GNN-based Track and Vertex Finding, Input features

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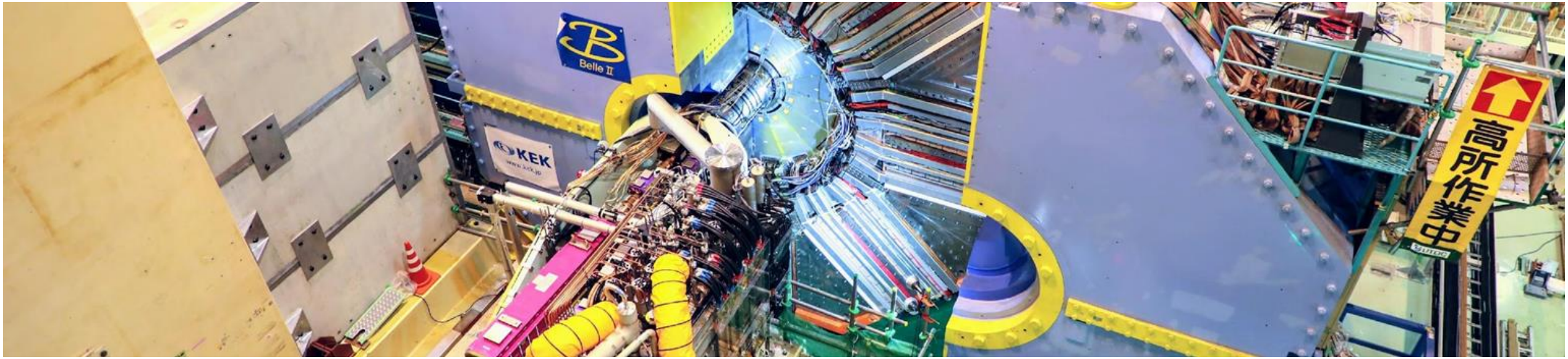


Information: processing of Data and MC

- Data: skimmed, exp 24, run 888
  - Skim: accept_mumutight

```
enECLTrack1 < 0.5 && enECLTrack2 < 0.5 && EMumutot < 2
&& acopPhi < 10 && acopTheta < 10 && nTracks == 2
&&    Pp1 > 0.5 && Pp2 > 0.5
```

  - Confluence: https://confluence.desy.de/display/BI/HLT+Skims
- MC (own simulation):
  - BKG: Early phase 3

```
/group/belle2/dataprod/BGOverlay/early_phase3/release-05-01-
15/overlay/phase31/BGx1/set0/
```

  - Use of default $\mu^+\mu^-$ generator:

```
ge.add_kkmc_generator(path=path, finalstate='mu-mu+')
```

  - Skim: accept_mumutight

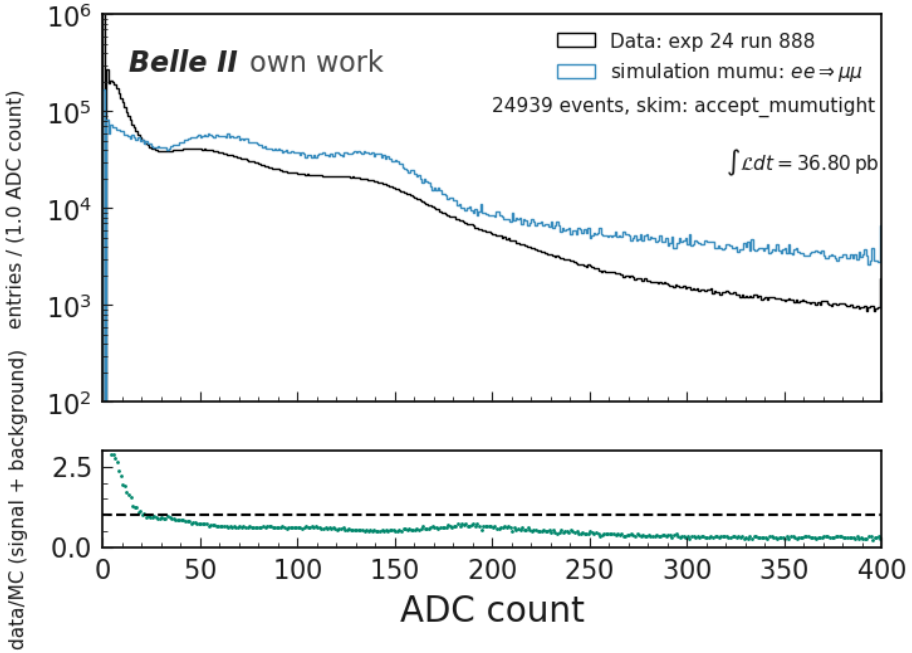
Global Tags: "L1_config_exp_22_run_290",'hlt_filters_exp24','L1_config_exp_24_run_740'

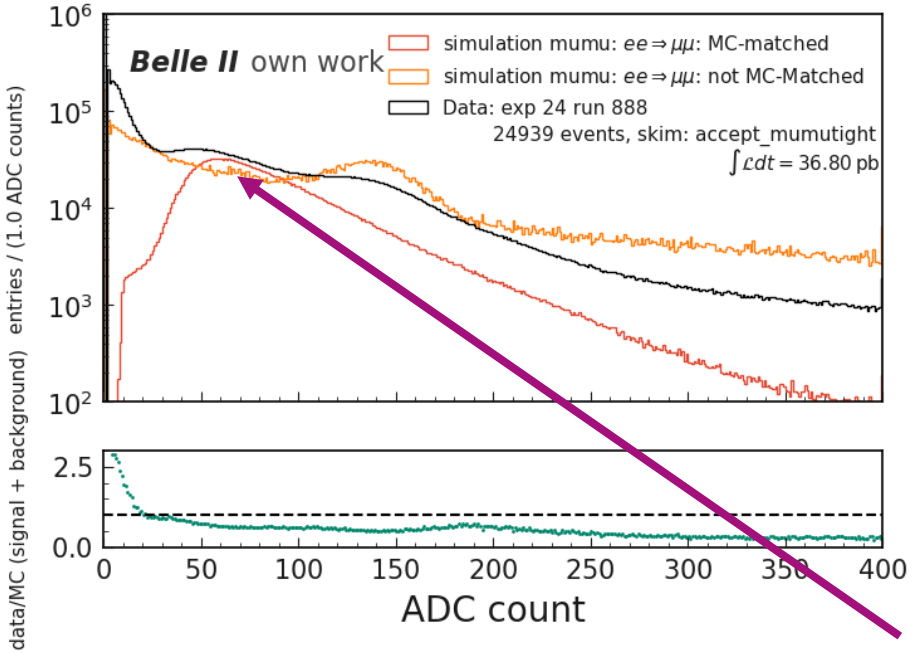
ADC Information

- Compare MC ADC with Data ADC

Possible MC / data differences

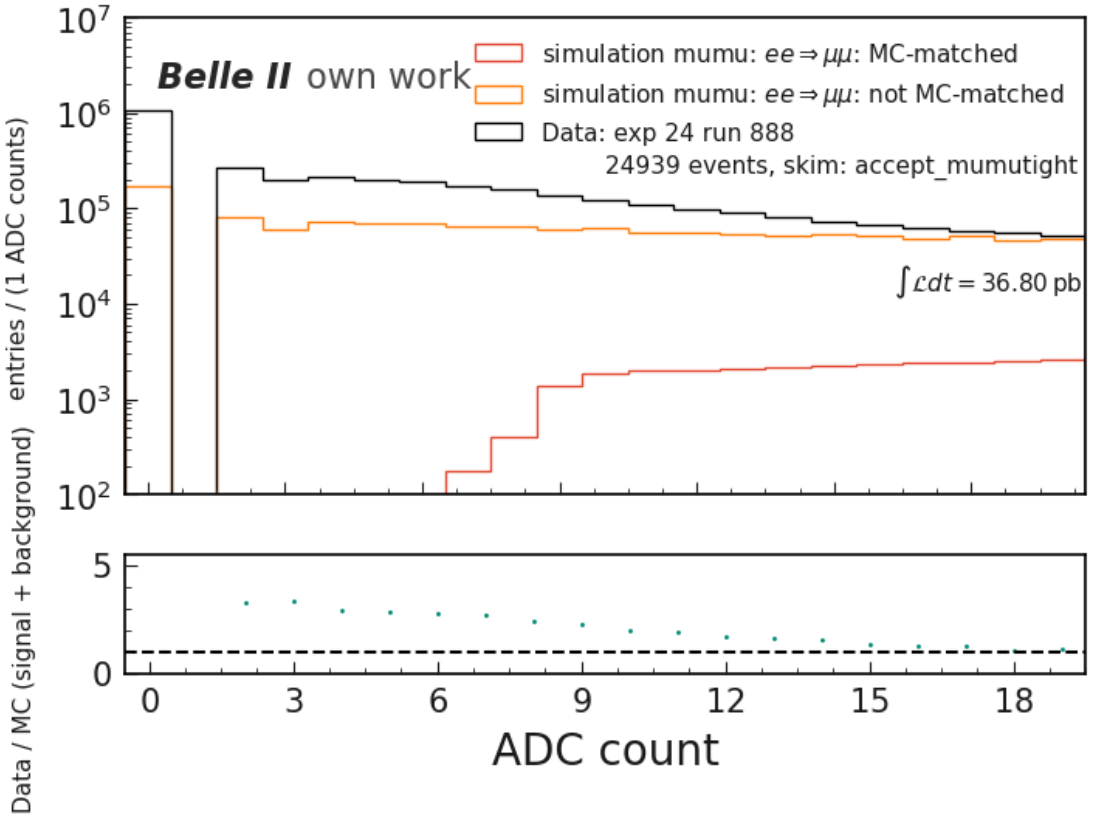
- Not real dimuon events → selection
- Only one run (high injection bkg?)
- Simulation: cross talk modeling
- Simulation: newer release for bkg





Monte Carlo shows separation potential.

ADC Information zoomed in



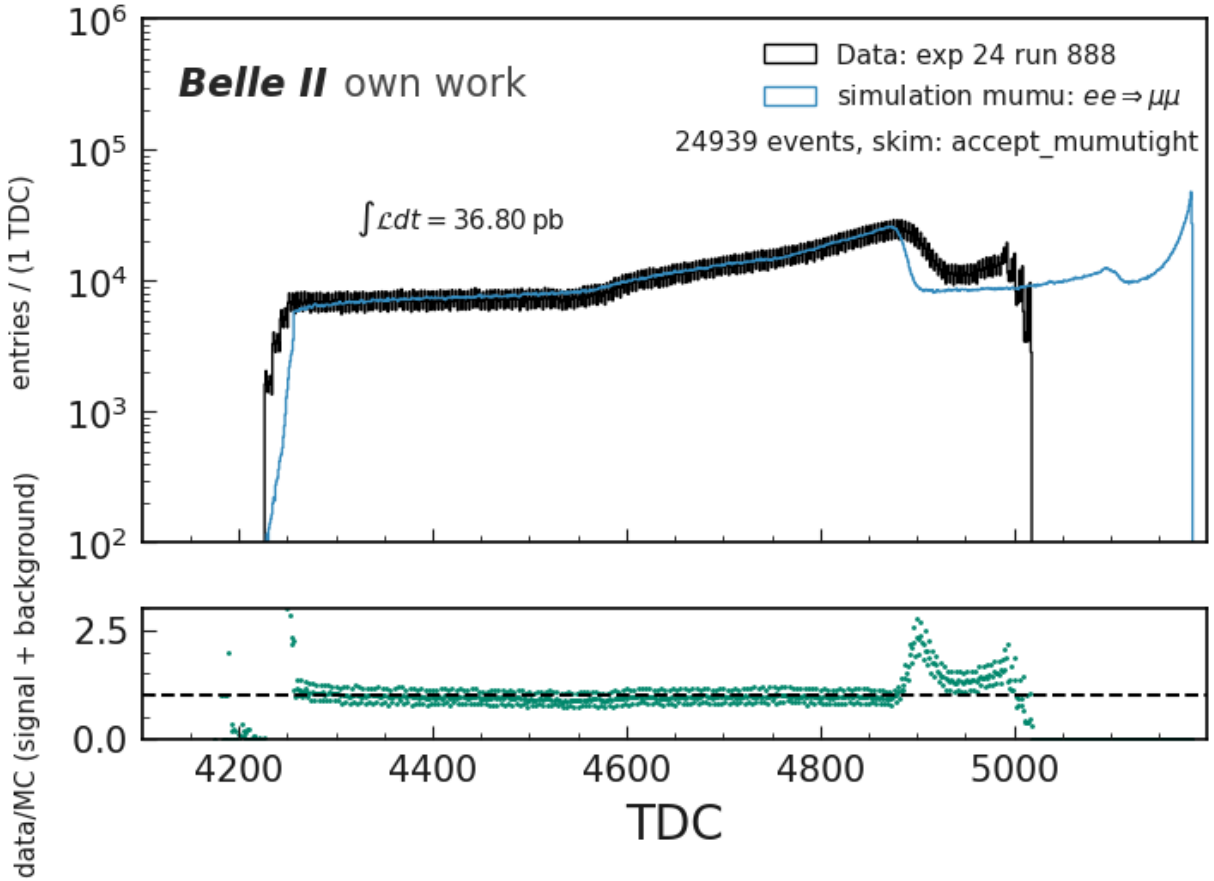
Possible MC / data differences

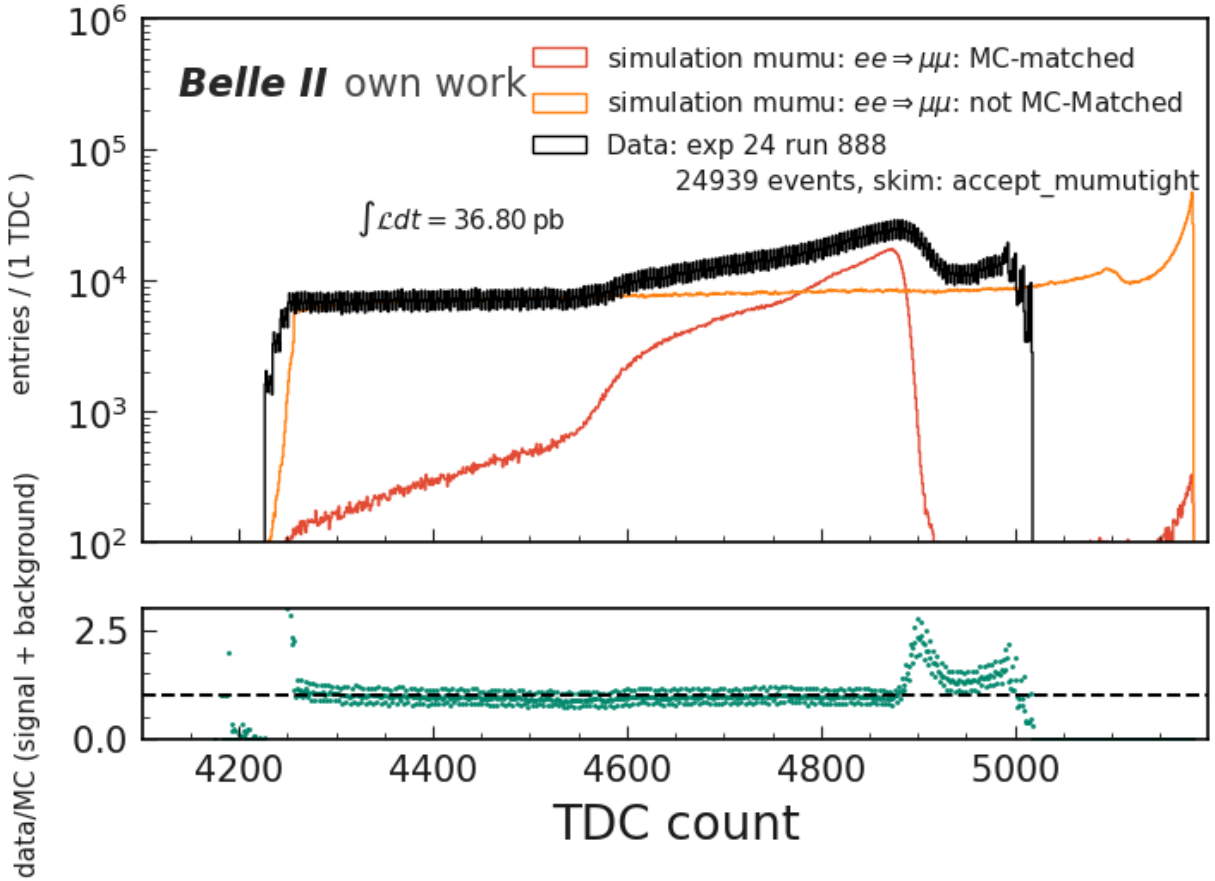
- Background close at zero

TDC Information

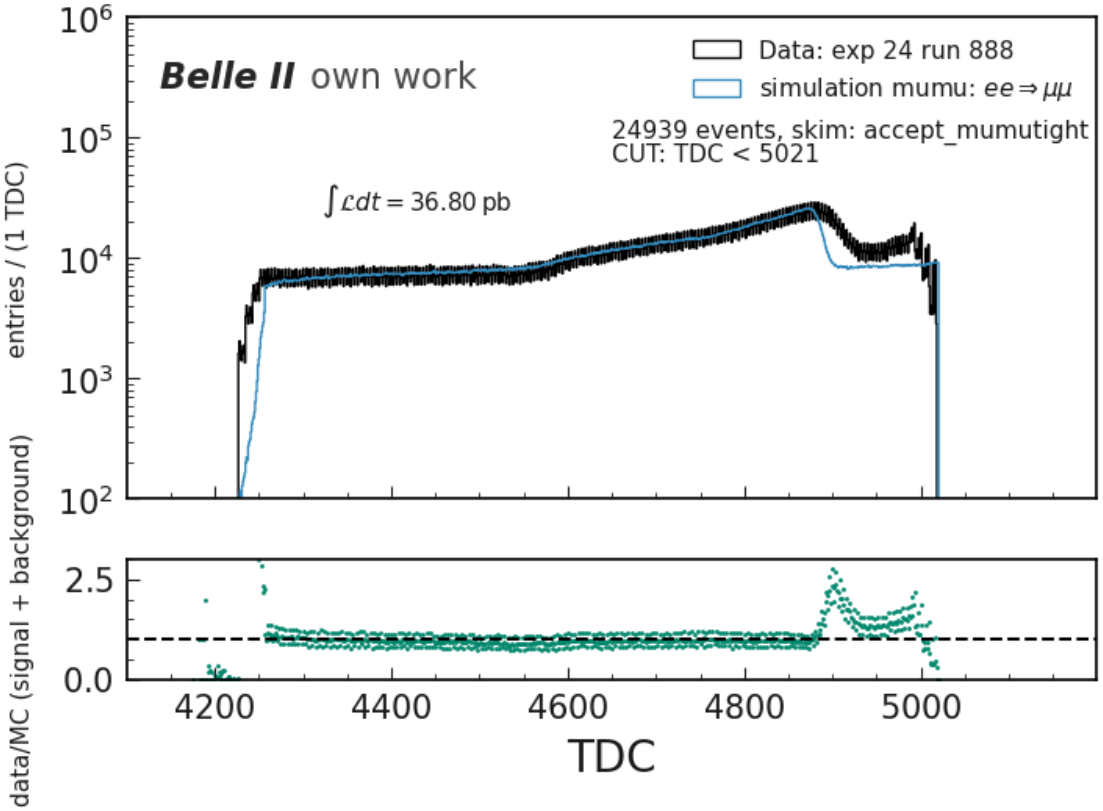
Possible MC / data differences

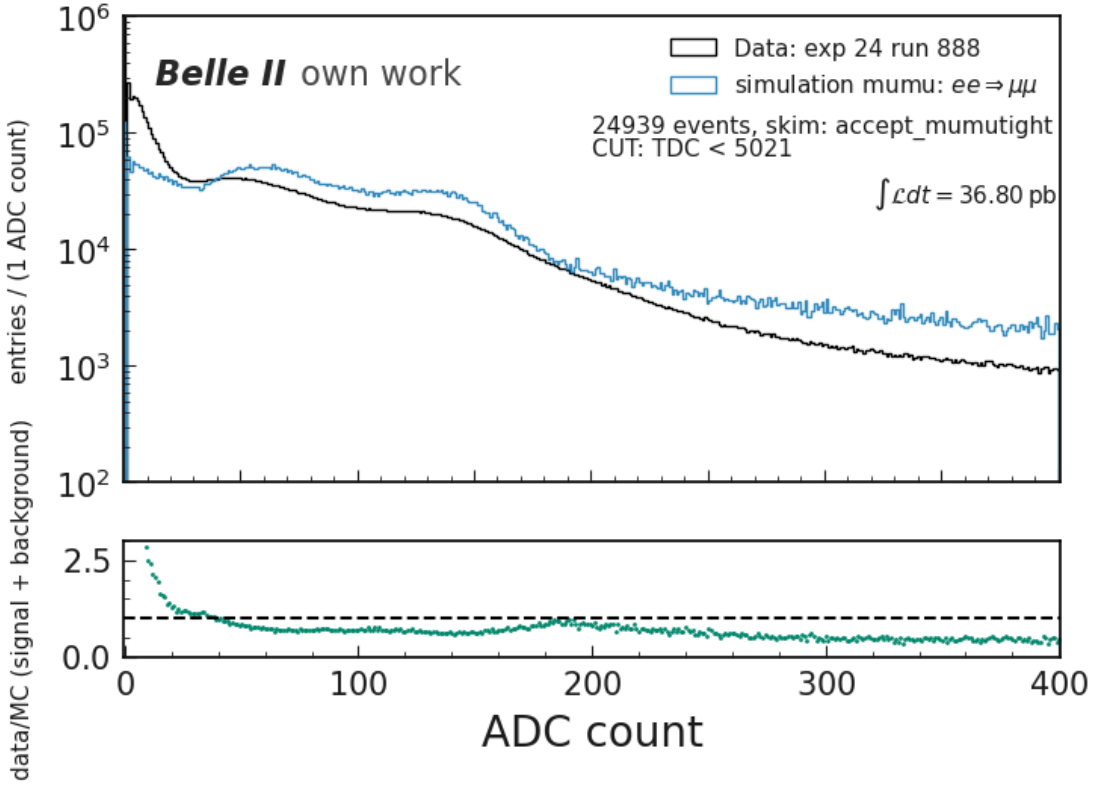
- Improve simulation in the large drift time region (=small TDC region) ongoing
- "TDC > 5020 in data" is out of time window of readout electronics.





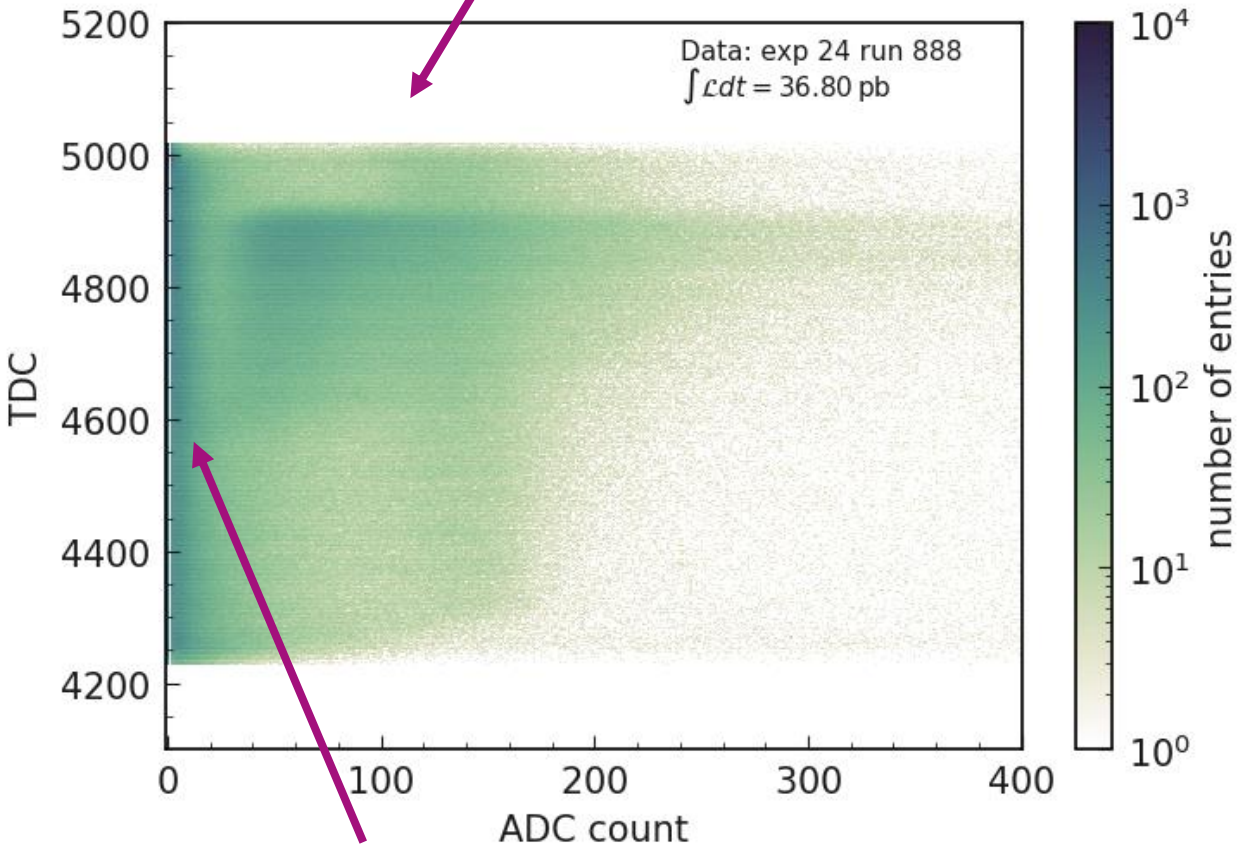
ADC with TDC Cut

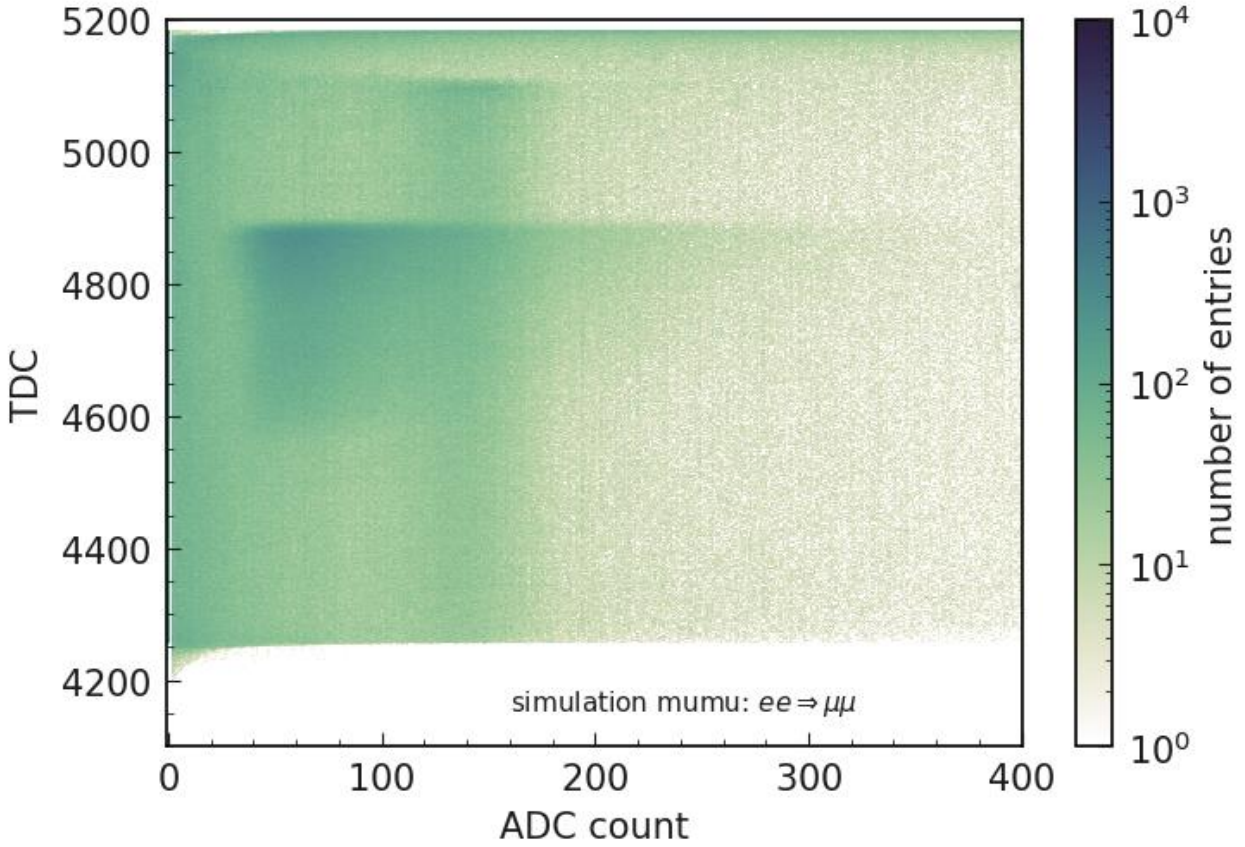




2D Comparison ADC and TDC

Much less entries

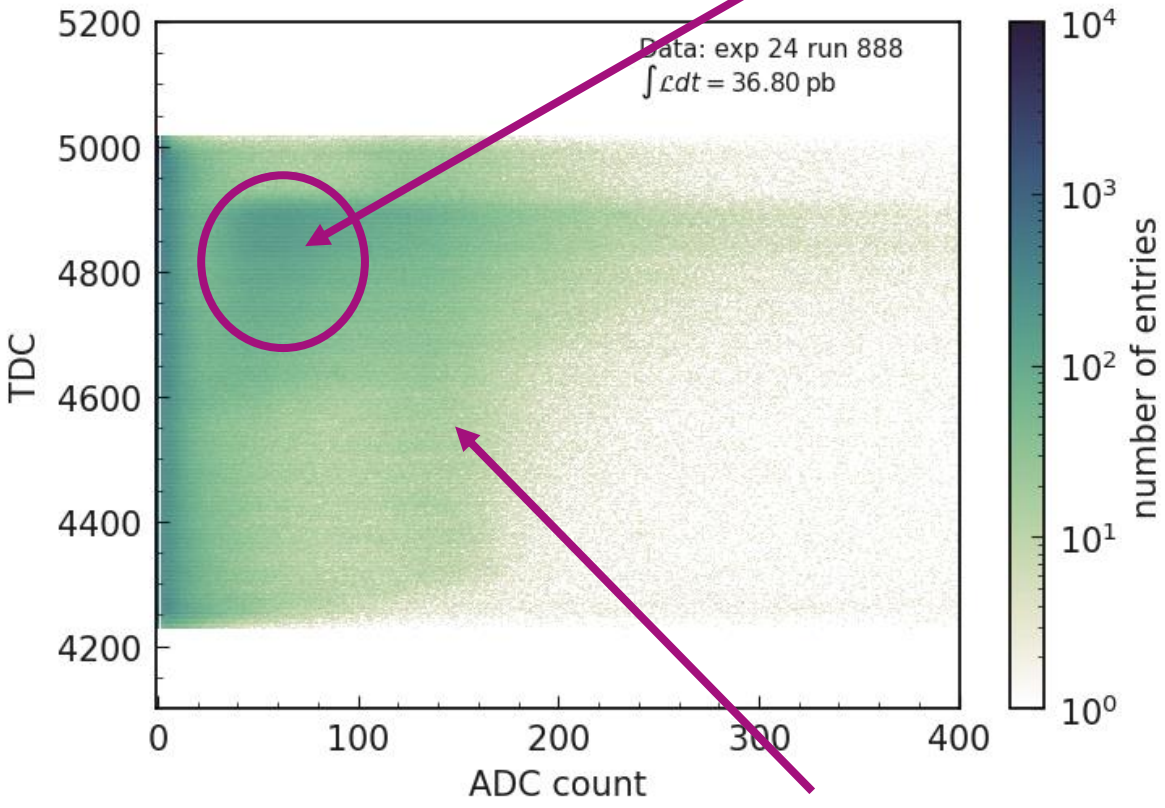




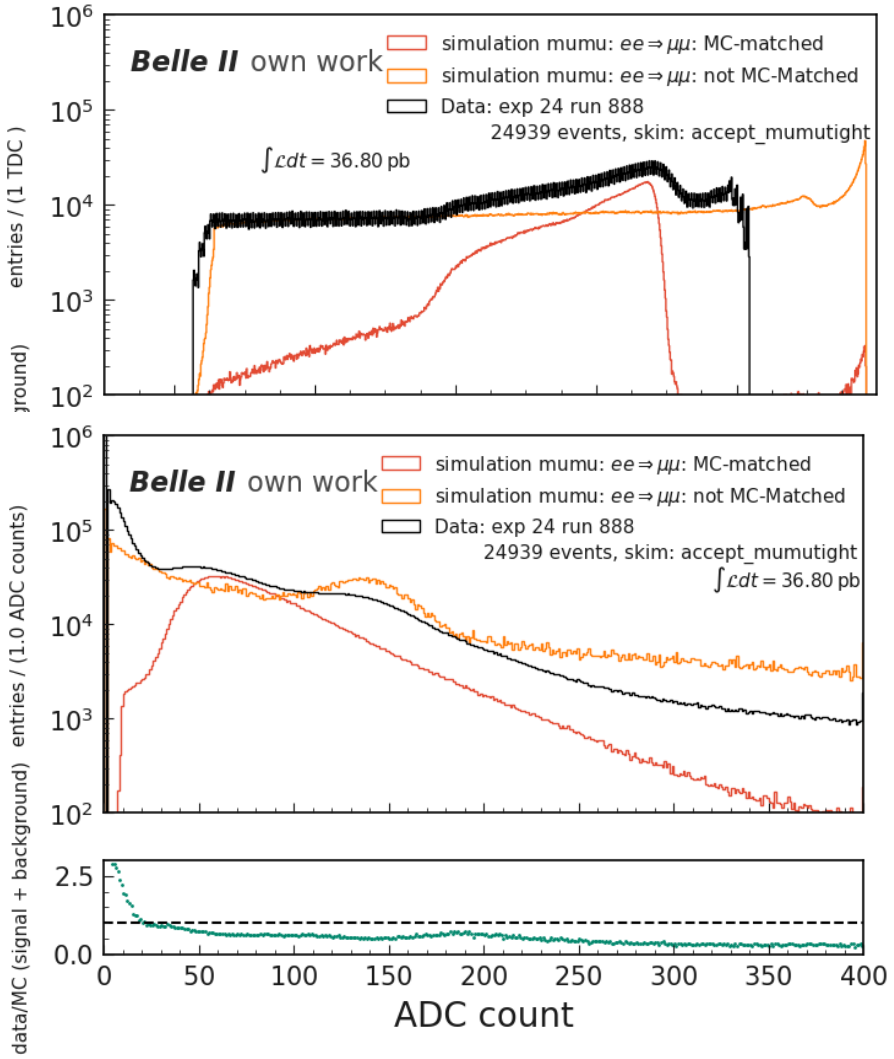
Much more entries

2D Comparison ADC and TDC

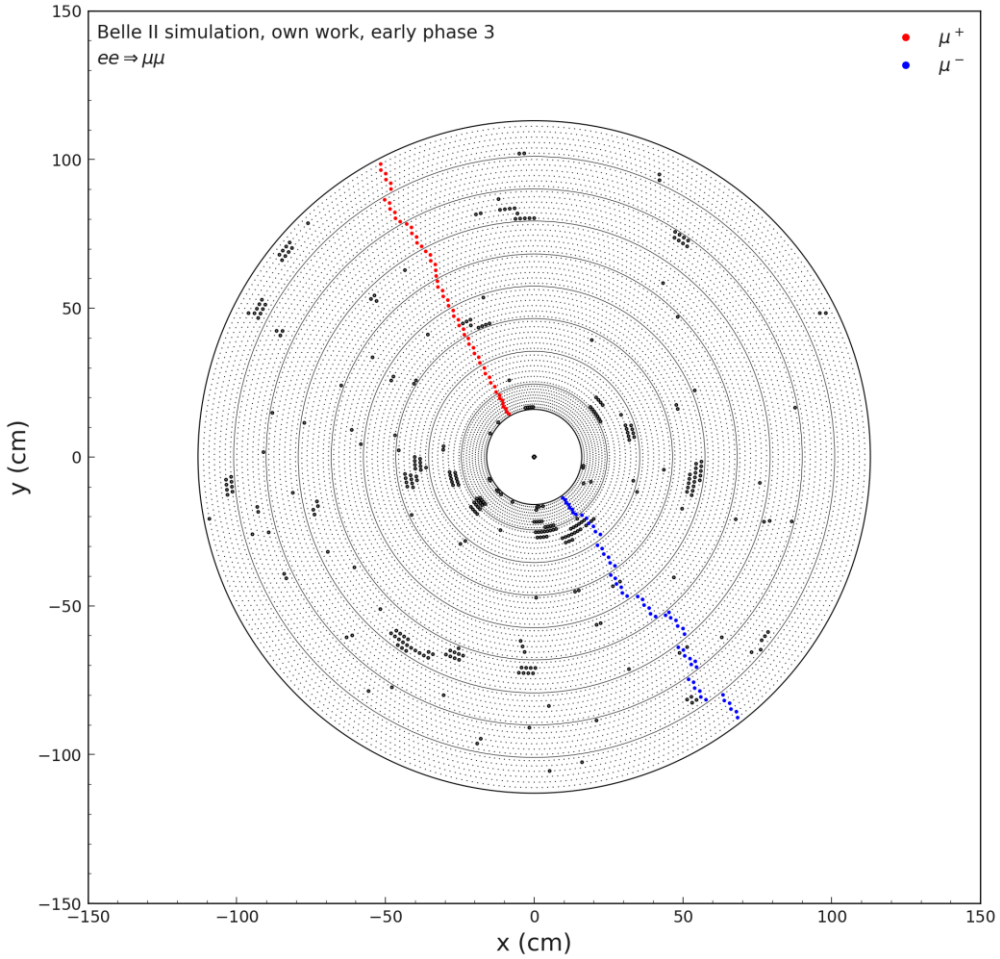
Signal region

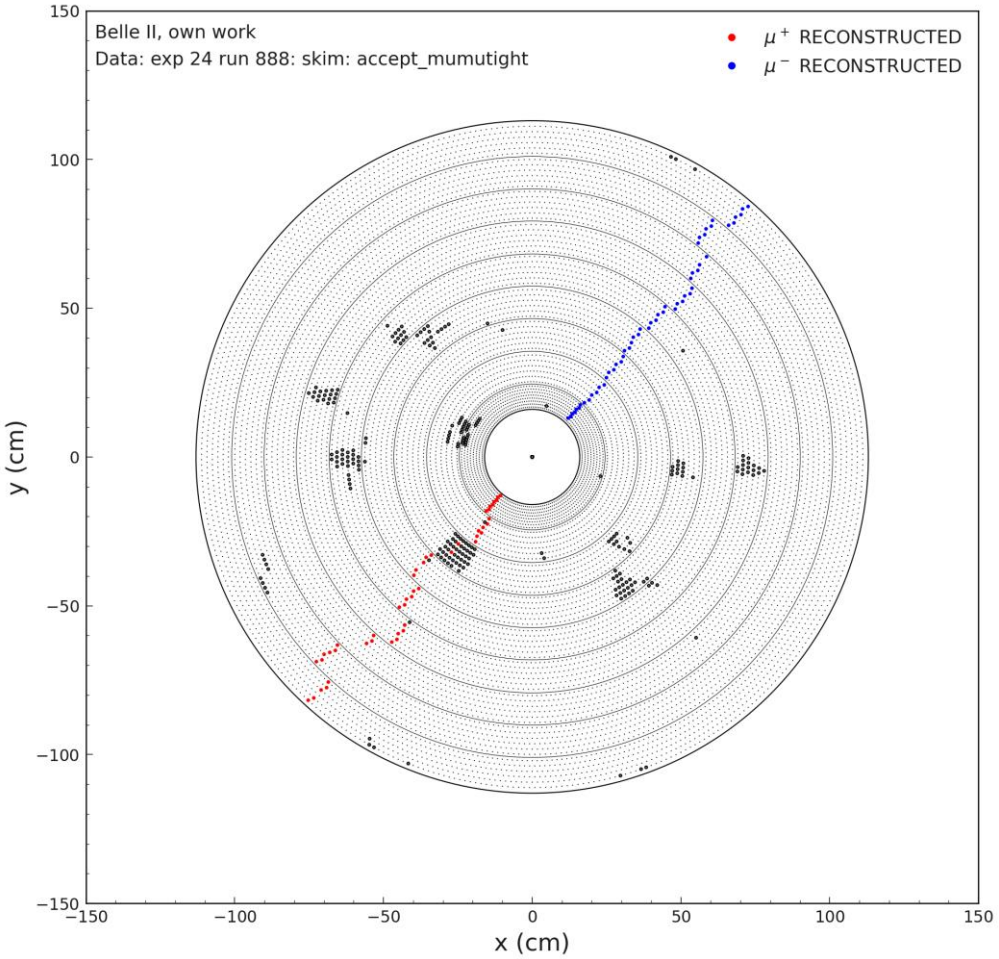


Background region



Event Displays of exp 24, run 888 and MC





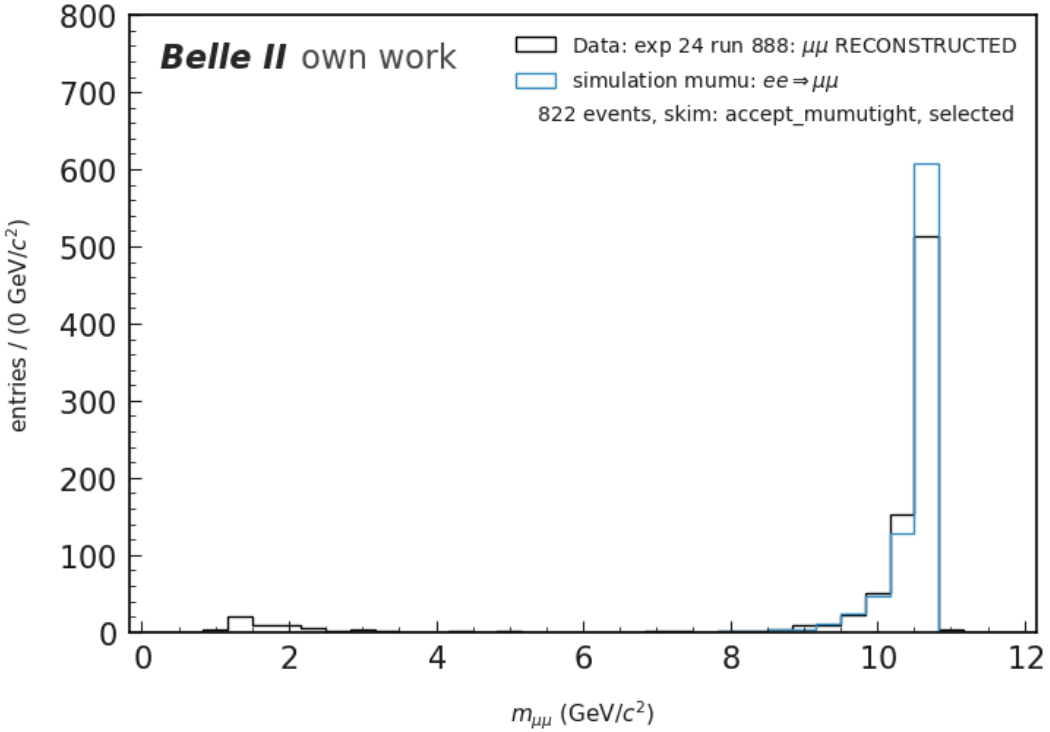
MC Data Comparison – further selection

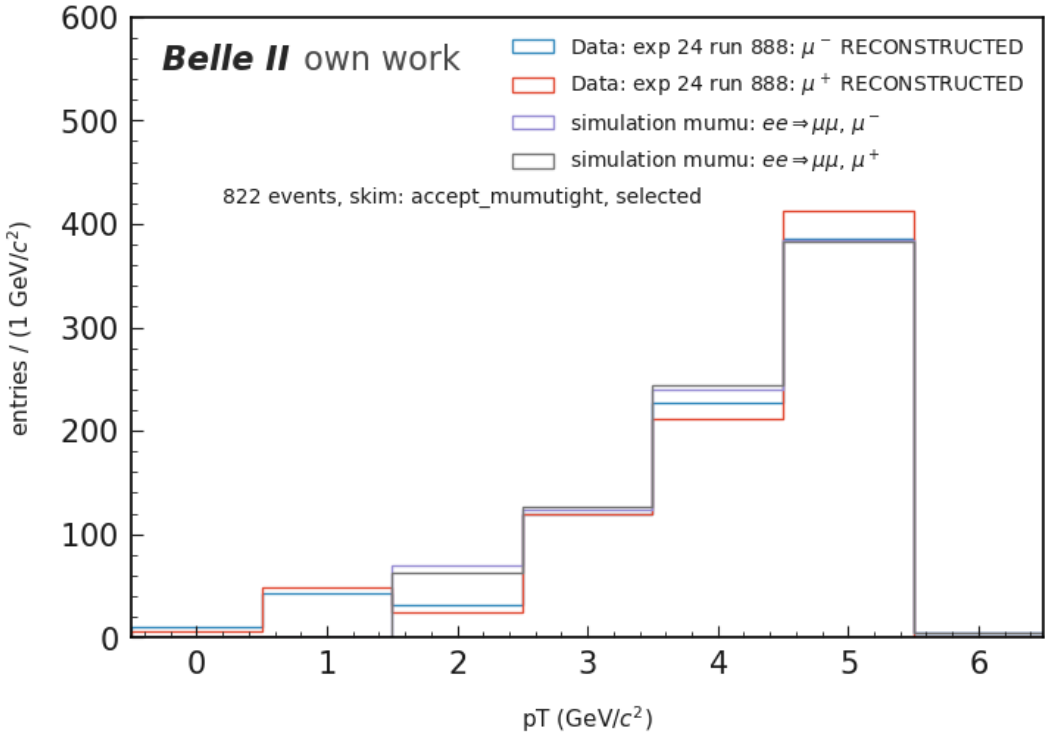
- First selection:

  Events with two muons as most likely particle for two reconstructed tracks

Outlook

- Tighter selection on PIDLikelihoods



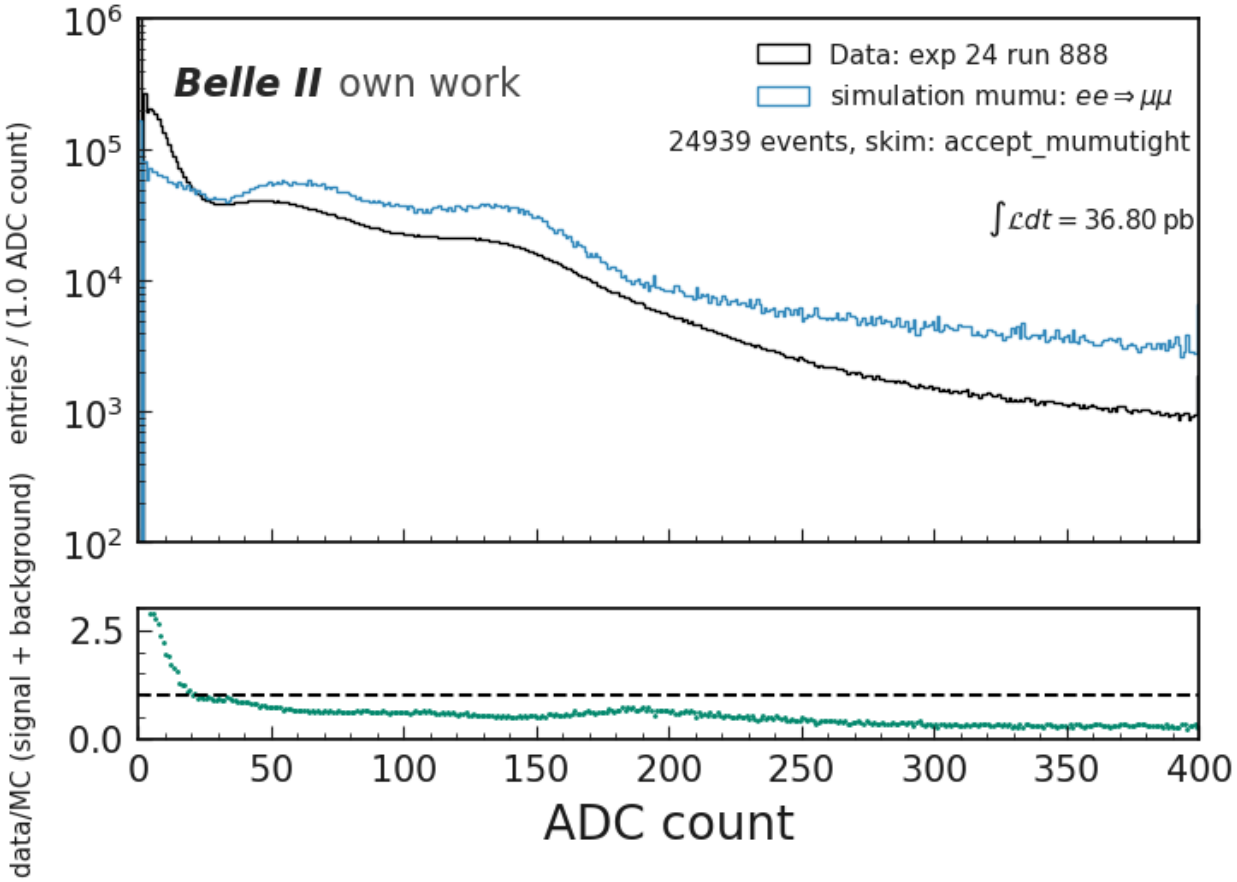


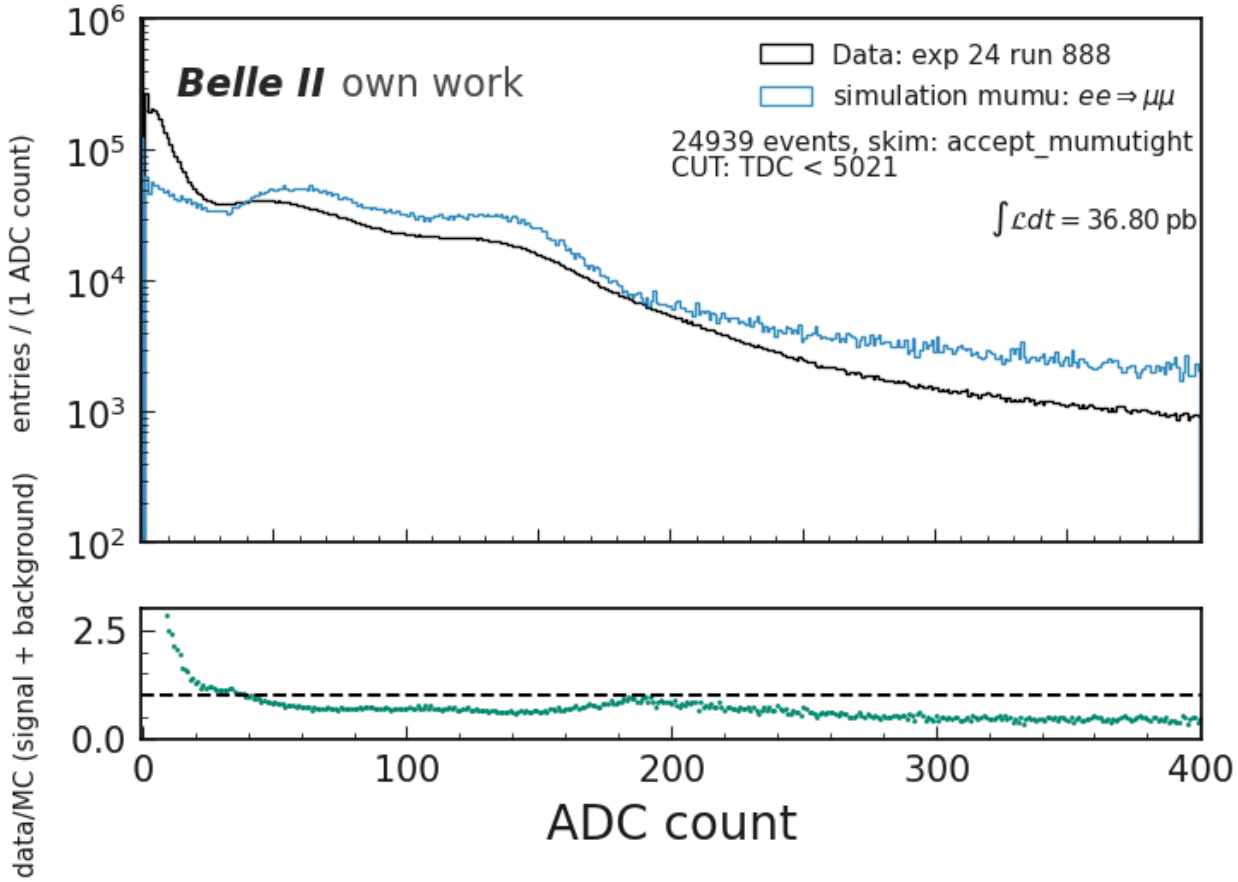
Outlook and Next Step

Outlook

- Apply tighter selection
  - Add the dimuon selection
  - Select on PIDLikelihoods
- Investigate event information, like di-muon mass and muon pt with more runs and all events
- Investigate bin at zero for the ADC counts
- Include more runs
- Event Display with TDC cuts
- New release for the background simulation (pre-release-07)
- Look at the cross-talk modeling

Comparison before and after TDC cut





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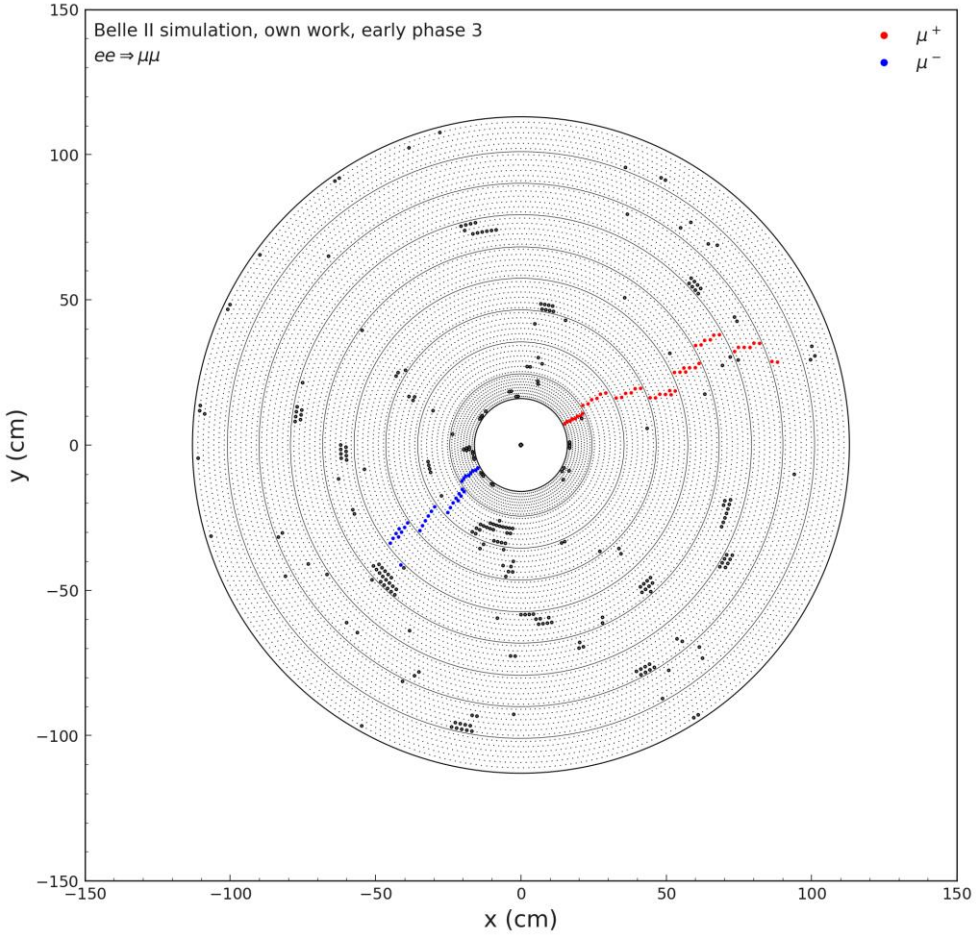

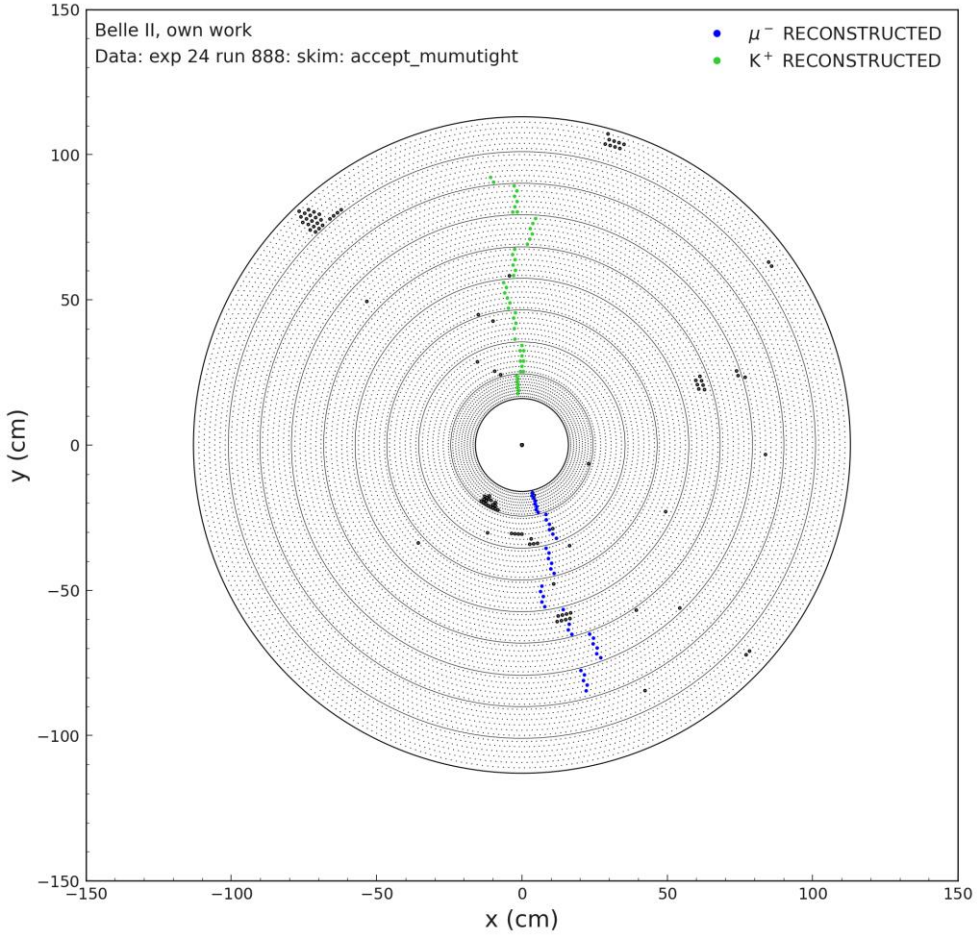

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