Andrea's comments to v4

Most of the comments are about style or to improve a bit further clarity. Only a few comments are substantial (indicated in bold) even if they can be fixed trivially.

Line 46: using "detectorS", plural, implies that we should cite other pixel detectors used in other experiments than CMS. I have no strong opinion: we can turn it into singular if you like.

The paragraph in rows 59-63 and the sentences in rows 55-58 could be merged or better coordinated to avoid a bit of duplication. All the concepts expressed there are interesting: nothing should be removed

Line 82: "but" should be replaced with "and"

Table 1: there is a comma which should be replaced in L2 row

Caption figure 3: remove "upgrade"

Line 126: write something like "higher pseudorapidity REGIONS"

Table 2: I suggest to use "ringS", plural.

Line 155: add that the pixels are oriented with the long side parallel to the beam line

Line 170: can you check if "micro system and sensors" requires capital letters?

Line 192: add an hyphen between "electro-collecting"

Line 231 and 232: please check 37 degrees and 215 um. In the section about the LA measurements the resulting LA is 27 degrees. Is there a typo which got propagated in the estimate of the charge width?

Lines 278 and 281: check if "double column" should be, actually, "double-column periphery"

Around line 302: We should add one sentence that confirms that PSI46dig performance were well within expectations during pp collisions. This is in parallel to the sentence in row 320

Lines 322 and 323: Isn't "high hit rates" better than "high data rates" in this case?

Lines 324 and 325: concerning the statement in parenthesis: the procedures are described also in this section. I would remove the parenthesis and write something like "described late in this section and in sections 10 and 11"

Line 331: is it "high trigger rates" or "high hit rates" which matter in this case?

Line 351: add "to synchronize the MODULE data transmission"

Figure 7: I think we should remove the lines "with resets" because it is a different reset from the one described in row 341 and we give the false impression that with the 70 Hz reset also the old PROC600 behaved nicely at high hit rate. The cons is that we do not explain why we have not caught this problem during the module testing (we explicitly describe the X ray test among those done to grade the modules). Alternative solutions are:
1) **Explain that in figure 7 the resets are issued after *every* trigger**
2) **Repeat the measurement of figure 7 with a 70 Hz reset (it can delay further the paper…)**

Line 361: add commas before and after "with one path inverted"

Line 372: I do not understand why digital zeros are not needed also for the TBM08: does it merge two different readout paths, too? I think I have asked this question already and maybe you answered (and I have not checked).

Line 382: indicate what has been the actual setting during the physics run.

Line 556: I would replace "about THIS calibration"

Line 565: adopted → adapted

Lines 731 and 733: I realized that reading this sentence I don' get where the cooling loops are embedded: there are two rings (called assemblies in this section) in each disk and two cooling loops in each disk: one for each assembly. Each assembly has two graphite rings: an inner and an outer one. In which of the FOUR graphite rings are the TWO cooling loops?

Line 778-779: quote also the inner diameters of those pipes

Line 793: also for FPIX states that the end flange is used to connect the detector ground to the CMS ground

Line 816: clarify that 10 Gb/s is the data transfer speed of each FED

Lines 818-820: make more clear that FEDs and FECs are FC7 boards with different f/w (and different FMCs)

Line 860: "DCU" is not defined in the paper

Line 1026: "HEP" is not defined in this paper

Line 1121: add a comma between setup and measurements

Line 1133: replace "for THE short commissioning"

Figure 31: add the information about the direction of the CO_2 flow in the two graphs. I think it is opposite in the two cases.

Lines 1423-1424: I am wondering if this reference to section 3.6 is needed:
- we have a more precise reference in row 1428 when we remind the S-curves method

- in rows 1416-1420 we explain briefly the strategy
- in row 1420 we refer to the paper [2] for more details.
I think that this reference to section 3.6 could be misleading here.

Line 1474: I would replace "The calibration of the internally injected charge" with "In the offline reconstruction the conversion of the internally injected charge from Vcal DAC units to electrons is done using..."

Line 1567: add "charge trapping" and an additional cause of signal loss

Lines 1567-1570: First of all, it is not only recalibration but also adjustment of the HV bias set points. Secondly, we have to report in the paper the HV bias settingS we have used in 2017 and 2018. No need to go in details but we can say we started at xxx V and at the end of 2018 run (after zz fb-1) we operated L1 at ... L2 at ... L3 and L4 at ... FPIX at ...

Line 1571: clarify that we use the cluster charge associated to reconstructed tracks ("on-track")

Line 1587: is there a sensible paper (CMS or PIXELAV) to be cited to support this statement? What about TRK-11-001? The original PIXELAV paper?

Caption figure 47: replace with "CLUSTER hit efficiency"