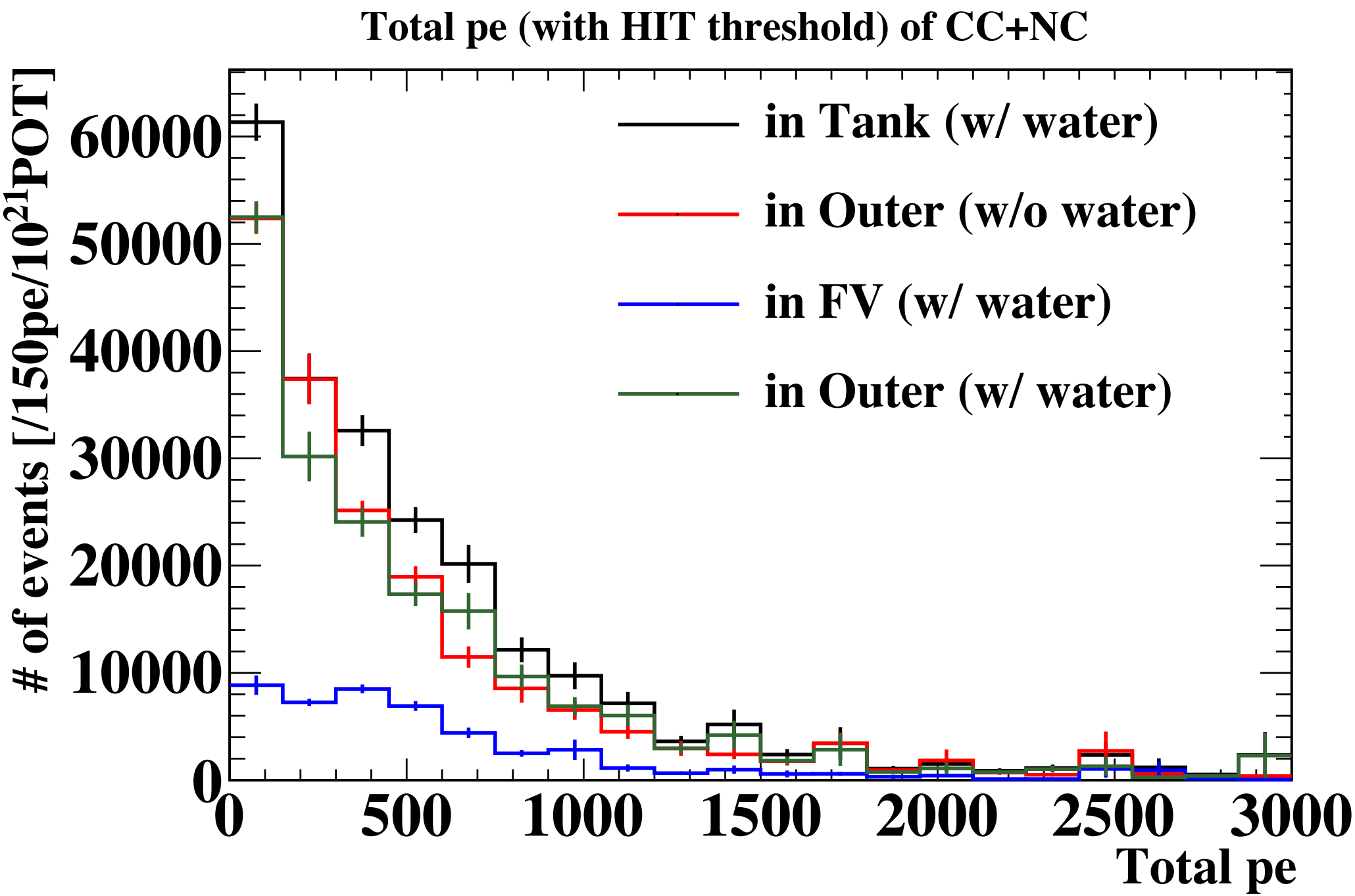
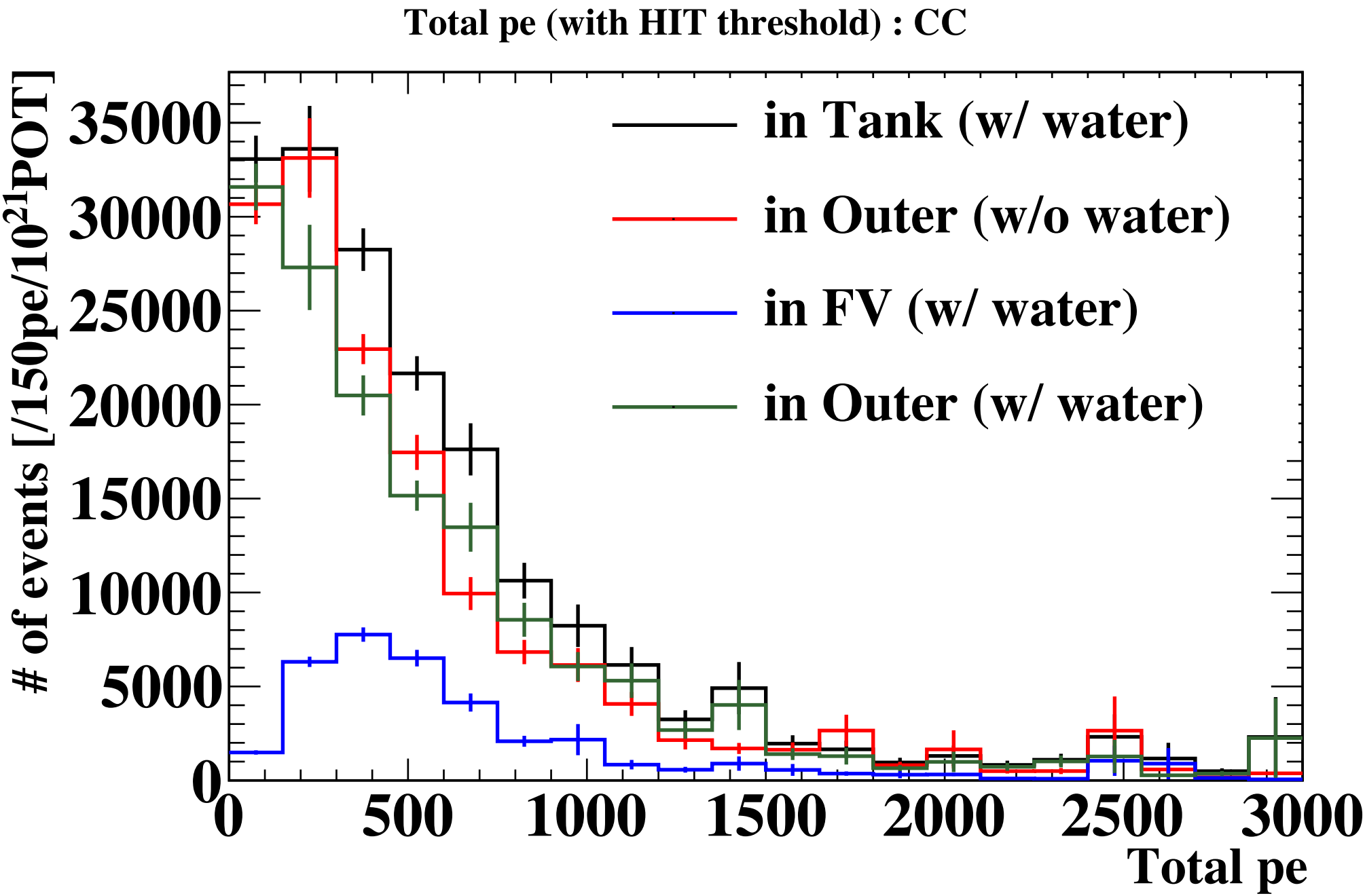
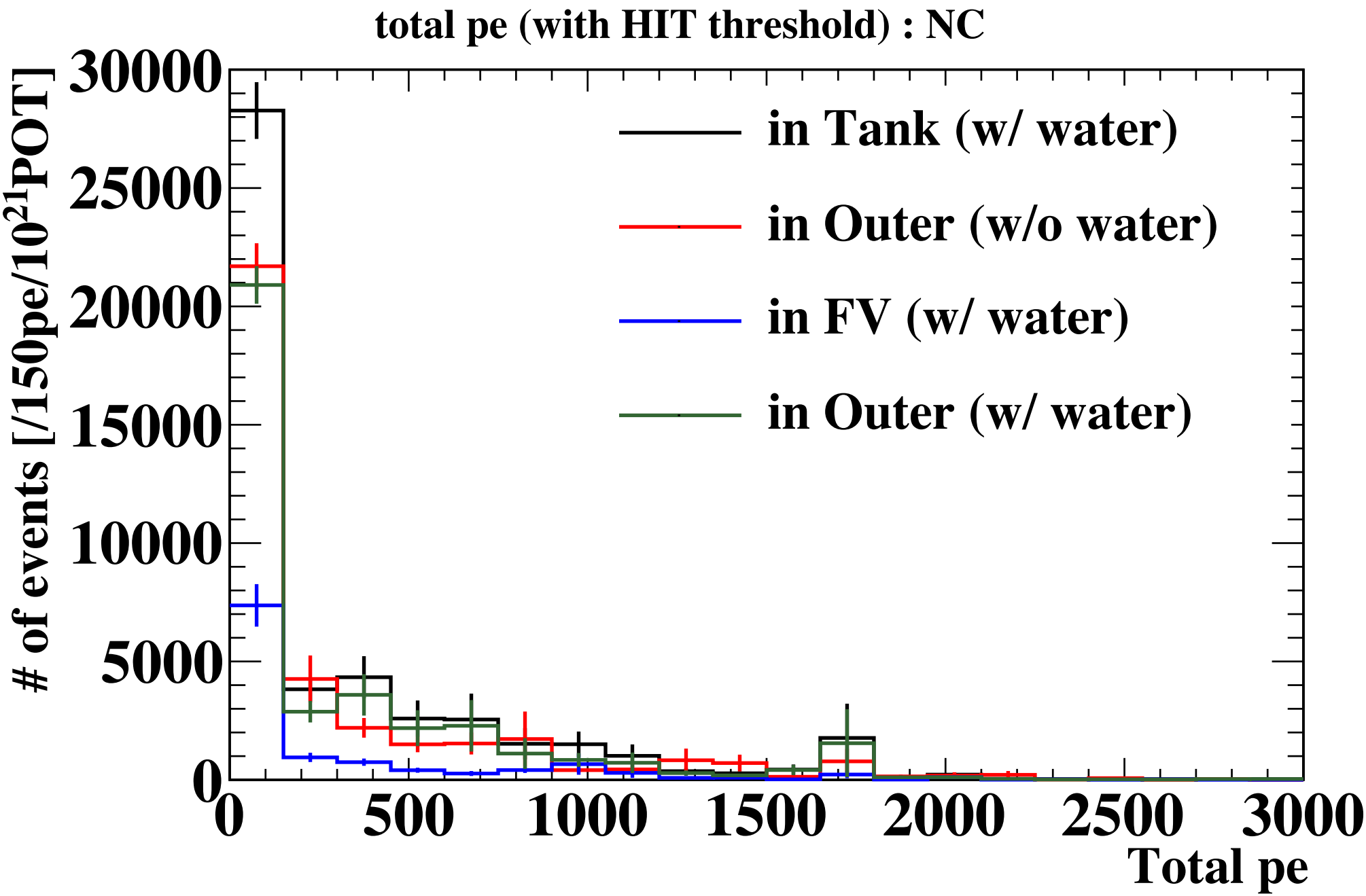
Mizuche MC
new plot

Total p.e. distribution

- Categories
  - Vertex in Tank (w/ water in FV)
  - Vertex in FV (w/ water in FV)
  - Vertex in Outer (w/ water in FV)
  - Vertex in Outer (w/o water in FV)
- Plot at interaction mode(CC+NC, CC, NC)

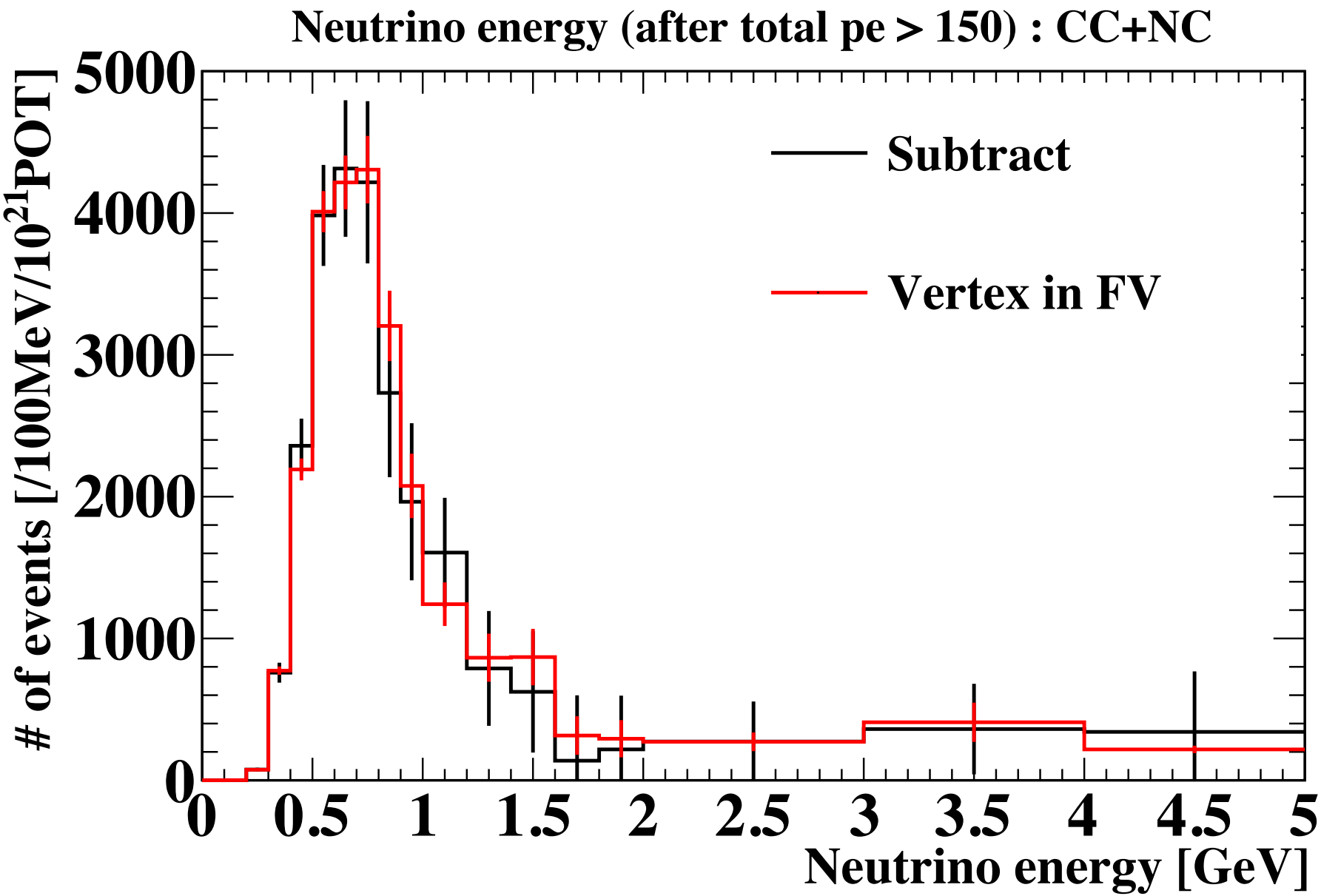

Total pe (with HIT threshold) of CC+NC
# of events [/150pe/10^21POT]
60000
50000
40000
30000
20000
10000
0
0
500
1000
1500
2000
2500
3000
Total pe
in Tank (w/ water)
in Outer (w/o water)
in FV (w/ water)
in Outer (w/ water)


Total pe (with HIT threshold) : CC
# of events [/150pe/10^21POT]
35000
30000
25000
20000
15000
10000
5000
0
0
500
1000
1500
2000
2500
3000
Total pe
in Tank (w/ water)
in Outer (w/o water)
in FV (w/ water)
in Outer (w/ water)


total pe (with HIT threshold) : NC
# of events [/150pe/10^21POT]
30000
25000
20000
15000
10000
5000
0
0
500
1000
1500
2000
2500
3000
Total pe
in Tank (w/ water)
in Outer (w/o water)
in FV (w/ water)
in Outer (w/ water)

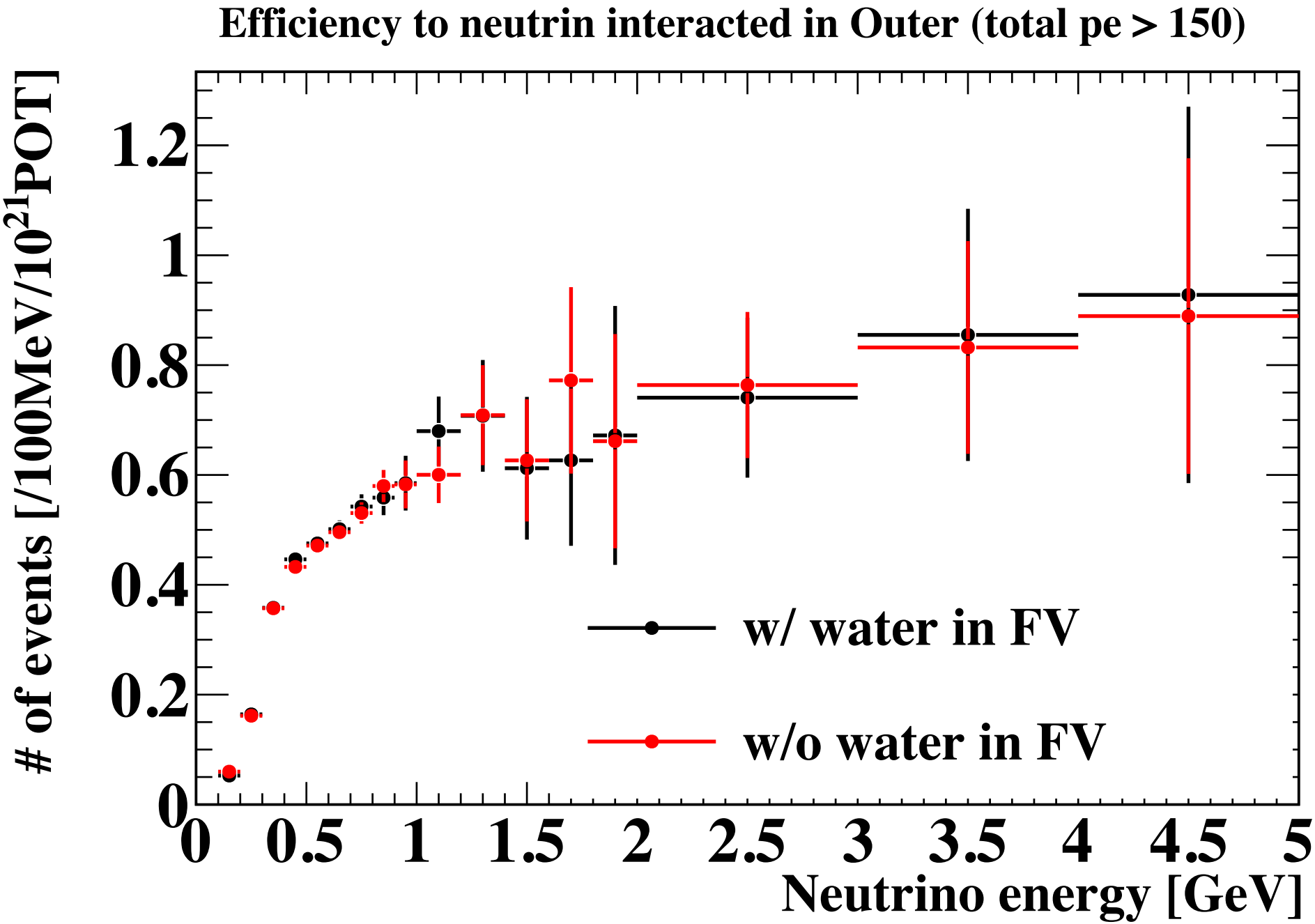
Observed neutrino energy spectrum

- After total p.e. > 150 cut
- Subtract : (# of observations in Tank w/ water in FV) - (# of observations in Tank w/ o water in FV)


Neutrino energy (after total pe > 150) : CC+NC
# of events [/100MeV/10^21POT]
Neutrino energy [GeV]
Subtract
Vertex in FV
0
1000
2000
3000
4000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

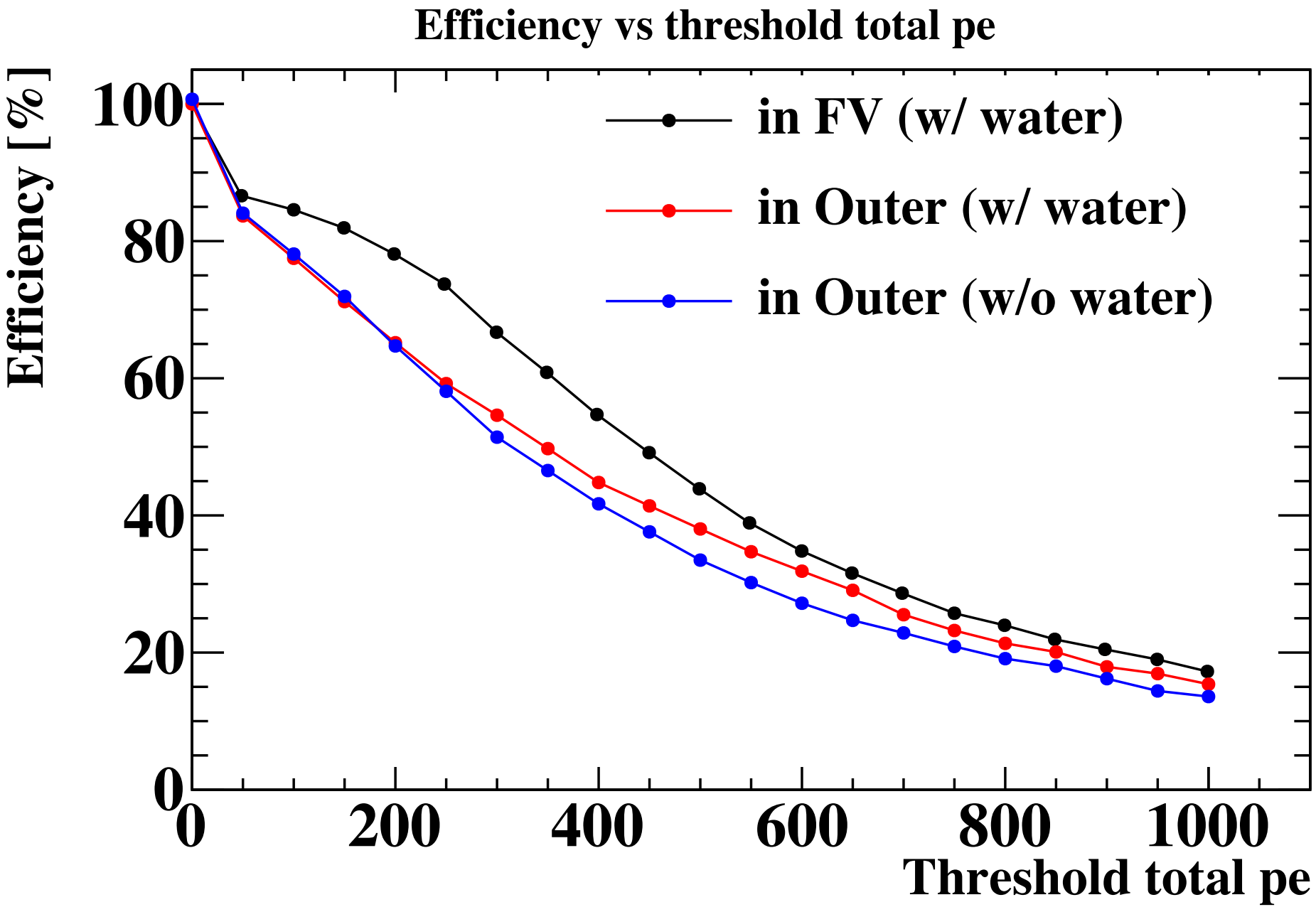
Efficiency to neutrino (total pe > 150)

- Efficiency to neutrino interacted in Outer (w/ water and w/o water)


Efficiency to neutrin interacted in Outer (total pe > 150)
# of events [/100MeV/10^21POT]
1.2
1
0.8
0.6
0.4
0.2
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Neutrino energy [GeV]
w/ water in FV
w/o water in FV

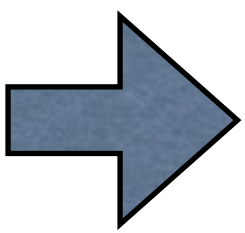
Efficiency vs threshold

- Categories
  - Vertex in FV (w/ water in FV)
  - Vertex in Outer (w/ water in FV)
  - Vertex in Outer (w/o water in FV)
- Use all interaction (CC+NC)


Efficiency vs threshold total pe
Efficiency [%]
100
80
60
40
20
0
0
200
400
600
800
1000
Threshold total pe
in FV (w/ water)
in Outer (w/ water)
in Outer (w/o water)

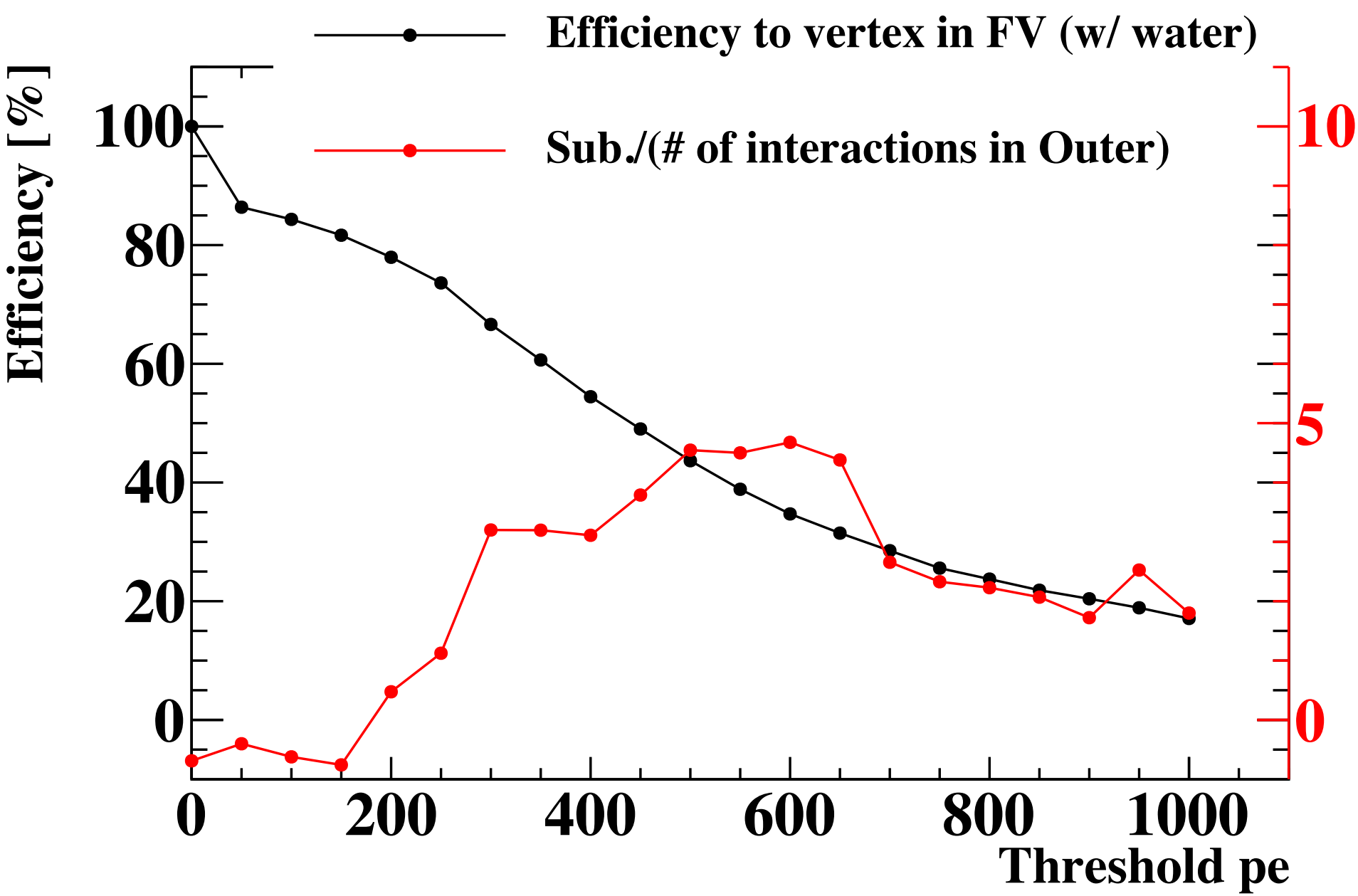
Signal efficiency vs remaining BG efficiency

- Two efficiency comparison
  - Efficiency to neutrino interacted in FV (w/ water)
  - Efficiency to remaining events after subtraction (w/ water - w/o water) interacted in Outer.

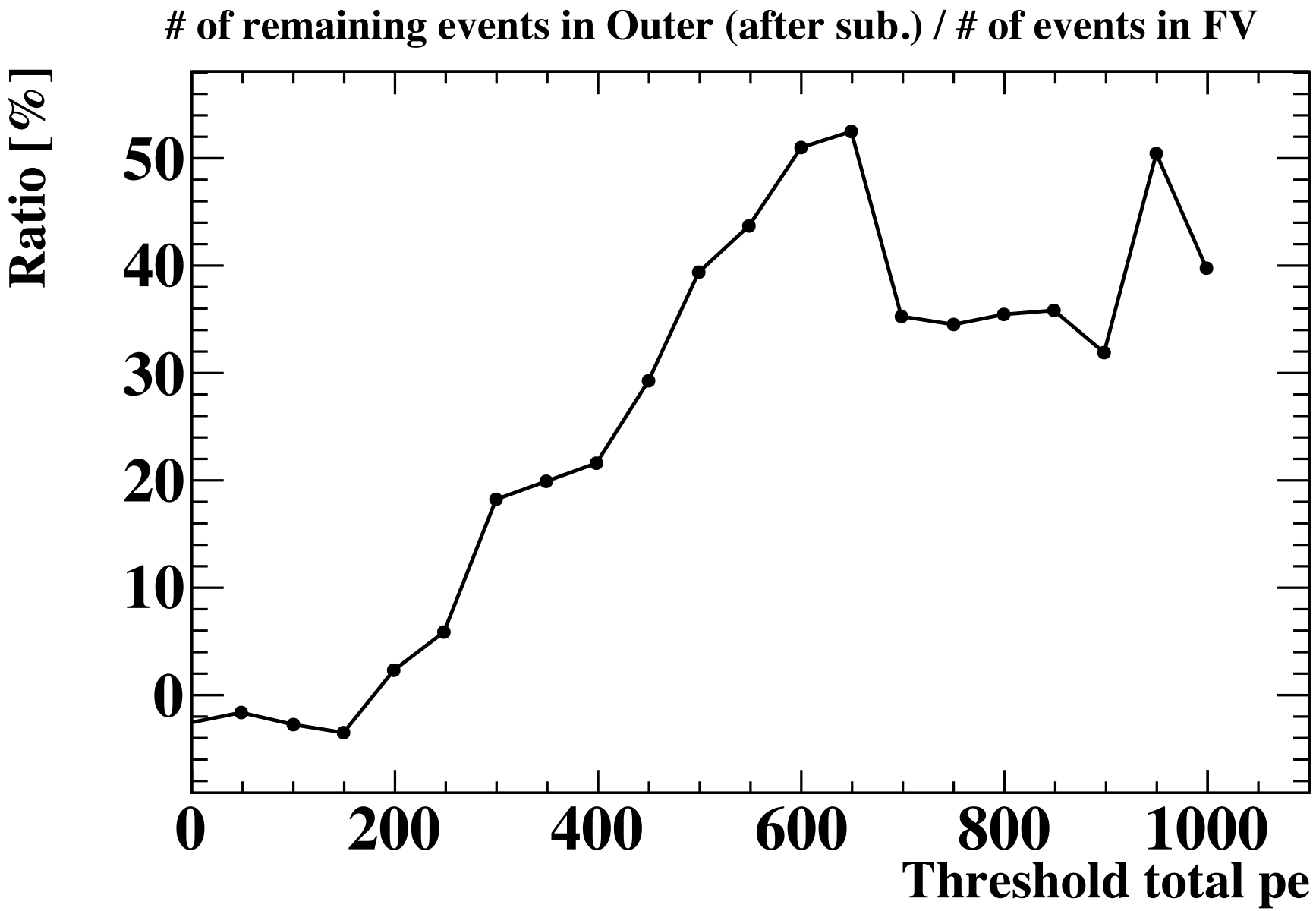


$$\frac{N^{with\ water}_{observation\ in\ outer} - N^{without\ water}_{observation\ in\ outer}}{N_{interaction\ in\ outer}}$$

CC+NC

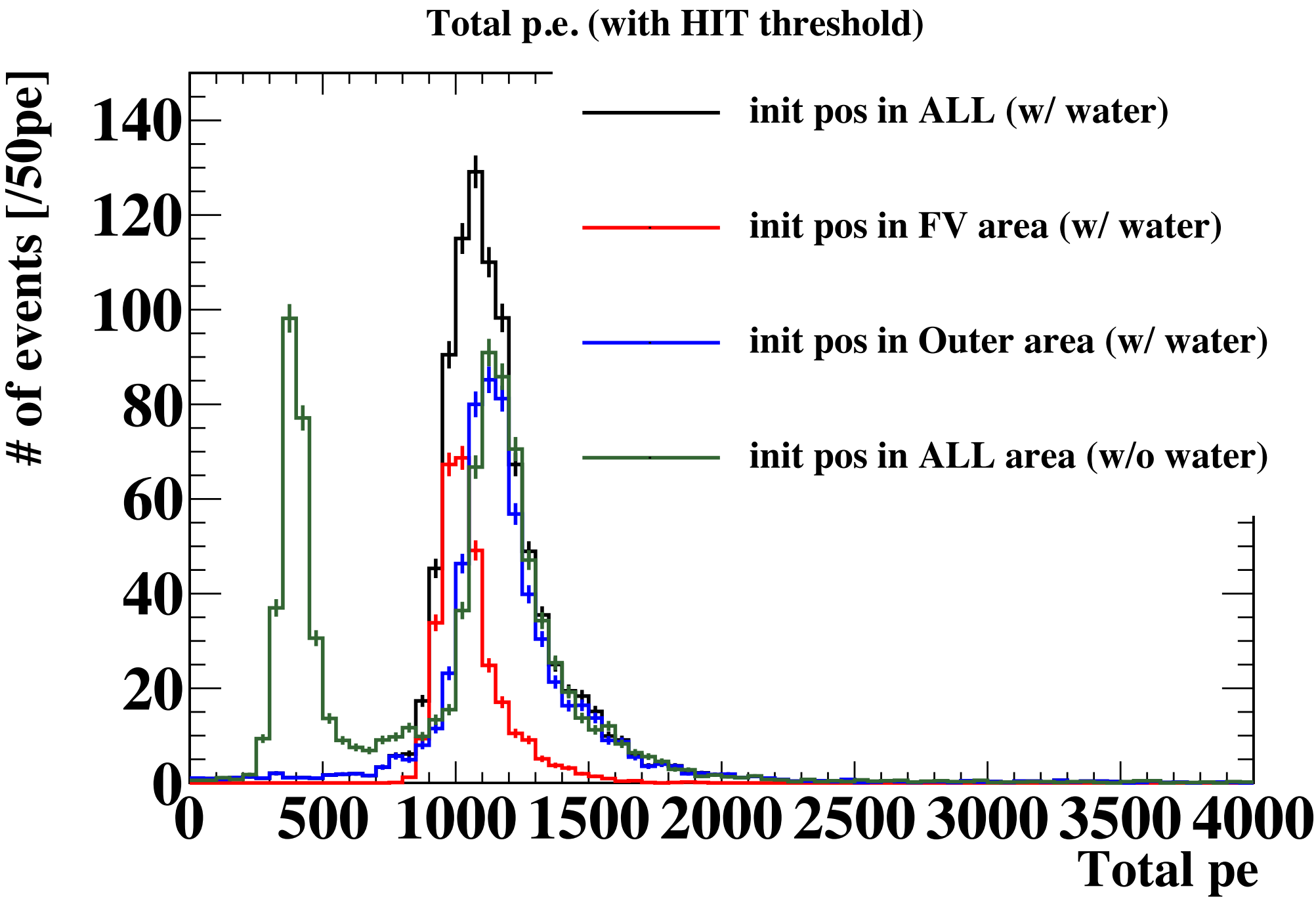

Efficiency to vertex in FV (w/ water)
Sub./(# of interactions in Outer)
Efficiency [%]
100
80
60
40
20
0
10
5
0
0
200
400
600
800
1000
Threshold pe

(remaining BG)/(Signal in FV)

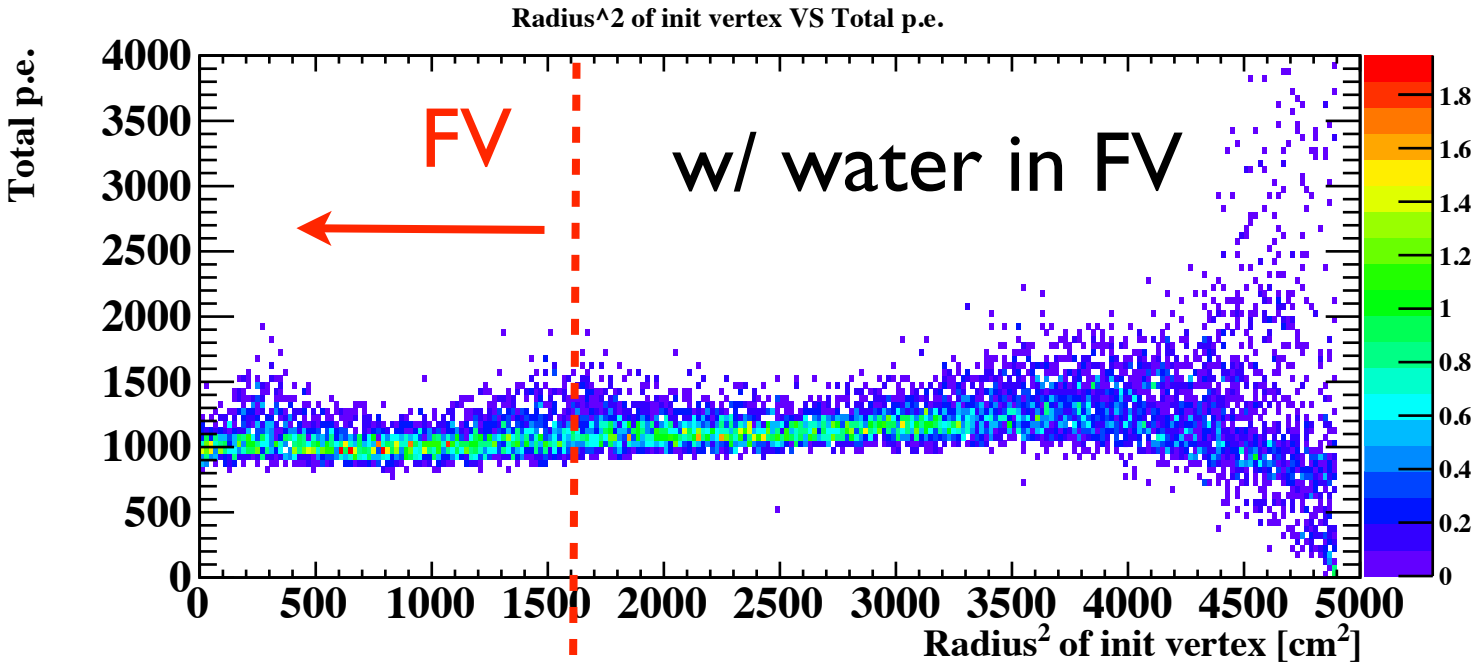


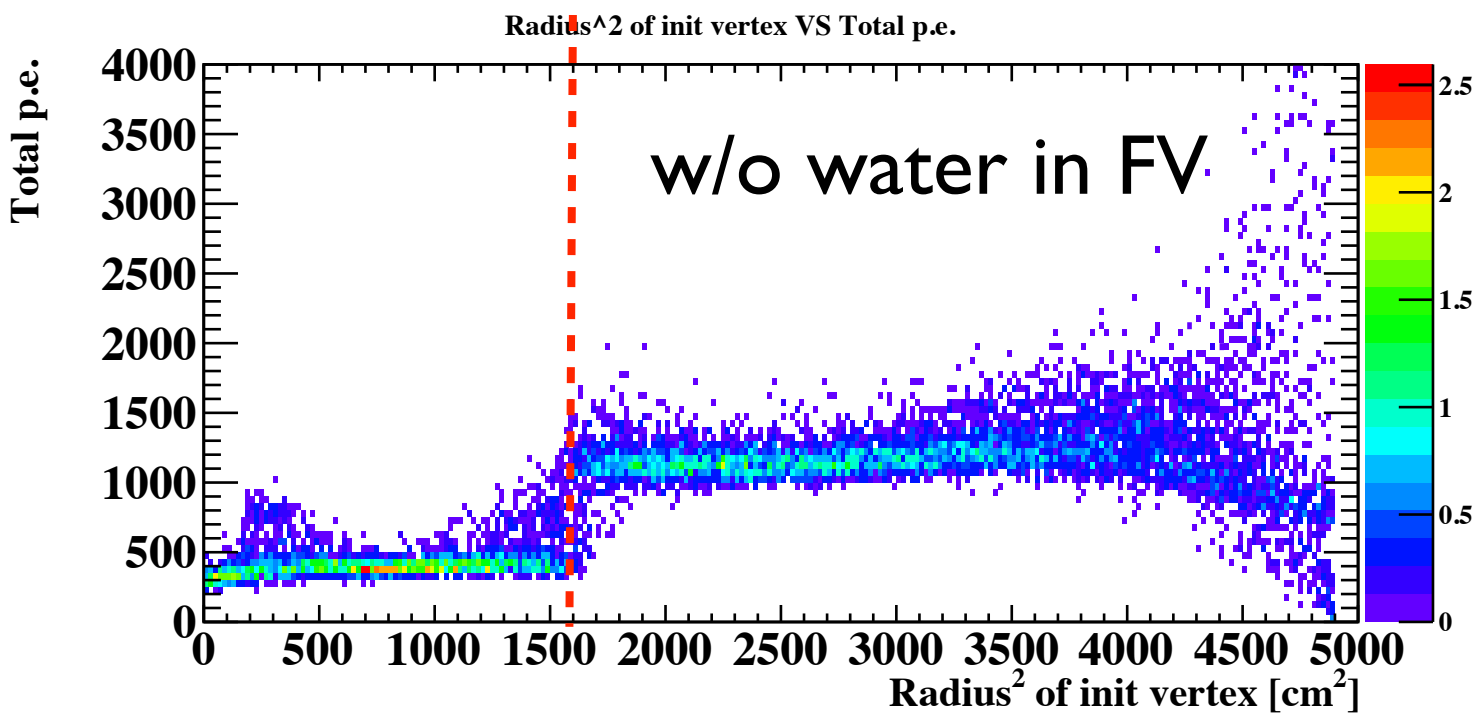
Rock muon study

- Total pe distribution (w/ water & w/o water)


Total p.e. (with HIT threshold)
# of events [/50pe]
140
120
100
80
60
40
20
0
0
500
1000
1500
2000
2500
3000
3500
4000
Total pe
init pos in ALL (w/ water)
init pos in FV area (w/ water)
init pos in Outer area (w/ water)
init pos in ALL area (w/o water)

Total p.e. vs radius^2





- In case of w/o water in FV...
  - Diff. of peak ~ 1100-350 ~ 750.
  - Diff. of path length = 100cm (correspond to FV length)
- Expected diff. of measured p.e. ~ 5.02p.e./cm × 100cm ~ 500 pe.
  - Ratio (MC)/(Expect) ~ 1.5
- Will check MC and expected calculation...

Back up

- Expected # of photons

Calc # of gen. photons

$$\frac{dN_{photons}}{dL} \simeq 2\pi\alpha z^2 sin^2\theta(\lambda_1^{-1} - \lambda_2^{-1})$$

- μ: Mass = 106MeV/c^2
- λ1, λ2 = 270, 610nm = 2.03, 4.6eV (MC used)
- QE = 0.2 (constant)
- Mean coverage = 6.25% (PMT:164, constant)

Cherenkov threshold (water:n=1.33)

particle	threshold momentum[MeV/c]
muon	**120**
pion	159
electron	0.57
proton	1069

μ mom. [MeV/c]	beta	cosθ	angle [deg]	Gen. photons [/cm]	Gen. pe [/cm]	Measure pe [/cm]
200	0.884	0.851	31.7	261	52.2	3.26
300	0.943	0.797	37.1	345	68.9	4.31
400	0.967	0.778	39.0	374	74.8	4.67
500	0.978	0.769	40.0	387	77.5	4.84
600	0.985	0.764	40.2	395	78.9	4.93
700	0.989	0.760	40.5	399	79.8	4.99
800	0.991	0.758	40.7	402	80.4	5.02

30cm path length → expect to measure 98~150 p.e.