



MTTR and Spare Parts in TS/ASE

Rui NUNES
TS-ASE



Outline

- Scope
 - Risks & scope covered by systems
 - Impact of systems malfunction
- Maintenance
 - Service Scope
 - Spare parts & D7i usage
 - Stores
- Dependencies
- Some Statistics
- Consolidation projects
- Operation issues
- Conclusion



Scope of ASE Systems

■ Alarm Systems

- Fire & Gas Detection
- Audible Evacuation Systems & BIW (sirens)
- Alarm Transmission (CSAM)

■ Access Systems

- ZORA Access
 - Primary Areas (PS & SPS)
 - Secondary Areas (mostly PS & SPS Experimental areas)
- SUSI Access
 - Access to site
- Video Surveillance



Impact of malfunction (1/3)

■ Alarm Systems malfunction

- Potential Personnel & Material Safety issues :
 - Detection Systems : no detection in case of real danger
 - CSAM: no alarm in FB / CCC → delayed human re-action

- **NO BEAM interlocks** in the LHC injector chain
 - Only optional interlock is CNGS area with Fire Detection
 - Note: BIW malfunction (Evacuation) can prevent transition to Closed Access Mode



Impact of malfunction (2/3)

- ZORA Access
 - PS Primary Access malfunction:
 - No beam in PS and as a consequence neither SPS or LHC
 - SPS Primary Access malfunction:
 - No beam in SPS and as a consequence neither in LHC (PS ok)
 - PS or SPS Secondary Areas Access malfunction
 - No beam in associated Exp. Area
- In all cases malfunction can lead to
 - Unwanted radiation exposure of personnel (main risk)



Impact of malfunction (3/3)

- SUSI Access
 - No beam interlocks
 - Malfunctions imply difficulty to get to
 - office or lab (buildings with access control)
 - Site entry (Meyrin, Preveessin, SPS & LHC surface sites)
 - Potential security implications but no safety issues
 - No trace of entry

- Video surveillance
 - Recently inherited from IT-CS
 - No beam interlocks
 - Worst cases
 - PS → no personnel access possible from CCC/CSA
 - SPS → no material access possible from CCC/CSA
 - Security implications



Maintenance

- Major maintenance activities performed with help of industrial contractors
 - Alarm systems → Contracts with manufacturers (4)
 - Access Systems → Contracts with the installers


- Stand-by Piquets provided
 - Fire & Evacuation piquet (contractor)
 - Gas & ODH piquet (contractor – under renewal)
 - CSAM controls piquet (contractor & CERN)
 - SUSI piquet (contractor)
 - ZORA piquet (CERN staff machine run only)



D7i tool

- D7i is the CAMMS tool used to manage the maintenance activities
 - CAMMS – Computer Assisted Maintenance Management System
 - *in French GMAO : Gestion de la Maintenance Assistée par Ordinateur*
 - Asset inventory and tracking system
 - Tracking of preventive and corrective maintenance activities
 - Spare parts management
 - Reporting tool for statistics
 - Complete use in Alarm Systems since approx year 2001
 - Recent use and implementation in SUSI access & video
 - Implementation done for LHC ZORA Access
 - Review needed for PS & SPS SUSI access

- To summarize :
 - it is an essential tool in the correct management of a large equipment park
 - See presentation later by D. Widegren



Spares & Stores

■ Spares

- Are a major part in the budget and strategy for the maintenance management
 - Alarm Systems – park is recent <20 years and spares are still available from manufacturers and are replaced when no more spares exist
 - Access Systems – most of systems have custom-made or (worse) home-made parts that cannot be found
- Spare parts availability dictate evolution and thus the replacement of systems
 - PS ZORA access systems (next major renovation)
 - No more access points can be added without removing existing ones
 - No easy management of access during shutdown can be done
 - No evolution possible for dosimeter access control
 - SPS ZORA access systems
 - Starting to grow old, but not in catastrophic state yet
 - Should we let it get catastrophic before we consolidate ? Is this acceptable ?
 - Difficulty to get S5 spare parts. No more key distributors or locks.
- Price of spares increases spectacularly when “custom-made” components are used
 - Custom-made “key distributors” and “locks”

■ Stores

- Area in B104 & B282 – Meyrin (as of next month) & Area in B876 – Preveessin



Dependencies: Controls

- Safety Systems increasingly depend on sophisticated controls for operation
 - *Note: Critical functions are shielded as much as possible from these phenomena*
 - Software
 - Operating systems
 - Windows (2000, 2003 Server, XP, Vista, etc...), Linux (SLC3, 4, 5,... And counting), Unix, LynxOS, etc...
 - Controls Software Products
 - FactoryLink, PcVue, WinCC, etc...
 - Other
 - Java updates, security patches, network changes, etc...
 - PLCs: S7, S5, Wago, ...
 - Software evolution drives hardware evolution
 - Dependencies on PCs and management of machines
 - This is not simple (CMF especially complex and impenetrable)
 - These activities are heavy and time (resource) consuming and require special competencies that need to evolve in the maintenance teams.



Dependencies : other

- **Electrical Power**
 - Autonomy varies from a few minutes to a few hours
 - autonomy of a few hours (~4) for critical systems
 - Degradations are to be expected in any case
 - More important systems are connected to Diesel generators
- **CERN Technical Network**
 - Alarm systems (detection) – not dependent
 - CSAM – very serious deterioration in case of TN failure
 - ZORA PS, SPS & LHC Access partially affected but safety functions intact
 - SUSI access will be partially affected
 - Video & intercom : not available in CCC
- **IT Central Database Services**
 - IT/DES – LACS, LASS, SUSI, CSAM
 - Not critical for machine operation but handicapping if not available for long periods
- **Radiation issues**
 - For PS & SPS there does not seem to be a major issue since electronics is generally placed in non radioactive areas



Some Statistics

■ Alarm Systems

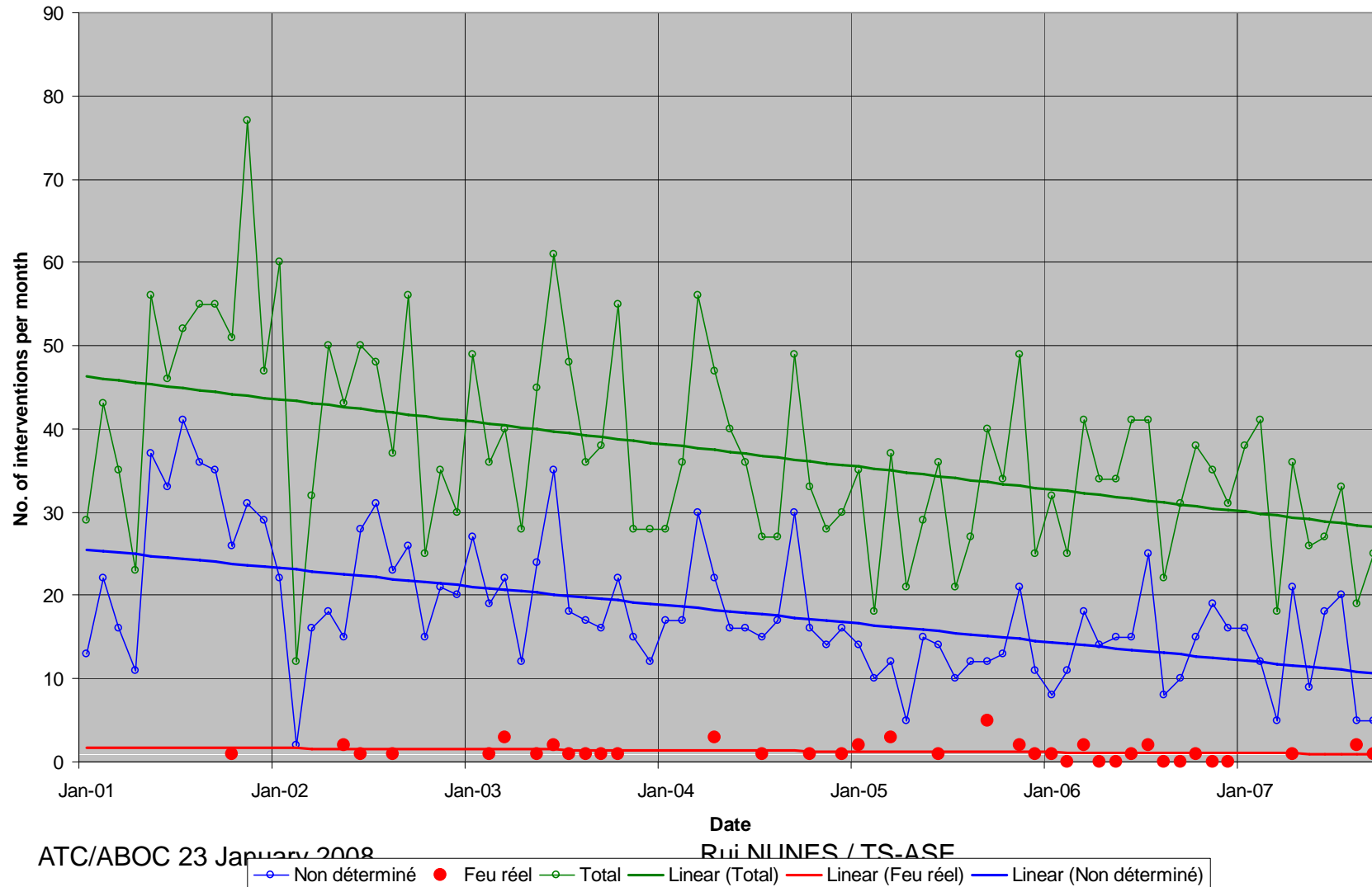
- More statistics available due to higher level of contractor supervision tools

■ Access Systems

- Such tools have not yet been implemented for ZORA PS & SPS access, so statistics are more difficult to obtain
- In SUSI domain the new integrated RFID Access System provides some statistical tools

Alarm Systems FB interventions

Fire Brigade interventions 2001-2007 Q1



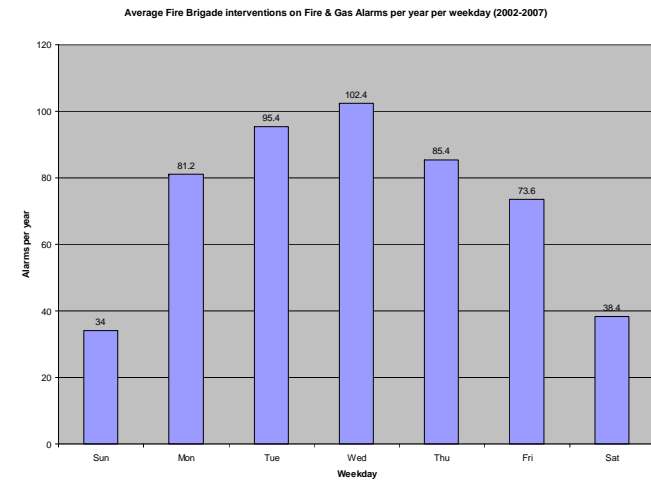
Alarm Systems FB interventions

Fire & Gas Detection Inventory numbers

Fire & Evac Panels (CIE)	~82
Fire Detectors	~7333
Gas Panels (CIE)	~41
Gas Detectors	~552

The “working days” phenomenon

Notice the strong (factor 3) decrease in “spurious alarms” during weekends



	2002	2003	2004	2005	2006	2007	Grand Total	Average
Sun	28	47	21	18	27	29	170	34
Mon	75	82	77	52	69	51	406	81.2
Tue	89	87	76	83	74	68	477	95.4
Wed	66	86	105	114	81	60	512	102.4
Thu	64	84	73	43	81	82	427	85.4
Fri	59	82	71	40	49	67	368	73.6
Sat	30	48	31	19	35	29	192	38.4
Grand Total	411	516	454	369	416	386	2552	510.4



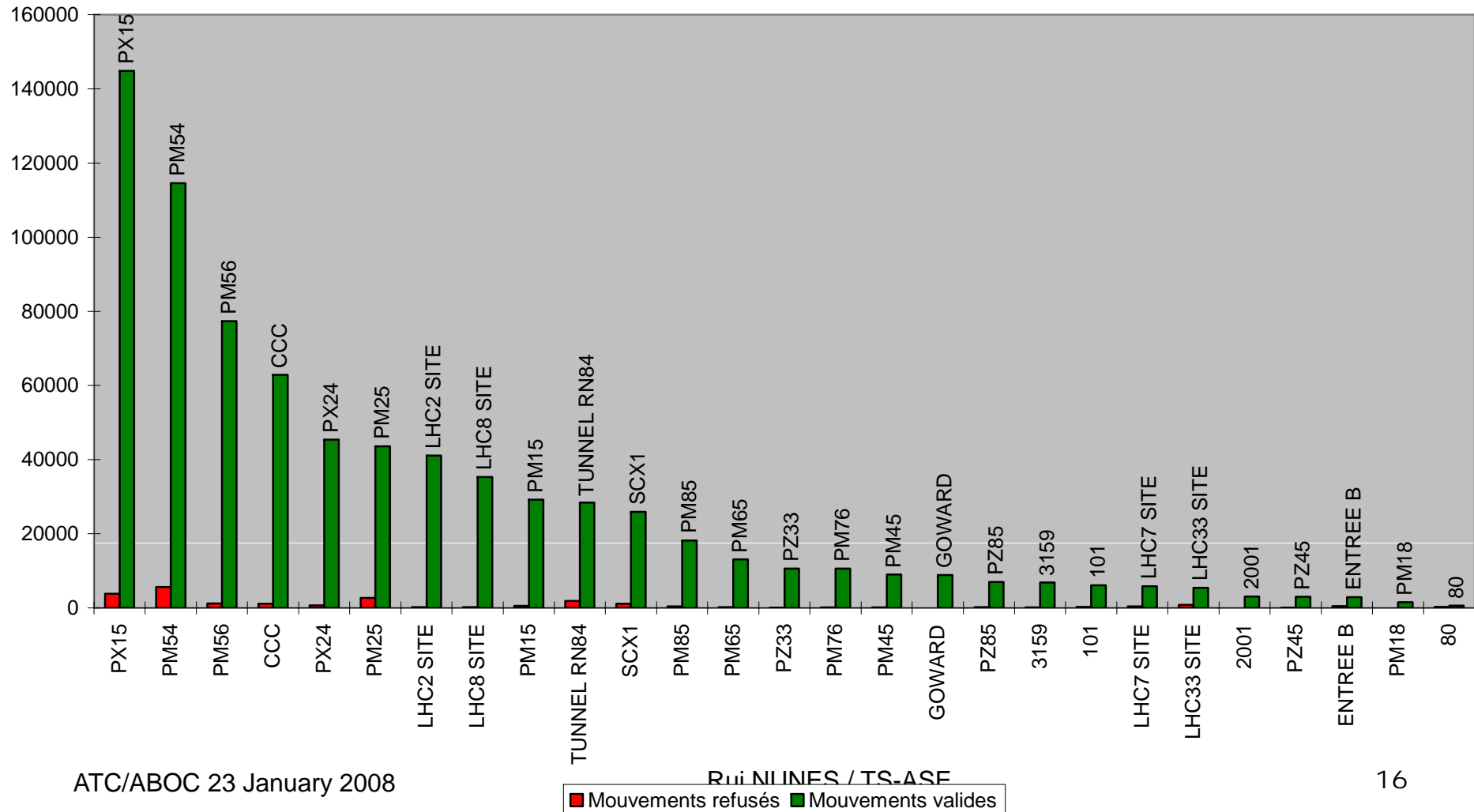
Some KPIs for 2007 from D7i data

Alarm Systems only

- Corrective / Preventive Ratio 17.8 [%]
 - *Time spent on corrective maintenance (1175h)*
 - *Time spent on preventive maintenance (6611h)*
 - *Corrective is 15.1% of total time*
- Repeated Failure Rate 2.49 [units]
 - *# repairs (956) / # equip concerned (384)*
- MTTR 1.31 [h]
 - *Careful – does not include reaction time*
 - *Time spent on corrective maintenance (1175h)*
 - *# depannages (899)*
- Fire Brigade Interventions 386 [interv]
- Piquet interventions 395 [interv]
 - *Approx 1 per day*

SUSI MIFARE Movements

SUSI MIFARE Movements from 01.07.2008 to 31.12.2007 (6 months)





PS Primary Access

Shutdown 2006/2007 (11.12.2006-09.03.2007)

Porte	Entries only (not exits)
D21	886
D31	1400
D101	84
D102	3553
D111	363
D121	1670
D221	1607
D401	256
D621	232
D151	204
D152	160
Total	10'415



Statistics faults in PS/SPS ZORA

- No real statistics available

- PS Primary areas

- 1 problem with Fire Detection (few hours stop)
 - Incidents with cable in D201 caused some trouble during shutdown
 - Problem found with help of TS/EL cable testing (bad connections in cable patch)

- SPS Primary areas

- No major events noted in 2007
 - Although some cable problems in North Area
 - Cables are to be tested this shutdown with TS/EL



Resource (budget) issues

- Consolidation is very important for safety systems
 - Lifetime of systems is estimated to be 15-20 years max
 - So every year, on average and in theory, there should be a minimum of 1/20 of the installed base replaced
 - → 5% per year
 - Of course this does not happen....

- So every now and then we have urgent and expensive consolidation projects....



Consolidation projects to be started

1. PS primary access (to be started ASAP)
 - Awaiting functional specs/requirements from AB
 - We TS-ASE remain available to advise and guide the technical issues
2. PS & SPS ZORA Video & intercom renewal
 - Service transferred from IT/CS in 2007
 - To migrate to VideoOverIP due to total obsolescence
3. SPS primary access
 - To be started immediately after PS
 - Structure very similar to LHC
4. SPS secondary acces
 - Structure identical to PS primary areas that is functional and working since 1 year now.
5. SPS fire detection consolidation
 - Complete revision of the SPS underground shall be needed to insure performance



Operation Issues

■ Operation issues

- Access to SPS requires dosimeter with RFID at present
- In SPS in order to ensure a better control of exits, it will be necessary to swipe the dosimeter for EXIT also.
 - Implementation under way in this shutdown on request of AB DSO
- Attention to the strain on purchase of the dosimeters for LHC access reasons can impact the whole CERN community
 - SC/RP provider has important delays
 - Good timing is important not to waste resources on people who do not need dosimetry before beam arrives



Conclusion

- ASE deals with Safety & Security Systems
 - Maintenance and Consolidation of these systems are strategic for the operation of the machines and for personnel safety
- Maintenance via external contractors allows CERN to optimise internal resources for “core” issues

- However these systems are evolving in technology and require an **evolving competence in controls and computing**
 - Networks, automation, databases and SCADA
- **Better usage of tools** (such as D7i) are needed in order **to obtain more significant statistics** and KPI
 - This gives better fundamentals for consolidation activities
 - Would be useful that AB/OP logbook refers to specific categories to help the ASE maintenance teams to track OP problems
- **Homogenisation of Access systems** is fundamental for improving the quality of the maintenance service and reducing the impact on operation of machines



Thank you for your
attention