Light Yield Comparison of Various Scintillator Bars

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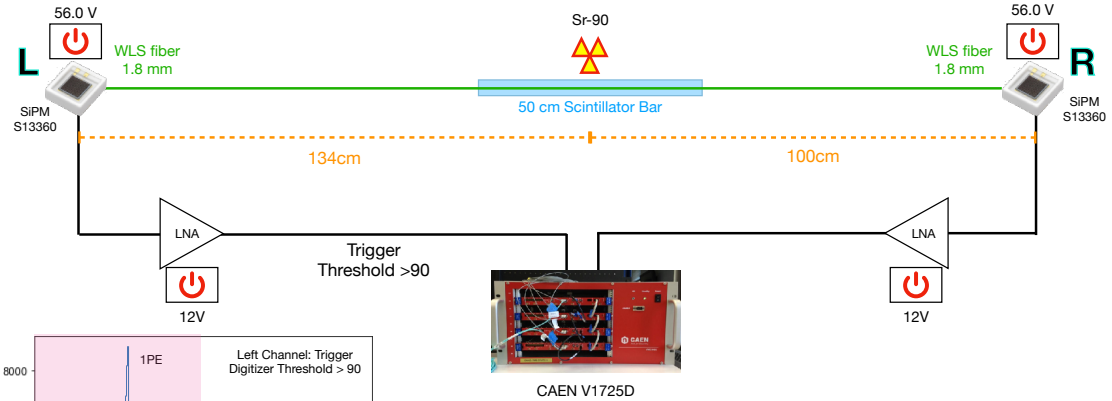
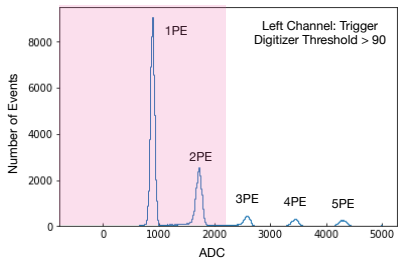
Test New Scintillator Bars with Sr^{90}

A few 1-meter scintillator bars with the co-extruded TiO2 reflector from Alan at Fermi were cut into 50cm long bars for light yield study. A Sr^{90} radiation source was placed 100cm away from the right SiPM (R) and 134cm from the left SiPM (L). Signals from the SiPMs were amplified by LNA; the left side signal was used to trigger the CAEN digitizer V1725D with a threshold of 90 set in WaveDump.





To reduce randomly triggered events caused by SiPM's dark current, only events with the trigger SiPM(L) signals exceeding 2.5 PE were retained in our light yield analysis.

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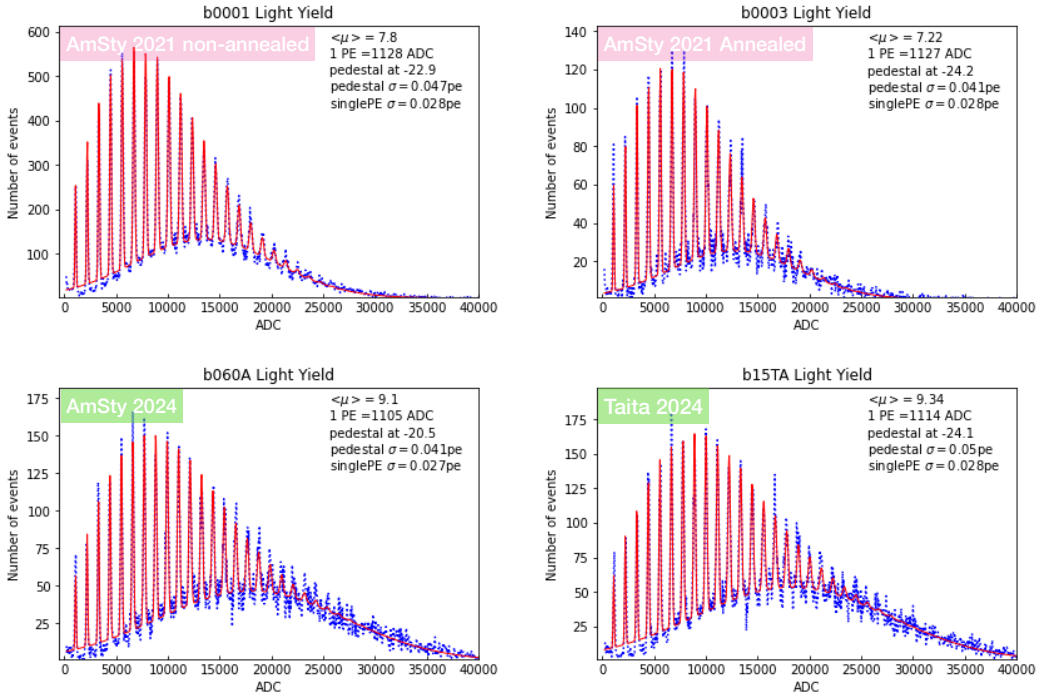
Light Yields Estimated by Fit for Various Scintillator Bars



The light yield in photoelectron (PE) was estimated by fitting each light yield spectrum with a gaussian of each PE peak convoluted with a Poisson and Sr^{90} energy spectrum. The first 10 peaks in each light yield spectrum were used to determine the spectrum's ADC-to-PE calibration.

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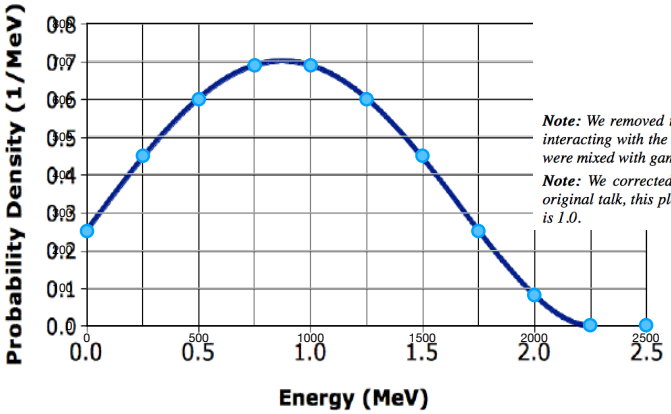
Strontium-90 Beta Spectrum

Electron Energy

- The 2.3 MeV is *maximum* energy of Sr-90 β.
- Average energy is 0.92 MeV.



- Glass window blocks all the 0.55 MeV β.
- Glass window blocks most of 2.3 MeV β.

Radiation Detection with Alignment Sensors

Muon Upgrade Meeting
CERN, 11-NOV-09

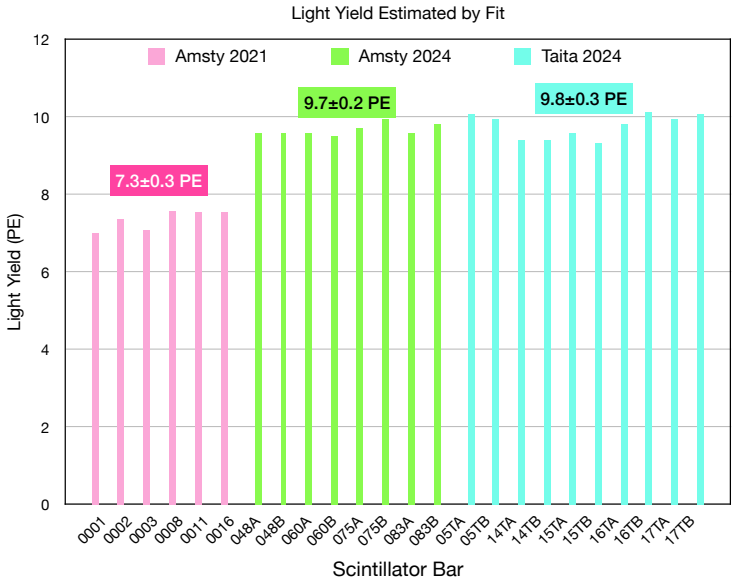
Kevan Hashemi, James Bensinger
Physics Department
Brandeis University
http://alignment.hep.brandeis.edu

Note: *We removed the page that claimed the spots in an image were the result of fast neutrons interacting with the sensor pixels. We had no basis for this claim, and the fast neutrons involved were mixed with gamma rays, which we know are capable of giving such hits.*

Note: *We corrected the probability density function for Y-90 beta particle production. In the original talk, this plot was scaled incorrectly. In the corrected version, the area under the curve is 1.0.*

2021.08.18

Light Yields of Various 50cm Scintillator Bars with 1.8mm WLS Fiber



On the average, the observed light yields of new Amsty's bars and Taita's bar are about 1.3±0.1 times higher than those of the Amsty's 2021 bars, consistent with our simulation. All bars used in this study were co-extruded with TiO_2 reflector.

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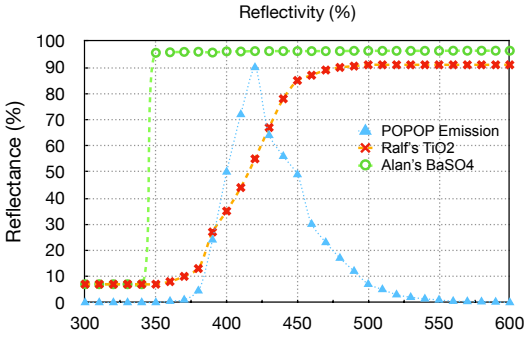
Light Yield Comparison by Monte Carlo Simulation

Ralf's Geant4

Polystyrene	AmSty PS665/1.8	Taita PS808/1.8	Taita PS808/1.4	Taita PS808/1.2
Reflector	Alan	Ralf	Ralf	Ralf
TiO_2	1.0	1.5	1.1	0.9
$BaSO_4$	1.3	2.3	1.7	1.5

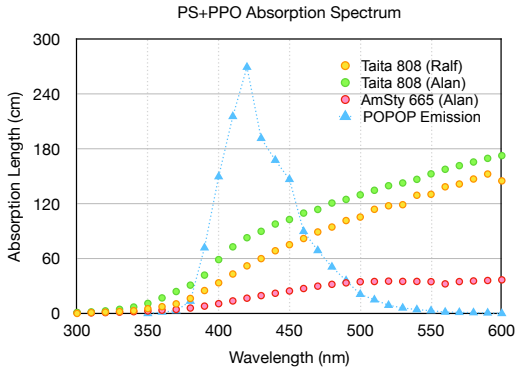
Normalized to AmSty PS665 with TiO2 reflector



Fortran

Polystyrene	AmSty PS665/1.8	Taita PS808/1.8	Taita PS808/1.4	Taita PS808/1.2
Reflector	Alan	Alan	Alan	Alan
TiO_2	1.0	1.6	1.3	1.1
$BaSO_4$	1.3	2.5	2.0	1.8

So far, all light yield measurements were done by using the bars co-extruded with TiO_2 reflector. We are preparing bars with $BaSO_4$ paint, or wrapped by Tyvek and Teflon.



2024.10.08