CyMBaL:
Update on the preliminary design

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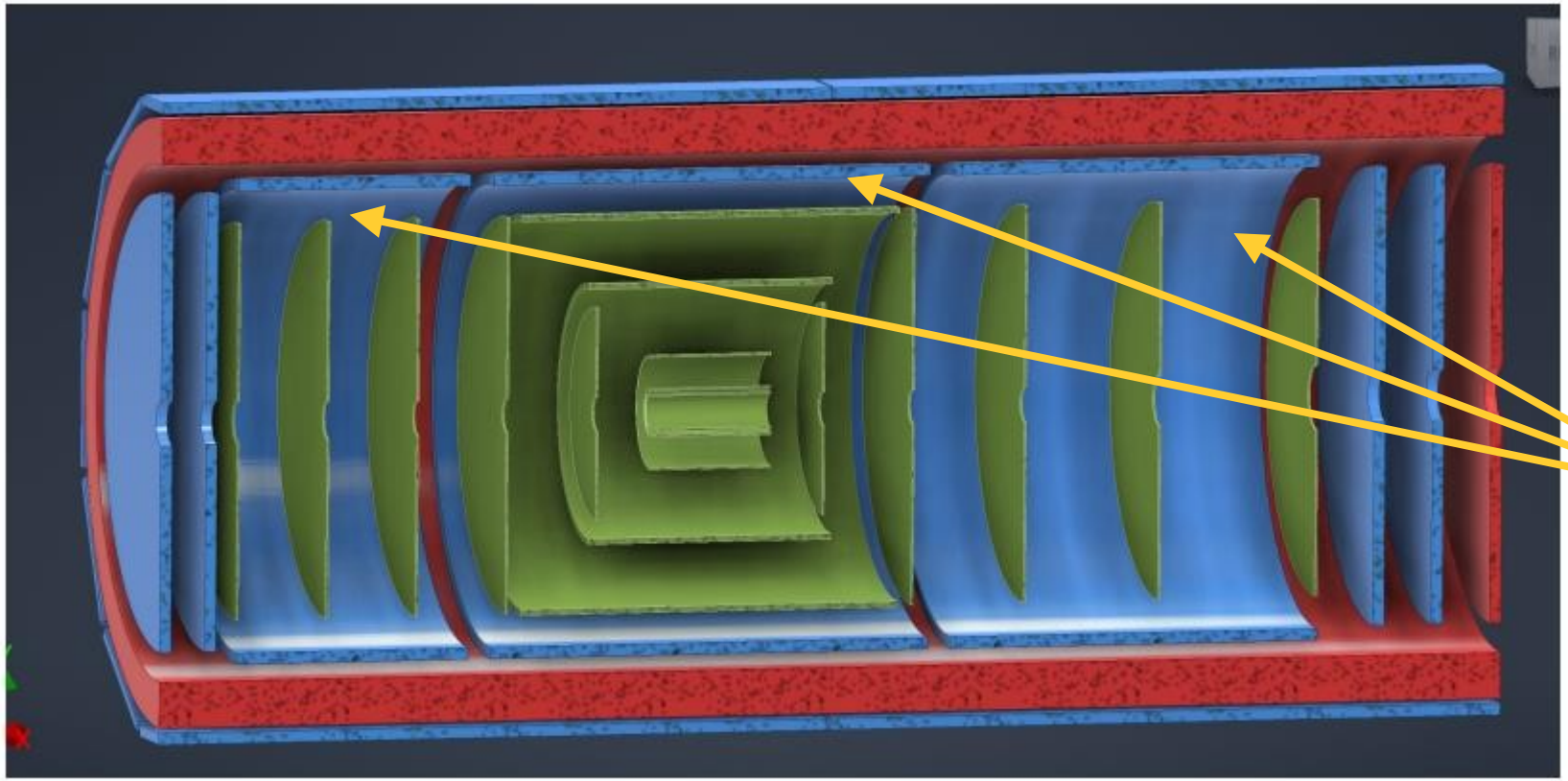
Sept 18th 2023 – TIC meeting

The new MPGD layout in ePIC



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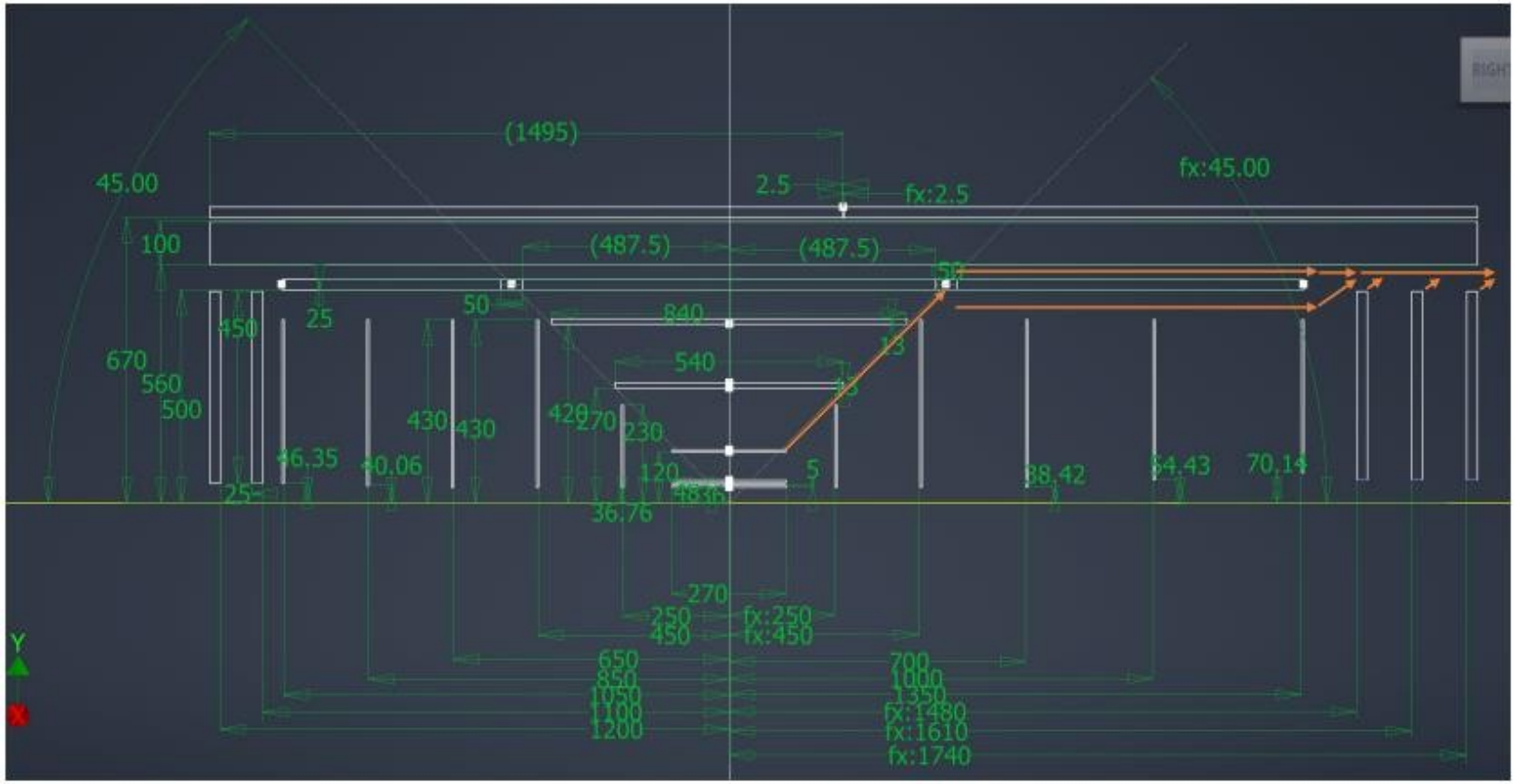
Three cylinders for different lengths at R=50cm

Keeping zones

- Three cylinders for different lengths at R=50cm
- Vertical keeping zone: 25mm
- Additional space?
  - 60mm to TOF
  - 70mm to the SVT
- Assumptions :
  - Hermetic in phi and z.

	z min	max	length
backward	-105	-53.75	51.25
central	-48.75	48.75	97.5
forward	53.75	135	81.25



Working hypotheses

- Making small modules is simpler and the production line more robust, than long detectors
- Making few (maybe just one) module types simplify enormously the production line
- Segmenting the system in module makes it more robust to local failures during data taking
- Hermetic system both in φ and in z
- Considering there is no available space for deporting FEBs

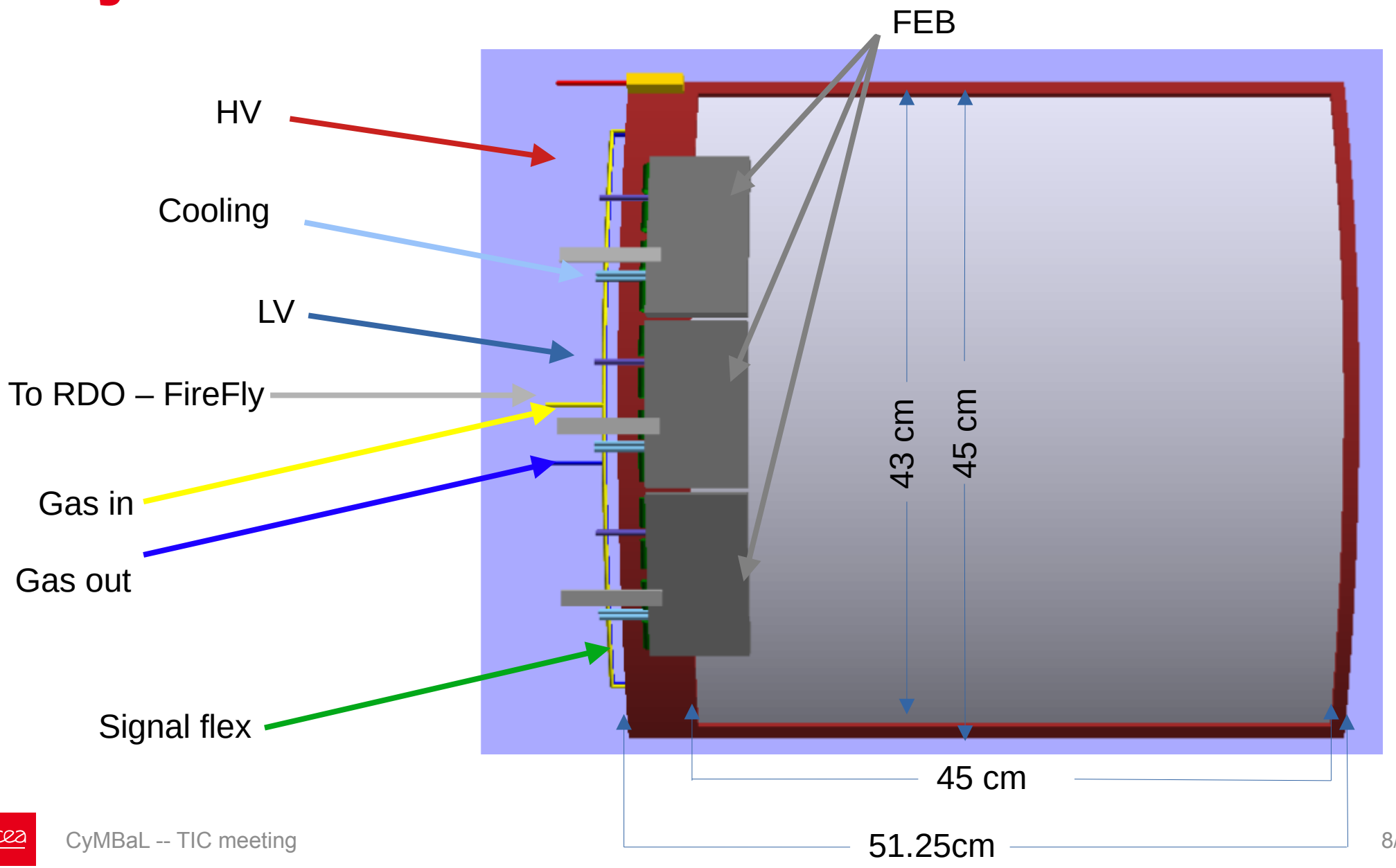
What follows is a VERY PRELIMINARY set of ideas put together in a simple CAD model. None of the numbers/dimensions are cast in stone yet. It is the starting point for further evolutions

Questions from last presentation

1) The layout of the three cylindrical MICROMEGAS (inner MPGD)

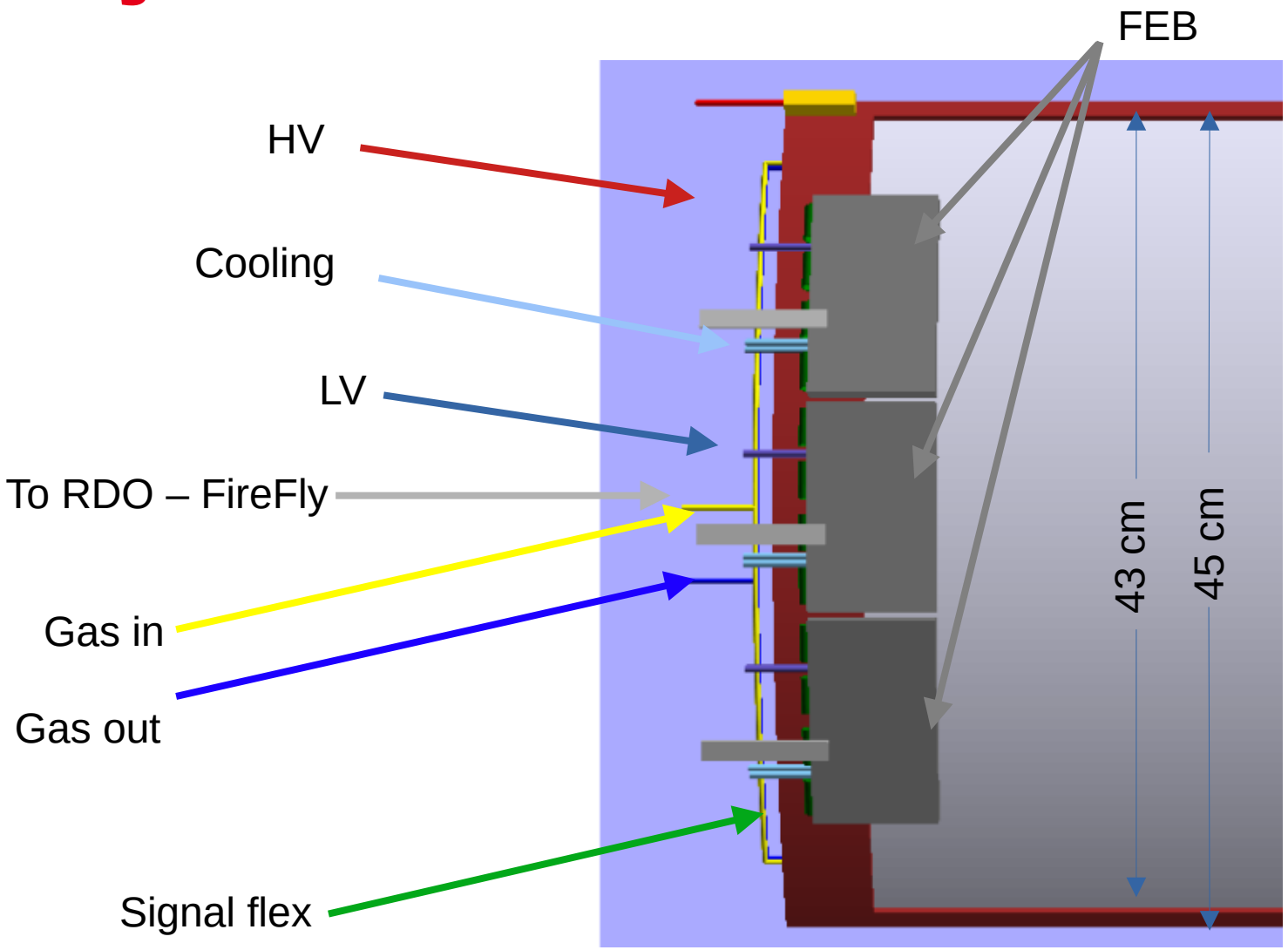
The concept of a tiled approach to the modular MPGDs of medium size has been appreciated.
The details of the implementation need further refinement, as there remain open questions:
- How large is the extended overlaps between adjacent tiles and what is the related space requirement?
- The tile services seem to consume all the clearance space between the cylinders, while the services of
the more inner subsystems may need the same space;
- The routing to the FEE of the signals from the coordinate different
from z have to be understood (parasitic capacitance, etc.)

CyMBaL – a tile



What's new:
- slightly bigger tiles
- FEB position, can be moved in, for less interference with other systems' services

CyMBaL – a tile



Assumptions:

- Size: 51.25 x 45 cm^2
- Active area: 45x43 cm^2
- ~1 mm pitch in both directions
- 768 strips per tile
- 32 channels per connector, 24 connectors

Services:

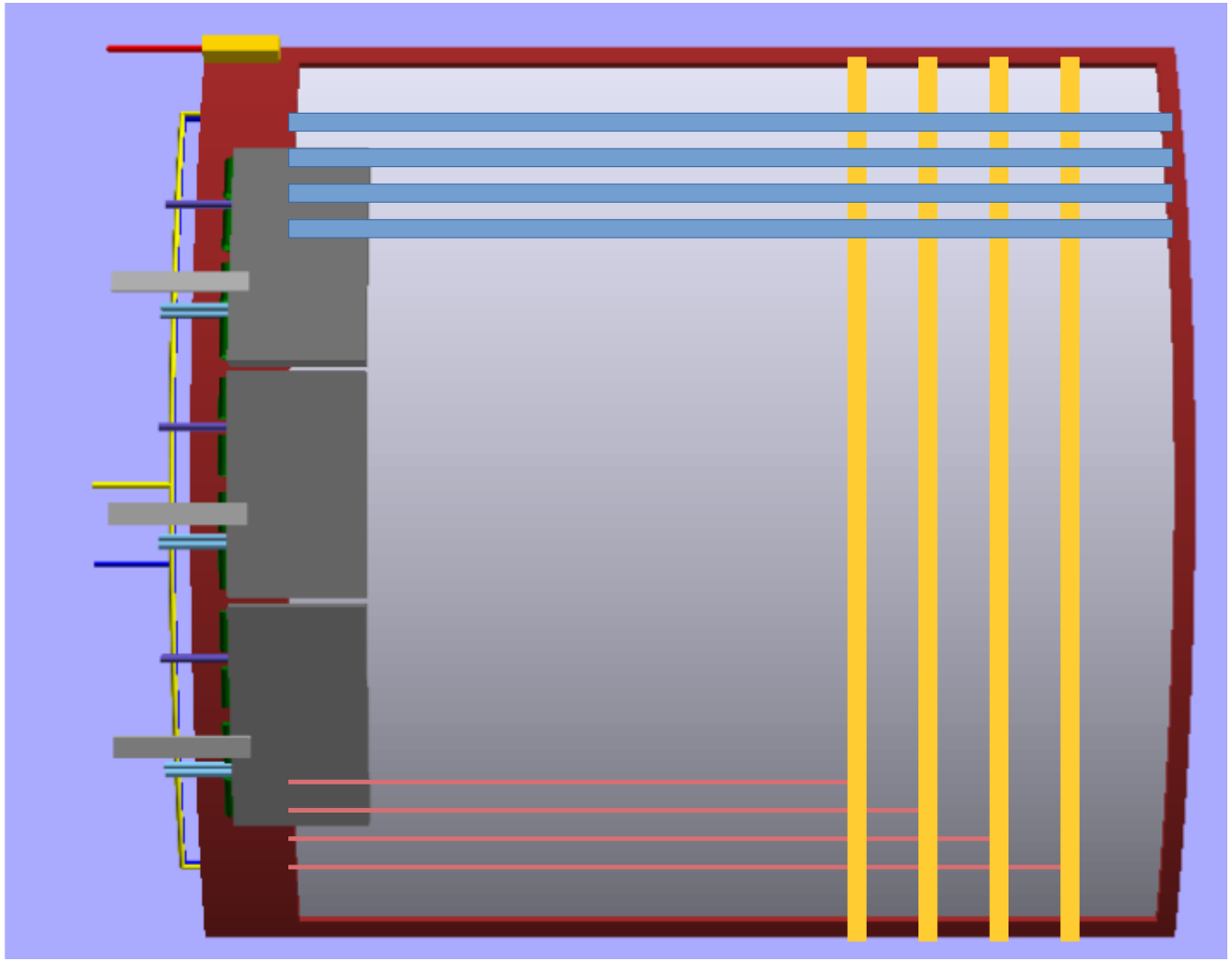
- HV: 2 channels (drift and resistive layer)
- Gas: 2 tubes (in and out)
  - Two tiles can be in series
- If 4 ASICs per FEB:
  - 1 8ch FireFly per FEB to the RDO
  - 2 short flex cables per ASIC, 24 flexes 10cm max
  - LV
  - Cooling in and out, possibly in series

CyMBaL – tile r/o routing

R phi

z

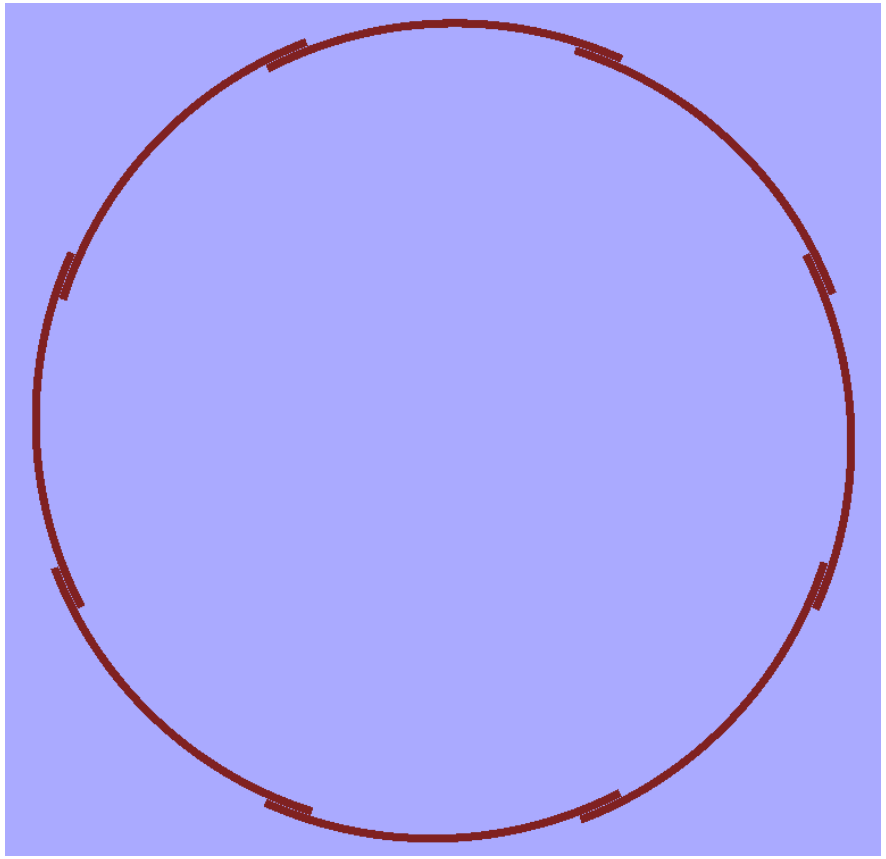
return trail for z strips



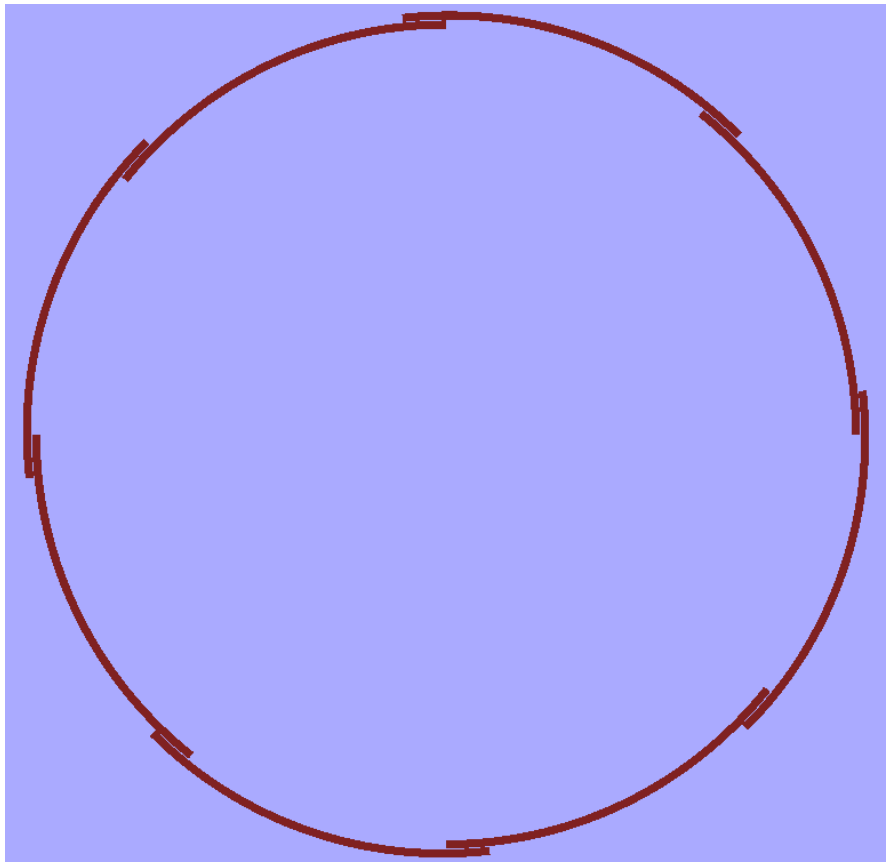
CyMBaL – a sector

- Two options under considerations:

« roof tiles »



« alternated »



CyMBaL – a sector

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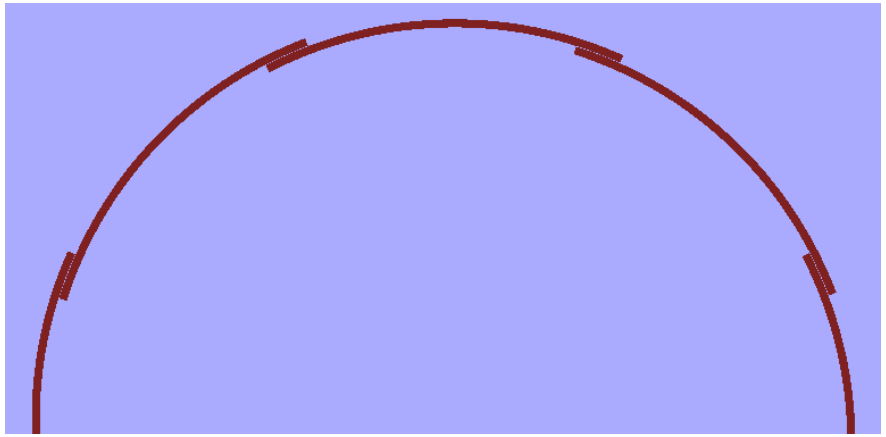
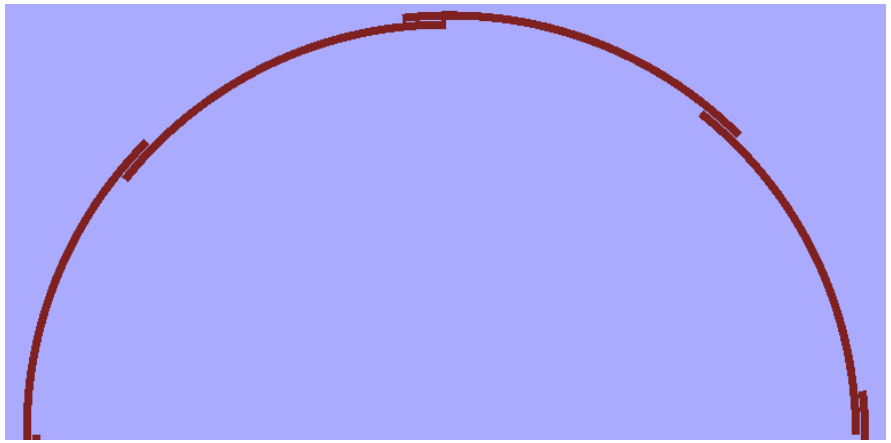


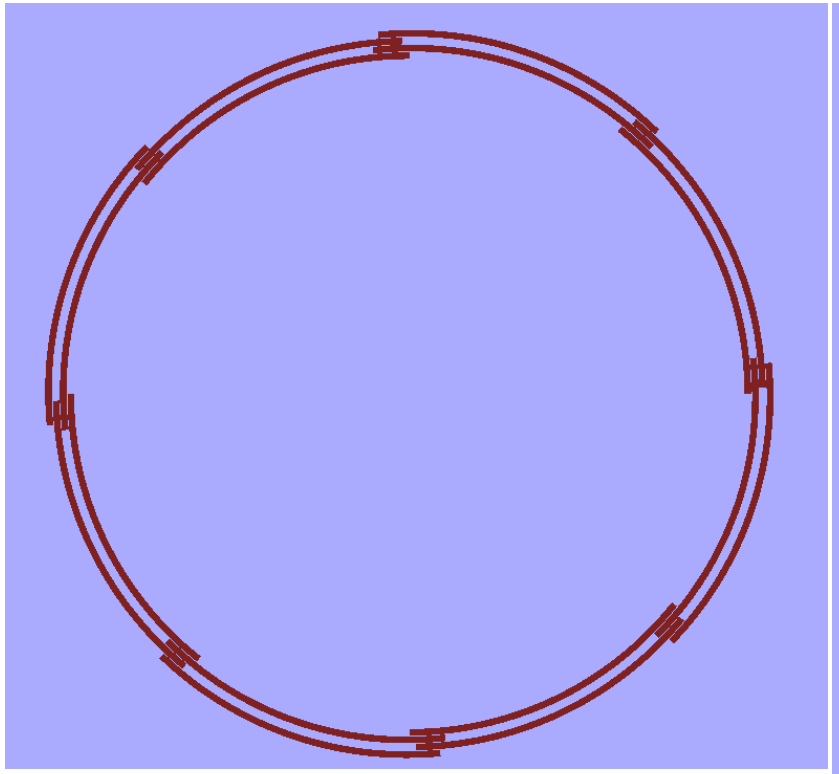
- Tilt in φ

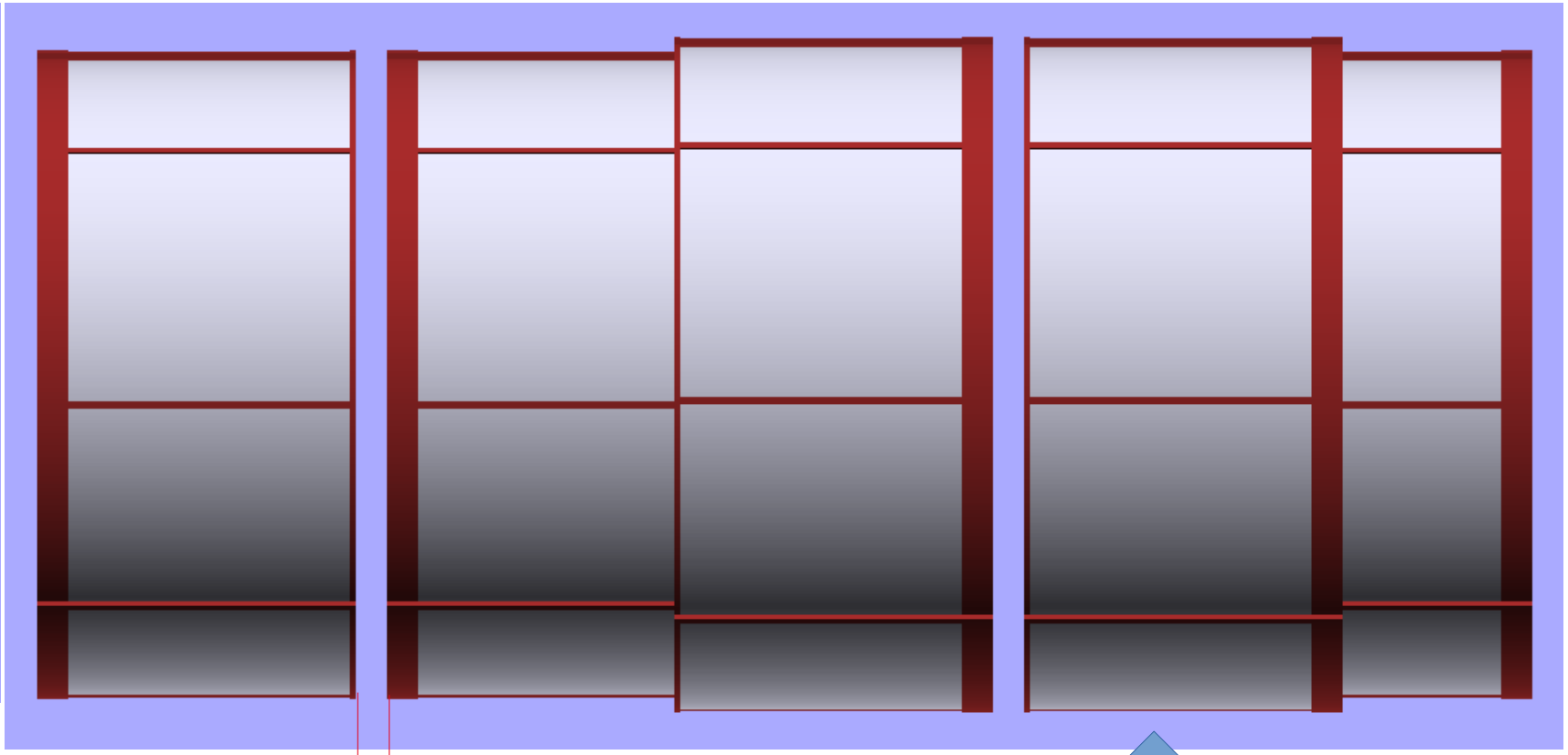
« alternated »



- No tilt in φ
- Radial displacement
- Probably easier to built in two halves

CyMBaL – the whole system



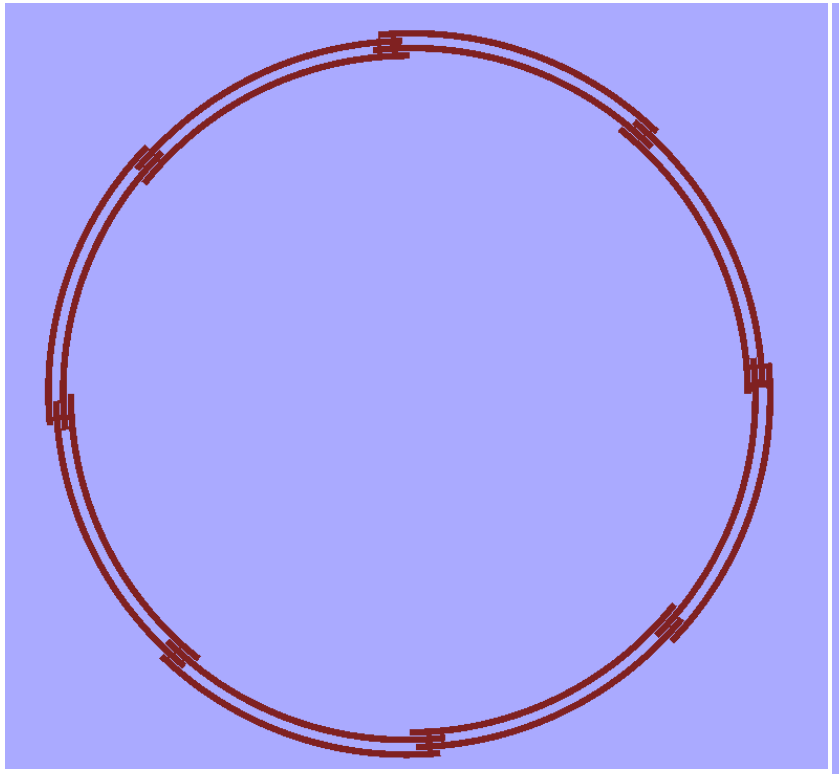


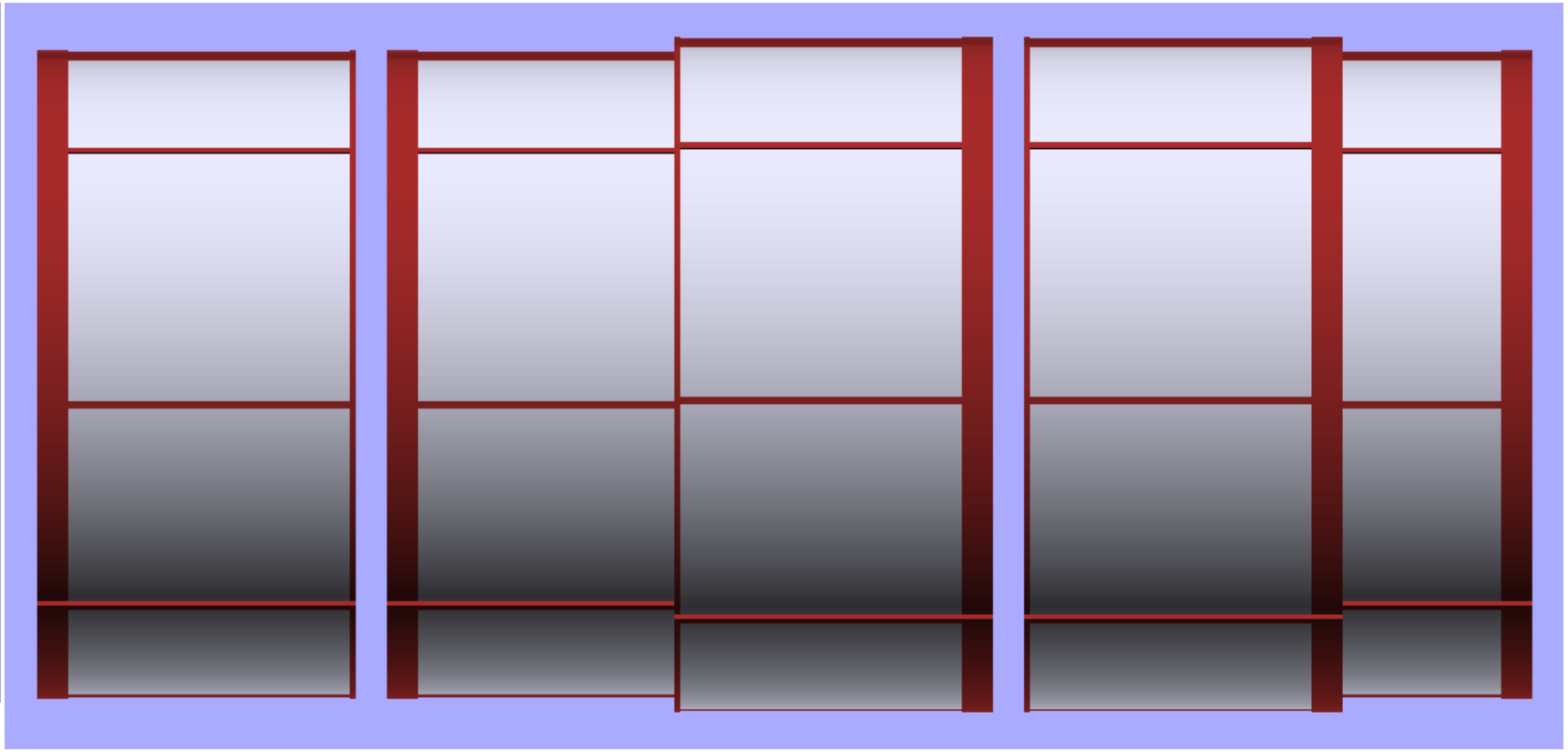
Two different radii 50 and 52.2 cm
To accommodate Z overlap

50mm

Reversed tile to increase the active area within the keeping zone and to route services away from the crac

CyMBaL – the whole system

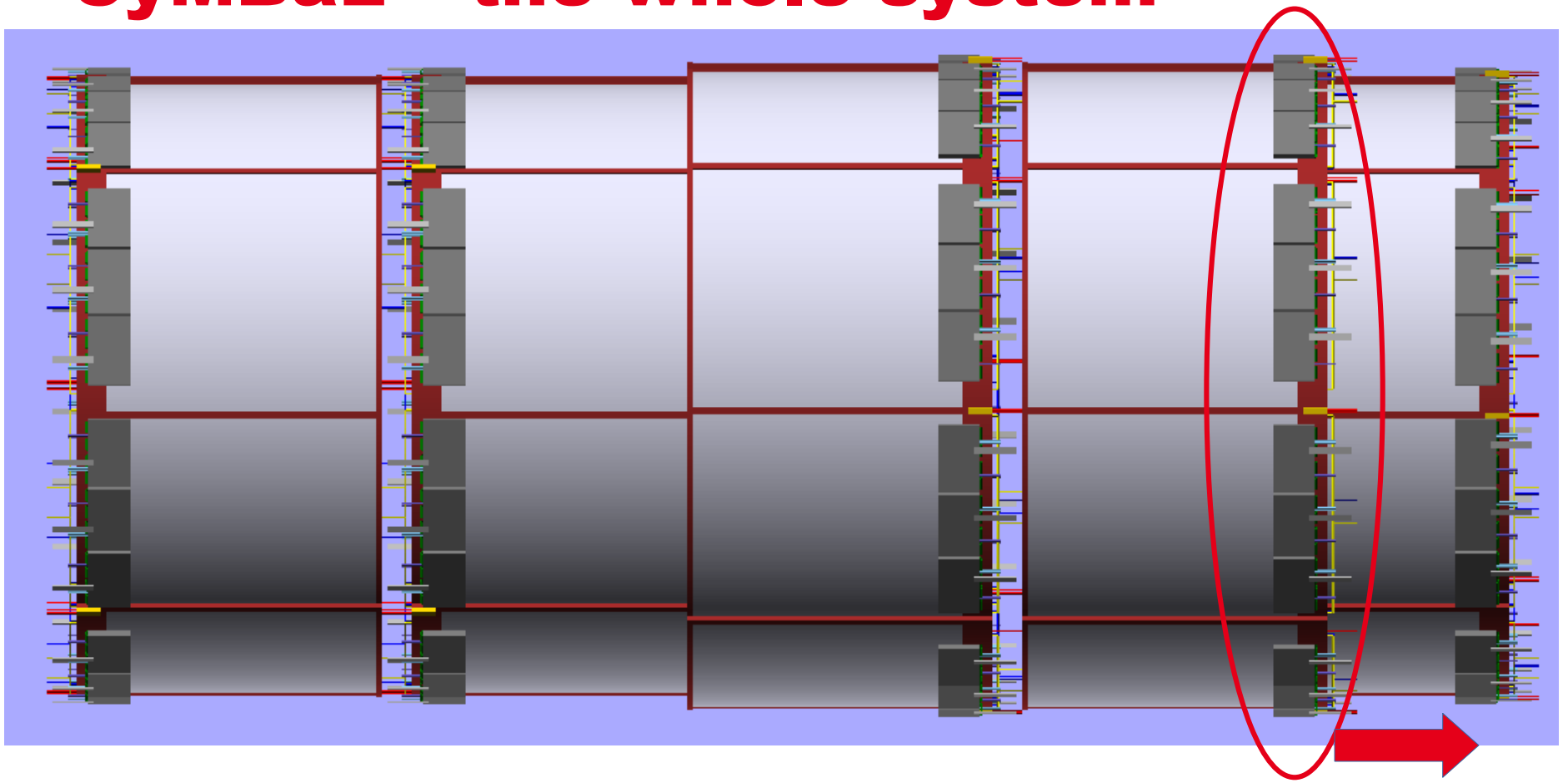




Overlap in φ:
- for the smaller radius, overlap: 5.7cm
- for the larger radius, overlap: 3.8 cm

Overlap in z:
- central, overlap: 2.5cm, barely enough
- forward, overlap: 10.4 cm

CyMBaL – the whole system

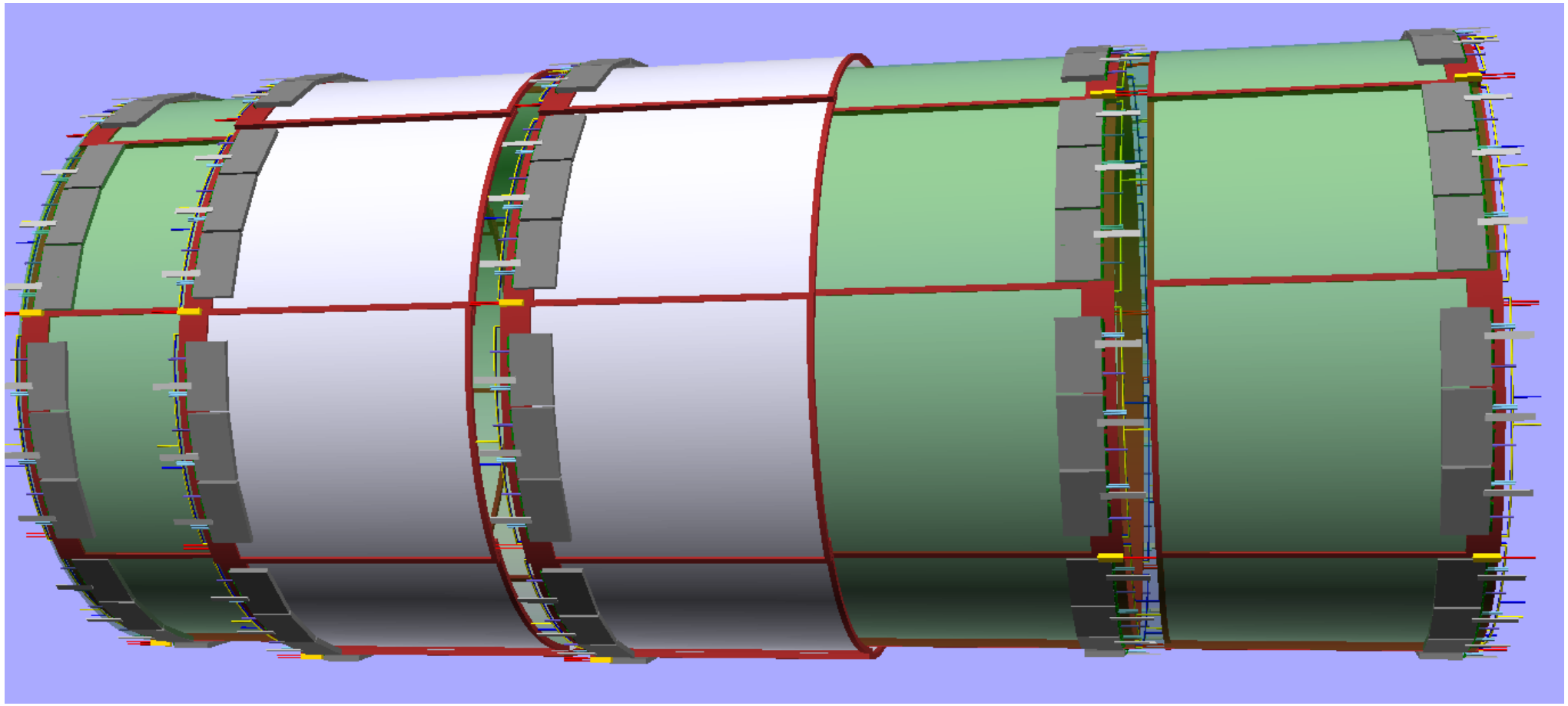


Number of tiles	40
Readout channels	30k
Number of FEBs	120
ASIC	SALSA

Reminder about services
- FEB cooling may be shared by ~3 boards
- gas can be shared by two tiles

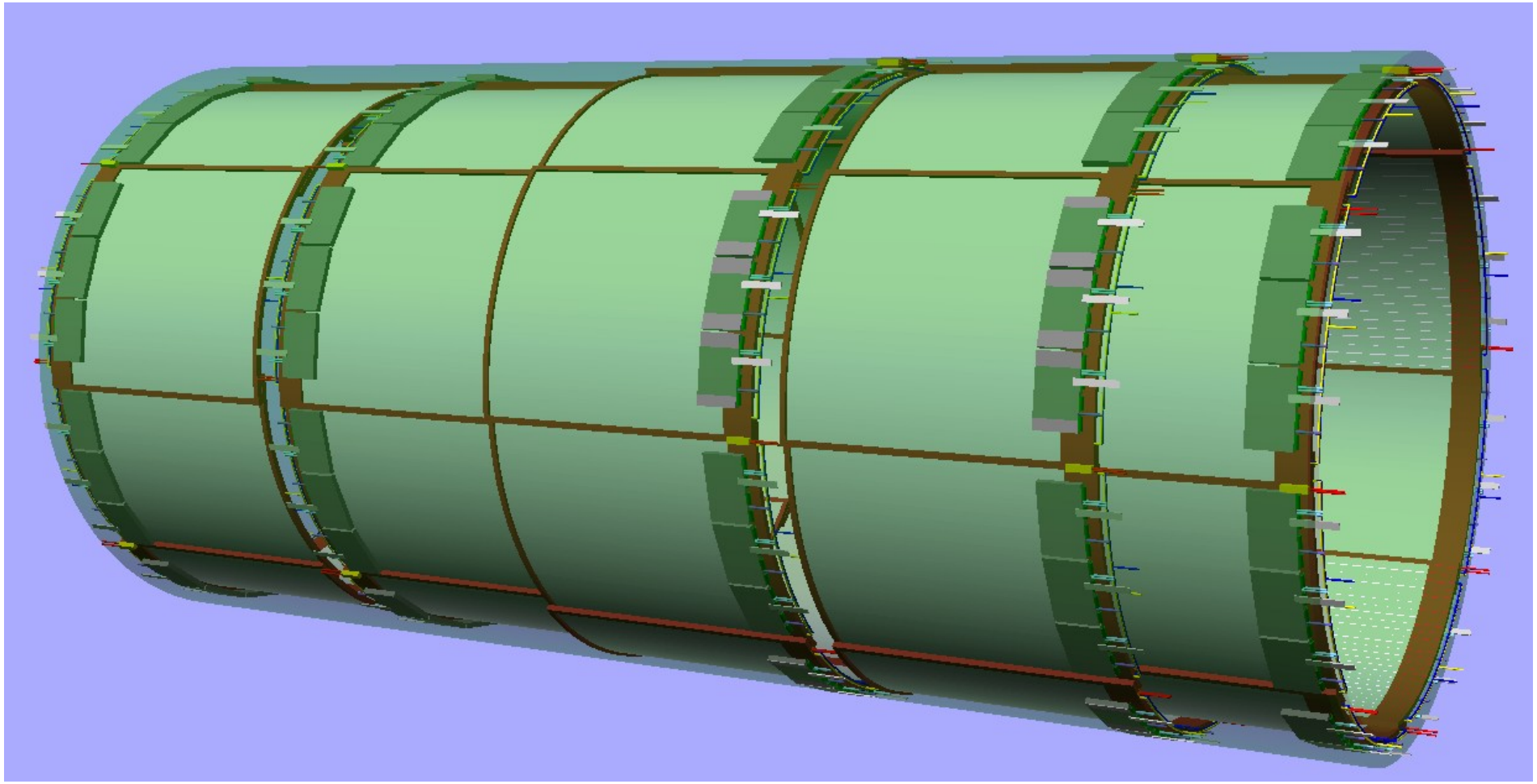
Services of the forward layer can be moved

Keeping zone



The green shade shows the 2.5 cm radial keeping zone assigned.
Unfortunately the system needs a bit more space

Keeping zone



The green shade shows the **5.5 cm** radial keeping zone that would allow us to fit everything (FEB included)
The design can be improved to fit in a slightly tighter region, but this is a “safe” assumption

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- This is preliminary sketch
- Based on a module 51.2x45 $cm^{2,}$
- FEB on modules,
  - Assuming no space available within ~2m distance from the tiles
  - This allows us to route only ~120 FireFly data cables instead of 120x2x4=960 micro-coaxial flat cables
- Two arrangement of tiles to allow for overlap in z and phi, the « alternate » option seems to be more suited for two-halves installation
- Modifications to the arrangement of the slides to free some space for services, mainly in the forward region
- The 2.5 cm radial keeping zone is too tight, the system will need more space, mainly due to the FEB-on-module choice