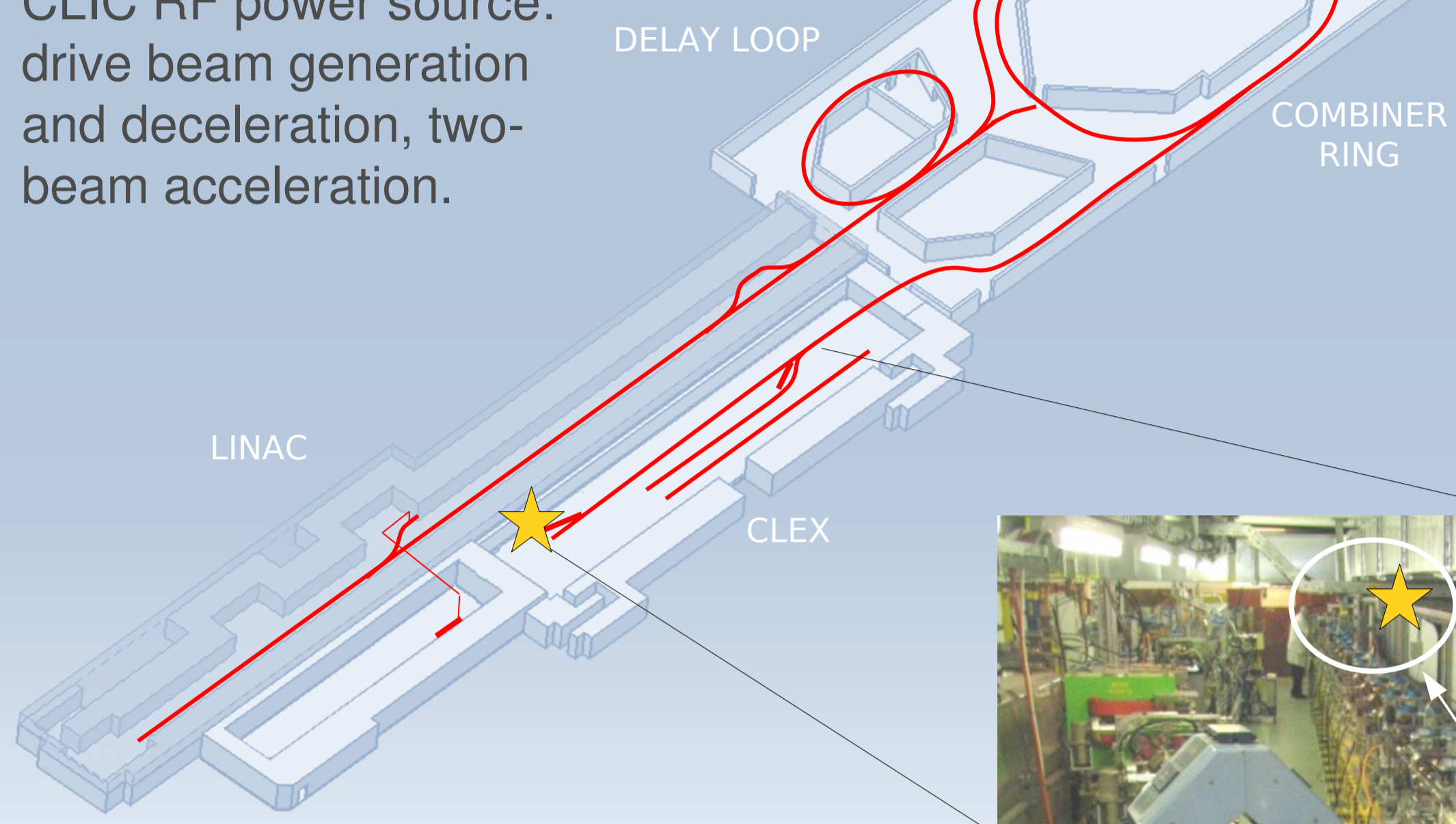
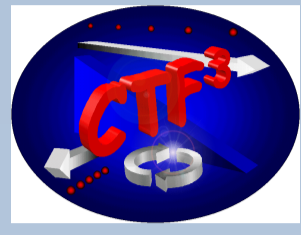


# Beam profile monitors for the high current electron beam at the Test Beam Line

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## The CLIC Test Facility 3:

Prove the feasibility of the CLIC RF power source: drive beam generation and deceleration, two-beam acceleration.



TBL beam parameters:

Nº of PETS #	Mean energy <E>	Energy spread $\sigma/⟨E⟩$
1	144.9 (MeV)	1.04%
4	129.7 (MeV)	1.4%
8	109.5 (MeV)	2.2%
16	68.8 (MeV)	5.8%

Injected beam: 150 MeV, 28 A, 140 ns, 12 GHz bunch frequency

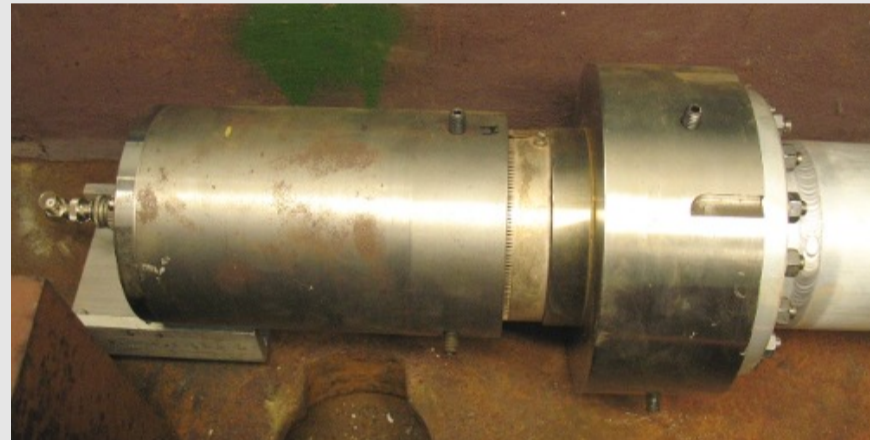
## The Test Beam Line (TBL):

Purpose: study the behavior of the drive beam in a small-scale CLIC decelerator

- 4 Power Extraction and Transfer Structures (PETS) installed
- Quadrupoles on precision movers for beam based alignment
- One BPM per quadrupole and PETS
- Two diagnostics sections, one before and one after the deceleration.

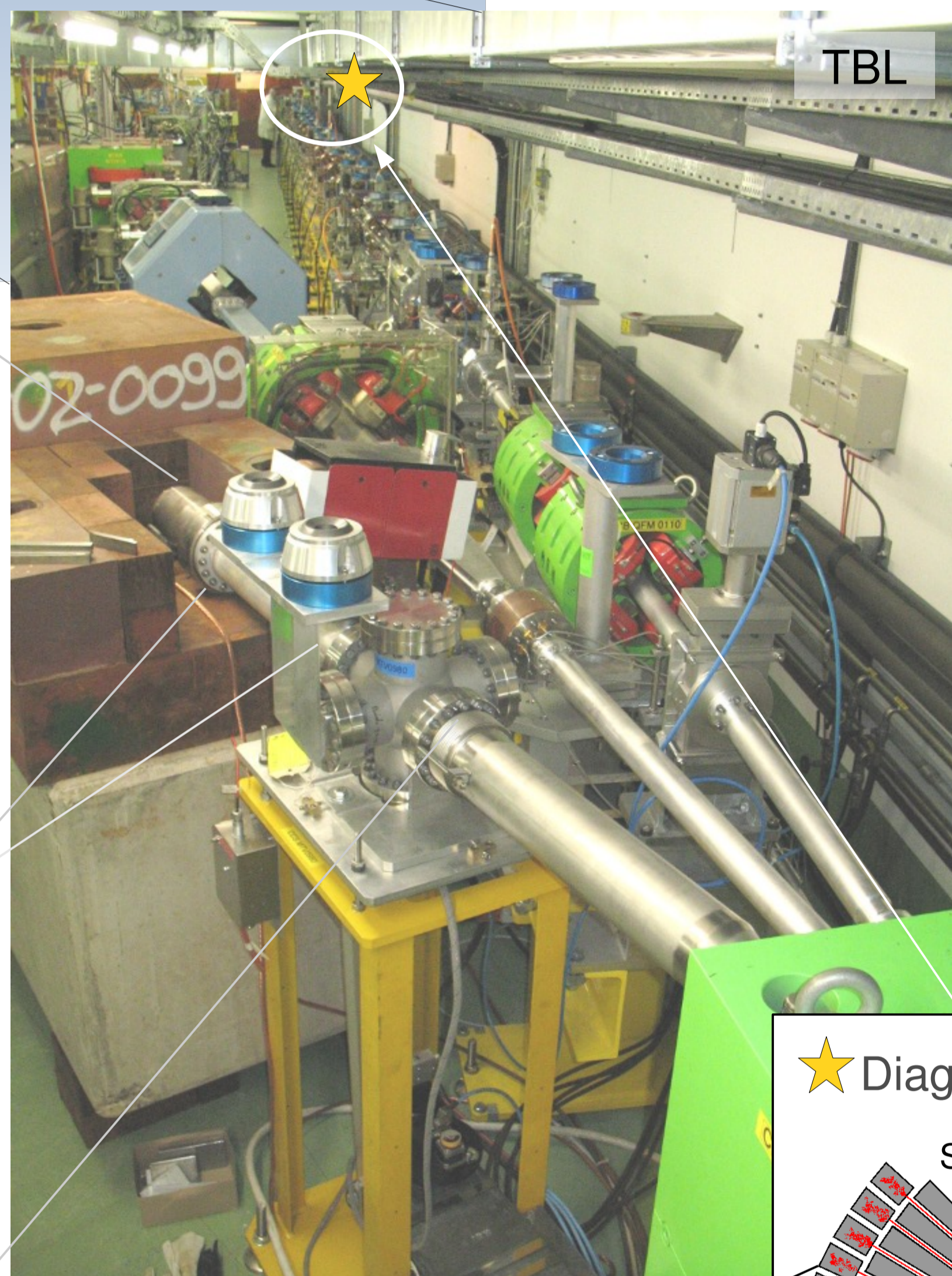
## Single-slit dump

Time resolved spectrometry through a dipole scanning method

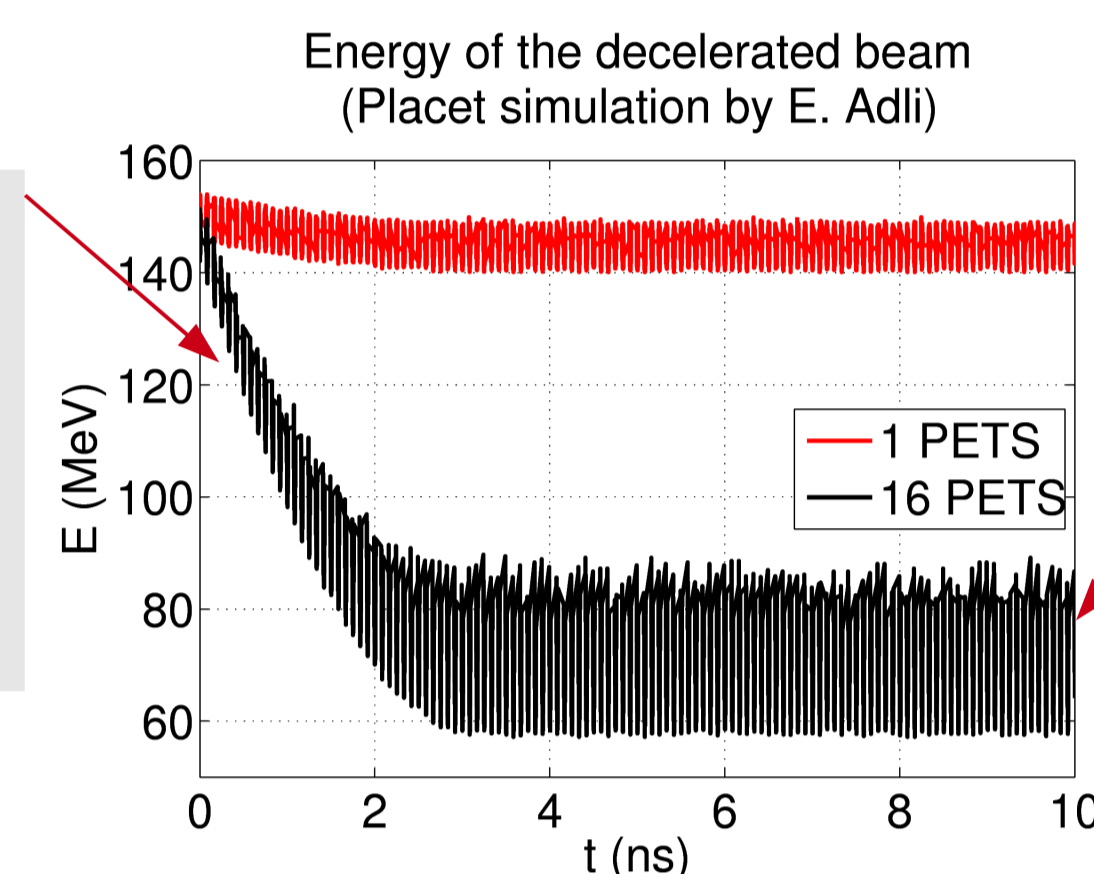


## OTR screens for high resolution spectrometry:

- 50  $\mu\text{m}$  carbon foil to stop synchrotron radiation.
- 100  $\mu\text{m}$  parabolic or diffusive aluminum screen
- CCD camera behind shielding
- Resolution  $\sim 100 \mu\text{m}$



high energy transient due to full beam loading in the PETS

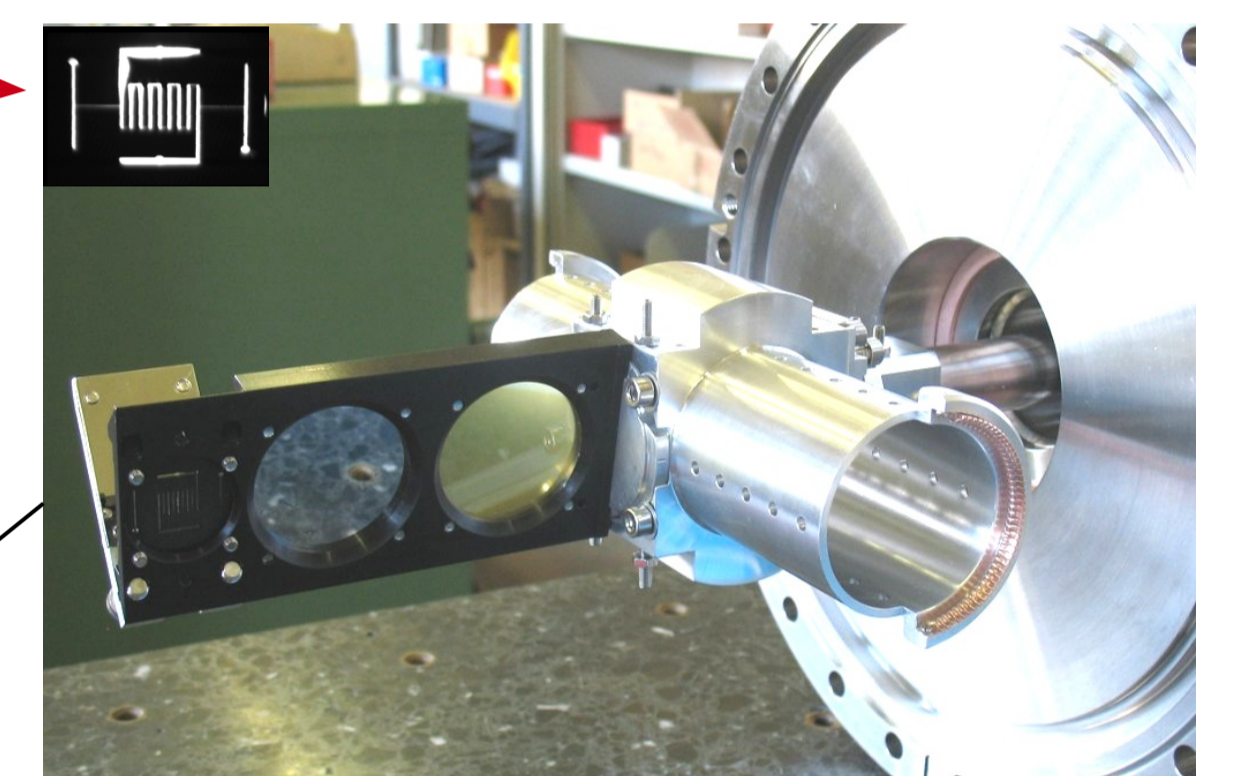


large intra-bunch energy spread

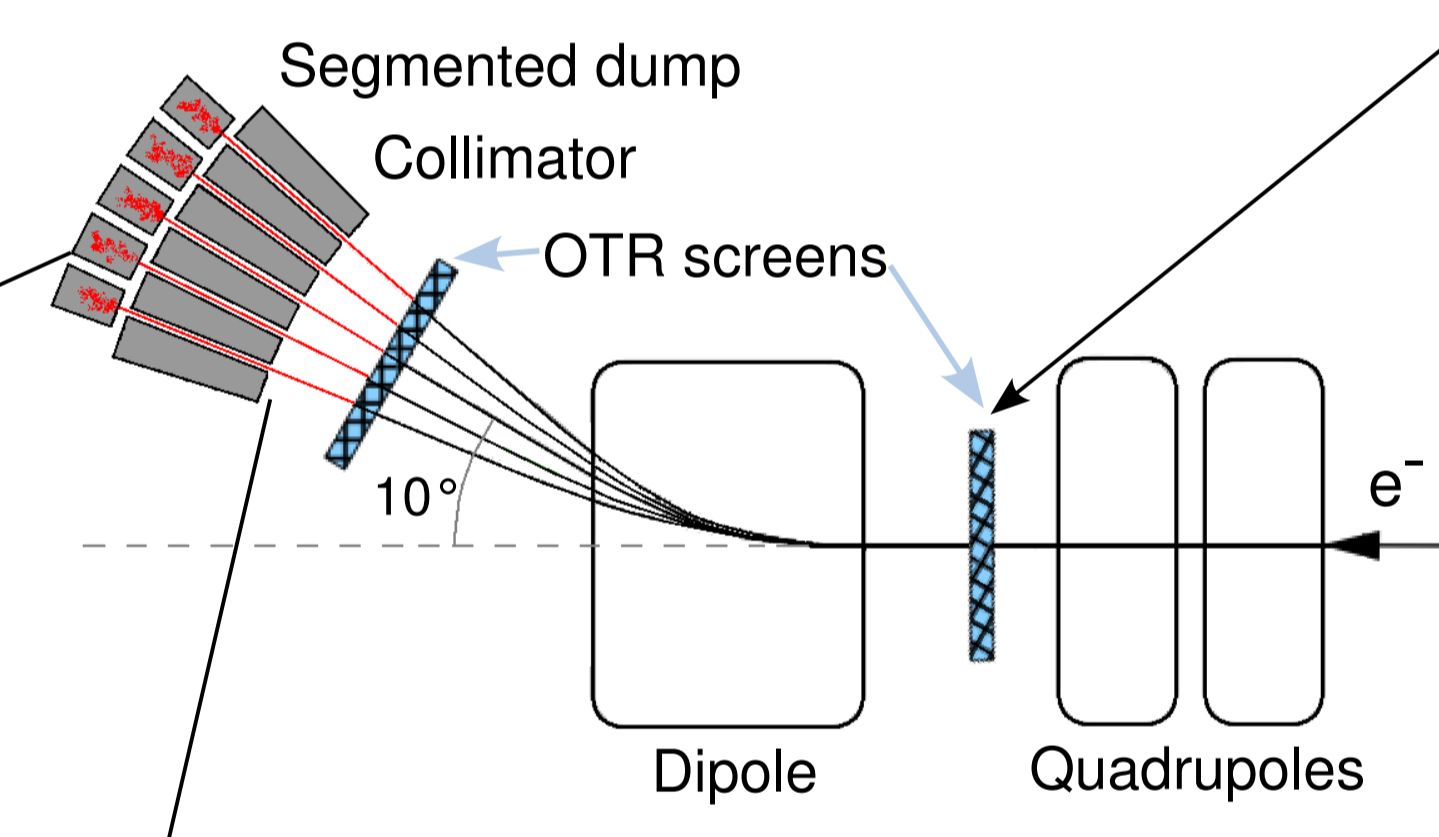
140 ns nominal pulse duration

## OTR screens for emittance measurements through quadscans:

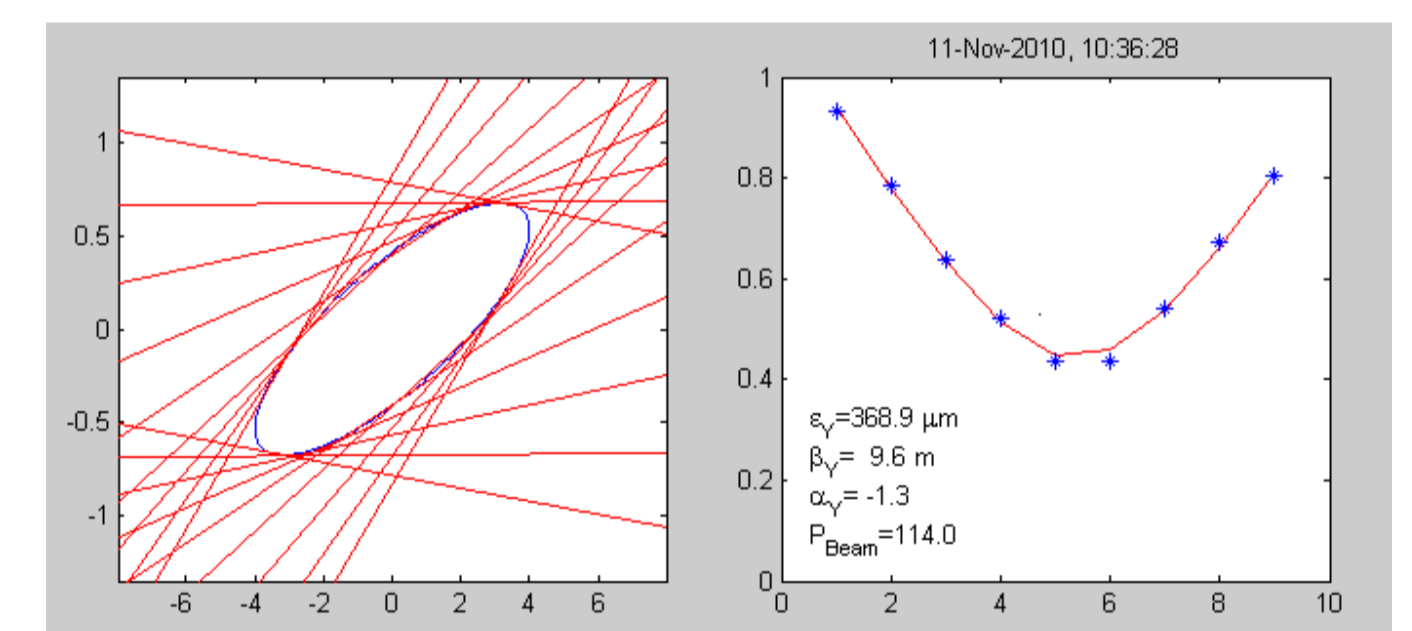
- Replacement chamber
- 200  $\mu\text{m}$  SiC screen for higher charge
- 200  $\mu\text{m}$  SiC screen for lower charge
- Calibration target



## Diagnostics section

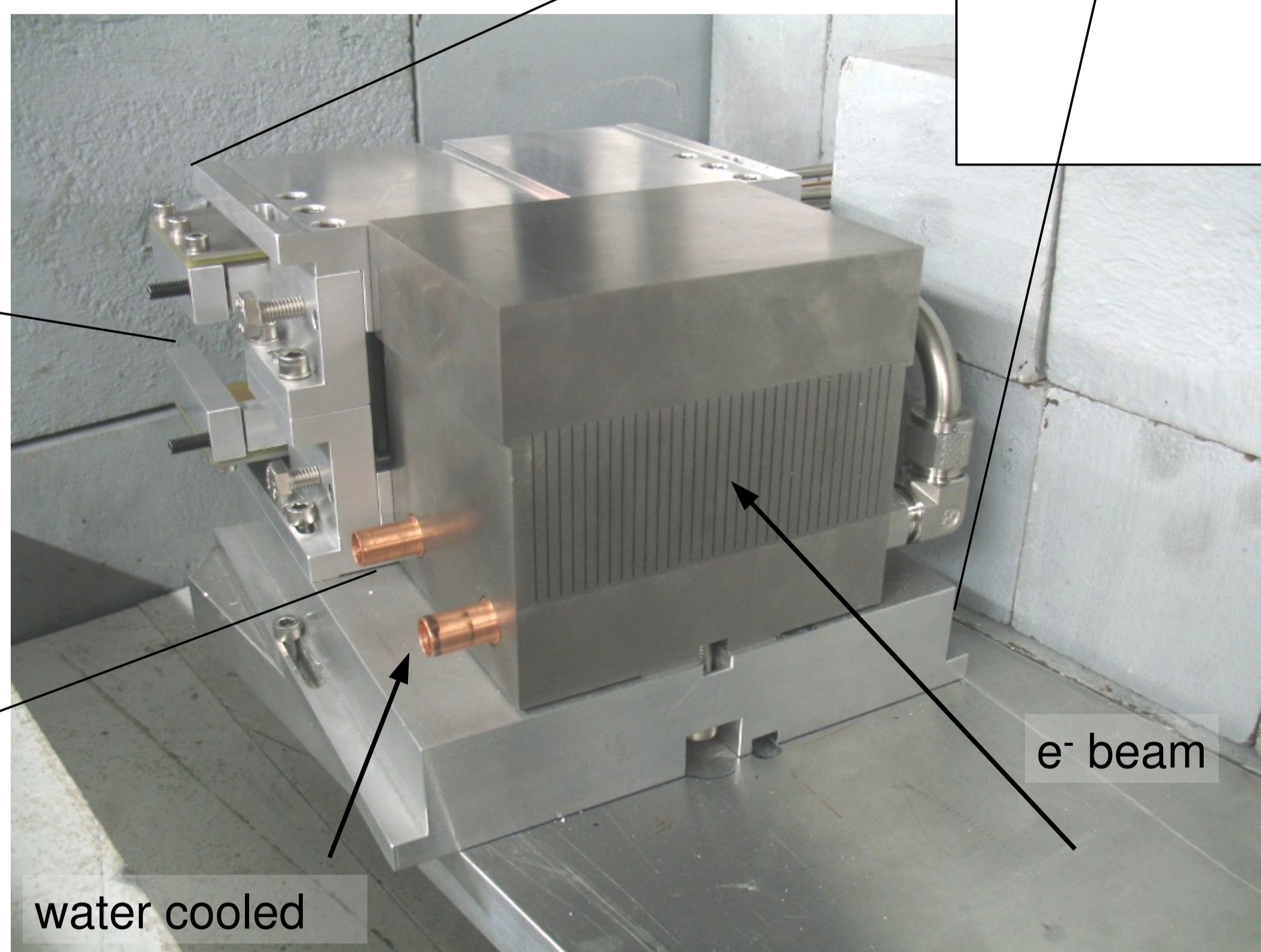
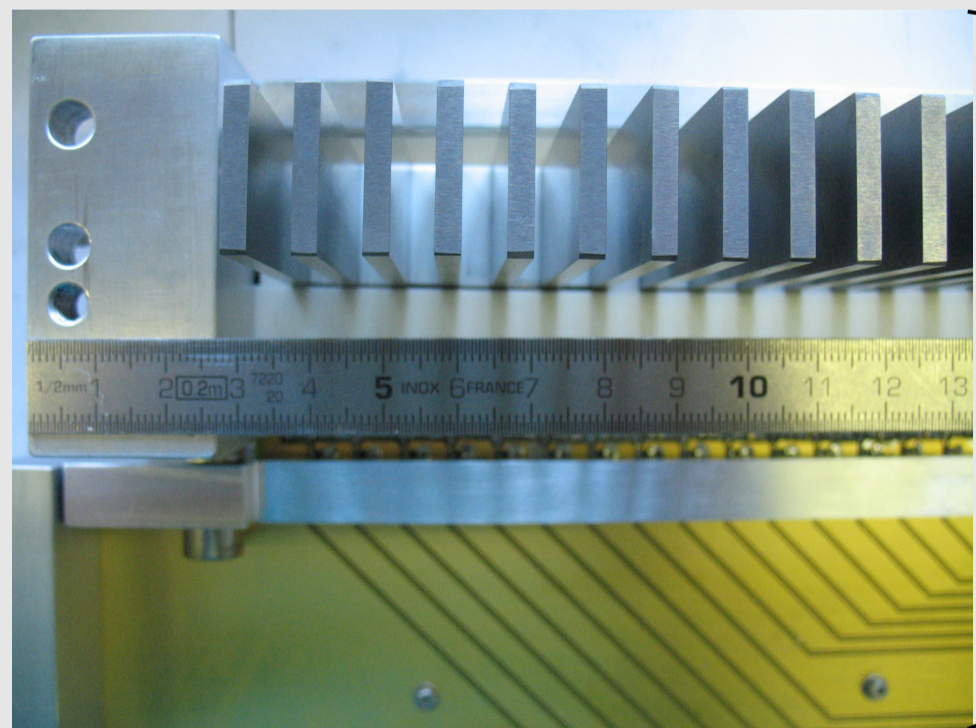


## Quadscan at OTR screen CC.MTV0970:



## 32 tungsten segments

- transverse width: 3 mm
- transverse spacing: 1 mm
- longitudinal thickness: 20 mm



## Collimator with 32 slits

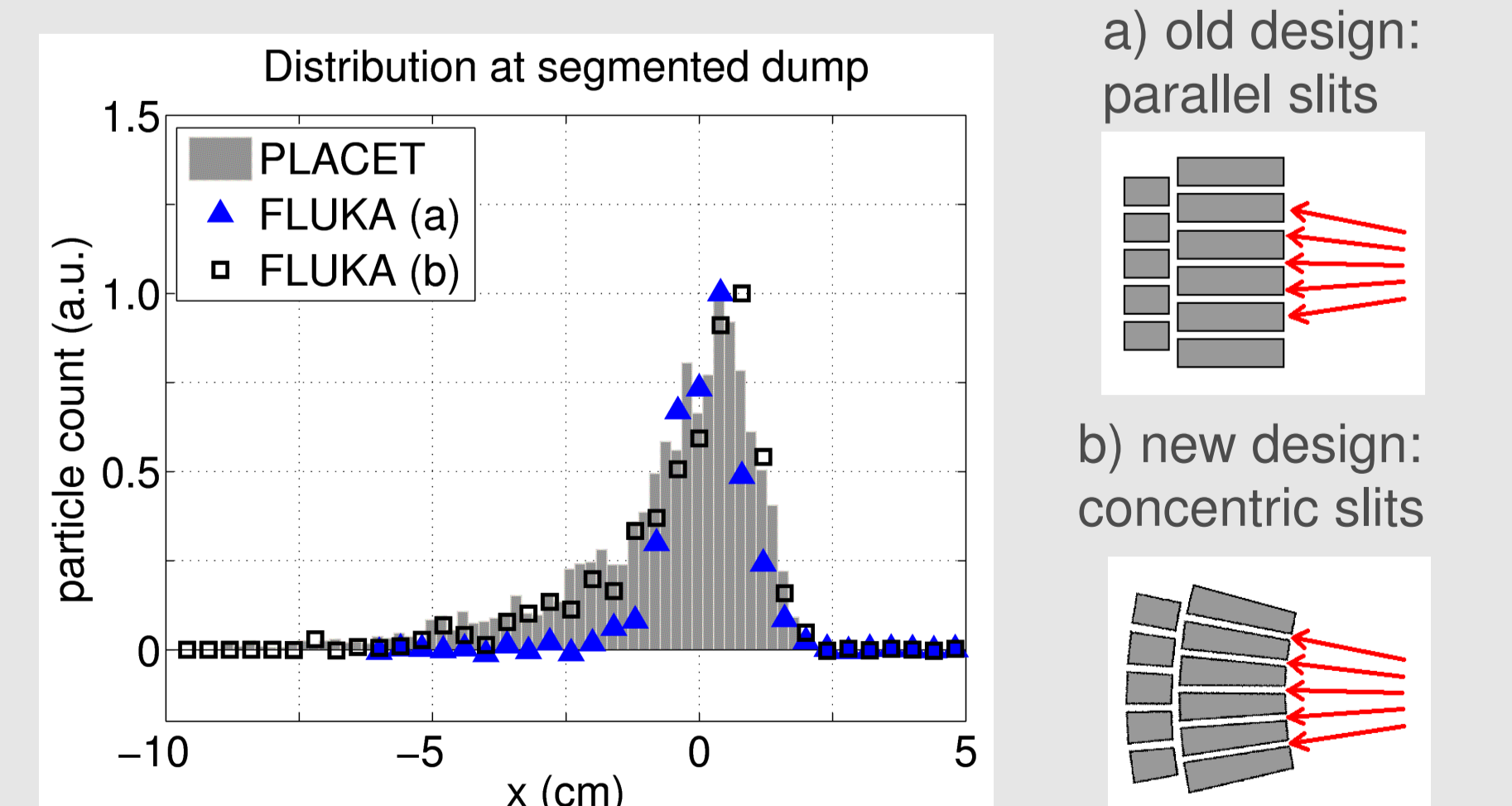
- high tungsten content (Inermet)
- slit width: 400  $\mu\text{m}$
- longitudinal thickness: 100 mm

## Segmented Beam Dump:

Single-shot time resolved energy and energy spread measurements

- Expected accuracy 5 % on energy spread.
- Energy resolution  $\sim 2 \%$ .
- Water-cooled to absorb most of the shower and to minimize segment cross-talk.
- Beam lets passing through collimator are stopped in tungsten segments.
- The absorbed charge detected and sampled at 250 Mhz, each segment by an individual ADC.

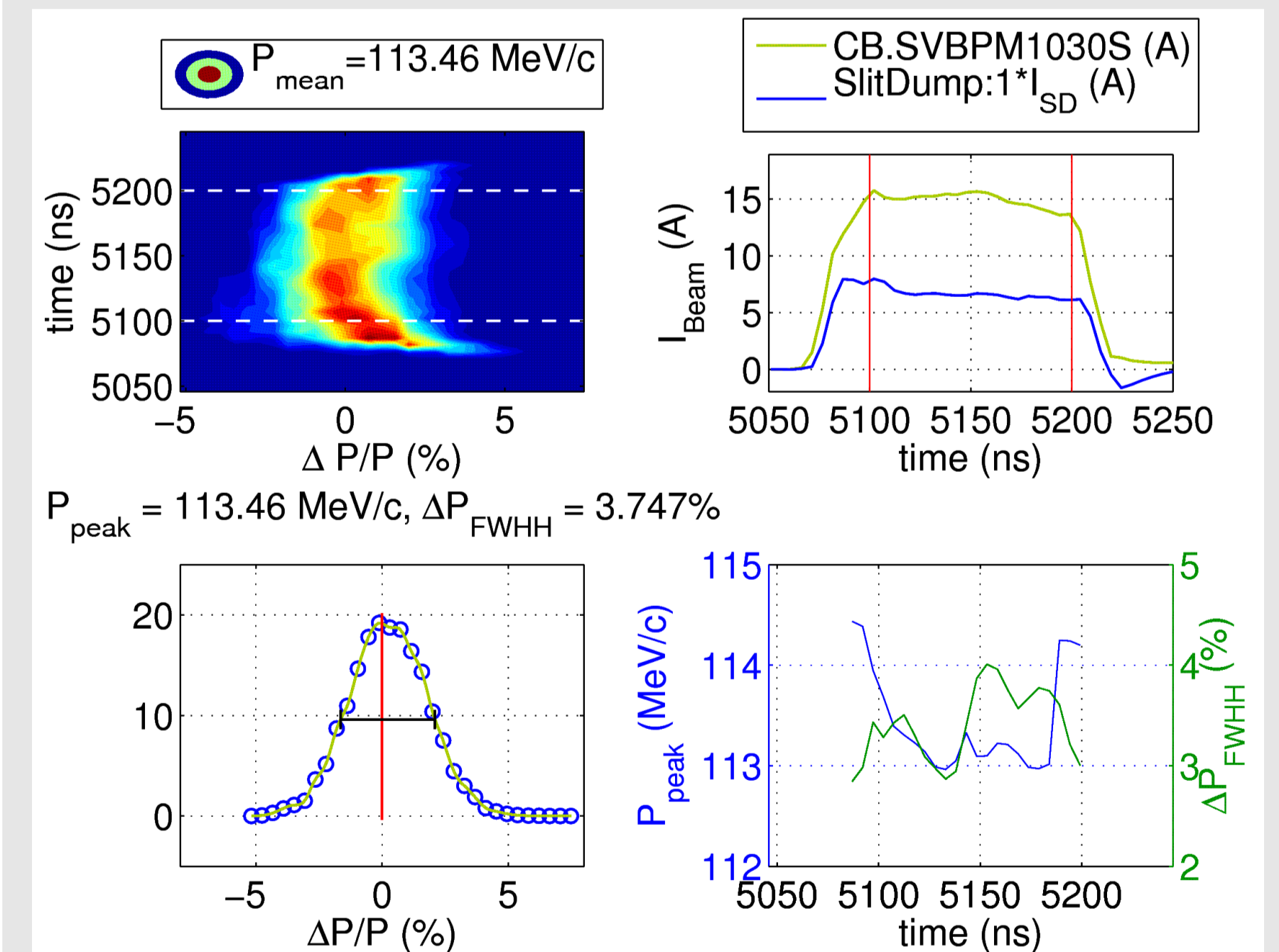
## Simulation of detector performance:



a) old design: parallel slits

b) new design: concentric slits

## Preliminary results, Single-slit dump (1 PETS)



## Outlook

- Commissioning of new segmented beam dump with 4 PETS in TBL.
- TBL commissioning with time-resolved spectrometry before and after beam deceleration.
- A performance study on OTR-based beam profile measurements on beams with an unusually large energy spread.
- Continue design of time resolved energy measurements to meet CLIC requirements: higher beam intensity, better time resolution.