

Group Update

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Today's update starts on [slide 2](#)

Current tasks

- Gamma-X events from calibration sources
 - Simulate LZ calibrations and see how they are impacted by gamma-x events
- Phase 1 optical maps
 - Improve the speed and accuracy of Phase 1 sims by adding in a map for S2 events
- Phase 1 Run 7 data analysis
- LUX 100T projection sensitivity paper
- LZ scale model

Gamma-X from calibration sources

Possible sources:

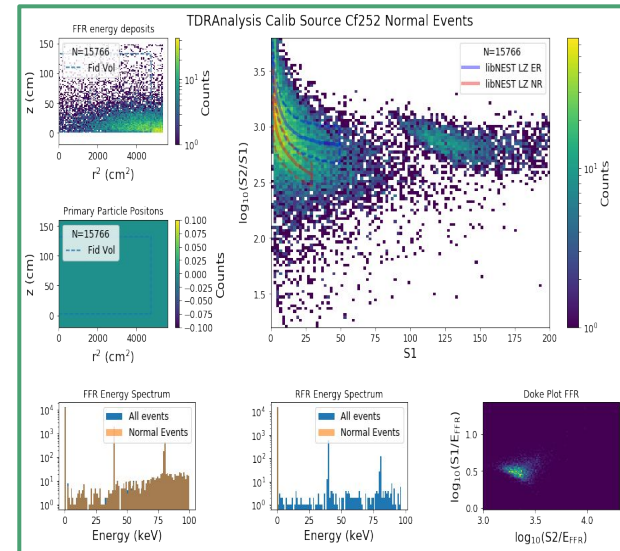
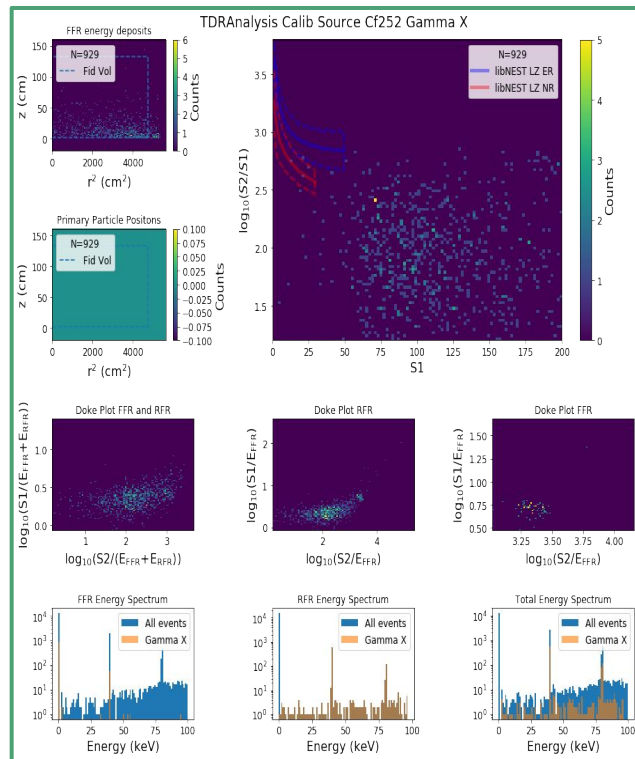
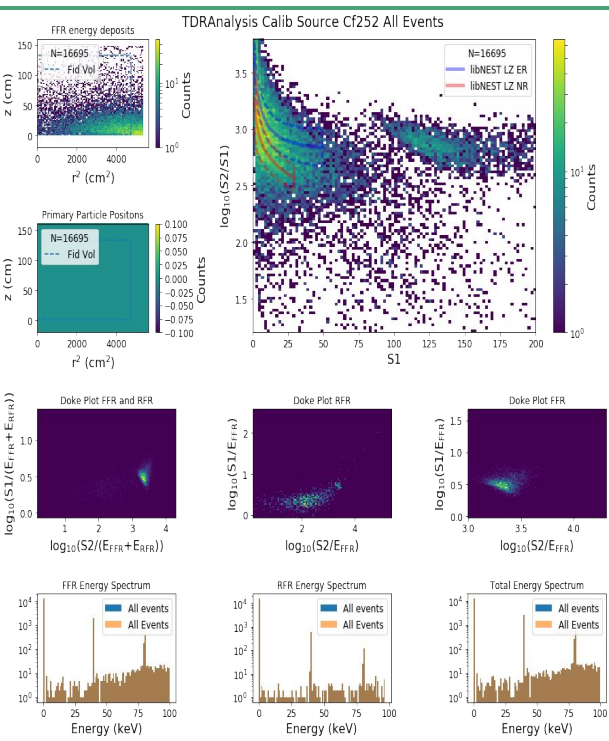
- AmLi (AmBe)
- ^{252}Cf
- ^{228}Th
- ^{57}Co (As a test)

All are CSD sources. Generate them in CSD tubes, located in the vacuum space, at $z=0$ (cathode)

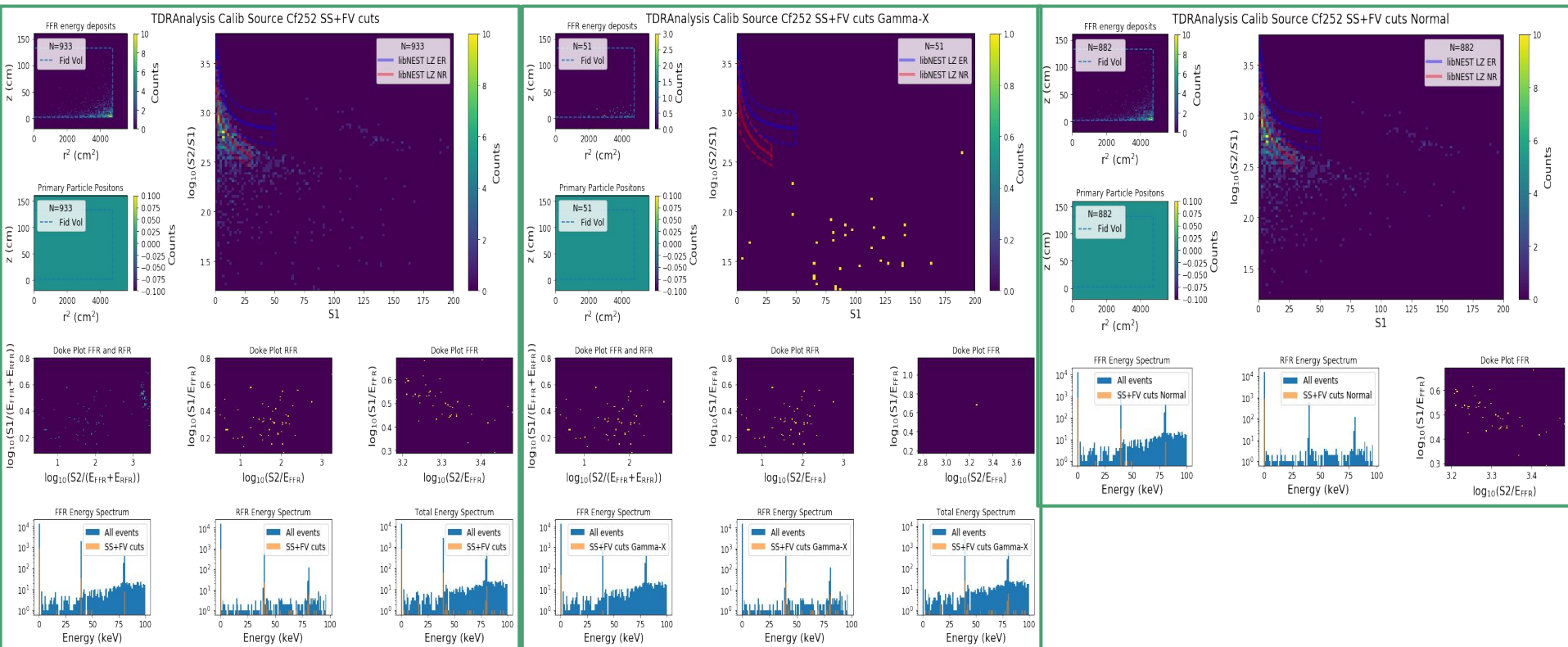
Table 7.0.1: Baseline calibration sources for LZ.

Isotope	What	Purpose	Deployment	Custom?
Tritium	beta, $Q = 18.6$ keV	ER band	Internal	N
$^{83\text{m}}\text{Kr}$	beta/gamma, 32.1 keV and 9.4 keV	TPC (x, y, z)	Internal	Y
$^{131\text{m}}\text{Xe}$	164 keV γ	TPC (x, y, z), Xe skin	Internal	Y
^{220}Rn	various α 's	xenon skin	Internal	N
AmLi	(α, n)	NR band	CSD	Y
^{252}Cf	spontaneous fission	NR efficiency	CSD	N
^{57}Co	122 keV γ	Xe skin threshold	CSD	N
^{228}Th	2.615 MeV γ , various others	OD energy scale	CSD	N
^{22}Na	back-to-back 511 keV γ 's	TPC and OD sync	CSD	N
^{88}Y Be	152 keV neutron	low-energy NR response	External	N
^{205}Bi Be	88.5 keV neutron	low-energy NR response	External	Y
^{206}Bi Be	47 keV neutron	low-energy NR response	External	Y
DD	2,450 keV neutron	NR light and charge yields	External	N
DD	272 keV neutron	NR light and charge yields	External	Y
^{133}Ba	356 keV gamma	OD and TPC	CSD	N
^{60}Co	1173, 1333 keV gamma	OD, TPC energy scale	CSD	N
^{124}Sb	23 keV neutron	low-energy NR response	External	N

Calibration results (Cf252)



Calibration results (Cf252) Single Scatter and FV cuts



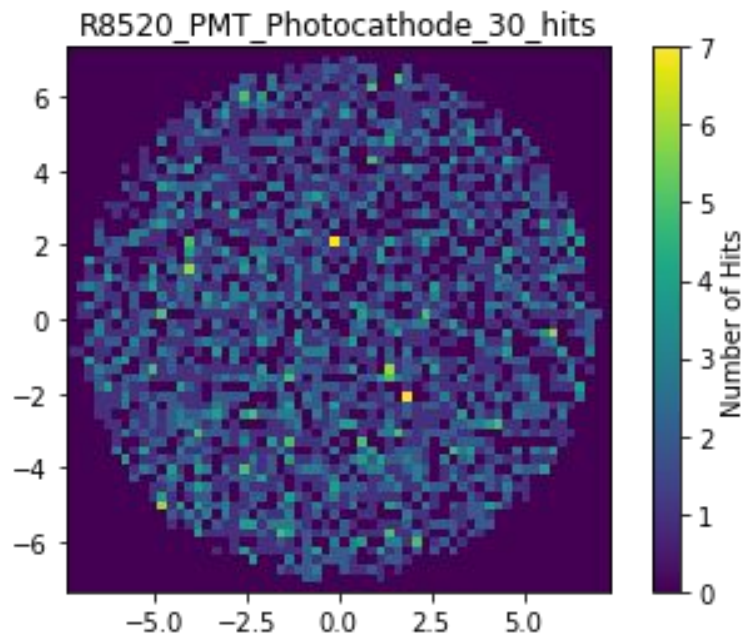
Calibration results

- AmLi (AmBe)
 - Only AmBe working in BACCARAT
 - Results are similar to shown for ^{252}Cf
- ^{252}Cf
 - Little impact of gamma-x at low energies
 - Potentially 1% gamma-x contribution at higher energies
- ^{228}Th
 - Events seen are near the walls
 - None are gamma-x
 - Nice ER band S1/S2 spectrum
- ^{57}Co
 - 2/2,000,000 events made it into the liquid
 - Neither of them were gamma-x

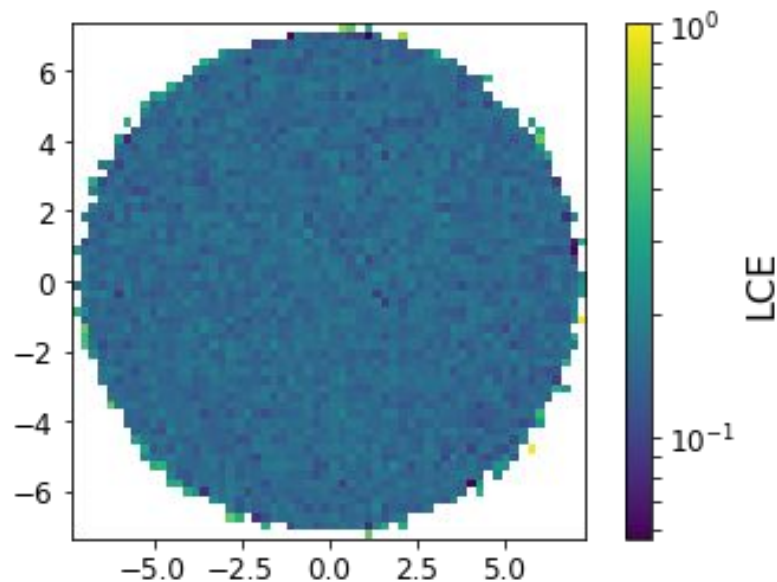
Phase 1 optical maps

- Used the scripts from Amy to make maps of ~ 10 million photons distributed in the liquid xenon for S1s and in the gas for S2s
- Implemented in BACCARAT
- Leaves LZ sims intact and unaffected
- Simply calls the phase 1 map instead if running phase 1 sims

Phase 1 photon maps (S1)

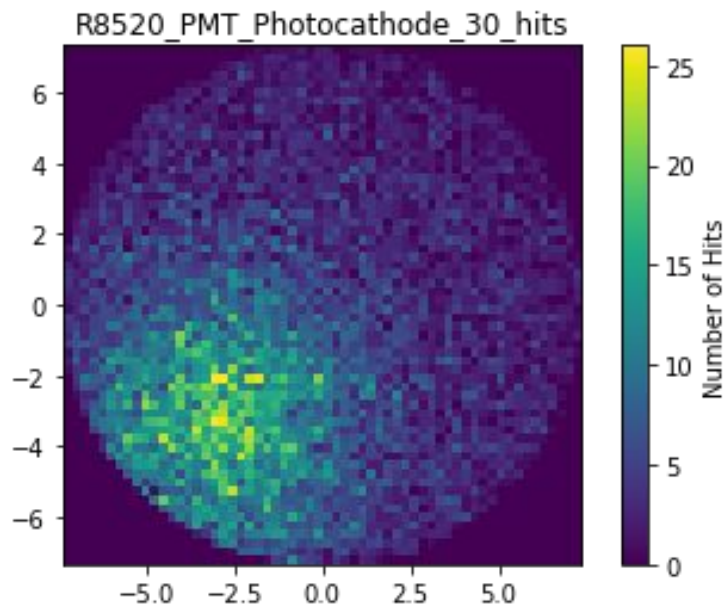


Example of a single PMT

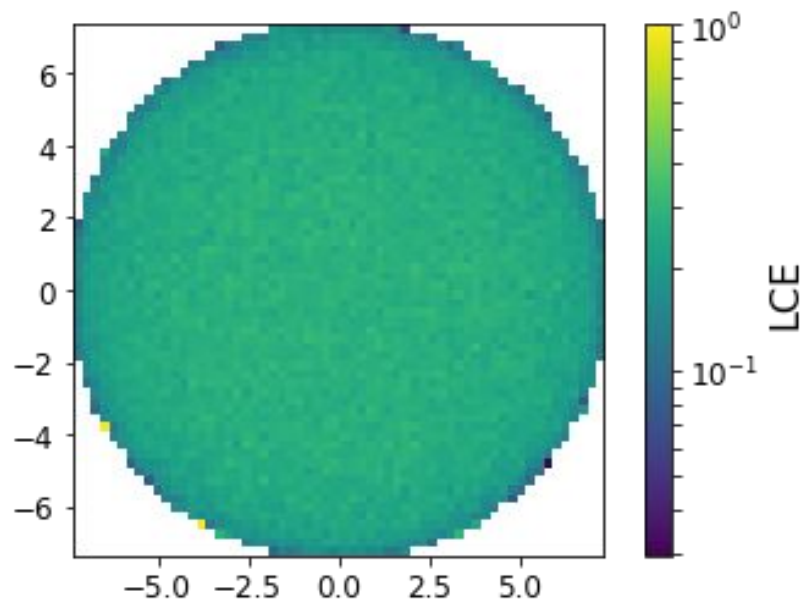


Combined light collection efficiency
Avg: 14.8% With QE: ~4.4%

Phase 1 photon maps (S2)



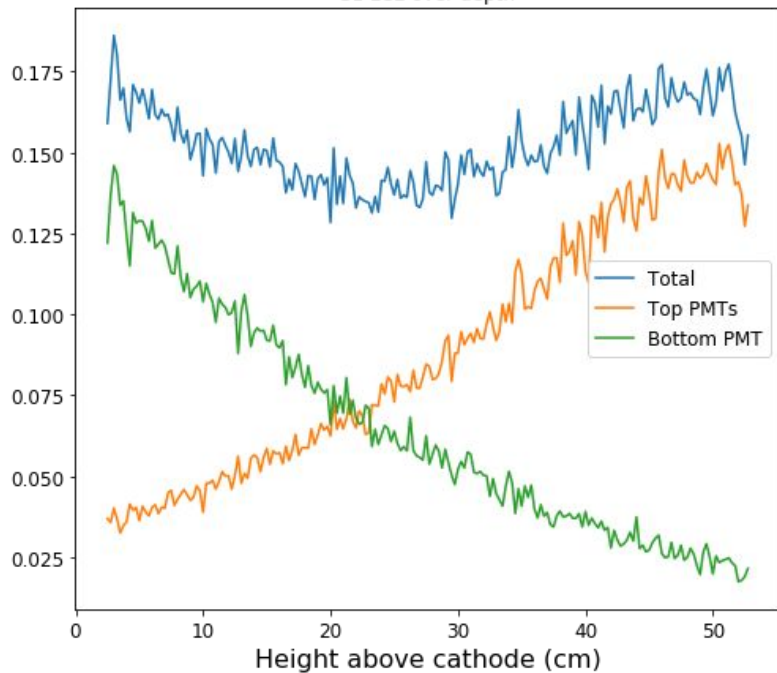
Example of a single PMT



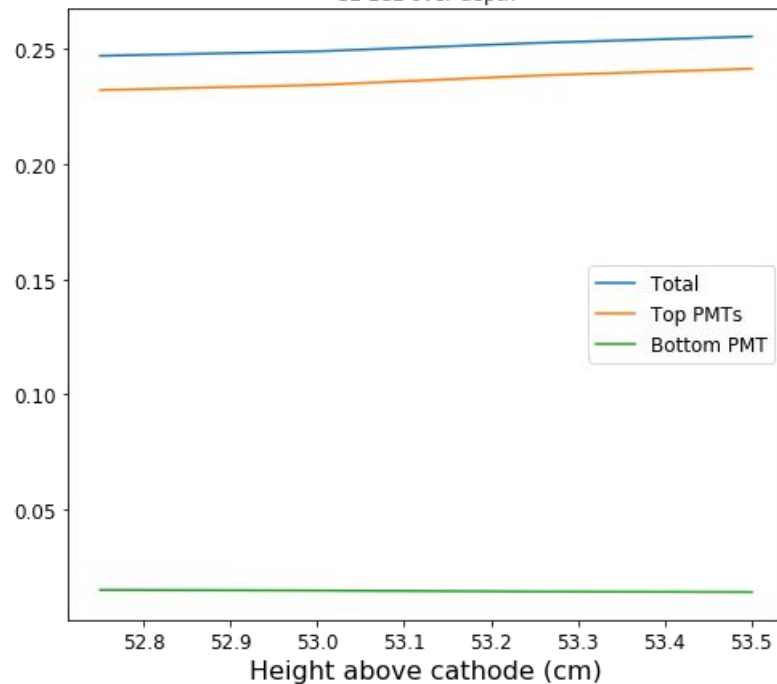
Combined light collection efficiency
Avg: 24.7% With QE: ~7.4%

LCE as a function of depth

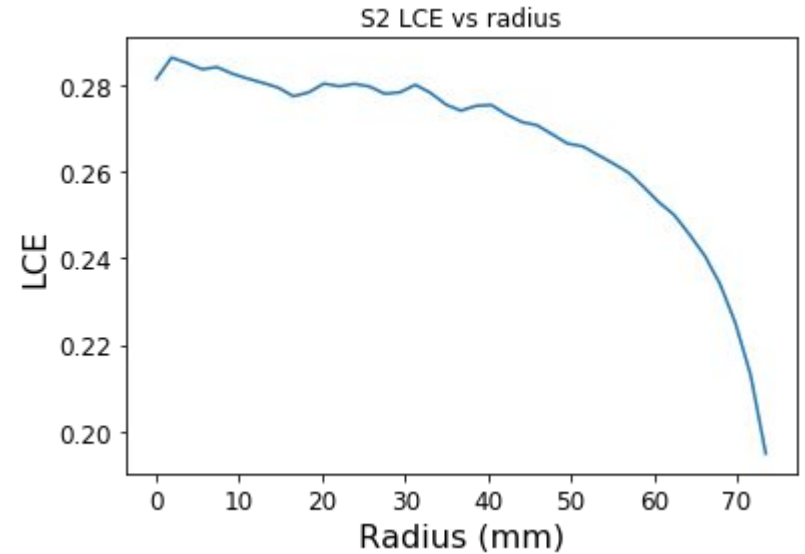
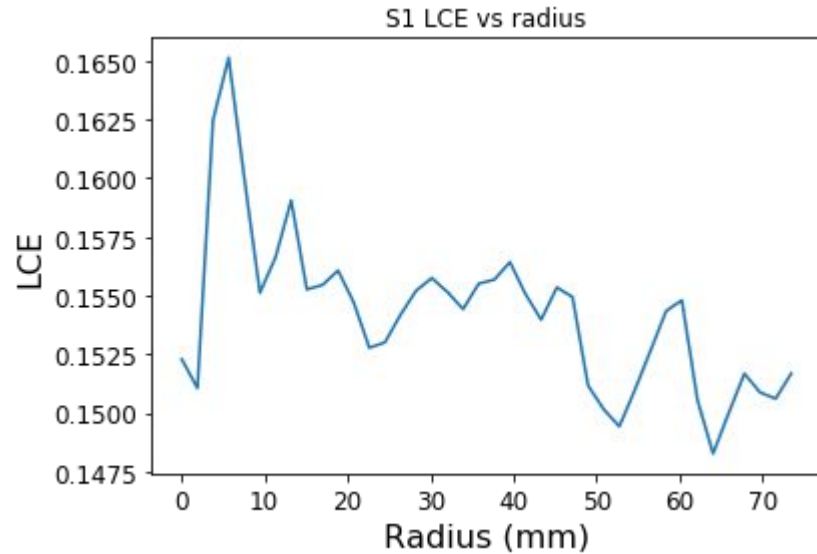
S1 LCE over depth



S2 LCE over depth



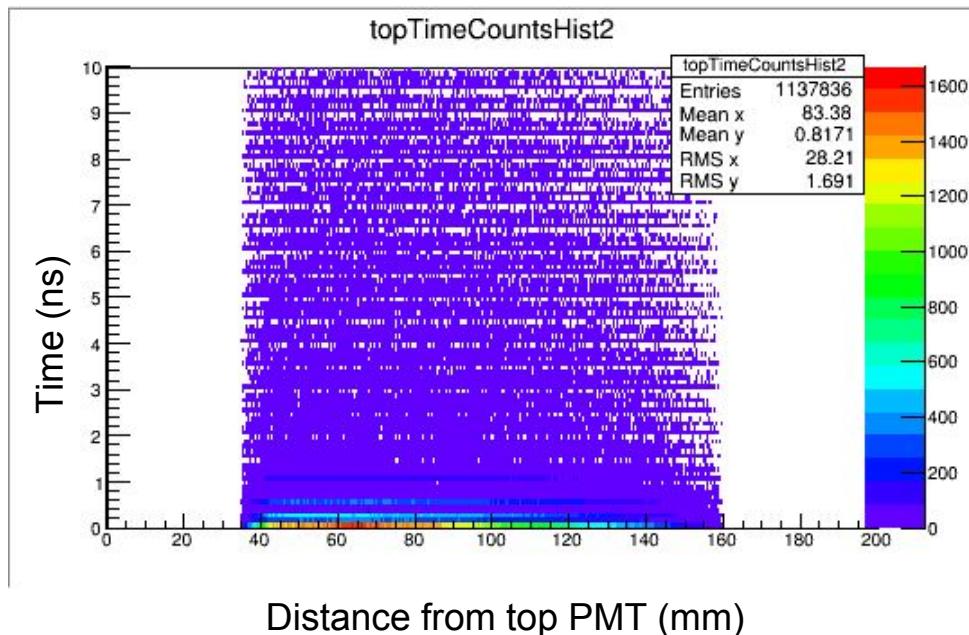
LCE as a function of radius



Time maps included

Time maps are needed by BaccMCTruth so needed to be simulated separately.

Shown here for S2 events.



Phase 1 Run 7 analysis

100 T sensitivity projections

LZ Scale Model

Ready to 3D printing
modifications.

Need 3D printer specs to
adjust minimum thicknesses,
overdraft

