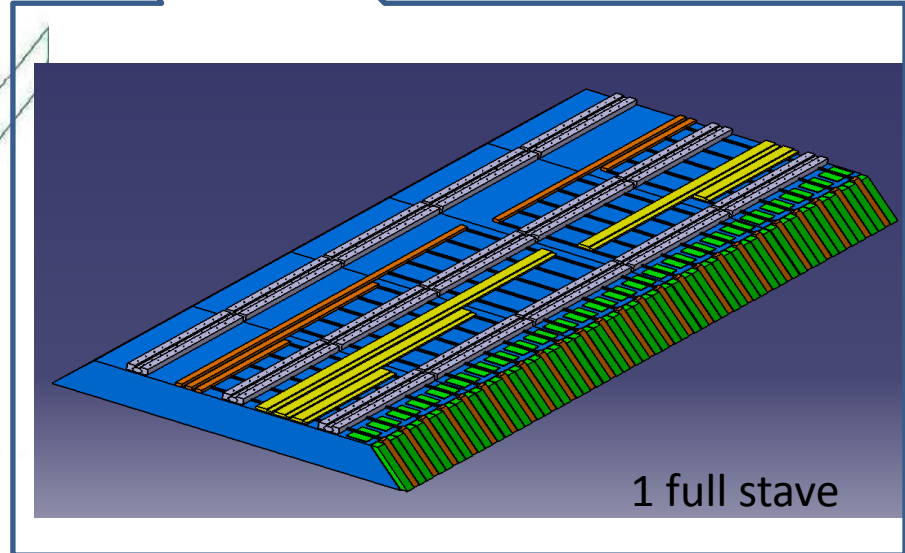
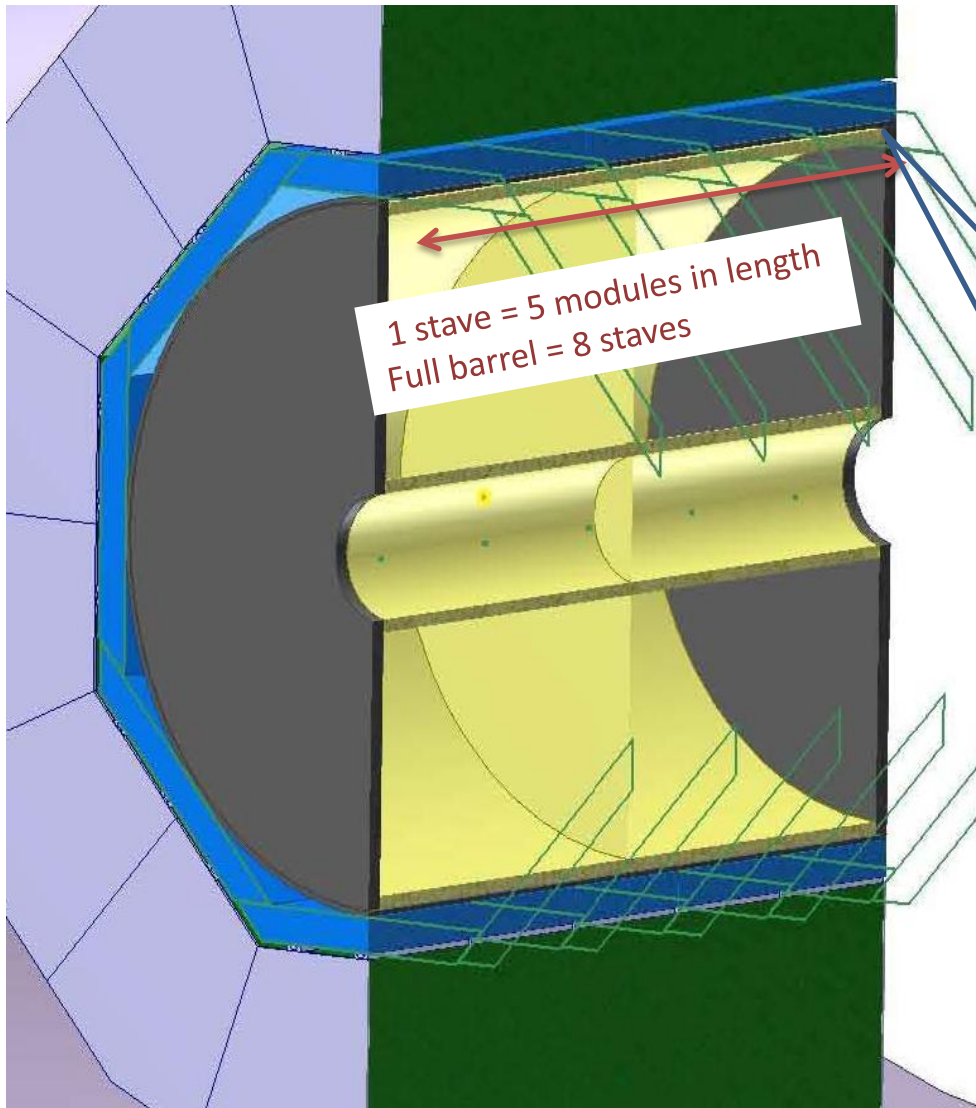


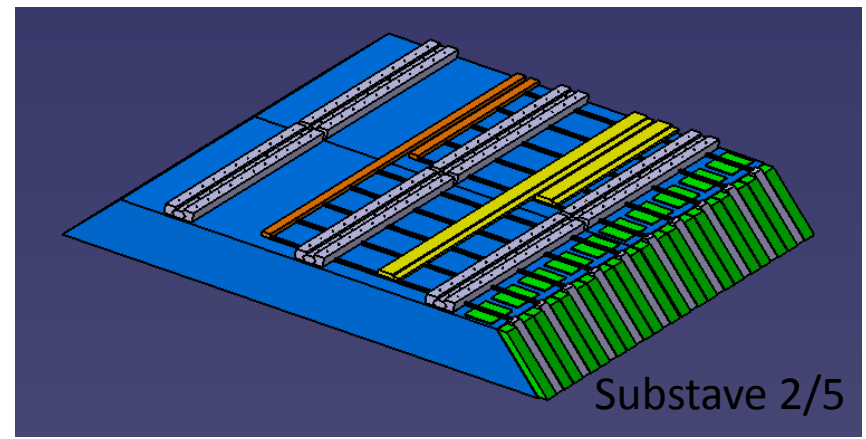
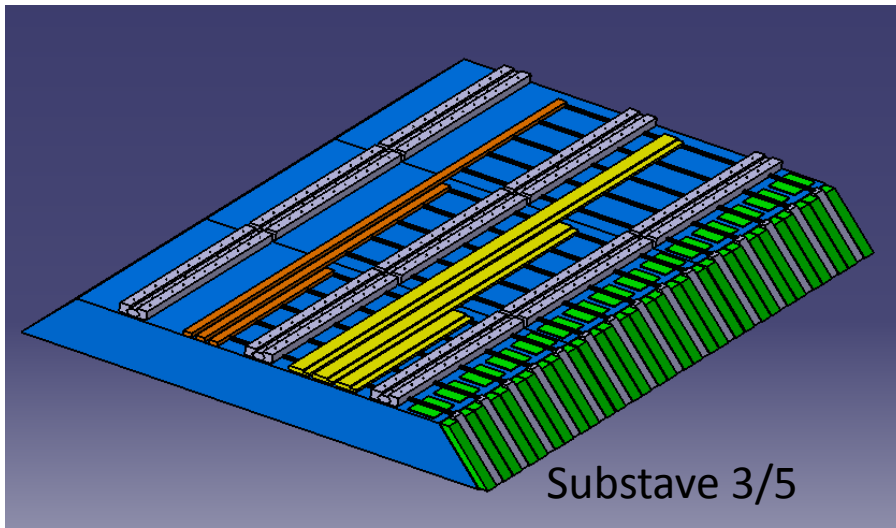
Ecal installation plans :

Catherine Clerc & Marc Anduze

preliminary reminders :

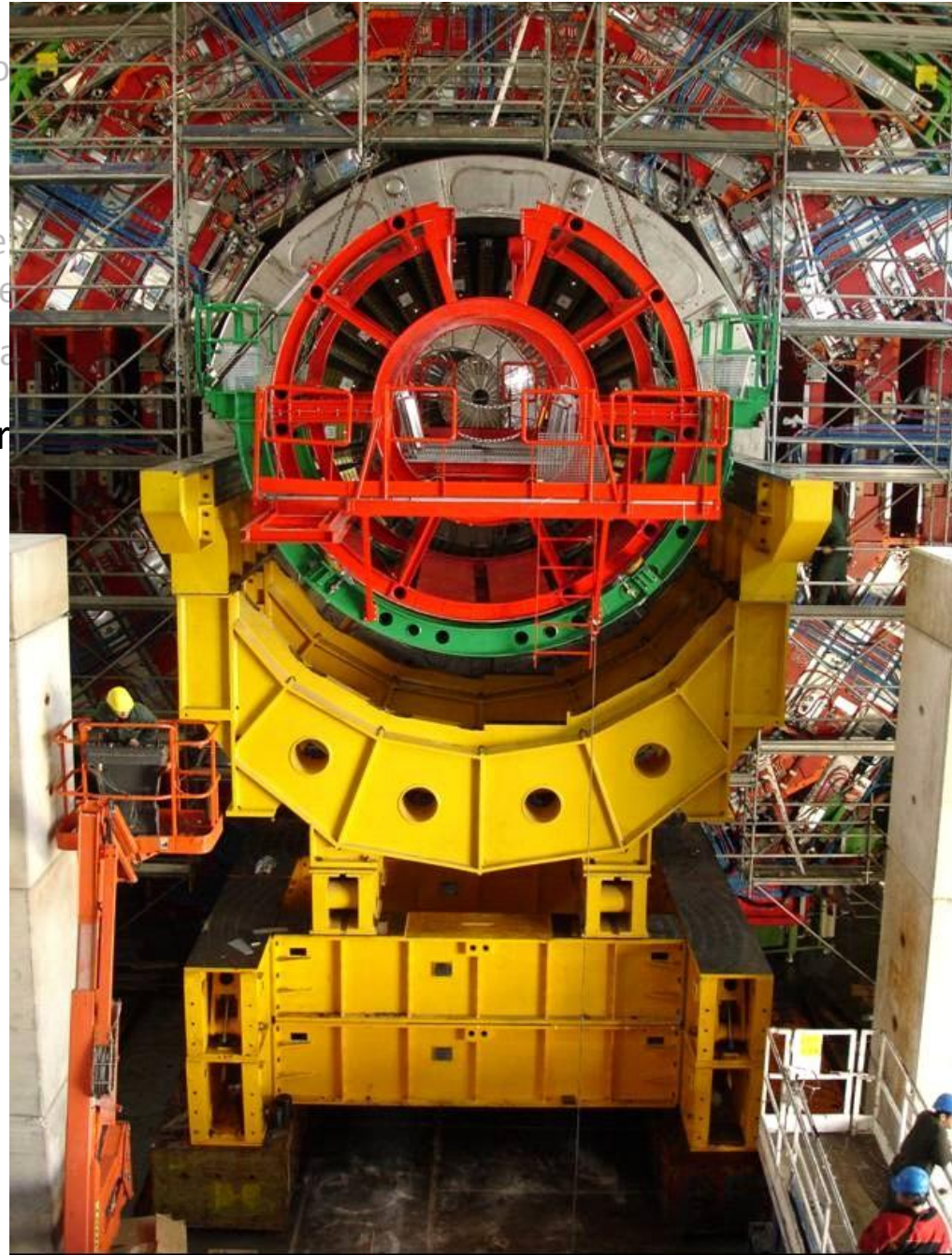
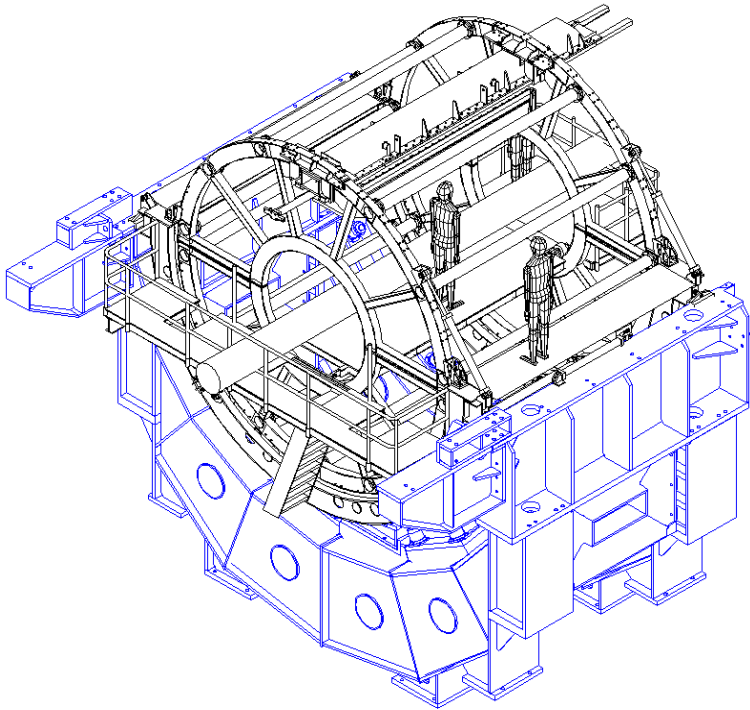


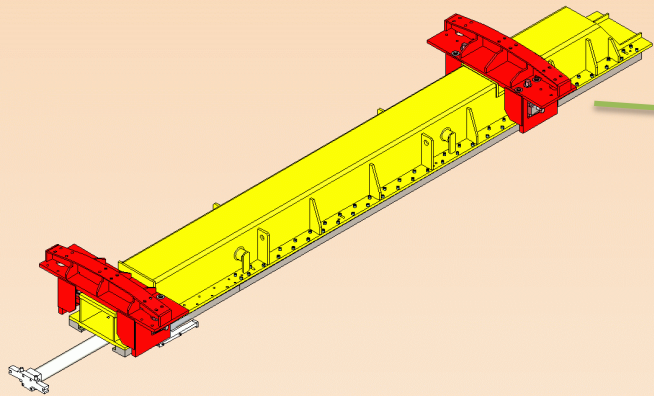
- Ecal is to be inserted into Hcal, hanging from it by rails
- The stave might be divided in two substaves composed of 2 modules and 3 modules respectively Substave 2/5 and substave 3/5.
- This subdivision is due to the fact that the services exit is share between the Z+ and Z- faces of the barrel. Thus, there is a dissymmetry of the volume of services.
- The insertion tooling will have to follow the angular repartition (pitch of 45 °)



- Ecal is to be inserted into Hcal, sustained from
- The stave might be divided in two substaves respectively Substave 2/5 and substave 3/5.
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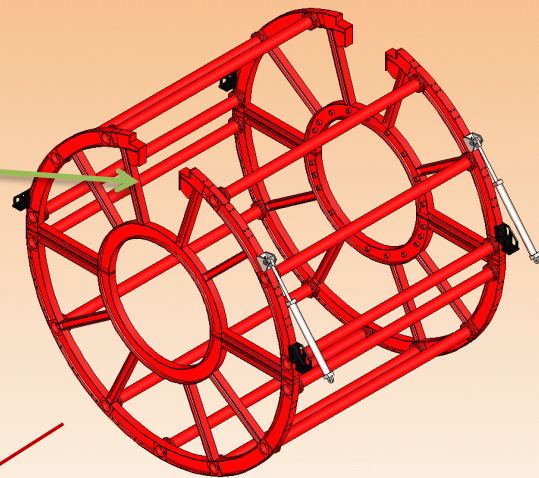
Marc Anduze's proposition is to use a similar tooling than the CMS Ecal insertion tool





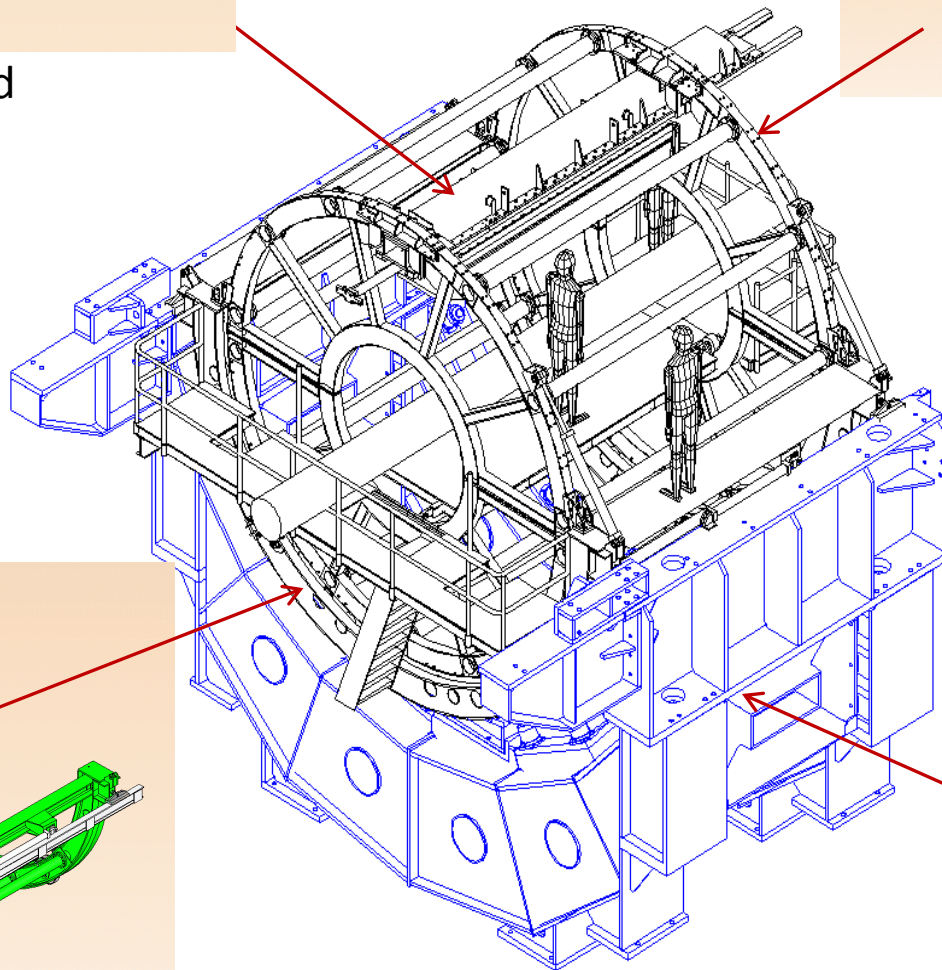
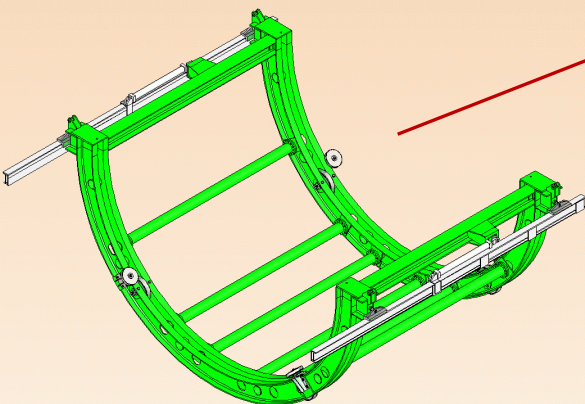
Stave pre-assembled
on frame : beam

Will be fixed on
free sector of the
cage

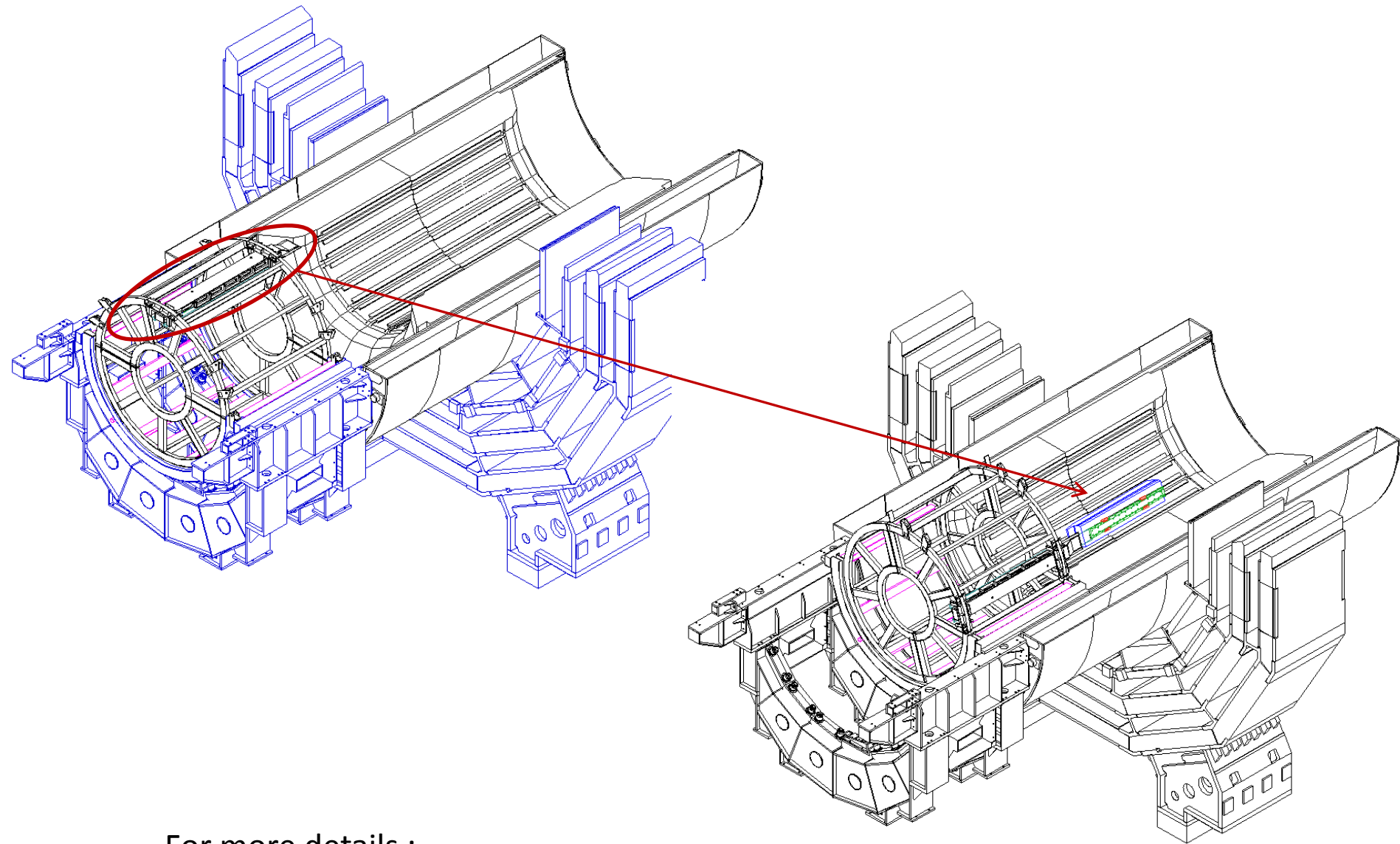


Rotating cage

Sliding cradle



Support cradle



For more details :

“ The CMS electromagnetic calorimeter supermodule insertion tooling” , [Sun, Zhihong](#) and all, NIM A, Vol.572, Issue 1, p. 141-144.

Assembly of the Ecal :

Parameters :

Barrel				
	Inner radius	1843		
	Outer radius	2028		
	Total length	4700		
	Total weigth	75 t		
Stave				
	Nber	8		
Sub-staves		Nber	Weigth	Length (in z)
	2/5	8	3.8 t	1880
	3/5	8	5.7 t	2820
Modules		Nber	Weigth	Length (in z)
		40	1.9t fully equipped	940
Slabs		Nber	Weigth	Length
		3000	From 10 to 15 kg	From 1350 to 1750

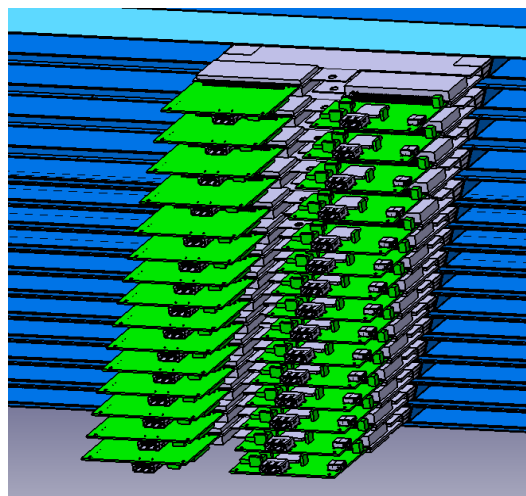
Remark : the following slides are preliminary studies of the Ecal assembly, and the steps of it are still to be refined either in time, FTE, or processes

It is not clear yet, if the modules can be fully equipped before or after mechanical inerconnection and alignment of the modules to form a stave.

1. Modules equipment and test

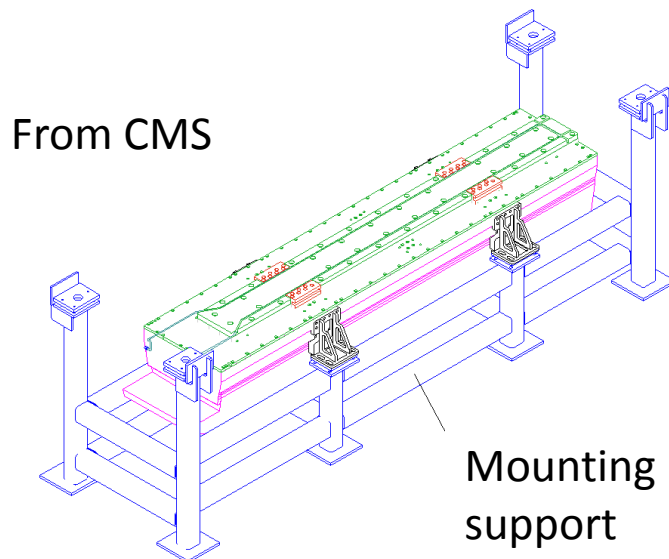
Task	Description / constraint	tooling	FTE	Time	Needed space	
1	Handling of 1 (over 40) module. Weigth :1 t	Scraft, table	2 T	1 week		
2	Insertion of 75 slabs per modules. 1 Slab =10 to 15 kg alignment within alveola = 500 μ m over 1.8 m		2 T			
3	Electrical connections up to LDA boards		2 T			
4	Cooling blocs (5) up to Module edge, over LDA up to main distribution line position		2 T			
5	Tests (electronic and signal)		2 T	1 week		To be done in parallel

Same processes repeated 40 times per group of 5 modules (equipment of a stave)



2. Staves assembly on mounting support

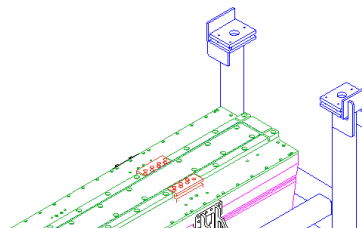
Task	Description / constraint	tooling	FTE	Time	Needed space
SubStE3-01-8					
1	Handling of 3 modules. 2 t each on stave support beam	Scraft, Mounting jig	2T	1 week	
2	Mechanical interconnection of the modules				
3	Cooling pipes connections over the 3 modules.				
4	Electrical connections up to Sub-stave edge (Face Z+)				
5	alignment of rails with template				
TTotal weigth : 5. 7 t + ?					



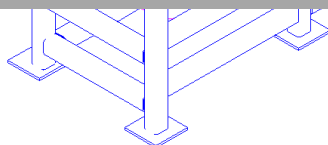
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4	Electrical connections up to Sub-stave edge (Face Z+)				
5	alignment of rails with template				
TTotal weigth : 5. 7 t + ?					

From CMS



Remark : the assembly in substave, or in full stave (5 modules long), will depend on the integration process in the cavern, the available space, but also on the maintenance scenario



Mounting support

Summary :

To have a fully equipped , tested and aligned stave or substave

- 1 month minimum
- Manpower : minimum of 6 persons working in parallel

Ecal fixation rails (female part) fixed in the inner radius of the Hcal :
it presupposes that the integration of the Hcal itself is finished .

- Positionning of the rails
- Alignment
- Checking

Needs :

Specific tooling to be defined

and time estimate : about 1 month

In case of cavern : this is done in assembly hall

Mountain site : to be done in the cavern

Per Beam (stave on its insertion tooling) :

- Positioning of the beam on rotating cage
- Prealignment operations
- Insertion

3 days of operations per beam , 4 FTE

In case of mountain site : the time to transport the beams has to be added, and depends on the room available for storage.

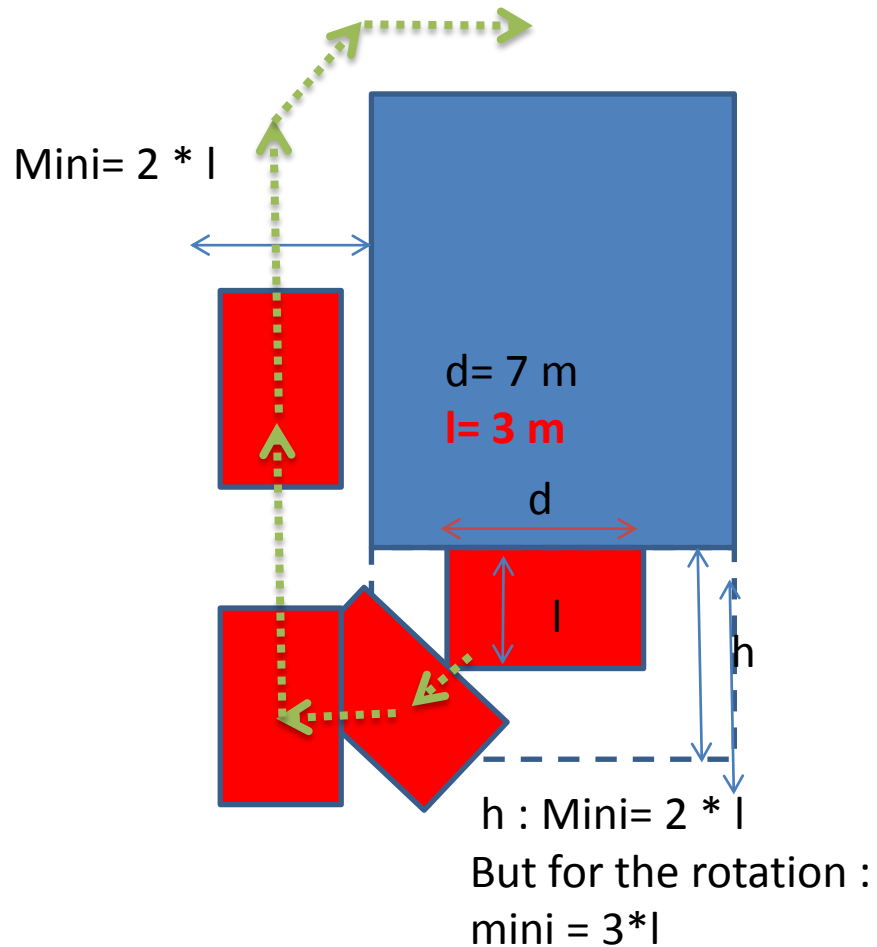
Total time : 3days per stave so multiply per 8 or 16 according to the configuration in full stave or substaves.

It depends if we can access from each side of the detector

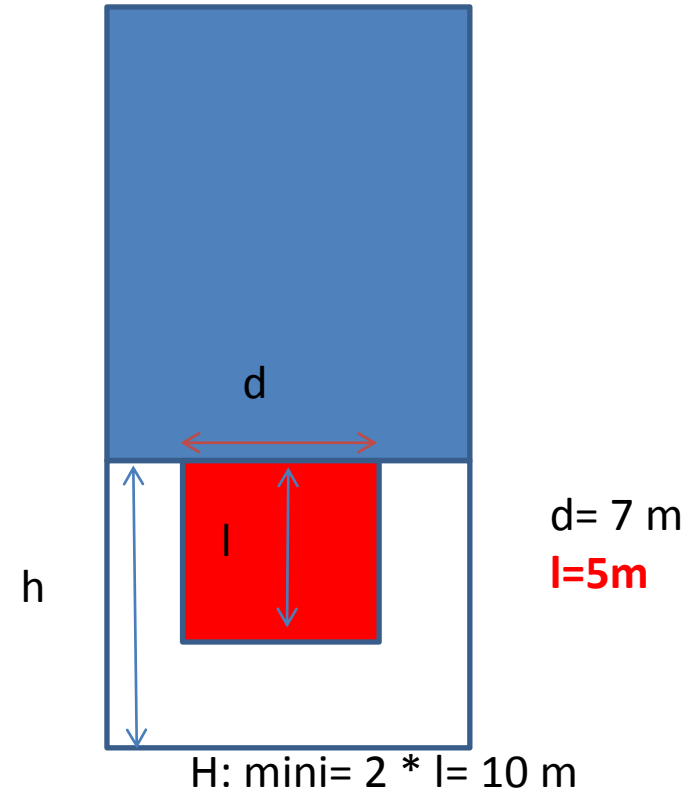
thus : if enough room around the detector to move the insertion tooling from one side of the detector to the other

Needed space around the detector for Integration and also for maintenance

Insertion from the two sides of the detector : per substave



Insertion from one side of the detector : per full stave



Storage area :
7 staves = 70
 m^2

Needed space around the detector for Integration and also for maintenance

Insertion from the two sides of the detector : per substave

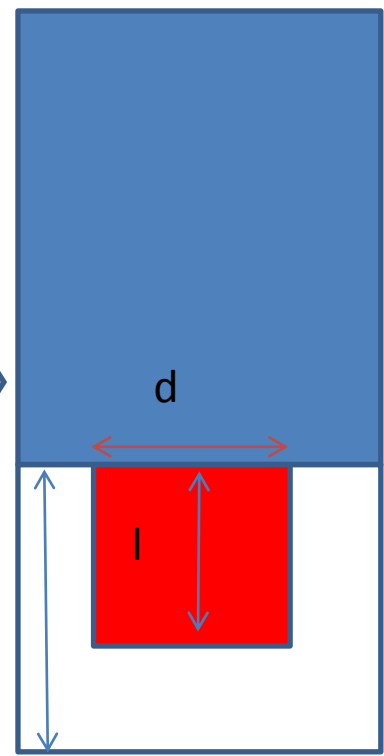


M

Remark :
*Even if the integration is in one side configuration ,
don't forget the maintenance .
In that case, we will still have to open the other side (endcap return yoke opening) to disconnect the services in order to slide the full stave*

$$\text{mini} = 3 * l$$

Insertion from one side of the detector : per full stave



$d = 7 \text{ m}$
 $l = 5 \text{ m}$

$$H: \text{mini} = 2 * l = 10 \text{ m}$$



Storage area :
7 staves = 70
 m^2

Summary :

➤ Stave preparation : 1 month per stave (or substave)

➤ In parallel :

- Hcal part of the rails mounted, aligned in the inner radius of the Hcal : 1 month
- Insertion tool transport , installation, alignment : 1 month

Then

➤ Ecal Insertion 3 days per beam

Time of services connection not included, not yet estimated