HL_LHC, WP9-Cryo

Proposed slides for WP6 - sc links

- *News on the subject for 2015*
- *Elementary approach for sc links safety aspects*
- *Few open points and future activities*

S. Claudet, 25 Oct'15

On behalf of Cryo team involved in HL_LHC activities

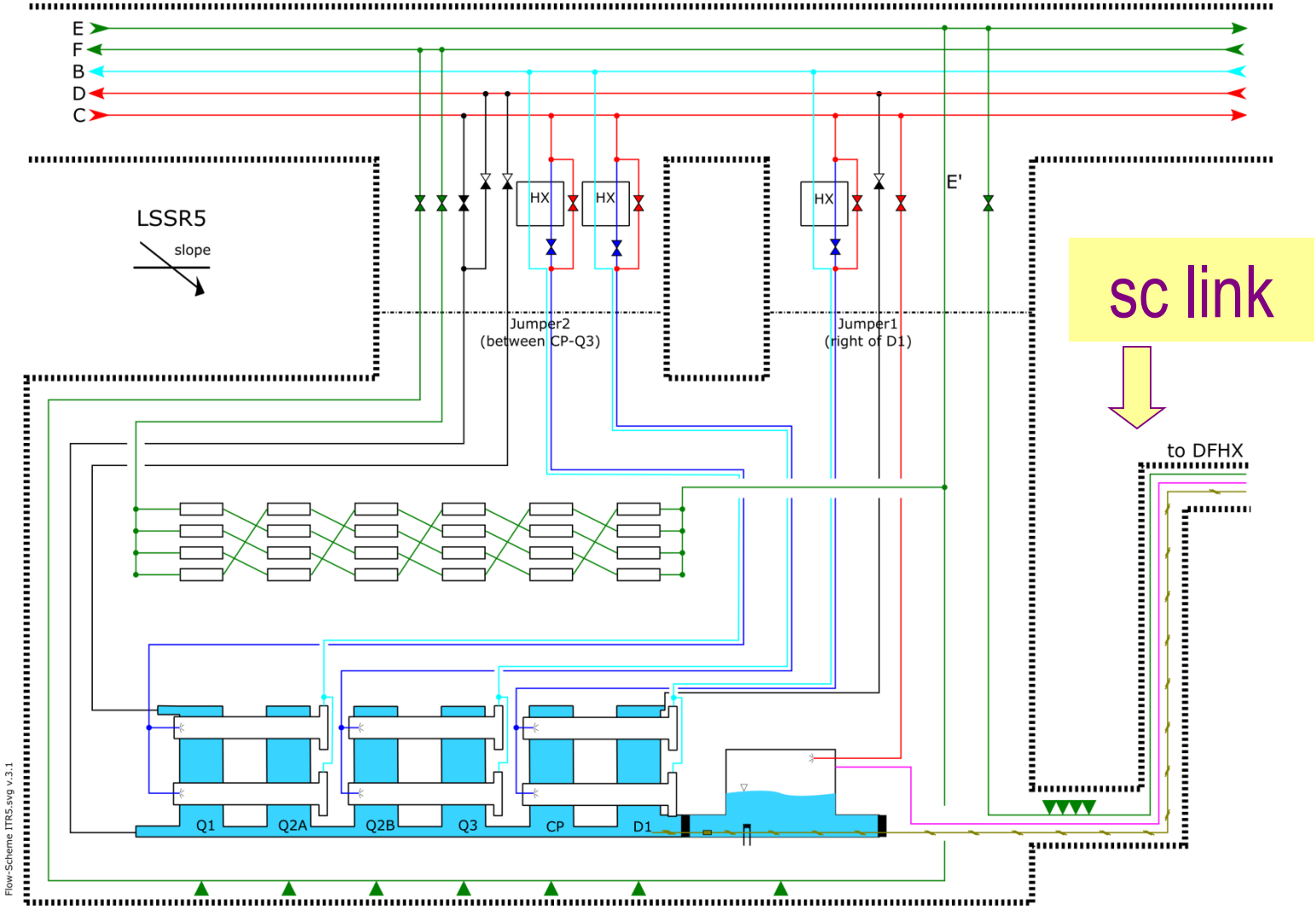
Cryogenics for sc links: News 2015

- Evolution of Baseline:
  - No more sc links at P7. Helps at short term, as this would have been tight for technical validation before LS2.
  - P1/P5: New baseline with “underground” infrastructure including current leads boxes (DFH’s). No significant impact for Cryo interfaces, it will just ease technical validation (no more large vertical parts)

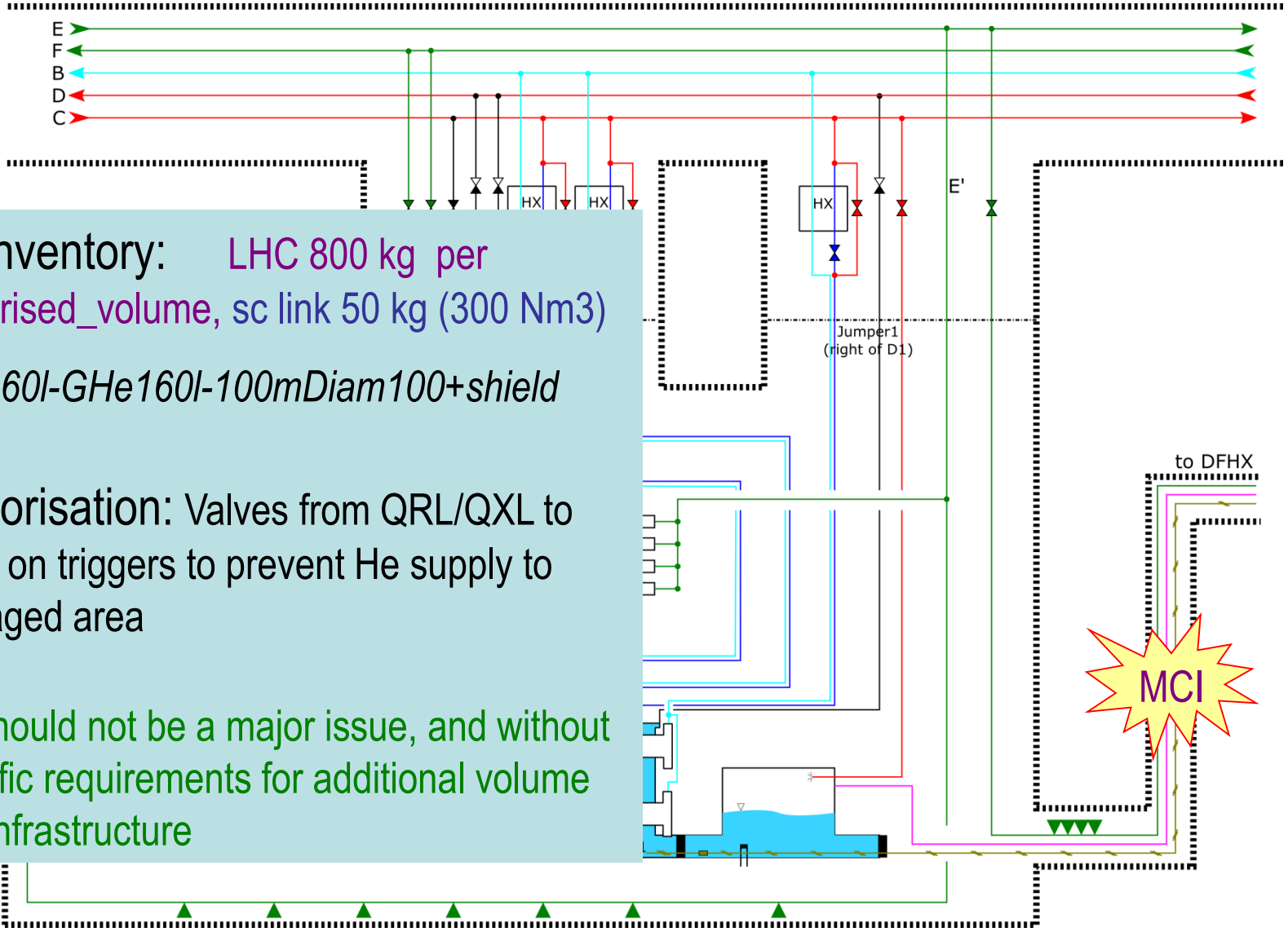
- Open points P1/P5:
  - Powering of D2 (now separated from D1) possibly in series with D1: No objection from Cryo perspectives, as cooling a secondary link was already considered for Q4-Q5-Q6 from D2, but a simple reminder that D2 correctors shall be in the same link than D2 main circuit. It would couple D2 with IT & D1 for powering sub-sectorisation, and leave Q4-A5-Q6 separated.
  - Revamping existing Q5’s in HL-Q6’s with operation at 4.5K: Besides clarification for Cryo and Vacuum considerations (why not considering HL-Q6’s as part of the ARC?), the powering scheme has to be considered: existing sc link from DFBL’s, new sc link with Q4-Q5. This will be treated in next 3 months.

Flow diagram IT-R5

Preliminary 2015, exists as well for SAM's, not yet for Crab Cavities



Few hints for sc links safety aspects



He inventory: LHC 800 kg per sectorised_volume, sc link 50 kg (300 Nm3)

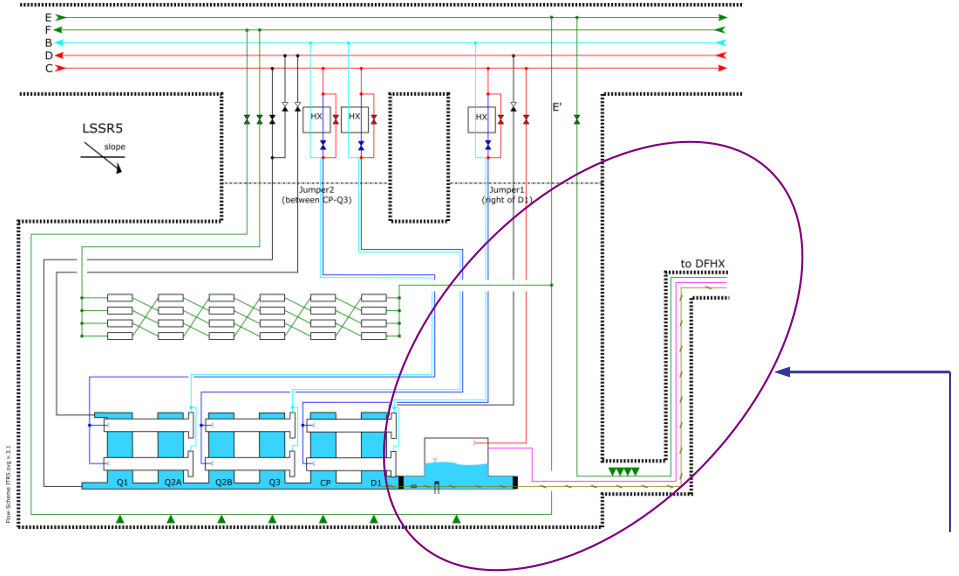
LHe160l-GHe160l-100mDiam100+shield

Sectorisation: Valves from QRL/QXL to close on triggers to prevent He supply to damaged area

=> Should not be a major issue, and without specific requirements for additional volume and infrastructure

Open points Cryogenics / sc links

- Next (2016) for P1/P5, *that applies as well for sc links*:
  - From known heat loads, definition of P, T, m' for each circuit, and then sizing of process pipe and major components
  - Cooling scenario for transients, including quenches and degraded vacuum
  - Iterate on heat loads, integration, process optimisation



- Specifically for sc links:
  - We need to work together to define better extremities of sc links, from LHe vessels hosting Nb+ splices, end termination pieces (like at D1), secondary links, cooling of leads and required instrumentation, to allow validation of cooling ability all along the sc parts

Spare slides that could be relevant in case of questions

P1/P5 Cryogenic architecture