Towards Benchmarking the Performance of LENS

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LENS (miniLENS) Overview

Precisely measure full spectrum of solar neutrinos w/ low threshold

Charged-Current (CC) reactions on indium-loaded scintillator

Optical segmentation to localize vertex of reaction

Position and time resolution is crucial for distinguishing low-energy neutrino events from background

- High internal background from natural indium beta-decay
Monte-Carlo Overview

- **LENS and miniLENS** have been extensively modeled.
- **Performance depends upon optical properties of the lattice** (attenuation length of materials, flatness of surfaces, percentage of diffuse scattering at interfaces).

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At LSU:

- Building prototypes to measure performance in different geometries
- Testing how different construction techniques affect performance
- Validating Monte Carlo calculations
- Development of electronics and DAQ
- Characterizing scintillator and PMT performance
Scintillator Testing

Setup: 3” diam. round acrylic container w/ 1cm LAB
Coupled to PMT with optical grease

Red is 137Cs spectrum white is 60Co

FWHM vs. area for Cs
width ~ 25 ns (PMT+LAB)
Measurements with fast tube show
~10ns FWHM

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13 litre prototype (LENS Line)
- same length scale as miniLENS
- used to benchmark optical properties for input into Monte Carlo
- optimize performance
- 10 cell lattice
- Cast acrylic layered w/ fluoropolymer

LAB scintillator

8cm

Cast acrylic (n=1.491)

Teflon (fluoropolymer) n=1.35
0.05 mm thick
Setup

- Using "conventional" electronics (VME QDC and TDC's)
- Developing digital signal processing
  - 500 MHz flash ADC (Caen Mod. V1721)

Triggers

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Triggers

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Tracking Light Output through Cells

- Shift in light output for different cells (expected)
- Large broadening of peak for cells close to PMT (problematic? – maybe not)
Position from Energy

• Attenuation in good agreement with Monte Carlo

PRELIMINARY

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Position from Timing

Cell 7
Cell 9
Cell 5
Cell 10

TDC1 - TDC2

Timing (TDC1 - TDC2)

Cell Number
Future

- Analyzing Compton-scattered gamma ray data
- Rebuilding 10x1 lattice to test improved construction techniques
- Now building 6x6x1 prototype
The LENS Collaboration


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