Technologies for the DFH, supply strategy and schedule

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Technologies

- Cryogenic pressure equipment device:
  - ✓ Inner helium pressure vessel integrated in an outer vacuum insulating vessel
  - ✓ Thermal insulation by vacuum, radiation shielding (MLI) and low thermal conduction supports (typically in G10/11 composite materials)
  - ✓ Interfaces to other systems (cryogenic, vacuum, electrical): ISO K flanges and elastomeric seals, Conflat™ flanges and metal seals, all-welded welds
  - ✓ Thermal contraction compensation elements (bellows, flexible hoses)

Technologies

- Materials:
  - ✓ Sheet-metal work, stainless steel grades, compatible with cryogenic temperatures
  - ✓ Machined parts (e.g.flanges), stainless steel grades, compatible with cryogenic temperatures
  - ✓ Composite materials (G10/11, other low conducivity materials)
  - ✓ Copper materials
  - ✓ Multilayer insulation materials (MLI)
- Assembly technologies:
  - ✓ Mechanical close fittings, bolted assemblies
  - ✓ All-welded stainless steel assemblies (TIG orbital/manual) compatible with PED requirements
  - ✓ Weld orbital cutting machines
  - ✓ Sealed assemblies (organic and metallic seals) for vacuum applications
  - ✓ Leak-tightness of assemblies to better than 10^{-6} mbar.l/s (helium mass spectrometry)
  - ✓ Wire routing and mounting of feed-through flanges (to be confirmed)

Technologies

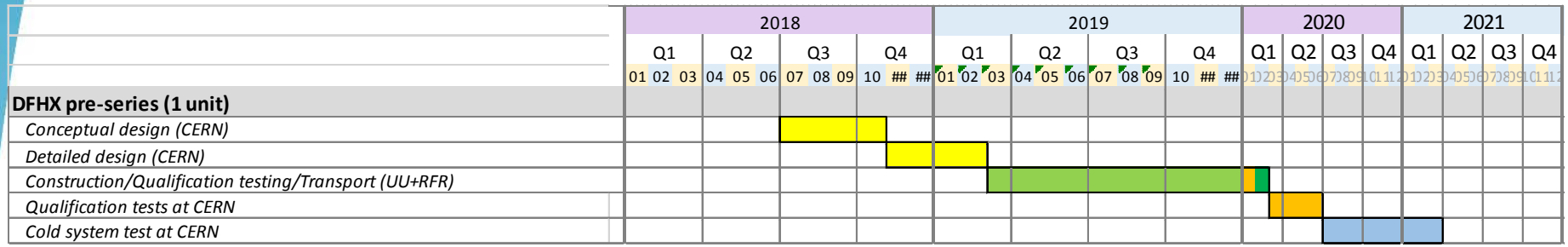
- Assembly and Quality testing area:
  - ✓ Facility with all necessary services and infrastructure (e.g. Handling devices)
  - ✓ LN2 shock and pressure tests area
  - ✓ Helium spectrometry leak-detection area (vented to reduce He back-ground)
- Quality Control & Testing:
  - ✓ Metrology and dimensional checks and measurements
  - ✓ X-rays of welds
  - ✓ LN2 shocks of welded assemblies
  - ✓ Pressure testing
  - ✓ Leak-tight testing (helium spectrometry)
  - ✓ Electrical tests of instrumentation wiring (continuity, insulation) (to be confirmed)

General strategy for DFH

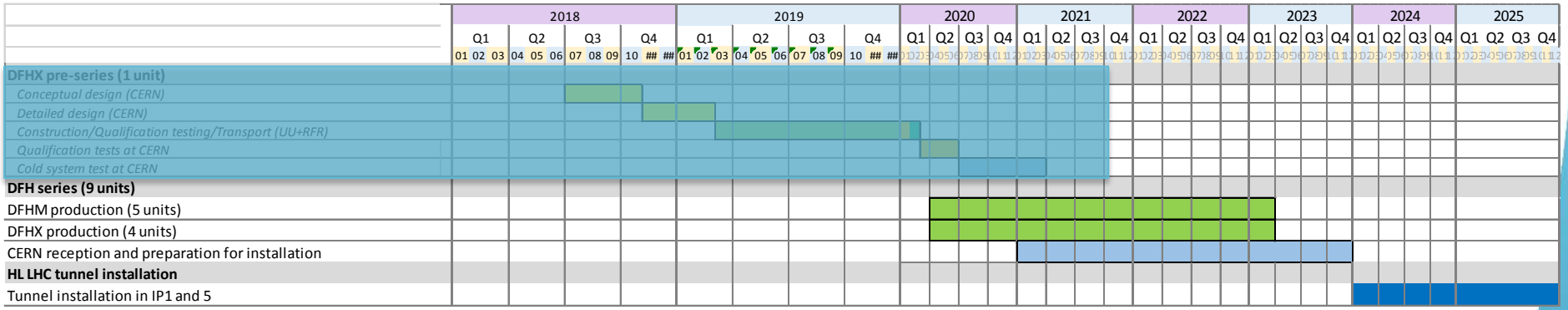
- Engineering design done by CERN
- CERN remains liable for functional performance (e.g thermal performance)
- CERN provides UU with CERN's technical specification and specification drawings
- UU is in charge of the procurement of the DFH based on CERN's specs
- Understanding that RFR will be contracted by UU for the construction of the DFH, based on UU's specifications and (presumably) CERN's drawings,
- RFR will be in charge of the construction, qualification testing and supply to CERN of the equipment and all the relevant documentation
- CERN reserves the right of introducing hold points at intermediate and final steps of the construction of the pre-series and series units. This will be part of the technical specification to UU
- The construction follow-up will be led by UU. CERN remains available for support

Schedule

✓ Pre-series



✓ Series




HiLumi
HL-LHC PROJECT