Impact of safety related requirements and evolutions on LASS and LACS

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In the name of the Access Team

Current major issues

1. MAD
2. EIS-f bypass (in/out of chain)
3. Resectorisation needs
   - Access vs Ventilation
   - “Overpressure” doors
   - Maintenance
4. New Interlocks
5. Moving equipment due to R2E
6. New access points
7. Other Technical Improvements

LHC Access in numbers

- 35 Access points
- 44 PADs – 30MADs
- 116 Sector doors
- 81 End-of-Zone doors
- 22 interlocked + 24 non-interlocked ventilation doors

- EIS-f/m interlocks (interfaces)
  - Magnets (6 Power converters & respective Cells)
  - Beam stoppers (2 TED)
  - Access Safety blocks (2 valves)
  - Electron stoppers (4 valves)
  - RF interlock
  - L BDS – LHC Beam dump system
  - BIS – Beam interlock System
  - SPS Access chains 3 & 5

LACS and LASS

- LHC Access **Control** System (LACS)
  - Authorise and authenticate the people who enter
    - Authorise = have the credentials
      - Valid Contract, Dosimeter, training, EDH, ADI, etc…
    - Authenticate = you are who you say you are
      - Biometrics
- LHC Access **Safety** System (LASS)
  - People => no beam
  - Beam => no people

MAD – Material Access Device

Guarantee that no person can enter through the MAD involuntarily or by mistake

Particularly in RESTRICTED MODE + PATROL :

Current solution is considered insufficient

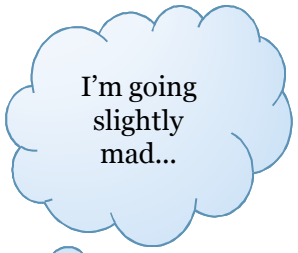
- Current approach
  - fine Movement detection
- but
  - Flashing lights,
  - Snow melting & water
  - Light changes, etc…

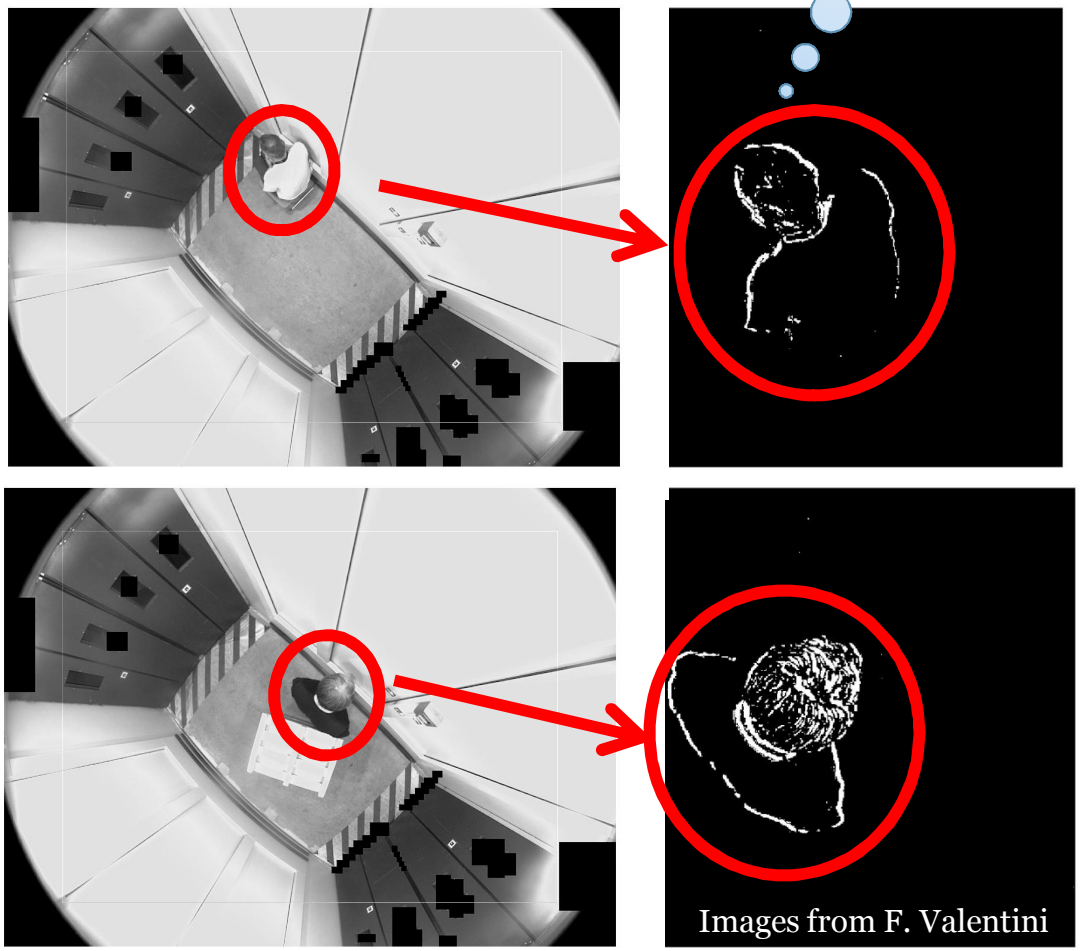
- Current difficulties include
  - too lax detection
    - False acceptance risk
    - ➔ potential Safety problem
  - too strict detection
    - False rejection high
      - ➔ Availability problem

MAD with people

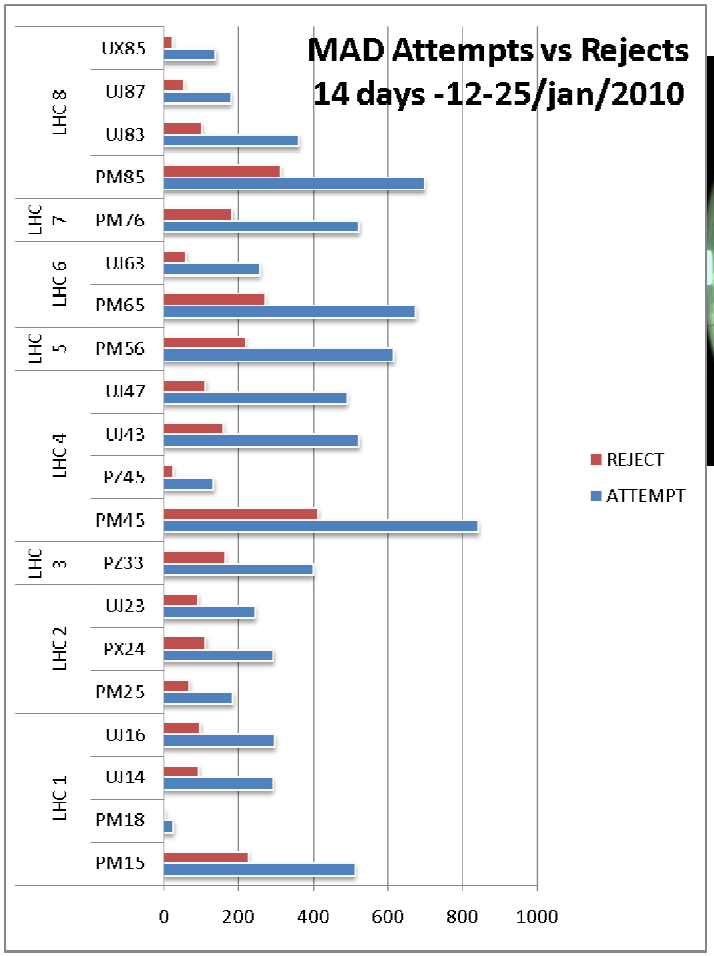
- Normal people trying to stay still
- Easily detectable target

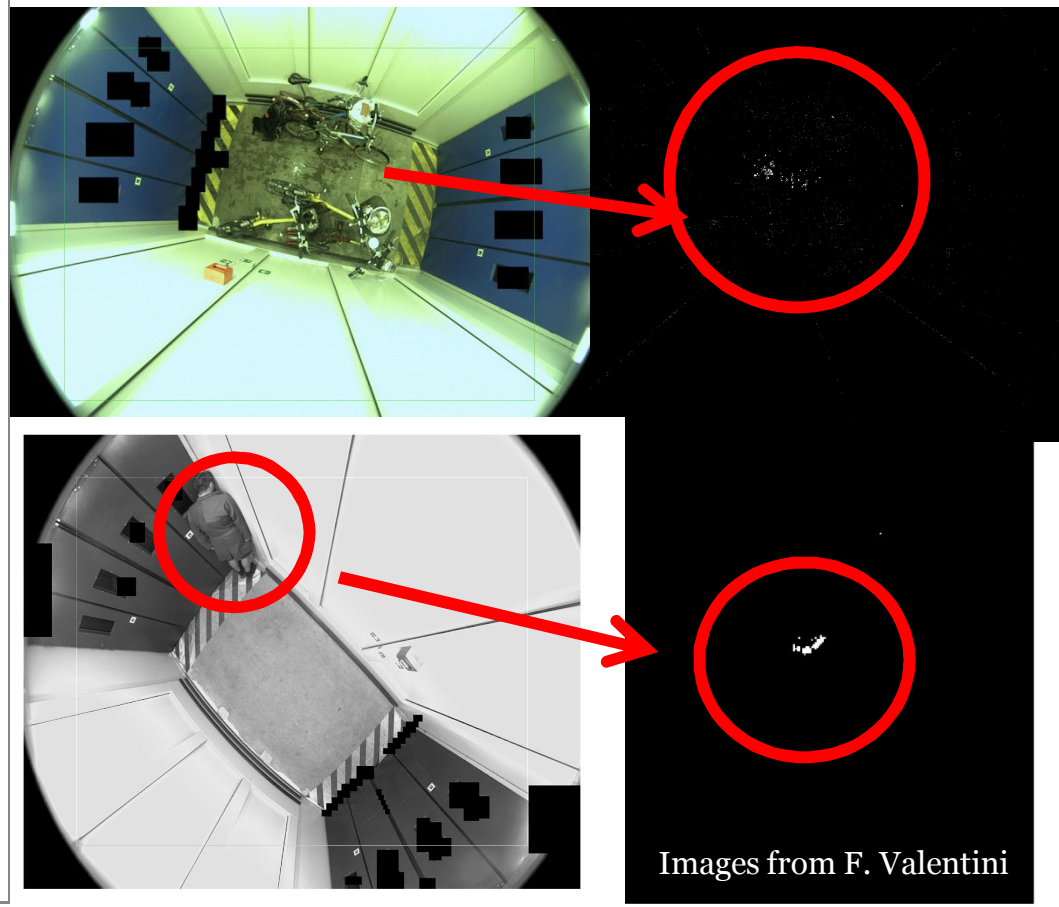
- However we are now with increased sensitivity in order to detect even the finest movement





MAD extremes

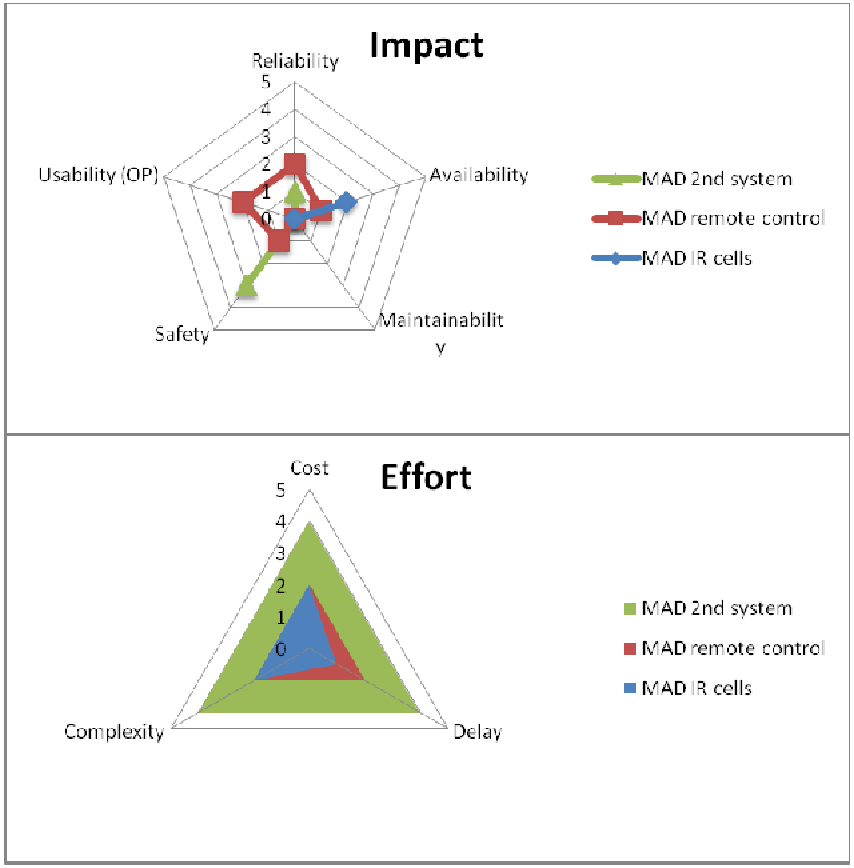




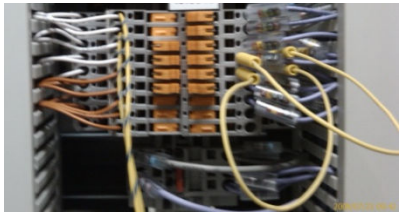
MAD – Material Access Device

- Design modification

- Actions foreseen
  1. Make detection "failsafe"
  2. IR cells as complement
  3. Remote control
  4. 2nd Redundant system of diverse technology (e.g. via thermal imaging)



EIS-f/m bypass



- 53 bypass action since June 2008
- 4 bypass actions in Jan 2010
- Each request is generally
  - Urgent
  - Moderately complex
    - 6-20 Cabled straps to execute each time
- If mistakes are made
  - Access forbidden in LHC
  - Evacuation sirens possible
- Status of EIS bypass available only in documentation

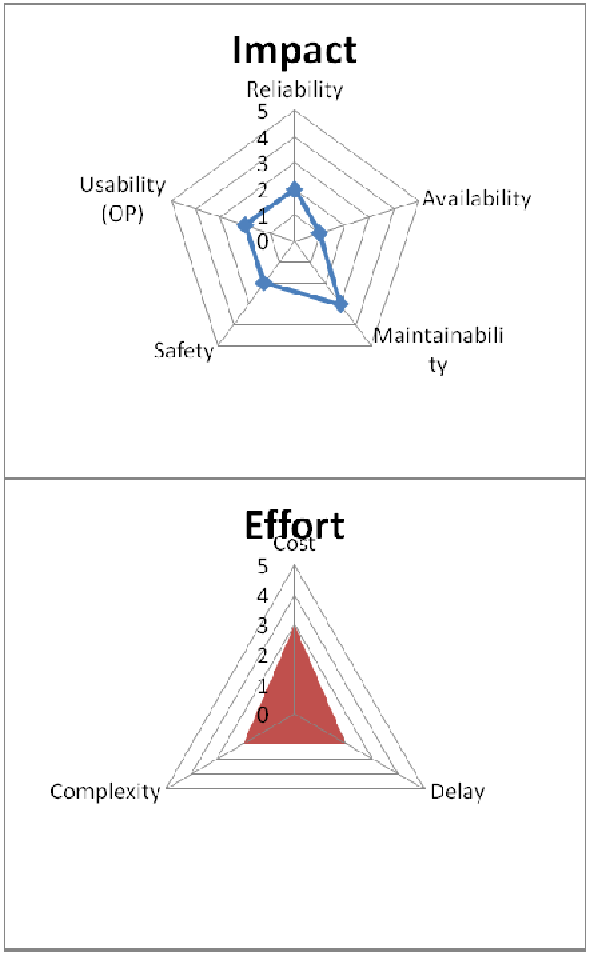
List of EIS

		22/01/2010	20/01/2010	19/01/2010	07/01/2010	16/11/2009	07/10/2009	05/10/2009	24/09/2009	21/07/2009	08/06/2009
EIS	LHC Point	Status	Status	Status	Status	Status	Status	Status	Status	Status	Status
RD34.LR3 + EMD304/3E	3.3	In chain	In chain	In chain	In chain	In chain	In Chain	In Chain	In Chain	Out of Chain	In Chain
RD34.LR7 + EMD304/7E	7	In chain	In chain	In chain	In chain	In chain	In Chain	Out of Chain	Out of Chain	Out of Chain	In Chain
ASB. VVSH.5L3.R	3.3	In chain	In chain	In chain	In chain	In chain	In Chain	Out of Chain	Out of Chain	Out of Chain	Out of Chain
ASB. VVSH.5L3.B	3.3	In chain	In chain	In chain	In chain	In chain	In Chain	In Chain	In Chain	In Chain	In Chain
MBIBH 2931M + ERD205/2R	2	In chain	In chain	In chain	In chain	In chain	In Chain	In Chain	In Chain	Out of Chain	Out of Chain
MSIB/MSIA 2952M + ERD135/2R	2	In chain	In chain	In chain	In chain	In chain	In Chain	In Chain	In Chain	Out of Chain	Out of Chain
TED29132	2	In chain	In chain	In chain	Out of Chain	In chain	In Chain	In Chain	In Chain	In Chain	In Chain
TED67765	8	In chain	In chain	In chain	Out of Chain	In chain	In Chain	In Chain	In Chain	In Chain	In Chain
MSIB 8813M + ERD220/8R	8	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain
MBAH 8783M + EMD401 (ou EMD605/8R)	8	Out of chain	Out of chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain
Conv. 18kV (RF)	4	In chain	In chain	In chain	In chain	In chain	In Chain	In Chain	Out of Chain	Out of Chain	Out of Chain
RF	4	In chain	In chain	In chain	In chain	In chain	In Chain	In Chain	Out of Chain	Out of Chain	Out of Chain
Electron Stoppers (4 valves)	4	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain	In Chain
LBDS	6	Out of chain	In Chain	In Chain	In Chain	In Chain	Out of Chain	Out of Chain	Out of Chain	Out of Chain	In Chain

EIS bypass in time

EIS-f/m bypass

- Technical improvement
- Solution foreseen
  - Pre-cabled electrical relay bypass possibility on main EIS-f/m signals
  - On-line signalisation in the CCC LASS Console
  - System built-in bypass procedure to give the DSO full control
    - e.g. interlocked keys, etc…

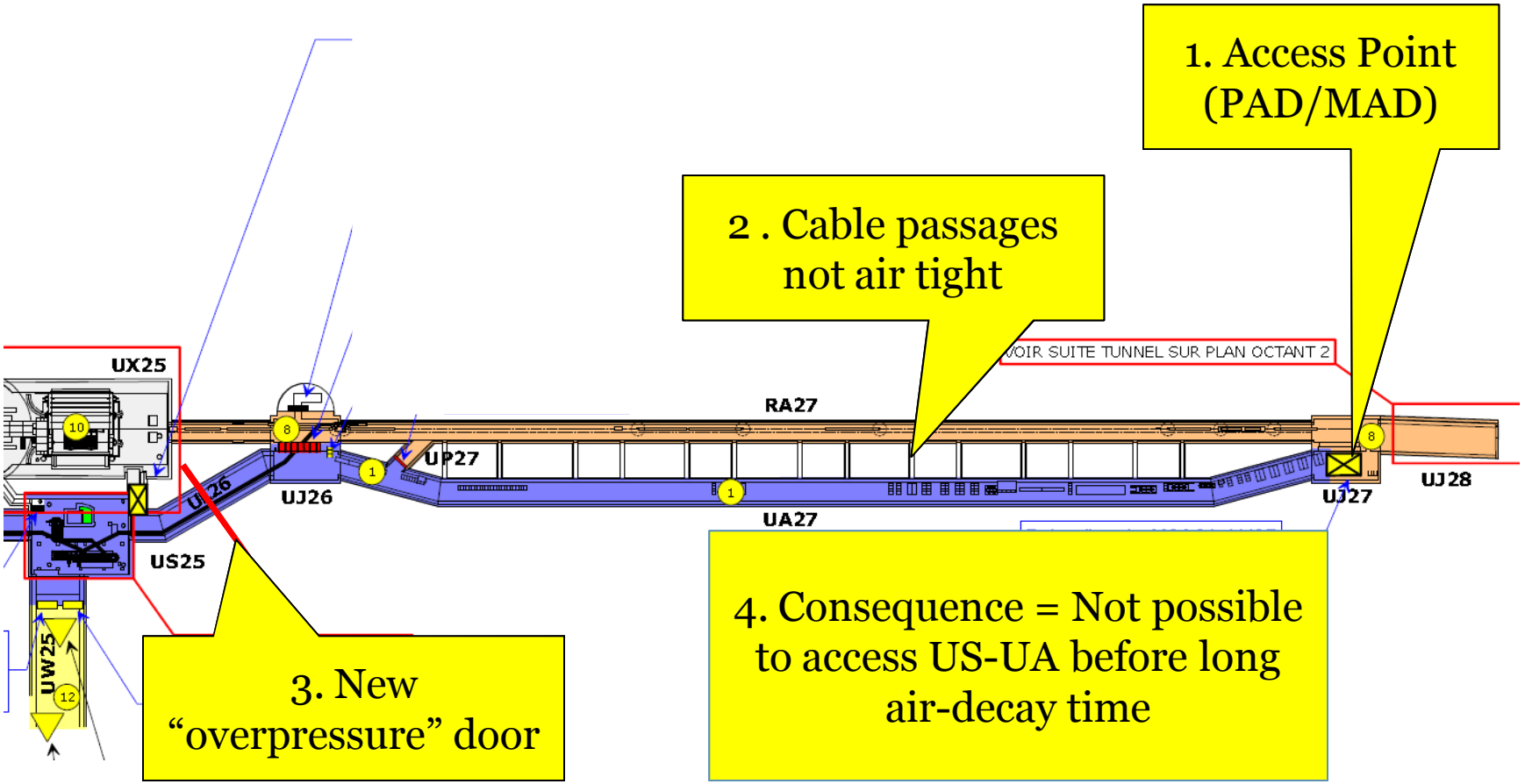


Access Safety vs. Ventilation

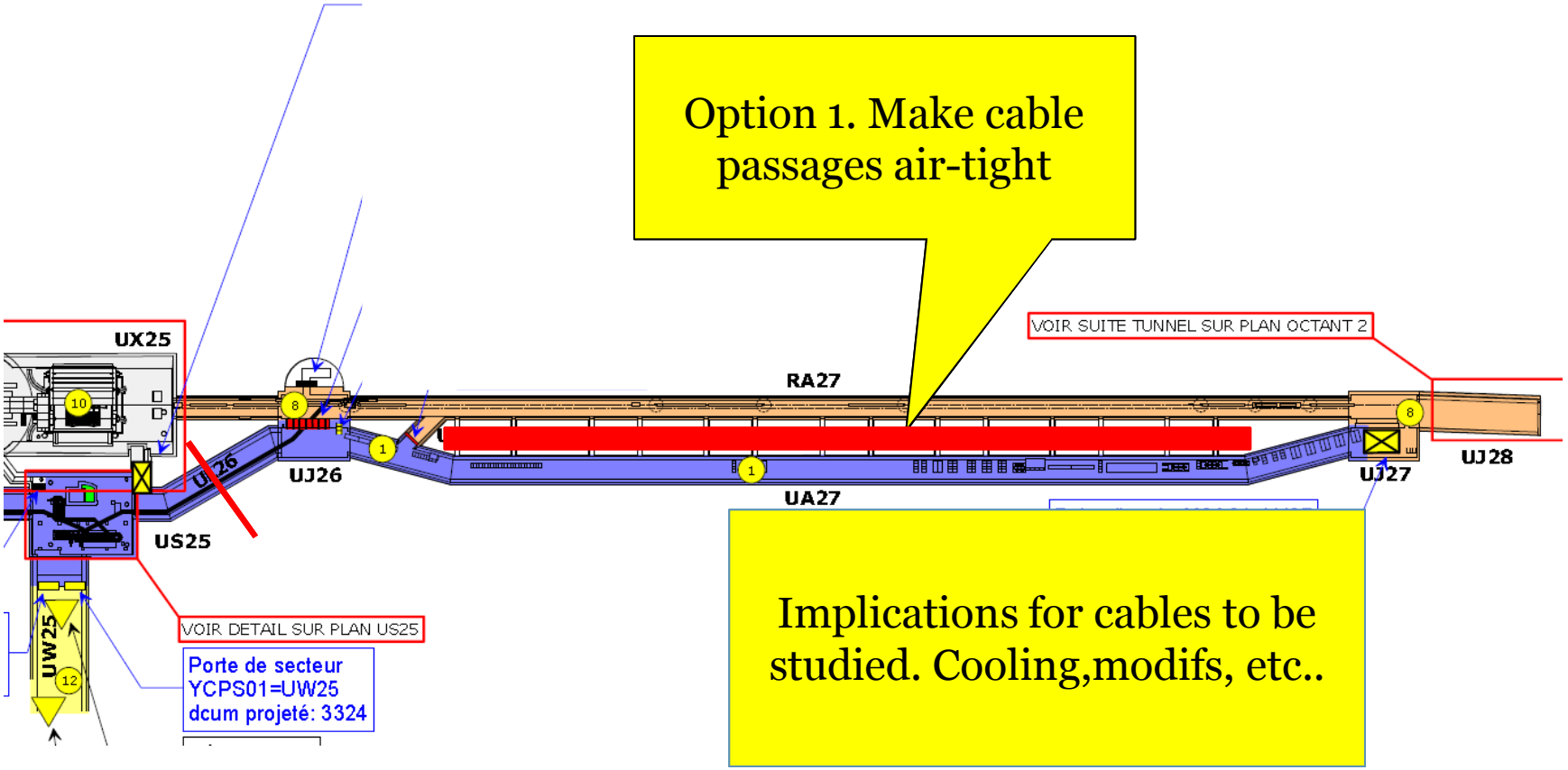
- Requirement
  - Align the Access sectorisation with the ventilation sectorisation
  - This is no longer the case, mostly in the UAs, but maybe also some other areas
- Consequence
  - If not done access to service areas shall be more limited than expected

- Let's take the example for LHC2 – UA27

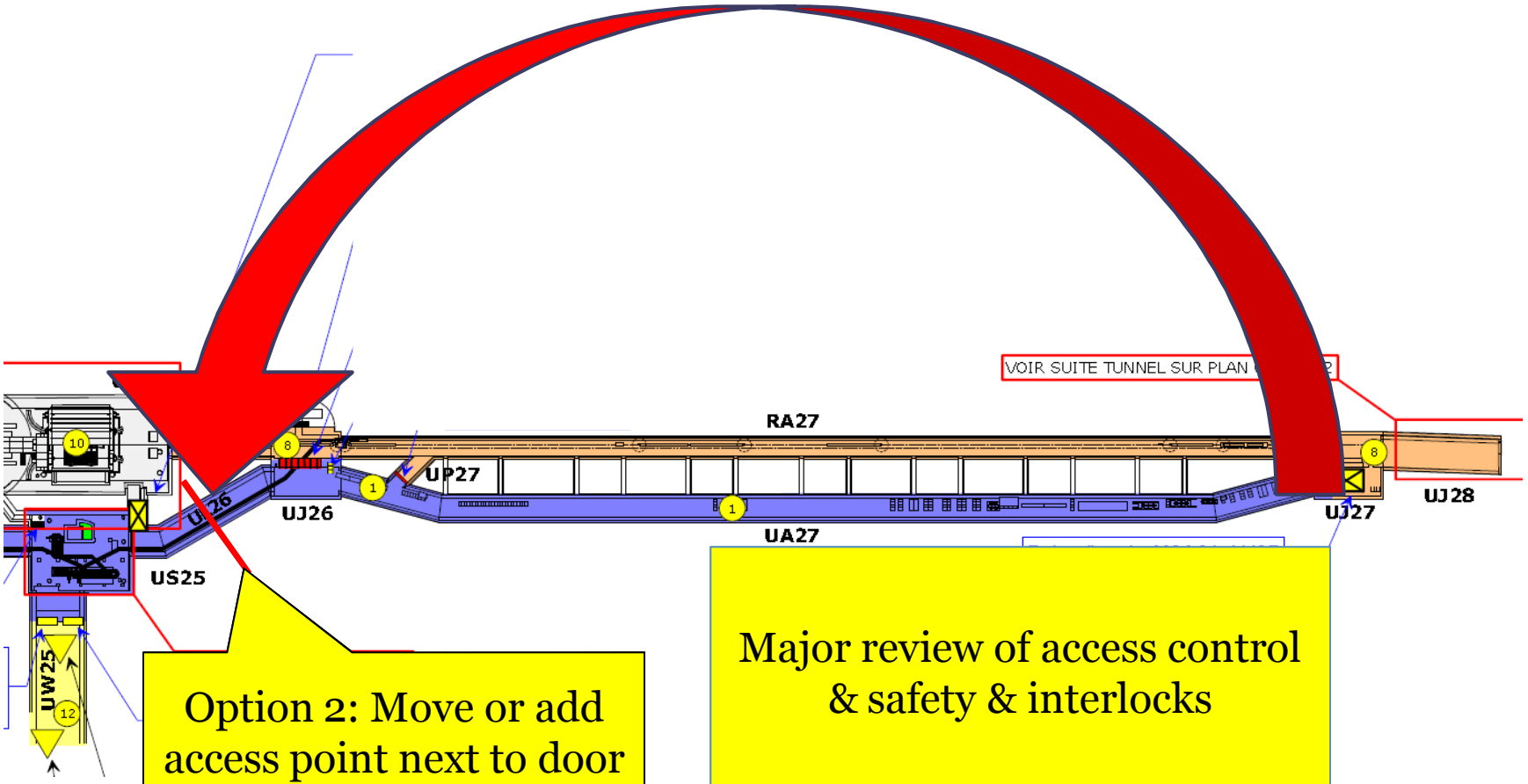
Access Safety vs. Ventilation



Access Safety vs. Ventilation - Option 1

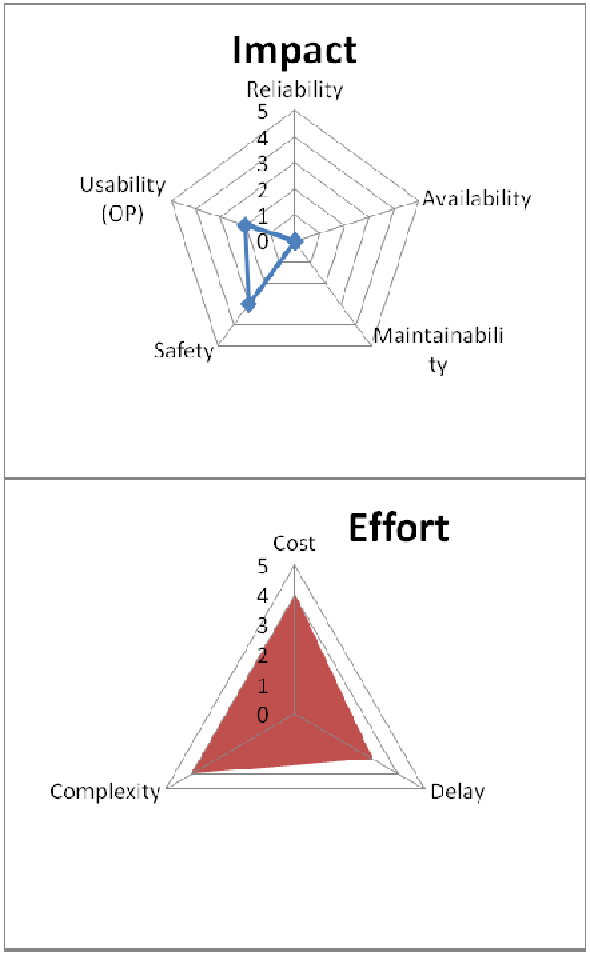


Access Safety vs. Ventilation - Option 2



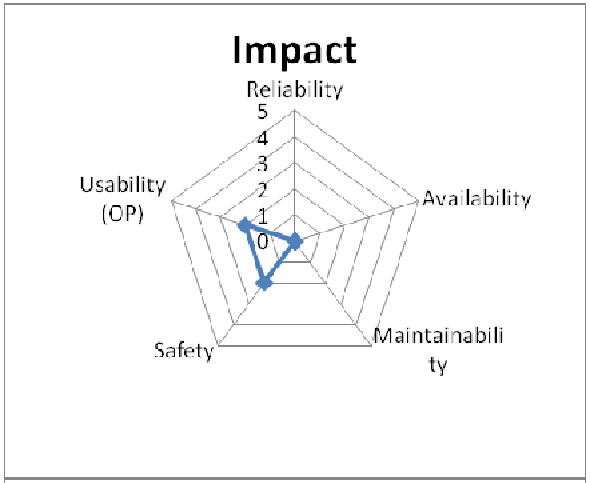
Access Safety vs. Ventilation

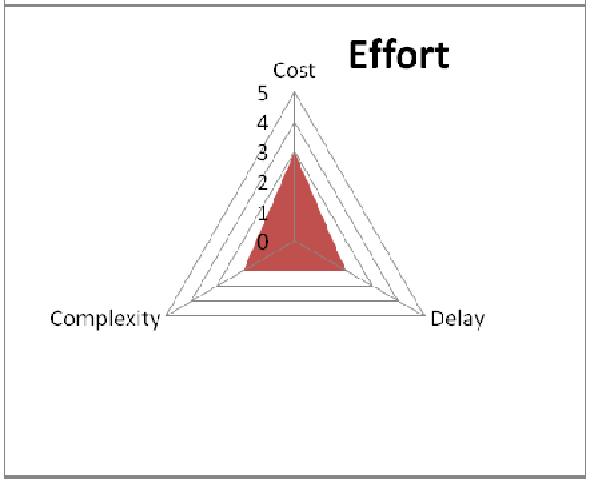
- This is not a new requirement
  - Non-air tightness has been known for a while
  - Must decide on course of action
    - Option 1 – make air-tight
    - Option 2 – modify Access
    - Option 3 – do nothing
- Study is necessary in 2010
- Design modification



“Overpressure” doors integration

- Requirement
  - Acquire the status of new doors in a more reliable fashion
  - related to previous issue on sectorisation and containment of a MCI
- Consequence
  - Not technically complex
  - Requires exhaustive non-regression testing
  - …New interlocks?
- Design modification/Scope increase

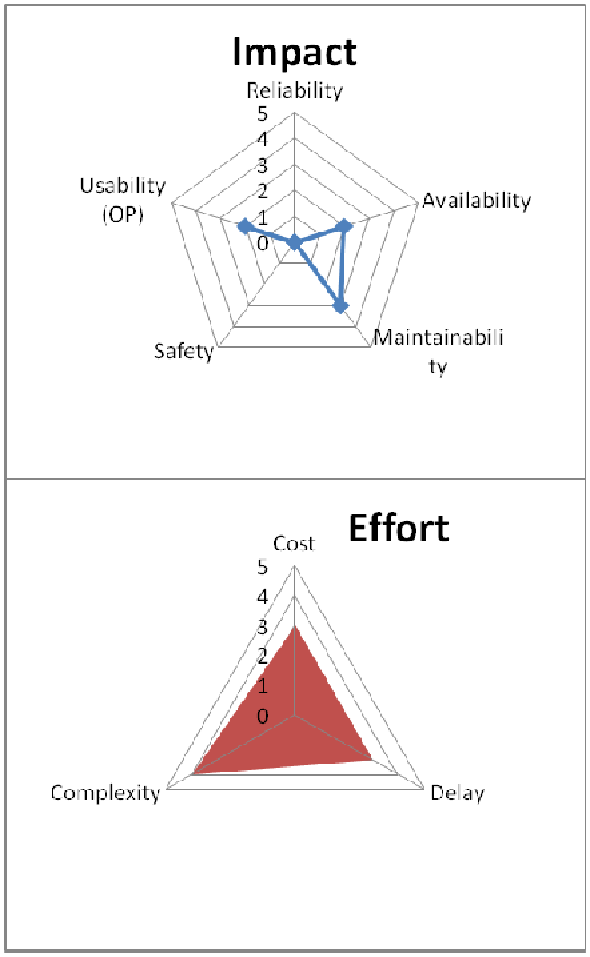


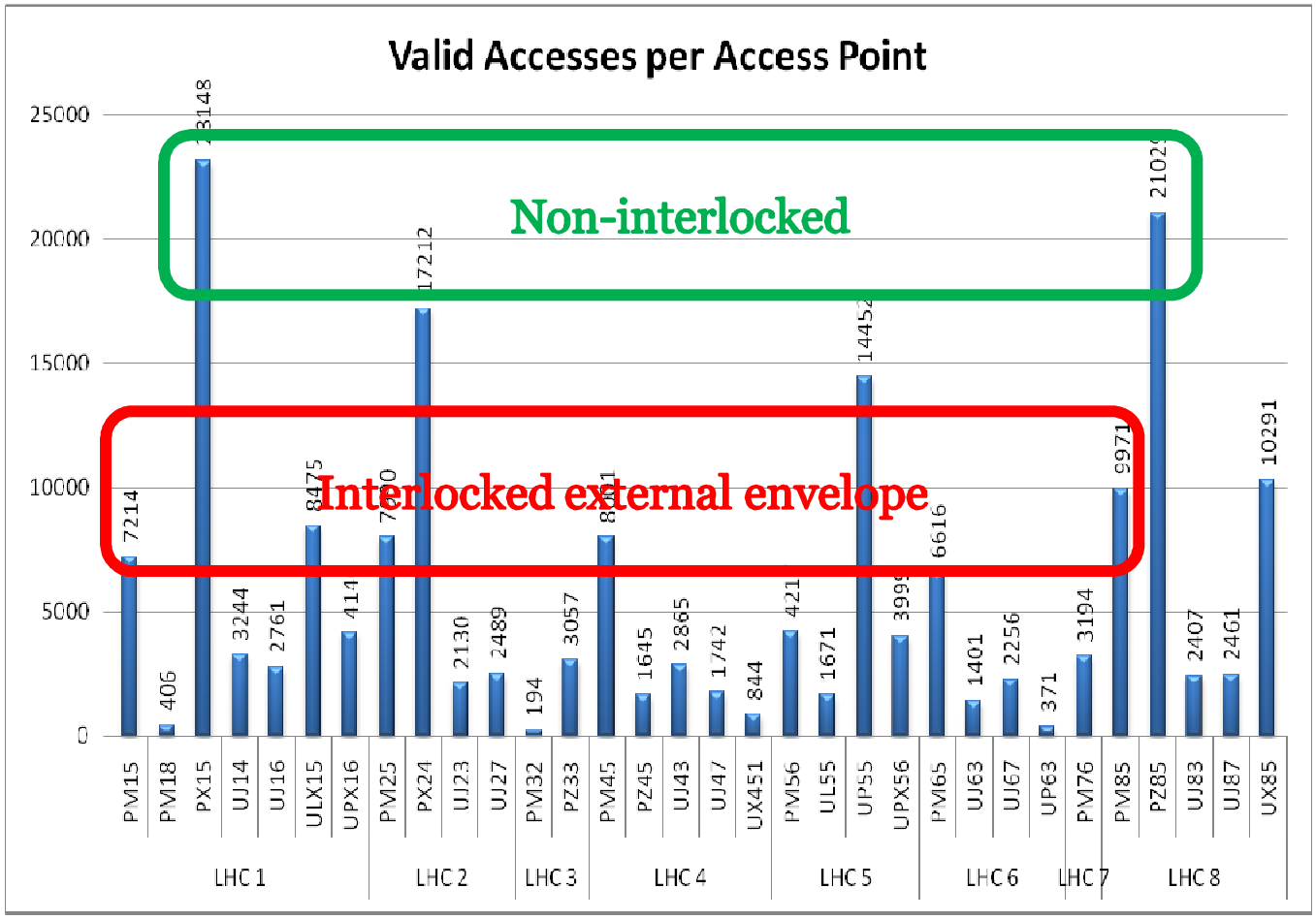


Sectorisation for Maintenance

- Requirement
  - Allow for maintenance in external envelope during run periods (PM shafts)
  - Most solicited interlocked access points
- Consequence
  - Move the external envelope inwards

  Or
  - Add additional door like in SPS
- Design modification



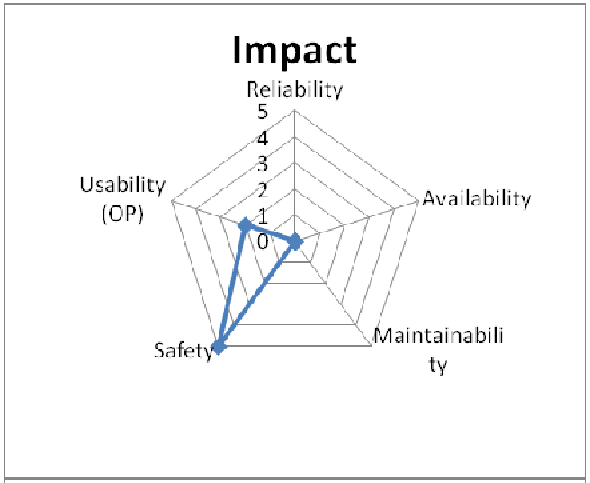


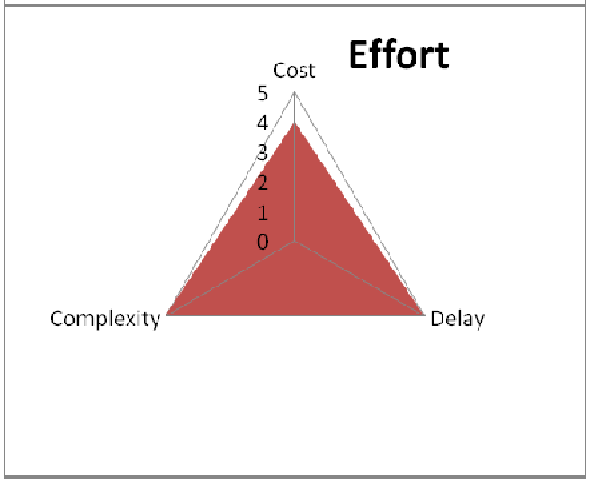
In 5 ½ month period

Aug 2009 – Jan 2010

New interlocks – Powering Tests

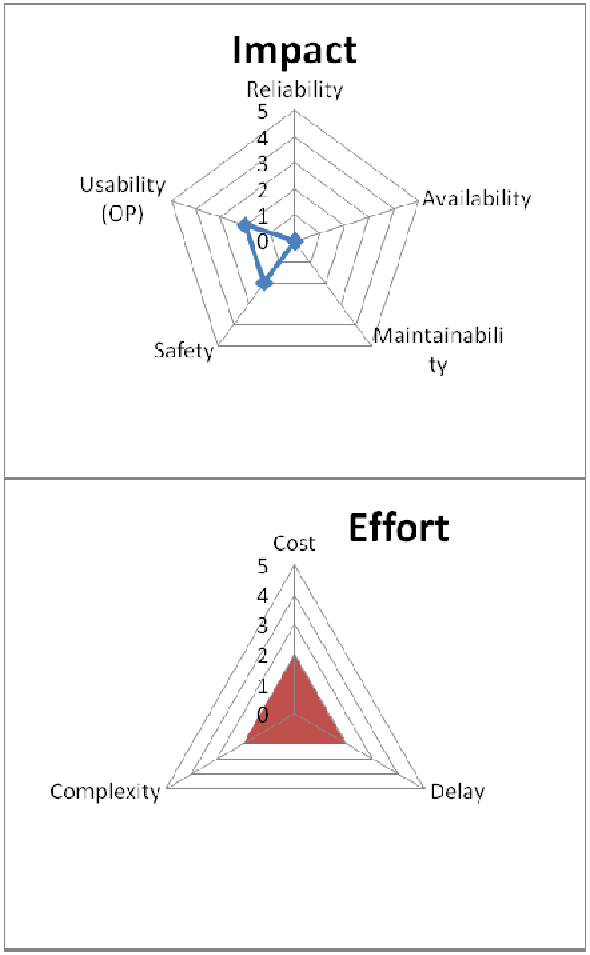
- Requirement
  - Cover the risk of MCI during Phase 2 powering tests
  - Interlock PCs in case of intrusion in (another) envelope
- Consequence
  - Risk analysis necessary
  - Can be extremely complex depending on the number of interlock points
  - May require Power Converter modifications to provide safety interlocks
  - May require re-sectorisation as before
- Scope increase/new risk





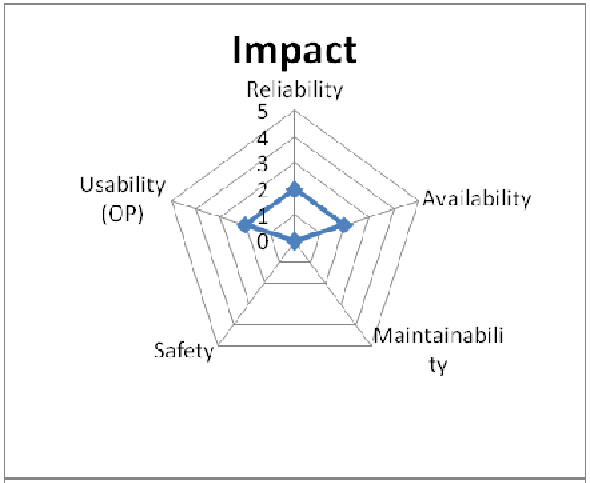
New interlock – fresh air supply

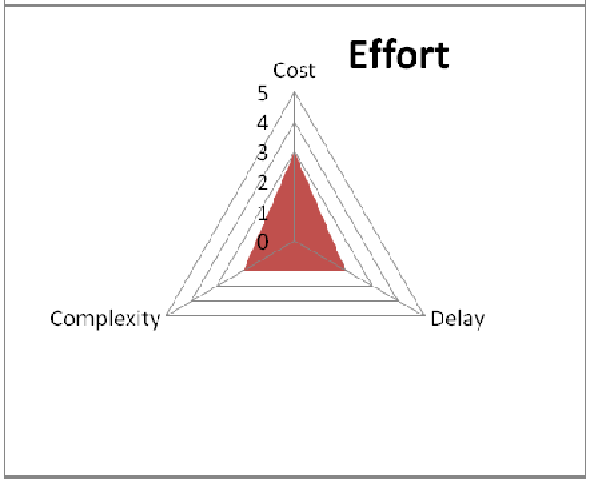
- Requirement
  - Stop people from entering LHC if the ventilation conditions are not OK
- Consequence
  - More complicated on the ventilation side than on the Access side.
  - Difficult to obtain this information
  - Technically not complex to implement for LACS
- Scope increase



R2E – Moving equipment

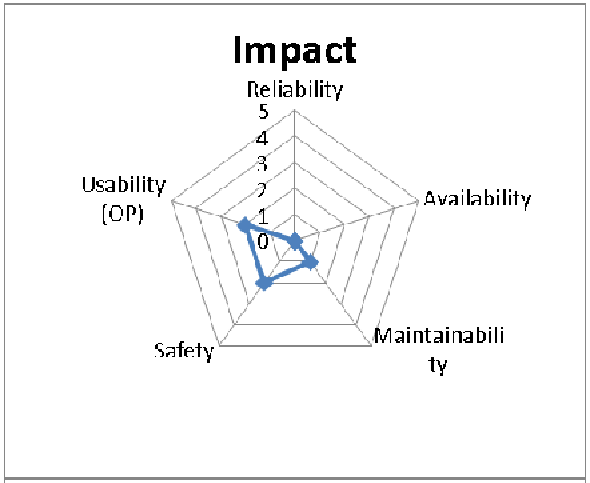
- Requirement
  - Remove critical equipment from areas that are subject to R2E effects
  - Areas concerned are
    1. UJ56
    2. UJ76.. ?
    3. UJ33, …. ?
- Consequence
  - Moving equipment requires re-cabling and finding new locations (integration)
- Design modification

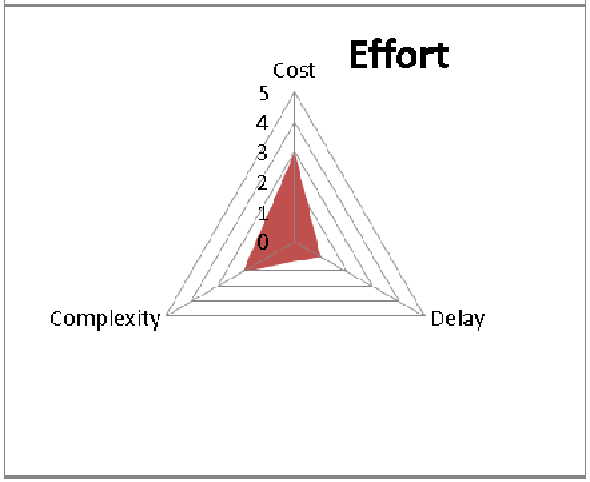




New access points (non-interlocked)

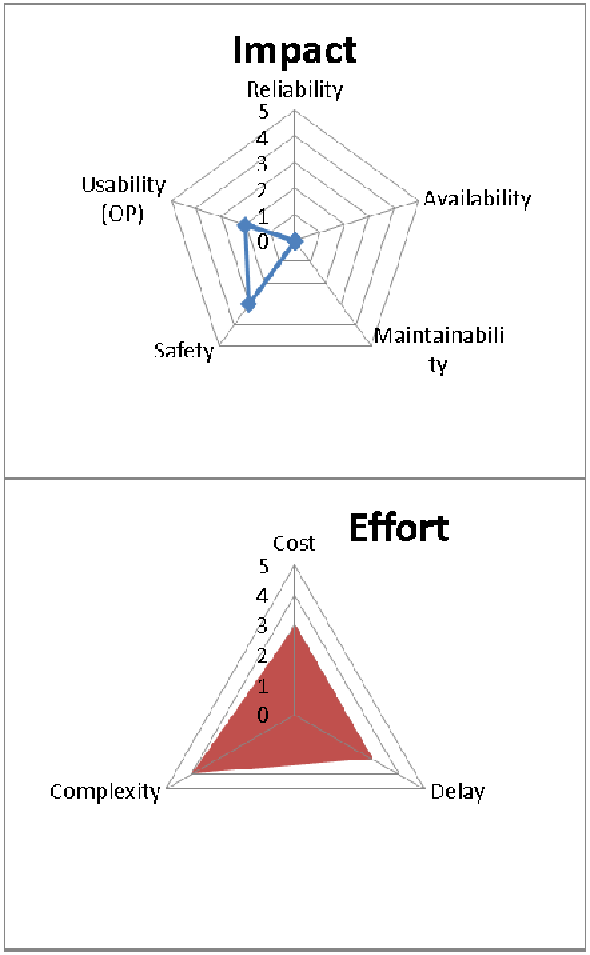
- Requirement
  - PM54 – CMS
  - Finish installation according to design so we can:
    - count underground occupants
    - Homogenise supervision & maintenance
- Consequence
  - Not technically complex
  - Civil engineering integration for new location requested by CMS
  - Can be done during beam
- Technical Improvement





New access points (interlocked)

- Requirements
  - TZ32 – CLIC alignment use
    - New PAD+MAD in US32
  - PZ65
    to be confirmed
    - when PM65 unavailable
- Consequence
  - Moving of existing end-of-zone doors & new interlocked zone
  - Re-sectorization implications
  - Re-cabling from PZ33
- Design modification



Other technical improvements

- PAD programme correction
  - To avoid losing patrols on passage
- Intercom improvement
  - Noise reasons next to compressor areas
- Video improvement
  - technological change to avoid freezing & improve fluidity
- IHM improvement
  - Capability of treating multiple access points simultaneously
- Improve LACS-LASS interfaces
  - Application of access modes
- Improve interface with ATLAS SSA

S2

S1

Slide 24

S1 include in list sharepoint as new item
Sedas, 1/19/2010

S2 include in list sharepoint as new item
Sedas, 1/19/2010

Thank you for your attention

Scale of graphs - example

Scale	Safety	Scale	Cost (CHF)	Delay	Complexity
0	no improvement	0			
1	minor improvement	1	> 1 000	6 months	simple SW or HW
2	medium improvement	2	> 10 000	1 year	SW or HW
3	major improvement	3	> 100 000	2 years	Complex SW or HW
4	New safety function	4	> 1 000 000	3 years	Re-Design issue
5	New risk covered	5	> 10 000 000	> 3 years	New concept

Other criteria: qualitative scale of 0-5

- Reliability
- Availability
- Maintainability
- Usability