Simulation of Beam Dynamics in Single Channeling of TCCP

Chiara Maccani
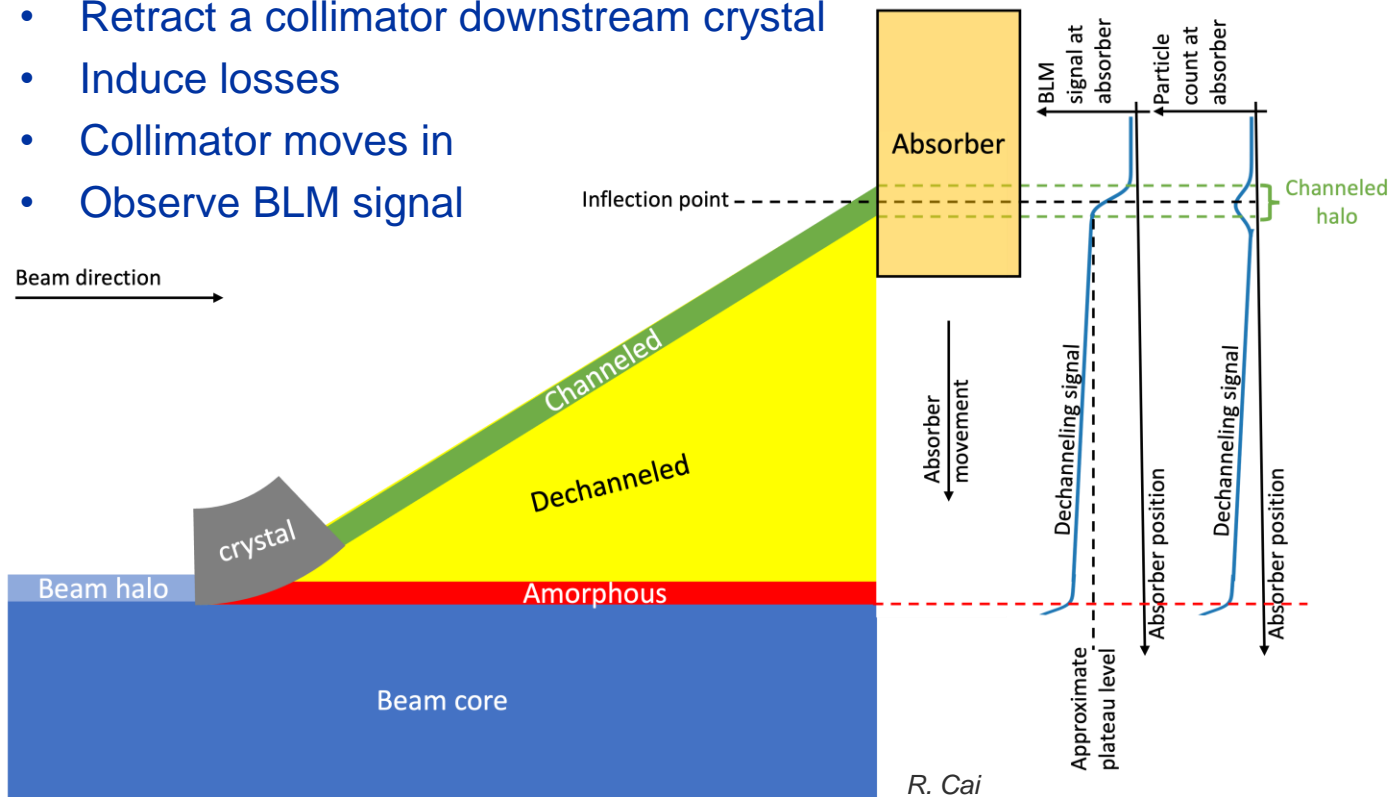
CERN BE-ABP-NDC

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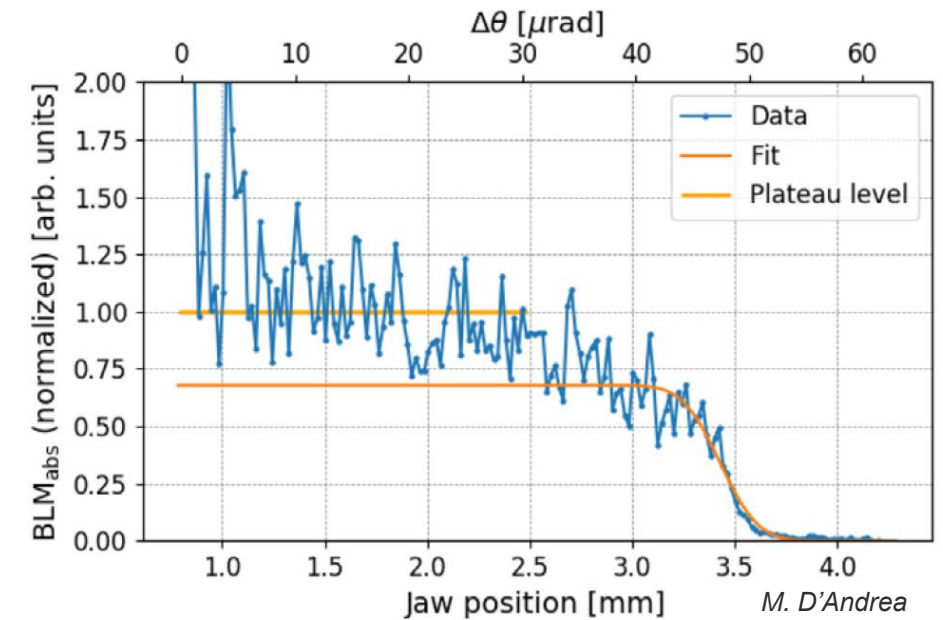# Linear scan with circulating beam

One of TWOCRYST key measurement is **TCCP multiturn channeling efficiency** estimation via **linear scans**

- Crystal in channeling
- Retract a collimator downstream crystal
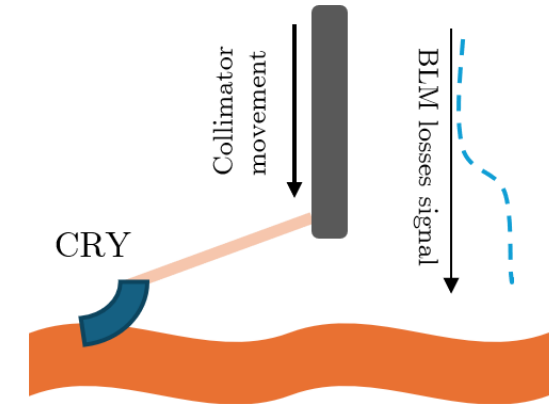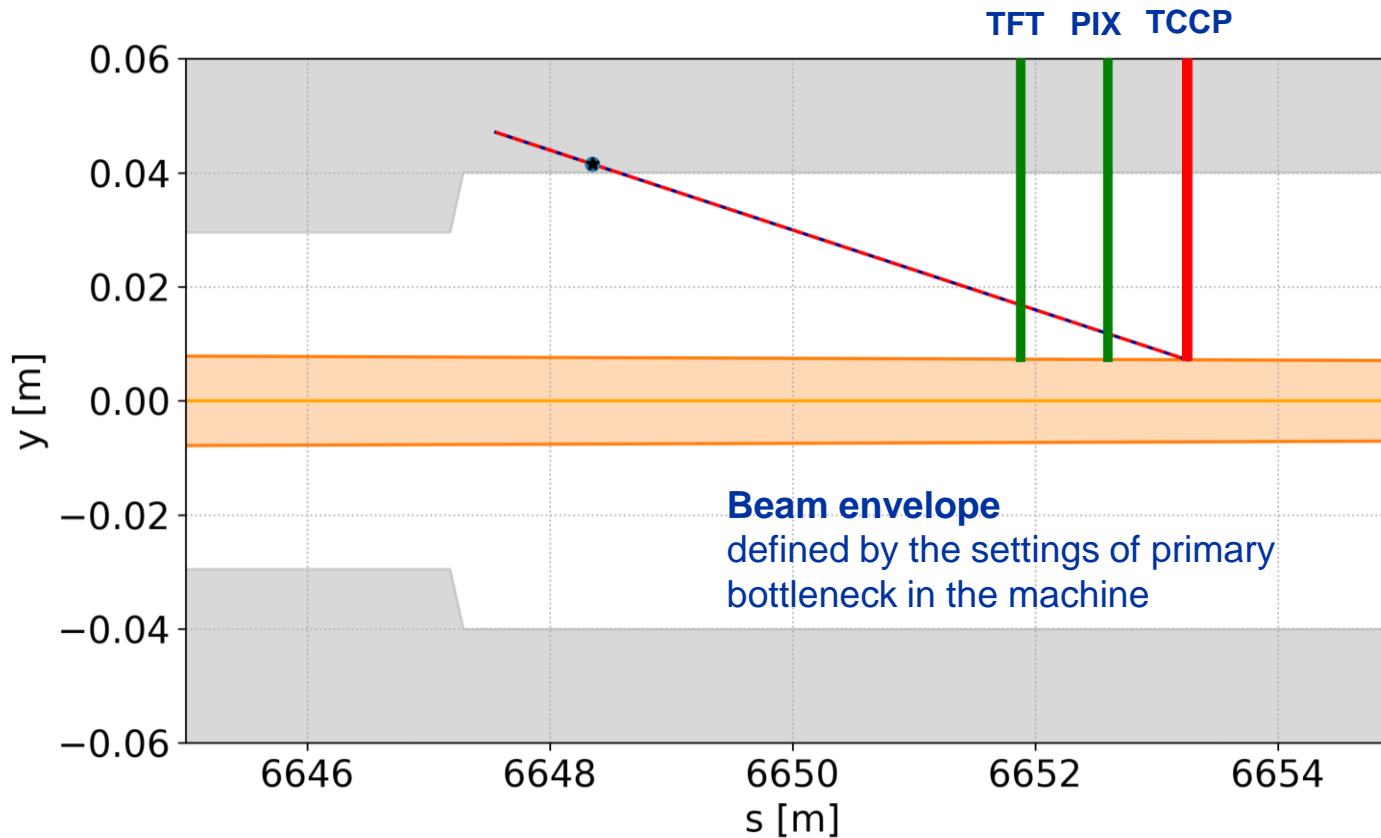- Induce losses
- Collimator moves in
- Observe BLM signal

Measures:
- Bending angle
- Multiturn channeling efficiency (see next slide)

R. Cai

M. D'Andrea

TCCP characterization

→ Linear scans are usually performed with collimator BLMs; in this region MUST be performed with **detectors**
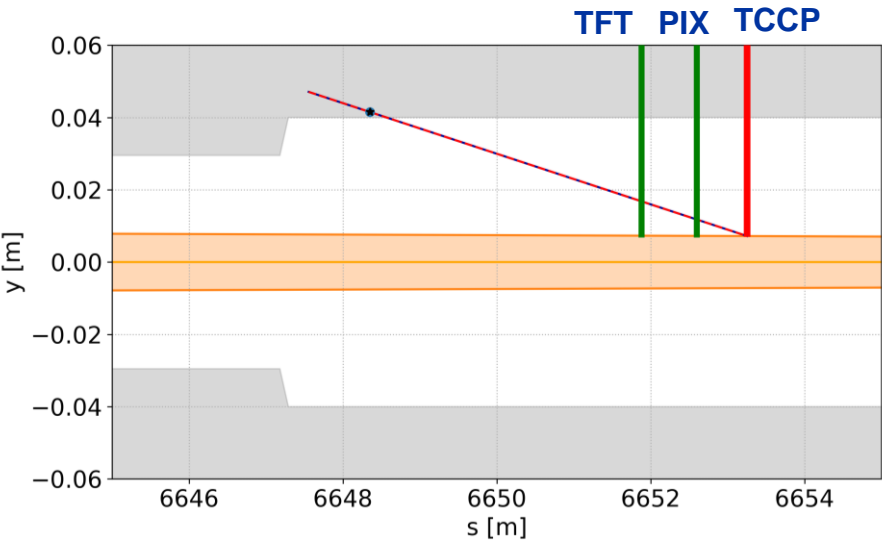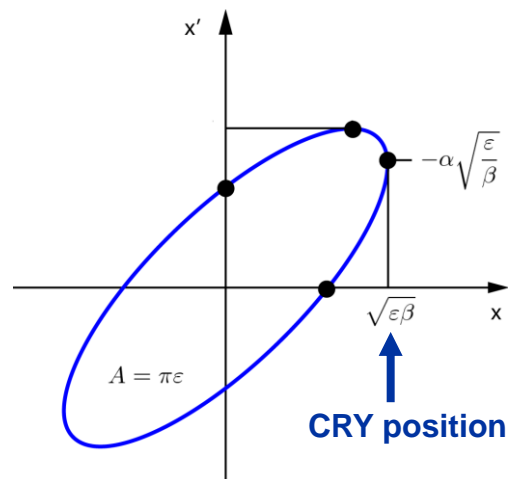

Detector requirements:

- Intercept the channeled halo
- Catch as much dechannled particles as possible
- Don't break the hierarchy

PIXEL is too close and/or too much retracted

Beam Dynamics

CRY position

❖ Twiss

$$\sigma(s,\gamma) = \sqrt{\varepsilon(\gamma) \cdot \beta_y(s)}$$

$$\theta_{beam}(s,\gamma) = -\alpha_y(s) \cdot \sqrt{\frac{\varepsilon(\gamma)}{\beta_y(s)}}$$

➜ TCCP location, 450 GeV:
$\sigma = 1.4389\ mm,\ \theta_{beam} = 75.95\ \mu rad$

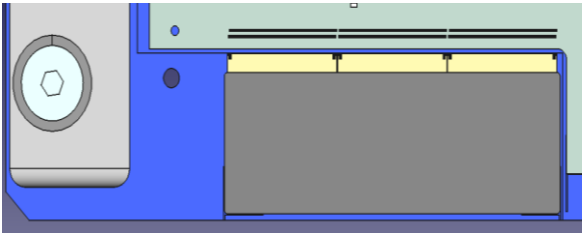## ❖ Channeled particles

➜ receive a kick of θ_b from TCCP

$$y_{chann} = \left|\left(s_{TCCP} + \frac{L_{TCCP}}{2}\right) - s_{PIX}\right| \cdot \tan(\theta_{b,TCCP} + \theta_{beam}) + n\sigma$$

s_{TCCP}	6653.2543 m
θ_{TCCP}	7 mrad

Beam envelope

TCCP
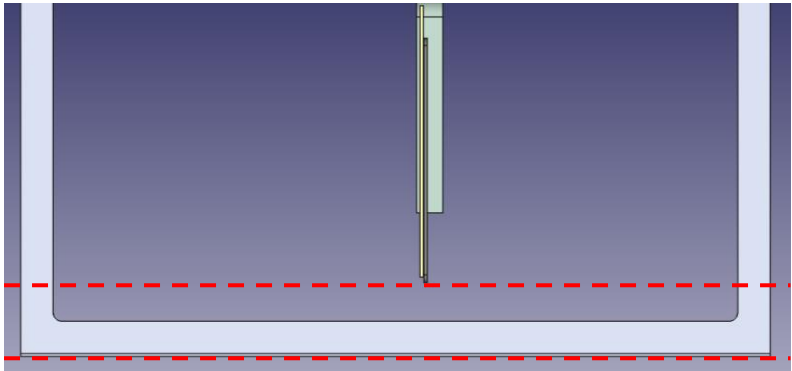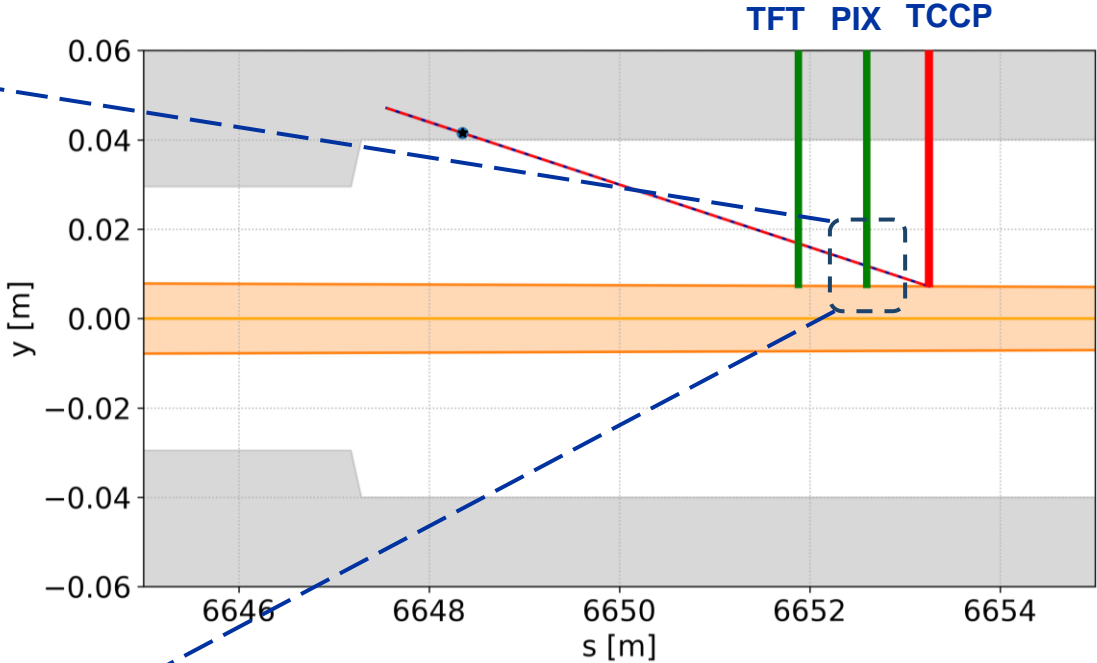
Position of active area

	Δs [mm]	y [mm]
PIX1	585.3	**11.338**
PIX2	596.4	11.416
PIX3	607.5	11.493

4.26 mm retraction
(wall thickness 2.14 mm)

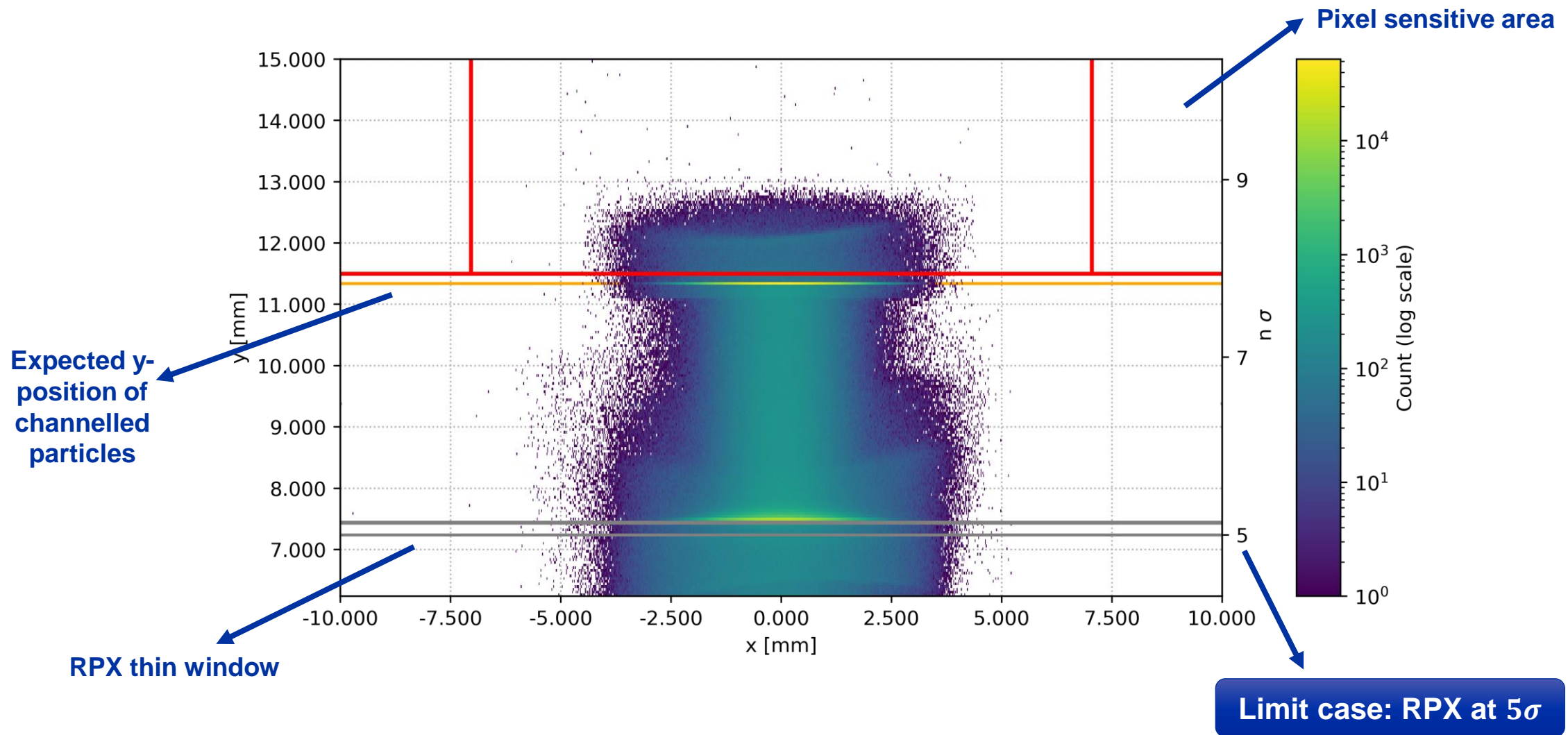**Reference for RPX** $\sigma - settings$

→ PIXEL location, 450 GeV: $\sigma = 1.4448 \; mm$ ➡   **Retraction $\cong 3\sigma$ in addition**
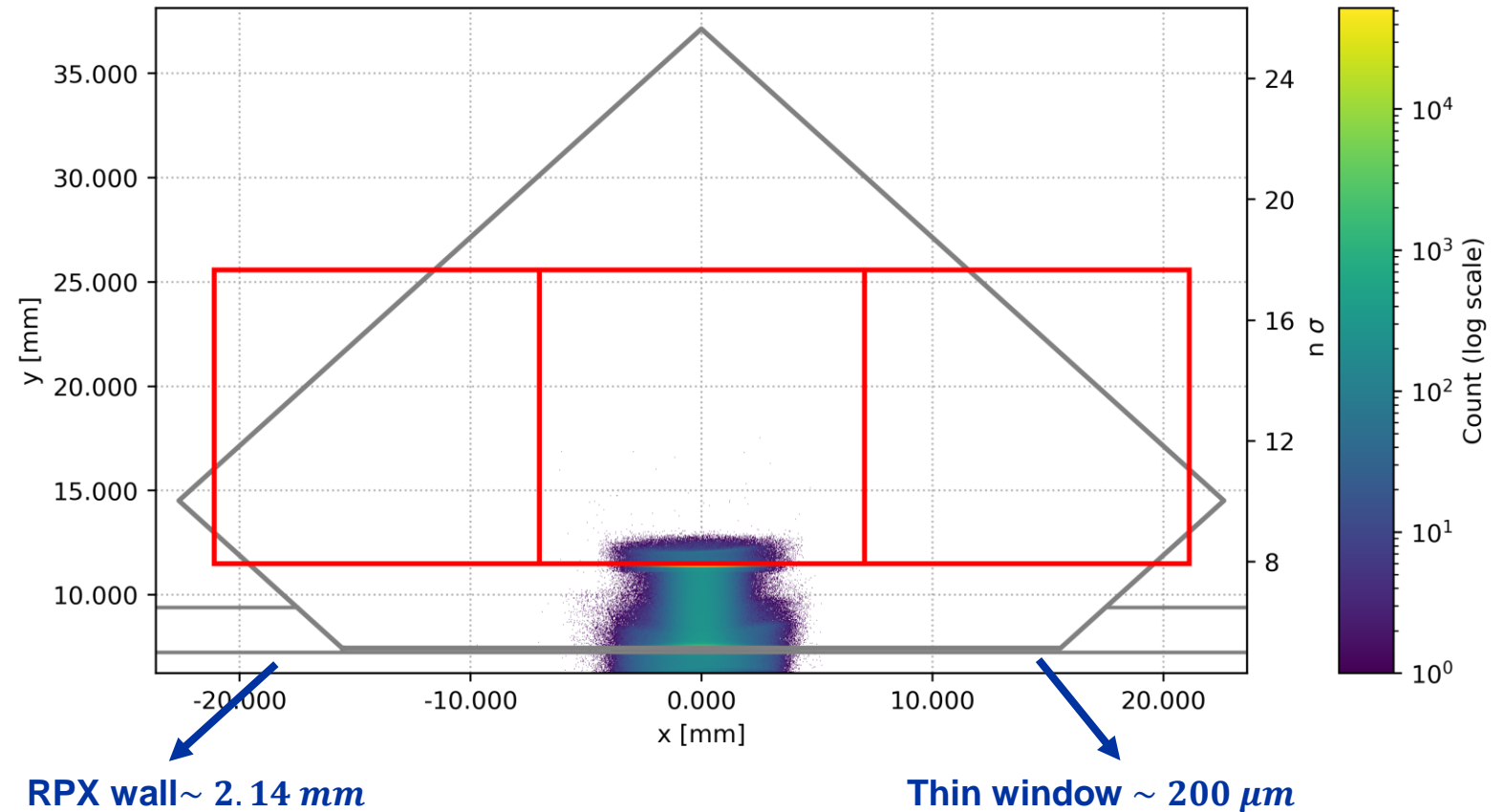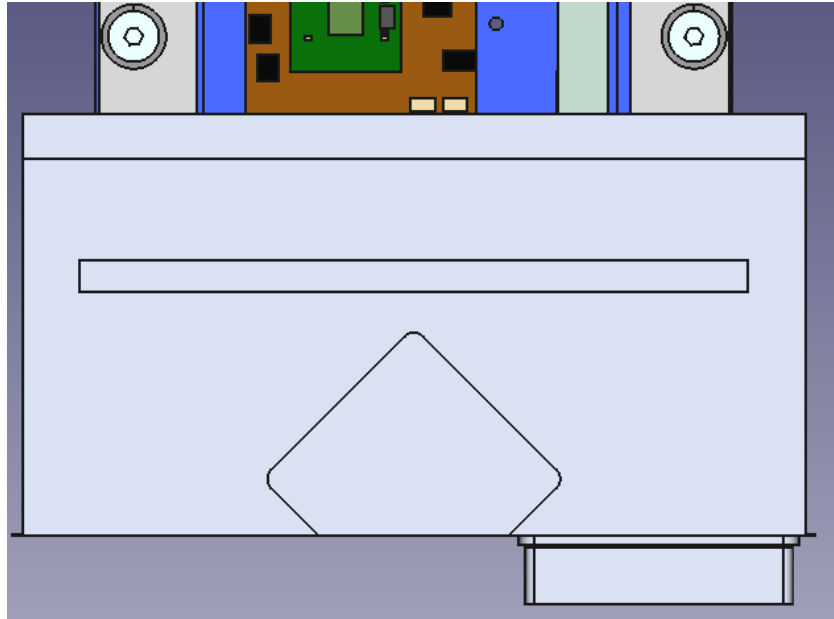

TFT   PIX   TCCP

TCCP must be the primary bottleneck: $n\sigma_{RPX} \geq n\sigma_{TCCP}$

Limit case: $n\sigma_{RPX} = n\sigma_{TCCP} = 5\sigma$

$y_{PIX} = \mathbf{11.499 \; mm} \cong \mathbf{8\sigma}$
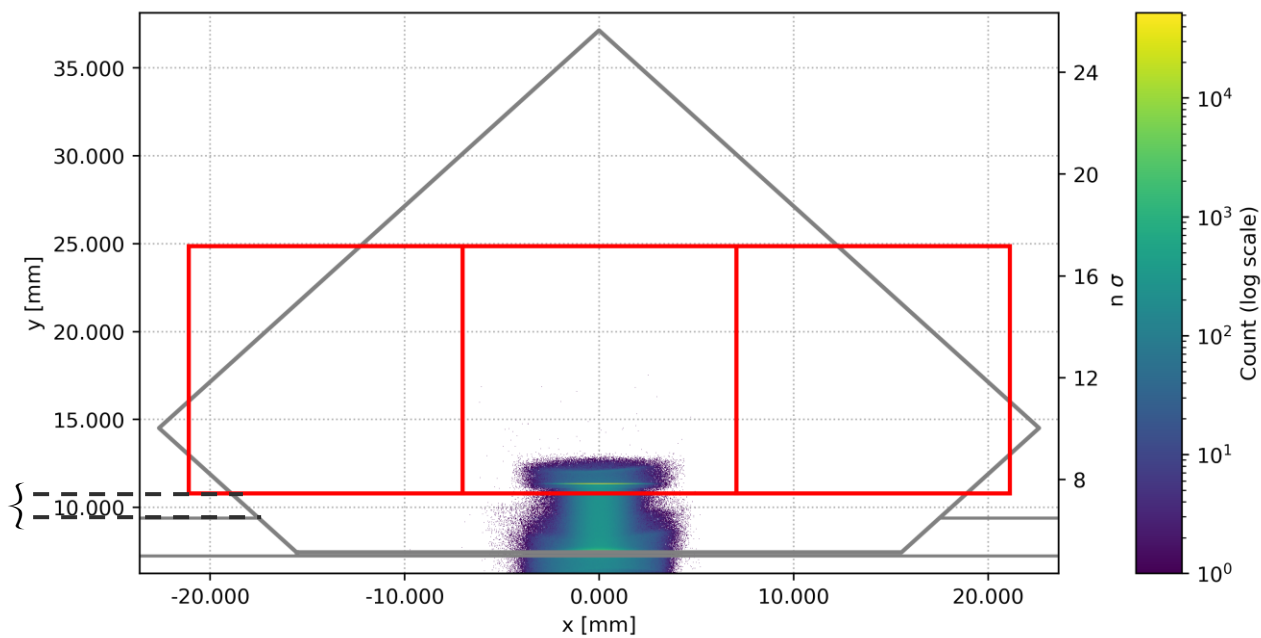
Transverse particles distribution - zoom

Pixel sensitive area

Expected y-position of channelled particles

RPX thin window

Limit case: RPX at 5σ

Particles transverse distribution

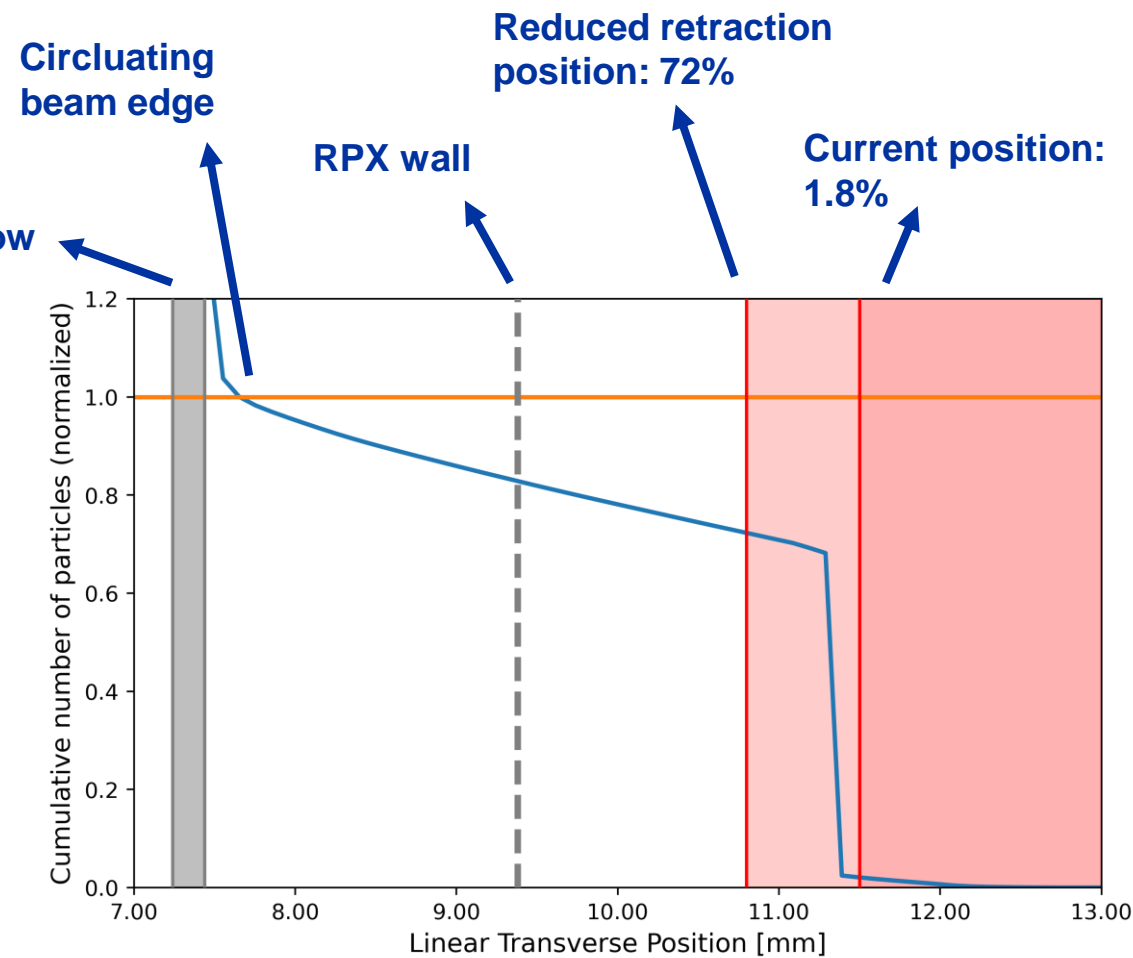RPX wall~ $2.14\ mm$

Thin window ~ $200\ \mu m$

Possible solutions - 1

❖ **Reduce PIX retraction**

Retraction reduced of 700 μm
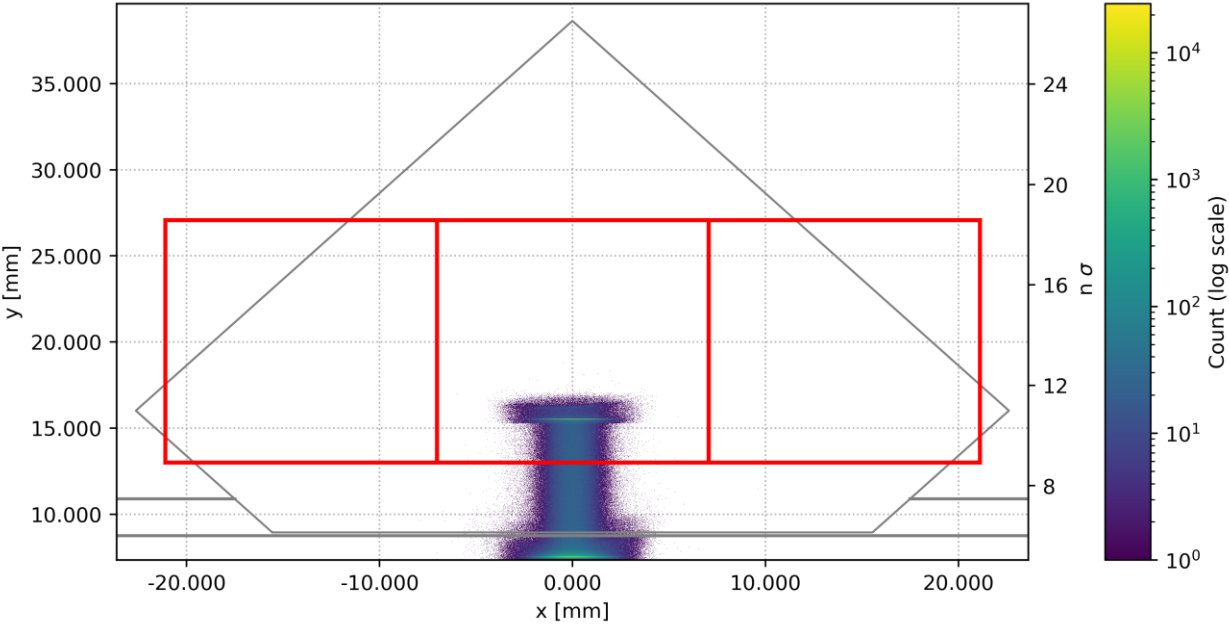
Possible solutions - 2

❖ **Swap the detectors**

Current RPX2:

TFT settings: 6σ

TFT in RPX1

PIX in RPX2

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