

General Assembly and Support scheme of the Barrel e.m. Calorimeter

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General assembly and support scheme

a) - Main constraints

- Handling stacks (16 absorbers with their bars, kapton boards and spacers constitute a stack) is the most critical point. Stacks are soft and fragile so they must be handled very carefully. When the stack is fitted with electronics mother board, the place that it is left to handle is restricted to rings fixation location.
- The other difficulty is to position stacks with high accuracy between neighbours and to obtain the right overall geometric shape. The outer rings give the indexing function and the circular stiffness of the whole cylinder. The longitudinal stiffness and linearity are given by rails and the outer cold wall of the cryostat.
- The compatibility of the assembly process with the structural design is also a difficult point, especially the cryogenic tests of stacks (with electronics and cables) must be feasible at a late stage.

b) - Assembly of the cylinder (half barrel, 3.2 meter length)

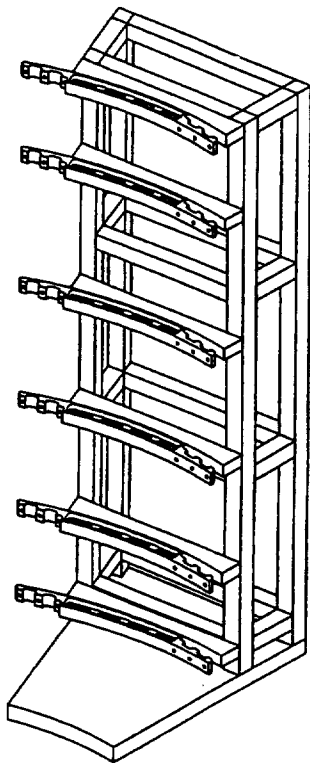
The assembly is based on a modular design. Rings are divided into 16 ring-bows which are put in position and fixed on a stiff modular frame. Four stacks are assembled (in the horizontal position) onto the modular frame and bolted to the ring-bows to form a super-stack". then mother boards and cables are installed. This super-stack is easy to handle, it will be tested inside a test cryogenis station before the overall assembly.

During the overall assembly, all super-stacks are rotated up to the vertical position and gathered to make two half cylinders on two platforms, the cylinder is then closed by shifting one platform in contact with the other one. After that all modular frames are bolted together to shape an overall structure that will allow the transport and the rotation to the horizontal position. This overall structure will be partially used to introduce the calorimeter into the cryostat (see assembly process). The modularity minimises the cost of handling equipment.

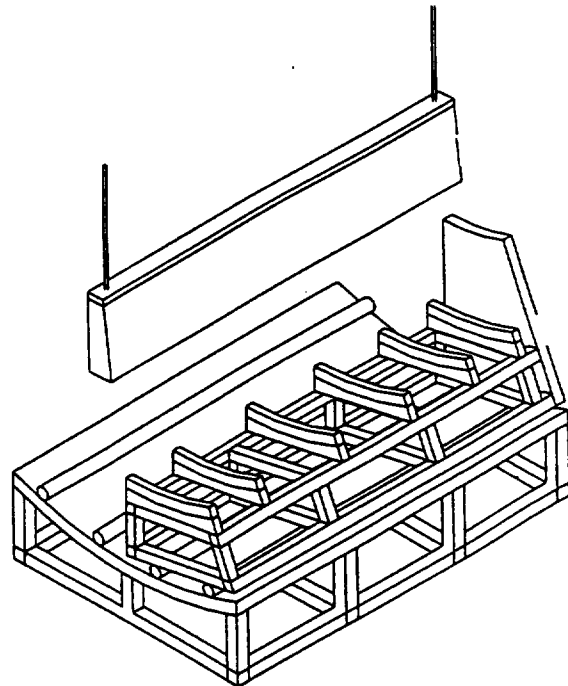
c) - Assembly process

1. Rough machining of ring-bows with a CNC milling machine.
2. Finish milling of ring-bow connexion surfaces.
3. Assembly of overall outer rings. Each ring-bow is identified and will keep the same location in the overall ring during all the assembly process.
4. Machining of inner and outer diameters of rings on a vertical lathe.
5. Gathering of modular frames (without rings) to make an overall frame. The overall frame is fixed on a vertical lathe.

6. Machining of bearing surface for ring positioning.
7. Rings positioning on modular frames.
8. Dismantling of the overall frame : each modular frame is separated and it will keep its ring-bows clamped on it during all the rest of the assembly process. These first eight steps of the assembly ensure the right positioning of the outer rings and guarantee the cylindricity of the cylinder. Pins or a system with stops will help to reconnect ring-bows with the minimum positioning variations when super-stacks are assembled.
9. Stack assembly (16 absorbers with kaptons and spacers).
10. Geometrical tests and H.T. tests.
11. Assembly of four stacks on the modular frame (picture a et b). Stacks are bolted on ring-bows. The modular frame has a sill on one end. Thus the super-stack can be rotated to the vertical position without contact on the edges of the stacks. As each ring-bow is identified each super-stack is identified too. Therefore it will be impossible to exchange a super-stack with another one. Only stacks are exchangeable.



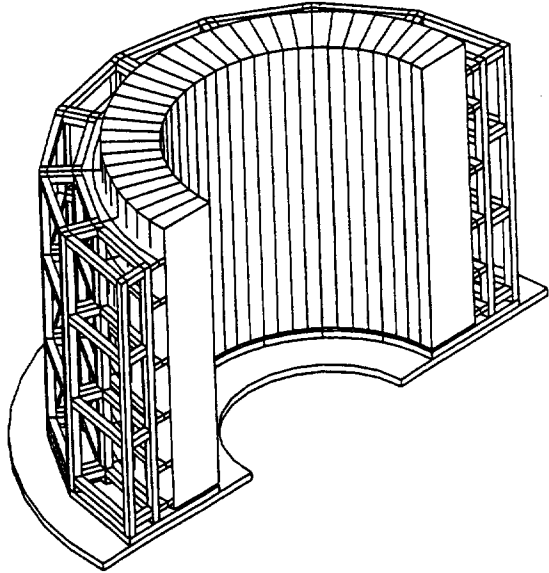
picture a
modular frame with its ring-bows
on the vertical position



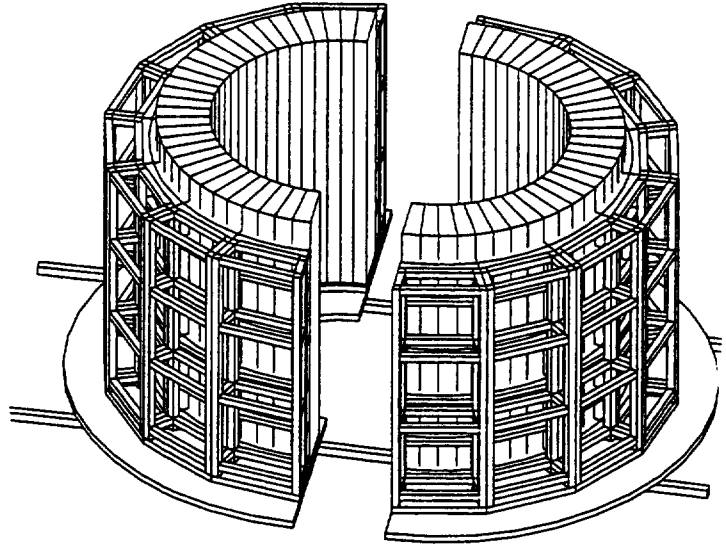
picture b
super-stack assembly tooling

12. Inner indexing rings are fixed.
13. Plugging of front and back mother-board and cabling. The super-stack is rotated to the vertical position for kapton noses access. Kapton noses are accessible through the modular frame.
14. Geometric, H.T. and electronic connexion tests at room temperature.
15. LN2 Cryogenic tests for all super-stacks.
16. Beam tests for several super-stacks in C.E.R.N.
17. Assembly of both half cylinders : Super-stacks are positioned in the vertical position on the platform and all ring-bow connexions are bolted (picture c).

18. The cylinder is closed : the first platform is fixed and the other one can be tilted or translated in the three directions in order to adjust the position of the two cylinders during closing (picture d).



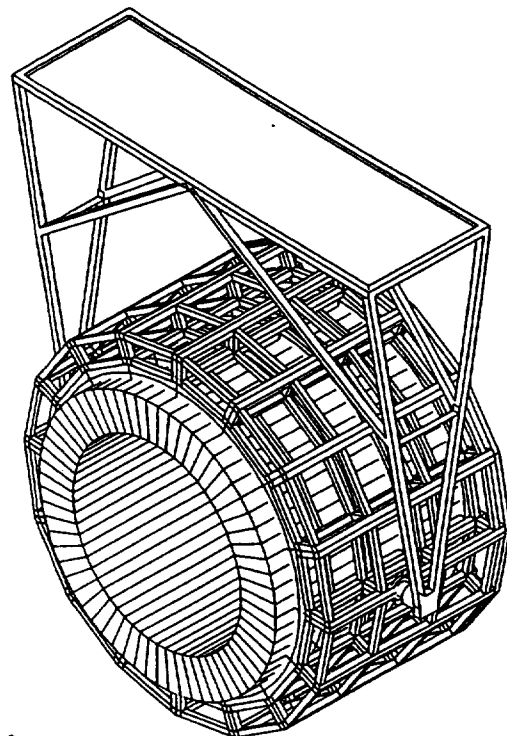
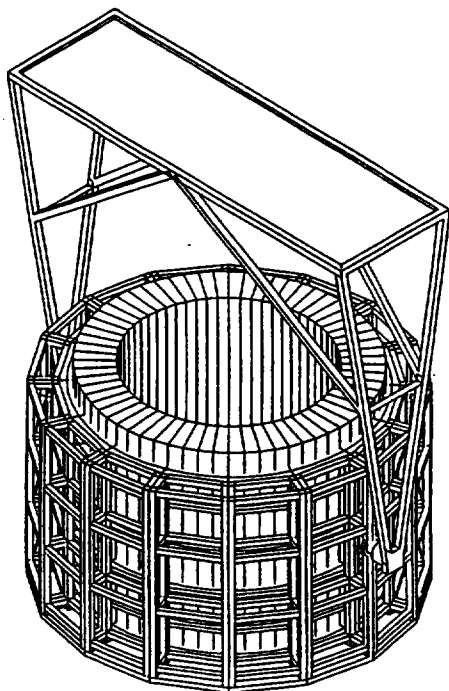
picture c
super-stacks gathering



picture d
cylinder closing

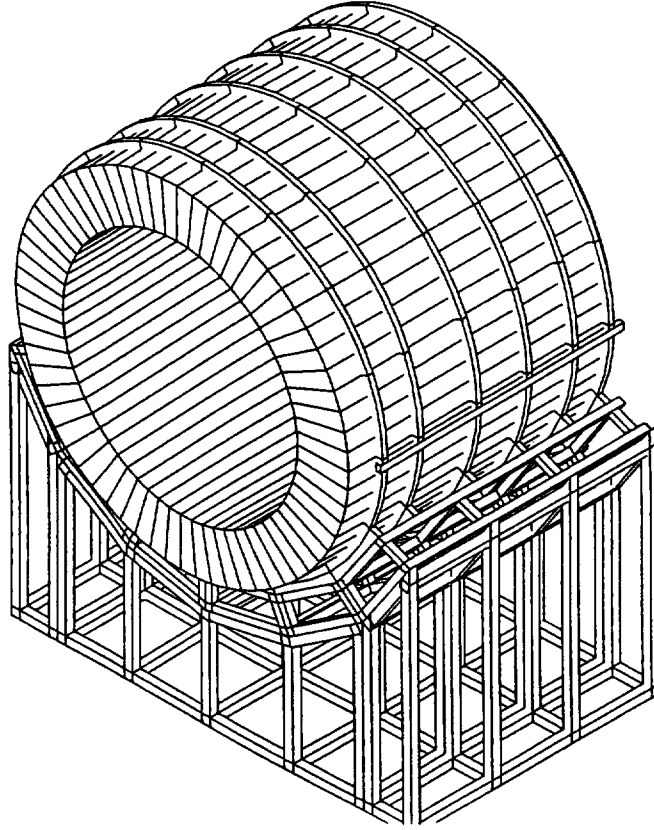
19. Each modular frame is fixed to its neighbours to create an overall structure.

20. Rotation of the cylinder to the horizontal position (picture e). The Cylinder with the over structure is laid on to a support frame.



picture e
cylinder rotation

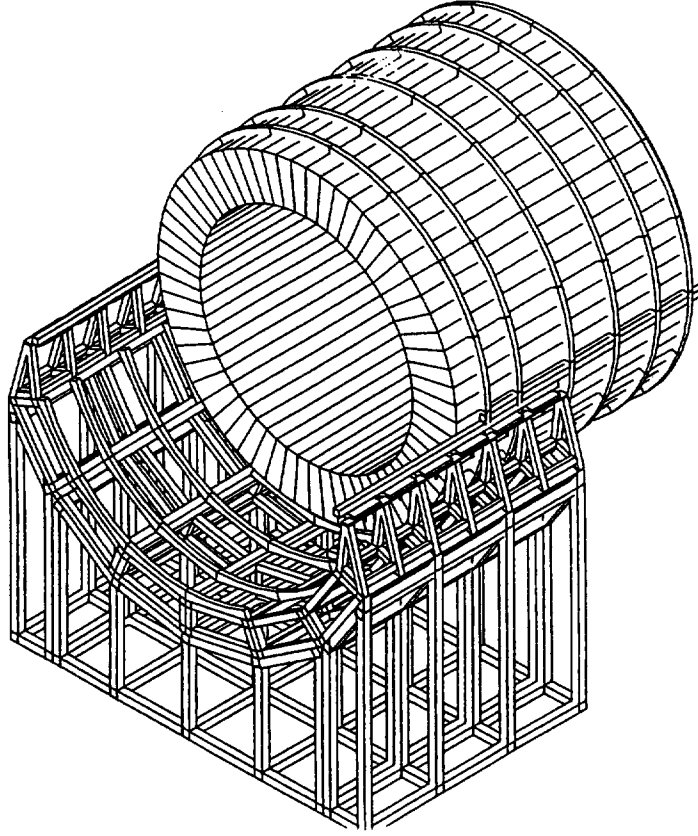
21. All upper modular frames are removed. The two modular frames just below the cylinder horizontal diameter are also removed in order to give access to sliding pads of outer rings (picture f).



picture f

22. Two rails with hydraulic jacks are fixed on the rest of the overall structure just below the sliding pads.
23. All lower ring-bows are disconnected from lower modular frames.

24. Hydraulic jacks lift up the cylinder by about 10 mm. Then all the cylinder mass is supported by sliding pads and a clearance between rings and modular frames allow the translation.
25. The cylinder is pushed by hydraulic jack and it inserted into the cryostat (picture g).



picture g