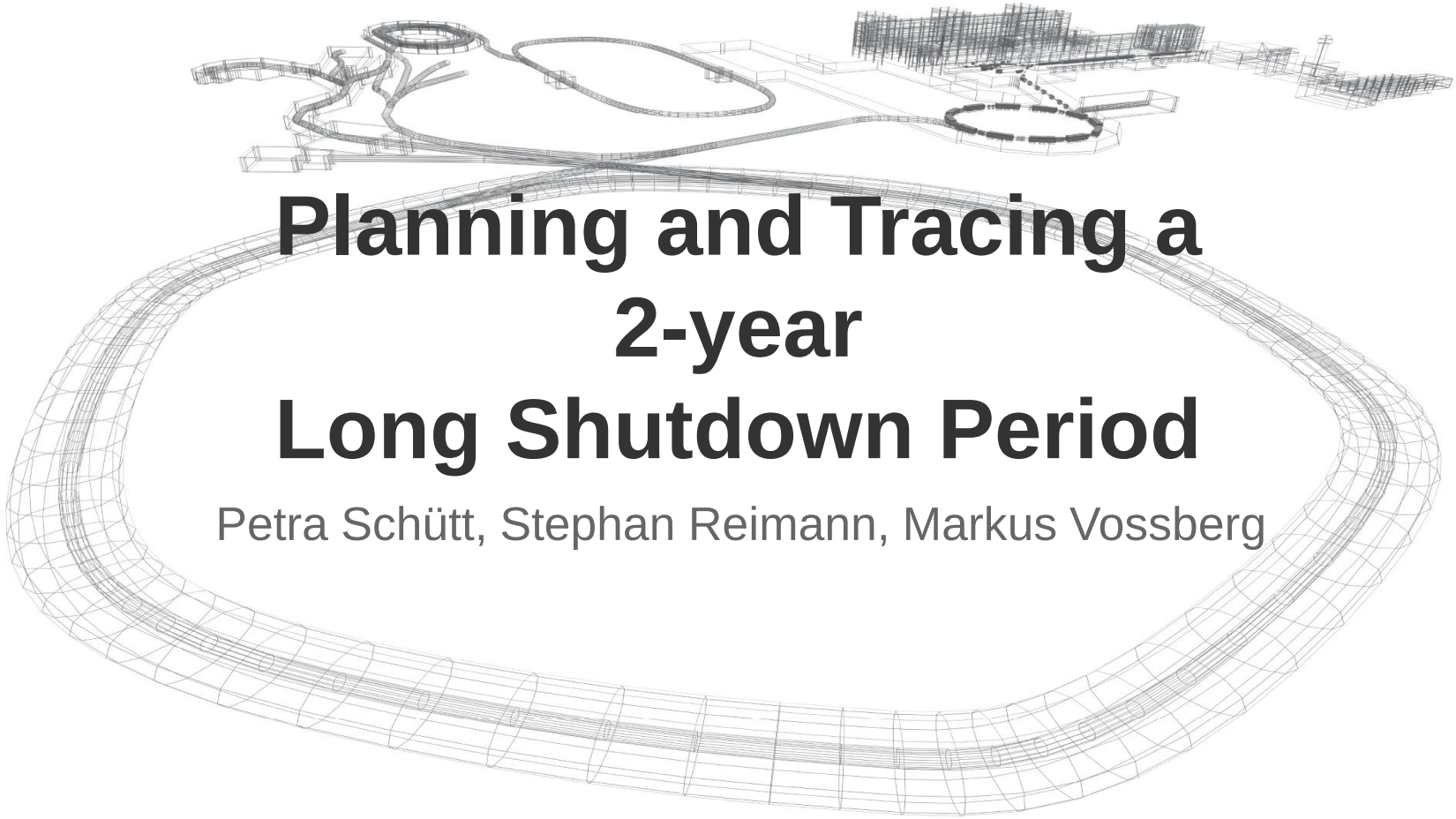


Planning and Tracing a 2-year Long Shutdown Period

Petra Schütt, Stephan Reimann, Markus Vossberg

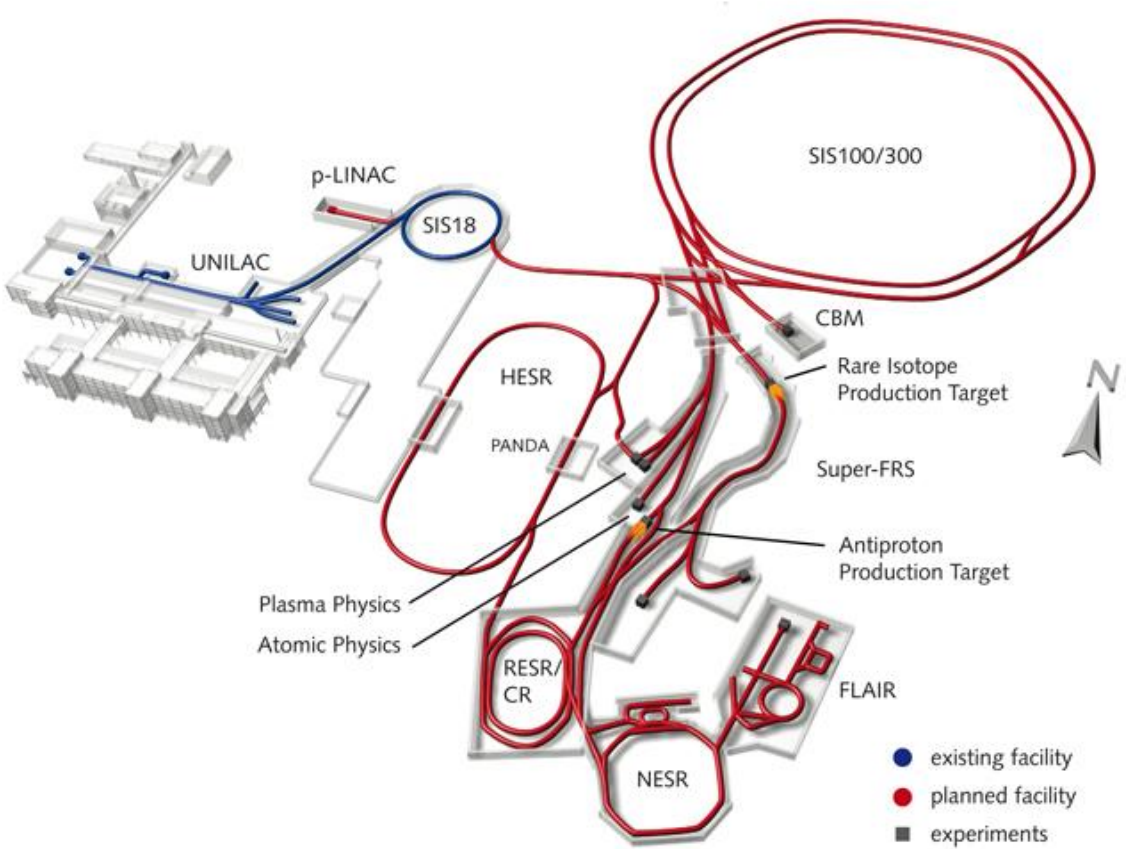
Content

- GSI & FAIR
- Previous Experience
- Timeline
- Challenges
- Current Organization
- Unexpected Incidents
- Conclusion

GSI


1. Ionenquellen
2. Hochladungsinjektor
3. Transferkanal
4. SIS 18
5. HITRAP
6. ESR
7. CRYRING
8. Target Halle (Hochenergie)
9. Experimentierhalle (Niedrigenergie)
10. UNILAC
11. Hochstrominjektor

FAIR


SIS100/300
p-LINAC
SIS18
UNILAC
CBM
Rare Isotope
Production Target
HESR
PANDA
N
Super-FRS
Antiproton
Production Target
Plasma Physics
Atomic Physics
RESR/
CR
FLAIR
NESR
existing facility
planned facility
experiments

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

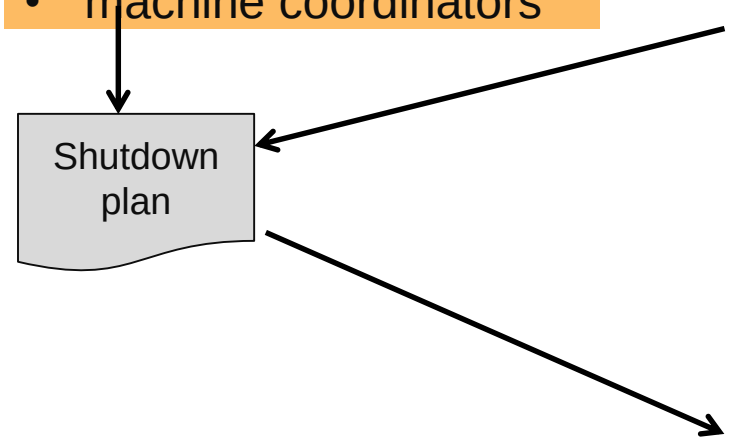
- Duration: 2 - 10 weeks
- Work on the accelerator system
  - maintenance work
  - repairs
  - insertion of new devices
- Prioritization and planning by machine coordinators
  - Personnel planning by department heads
- Scheduling and tracing by shutdown coordinator
  - operations department
  - MS Project 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

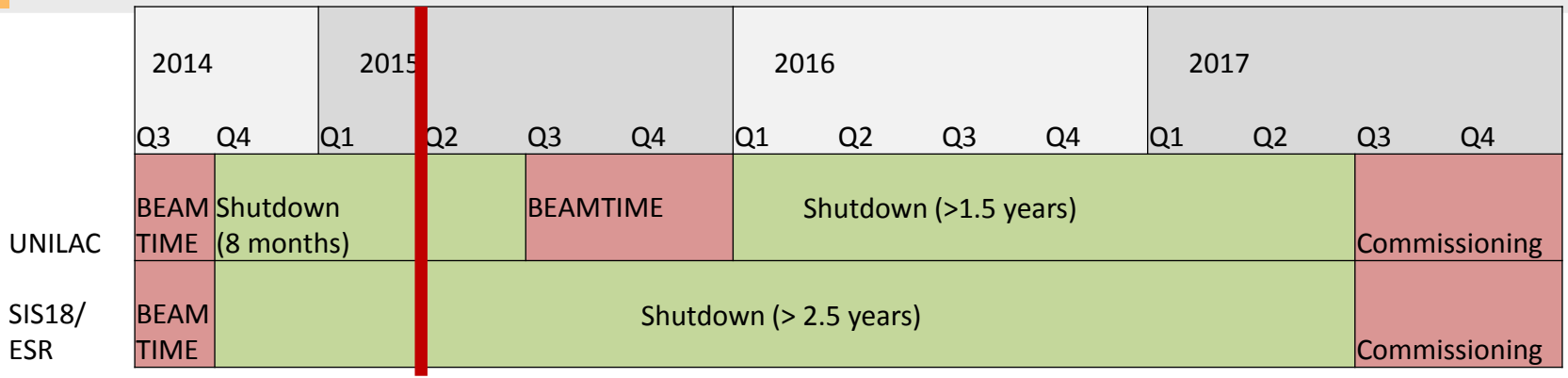
Main changes:

- 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

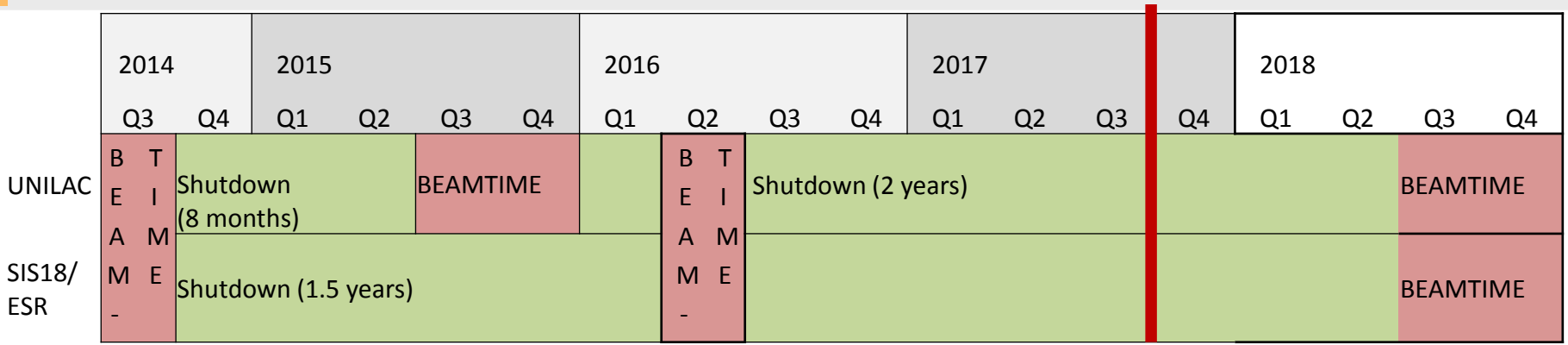
The Major Shutdown Expected in 2015...



- 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.

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

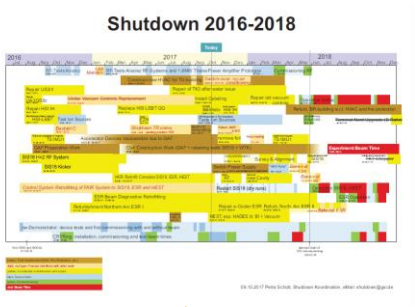
Preparation phase	Nov. 2014	Start of Long Shutdown SIS, ESR
	Jun. 2015	Civil Construction (GSI link to FAIR) delayed by 13 months
	Aug. 2015	Additional Beam Time scheduled for 2016 April - July
	Apr. 2016	List of 40 Projects (Upgrade, Refurbishment) in discussion
Running shutdown	July 2016	Re-Start of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

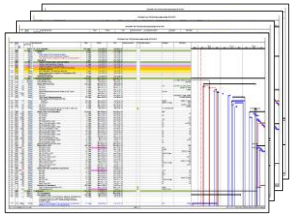
8 Projects finally approved*

Project	Accelerator Section
Installation new LEBT QQ	UNILAC upgrade
Refurbishment Poststripper RF FOS	UNILAC RF Refurbishment
Upgrade Beam line SIS18 to HADES	HEST
Retrofitting ESR beam diagnostics	ESR
Commissioning Cryring	Cryring
Alignment SIS18/HEST/ESR/Cryring	SIS18/HEST/ESR/Cryring
Upgrade Main Control Room**	SIS18/HEST/ESR/Cryring
FAIR Migration SIS18/HEST/ESR controls	SIS18/HEST/ESR

*) 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

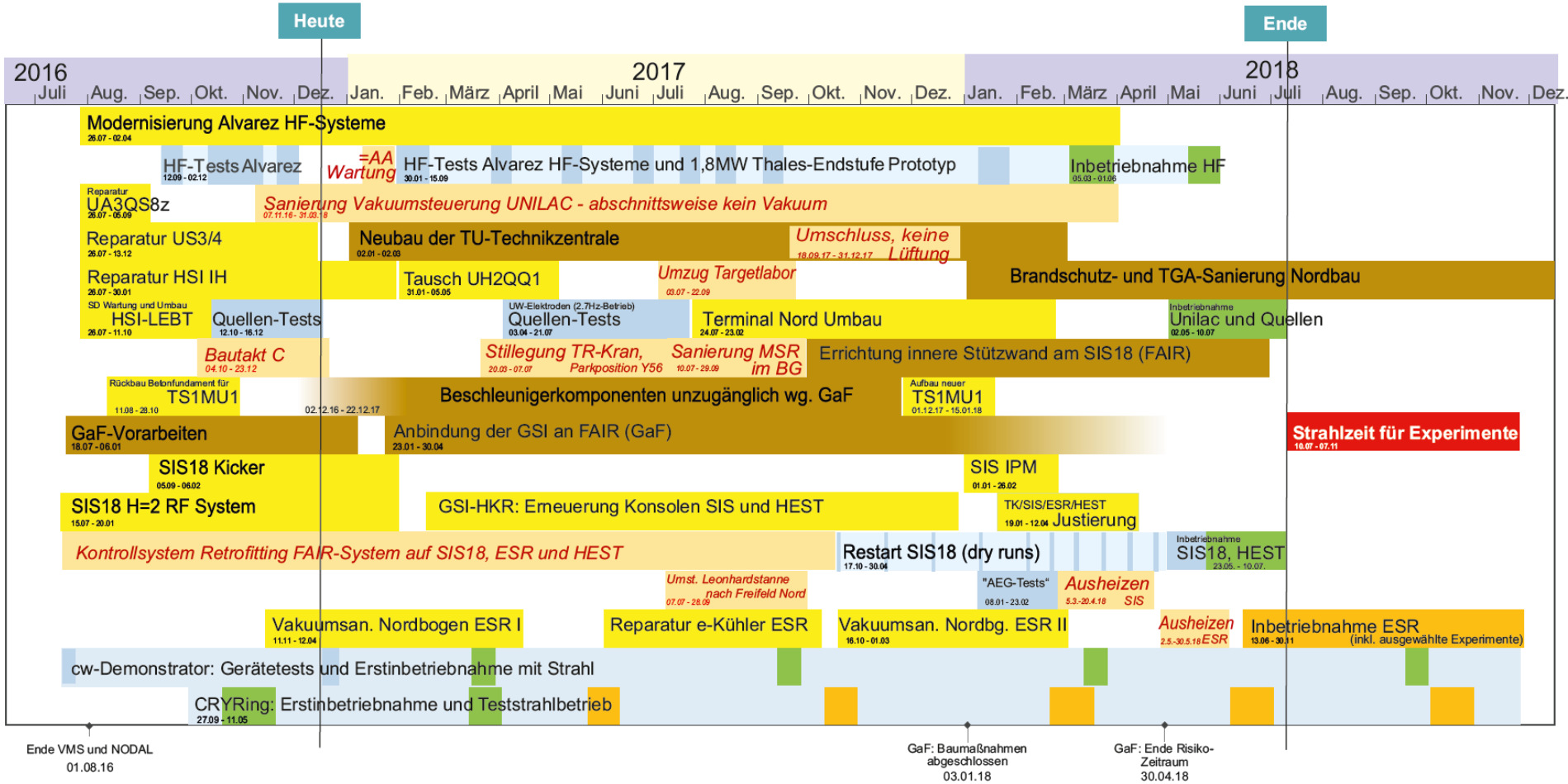




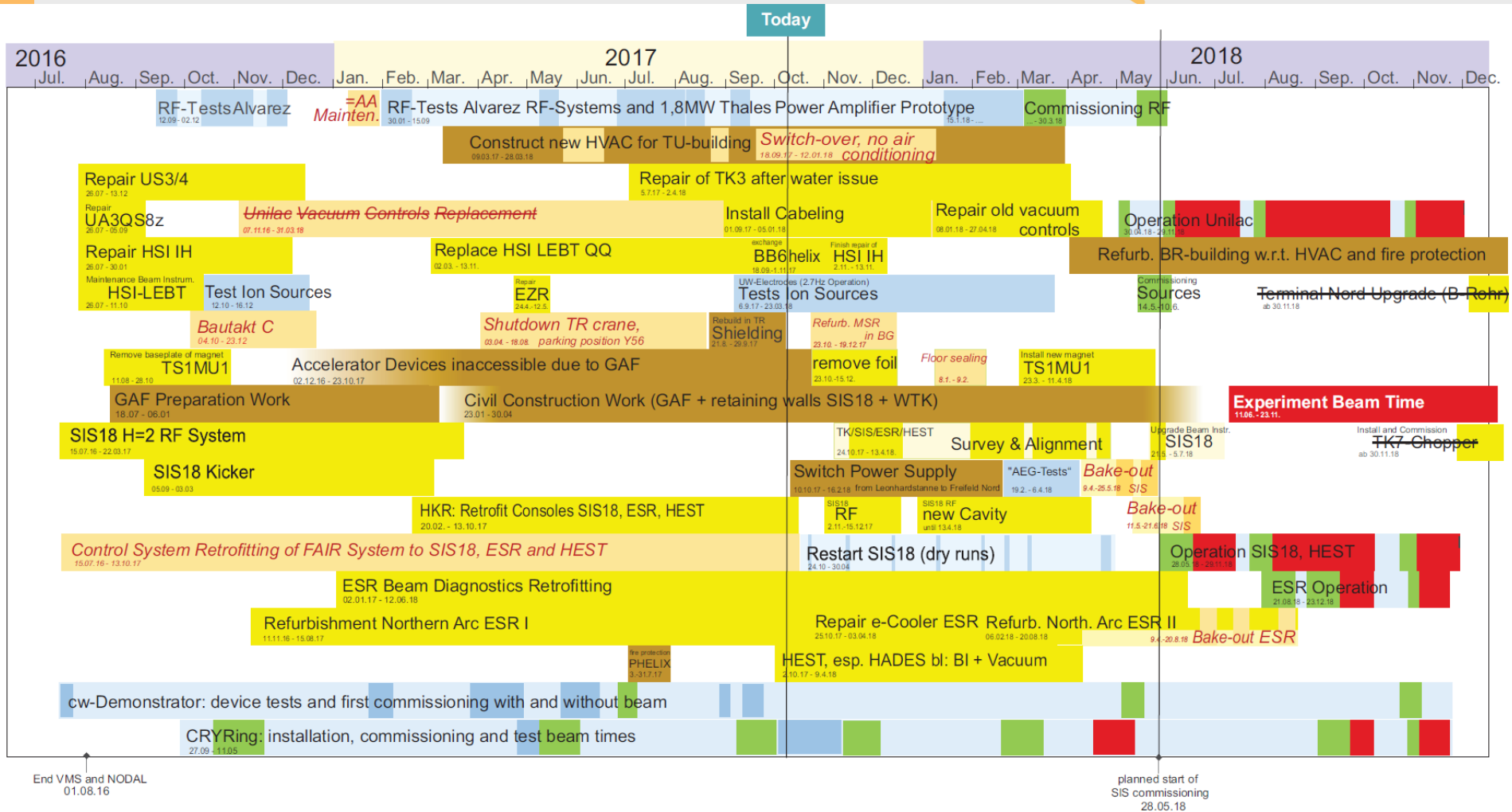
2000 tasks
15 pages

- 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

Status of Schedule Dec. 2016



Status of Schedule today (Oct. 2017)



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?