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# Report from WG3 (Cryomodule) and objectives of the meeting

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# Goals & Motivation

## Goal:

- Design and construct a full-scale cryomodule prototype (Part of the **SPL Design Study** for a Project Proposal in 2012)



## Motivation:

- Demonstrate the **construction capability**, CM with  **$\beta=1$  cavities** and **SC quadrupoles**;
- **Validate** and **improve design** and **construction features**
- Learning of the **critical assembly phases**
- **Enable RF testing** on a **multi-cavity** assembly in real operating conditions
- Validate operation issues **cryogenic cooling principles** and **acquire experience**
- Support **cost estimates**



System/Activity	Responsible	Lab
Machine parameters and layout	F.Gerigk	CERN, BE/RF
WG3 coordination	V.Parma (O.Capatina)	CERN, TE/MSC (EN/MME)
Cryomodule design & Integration	V.Parma /P.Duthil	CERN, TE/MSC CNRS/IN2P3-Orsay
Cryostat assembly tooling	S.Chel	CEA-Saclay
RF cavities/He vessel/tuner	W.Weingarten/S.Chel	CERN BE/RF, CEA-Saclay
RF coupler	E.Montesinos <i>New entry</i>	CERN BE/RF
Vacuum systems	S.Calatroni	TE/VSC
Quad.doublet	E.Todesco/D.Tommasini	TE/MSC
Magnet powering/protection	A.Ballarino	TE/MSC
Cryogenics	U.Wagner	TE/CRG
Survey	D.Missiaen	BE/ABP
SPL integration	S.Weisz	DG/PRJ



Institute	Responsible person	Description of contribution
CEA – Saclay (F)	S. Chel	<ol style="list-style-type: none"><li>1. Design &amp; construction of 2 <math>\beta=1</math> cavities (EuCARD task 10.2.2)</li><li>2. Design &amp; construction of helium vessels for 2 cavities (French in-kind contribution)</li><li>3. Design &amp; construction of cryostat assembly tools (French in-kind contribution)</li><li>4. Supply of 8 tuners (French in-kind contribution)</li></ol> 
CNRS - IPN – Orsay (F)	P. Duthil	<ul style="list-style-type: none"><li>• Design and construction of prototype cryomodule cryostat (French in-kind contribution)</li><li>• Design &amp; construction of 1 <math>\beta=0.65</math> cavity (EuCARD task 10.2.1)</li></ul>
Stony Brook/BNL/AES team		<ul style="list-style-type: none"><li>• Under DOE grant allocation</li><li>• Designing, building and testing a 5 cell <math>\beta=1</math> SPL cavity.</li></ul> 

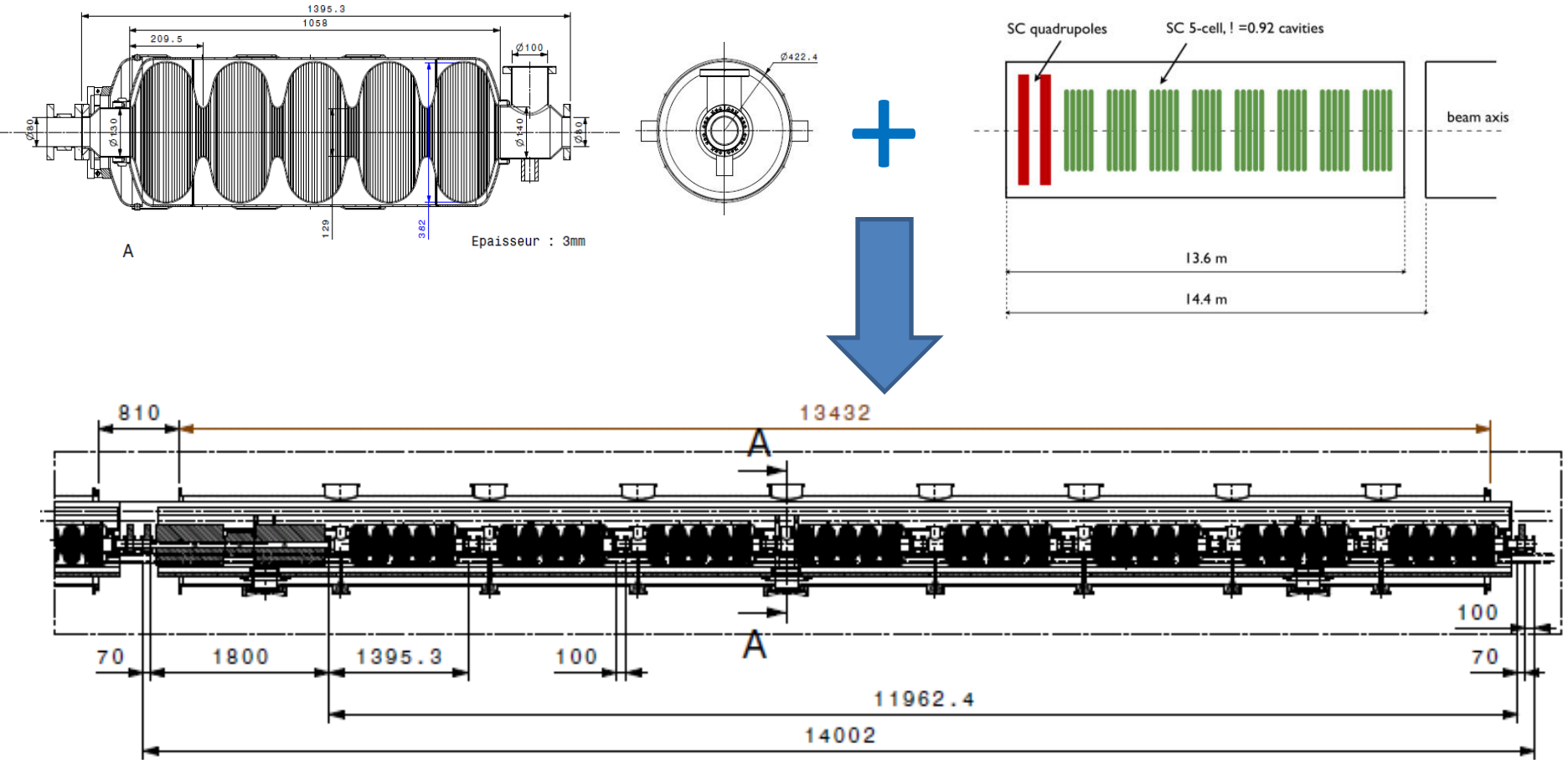


- Regular WG meetings since May
  - Web page: <https://twiki.cern.ch/twiki/bin/view/SPL/CryoModules>
- Topics covered:
  - Cryomodule longitudinal integration study
  - SPL mechanical layouts
  - Cryogenics
- Close collaboration with WG2 (cavities):
  - Workshop on *Mechanical issues of SPL cavities/cryomodules*:  
<http://indico.cern.ch/conferenceDisplay.py?confId=68968>
- Workshop on *Cryogenic and vacuum sectorisation of the SPL*:  
<http://indico.cern.ch/conferenceDisplay.py?confId=68499>

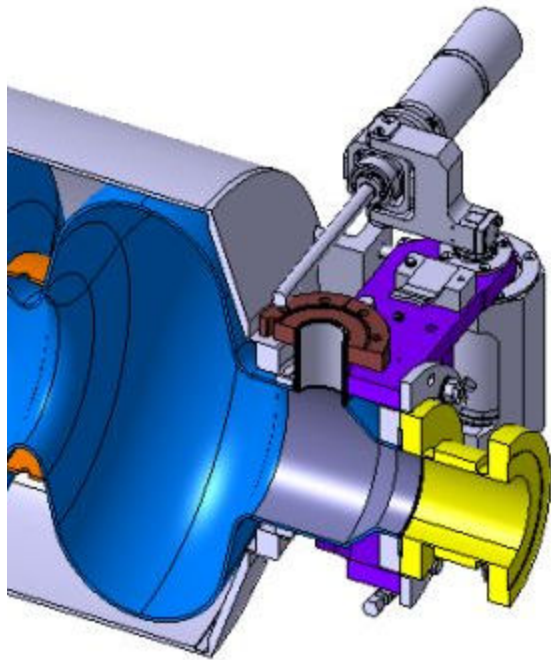
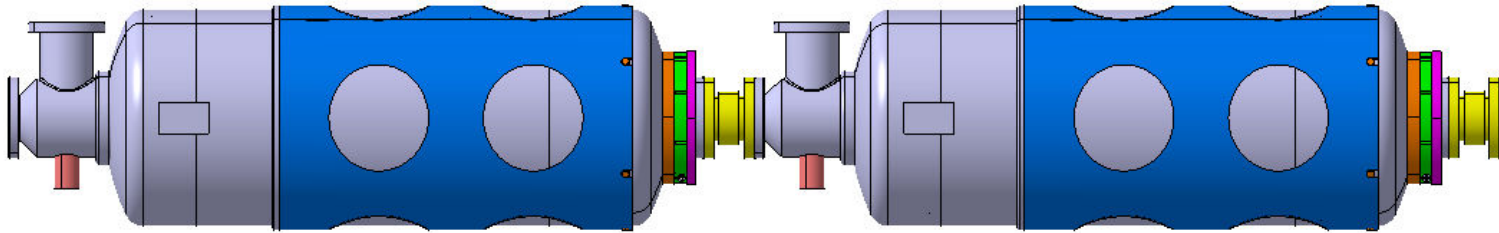


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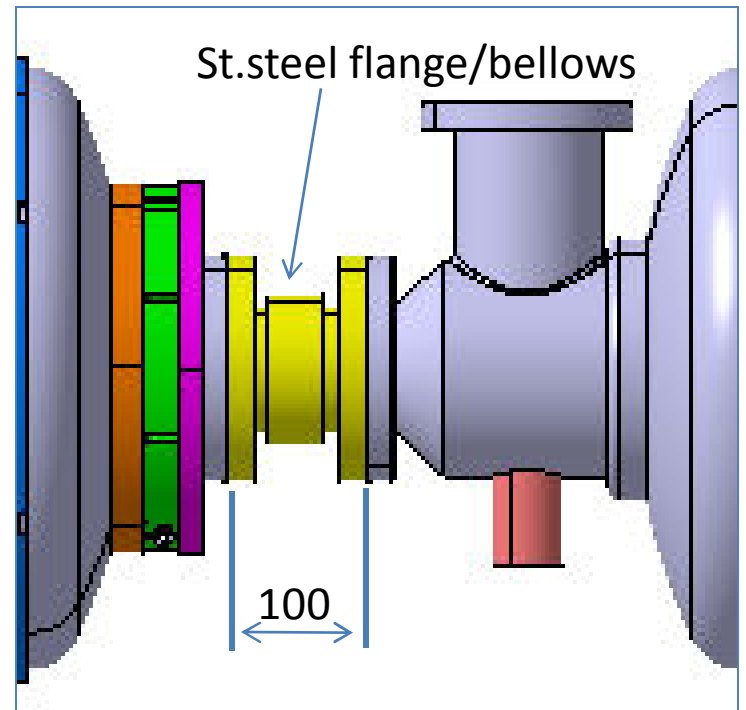
# Cryo-module longitudinal integration study ( $\beta=1$ )



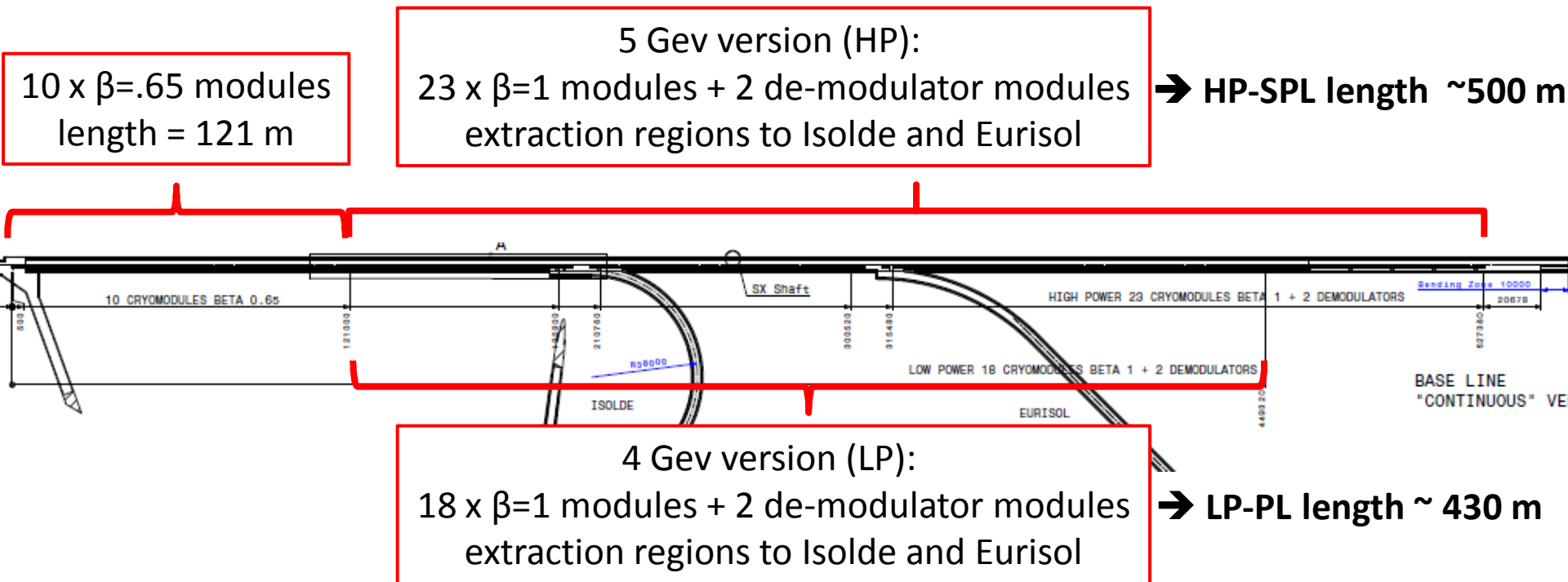
# Inter-cavity space



Integration of CEA tuner

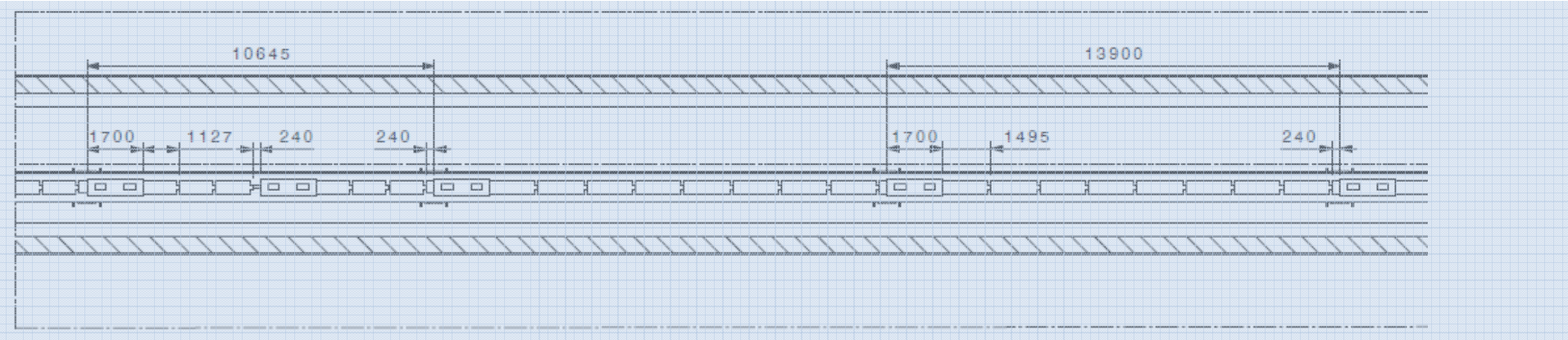


# SPL mechanical layouts



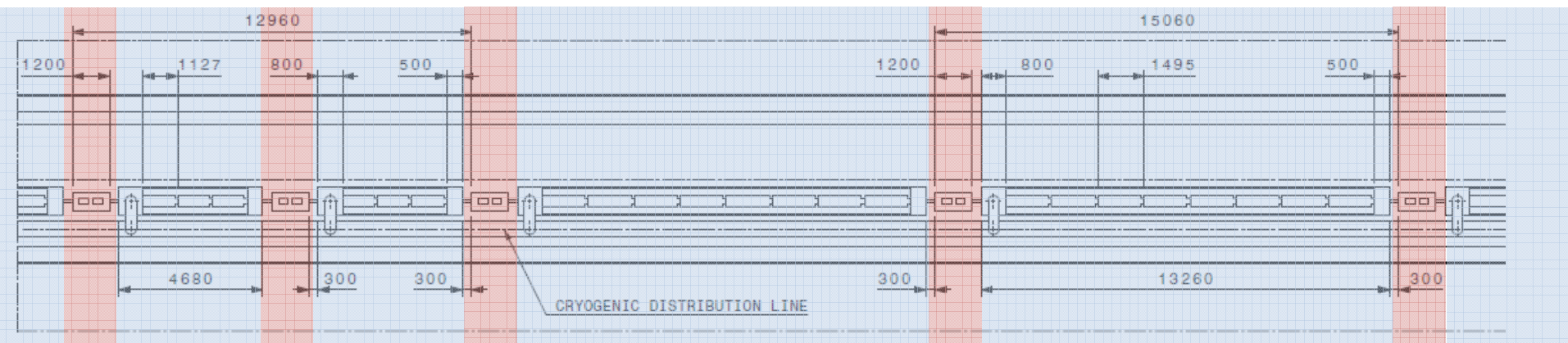


Continuous cryostat "Compact" version (gain on interconnections):



➔ 5 Gev version (HP): SPL length = 485.14 m (550 m max available space)

"Warm quadrupole" version (with separate cryoline):



➔ 5 Gev version (HP): SPL length = 535.92 m (550 m max available space)

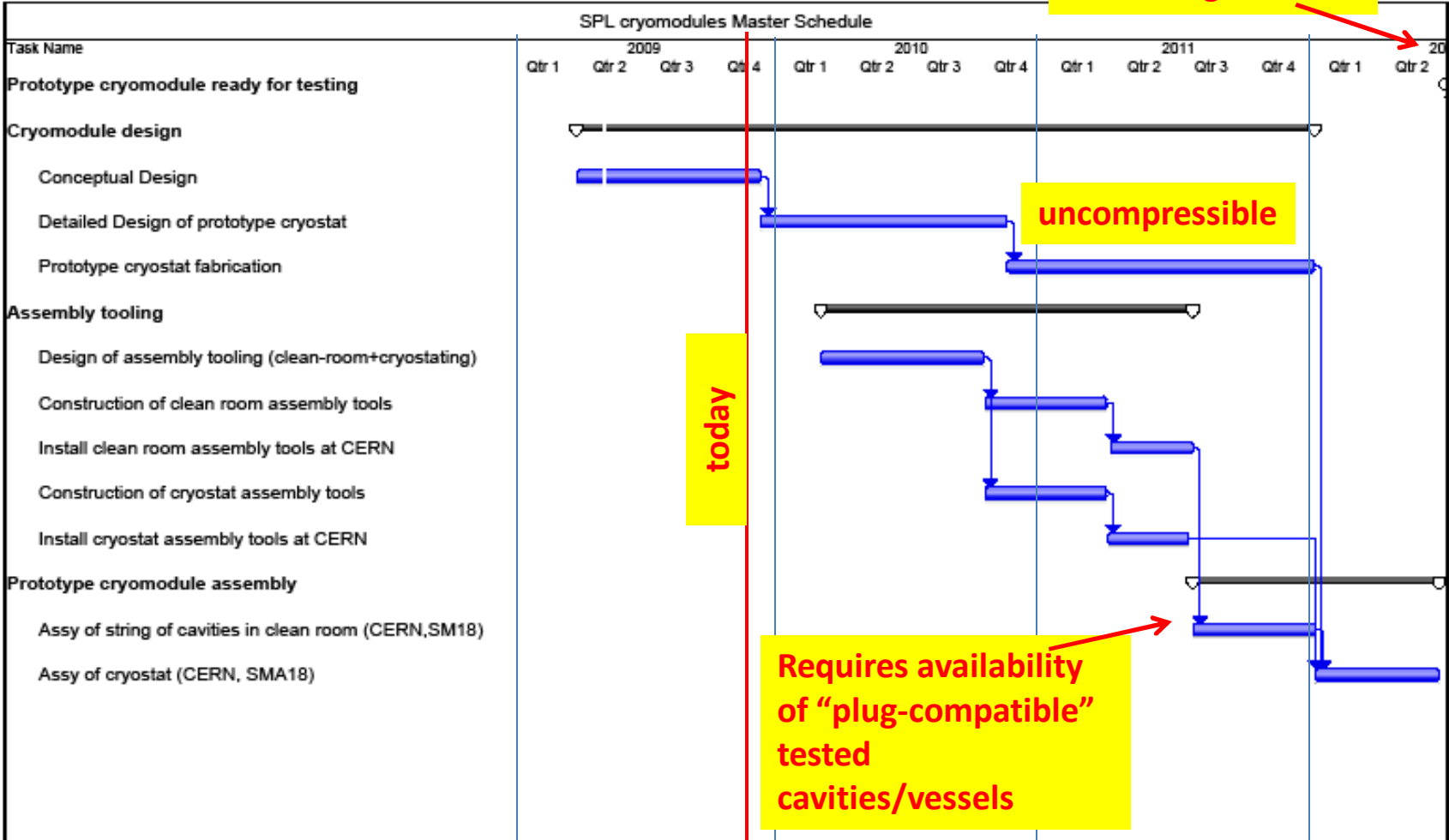


# Subjects for this collaboration meeting

*(in WG3 and common sessions)*

- Sectorisation layouts: options and impact on cryo-modules
- Dimensions, pressures and temperatures of cryogenic circuits
- Cryo-module longitudinal layouts
- Required interfaces for cryostat design/integration
- Mechanical layout and technical specification of the cavity-tuner-He-tank unit
- Sensitivity study on the SPL : definition of alignment tolerances, diagnostics and correction systems
- SPL coupler options and integration requirements
- Warm quadrupole magnets
- Cryo-modules for ERL at BNL

**Cryomodule ready for testing**



**today**

**uncompressible**

**Requires availability of "plug-compatible" tested cavities/vessels**

Project: SPL cryomodules 03December Date: Fri 5/8/09	Task		Milestone		External Tasks	
	Split		Summary		External Milestone	
	Progress		Project Summary		Deadline	

# Objectives

- Warm or cold magnets?
- Technical spec. and interfaces for cavity helium vessel and tuner
- Coupler requirements and assembly constraints
- Alignment requirements for cavities and quads
- Dimensions , T and P for cryomodule cryogenic lines (depending on cryogenic scheme adopted)
  
- ***Prepare ingredients for:***
  - ***The preparation of the technical specification for the prototype cryomodule***
  - ***And refining the objectives for the prototype cryomodule program***



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**THANK YOU FOR YOUR ATTENTION!**