Flip Mode Referees Meeting

14:00 GMT 6th December 2021
Chris Rogers, Ken Long, Paul Soler, Dan Kaplan, Jaroslaw Pasternak

Main update is to address systematic uncertainties.

Paul has looked at the TOF efficiency. We noted that the efficiency in data is almost always better than efficiency in MC.

Noted discrepancy between TOF01 in MC vs data. Paul performed a scaling procedure. Normalised by the electron peak i.e. TOF → TOF/TOF(electron) and noted things looked quite good for electrons and pions. Muons on the other hand have a decay so things are not so clear. After cuts Paul noted a discrepancy in muon relativistic beta of about 0.5 %. It seems to be significant (in a statistical sense) across all the data sets. Corrections seem to make things worse. We concluded that TOF is good enough for PID and we will leave it as far as e.g. momentum calculation is concerned. However it does need to be considered as a possible source of systematic error in addition to the ones already considered. **Action: Add TOF01 discrepancy to the systematic uncertainties list.**

Paul considered using TOF normalised to the electron peak to look at momentum. Noted that the data vs MC discrepancy looks worse. Systematic offset is about 1 MeV/c. We noted that this is comparable to e.g. the systematic associated with track reconstruction.

Paul noted updates in the hybrid MC. Systematic effects now look physically correct. We discussed what should be the magnitude of the Centre Coil systematic. Field variations are about 1 %. Dan noted that the field measurements are known to much better than 1 %. Noted that another estimator for the momentum uncertainty is the energy loss in the absorber. **Action - couple of options:**

1. Propose to fit as best as possible the MC field at the Hall probe position to the Hall probes and data from Joe Langland's thesis. Redo the reconstruction. Systematic uncertainty is the difference between the fitted field and the Hall probe field.
2. Look at the effect of moving the coils to make the field closer to the mean field. What is the effect of changing from uniform to non-uniform? Put in a uniform field.

Action: Also noted that we can use momentum change in the absorber as a proxy for emittance change/cross-check. Momentum is exactly conserved in the magnetic fields, and for empty absorber case at least there is not much material in the beamline; compare MC truth/MC recon/data recon of total momentum difference upstream to downstream. We noted that in the nature paper only TKU CC was included in the systematic uncertainty budget.

We discussed the MC sample size. Paul noted that while some MC statistics can be a little low, they don't affect the result. The analysis is systematics limited.

We pointed out that it may be appropriate to look at some systematic effects on the MC simulation. Misalignment of the MC beam to the solenoid, as compared to the data, was the leading order systematic on the nature paper. **Action: Have a look. Propose some reasonable approach.**

We asked about the 170 MeV/c data. Paul noted that he is working on it, on a "best effort" basis.

Submission deadline is April. Plan to submit ASAP. Chapter should have been written by the end of the year. Noted that 140 MeV/c analysis is the most important part of the analysis. 170 MeV/c will come next.

6 pm Wed. 15th December GMT.