The University Of Sheffield.

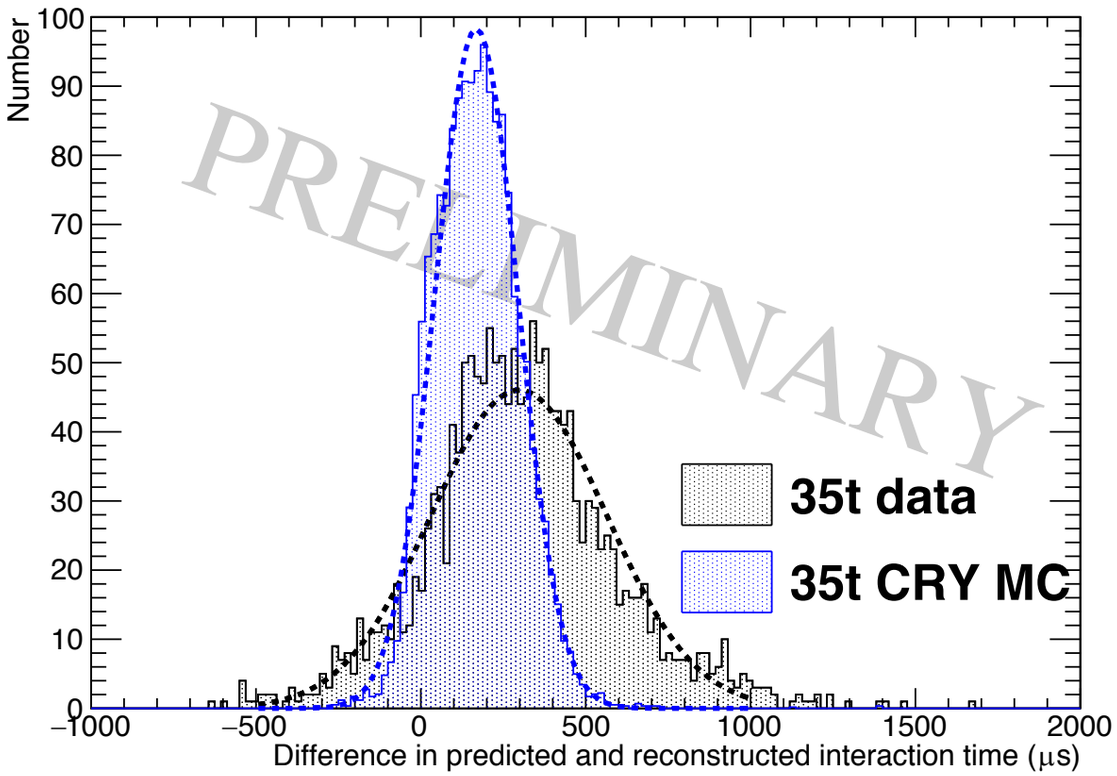
Diffusion updates – mainly MC simulations

Thomas Karl Warburton, with help from Michelle Stancari and Dom Brailsford

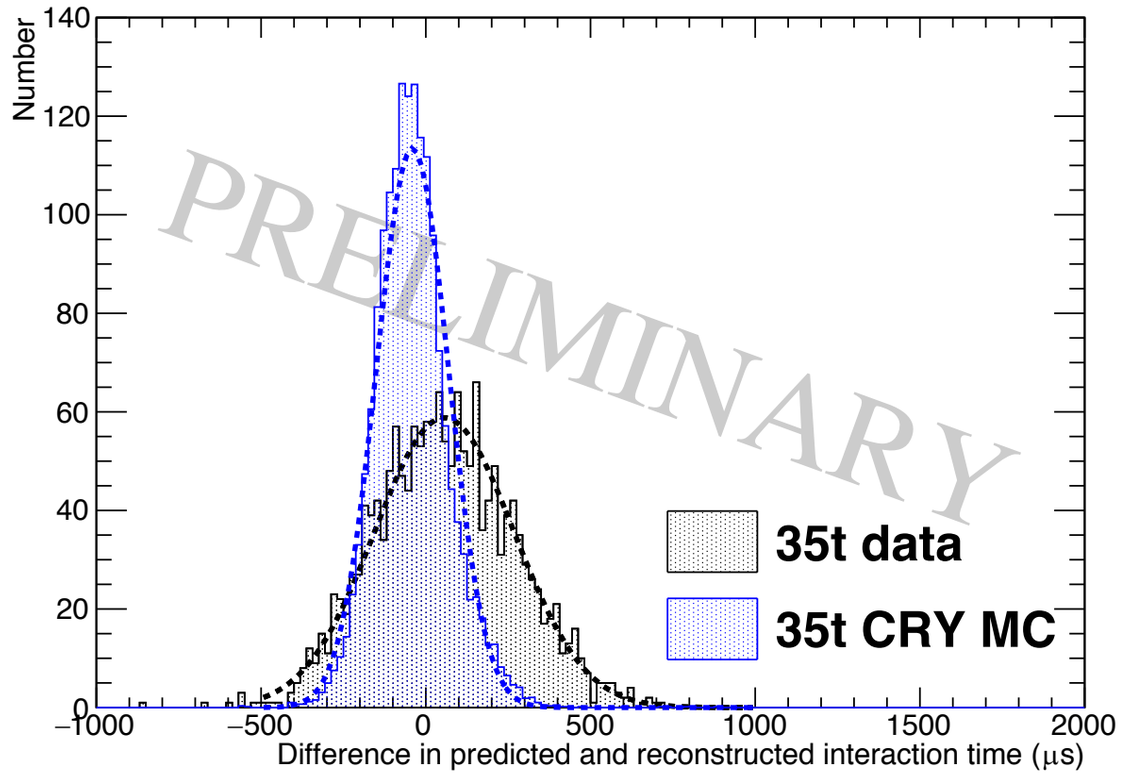
What I've shown before

- Want to determine interaction times using diffusion.
- Use the change in RMS and the change in RMS/Charge of the hits along the track.
- Make look-up tables using tracks with known angles (using the counter coincidences).
- Use these look-up tables on a set of tracks to predict an interaction time for the track.
  - This interaction time can then be compared with the time of the counter coincidence.
- I did this for both a sample of data runs, and an MC sample at 250 V.

What I've shown before – Sept Collab



Predicted times using the RMS metric



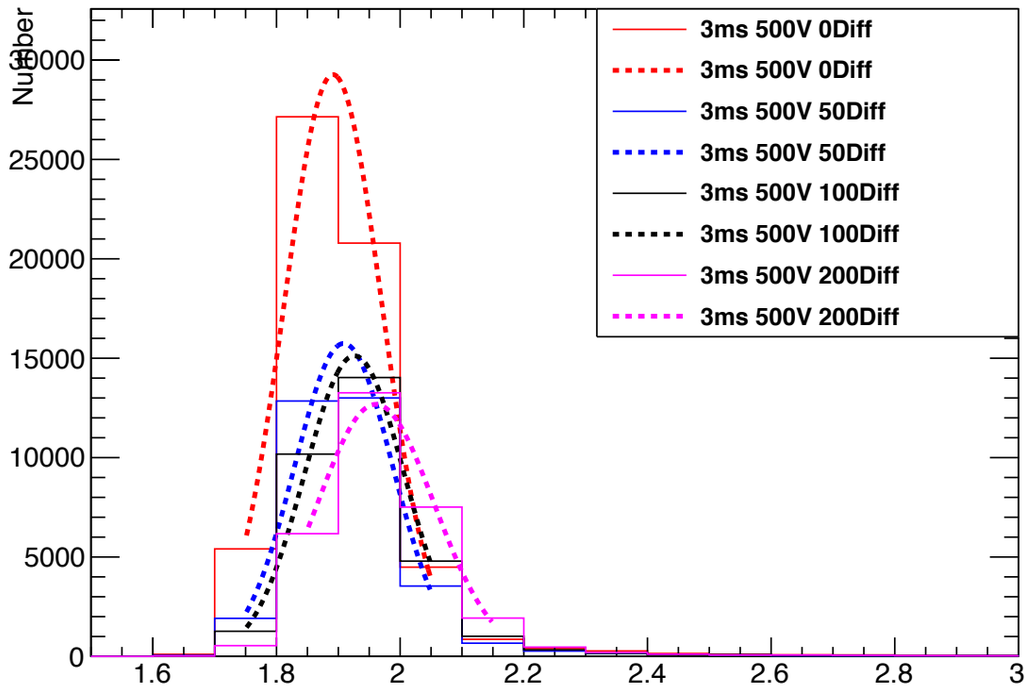
Predicted times using the RMS/Q metric

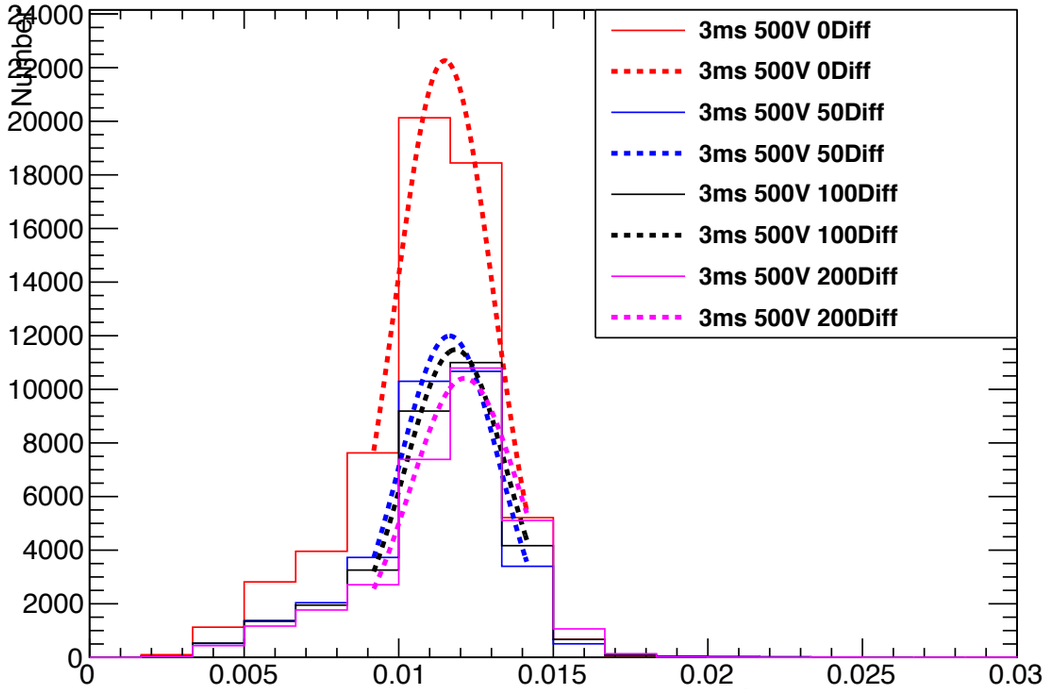
- Increased width of data predictions.
- Tighter distribution around 0 difference for RMS/Q
- When converted to a drift distance this times are < 5 cm.

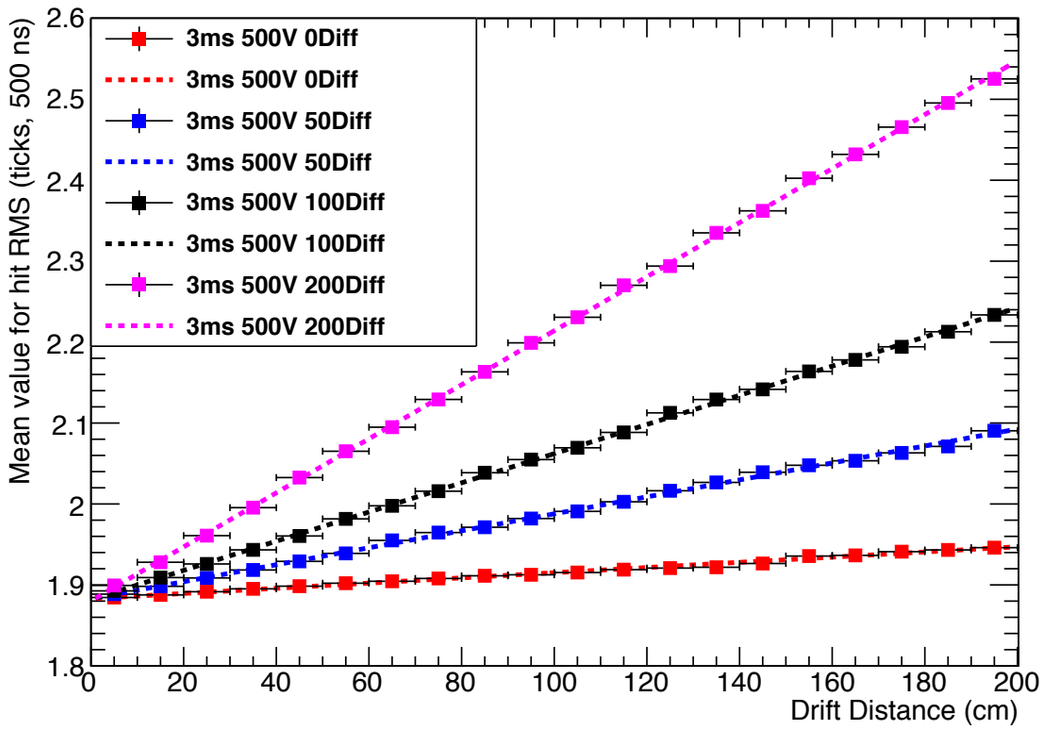
What is new?

- I made some MC challenge like samples with different:
  - Diffusion consts. 0, 50, 100, 200
  - Electron lifetimes: 1, 2, 3, 5, 8
  - Electric fields: 250, 275, 500
- Didn't want to make LOADS of samples, so only change one parameter from a baseline of 100% diffusion, 3 ms, 500 V.

Changing the diffusion constants





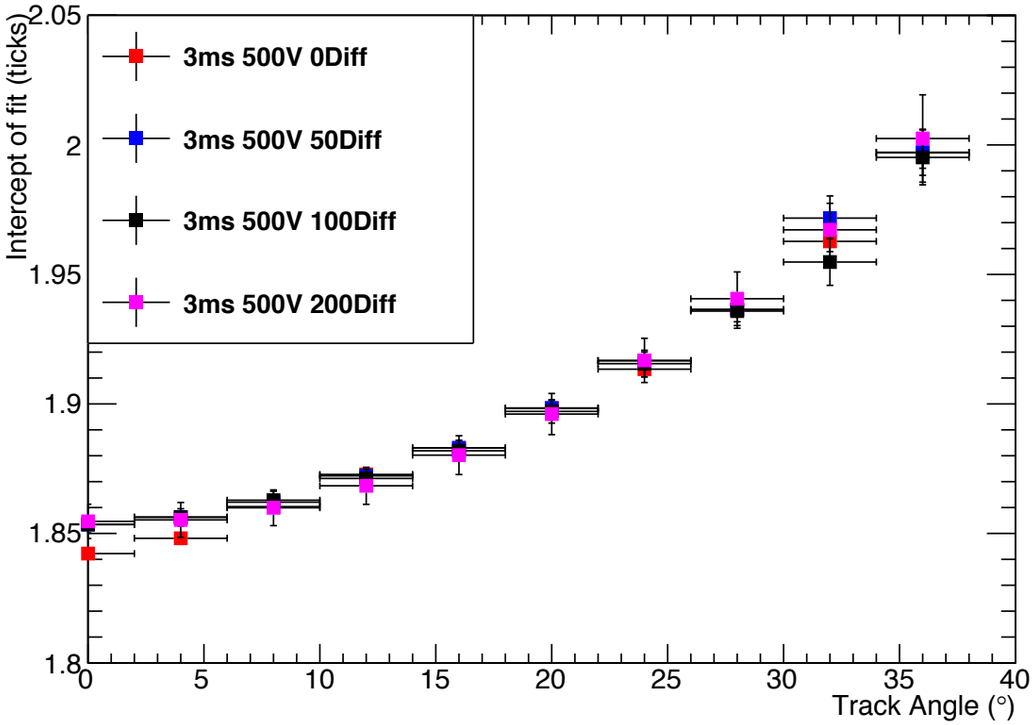


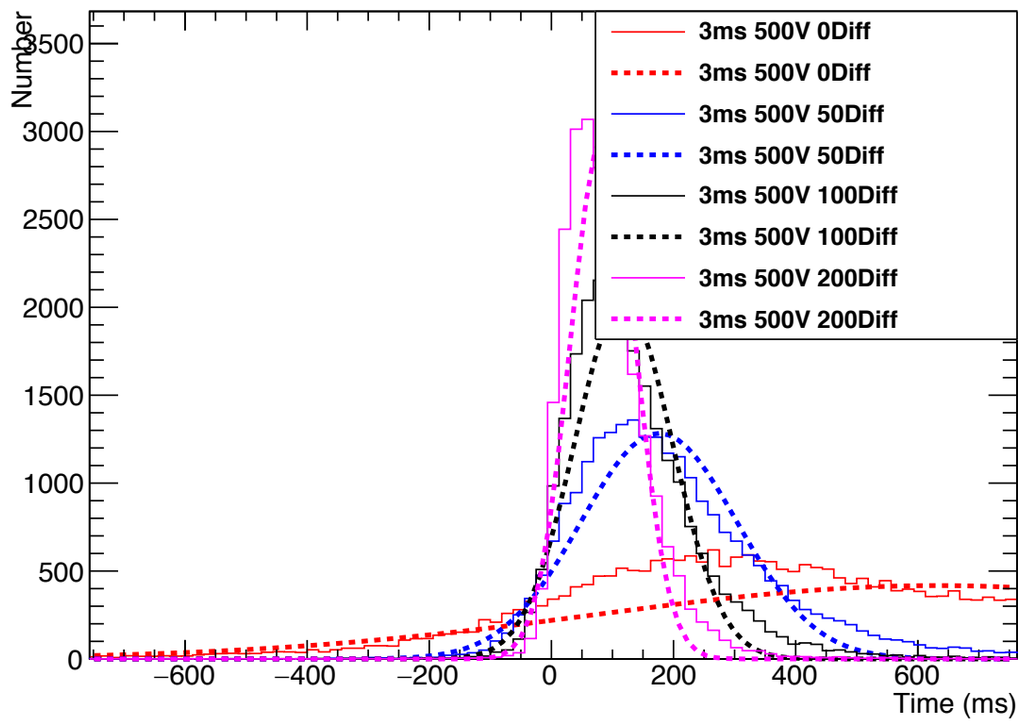
Top Left – RMS at 20 cm

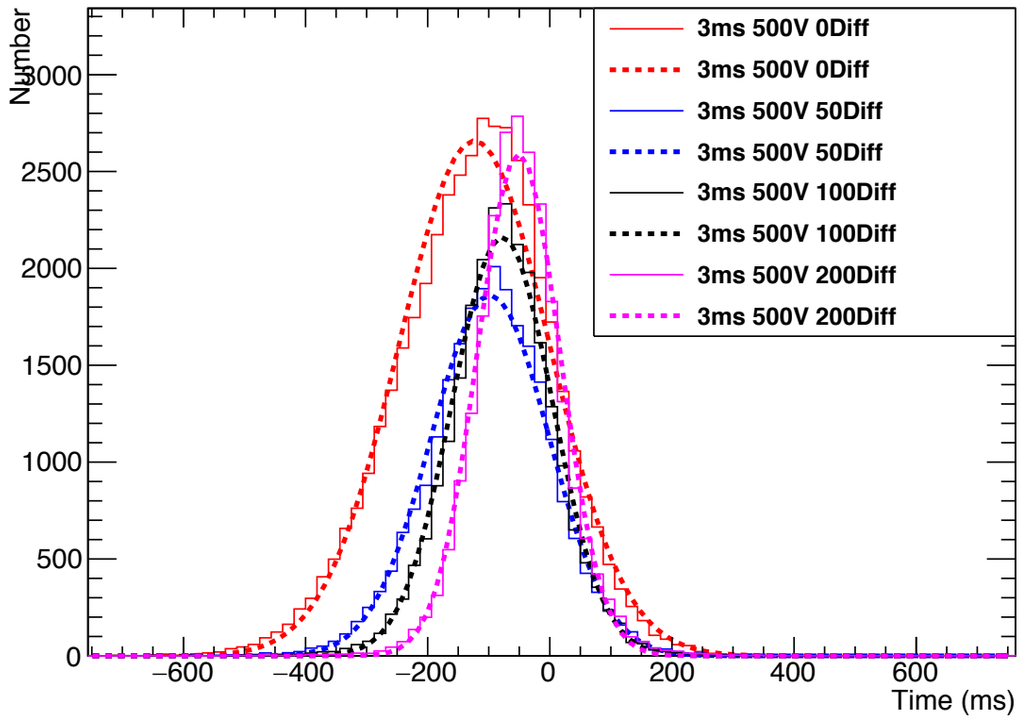
Top Right – RMS/Q at 20 cm

Bottom left – RMS MPVs at increasing drift distances

Changing the diffusion constants





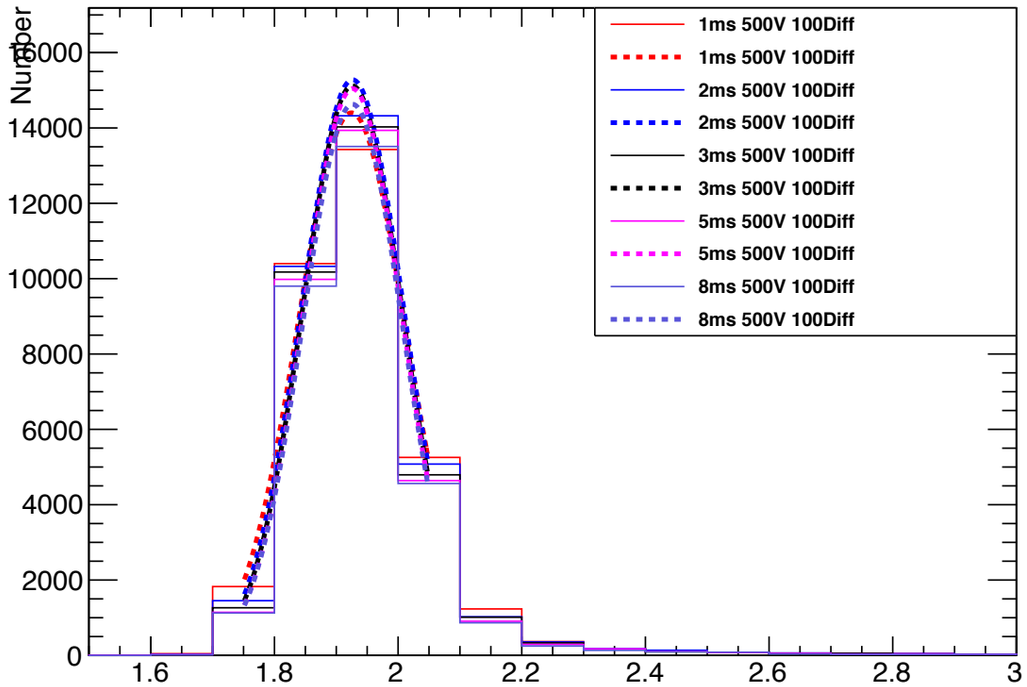


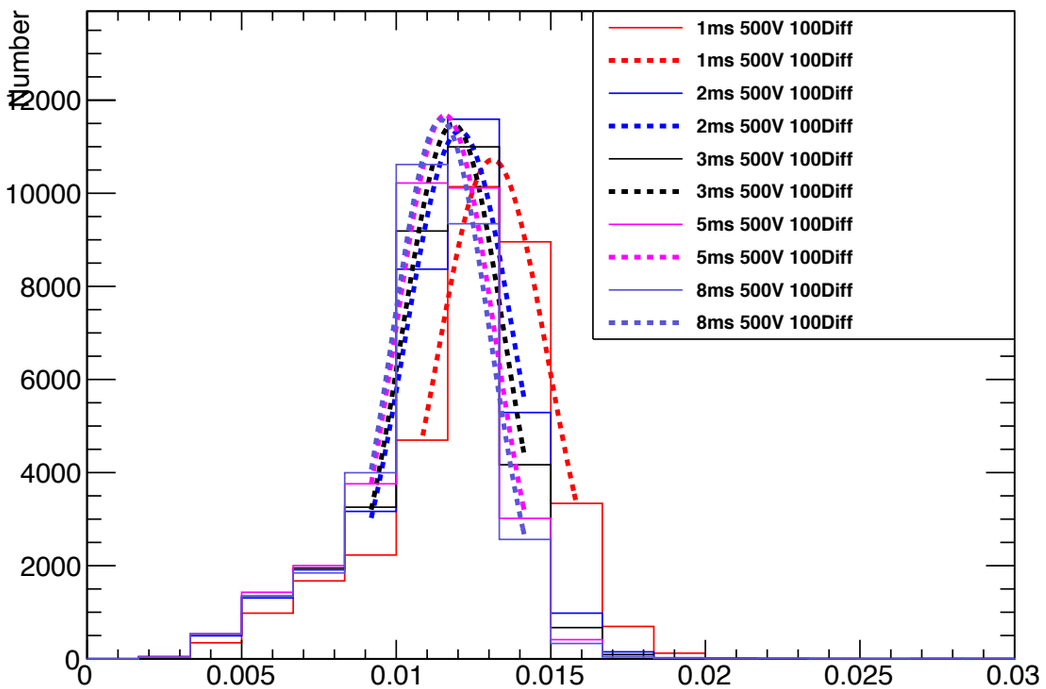
Top Left – RMS MPV at 0 cm

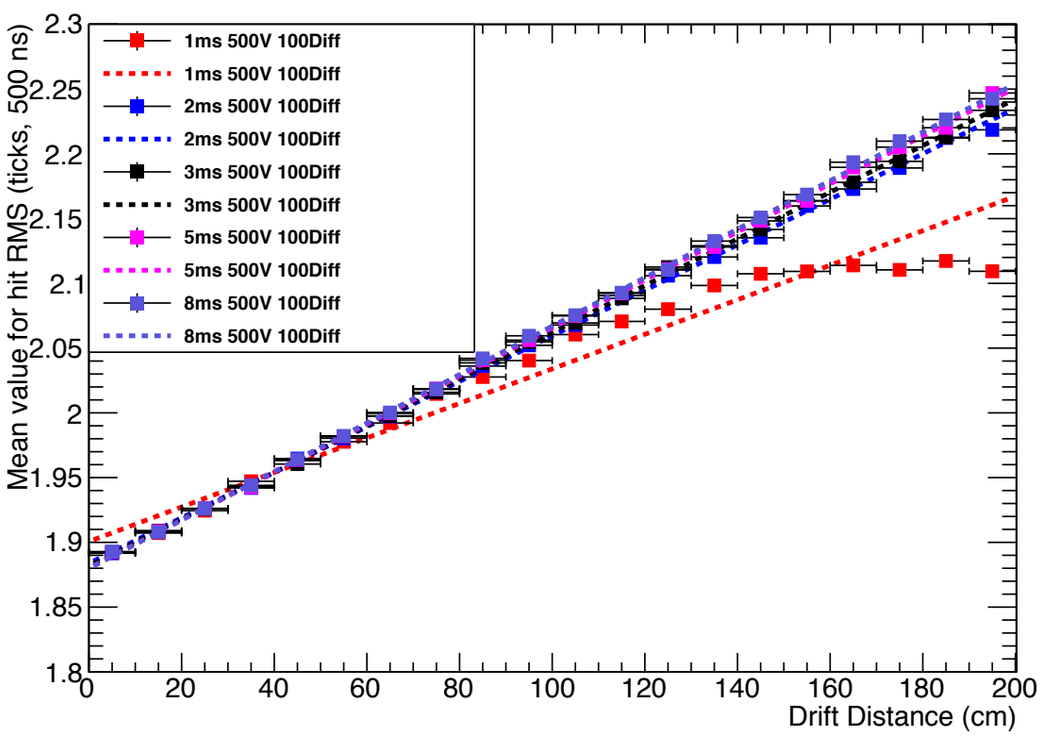
Top Right – AvDiff in predicted and counter time for RMS

Bottom left – AvDiff in predicted and counter time for RMS/Q

Changing the electron lifetime





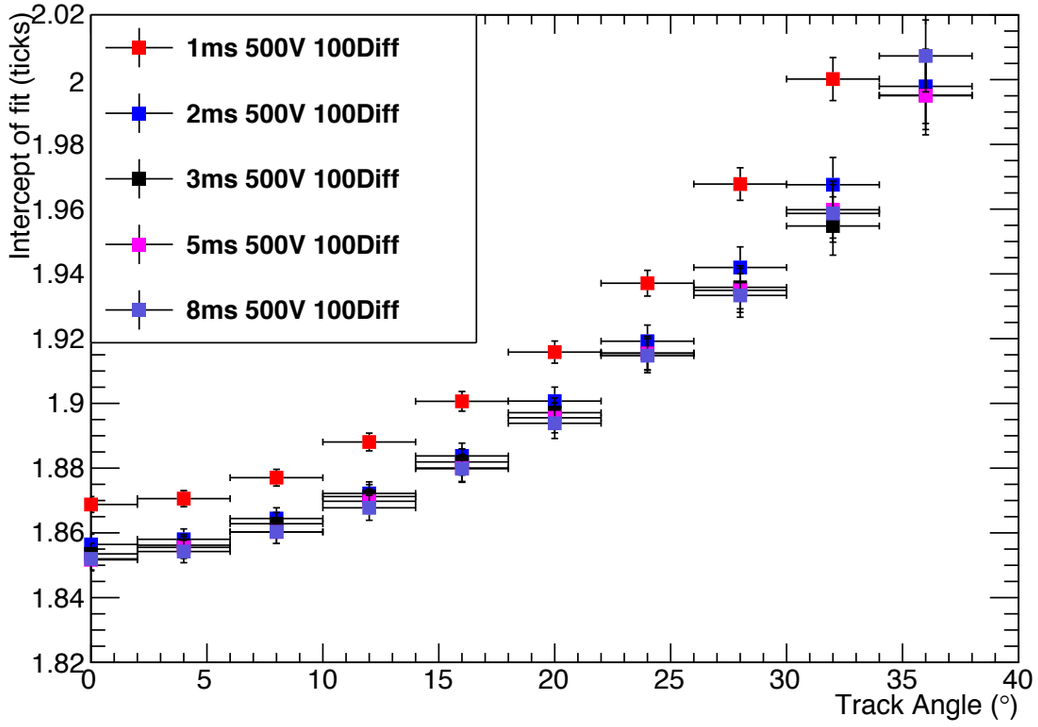


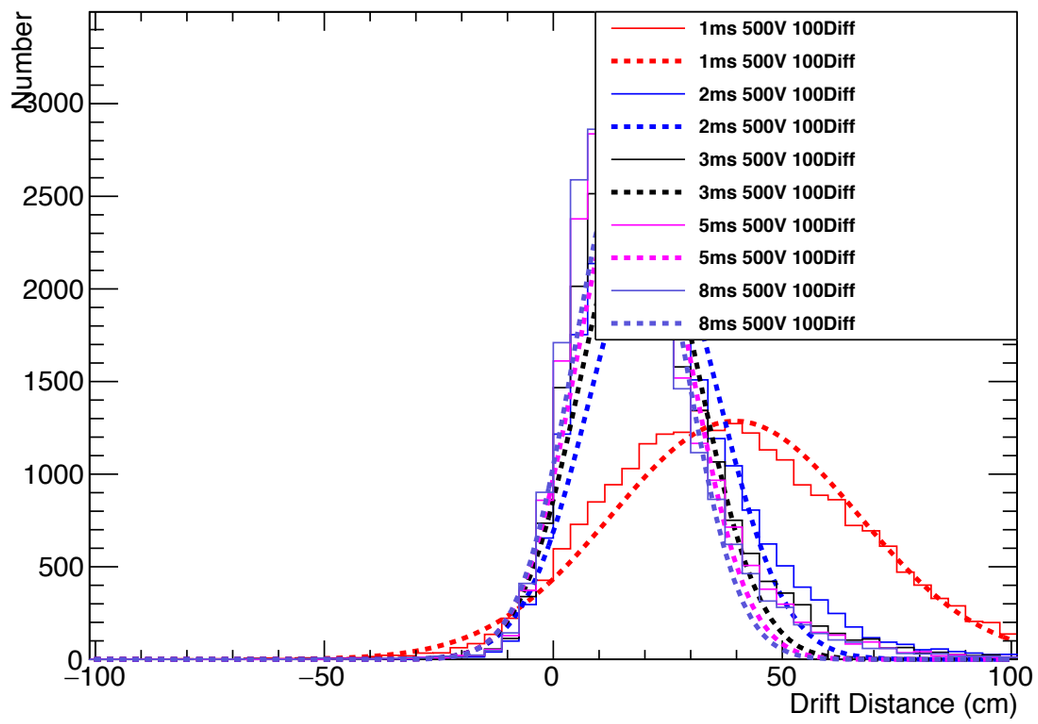
Top Left – RMS at 20 cm

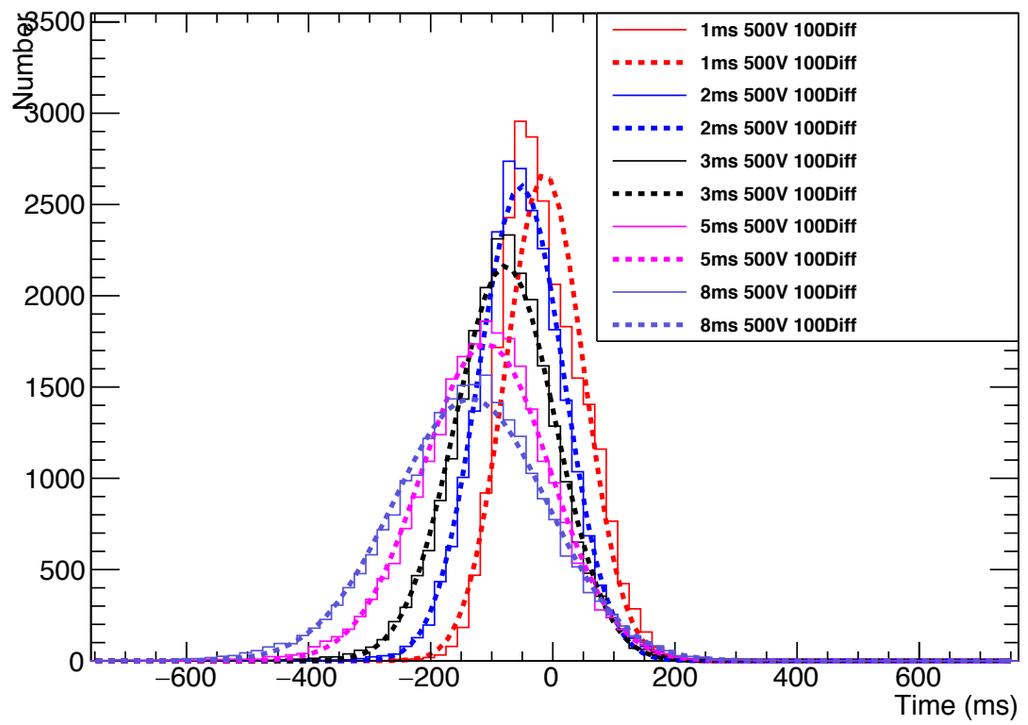
Top Right – RMS/Q at 20 cm

Bottom left – RMS MPVs at increasing drift distances

Changing the electron lifetime





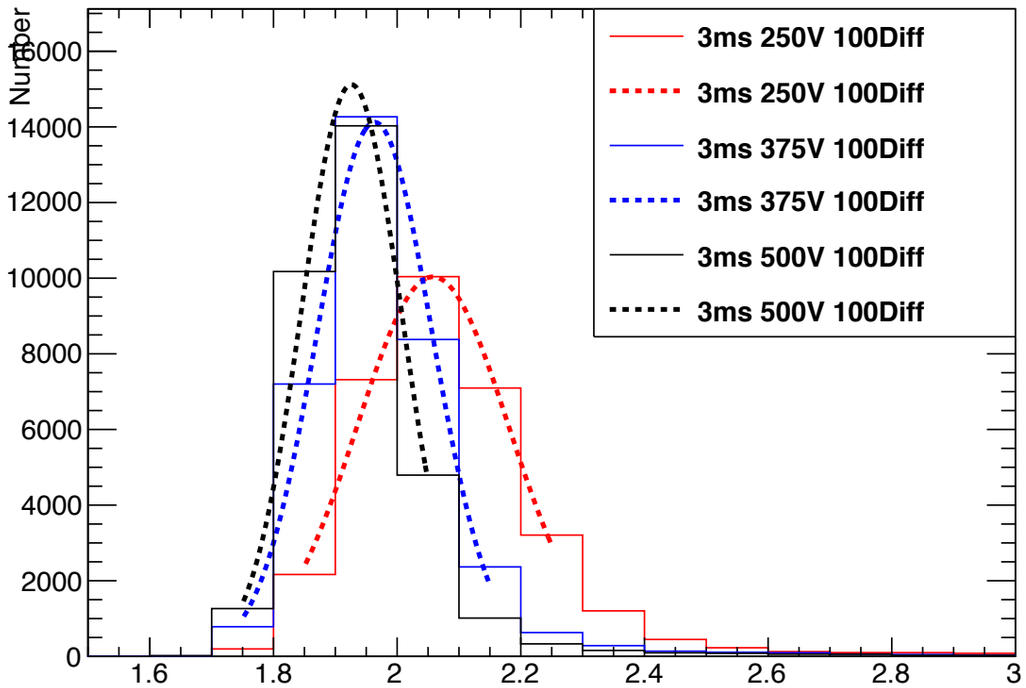


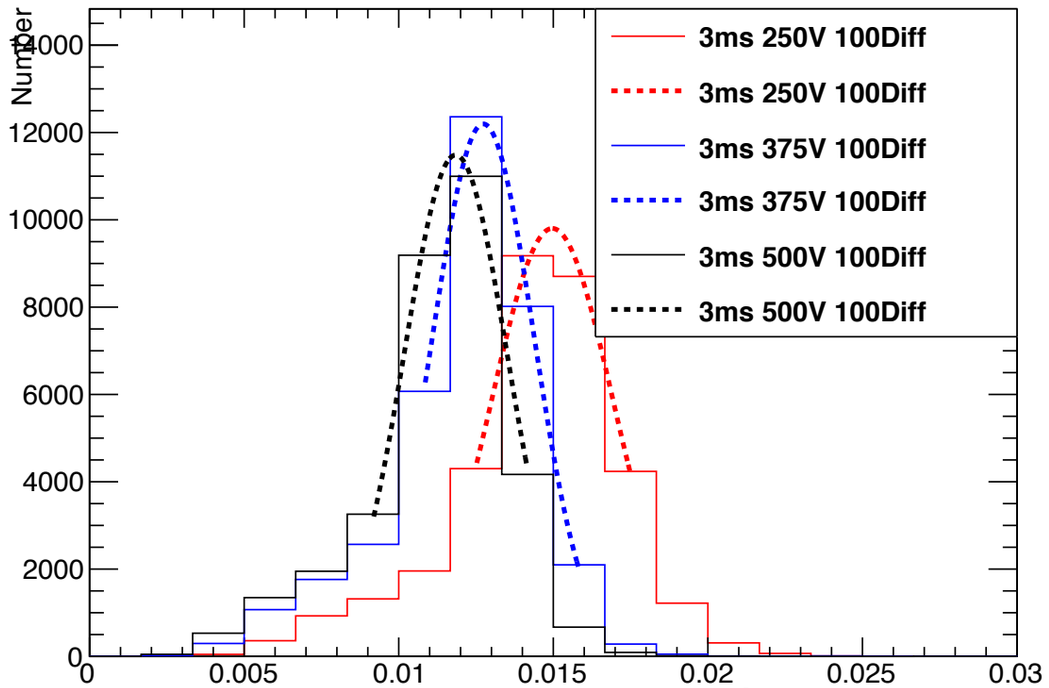
Top Left – RMS MPV at 0 cm

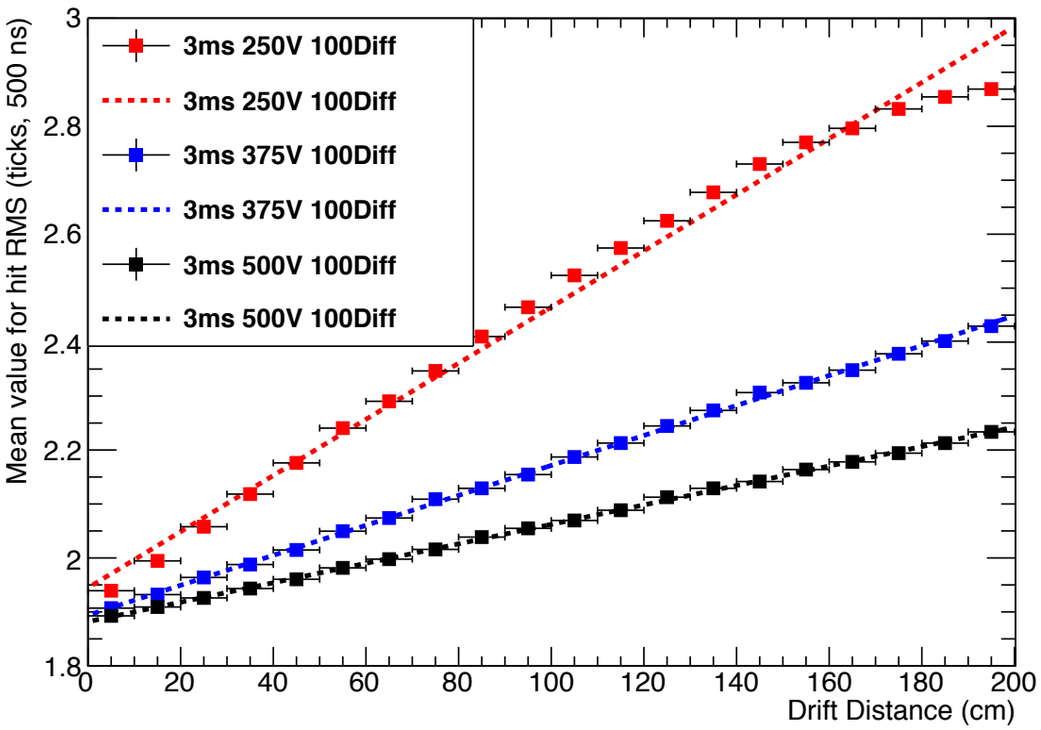
Top Right – AvDiff in predicted and counter time for RMS

Bottom left – AvDiff in predicted and counter time for RMS/Q

Changing the electric field





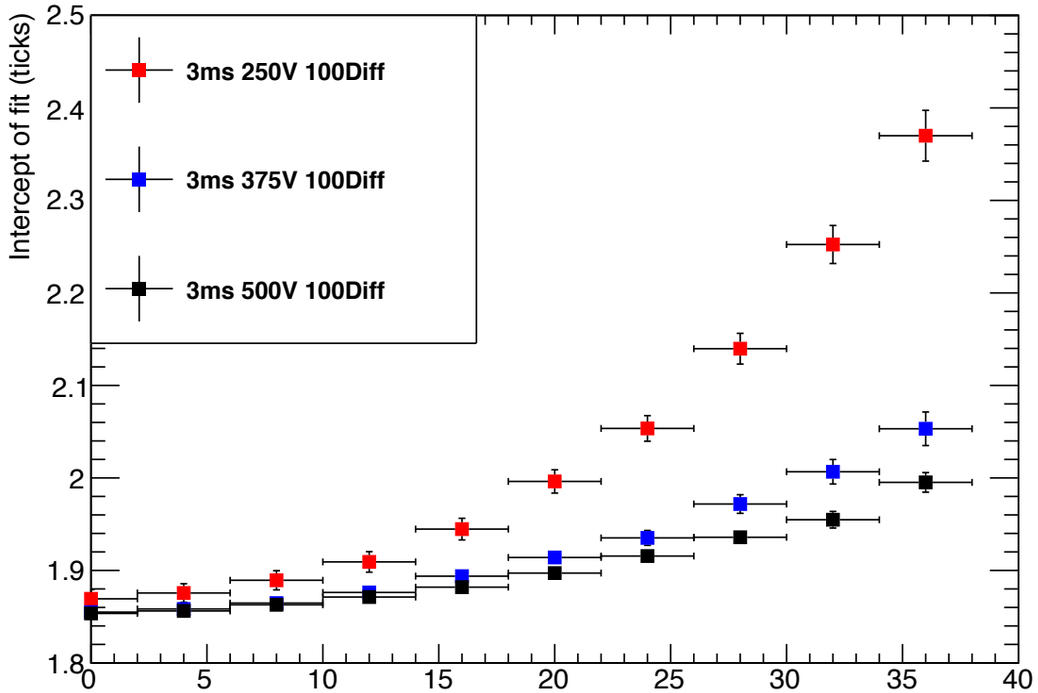


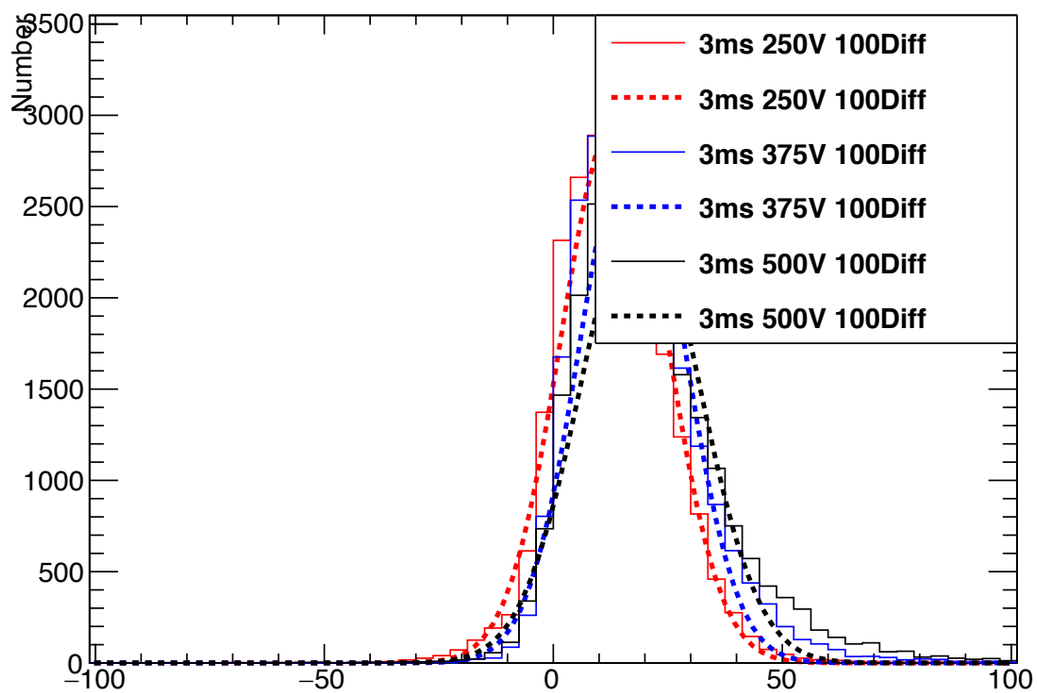
Top Left – RMS at 20 cm

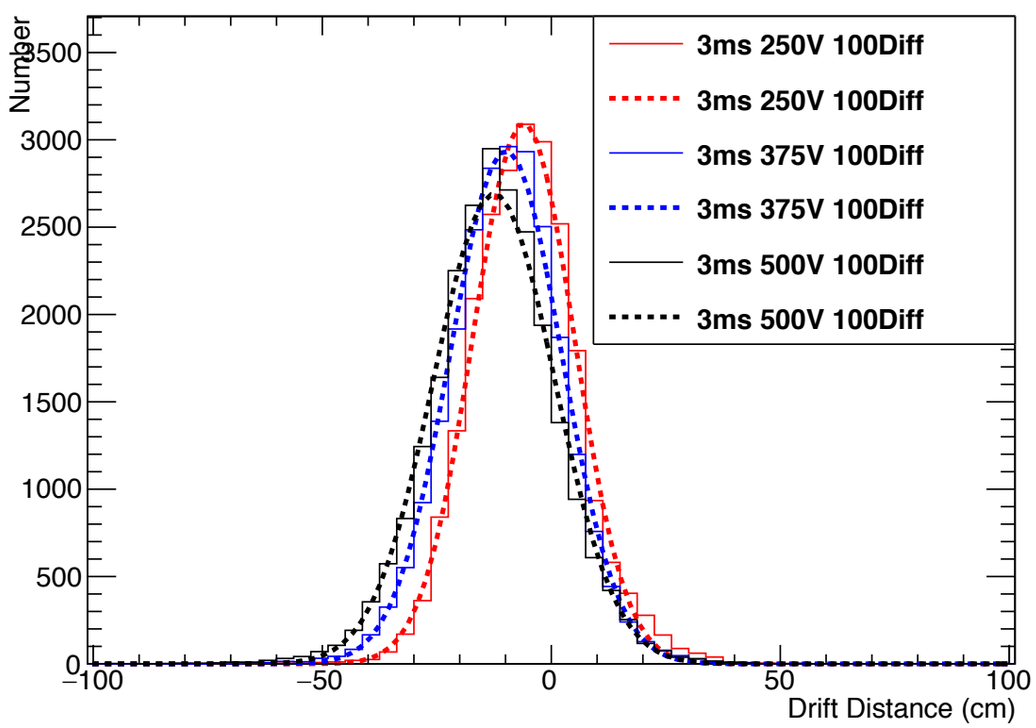
Top Right – RMS/Q at 20 cm

Bottom left – RMS MPVs at increasing drift distances

Changing the electric field







Top Left – RMS MPV at 0 cm

Top Right – AvDiff in predicted and counter time for RMS

Bottom left – AvDiff in predicted and counter time for RMS/Q

Observations from these samples

- I need to sort out the placing of the legends…
- The RMS/Q method is more accurate, even when the electron lifetime grows and when the electric field is increased.
- The distributions are not centered around 0.
  - This is because of averaging numbers found by predicting times from non-symmetric distributions.
  - The first two plots for each sample aren't symmetric but when calculating AvDiff I take the average of the predicted times for hit.

Still to do…

- I also want to make a sample which has increased noise levels. I wasn't sure what to do about tuning of reco, but I think I'll just try increasing threshold?
- Only using EW counters for this, so a very narrow range of angles.
- Only using collection plane wires, so not sensitive to vertical muons.
  - I don't have time to expand the angular range used for my thesis, but as a proof of principle application to only collection planes is enough (Michelle and I).