Assessing Age Effects on Pulse Shape Discrimination Capabilities of Organic Glass Scintillators

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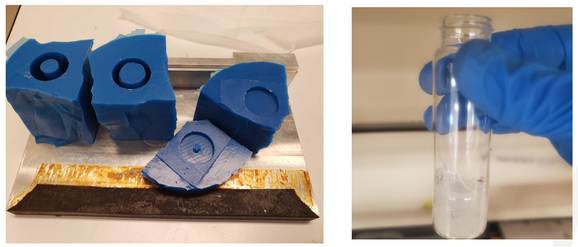
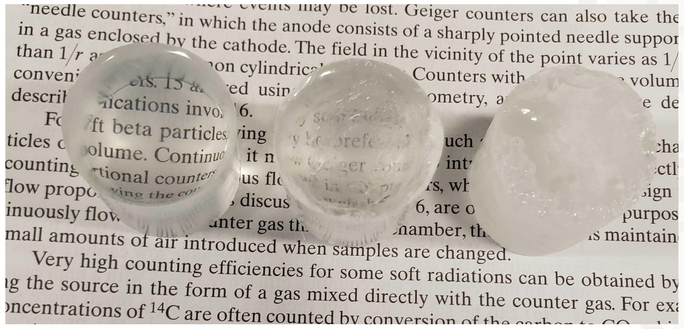
Introduction and Motivation

- Organic scintillators are used for detection of weapons testing
- Current detectors use plastic scintillators
- Organic glass scintillators (OGS) offer greater energy resolution and pulse shape discrimination



Silicone molds (left) and melted OGS (right)



Three OGS (left to right) from 2024, 2022, 2019

- Three 1” OGS scintillators from 2019, 2022, 2024 respectively were compared using a Cf-252 source
- Gain matching was performed using a Cs-137 source
- Pulses were collected for 3 minutes

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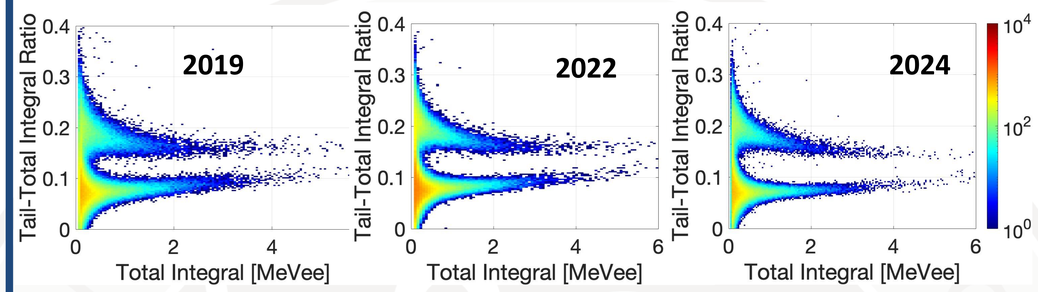
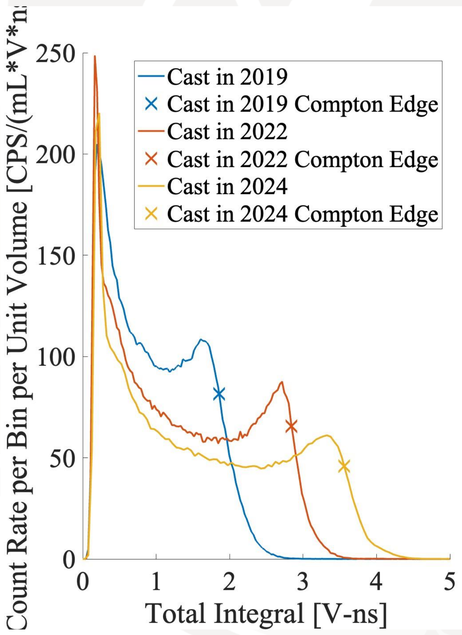
Technical Approach



Results

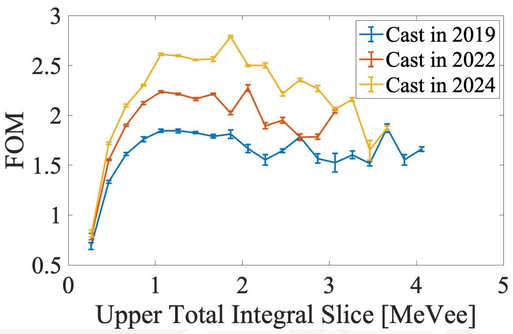
Light Output Comparison



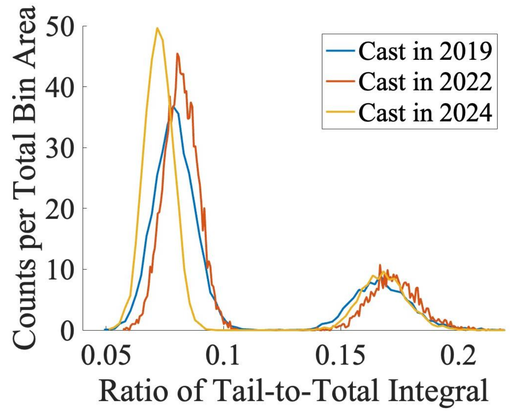
- Newer cylinders displayed higher light production
- Compton edges were marked at 75% for alignment
- To the left: light light output for each of the cylinders

Figure of Merit Comparison

$$FOM = \frac{Peak\ Separation}{FWHM_\gamma + FWHM_n}$$



- The PSD distributions for each cylinder were used to calculate their figures of merit
- The newest cylinder displayed superior PSD capability
- PSD capabilities converge at higher energies



- PSD capabilities from 1 to 2 MeVee. The gamma peak can be seen to broaden with aging.

Impact

- This work is a collaboration with Sandia National Labs with Dr. Feng
- This work has direct application to radio-xenon monitoring systems

Conclusion

- OGS demonstrate degradation of pulse shape discrimination through age
- Older OGS still are PSD capable
- Newer cylinders have higher light output
- It is unclear if these results are from surface effects

Next steps:

- Include assessment if these results are from surface effects
- Cast beta cell using PVA mold

National Nuclear Security Administration