# A proposition to measure the beam halo in CTF3

# Outline

1. Motivations
2. Experimental set-up
3. Calibration in the lab
4. Upgrading the actual set-up
5. Perspectives

# Motivations

- A device

-to image the beam halo, to measure its divergence and its energy distribution;

-to measure the temporal evolution of the halo inside a pulse duration;

- Proposition:

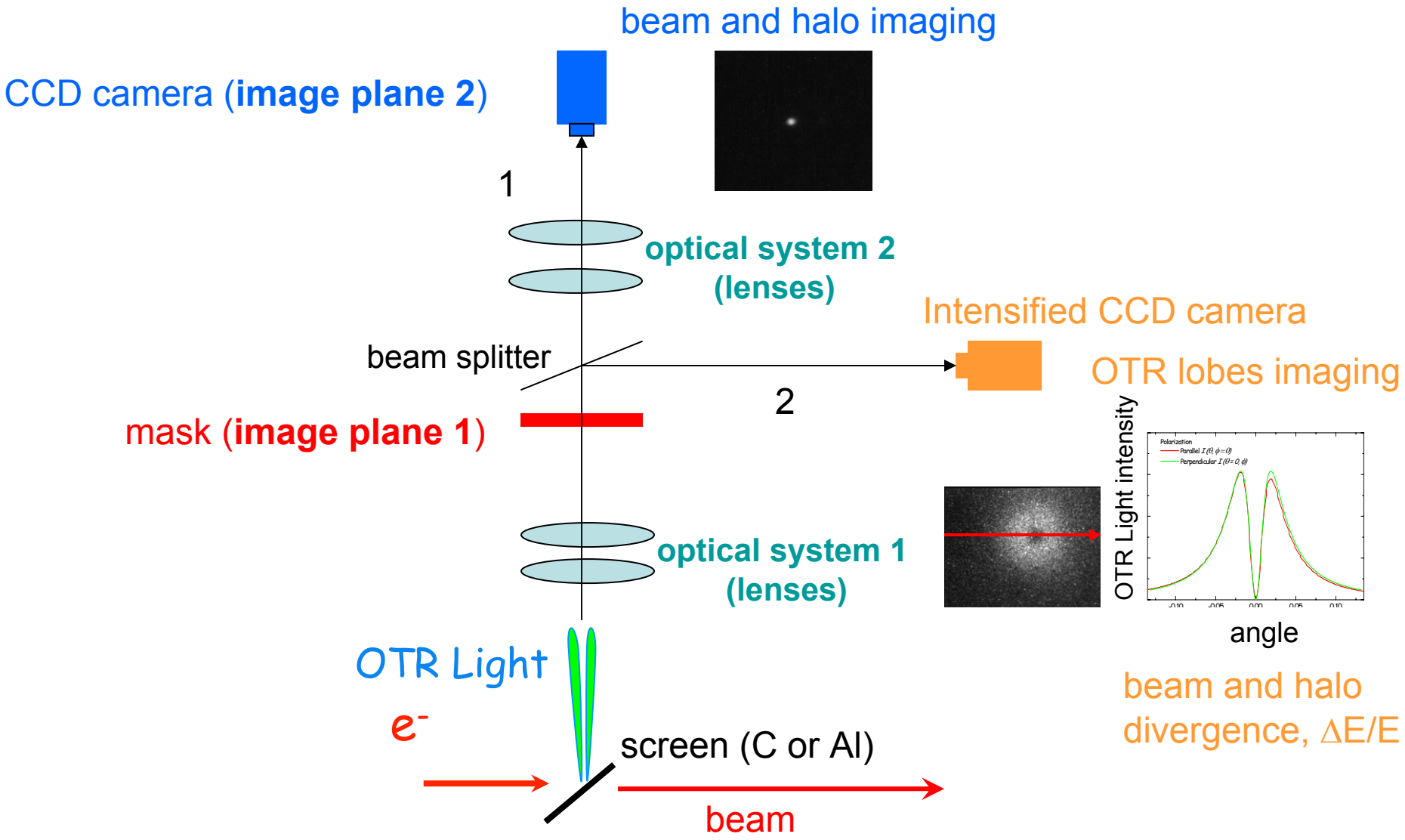
-use optical transition radiation (OTR) (measure of beam size, energy and divergence)

-use a simple mask and optical density filters (dynamic range)

-use gated camera (temporal evolution)

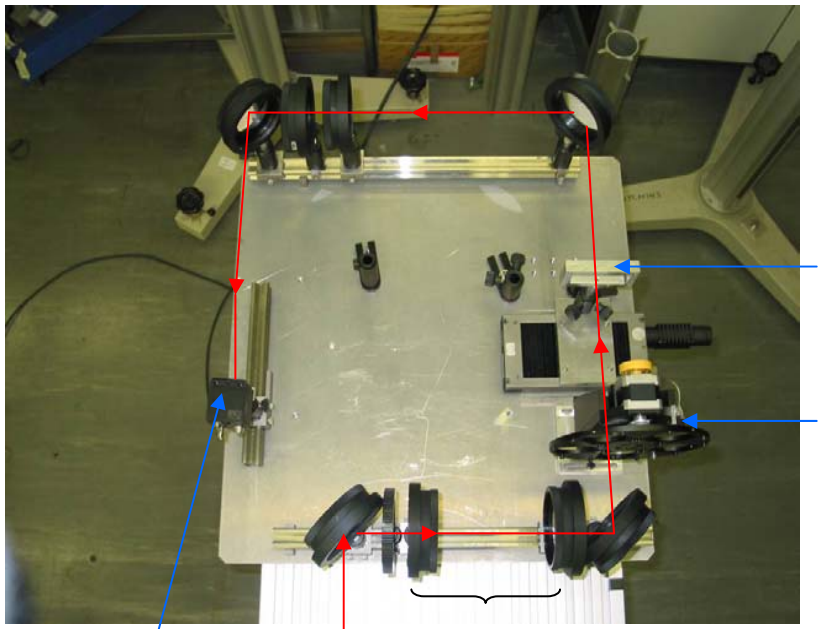
our first objective: a **test of feasibility**

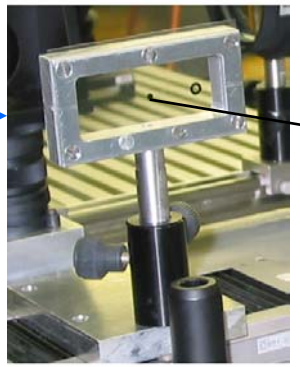
# The set-up under investigation!



# Top view of the set-up (in lab)

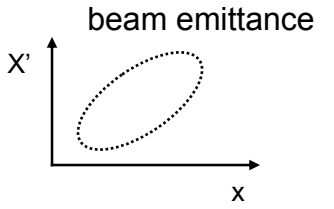
optical system 2





**Mask:** spot printed on polyesther foil

- option 1: in-out (beam core)
- option 2: translation inside the beam




mask (**image plane 1**)

filters wheel

CCD camera (**image plane 2**)

optical system 1

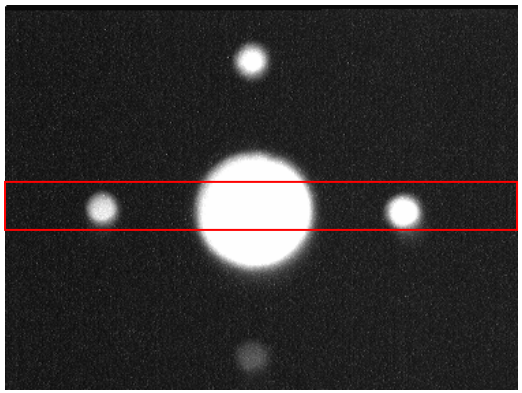
OTR light

## Magnification (M) of the system

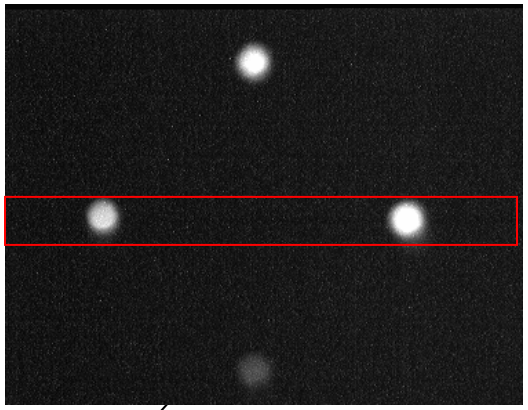
- at the **image plane 1**, $M_1$~0.6 (prediction: 0.63)
- at the **image plane 2**, $M_2$~0.5 (prediction: 0.56)

# Calibration in the lab: the mask opacity

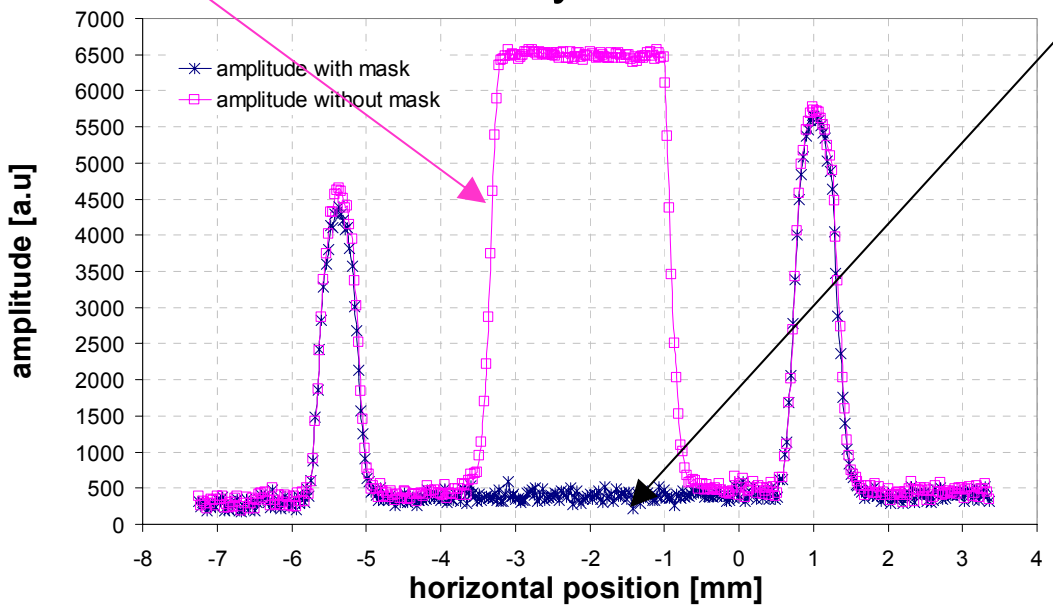
Phantom image without mask



Phantom image with mask



Profile intensity measurement



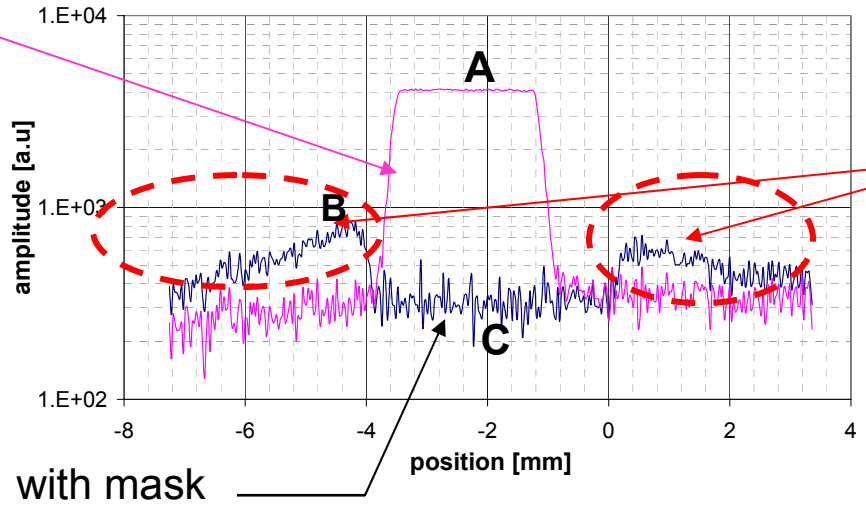
# Calibration

Intensity of the light source at its maximum;
-image with mask
-image without mask => saturation => use filter (optical density =2)

A/C ⟶ mask opacity (rejection factor>1250)

B/A ⟶ aberrations ~ 1.5 $^{0}/_{00}$ on ~ 1 mm

without mask
(with filter)

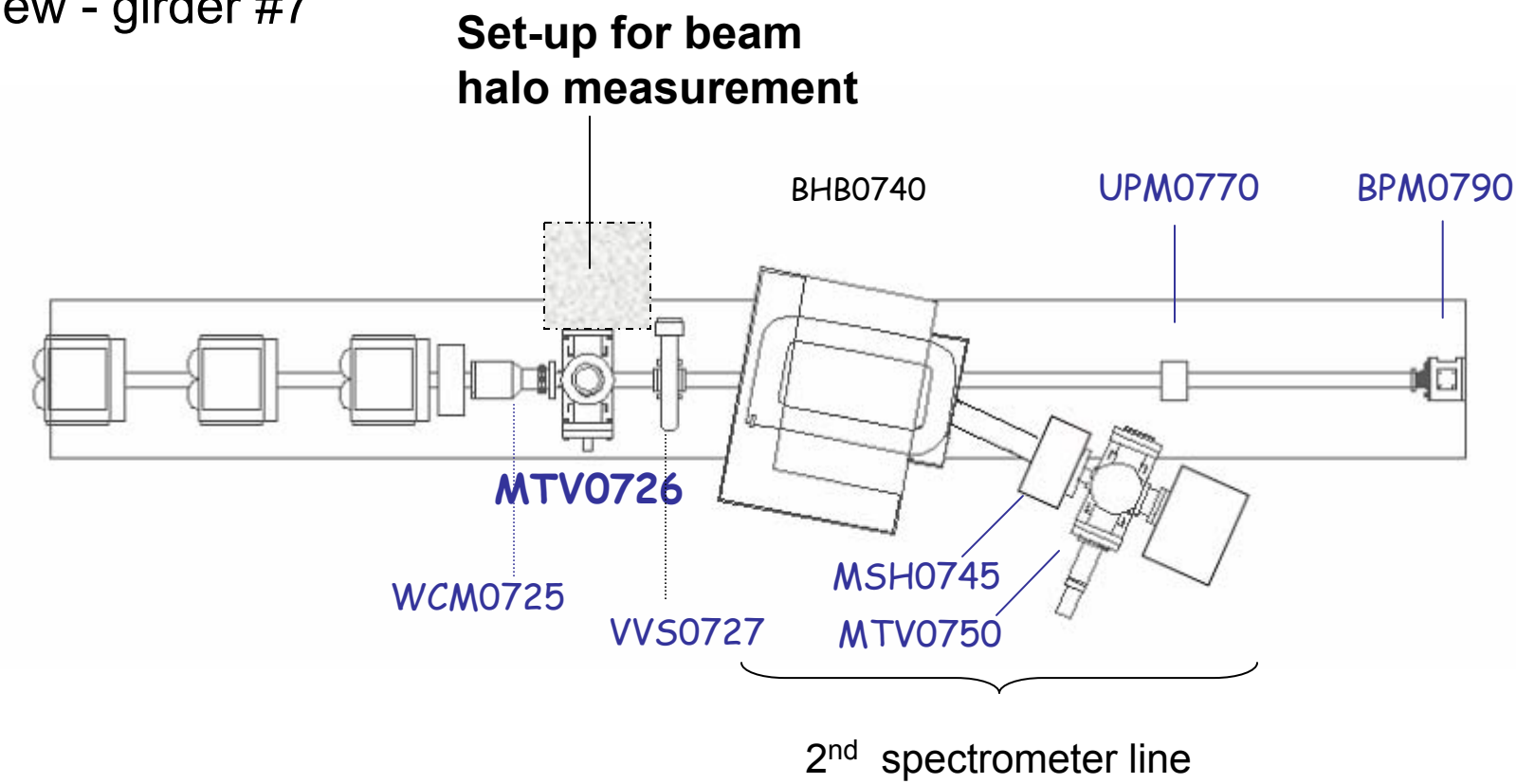



with mask

aberrations on the
mask extremities

# Installation in CTF3

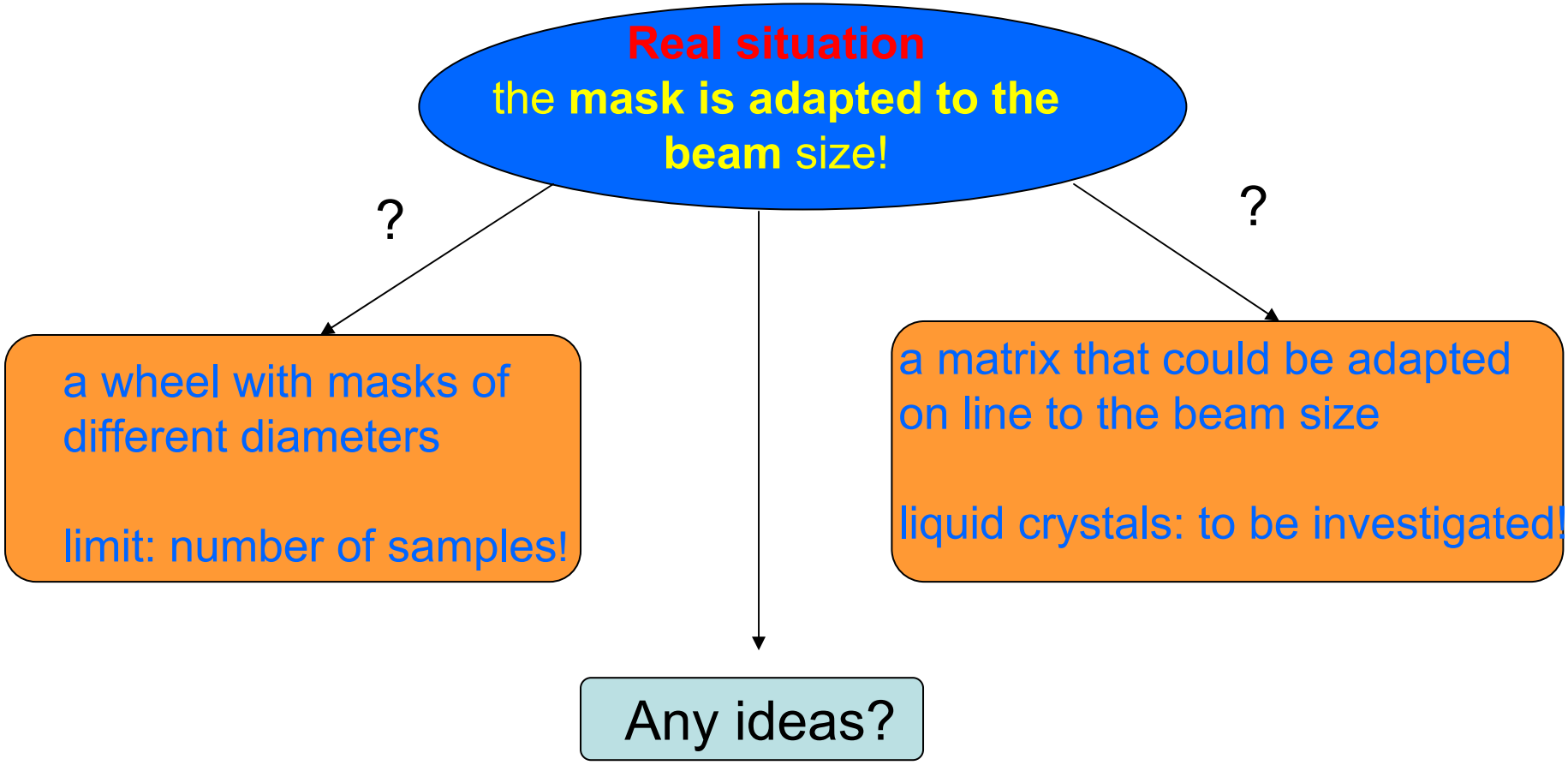
Top view - girder #7




-OTR light from the C or Al screen in the MTV0726
-at MTV0726: $E_{beam}$= 40 MeV; $\sigma_{beam}$~ 1.5 mm

# Upgrading the actual set-up

During the feasibility test the beam size will be adapted to the mask dimensions



# Towards CLIC

**the main beam**

100 nC/pulse
pulse duration: 102 ns } I=1 A

beam size: micron order

**the drive beam**

690 μC/pulse
pulse duration: 91.6 μs } I=7.5 A

beam size: mm order

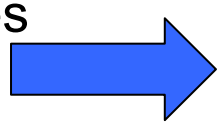
**Thermal problems** limit the use of OTR screens

the main beam
(e.g., with Carbon screen
$\sigma$~50 μm, $\Delta t_{screen}$=2200ºC)

the drive beam
(e.g., with Carbon screen
$\sigma$~5 mm, $\Delta t_{screen}$=1537ºC)

An alternative: **OTR slit only in the halo**


Diffraction radiation (DR) of the beam core on the slit extremities
If $DR_{beam\ core}$ ~ $OTR_{halo}$



**beam loss monitoring**
to measure showers due to the halo on the slit