

# A look at NC in 3DST

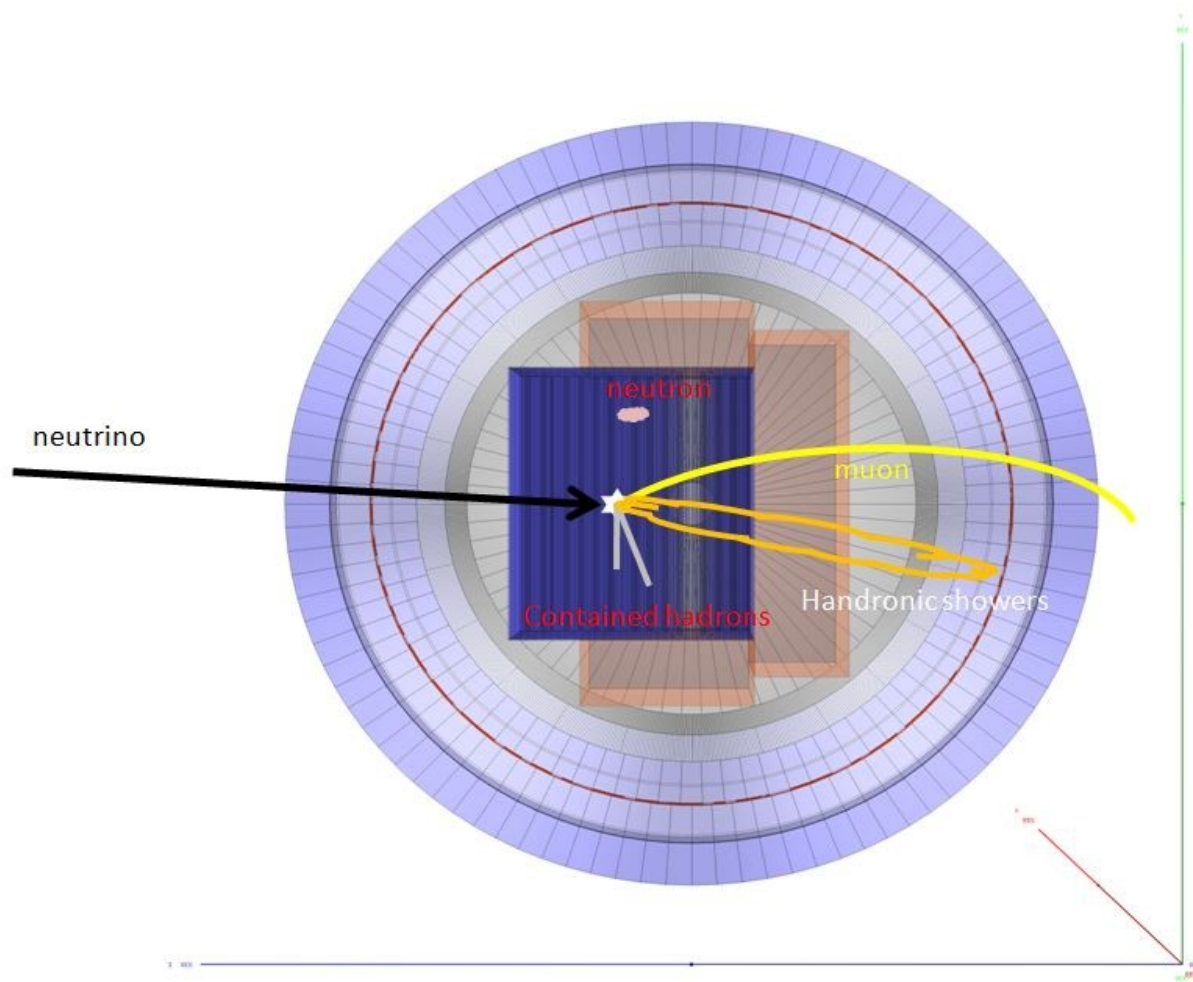


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# Introduction

- NC with a charged pion in the FS can be misselected as a CC candidate.
- Beam monitoring will use CC inclusive sample thus NC will worsen the beam parameter sensitivity.
- First look at NC by comparing the most energetic charged pion and the CC muon.
- This could be plugged into the beam monitoring table soon.
- Caveat: wrong-sign included, NO nue considered.

# Geometry

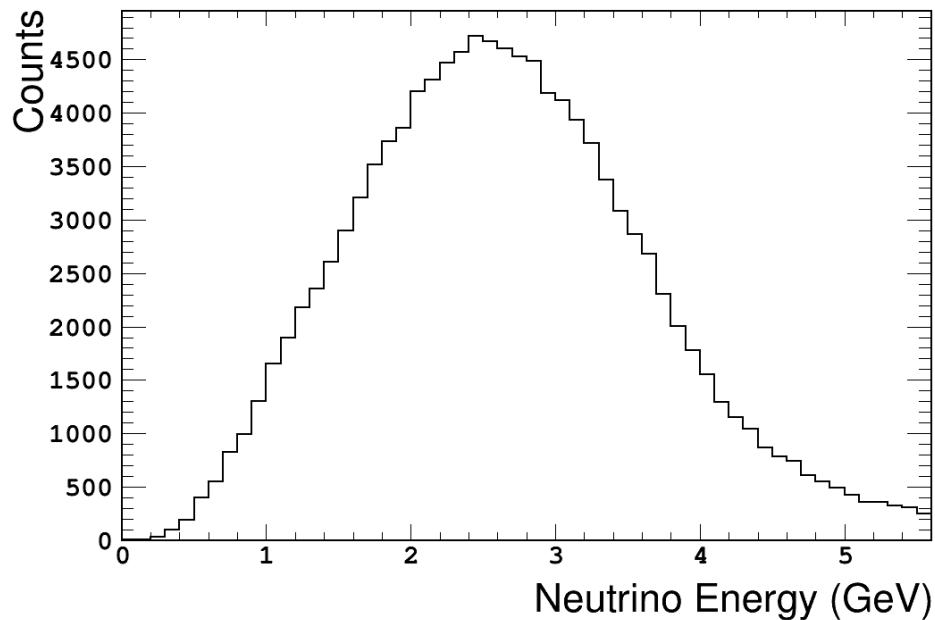


- 3DST :  
252 x 236 x 200
- ECAL inner cylinder volume:  
Length: 3.84 m  
radius: 2 m
- ECAL :  
23 cm thickness  
with  $\sim 5$  g/cc  
averaged density
- Caveat: I took out Yoke here (does not matter).

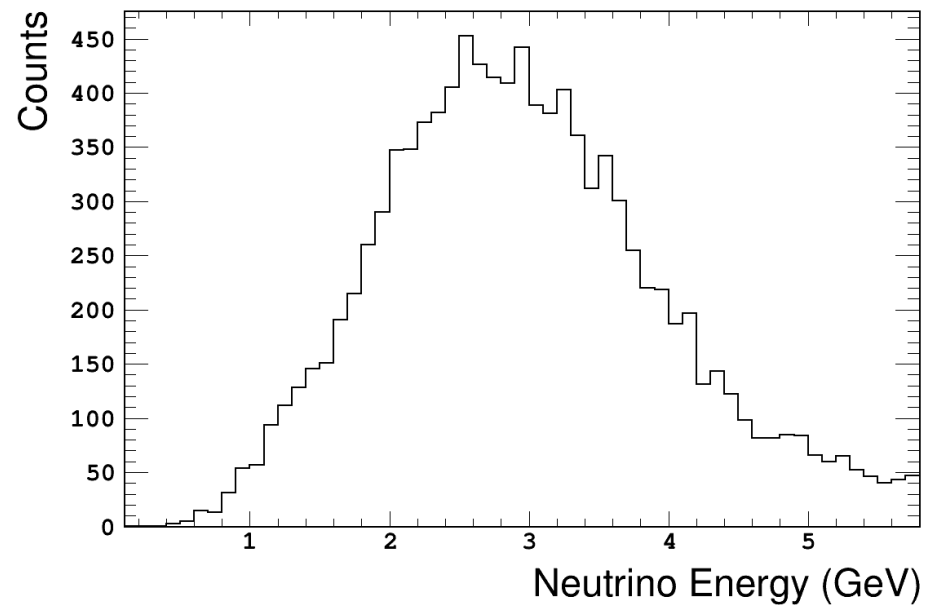
# NC component

- CC inclusive per year:  $1.5e7$
- NC total per year :  $5.3e6$
- NC with at least one charged pion in the final state per year:  $1.75e6$

neutrino spectrum with CC



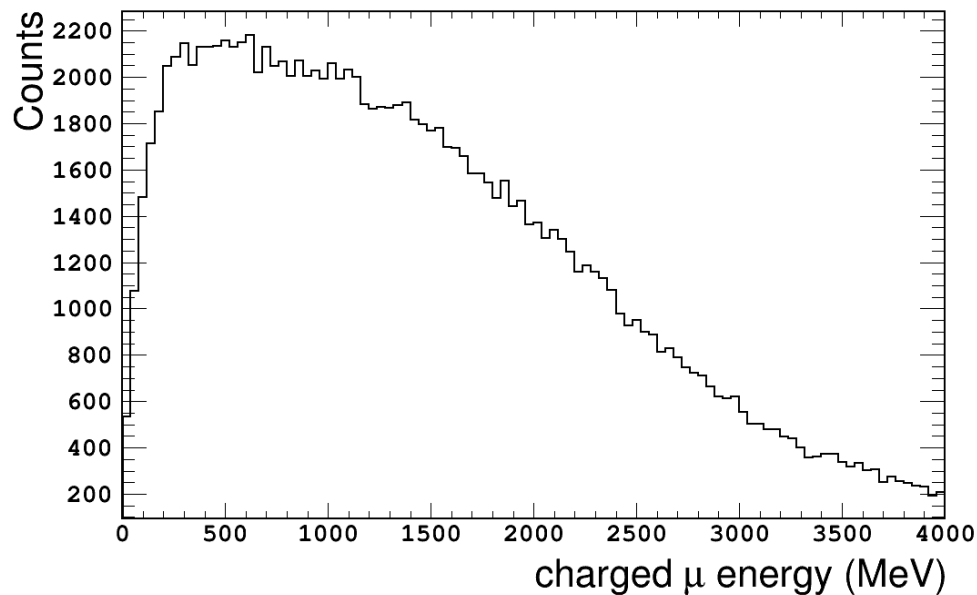
neutrino spectrum with NC charge pi



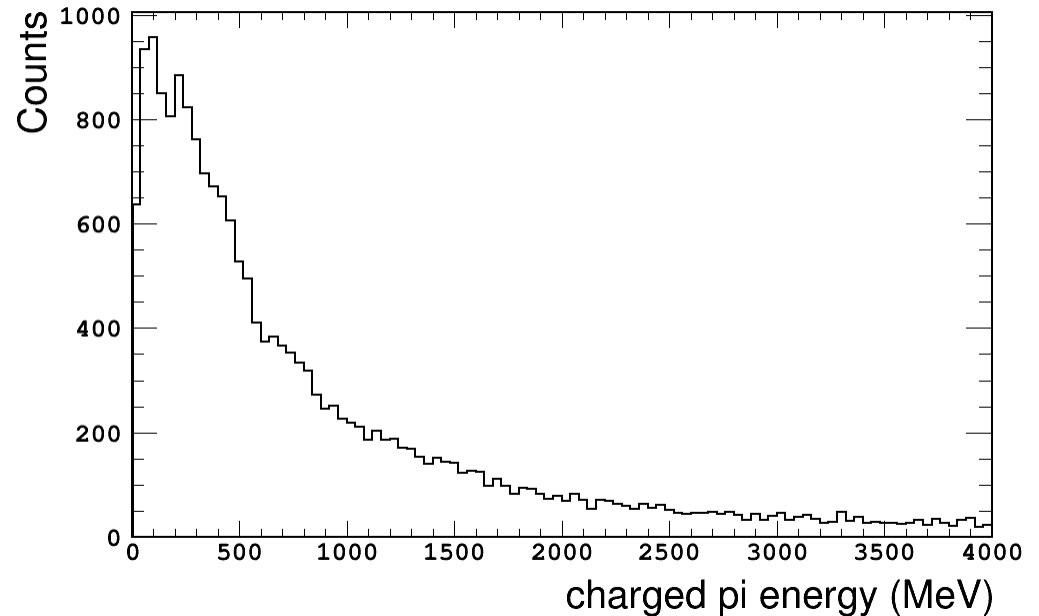
# Energy of muon/pion

- The CC muon energy is much higher than charged pion in NC. The containment in SAND should be very different.

muon spectrum with CC

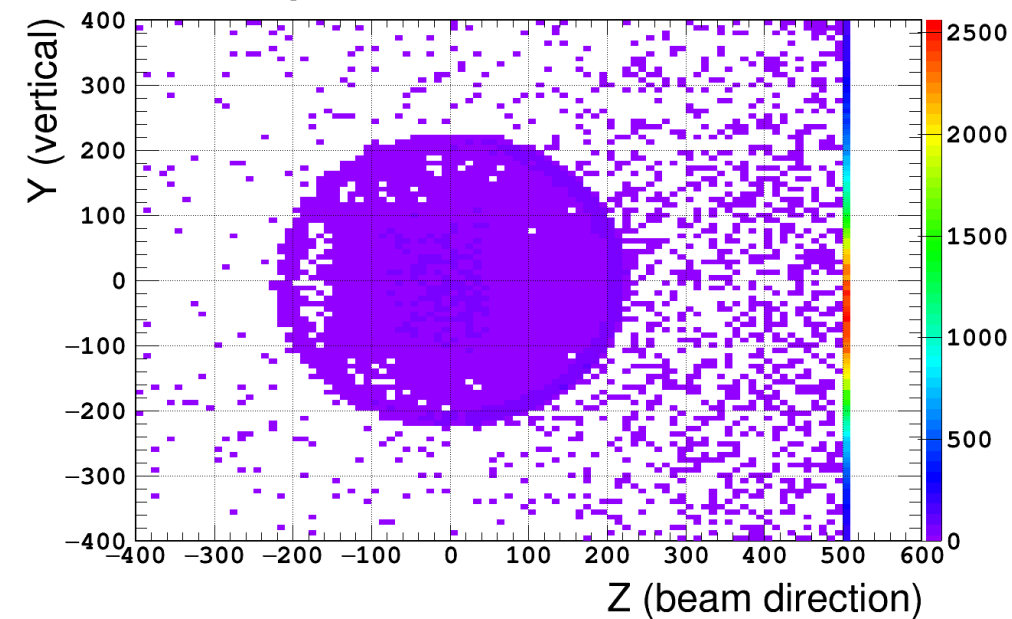


pion spectrum with NC charge pi

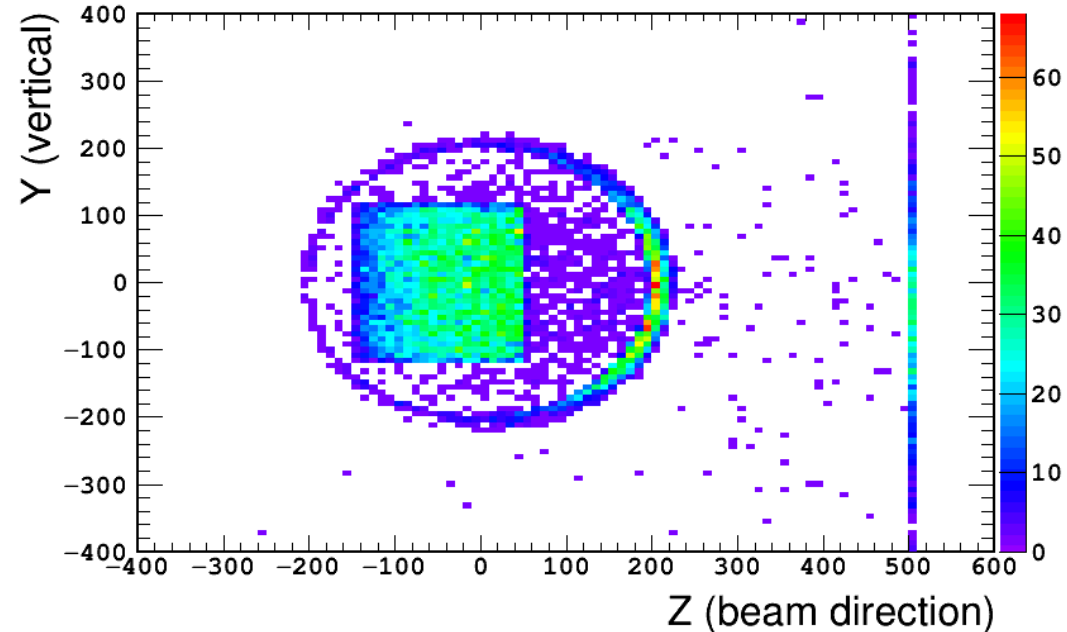


# End point of muon and pion

CC muon end point



NC charge pi end point



- Three categories can be identified based on the end points:
  - 3DST contained, ECAL contained and escaped

# Fraction of three categories

- CC muon:
  - 3DST contained: 6%
  - ECAL contained: 11%
  - escaped: 83%
- NC pion:
  - 3DST contained: 65%
  - ECAL contained: 29%
  - escaped: 6%
- Obviously, containment itself can provide a very powerful discrimination. 6% of the escaping pion may be a potential background.
- Decay can be used for 3DST contained while ECAL should be used for the ECAL contained.



# Conclusion

- NC should be controlled at  $< 10\%$  level .
- The remaining part of NC can be added into the beam monitoring table.