Updates on RPC RE3/1 and RE4/1

[1,2] E. Voevodina, [3] I. Crotty, [2,3] S. Buontempo,

[3] B. Smiljkovic

[1] Universita Federico II di Napoli, 1-80125 Napoli,

[2] Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Napoli,

[3] European Organization for Nuclear Research, Geneva (Switzerland)

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Plan

1. RE3/1:

- Studies of the value “Z” for RE3/1 (four methods of the determining) ;
- Fastening elements for fixing RE3/1 chambers on the YE3.

2. RE4/1:

- Studies of the value “Z” for RE4/1;
- Mounting plates for RE4/1 chambers ;
- The proposed MP outer “R” M24 posts which are underneath the RE4 SMs.

3. Future work for RE3/1 and RE4/1

Conclusion

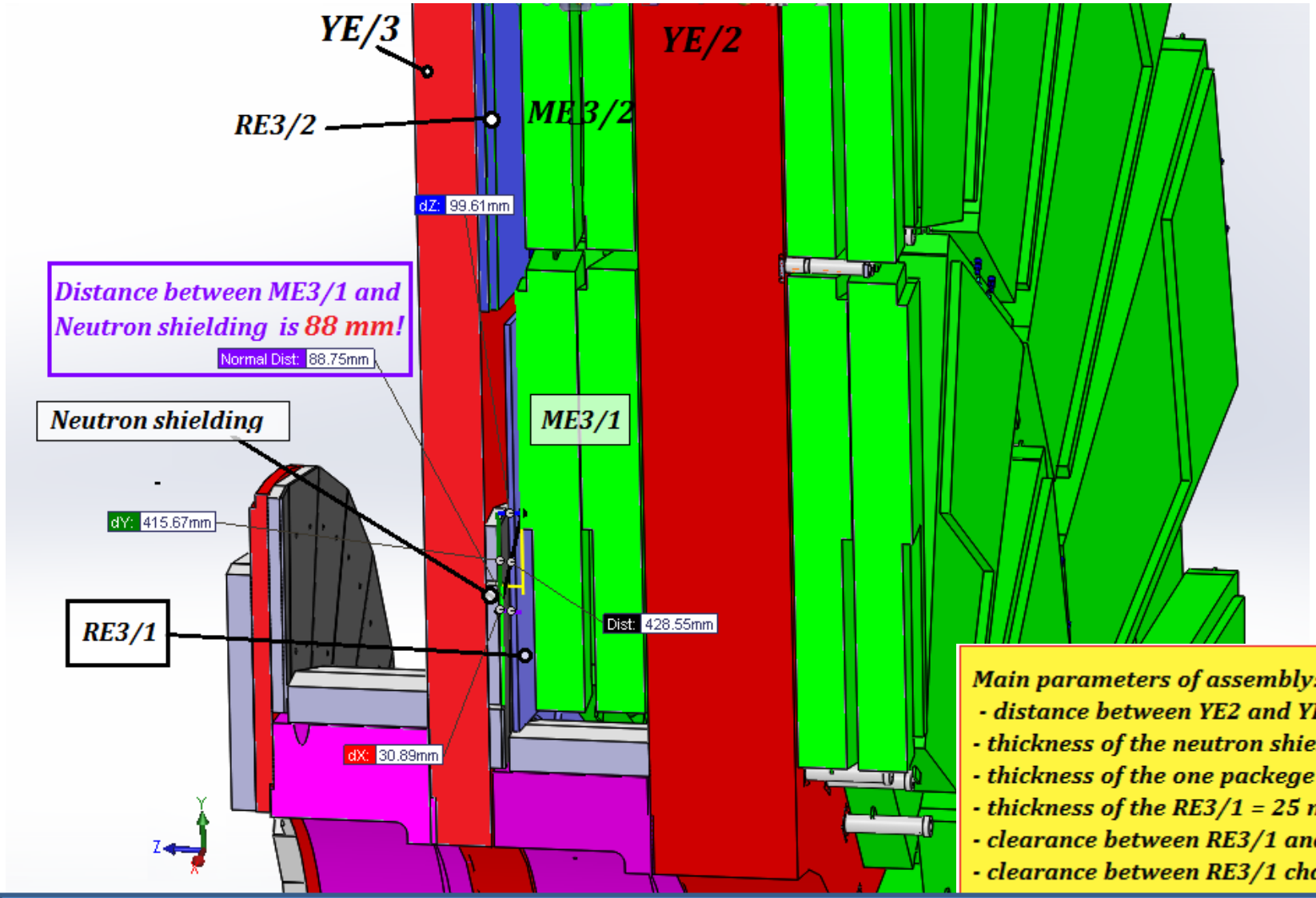
Four methods to determine the value "Z" for RE3/1

1. Main drawing of the CMS;
2. Manual measurements;
3. Laser scanner and laser tracker;
4. IR - sensors.

The value "Z" for RE3/1

1. Main drawing

➢ **On basis the main drawing of the CMS the value "Z" for RE3/1 is 88 mm!**



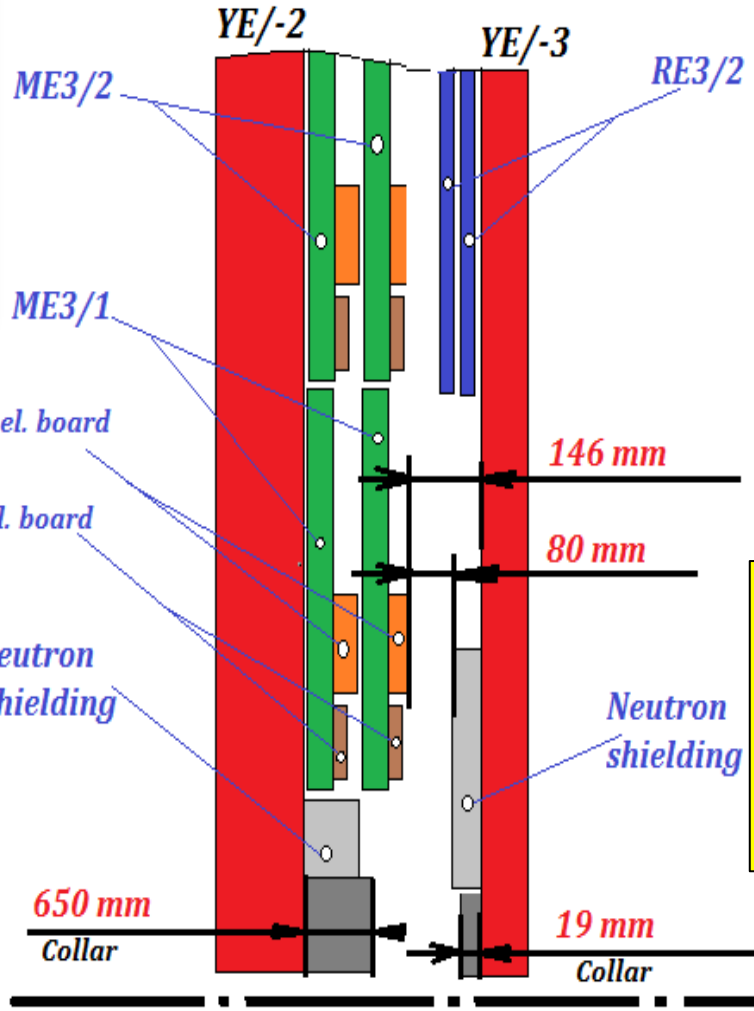
Main parameters of assembly:
- *distance between YE2 and YE3 = 655 mm;*
- *thickness of the neutron shielding = 63 mm;*
- *thickness of the one packege of CSC = 504 mm;*
- *thickness of the RE3/1 = 25 mm;*
- *clearance between RE3/1 and shielding =5 mm;*
- *clearance between RE3/1 chambers = 5 mm.*

2. Manual measurements

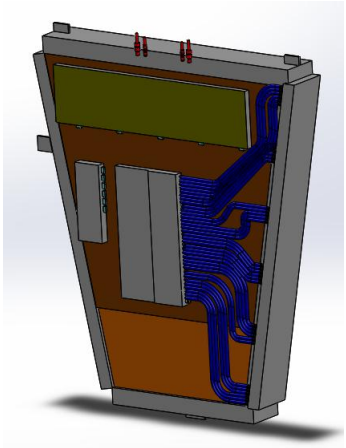
The value "Z" for RE3/1

➢ The value "Z" for RE3/1 from manual measurements is 80 mm! IO requires more 20 mm for clearance between CSC and RPC.

Principle scheme for determination the value "Z"



* The features design of the CSC chamber were taken into account.



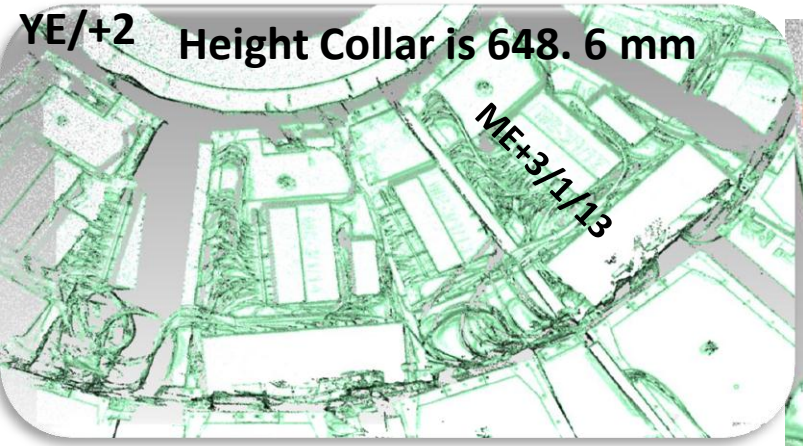
(650+19)-523-66 = 80 mm
- 523 mm is CSC thickness
- 66 mm is the neutron shielding

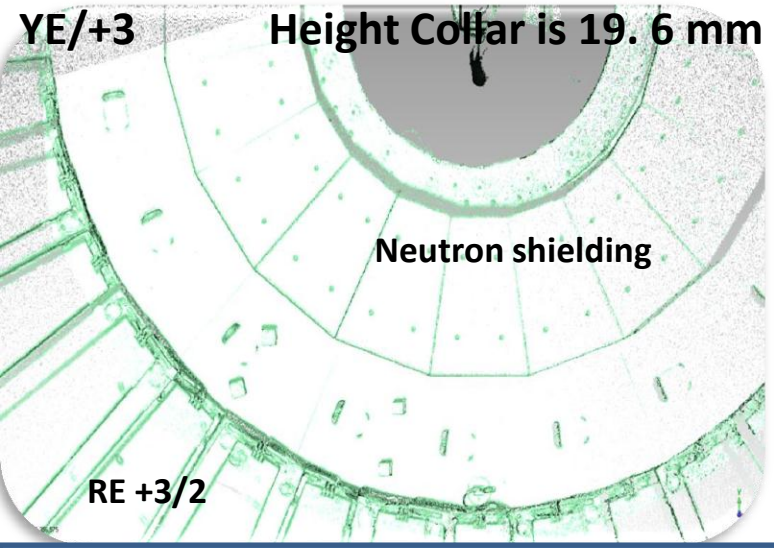
* Manual measurements in P5 was 19 of December 2016

The value "Z" for RE3/1

3. Laser scanner and laser tracker

** Laser scanning in P5 was done 19 of December 2016 (for YE-2 and YE-3 around the ME-3/1/13) and 10 of January 2017 (for YE+2 and YE+3 around the ME+3/1/13)*





The value "Z" for RE3/1

Main results from laser scanner :

- Surfaces between YE-2 / / YE+2 and YE-3// +3 around the CSC chambers ME/-3/1/13 // ME/+3/1/13 (below the beam pipe on far side) have been measured;
- The topology of CSC chambers is determined very good;
- The average error of the best-fit is :

  for YE/-2 and YE/-3 is +/-1.8 mm;
  for YE/+2 and YE/+3 is +/-3.0 mm.
- The maximum error is :

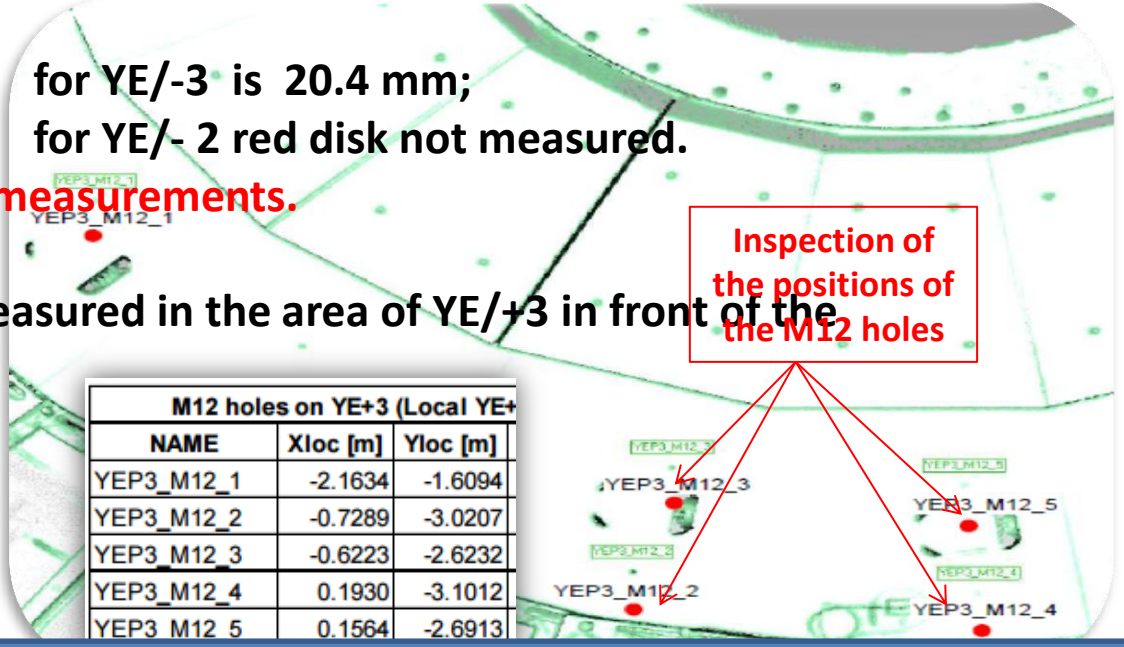
  for YE/-2 and YE/-3 is +/-2.5 mm;
  for YE/+ 2and YE/+3 is +/-3.0 mm.
- The height of the collars are:

  for YE/+3 is 19.6 mm;
  for YE/+ 2 is 648.6 mm;
  for YE/-3 is 20.4 mm;
  for YE/- 2 red disk not measured.

These values agree with the manual measurements.

- The position of five M12 holes measured in the area of YE/+3 in front of the CSC chamber ME+3/1/13.

M12 holes on YE+3 (Local YE+		
NAME	Xloc [m]	Yloc [m]
YEP3_M12_1	-2.1634	-1.6094
YEP3_M12_2	-0.7289	-3.0207
YEP3_M12_3	-0.6223	-2.6232
YEP3_M12_4	0.1930	-3.1012
YEP3_M12_5	0.1564	-2.6913



The value "Z" for RE3/1

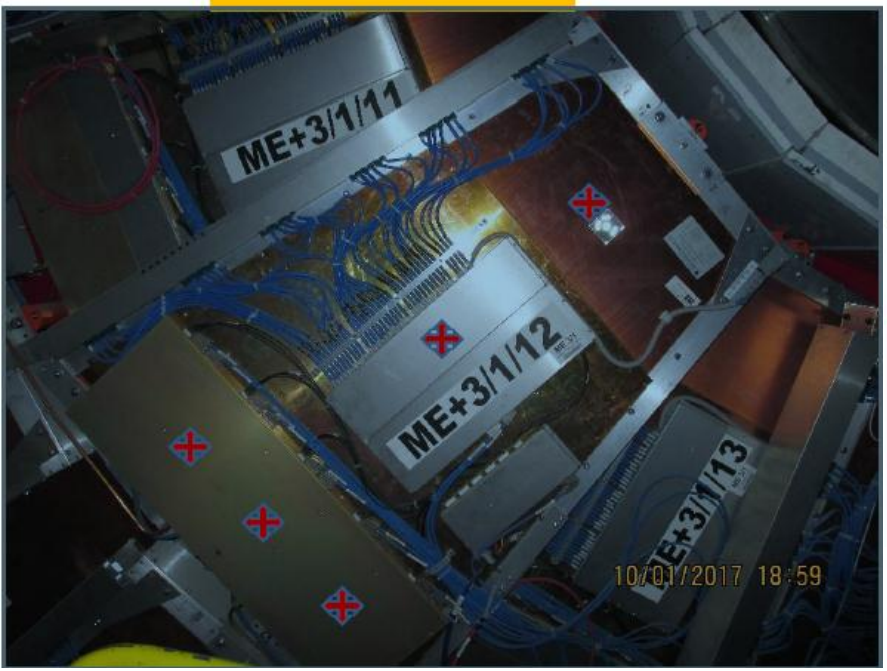
4. IR sensors

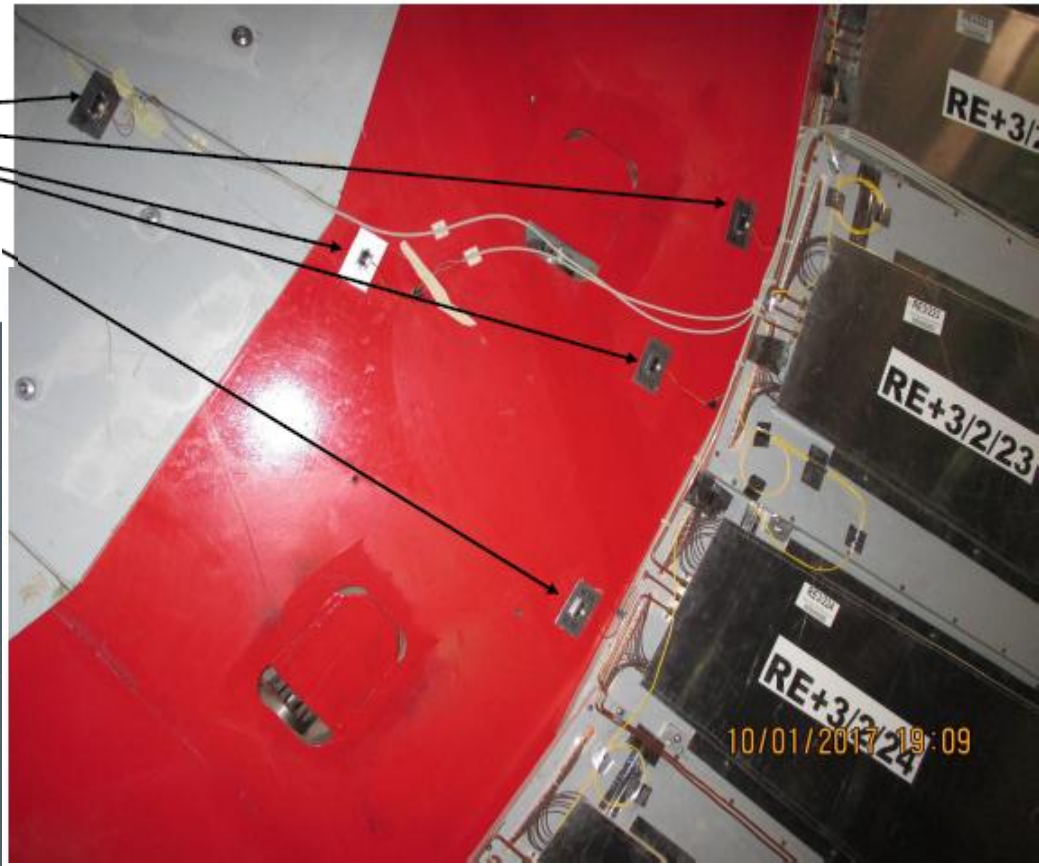
* IR sensors were installed in 10th of January 2017

➢ **Results will be come later after closing YE/+2 and YE/+3.**

IR sensors with individual shielded cable

Target areas





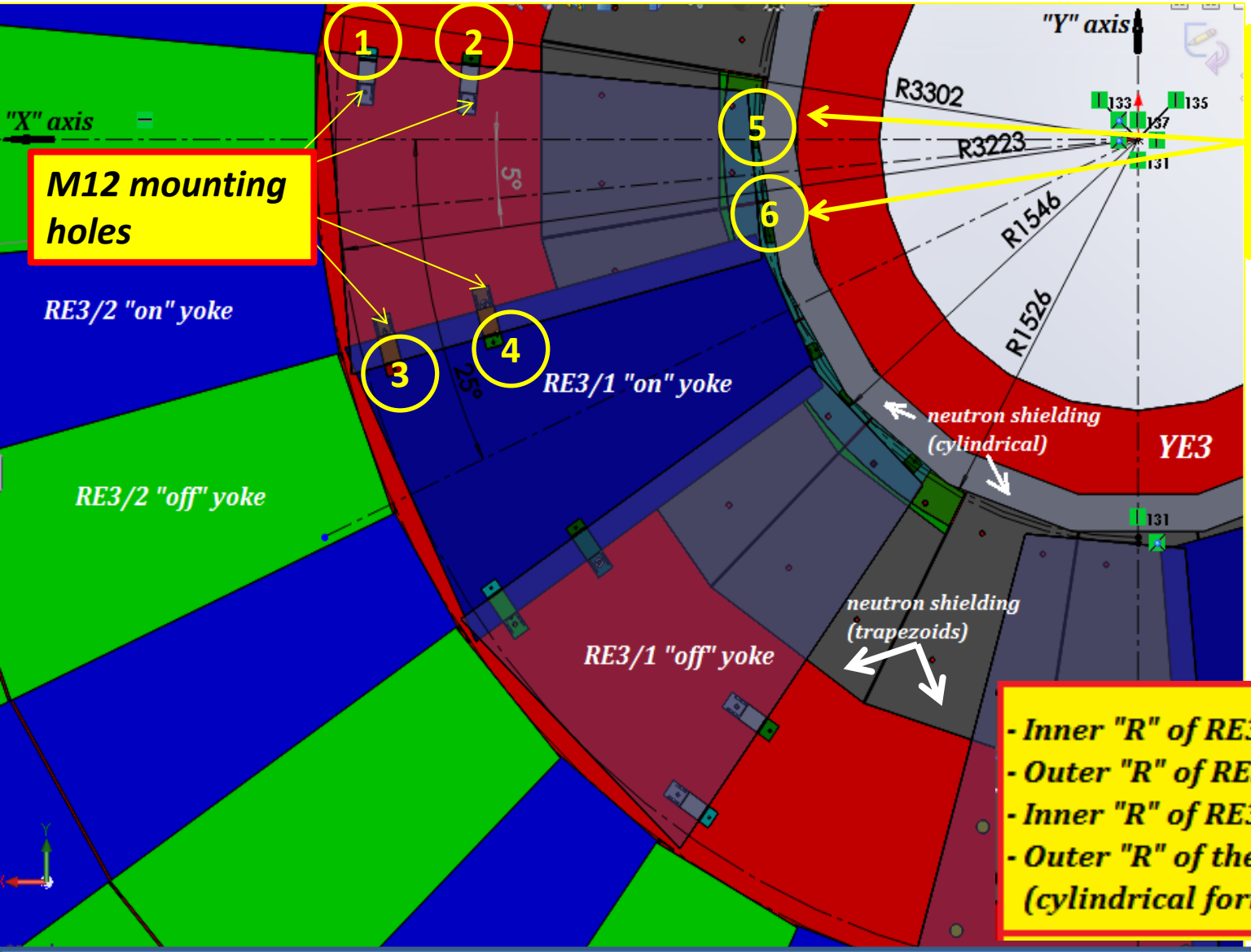
Conclusion

Table of the main results

Main parameters	CMS drawing	Manual measurements	Laser scanner	IR sensors
1. Distance between YE2 and YE3 , mm	655	650 + 19 = 669	648.6 + 19.6 = 668.2	-
2. Thickness of the neutron shielding, mm	63	64.5 ÷ 66.0		-
3. Distance between YE2 and max. higher surface of the CSC chamber, mm	524	523		-
4. Available space for RE3/1, mm	88	80 ± 0.5	79.5 ± 3.0	Data will come soon

Fastening elements for mounting RE3/1 chambers on the YE3

1. Mounting of the RE 3/1 chambers on the YE3

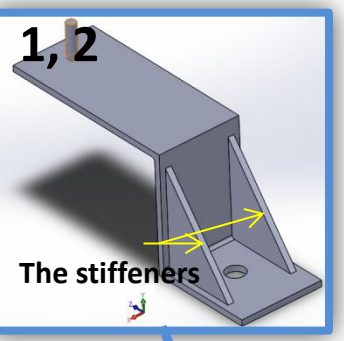


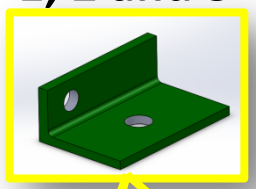
Each RE3/1 chamber is fixed at six points

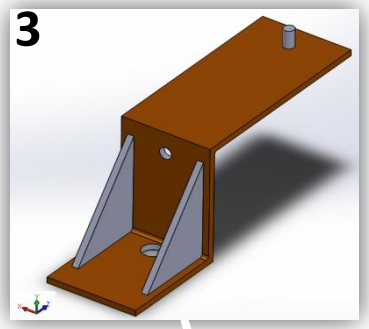
- Inner "R" of RE3/2 is 3302 mm;
- Outer "R" of RE31 is 3223 mm;
- Inner "R" of RE3/1 is 1546 mm;
- Outer "R" of the neutron shielding (cylindrical form) is 1526 mm .

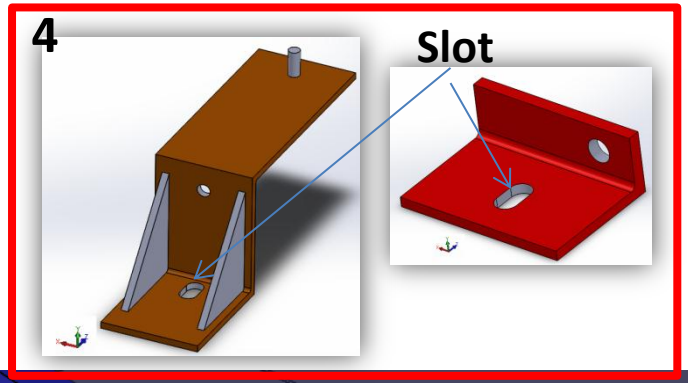
Fastening elements for fixing RE3/1 chambers on the YE3

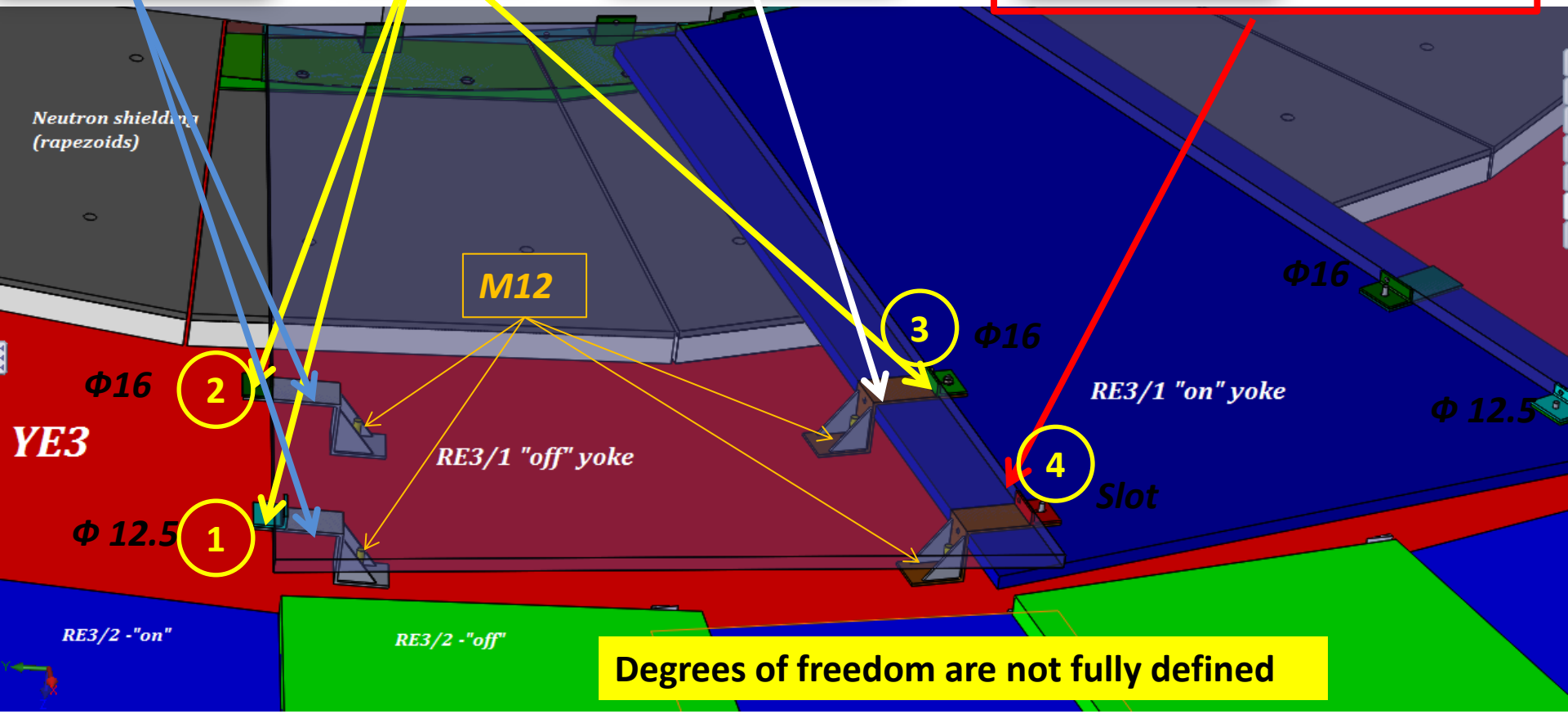
2. Mounting brackets for the RE 3/1 chambers









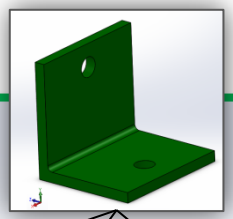


Degrees of freedom are not fully defined

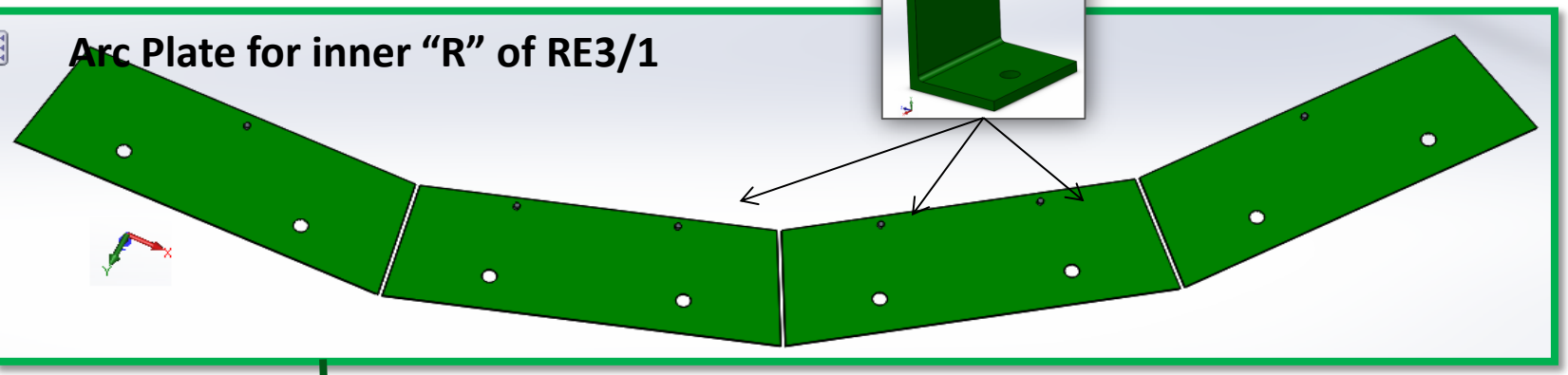
Supplementary inner "R" mounts RE3/1 chambers on the YE3

3. Mounting arcs for the RE 3/1 chambers

Brackets

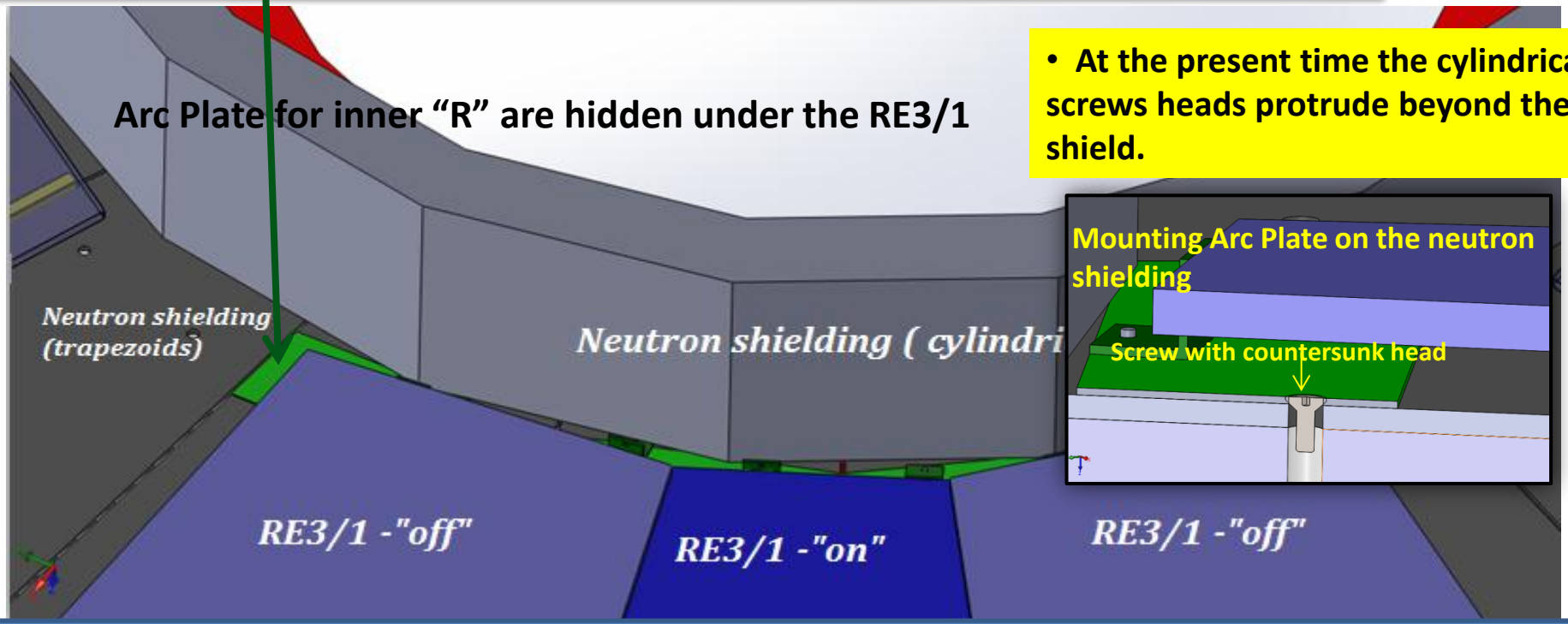


Arc Plate for inner "R" of RE3/1



Arc Plate for inner "R" are hidden under the RE3/1

- **At the present time the cylindrical screws heads protrude beyond the shield.**



Mock up for RE3/1

Work schedule

Studies of the value “Z” for RE4/1

Available space for RE4/1 chambers

- On basis the main drawing of the CMS the value "Z" for RE4/1 is 85 mm.
- At the present the IO thinks that there is only 80 mm available.
- During the RE4/2 Super Module assembly the extra space was available and so the distance between CSC and RPC was increased.

The space between neutron shielding and RE4/1 should be a minimum of 20 mm;
Thickness of the RE4/1 “on” yoke is 25 mm;
Thickness of the RE4/1 “off” yoke is 25 mm;
The value gap is 5 mm;
Thickness Alu mounting plates is 8 mm.

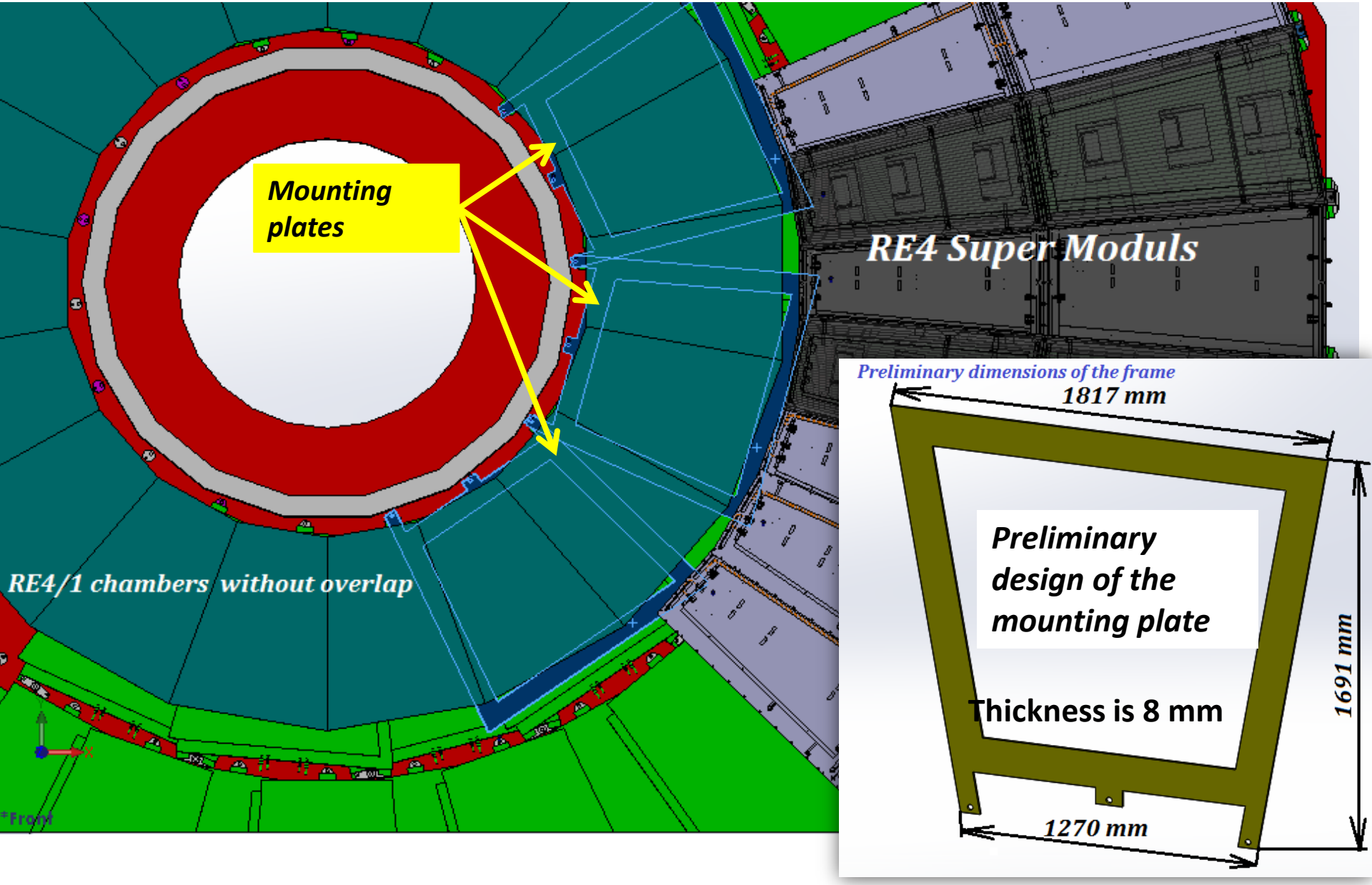
_____

Total: 83 mm

Thus, we have the available space for RE4/1 chambers without overlap!

Once this design we will be able to study the overlap configuration.

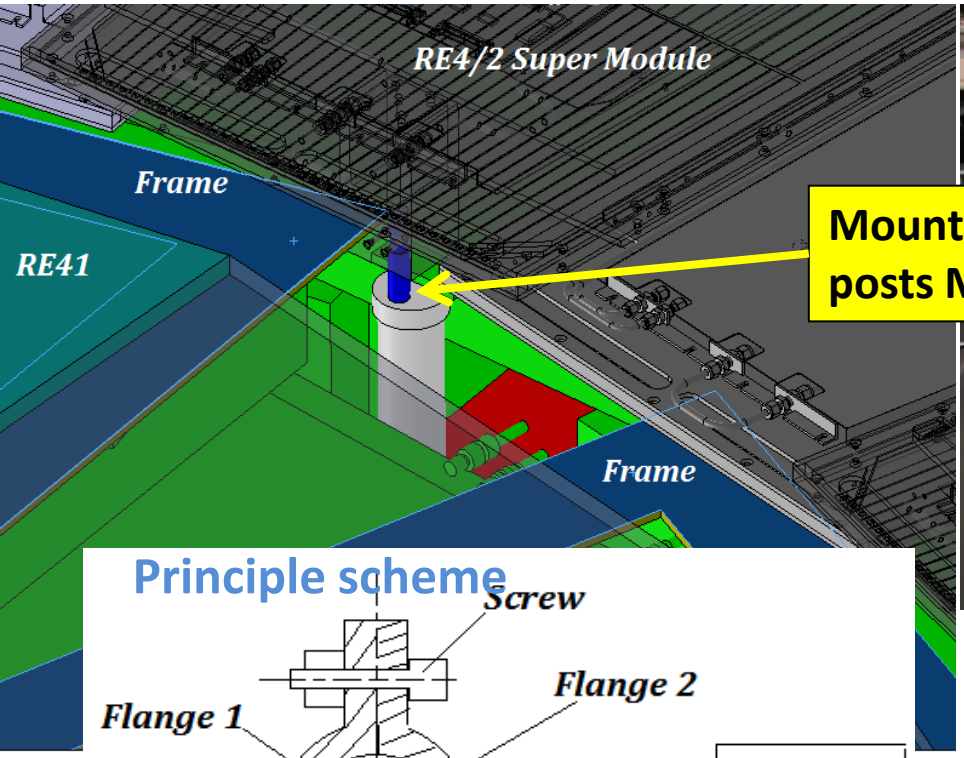
Mounting plate for RE4/1 chambers

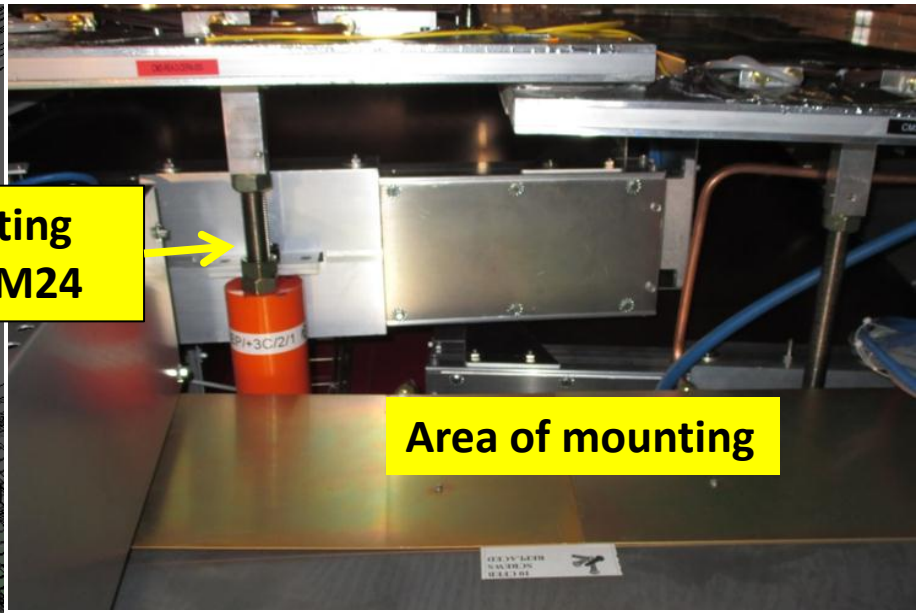


The proposed MP outer "R" M24 posts which are underneath the RE4 SMs

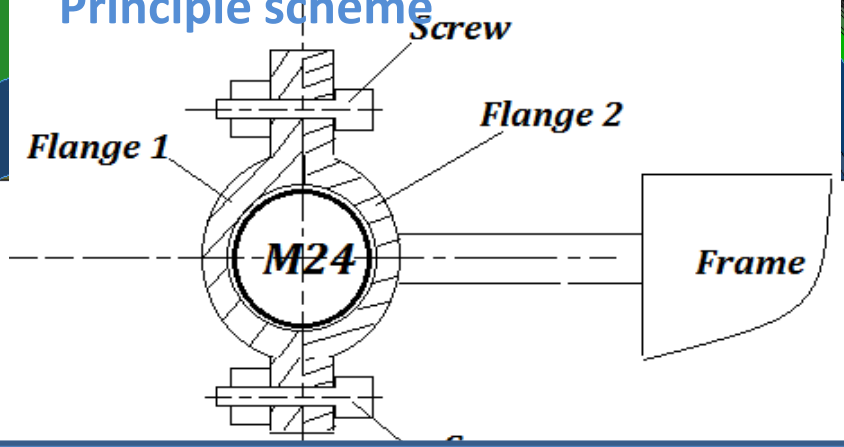
Two interesting questions:

1. **How to mount the frame using the mounting positions M24?**
2. **How to attach the RE4/1 chambers on the frames?**

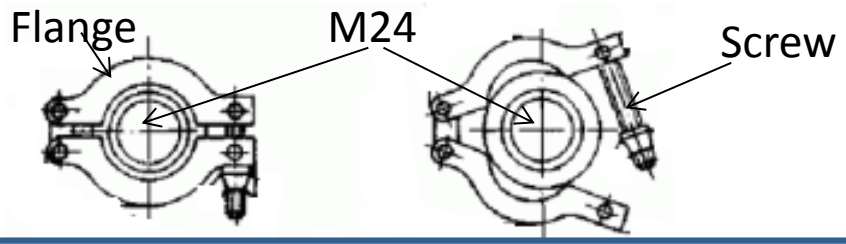




Principle scheme



Or another version



Conclusion

RE3/1:

- On the basis all received results we have the value “Z” for RE3/1 chambers 80 mm;
- The RE3/1 chambers brackets and mounting plates for fixing were drawn;
- Next step will be study of the Patch Panel and connectors with cables outside the chamber.

RE4/1:

- The available space for RE4/1 chambers is about 80 mm. It isn’t enough for RE4/1 chambers with overlap (total space for RE4/1 chamber with overlap is 83mm);
- RE4/1 FEBs are visible and accessible in this design.

Future work for RE3/1 and RE4/1

1. Section for RE3/1:

- Neutron shielding support will require modification;
- IR sensors will give definitive “Z” value;
- Full photographic record for ME3/1 (cabling, pipes and etc.)
- Mock up for PP and services over 60 degree in 904;
- “B” field deflection of YE3 and YE2 should be negligible but to be checked .

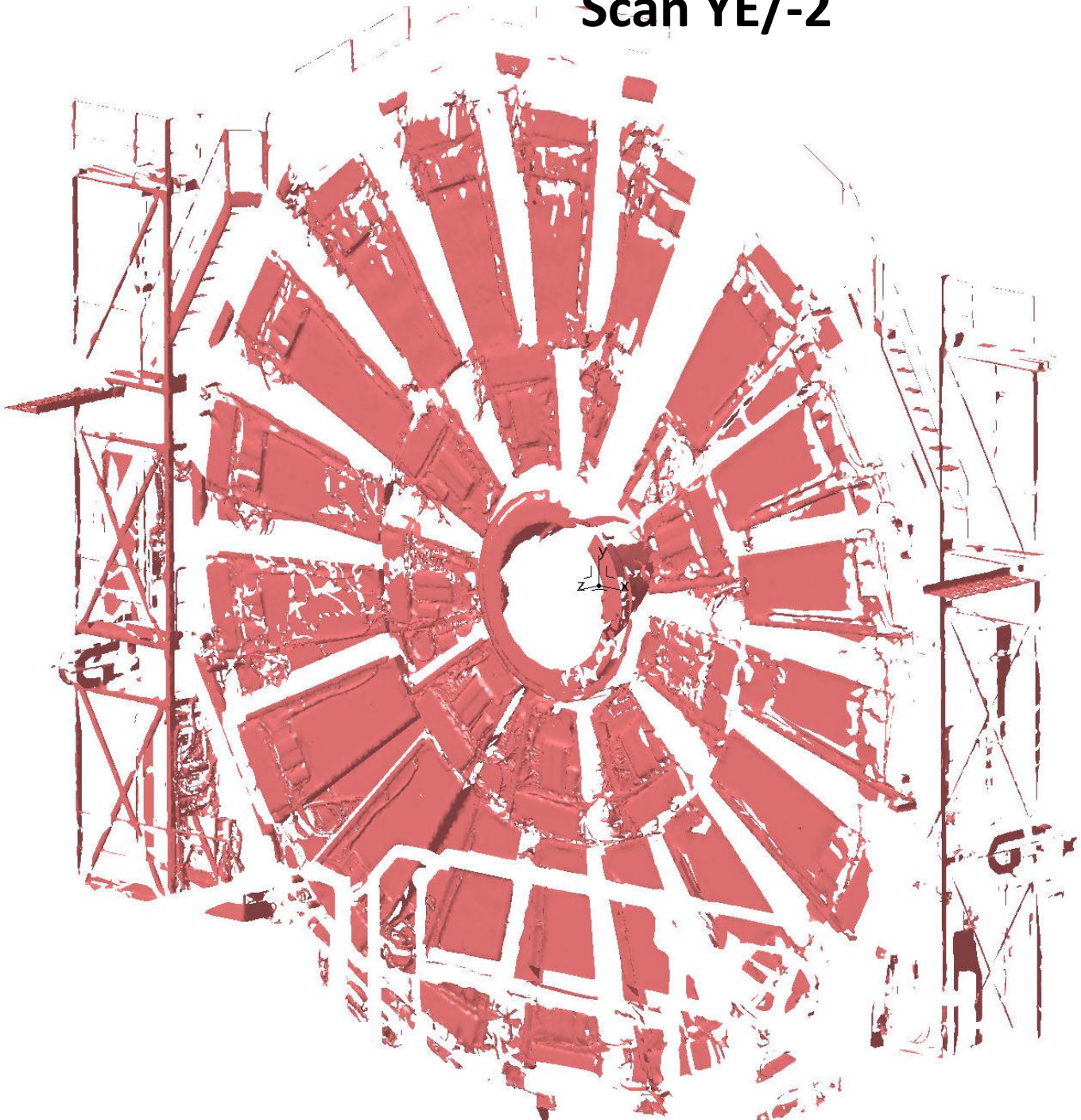
2. Section for RE4/1

- Require ME4/1 laser scan
- Install MP in P5 to study CSC services;
- Install IR sensors in RE4/1 gap for real “Z” values;
- Measure YE4 deflection with IR sensors;
- Mock up of MP and chambers in 904.

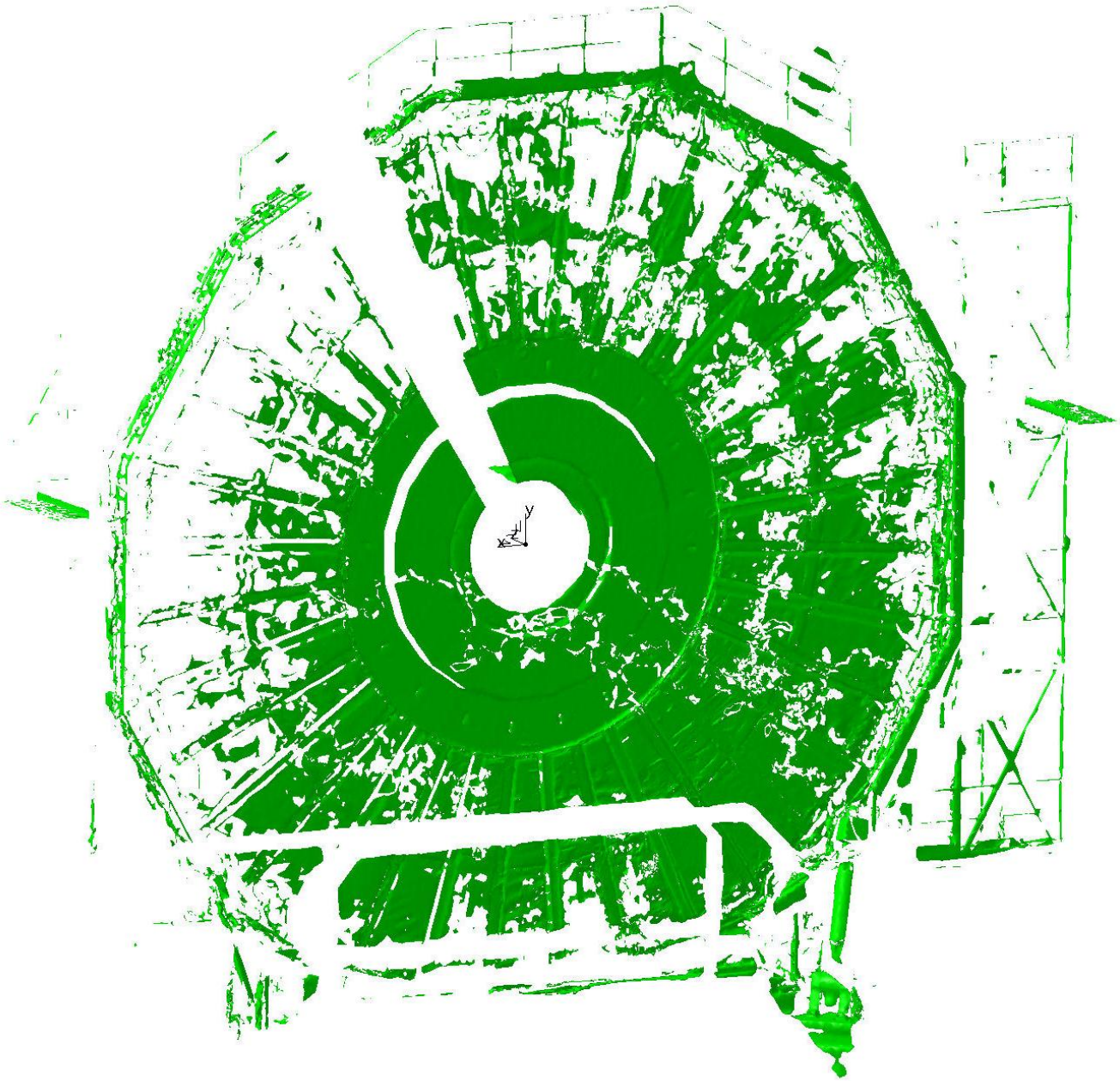
Thanks for attentions!

Backup

Scan YE/-2

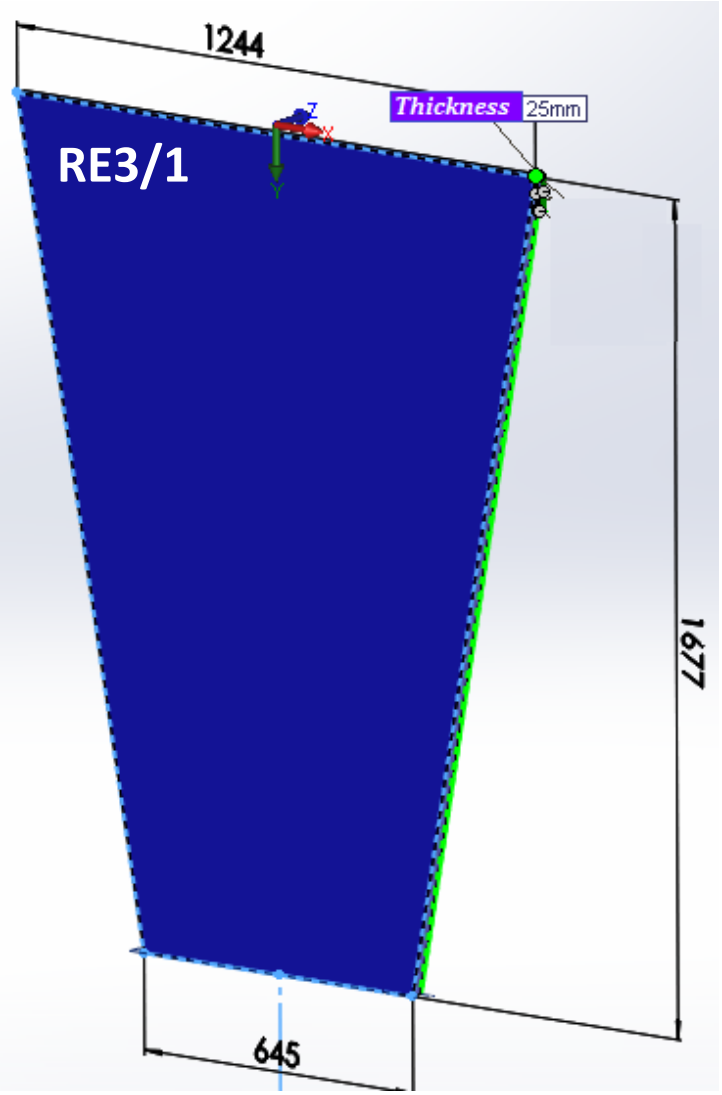


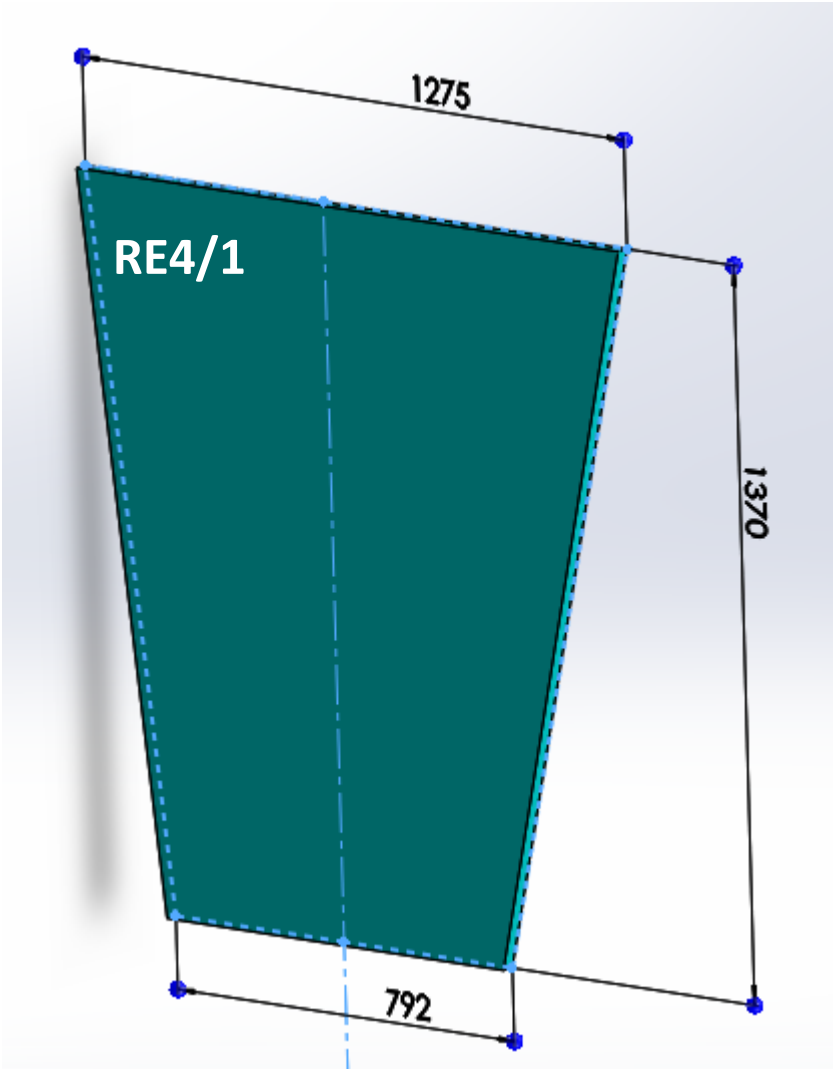
Scan YE/-3



Design of the RE3/1 and RE41 chambers

Thicknesses RE3/1 and RE4/1 are 25 mm.

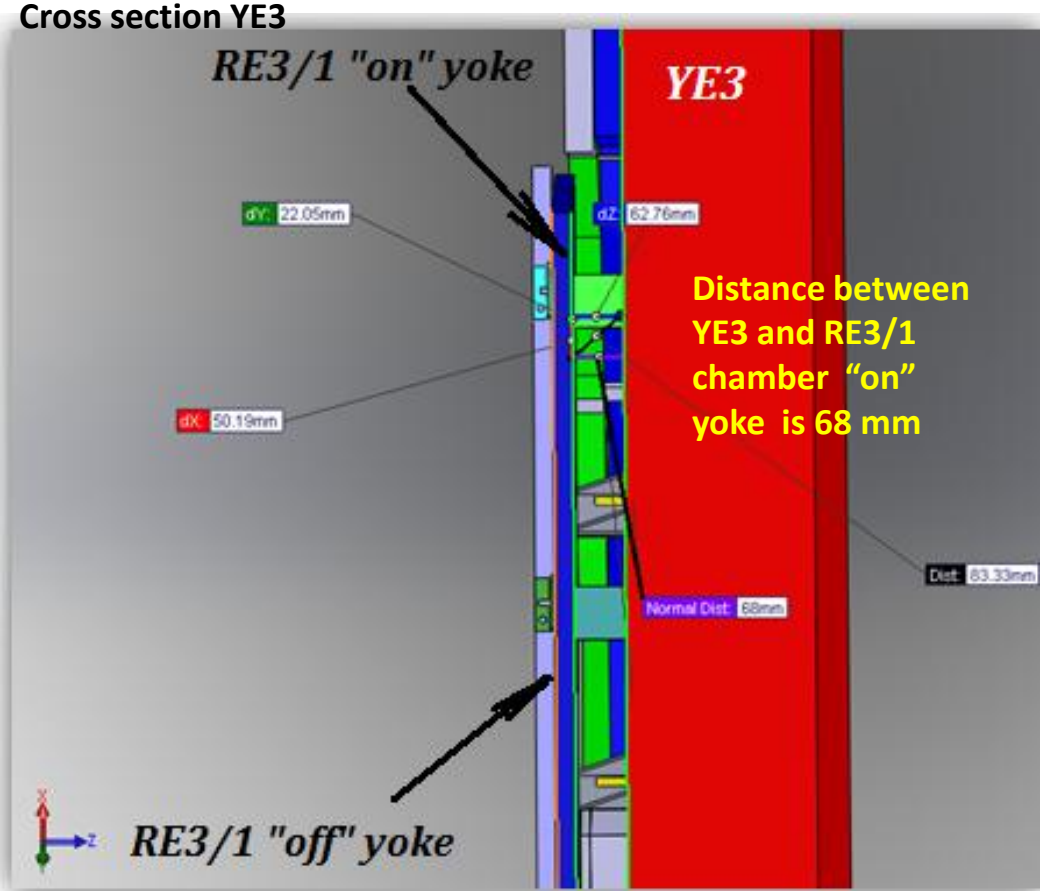




Available space for mounting FEBs

Available space for mounting FEBs is 68 mm

Cross section YE3



Space between RE3/2 and RE3/1 for the cooling/power connectors