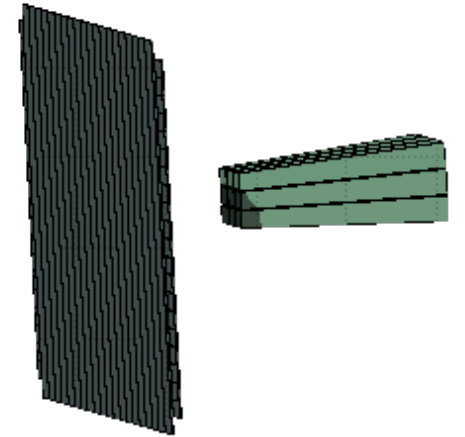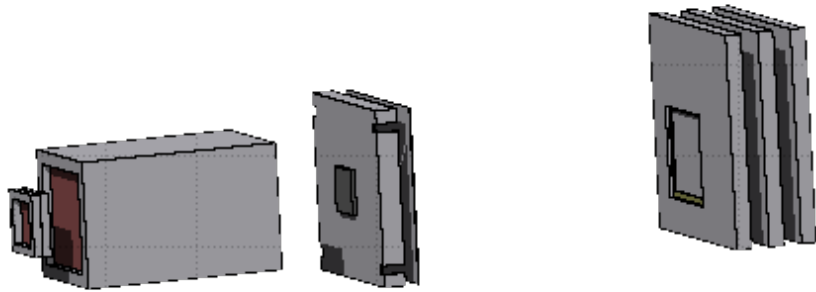# Some topics on the new MC simulations with passive materials

Preliminary productions: new regions added "by hand" (not known by shoe/genfit from geomaps)

GSI2021_MC run 400 and 401

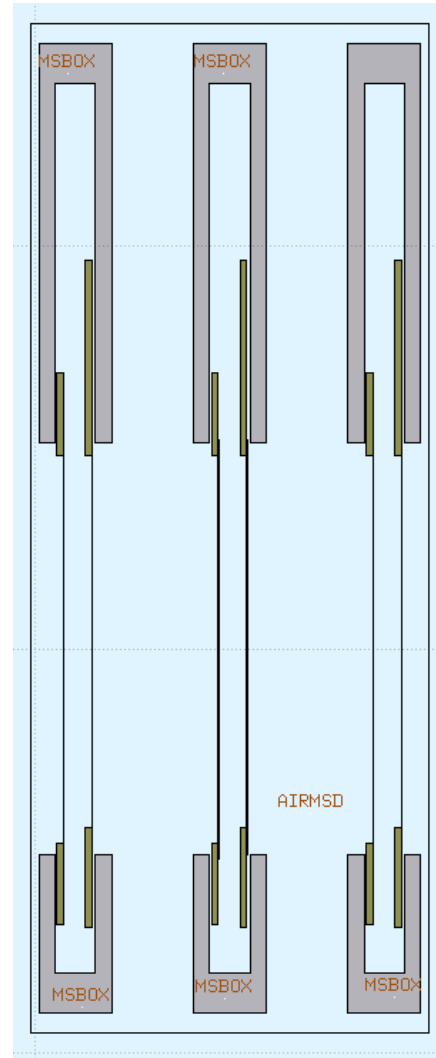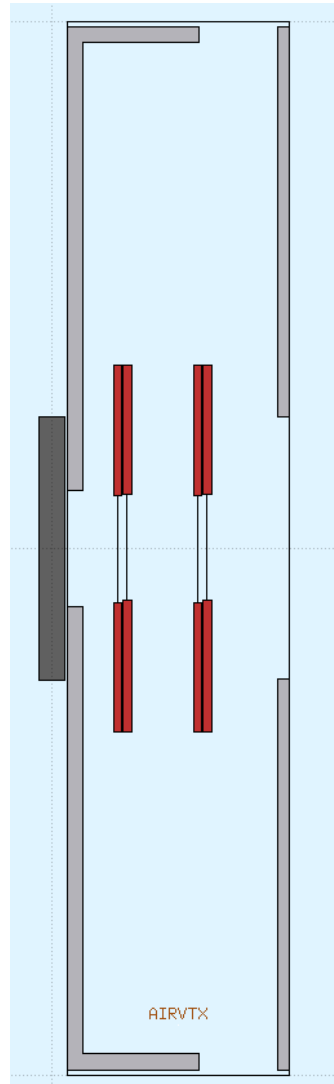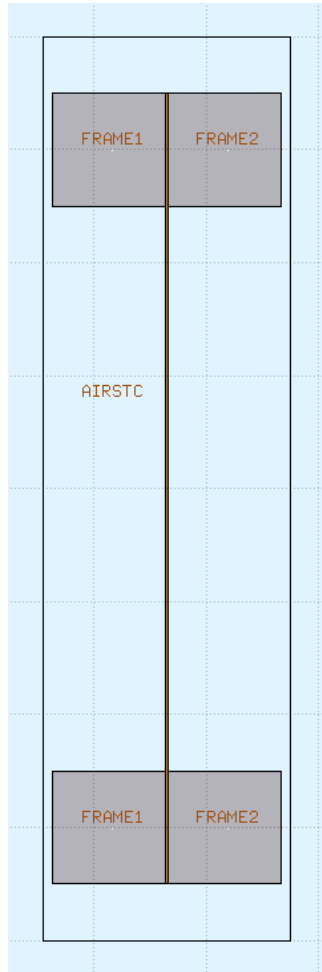Tier1: /storage/gpfs_data/foot/shared/SimulatedData/GSI2021pass_MC

16O_C_400pass_shoereg.root $5 \cdot 10^6$ primaries

16O_C2H4_400pass_shoereg.root $5 \cdot 10^6$ primaries

Preliminary productions: new regions added "by hand" (not known by shoe/genfit from geomaps)

MSD have 3 boxes

For technical reasons, now SC, VTX and MSD are each one enclosed into an air box:

AIRSTC
AIRVTX
AIRMSD

That means: if you use "crossings" in MC analysis, then you need to take into account that particles entering, for instance, in VTXE0 are no more coming from AIR1 but from AIRVTX (AIR1 → AIRVTX → VTXE0)

Preliminary productions: new regions added "by hand" (not known by shoe/genfit from geomaps)

New passive regions have been defined at the end: that means that all active regions are numbered exactly as before.

The new regions (after calorimeter) to be added in FOOT.reg:

```
Region n.        131 AIRSTC   Air box
Region n.        132 FRAME1   1st Al frame          } SC
Region n.        133 FRAME2   2nd Al frame
Region n.        134 AIRVTX   Air box
Region n.        135 VBOXF    Front part of VTX box
Region n.        136 VBOXB    Rear part of VTX box
Region n.        137 VTXB0    PCB 0                  } VTX
Region n.        138 VTXB1    PCB 1
Region n.        139 VTXB2    PCB 2
Region n.        140 VTXB3    PCB 3
Region n.        141 AIRMSD   Air box
Region n.        142 MSBOX    The 3 Al boxes together
Region n.        143 MSDB0    PCB 0
Region n.        144 MSDB1    PCB 1
Region n.        145 MSDB2    PCB 2                  } MSD
Region n.        146 MSDB3    PCB 3
Region n.        147 MSDB4    PCB 4
Region n.        148 MSDB5    PCB 5
```
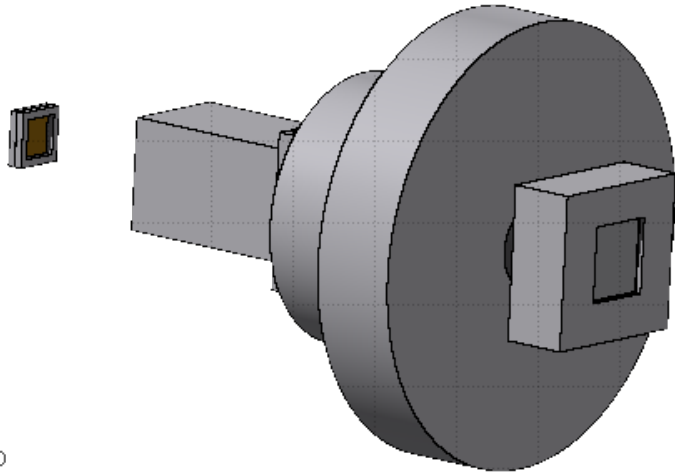
Note:

there is a new material definition, needed for the PCB. It is a mixture of several elements. Non know in Shoe at present

Preliminary productions: new regions added "by hand" (not known by shoe/genfit from geomaps)
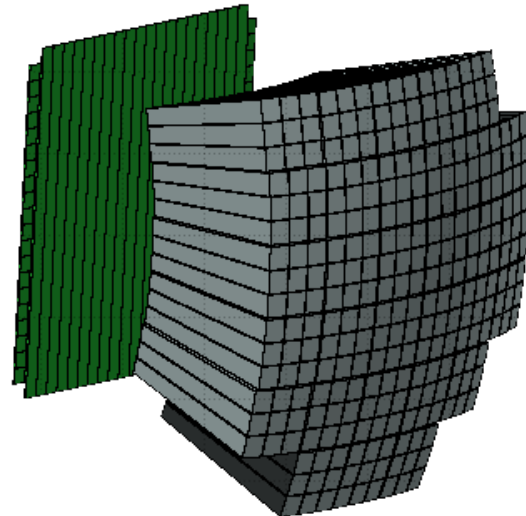
CNAO2023_MC run 1

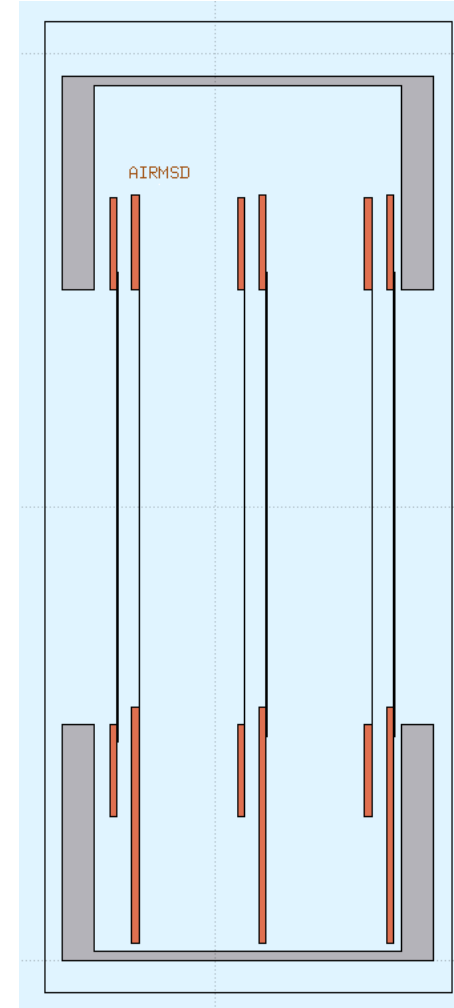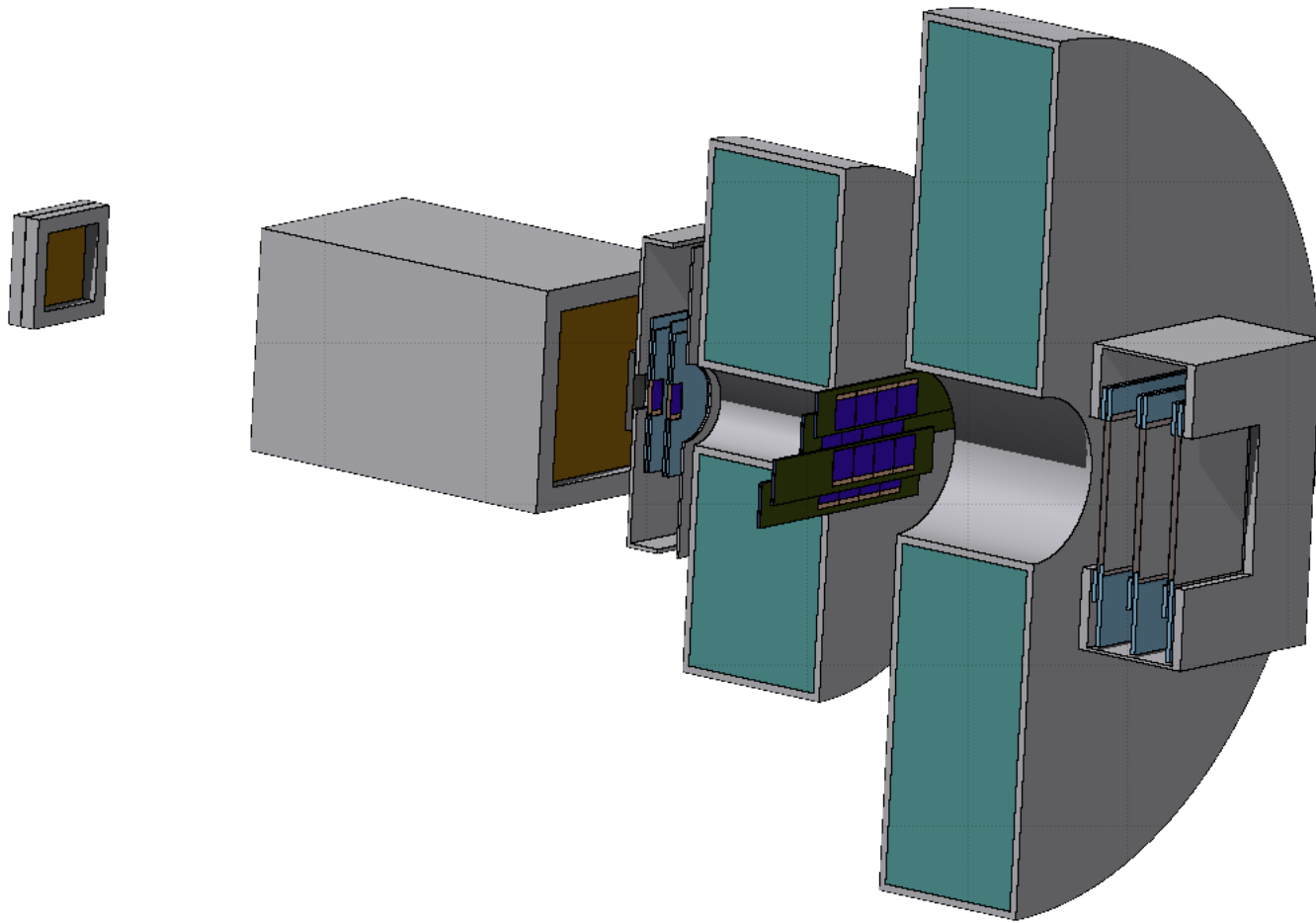Tier1: /storage/gpfs_data/foot/shared/SimulatedData/CNAO2023pass_MC

12C_C_200pass_shoereg.root 10^6 primaries

Preliminary productions: new regions added "by hand" (not known by shoe/genfit from geomaps)


AIRMSD

MSD have now a single box

Preliminary productions: new regions added "by hand" (not known by shoe/genfit from geomaps)

Also in this case new passive regions have been defined at the end: that means that all active regions are numbered exactly as before.

The new regions (after calorimeter) to be added in FOOT.reg:

```
Region n.        658 AIRSTC   Air box
Region n.        659 FRAME1   1st Al frame        SC
Region n.        660 FRAME2   2nd Al frame
Region n.        661 AIRVTX   Air box
Region n.        662 VBOXF    Front part of VTX box
Region n.        663 VBOXB    Rear part of VTX box
Region n.        664 VTXB0    PCB 0
Region n.        665 VTXB1    PCB 1              VTX
Region n.        666 VTXB2    PCB 2
Region n.        667 VTXB3    PCB 3
Region n.        668 AIRMSD   Air box
Region n.        669 MSBOX    The 3 Al boxes together
Region n.        670 MSDB0    PCB 0
Region n.        671 MSDB1    PCB 1
Region n.        672 MSDB2    PCB 2              MSD
Region n.        673 MSDB3    PCB 3
Region n.        674 MSDB4    PCB 4
Region n.        675 MSDB5    PCB 5
```
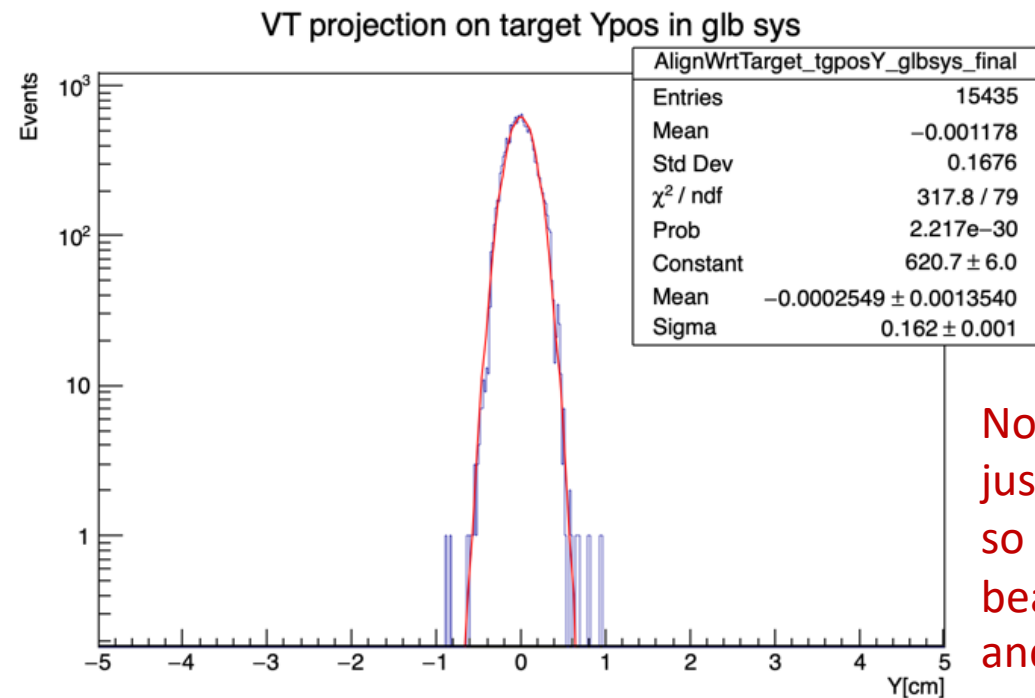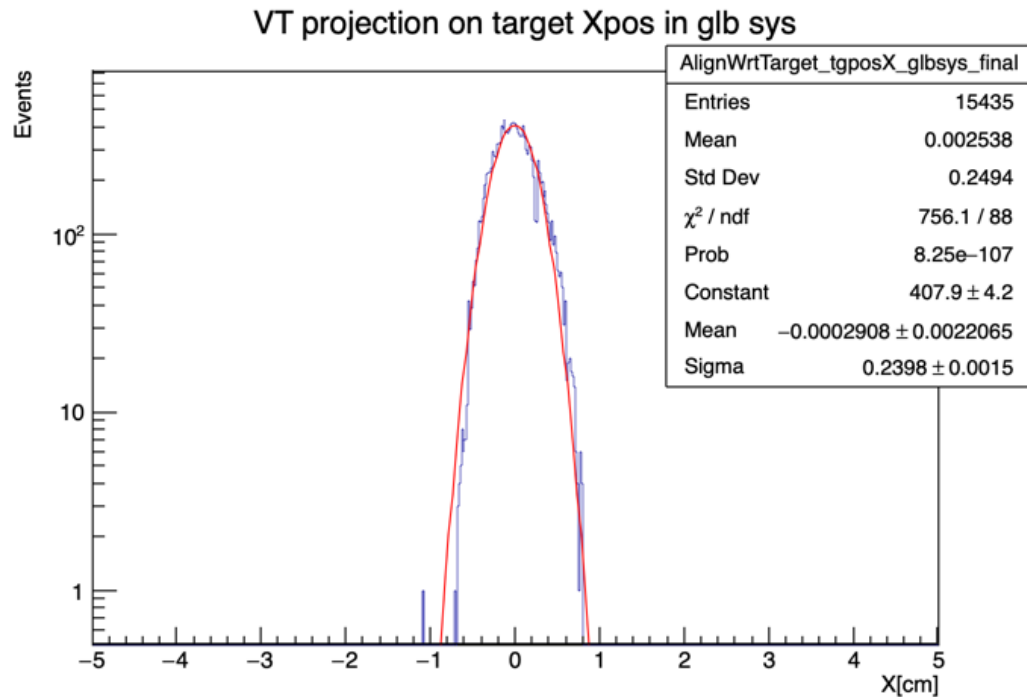
IT already had the main passive elements
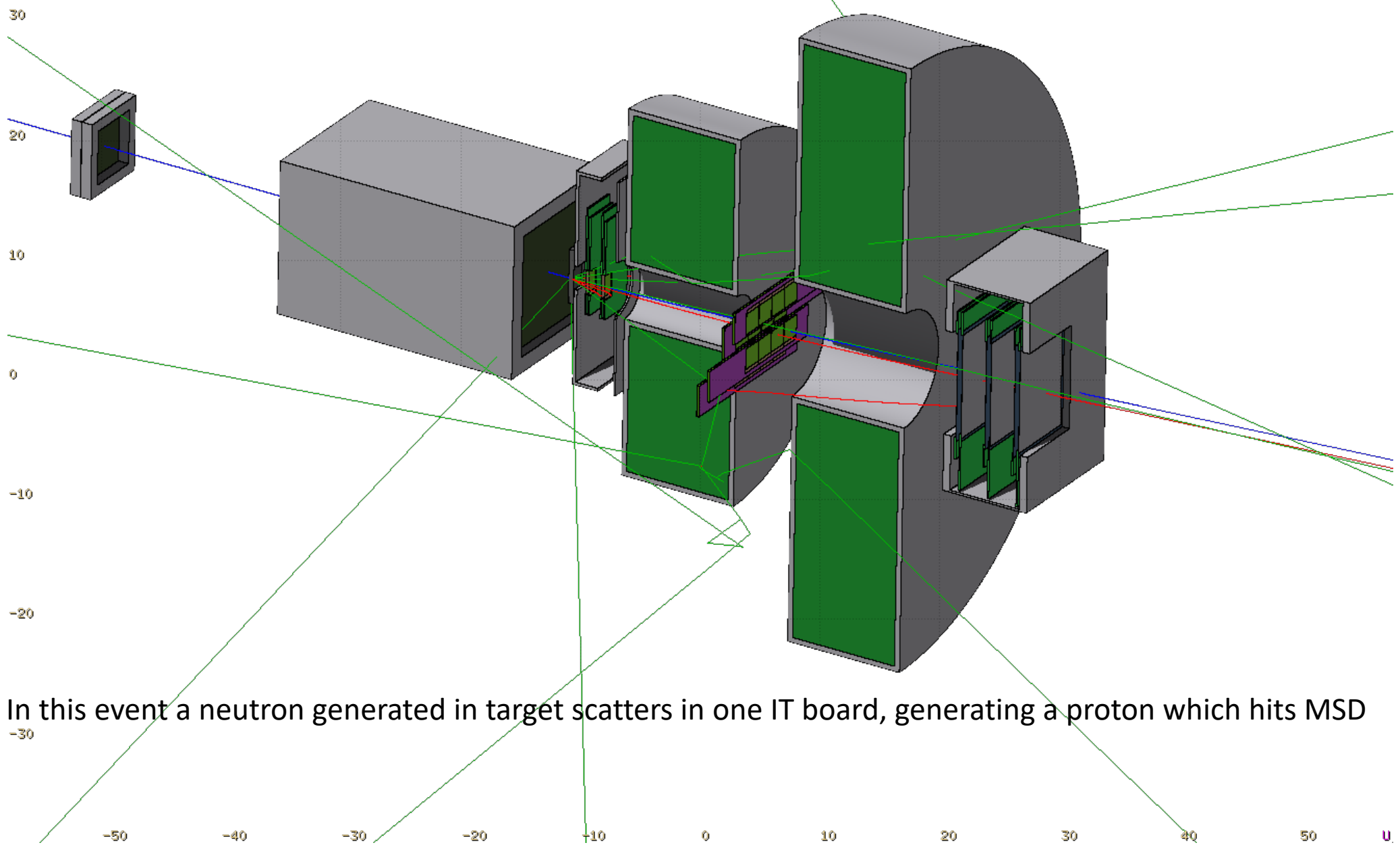
In this event a neutron generated in target scatters in one IT board, generating a proton which hits MSD

Towards a meaningful simulation of GSI2021

- The main issue is the Beam Model and its lateral structure (otherwise the addition of passive material might be not considered in the correct way)

VT projection on target Xpos in glb sys

AlignWrtTarget_tgposX_glbsys_final	
Entries	15435
Mean	0.002538
Std Dev	0.2494
χ^2 / ndf	756.1 / 88
Prob	8.25e−107
Constant	407.9 ± 4.2
Mean	−0.0002908 ± 0.0022065
Sigma	0.2398 ± 0.0015

VT projection on target Ypos in glb sys

AlignWrtTarget_tgposY_glbsys_final	
Entries	15435
Mean	−0.001178
Std Dev	0.1676
χ^2 / ndf	317.8 / 79
Prob	2.217e−30
Constant	620.7 ± 6.0
Mean	−0.0002549 ± 0.0013540
Sigma	0.162 ± 0.001

Note: we have just realized that so far in MC beam model X and Y width were swapped

From the no-target run at 400 MeV/u: single track in VTX estrapolated to target
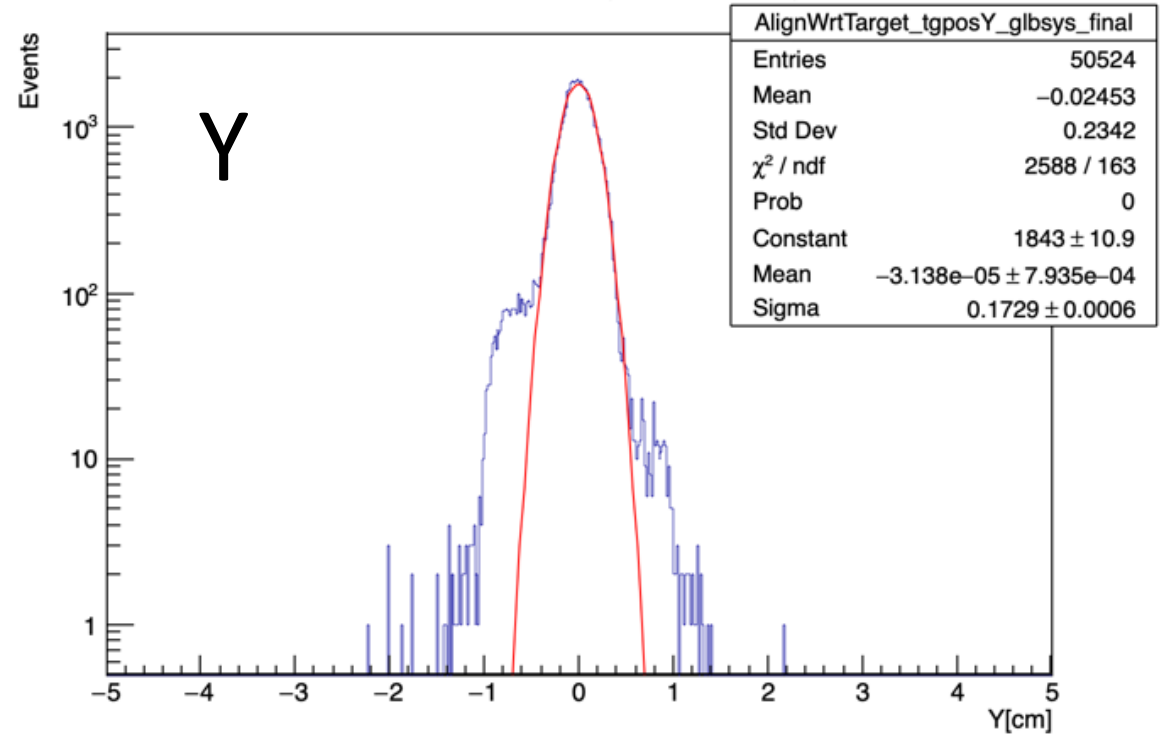
Doubts: is this too clean?
Can the request of a track matching BM and VTX have erased all dirty situations? (lateral tails)

Towards a meaningful simulation of GSI2021
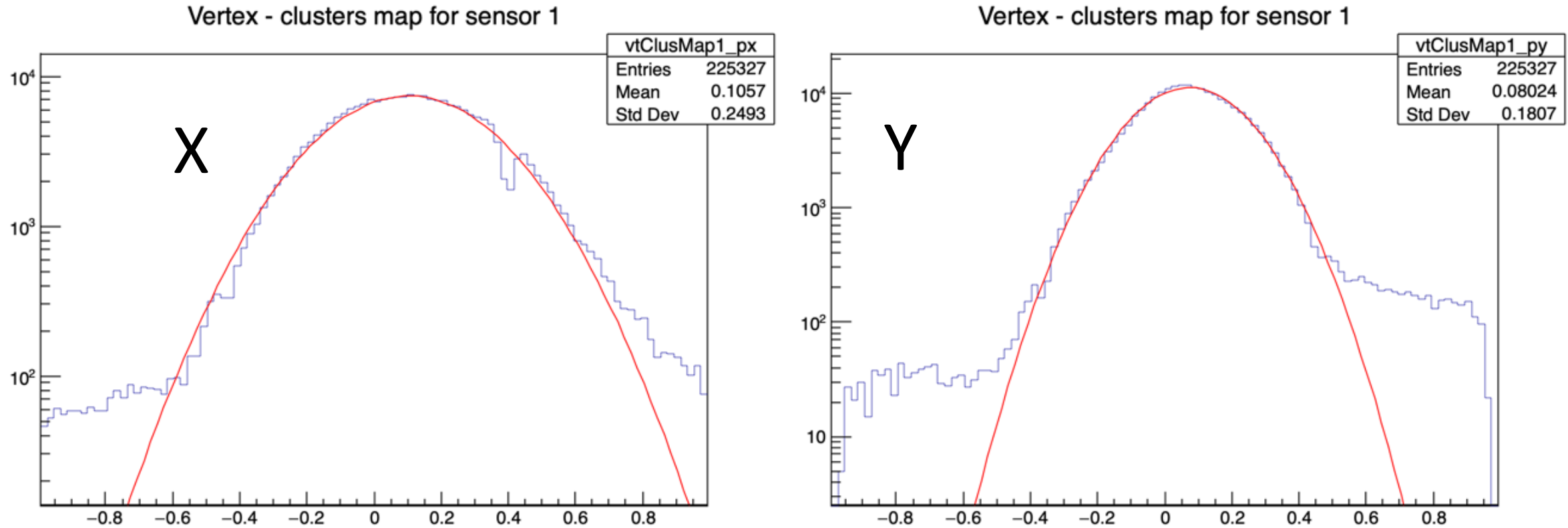

Raw BM map

Towards a meaningful simulation of GSI2021

Raw VTX0 Cluster map run 4313 (with target)

Summary of main questions for GSI2021_MC

- Which beam model?

- Should we make a new production? (we have still to produce the requested case of no target)

- While waiting for a situation in which the new regions are automatically considered by Shoe, can people use the preliminary production?

New work in progress:

- Passive regions/materials managed by Shoe. A new branch called SimPass has been created. When ready it will be merged with newgeom

- We are starting from CNAO2023_MC

- SC and VTX are ready (a part from new material for PCB composition)

- MSD not yet ready

- Question: how do we manage the fact that MSD boxes (and PCB orientations) are different from one campaign to the other?

- A few other questions are emerging…

The issue of Target+VTX and their roto-translations

So far in our geomaps, TG ad VTX are considered as separate objects, but in reality we have always attached TG to the VTX box

They should be moved together

AIRVTX
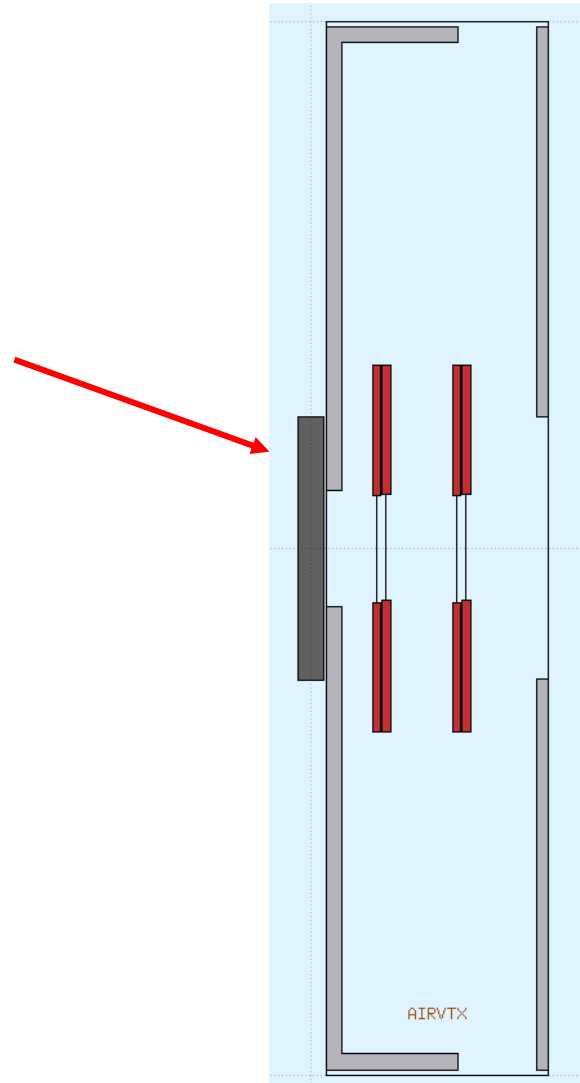
The issue of Target+VTX and their rotations

Exagerate rotation to visualize the issue

Even if you rotate them of the same amount, there is a (small) mistake if you consider them independent objects, each one rotating around their center:

Note: this "problem" of having 2 separate local frames for TG and VTX has been existing since the beginning, but it was realized only now, after introducing the VTX box

The target moves up (or down) with respect to the box (2 independent rotation centers, 2 independent local frames)
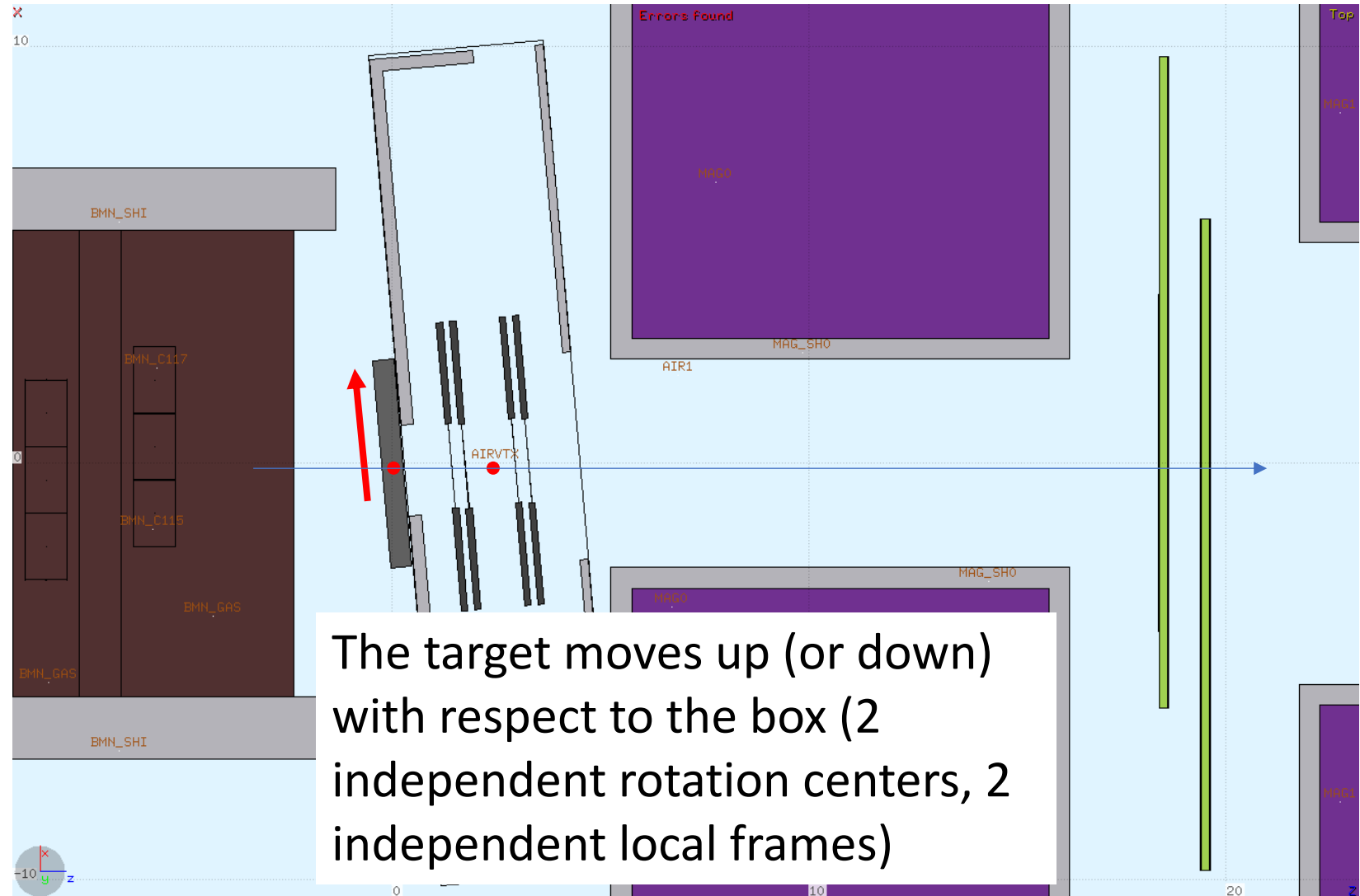
The issue of Target+VTX and their rotations

An easy alternative (but we do not like it…):
Consider in 1st approximantion TG and VTX box as fixed, and rotate only the sensors

Justified by the fact that in any case we should have very small angles
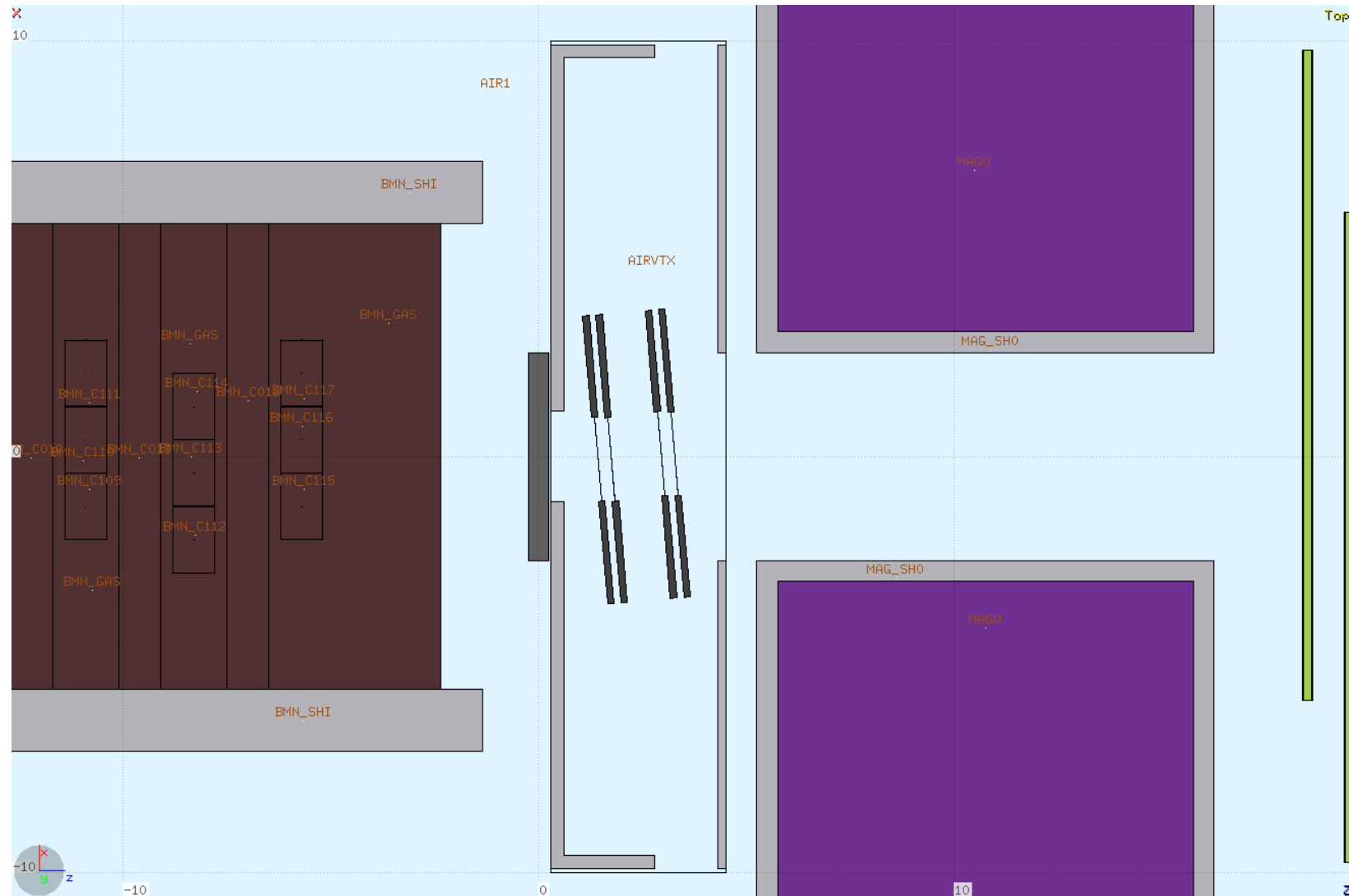
The issue of Target+VTX and their rotations

The faithful representation would be to consider TG as a further element of VTX

This would require some changes... (TAGdetctor.geo inside TAVTdetector.geo?)

Doubt: will TG always be linked to VTX box or there will be alternatives?

Another side consideration:

So far we have beem putting the 0 of geometry at the center of TG. This creates the need to move everthing in FOOT.geo when using a target of different thickness, as for C_2H_4

Would it be better to put our 0 in a stable meaningful position? For example: the center of the 2 magnet system

Summary of all main questions

- Are the preliminary new productions with passive materials usable?

- Which beam model should be used?

- Should we re-produce GSI2021 (C, Polyethylene, No-Target) with a more realistic beam model?

- Should we have first the new Shoe ready? It will take time...)

- How do we manage the different boxes of MSD in shoe?

- How do me manage the coupling of TG and VTX (box)?

- Any idea about the issue of the assignement of (0,0,0) point?