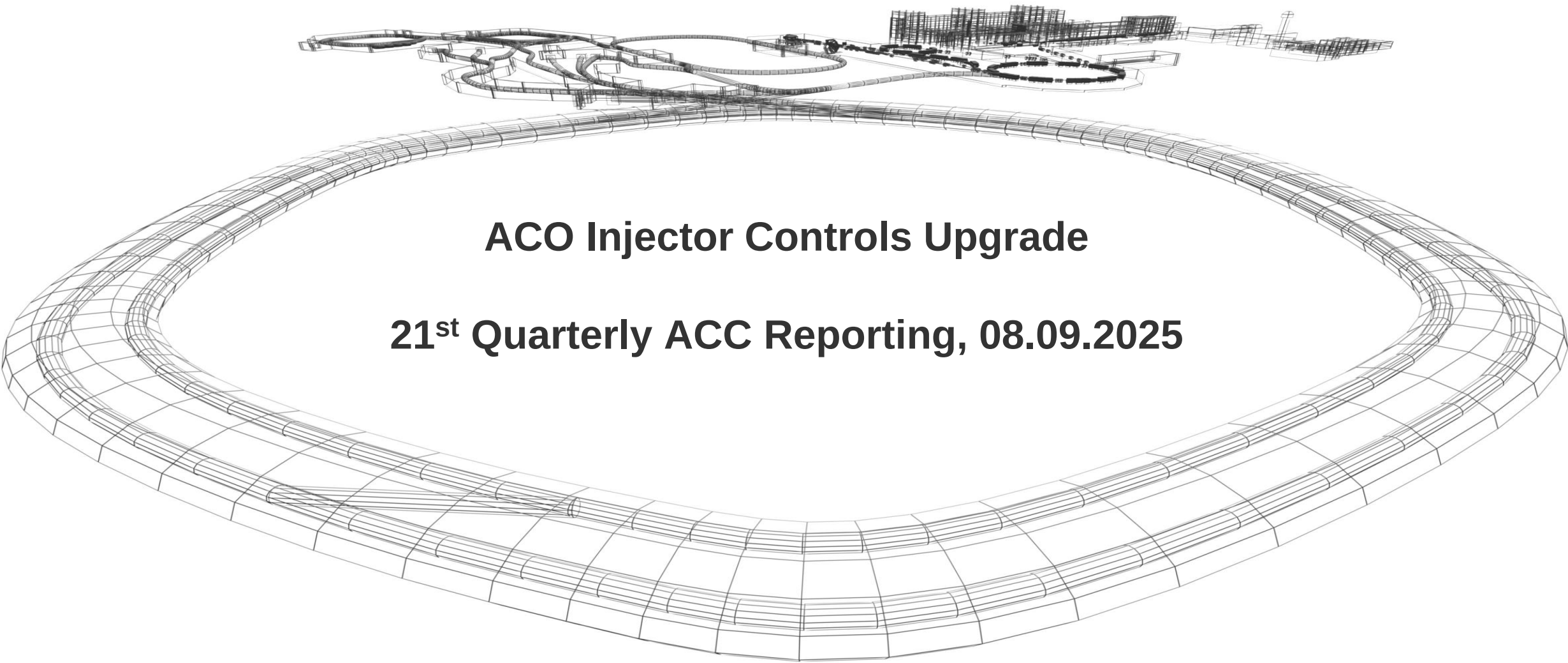




ACO Injector Controls Upgrade

21st Quarterly ACC Reporting, 08.09.2025

- Achieved milestones and activities in progress
- Project planning
- Critical issues and corresponding mitigation
- Risk management
- Highlights

Achieved:

- **Wet run in July 2026 successful**
 - All primary and secondary objectives achieved
 - Optional objectives mostly successful
 - No unexpected missing items
- **LSA framework**
 - Extensive testing and debugging in INT system
 - Unified Pattern concept rolled out to UNILAC and SIS18
- **Applications and services**
 - Adaptations to standalone chains ready for PRO testing
 - Provisional version of BSS server + client, updated Emergency App
- **Timing**
 - Data Master-to-Data Master communication established
 - Integrated scheduling: Start threads in Ring-DM out of Master Schedule in UNILAC-DM
- **Chopper control interface**
 - Data acquisition from chopper control system ready for INT testing
- **LSA hierarchy and device settings generation for UNILAC**
 - UNILAC stripper model complete

In Progress:

- **Implementation of controls upgrade strategy 2026**
 - Review status after wet run
- **LSA hierarchy and device settings generation for UNILAC**
 - Review magnet hierarchy
 - Complete UNILAC calibration data in CDB
 - General enhancements
- **LSA framework and Applications**
 - Review changes made during wet run
 - Refactoring and clean-up of workarounds
 - Re-implement coupling after wet run
 - Integrate HITRAP, ESR and CRYRING into Unified Pattern Concept
 - Review applications for operational readiness
- **Timing**
 - Integrated scheduling for all accelerators
 - Upgrade of intermediate master schedule generation
- **Interlock system and chopper control interface**
 - Upgrade from emergency to production system
- **MCR modernization**
 - Complete unfinished work packages
 - 8th meeting 12th September 2025

Achieved milestones and activities in progress



**Preliminary status update,
in-depth review after WR
currently being finalized**

Index / changes:

 new activity +2

 achieved +28

 in progress +10

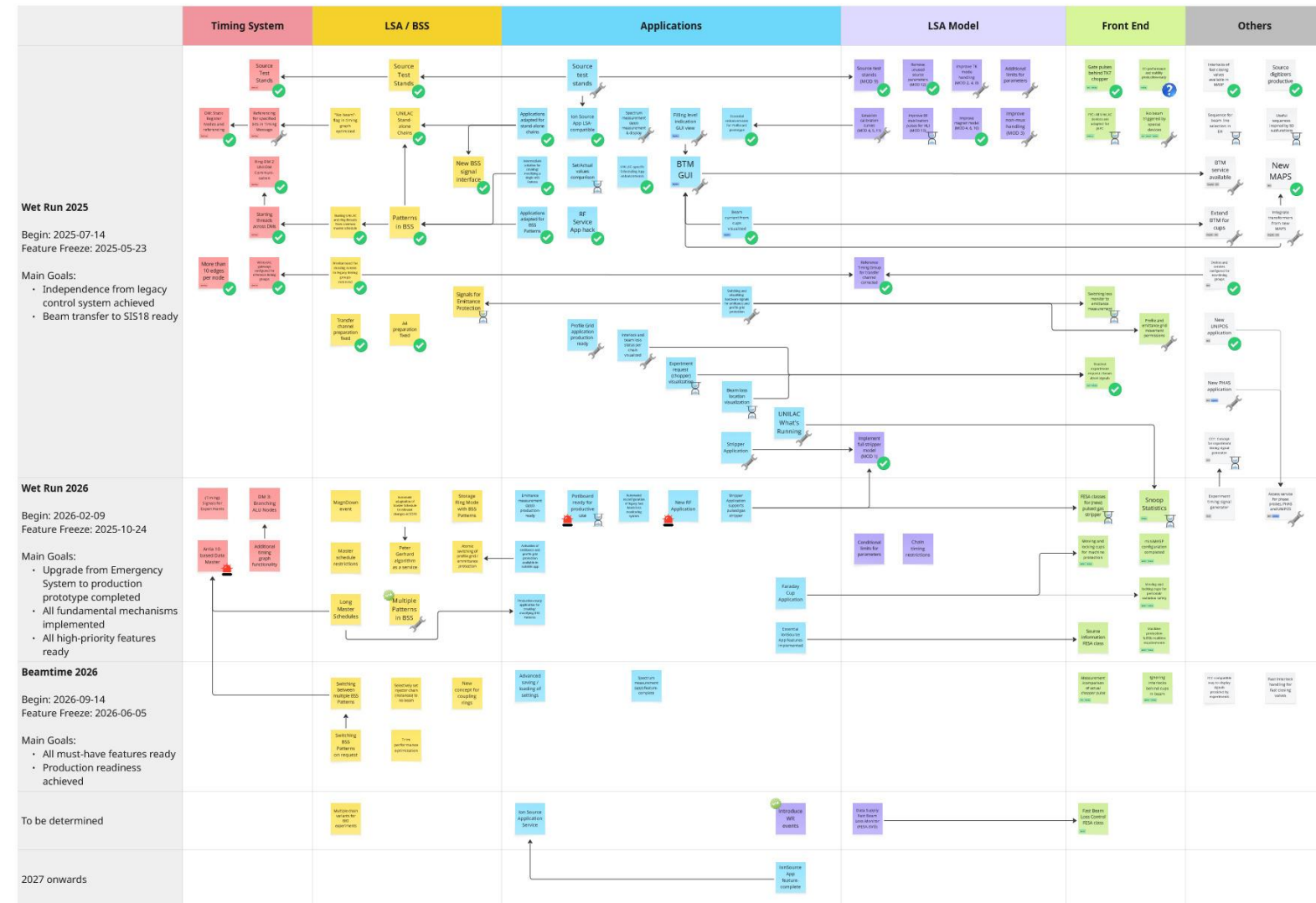
 pending +7

 cancelled ± 0

 to be clarified +1

 critical ± 0

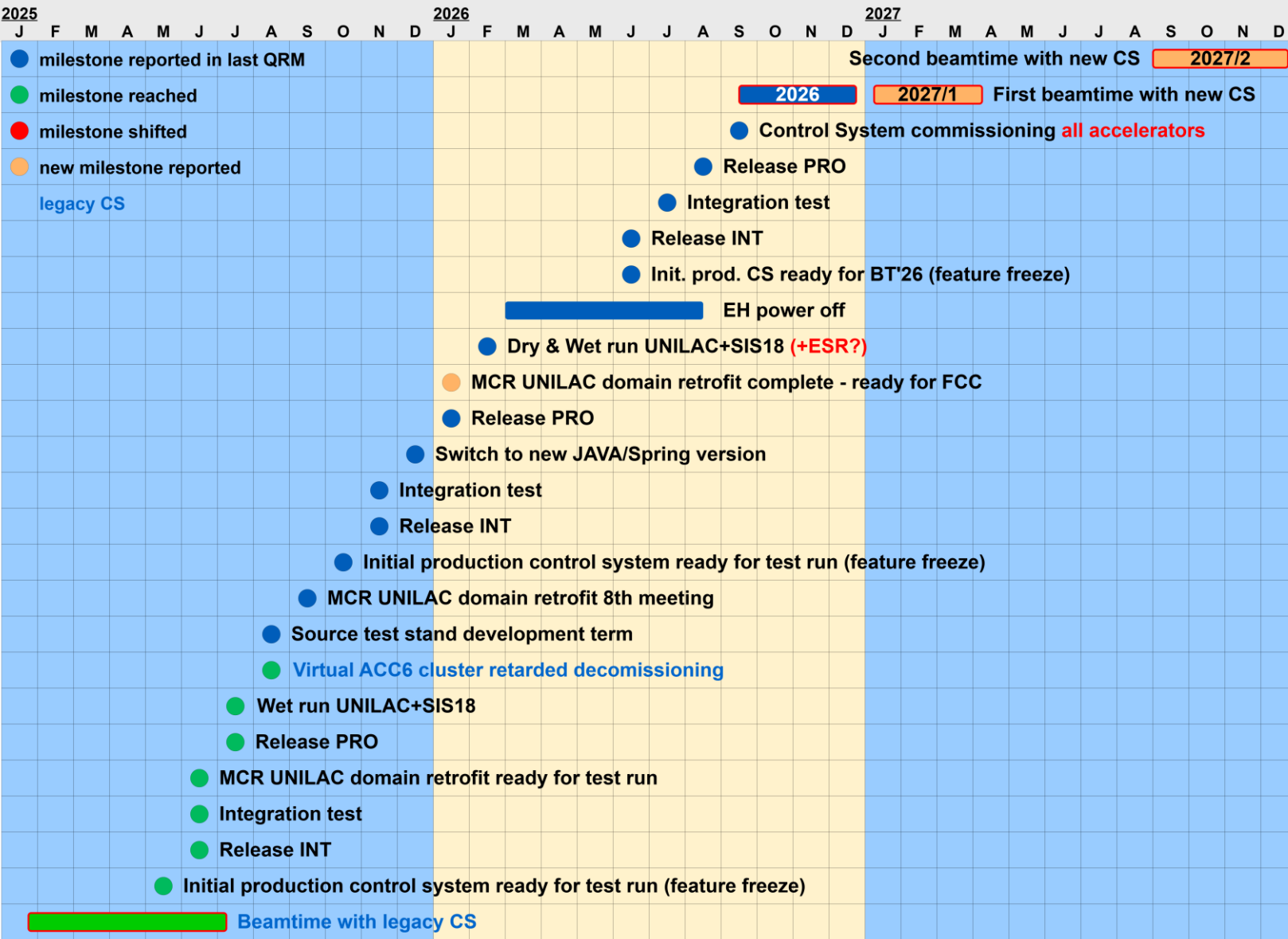
Injector Controls Upgrade Project Milestones/Deliverables Overview 2025/26



- First test run with beam injection into SIS18 successful ✓
- Legacy Control System (ACC6) decommissioned ✓
- MCR retrofit not complete
⇒ test run Jan '26!
- From control system perspective:

Single beamtime 2026 and 2027/1

⇒ no major CS upgrade possible before 2027/2



Rank	Risikoklassifizierung Risk classification		Bow-Tie-Analyse Bow Tie Analysis			Projektverzug			Qualität		
	Risiko-Nr. Risk ID	Risikogegenstand Risk subject	Risikoursache Risk cause	Risikoereignis Risk event	Risikoauswirkung Risk consequences	Erwartungswert Gewichteter Fall			Erwartungswert Gewichteter Fall		
						Glob-WS [%]	Erwartungs- wert [Monate]	REW	Glob-WS [%]	Erwartungs- wert [%]	REW
27.08.2025: Neubewertung nach Testlauf: REW Qualität von R15 auf R7 abgesenkt.	2023-ACC- P-12	(ID: 845) Verfügbarkeit von Fachpersonal	1. Auslastung/Überlastung der beteiligten Personen/Abteilungen durch parallel ablaufende Arbeiten im selben Projekt sowie durch FAIR-Arbeiten. Weniger wirksam: 2. Wissenstransfer zur Ablösung des alten Kontrollsystems erschwert durch Weggang einer Schlüsselperson und mögliche eingeschränkte Verfügbarkeit einer zweiten Schlüsselperson.	Planung, Entwicklung und Inbetriebnahme nur mit Einschränkungen möglich. Kompensation des Wegganges von Know-how und Betriebserfahrung.	Verzögerung der Inbetriebnahme. Gefahr von Qualitäts- und Leistungseinbußen.	75	7	R9	50	9	R7
27.08.2025: Neubewertung nach Testlauf: Unverändert gegenüber QRM 20.	2023-ACC- P-13	(ID: 846) Verzögerung durch Entwicklungsrisiken	1. Komplexe Entscheidungsprozesse wirken mit Kapazitätsengpässen zusammen. 2. Fehlentwicklungen/-entscheidungen sind schwer zu korrigieren, Anpassungen sehr aufwändig. 3. Umfang und Aufwand der Neuentwicklung sind unübersichtlich. 4. komplexe, übergreifende Entwicklungsprozesse, sehr viele Beteiligte, gruppen-/abteilungsübergreifend. 5. Sehr hoher Koordinierungsaufwand. 6. (fast) keine Dokumentation für neues Kontrollsystems, Einarbeitung nur gemeinsam mit vorhandenen Experten möglich -> begrenzte Zeit, begrenzter Wissenstransfer. 7. Wir bringen nicht mehr viele Entwicklungszyklen bis zur Inbetriebnahme unter.	Planung, Entwicklung und Inbetriebnahme werden verzögert. Ergebnisse können schlechter als geplant (und als benötigt) ausfallen.	Kapazitätsengpässe bei der Weiterentwicklung des FAIR- Kontrollsystems für die FAIR- Anlagen. Mögliches Betriebsrisiko für ACC ab ca. 2026.	40	4	R3	40	17	R13
27.08.2025 Neubewertung nach Testlauf: Deaktiviert.	2023-ACC- P-14	(ID: 847) Qualitätseinschränkung durch Systemeigenschaften	1. Bestehendes Kontrollsystem für grundlegend andere Art von Beschleunigern entwickelt, für Linacs (UNILAC) lassen sich manche Funktionalitäten (noch) nicht oder nur mit großem Aufwand abbilden. 2. Datenversorgung in Echtzeit notwendig für effizienten Betrieb. Hier gibt es noch ein Restrisiko für Einschränkungen.	Planung, Entwicklung und Inbetriebnahme werden verzögert.	Mögliche (temporäre) Nutzungseinschränkungen aufgrund fehlender Umsetzbarkeit oder verspäteter Umsetzung von LINAC-Anforderungen.	15	2	R2	15	2	R2

Pending: Review of changes to risk assessment after wet run July 2025
and decommissioning of legacy CS with Peter Gerhard

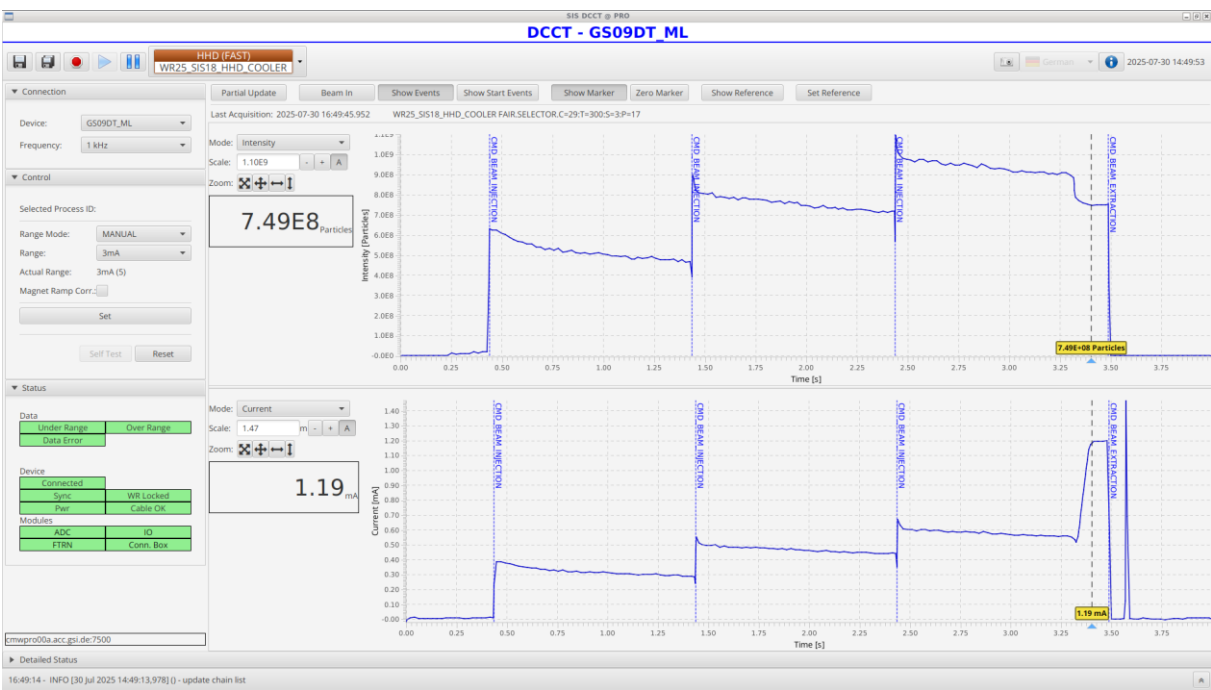
Critical issues and corresponding mitigation

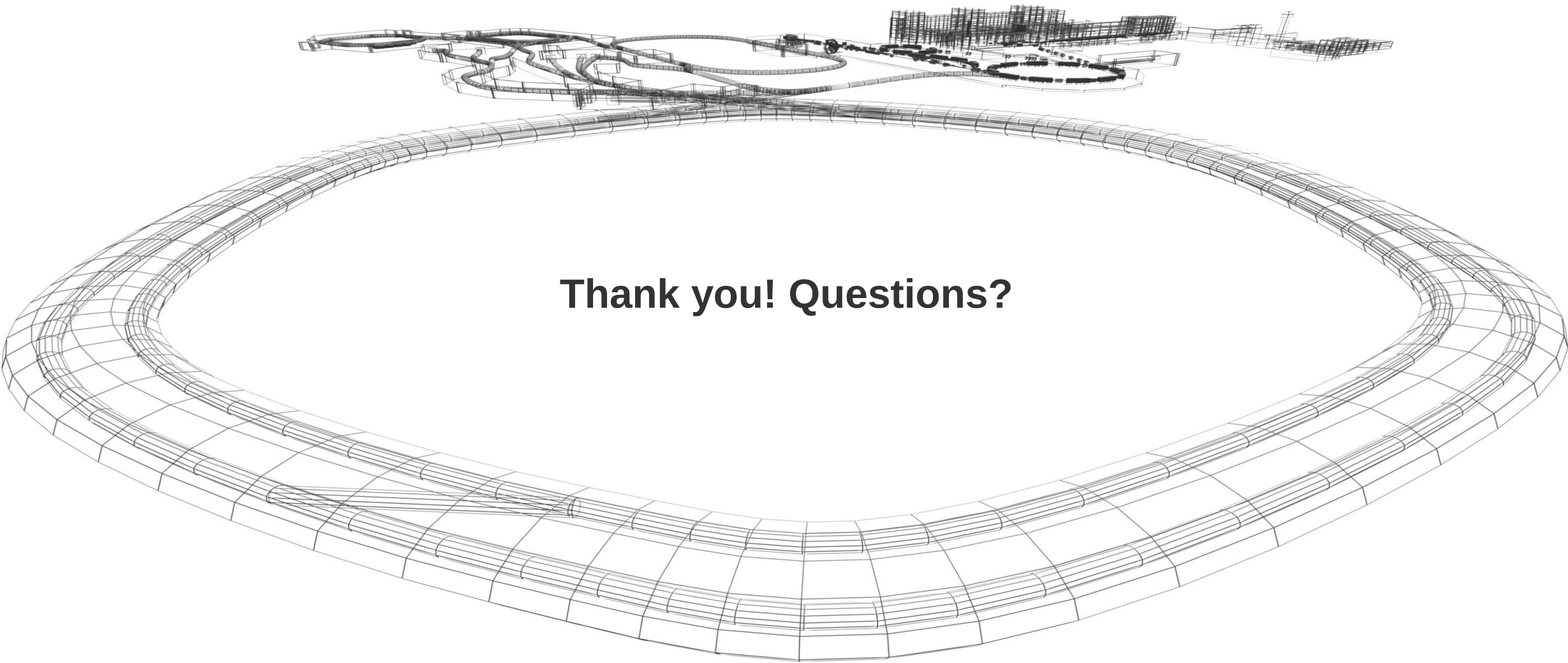


Risk	Issue	Comment	Counter measures
Current operating system (Red Hat 6 and older)	- End of life 11/2020 ($\Rightarrow$) - Needed until July 2025	- Extended Life Cycle Support : Patches only for severe security issues - Connections to other services may break any time (Oracle, Users, ...)	- Move services, replace thin clients - Reduction of access - Extended Life Cycle Support until 2024 - Replacement for beamtime 2026
Maintenance and replacement of running CS (2023-ACC-P-12)	- Relies on 1 ACO key expert with health issues - Imminent risk of losing key persons (contract expires) - Late recruitment of repl. staff - Maternal leave Long term sick leave ended	Pulszentrale decommissioned - Device access, 100% of UNILAC devices + SIS18 + ... - On-call service UNILAC software at risk, only partial coverage possible for 2025 - Development of UNILAC specific applications (RF App)	- Replacement of high level CS and device access layer as soon as possible 1 replacement has taken up position (succ. Heymell) 1 replacement in hiring process (strategic staff planning) Maternal leave replacement has taken up position Still shortage of manpower in Applications team
General CS design (2023-ACC-P-13, 14)	- Scope of upgrade complexity - Previous development with focus on ring machines, some existing concepts contradict linac requirements	- Implementation of UNILAC more time-consuming throughout CS than expected - Many developers from many groups involved, all need common understanding and consent - No documentation available	- Parallel development of UNILAC settings generation - Agree on more simple, practical intermediate solutions, accept drawbacks - Additional dry/wet runs, machine dev. beam times - Adapted transition strategy and schedule
Move to FCC in Q4/25 (2023-ACC-P-13)	UNILAC on new CS (high level) and MCR retrofit needed	- Availability of resources - Very few possibilities for test runs - Competition for resources within ICU	- Work packages established - Adapted transition strategy and schedule
Beamtime 2025	No backup for legacy control system	Needed if legacy system becomes unavailable due to security issue or technical failure	Intermediate stage of new control system serves as backup on emergency level ("emergency system")
Beamtime 2026	First beamtime with new control system	Limited time for development and number of development-testing cycles	- Re-priorisation within ACO, more support from SYS - Additional dry/wet runs, machine dev. beam times

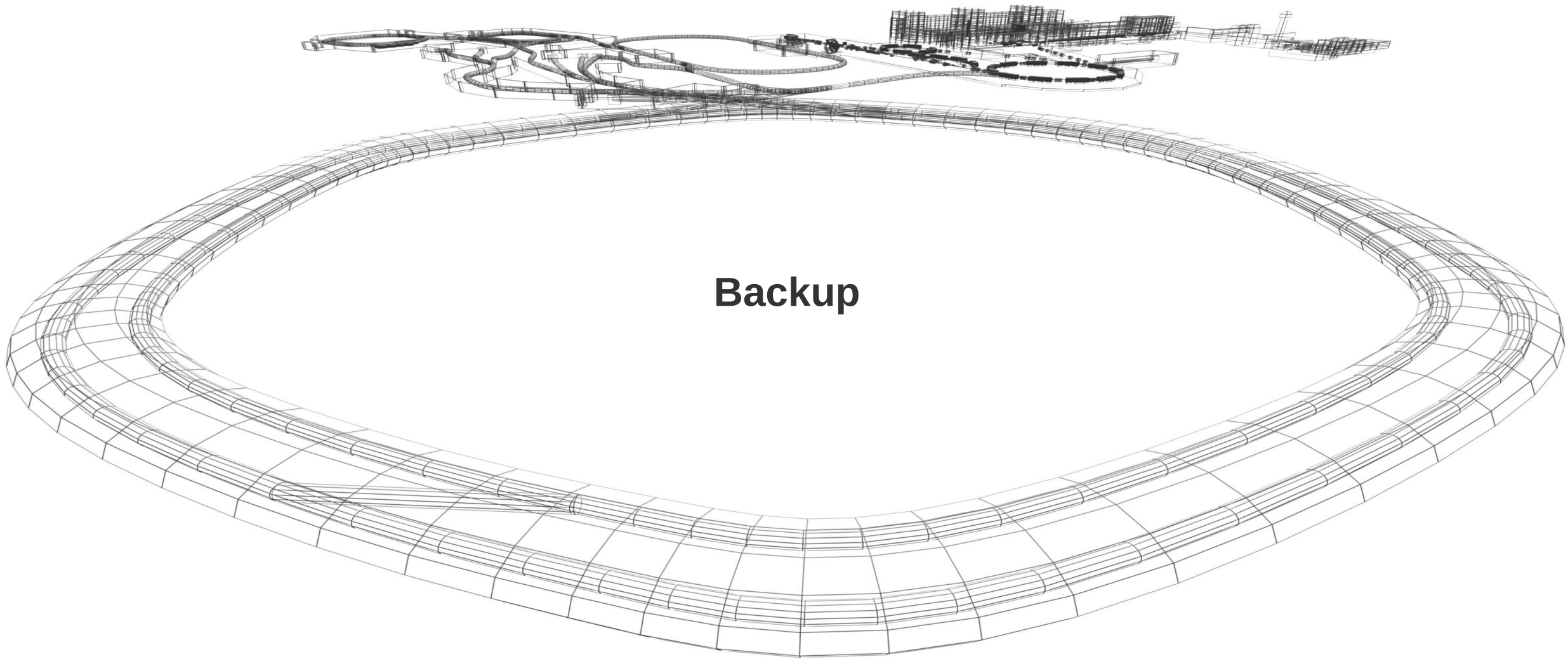
3 different beams injected into SIS18 (round robin)

Triple Multi-Multiturn-Injection into SIS18





Thank you! Questions?



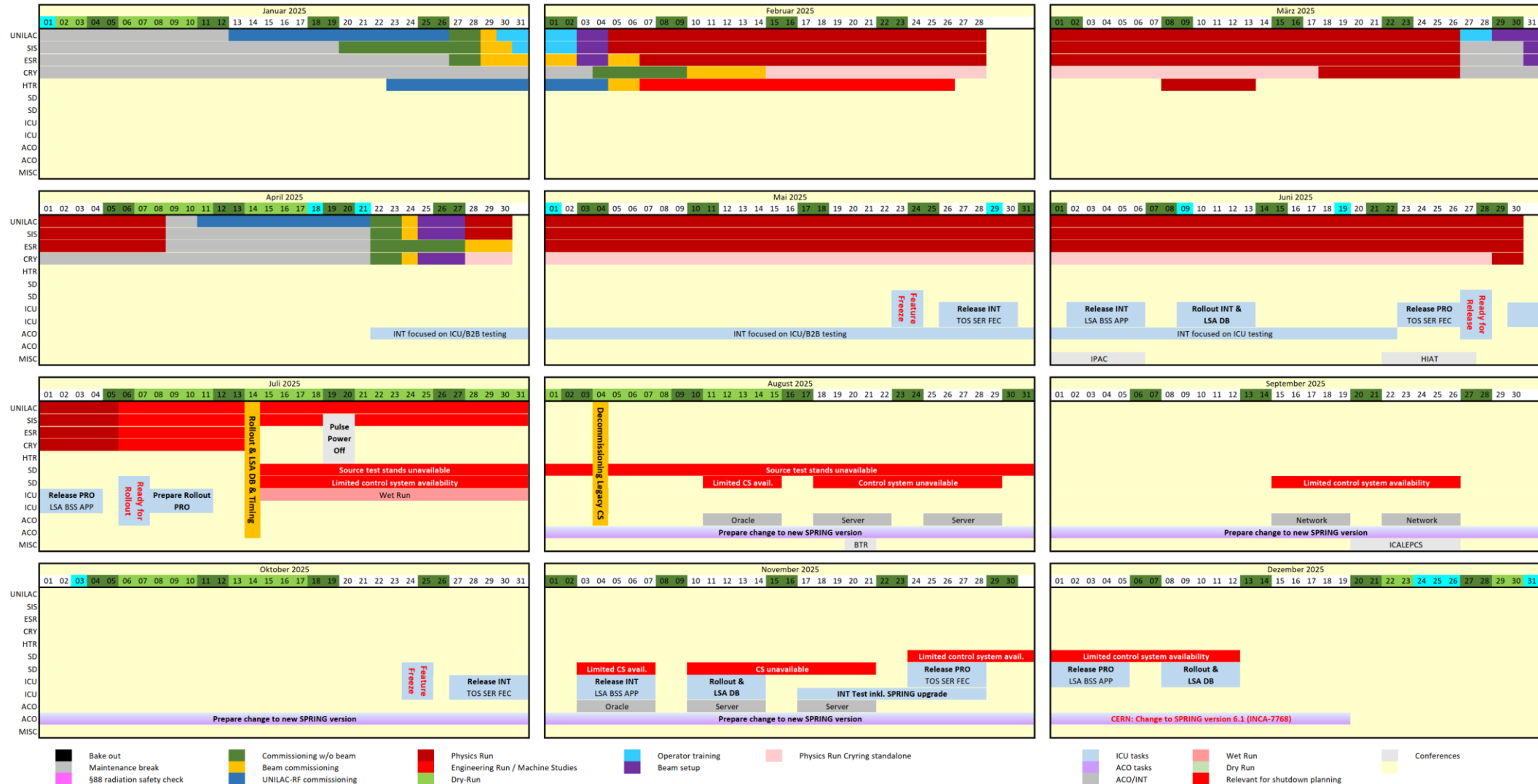
Project planning 2025



OPE status: 21.11.2024

Injector Control Upgrade Planning 2025

ACO V3.0.0 17.03.2025



Project planning 2026



OPE status: DRAFT V2 27.02.2025

Injector Control Upgrade Planning 2026

ACO V3.0.0 17.03.2025



-
- The diagram illustrates the timeline for the transition to a new control system (LSA, Data Master) starting from Beamtime 2026. The timeline is divided into two main sections: the current system (top) and the new system (bottom).
- Current System Timeline:**
- Beamtime 2026:** The first period of operation.
 - Test:** A period of testing following Beamtime 2026.
 - Beamtime 2027:** The second period of operation.
 - Test:** A period of testing following Beamtime 2027.
- New System Timeline (LSA, Data Master):**
- Beamtime 2026:** The first period of operation, starting from the beginning of the timeline.
 - Beamtime 2027/1:** The second period of operation, following Beamtime 2026.
 - Test:** A period of testing following Beamtime 2027/1.
 - Beamtime 2027/2:** The third period of operation, following the test.
 - Beamtime 2028/1:** The fourth period of operation, following Beamtime 2027/2.
 - Beamtime 2028/2:** The fifth period of operation, following Beamtime 2028/1.
- Transitions and Enhancements:**
- Bugfixing, Tuning and Enhancement:** These periods occur between the beamtime periods in both the current and new systems.
 - Red Arrows:** Indicate the flow from the current system's beamtime periods to the new system's beamtime periods.
 - Red X:** Marks the transition point between the current system's Beamtime 2027 and the new system's Beamtime 2027/1.
- Regular operation with new Production System from Beamtime 2026**
- New Control System (LSA, Data Master)**