bECAL Kuraray Fiber Tests @Regina - Update 2

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Presentation to the weekly Barrel ECAL Meeting, August 1, 2023

Timetable - (July/August)

- Jul 31 - Aug 4: fiber polishing and testing at Photodiode station
- Aug 7-11: fiber testing at Npe station
- Aug 14-18: bECAL Group discussions, polish more fibers
- Aug 21-25: Remeasurements and measure additional fibers
- Aug 28- Sep 1: Finalize results for September Review

* the same fibers will be measured with photodiode and SiPM/PMT; initially: 5 single-, 5 double-clad Kuraray, 5-Luxium

Fiber Activities (July 31-August 14)

- No activities since July 20 (Maggie and Zisis left Regina) - Love, Stjepan and Aram are taking over; new crew training last weekend.
- Aram is searching for the Luxium shipment. It arrived at UofR but Luxium did not send a tracking number; we requested it again.
- Logistics developed:
  - Detailed step-by-step instructions developed.
  - Google doc Logbook and Google Drive folder for data and results.
  - New Slack channel; Daily group meeting at 11am Regina.

How-To Manual and Training

Fiber Handling - General Guidelines

When handling fibers, ensure that you are always doing the following:
Ensure that all surfaces that will have fibers on them are clean...

Removing New Fibers From Packaging

Prepare a clean surface in LB116 (LB127 is very crowded right now, although the desk with the PC desktop could be used, once cleaned...

How-To Manual and Training

Fiber Transportation

Fibers should be moved back and forth between the GlueX and Nuclear Imaging labs using the transport tray, which has a double layer of UV-absorbing film..

Fiber Polishing

The Kuraray single and multi clad fibers come unpolished, so they must be polished before measurements can be taken. The fiber polishing machine..

How-To Manual and Training

Attenuation Length Measurement (spectrophotometer)
QUESTIONABLE RIGHT NOW; SKIP
Order LEDs and test wavelength response

Attenuation Length Measurement (photodiode/picoammeter)
Turn on the LED light - to do this, power on the power box and then press the on/off button. The LED should be at 3.8 V, which corresponds to a current of about 0.041 A...

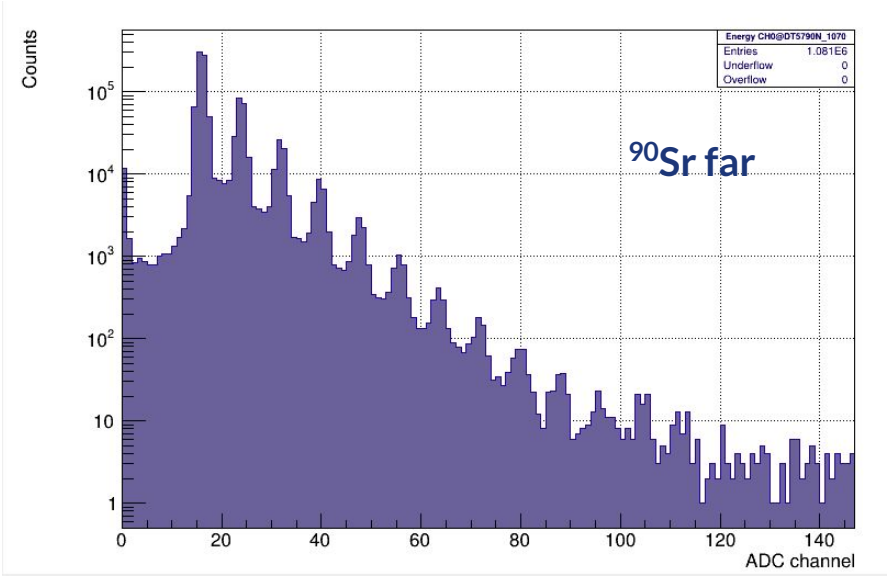
How-To Manual and Training

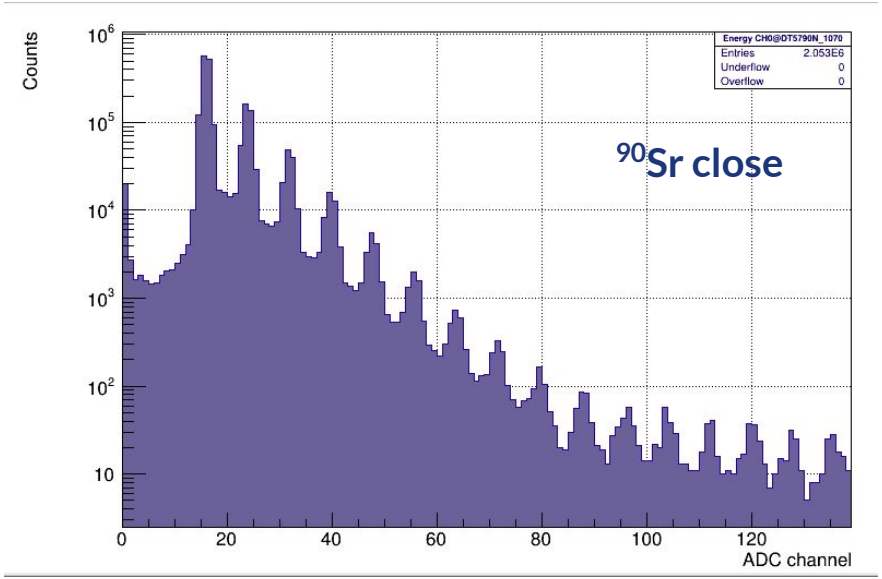
Attenuation Length and Npe Measurement (SiPM and PMT)

UNDER DEVELOPMENT - ready by end of week

- Manufacture a suitable mechanical setup.
- Position fiber in the coffin, such that one end is viewed by the Hamamatsu 1xmm^2 Module (high res, low noise, temp monitoring) and the other by a 2” Hamamatsu PMT.
- Use a CAEN digitizer to form coincidences and record the data. Place a 90Sr source at different locations on the fiber. Fit and extract <Npe> as a function of position…

SiPM Module (Singles) - Blue Fiber; capability





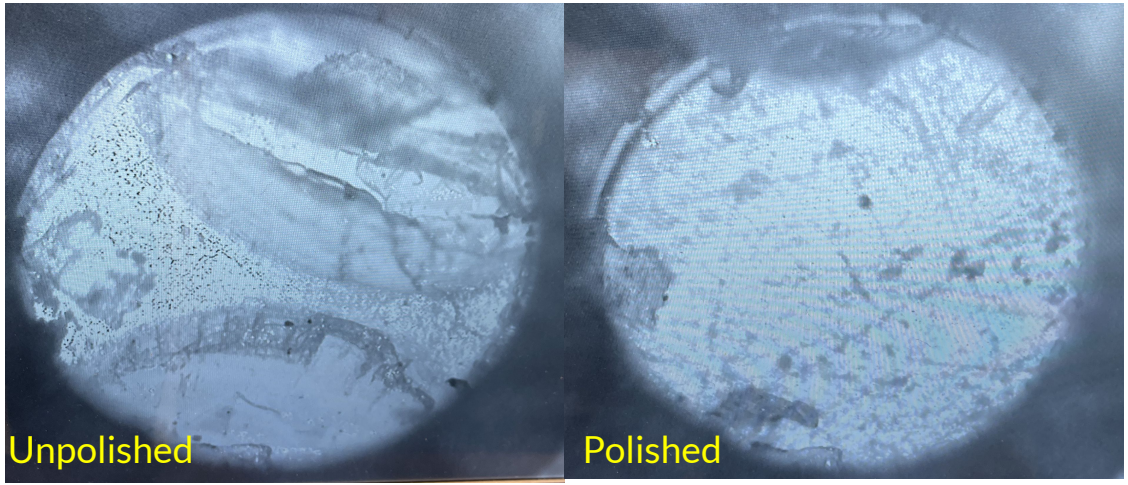
Next Steps

- New photodiode measurements underway today
  - Kuraray Tue-Wed, Luxium Thu-Fri
- Currently configuring SiPM set-up; measurements next week
- Timelines:
  - Initial Photodiode (atten len + relative light output) measurements by 8/7
  - Initial SiPM/PMT (atten len + absolute light output) measurements by 8/15
- Personnel secured; 3 freshmen undergraduate students joining effort.
- **No Luxium fibers yet** (Steven Robare on holidays until Aug 2)

Backup slides

(Maggies' July 18 presentation)

Fiber Polishing

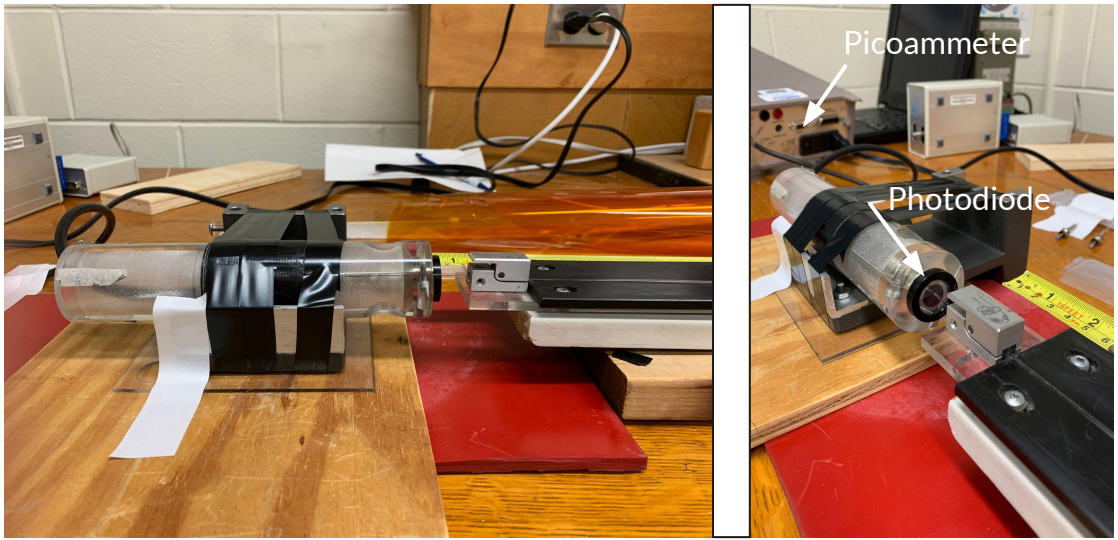


- Kuraray fibers came unpolished
- RBTX-12B[1] machine used for fiber polishing; from plant imaging lab
- Fibers were polished for 45 min each using 30µ, 9µ, 1µ grinding sheets
  - new fibers were covered with double layer of UV-absorbing film[2] for protection
- Inspected with RBTX-400GM[1] fiber microscope; quick cleaning needed

[1]Shenzhen Rongbang Optical Fiber Equipment Manufacturing Co., Shenzhen, Guangdong Province, China (www.rbtx.cn/EN/)
[2]Window Film Systems, London, ON, Canada (www.windowfilmsystems.com)

Photodiode Set-up for Attenuation Length Extraction

- New set-up for attenuation length extraction
- Fiber still in groove of tray, but now placed against Hamamtsu S2281 photodiode[1] connected to Keithley 6485 picoammeter[2]



[1]Hamamatsu Photonics, Shizuoka, Japan (www.hamamatsu.com/jp/en.html)
[2]Keithley Instruments, Cleveland, OH, USA (www.tek.com/en/products/keithley)

Photodiode Results

Quick measurement

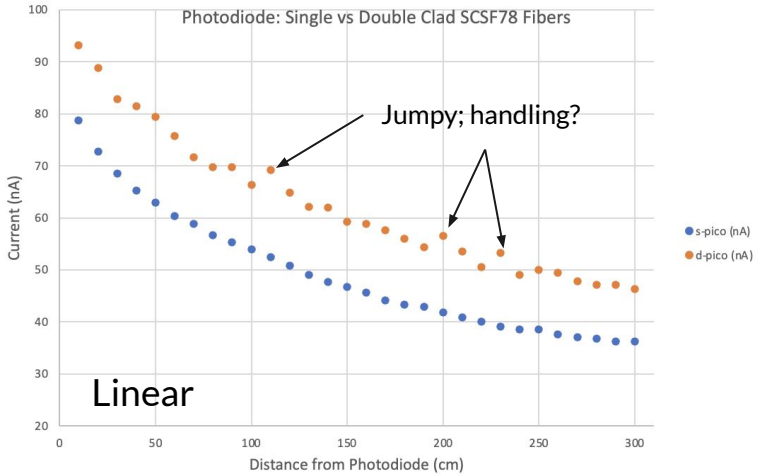
1 single, 1 multi clad

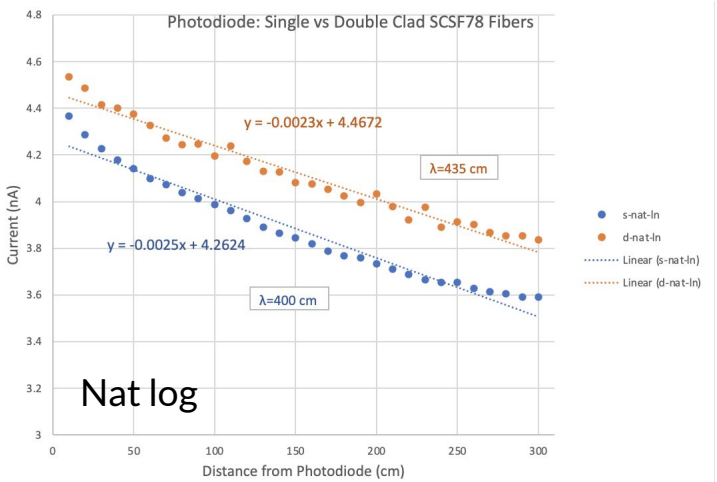
1 end polished (photodiode)

Fiber handling issue?

Stability +/-0.2nA

LED off: 0.1 nA





[1]Hamamatsu Photonics, Shizuoka, Japan
(www.hamamatsu.com/jp/en.html)

Hamamatsu Module

- MPPC: S12571-050C/Module: C11205[1]