Joint Institute for Nuclear Research (Dubna)

ν_μ CC events purity and efficiency for ECAL+3DST+TPC configuration

SAND meeting

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Motivation

Check detection efficiency and purity of ν_μ CC interactions in ECAL+3DST+TPC configuration

Events were generated in Dubna with the help of GDML file provided by Guang. Edep-sim program was modified to have a smaller steps in Trajectory.Point class, $\sim$ 1 mm to evaluate particles' momenta at the border of detector volumes

Note

Events are normalized to the 1 week statistics for front ECAL with the following FV:
$|x| < 169\ cm,\ 200 < R < 223\ cm,\ z < 0$
Simulated events number: 1 071 506

CDR geometry

In GDML file active 3DST and TPC volumes did not take into account boxes, supports and electronics

3DST box dimension $252 \times 236 \times 200$ cm - from gdml file

Used scintillator dimension $240 \times 224 \times 192$ cm - from CDR

For y and z dimensions of TPC we removed 3 cm from each side

FV for primary vertex inside 3DST: 2 cm from each side - exclude interactions in 3DST box (it is necessary to investigate)

CC identification

3DST group method:

Muon track range cut - 3DST > 20 cm or in TPC > 20 cm (same as in CDR)

Developed method:

- detector identification: muon is going out of Yoke at z > 0
- for other muons we are applying range cut:
  3DST>100 cm and 3DST+TPC>130 cm
- excluding muon candidates with inelastic interactions in 3DST (more than 1 charged particles outgoing at the end of track with 100% efficiency of secondary charged track reconstruction)

Event statistics - CC identification

3DST-group method

	Simulated events			Reconstructed events			Efficiency		Purity
	CC+NC	CC	NC	CC	true CC	true NC	CC	NC	CC
ECAL	1457562	1 071 507	386055	594476	559382	35094	0.52	0.09	0.94
3DST	545673	398210	147463	428949	390860	38089	0.98	0.25	0.91
ECAL+3DST	2003235	1469717	533518	1023425	950242	73183	0.65	0.14	0.93

CC identification

	Simulated events			Reconstructed events			Efficiency		Purity
	CC+NC	CC	NC	CC	true CC	true NC	CC	NC	CC
ECAL	1457562	1 071 507	386055	487029	474078	12951	0.44	0.03	0.97
3DST	545673	398 210	147463	351993	337472	14521	0.85	0.10	0.96
ECAL+3DST	2003235	1469717	533518	839022	811550	27472	0.55	0.05	0.97

Summary

- with default muon selection procedure we have 65% ν_μ CC selection efficiency in ECAL+3DST with purity 93%
- with developed method of CC identification we have 55% ν_μ CC selection efficiency in ECAL+3DST with purity 97%
- impact on beam monitoring sencitivity is under investigation