

COMET Experiment

High intensity proton beam @ J-PARC

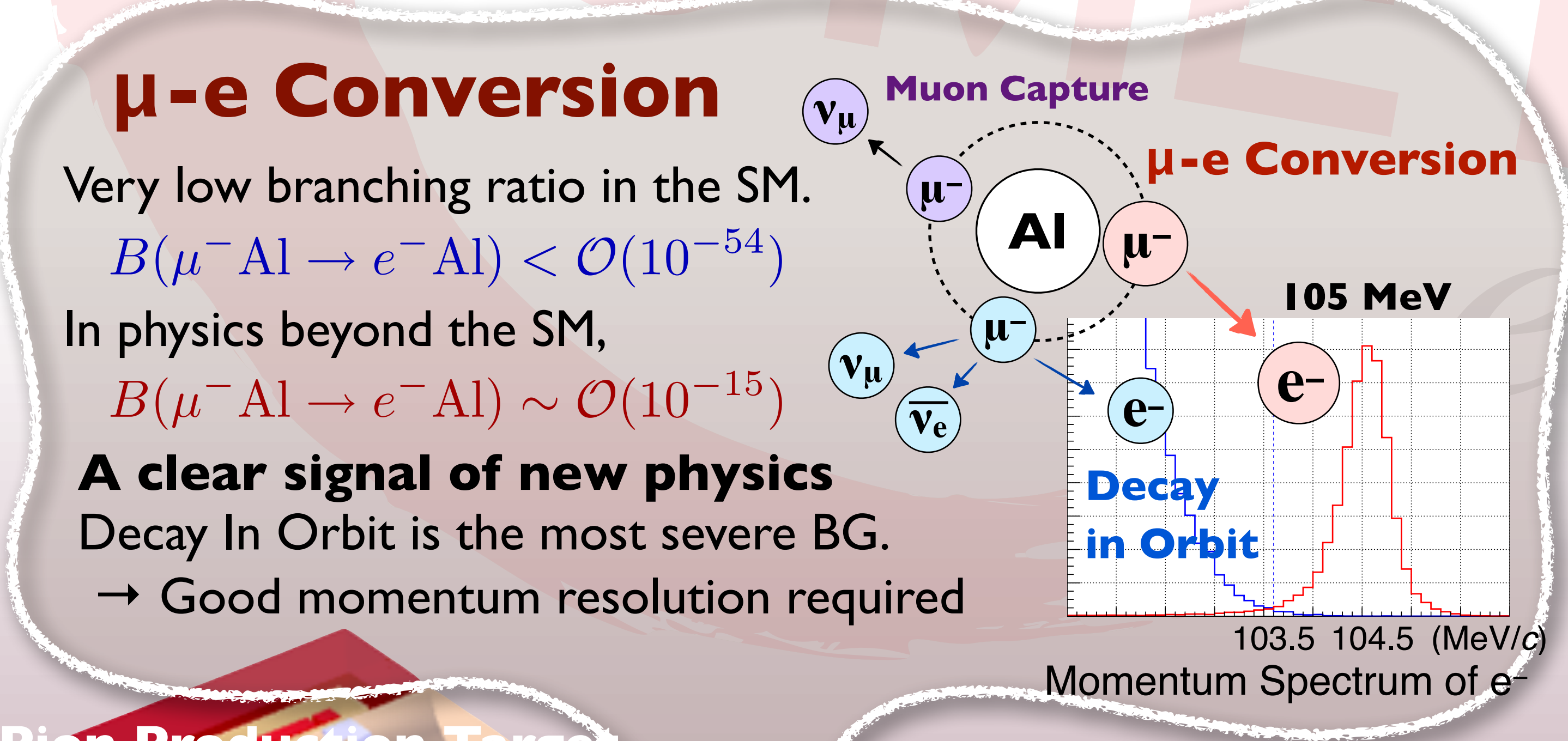
Phase-I (2022)

Sensitivity of $\sim 10^{-15}$

Beam measurement programme to investigate profiles of time, momentum, and particle kinds.

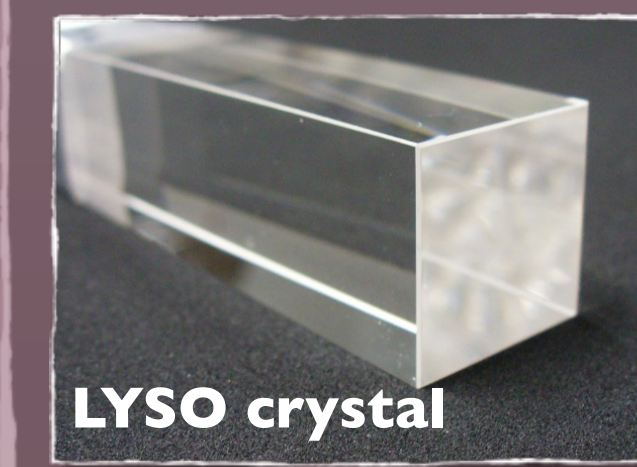
Phase-II (202x)

Sensitivity of $\sim 10^{-18}$

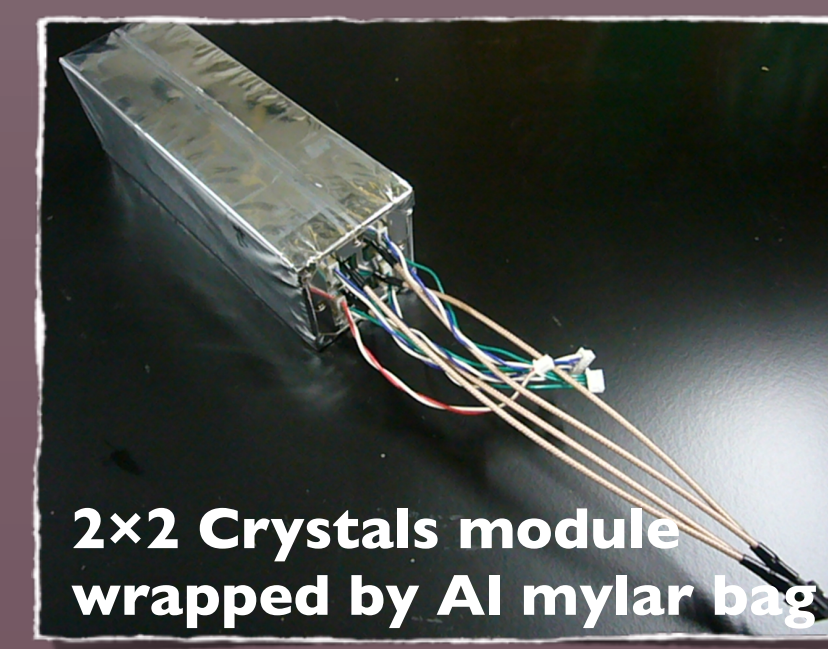


ECAL Prototype

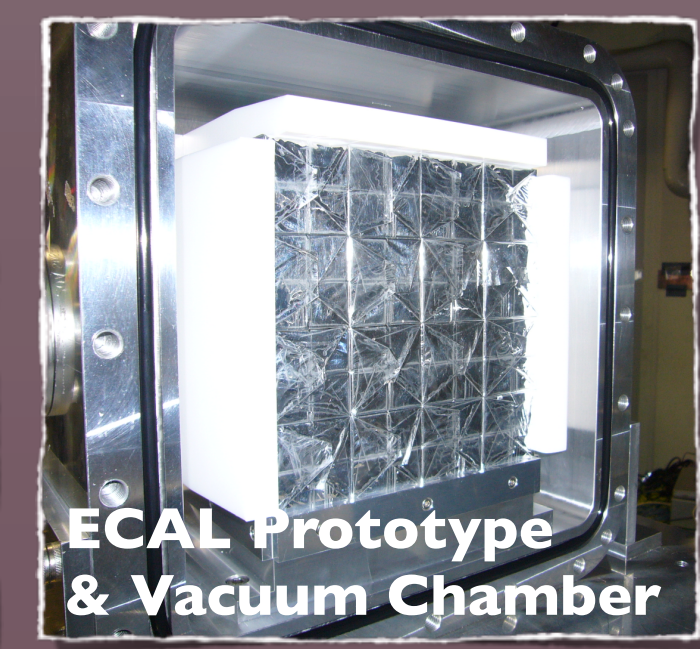
- Crystal-segmented calorimeter
 - ~ 2000 crystals ($\sim 1\text{m}$ diameter)
- LYSO inorganic crystal scintillator
 - High density (7.1 g/cm^3), high light yield (70% NaI), and fast decay constant (40 nsec)
- $10 \times 10\text{ mm}^2$ APD photo sensor
- Temperature monitor
- LED calibration source



LYSO crystal



2x2 Crystals module wrapped by Al mylar bag



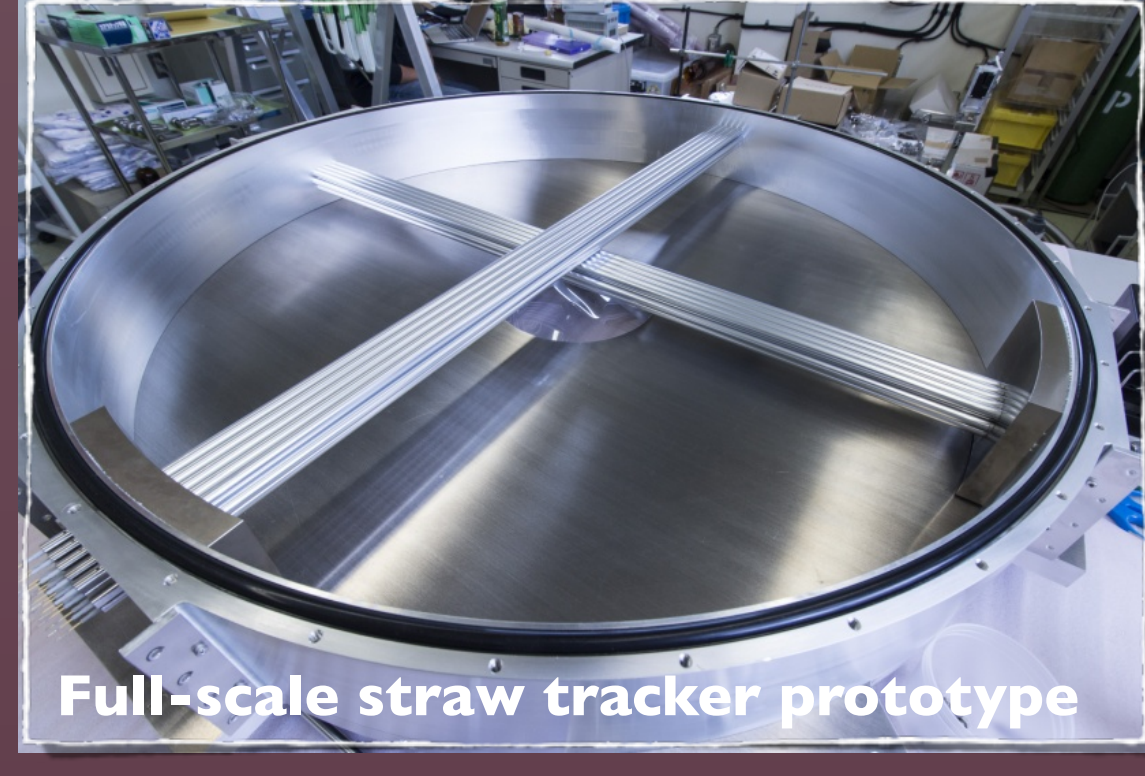
ECAL Prototype & Vacuum Chamber

Straw Tracker Prototype

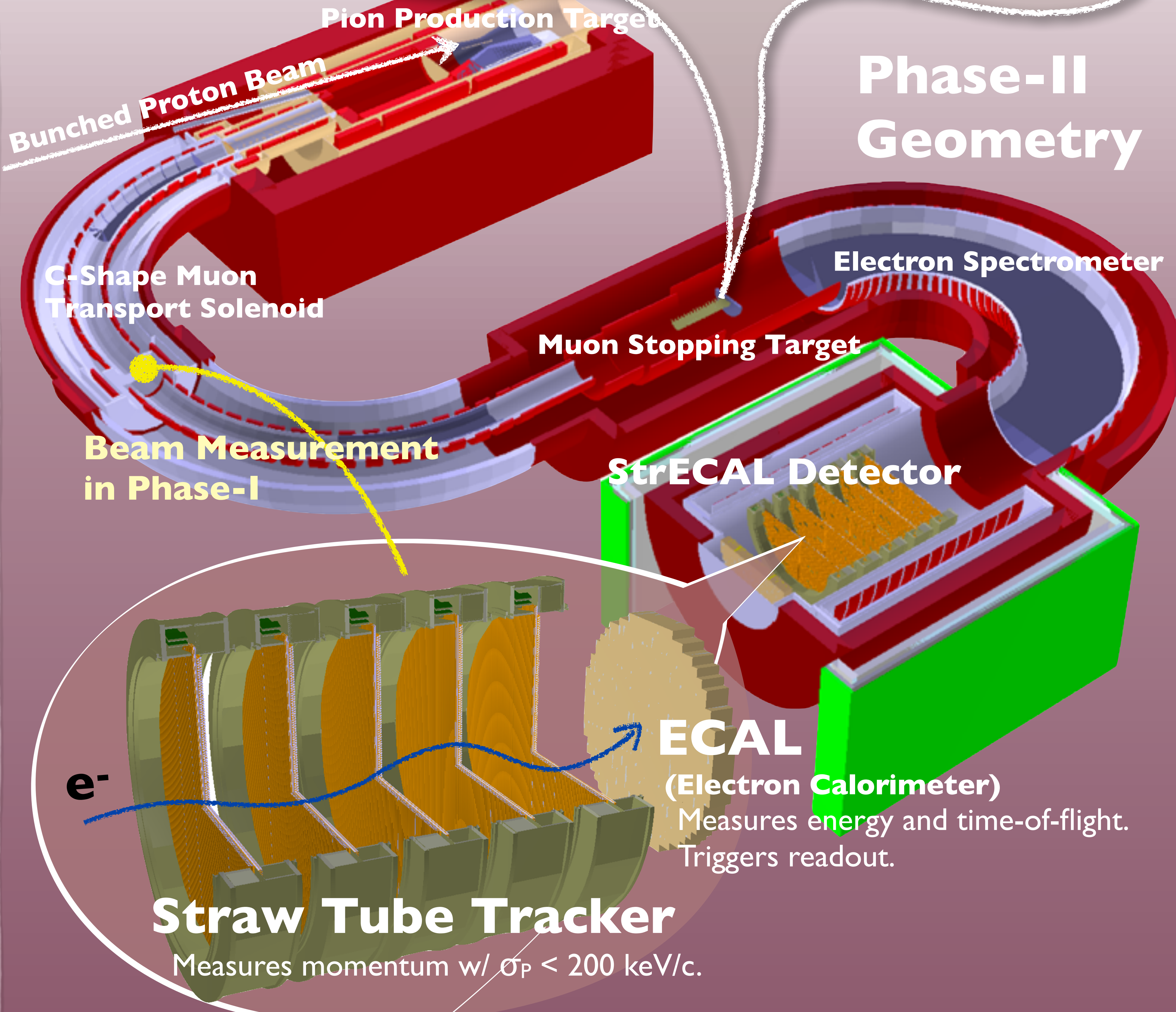
- Full-scale Phase-I straw tube chamber w/ $20\text{ }\mu\text{m}$ thickness
 - In Phase-II, more thinner tubes ($12\text{ }\mu\text{m}$) will be used.
- 16 straw tubes (3 layers) / axis
- Operated in a vacuum chamber.
- Two candidate gas mixtures
 - Ar: C_2H_6 (50:50) and Ar: CO_2 (70:30)



Phase-I straw tubes



Full-scale straw tracker prototype



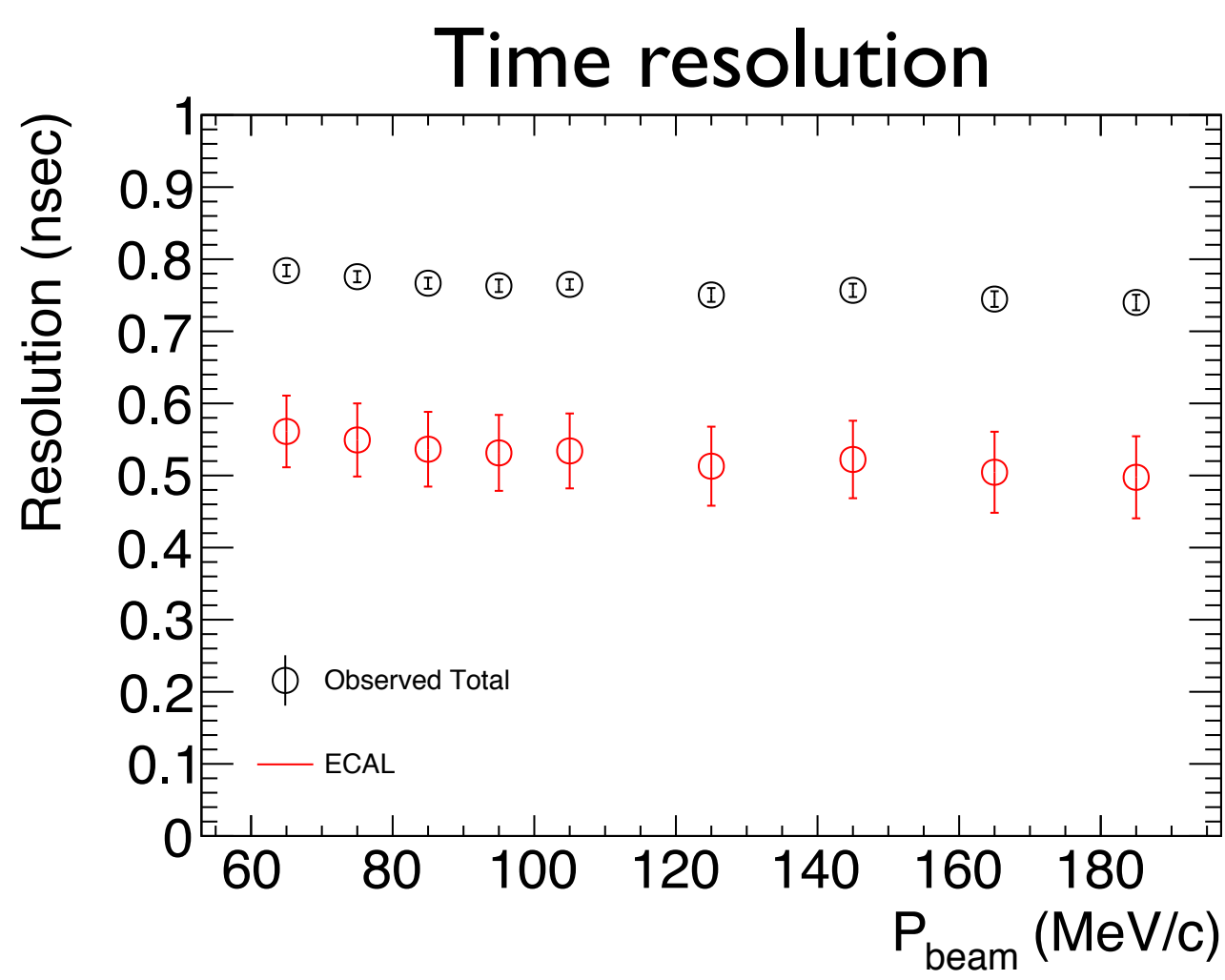
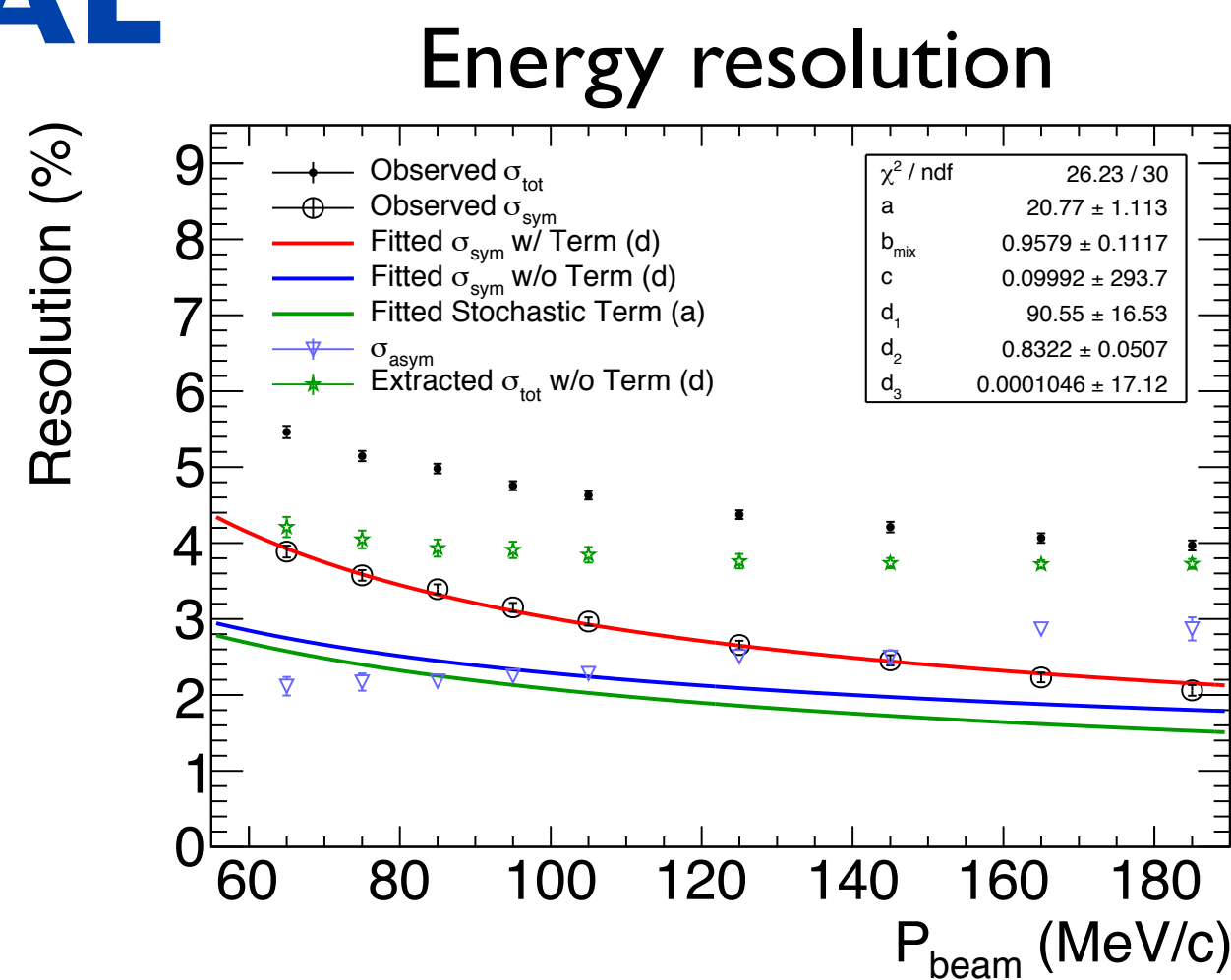
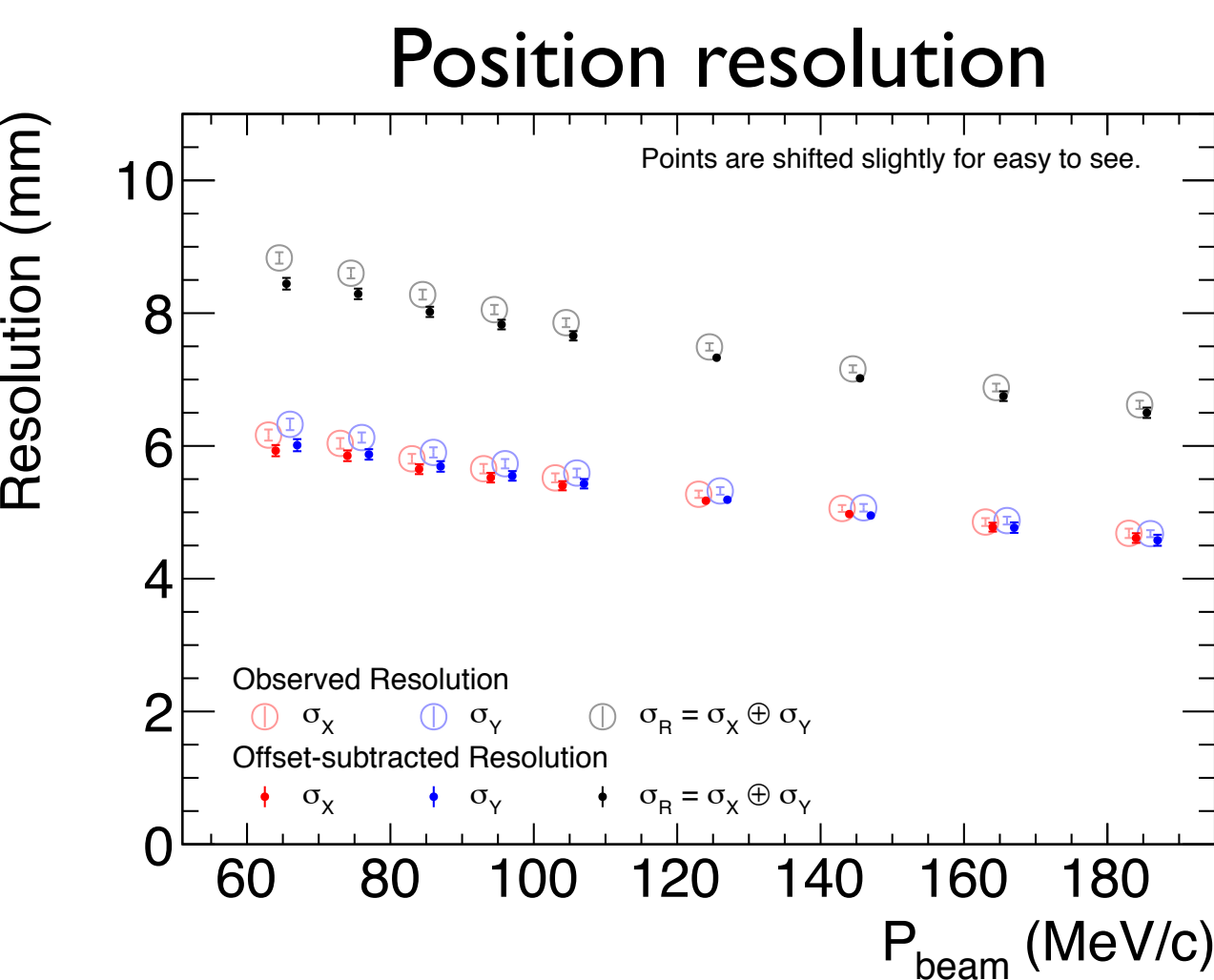
StrECAL Combined Test

- ★ The tracker & ECAL prototypes were tested together. (Tohoku Univ. 2017 March)
- ★ All the detector and electronics worked properly.
- ★ Achieved a vacuum pressure $< 1\text{ Pa}$.

Performance of ECAL

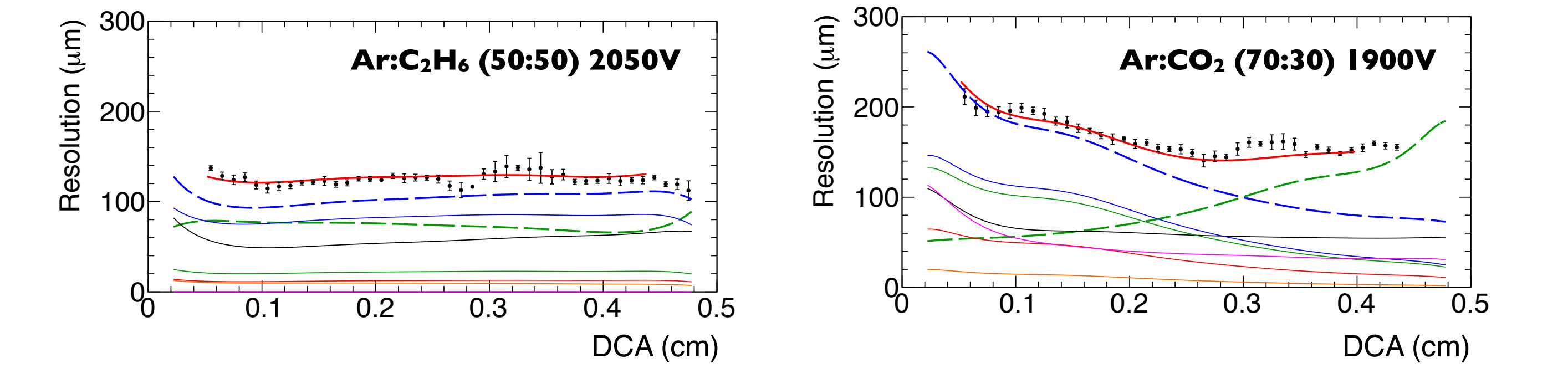
All the requirements satisfied.

Performance @ 105 MeV	
Energy Resolution	3.9%
Position Resolution	7.7 mm
Time Resolution	0.53 nsec



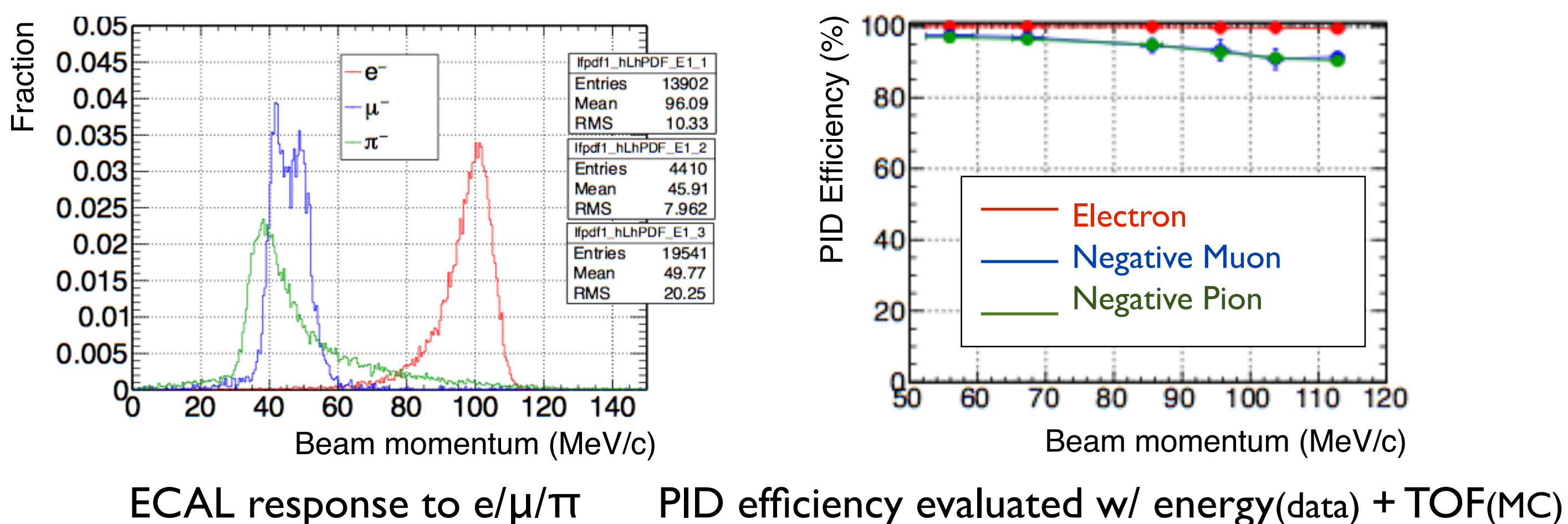
Performance of Straw Tracker

The position resolution of the straw tube was evaluated and achieved the requirement of $< 200\text{ }\mu\text{m}$.
 The gas mixture of Ar: C_2H_6 showed a better performance.



Particle Identification (PID)

Different responses of ECAL to $e/\mu/\pi$ were measured @ PSI, Switzerland in 2015.
PID efficiency $> 90\%$ is achievable by combining with time-of-flight (TOF) variable, which is measured by the tracker + ECAL.



References

- H.Nishiguchi, et al., Development of an extremely thin-wall straw tracker operational in vacuum The COMET straw tracker system, Nucl. Instrum. Methods A, 845 (2017), pp. 269-272
- K.Oishi, Development of Electromagnetic Calorimeter Using LYSO Crystals for the COMET Experiment at J-PARC, Proceeding of Science, 314 (2018), doi.org/10.22323/1.314.0800