CNRS' cryomodule Activities

Patricia DUCHESNE – Patxi DUTHIL

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July 1st 2010

SUMMARY

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III. PLANNING

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V.2. Cryostating

I. GOALS & MOTIVATIONS

Goals :

Including evolutions and news since June 2010 :

- *Design and procurement of a short cryomodule prototype to test a string of cavities for the HP SPL*
  - *8 cavities ⇒ 4 cavities*
  - *1 doublet of quadrupoles SC ⇒ none*
- *Design of a system to support and align the cavities into the vessel*
- *Procurement of a technical cryogenic module (cold box)*
- *Design and procurement of the cryostat assembly tooling outside the clean room*

➔ *Conception must be valid for a machine configuration*

I. GOALS & MOTIVATIONS

Motivations :

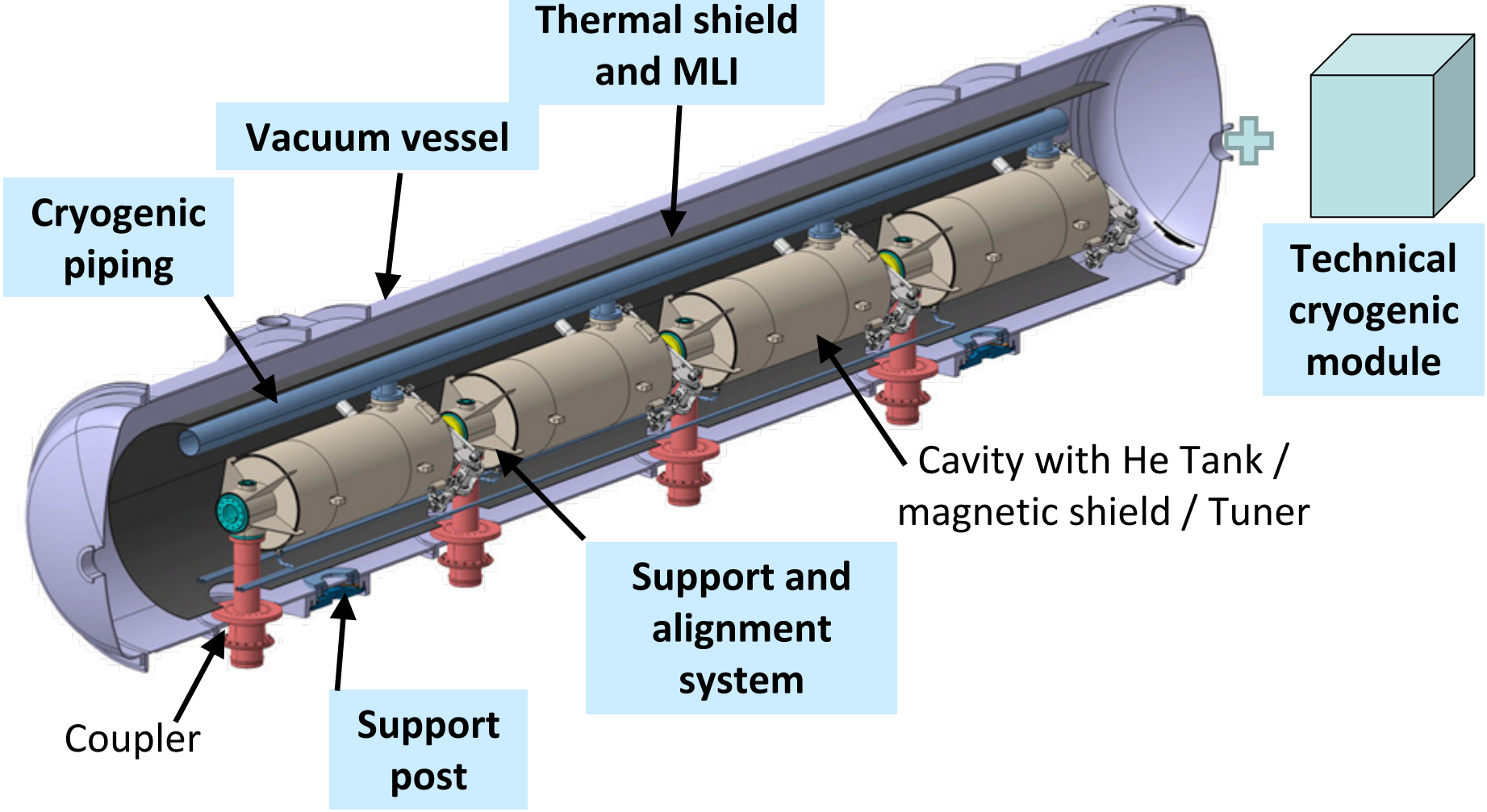
- ***Learn :***
  - *Critical assembly phases*
- ***Validate :***
  - *The design of the support and alignment system*
  - *The cooling principles*
- ***Enable RF testing :***
  - *Low / High power*

*Functional specifications **have to be defined** by CERN (in collaboration with CNRS)*

III. DESCRIPTION OF THE CRYO-MODULE PROTOTYPE

Main components :

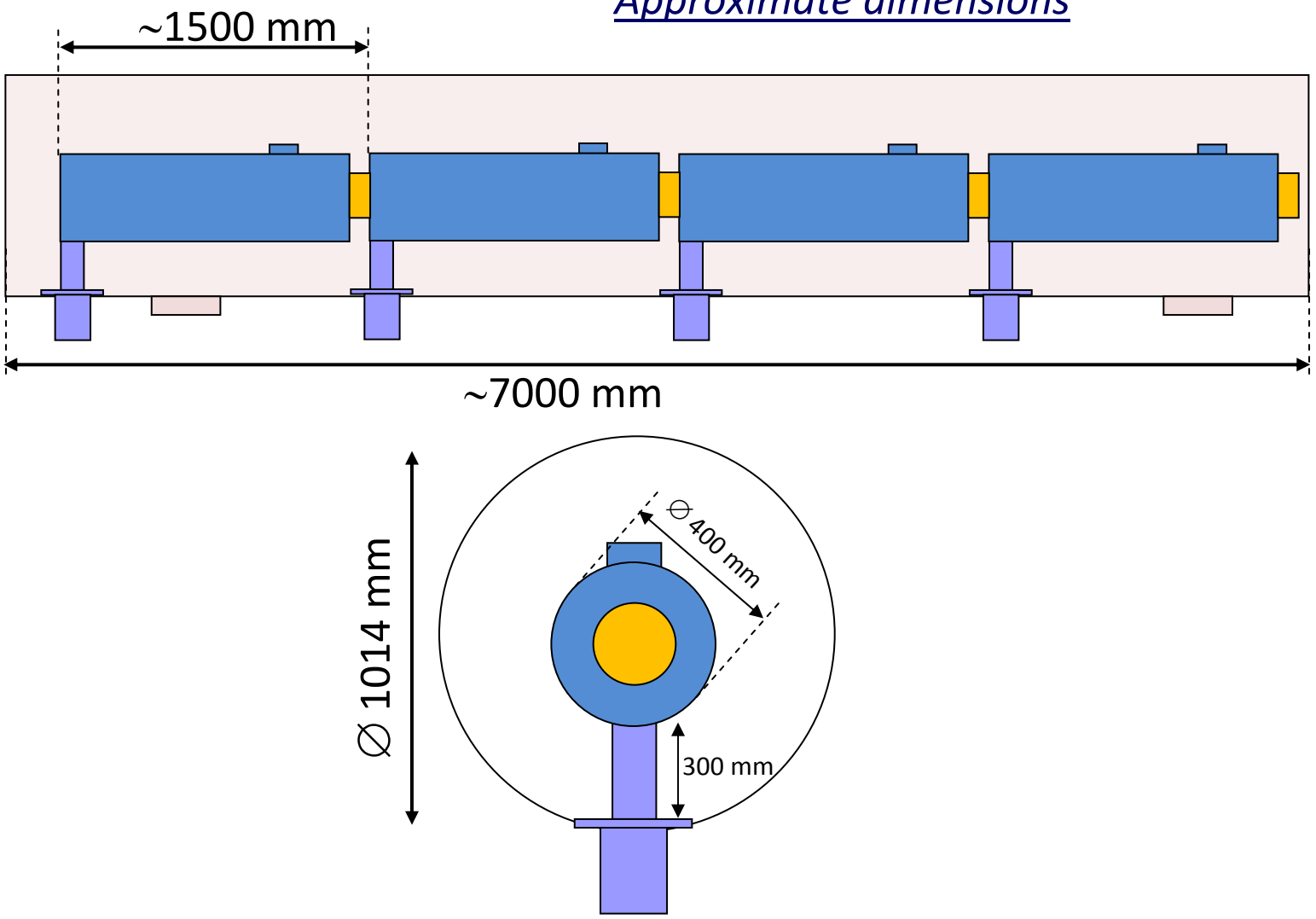
Components provided by CNRS



III. DESCRIPTION OF THE CRYO-MODULE PROTOTYPE

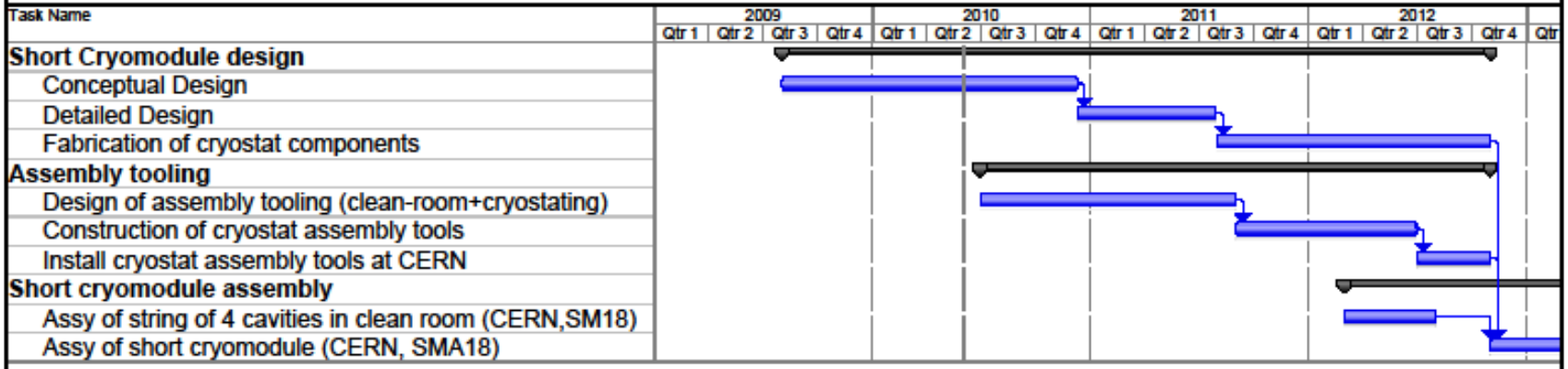
Overall dimensions :

Approximate dimensions



III. PLANNING

Short Cryo-module
Master Schedule

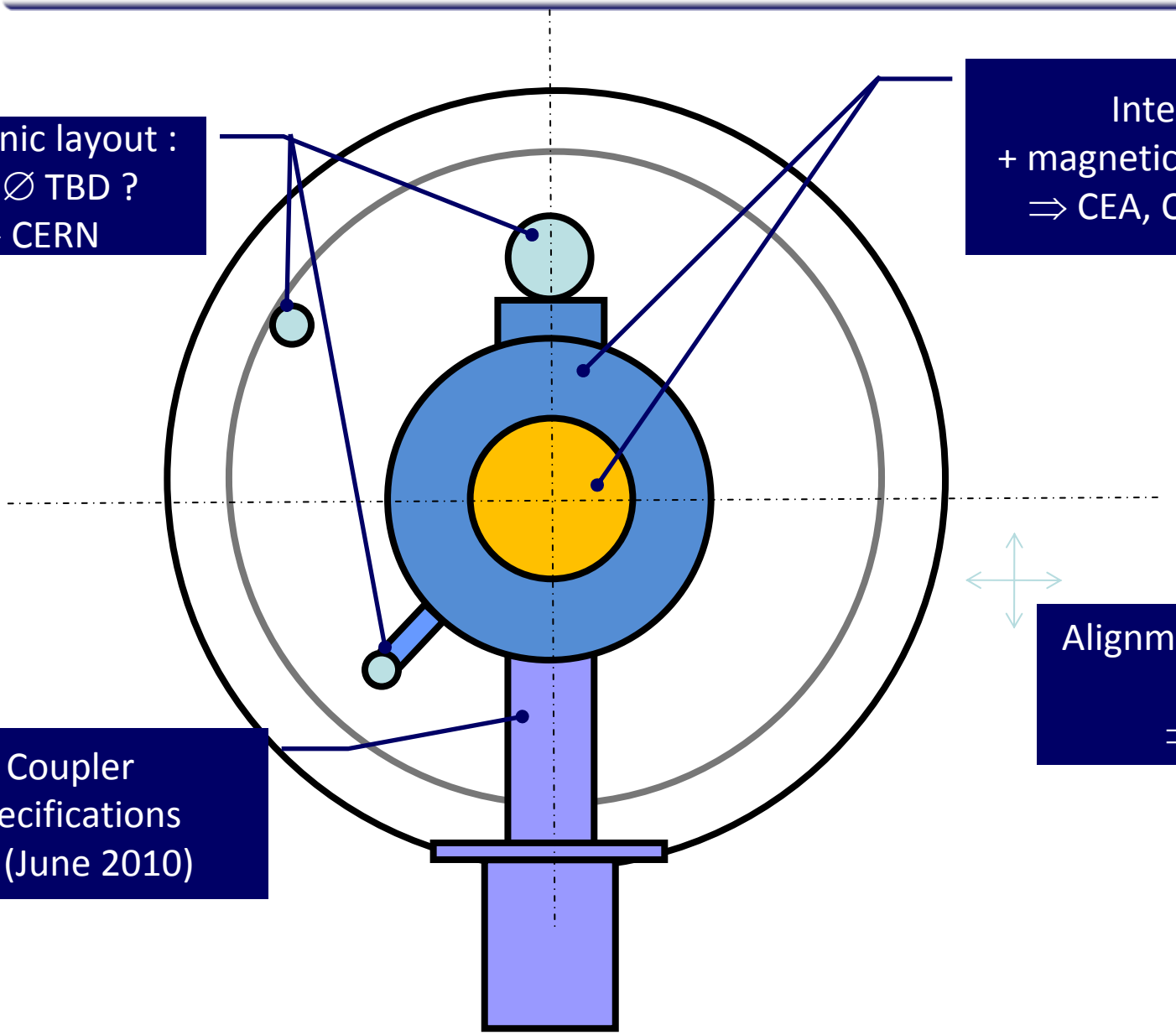


Milestones and Deliverables	
Date	***Description***
July 2010	Functional specification of short cryomodule by CERN, with input from CNRS/CEA.
November 2010	Conceptual Design Review of short cryomodule
July 2011	Detailed Design Review. Detailed CAD models and detailed design engineering studies by CNRS finished.
September 2011	Review of tender files for procurement. Tender documents available.
December 2011	Contract orders signed by CNRS.
October 2012	Complete set of components, accompanied by relevant documentation, available for starting assembly of the short cryomodule.

IV. CURRENT STATUS

Cryogenic layout :
T, P, ∅ TBD ?
⇒ CERN

Interfaces
+ magnetic shield TBD ?
⇒ CEA, CERN, CNRS

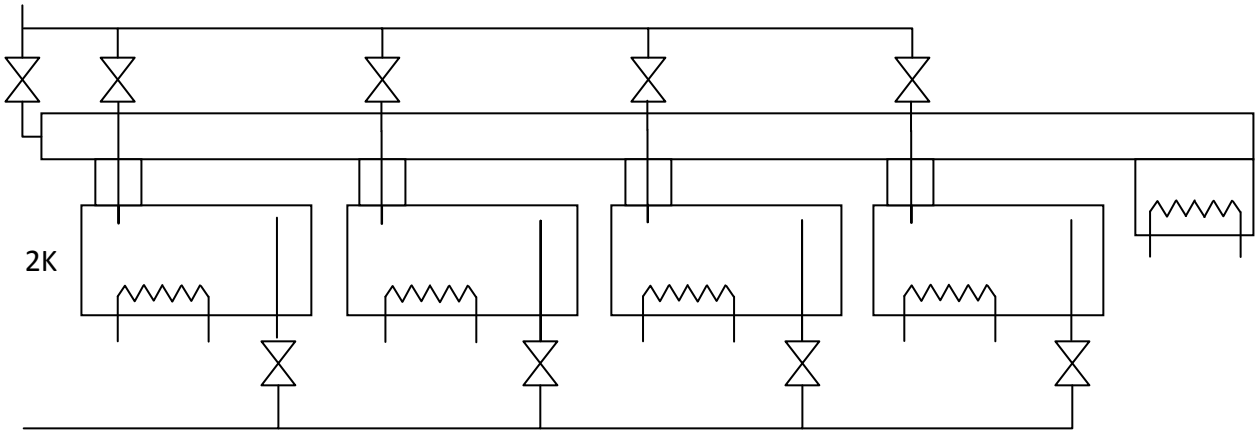


Alignment diagnostic
TBD ?
⇒ CERN

Coupler
specifications
OK (June 2010)

IV. CURRENT STATUS

The cryogenic layout (to be defined by CERN) :



Hypotheses to be confirmed by CERN :

- ***3 circuits*** *: cavities / shield / couplers*
- ***Control valves*** *: 1 on the biphasic return tube / 2 per cavity (cooling & filling in)*
- *1* ***heater*** *per cavity (to simulate the nominal thermal load), 1 heater on the helium tank*
- *Possibility to change the* ***inclination*** *of the cryo-module (0-4%) :*
  - *→ Flexible interconnections with test bench*
  - *→ Internal cryofluid distribution (biphasic LHe buffer)*

➔ *The technical cryogenic module may contain all cryogenic valves*

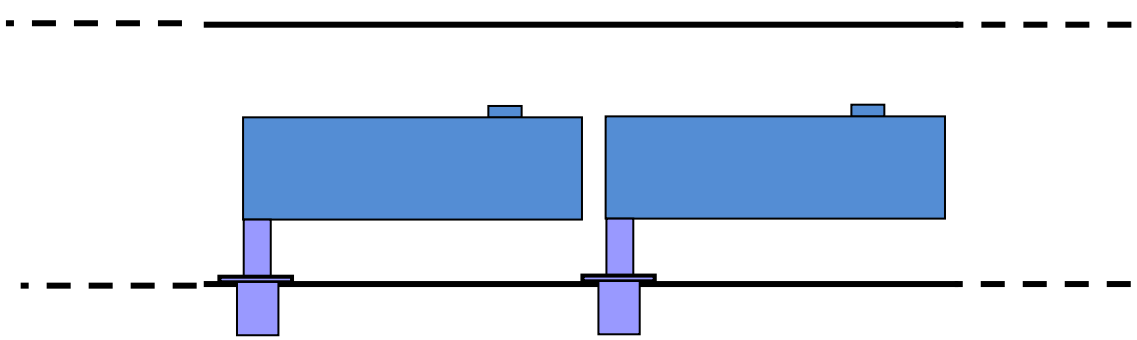
Short term actions :

- *Functional specifications to be defined by CERN in collaboration with CNRS (July 2010)*

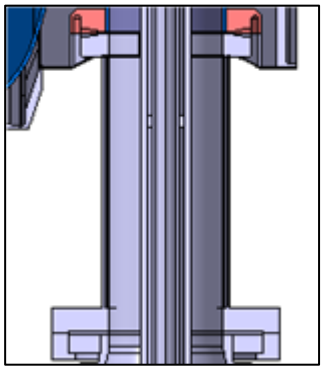
- *Conceptual design (November 2010)*
  - *Support and guiding system*
  - *Cryostating procedure and assembly tooling*
  - *Technical cryogenic module*

V.1. Support and guiding system

➢ *Principle : the main support point is the coupler (double walled tube)*



double walled tube :



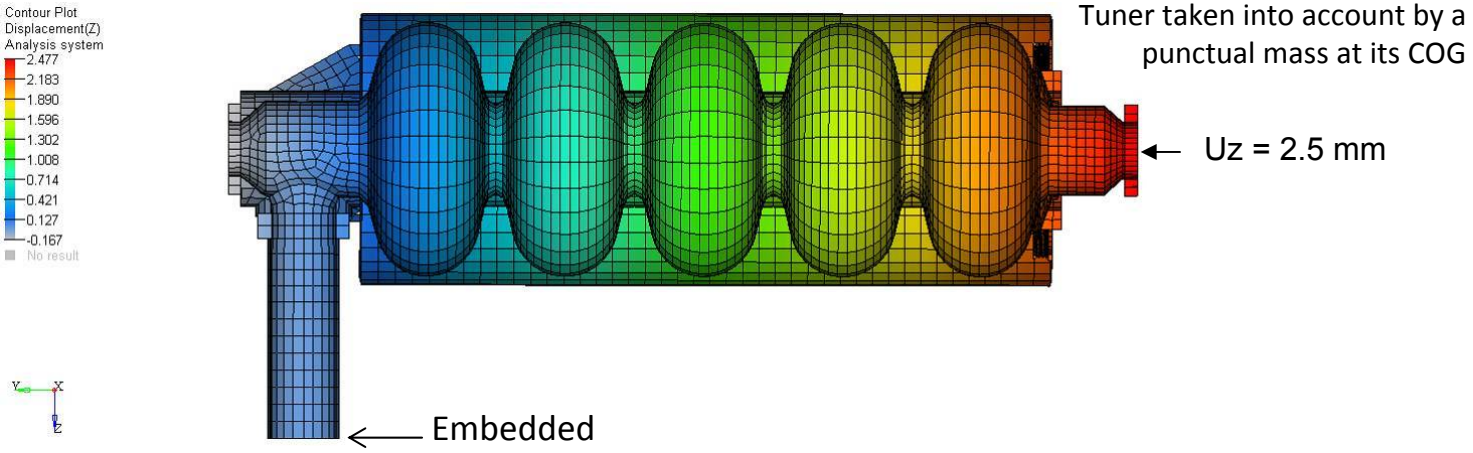
➢ *Tolerance requirements :*

Positioning accuracy of the string / reference beam axis		Positioning stability / vacuum vessel fiducials
Transversal	Longitudinal	Transversal
± 0.5 mm	± 2 mm	± 0.3 mm

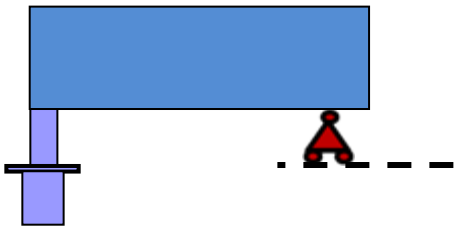
V.1. Support and guiding system

➢ *Simulation of the deflection under 1g :*

Cavity maintained only by the coupler



⇒ ***Need of a second guiding point allowing longitudinal contraction movements*** :

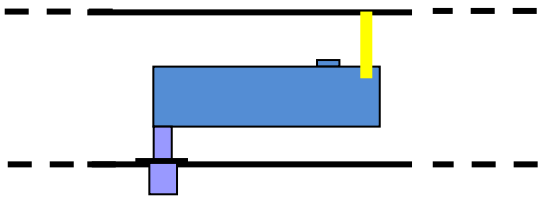


V.1. Support and guiding system

➢ *Possible guiding systems :*

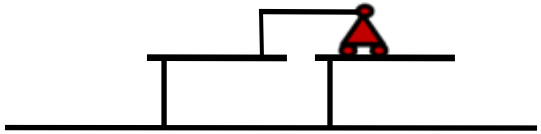
- ***Cavity-Tank / Vacuum vessel :***

➔ *solution not selected (CERN)*



- ***Cavity-Tank / Cavity-Tank :***

➔ *chosen solution*



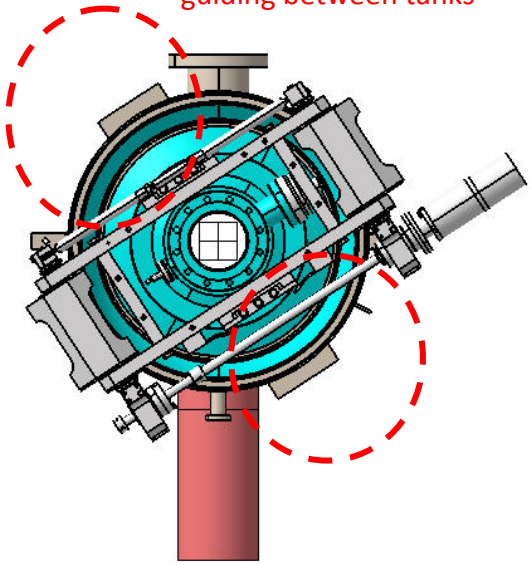
- He tank / He tank
Rem. : Current brackets of LHe tank not suitable

- Cavity flange / He tank

- Tuner / cavity flange

For the last cavity : provide a specific guiding system

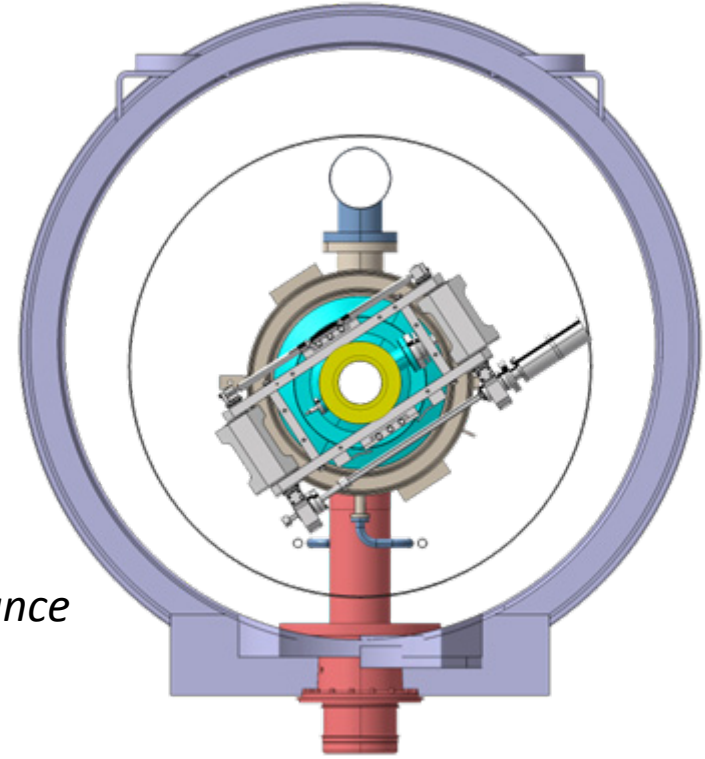
Available areas for a guiding between tanks



V.2. Cryostating

The cryostat tooling must allow :

- *The installation of :*
  - *the string of cavities previously aligned,*
  - *the thermal shield,*
  - *the cryogenic piping,*
  - *the instrumentation.*
- *The disassembly of the cryo-module for the maintenance*



Keep in mind there are a lot of assembly/disassembly cycles (TESTING cryostat)

V.2. Cryostating

Two possible methods :

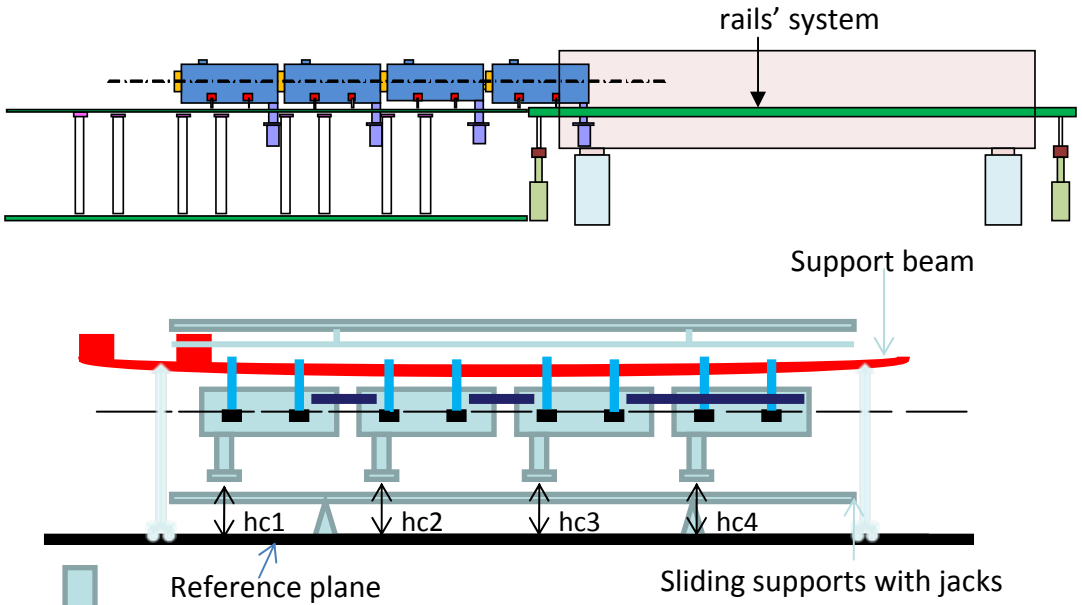
➢ *Longitudinal cryostating :*

The string of cavities is introduced into the vessel by a rail system

- String is placed on a tool

or

- String is hanging from a tool

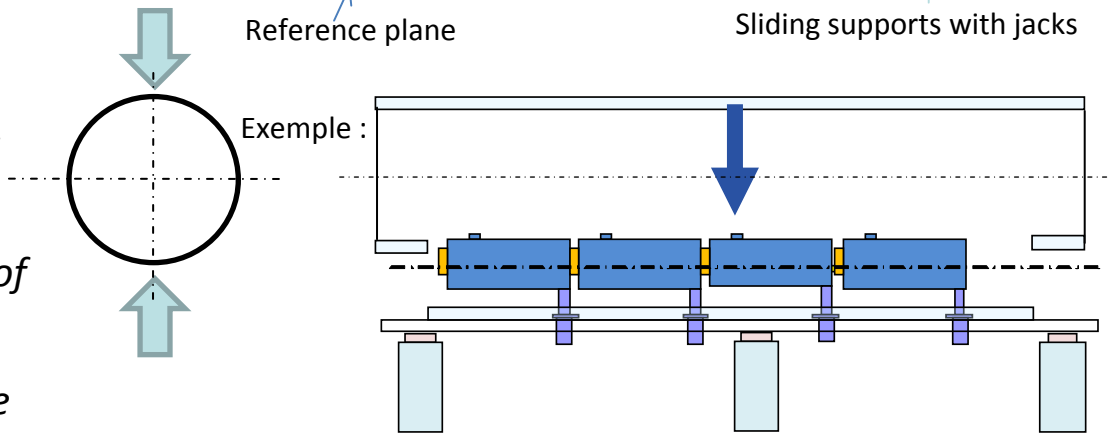


➢ *Radial cryostating :*

A big opening in the vacuum vessel is required :

- Allowing the insertion of the string of cavities

- Making easy the accessibility for the maintenance



V.2. Cryostating

Criteria to take into account :

- *Accessibility :*
  - *Tuners*
  - *Couplers*
  - *Cryogenic distribution*
  - *Instrumentation*
- *Reliability :*
  - *Cryostat vacuum and beam vacuum*
  - *Keeping the alignment of cavities*
- *Interfaces (time of interfacing) :*
  - *Cold box and cryogenic lines*
  - *Vacuum pumping connections*
  - *Instrumentation connections*
  - *Size of the cryostat*

THANK YOU !