TOWARDS A COMMON MONITORING SYSTEM FOR THE ACCELERATOR AND TECHNICAL CONTROL ROOMS AT CERN

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CERN Operation Today
Why?

• The LHC challenge
• **Increase the overall accelerator availability** by reduction of restart time after (major) breakdowns
• **Monitor the availability of accelerators** for concurrent modes of operation in close collaboration with all operation teams
• **Tool for re-scheduling and training**
“Gestion Technique Pannes Majeures” (GTPM)

http://gtpm.web.cern.ch/gtpm/SPSRestart/index.html
What to Monitor?

- Cooling & Ventilation
- Electricity (HT, MT, BT, …)
- Safety (Technical Faults)
- Access (Technical Failures)
- Computing Infrastructure
- Vacuum (Pumps, Pressures …)
- Accelerators (power supplies, magnets, …)
- Cryogenics (Pumps, Temperatures)

MCR
PCR
TCR
How to get there?

- **Accelerator Oriented Monitoring**
- **Homogeneous method to define/engineer monitoring tools:**
  - Identical for all actors: (MCR, PCR, TCR, stand-by services, …)
  - Oriented to operator role & tasks
- **Monitoring tools for:**
  - Failure assessment & accelerator restart
  - Systems, functions and correlations: (elec., cooling, RF, power converters …)
The Method

Accelerator Operation Scenarios

System Remote Supervision

Accelerator Control System

Technical Infrastructure Monitoring System

Monitoring Engineering

Accelerator Systems & Processes

Technical Infrastructure Systems & Processes

System Design and Documentation

Task Oriented Monitoring Diagrams / Tools

Operation Oriented System Documentation

System Remote Supervision

Accelerator Control System

Technical Infrastructure Monitoring System

Monitoring Engineering

Accelerator Systems & Processes

Technical Infrastructure Systems & Processes

System Design and Documentation

Task Oriented Monitoring Diagrams / Tools

Operation Oriented System Documentation
Individuation & Identification

• Operation scenarios
  – Injection, beam acceleration, proton physics, ion physics …
• Actors & Responsibilities
  – control room operators, stand-by services, equipment experts …
• Accelerators/Experiments: main systems/processes
  – vacuum, magnets, beam instrumentation …
  – critical for the running of the accelerator/experiment
• Technical infrastructure systems
  – electricity, cooling, ventilation, access systems …
• Sub-systems/processes
  – dipoles, kickers, cooling towers, demineralised water …
• System/process/sub-process correlation
• Critical paths for each operation scenario
4 Levels of Monitoring Tools

- General States Overview
- Accelerator Functionality View
- Detailed Infrastructure Monitoring Diagram
- Process Equipment View
Functional/Logical switch-on Sequence
Power Supply

Cooling
Accelerator Functionality - 2

SPS injection - BA2

- MM Cooling

Demineralized water

PS  DP  MM  Main magnets

SMD

Lines  Uptimes

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Detailed Infrastructure Monitoring Diagram

Functional/Logical switch-on Sequence

Preferred switch-on

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Process Equipment

Power Supply

Cooling
Benefits

- **Improvement of collaboration** and understanding between all actors
- Best possible **restart strategy** to respond to the **operation scenarios**:
  (beam in TT10, beam acceleration …)
- Impact estimation of failure to redefine priorities and **machine schedules**
- Impact evaluation of maintenance & process derivations on machine exploitation – **conditional maintenance**
- **Training tool** for newly recruited operators and external contractors
Accelerator Oriented Monitoring

- Accelerator Operation Scenarios
  - Accelerator Control System
  - Technical Infrastructure Monitoring System

- System Remote Supervision
  - Monitoring Engineering
  - Accelerator Systems & Processes
  - Technical Infrastructure Systems & Processes
  - System Design and Documentation

- Task Oriented Monitoring Diagrams / Tools

- Operation Oriented System Documentation

- Technical Infrastructure Monitoring System

- Accelerators: power supplies, magnets...

- Cryogenics: pumps, tritators

- TCR

- Computing Infrastructure

- Vacuum

- Refrigeration

- Electricity: HT, MT, BT...

- Safety: Technical Faults

- Access: Technical Faults

- Cooling & Ventilation

- Operation: MDR, PCU, JT, Equipment, Machines, ID, IDP

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Perspectives …

• Extension to the **PS-Complex**
• Extension to the **experimental areas**
• Complete implementation in **monitoring systems**
• Establish **Information & Data Management**
• Extension to the **LHC machine**
• Extension to **LHC experiments**