Planning and Tracing a 2-year Long Shutdown Period

Petra Schütt, Stephan Reimann, Markus Vossberg
Content

- GSI & FAIR
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- Current Organization
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Petra Schuett: Planning and Tracing a Long Shutdown
FAIR Phase 0

- FAIR experimental program carried out using FAIR detectors, upgraded GSI accelerators for FAIR and CRYRING, first beam time 2018
- Upgrade of existing accelerators for better reliability and better performance
- Construction of FAIR: Civil Construction and Implementation of Accelerators (and Experiments)
- Refurbishment of campus infrastructure → contradictory requirements → resource conflicts (money, personnel)
Standard Shutdown

- Duration: 2 - 10 weeks
- Work on the accelerator system
  - maintenance work
  - repairs
  - insertion of new devices
- Prioritization and planning by machine coordinators
  - Personnel planning by department heads
- Scheduling and tracing by shutdown coordinator
  - operations department
  - MS Project plan
  - logical and chronological dependencies
  - 150 tasks per week
- weekly meeting
  - with shutdown coordinator, all machine coordinators,
  - the security responsible person for each machine and
  - one contact person of each concerned department
Shutdown Coordination

**preparation phase**

prioritization, scheduling

- shutdown coordinator
- machine coordinators

**weekly Coordination Meeting**

reporting, adjusting

- shutdown coordinator
- machine coordinators
- safety responsible persons
- involved executing departments
- project responsible persons
Previous Experience of longer shutdowns

- one year of shutdown in 2013
- 1,5 years of shutdown in 2014-2016

Main changes:
- Group shutdown tasks by subprojects, not by department
- Testing periods are helpful not only to test devices and sustain reliability but also to force the departments to meet the deadlines
- Detailed planning of media availability is necessary

Same as for normal shutdowns
- Planning of subprojects and prioritization done in the preparation phase by machine coordinators.
- Expect several 100s of individual tasks in the MSproject plan.
- Discuss weekly a time window of 2-3 weeks, plus implications of incidents for the future
The Major Shutdown Expected in 2015...

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
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<th>2016</th>
<th>2017</th>
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</thead>
<tbody>
<tr>
<td>Q3</td>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
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<tr>
<td>UNILAC</td>
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<tr>
<td>BEAMTIME</td>
<td>Shutdown (8 months)</td>
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<td>Shutdown (&gt;1.5 years)</td>
<td>Commissioning</td>
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<tr>
<td>SIS18/ESR</td>
<td>BEAMTIME</td>
<td></td>
<td>Shutdown (&gt;2.5 years)</td>
<td>Commissioning</td>
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- min. 1.5 years of UNILAC shutdown starting 2016
- min. 2.5 years of SIS18/ESR shutdown since 2014
- 4 months of shutdown parallel to operations

- from 2016 at least 1.5 years without any operation
  - operators are delegated to other departments
  - reduced operations department → shutdown department
... mutated to a shutdown 2016/2018

- Including a civil construction project with construction work in the existing accelerator buildings.
- With parallel work on HVAC systems (e.g. air conditioning in the klystron gallery, water cooling systems)
- Additional beamtime 2016
- Retrofitting the FAIR control system to the existing machine.
- Late definition of accelerator related subprojects.

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<td>Shutdown (8 months)</td>
<td>Shutdown (2 years)</td>
<td>Shutdown (1.5 years)</td>
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<td>BEAMTIME</td>
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17.10.2017
Stephan Reimann
Beam Time 2016*

- Major civil construction project was delayed by > 1 year
- Upgrade measures on accelerator had started
- Restricted performance of accelerators
  - Lower end energy of linac
  - lower injection energy of synchrotron
  - Lower end energy of synchrotron, lower intensity
- Personnel effort had to be minimized
- Agreed on “simple and effective” beam time:
  - Reduce to few ion species
  - Several weeks of beam time without new setup
- Lessons learnt
  - Recommissioning after 1.5 years of shutdown
  - Early RF conditioning and device tests

*) see Poster of O. Geithner: “Calculation of the Machine Availability for the Complex Parallel Operation“
## Timeline

<table>
<thead>
<tr>
<th>Preparation phase</th>
<th>Nov. 2014</th>
<th>Start of Long Shutdown SIS, ESR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jun. 2015</td>
<td>Civil Construction (GSI link to FAIR) delayed by 13 months</td>
</tr>
<tr>
<td></td>
<td>Aug. 2015</td>
<td>Additional Beam Time scheduled for 2016 April - July</td>
</tr>
<tr>
<td></td>
<td>Apr. 2016</td>
<td>List of 40 Projects (Upgrade, Refurbishment) in discussion</td>
</tr>
<tr>
<td>Running shutdown</td>
<td>July 2016</td>
<td>Re-Start of Long Shutdown SIS, ESR</td>
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<tr>
<td></td>
<td>Feb. 2017</td>
<td>List reduced to 23 Projects</td>
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<tr>
<td></td>
<td>Feb. 2017</td>
<td>Commissioning and Operation Schedule 2018 fixed</td>
</tr>
<tr>
<td></td>
<td>Apr. 2017</td>
<td>Decision on 8 Projects to be finished before beam time 2018</td>
</tr>
<tr>
<td></td>
<td>Apr. 2017</td>
<td>Call for Proposals for beamtime 2018/19.</td>
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<tr>
<td></td>
<td>May 2017</td>
<td>Include Civil Construction work for new p-Linac building</td>
</tr>
</tbody>
</table>
8 Projects finally approved*

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<tr>
<th>Project</th>
<th>Accelerator Section</th>
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<tr>
<td>Installation new LEBT QQ</td>
<td>UNILAC upgrade</td>
</tr>
<tr>
<td>Refurbishment Poststripper RF FOS</td>
<td>UNILAC RF Refurbishment</td>
</tr>
<tr>
<td>Upgrade Beam line SIS18 to HADES</td>
<td>HEST</td>
</tr>
<tr>
<td>Retrofitting ESR beam diagnostics</td>
<td>ESR</td>
</tr>
<tr>
<td>Commissioning Cryring</td>
<td>Cryring</td>
</tr>
<tr>
<td>Alignment SIS18/HEST/ESR/Cryring</td>
<td>SIS18/HEST/ESR/Cryring</td>
</tr>
<tr>
<td>Upgrade Main Control Room**</td>
<td>SIS18/HEST/ESR/Cryring</td>
</tr>
<tr>
<td>FAIR Migration SIS18/HEST/ESR controls</td>
<td>SIS18/HEST/ESR</td>
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*) see poster of M. Vossberg: “Reliability of the GSI / FAIR Facility After a Long Shutdown Phase.”
**) see poster of S. Reimann: “Main Control Room: Upgrade Measures in Preparation for FAIR Phase 0”
Tracing of Progress

- schedule overview
  - poster in meeting room
  - report to management
  - inform GSI public

- weekly coordination meeting
  - report on progress
  - report on decisions from management
  - report on incidents
  - adjust schedule

2000 tasks
15 pages

2016
- Juli
- Aug.
- Sep.
- Okt.
- Nov.
- Dez.
- Jan.
- Feb.
- März
- April
- Mai
- Juni
- July
- Aug.
- Sep.
- Okt.
- Nov.
- Dez.

2017
- Jan.
- Feb.
- März
- April
- Mai
- Juni
- July
- Aug.
- Sep.
- Okt.
- Nov.
- Dez.

2018
- Jan.
- Feb.
- März
- April
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- July
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- Dez.

FAIR GmbH | GSI GmbH
Petra Schuett: Planning and Tracing a Long Shutdown
18.10.2017
Status of Schedule today (Oct. 2017)

- **2016**
  - Repair US3/4
  - Repair HSI IH
  - GAF Preparation Work
  - SIS18 H=2 RF System
  - SIS18 Kicker
  - Control System Retrofitting of FAIR System to SIS18, ESR and HEST

- **2017**
  - RF-Tests Alvarez
  - RF-Systems and 1.8MW Thales Power Amplifier Prototype
  - Construct new HVAC for TU-building
  - Switch-over, no air conditioning
  - Repair of TK3 after water issue
  - Replace HSI LEBT QQ
  - Install Cabling
  - Repair old vacuum control
  - Unilac Vacuum Controls Replacement
  - Repair old Unilac vacuum control
  - Install BB helix
  - Refurb, BR-building w.r.t. HVAC and fire protection
  - Rep. HSI IH
  - Repair HSI LE-BT QQ
  - Shielding
  - Refurb, MR
  - Floor sealing
  - Refurb. TR crane, parking position Y56
  - Refurb. MRT
  - Install new HVAC E5.1.0

- **2018**
  - Terminal Nord Upgrade (B-Form)
  - Operation Unilac
  - Operation SIS18, HEST
  - Experiment Beam Time
  - Operation SIS18, HEST
  - ESR Operation

**End VMS and NODAL**
01.08.16

**planned start of SIS commissioning**
28.05.18
Incidents

- Main electric switch broken during a test of the emergency stop
  - legacy equipment, hard to replace
  - for > 2 months no work possible on refurbishment of rf systems
- Compensation plate in IH tank broke
  - no spare part
  - manufacturing and copper plating, delay > 6 months
- Water leak in beam line
  - known vacuum problem not followed up (no priority)
  - 400 liters of cooling water in beam pipe
  - damage to foil stripper and to several beam diagnostics devices
  - repair on-going
Civil construction in existing buildings

- secure accelerator devices (cover)
- two pulsed power HV cables damaged during excavation work
- buildings moved by ~10 mm, horizontally and vertically
  - open beam pipe
  - loosen cables, gas pipes etc.
- rain water intruded into accelerator tunnels and into the central electronics room with false floor
  - extensive cleaning work, open issue
Device Tests and Dry Runs

- Testing Periods
  - Are Integral Part of Development of Ion Sources
  - and of the Refurbishment of the Linac RF
  - Needed to keep Power Supplies “alive” (Capacitors dry out)

- But:
  - Refurbishment of Infrastructure (Air conditioning, Water cooling) needs shutdown periods
  - Careful synchronization necessary

- Control system for all machines except UNILAC is replaced by the new FAIR control system

- Dry Runs scheduled for early testing, debugging and adaption to operations needs
CryRing Beam Commissioning

- Stand-alone accelerator with local injector and small ring.
- Operators integrated in commissioning
  - delegated operators joined in
- Organized as a 5 week beam time block including
  - shift schedule
  - on call service
  - daily coordination meeting
- Outcome:
  - (circulating beam)
  - first contact of operations with the new control system
  - revitalization of rules and processes – especially important for new personnel, (technical and administrative)
Conclusion

- **Transparency**
  - provide the same information to the management and to the GSI public
  - keep the schedule up-to-date
  - open communication of priorities, incidents and risks

- **Early milestones and tests**
  - Dry Runs, Beam Time CryRing, (Beam Time 2016)
  - Motivation to finish subprojects or tasks
  - Enable feedback to developers

- **Monitoring**
  - daily patrols of civil construction areas
  - uninterrupted monitoring of vacuum quality
Questions?