Dear Editor and Referee,

Thank you very much for the additional comments and suggestions, we have implemented them all with specific comments addressed below:

"-line 290: maybe you can first mention figures 5 a,b and c , and then figure 5 (d) ? right now it's a bit confusing that figure 5d is mentioned and then figure 5 (but figure 5 d is part of figure 5)"

Implemented as requested, clarifying the wording and putting references to 5abc before 5d.

"-figure 5d: one doubt I have on Figure 5d is why the angular separation is not peaking at zero. Of course the absolute value is plotted in this case but still shouldn't it peak at zero and then have a width given by the resolution ? maybe a brief explanation could be given of why it isn't the case (for both MOO and LSQ) ? I think the same effect can be seen in the 2D plot, in particular in the theta difference shown in figure 5 (c)."

The distribution of angular errors peaking above zero is an interesting point. First, we would like to clarify that the distribution in the 2D plot (5c) does in fact peak at (0,0), and the distribution looking asymmetric was a binning artifact. We have centered the binning of the plot to make this clearer.

As for the peak of the angular error distributions, this largely stems from our decision to present angular error as an angle, rather than its cosine. We feel it is a more intuitive metric of the algorithm's performance. There are two ways that we have found helpful to understand why the mode of the pointing error is above 0:

Firstly, the pointing accuracy is calculated as the arccosine of the dot-product between the generated and reconstructed unit vectors (we have added a line to make this clear to the reader). The distribution of dot-products is steeply-falling away from +1 (which corresponds to an angular error of 0). Making the arccosine transformation to degrees brings with it an inverse Jacobian factor of sin(x), which vanishes at 0 and so the distribution as in 5c will do so as well.

Secondly, to leading-order, the pointing accuracy is the square-root of the sum of the squared errors in the theta and phi reconstructions, each of which are symmetric, zero-centered, and (at least approximately) independent. This makes the pointing accuracy distribution similar in character to that of a chi-squared distribution, which exhibits a mode above zero.

We have added a small explanation of this effect in the caption of Figure 5 as well.

"- line 316: outperform -> outperforms"

Implemented as requested.

"- figure 6 b: maybe a comment can be added in the caption, on why there is some more clusterization at reconstructed track length = 50 mm ?"

Implemented as requested, we have added some additional sentences to the caption commenting on this phenomenon and its origin.

“- table 1: I don’t know if you can add errors on the values quoted ? Or,
specify if always the same events are being processed ?”

We have implemented both comments, adding 1σ standard errors on the mean and standard deviations, and clarifying that the estimates are on the same sample of tracks.

“- table 1: maybe you have an explanation of why the sigma of the pointing
accuracy improves in the case of the saturation scenario ? although of course
the mean is more relevant to assess the performance of the alg.”

Generally, it is certainly possible for one of the distributions to be more tightly clustered about a worse mean where, as you highlight, the mean value is more important overall for the reconstruction. In this case however, based on the standard errors, the difference is also compatible with a ~1σ statistical fluctuation in the estimates of the standard deviations being equal for the “saturation” and “perfect-energy” distributions.

Once again, thank you very much to our reviewer for their careful comments.

Sincerely,

Julian Yocum, Daniel Mayer, Jonathan Ouellet and Lindley Winslow