

# Particle Identification for Strangeonium Systems in PANDA and GlueX

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## Motivation:

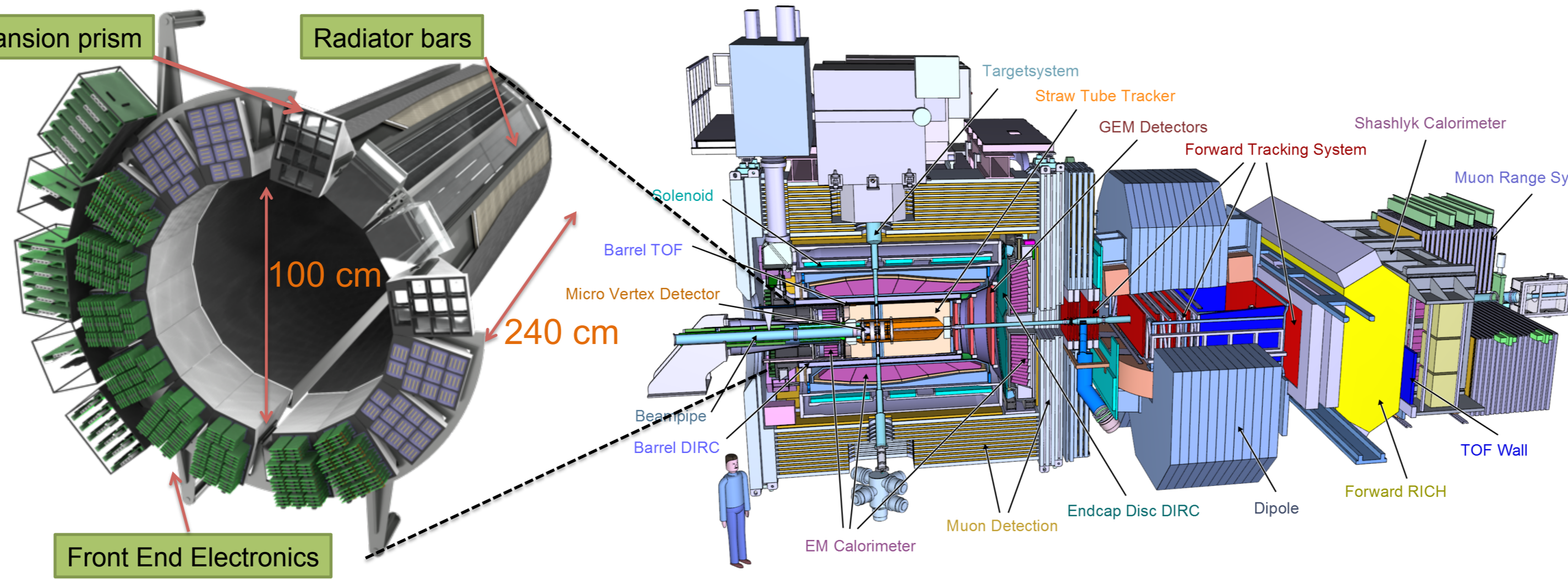
- FAIR phase 0: DIRC detectors (Detection of Internally Reflected Cherenkov light) for PID in PANDA and GlueX
- PANDA DIRC simulation and reconstruction algorithms, to be validated with GlueX DIRC data
- Develop calibration strategies for PANDA DIRC, apply to GlueX DIRC

## The PANDA Experiment

### The PANDA Barrel DIRC

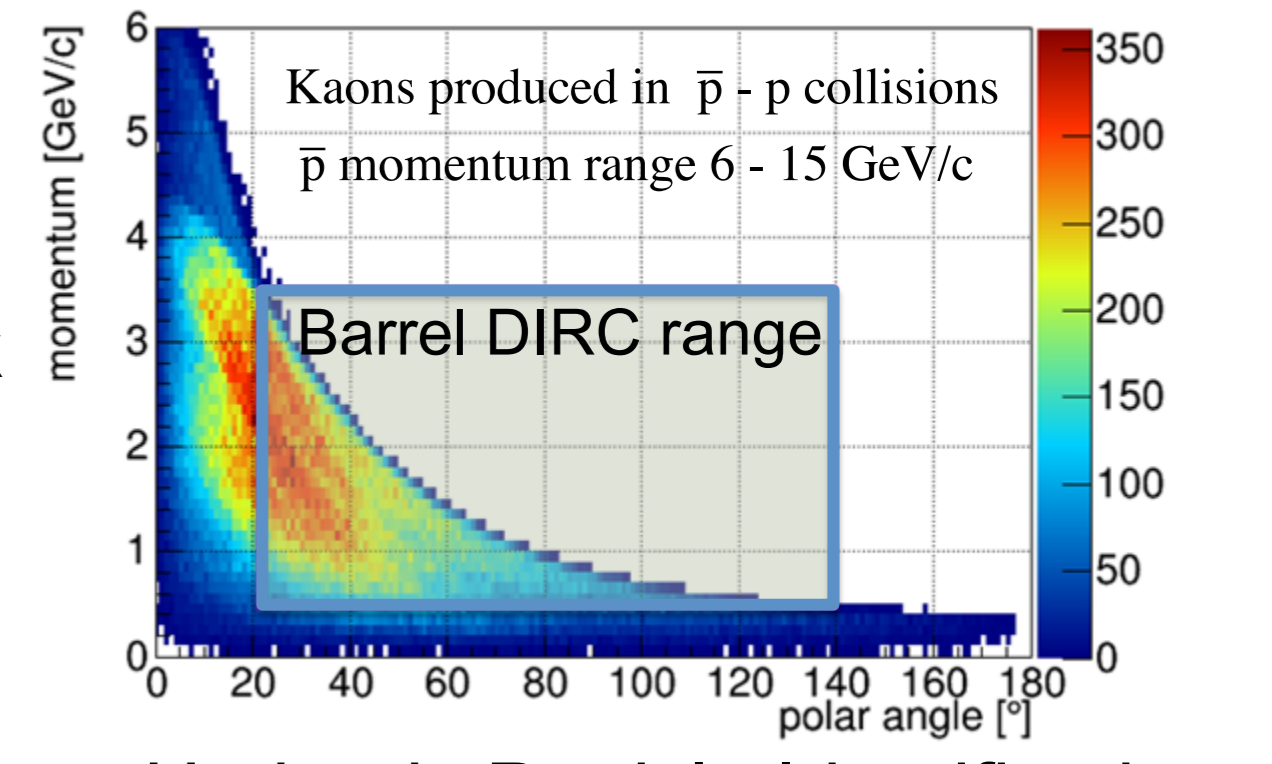
#### Key Components

- Radiators:** 48 synthetic fused silica bars
- Focusing optics:** Spherical lens system
- Expansion volume:** Quartz prism, 30 cm depth
- Sensors:** Microchannel Plate, Photomultiplier Tubes (MCP-PMTs)



- Designed for Hadron physics, Exotic quark systems, Nucleon structure and Charmonium spectroscopy

- Use Antiproton beam 1.5 GeV/c – 15 GeV/c



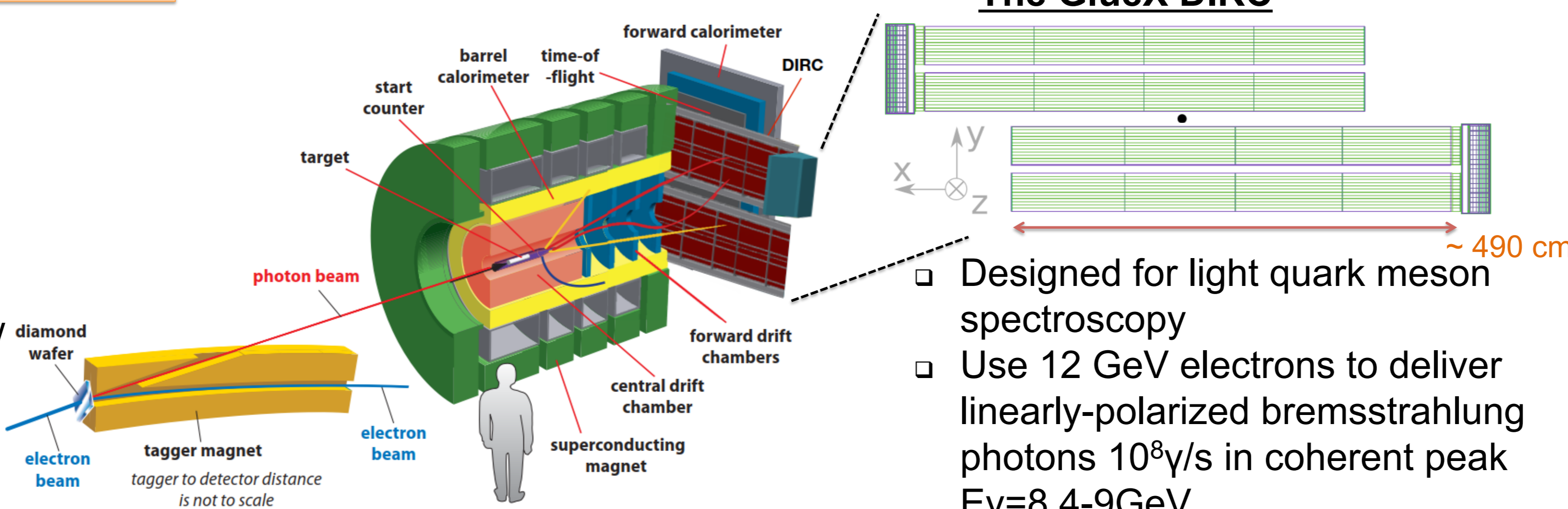
Hadronic Particle Identification goal:  $3\sigma$   $\pi/K$  separation power up to 3.5 GeV/c

PANDA Barrel DIRC TDR  
arXiv:1710.00684

## The GlueX Experiment

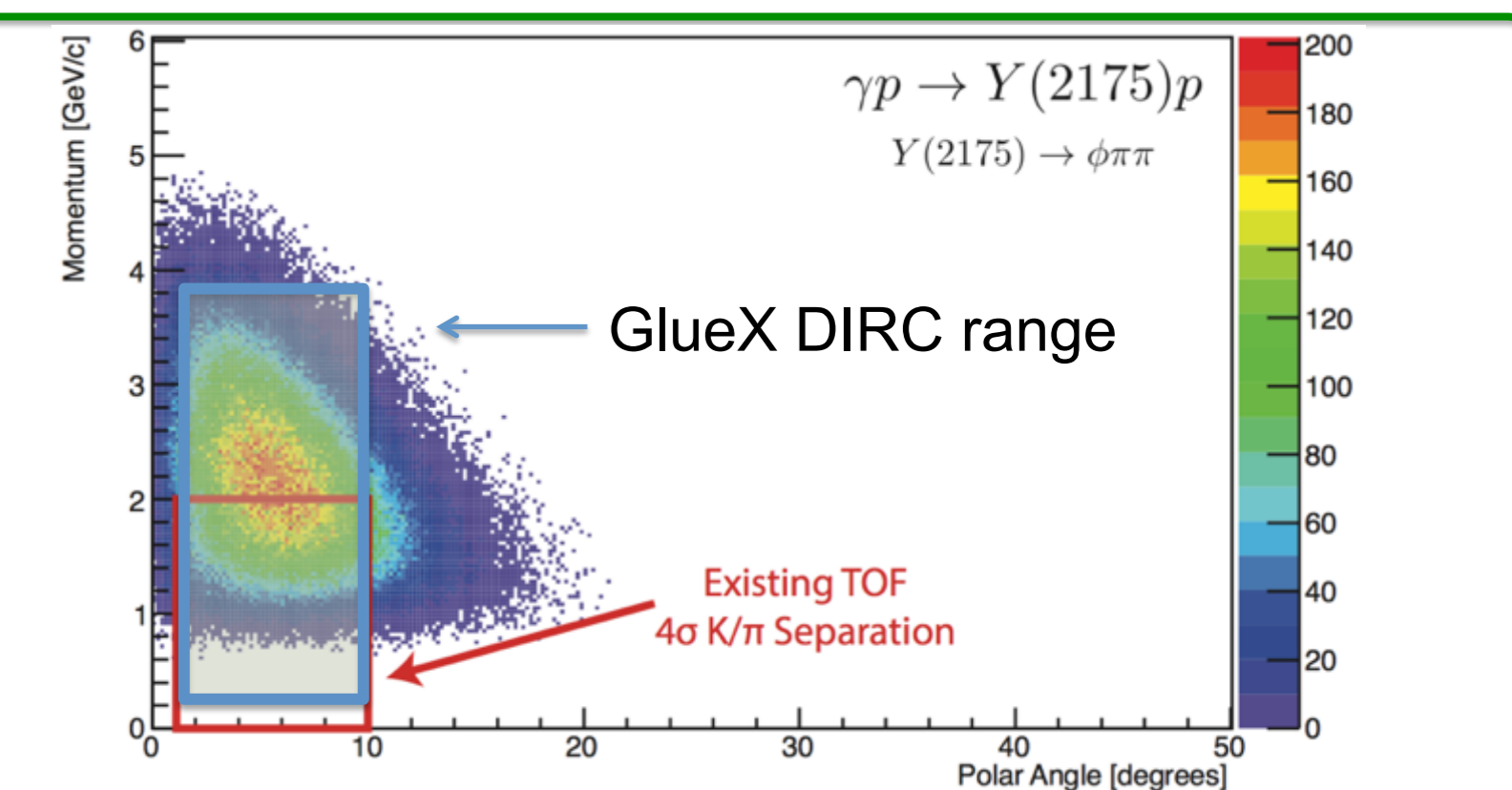
#### Key Components

- Radiators:** Reusing 48 synthetic fused silica bars (4 bar boxes) from BaBar experiment at SLAC.
- Expansion volume:** The water tanks are new and follow the concept from SuperB FDIRC.
- Sensors:** Multi-anode Photomultiplier Tubes



### The GlueX DIRC

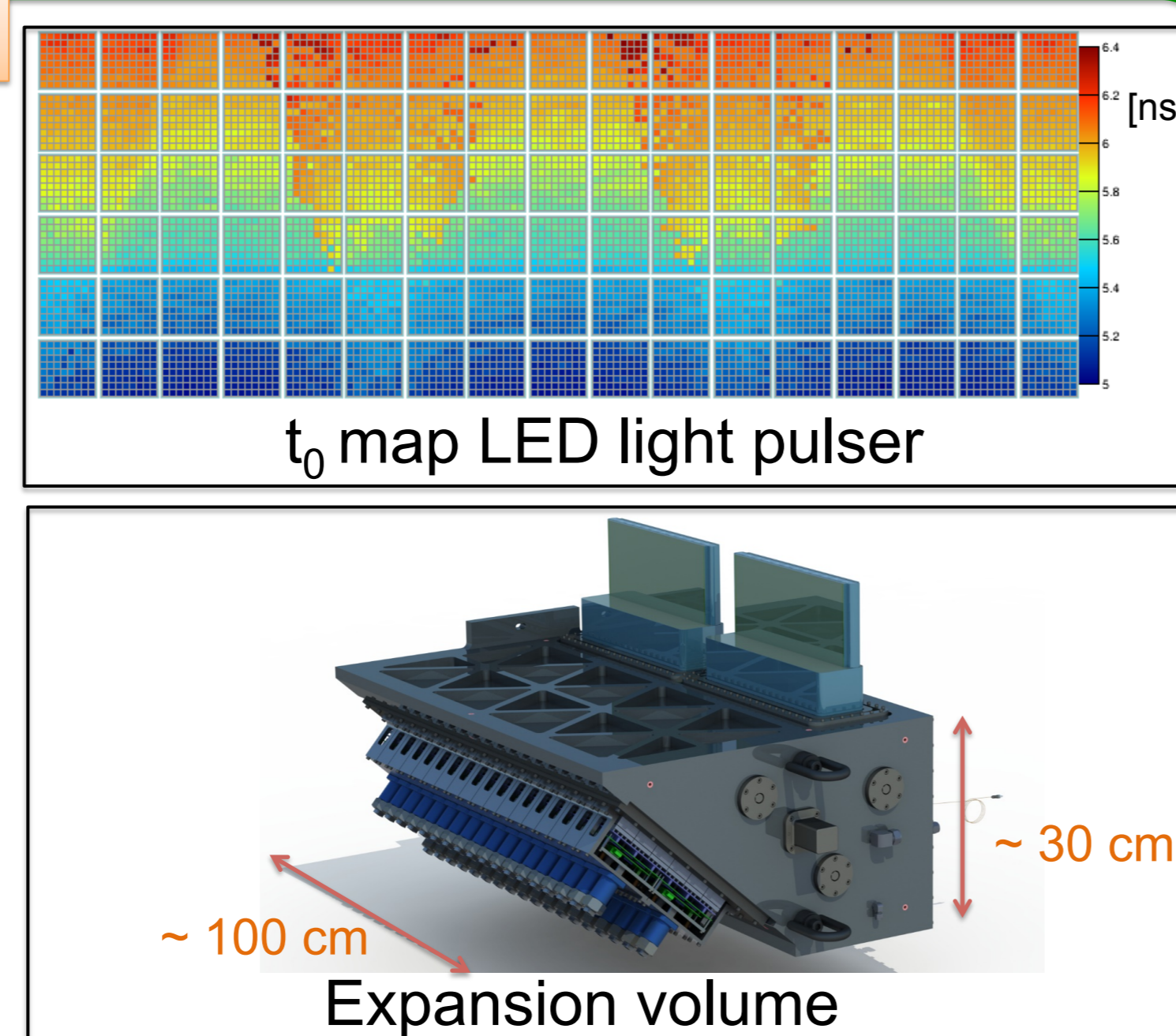
- Designed for light quark meson spectroscopy
- Use 12 GeV electrons to deliver linearly-polarized bremsstrahlung photons  $10^8$ γ/s in coherent peak  $E_\gamma=8.4-9$ GeV



Excellent particle identification is crucial to the success of GlueX physics program. DIRC upgrade will extend GlueX physics reach with coverage 3.5 s.d. for  $\pi/K$  up to 4 GeV/c

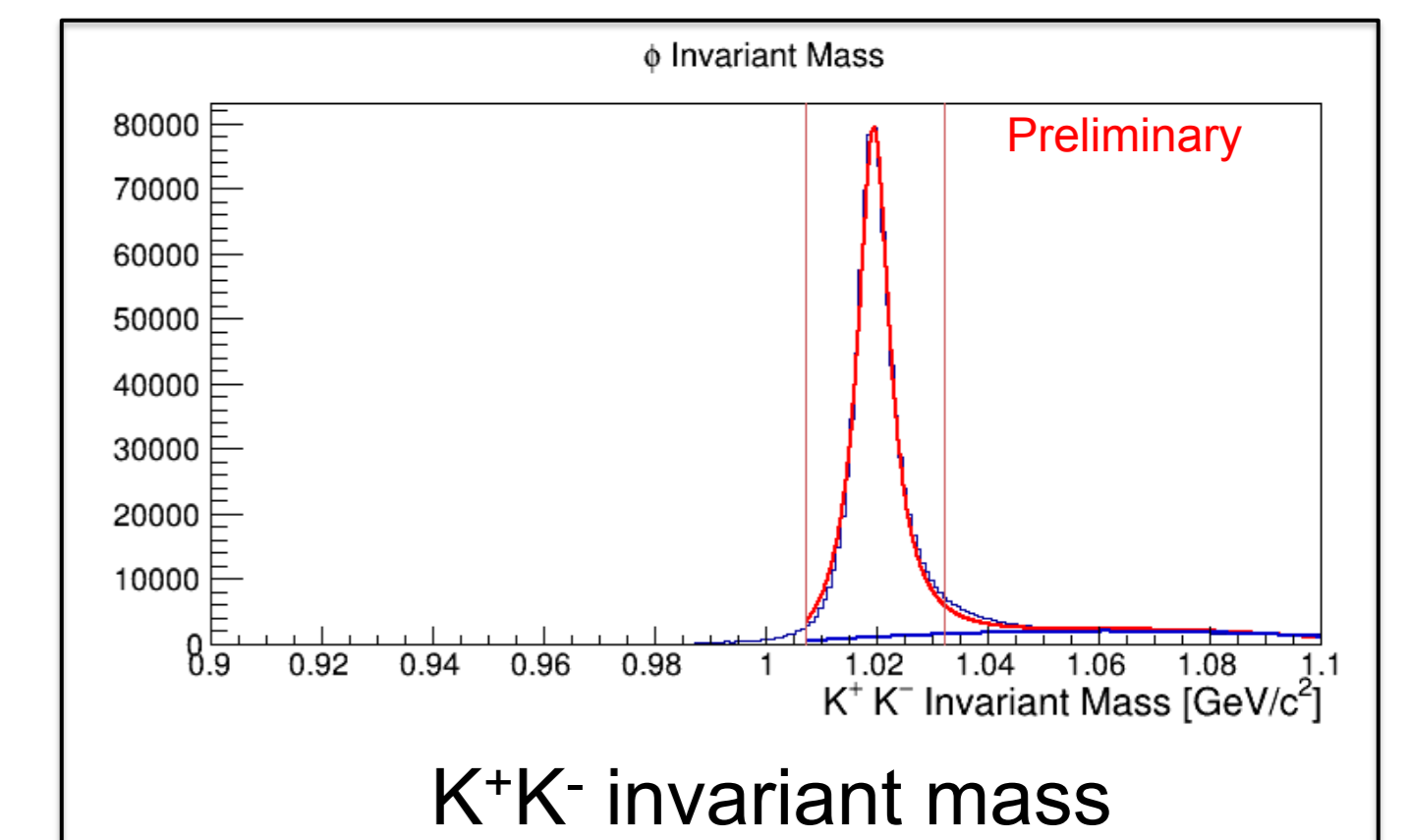
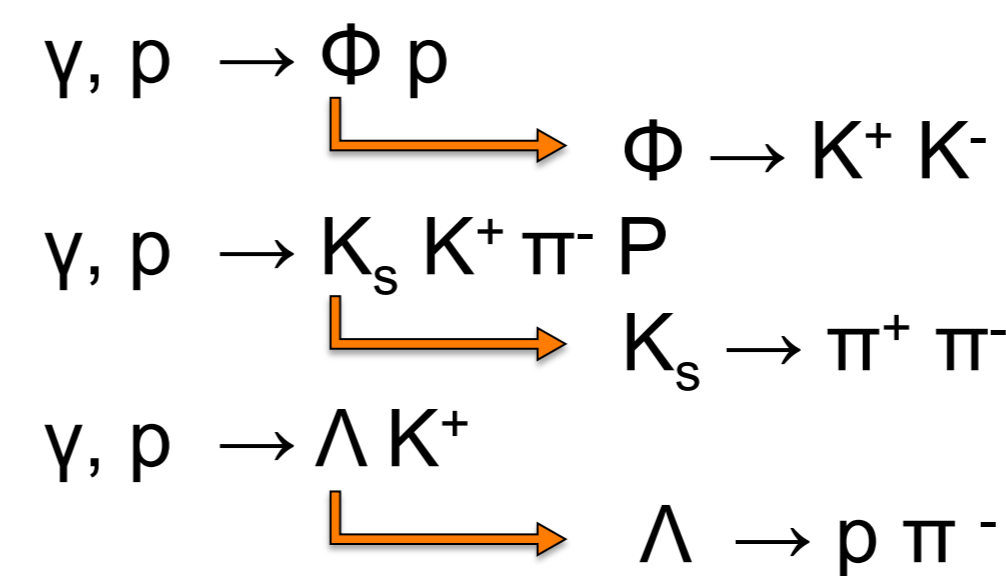
## GlueX DIRC Sensors Calibration

- LED light pulser system will be used to calibrate channel delays to get the optimum timing prevision of the readout chain, from sensor to electronics and cable.
- Simulation of the LED-based calibration system shows stable  $t_0$  determination with an error  $< 100$  ps.



## GlueX PID Calibration

Calibration, efficiency and miss ID will be carried out using identified selected channels:



## Test Beam Validation

- Setup was in T9 east area at CERN
- Mixed hadron beam with momenta up to 10 GeV/c
- Radiator: Fused silica bar/plate
- Expansion volume: Fused silica prism
- Focusing optics: 3-layer spherical lens
- Array of 12 MCP-PMTs for photon detection
- Readout with timing resolution  $\sim 150 - 300$  ps

