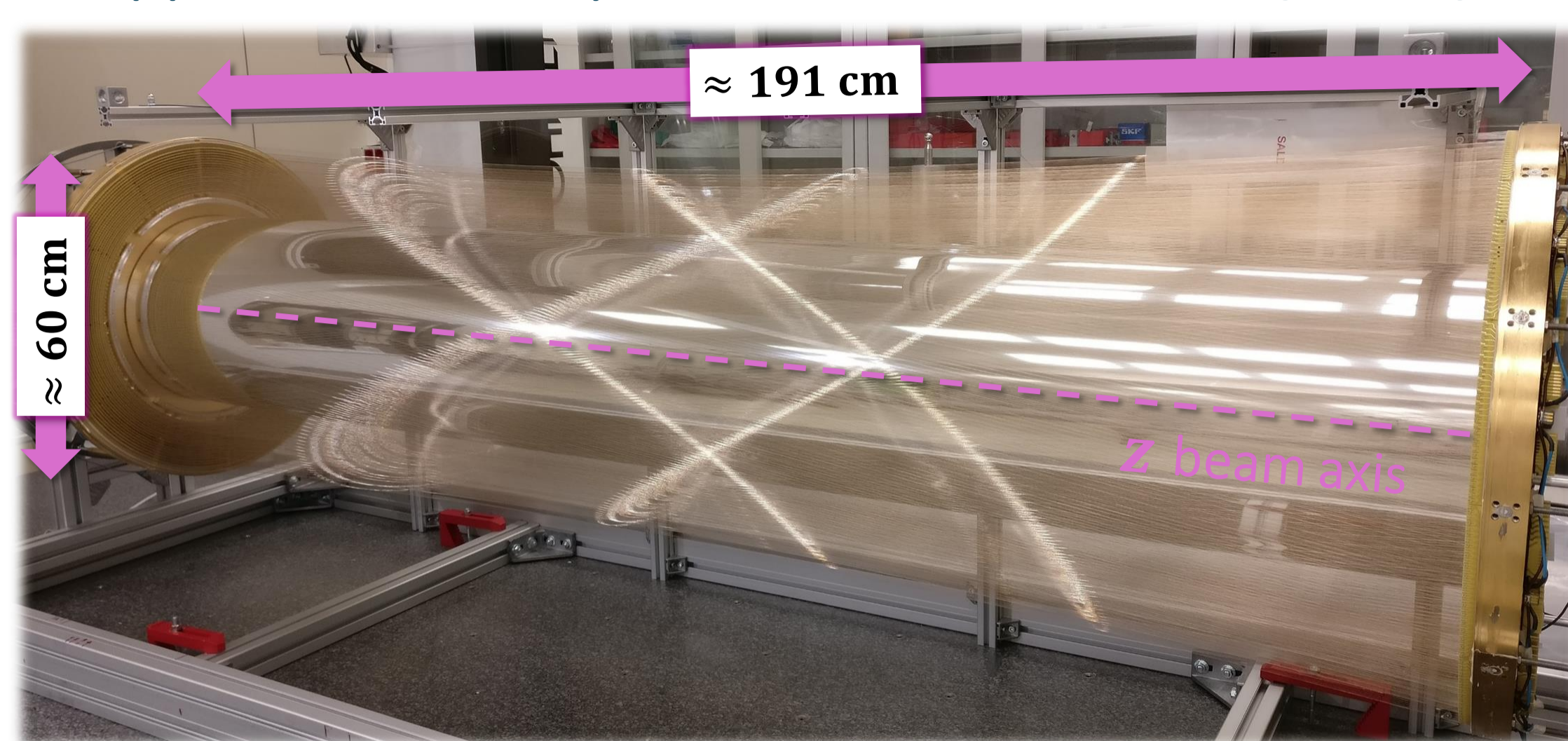
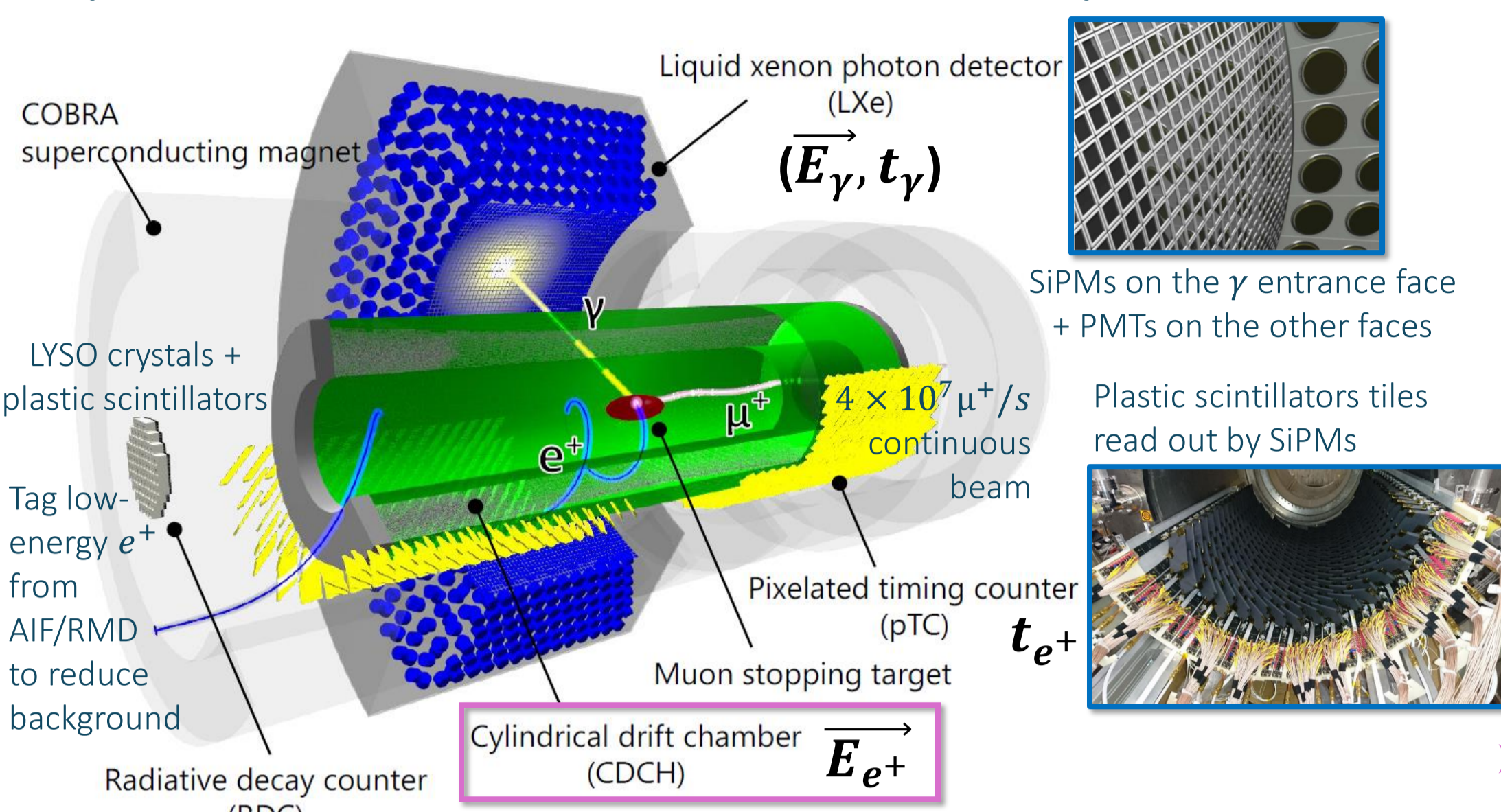


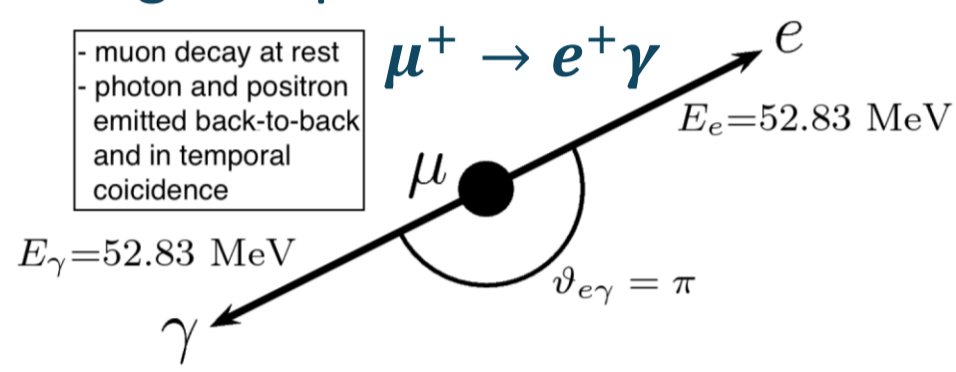
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## Physics context: the Mu-E-Gamma II experiment at PSI

## Application: the Cylindrical Drift Chamber (CDCH)



### Charged Lepton Flavour Violation



$e^+$ variable	Measured on data
$\Delta E_e$ (keV)	89
$\Delta \theta_e, \Delta \phi_e$ (mrad)	7.2, 4.1
$\Delta Z, \Delta Y$ (at target, mm)	2.0, 0.7
$\epsilon_e$ (%)	67

- Low-mass single volume detector with high granularity filled with He: $iC_4H_{10}$  90:10 gas mixture
  - + additives to improve the operational stability: 1.5% isopropyl alcohol + 0.5% Oxygen
  - 9 concentric layers of 192 drift cells defined by  $\approx 12000$  wires
  - Small cells few mm wide: occupancy of  $\approx 1.5 \text{ MHz/cell}$  (center) near the stopping target
  - High density of sensitive elements:  $\times 4$  hits more than MEG phase 1 Drift Chamber (DCH)
- Total radiation length  $1.5 \times 10^{-3} X_0$ : less than  $2 \times 10^{-3} X_0$  of MEG DCH or  $\approx 150 \mu\text{m}$  of Silicon
  - MCS minimization and  $\gamma$  background reduction (bremsstrahlung and Annihilation-In-Flight)
- Single-hit resolution (measured on prototypes):  $\sigma_{hit} < 120 \mu\text{m}$
- Extremely high wires density ( $12 \text{ wires/cm}^2$ )  $\rightarrow$  modular design and assembly

## The MEG II wiring machine inside the INFN Pisa cleanroom

Class IV IR laser for micro-soldering

20  $\mu\text{m}$  W(Au) sense wire  
50  $\mu\text{m}$  5056 AL field wire

32 wires per module

Tamura-Elsold AL-S tin designed for AL soldering

Laser pulse

Wiring tension feedback control

Average value: 20.45 g

delta:  $\pm 0.2 \text{ g}$

Wiring drum rotation in degrees

Soldering stage

Tin feeder sync with laser shot

Fully wired PCB on the wiring drum

EM brake for tension feedback

Wiring stage

Strain gauge for wire tension measurement

Wire spool

Pulleys to guide the wire to the wiring drum

Control through NI Compact-RIO modules and LabVIEW custom SW

Assembly station

Instrument axis

PCB template

Wiring drum

Pulley to guide the wire to the wiring drum

Modular detector assembly

Hydraulic glue (3M DP-100) dispenser with automatic drop deposition

Final result: wires locked with soldering (electrical contact) and glue (mechanically ensured) drops

Reference marker for PCB alignment

Micro-gluing needle

Final stack of wire PCBs and PEEK spacers in one sector

CMM measurements for geometry tuning

Wire PCB module on the mounting arm to be guided to the proper endplate sectors ( $\pm 6-8^\circ$  stereo geometry)

Glueing stage

Since the extreme difficulty to solder very thin AL wire and avoid micro-slipping

References

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- The Cylindrical Drift Chamber of the MEG II experiment, M. Chiappini et al., NIMA, Volume 1047 (2023) 167740
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