Trying to reconstruct the proton when it is above Cherenkov threshold...

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Introduction

- In a QE elastic event, the proton can be above Cherenkov threshold (E_{th}=1419 MeV, P_{th}=1069 MeV for a proton)

- If we can identify such event and reconstruct the energy accordingly, this could improve our energy resolution and direction resolution and thus improve the L/E analysis.

A few numbers

Number of events normalized to 1489 days (used 100 years of nuance MC)

	nring=1	nring=2	2 mu-like	e mu
All events	1988	565	110	454
QE events	1252	48	12	36
Visible proton	74	32	8	23
QE+ Vp	69	21	6	14

With the following precuts:
top/bottom distance >150cm
barrel distance>100cm
nhitac<10
evis>30
first ring=mulike *(will correct to most energetci ring soon)*
p_{mu}>200MeV if single ring
p_{mu}>600MeV if multi ring

If visible proton:
ipnu(4)=2122 (proton)
pnu(4)>1.1GeV

How often could we identify the proton?

nring=2

Looking at QE events, with a visible proton, and passing the precuts (normalized to 1489 days of data)

mu mu	mu e	e e
3.91	8.88	5.78

What are those?

Usually, we ask that the first ring be mu-like, for info I gave also the number of ee events

nring=2 mulike e-like

I looked at which ring is what (scanned 10 yrs=25 events)

- the mu-like ring was always the muon good!!

- the e-like ring was: proton: 15 times
  secondary particle
  (often pion) 6 times
  junk: 4 times

nring=2 mulike mu-like

I looked at which ring is what (scanned 10 yrs=13 events)

- the mu-like ring high-energy was always the muon good!!

- the mu-like ring low-energy was: proton: 11times
  secondary particle
  (often pion) 0 times
  junk: 2 times

Conclusion so far

The limiting factor so far is to be able to identify QE events with a visible proton:

only 3% off 2 ring sample for example

But if we succeed in doing so, then there is room for improvements.