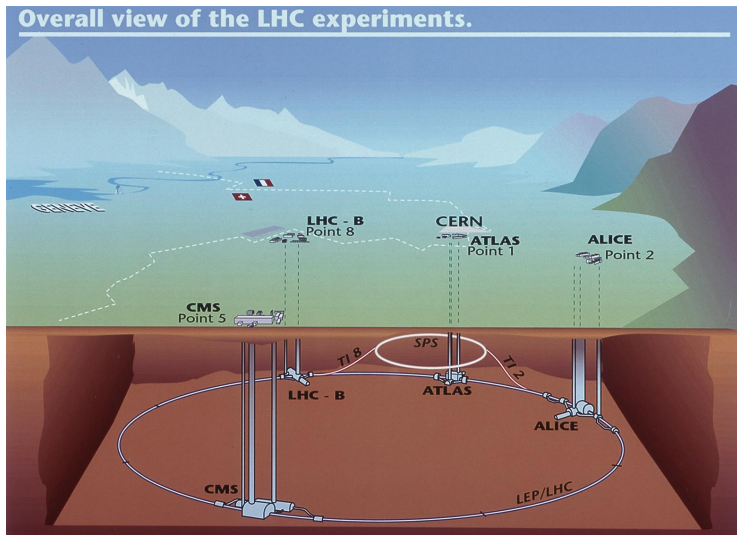
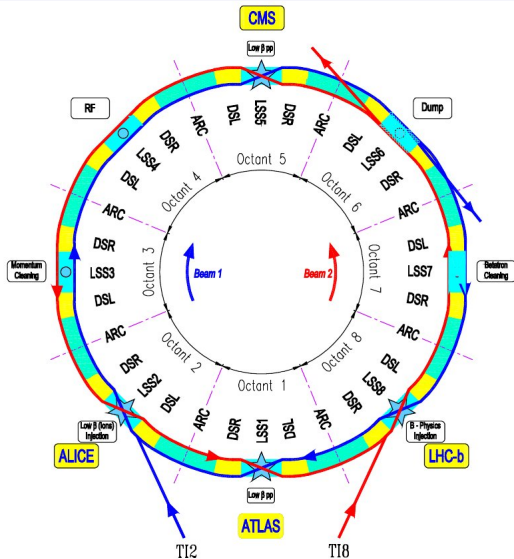


Vakuový systém urychlovače LHC



50 - 150 m pod zemí, delka 27 km



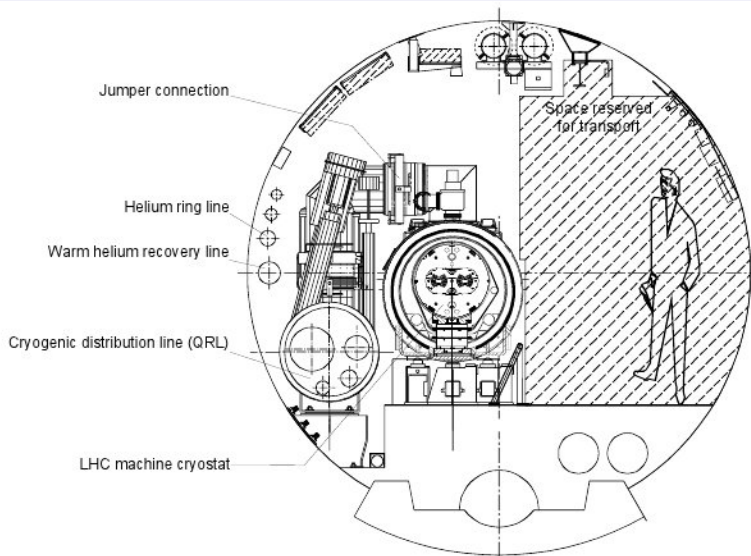
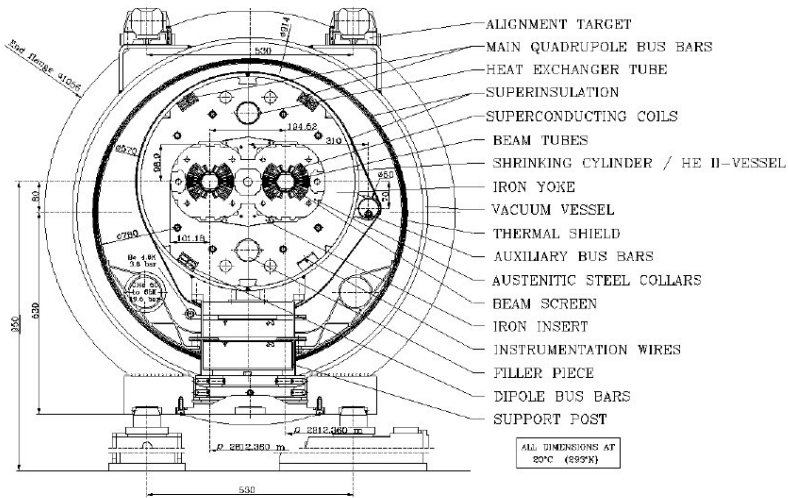


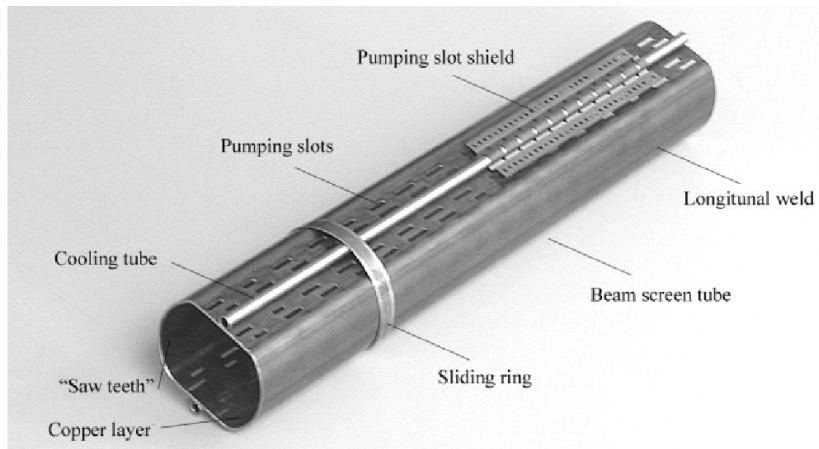
Figure 11.1: Transverse cross-section of the LHC tunnel



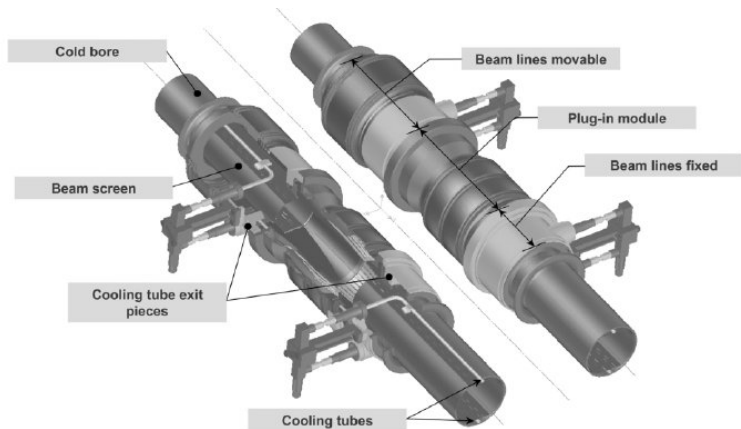
Vakuové systémy:

- kryomagnety - sektory s délkou 214 m, teplota 1.9 K
- He-rozvody - sektory s délkou 428 m, 10 Pa při pokojové teplotě
- urychlovač - různé délky sektorů, délka přibližně 2900 m, $10^{-8} - 10^{-9}$ Pa

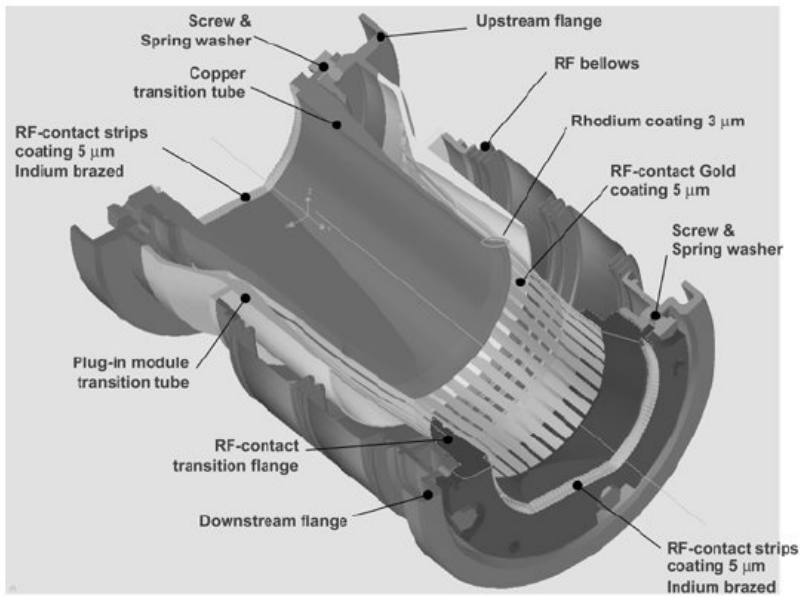
GAS	Nuclear scattering cross section(cm^2)	Gas density (m^{-3}) for a 100 hour lifetime	Pressure (Pa) at 5 K, for a 100 hour lifetime
H_2	$9.5 \cdot 10^{-26}$	$9.8 \cdot 10^{14}$	$6.7 \cdot 10^{-8}$
He	$1.26 \cdot 10^{-25}$	$7.4 \cdot 10^{14}$	$5.1 \cdot 10^{-8}$
CH_4	$5.66 \cdot 10^{-25}$	$1.6 \cdot 10^{14}$	$1.1 \cdot 10^{-8}$
H_2O	$5.65 \cdot 10^{-25}$	$1.6 \cdot 10^{14}$	$1.1 \cdot 10^{-8}$
CO	$8.54 \cdot 10^{-25}$	$1.1 \cdot 10^{14}$	$7.5 \cdot 10^{-9}$
CO_2	$1.32 \cdot 10^{-24}$	$7 \cdot 10^{13}$	$4.9 \cdot 10^{-9}$



průměr asi 45 mm, 1 mm nerez ocel + $75\mu\text{m}$ Cu, 5-20 K



elektrický odpor 0.1 mΩ



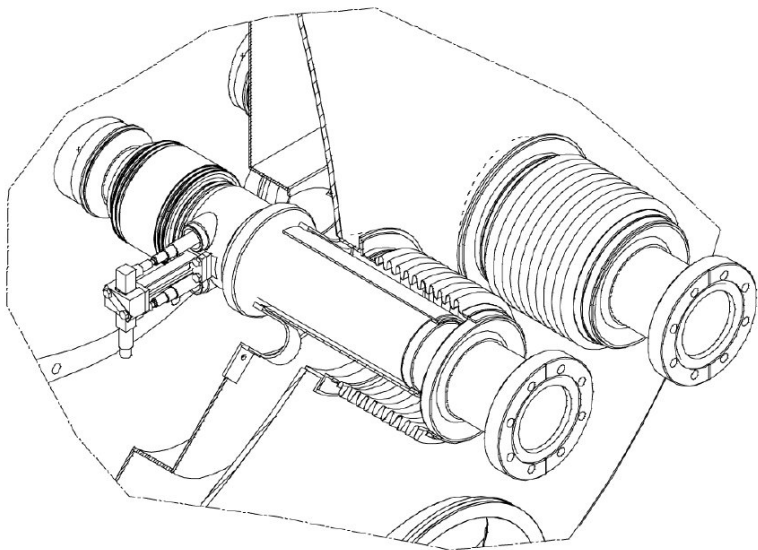


Figure 12.7: Details of a cold-to-warm transition

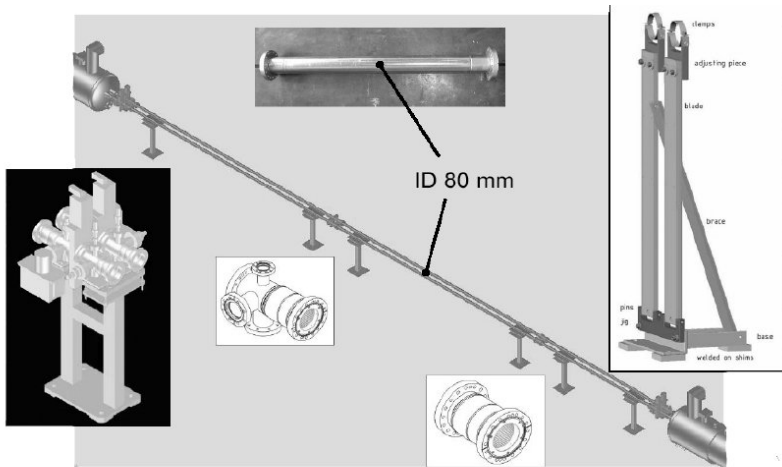


Figure 12.8: Standard layout of the RT beam vacuum system between two cryostats.

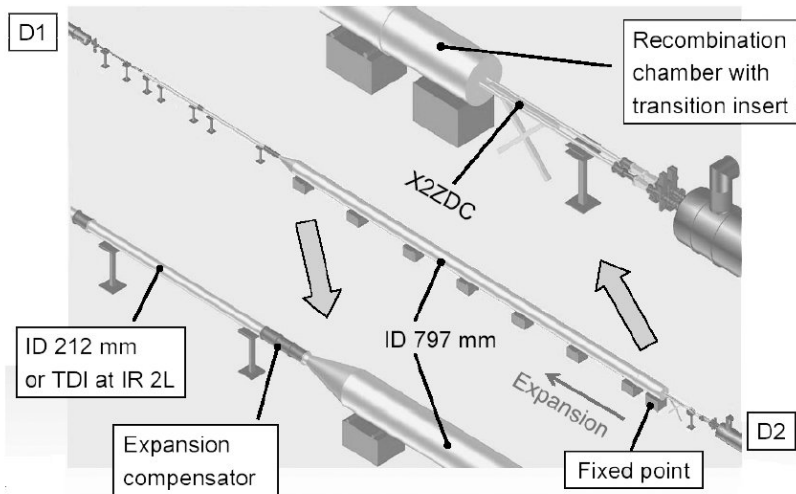


Figure 12.10: Layout of the RT beam vacuum system at right of IR point 2

- mobilní čerpací stanice
- trubice urychlovače - kryogenní vývěva
- části na pokojové teplotě - NEG getr - TiZrV, iontové vývěvy asi po 28 m
- manometry v každém sektoru - 1x Pirany, 2x ionizační se studenou katodou, 1x ionizační se žhavenou katodou
- analyzátor plynu (hmotový spektrometr) na mobilní čerpací jednotce + další manometry

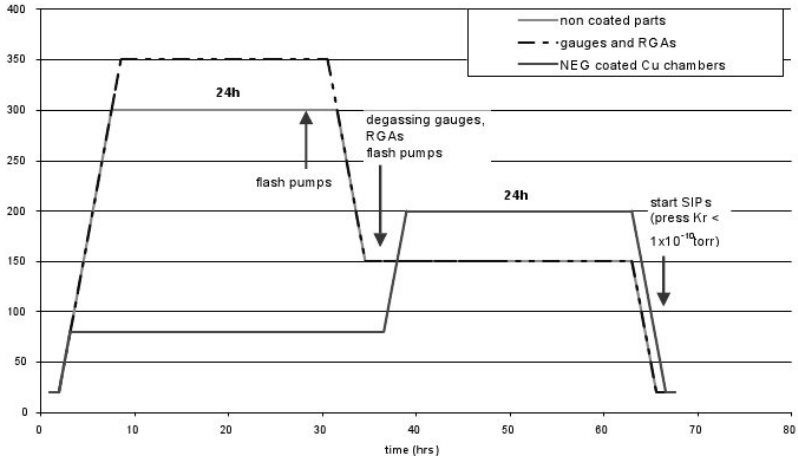


Figure 12.13: Proposed bake-out cycle with NEG activation

Aktivace NEG getrů

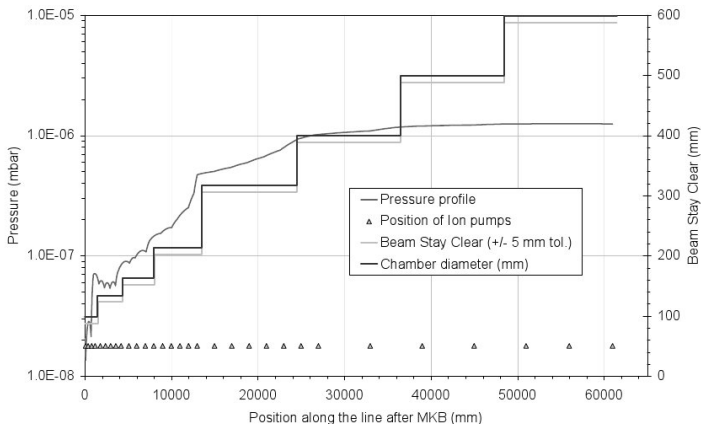


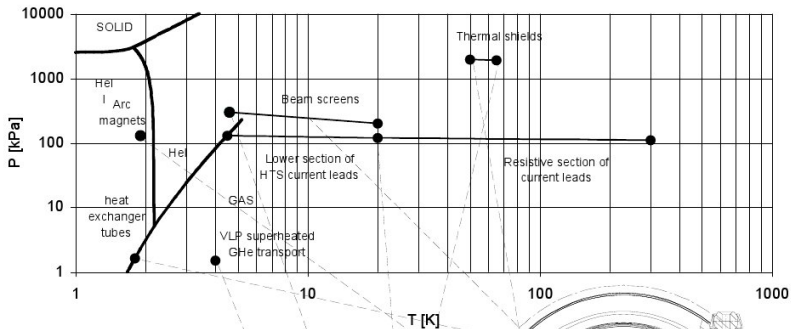
Figure 12.15: Pressure profile, distribution of ion pumps, vacuum chamber diameters and beam stay clear along the beam dump line starting downstream of the diluters (MKB) down to the dump (TDE).

Výstupní část urychlovače

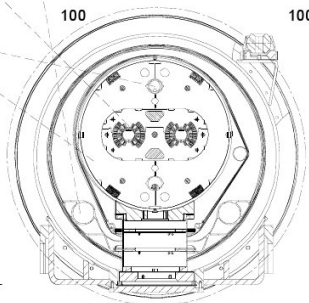
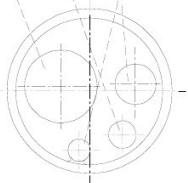
Table 12.3: Main characteristics of the insulation vacuum sectors

	Cryomagnet	QRL
Volume (m ³)	80	85
Length (m)	214	428
MLI (m ² /m)	200	140
Sectors per arc	14	7

Vakuum pro kryomagnetny a He rozvody.



QRL



Cryo-magnet

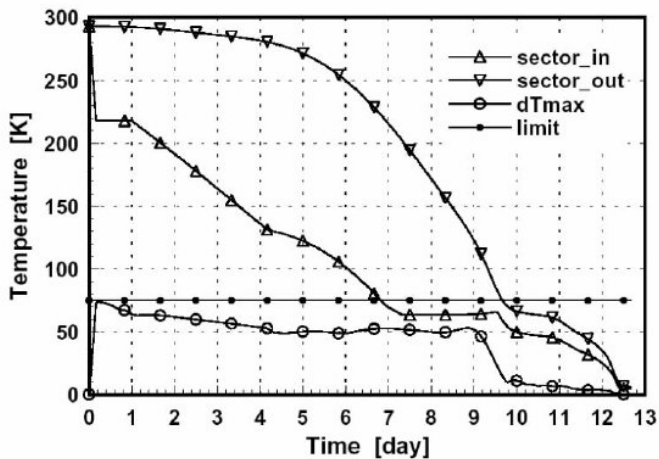


Figure 11.12: Normal cool-down from 300 K to 4.5 K of LHC sectors

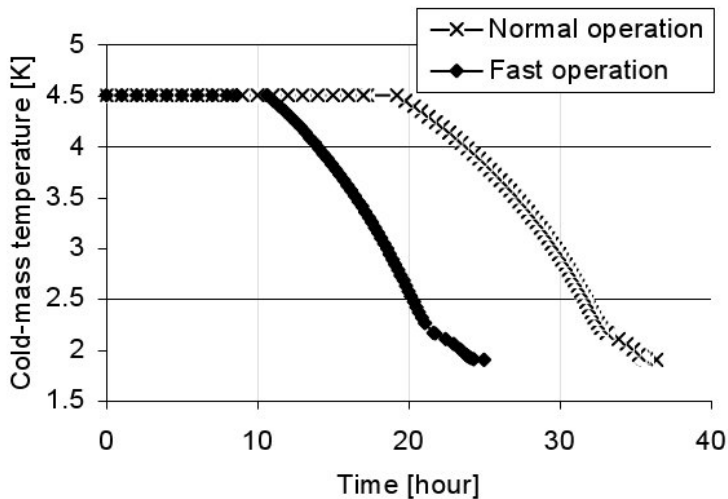


Figure 11.13: Magnet filling and cool-down down from 4.5 K to 1.9 K

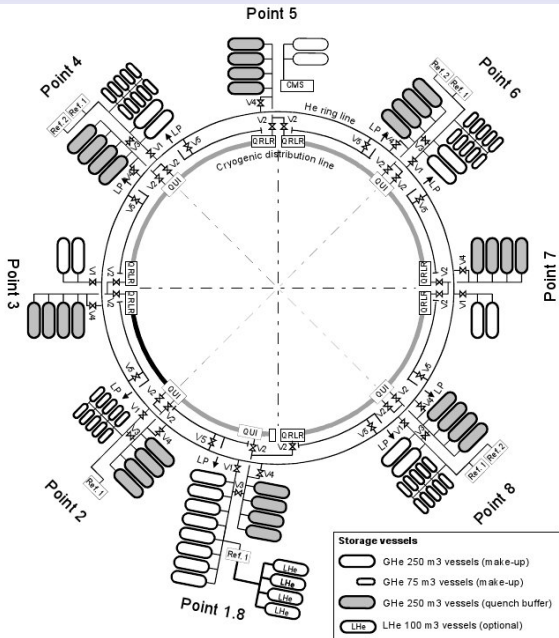


Figure 11.17: Helium storage management