Radon-Induced Backgrounds: Alpha Scintillation Light Yield

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DEEP UNDERGROUND NEUTRINO EXPERIMENT

DUNE Backgrounds Mitigation Strategies Workshop

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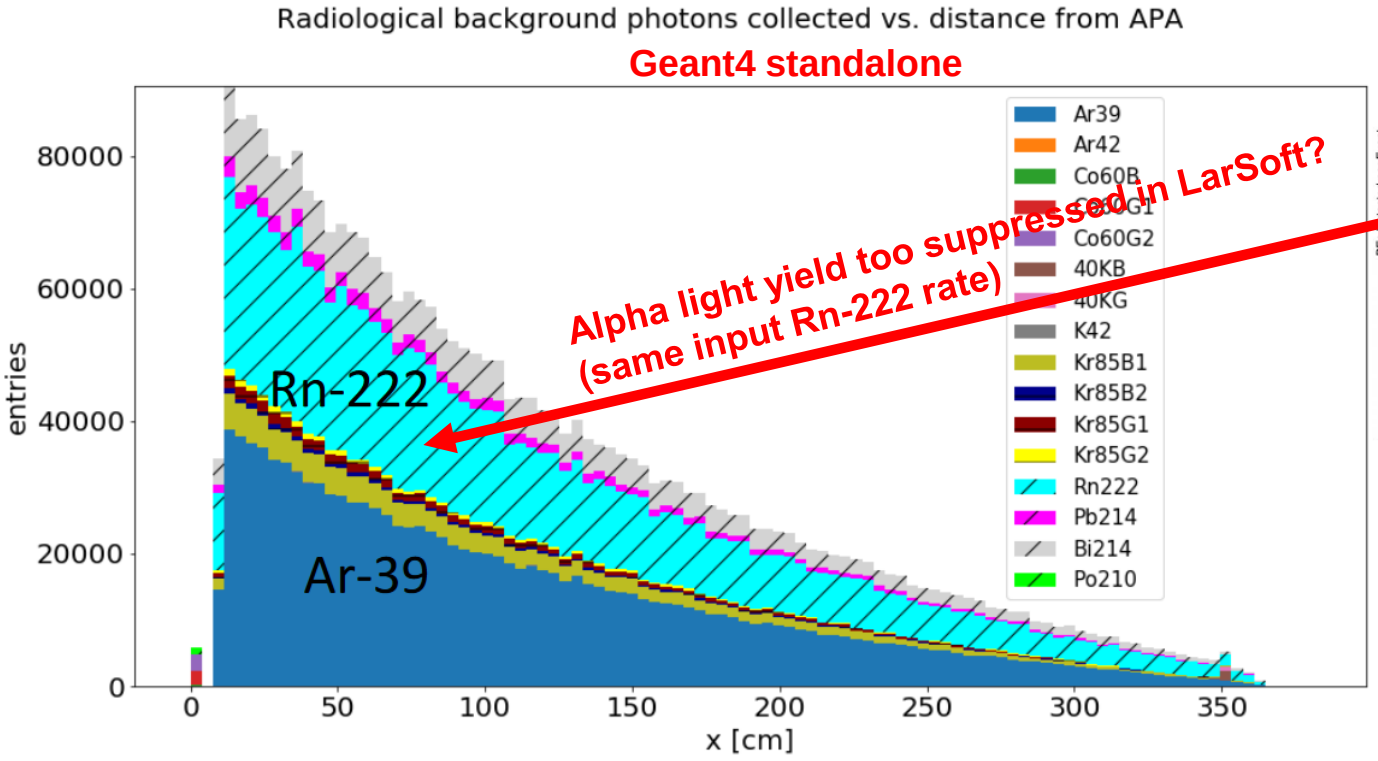
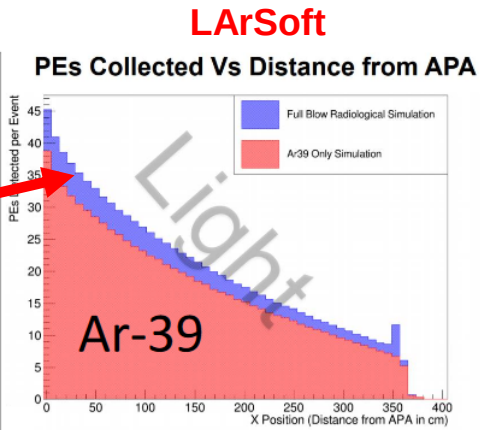
LArSoft Simulation Issues to be Solved:
a) Light and Charge Yields in its Default Configuration
b) Implement Migration Model

MANCHESTER 1824
The University of Manchester

Photons detected Vs. distance from APA





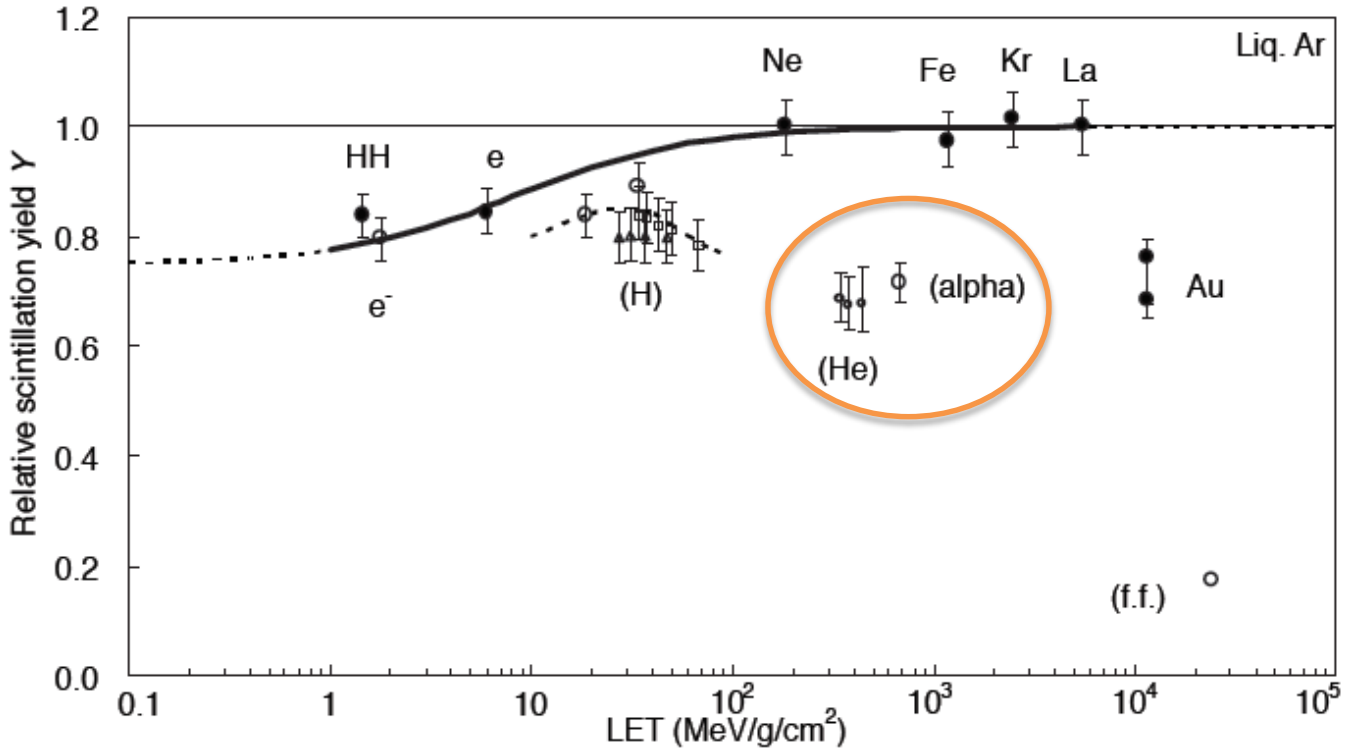
Jason Stock
(APS 2017)

Jingyuan Shi

=> Manchester group works on migration model

Light Yield for alphas at ~70% of 'Full' Yield

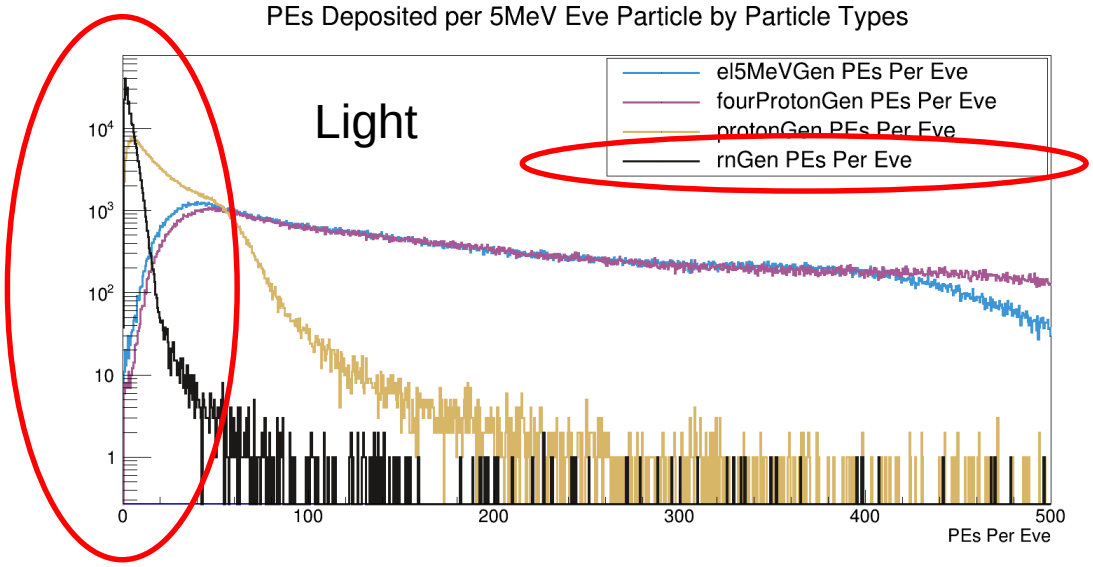
1540 Jpn. J. Appl. Phys. Vol. 41 (2002) Pt. 1, No. 3A (Doke et al)



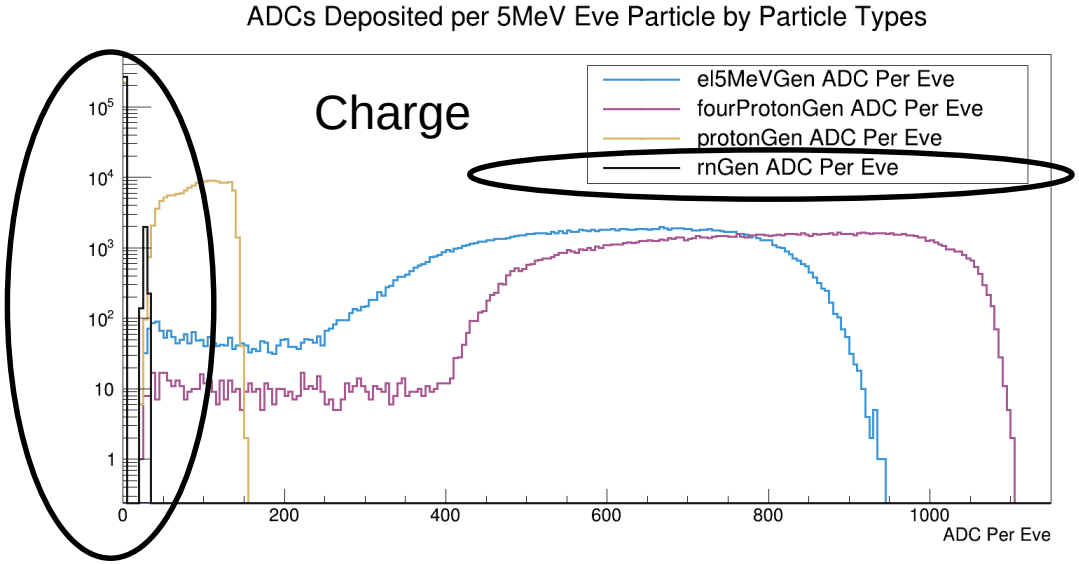
cross-checked with Stephen Pordes, Matthew Szydagis (LUX/LZ), Andrzej Szelc, Justin Evans, and Hans-Joachim Wenzel (LArSoft Developer)

=> Mike Mooney's group worked on LArNEST (to be implemented in LArSoft)

Systematic Checks on Light and Charge Yields in LArSoft:



incorrect alpha "quenching" for **light** (factor ~40 instead of ~30%)



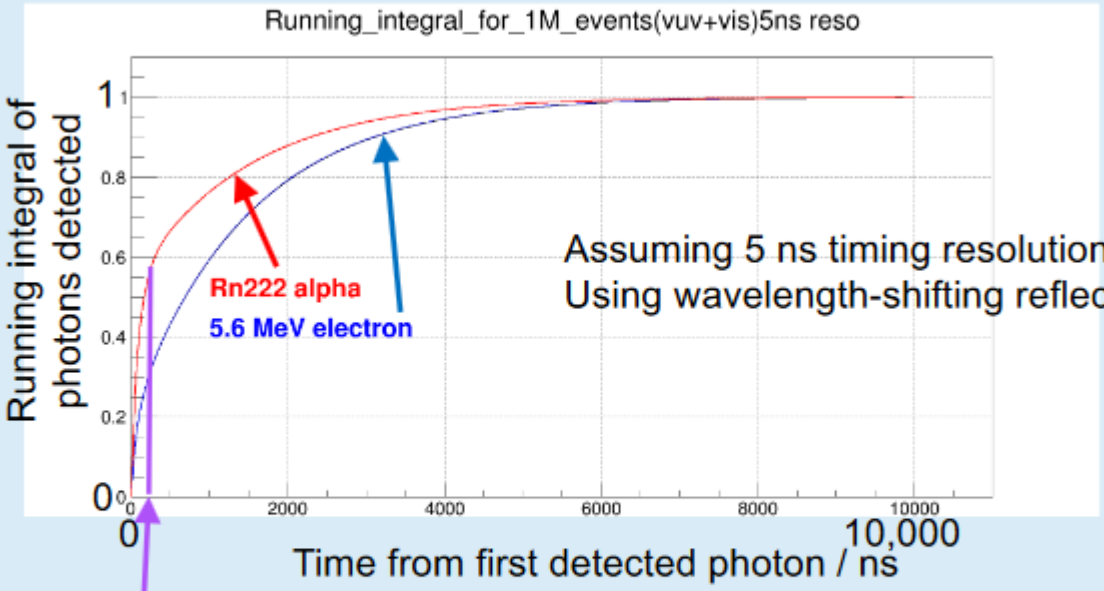
correct alpha "quenching" for **charge** (in agreement with Icarus paper)

(Jason Stock, Juergen and Hans-Joachim Wenzel)

Further Future Improvement w/ Pulse Shape Discrimination (alpha's vs beta's)

Jing Yuan Shi, Justin Evans, Stefan Söldner-Rembold & Andrzej Szelc

Running integral and F_{prompt}



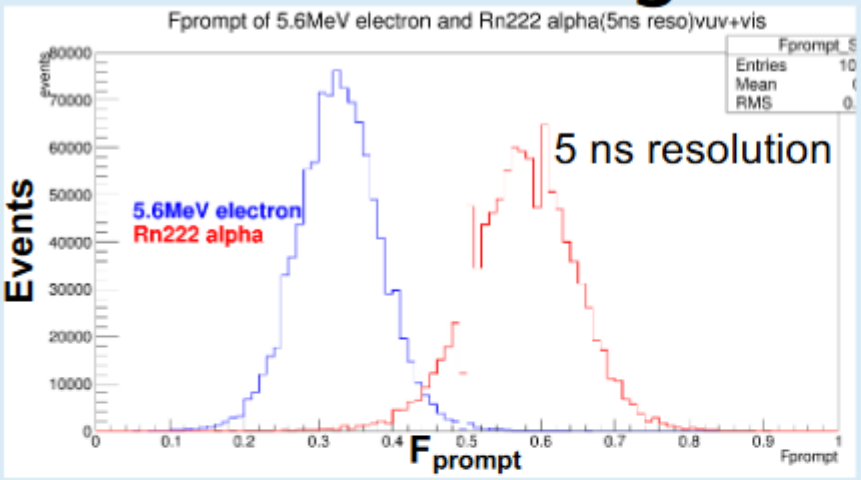
For each event, define F_{prompt}

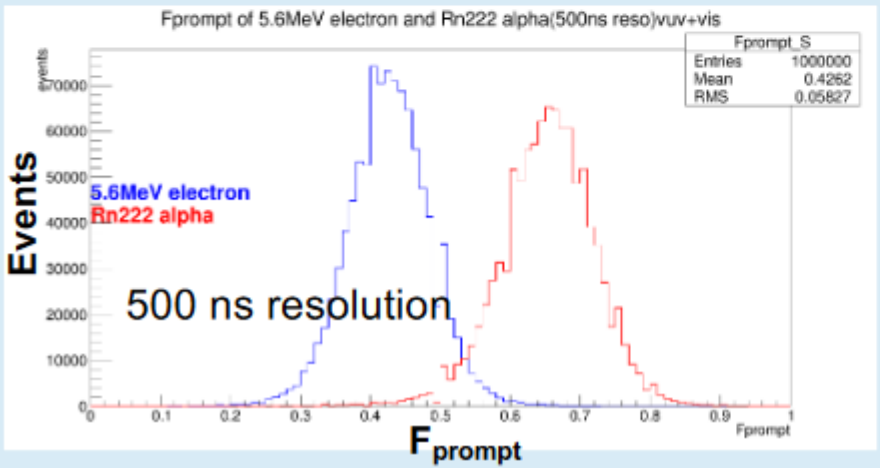
- Fraction of all photons that occur within the first 280 ns
- '280 ns' can be tuned depending on detector configuration / performance

Pulse Shape Discrimination (alpha's vs beta's)

Jing Yuan Shi, Justin Evans, Stefan Söldner-Rembold & Andrzej Szelc

Timing resolution





Reducing the timing resolution of the detector pushes the two distributions closer together

- Worse discriminating power