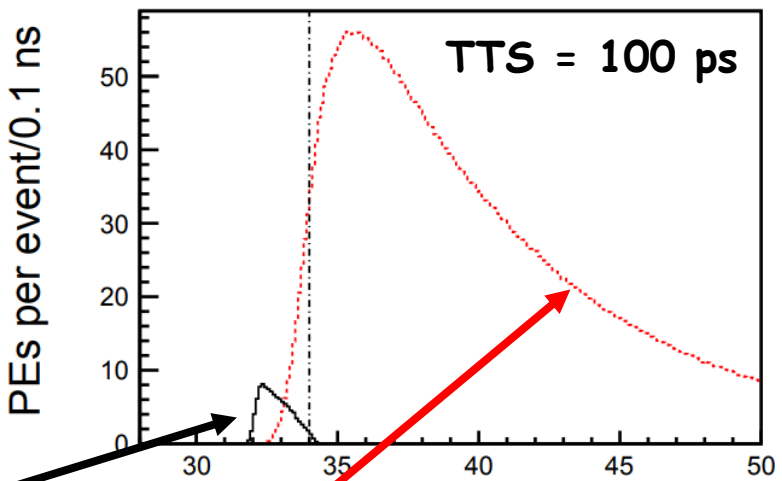
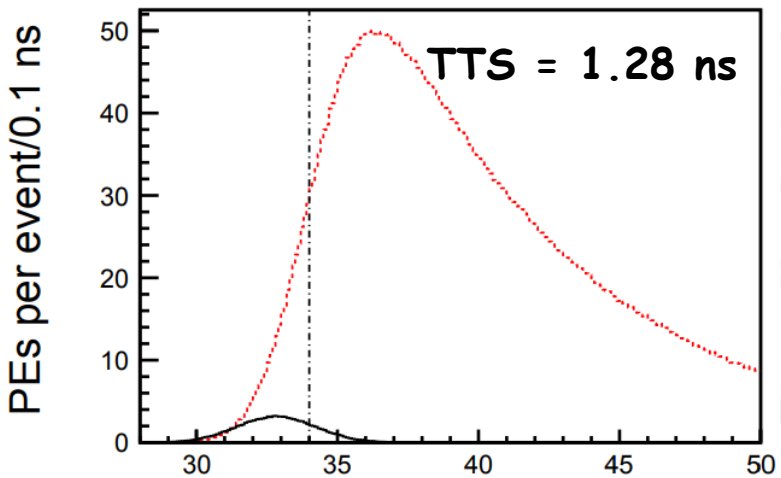
Cherenkov/Scintillation Separation

Simulation of a KamLAND-like detector

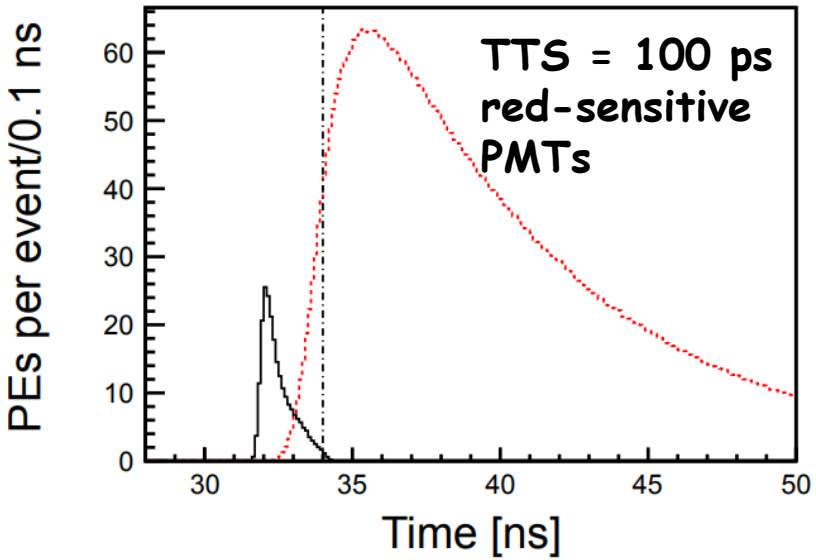
Photon arrival times for events originated at the center of the detector





Cherenkov

Scintillation



Cherenkov light arrives early

C. Aberle,
A. Elagin,
H. Frisch,
M. Wetstein,
L. Winslow

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Cherenkov light can be used to suppress ^{8}B and other backgrounds in searches for $0\nu\beta\beta$-decay

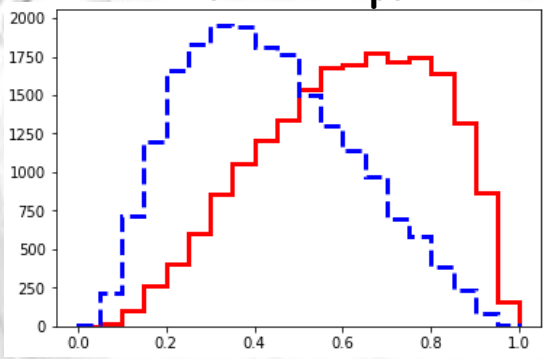
How Good the Timing Should Be?

A. Elagin and R. Jiang

^{130}Te 0νββ-decays vs ^{8}B (2-tracks vs 1-track)

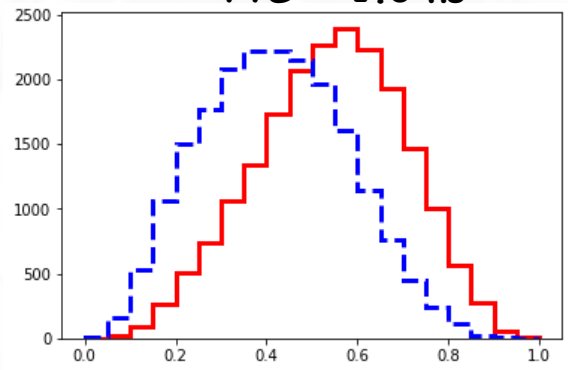
A classifier based on spherical harmonics (arXiv:1902.06912)

TTS = 100 ps



^{8}B-like <- -> 0νββ-like

TTS = 1.0 ns

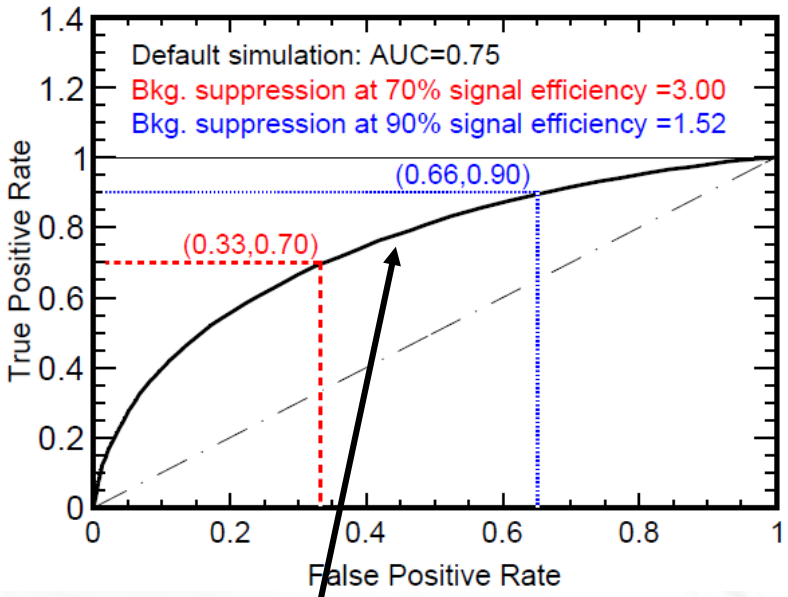


^{8}B-like <- -> 0νββ-like

ROC-curve at 100 ps

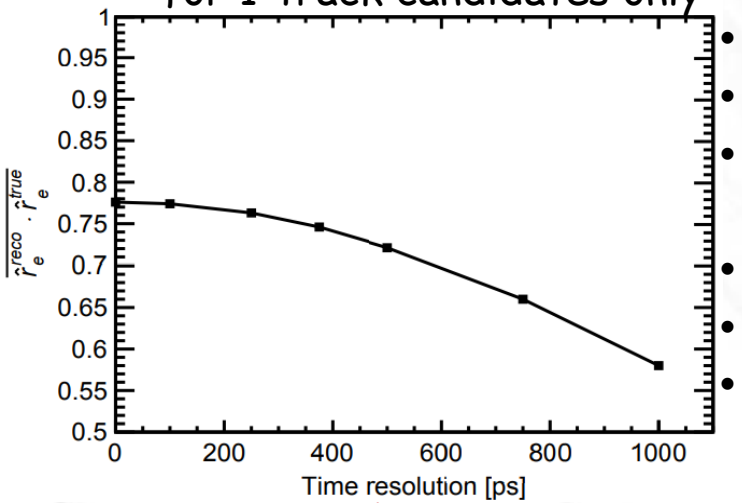
True positive: correctly labeled 0νββ

False positive: ^{8}B mislabeled as 0νββ



Directionality reconstruction

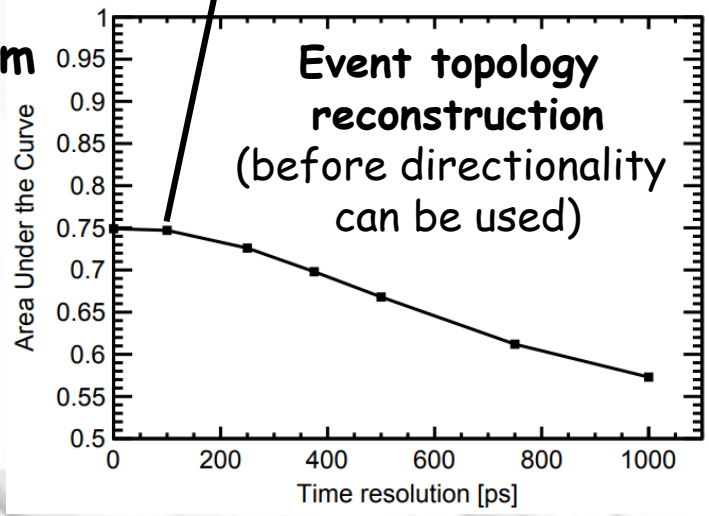
- in addition to topology reco
- for 1-track candidates only



Simulation details

- Spherical detector **R=6.5m**
- Fiducial volume **r=3.0m**
- KamLAND-like liquid scintillator
- Photo-coverage: **65%**
- QE: **Che~12%**, **Sci~23%**
- ^{130}Te 0νββ-decays

Event topology reconstruction (before directionality can be used)



Time resolution of 100 ps is close to optimal for a KamLAND-like detector