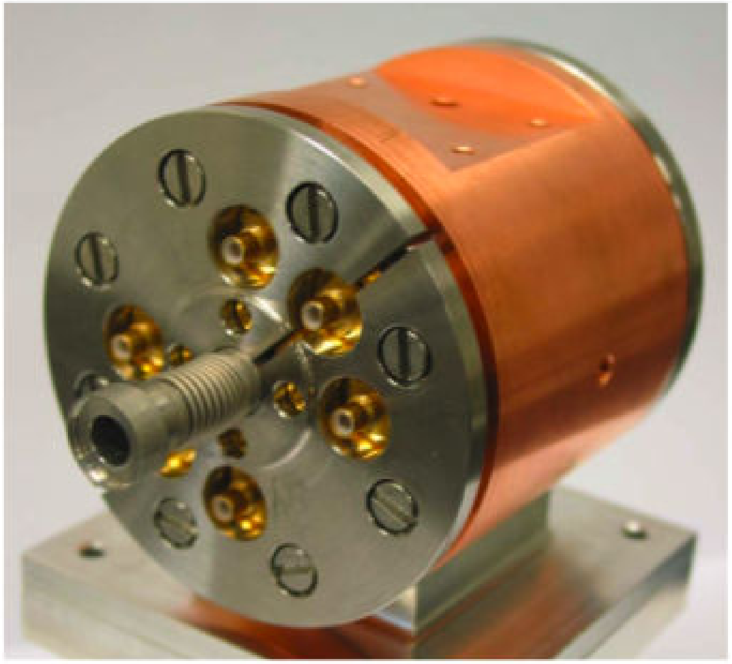
BPS Amplifiers :
Univ. Politècnica de Catalunya (UPC)

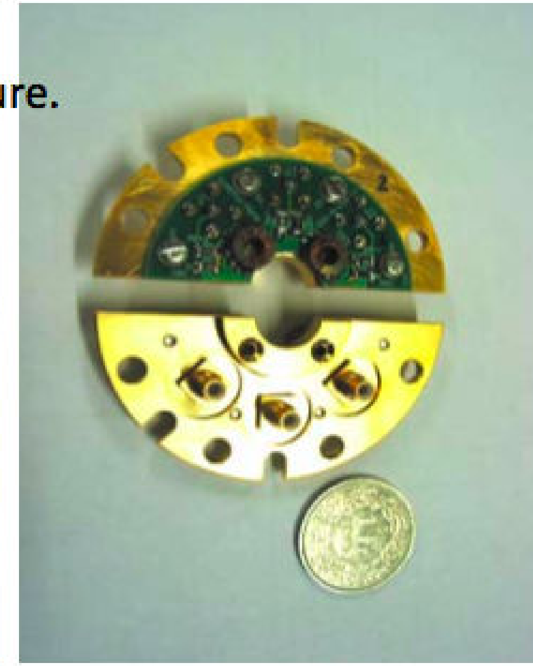
- 16 built
- Bandwidth 200 MHz
- Rad hard:

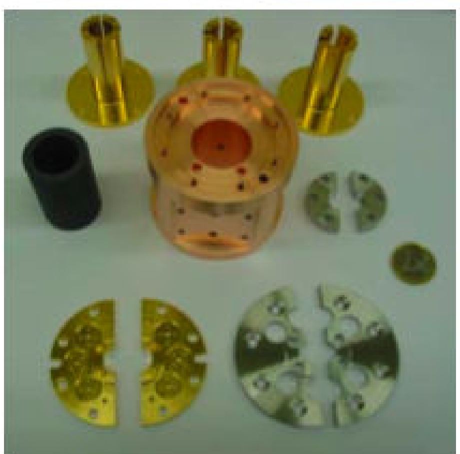


- Inductive BPMs could be suitable for final **CLIC drive beam**
- **Mechanical design** should be simplified, cost

EUROTeV PBPM







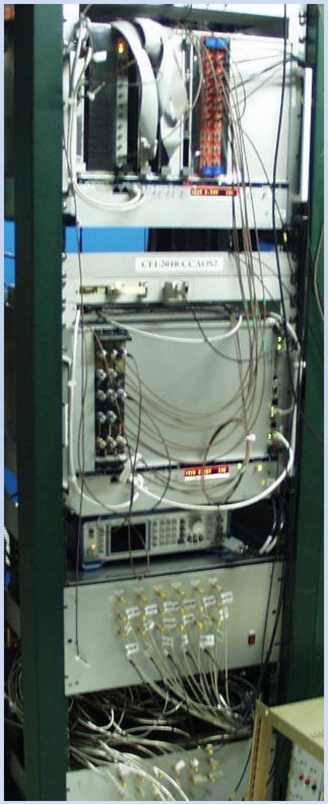
Measured 600nm resolution with beam in CTF3.

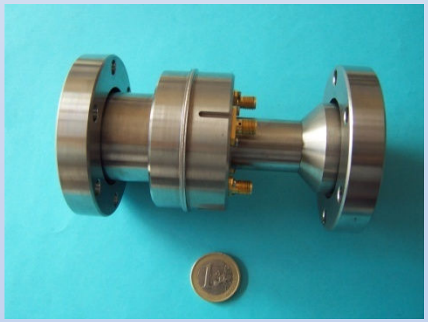
BPM details, L. Soby Talk CLIC Workshop 08, October 2008

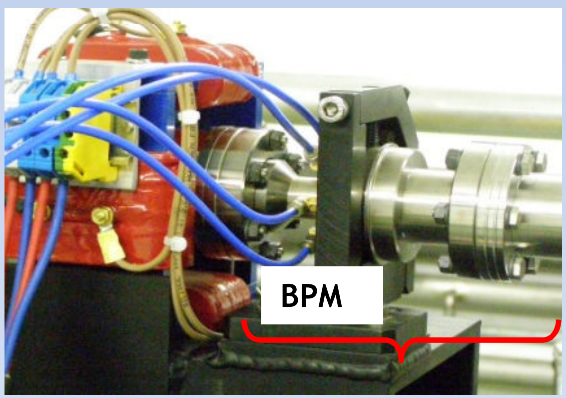
Re-entrant Cavity BPM for CALIFES (1)

Califes C. Simon, CEA Saclay

- It is operated in single and multi-bunches modes
- Charge beam measurement







Re-entrant Cavity at CALIFES

Eigen modes	F (MHz)	Q_l	$(R/Q)_l$ (Ω) at 5 mm	$(R/Q)_l$ (Ω) at 10 mm
	Measured	Measured	Calculated	Calculated
Monopole mode	3988	29.76	22.3	22.3
Dipole mode	5983	50.21	1.1	7

Damping time of the cavity : 2.8 ns

with 5 mm offset and charge = 0.6 nC → **Resolution :** < 5 µm (simulated)

with 0.1 mm offset and charge = 0.6 nC → **Resolution :** < 0.5 µm (simulated)

Position Monitors & CLIC

	Drive Beam	Main Beam	CAVITY BPM Saclay	EuroTeV BPM (P-BPM)	BPS
Accuracy	20 µm	5 µm			<50 µm
Resolution pos.	2 µm	50 nm	< 5 µm	0.600 µm (meas CTF3) 0.036µm (meas lab)	<5 µm
Range	< 5 mm	± 100 µm	± 5 mm	± 1.5 mm	± 5 mm
Bandwidth	35 MHz	35 MHz	119 MHz (cavity)	80 MHz	100 MHz
Beam tube aperture	23 mm	8mm	18 mm	6 mm	24 mm
Length [mm]	104/74 mm	95/65 mm	124.7 mm	99.7 mm	129.5 mm

LAPP in CTF3: Pick-ups acquisition

Initial motivation: *reduction of costs of long analog cables/VME ADCs with the idea that future electronics should be close to the beam.*

→ *Development of a rad-tolerant acquisition electronics close to beam.*

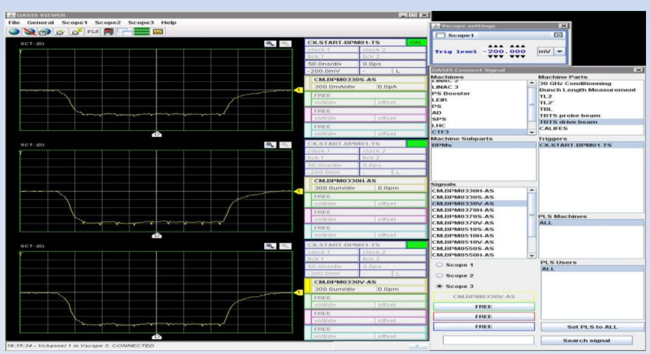
From November 2006 to summer 2009*: production and installation of 47 analog modules and 46 DFE boards in 12 crates in CR, TL2 and CLEX. Software development for FESA framework. Acquisition of BPM, BPI and BPS.*

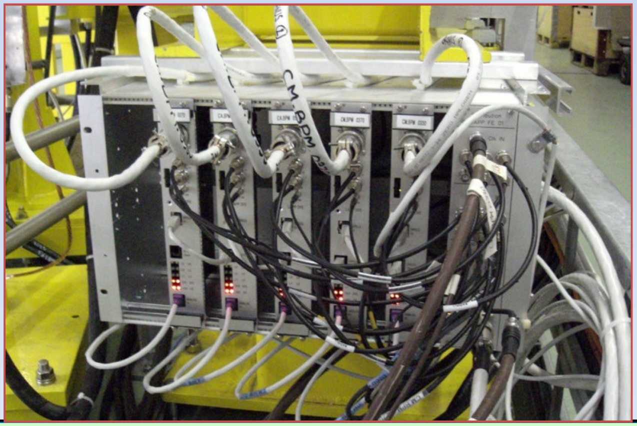
→ *Man power 2,5men/year FTE.*

→ *IN2P3 funding 100k€ .*

Results: ***local acquisition with a cost divided by a factor 3 comparing to a « far » acquisition***

Future: *LAPP writing a proposal to move R&D towards to CLIC specifications.*





Sebastien Vilalte, Talk at this workshop

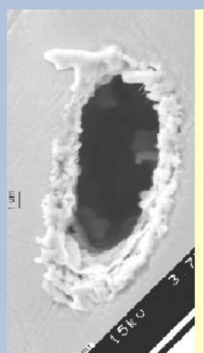
Profile monitors @ CTF3

12 TV stations for OTR based emittance measurements

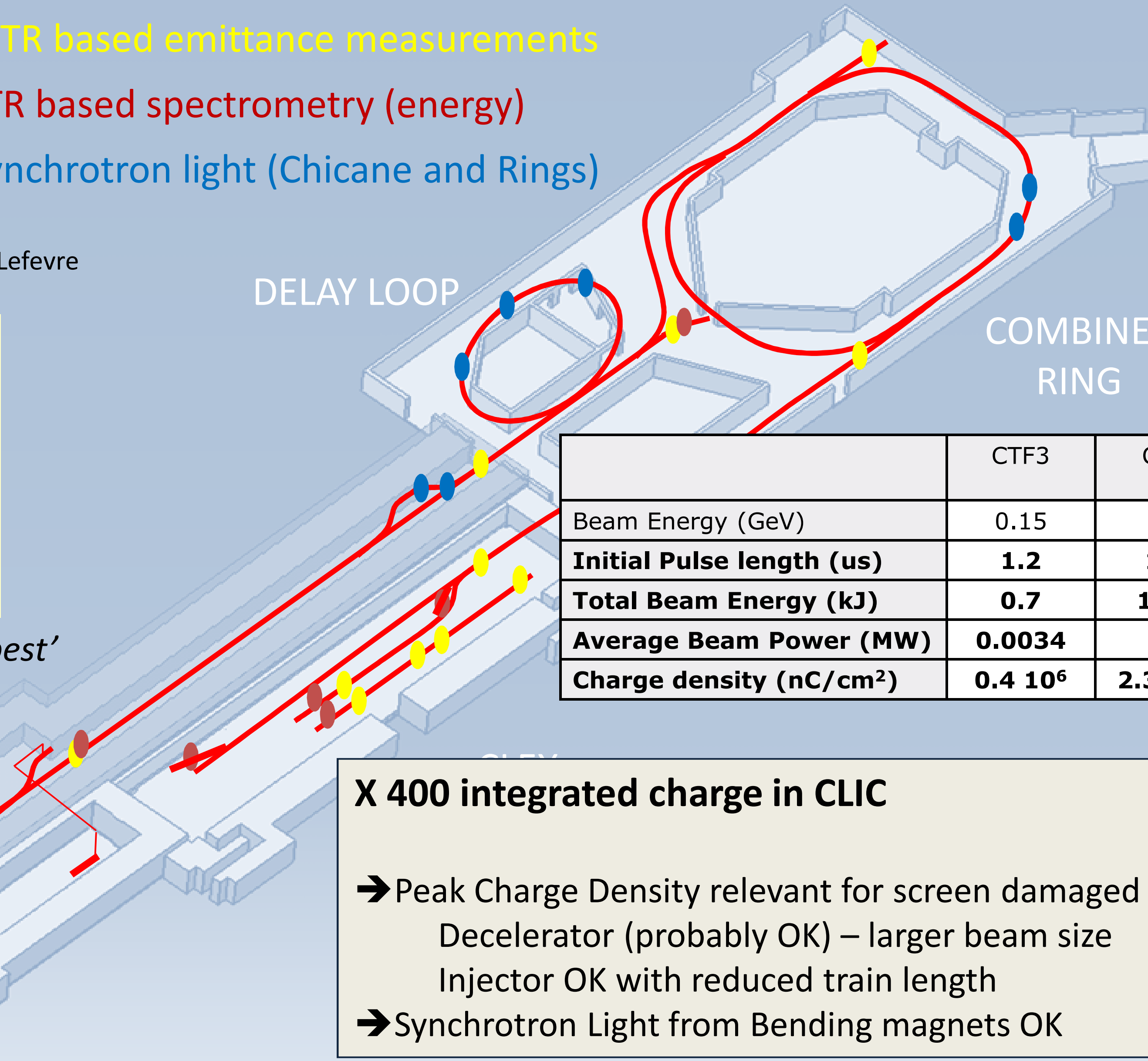
7 TV stations for OTR based spectrometry (energy)

7 TV stations for Synchrotron light (Chicane and Rings)

T. Lefevre



The thermal limit for 'best' material (C, Be, SiC) is 10^6 nC/cm²



	CTF3	CLIC
Beam Energy (GeV)	0.15	2.4
Initial Pulse length (us)	**1.2**	**140**
Total Beam Energy (kJ)	**0.7**	**1400**
Average Beam Power (MW)	**0.0034**	**70**
Charge density (nC/cm²)	**$0.4\ 10^6$**	**$2.3\ 10^{10}$**

X 400 integrated charge in CLIC

➔ Peak Charge Density relevant for screen damaged
- Decelerator (probably OK) – larger beam size
- Injector OK with reduced train length

➔ Synchrotron Light from Bending magnets OK

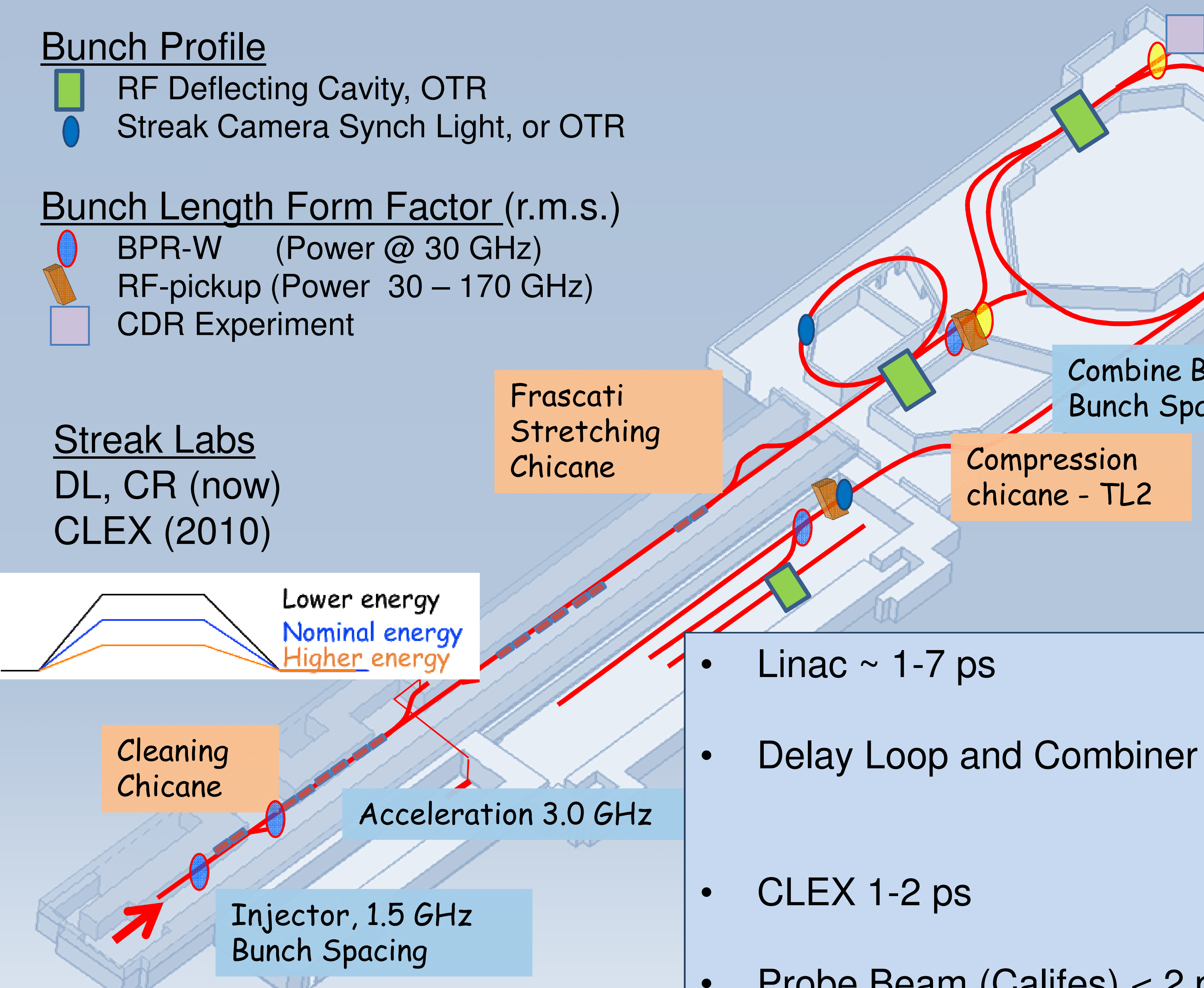
Longitudinal Measurements

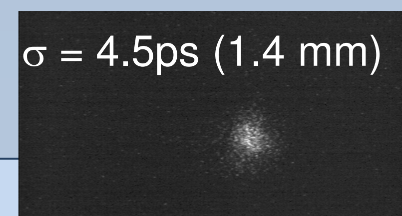
Longitudinal Beam Dynamics Considerations

Bunch Profile
- RF Deflecting Cavity, OTR
- Streak Camera Synch Light, or OTR

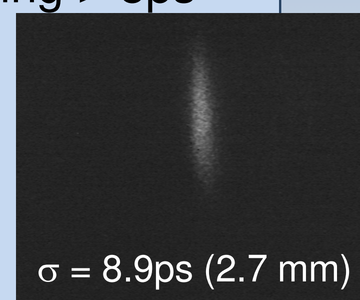
Bunch Length Form Factor (r.m.s.)
- BPR-W (Power @ 30 GHz)
- RF-pickup (Power 30 – 170 GHz)
- CDR Experiment

Streak Labs
DL, CR (now)
CLEX (2010)



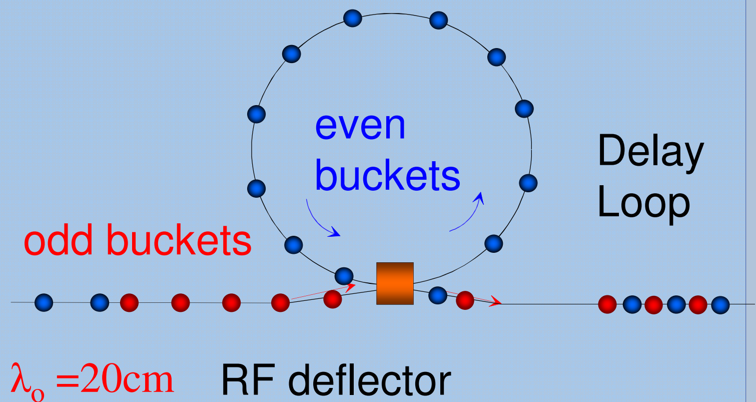


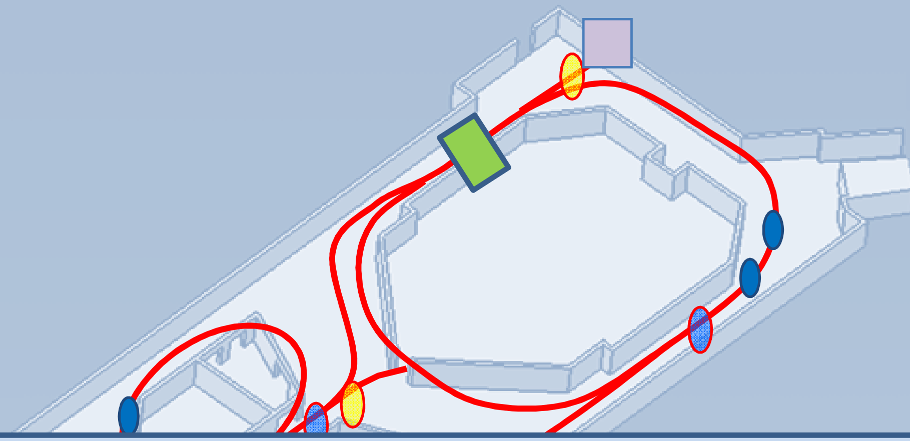
- Linac ~ 1-7 ps
- Delay Loop and Combiner Ring > 8ps
- CLEX 1-2 ps
- Probe Beam (Califes) < 2 ps



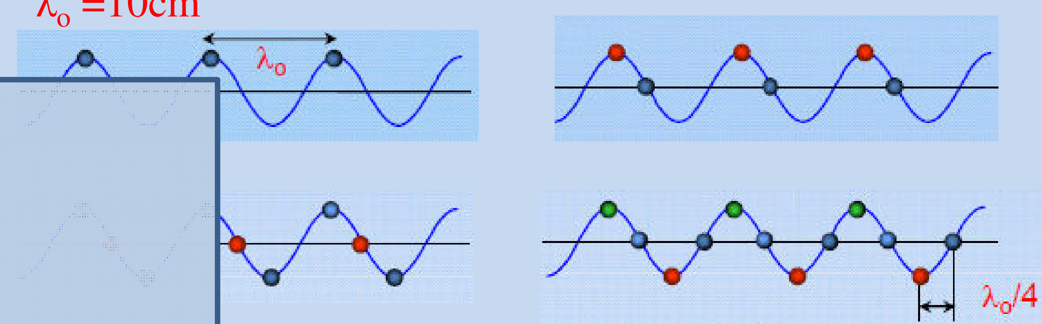
Longitudinal Beam Dynamics Considerations

Combination scheme





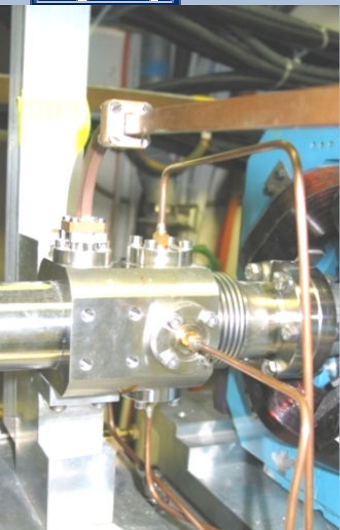
Combiner Ring Multiplication



Bunch combination efficiency

- **Streak Camera using Synch Light**
- **BPR** (3 GHz Beam signal mixed with ref. 3 GHz signal)
- **Phase monitor**
  - DL: Harmonics of 1.5 GHz and 3.0 GHz
  - CR: Harmonics of 3 GHz [6, 9 12, 15 GHz]

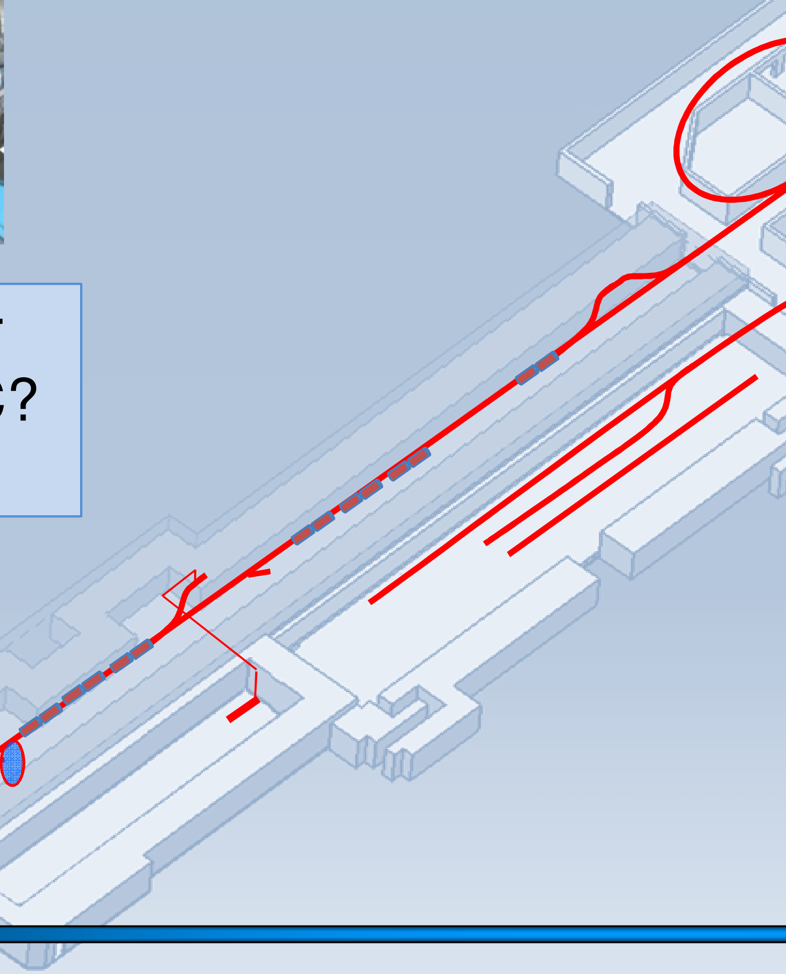
Longitudinal – BPR – phase monitor

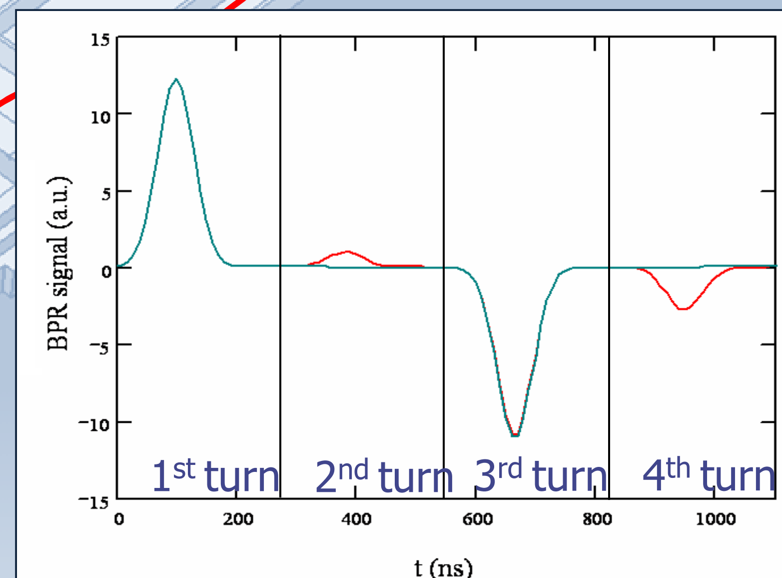


Applications BPR 3 GHz

- Used as relative phase monitor
- Measure ring length

Adapted for use in CLIC? Yes



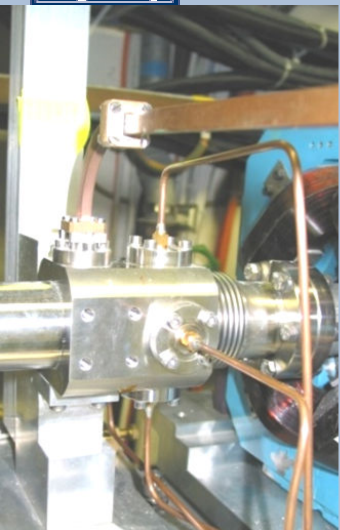


Simulated signal

Combination factor 4

Combination factor 4 with ± 5° error

Longitudinal – BPR – phase monitor

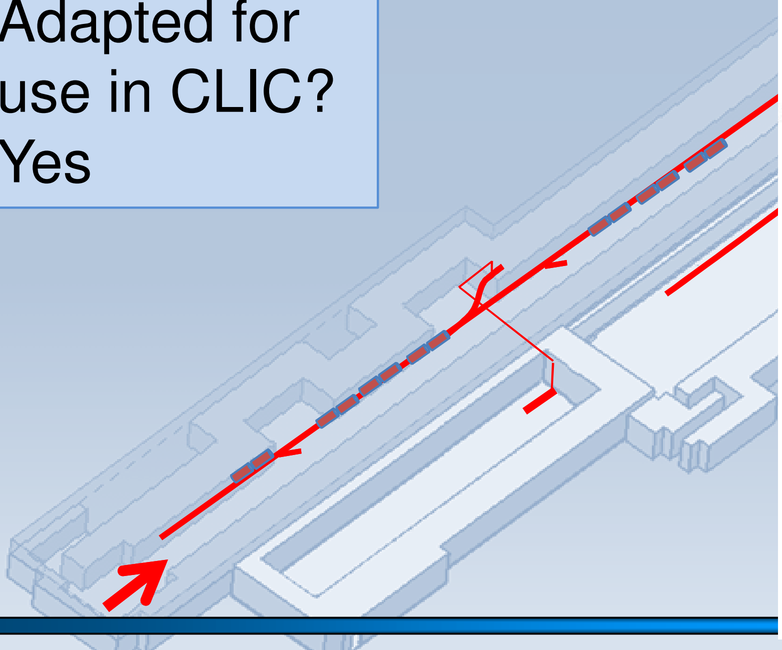


Phase Monitor

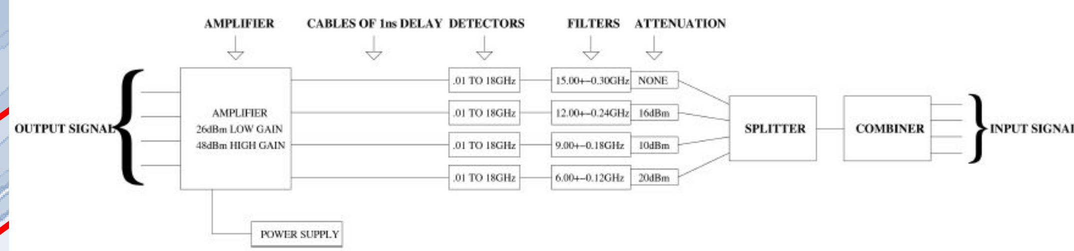
1. DL: Harmonics of 1.5 GHz and 3.0 GHz
2. CR: Harmonics of 3 GHz [6, 9 12, 15 GHz]

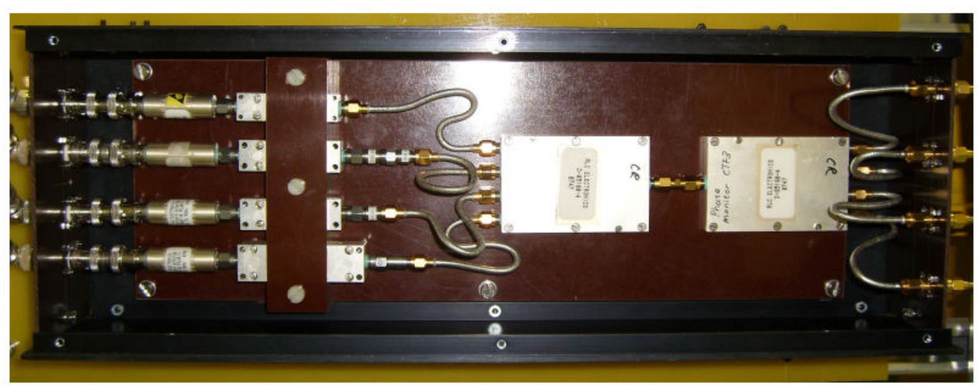
System of filters and diodes

Adapted for use in CLIC? Yes

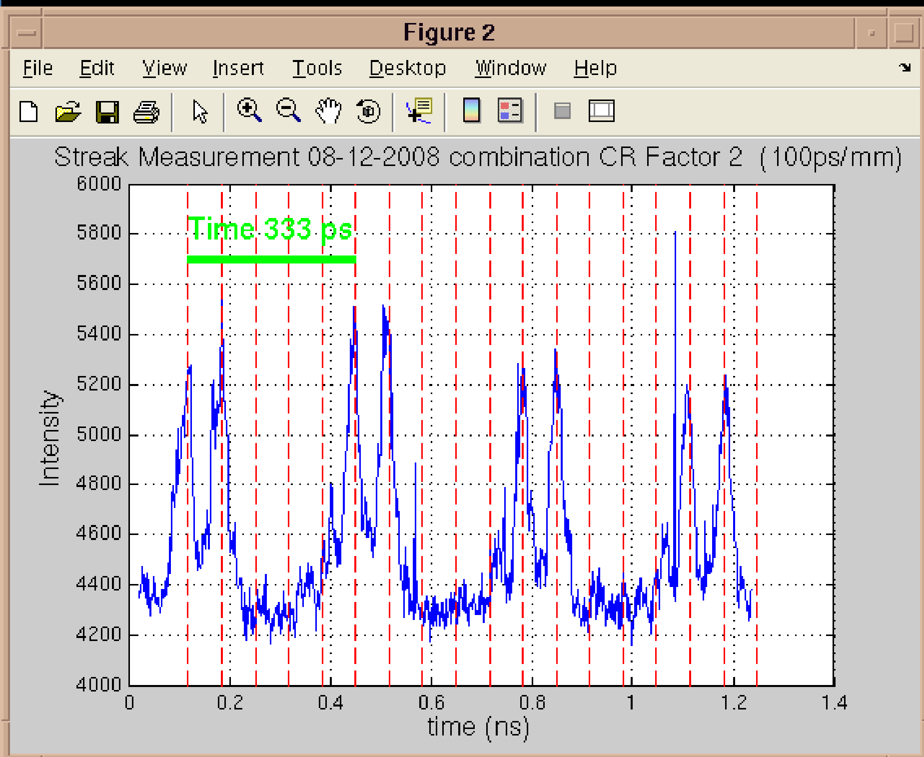


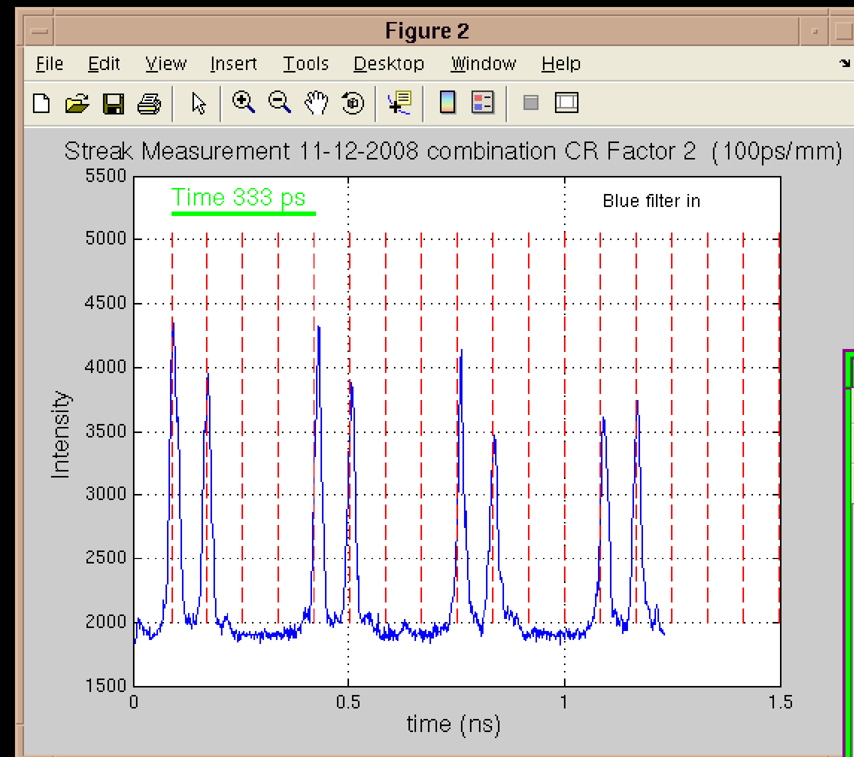
Phase monitor





Streak Camera during CR Commissioning





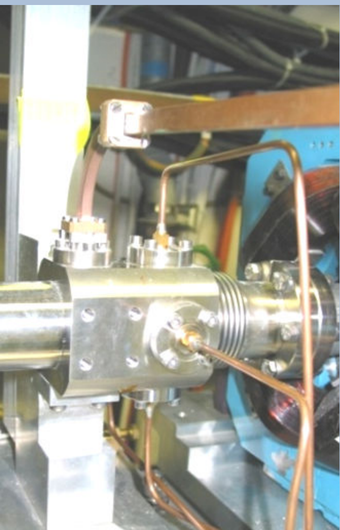
Poor Combination → Spacing between bunches 333ps/5

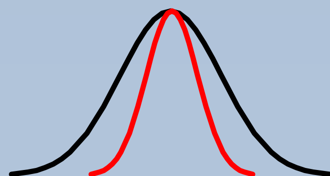
Good Combination → Spacing between bunches 333ps/4

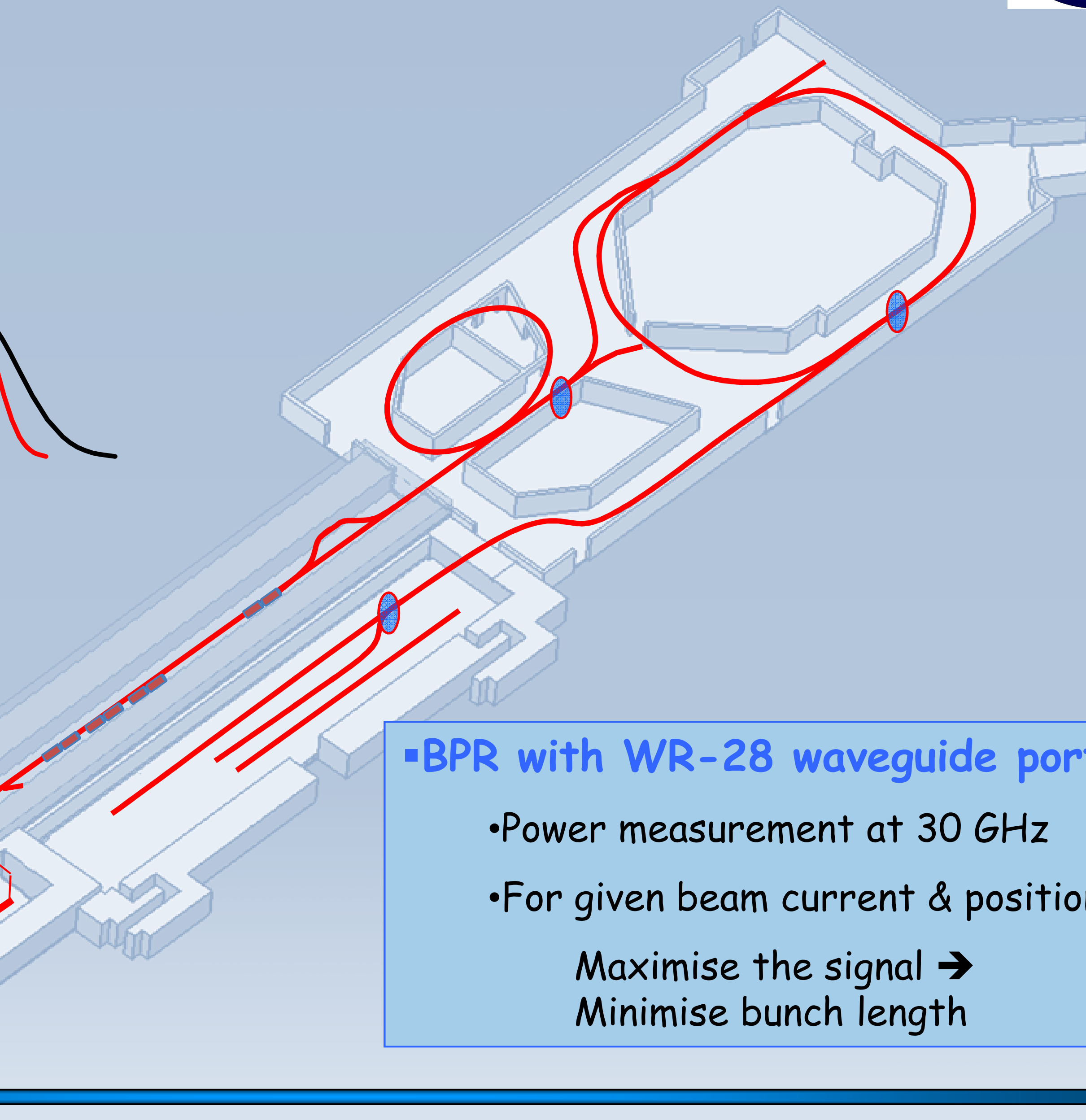
Sweep 100ps/mm

Adapted for use in CLIC? Yes

Relative Bunch Length – 30 GHz waveguide port





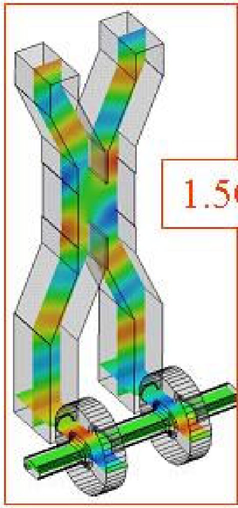


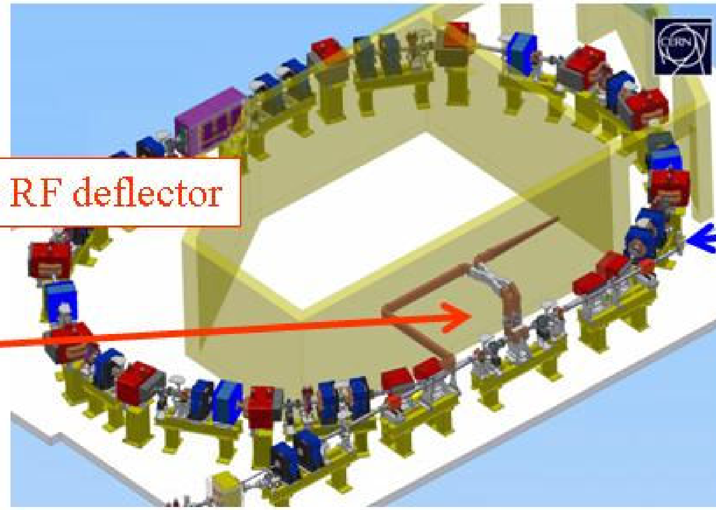
Adapted for use in CLIC? Yes

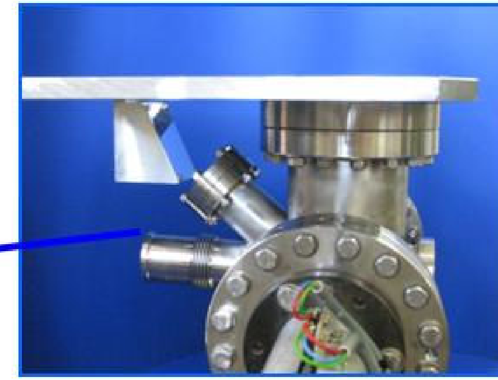
- **BPR with WR-28 waveguide port**
  - Power measurement at 30 GHz
  - For given beam current & position:

    Maximise the signal ➔ Minimise bunch length

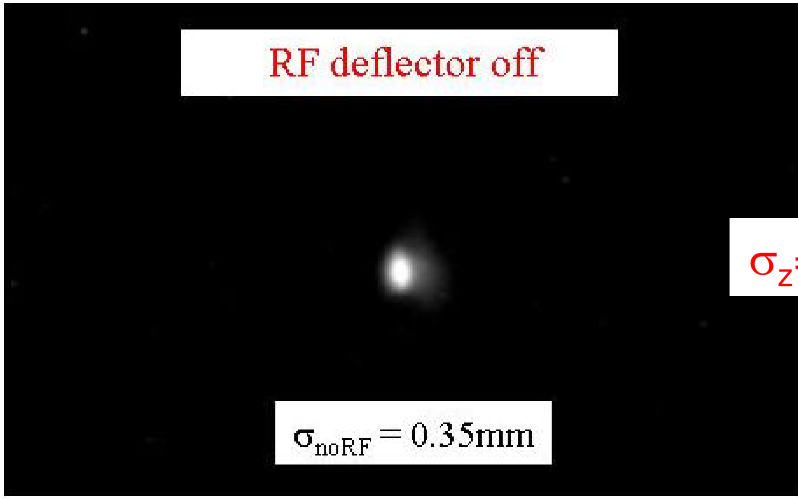
RF by Deflecting Cavity



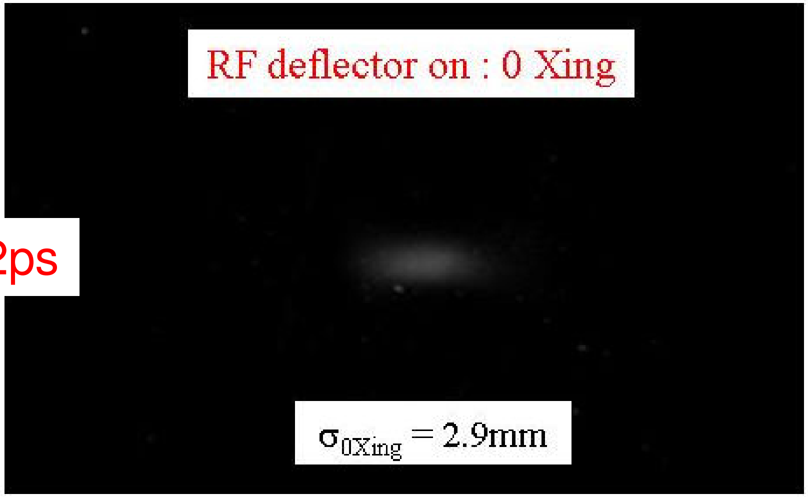




OTR screen



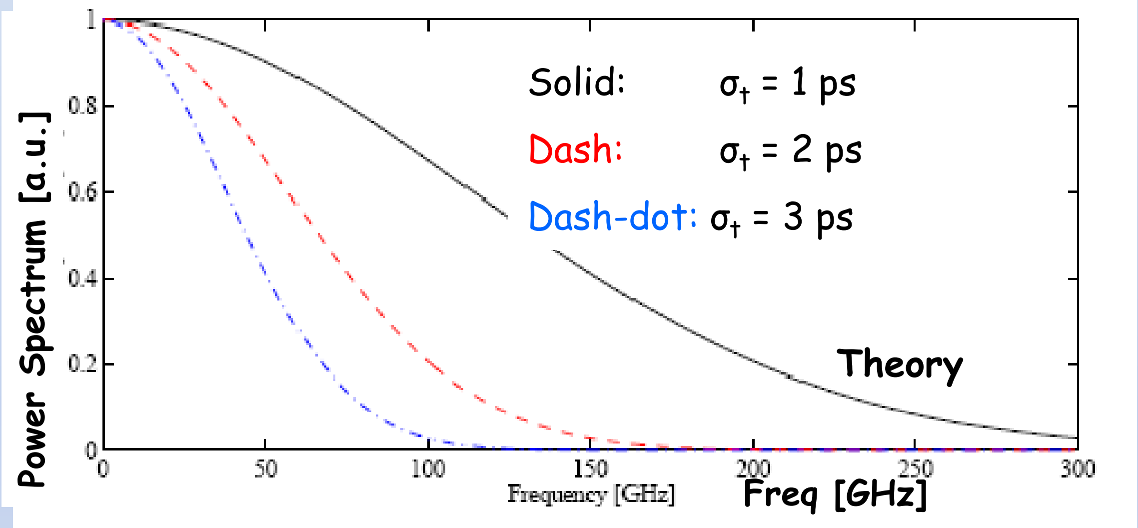
σ_z=2ps

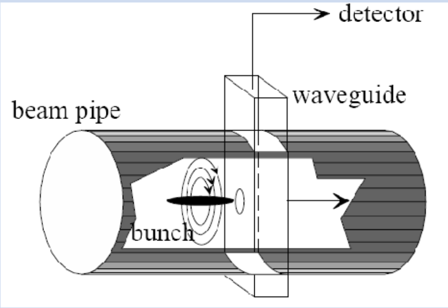


T. Lefevre

Bunch length measurement with "RF Pickup"

Power spectrum for Gaussian bunches of different length.





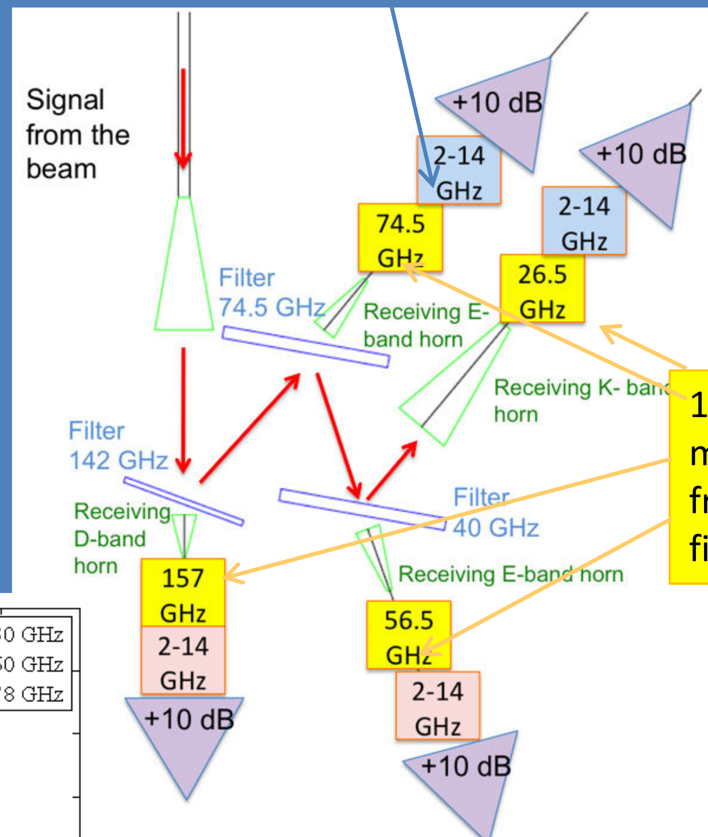
(30 – 39) ; (45-69) ; (78-90) & (147-171) GHz

PAC07 proceedings, http://doc.cern.ch/archive/electronic/cern/preprints/ab/ab-2007-070.pdf

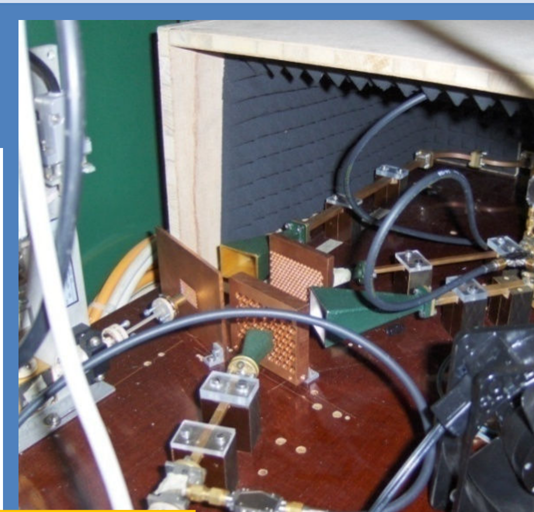
Bunch length measurement with "RF Pickup"

Non-intercepting device,
- ➔easy to implement in machine
- ➔Sub-ps resolution (0.3 ps based on existing hardware)
- ➔Self calibrating (perform bunch length scan, assume certain bunch shape)
- ➔Relatively inexpensive

2nd down mixing frequency variable

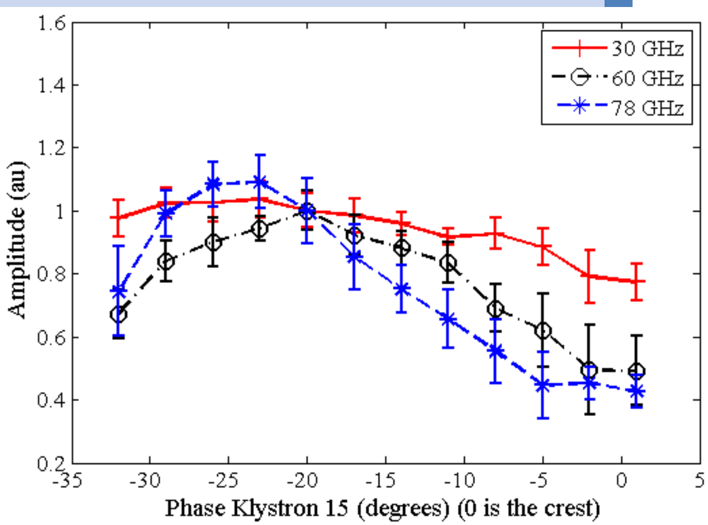


1st down mixing frequency fixed



Acqiris DC282 Digitizer 2GS/s per channel

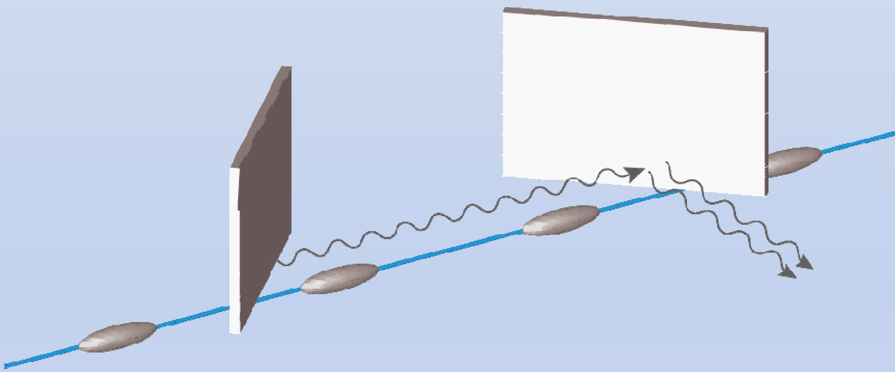
Adapted for use in CLIC?
YES



Work ongoing to fully understand performance
First benchmarking against RF deflector LINAC08

Longitudinal profile measurements

- Coherent Diffraction Radiation (CDR)
  - Charged particle beam travels in the vicinity of a target
  - DR is emitted by the target
  - Signal spectrum $S(\boldsymbol{\omega})$ can be obtained by an interferometer
  - Longitudinal bunch form factor $F(\boldsymbol{\omega})$ can be reconstructed using the coherent radiation part of diffraction radiation



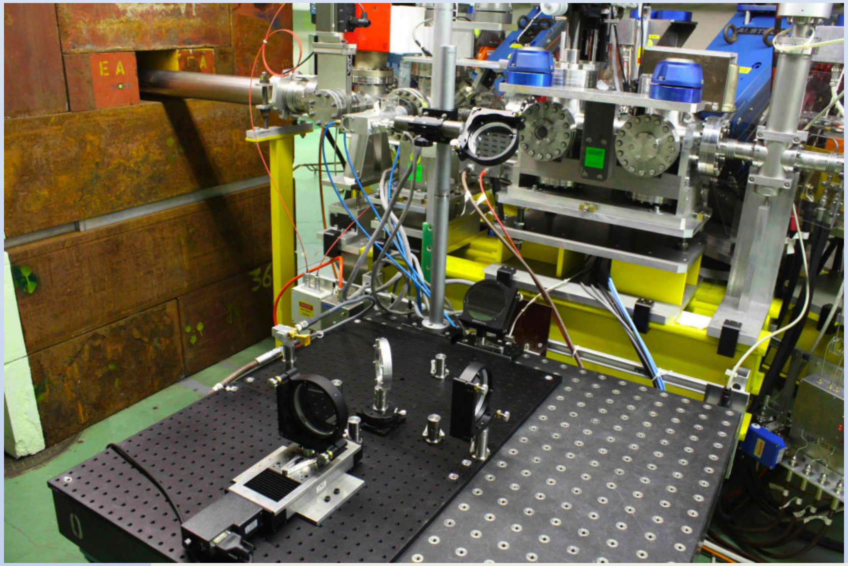
$$S(\boldsymbol{\omega}) = [N_e + N_e (N_e - 1) F(\boldsymbol{\omega})]\, S_e(\boldsymbol{\omega})$$

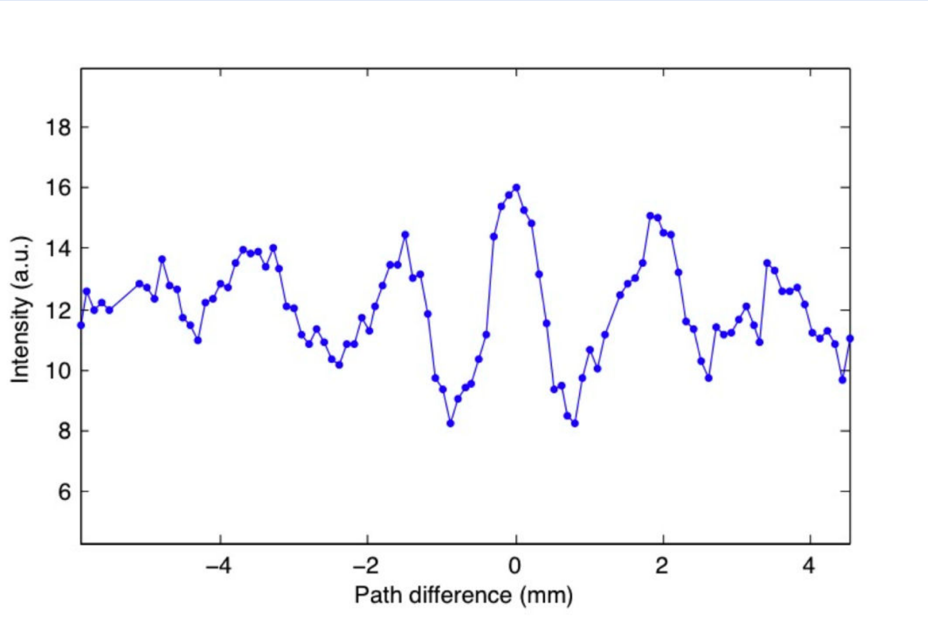
Incoherent part (N_e) — Coherent part ($N_e (N_e - 1) F(\boldsymbol{\omega})$)

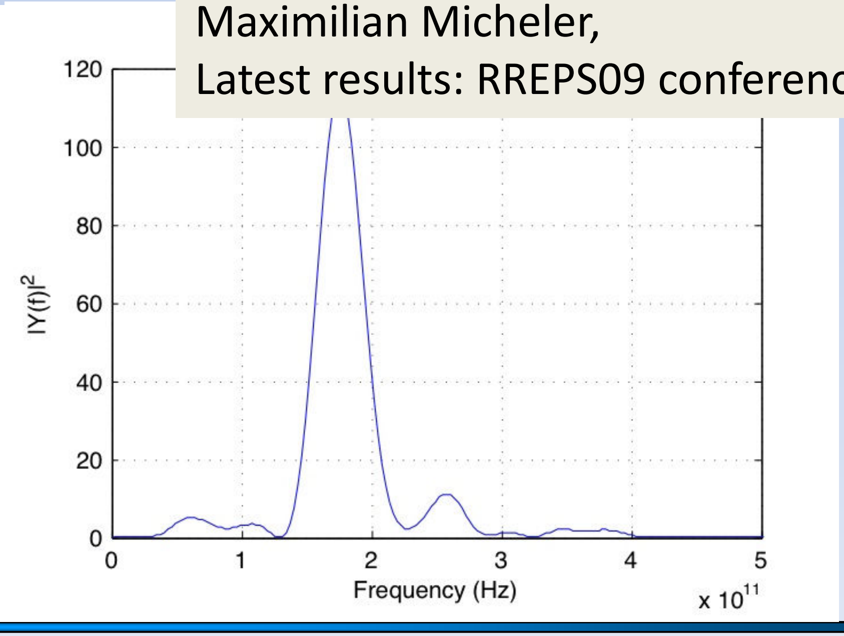
Maximilian Micheler

Longitudinal profile measurements

- CDR system installed in CTF3
  - Installed in the CRM line
  - System with a single target and interferometer available since April 2009
  - Established working order and obtained first interferogram for CSR
  - First spectrum of CSR extracted







Maximilian Micheler,
Latest results: RREPS09 conference

- Work to be done before end of 2010
  - Off-centre flange to minimize backgrounds will be installed shortly
  - Obtain CDR and CSR interferograms
  - Modify/refine reconstruction method using Kramers-Kronig relation
  - Upgrade the system in February/March: second target will be installed
- Resolution expected:
  - In principle, there is no limit for the minimum bunch length to be measured
  - The spectral response of the detector simply needs to be adapted to the bunch length at the measurement station
  - Resolution is mostly affected by the reconstruction method
- For 2011 …
  - Detector design, adapted for particular CLIC parameters, simple with few as possible active components in system (cost effective + reliable)

Maximilian Micheler

Summary Longitudinal Devices & CTF3 CLIC

CLIC Drive Beam Complex and CTF3 have comparable bunch length and bunch spacing – provide test bed for CLIC Drive beam Devices

R&D should continue on cost effective, non-destructive techniques

- RF Pickup
- Coherent Diffraction Radiation (CDR)

Cross Calibrated against RF-Deflector and Streak Camera (bunches > 2ps)

Use Califes to to bench mark diagnostics for shorter bunches ?

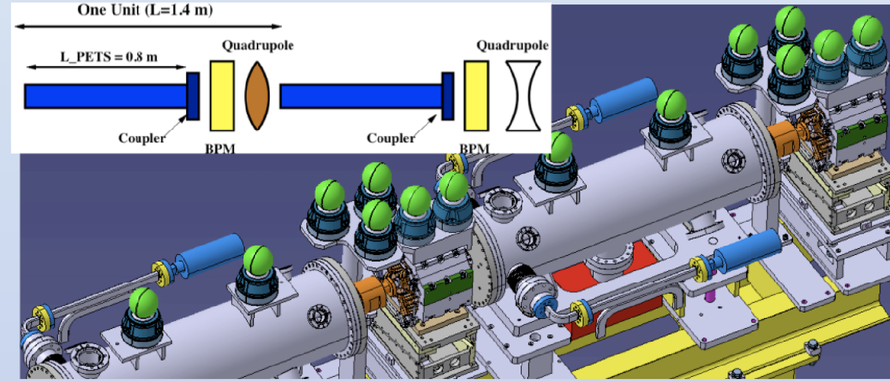
- CLIC Bunch Form factor measurements
  - DB decelerator for RF production efficiency verification : 300fs resolution
  - MB for feedback : 30fs resolution

Difficult to test that @ CTF3 → will work on 300 fs resolution for RF-pickup and CDR by 2010

TBL – study decelerated beam

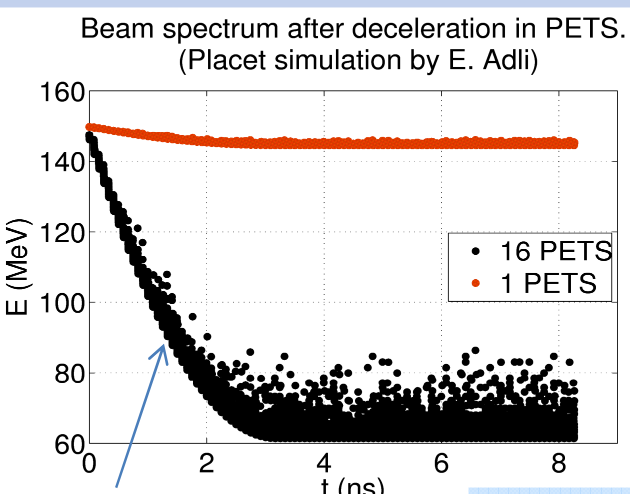
Verify beam dynamics of CLIC decelerator, scaled to current, energy of CTF3

- 16 PETs in final line
- measure beam energy before & after deceleration
  - compared to simulation



TBL girder BPS on precision movable support

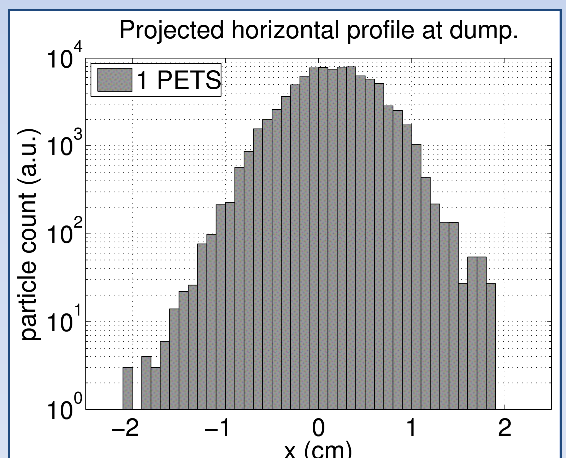
Energy

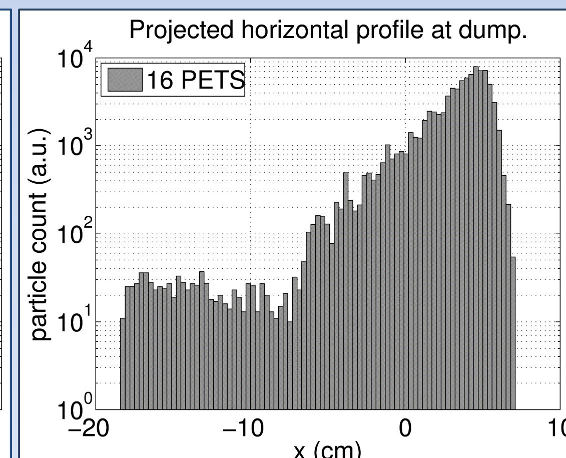


High energy transient

Nominal pulse length: 140 ns

Corresponding transverse profile in 10 spectrometer



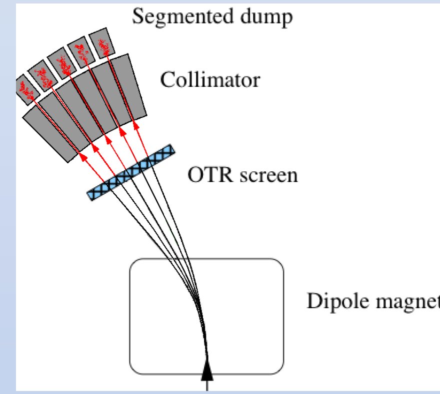


E. Adli Placet simulatiions

TBL – Time resolved Energy - NEW

Instrumentation design by CERN/Uppsala PhD Student **Maja Olvegård**

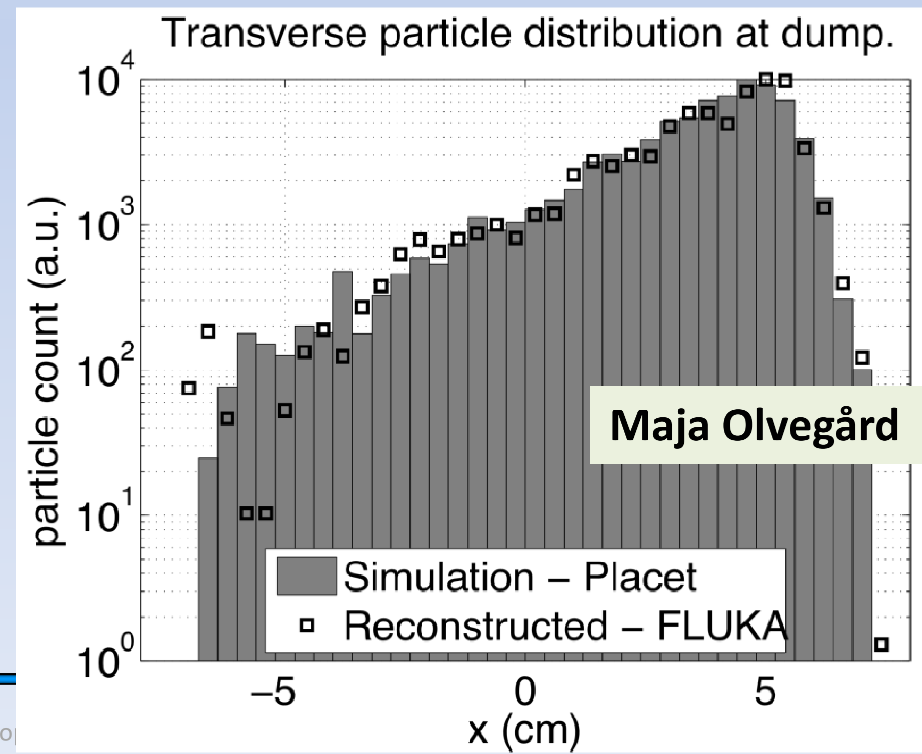
- Physics Principle
  - Reconstruct transverse
  - Stop primary electrons
  - Read current proportional to charge



- Design:
  - includes full FLUKA simulation
  - realistic beam profile from PLACET
  - 10° spectrometer
  - 32 channels,
  - 3 mm segments, 400 µm slits collimator
  - Single shot measurement – steady state

- Reconstructed spectrum ➔ compares well to Placet simulation ~ **5% measurement on energy spread**

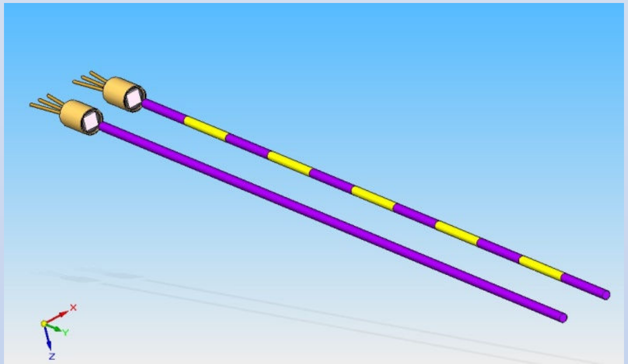
- Engineering drawings have started
- Implement in Machine TBL Fall 2010



Beam Loss Monitoring - TBL

TBL – Show loss-less transport of decelerated beam

- Optical Fiber Sensor based on SiPM composed of SPAD Array.
- Two arms:
  - Reference fiber;
  - Composite fiber.



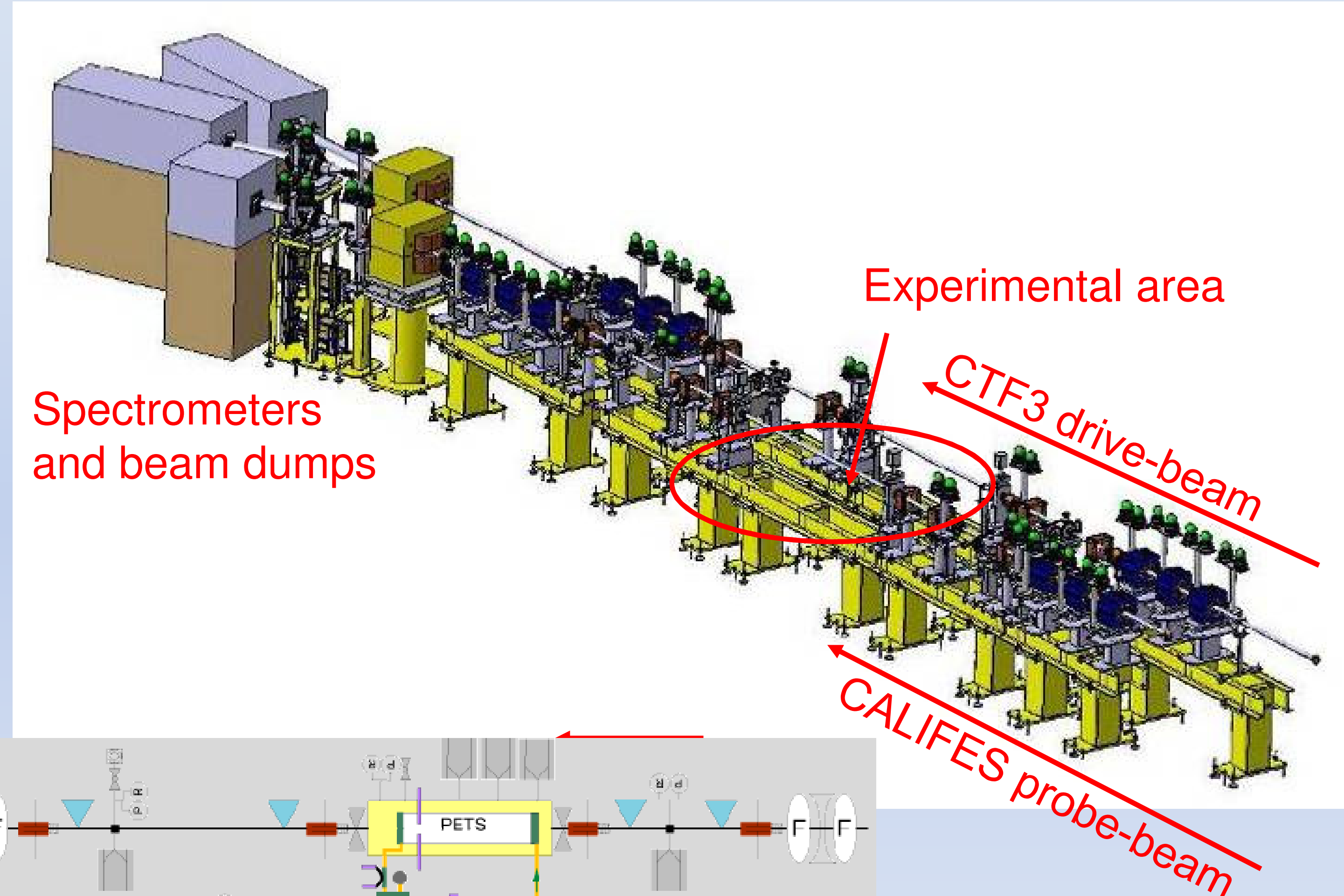
A. Intermite et al., DIPAC09

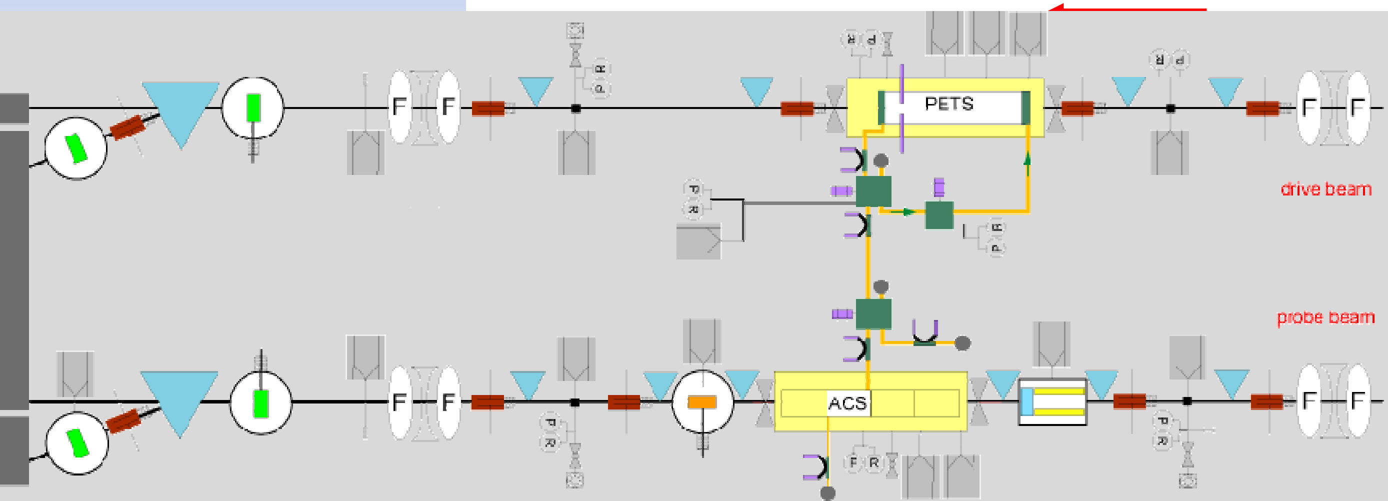
Characteristics:

- Fast time response;
- 3D information on losses from two beams;
- Insensitive against E and B fields.

- Lab tests ongoing, different fibres being tested;
- Installation in CTF3 in 2010, tests with beam.

TBTS





Slides from Roger Ruber

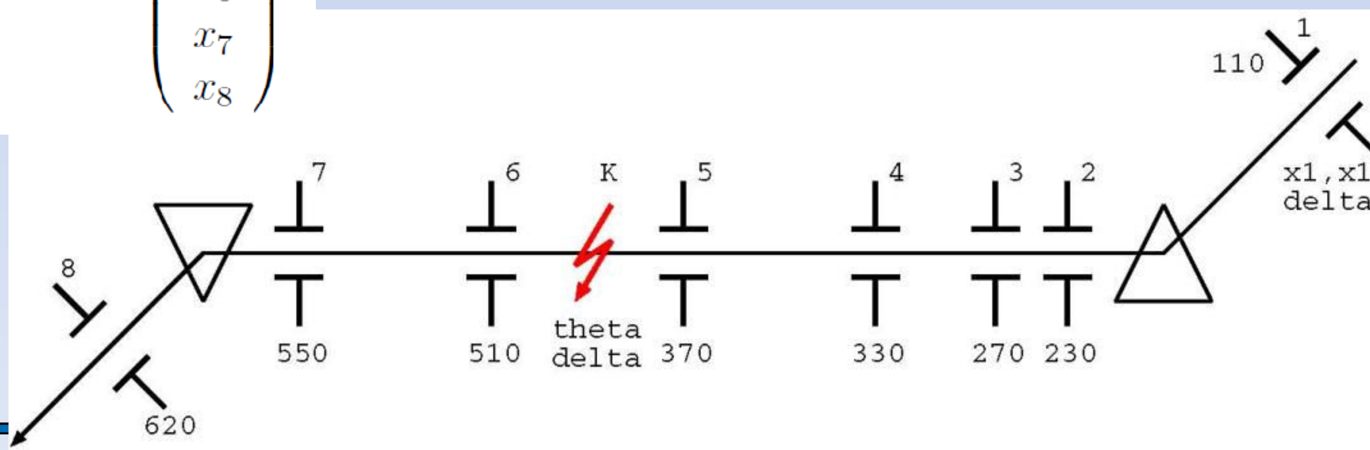
TBTS

Spectrometer's before and after PETS

Measure energy lost by drive beam, and compare to RF signals
Measure energy gained by main beam, and compare to RF signals in PETs

Kick measurements: BPM and RF Data logged
➔ Study effect of a break down in PETs on the drive beam

$$\begin{pmatrix} x_1 \\ x_1' \\ \delta_1 \\ \theta \\ \delta \end{pmatrix} = (A^t A)^{-1} A^t \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \end{pmatrix}$$

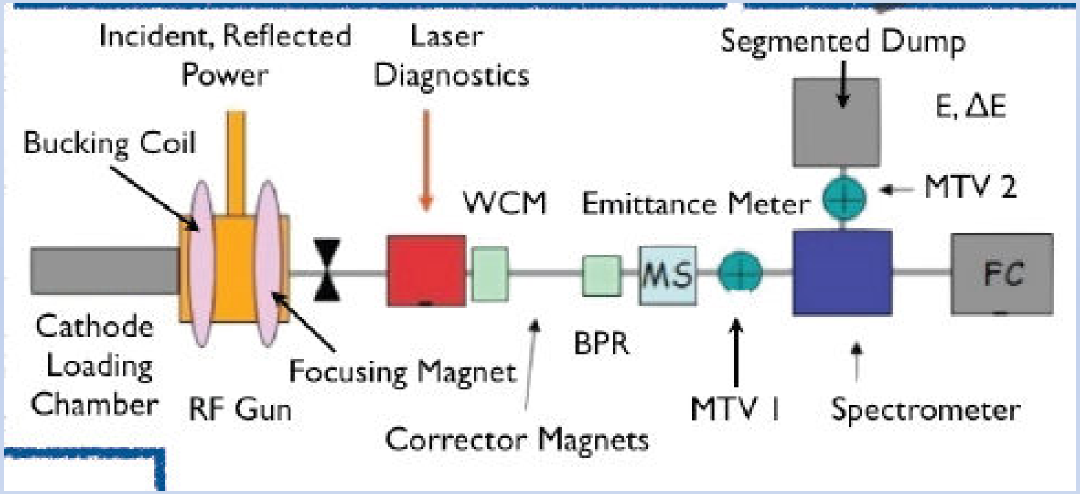


Roger Ruber

PHIN Photo-injector

Instrumentation tolerances for the CLIC injector?

Non-polarised, laser driven, e- high charge alternate source for **CTF3 drive beam injector**



- Nominal parameters of CTF3 thermionic injector achieved in March 2009 (except phase coding)
- Stability issues studied September 2009
- Laser energy and spot position monitored on laser table and in CTF2
- Use Proxitronic Gated Camera's to measure all beam properties along pulse train (50 ns / 5 ns steps)
    - Emittance & energy measurements

PHIN Time resolved Energy

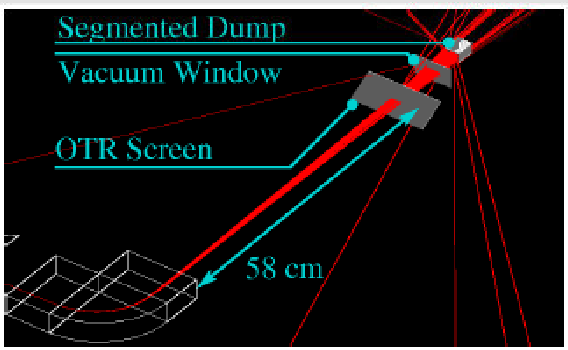
Work Daniel Egger (EPFL)

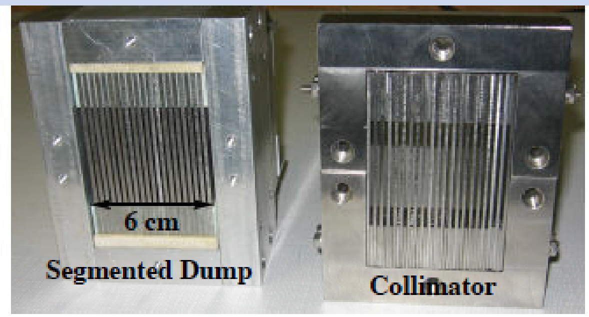
PRINCIPLE:

- Stop primary charged particles, measure transverse intensity profile in spectrometer line
  ➔ energy profile
- New detector designed (Geant4 + realistic beam parameters), built and installed & commissioned at PHIN

PHIN Spectrometer

- Segmented dump at 78 cm
- OTR screen at 58 cm





Geant4 Simulations

- Simulated segmented dump
- Correct for vacuum window

Segmented Dump

- 20 stainless steel segments
- 77 mrad acceptance
- 204 mrad for OTR
- Time resolved energy spread
- Single shot
- 0.35% error from segmentation

PHIN Time resolved Energy

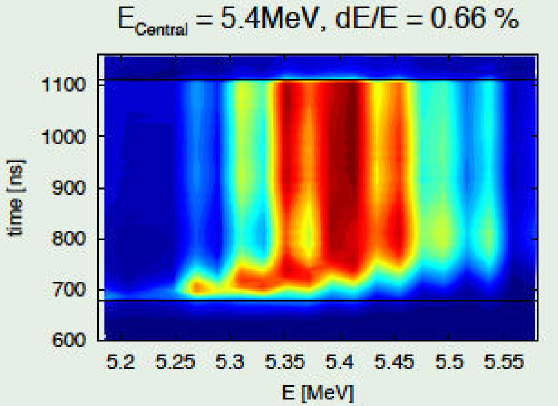
Work Daniel Egger (EPFL)

Energy spectrum shows good beam loading compensation with RF

Obtaining the energy spread

- Dump: $\Delta E/E = 1.10\%$
- Data corrected with G4
- Screen: $\Delta E/E = 1.09\%$
- Agrement: $\sim$ few %

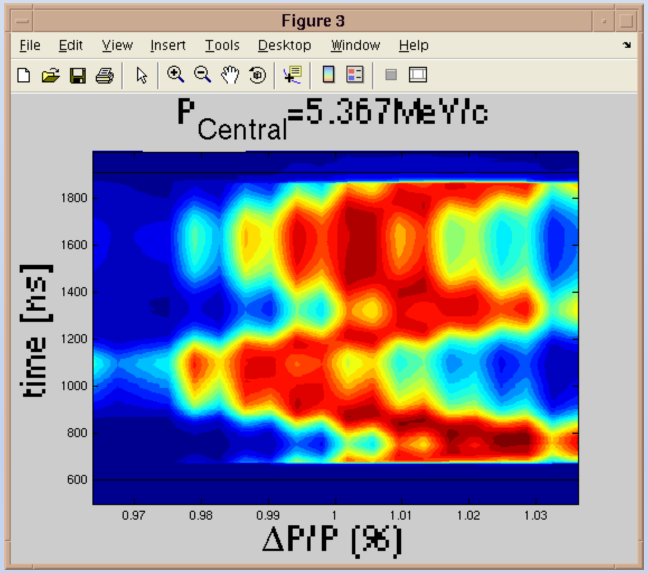
Additional data: $\Delta E/E < 1\%$

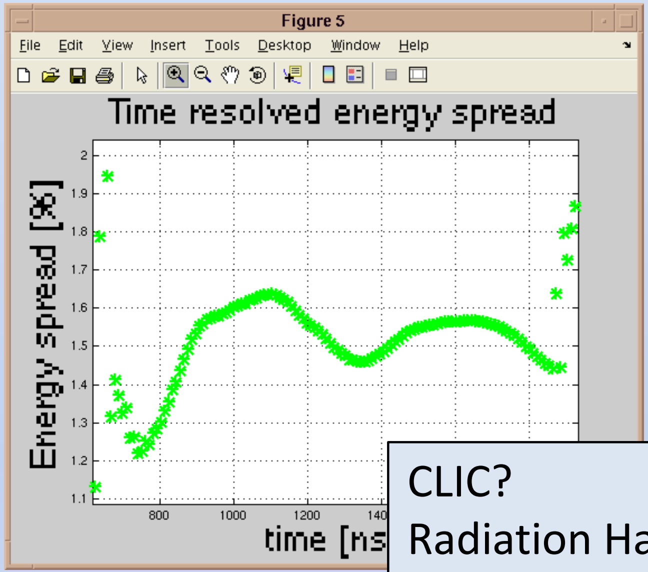


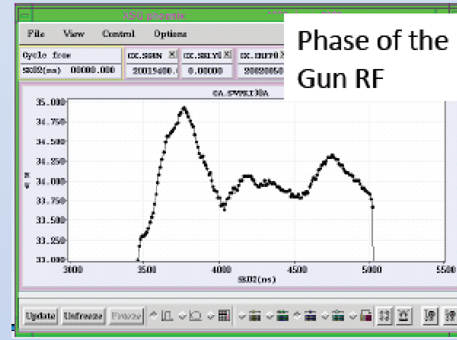
PHIN Time resolved Energy

Work Daniel Egger (EPFL)

Diagnostics Helpful during Commissioning







Example saved at same time

	CTF3	CLIC
Initial Pulse length (us)	**1.2**	**140**
Total Beam Energy (kJ)	**0.7**	**1400**
Average Beam Power (MW)	**0.0034**	**70**
Charge density (nC/cm^2)	**$0.4\ 10^6$**	**$2.3\ 10^{10}$**

CLIC?
Radiation Hard solution

Usable only at Low Energy (resolution secondary shower development)

Long pulse train & higher bunch charge could cause thermal problems?

Require cooling?

TO be studied …

Conclusion CTF3 Instrumentation & CLIC

Adapted for **use in CLIC**

necessary to **test CLIC beam dynamics / RF issues**

CTF3 diagnostics can be used for CLIC drive beam, adapted to higher charge and energy

Non-invasive, bunch length techniques CDR, RF pickup → bench marked against RF deflector Streak

Active BPM & Electronics development

TBL:
- Time resolved Energy Decelerated Spectrum
- Measure Loss-Free transport

TBTS
- Compare energy loss of beam to RF measurements
- Effect of break down on the beam

PHIN
New instrumentation for time resolved measurement

Extra slides

BPM summery

	Accuracy	Resolution	Stab.	BW	Φ	NB	FB	MPS
Injectors	100 µm	50 µm	?	1 GHz	40 mm	189	?	?
Pre damping rings	10 µm	10 µm	?	10MHz	20/9 mm	600	Yes	?
Damping rings	10 µm?	2 µm	?	10MHz	20/9 mm	600	Yes	?
BC1, Booster Linac, Transfer lines, BC2	100µm	10µm	?	10MHz?	?	1404	?	?
DBA, DL's, CR's and transfer lines	20µm	20µm	?	100MHz	40mm	900	?	?
DB long transfer lines	?	?	?	100MHz	200mm	848	?	?
DB Turn around's	20µm	20µm	?	100MHz	Var.	1920	?	?
DB decelerator's	20µm	2µm	2µm	10MHz	23mm	41576	Yes	Yes
MB Linac	5µm	50nm	5µm	10MHz	8mm	4776	Yes	Yes

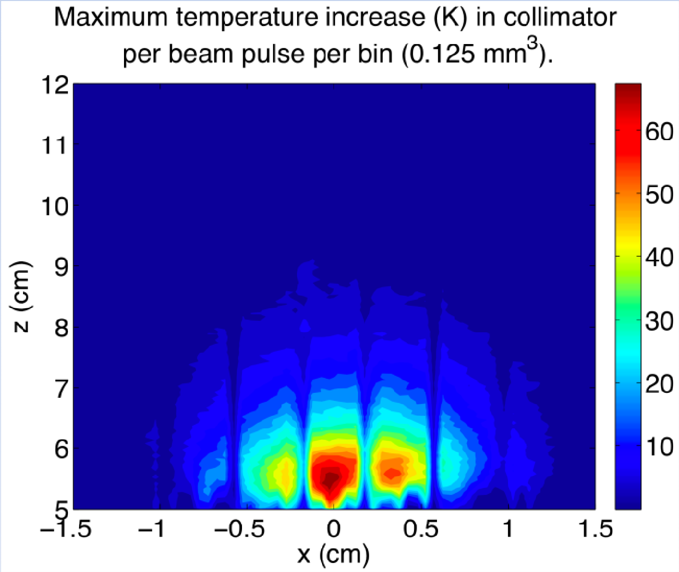
A total of 52813 BPMs!!...

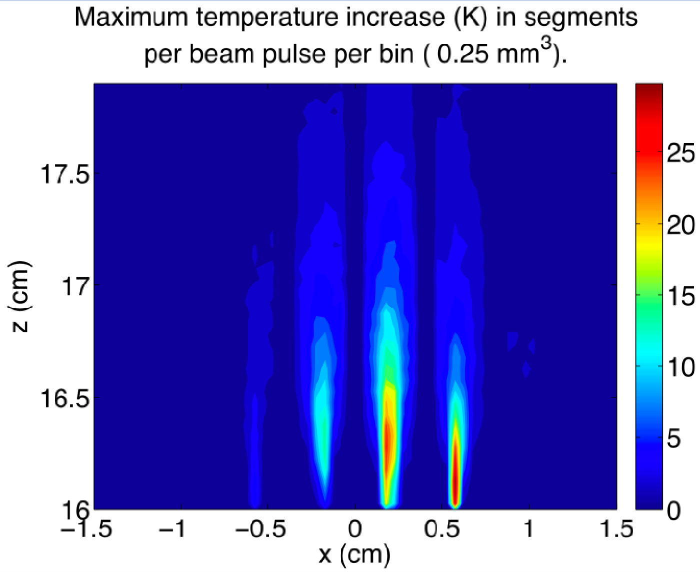
TBL – Time resolved Energy

NEW instrumentation design by CERN/Uppsala PhD Student Maja Olvegaard

- Thermal Issues studied with Fluka
- Most important for 1 PETs case
- Water cool collimator ➔ but NOT active segments

The maximum temperature increase per bin is 70.7 degrees in the collimator and 31.3 degrees in the segments. Bin size= 0.125 mm3 .
This temperature increase is from one beam pulse of a nominal beam (140 ns, 150 MeV and 28 A).



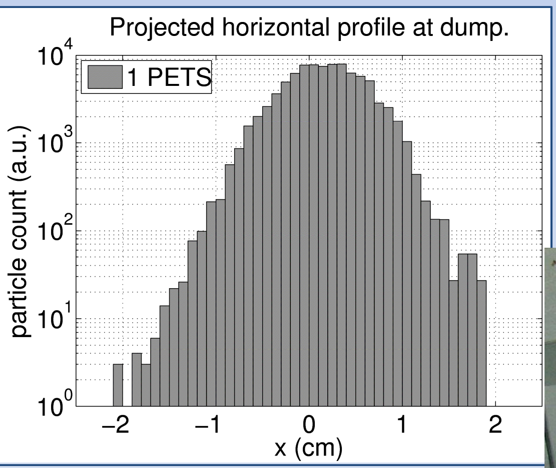


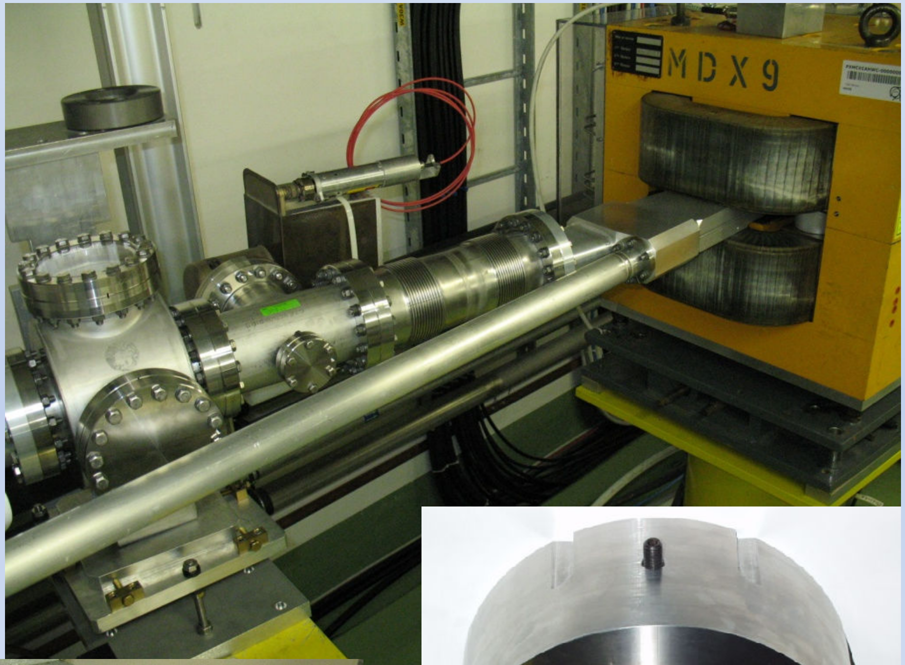
TBL – Time resolved Energy – Slit Dump

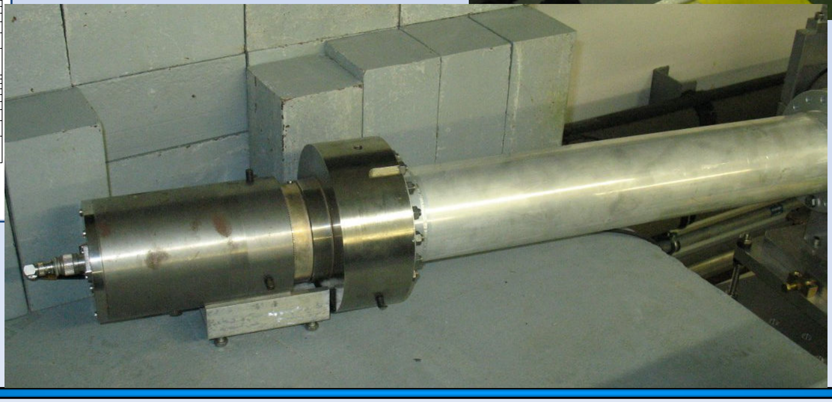
Maja Olvegård

Sept 2009 Shutdown, Slit dump installed in TBL – ready to measure 1 PETs

- Design:
  - Recuperated from CTF3
  - Single slit and segment – Scan magnet current
- Compare to MTV in spectrometer line:
- TBL 10 degree bending

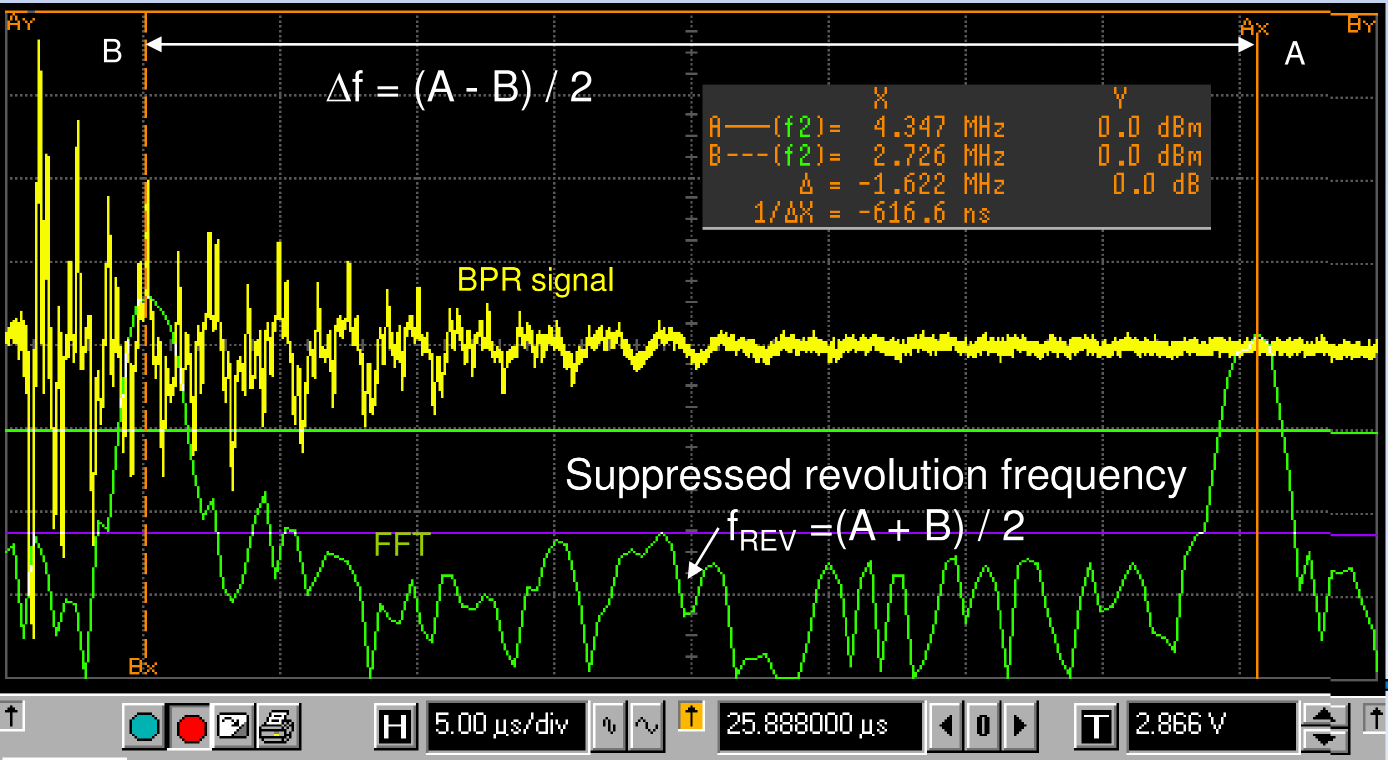






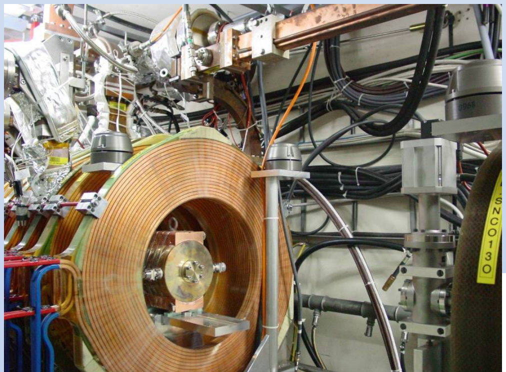
BPR measurement

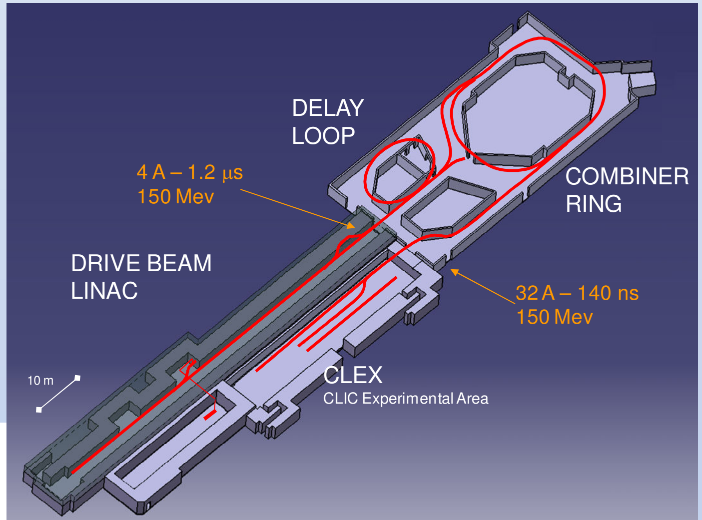
- Short pulse for many turns
- FFT of the BPR signal gives the ring length
  - f_{rev} gives total ring length $L_R = (N - 1/CF)\ \lambda_{RF}$
  - Δf gives fractional part of ring length $1/CF\ \lambda_{RF}$

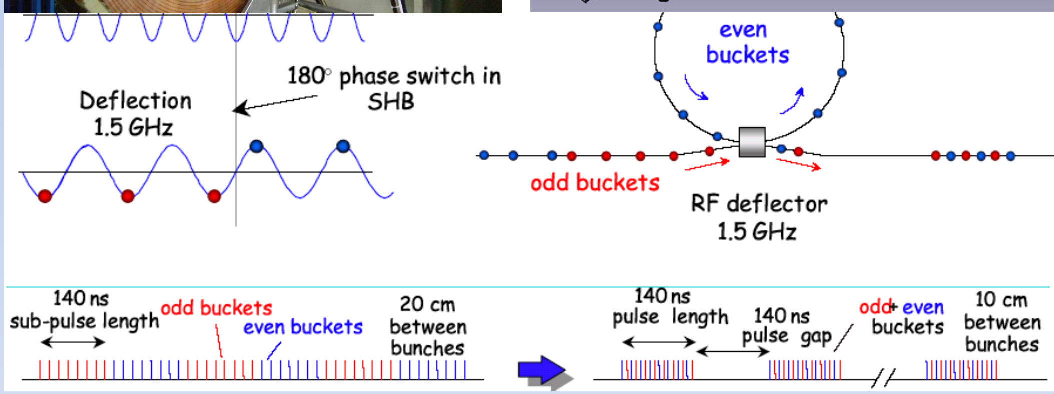


Delay loop: fast phase switch & satellites

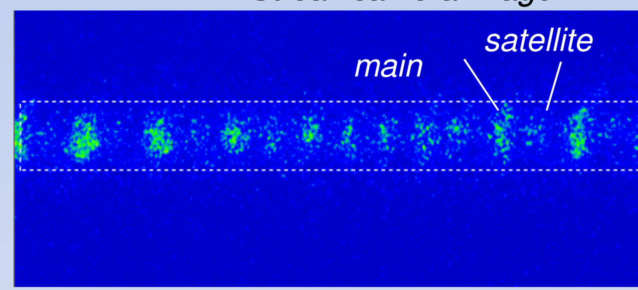
Fast phase switch from SHB system

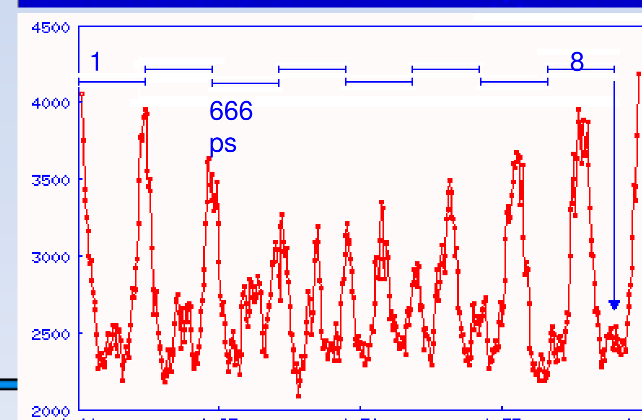






Streak camera image

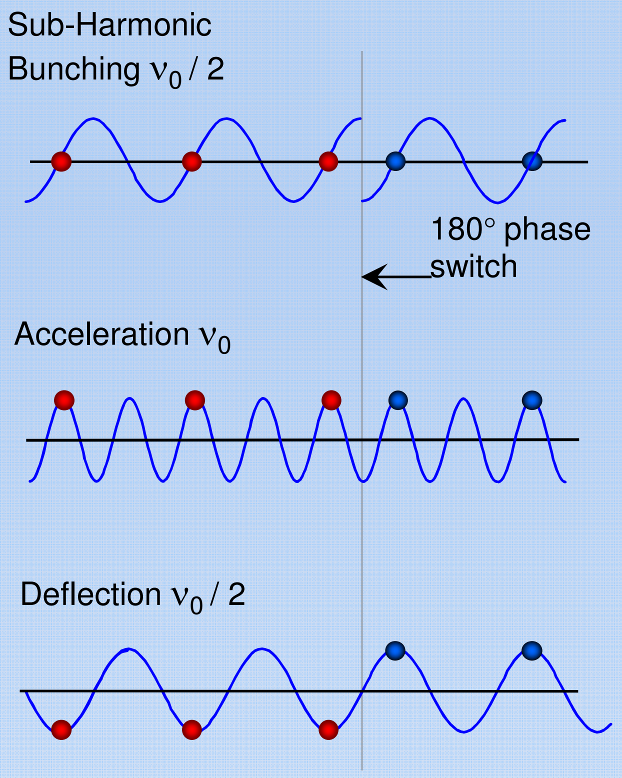




Gap creation and x2 multiplication

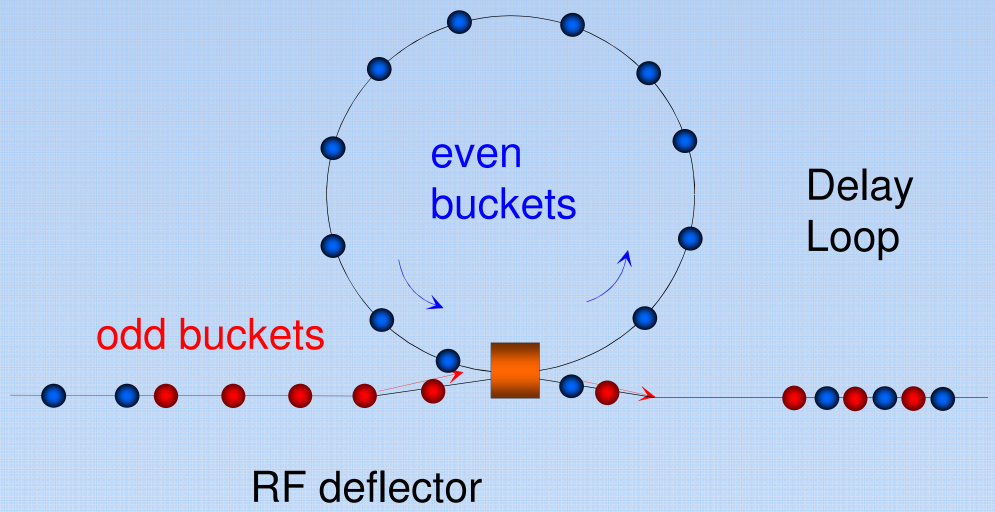
Phase coding

How to "code" the sub-pulses

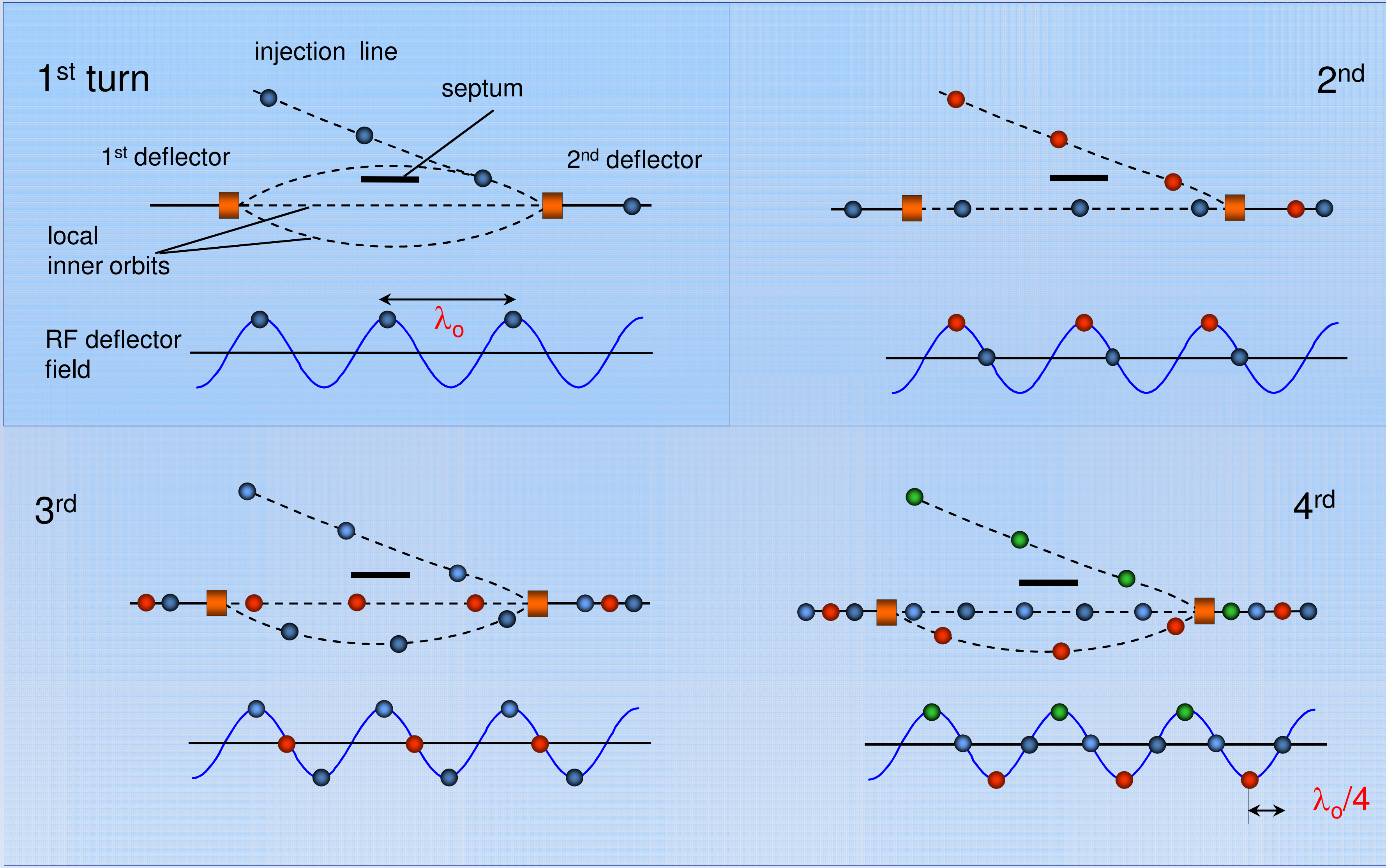


$$L_{delay} = n\, \lambda_0 = c\, T_{sub\text{-}pulse}$$

Combination scheme

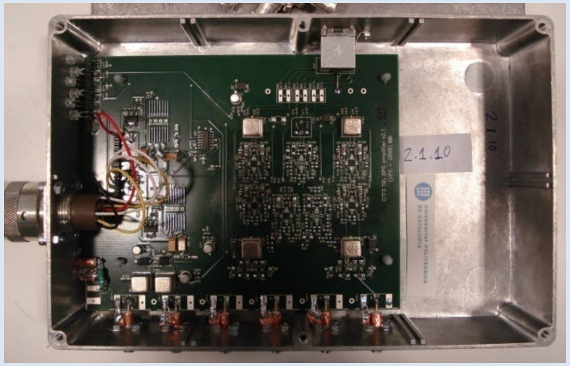


Combiner ring multiplication



Development of BPS amplifiers for the CTF3 TBL

Gabriel Montoro, Yuri Koubychine, Antoni Gelonch
Universitat Politècnica de Catalunya (UPC)

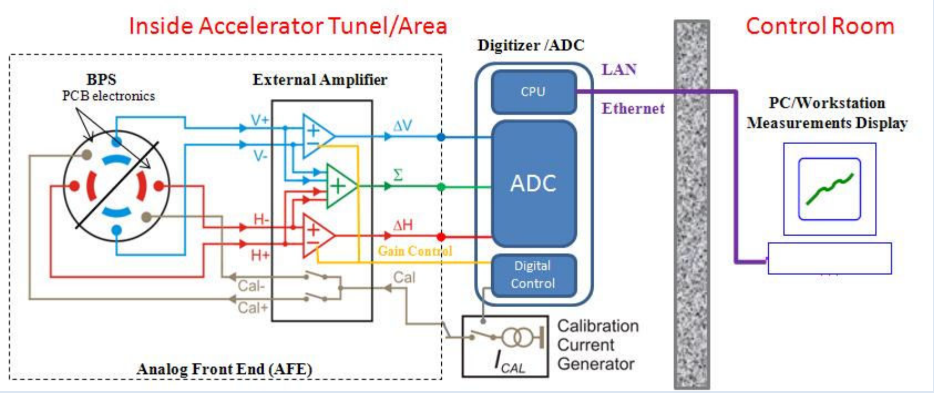


Amplifiers specifications

- Delta channels: up to 200 MHz bandwidth.
- Sigma channel: up to 150 MHz.
- It's been used rad tolerant amplifiers IC's.

Work done: A total of 16 amplifier have been built

- 1 unit installed in TBL on 2008.
- 2 units installed in TBL on April 2009.
- 13 units delivered for installing the current week.



Next work to do:

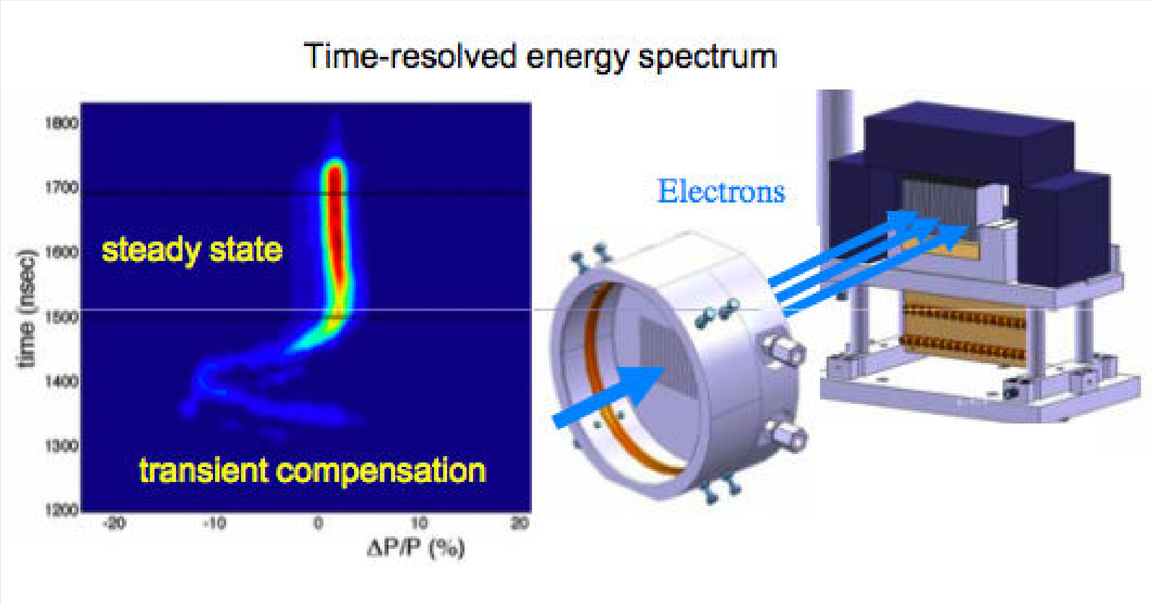
To test the amplifiers and to solve mismatches

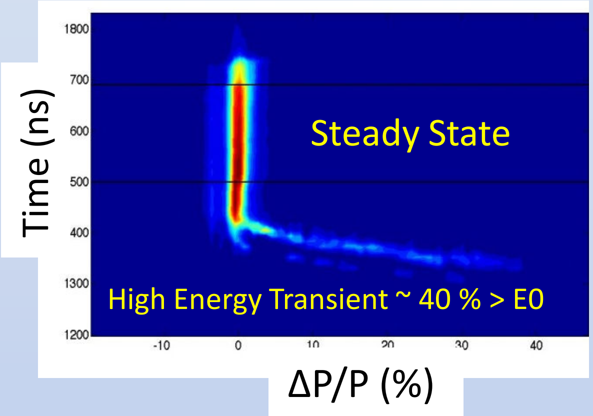
UNIVERSITAT POLITÈCNICA DE CATALUNYA

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
FPA2007-30577/E

CTF3 Drive Beam Linac

- **Time resolved energy measurement using segmented dump**





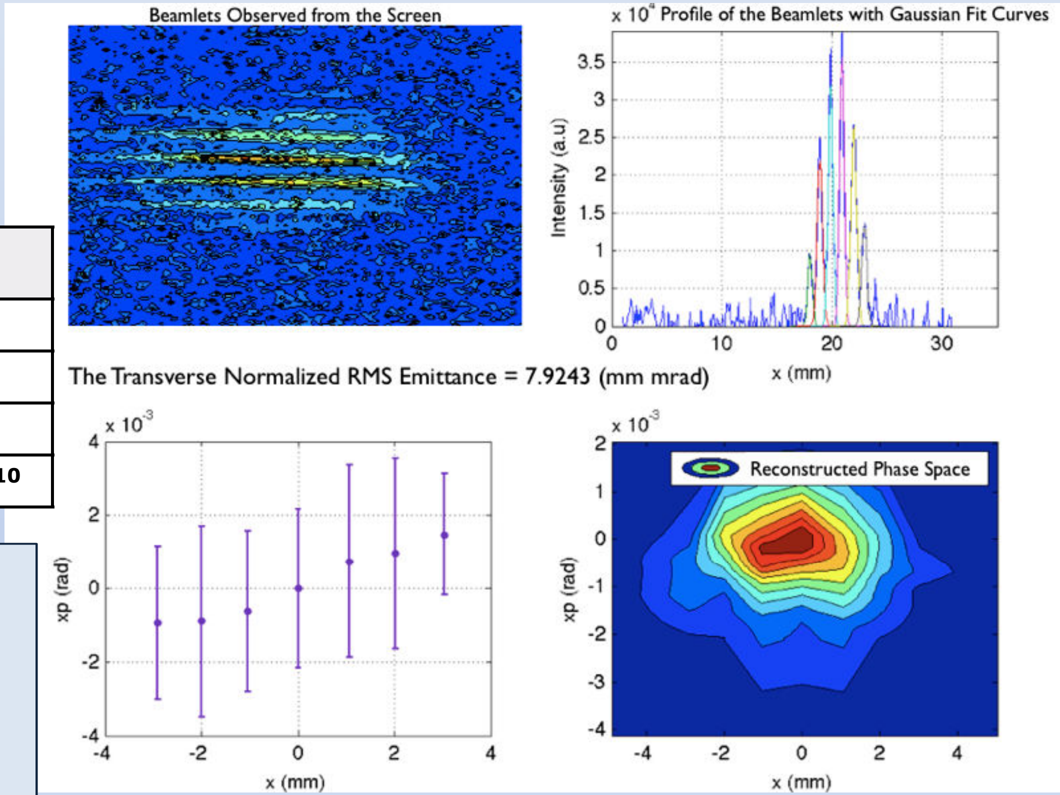
	CTF3	CLIC
Beam Energy (GeV)	0.15	2.4
Initial Pulse length (us)	**1.2**	**140**
Total Beam Energy (kJ)	**0.7**	**1400**
Average Beam Power (MW)	**0.0034**	**70**
Charge density (nC/cm²)	**0.4 10^6**	**2.3 10^{10}**

High Energy ➔ increased shower / shower shape in dump

Much increased Beam power → not usable for CLIC

PHIN Emittance – Pepper Pot

	CTF3	CLIC
Initial Pulse length (us)	**1.2**	**140**
Total Beam Energy (kJ)	**0.7**	**1400**
Average Beam Power (MW)	**0.0034**	**70**
Charge density (nC/cm^2)	**0.4 10^6**	**2.3 10^{10}**



CTF3 ➔ CLIC

Integrated charge increase ~ X 400 !

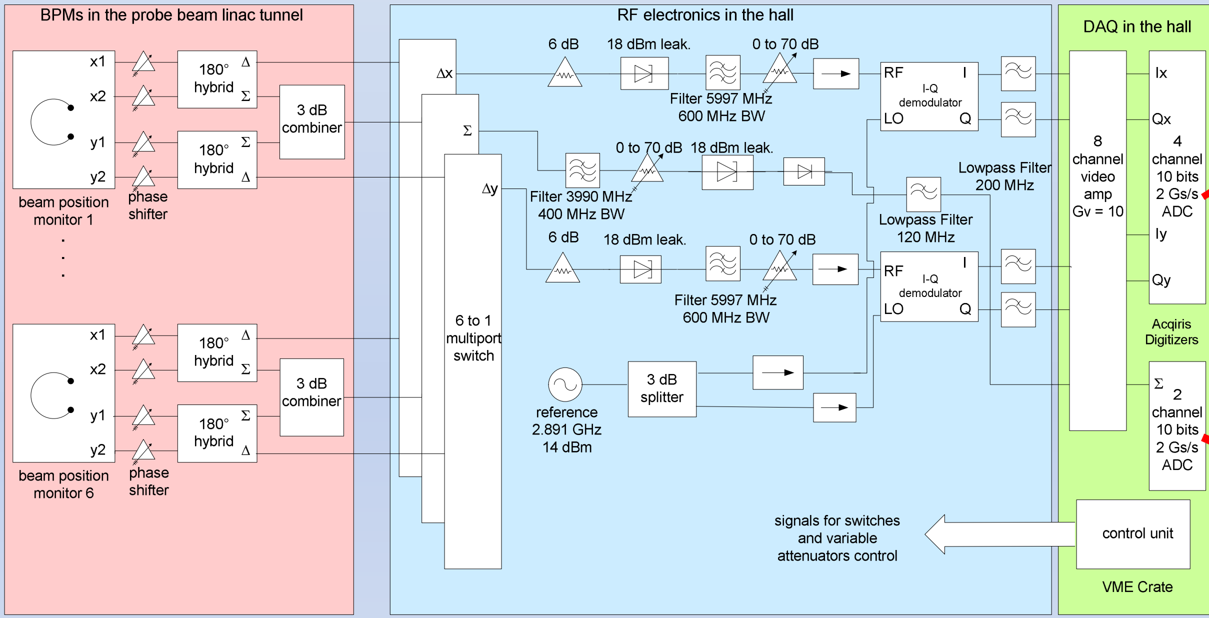
Impact on **thermal properties** of screen & pepper-pot

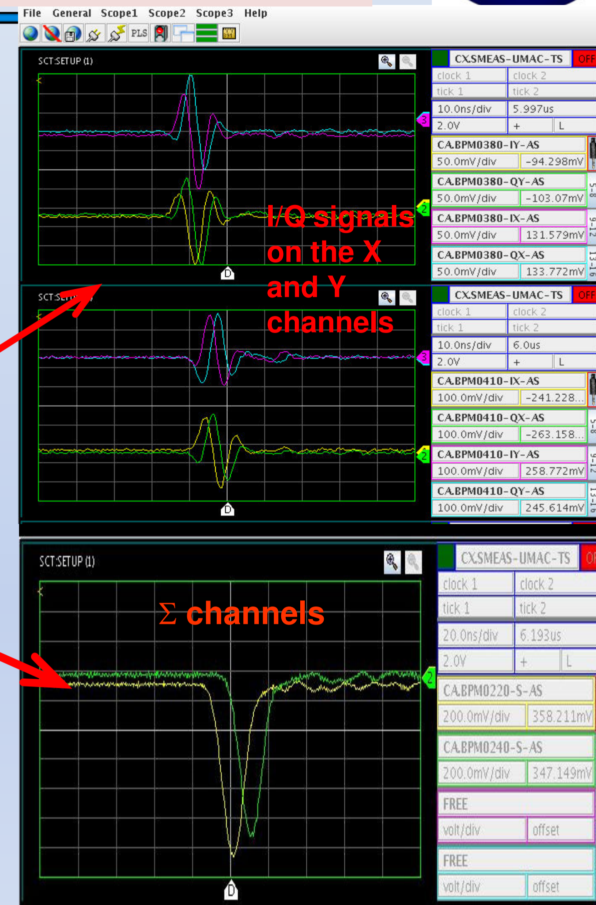
This instrumentation is probably NOT suitable for CLIC DB nominal parameters

But should work for a REDUCED TRAIN LENGTH

See talk Oznur Mete

Re-entrant Cavity BPM for CALIFES (2)



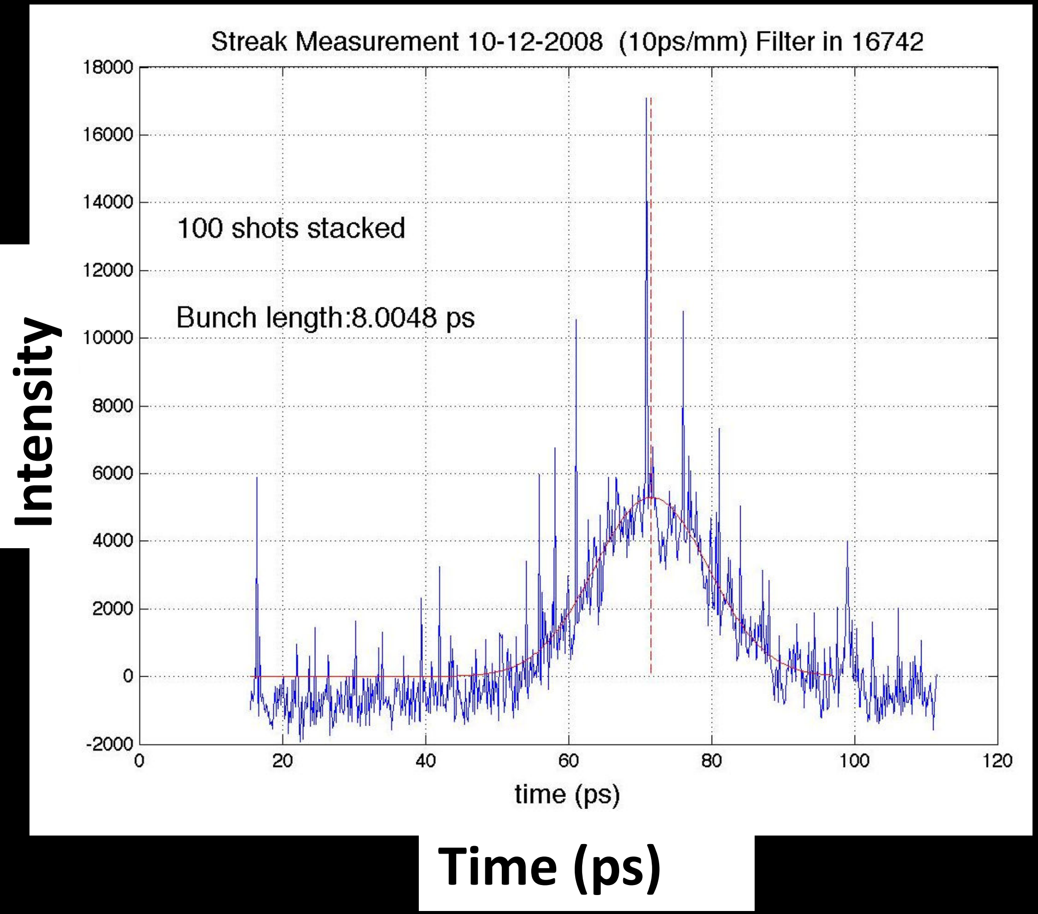


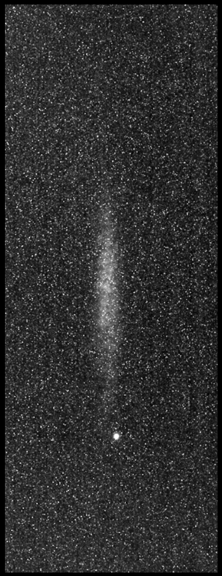
Re-entrant Cavity at CALIFES

with 5 mm offset and charge = 0.6 nC → **Resolution :** < 5 µm (simulated)

with 0.1 mm offset and charge = 0.6 nC → **Resolution :** < 0.5 µm (simulated)

Bunch Length measurement in CR





Parasitic Bunch length measurement during commissioning

Sweep of Streak max 10 ps/mm

Filter installed before entrance of Streak

Bunch Length ~ 8ps

Adapted for use in CLIC? Yes

- Best Streak Camera: 200 fs resolution

Bunch length Measurement - CLIC

	Resolution	Φ	NB
Injectors	1-2ps	40 mm	9
Pre damping rings	1-2ps ?	20/9 mm	2
Damping rings	200fs ?	20/9 mm	2
BC1, Booster Linac, Transfer lines	30fs	?	4
BC2	30fs		2
DBA, DL's, CR's and transfer lines	<1ps ?	40mm	20
DB long transfer lines	-	200mm	-
DB Turn around's	1%-300fs	Var.	48
DB decelerator's	1%-300fs	23mm	96
DB Post decelerator line	1%-300fs	?	48
MB Linac	-	8mm	0
BDS	30fs	16mm	2

T. Lefevre CLIC BI workshop

- Longitudinal profile monitor in Bunch compressors and BDS with high resolution (30fs)
  - RF Deflecting cavity
  - E-O Optics techniques
  - *Optical Repliqua Technique*
- Bunch Form factor measurements
  - DB decelerator for RF production efficiency verification : 300fs resolution
  - MB for feedback : 30fs resolution

LAPP **Evolution** of acquisition

New motivation:

LAPP learnt a lot with this first experience. Problems and lack of resolution in CTF3 motivates for a new full system development.

→ Logical evolution dedicated to a larger accelerator as CLIC: CTF3 is the facility where CLIC future solutions can be developed.

Future CTF3 and CLIC needs are converging: 4 BPMs crates.

*LAPP is now **committed in beam instrumentation**.*

LAPP is currently writing a proposal according to CLIC specifications.

→ elimination of last copper links, reduction of costs, simpler architecture.

Next steps 2011-2012:

After final technical discussion next month and validation of proposal,

LAPP planed to produce a prototype of a full acquisition system fall 2010.

If validated, this system could replace the actual one in CTF3 during 2011 shutdown.

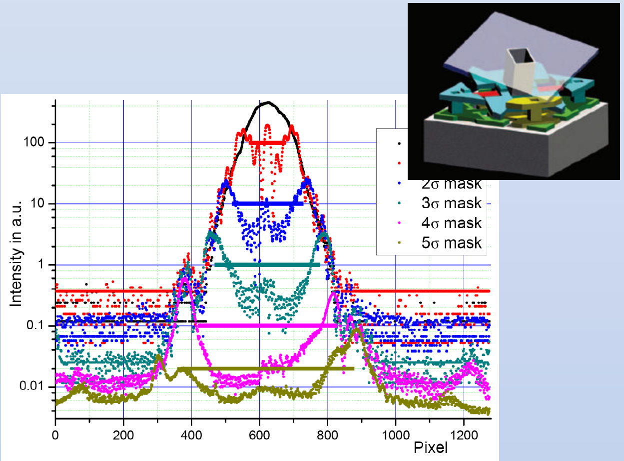
A data collection development for a larger network as CLIC is foreseen in 2011.

Man power ~3 men FTE and IN2P3 funding ~30k€/year.

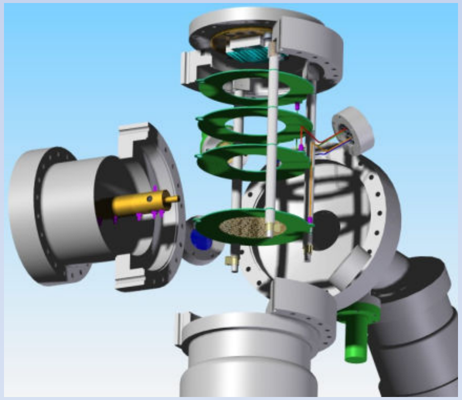
Sebastien Vilalte, Talk at this workshop

Beam Halo Monitoring

- MMA-based design
- Designed for measurement of SR, OTR, DR,…
- Tests at U Maryland in Nov 09
- Tests at CTF3 possible in 2010.



J. Egberts et al., DIPAC09



M. Putignano et al., Hyp. Inter. (2009)

- Curtain-shaped atom gas jet
- Ions projected onto MCP allow for profile measurement
- Vacuum chambers designed and presently being built up
- First tests early in 2010.