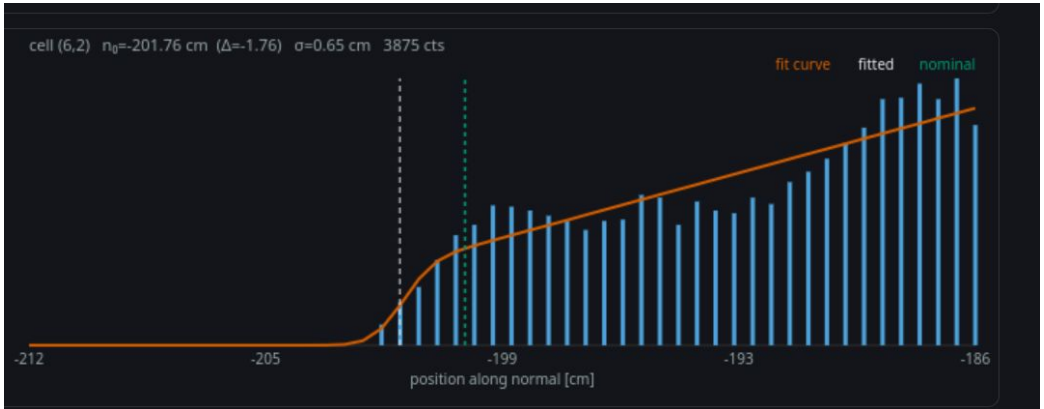
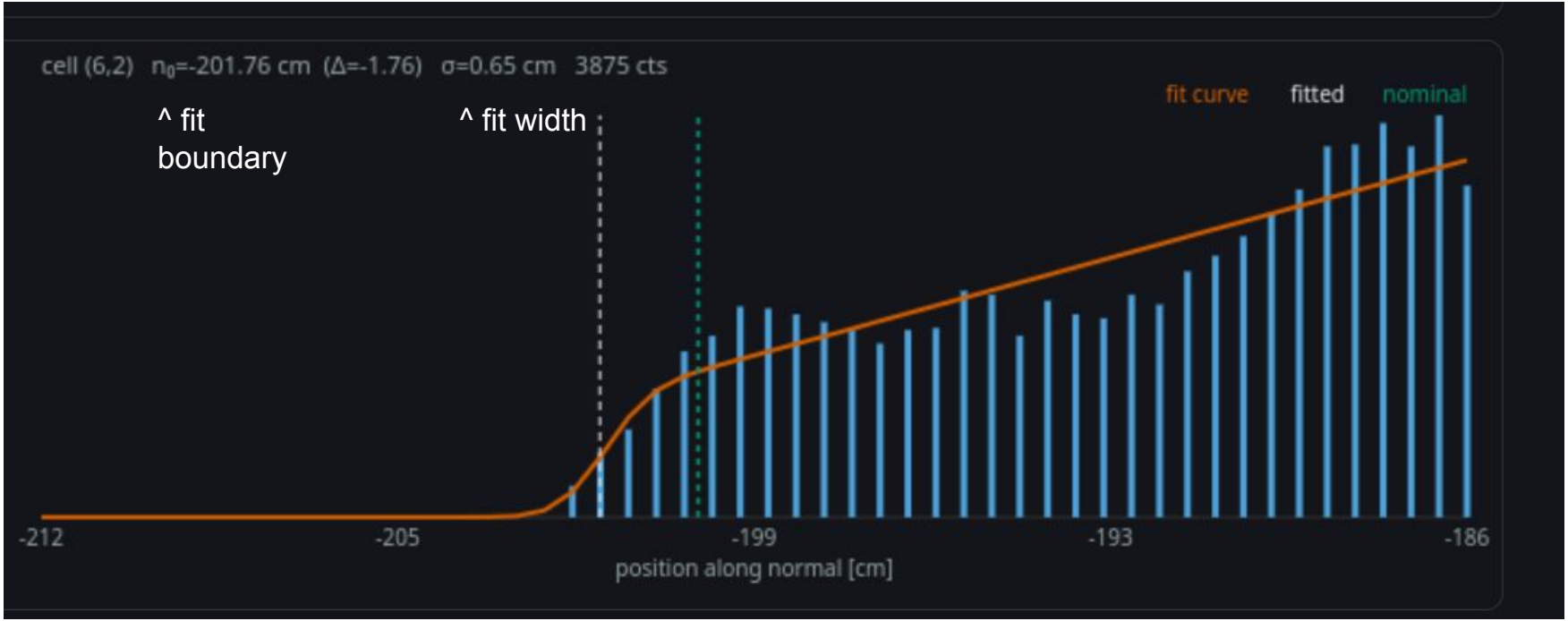
Finding APA boundary by fitting to edge spread function

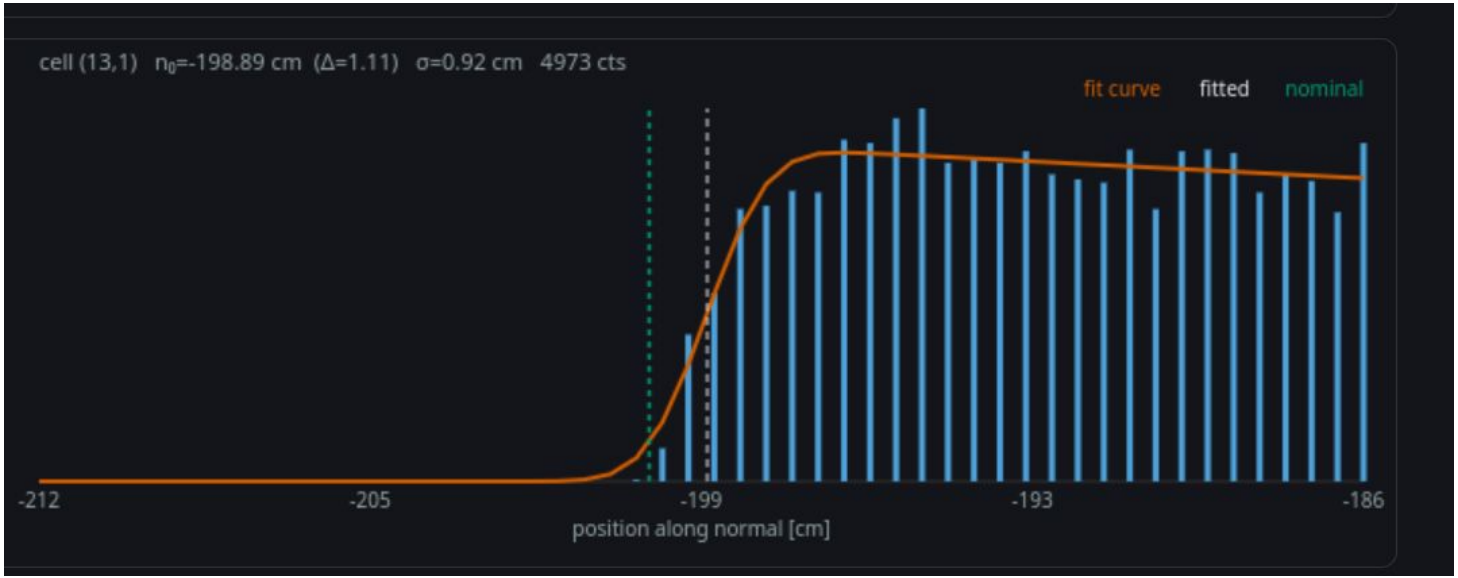
- Hull is not robust to outliers, reconstruction smear
- Alternative method: divide APA boundary into cells, and then fit the profile of points in the interior up to the boundary of that cell to an error function (edge-like) * linear (to capture internal structure to first-order) function. The difference between the center of the error function and the nominal position is the distortion of the boundary there.

Relevant example that uses same method for turn-on curves : https://link.springer.com/article/10.1140/epjc/s10052-019-6841-1

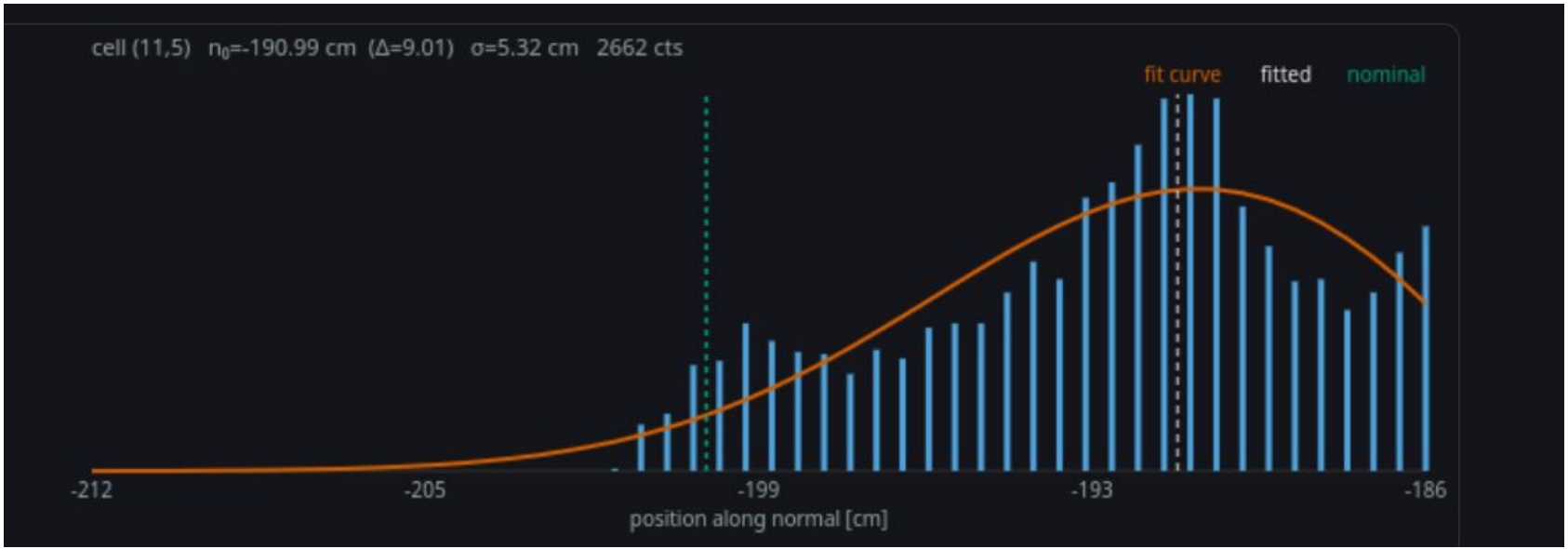



cell (6,2) n_0=-201.76 cm (Δ=-1.76) σ=0.65 cm 3875 cts
^ fit boundary
^ fit width
fit curve
fitted
nominal
-212
-205
-199
-193
-186
position along normal [cm]

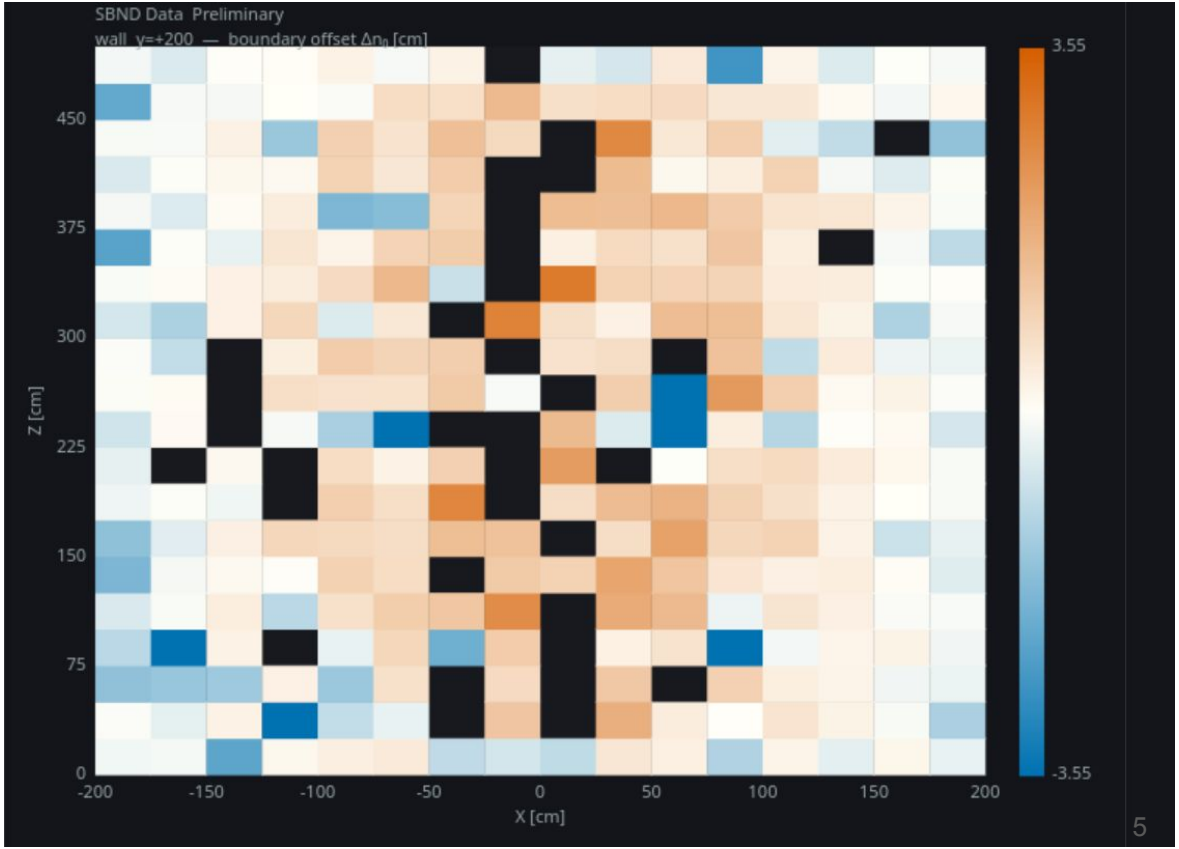
In some cases the nominal boundary looks more reasonable by eye



Sometimes the fit is just poor

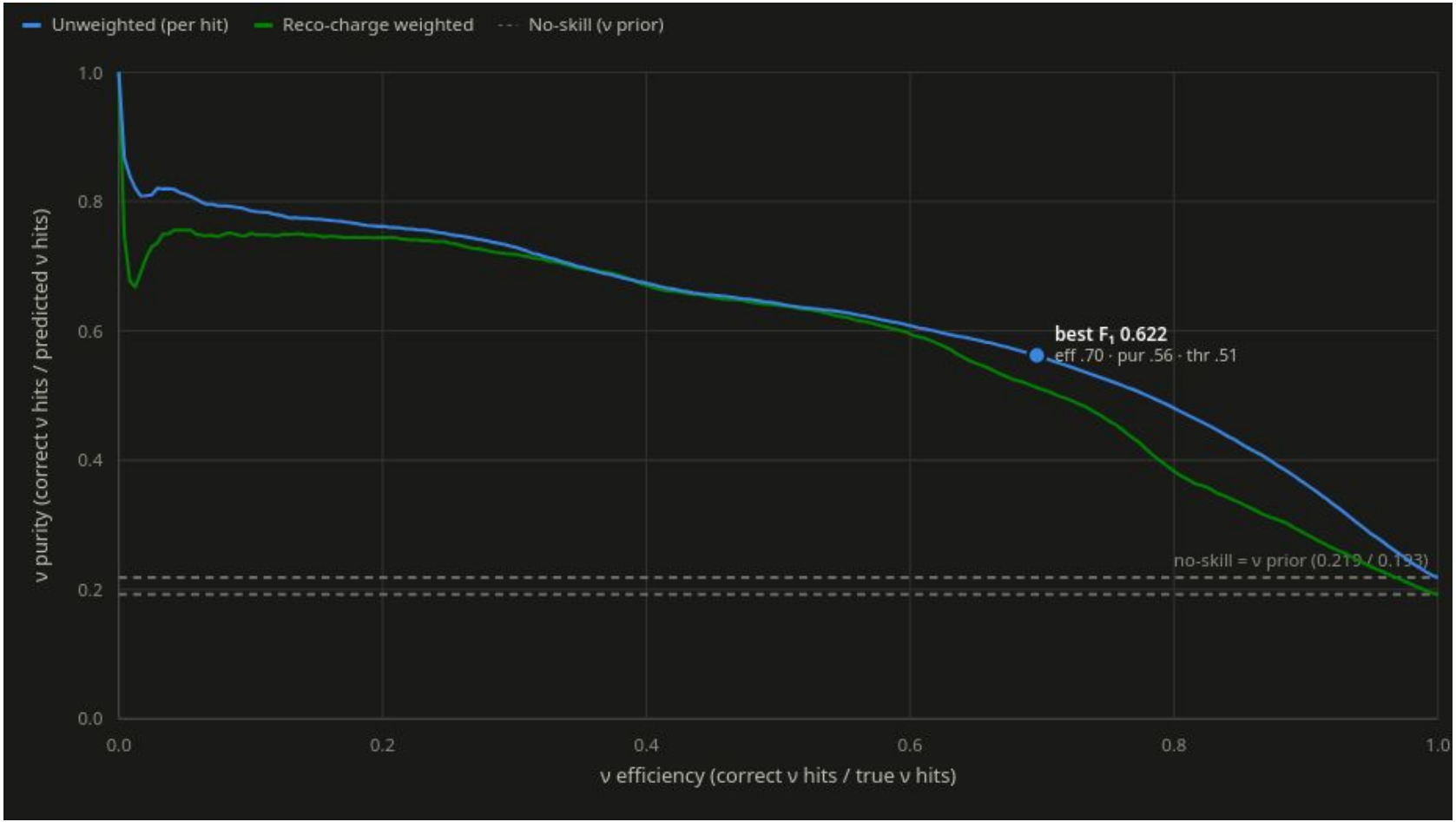


- Orange = bulging inwards
- Blue = building outwards
- Reasons for gaps
  - Too few points (<400)
  - Too few distinct events (<5 contributors)
  - One event hogs cell (>30% contribution)
  - Fit failure (fit boundary behind cell's interior position)
  - Large fit uncertainty (>1cm)



GNN Clustering

- My understanding is that there doesn't exist a neutrino tagger after QL matching in the traditional wirecell algorithm. We need that in order to do a comparison with nuGraph's semantic head, so an apples-to-apples comparison isn't possible
- Can find neutrino purity and efficiency (at threshold = 0.5) with sample mc_MCP2025B_prodgenie_corsika_proton_rockbox_sbnd_CV_gen_g4_detsim_reco1_sbnd (~22% neutrino, 78% cosmics)
  - Purity as defined by number-of-charge-weighted-3D-node_nu_pred&truth / number-of-charge-weighted-3D-node_nu_pred
    - I find charge weighted neutrino purity is 0.497
  - Efficiency as defined by number-of-charge-weighted-3D-node_nu_pred&truth / number-of-charge-weighted-3D-node_nu_truth
    - I find charge weighted neutrino efficiency is 0.716
- Neutrino F1 is 0.587, AUC is .829


Unweighted (per hit)
Reco-charge weighted
No-skill (ν prior)
1.0
0.8
0.6
0.4
0.2
0.0
ν purity (correct ν hits / predicted ν hits)
best F1 0.622
eff .70 · pur .56 · thr .51
no-skill = ν prior (0.219 / 0.193)
0.0
0.2
0.4
0.6
0.8
1.0
ν efficiency (correct ν hits / true ν hits)