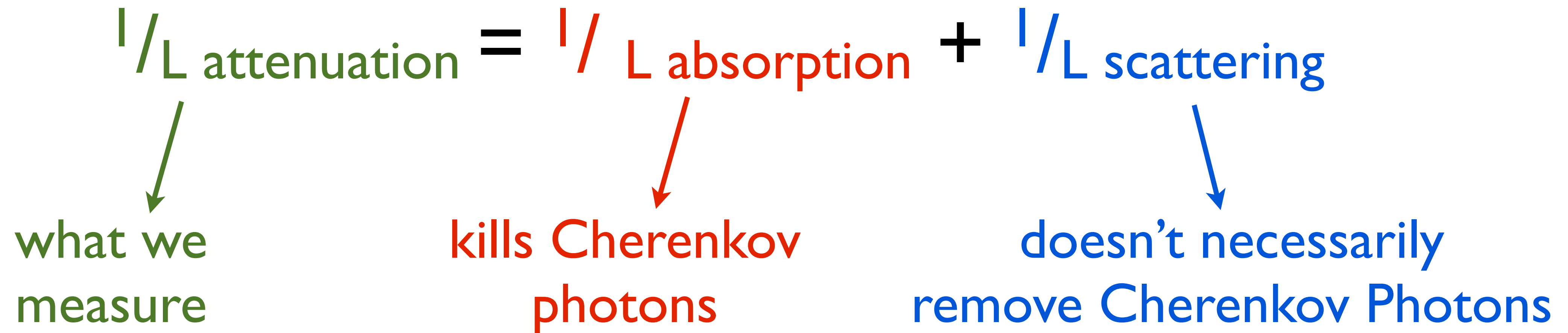


Water Quality Study Using Muon Signals

Josh Wood

Motivation

- Are the attenuation lengths we measure a good indication of how many Cherenkov photons reach our PMTs?



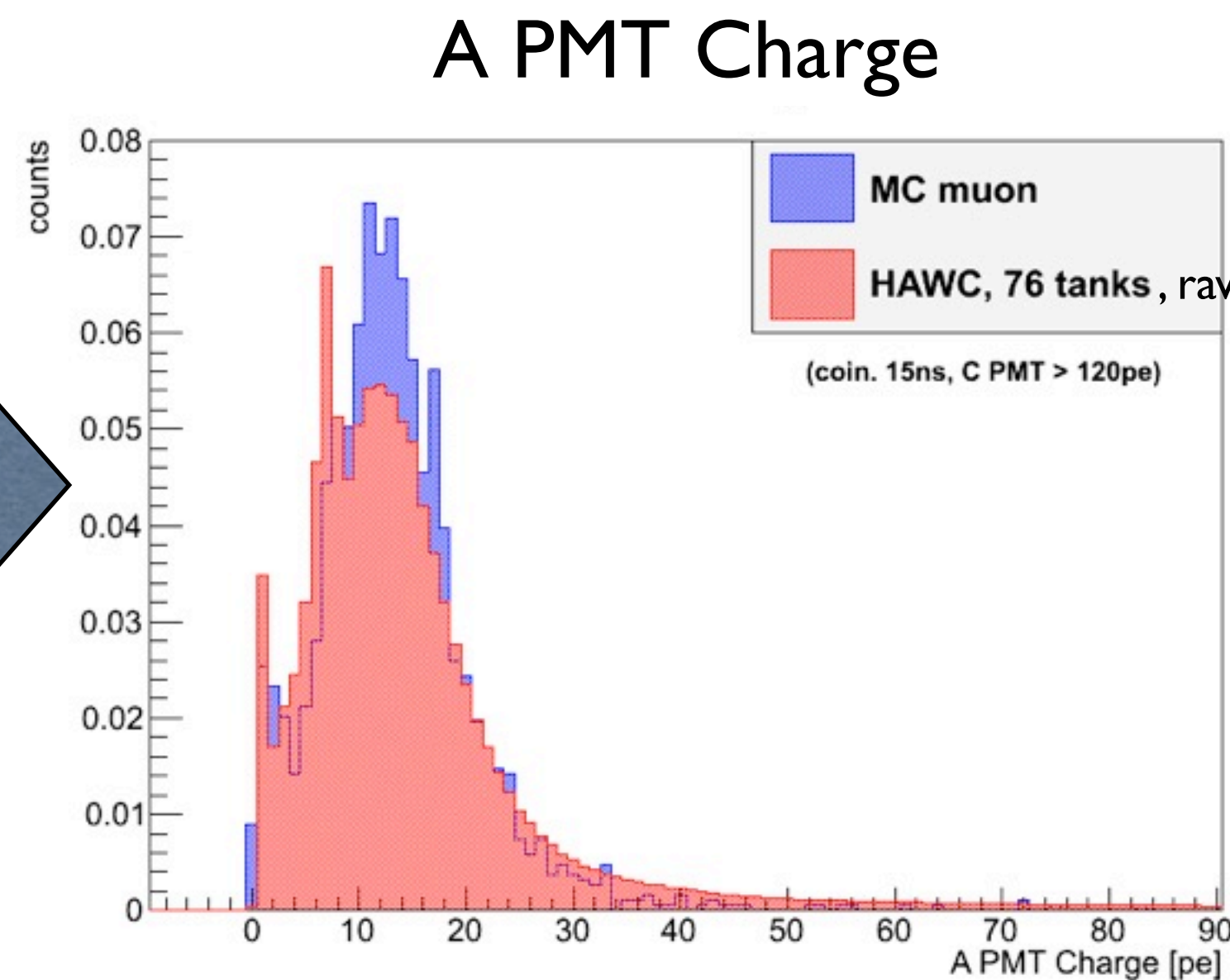
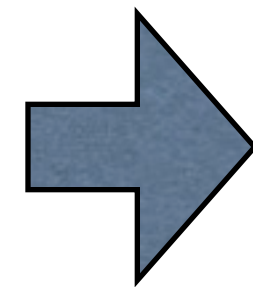
Method

- Use muon geometry presented in Pachuca to produce charge peaks in outer PMTs for known Cherenkov photon pathlength

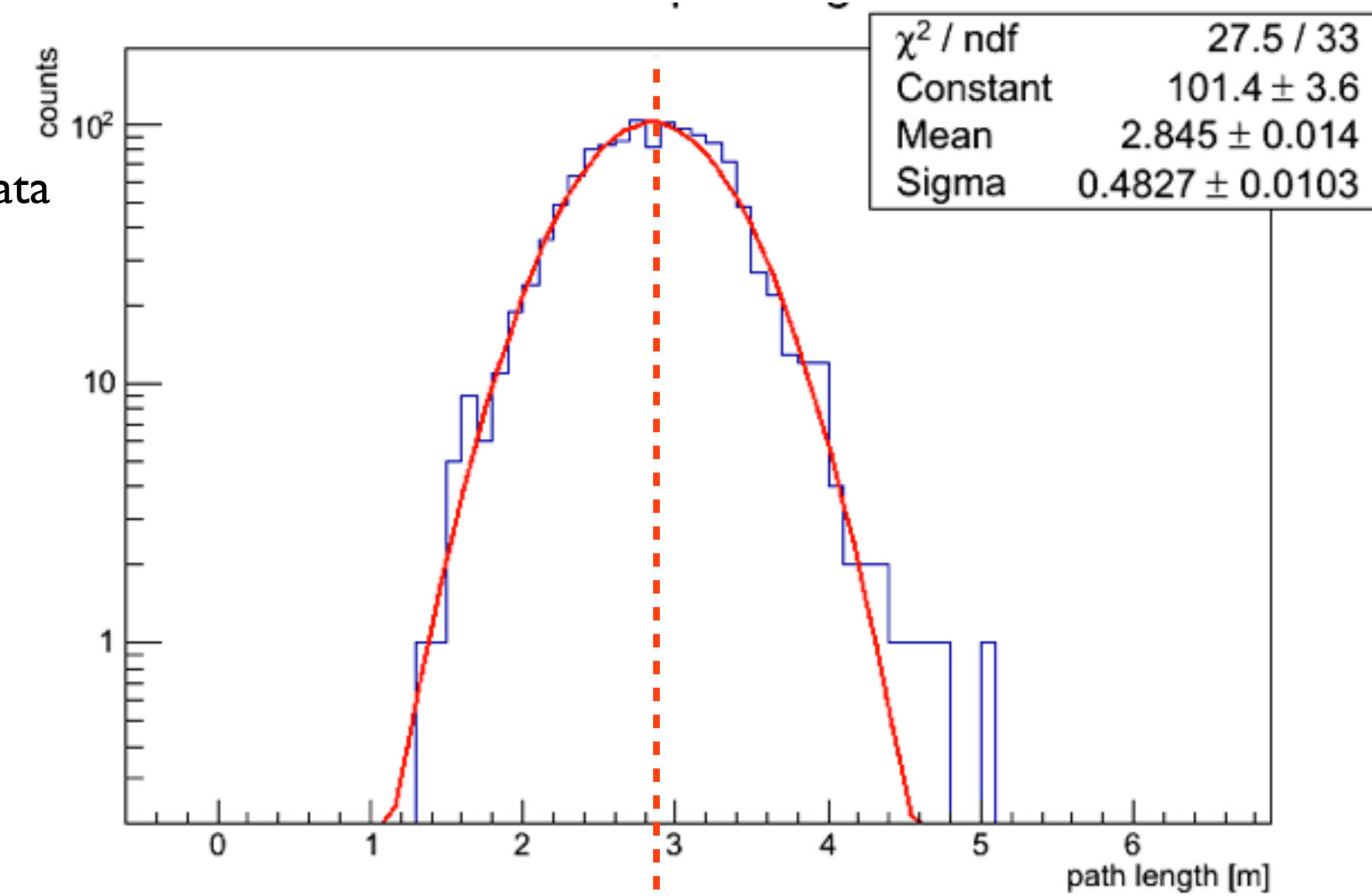
http://private.hawc-observatory.org/wiki/images/f/fc/20140225_muon_study_wood_pachuca.pdf

Select muons hitting C PMT

- Raw Data
- C PMT > 120pe
- A,B,D within 15ns



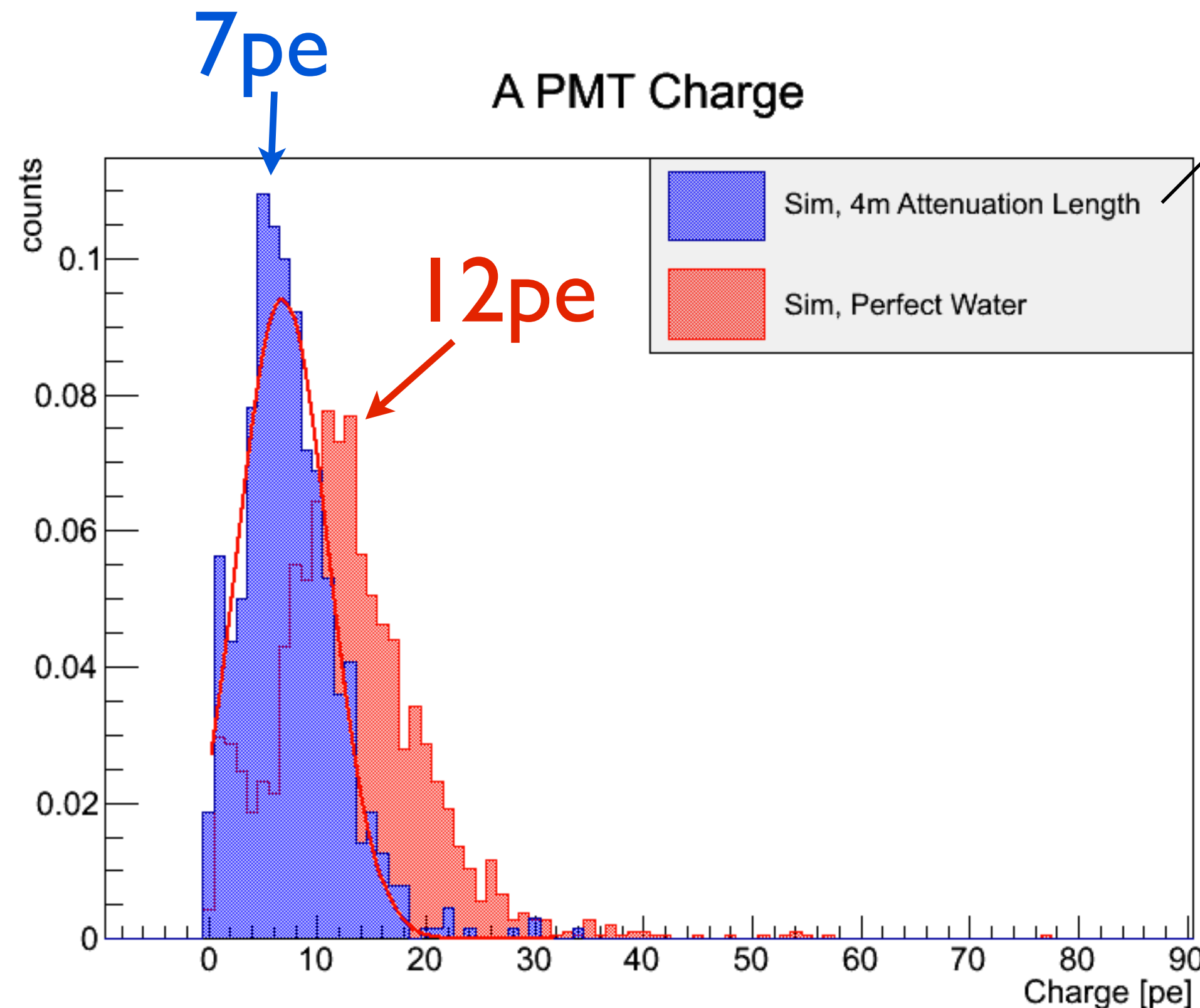
Cerenkov photon pathlength to outer PMT



~2.85m

What We Expect

- Simulation says we should see a noticeable difference in the outer PMT charge peaks if attenuation length is absorption dominated (i.e. it causes us to lose photons)

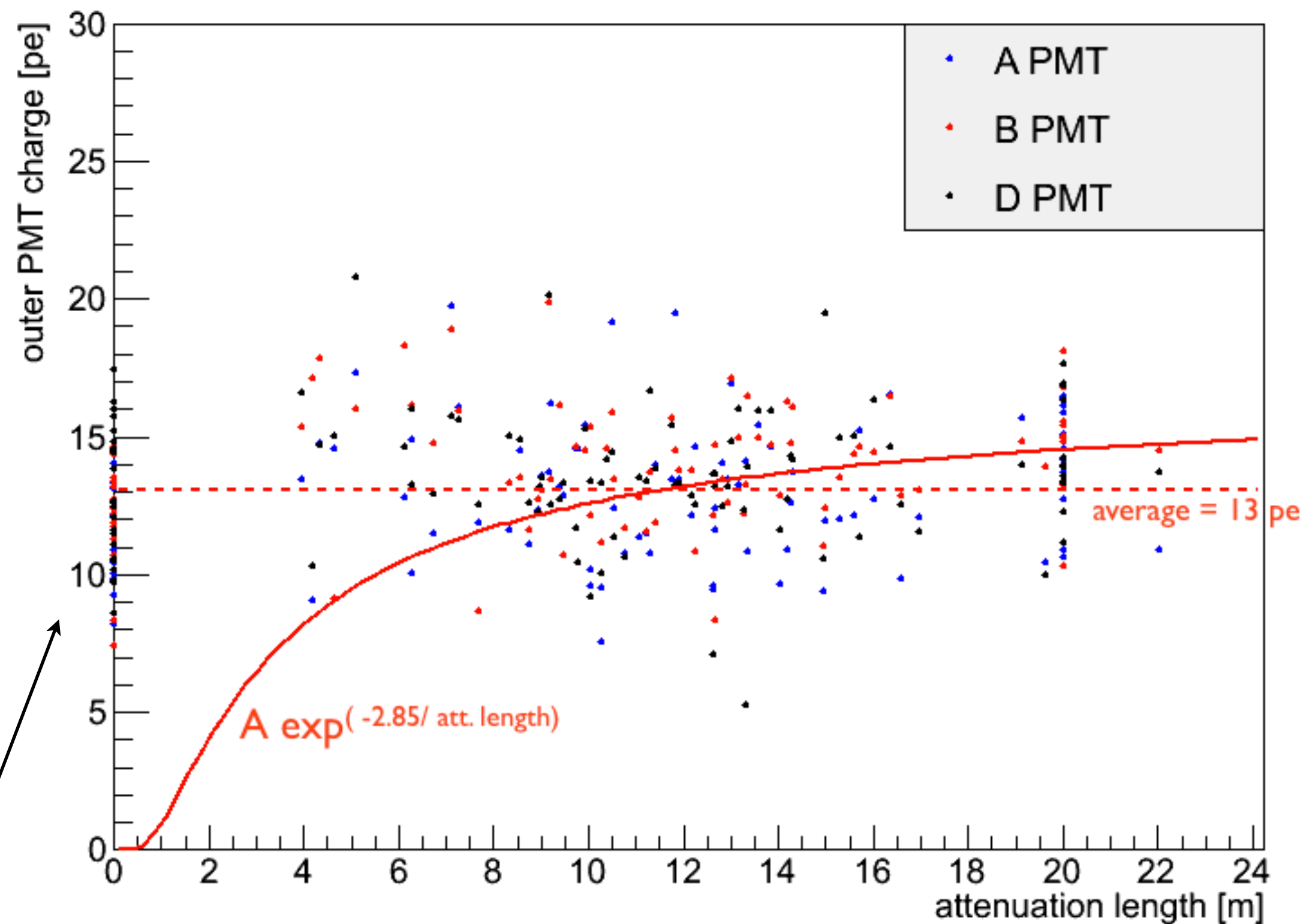


We expect to lose
1/2 our photons
if all absorption,
4m att. length

$$e^{-2.85/4} = 0.5$$

What We Get

- Outer PMT charge peaks are insensitive to measured att. lengths. Not losing 1/2 photons in tanks with 4m water.



RMS for avg. pe
3.64pe

RMS for full absorption
4.44pe

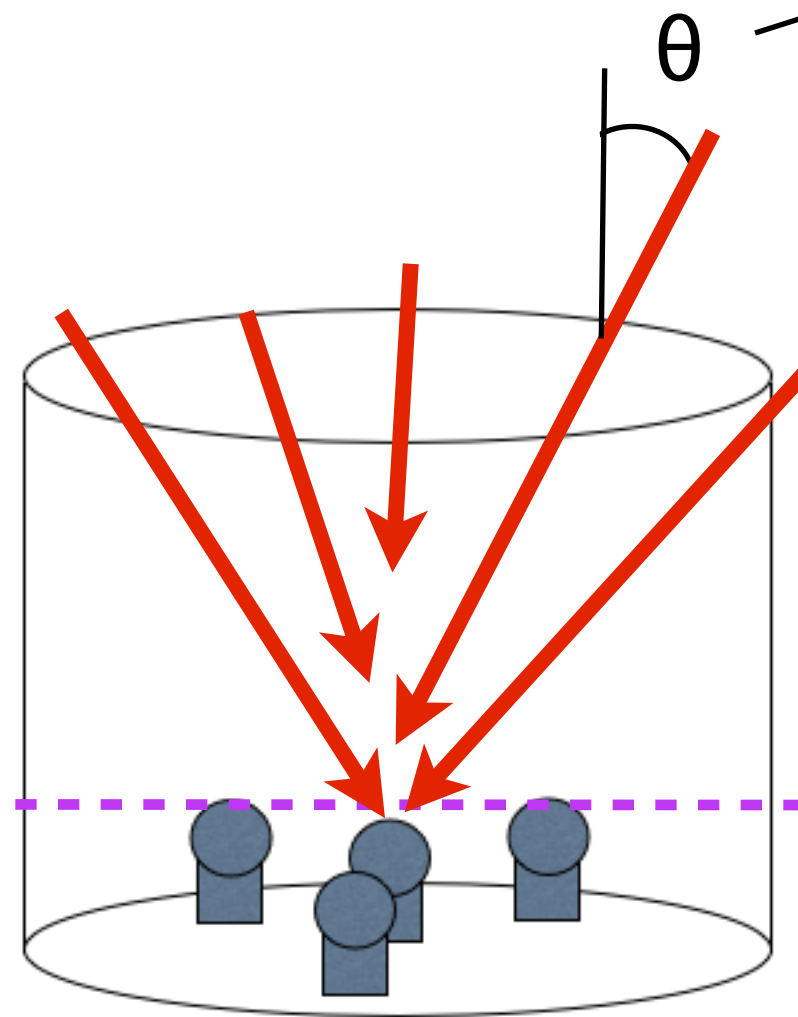
tanks without att. length
measurements are assigned 0

End

Muon Simulation (WITH CUT)

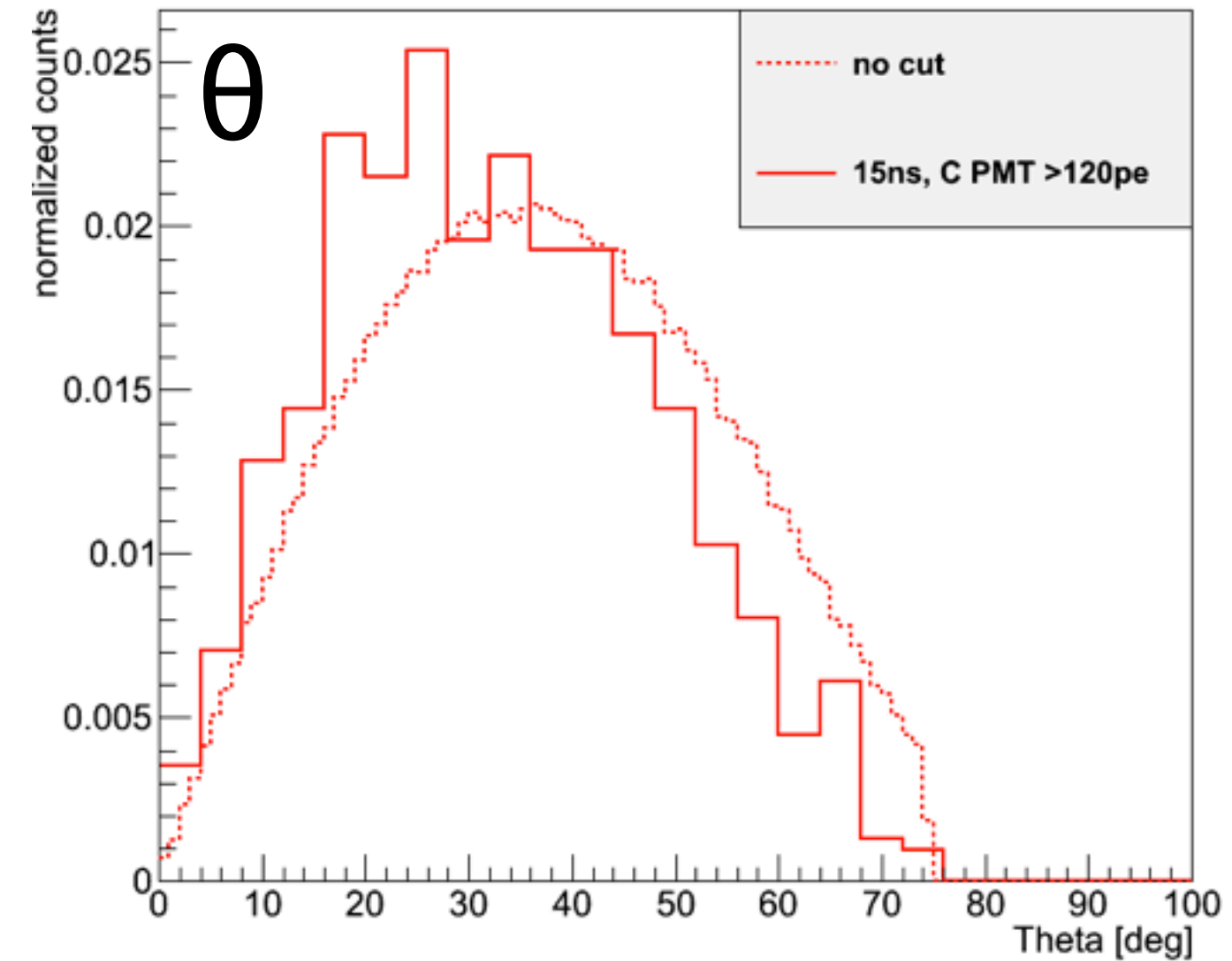
C PMT > 120pe,
A,B,D within 15ns

μ^+ @ 5 GeV



$z = 0.84$ m

- localizes muon final positions near PMT C (RMS goes from 5.3m to 0.4m)
- doesn't restrict angle



C PMT > 120.00pe, Outer PMT within 15ns

