



The forward RPC system (TDR)

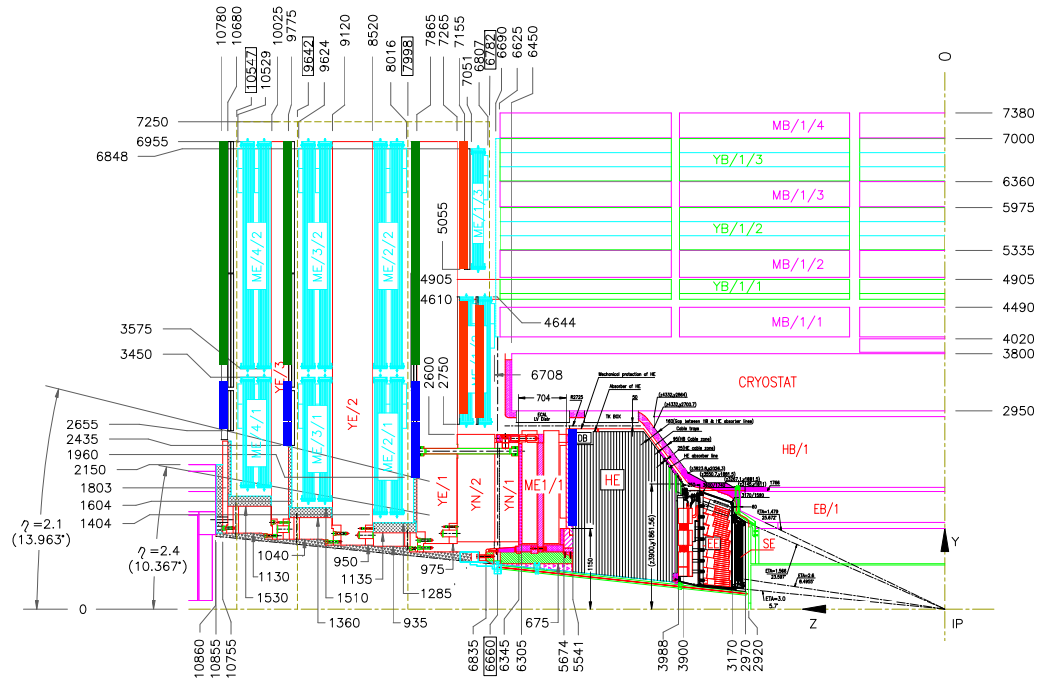


- China
- Korea
- Pakistan

“Thin design everywhere”

Gap production
Korea

Front-end electronics
Pakistan



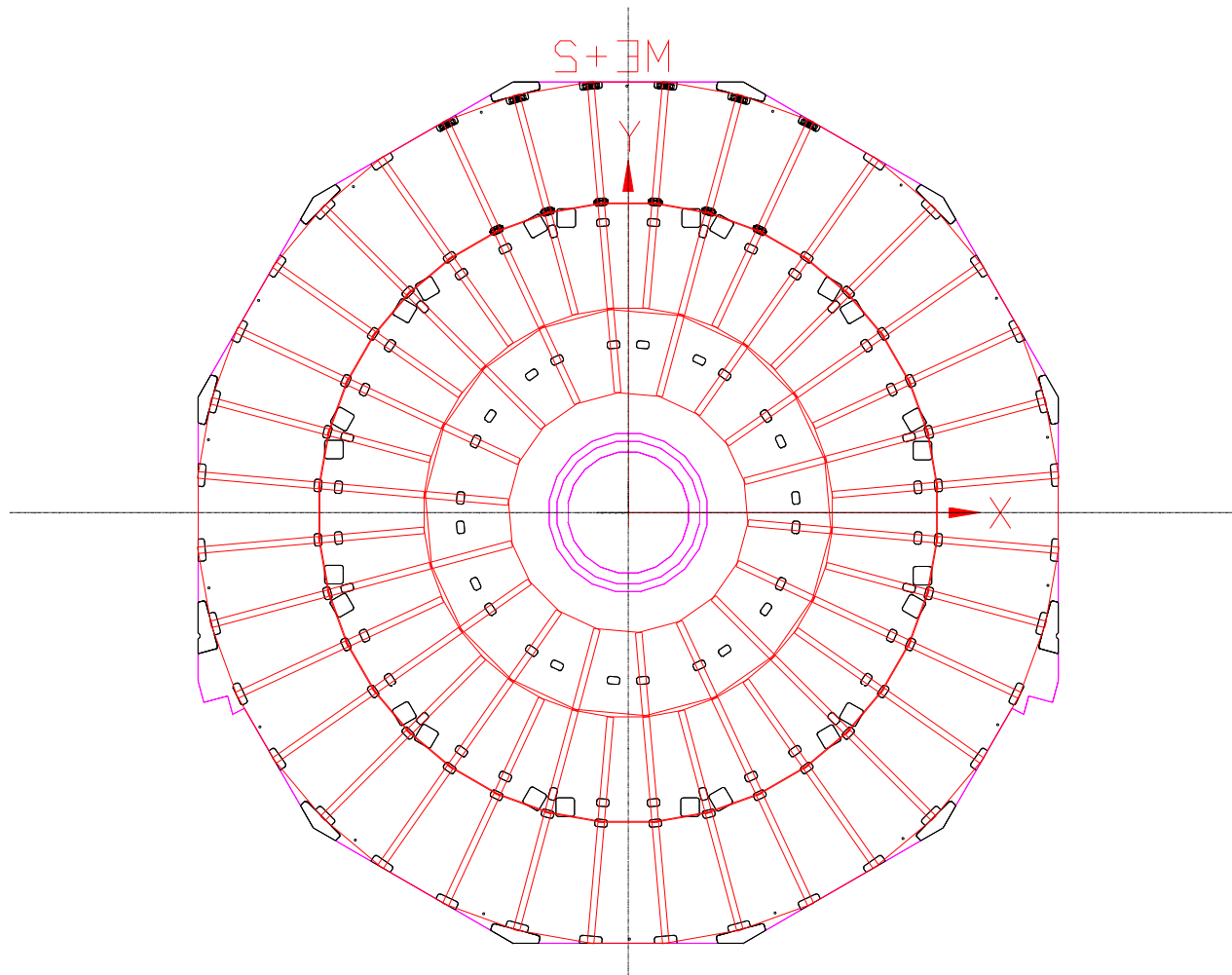
	RE 1/1	RE 1/2	RE 1/3	RE 2/1	RE 2/2	RE 2/3	RE 3/1	RE 3/2	RE 3/3	RE 4/1	RE 4/2	RE 4/3
No. of chambers	36*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*2



3 Concentric rings per station



Wedge shaped double gap RPC's with ϕ overlap RE i/1,2,3



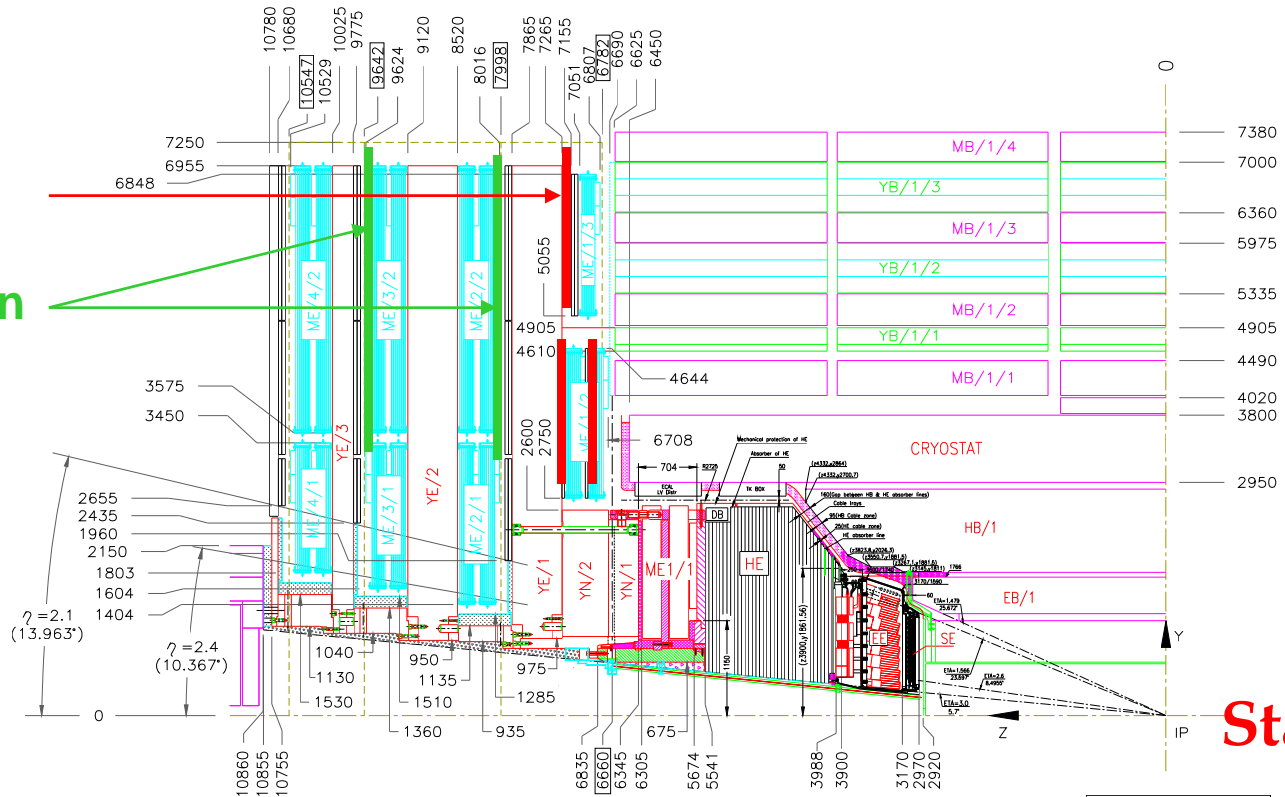


The proposed initial system; 3 stations up to $\eta = 1.6$

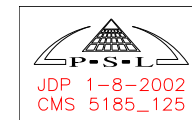


China

Pakistan



Low eta chambers identical for stations 2,3 and 4



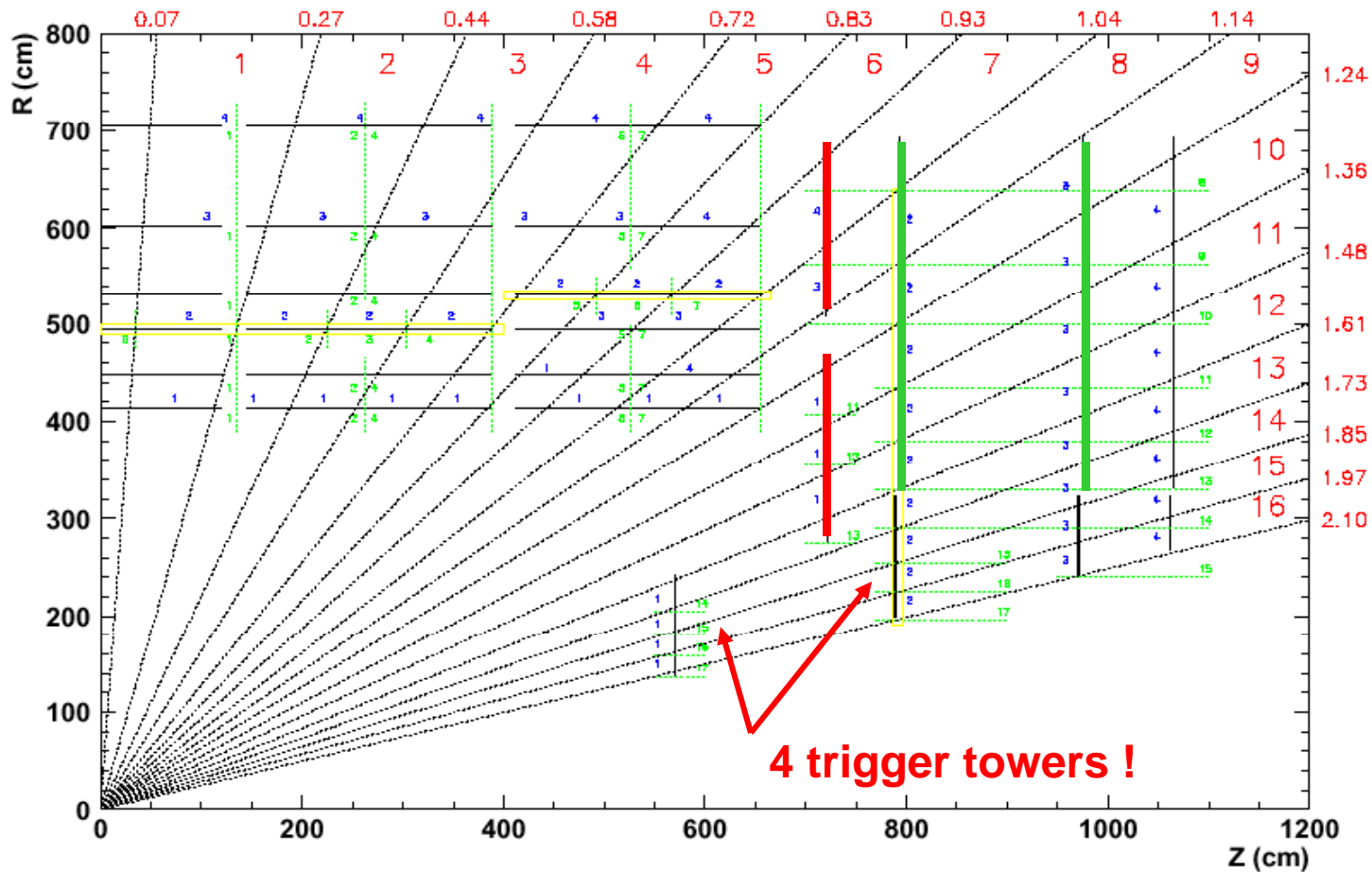
	RE 1/1	RE 1/2	RE 1/3	RE 2/1	RE 2/2	RE 2/3	RE 3/1	RE 3/2	RE 3/3	RE 4/1	RE 4/2	RE 4/3
No. of chambers	36*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*



**η Coverage of initial system
 ≥ 4 stations up to ~ 1.24 ; 3 up to ~ 1.6**

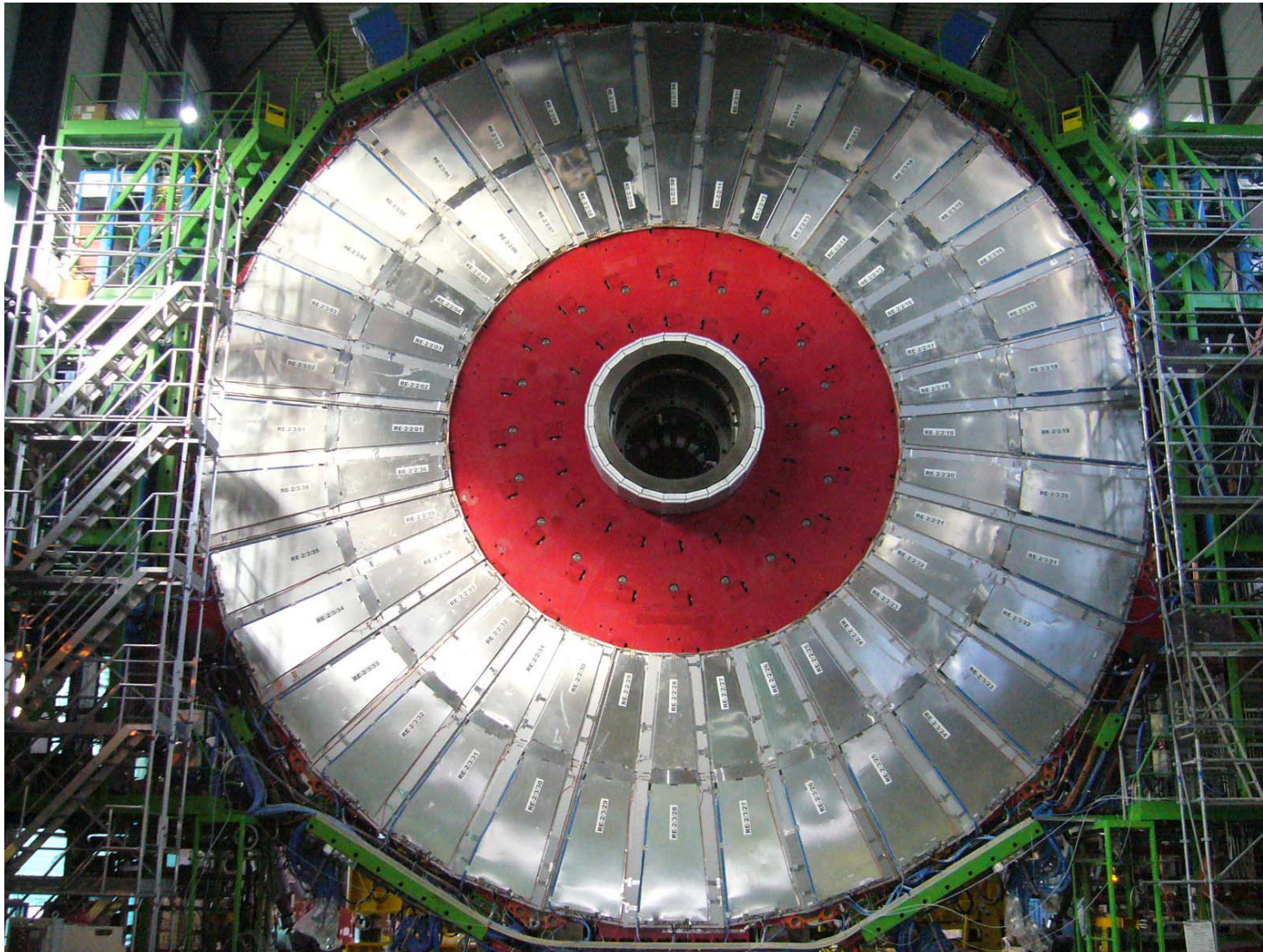


RPC Trigger Segmentation (new)





RE-2 station



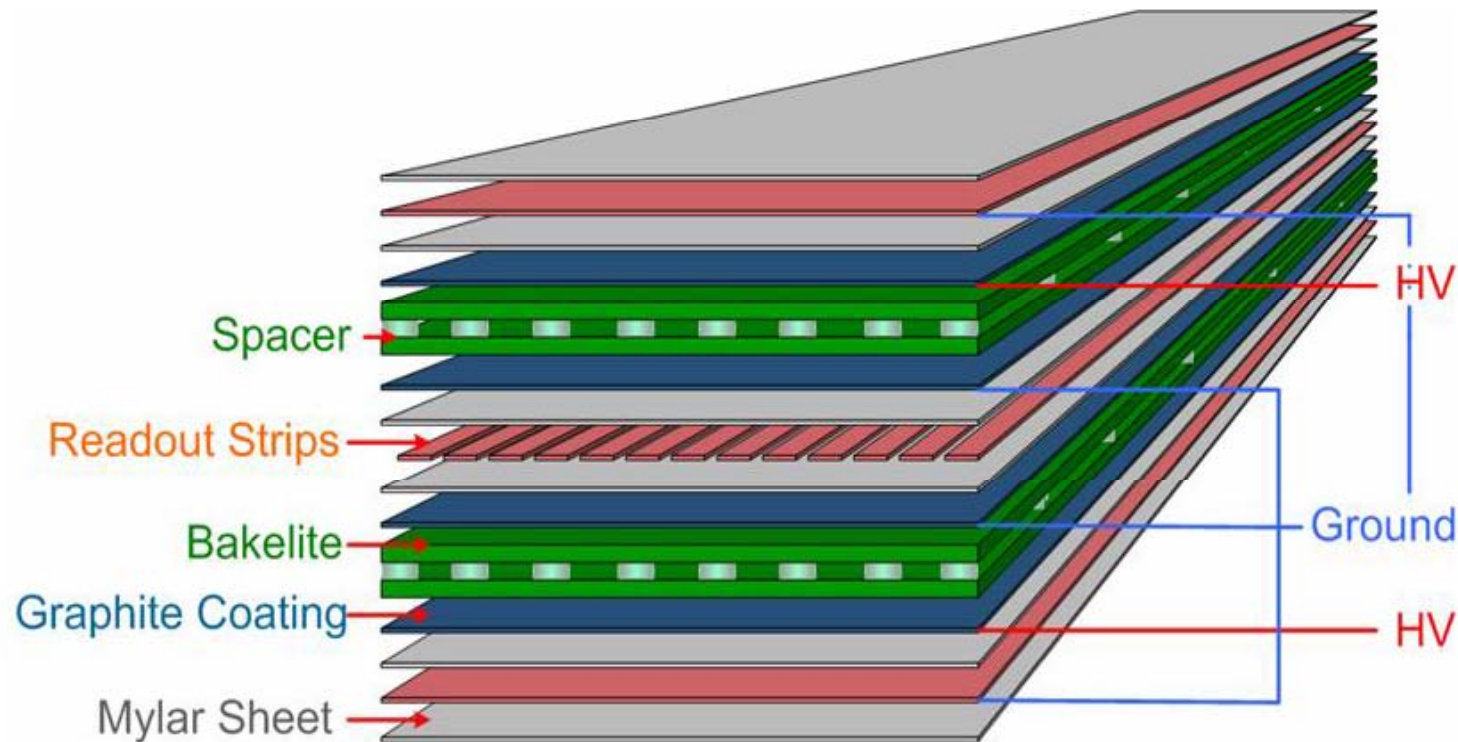


Resistive Plate Chamber RPC



Final Gas mixture used in all tests

95.5 Freon 3.5 Isob 0.3 SF6 + RH 50% = 5000 ppm

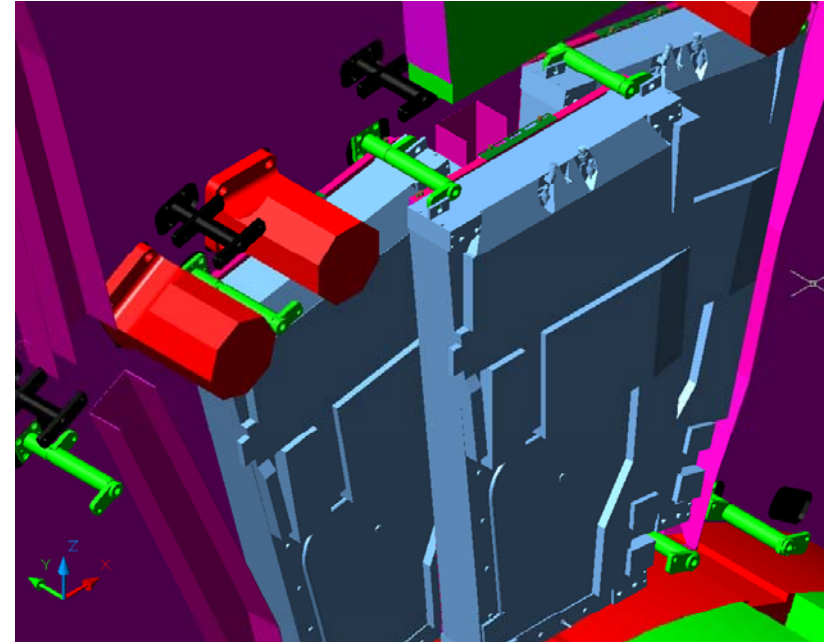
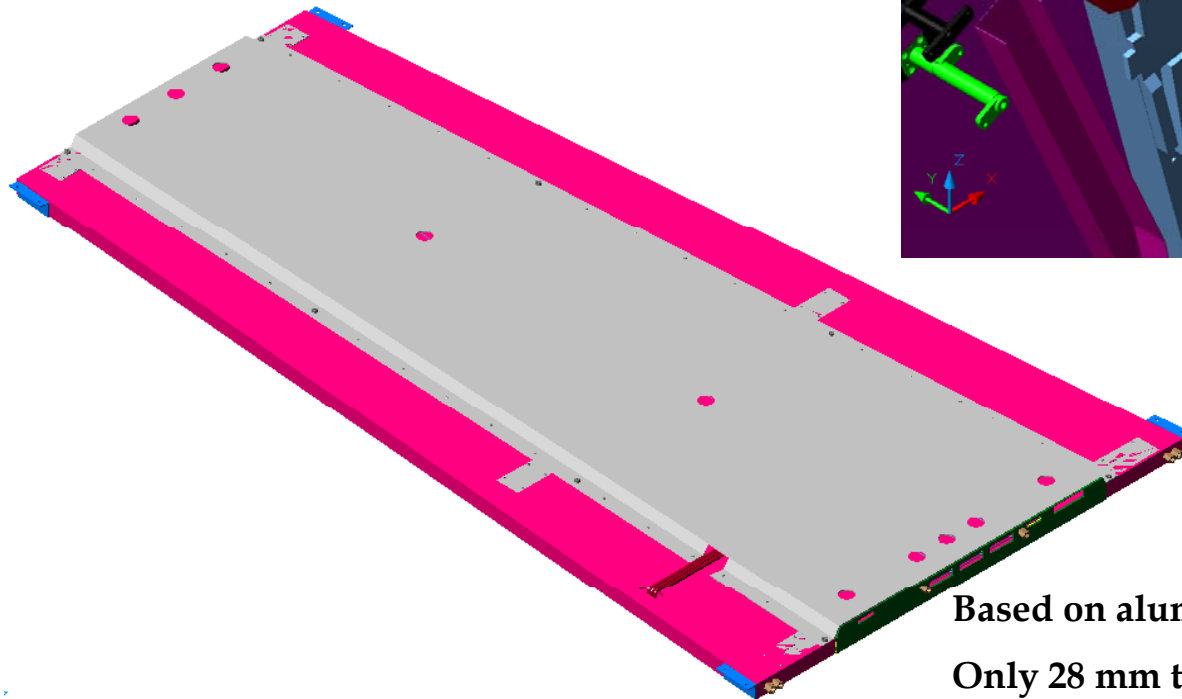




“Thin” RPC everywhere



RE 1/2 integrated with corresponding CSC's



Based on aluminium honeycomb panels (China)
Only 28 mm thick



Flow of components





Gas gap production in Korea

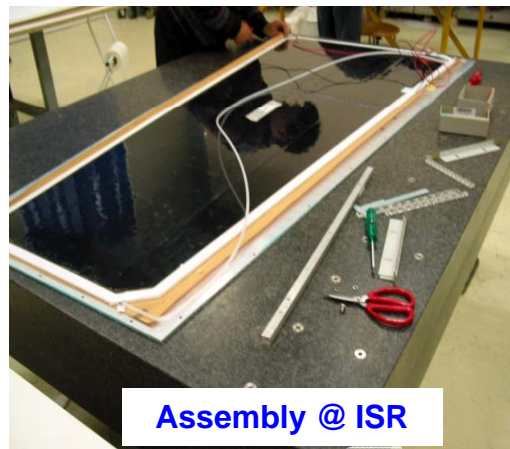




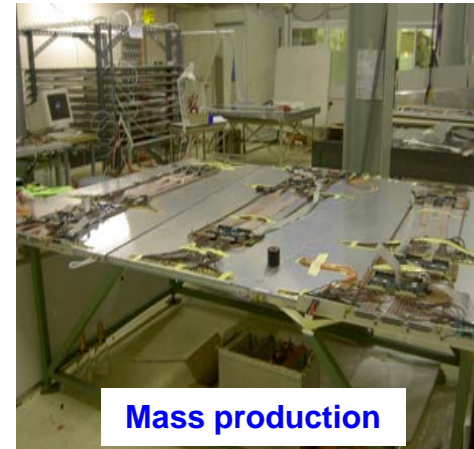
RE1/2 and RE1/3 assembly @ ISR



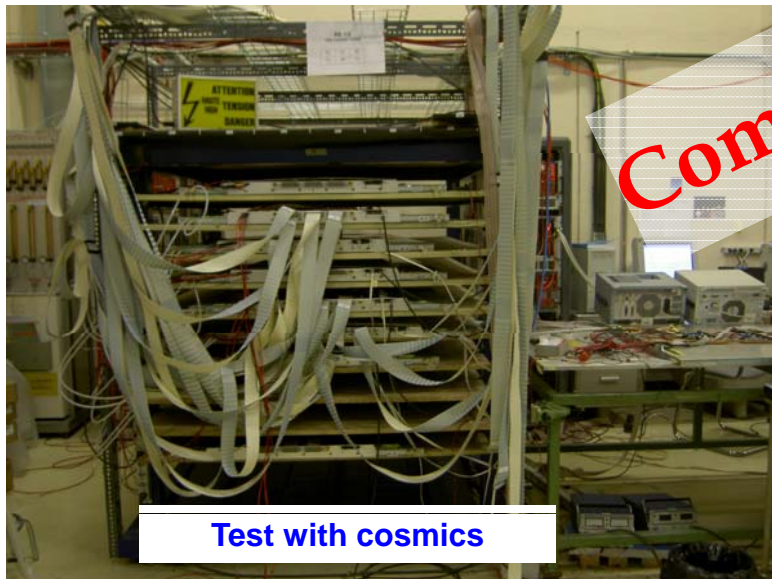
Parts from China



Assembly @ ISR



Mass production



Test with cosemics

Completed



Ready for installation



RE1 assembly lab @ ISR





RE 2&3 production in Pakistan



Still in progress

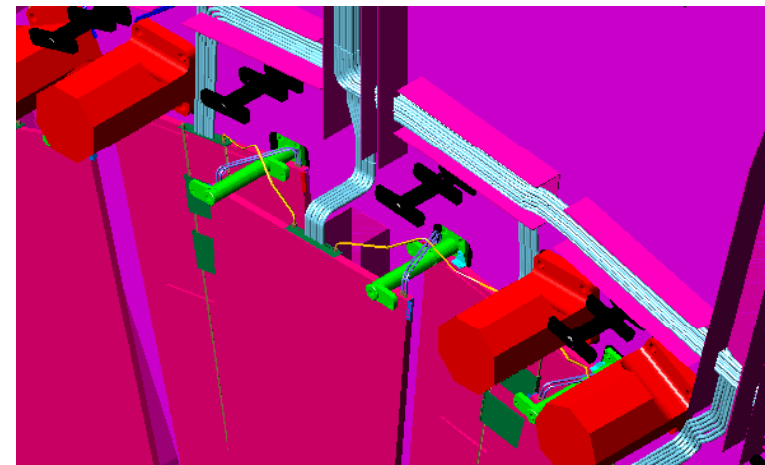
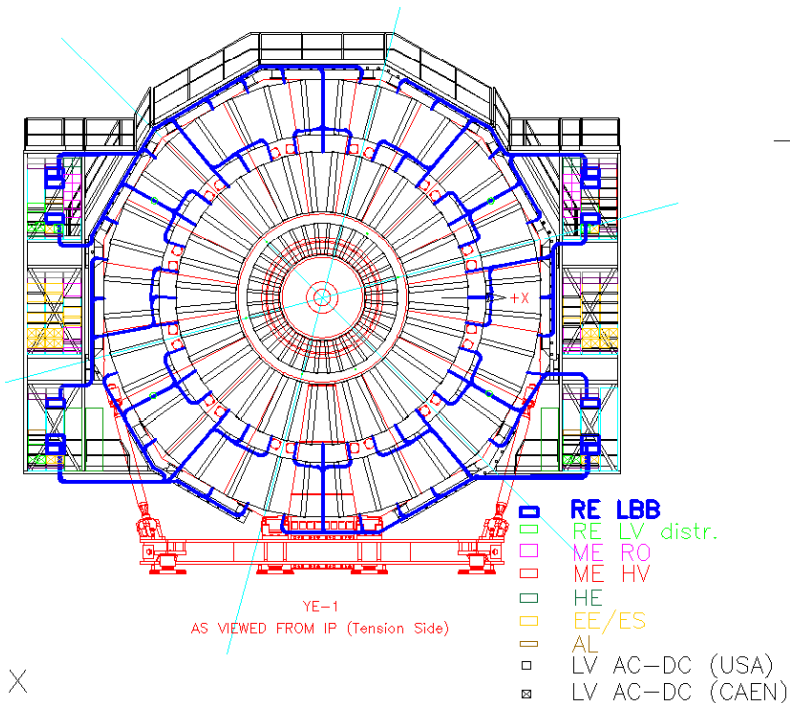
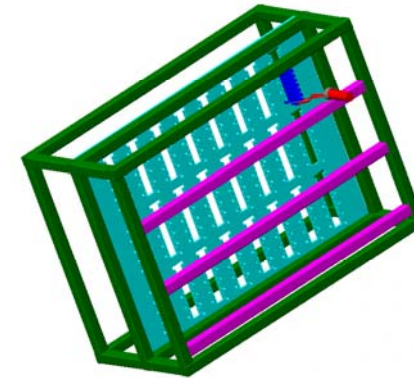




CERN involvement

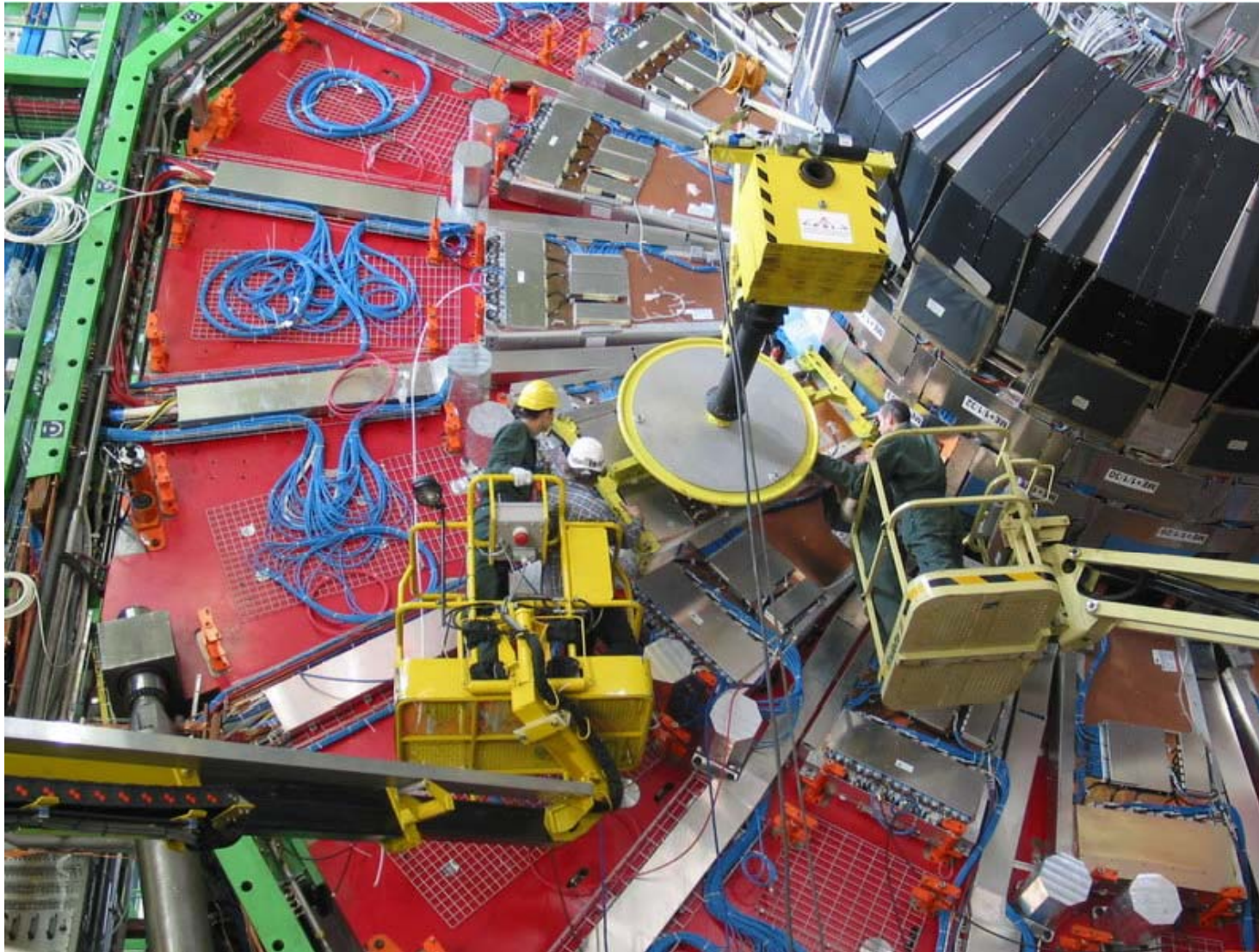


- Project steering & coordination
- Integration
- RE 1 cosmic tests
- Logistics
- Finances
- Installation & commissioning
-
-



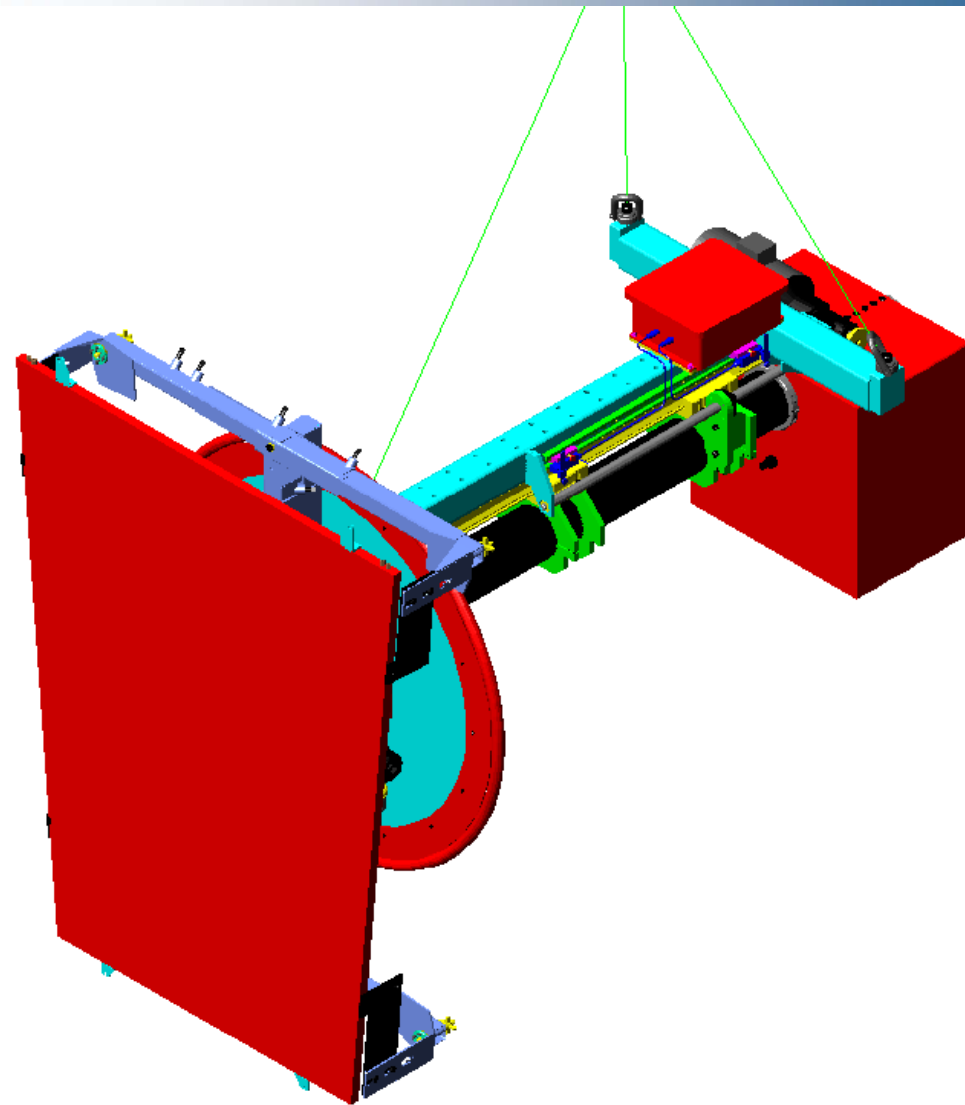


Install ME1/2-RE1/2 packages



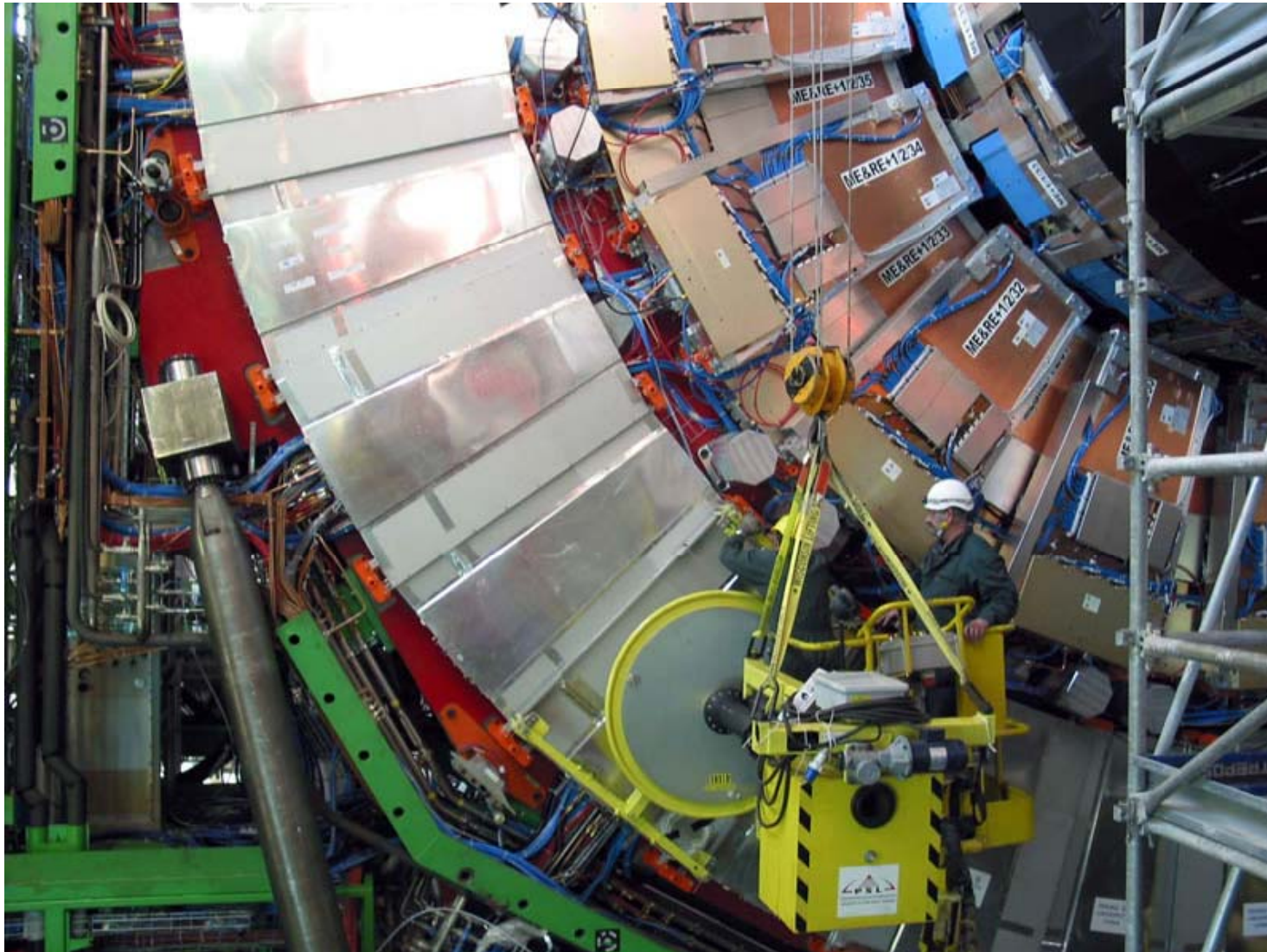


Installation fixture



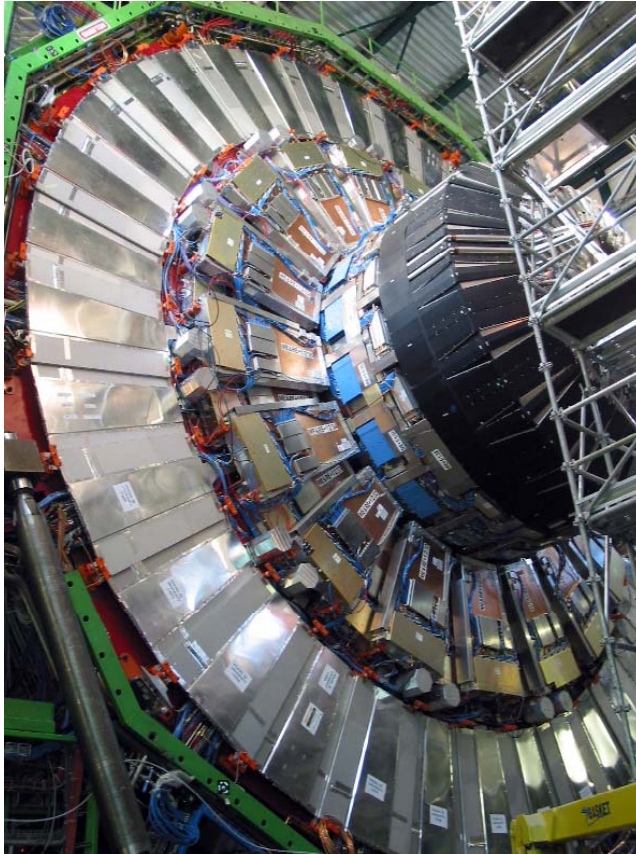


Install RE1/3

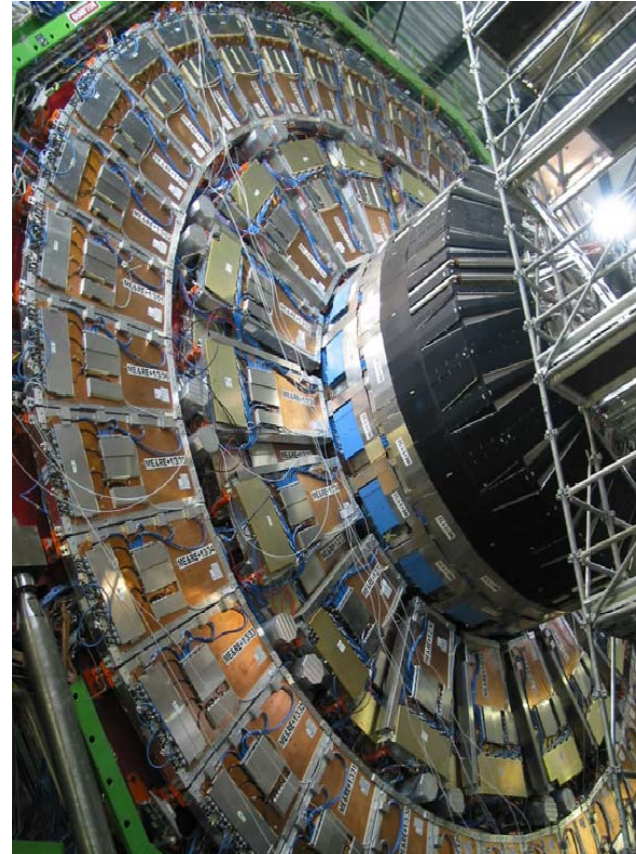




Moving forward !



YE+1 yoke equipped with CSC/RPC packages (inner ring) and RE1/3 RPC's (outer ring).



The ME1/3 CSC's now cover the RPC outer ring and hence complete the first muon station on YE+1.



And RE2 on the back of YE+1



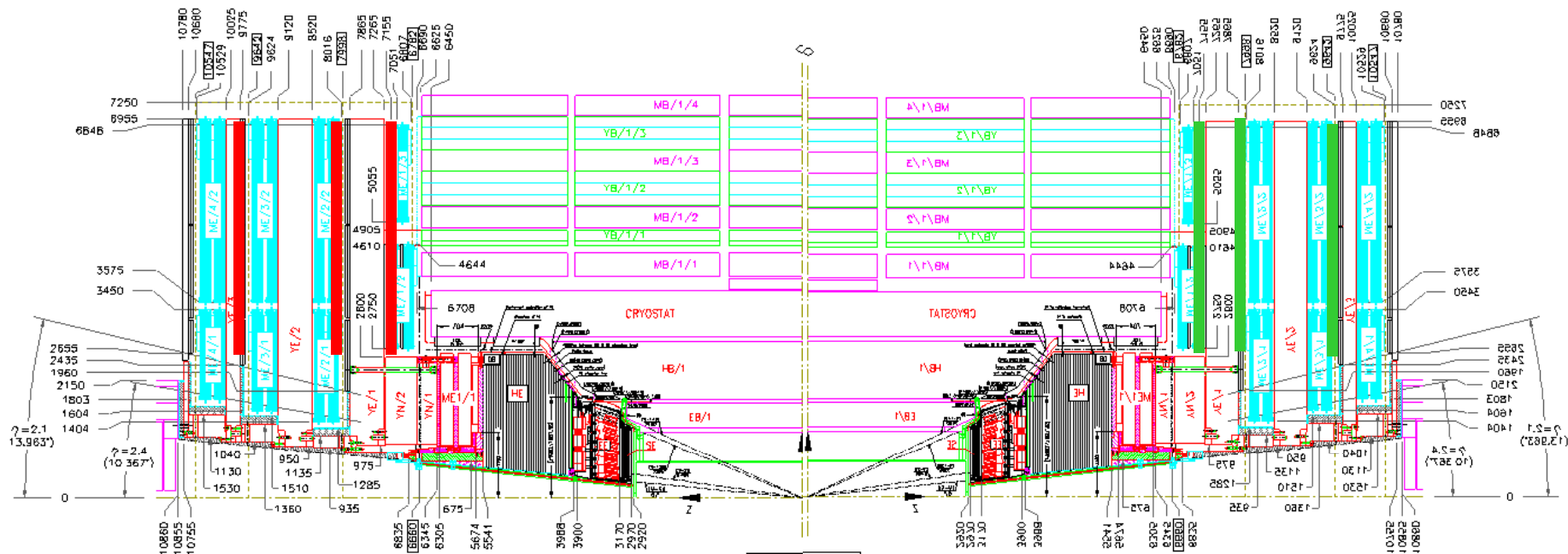


Progress summary and schedule



+ end cap

- end cap



— Installed, services done, pre-commissioned (in UXC)

— Installed, services done, pre commissioned



Restoring the TDR system

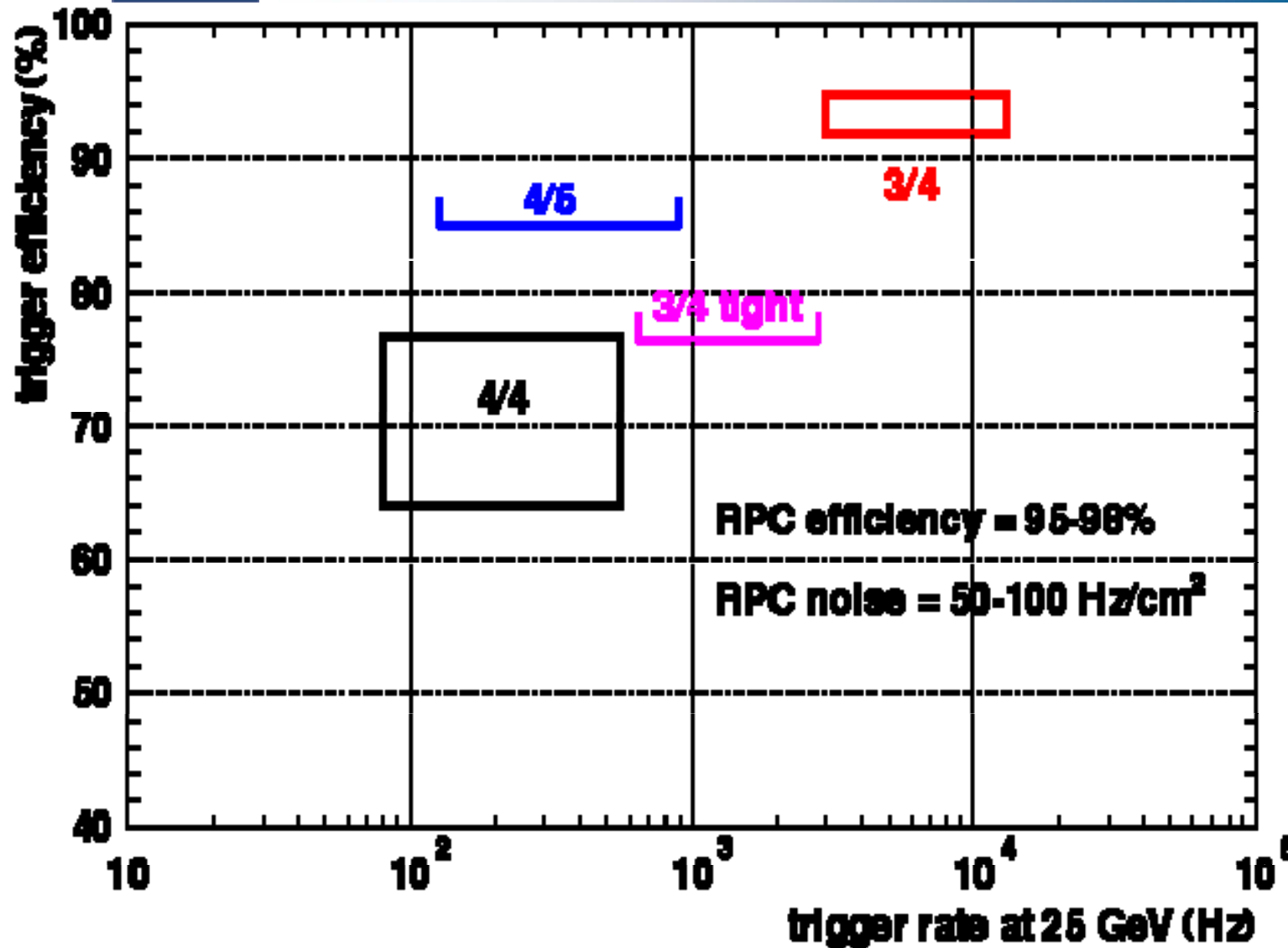


- Requires YE4 shielding walls to support RE4
- Build station RE4 i.e. **144** RPC of the low η type
- Services to the RE4 station
- High η RPC's: **72** RE1/1 + **36** RE2/1 + **36** RE3/1 (high rate!)
- Services to high η RPC's (gas & cooling foreseen)
- Restore HV to 1 channel/chamber (**NOT 2 ch/ch**)
- Little design and integration required

Price tag (without link and trigger system) ~ 3.8 Mio CHF



Improvement from extra plane



Results shown
for range of
RPC efficiency
& noise



A possible road to a 5 station system



- ❑ Get the YE4 shielding walls to support station RE4 **OR support from YE3**
- ❑ Move the present RE2 station to YE4 to become RE4
- ❑ Rebuild a new DOUBLE station RE2 (Call it RE2bis)
i.e. **144** "packages" for the low η part.
- ❑ Limit the services to present station RE2 (LBB,gas,etc...)
Hence make AND/OR on the chamber package.
But need extra HV, LV. **NO increase of the trigger system wrt TDR**
- ❑ Live in EXISTING envelope (no shimming of magnet).
- ❑ Design work and integration required !

⤵ Rest of this talk

- ❑ High η part as before (with RE2/1 double RPC)

Price tag (without link and trigger system) ~ 5.0 Mio CHF



Cost breakdown vs. eta



Forward RPC TDR version

WVD

6/12/2007

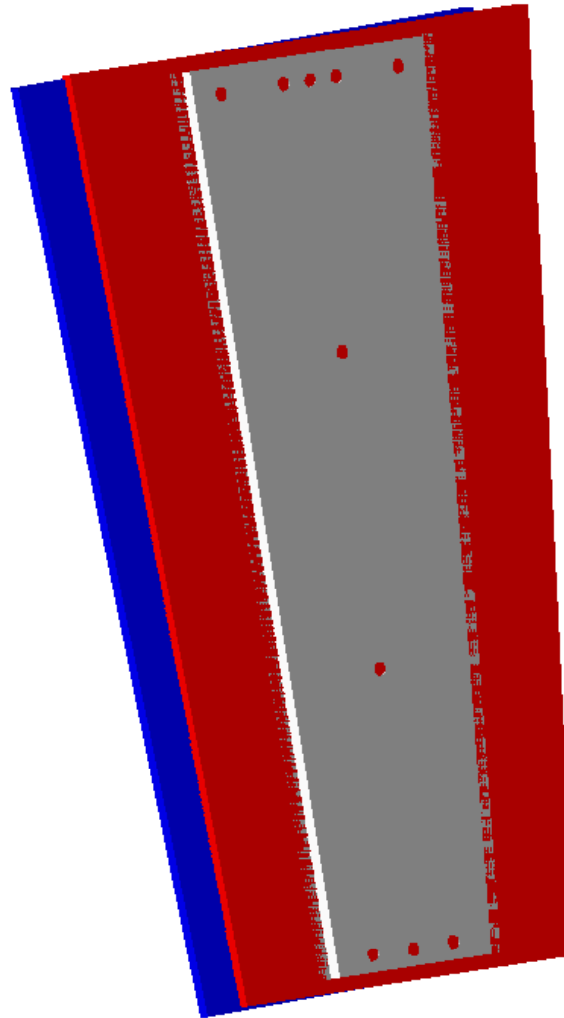
	Done	4st;1hv/2ch	hi eta	4st;1hvch	hi eta	"5"st;hi eta;1hvch
Detector components	1740	620	420	620	420	1535
Bakelite	210	70	40	70	40	135
Honeycomb panels	520	175	100	175	100	300
Single gaps	500	190	150	190	150	580
Strips	60	20	20	20	20	60
Mechanics & Assembly	380	150	100	150	100	410
Copper&mylar sheets	70	15	10	15	10	50
FE electronics	460	160	260	160	260	600
VLSI	40	15	15	15	15	60
FE boards	300	100	200	100	200	400
Strip connections to FE	30	15	15	15	15	50
HVconnector	90	30	30	30	30	90
Assembly & Installation	200	70	70	70	70	200
Monitoring	60	30	30	30	30	60
Services	1070	465	345	1050	345	1830
HV&LVsystem	600	185	315	770	315	1450
Cooling system	100	30	30	30	30	80
Gas system	370	250		250		300
Cables	340	130	210	130	210	410
"Skew clear"	240	85	165	85	165	250
HV,LV,DCS	100	35	35	35	35	140
Fibres	?	10	10	10	10	20
Off detector electronics	25	355	605	355	605	970
Distribution Boards	25	10	10	10	10	30
Link Boards	?	250	500	250	500	750
Link Board Boxes	?	10	10	10	10	20
LVlink system		45	45	45	45	90
Trigger Boards	?	40	40	40	40	80
Not in costbook						
Umbilical HV/cable		50	50	50	50	130
Shipments & logistics on chamber and/or		150	150	150	150	300
						?
TOTAL	3895	2030	2140	2615	2140	6035
			4170		4755	6035
		4.0 M		4.7 M		6.0 M

TDR

ULTIMATE GOAL?

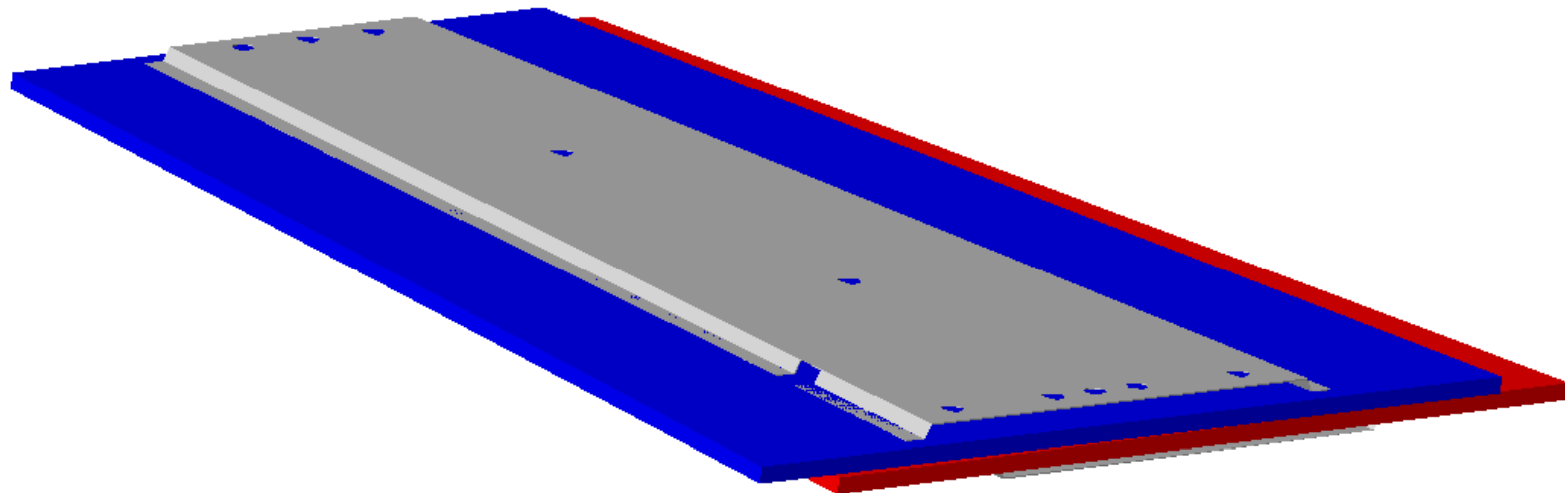


RE2bis : the unit cell a double-double gap RPC



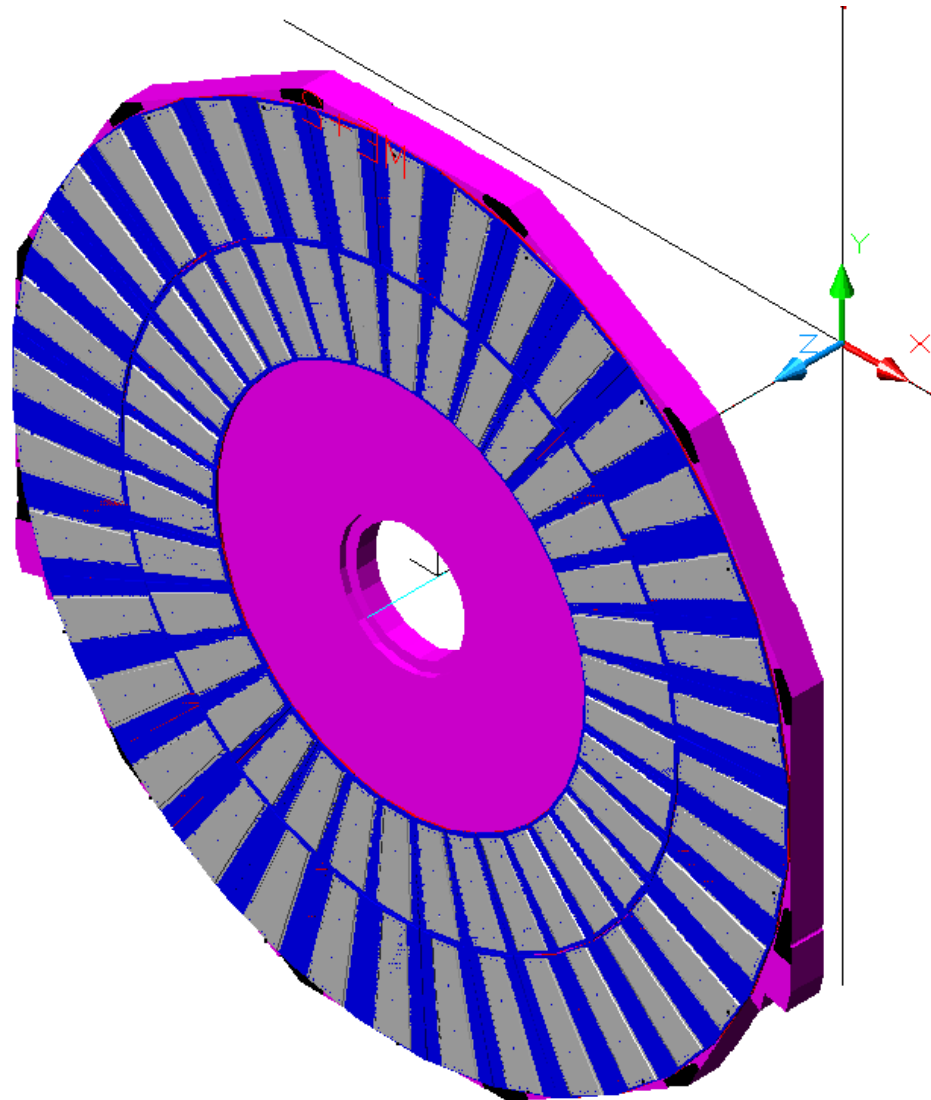


RE2bis



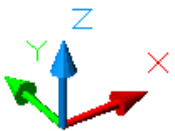
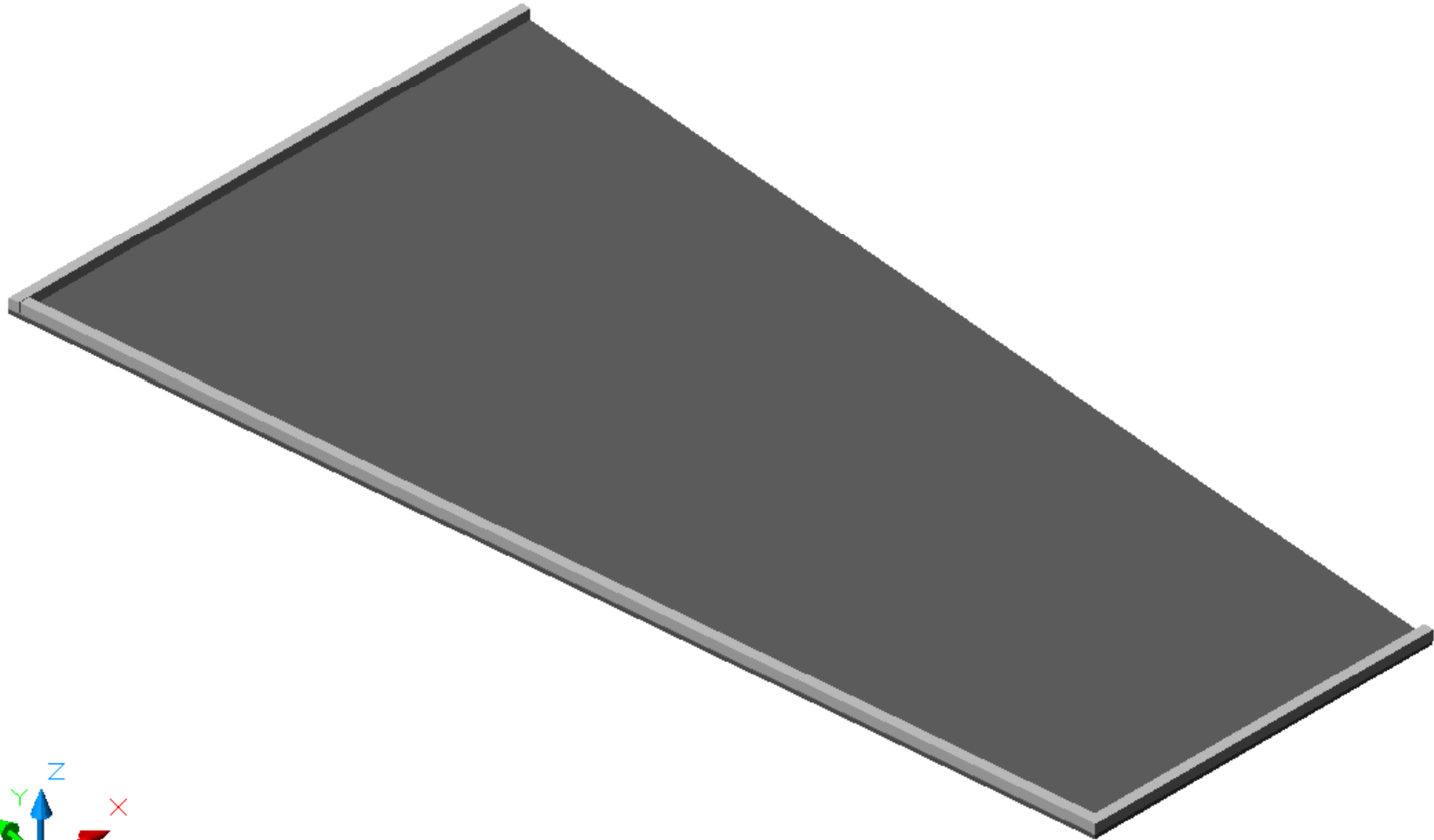


RE2bis low η layout



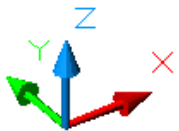
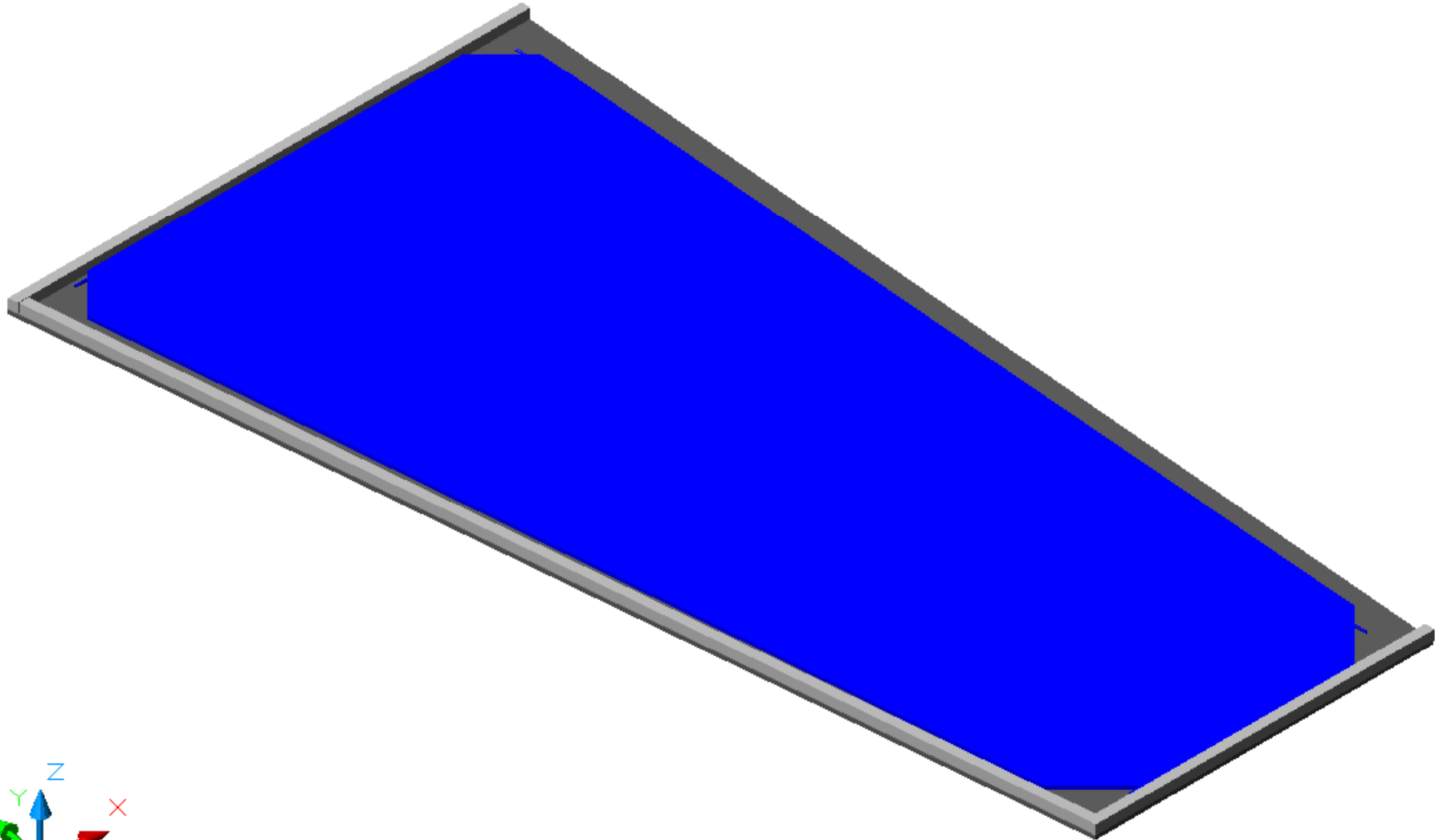


RE2bis build up



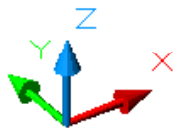
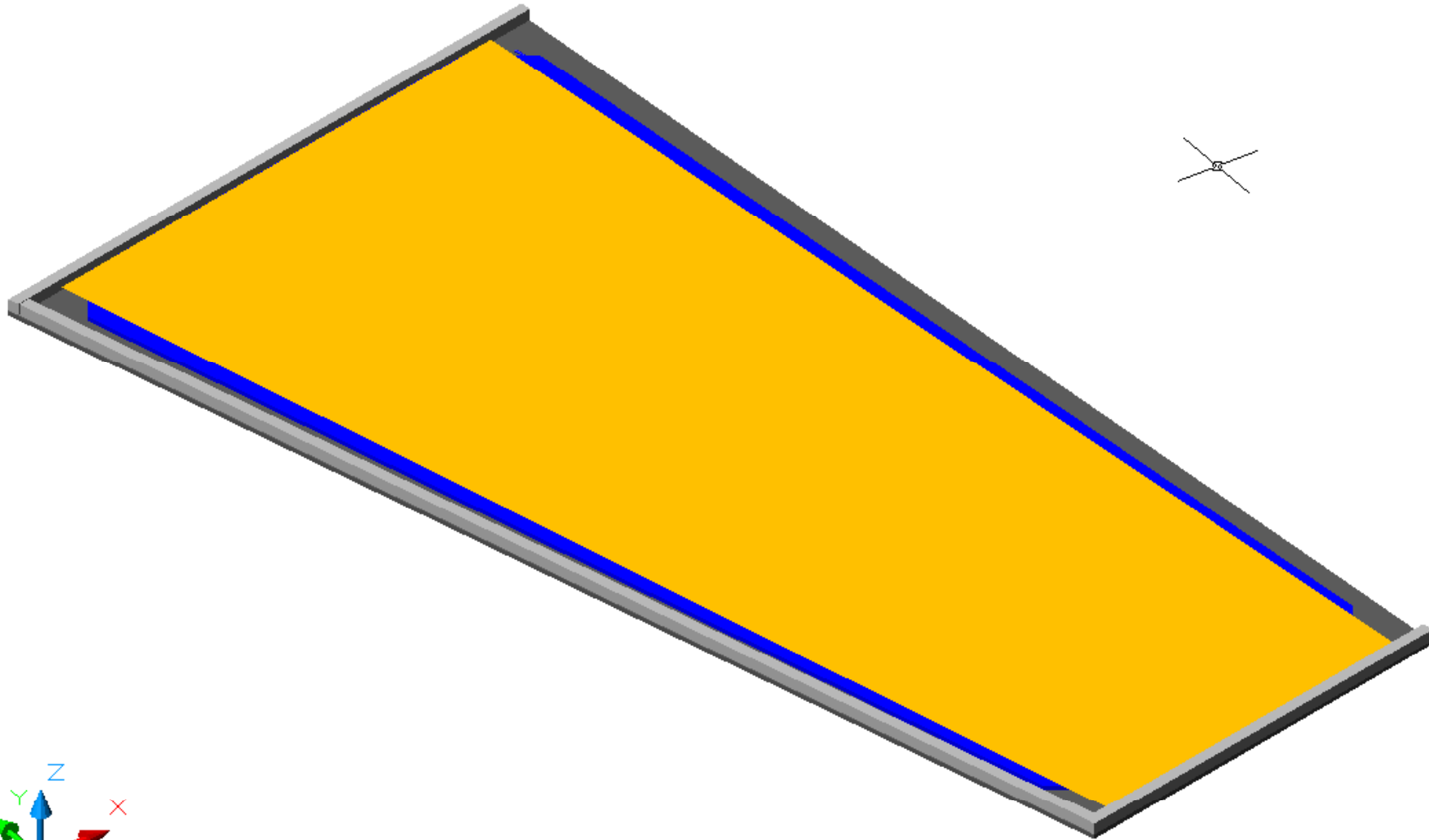


RE2bis build up



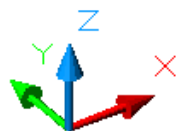
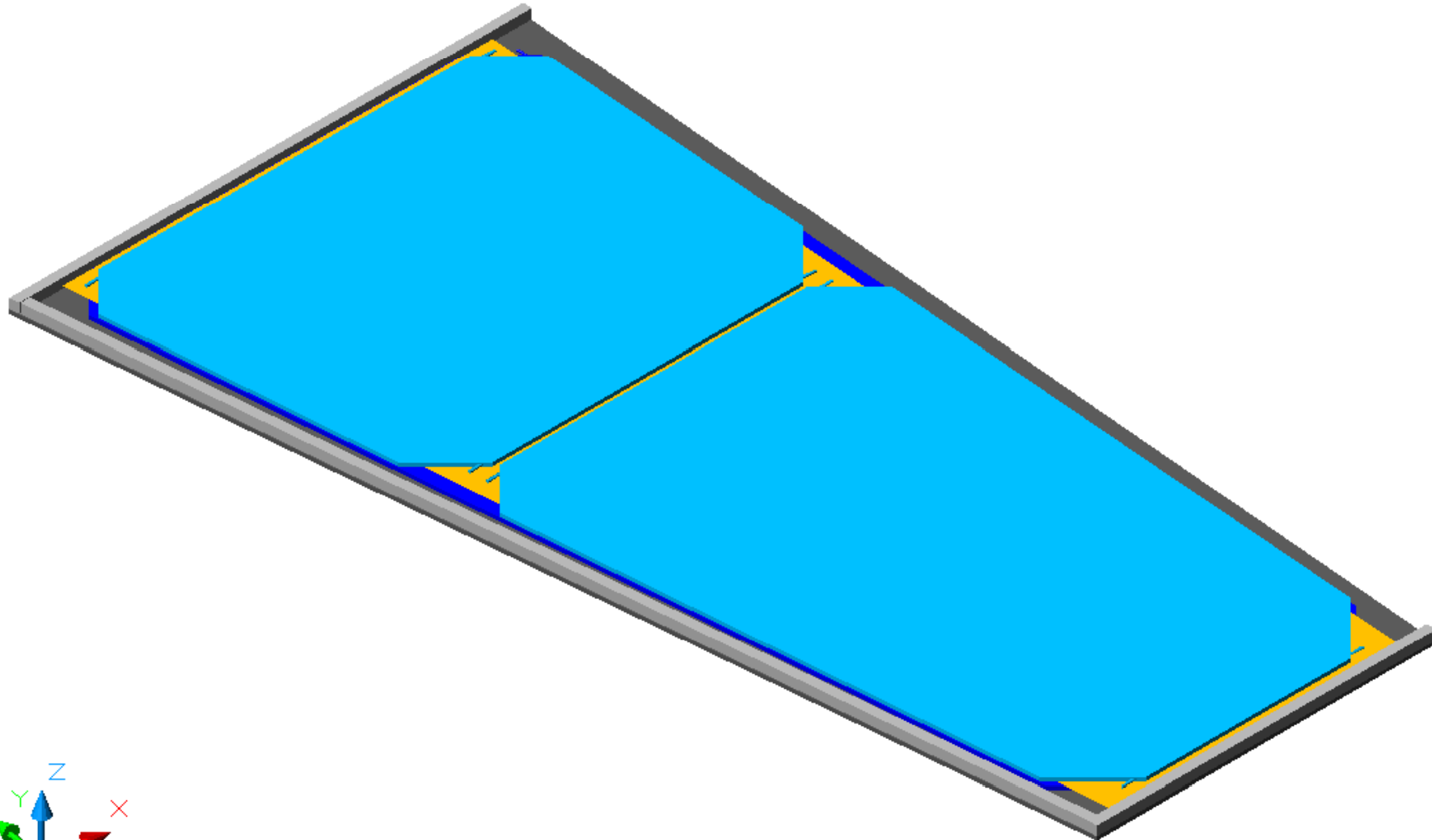


RE2bis build up



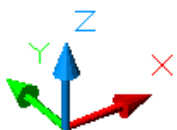
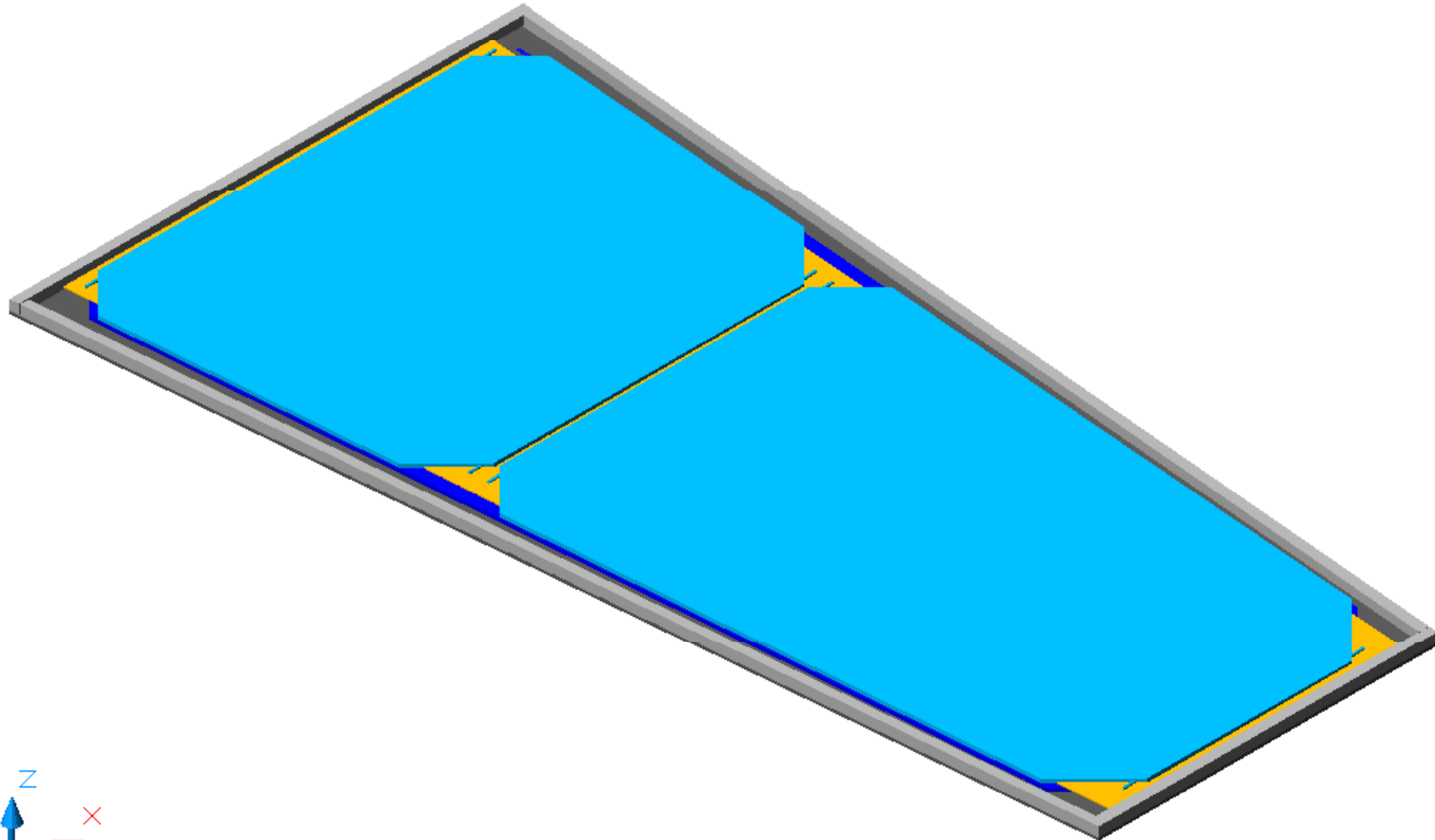


RE2bis build up



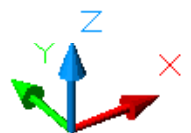
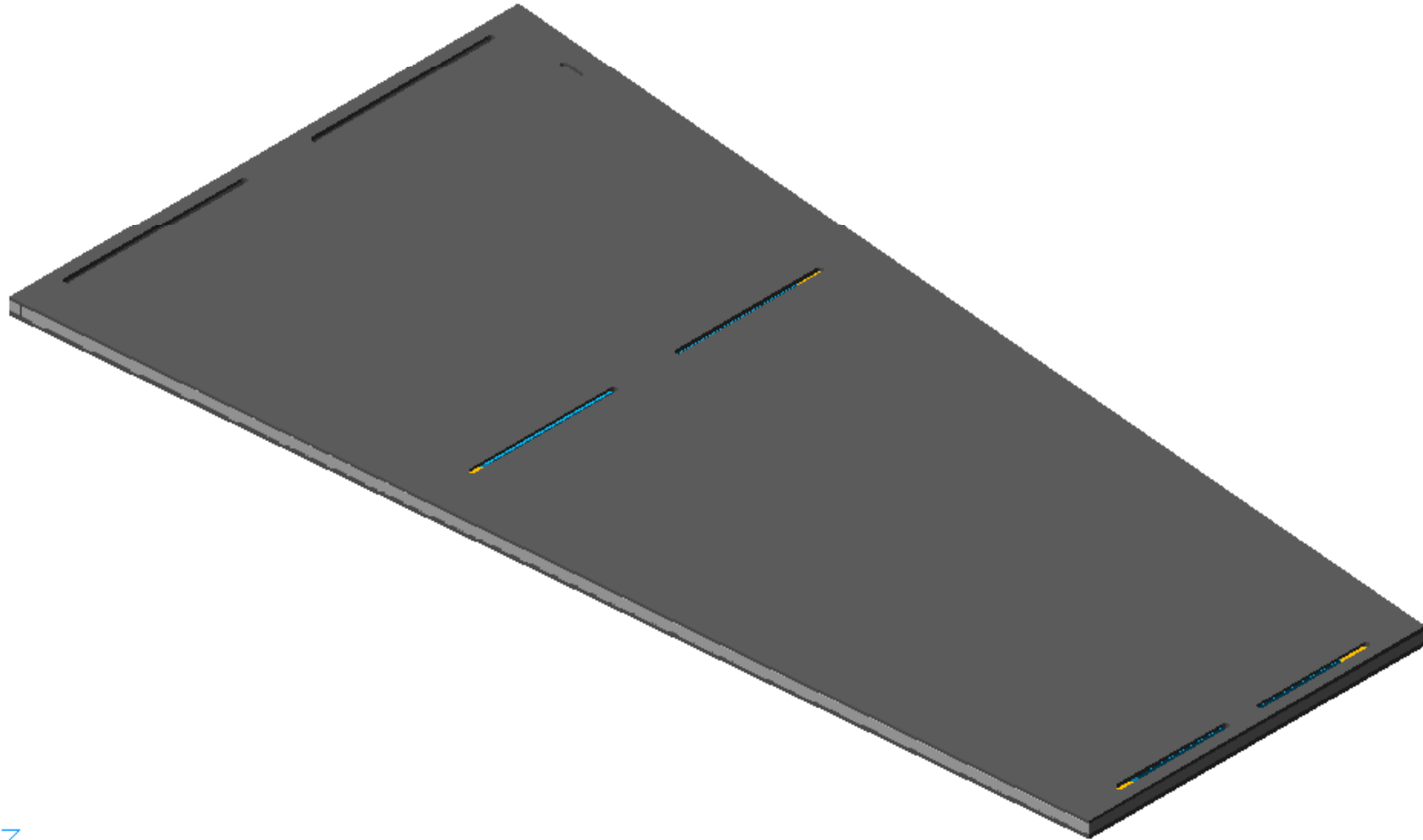


RE2bis build up



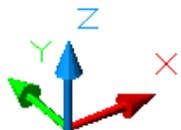
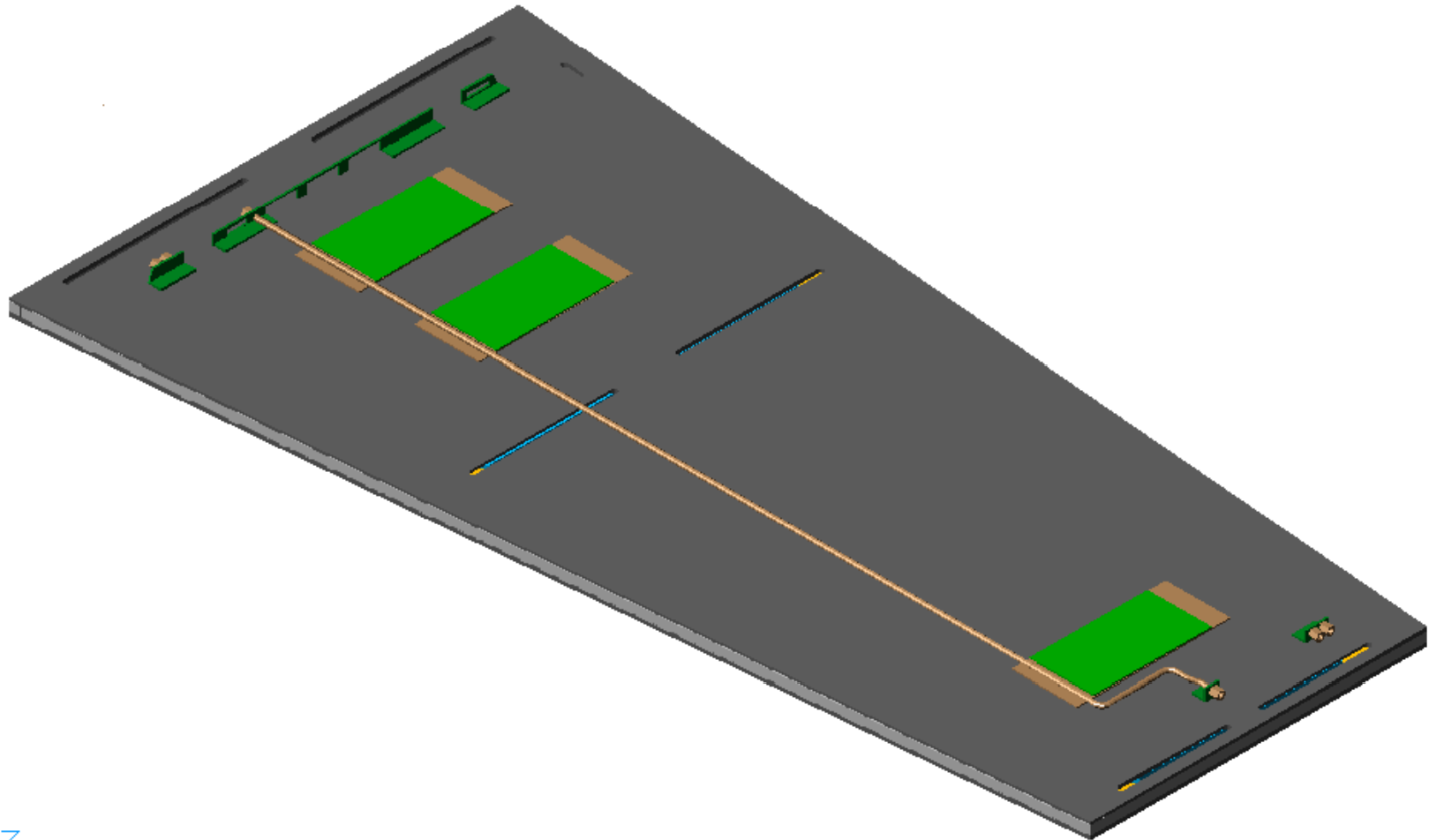


RE2bis build up



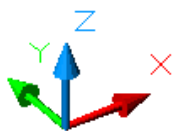
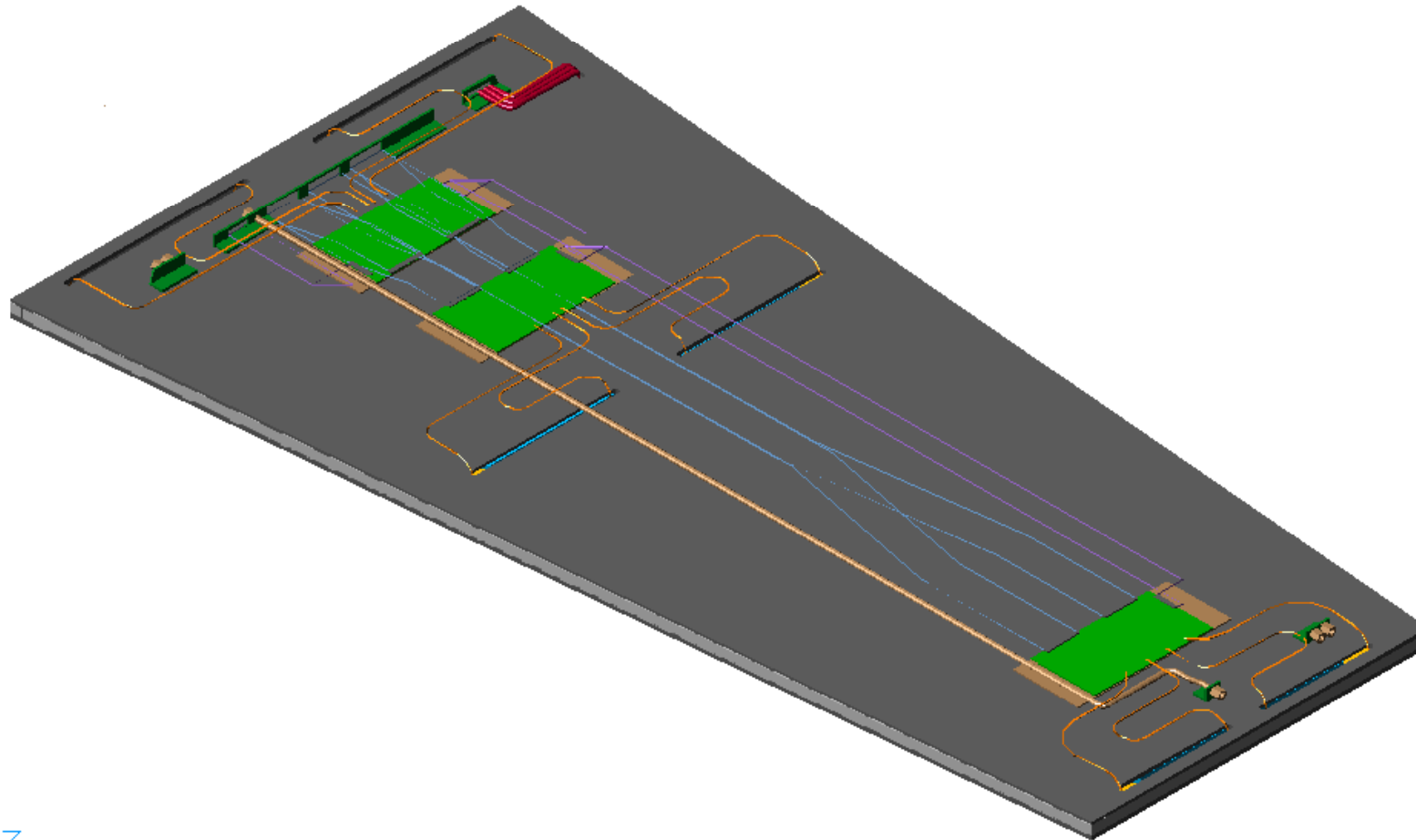


RE2bis services



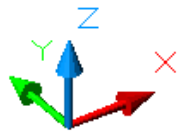
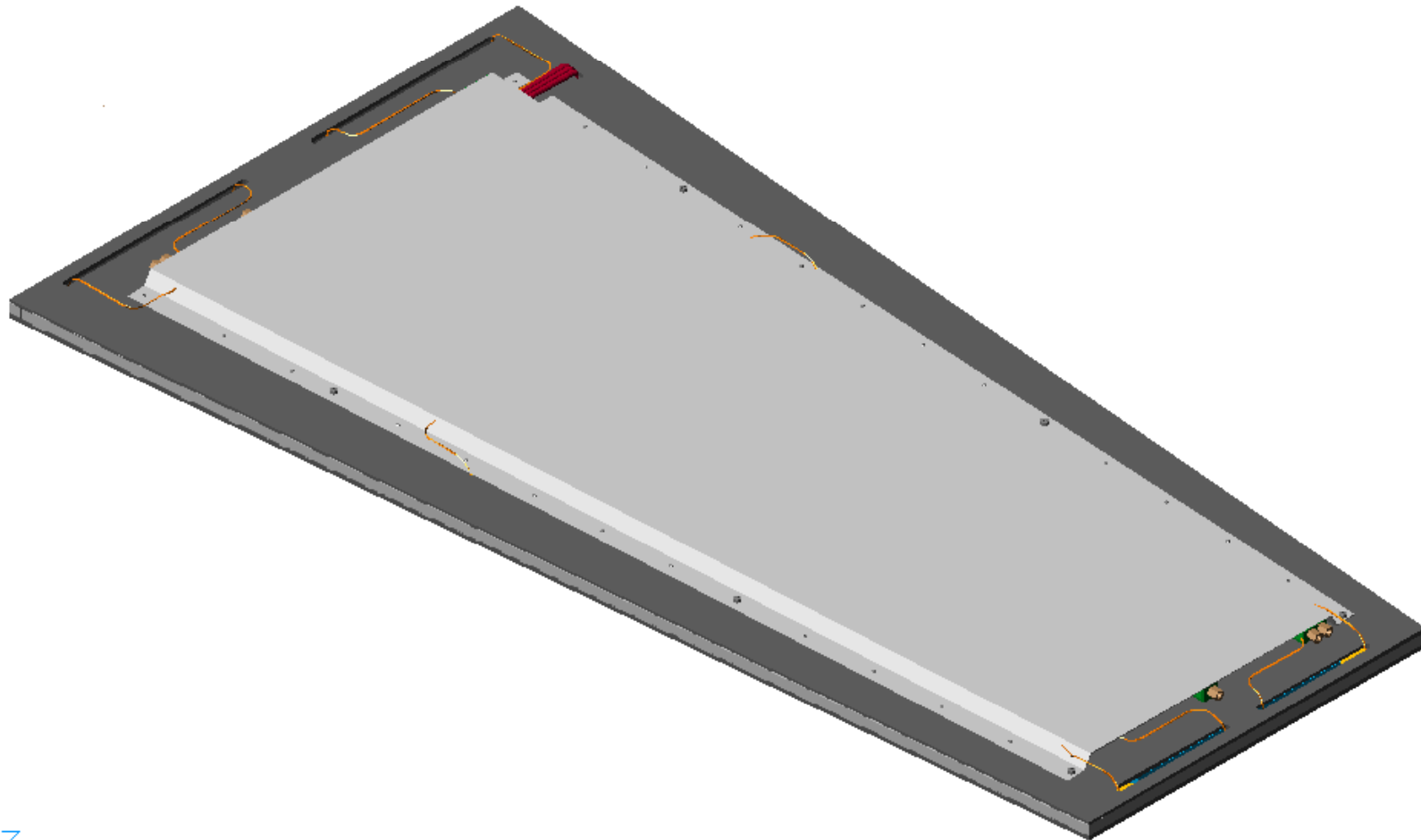


RE2bis services



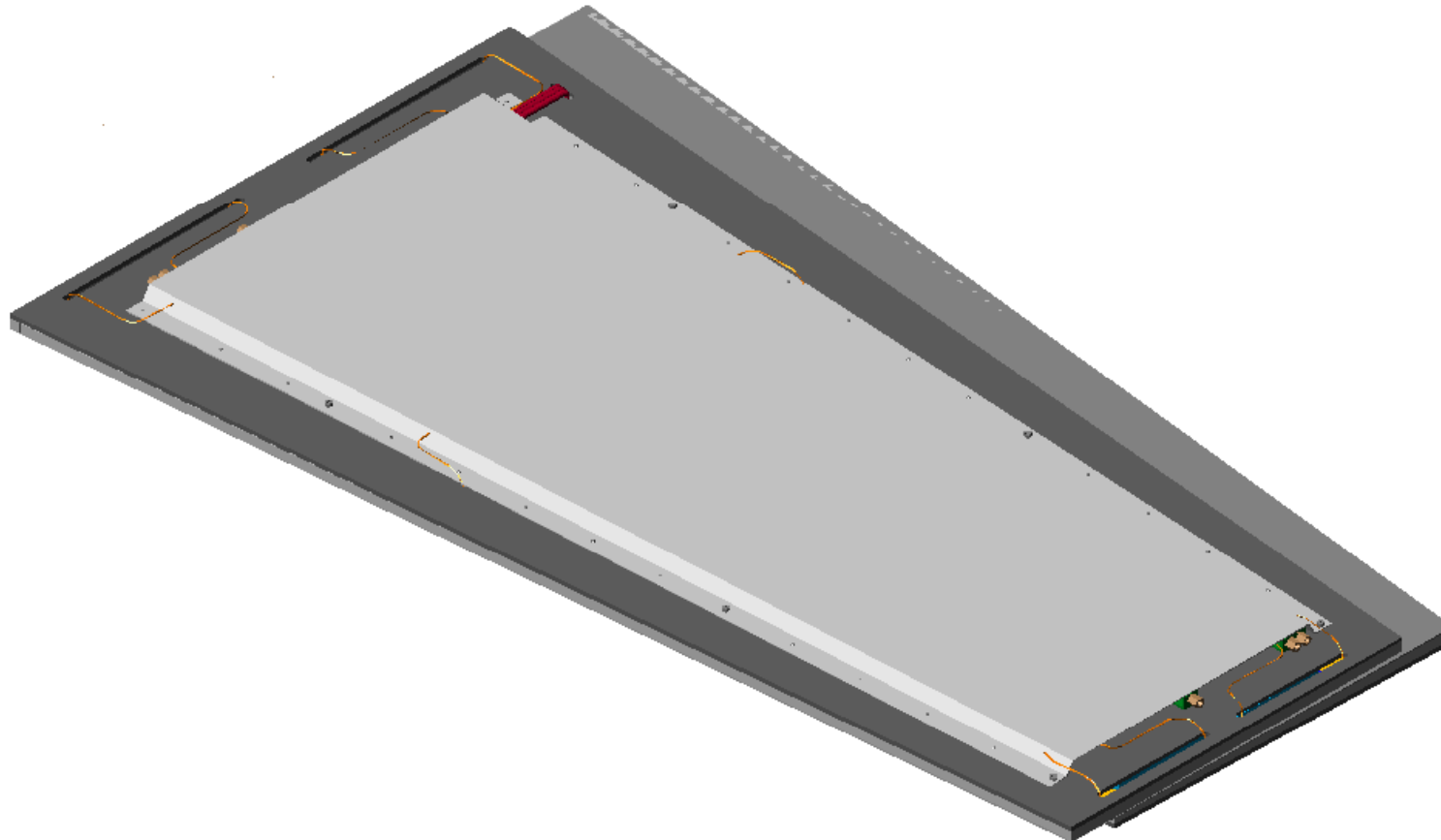


Single double gap RPC (as before)



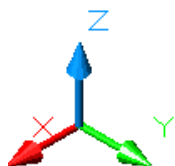
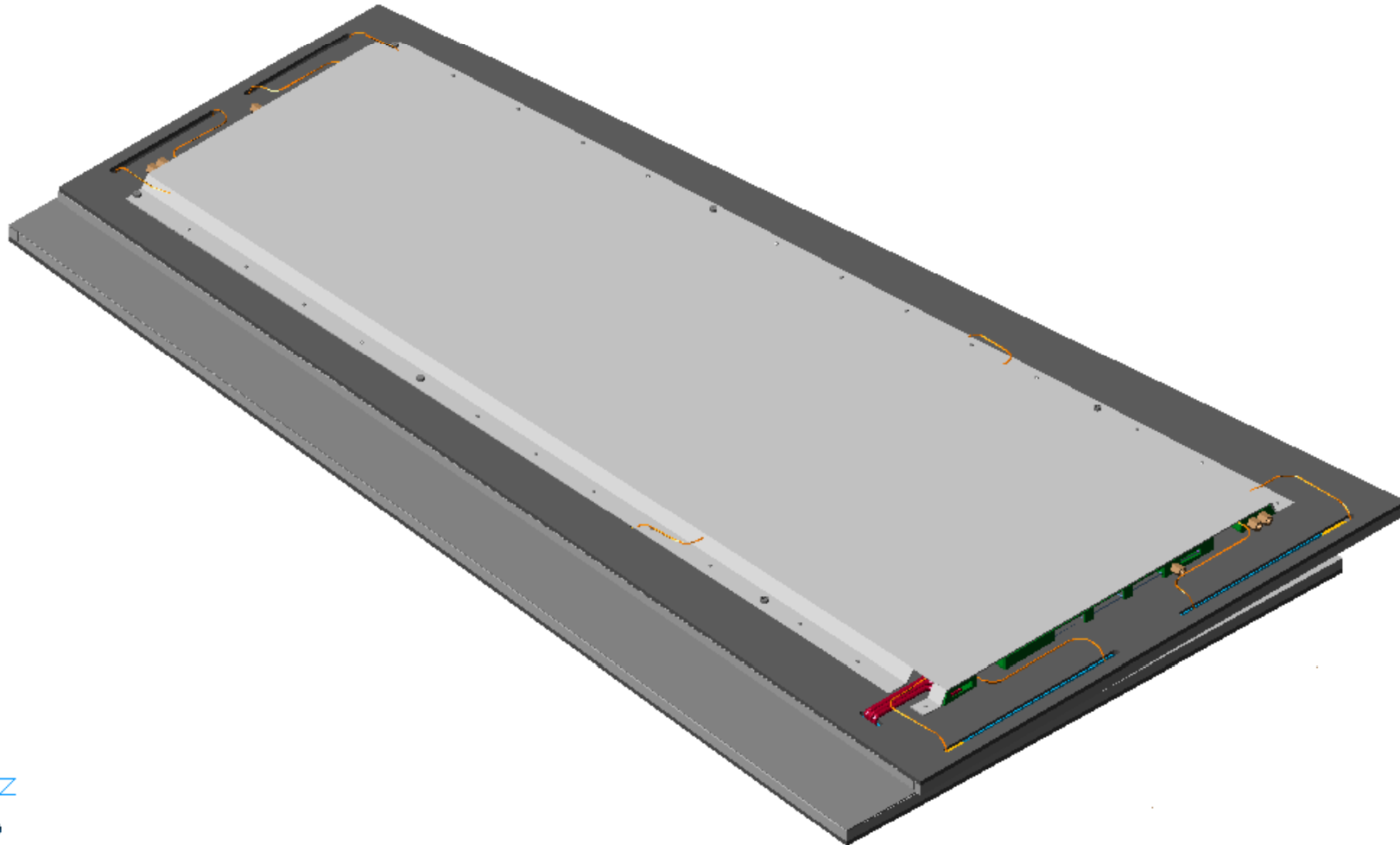


RE2bis double RPC mount back to back



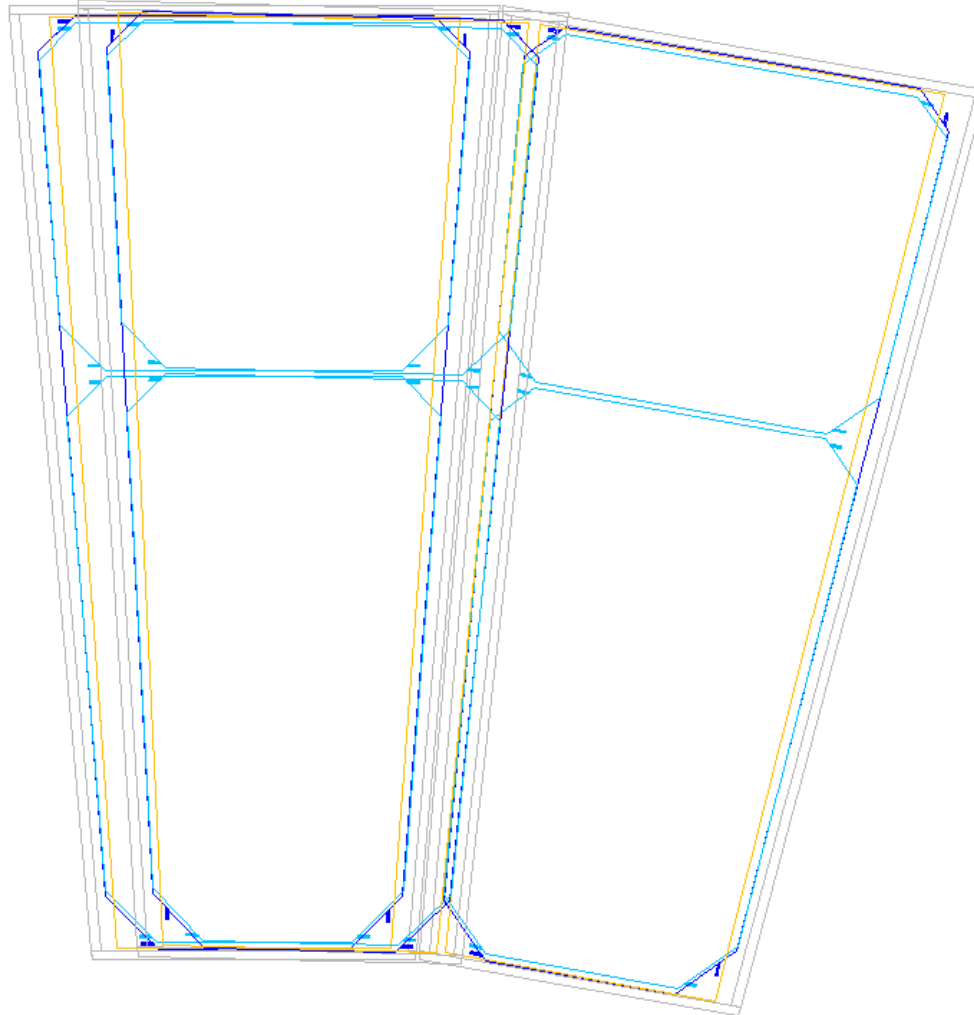


RE2bis double RPC



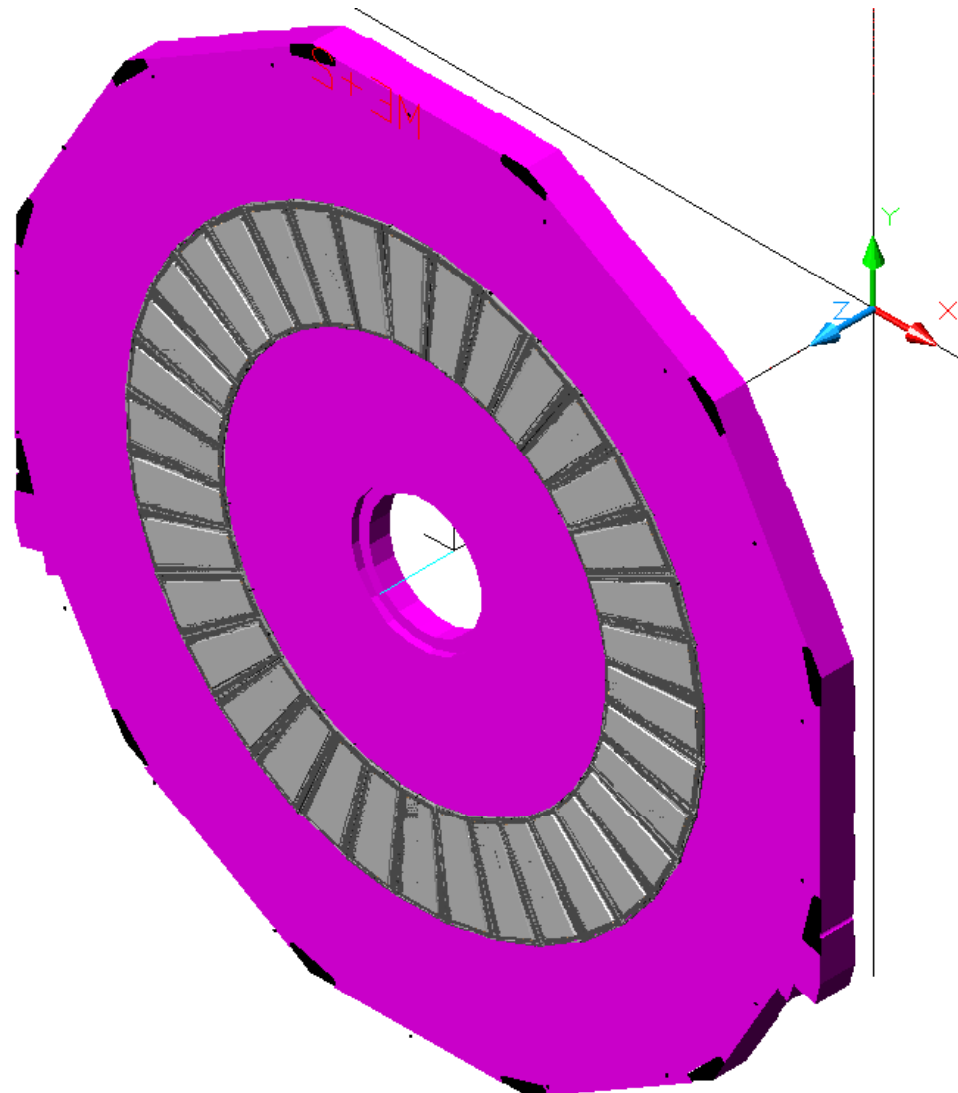


RE2bis coverage: 86% double-double



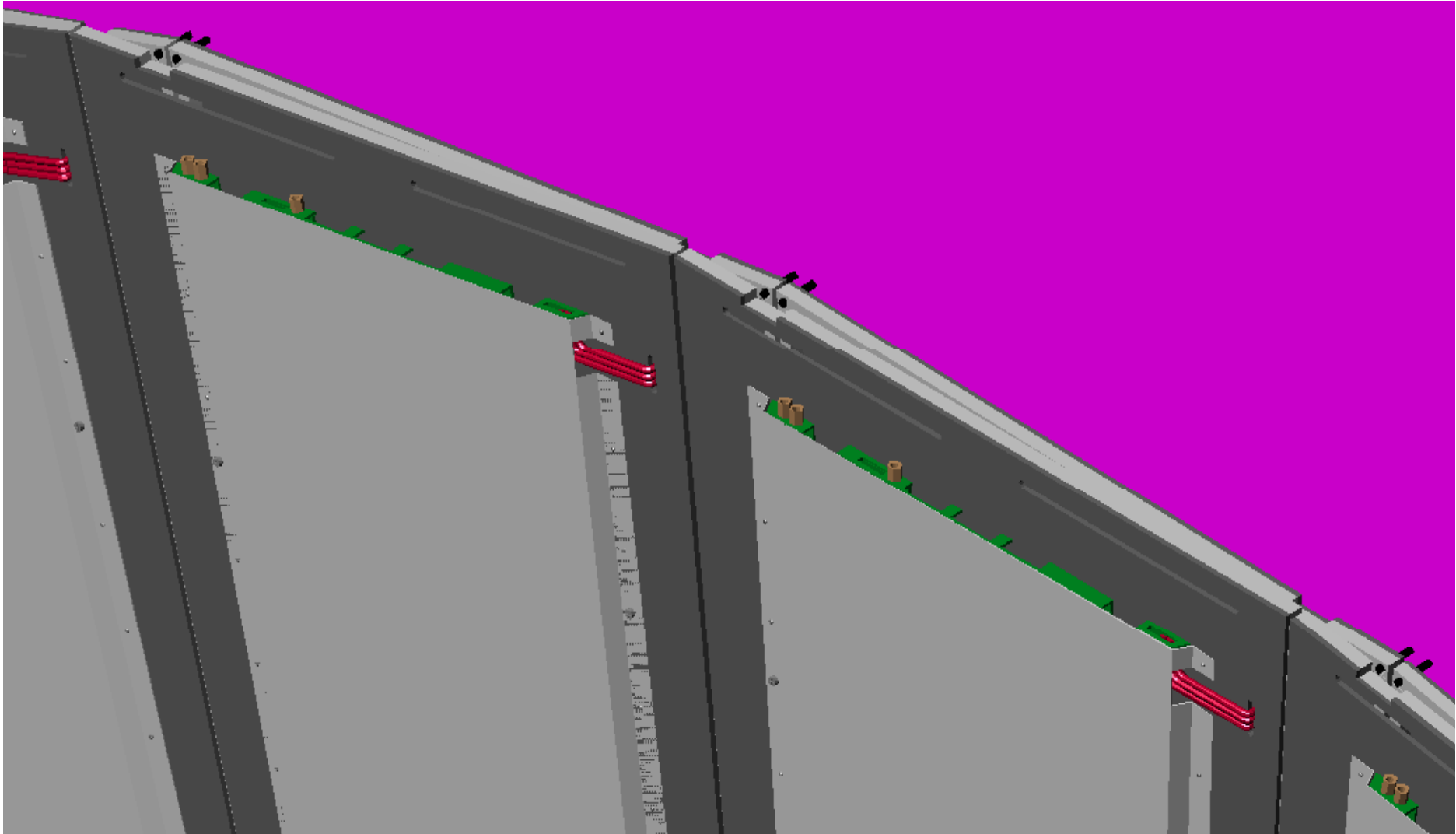


RE2/2bis on yoke



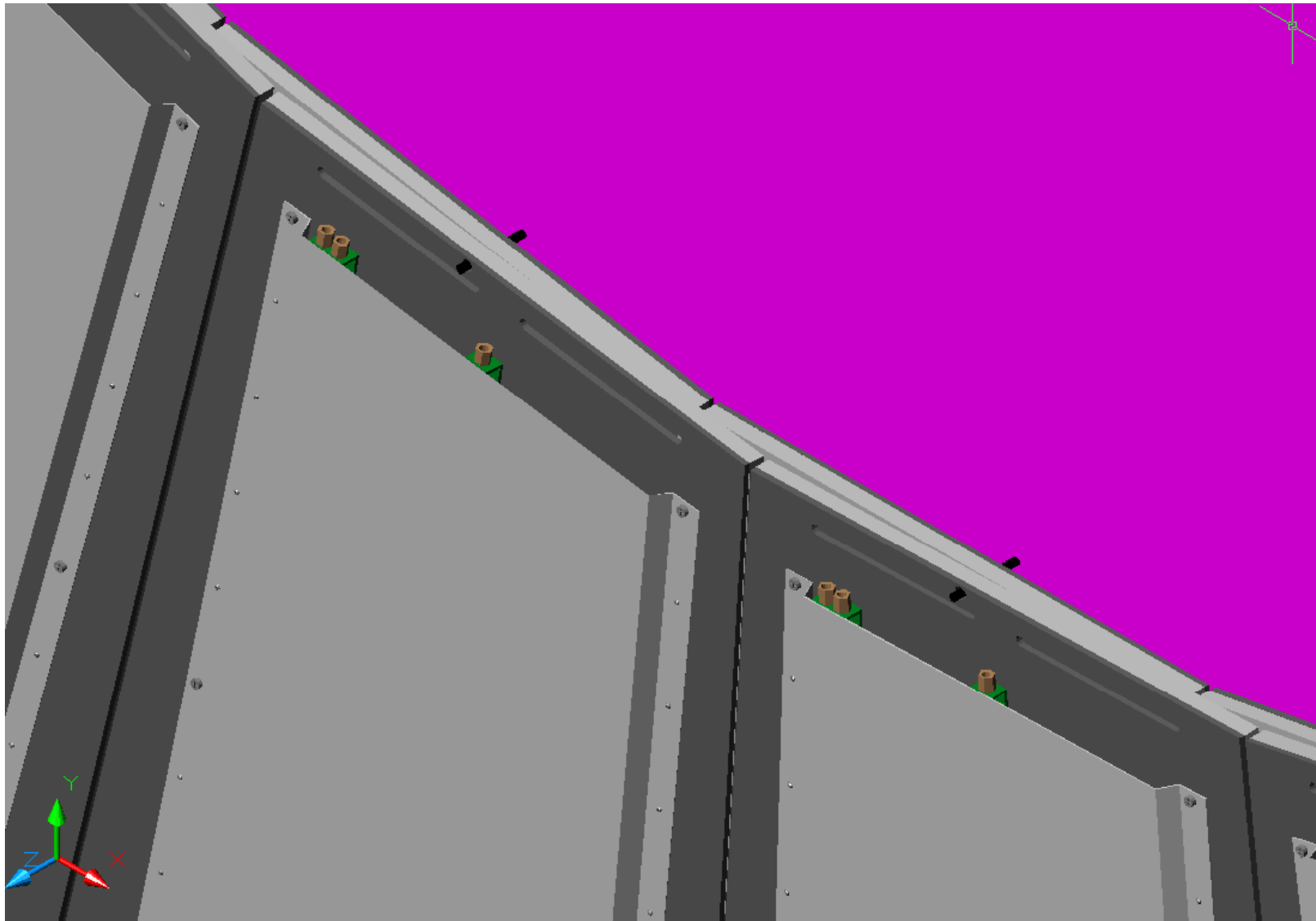


Fixation to yoke (new holes!)





At small radius (new holes !)





Cost breakdown



Forward RPC TDR version								WVD	12/06/2007	09-10	10-11	Any t
	Done	4st;1hv/2ch	hi eta	4st;1hv/ch	hi eta	"5"st;hi eta;1hv/ch	hi eta only		Phase I	Phase II	Phase III	
Detector components	1740	620	420	620	420		1535	420	1115	420		
Bakelite	210	70	40	70	40		135	40	95	40		
Honeycomb panels	520	175	100	175	100		300	100	200	100		
Single gaps	500	190	150	190	150		580	150	430	150		
Strips	60	20	20	20	20		60	20	40	20		
Mechanics & Assembly	380	150	100	150	100		410	100	310	100		
Copper&mylar sheets	70	15	10	15	10		50	10	40	10		
FE electronics	460	160	260	160	260		600	260	340	260		
VLSI	40	15	15	15	15		60	15	45	15		
FE boards	300	100	200	100	200		400	200	200	200		
Strip connections to FE	30	15	15	15	15		50	15	35	15		
HV connector	90	30	30	30	30		90	30	60	30		
Assembly & Installation	200	70	70	70	70		200	70	130	70		
Monitoring	60	30	30	30	30		60	30	30	30		
Services	1070	465	345	1050	345		1830	345	900	345	585	
HV & LV system	600	185	315	770	315		1450	315	550	315	585	
Cooling system	100	30	30	30	30		80	30	50	30		
Gas system	370	250		250			300		300			
Cables	340	130	210	130	210		410	210	200	210		
"Skew clear"	240	85	105	85	105		250	105	85	105		
HV, LV, DC S	100	35	35	35	35		140	35	105	35		
Fibres	?	10	10	10	10		20	10	10	10		
Off detector electronics	25	355	605	355	605		970	605	365	605		
D istribution Boards	25	10	10	10	10		30	10	20	10		
Link Boards	?	250	500	250	500		750	500	250	500		
Link Board Boxes	?	10	10	10	10		20	10	10	10		
LV link system		45	45	45	45		90	45	45	45		
Trigger Boards	?	40	40	40	40		80	40	40	40		
Not in costbook												
Umbilical HV cable		50	50	50	50		130	50	80	50		
Shipments & logistics on chamber and/or		150	150	150	150		300	150	150	150		
							?					
TOTAL	3895	2030	2140	2615	2140		6035	2140	3310	2140	585	
			4170		4755		6035		3310	2140	585	

Common Fund ~ 1.5 M

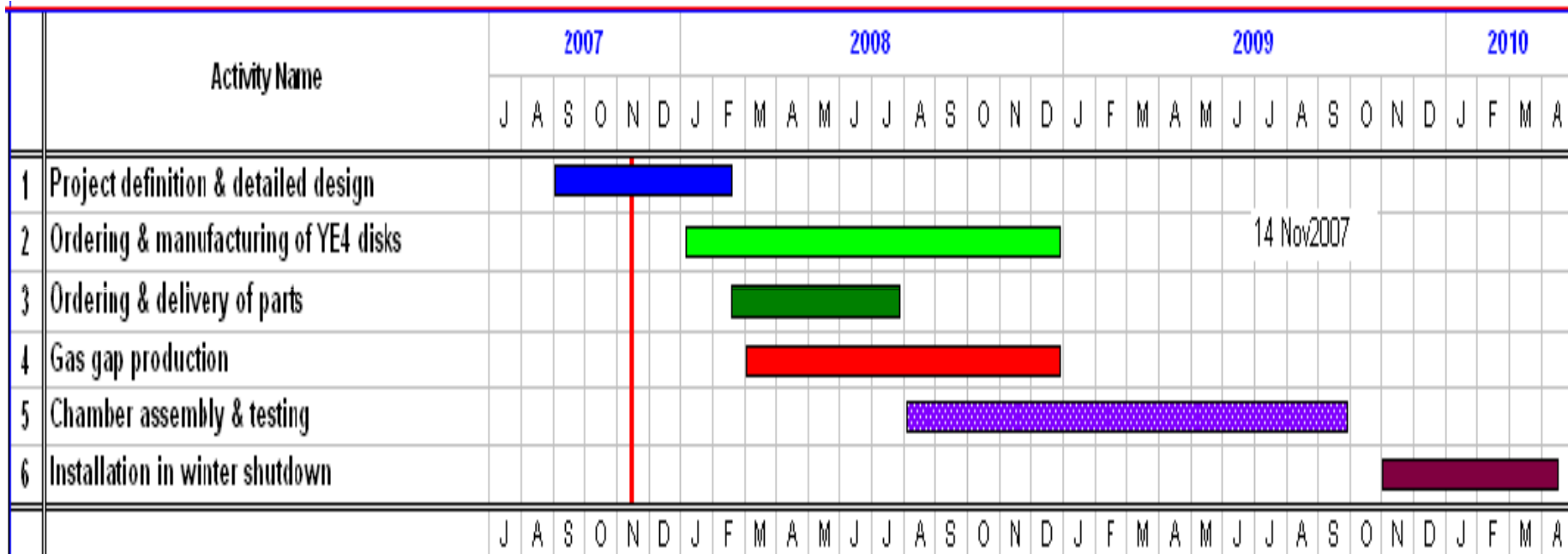
3.3 M

2.2 M

0.6 M



Possible timeline for phase I



14 Nov 2007



Mumbai RPC conference



Status of discussions



- Korean Gas gap production facility to remain active and funded
- Mechanical parts from China (funded)
- Continuing help from barrel RPC's (FEB, Coincidence etc...)
- Keep the ISR lab facilities active (continued support from CERN)
- Enough funding available ?
 - Upgrade is estimated at ~ 6 Mio CHF (cfr. RRB document)
 - Confirmed partnership: Belgium-China-India-Korea-Pakistan
 - Under discussion: CERN-Italy-Iran-Egypt
- Define the responsibilities among the partners

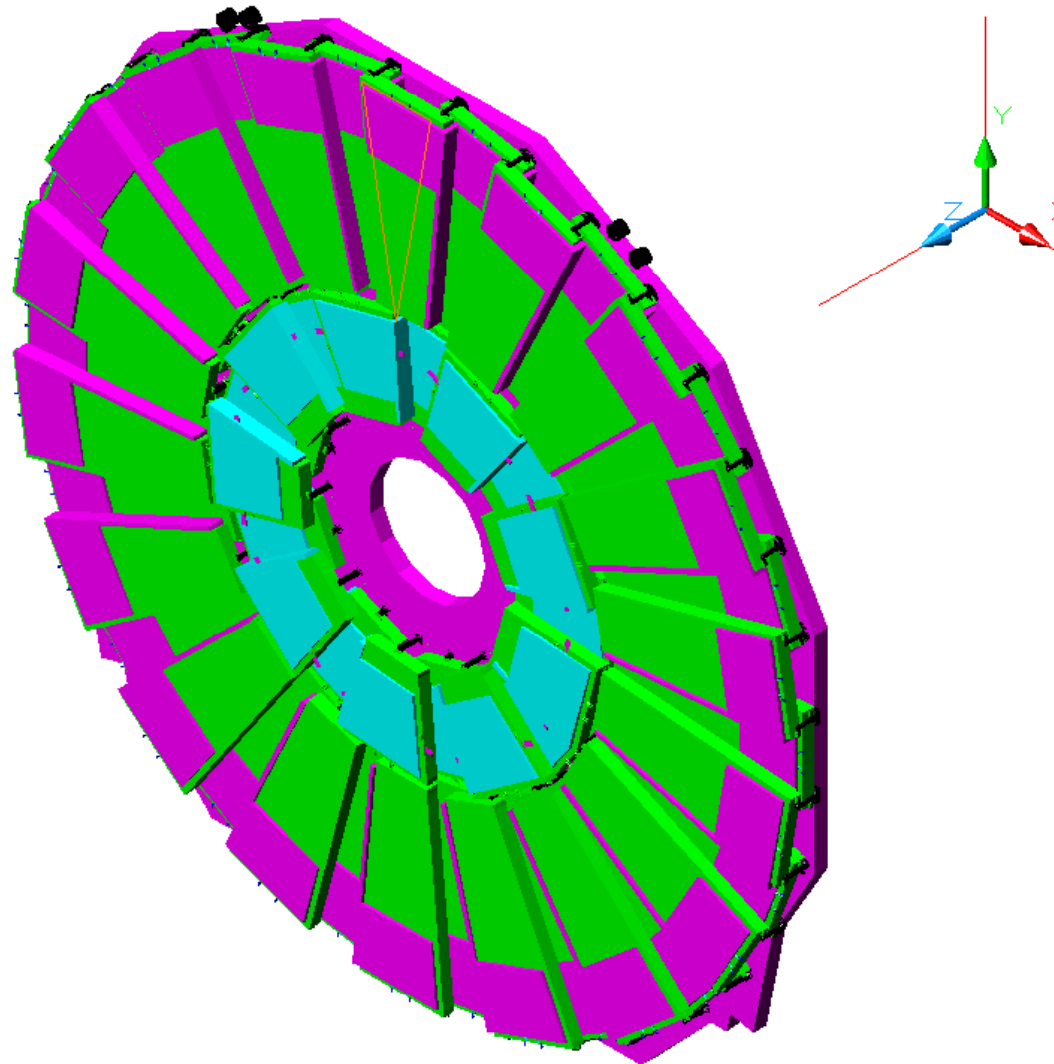
The FW RPC upgrade is mandatory for physics at the design luminosity of LHC and even more so for SLHC

The presently build initial system of 3 stations at low η requires to be more than doubled !

Can the "enlarged" consortium of collaborating institutes handle it ?

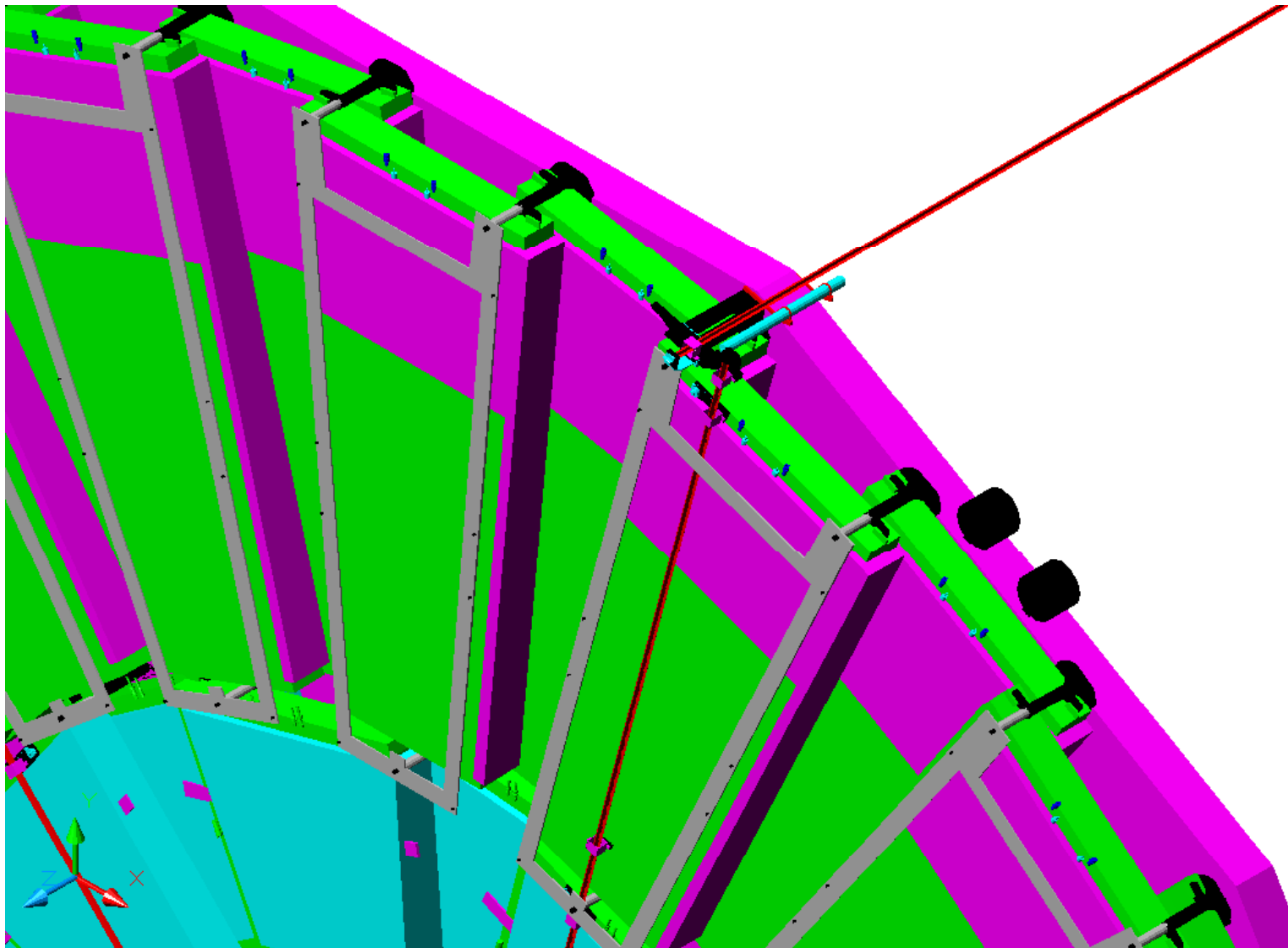


ME4



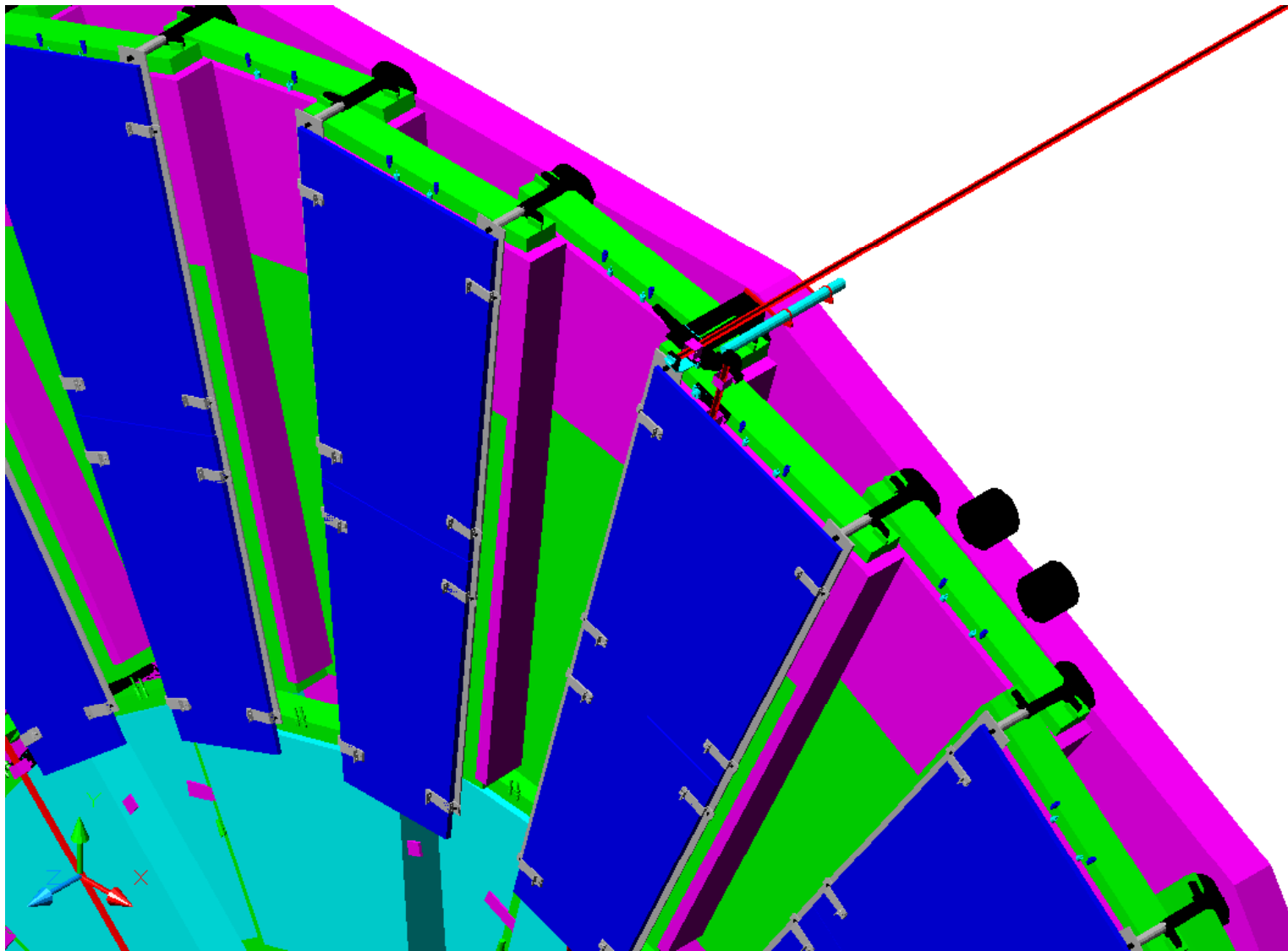


Interface



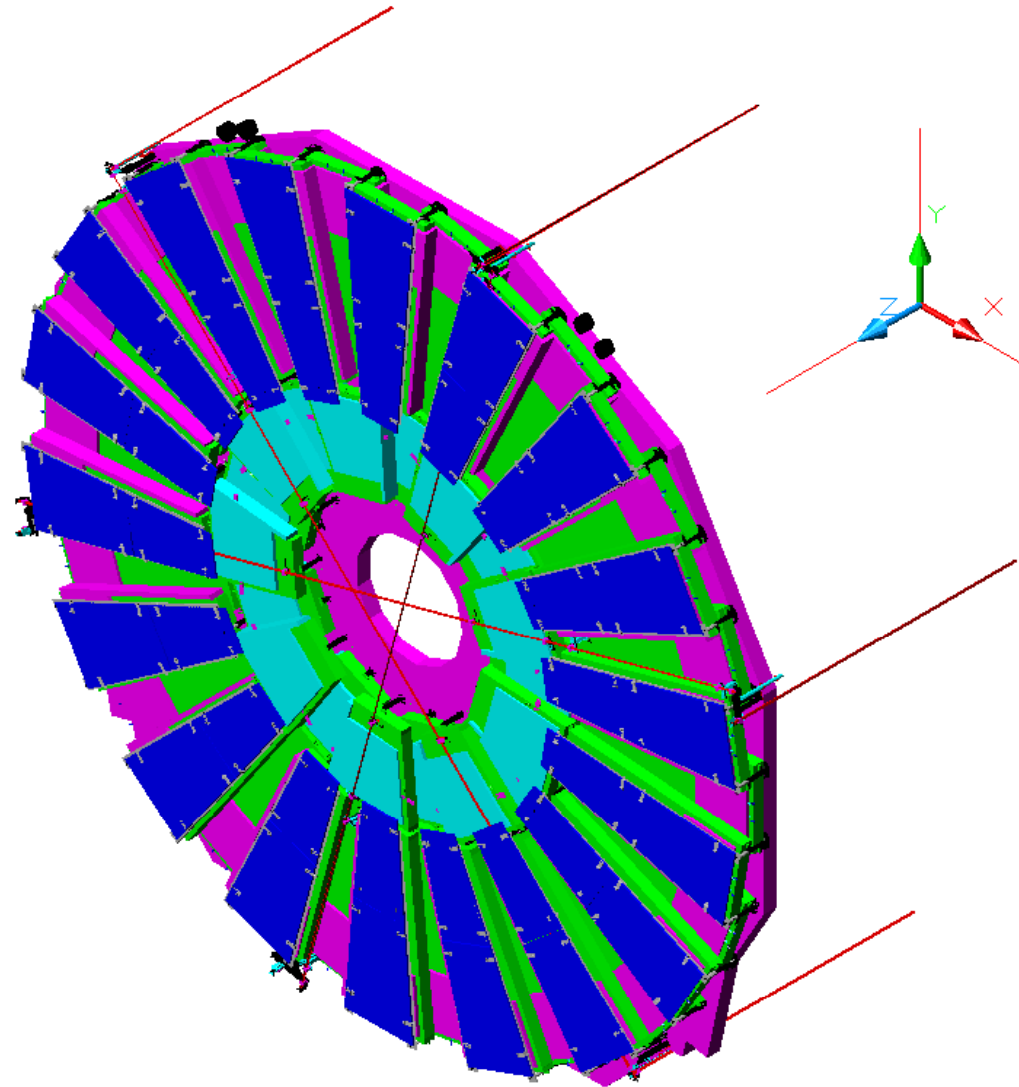


RE4 near yoke





RE4 near yoke





And off yoke RE4

