

Dear Ulrich,

Thank you for your comments. We addressed all of them and detailed answers are added below.

General comments:

- Thank you very much for the new draft, which is very much improved in the chapters that I had many comments on last time
- I've given my input on chapter 3.4 in a response to a request by Wolfram Erdmann, including these that I think are worth referring to

Line-by-line comments:

- L64: no comma after "modifications" → ok
- L73: "summary and conclusions **are** given" → ok
- Table 1: The information advertised in the caption isn't in the table, I only see radius, z position and number of modules → ok, caption fixed
- L100: typo: "shown" → ok
- L137: small i in "Since" → ok
- Table 2:
  - swap order of does and fluence in the caption (or in the table) → ok
  - use macro 500\fbinv → ok
- L169: add comma after "Germany" → ok
- L181: state more concretely why this is "of advantage": can run underdepleted without losing position resolution (if still away from thresholds) → ok
- L189: after "sensor edges": delete "are" → ok
- L284: suggest to move the last sentence to the following paragraph, as it is related to the PROC600 → ok
- L313: "This can happen often" → ok
- L317: "This **in** itself" → ok
- L331: "arrival of \*an" L1 trigger signal" → ok
- L359: delete duplicate sentence "An automatic reset..." → ok
- L405: DESY → ok
- L406: Suggest to add the information that the UBM is electroless nickel plating by PacTech, Nauen, Germany, and that this UBM technology is shared with the KIT process (where the credit goes to DESY) → ok, added.
- L411: "This test verified that" → ok
- Fig. 8: suggest to add the coordinate system you have introduced before, to clarify that this is a side view along the y axis, so the horizontal coordinate is x → ok
- L425: motivate choice of silicon nitride (same/similar coefficient of thermal expansion as silicon) → ok
- L456: the sentence seems strange, maybe the verb is just in the wrong position? "The gantry for ... is software controlled"? → ok
- L465: Suggest to swap words "connected to a PC via USB" → ok
- L492: "\*was\* considered functional" (you are using past tense for everything else) → ok
- L524: I find "a parallel route designed for..." hard to understand. → ok, rephrased.
- Fig. 12 caption: "internal **calibration** signal"? → yes, ok.
- L574: The reader may want to know to what the ROC failure is related if not to the assembly → statement is removed.
- L586: "This issue **was** mitigated" → ok
- Fig. 16 caption: The word "facet" is not used in the main text, is it needed here? → changed to „ladders“

- L614: add comma after "Fig. 18" → ok
- L656: remove hyphen between "in" and "turn" → ok
- Fig. 23: I had a hard time connecting the readout parts described in the main text to this figure. tkFEC does not show up in the text, some arrows point to nowhere (from Delay25, CCU I2C, TPLL, ...) → names in the figure now match the text. The arrows in magenta show which devices can be programmed via I2C by the CCU.
- L775: "data streams" (plural) → ok
- L867: suggest to change order of words "the core is made from plastics since ferrite..." → ok
- L869: reduce AC components of what? noise? → changed to: „to reduce AC components of the voltage (commonly referred to as noise)“
- Fig. 27: I do not know where to look for the cooling blocks, so I cannot tell where they are on the right-hand side picture → changed to „the cooling blocks that are placed under the \dcde converters and provide the thermal path to the cooling loops are clearly visible“
- L944: suggest to move "In general" to beginning of sentence → ok
- L966: "expected to cure **the** problem" → ok
- L974: "very small" is rather unspecific. Is it referring to the diameter, wall thickness, length, ...? → changed to „small diameter, thin-walled pipes“. The actual thickness is then given later in the BPIX and FPIX sections.
- L975: why "also" simple → removed „also“
- L984: at some point (here or earlier) you need to mention that the two phases are liquid and vapor → L983 says „liquid CO2“ and L986 says „CO2 evaporates“. Should be clear from this.
- L987: remove "at" after "slightly above" → no, this means „it is slightly above 33% at room temperature“. Changed „above“ to „higher“
- Fig. 28:
  - Upper plot: red text on green background is hard to read (for the color blind), axis labels much too small
  - Lower plot: it would help to match the six points of the cycle from the upper plot if the labels (number with circle) were the same as in the upper plot
  - Caption: upper and lower plot swapped
  - → ok, Figure improved and caption fixed
- L1000: "estimated maximum" → ok
- L1001: "stage \*was\*" → ok
- Fig. 30: figure would profit from larger labels and higher resolution (or vector graphics) → Resolution has been improved, label size unchanged, but numbers added.
- L1078: integration of what? → removed this part of the sentence.
- L1084: remove comma after "test stand" → ok
- L1084: typo "separate" → ok
- L1100: remove redundant sentence "The problem with..." → ok
- L1106: This sentence is part of the motivation for the pilot system and should be moved to the beginning of the chapter → ok
- L1140: typo "four" → ok
- L1182: replace number 4 with word "four" (twice) → ok
- L1202: "commercial \*airplane\*"? → ok
- L1217: typo "connections" → ok
- L1234: replace number 9 with word "nine" → ok
- L1236: replace numbers 9 and 7 with words "nine" and "seven" → ok
- L1266: suggest to add "\*optical\* fiber plant" → ok
- L1269: spell out acronym MFS (I found "Ministerium fuer Staatssicherheit", vulgo "Stasi") → ok
- L1341: "further delays are added" sounds strange to me, maybe "The LCDS driver chip is used to add further fixed-time (length?) delay lines to each modules" → ok
- Fig. 42: suggest to add the 0.1 mA minimum output current as a horizontal line in the figure → ok
- L1378: remove redundant sentence "Therefore the threshold" → ok
- L1389: "measuring the SCurve" sounds too colloquial, suggest "performing the SCurve test described in chapter 3.6" (where SCurve typeset this way is the name of test, not of the curve) → ok

- L1423: suggest to add "leading to (extended) charge clusters" after "of collected electrons", as you are referring to "clusters" later on. You may instead move the sentence in L1522 here, including the reference [3] → ok, adopted first suggestion
- L1427: point reader to chapter 3.6, where the test is described → ok
- L1429: how the gain and pedestal are determined has been explained before, suggest to delete and point to that chapter → added pointer but kept sentence
- L1432: typo "pedestal" → ok
- L1521: "convert the charge ... to electrons" sounds a little too colloquial, maybe "express the charge in units of (minus) the elementary charge" → ok
- Fig. 47:
  - Is this really just a Landau distribution, or convoluted with a Gaussian? → Landau convoluted with a Gaussian. Caption fixed.
  - "increased **number** of clusters" → ok
  - "the broken cluster caused by..." cannot be appreciated without further explanation → has been modified.
- L1547: "difference \*is\*" → ok
- L1552: introduce LA as an acronym for "Lorentz angle" here → ok
- L1564: "Saturation is never" (delete "A") → ok
- L1573: suggest to move sentence in L1610/1611 here → ok
- Fig. 50: suggest to make plot less busy by removed all but four (or so) sets of points at different luminosities → Figure has been removed.
- L1590: "these signals" -> "the corresponding smaller signals" → ok
- L1600: "The **measured leakage currents** are shown → ok
- L1602: which leakage current formula do you refer to? → used to have a reference here, but this has been removed according to Katja's comment since it is a standard textbook formula
- L1610: move sentence to L1573? → yes, done.
- L1618: use degree symbol? → ok
- L1625: explain "shallow tracks" better, maybe "tracks with shallow incident angles to the sensor surface" → ok
- L1626: are these clusters "long" or "wide"? → changed to „large“
- L1643: "temporary loss of data" is misleading. The data that is lost cannot be recovered. Suggest "temporary inefficiency due to the loss of data" → ok
- L1653: does 97.5% refer to 1.9e34 as Fig. 54 suggests? If so, state in the text to make it comparable to the "well below 90%" in L1655 → yes, added.
- L1662: "\*position\* resolution? → ok
- L1664: suggest to remove "so-called", as "triplet" is already in quotes → ok
- L1694: improve typesetting of  $\sqrt{2/3}$ , bar does not extend to  $2/3$  → ok
- L1694: motivate factor of  $\sqrt{2/3}$  → has been removed.
- Fig. 55: axis titles of FPIX plots: "Residuals r direction" and "Residuals phi direction" → FPIX plots removed.
- L1690: "The **upgraded** system" → ok
- L1690: do you also want to mention the benefits of the fourth layer in addition to the better readout? → yes, added.
- L1740: S. Klonig → ok
- L1748: suggest to cite the 2003 IEEE paper by A. Huffman et al. on the RTI process → ok, added.
- L1749: This is not a CMS paper but a short author list paper, "M. Caselle et al." → ok
- L1819: This is not a CMS paper but a proceedings report, author: "B. Akgun" → ok
- L1827: "M. Schröder" → ok
- L1836: this was a Master's thesis, not a PhD thesis → ok