

## Solenoid Mode Referees Meeting

08/09/2021 15:00 BST

Ken Long

Chris Rogers

Tom Lord

Steve Boyd

Jaroslav Pasternak

Maurizio Bonesini

Tom introduced the analysis with a general status update. Official MC update has been included but missing some 3-140. Systematics is in progress. More systematics is coming. Tom has found a discrepancy in the Q4-9 settings for some settings which explains the difference in the data for some “nominally same” setting.

Tom noted that data had a number of events with no TOF0 spacepoints that were not reproduced in MC. There was slightly worse agreement for TKU chi2 but not expected to be significant for the analysis. TKU fiducial volume cut showed some slight discrepancies. The TKU momentum looked quite good. TOF01 was offset by about 100 ps (as usual).

Diffuser aperture radius cut showed some reasonably significant discrepancy. A second peak was still present in the 10-140 data. Tom thought that it occurred due to the incorrect description of the diffuser at the edge of the bore, especially when the irises are closed. The residual support structure, which becomes dominant at 10-140, is not well-described. **We proposed normalising the plot to number of events inside the cut, or perhaps normalise to the peak.** The incorrect tail may have messed up the normalisation, which makes the data inside the cut look worse.

TKD chi2 also has not great agreement, but again not in the region where we are cutting. Tom pointed out there is also a low pt hole in MC which could cause it, and is not present in the data. It was noted that incorrect simulation of TKD misalignment and glue density can also produce the discrepancy.

TKD fiducial cut looks good.

TKU px shows reasonable agreement. There were fewer events in the peak in the data as compared to MC. A quite visible misalignment in TKU py between MC and data was observed, systematic across all the samples. Also misalignments were visible in x and y. We noted some slight discrepancies in 3-140 - it looks like stronger correlation between x y in the MC.

We asked about sample sizes. Samples varied between about 20k - 100k, after cuts. MC sample size was more like about 40k-50k. At the moment we don't know if we are systematics limited but suspect we are, so come back to MC sample when we have a better handle on systematics.

We looked at downstream distributions. **Tom was asked to include a TKD pz plot.** Otherwise they looked good.

Tom showed the PDFs. The band width is combined stats + sys errors (but note that sys error is not well-done). We briefly discussed errors but decided to postpone until the sys errors are done better. **Please include systematics correctly – thanks.**

Tom noted concern over the 3-140 PDF ratios. The upstream amplitude distribution seems to be quite different. The data has lower emittance. **We suggested looking at the amplitude ellipses as a function of amplitude cut.** We discussed looking at the upstream amplitude distribution of the downstream sample – it would exclude the effects of inefficiency and scraping while including filamentation effects.

We noted that there is some evidence of apparent cooling in the 10-140 setting. We were a bit confused about the CDF ratio in the 10-140 which did not seem to be consistent with the amplitude histogram. Tom said during the meeting he thought he had messed up the plot versioning. **Please check.**

Tom showed the magnitude of the correction (efficiency and resolution). 3-140 the lowest amplitude bin is about 20 % correction. For others it is more like a few %. We discussed the origin, noting that resolution can potentially have an effect. There was a concern that the corrections were on the large side. Chris commented that in the nature paper the correction was about half the signal; and the systematic error was half again (so about one quarter the signal).

Tom summarised outstanding issues.

- 3-140 LH2(-EMPTY) amplitude distributions show MC-Data disagreement after updated MC, data is denser around low amplitudes than MC
- Canonical angular momentum tracker alignment
- Hybrid MC production still coming, having resolved some bug fixing.
- Inclusion of MC beam position offset systematic, expected to provide large contribution to errors

We discussed systematics status. There was an issue with the systematics – Tom has found a bug and corrected. Rerunning.

We discussed the systematic errors. We asked about whether we should add a systematic error on the vertical displacement, or vertical angle, as well. Chris comments that a 3 mm displacement or rotation could be about any axis, but the horizontal was chosen for convenience. The referees were satisfied.

We discussed the possibility to do angular momentum in a separate paper, as requested by the other referees. Tom and Jaroslaw agree. Concerns were expressed with the thesis time frame.

Jaroslaw proposed finding an “integrating” author. It would need someone who already knows how to drive the analysis/etc.

Proposed when the next iteration should be. Thesis submission deadline is Nov 1<sup>st</sup>. Mid-October was proposed.