LHC Cryogenics in UX85 and Strategy against radiations

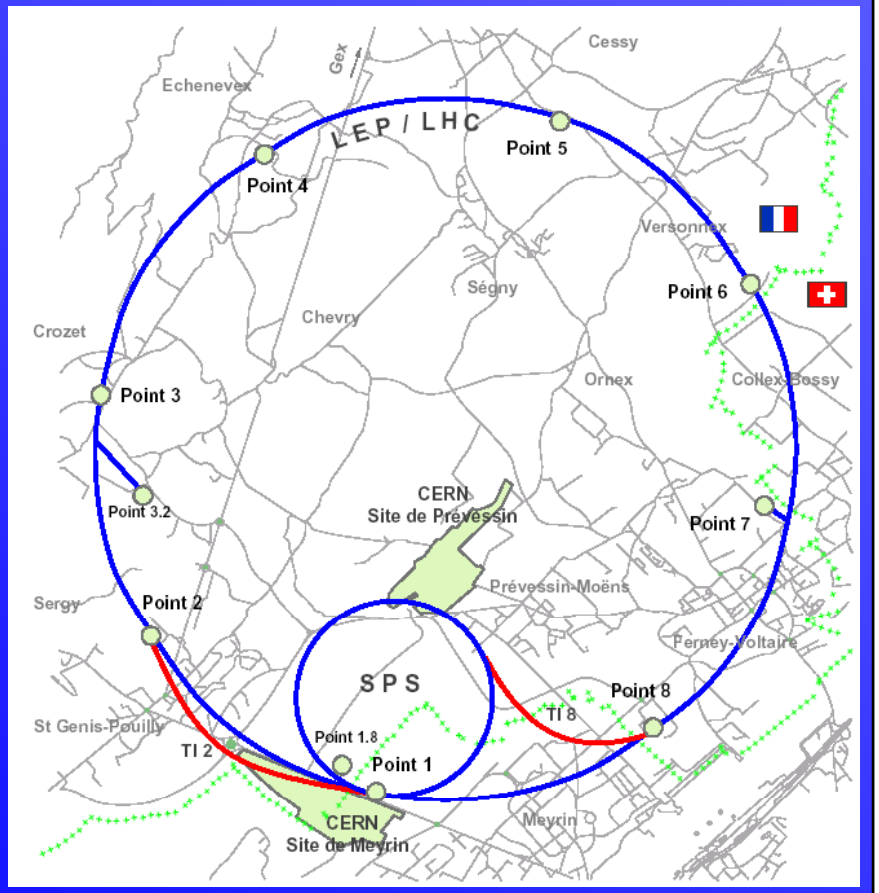
S. Claudet, LHC cryogenics

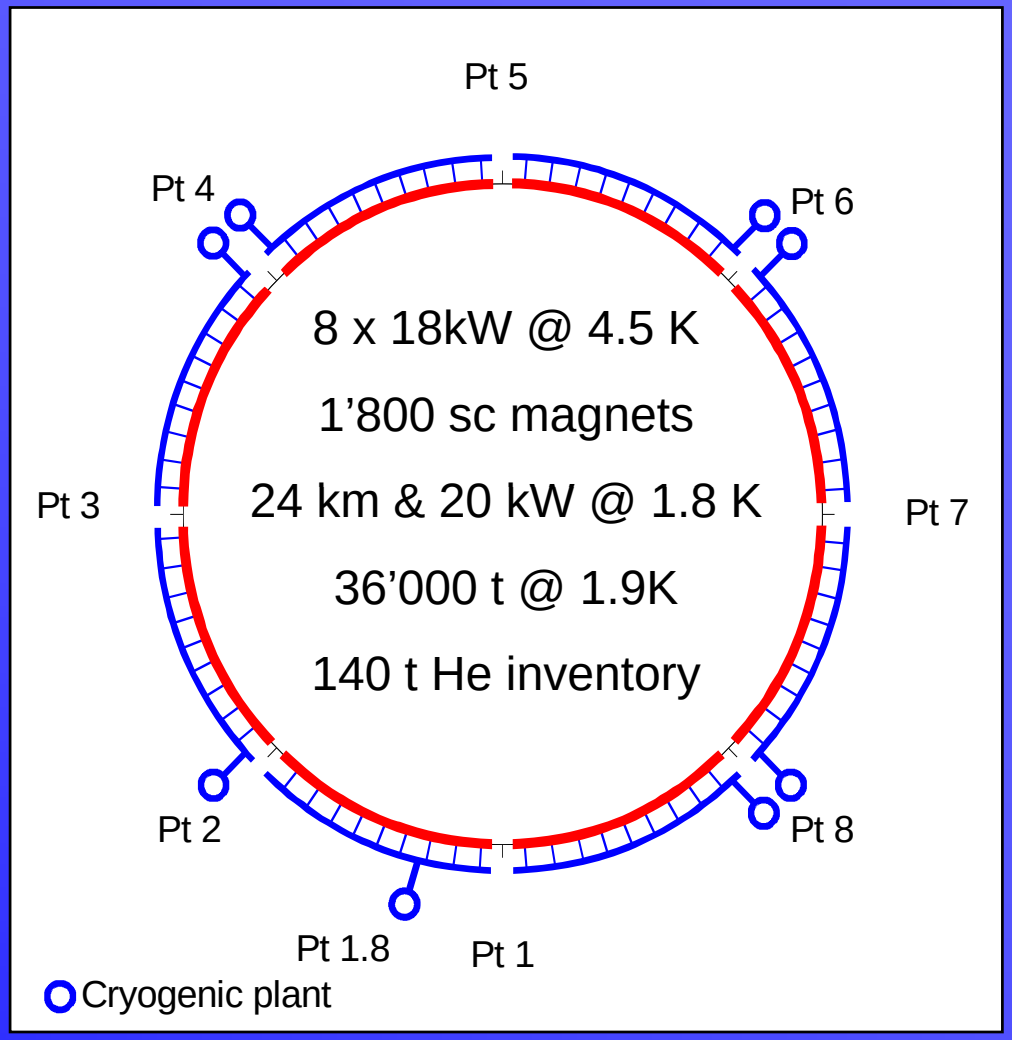
LHC Radiation days, 29-30Nov'07

Content

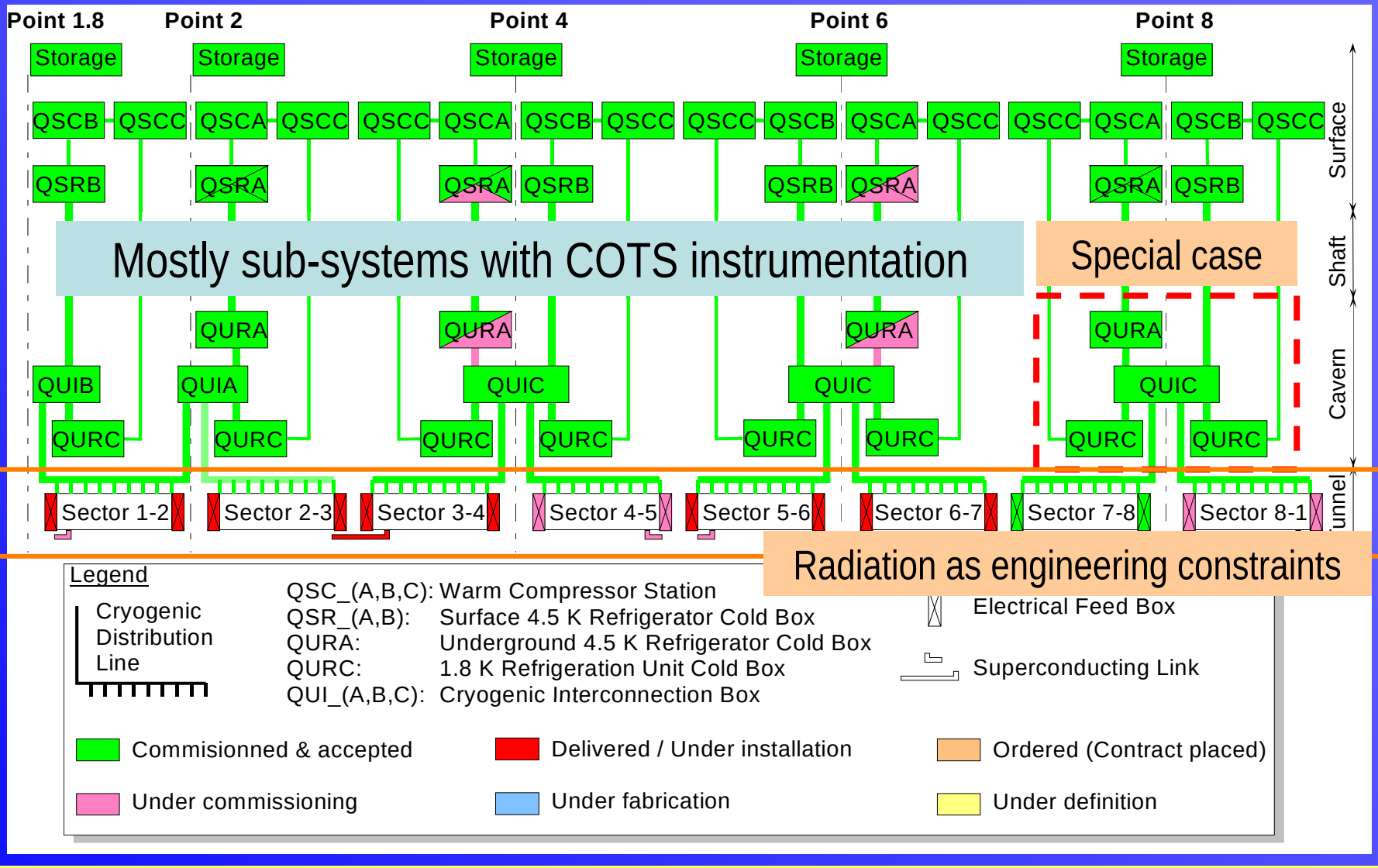
- Introduction
- Specificities of UX85 cavern
- Impacts on cryo related components
- Proposed actions and status
- Summary

Introduction to LHC Cryogenics (1/3)

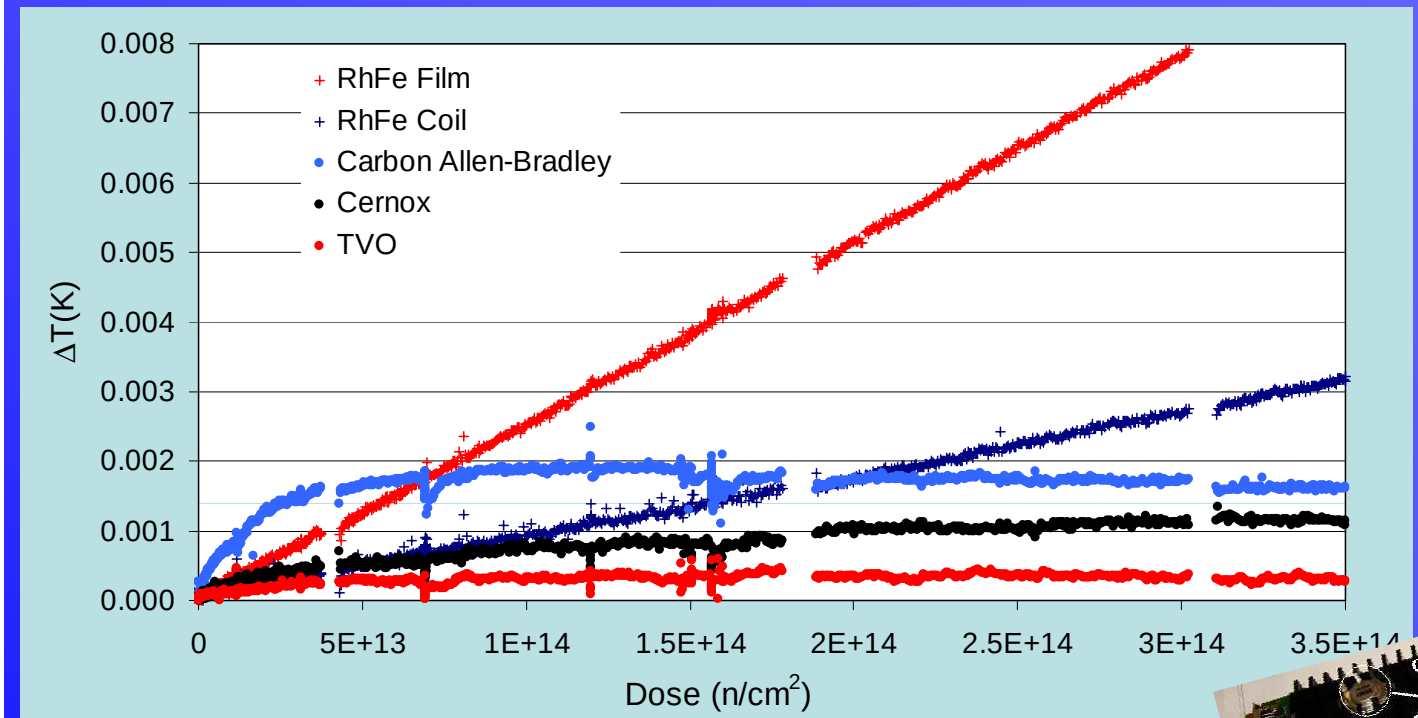


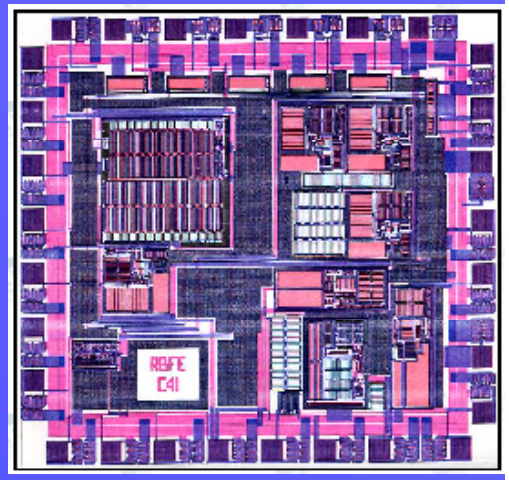


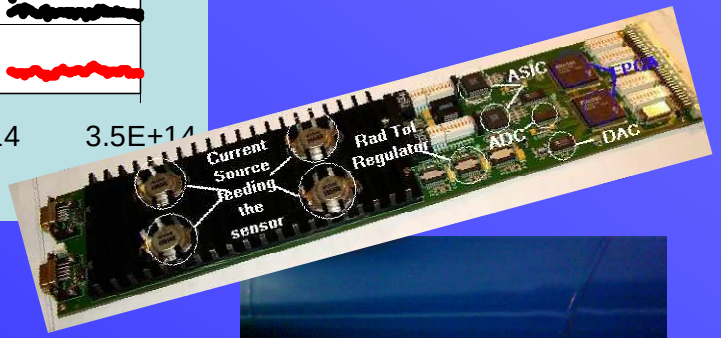
Introduction to LHC Cryogenics (2/3)



Introduction to LHC Cryogenics (3/3)







Machine interface:
From Rad-Hard sensors to Rad-Tol electronics in sheltered areas

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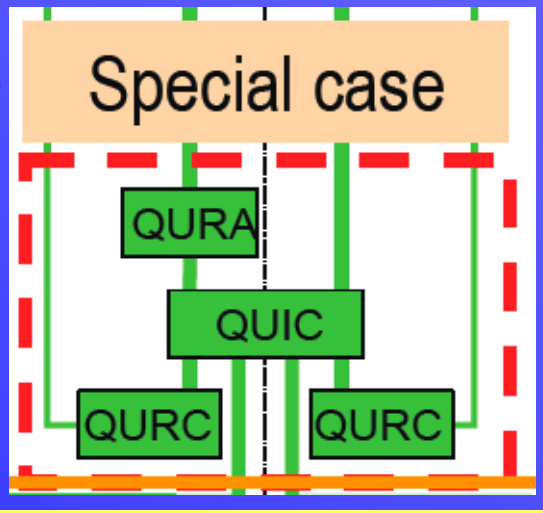
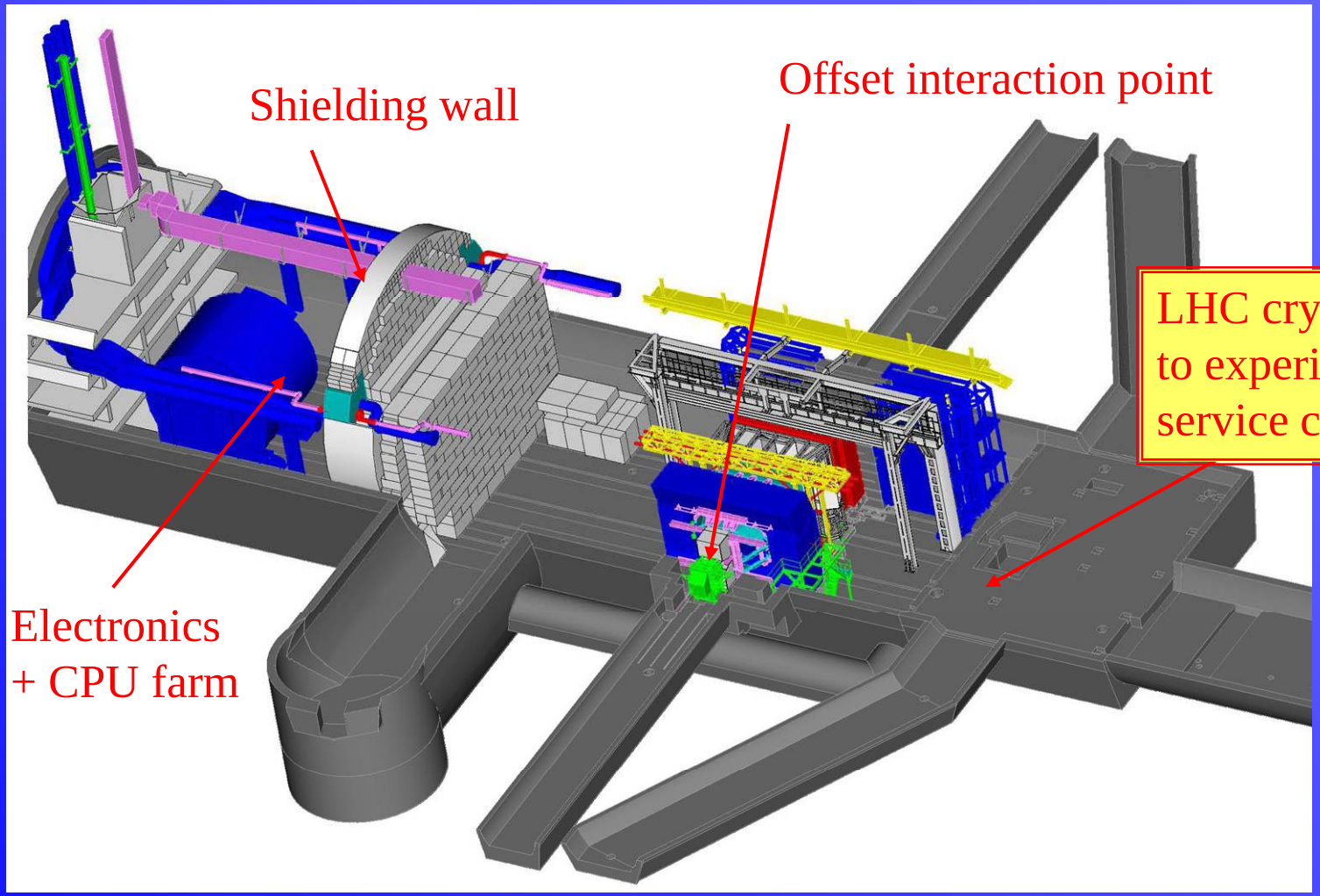


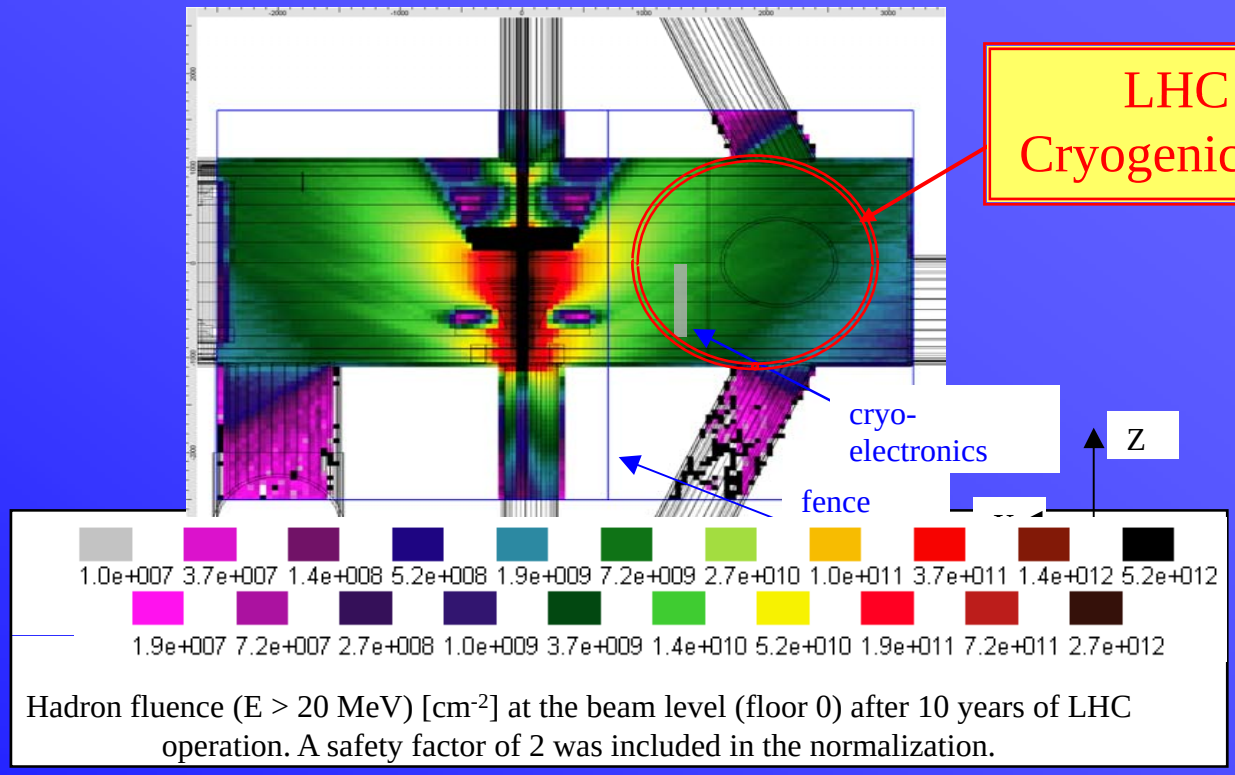
LHCb – detector area



J. Christiansen

UX85: Simulated doses for single events

(C. Theis & co-workers, EDMS 735075)

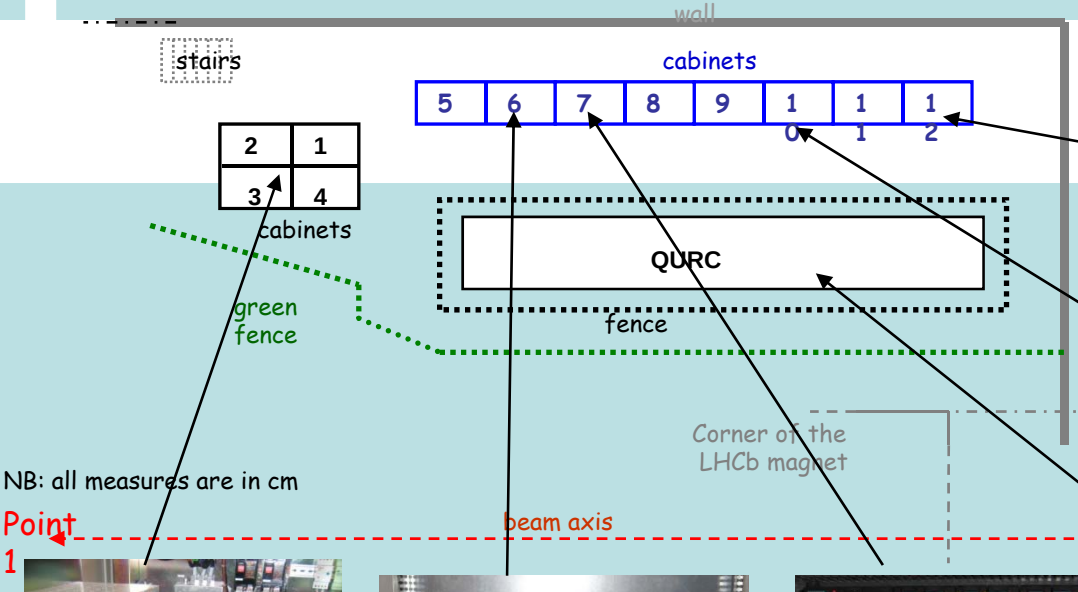


Hadron fluence (E > 20 MeV) [cm^{-2}] at the beam level (floor 0) after 10 years of LHC operation. A safety factor of 2 was included in the normalization.

Complete technical assessment of the problem can be found in TS note 2006-001 LEA by A-L Perrot (EDMS 695442)

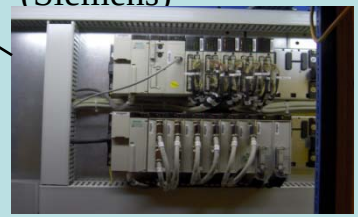
UX85 Cryogenics Installation

Radiation sensitive devices



Level 1

DP/PA couplers and links (Siemens)



PLCs Schneider (Modicon)

High frequency converters, Magnetic level controllers.

Thyristors

PLCs Siemens S7-300

Electro-pneumatic valves positioners

Frequent stops could be due to single events !!!

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Proposed actions
endorsed by LHC project leader's office

CERN
CH-1211 Geneva 23
Switzerland

the **Large Hadron Collider** project

LHC Project Document No.
LHC-QI-EC-0007

EDMS Document No.
819444

Engineering Change requested by (Name & Div./Grp.) :
T.Wijnands, S.Claudet

Date: 2007-03-05

Engineering Change Order – Class I

Radiation tolerance of the cryogenic installation in UX85

Brief description of the proposed change(s) :

To improve the radiation tolerance of the cryogenics installation in UX85 with the LHC baseline by relocating the industrial controls equipment to UL84 (stage I) and to equip the QUI and the QURC in UX85 with electro-pneumatic valve positioners with remote electronics (stage II) equally located in UL84. This will give an operational safety with regard to radiation effects in line with that of the LHC baseline.

Equipment concerned :	*Drawings concerned :*	*Documents concerned :*
QUI in UX85 **QURC in UX85**	**LHCLJ8US0019** **LHCJUX850004**	

Sequence of actions to be taken
(considering sensitivity of components and possible effects)

Phase 1:

Displacement of Cabinets for Cold Compressor magnetic bearings, PLCs and Profibus cards

Halogen free cables for CC magnetic bearing:	90'000 CHF
Cabinets for PLC's, Profibus, cabling (QUI):	30'000 CHF
Cabinets for PLC's, Profibus, cabling (QURC):	50'000 CHF
Supporting frame, handling:	10'000 CHF
Total Phase 1:	**180'000 CHF**

Phase 2:

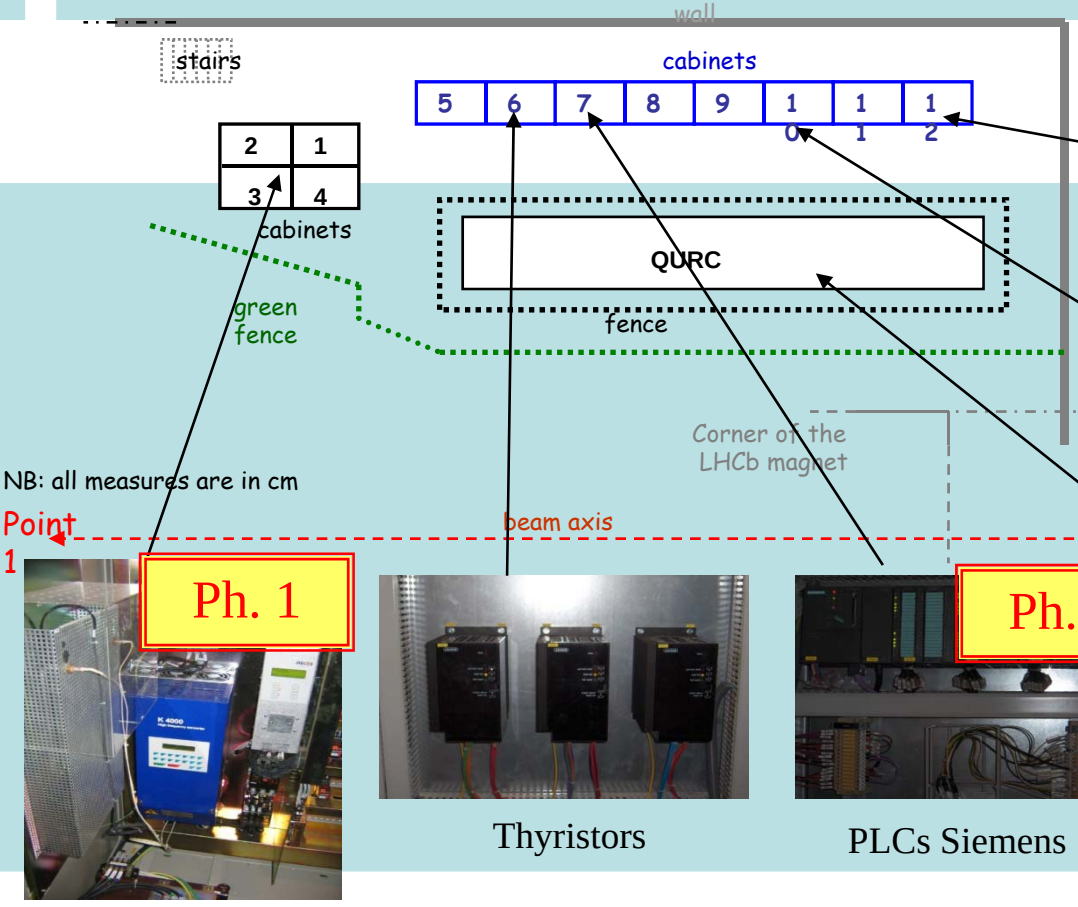
Remote valve positioners

Supply & Installation of digital positioners (QUI):	90'000 CHF
Supply & Installation of digital positioners (QURC):	60'000 CHF
Supporting frame, handling:	10'000 CHF
Total Phase 2:	**160'000 CHF**

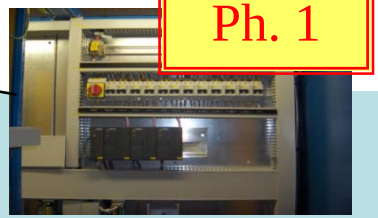
The delay for the supply of hardware like special cables is at least six months. With the present LHC schedule, the earliest implementation of phase 1 could be second half of 2007 after the hardware commissioning of Point 8.

UX85 Cryogenics Installation

Radiation sensitive devices

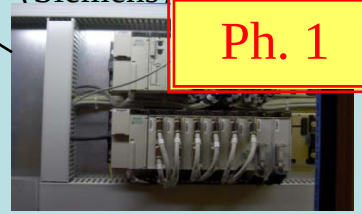


Level 1



Ph. 1

DP/PA couplers and links (Siemens)



Ph. 1

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High frequency converters, Magnetic level controllers.

Thyristors

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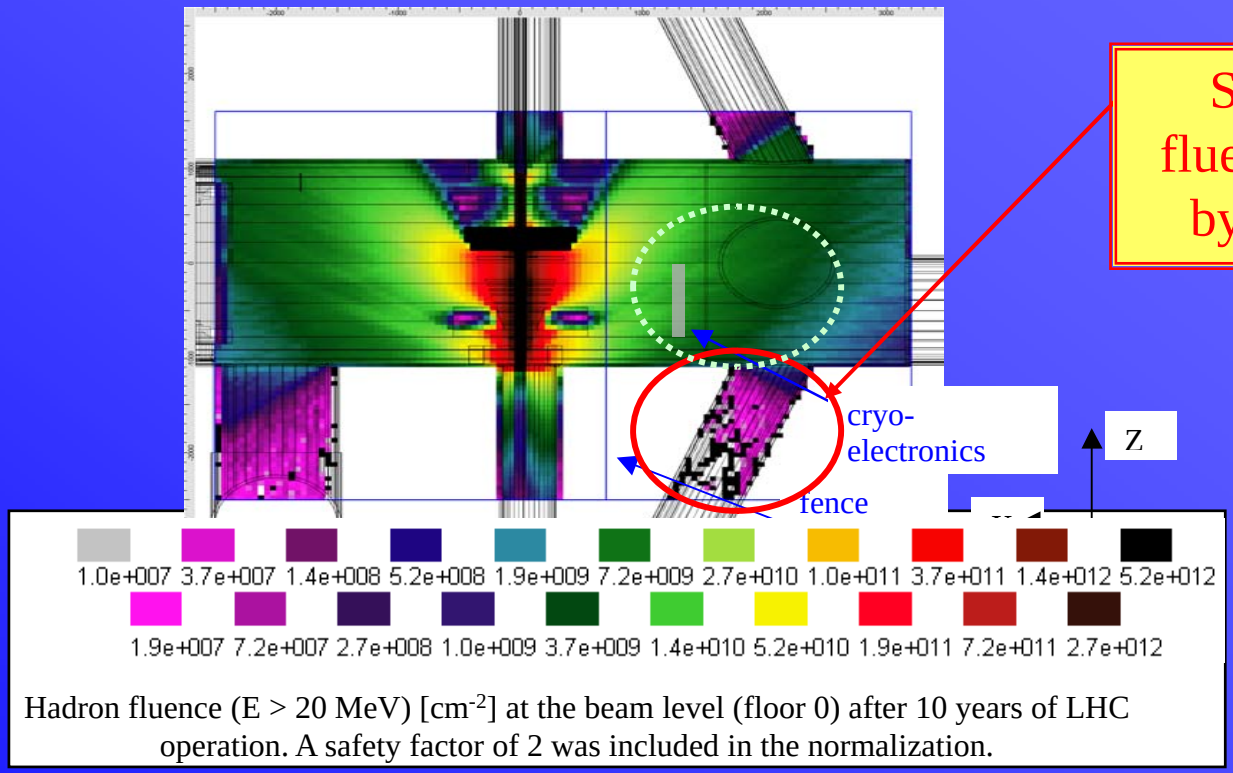
PLCs Siemens S7-300

Ph. 2

Electro-pneumatic valves positioners

A-L Perrot

UX85: Simulated doses for single events



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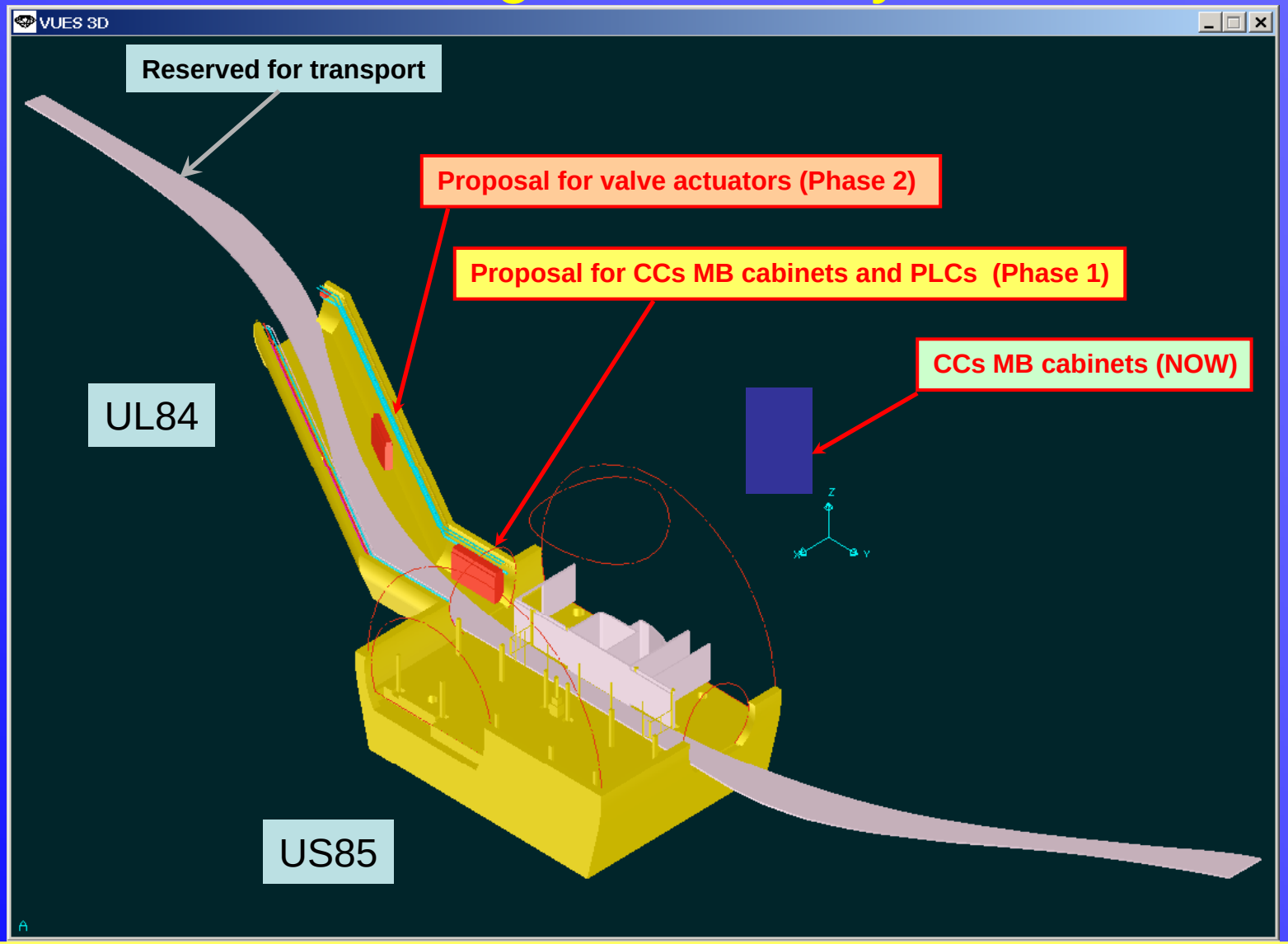
Integration study



Timing of actions to be taken

Proposed approach:

- Phase 1: Before collisions at high luminosity, remove the most sensitive equipment like PLC's, DP/PA couplers, controllers for cold compressor magnetic bearings. A proposal was integrated in UL84.
- Phase 2: Based upon monitoring and operating experience, digital valve positioners with remote electronics could be installed.

- Long delivery items have been ordered last summer, delivery Jan'08
- Project for electrical cabinets remote PLC's to be launched
- Implementation as foreseen after hardware commissioning of P8

The modifications proposed above will reduce the risk of radiation induced failures in cryogenic equipment in UX85 to a level comparable to that of cryogenic equipment in the tunnel.

Summary

- Follow standard procedure (as we did for all other areas with similar problems)
- Complete technical assessment of the problem can be found in TS note 2006-001 LEA by A-L Perrot (EDMS 695442)
- We take reasonable precautions where we know there will be a problem :
  - Most sensitive components to be treated before LHC collisions at moderate energy (long delivery items ordered)
  - Radiation monitoring system in UX85 and US85 is in place & operational to assess real situation
  - For the cold compressors (critical elements of QURCS) no solution exist but fallback solutions will be prepared in case we need them

Thanks to A-L. Perrot, T. Wijnands and P. Proudlock for help and support