Dear Reviewers

A very happy new year to you and your family.

Thank you for the very careful reading of the manuscript. Your comments and questions have improved the quality of the manuscript significantly.

Here below the replies/answers to questions and remarks and actions in blue that were taken.

   See you Peter Kluit

Reviewer #1: Dear authors, thank you for addressing in detail point by point

comments and for improving the manuscript.

Reviewer #2: The first revision of the manuscript has been improved on many

points of criticism mentioned in the review. However, there are still some items

that should be considered before publication. Some of the points below are

actually a repetition of previous comments, which were not addressed, despite

the authors claim in their response that they were taken into account. It is

needless to say that it is quite tiring having to cross-check and repeat these.

Some typos or semantic problems could have been spotted by careful proofreading

of the full paper before resubmitting it.

Section 5:

The definition of the residual in line 214f is still not satisfactory. Being a

distance, it cannot be the "closest point" as stated here. The authors should be

more careful, taking into account that this was already brought up in the first

review. Since I want to avoid more iterations on this, I suggest the following

(if I have understood the authors' intention correctly):

"The track residual in xy is defined as the closest distance between the hit at

the center of the pixel and the xy-projection of the track. The residual in z is

calculated at this point of closest approach on the track."

However, this definition of the residuals (which is not standard in my opinion)

brings up the following question:

-> Apparently there is still some misunderstanding of the meaning of the words and precise definition of the distance and residual.

Section 4.2:

The authors should mention in line 188, which quantity is actually minimized in

the track fit. Normally, one would expect that the track fit minimizes the

squared 3-D distances from the hits to the track, weighted by the respective

uncertainties in xy and z. If this is indeed what has been done, why then are

the residuals in Sec. 5 defined as the closest distance of approach in the xy

plane? Unless the uncertainties on z are much larger than the ones in xy (which

is not the case here), the two quantities are not expected to be the same.

Depending on the quantity actually minimized in the fit, it would be more

consistent to define the xy residuals as the xy component of the 3D residual,

and not the DCA in xy.

Reply: it is only the xy component of the 3D distance that is minimized (excluding the z component).

 Text was: "The track residual in xy is the closest point of the hit at the center of the pixel to track in the xy plane"

 Proposal is: "The track residual in xy is defined as the closest distance - defined as the 2D xy projection of the 3D distance between the hit at the center of the pixel and the track."

Section 5.3, lines 303-322 and 344-357:

The authors did not really attempt to improve this part. The procedure of

regrouping and superimposing chips is still not clear. Changing "four 256x256"

to "(4x256)x256" does not change anything. The example is not very helpful

either. The authors should explain clearly and unambiguously, HOW they are

regrouping and combining chips, and, most of all, WHY they are doing it in this

particular way. E.g. investigating deformations along the x or y-axis, etc.

Reply: We did give an intuitive/descriptive picture of the procedure. We understand that for clarity it is useful to give the mathematical procedure and add this as a footnote.

New text:

"In order to reduce the statistical fluctuations and quantify the tracking precision, the pixels were regrouped into larger bins respecting the module geometry. After the regrouping procedure, a module plane with (4$\times$256)$\times$256 bins is obtained, as shown in Figure \ref{fig:deformationsGroupedB0} \footnote[]{The mathematical procedure is defined as follows. The original mean residual - before rebinning - is given by mean_residual(i,j) where i runs horizontally and j vertically. The rebinned result for the mean_residual(4$\times$256,256) is equal to mean_residual(i$\%1024$,j$\%256$). The mean_residual(256,4$\times$256) - discussed later in the paper - is equal to mean_residual(i$\%256$,j).}."

Section 5.4:

The term tracking precision is still not defined. Is it the average track

uncertainty propagated to the plane at y=1436? As requested in the first review,

the authors should also give the standard deviation of these numbers to quantify

the width of the distribution.

Reply: The text reads:
" The tracking precision in the middle of the TPC (at y = 1436 pixels) was derived on a track-by-track basis, by propagating the pixel TPC hit uncertainties."

So yes: the "track uncertainty propagated to the plane at y=1436"

Second point: Indeed, in the reply we should have mentioned the standard deviation on the uncertainties. The rms on the uncertainties in xy is 2.4 microns and in z 2.8 microns.

Section 6:

Ref. [4] is not publicly accessible. Why not show the ToT distributions here, as

suggested in the first review? Especially since quantitative results are quoted

and discussed for ToT.

Reply: Ref [4] is a publicly available result. In Figure 6 of ref [1] the ToT distribution is also shown. Proposal: in the text we also cite the published plot in ref [1].

The term "deposited charge" is misleading. Deposited in the detector or in the

pixel? It probably should be the "charge after avalanche multiplication,

Reply: Yes that is clearer.

Old text "The time over threshold is related to the deposited charge."

New: "The time over threshold is related to the charge after avalanche multiplication"

collected by a given pixel". In line 386, it should probably read "the mean

collected charge per pixel", contrasting it with "the most probably value" in

the next line.

Reply: Yes that is better

Old text "This means that the deposited charge per pixel .."

-> "This means that the mean deposited charge per pixel .."

The reasoning in line 391ff is difficult to follow: For B=0T, the

mean number of e-ion pairs predicted by MagBoltz is 106. The mean number of hits

is measured to be 124. Should these two numbers be directly compared for the agreement?

Reply: One could compare the mean and mop values of the B=0 and 1 T data to the Magboltz expectation, taking into account that in the observed mean number of hits there is also a contribution from hits produced by photons in the avalanche process. That process is not included in the Magboltz expectation(s).

Minor comments from the reviewer:

- references: use [1,2], not [1], [2].

Done

- check hyphenation, especially for compounds, e.g. "high-precision tracking", "single-electron resolution", "follow-up paper"

Done

- line 53: "envelope"

Done

- line 108: semi colon or full stop before "this"

Done

- Figure 2 caption, line 5: "as"

Done

- Tables 1 and 2 are still not formatted properly

Done added top and bottom rules (lines)

- line 163: check language "were selected were required"

Done

- line 183: add "...wide in z, corresponding to the size of the quartz window, were not...."

 Done

- line 191: "at"

Done

- line 204f: This sentence is not clear: What are the items in parentheses?

"Row" and "column" are not defined. Why not use dx/dy, ... instead?

Done. The parentheses give the different coordinates and angles. A proposed by the reviewee, now x and y are used instead of row/columns

- Figure 4: In the upper plot, the black dots for 0<y<3000 seem to be covered by blue symbols. Please check! Why are there only two and not three Mimosa hits for y>4000?

Done. The plot is remade with the right color coding.

Answer:The detector/clusterisation is not 100% efficient and one (2D) hit is lost.

- Figure 4 caption: "(top) in the precision plane (x,y) and (bottom) drift plane (z_drift,y)".

 Done

- line 219/221: As I understand, the arguments under "Firstly" and "secondly"

are not 2 separate items, but rather is the second item a logical consequence of

the first. Then I would suggest to remove "Firstly" and to replace "Secondly" by "Therefore"

 Done (Indeed excellent proposal)

- line 223: mention that these are "biased residuals"

 Done text reads now: "the - biased - z residuals"

- Eq. (3): there is one "+" too many

Done

- Figure 5 caption: "... for (left) B=0T and (right) B=1T", same for Fig. 6

 Done

- line 267: sigma => \sigma

Done

- line 284: check language in "deformations in the pixel plane deformation"

Done

- line 289: In their reply, the authors state that 8x16 pixels is wrong, as I

realized in the first review. It is still not corrected here. In addition, "bins

were grouped into 8x16 pixels" is not understandable. It should probably rather

read "groups of 16x16 pixels were combined into one bin"

This should have been corrected already. Done adding this explanation.

- line 295: "upper corner edge" is not understandable; maybe one could direct

the reader by values of the coordinates, e.g. y>2500, x>500?

  Added "to the right upper corner edge" looking back at Fig the reader can find the location of chip16

- line 296: "inhomogeneities"

  Done

- line 296: add "...pillars, where the..."

Done

- line 308: the expression "dike" is used here for the first time without explanation. Probably this should
be defined in Sec. 2.

Due to the presence of the 'dike' was created in the TPX3 post-processing step to protect the TPX3 chip,

- line 309: "became" => "were"

Done

- line 310f: "the chip" => "each chip" (2x)

Done

- Figure 9 caption: "in the (top) pixel and (bottom) drift plane", same for Fig.10

 Done

- line 334: "bins were grouped into 16x16 pixels" is not understandable, see above.

 Corrected

- line 338: "upper corner edge", see above

Done

 -line 348 and 358: "deformation studies"

Done

- Figure 11 caption: "(left) B=0T and (right) B=1T data"

Done

- line 380: comma before "respectively"

Done

- line 414: I suggest to add a footnote to contact the author if interested

Done