



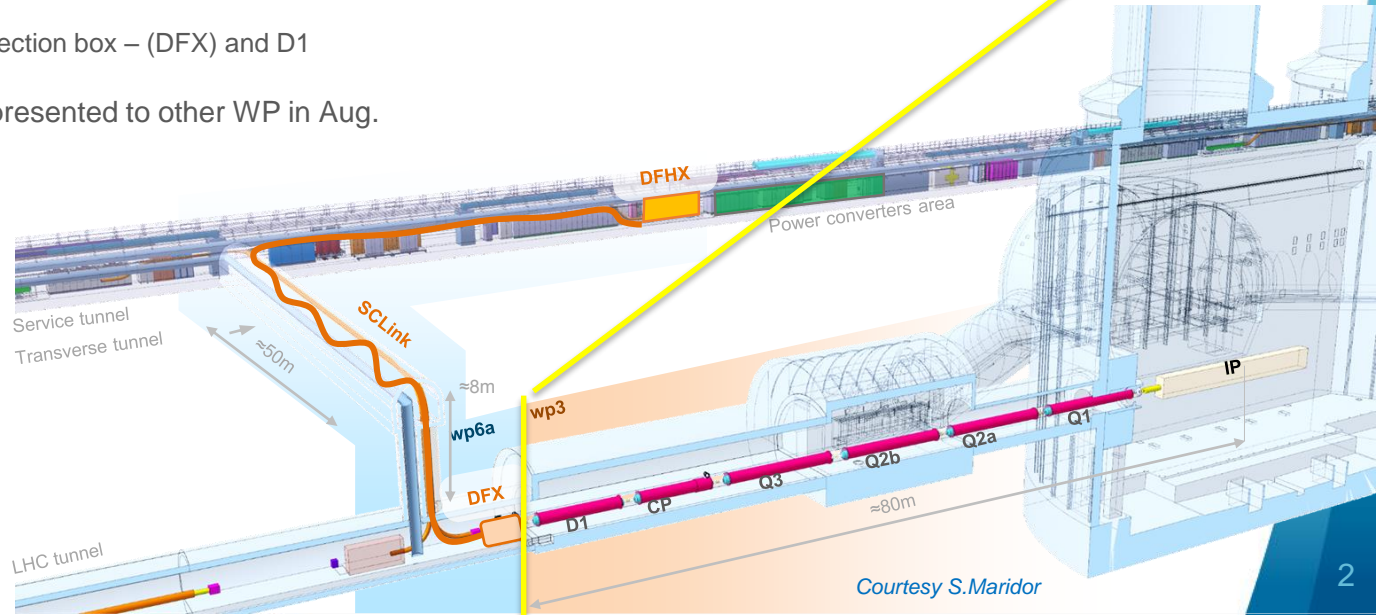
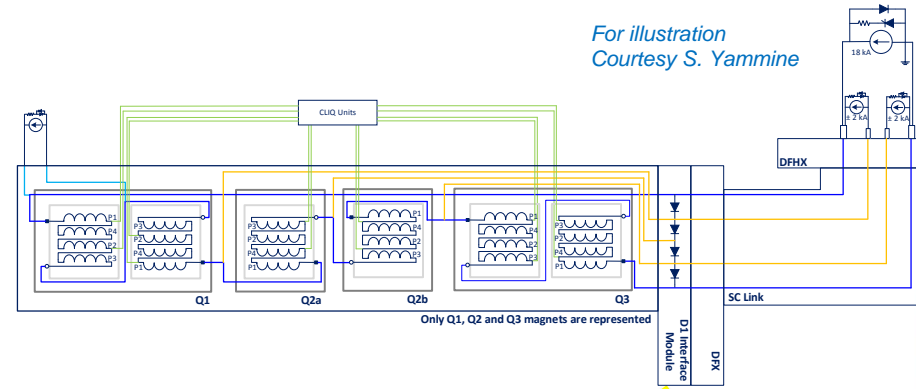
Cold diodes module : Conceptual integration studies

8th HL-LHC collaboration meeting : 17 Oct. 2018

Context

- Request to study the integration of 4 x cold diodes in the triplet magnet electrical circuit
- Jan. 2018: engineering study start
- April 2018: dedicated integration study start
- Due to the complexity of the cryostats interconnects and the installation of cables
 - ➔ Best compromise for integration is between Magnets and SCLink
 - Between SCLink connection box – (DFX) and D1
- 1st conceptual pre-design presented to other WP in Aug. 2018

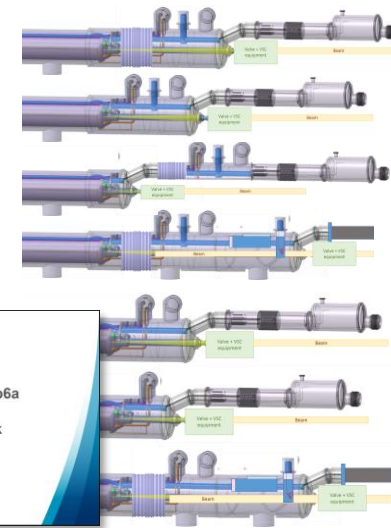
For illustration
Courtesy S. Yammine



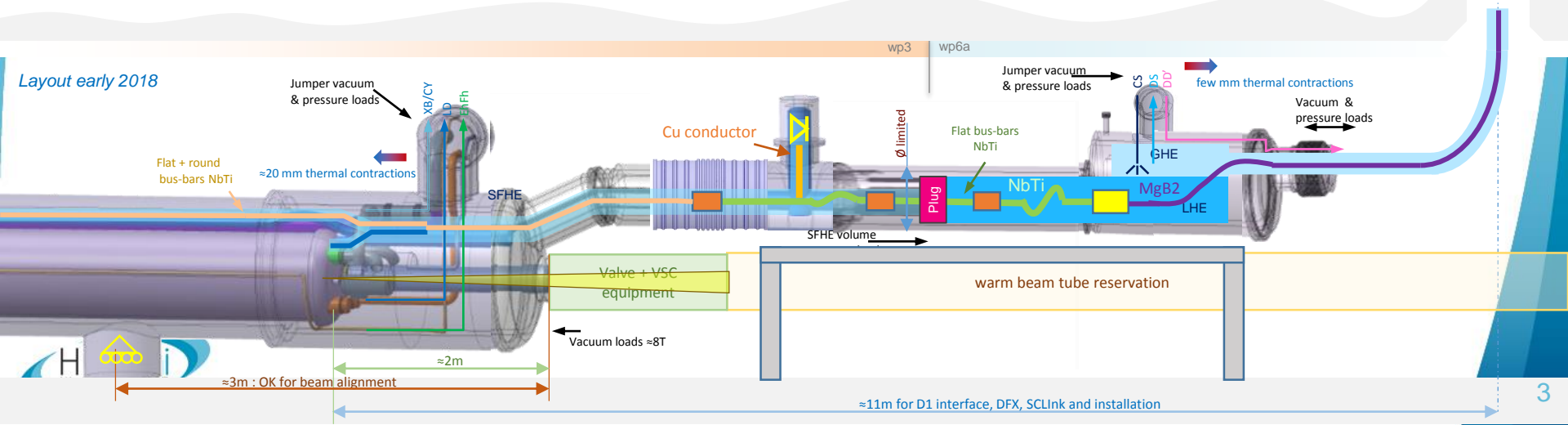
Courtesy S.Maridor

Conceptual position of the cold diodes

- Cold diodes shall be integrated considering:
 - Beam aperture limitations
 - Beam alignment requirements
 - Cryogenic lines distribution & thermal contractions
 - Bus bars integration & connection
 - Cold diodes replacement
 - Vacuum and hydraulic induced loads
- → study led to a 1st compromise concept



| | | | | | | |
|------------------------------------|----|----|----|----|----|----|
| Beam alignment + Sector valve | OK | OK | OK | OK | OK | OK |
| No access for bus bars connection | OK | OK | OK | OK | OK | OK |
| Cryo pipe integration | OK | OK | OK | OK | OK | OK |
| Beam alignment + sector valve | OK | OK | OK | OK | OK | OK |
| Beam alignment + sector valve | OK | OK | OK | OK | OK | OK |
| Splice access + radial integration | OK | OK | OK | OK | OK | OK |
| Beam alignment + sector valve | OK | OK | OK | OK | OK | OK |



Iterations

Diodes assembly assumptions:

- Volume $\varnothing 175 \times 600$ mm

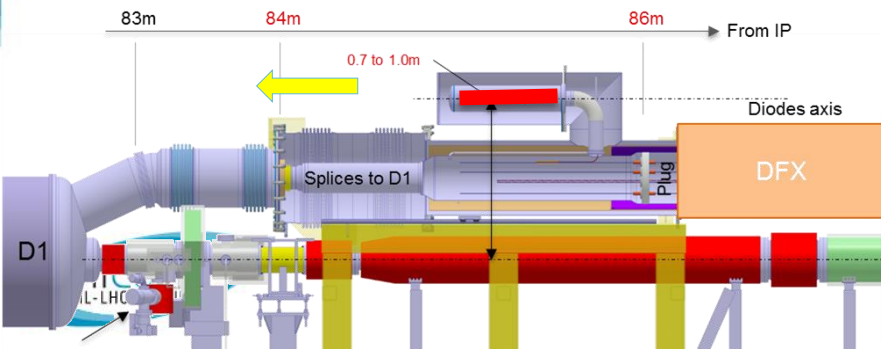
Preliminary Concept :

- 1Mev neutron fluence $\approx 1.4 \times 10^{14} \text{ cm}^{-2}$
- Dose: ≈ 60 kGy

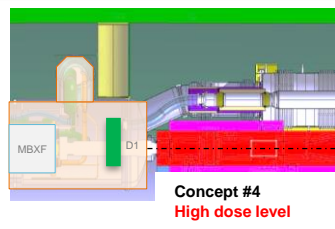
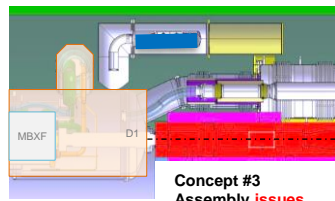
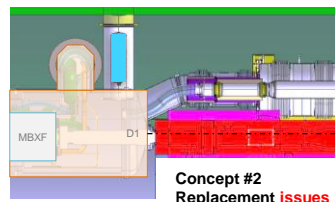
Request to review position of cold diodes toward D1 to minimise dose

Other concepts being analysed

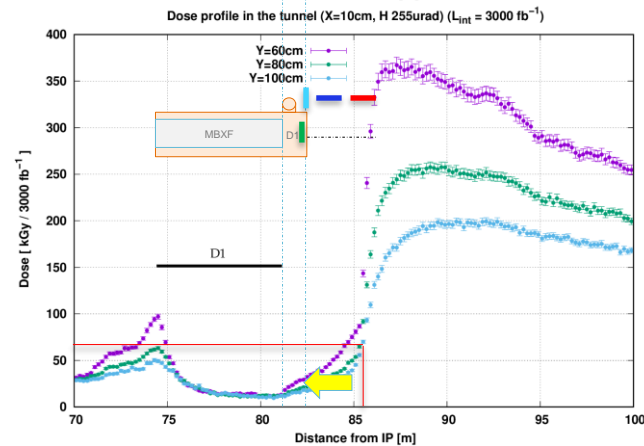
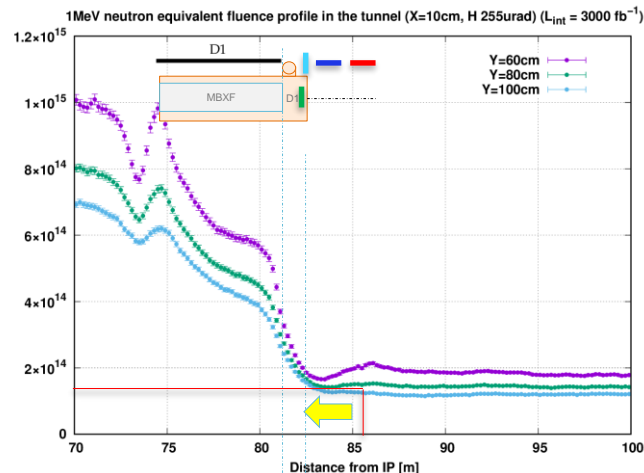
Iterative work in progress



| Concept | 1 Mev neutron fluence [cm ⁻²] | Dose [kGy] |
|---------|--|---------------|
| #1 | $\approx 1.4 \times 10^{14}$ | ≈ 60 |
| #2 | $\approx 1.5 \times 10^{14}$ | ≈ 30 |
| #3 | $\approx 1.4 \times 10^{14}$ | ≈ 35 |
| #4 | . | . |



Courtesy Ruben Garcia Alia



Summary and next steps

- Consequences of cold diodes integration are identified
- Preliminary concepts start being discussed between work packages
- Iterations are needed to define the best compromise between radiation level, integration, installation and maintenance



Spare slides

Conceptual functional design (for discussion)

Cryogenic layout

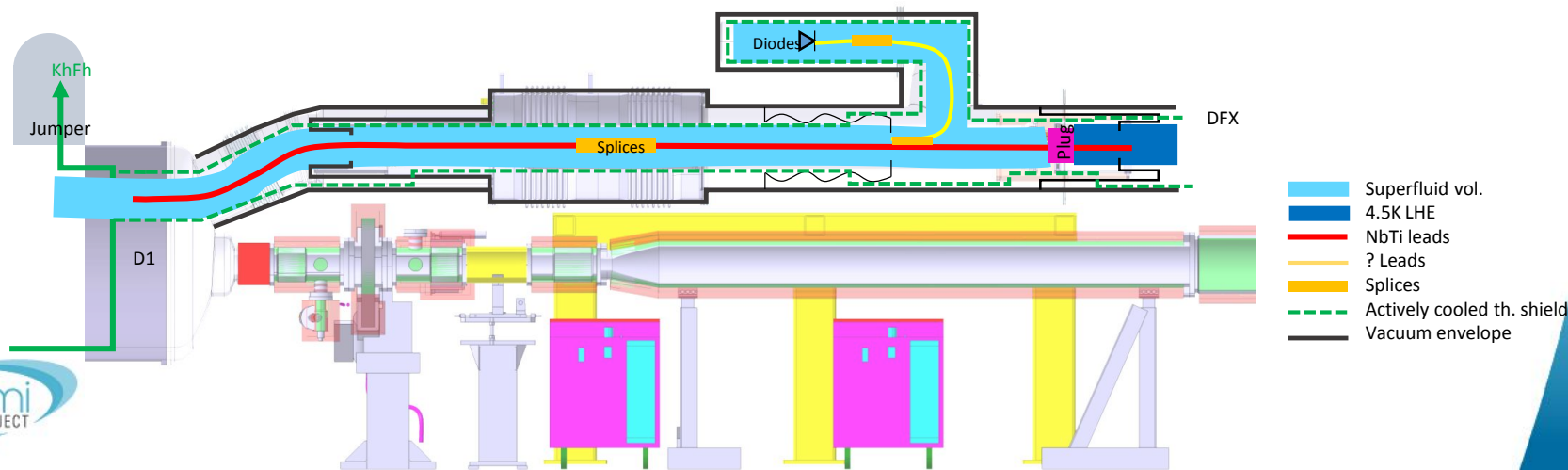
- Shared superfluid helium volume with triplet
- Plug : hydraulic separation

Electrical layout

- CDM : diodes + plug

Design guidelines

- Replacement optimisation
 - Easy access
 - Full set with standard dimensions



Cold Diodes Module integration

- Integration boundaries extrapolated from EDMS 1991506
- Cold diodes preliminary location:
 - 84-86 m from IP
 - Radially : $\approx 0.7\text{m}$ to 1.0 m from beam axis

