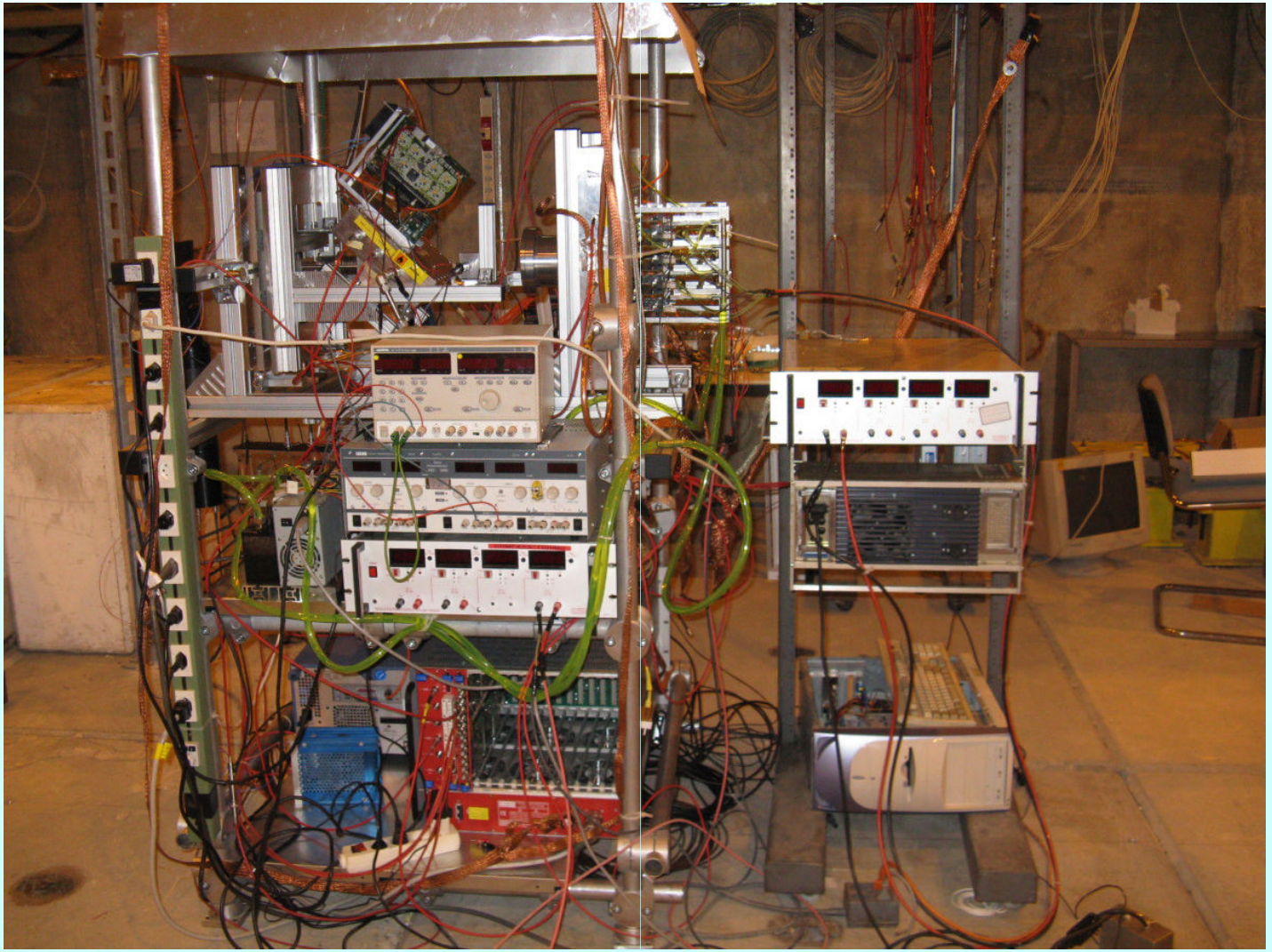
October Test beam - THGEM group

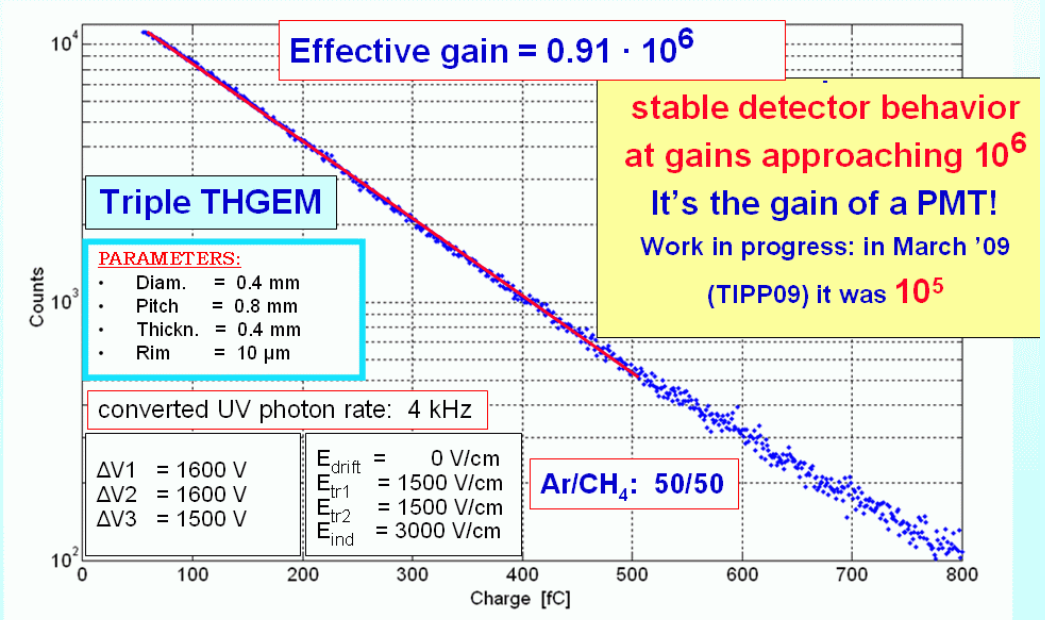
Alessandria-CERN-Freiburg-Liberec-Prague-Torino-Trieste Collaboration



Reminder

- Intense R&D activity towards THGEM-based photon detectors.
- Testing prototypes with X-rays, CsI.
  Significant improvement in 2009 (pushing the gain up to 10^6)
- Photoelectron collection efficiency under study. Need of IBF study.

Amplitude distribution for single photon signals



Time distribution for single photon signal

Triple THGEM

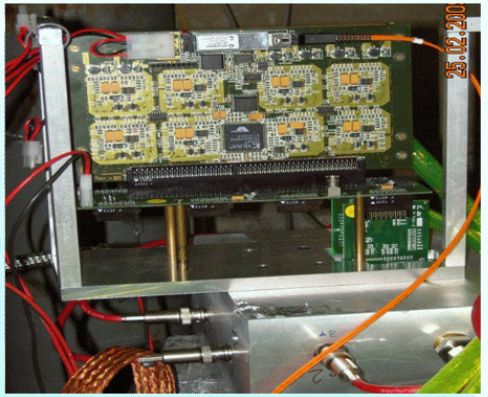
Ar/CH_4: 50/50

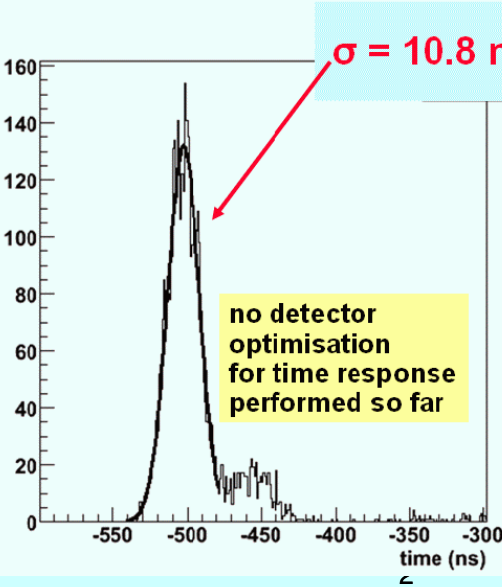
gain ~ $5 \cdot 10^5$

PARAMETERS:
Diam. = 0.4 mm
Pitch = 0.8 mm
Thickn. = 0.4 mm
Rim = 10 μm

converted UV photon rate: 3 kHz

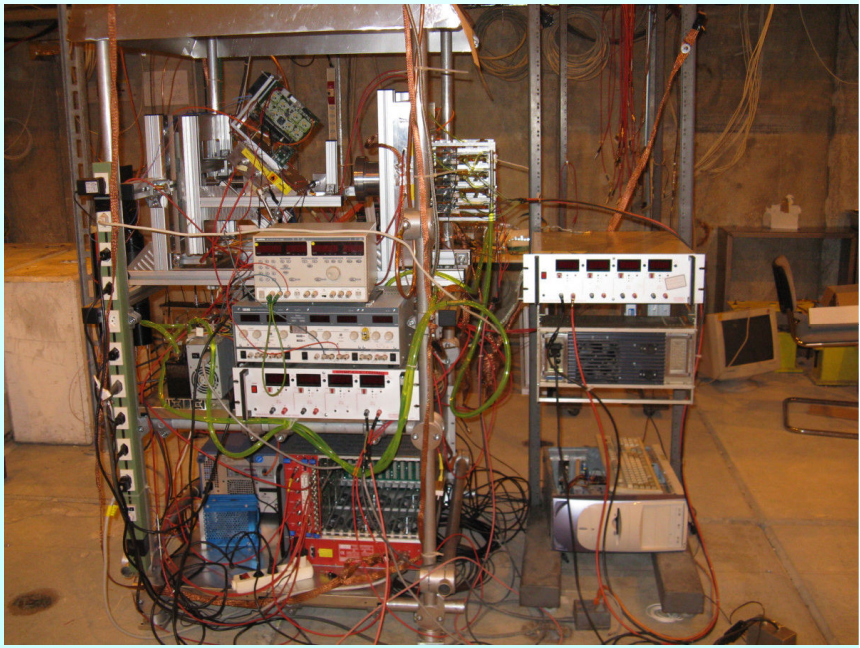
TDC bin size: 108 ps
pulse width: 600 ps





Need to demonstrate THGEM operation in real conditions

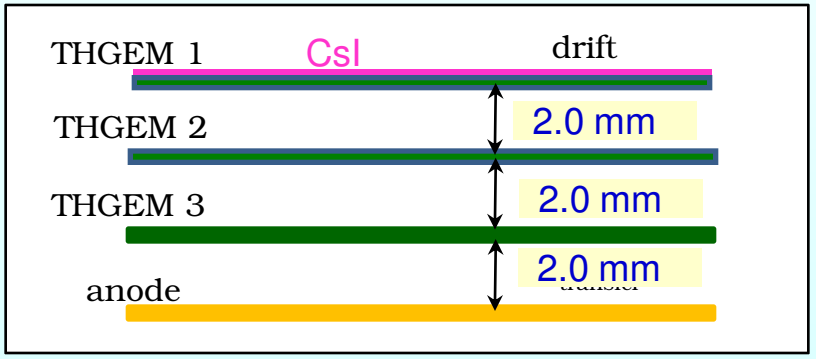
- In the LAB detector looks very promising
- What is the behavior in realistic conditions: MIPS + single photons (stability, response of detector,..)
- Dedicated setup has been build
  - 2 chambers with CsI + quartz radiator
    30x30mm^2 triple THGEM
    100x100mm^2 triple THGEM
  - Setup allows full control and monitoring

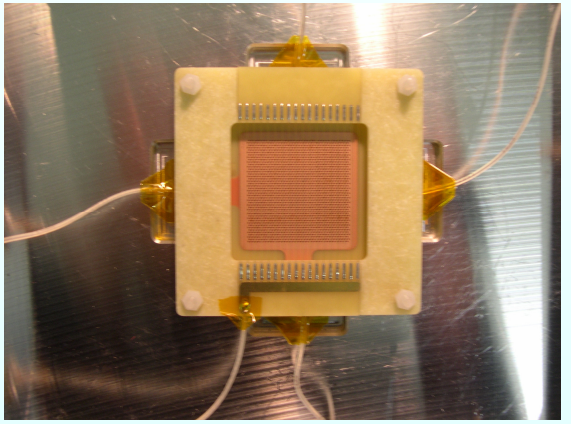


Small 30x30mm^2 THGEM

Using same structure as detector tested in the LAB in 2009

Triple THGEM (CsI) Ar/CH_4 50/50
Diam=0.4 mm, pitch =0.8, Thick=0.4, rim ≤10 μm





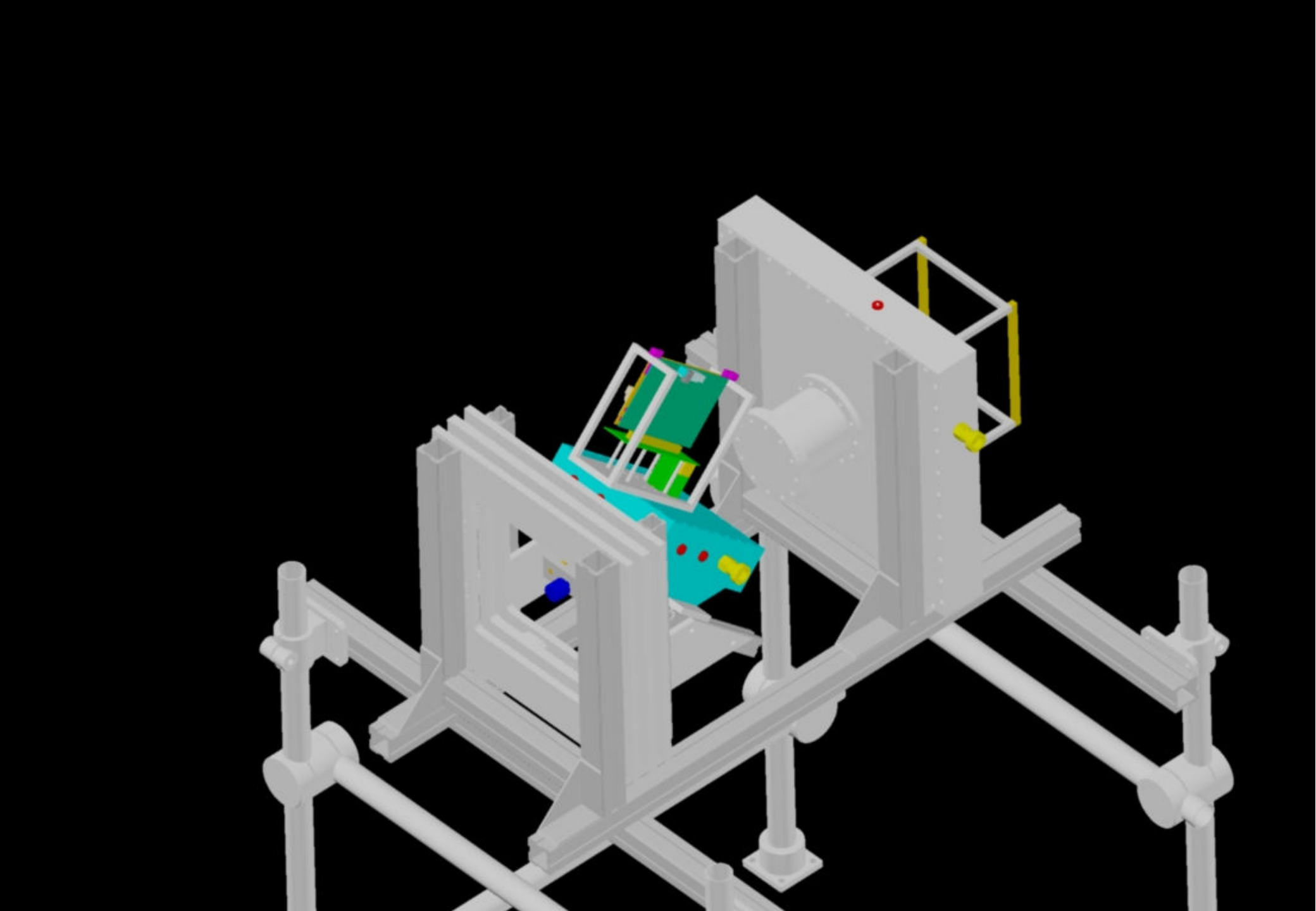
- HV provided by resistive divider
- Currents measured at BOTTOM3 and TOP1

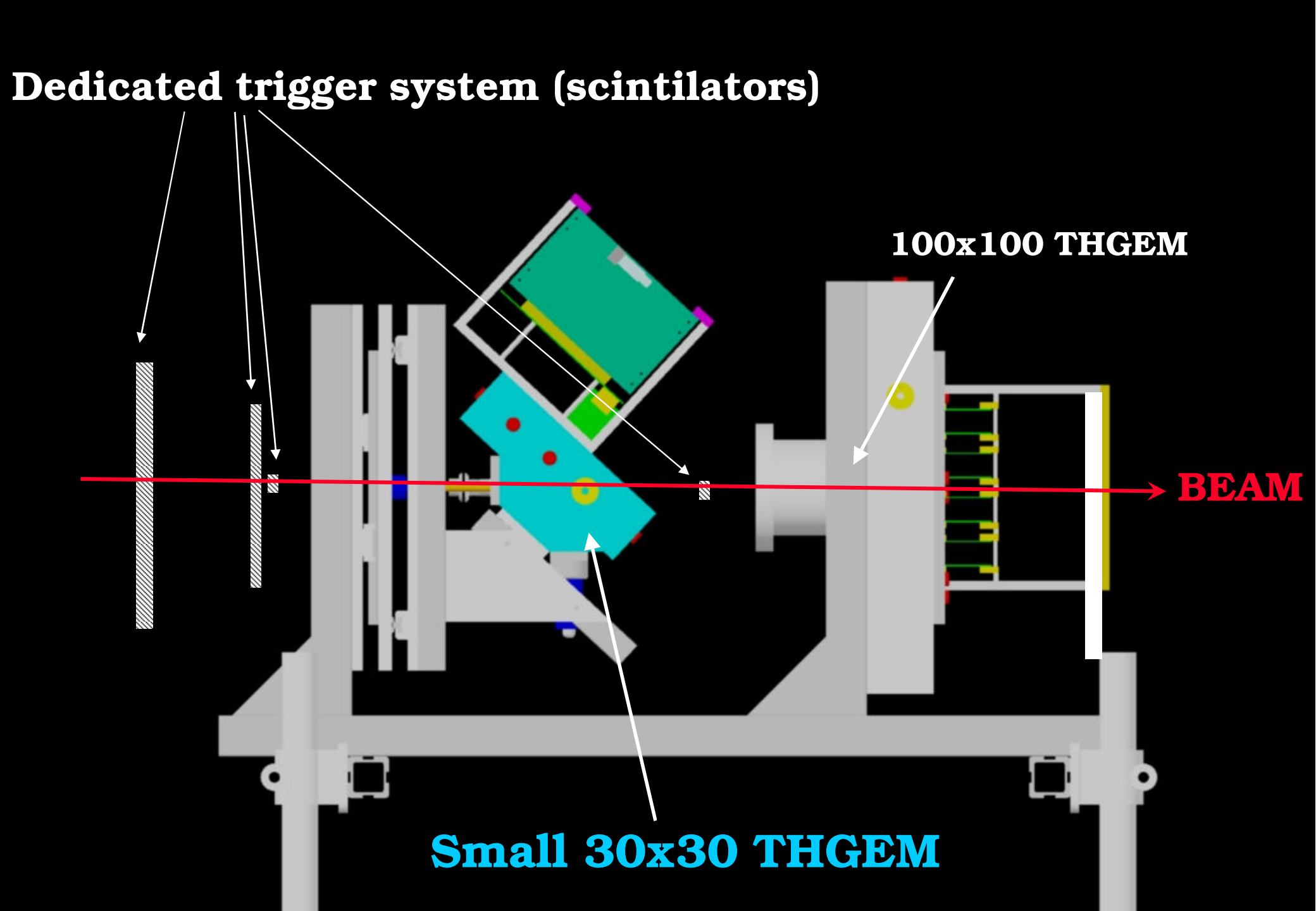
Goal: full control + possibility to check performance of chamber

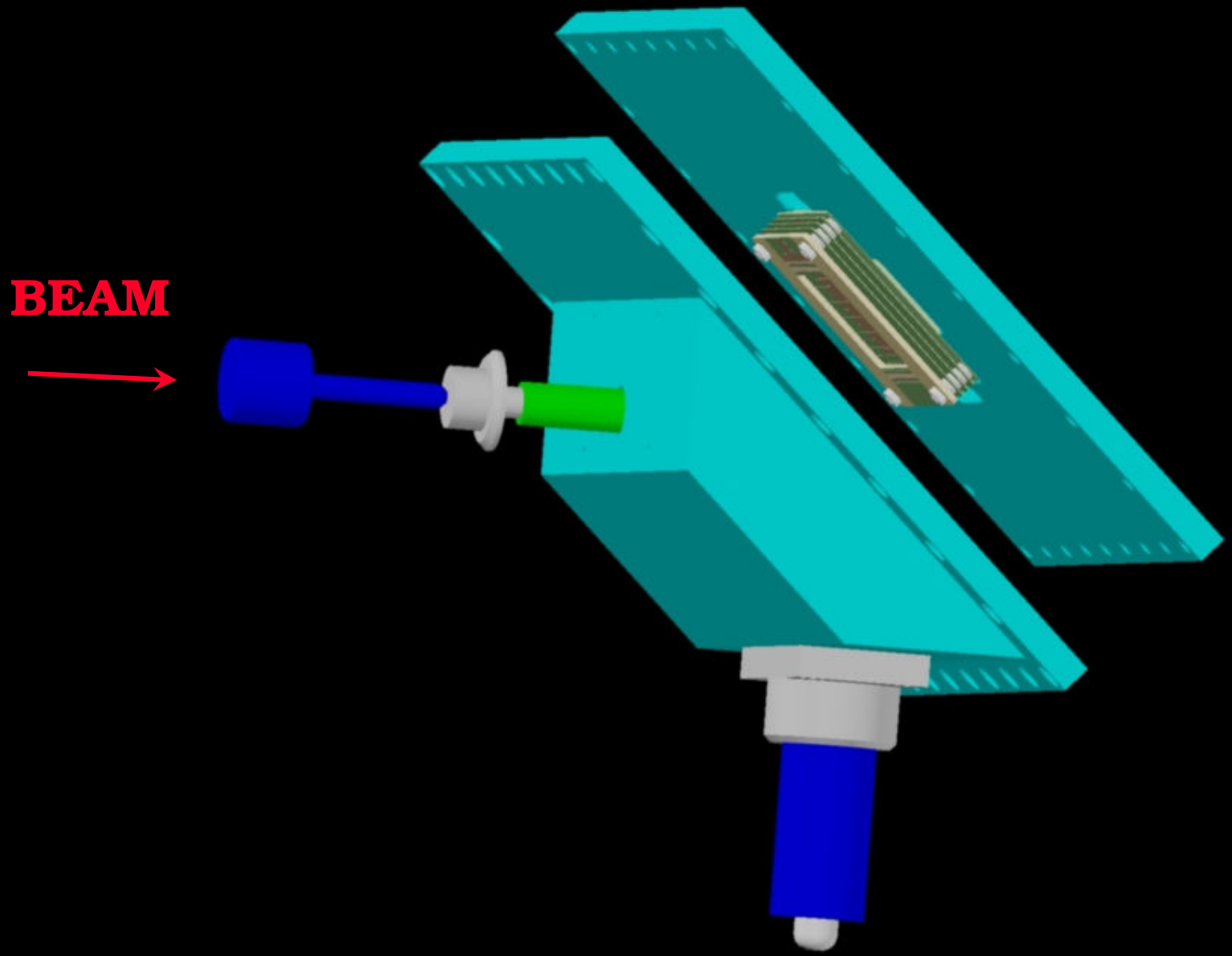
- External illumination – pulsed UV laser

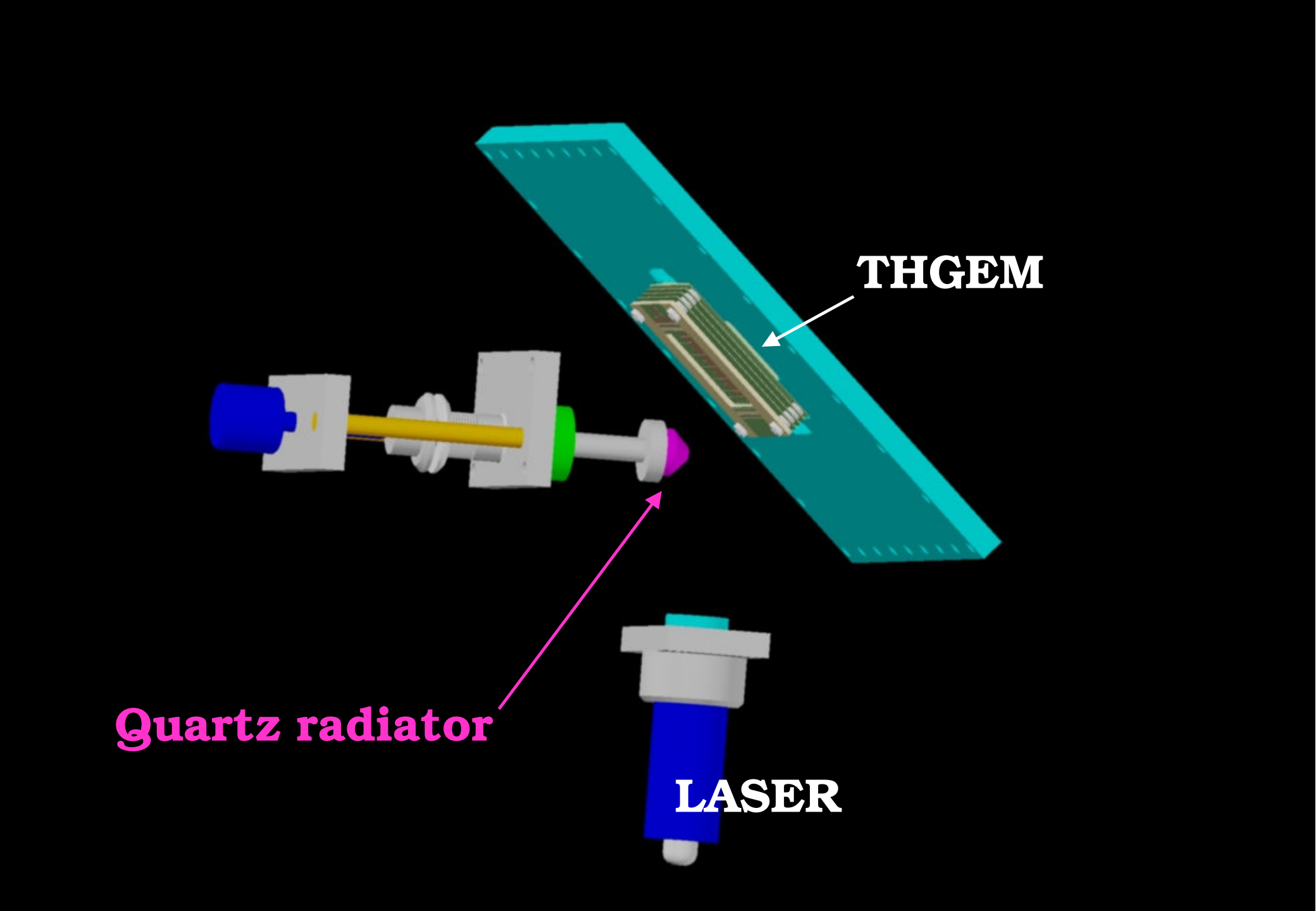
(monitoring currents, analog readout, digital readout – in single photon mode)

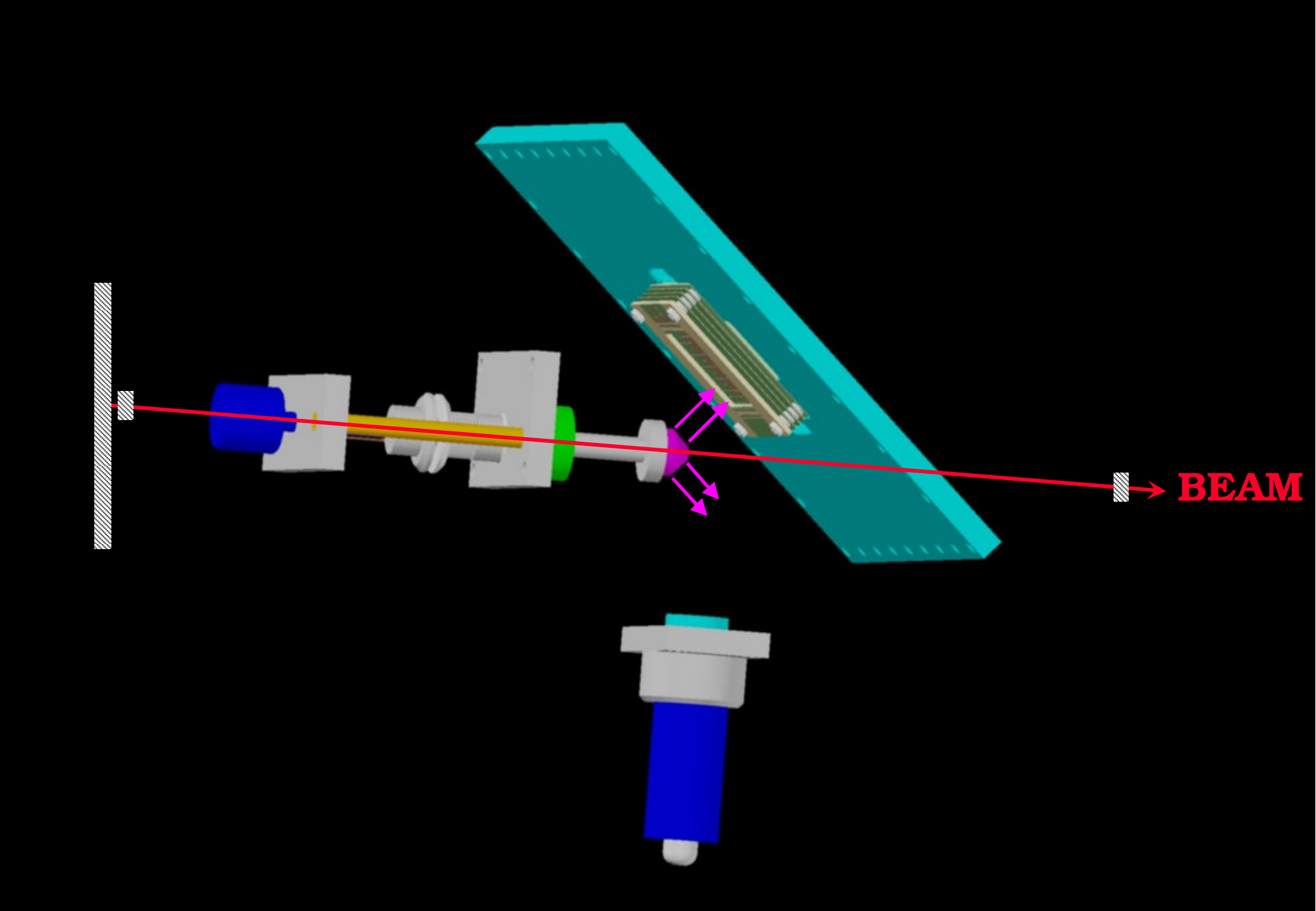
- Adjustable quartz radiator – Cherenkov photons

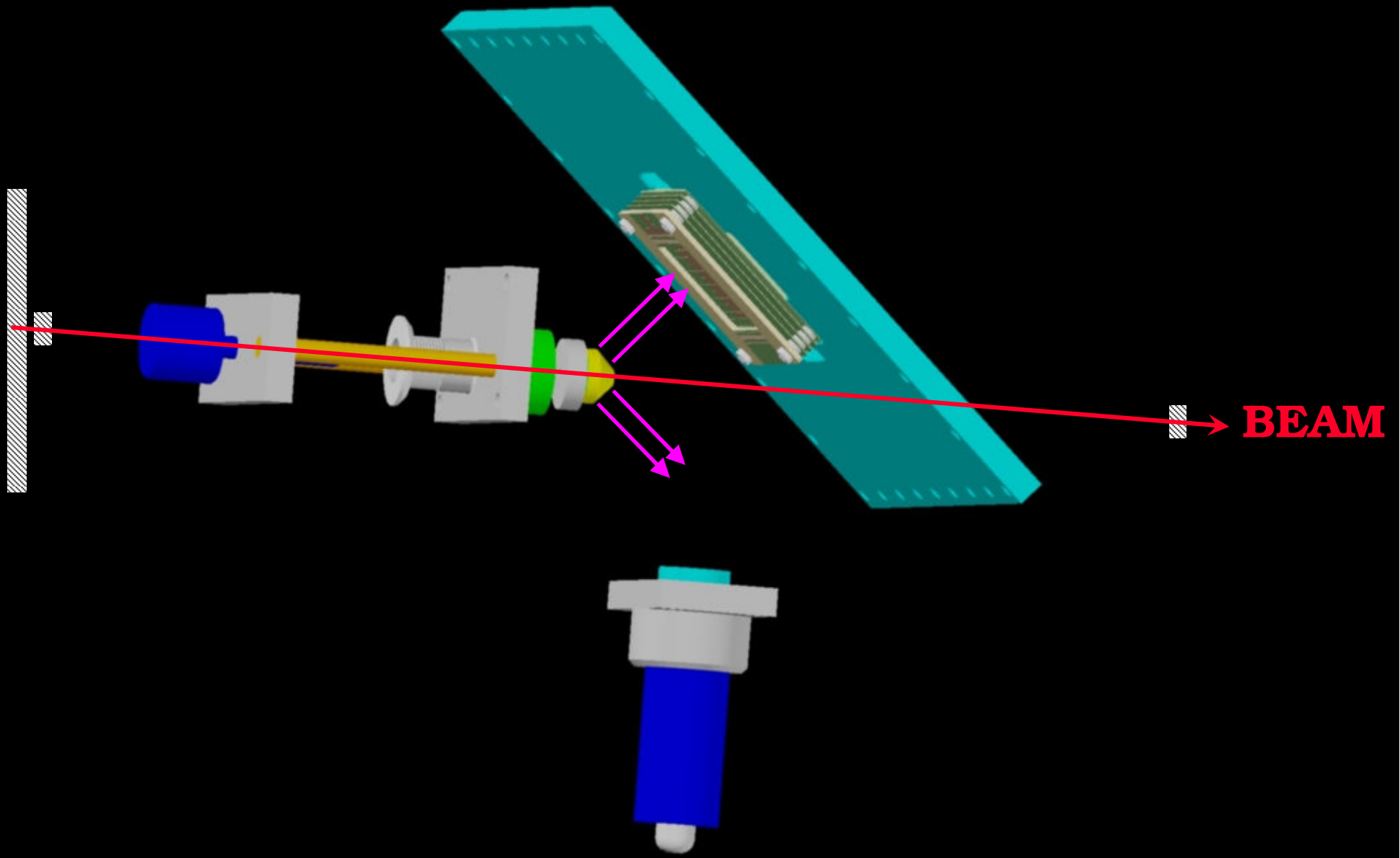



Dedicated trigger system (scintilators)
100x100 THGEM
BEAM
Small 30x30 THGEM

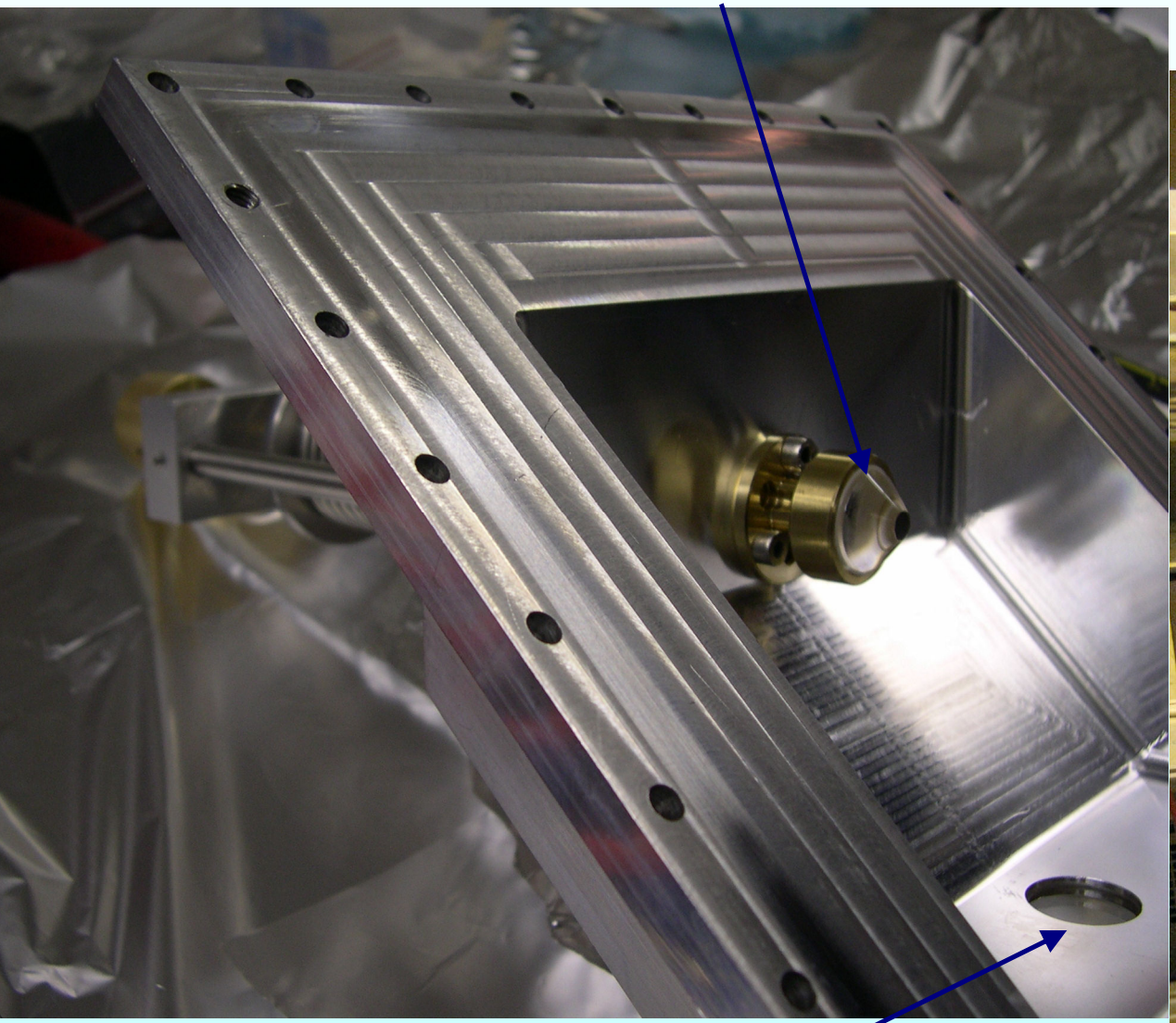

BEAM

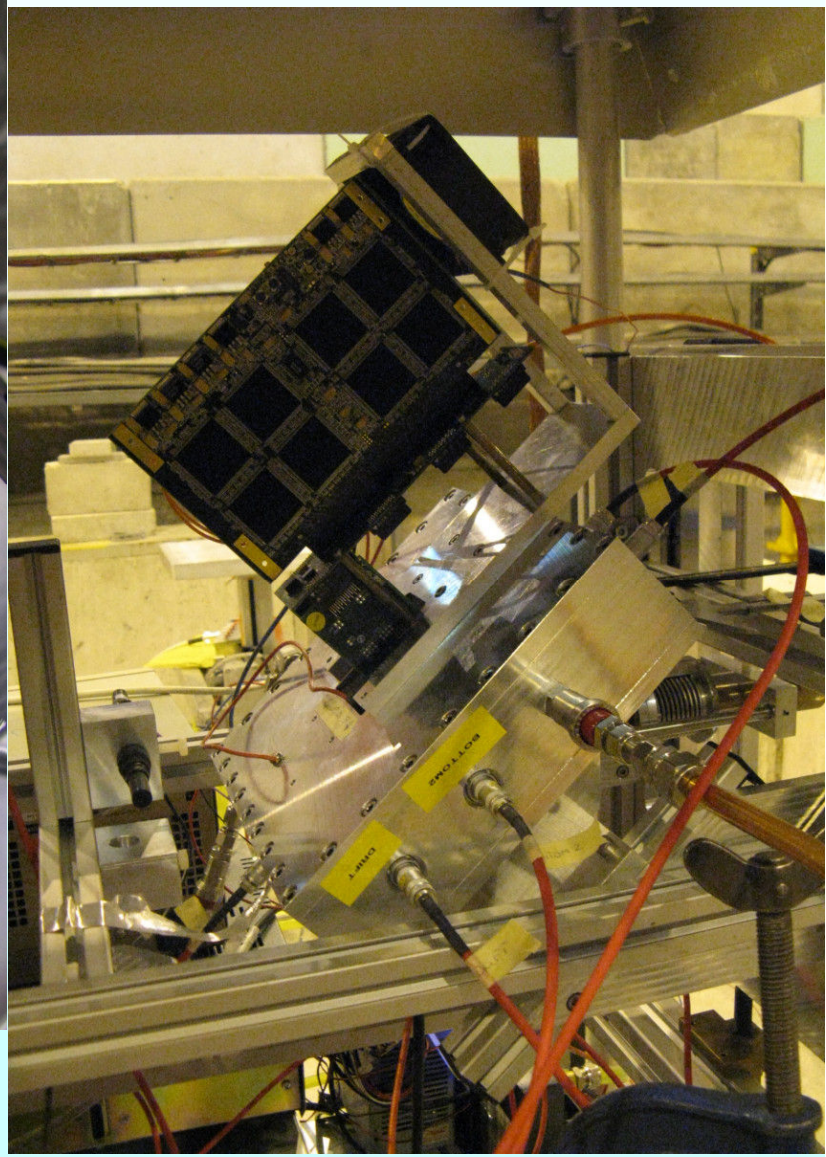

THGEM
Quartz radiator
LASER


BEAM


BEAM

Quartz radiator

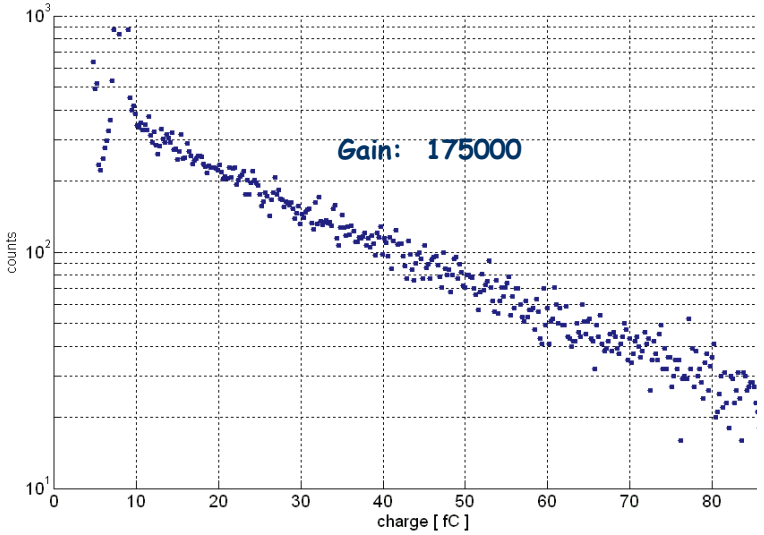




Window for LASER

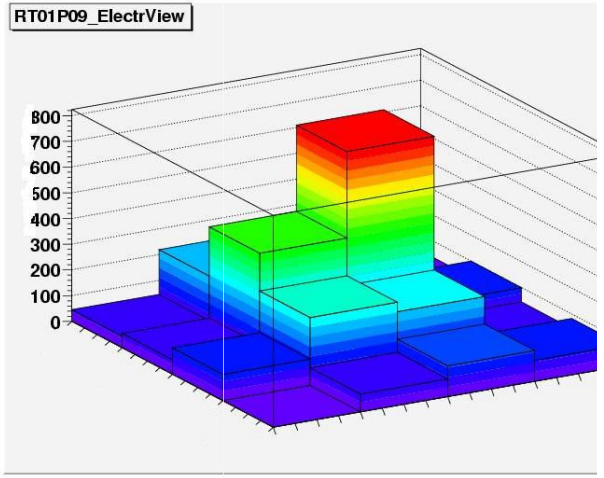
NO beam + laser

Analog readout
Amplitude spectra

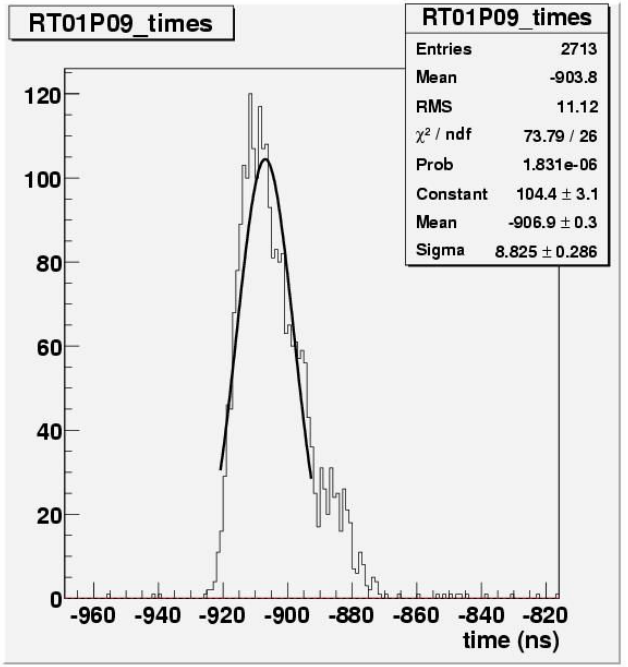


Digital readout

hits



timing peak



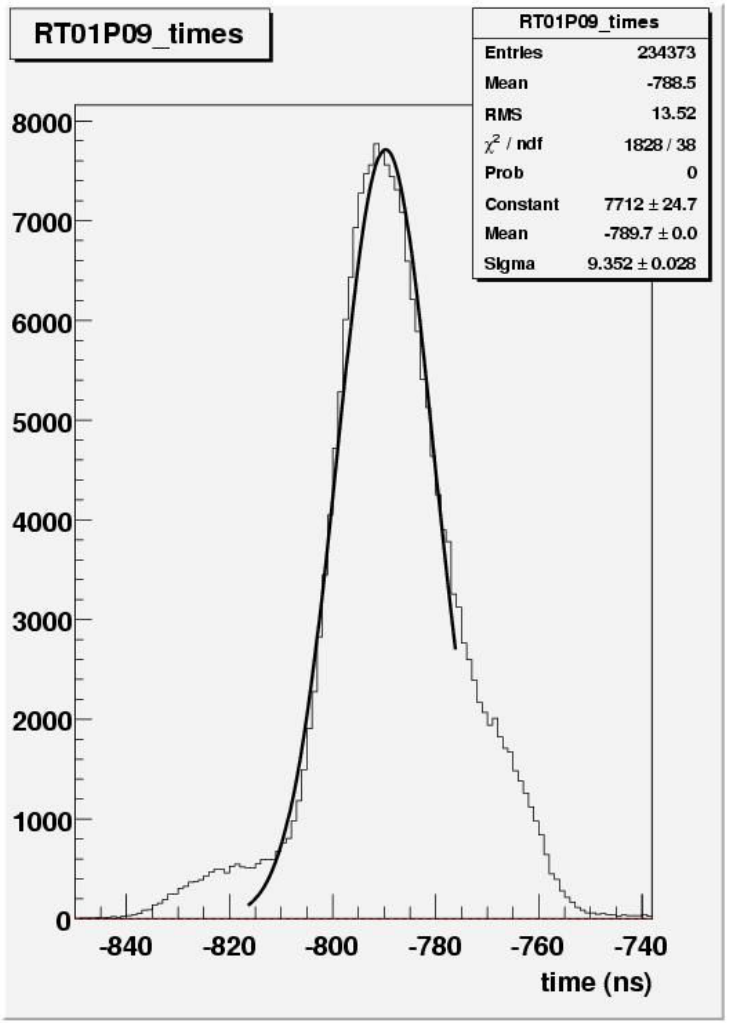
Detector behaves in the same way as in the LAB:
Gain up to 10^6, good reproducibility, full control

BEAM ON = serious problem with stability

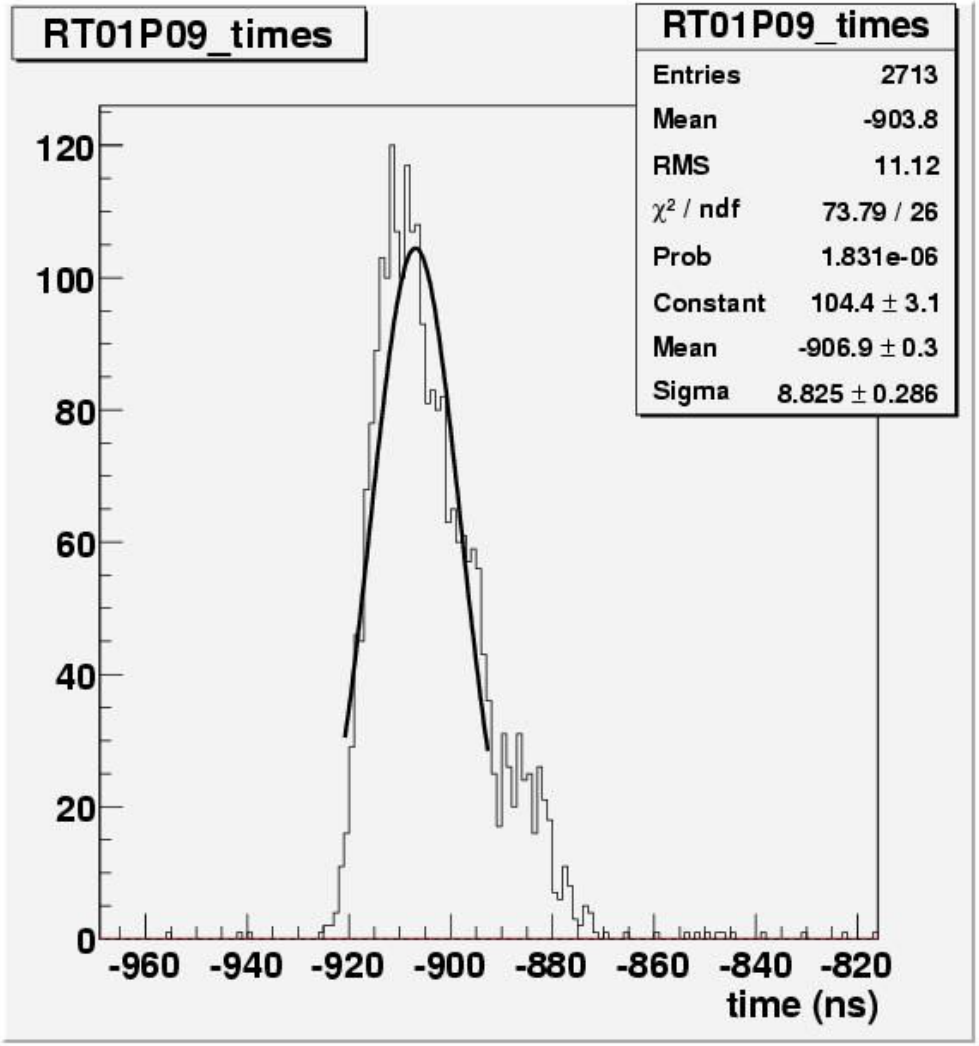
Max. sustainable gain:
Low intensity beam: ~ $1\text{-}2.10^5$
High intensity beam: ~ 4.10^4

Timing peak

HIGH intensity beam
gain: ~ 4.10^4



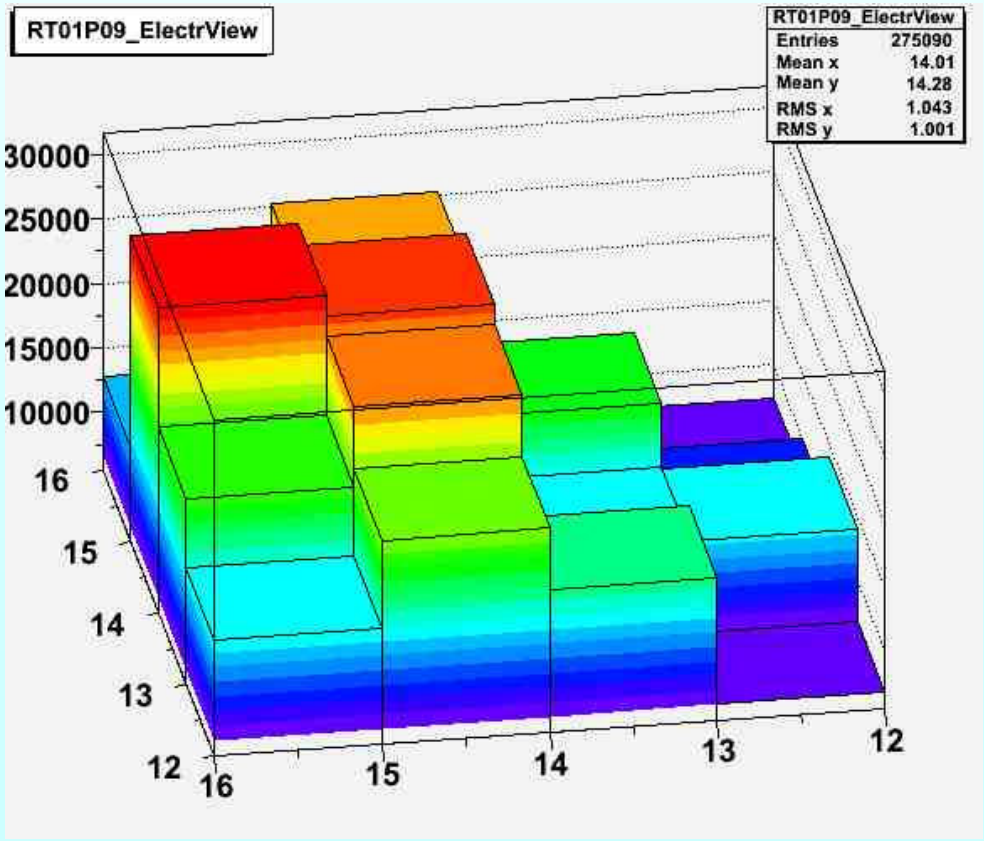
LASER + NO BEAM
gain: ~ 7.10^4

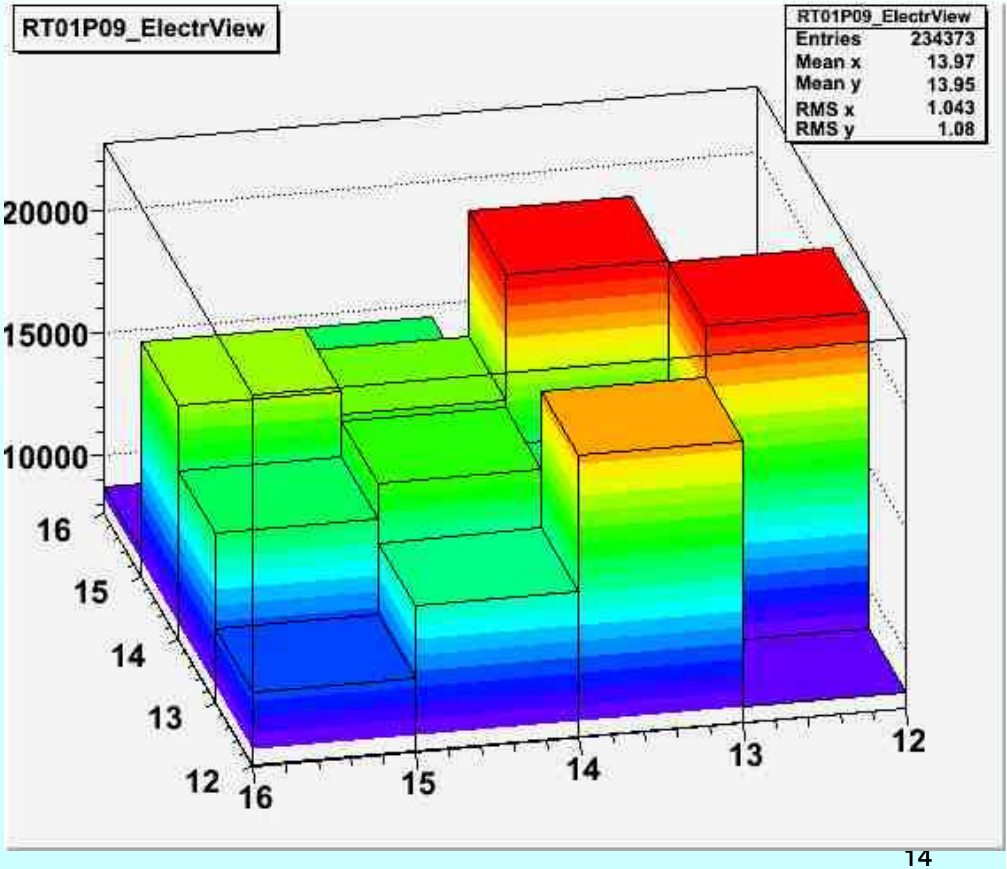


First indication of Cherenkov light

HIGH intensity beam
gain: ~ 4.10^4

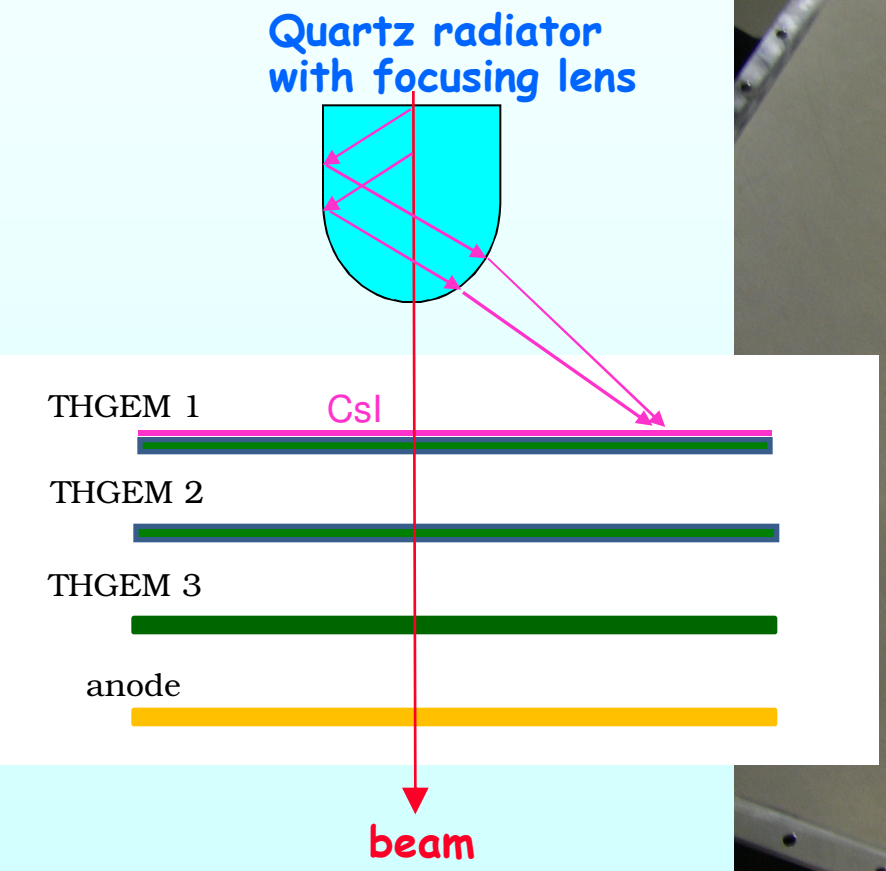
2 different positions of radiator (change of 20mm)

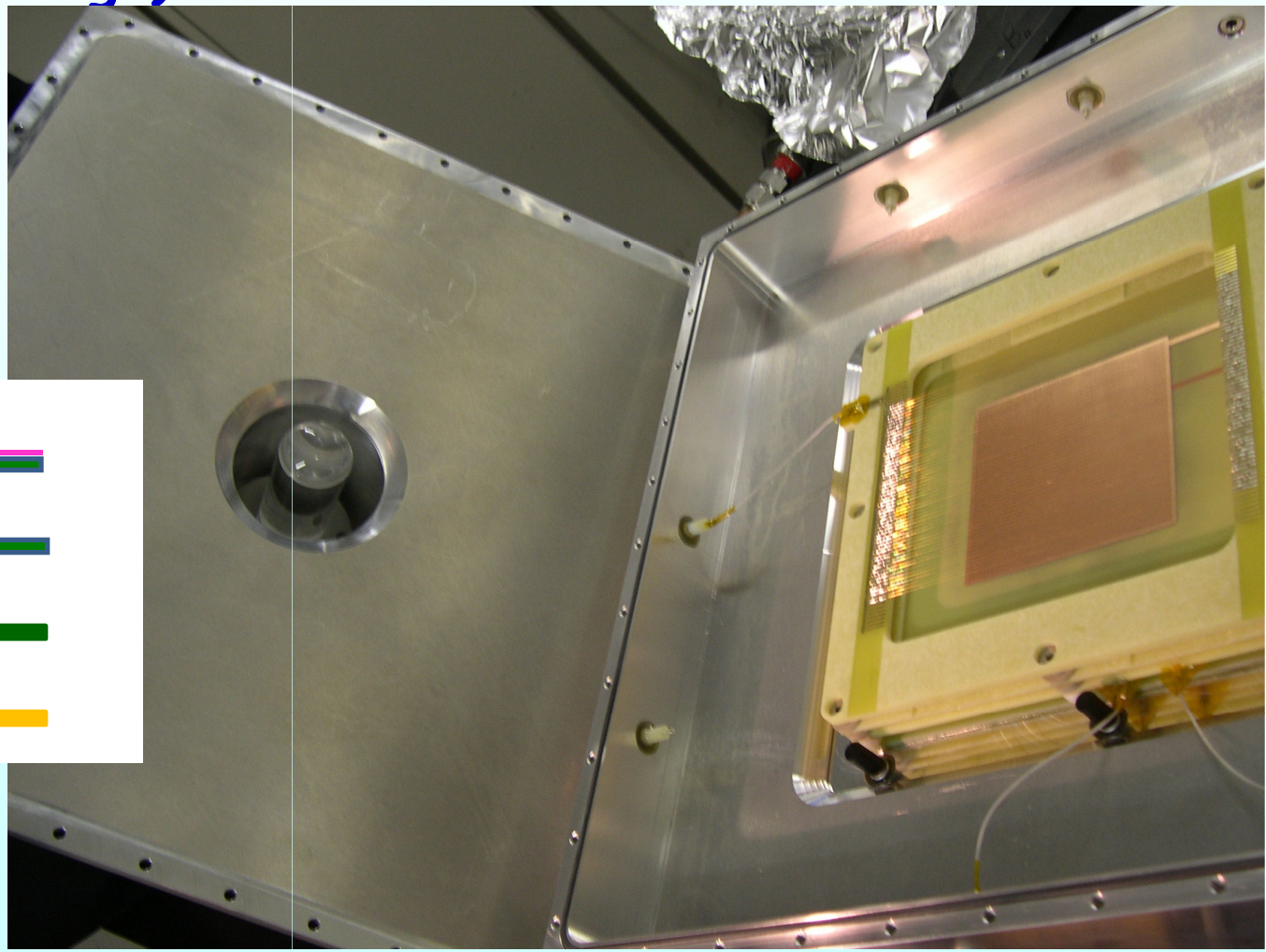




100x100mm^2 THGEM - trial installation

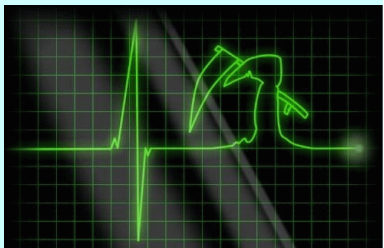
(looking for Cherenkov rings)





Solving many engineering problems, understanding the chamber.

We did not have enough time to solve all problems related to coupling of electronics to detector



Conclusions

- Multiple THGEM with CsI prototype build and put in SPS test beam with radiator for checking stability in experimental conditions.
- Detector did not show specific deterioration –
  when no beam – exactly the same response (gain up to 10^6)
- At beam – need to operate this particular detector at low gain
- Preliminary indication of Cherenkov light seen by THGEM + CsI
- This was first test, we need to improve…

…more test beams needed (in 2010).

this work is progressing thanks to many colleagues…

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i University of Bari, Bari, Italy
j Technical University of Liberec, Liberec, Czech Republic

Backup slides

UV LIGHT PULSED SOURCES

1. **Model UV LED-255**

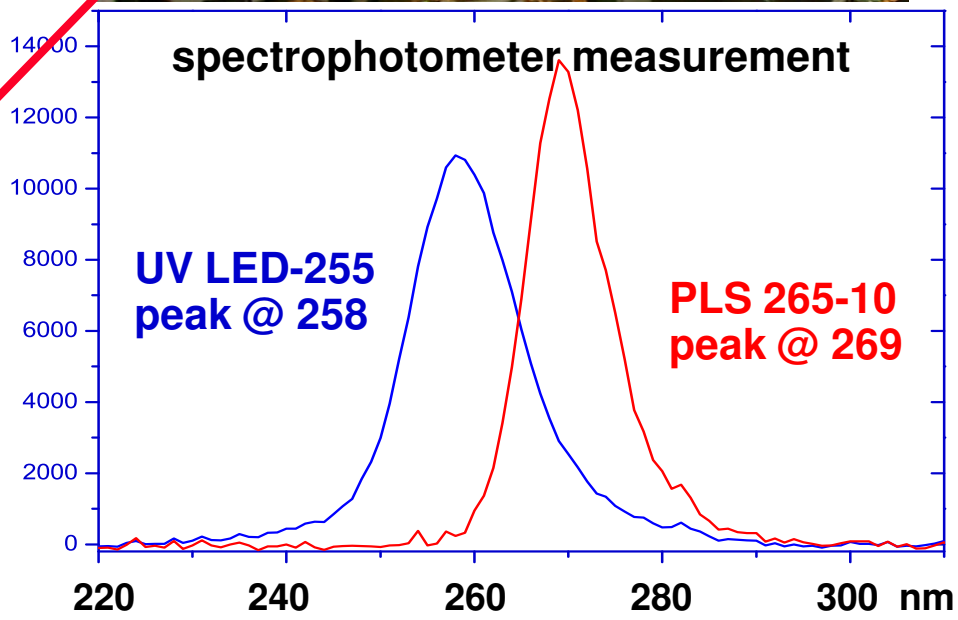
   by Seoul Optodevice Co., Ltd, Seoul, Korea (South

- **Central wavelength: 255 ± 10 nm**
- **Spectral line width: <20nm FWHM**
  - **also called germicidal ray (disinfection)**
  - **Applications: Water/Surface purification, Laboratory testing**

2. **PLS 265-10 (pulsed LED) and controller**

   by PicoQuant GmbH, Berlin, Germany

- **600 ps long pulses**
- **up to 40 MHz**



HV scan in " photon counting"
(relative efficiency)