CURRENT STATUS OF SYSTEMATICS AND SENSITIVITY CALCULATION: OTHER SYSTEMATICS

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Beam Systematics

- Beam systematics (for one detector):
  - secondary particle production in the target;
  - reinteractions of secondaries;
  - primary beam position and divergence;
  - collimator and horn.
- Beam systematics for two detectors:
  - impact of the previous items on the far/near ratio: some cancellations occur (to be quantified);
  - warning: not a point like source in a short baseline. How the decay tunnel length affects the near to far beam extrapolation?

Detector systematics

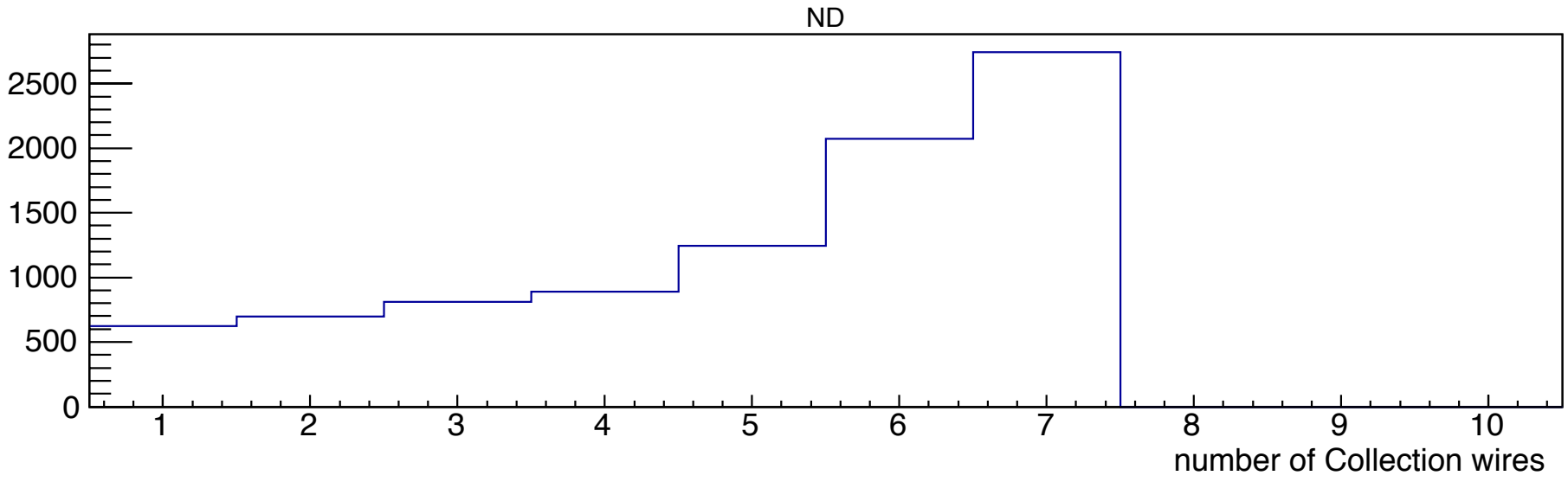
- Differences between the near and far detectors:
  - LAr purity levels;
  - light collection systems and identification of off beam interactions by time;
  - stereo angle of the wires and wire pitch;
  - electric drift field (absolute value and homogeneity);
  - electronics (shaping, sampling time, S/N ratio, general noise conditions affecting the identification/measurement efficiency).
- Effects induced by the different rates at the two sites: different background levels from cosmic rays and beam dirty events.
- Effects induced by different aspect ratios of the near and far detectors through possible variations of acceptance/efficiency
- Residual cross sections systematics due to different spectra at the two locations.

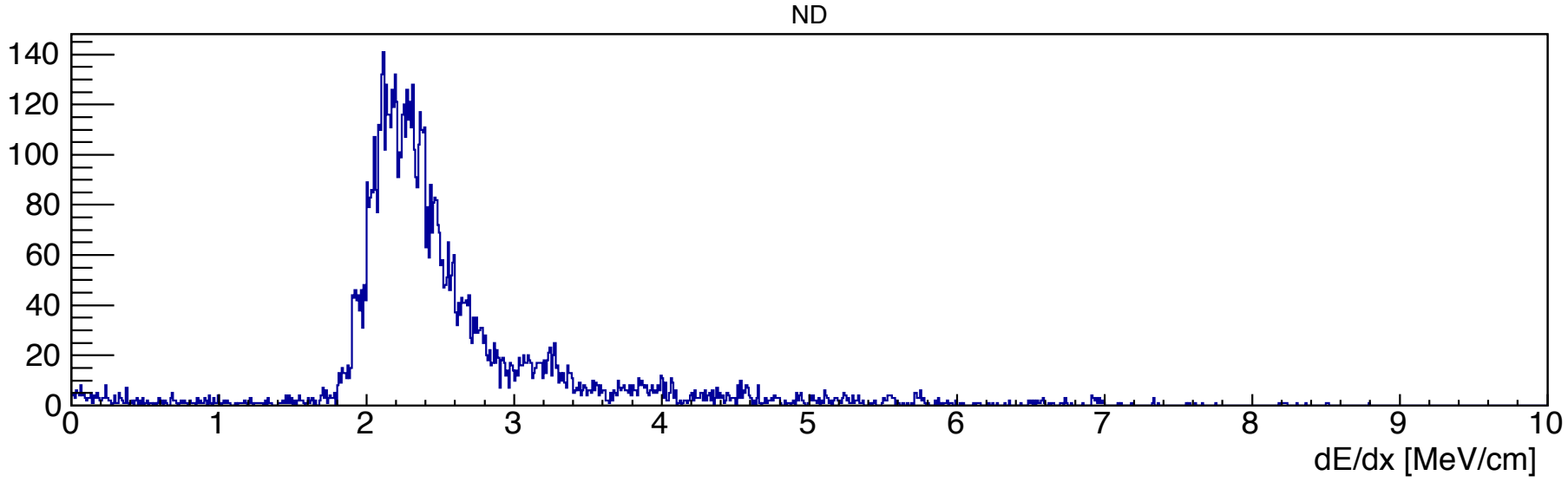
Systematics related to the wire orientation

The different wire orientation in ICARUS-T600 and LAr1-ND could, in principle, affect the capability of separating electrons from photons relying on the ionization of tracks close to the interaction vertex.

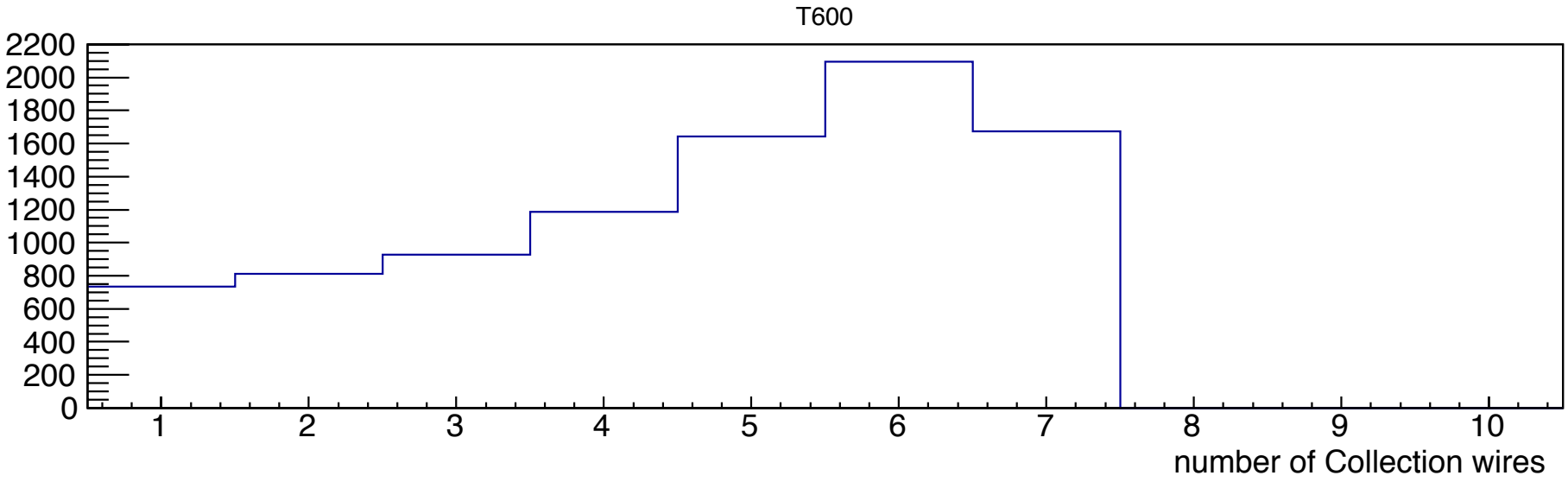
1) In order to investigate this issue, a sample of ~ 1000 electrons was simulated via MonteCarlo for each energy bin with isotropic distribution of the track direction. The dE/dx distribution in the first 2 cm of track was then computed as a function of the number of wires occupied by the electron track in Collection view.
2) This information has been then applied to a sample of ~ 9000 simulated BNB intrinsic electron neutrinos: for each of them, the number of Collection wires occupied by the electron track has in the first 2 cm from the interaction vertex has been computed both for the LAr1-ND and the ICARUS-T600 Collection wires orientation, and a dE/dx value has been randomly drafted from the corresponding distribution obtained in step 1.

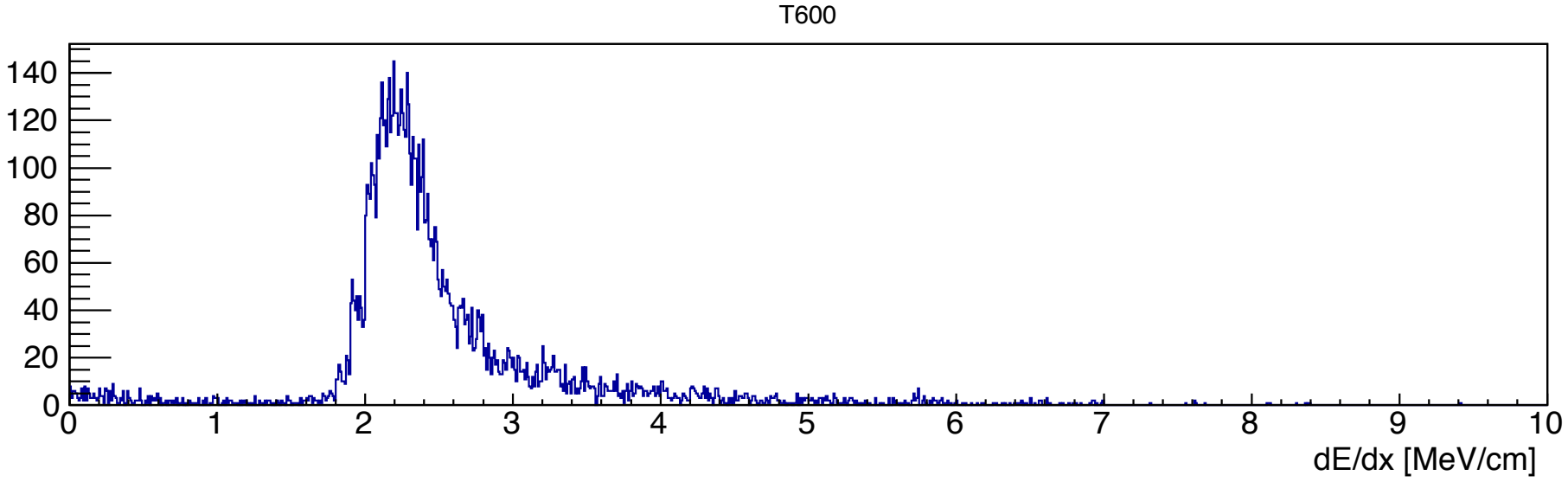
LAr1-ND


ND
2500
2000
1500
1000
500
0
1
2
3
4
5
6
7
8
9
10
number of Collection wires


ND
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
dE/dx [MeV/cm]

ICARUS-T600


T600
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
number of Collection wires


T600
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
dE/dx [MeV/cm]

Systematics related to the wire orientation: results of the simulation

- In order to get a 90% efficiency on the electron identification in ICARUS-T600 the value of the cut on the dE/dx distribution is 3.425 MeV/cm. Having this value fixed, the corresponding electron identification efficiency for LAr1-ND results to be 89.86%.

- Therefore, under the realistic assumption that the dE/dx distribution of electrons from BNB electron neutrinos is comparable with that one of isotropic electron tracks, we can conclude that the different orientation of Collection wires in the two detectors introduce a negligible systematic error (order of 1 per mille).