

Regina Tooling for the EIC Imaging Calorimeter

Talk to ANL-Canada-Korea Collaboration

University
of Regina

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May 9, 2023

GLUEX
Experiment

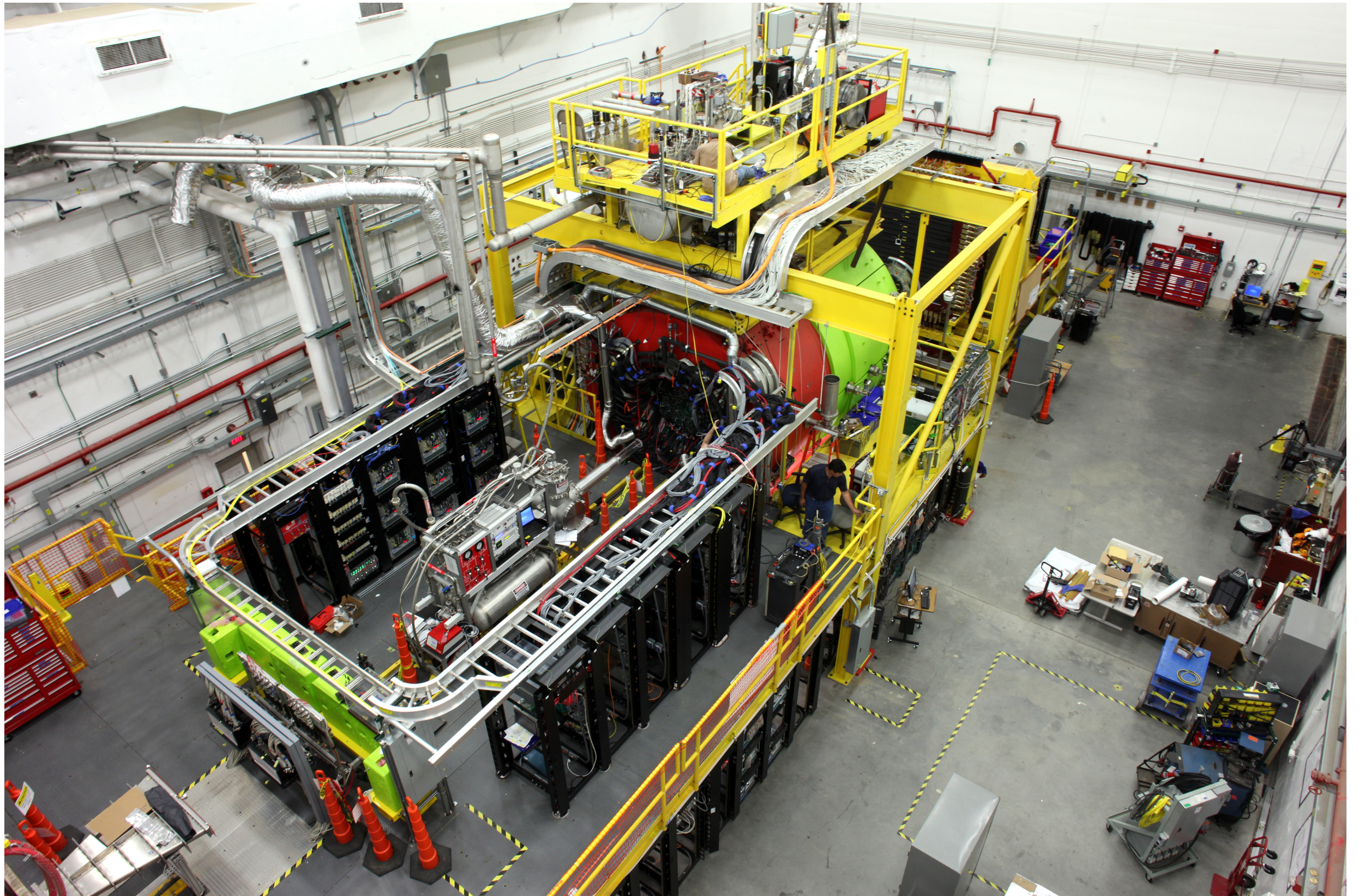
Jefferson Lab
EXPLORING THE NATURE OF MATTER

Experimental Hall D

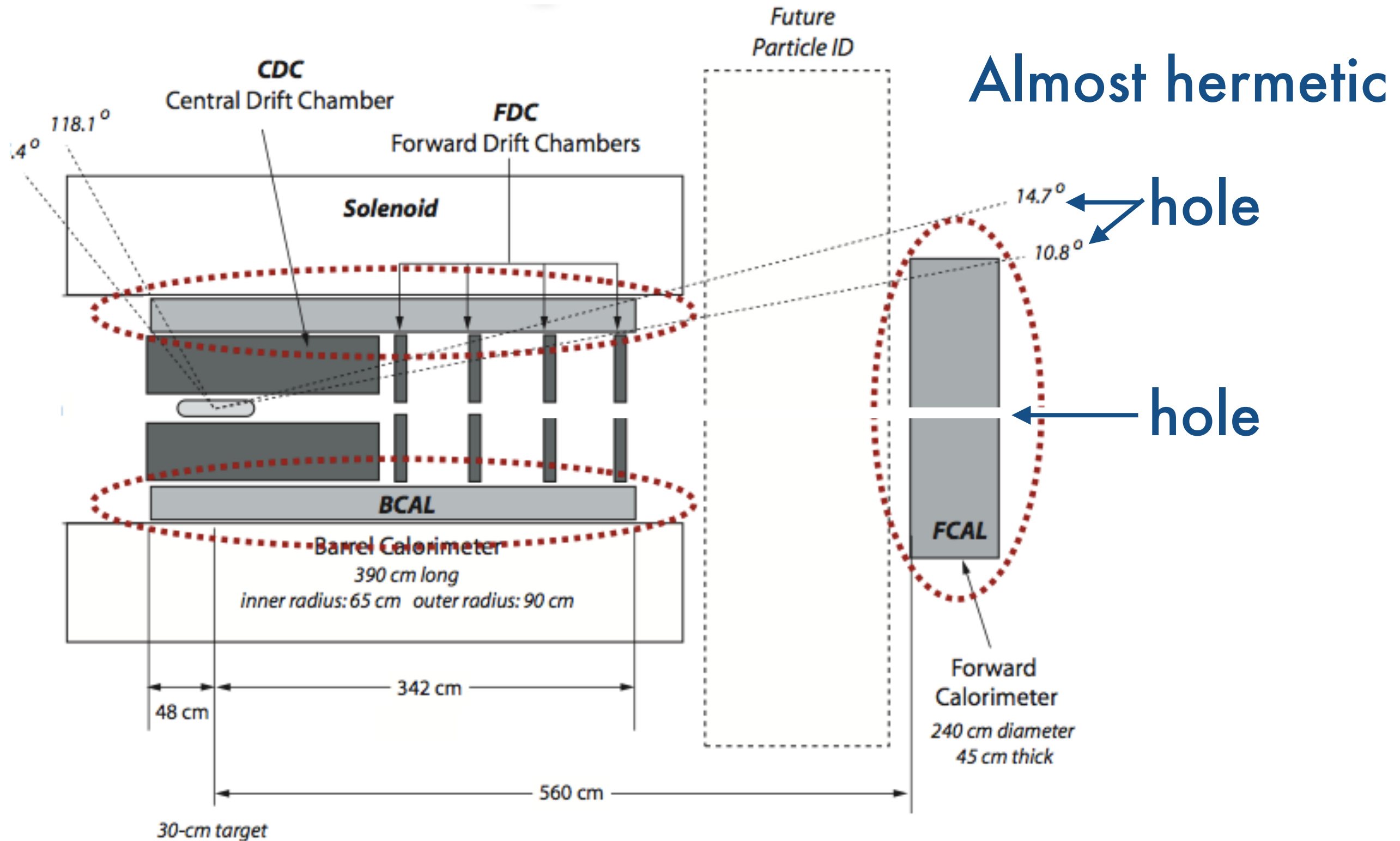
The Barrel Calorimeter

- A bit about GlueX
- Fiber tests
- PbSciFi construction
- Mini BCAL beam test

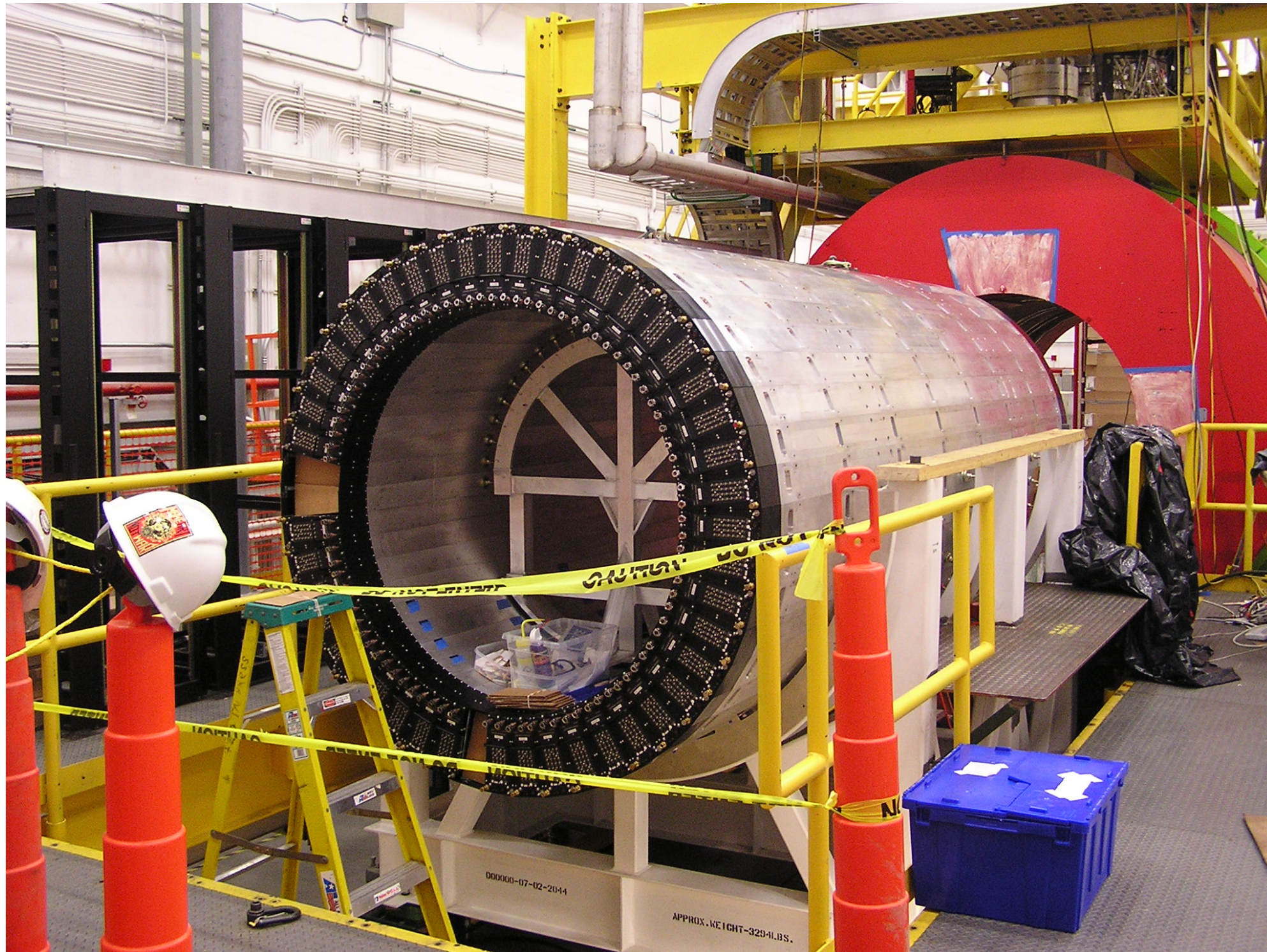
The Detector



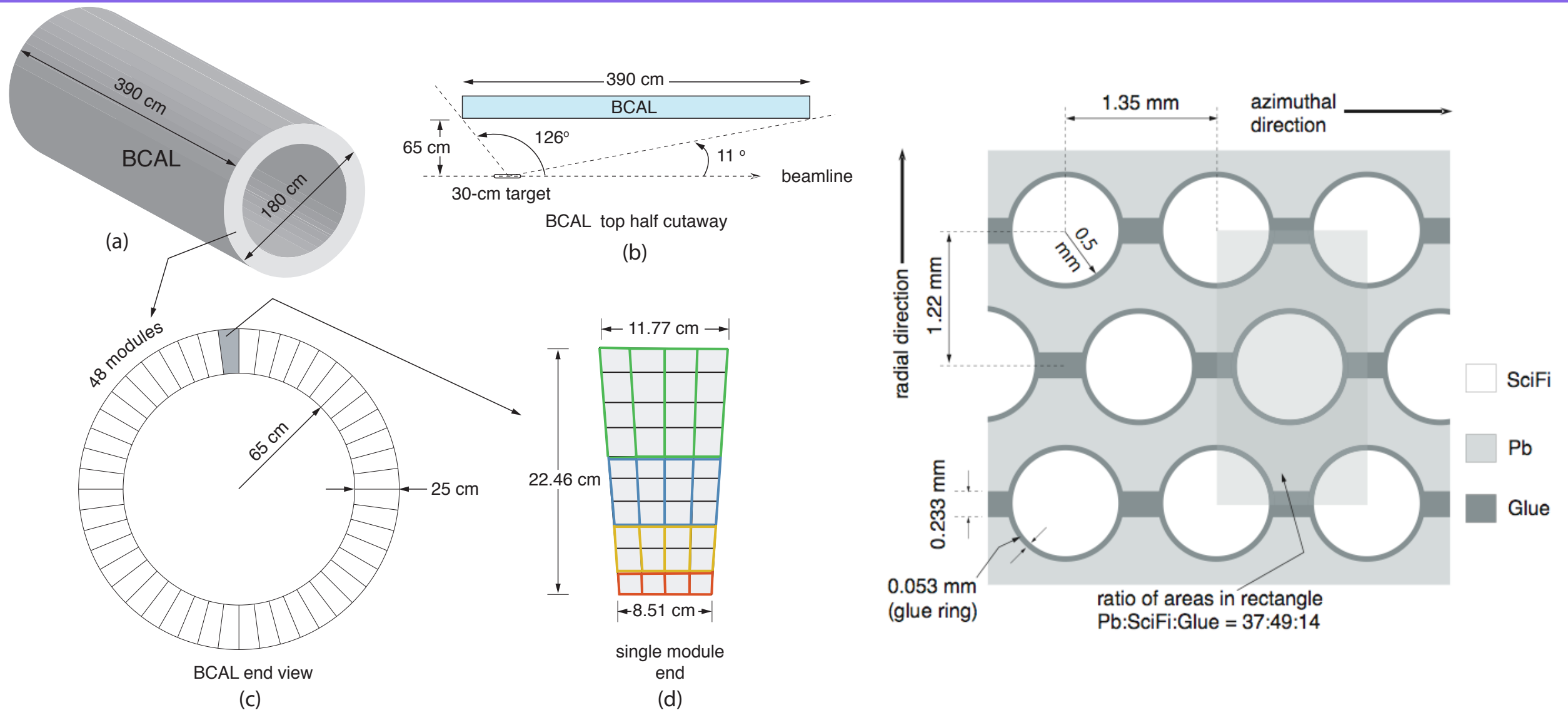
Calorimetry



The Barrel Calorimeter



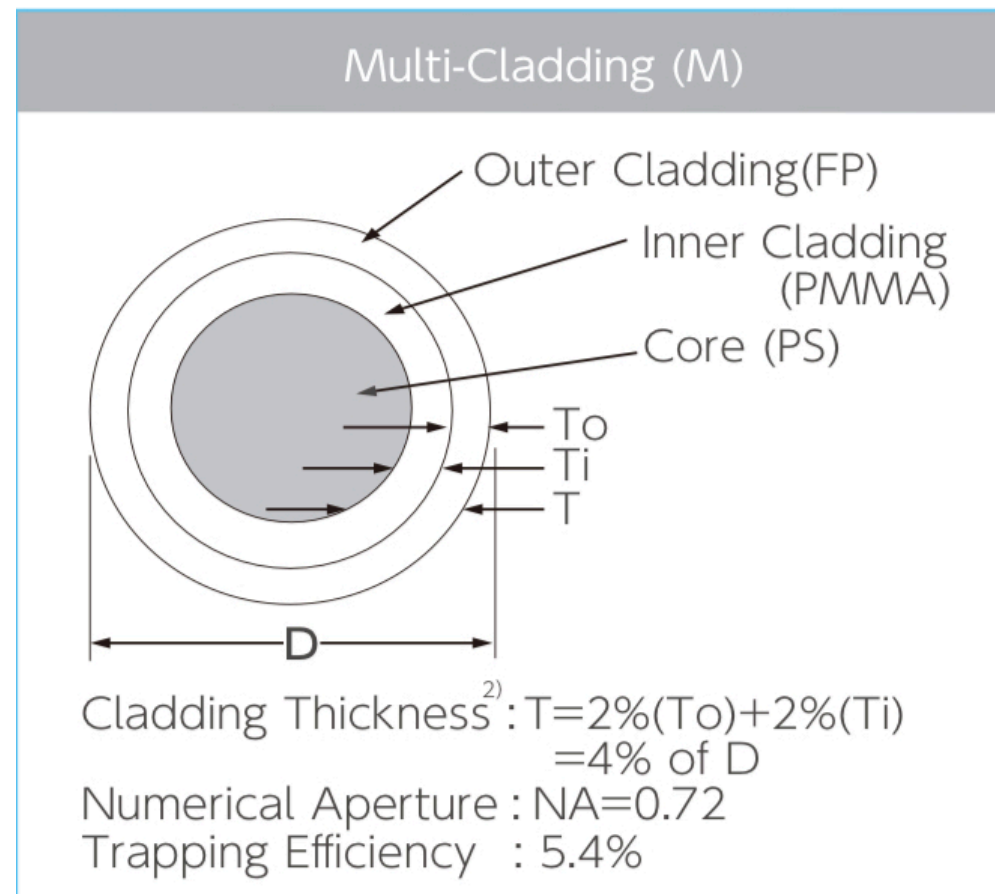
The Barrel Calorimeter



- 48 azimuthal sections (modules)
- Reconstructs γ showers from π^0 and η decays
- Provides timing information (neutrals/charged)
- With the CDC it provides charged particle PID

- Sampling calorimeter (9.5% sampling fraction)
- 750,000 double-clad scintillating fibers
- BCAL: 25 tonnes

Kuraray SCSF-78MJ



Formulations¹⁾

Description	Emission			Decay Time [ns]	Att.Leng. ²⁾ [m]	Characteristics
	Color	Spectra	Peak[nm]			
SCSF-78	blue	See the following figure	450	2.8	>4.0	Long Att. Length and High Light Yield
SCSF-81	blue		437	2.4	>3.5	Long Attenuation Length
SCSF-3HF(1500)	green		530	7	>4.5	3HF formulation for Radiation Hardness

1) Test fibers are Non-S type, 1 mm ϕ .

2) Measured by using bialkali PMT and UV light(254nm).

Quality control is made by another measurement of the transmission loss every batch.

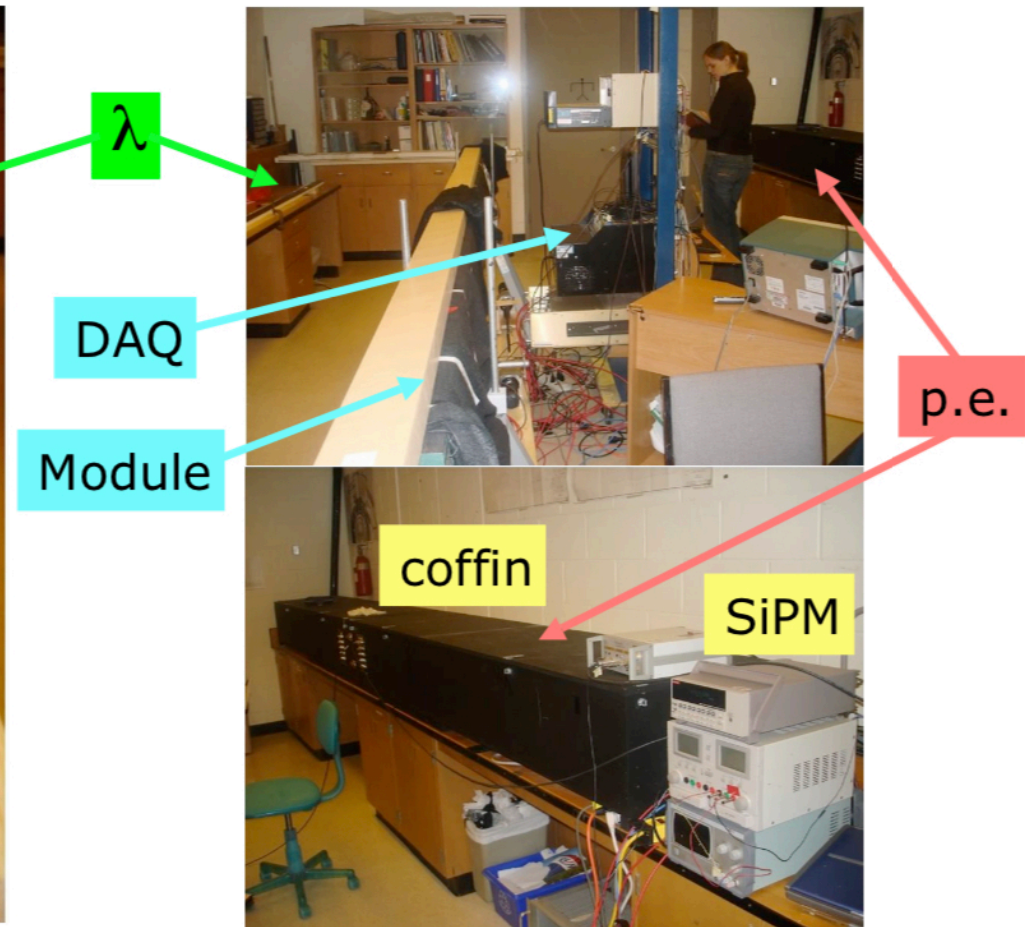
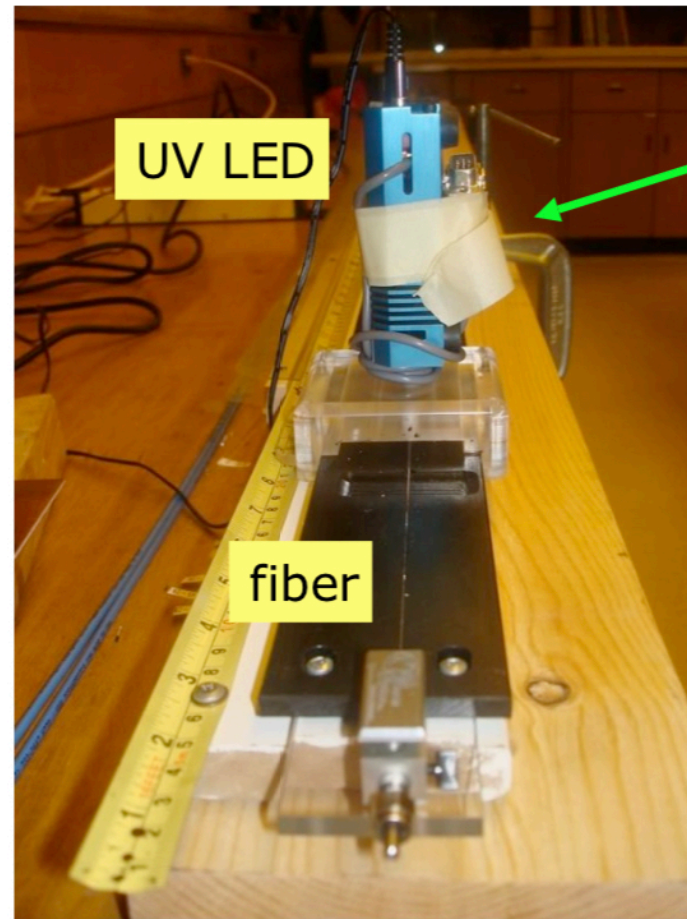
Fibre Testing lab

- First article

- Regina data
- JLab data
- GlueX-doc-1317
- Bench Reference

- Production (Regina)

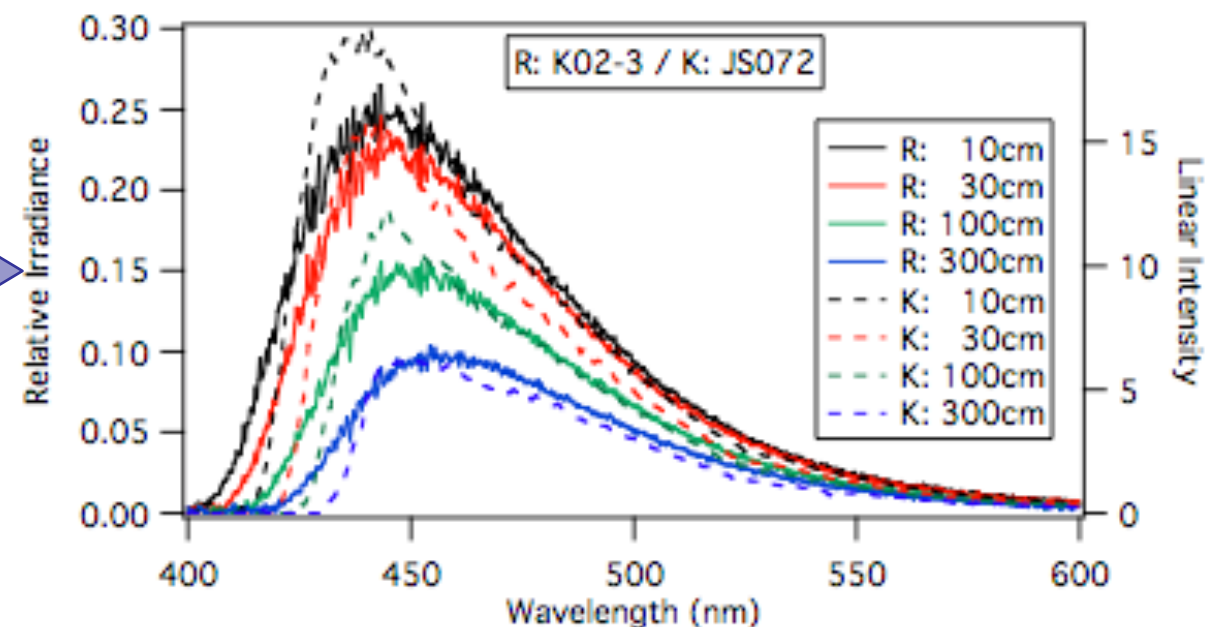
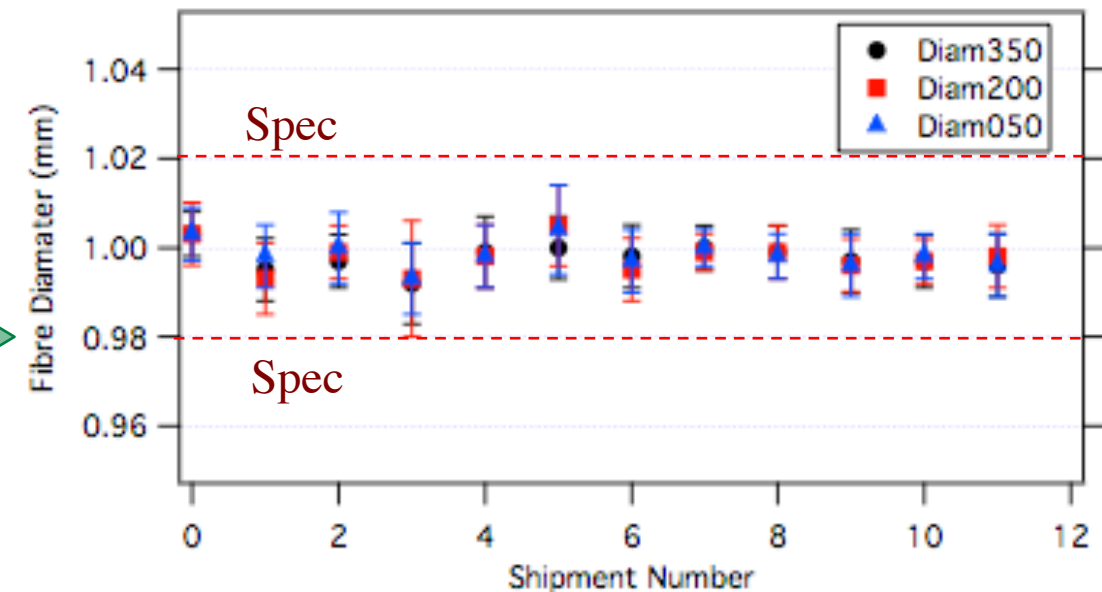
- ☒ Condition/packaging
- ☒ Diameter
- ☒ Attenuation length: LED, photodiode current
- ☒ N_{pe} at 200cm: ^{90}Sr , PMT, external trigger



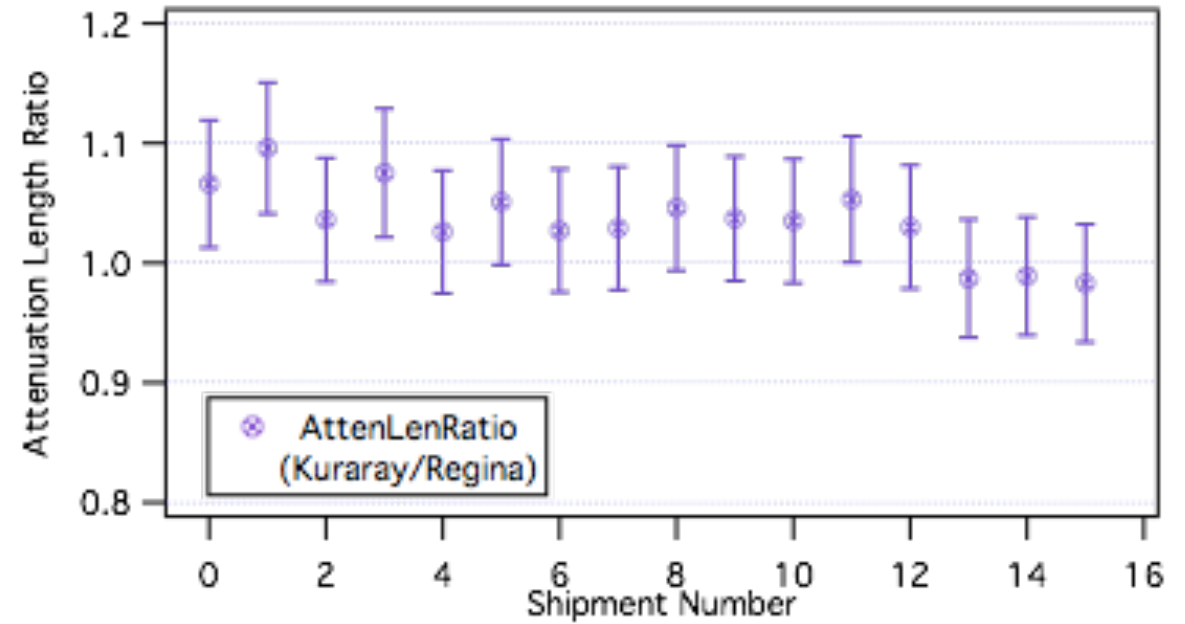
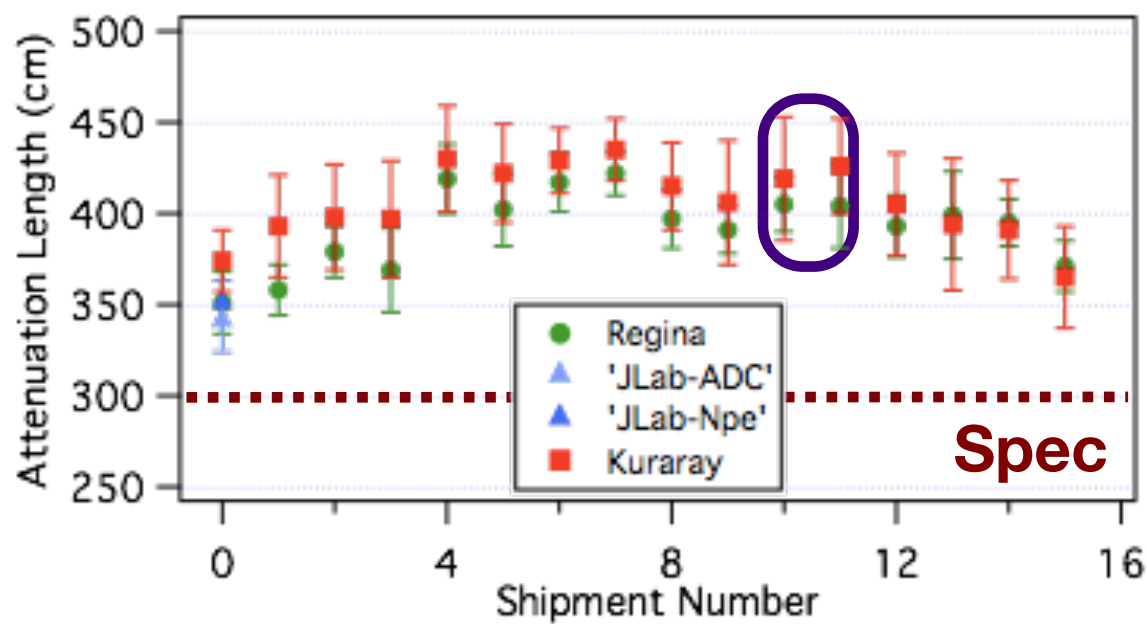
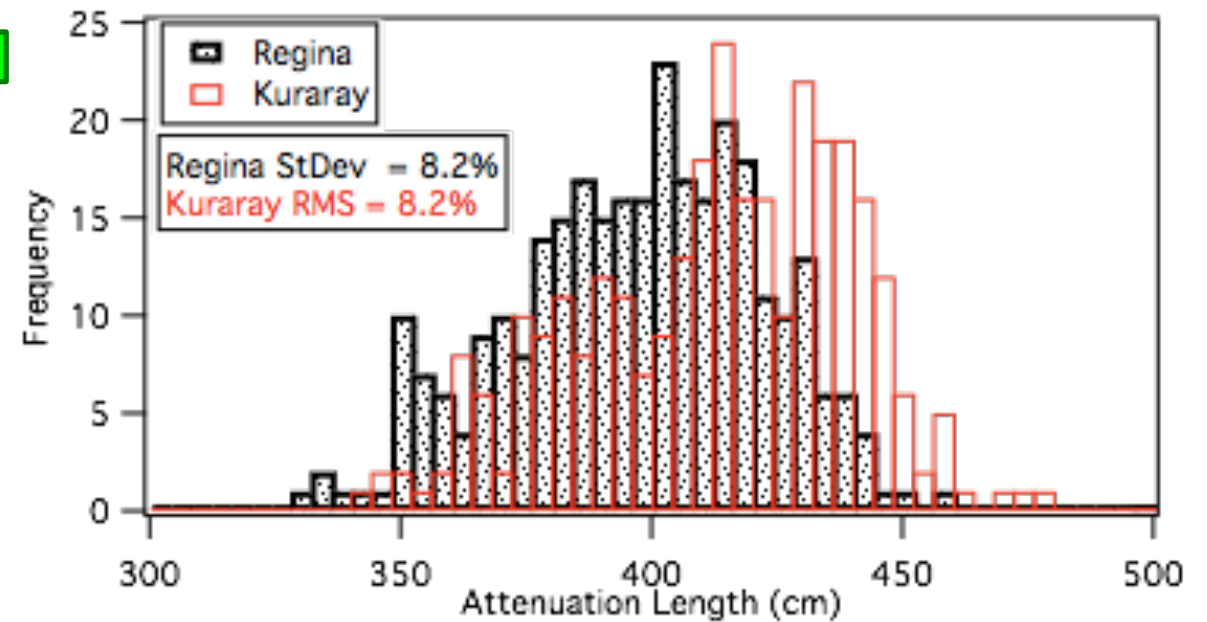
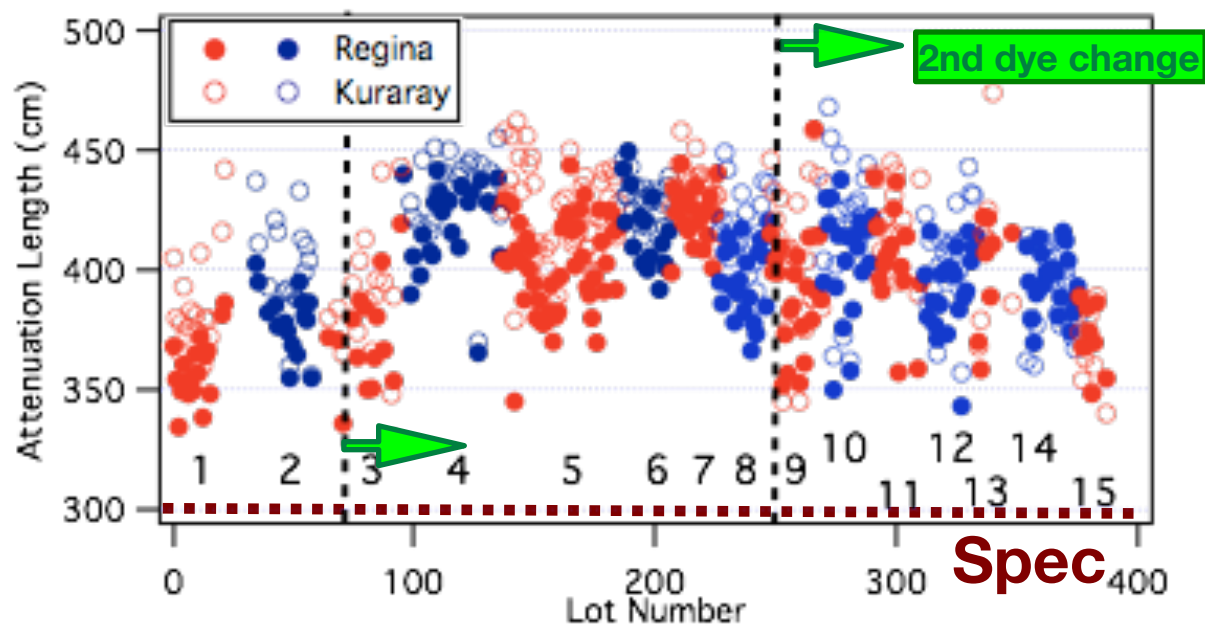
BCAL Construction QC/QA: Fibres

780,000 fibres!

- Kuraray SCSF-78MJ (blue-green); selected in late 2008
- **diameters: within specs**
- Spectra measured at Regina qualitatively agree with Kuraray's
- integrals are close, but shapes are different; response is acceptable and scales by distance in a similar fashion



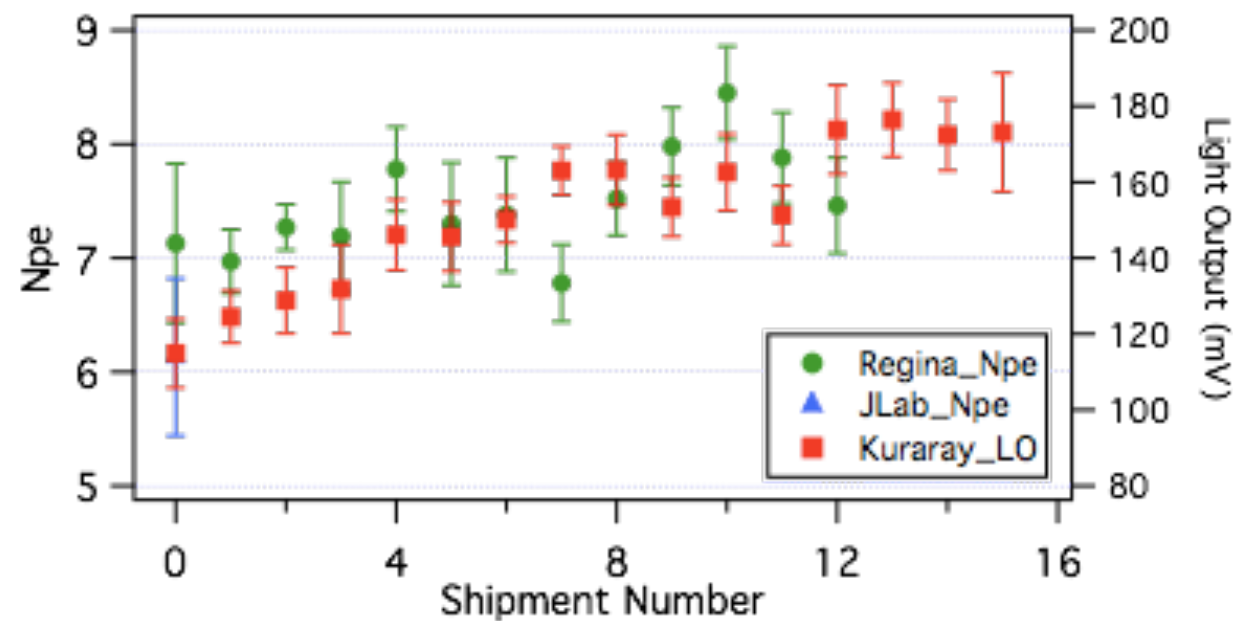
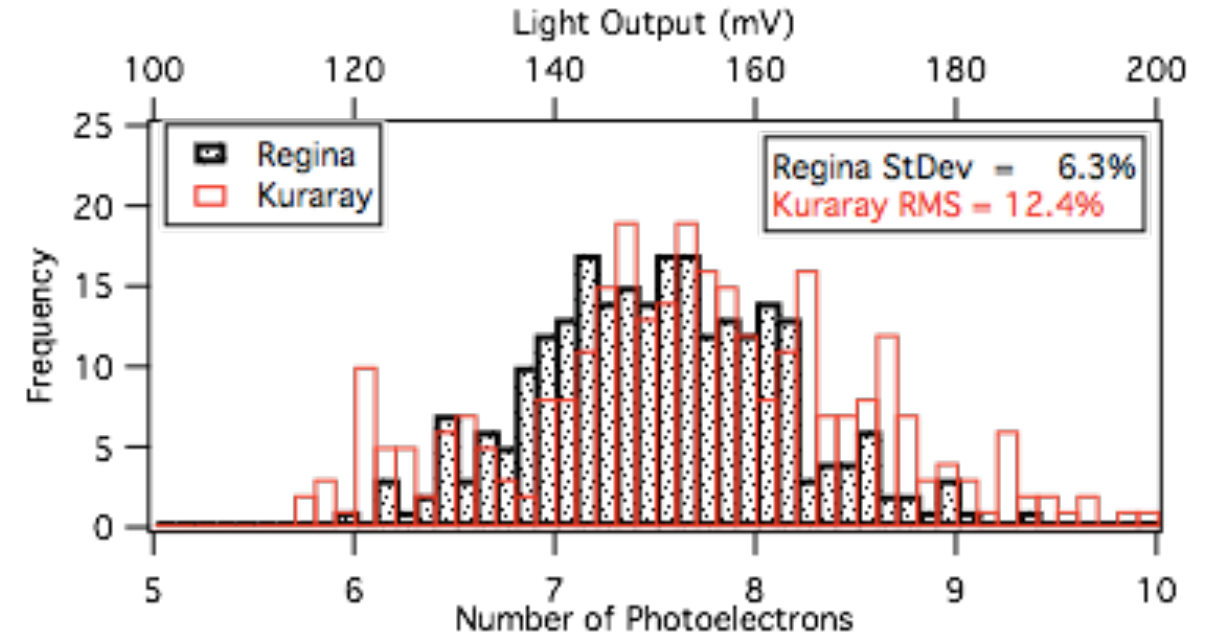
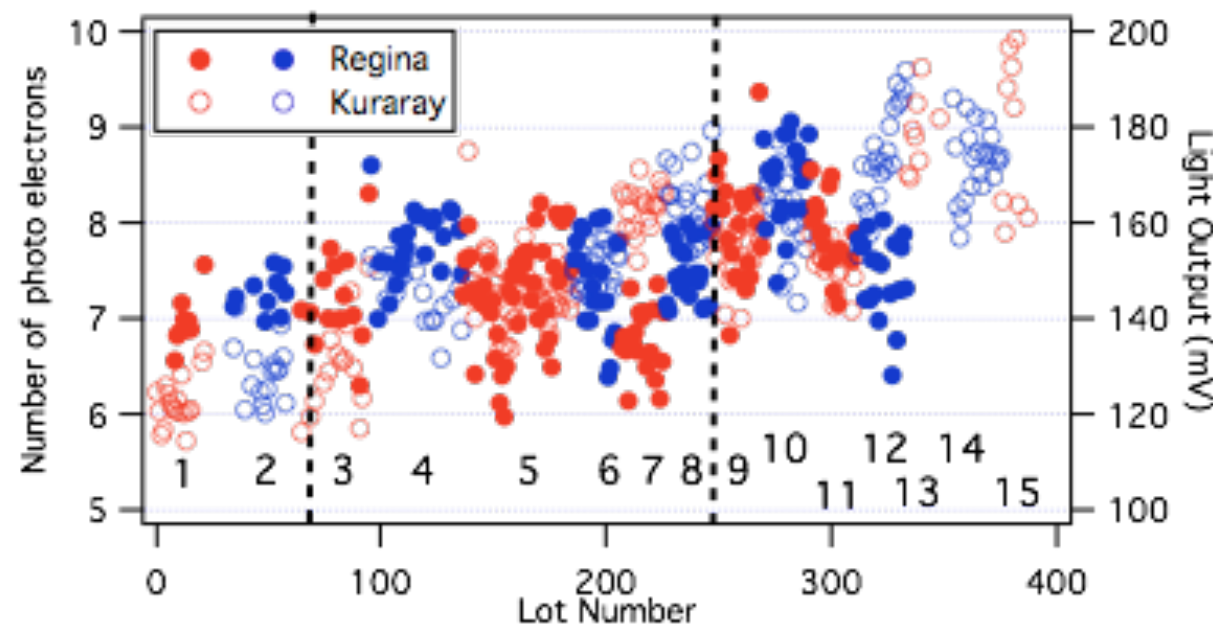
Fibre Attenuation Length



Per lot and shipment change; but Kuraray and Regina track

... and fibres meet specs

Fibre Light Output



Methods are very different:

- K: scope
- R: Npe w. 90Sr

Per lot and shipment change; Kuraray and Regina roughly track

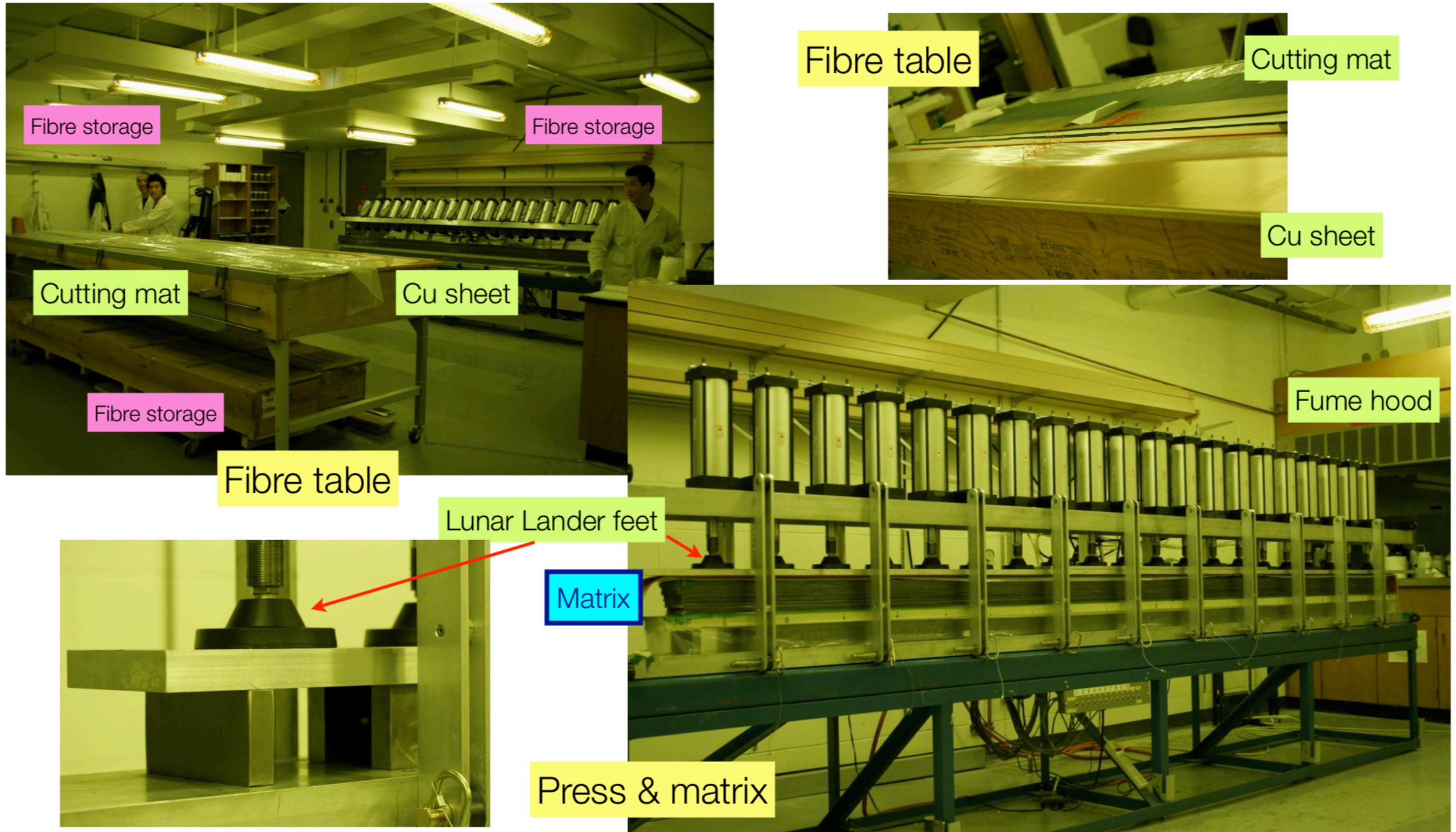
... and fibres meet specs

Matrix construction progress - details

- Press MAJOR adjustments
 - reassembly
 - casters
 - channel mismatch
 - 3/8" holes, 5/16" bolts
- A-frame hoist
 - UofR funds
- Fibre table adjustments
- Fibre crate storage
 - acute in Dec-Jan



Matrix construction progress - panoramatic



Construction Facility @ Regina

ROLLING



GLUING



QUALITY CONTROL AT EVERY STEP

SWAGGING



PRESSING



Machined Modules



Prototype



02



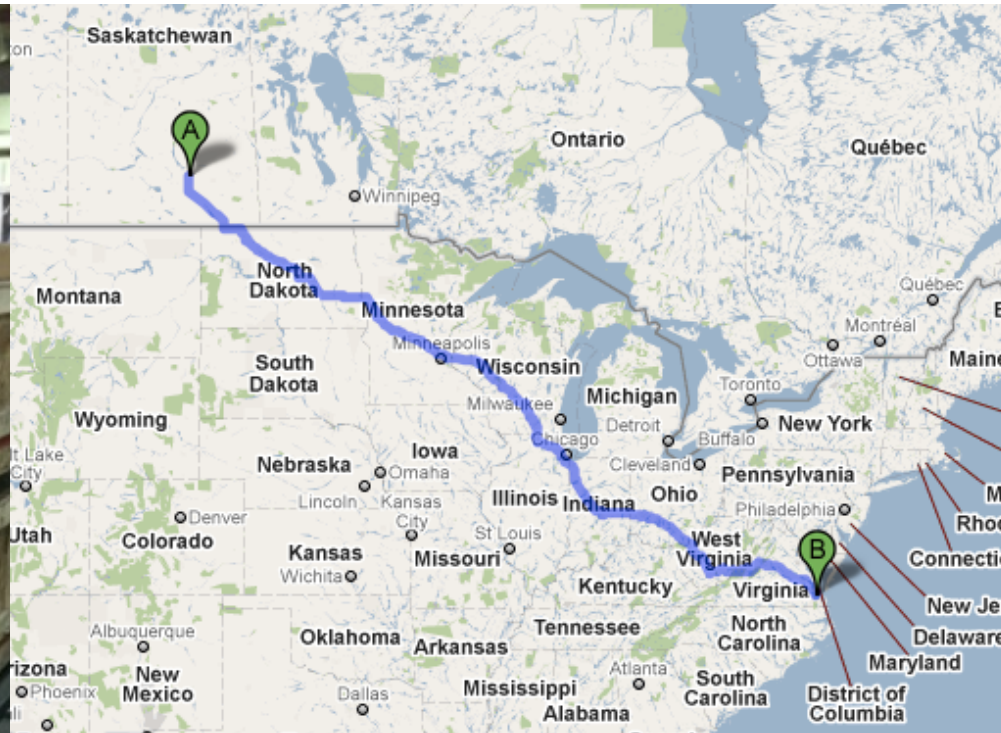
04

- Excellent finish of end faces & transmission uniformity
- 52 modules have been built & machined

Module Delivery to JLab



Left Regina
(April 22, 2023)



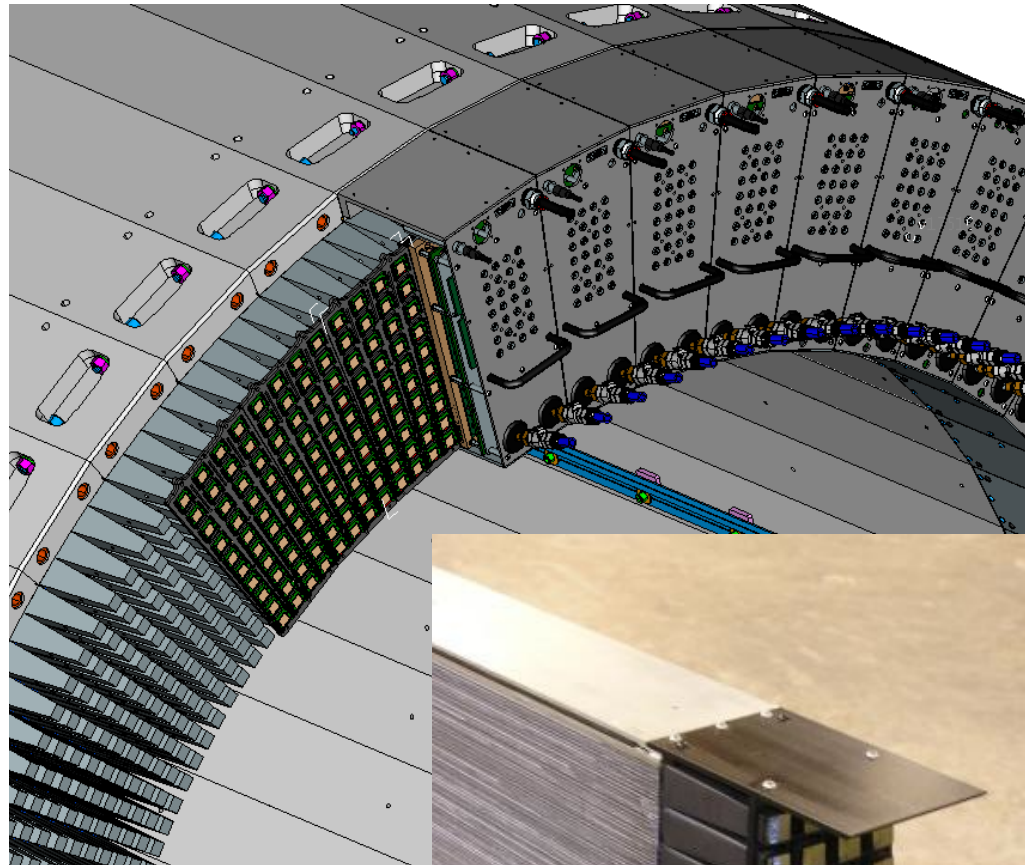
~3,300 km
in refrigerated truck



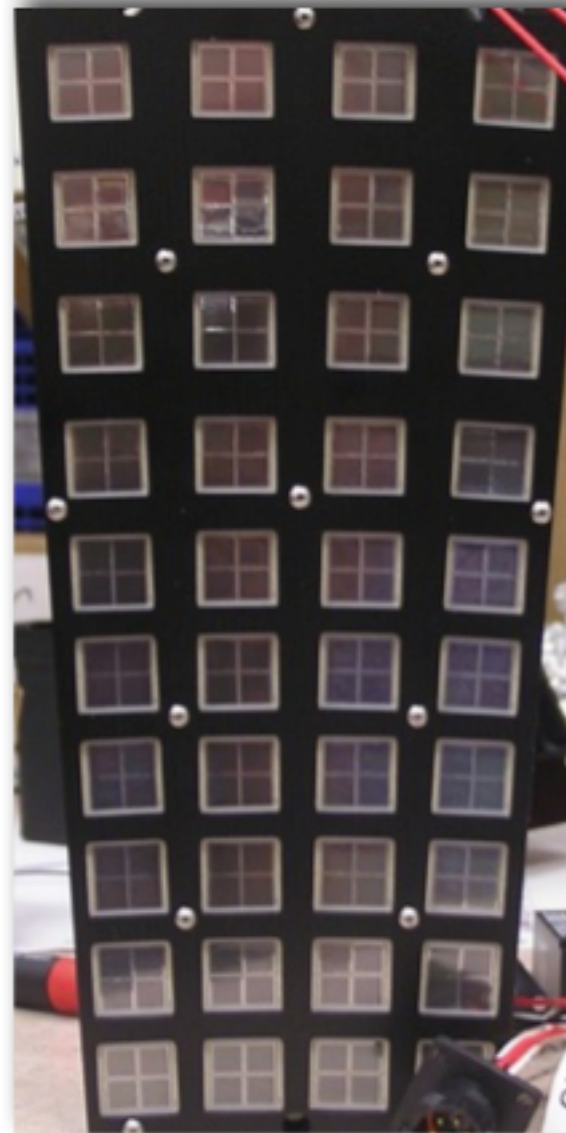
Arrived at JLab
(April 26, 2010)

Modules 01-04: 1st detector delivery for 12 GeV program!

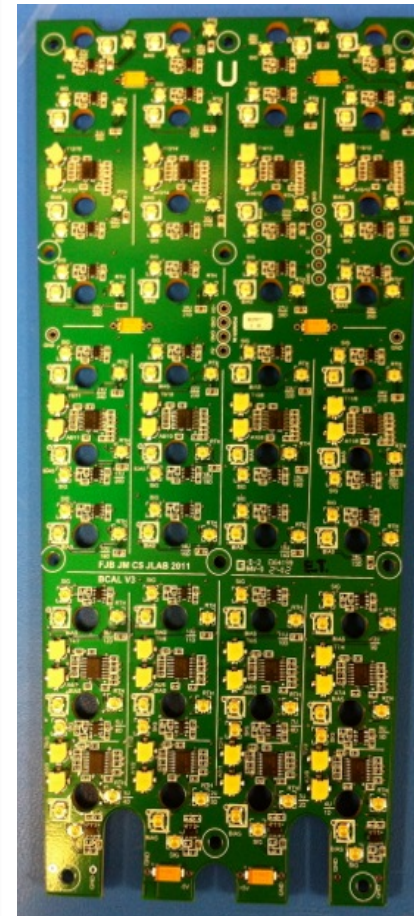
SiPM Readout Assemblies



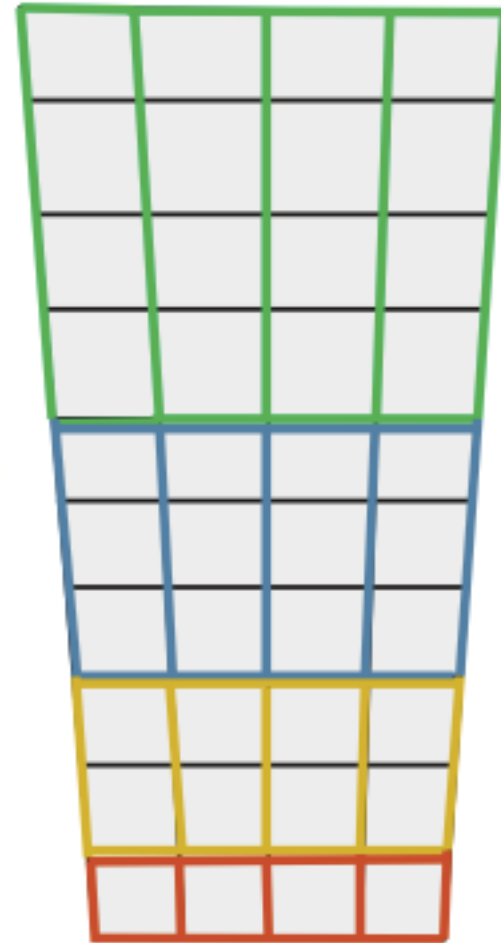
Light
guides



Assembly



Electronics

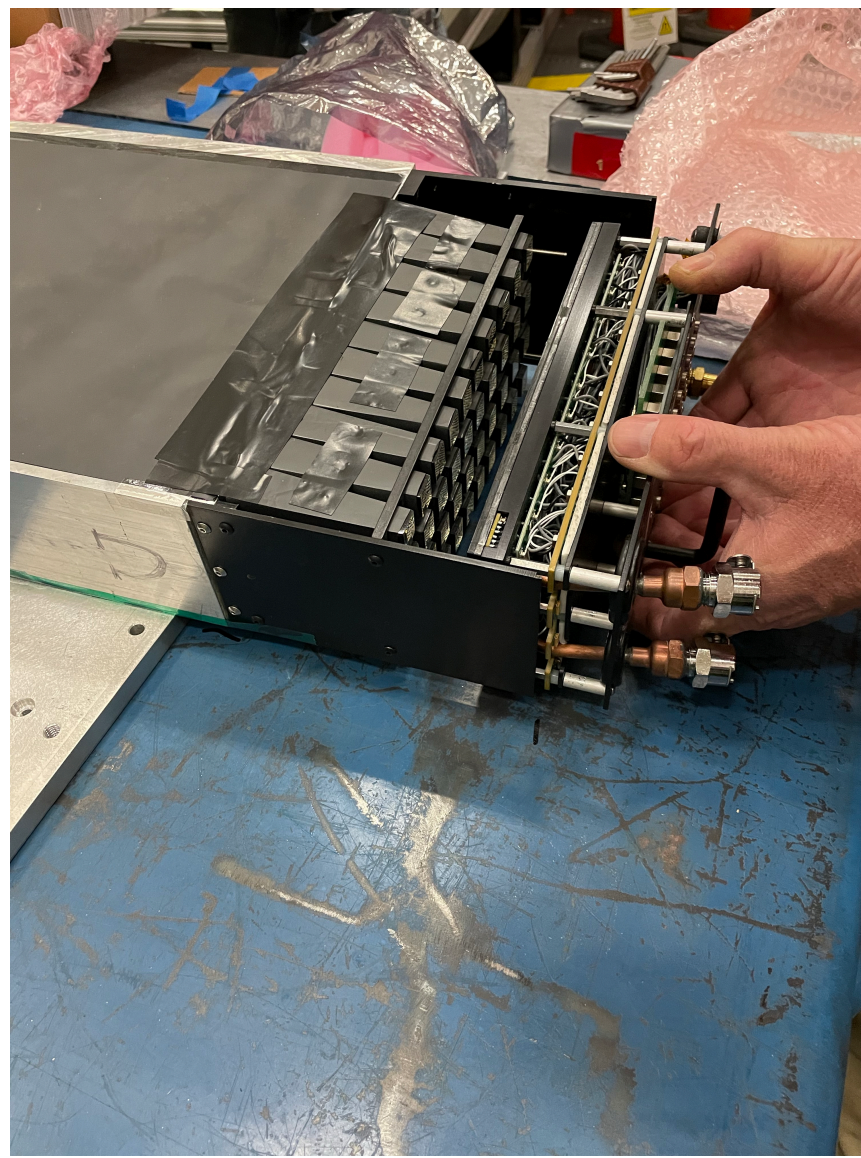


Summing
Scheme

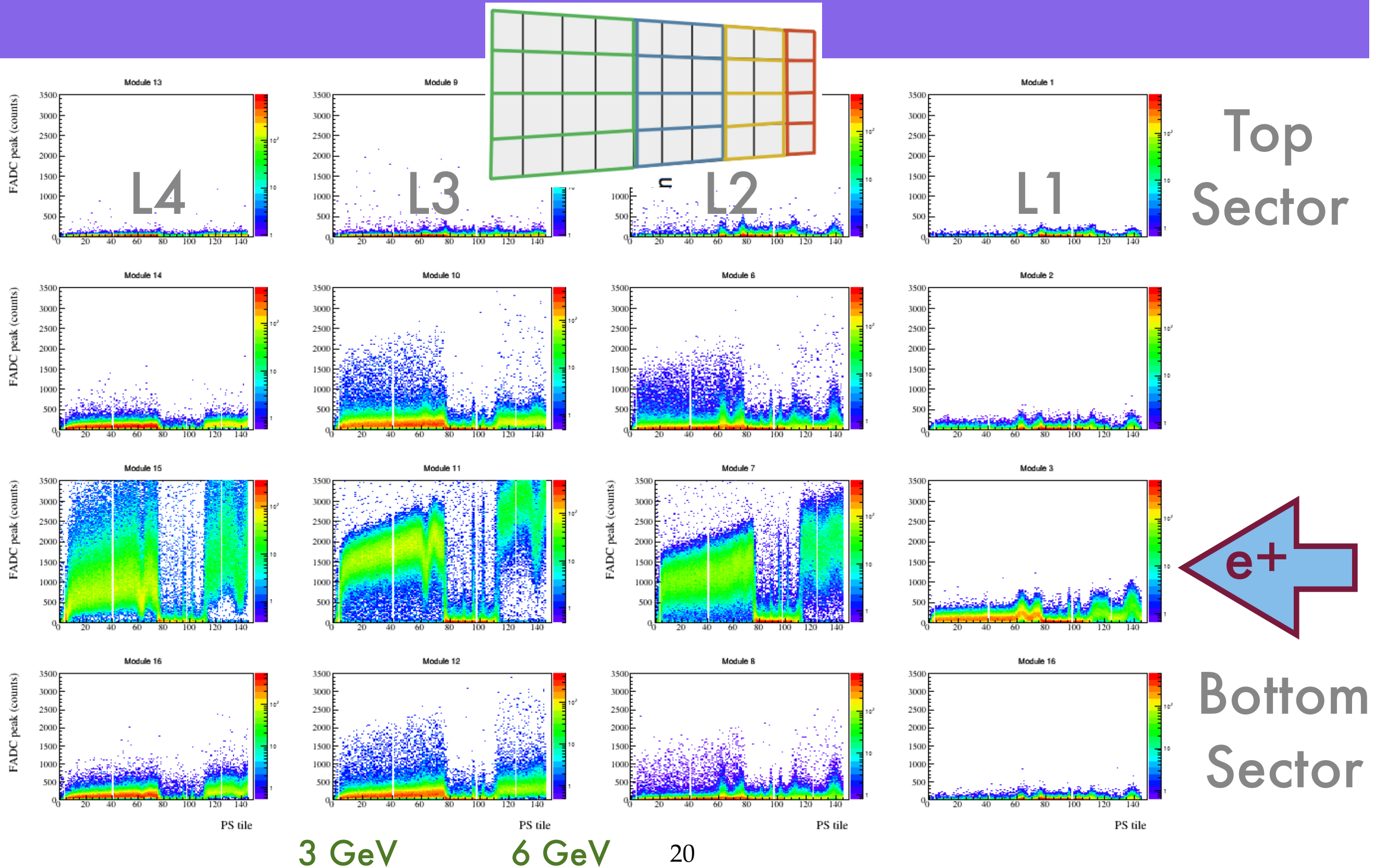
GlueX Pair Spectrometer



BCAL SiPM Assemblies



BCAL Readout



Beam Test Goals

- Energy resolution: constant term
- Number of photoelectrons
- Angle data
- Waveforms

Assessment

- Summer: test fibres from vendors
- Summer: SciFi prototype with AstroPix
- Production venue?
- Labour?