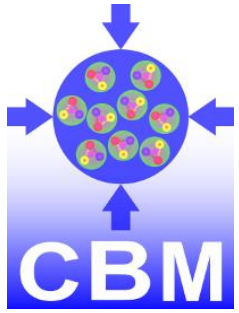

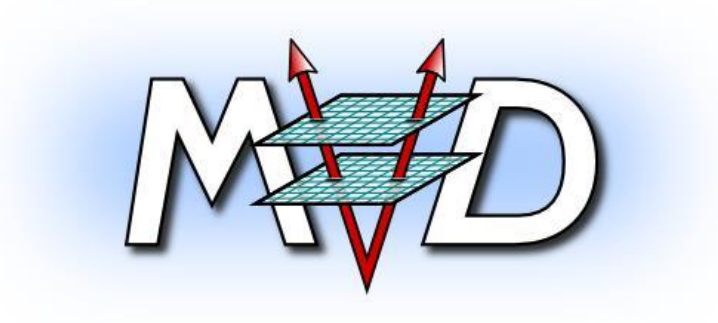

HIC for FAIR
Helmholtz International Center

HGS-HIRe for FAIR
Helmholtz Graduate School for Hadron and Ion Research

H-QM Helmholtz Research School Quark Matter Studies

IPHC Institut Pluridisciplinaire Hubert CURIEN STRASBOURG

IKF Institut für Kernphysik Frankfurt

IKF T-Lab

Federal Ministry of Education and Research

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

81. Jahrestagung der DPG und DPG-Frühjahrstagung, Münster
30. März 2017, HK 53.7, 18:30

Finalizing the CBM-MVD Geometry: CAD and Simulation

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This work has been supported by BMBF (05P15RFFC1), GSI and HIC for FAIR

Outline

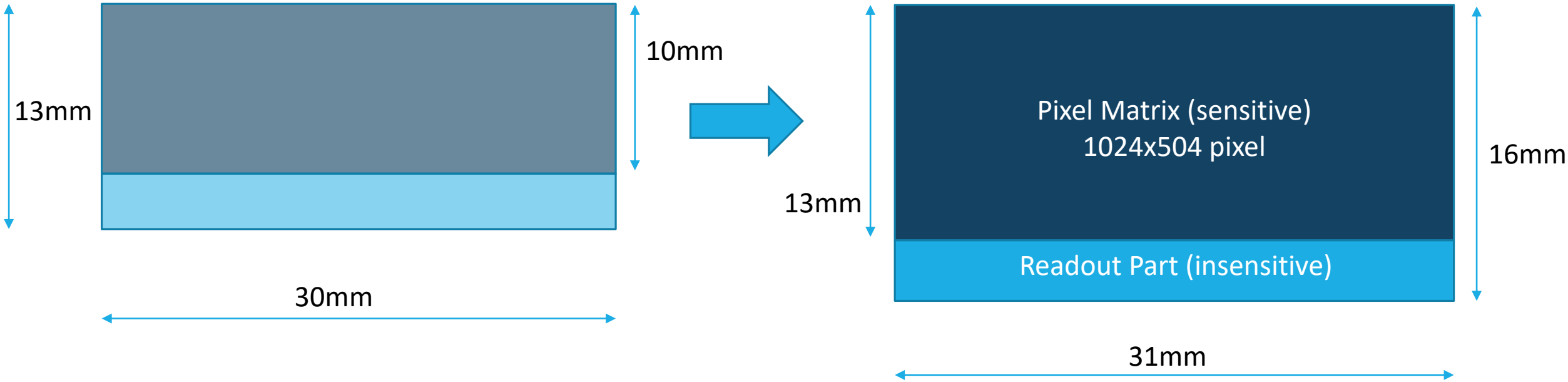
- Updated sensor dimensions
- Geometries of the MVD: Mechanics & Simulation
- Comparison Cad2Root ⇔ Scripting in Root
- New MVD Geometry via Scripting
- Summary

Need for Geometry Change due to Update of Sensor Dimensions

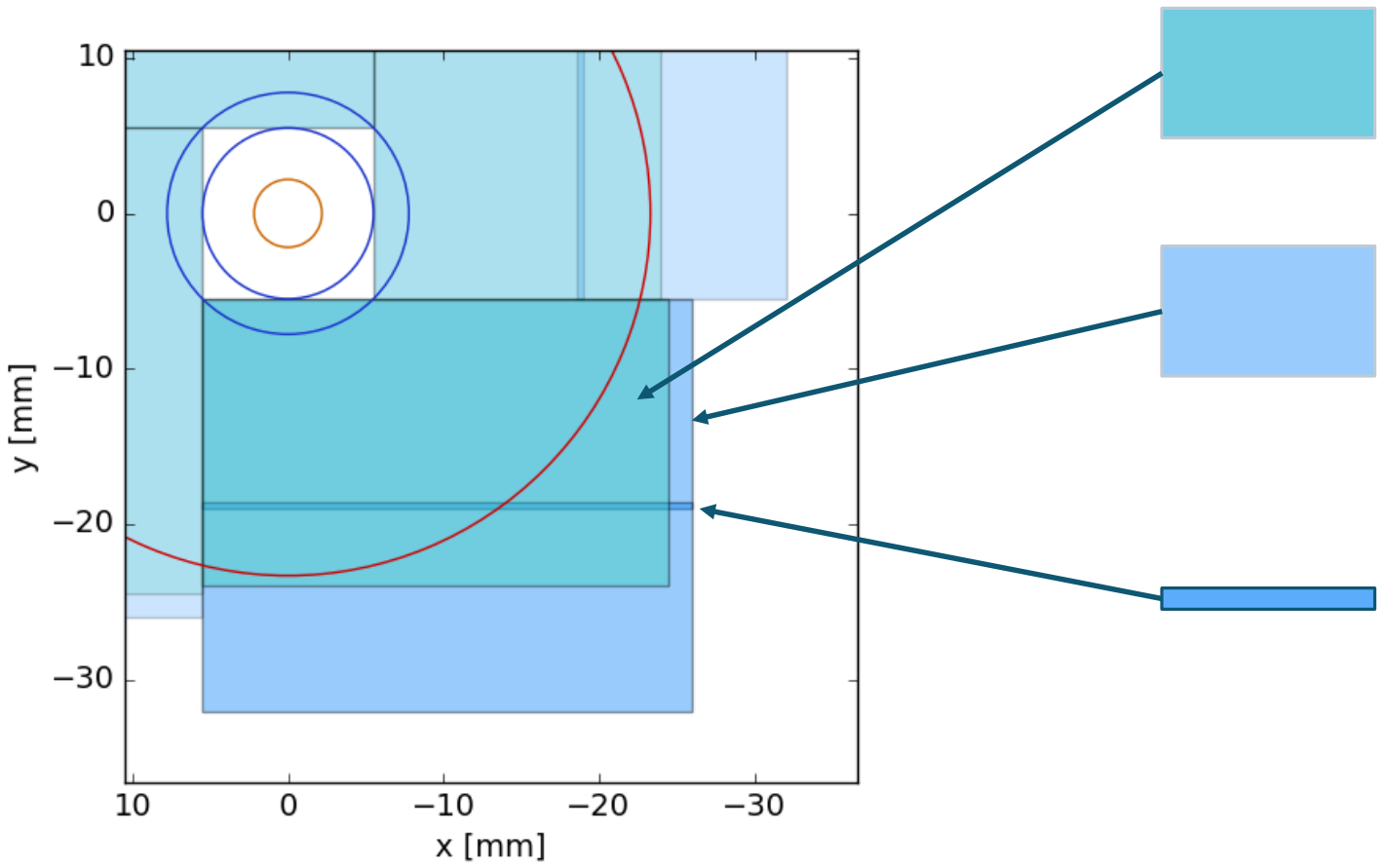
Preliminary

Previous (assumed) sensor:
“3x FSBB”

New (assumed) sensor:
“MIMOSIS-1”



Plot Legend



Quadrant acceptance of previously assumed 3xFSBB quadrant composition (PhD Thesis of Tobias Tischler)

Quadrant acceptance with new (assumed) MIMOSIS-1 sensor dimensions, if same sensor arrangement to be used as in PhD Thesis of Tobias Tischler

Overlap area of sensors on front and back side of the carrier with new sensor dimensions

Plot Legend

Actual inner CBM-MVD acceptance limit:

Resulting beam hole

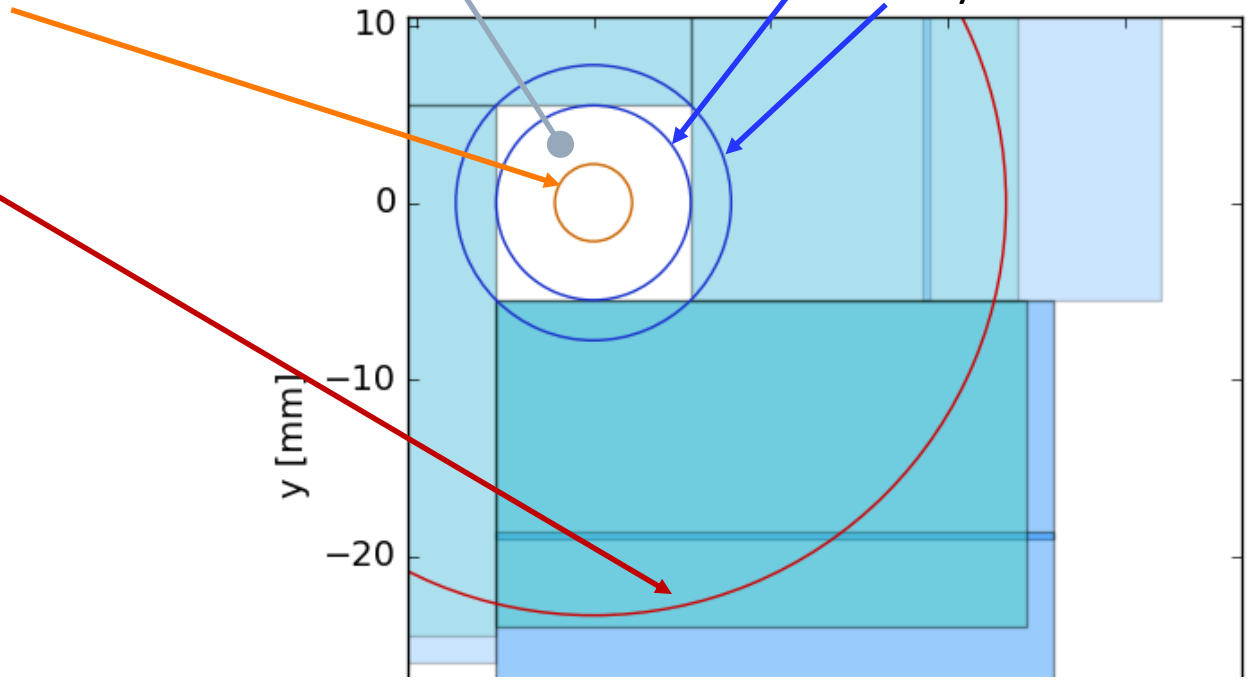
Begin of acceptance

Fully established acceptance

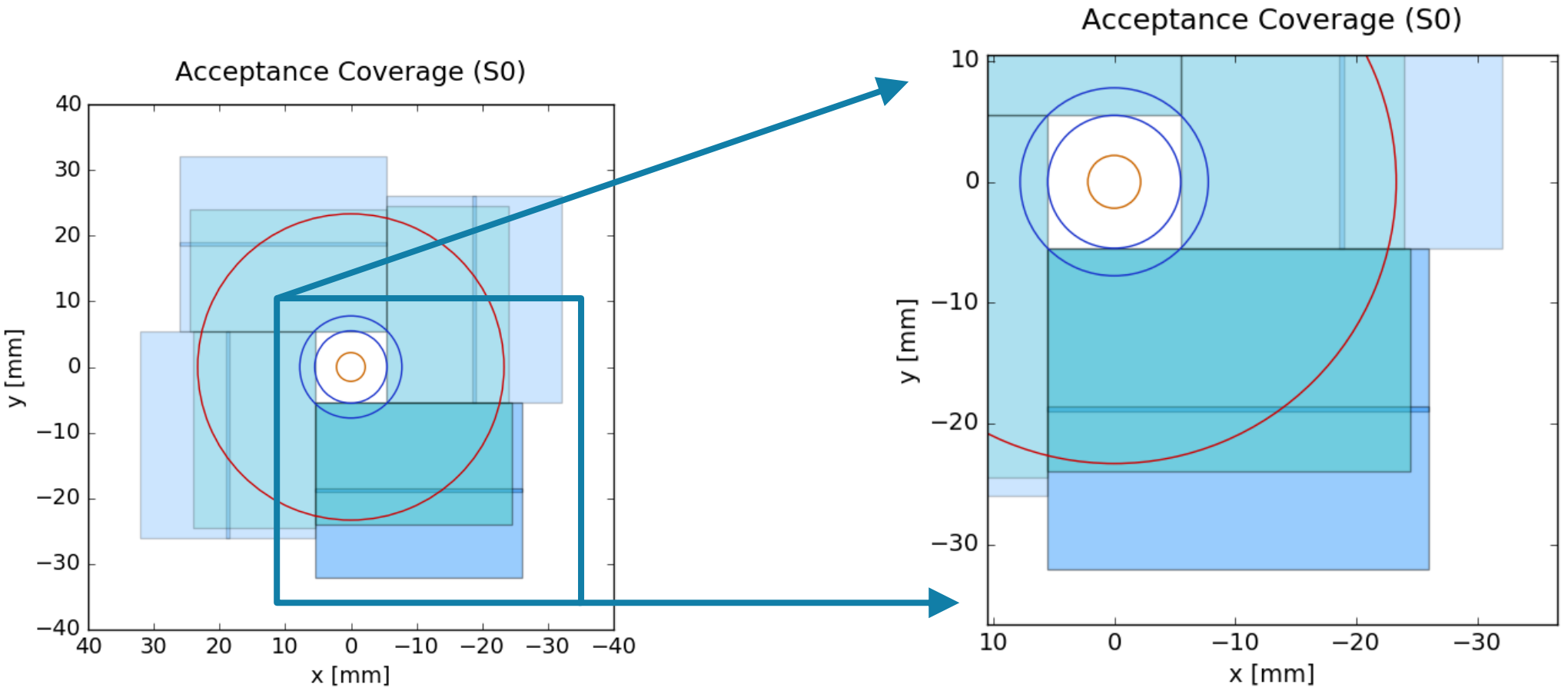
Nominal CBM acceptance limits:

2.5 degrees

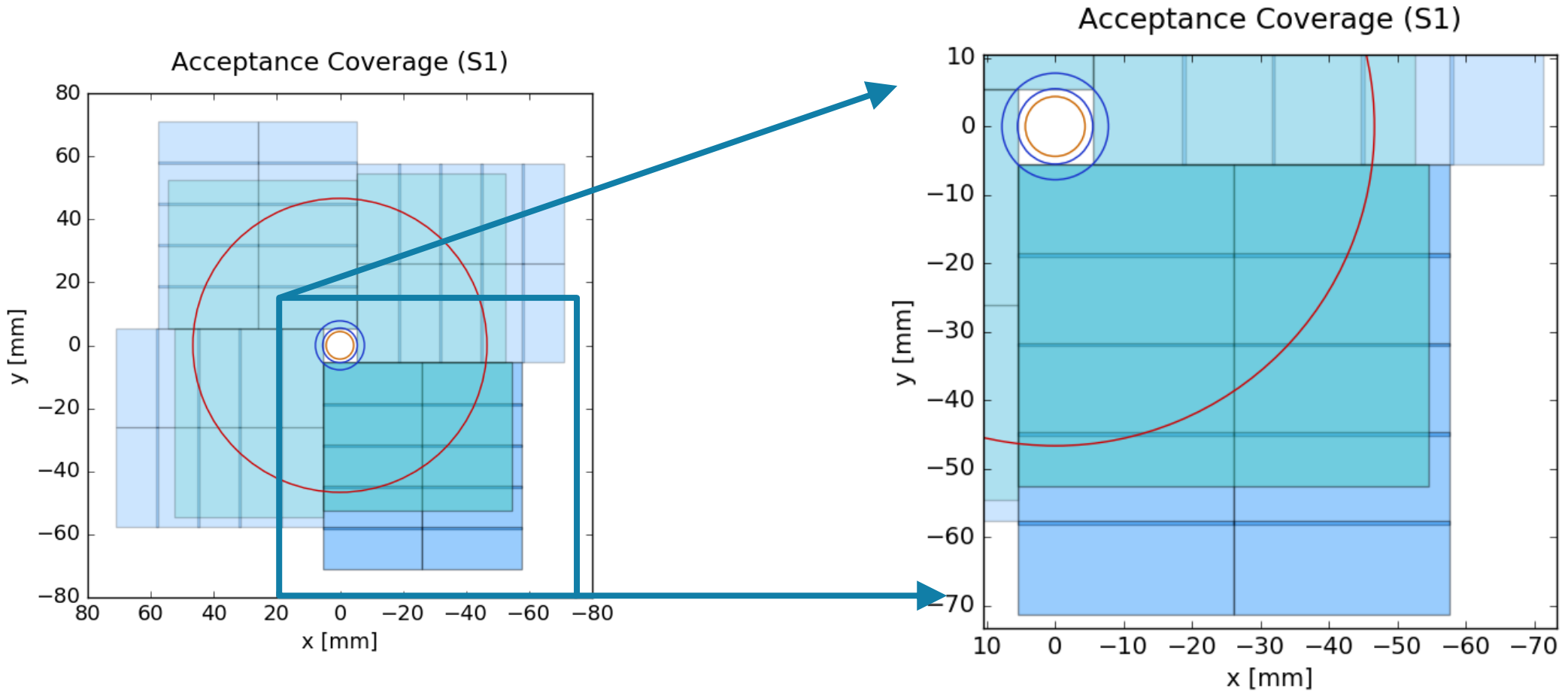
25 degrees



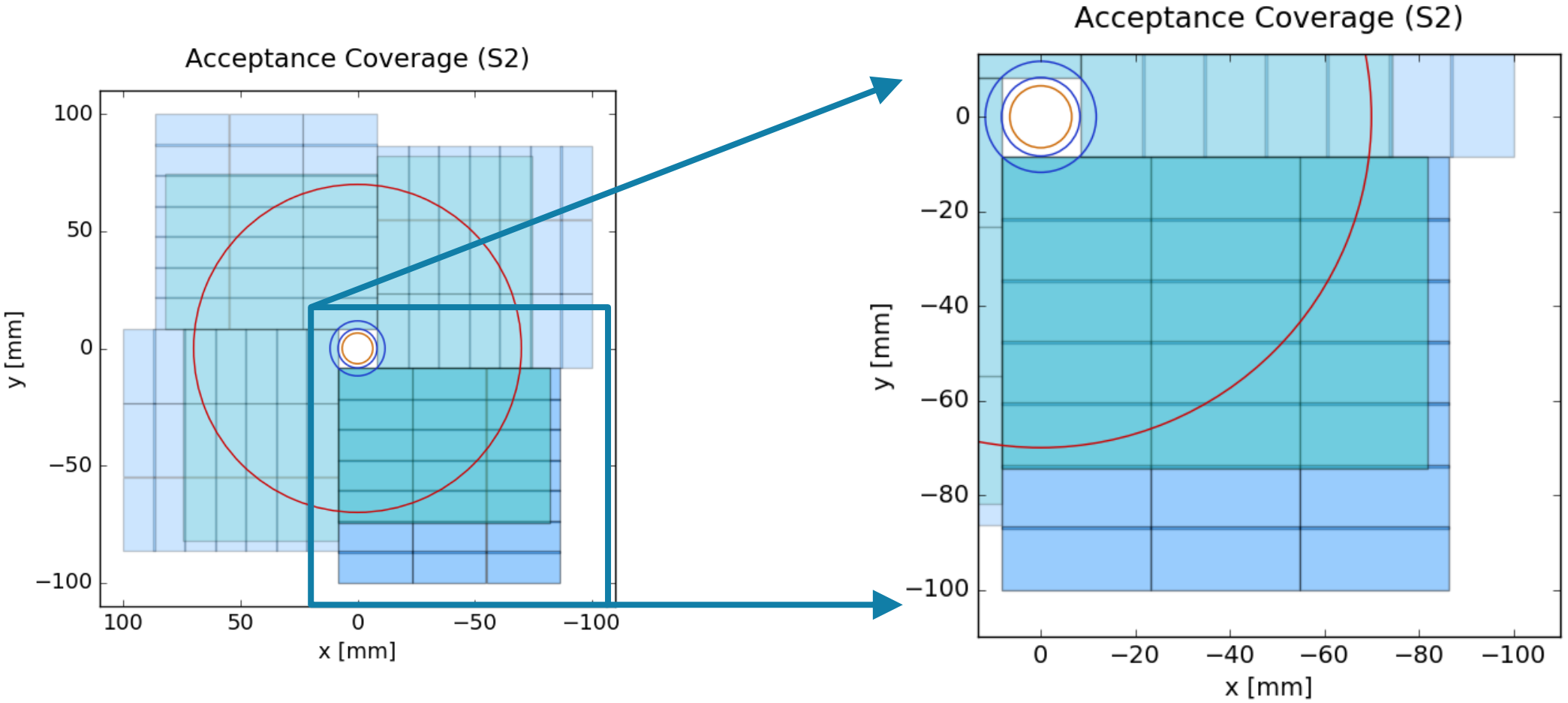
Acceptance Coverage: Station 0



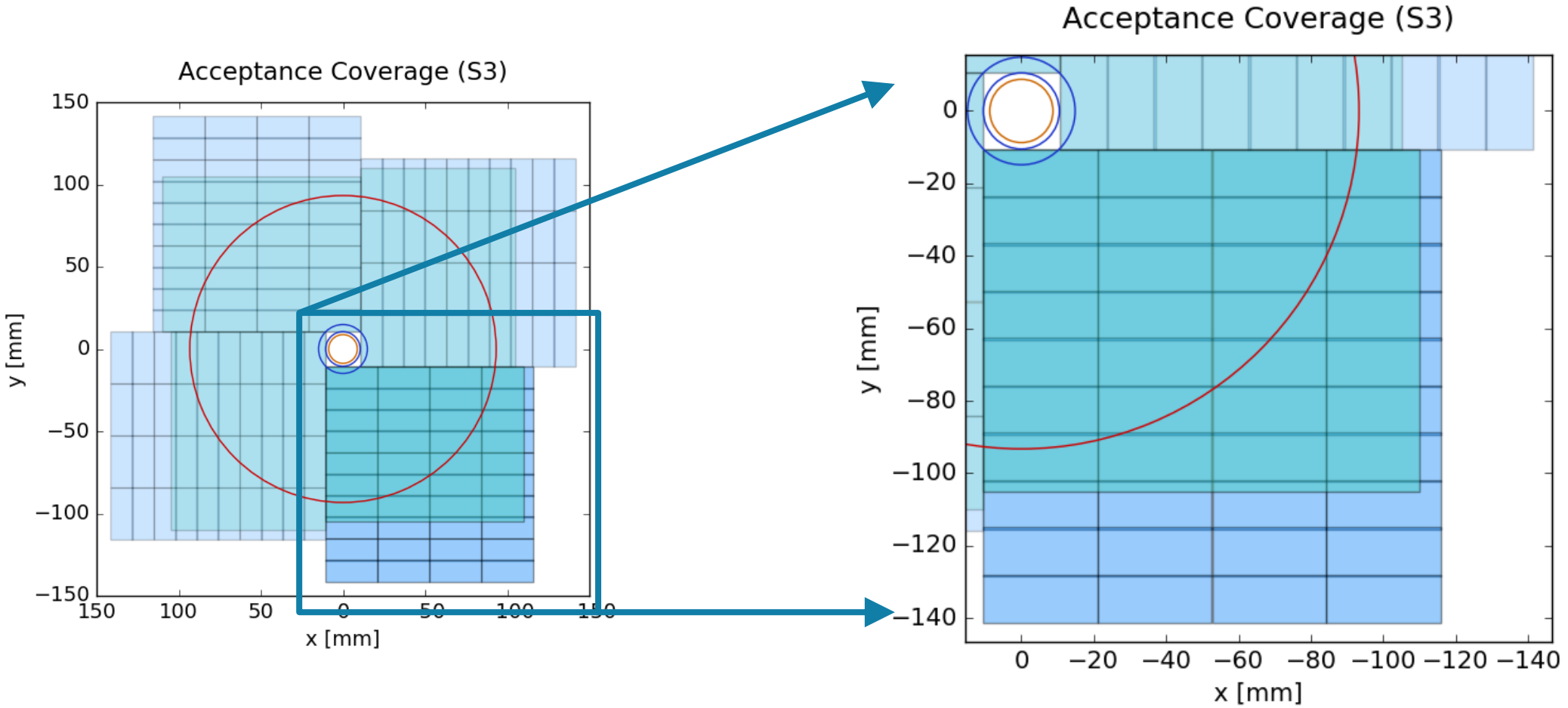
Acceptance Coverage: Station 1



Acceptance Coverage: Station 2



Acceptance Coverage: Station 3



Result of Updated Sensor Dimensions

- For some stations, the new sensor dimensions allow to reduce the integration complexity by removing some rows of sensors.

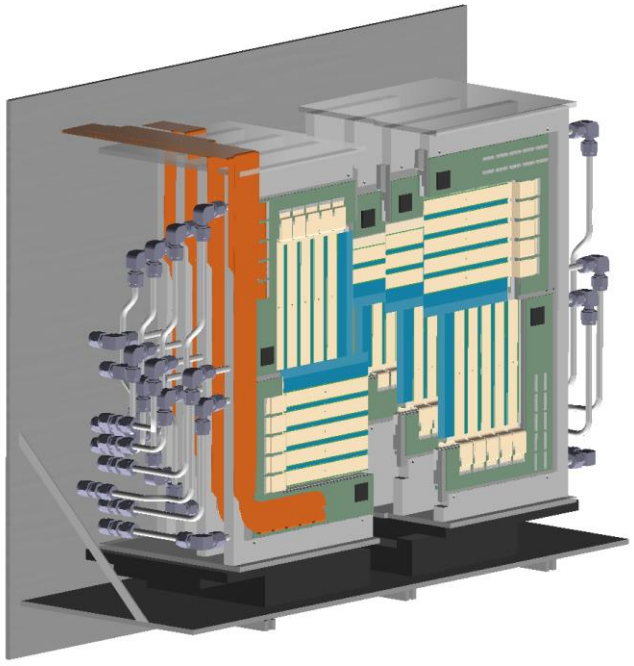
- The MVD geometries for engineering and simulation need to be updated.

  This is where the problems started…

Geometry Status of the MVD up to now

→ Geometry for Engineering / Mechanics → Geometry for CbmRoot Simulations

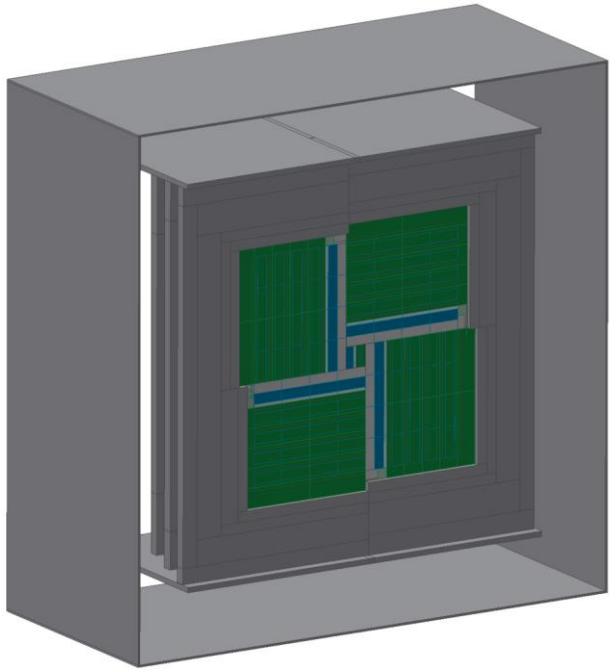
Parametric feature based modelling (“CAD”) with Autodesk Inventor



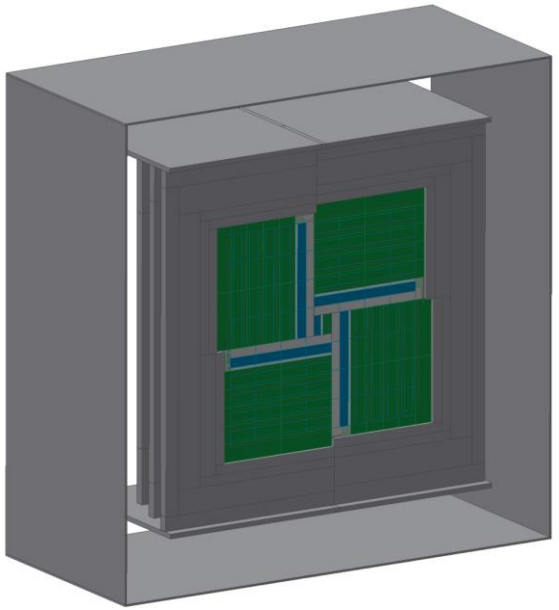
←software: same→
← look: similar →
← still: quite different →
← required: consistency →

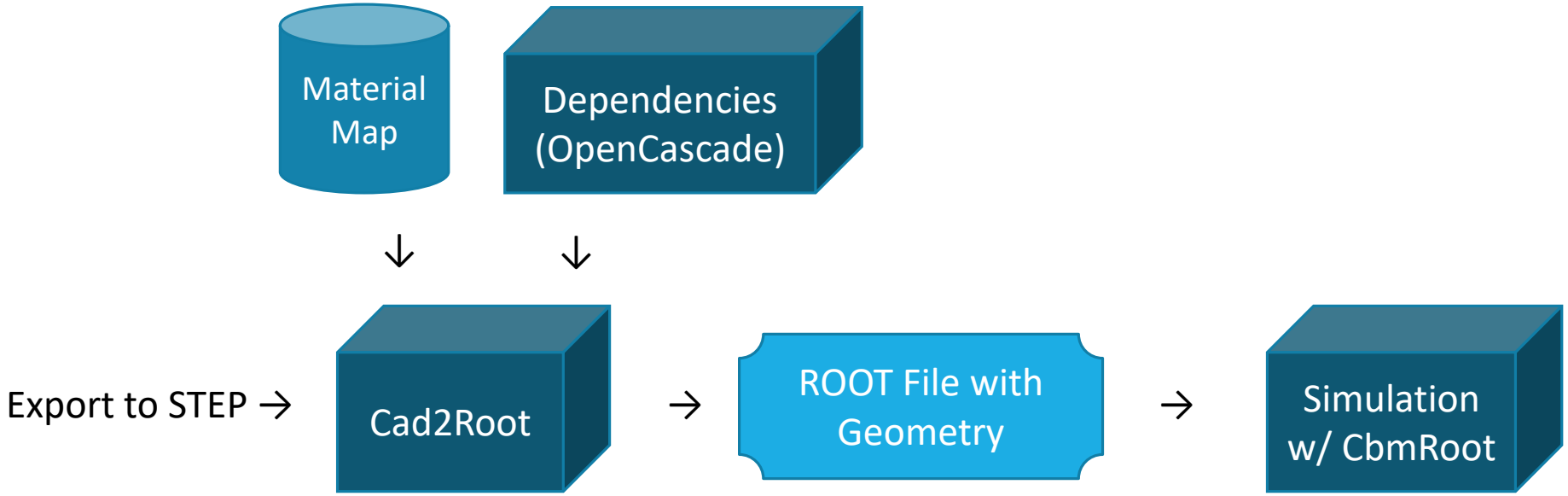
Where they differ, there should be a justified reason such as:

- Simulation Speed
- Simplicity
- Particle distributions



Workflow of the “Cad2Root ” Conversion Approach For CbmRoot Geometries





https://panda-wiki.gsi.de/foswiki/bin/view/Computing/CadConverter

[Autor: Dr. Tobias Stockmanns, FZ Jülich]

Cad2Root Conversion Aspects

Using Parametric feature based modelling (“CAD”) with Autodesk Inventor

Why good / Pros:

- Creating the geometry can be done very quickly if experienced with CAD software
- Work can be offloaded if you have an engineering department
- Component interferences can be checked and visually inspected nicely
- Interferences with other detectors can be checked well, if also created with CAD software.
- Better UI than ROOT.

Why bad / Cons:

- Many dependencies for the conversion:
  - Cad2Root, FairROOT, OpenCascade
- More difficult to track changes to the geometry (no text file in version control)
- Bigger workflow for changes
- Small userbase of Cad2Root / maintenance needed to keep up to date

New geometry will be scripted in a ROOT macro instead of being created with Cad2Root.

Previous Approaches to CAD ⟷ ROOT Conversion (for completeness)

STEP-to-ROOT – from CAD to Monte Carlo Simulation — "Cad2Root"

Tobias Stockmanns 2012 J. Phys.: Conf. Ser. 396 022050

DOI: https://doi.org/10.1088/1742-6596/396/2/022050

STEP → ROOT

Development and application of CATIA-GDML geometry builder — CATIA ⟷ ROOT

S Belogurov et al 2014 J. Phys.: Conf. Ser. 513 022003

DOI: http://iopscience.iop.org/article/10.1088/1742-6596/513/2/022003

TGeoCad: an Interface between ROOT and CAD Systems — ROOT → STEP

C Luzzi and F Carminati 2014 J. Phys.: Conf. Ser. 523 012017

DOI: https://doi.org/10.1088/1742-6596/523/1/012017

Scripting a new Geometry in Root

Documentation

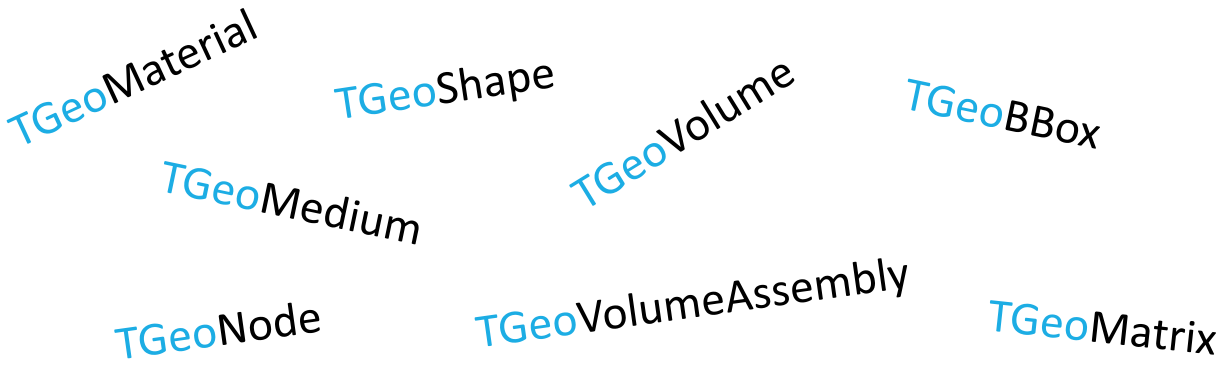
Root User Guide (v5.34) chapter ”The Geometry Package”:
https://root.cern.ch → Documentation → User’s Guides → User’s Guides (all formats and series) → HTML – Geometry

FairRoot HowTo “Detector Geometry and Media”:
https://fairroot.gsi.de → HowTo → Detector Geometry and Media

In short:

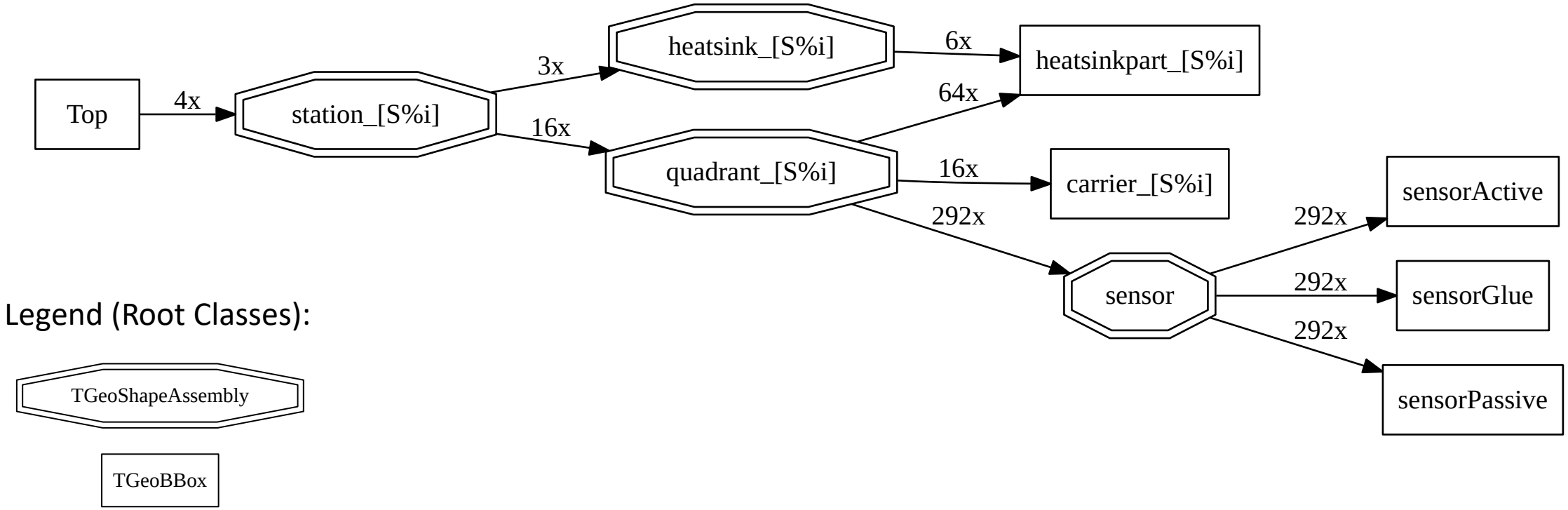
Define Materials, Media, Shapes, Volumes, Volume Assemblies, and instances of the Volumes positioned in a mother volume using a transformation Matrix.

Relevant classes in Root:



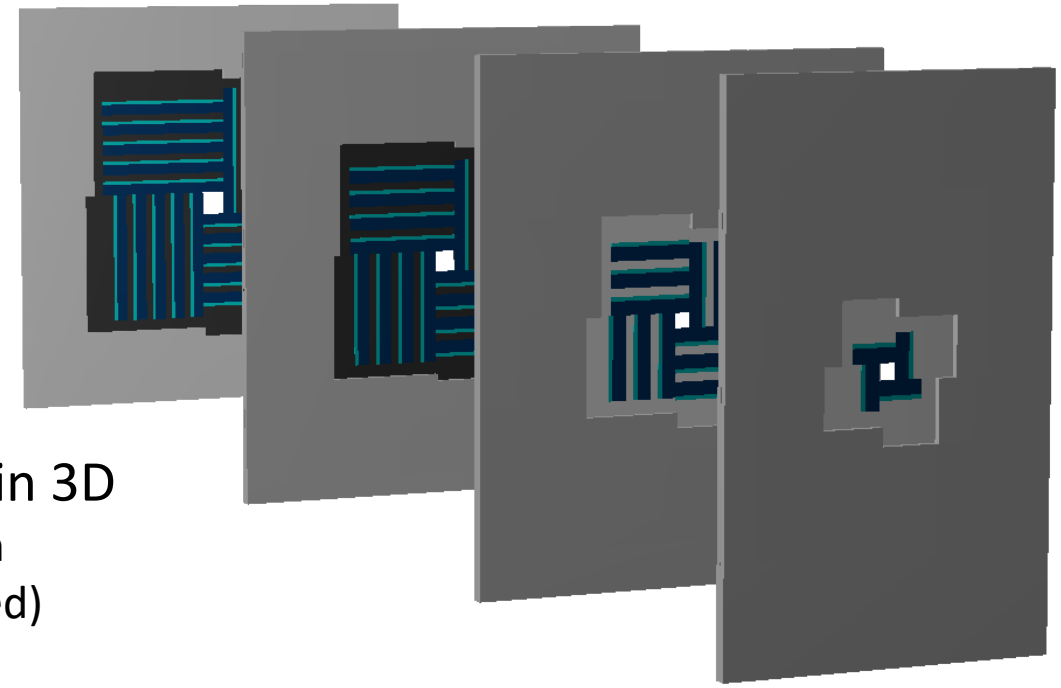
Structure of the New, Scripted CBM-MVD Geometry

Preliminary



Current Status - Scripted Geometry

Preliminary



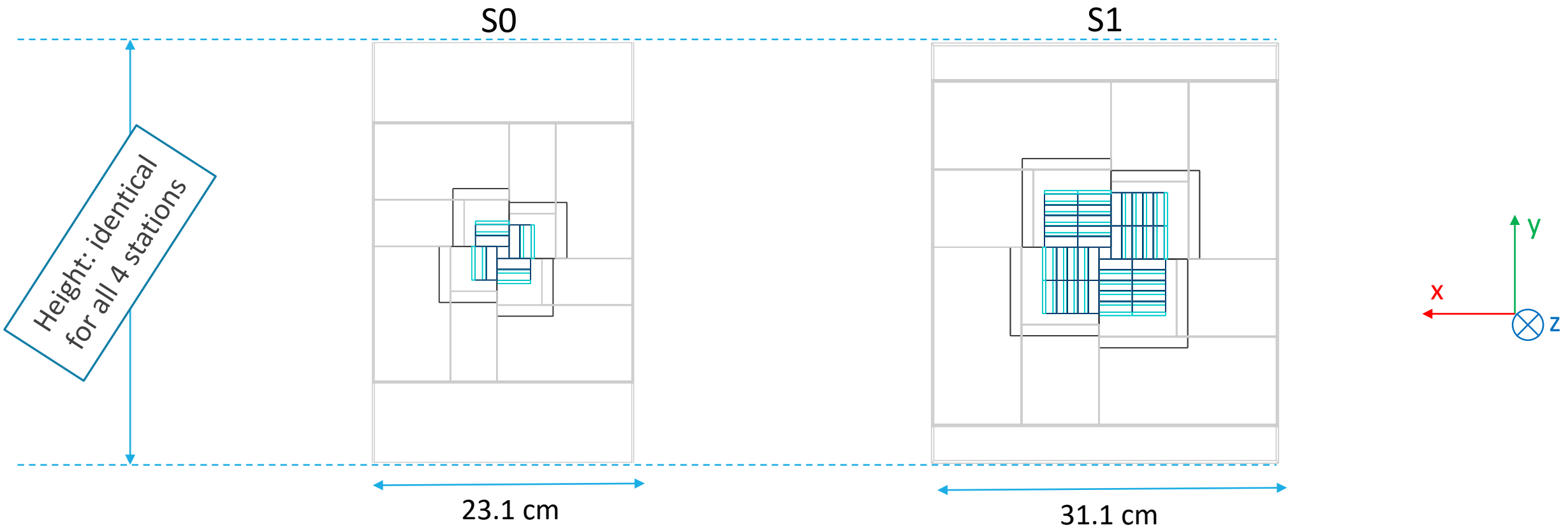
An impression in 3D
(station position in
z-direction streched)

A success so far.

<u>Up next:</u> MVD Digitizer to be adapted to work with the new geometry.

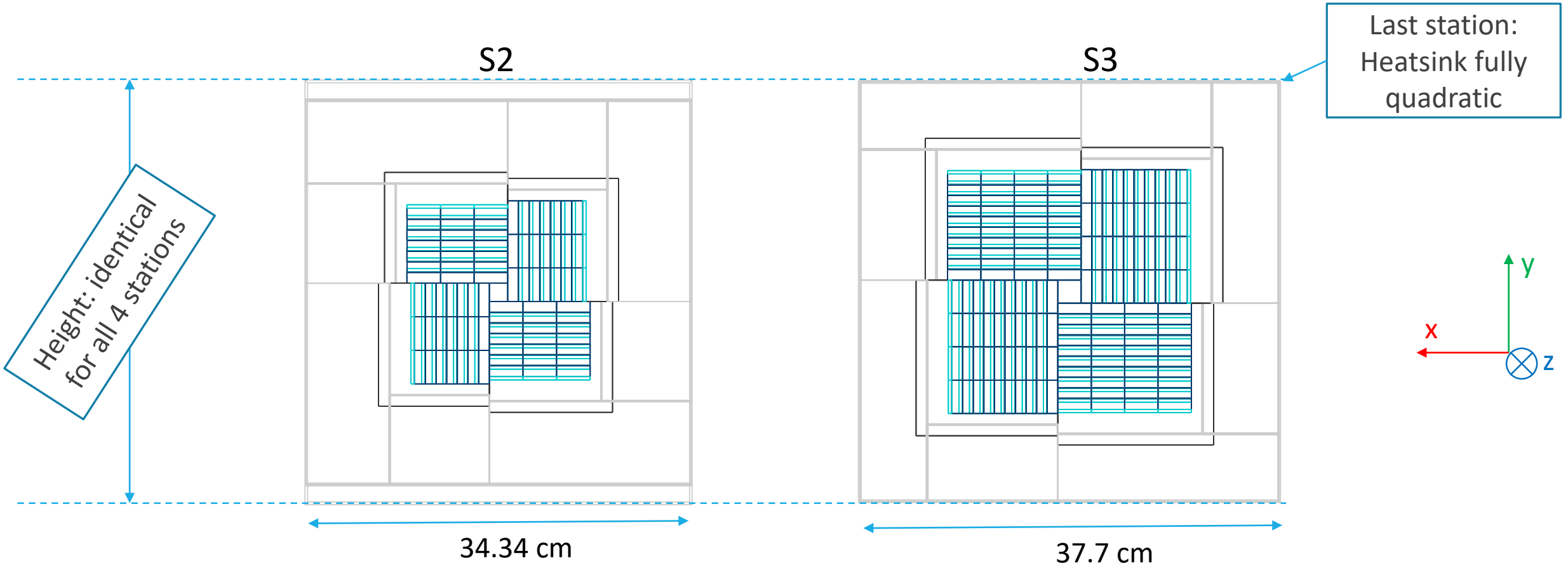
Current Status - Scripted Geometry Stations 0 and 1

Preliminary



Current Status - Scripted Geometry Stations 2 and 3

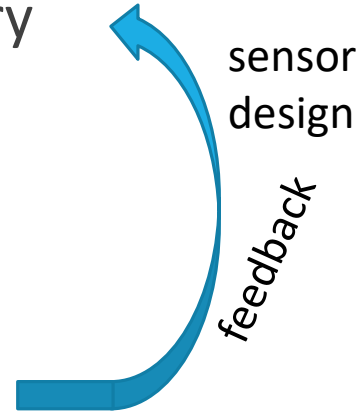
Preliminary



Summary

- Changed sensor dimensions require an update of the MVD geometry
- Move away from Cad2Root → geometry scripted in Root

- Goals for the scripted geometry:
  - First step: reproduce current v15a MVD geometry
  - Next step: update for the changed sensor dimensions → simulation →
  - Next next step: evaluate additional station configurations of the MVD to cover more physics cases



Thank you for your attention!

If you are interested in the slides, write to:
klaus@physik.uni-frankfurt.de