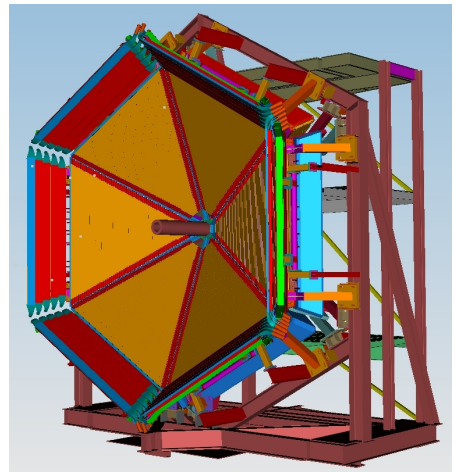
CLAS12 – Forward Time-of-Flight (FTOF)

The **CLAS12 FTOF** system will be part of the forward detector used to measure the time-of-flight of charged particles emerging from the target. The FTOF system includes 6 sectors of plastic scintillators with double-sided PMT readout. Each sector consists of three arrays of counters:

- Panel-1a – 23 counters
- Panel-1b – 62 counters
- Panel-2 – 5 counters

The system is required to have excellent timing resolution for particle identification and good segmentation for flexible triggering options.

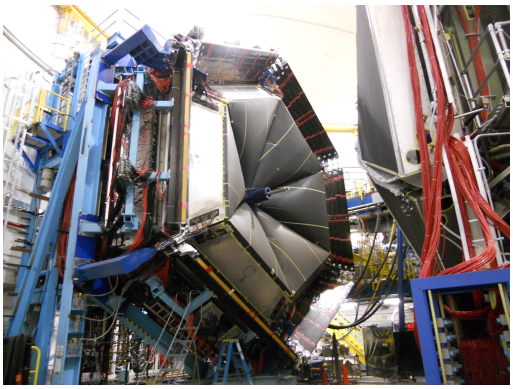


FTOF - TECHNICAL PARAMETERS

PARAMETER	DESIGN VALUE
Panel-1a:	
Angular Coverage	θ: 5° → 35°, ϕ: 50% at 5° → 85% at 35°
Counter Dimensions	L = 32.3 cm → 376.1 cm, w x h = 15 cm x 5 cm
Scintillator Material	BC-408
PMTs	EMI 9954A, Philips XP2262
Design Resolution	90 ps → 160 ps
Panel-1b:	
Angular Coverage	θ: 5° → 35°, ϕ: 50% at 5° → 85% at 35°
Counter Dimensions	L = 17.3 cm → 407.9 cm, w x h = 6 cm x 6 cm
Scintillator Material	BC-404 (#1 → #31), BC-408 (#32 → #62)
PMTs	Hamamatsu R9779
Design Resolution	60 ps → 110 ps
Panel-2:	
Angular Coverage	θ: 35° → 45°, ϕ: 85% at 35° → 90% at 45°
Counter Dimensions	L = 371.3 cm → 426.2 cm, w x h = 22 cm x 5 cm
Scintillator Material	BC-408
PMTs	EMI 4312KB
Design Resolution	140 ps → 165 ps
PID:	
π/K Separation	4σ separation up to 2.8 GeV
K/p Separation	4σ separation up to 4.8 GeV
π/p Separation	4σ separation up to 5.4 GeV

- **Construction Strategy and Project Leadership:**
  - FTOF Group Leader: Daniel S. Carman
  - Construction Strategy:
    - *Panel1a and panel-2 arrays refurbished at JLab*
    - *Panel-1b counter assembly at Univ. of South Carolina under direction of Prof. Ralf Gothe*
    - *Final panel-1b assembly and QA at JLab*

- **Significant Dates:**
  - May 2012 – May 2013: Panel-1a and panel-2 refurbishment and QA at JLab
  - Apr. 2011 – Jun. 2013: Panel-1b counter assembly and QA at USC
  - Jun. 2013 – Dec. 2013: Panel-1b frame assembly and QA testing at JLab
  - Dec. 2013 – Jan. 2014: Panel-1a installation in Hall B
  - Feb. 2014: Panel-1b installation in Hall B
  - Mar. 2014 – present: Detector calibrations with cosmics
  - Mar. 2016: Panel-2 S1→ S4 installation
  - Dec. 2016: Panel-2 S5, S6 installation
  - Feb. 2017: KPP beam run



- **Project Status:**
  - FTOF Hardware:
    - *Detector arrays installed in Hall B*
    - *All design specs met or exceeded*
  - FTOF Software:
    - *Reconstruction code written*
      - validation in progress
    - *Calibration suite well advanced*
      - used for KPP beam run data
    - *GEMC hit process routine developed and validated*
    - *Monitoring tools developed*

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