# WG3
# Cryo-module design & integration

V.Parma, P.Duthil
for the Working Group

**GOALS and RESULTS:**

- **Understand limits of scope of CEA and CNRS contributions**

  **Result:**
  - **CNRS: H/W contribution clear;**
  - **CEA: not treated (busy in other WG). Limits of scope of CEA assembly tools to be appreciated later**

- **Identification of integration needs: components type, interfaces, functional needs (ex.cooling of HOM)**

  **Result:**
  - **Most components identified, but interface/functional needs need further iteration and work.**

- **Identify non covered items and possible distribution to institutes interested**

  **Result:**
  **Still unclear choice for some components and no commitment yet from institutes:**
  - **ex. Coupler: CEA's solution; tuner (CEA?, BNL?) HOM type? (who supplies it?); magnetic shield?**

- **Define list of topics towards a functional specification: alignment requirements, thermal budgets (static+dynamic), mechanical requirements**

  **Result:**
  **Most of them addressed, but functionalities/specifications need iteration/definition (ex. T of heat intercepts).**

# WG3 (cont.d)

- **Define input for mechanical layouts (longitudinal and x-sectional),**

  Result:
  New issues:
  - Continuous SPL cryostat? Need for warm regions (diagnostics that cannot be cold)? Important cryomodule design consequences (cold to warm transitions).
  - Vacuum valves:
  - Cold/manual valves for cryomodule maintenance (remove at shut-downs)?
  - Cold/fast valves for safety (vacuum break/leaks)?

  → Input from SPL beam physics and learn from XFEL or others

- **Cryogenics specs (pressures & temperatures):**

  Result:
  Temperature: ~2K is the baseline (but with provision for operation at 4.5K):
  - 1.7% tunnel slope. No show stopper identified (control/instrumentation issues need to addressed)
  - HeGRP (large gas return pipe) needs to be designed specifically for HPSPL (large vapor mass flow)

  Pressure: design pressure and operating stability (impact on cavity design/operation) was not addressed.

# WG3 (cont.d)

- **Define the key ingredients for defining a layout for tunnel interfaces: longitudinal layout, interconnect space, coupler layout (vertical, lateral?)**

  Result:
  Many ingredients identified:
  - Supporting/hanging system: LHC system proposed but needs thorough tunnel integration study
  - Couplers: vertical seems better but…difficult integration?
  - What about connection to wave guides? (Not addressed in this WG)

  → Needs an urgent study with tunnel integration/civil engineering people

- **Elaborate a work organization structure (for cryo-module prototype design/manufacture)**

  Result
  - Proposal: Dedicated cryo-module Working Group steered by CERN, with regular (monthly?) meetings with CEA/CNRS (and other labs if any)

# Other Issues

- **Quadrupole magnets.**
  - Powering schemes (individual? in series? clustered?) and gradient along linac? Fringe fields acceptance on cavities?
  - Trimming needs? Permanent magnets could be also used but may need trim coils.

  → Needs will be addressed in SPL beam dynamics.

- **Type of piezo tuner?** CEA type could be used but also BNL (cold motor and piezo). Pending decision.
  - Inner cold motor? Yes,
  - Needs maintenance ? In principle no, but...

- **Magnetic shielding** design & integration (internal? external?) <10 milligauss Fringe field acceptance from adjacent quad magnets?

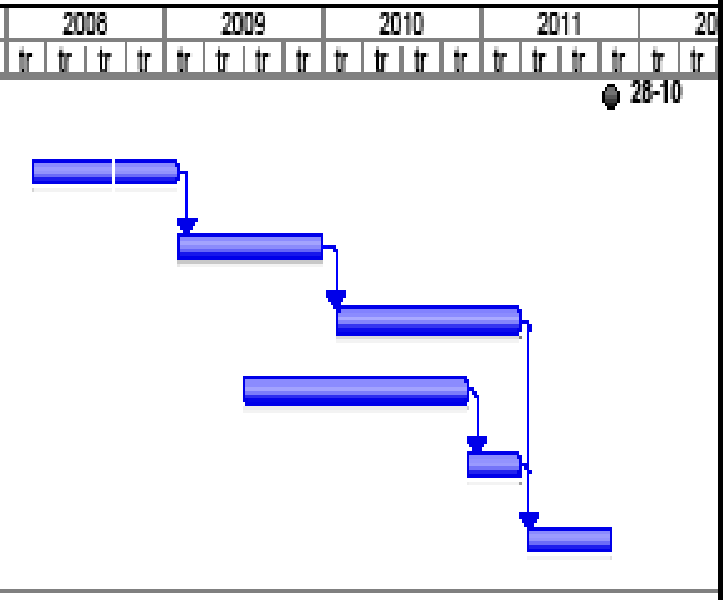
- **Helium vessel**: material? Interface to piping? if Ti needs transition or Ti piping.

- Alignment requirements?
  - Cavity alignment today as tight as quad? Can be relaxed? → Q. to WG4. Will be addressed.

# Prototype cryo-module

SPL cryomodules Master Schedule

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | Prototype cryomodule ready for testing | 0 days | Fri 28-10-11 | Fri 28-10-11 | |
| 2 | Conceptual Design | 12 mons | Mon 03-03-08 | Fri 30-01-09 | |
| 3 | Detailed Design of prototype cryostat | 11.95 mons | Mon 02-02-09 | Thu 31-12-09 | 2 |
| 4 | Prototype cryostat fabrication | 15.2 mons | Mon 01-02-10 | Thu 31-03-11 | 3 |
| 5 | Design & construction of assembly tooling | 18.5 mons | Wed 01-07-09 | Tue 30-11-10 | |
| 6 | Install cryostat assembly tools at CERN | 87 days | Wed 01-12-10 | Thu 31-03-11 | 5 |
| 7 | Prototype cryomodule assembly | 7 mons | Mon 18-04-11 | Fri 28-10-11 | 4,6 |




**Time is very short!!**



Thanks to all for the collaboration work!