Injector Controls Upgrade Project

- Modernisation of Control System for injector chain (ion sources, UNILAC, TK)
  - Complete modernisation → beyond scope of this presentation
  - Main objectives: Fit for FAIR (e.g. booster mode) and keep the system operable

- Replacement of UNILAC controls is a complex endeavor
- Lessons learned from replacement of SIS18/ESR controls
- Careful planning & communication is the key for success
  - Project plan revised in 05/2023
  - Commissioning 2025 aligned with strategic operation schedule
  - Detailed planning to be further refined in 11/2025 (BEA/OPE/…)

UNILAC Controls Transition

Decision on Strategy for 2024-26

2024 2025 2026

ACC6 & Pulszentrale

Scenario 1
LSA and/or DM4UNILAC not ready ACC6 still available

Have
ACC6 Pulszentrale

Need
-

Risk
ACC6 not available (technical/security) Expert for PZ is currently unavailable Only partial on call duty coverage possible from 2025 due to retirement

Advantage
Known system

Do not
Replace DevAcc devices with FESA (except where new Java apps are available, e.g. IonSource) DM4UNILAC development limited

2024 2025 2026

LSA & Pulszentrale

Scenario 2
ACC6 not available DM4UNILAC not available

Have
Pulszentrale

Need
LSA data supply Apps Pulszentrale supply by LSA/Apps

Risk
LSA data supply not ready Apps not ready Pulszentrale supply by LSA/Apps not ready No/little test time Expert for PZ is currently unavailable

Advantage
Change only part of the control system at once

Do not
Effort/risk for replacing DevAcc with FESA DM4UNILAC development limited

2024 2025 2026

LSA & DM

Scenario 3
LSA & DM4UNILAC available

Have
-

Need
LSA data supply Apps/Services (+Potiboard) DM4UNILAC & connection to SIS18ff WR2MIL-Gateways / DevACC > FESA Replacement for Pulszentrale-Parts (Interlock, RPG, ...)

Risk
LSA data supply not ready Apps not ready DM4UNILAC not ready No/little test time Knowledge from PZ expert needed to replace Pulszentrale parts

Advantage
Minimize effort

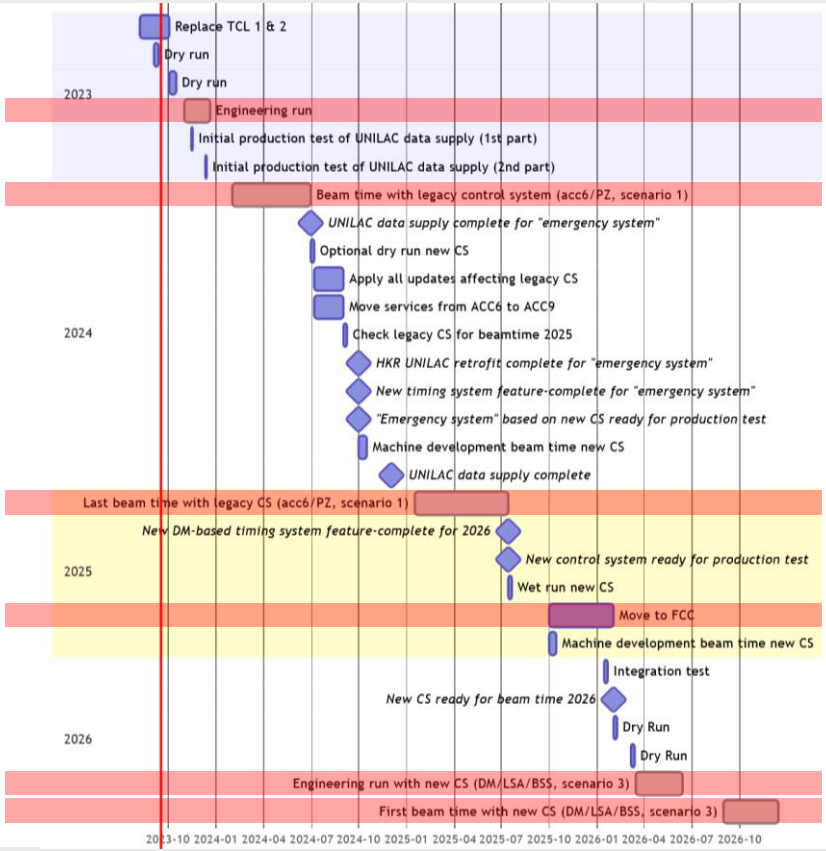
Do not
-

- **Main considerations**
  - Support beamtimes 2024 and 2025
  - Extend operation of legacy control system **ACC6 & Pulszentrale**
  - Assure readiness of new control system **LSA & DM** for beamtimes 2025 and 2026
  - Minimize risk and effort
- **Risk Mitigation**
  - "Emergency System" for BT 2025
  - Intermediate development step

UNILAC Controls Transition

Timeline until 2026

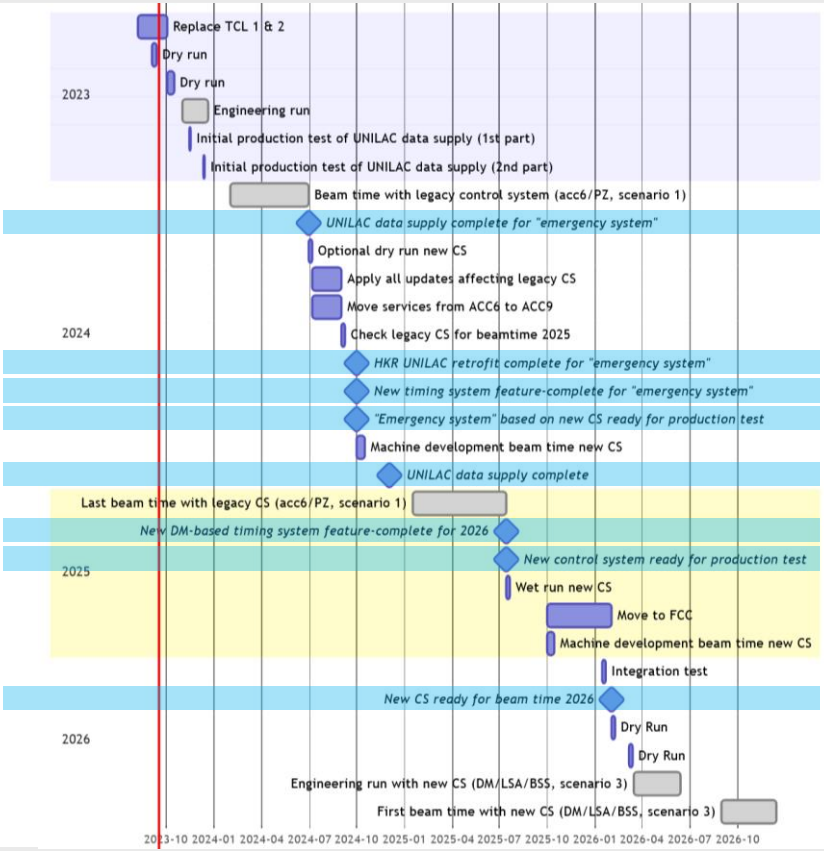
Obligations



UNILAC Controls Transition

Timeline until 2026

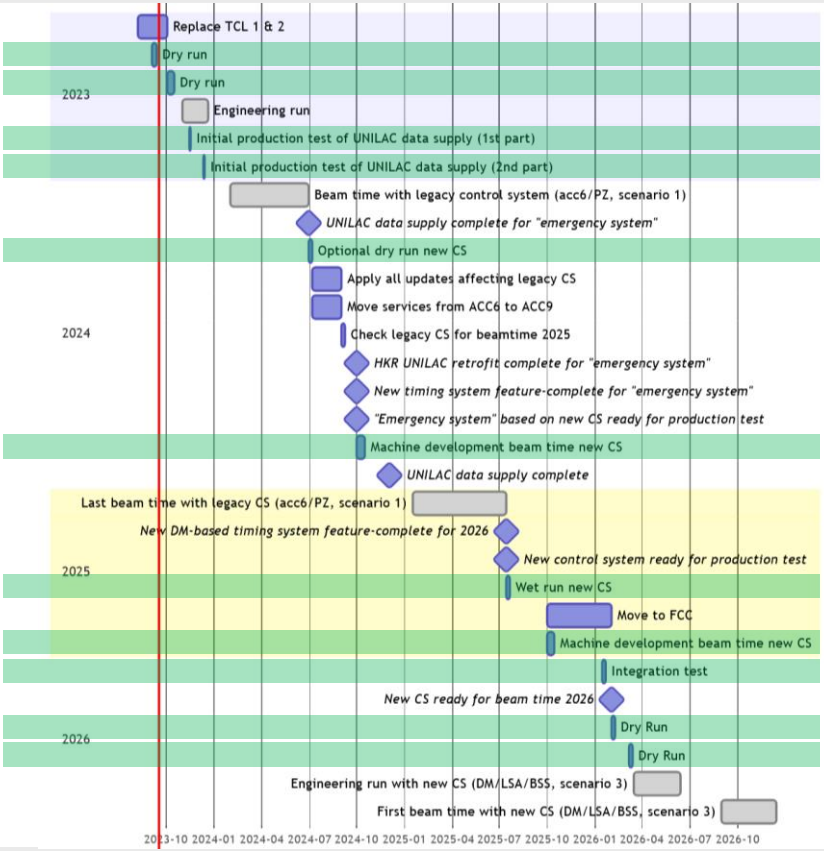
Top level milestones



UNILAC Controls Transition

Timeline until 2026

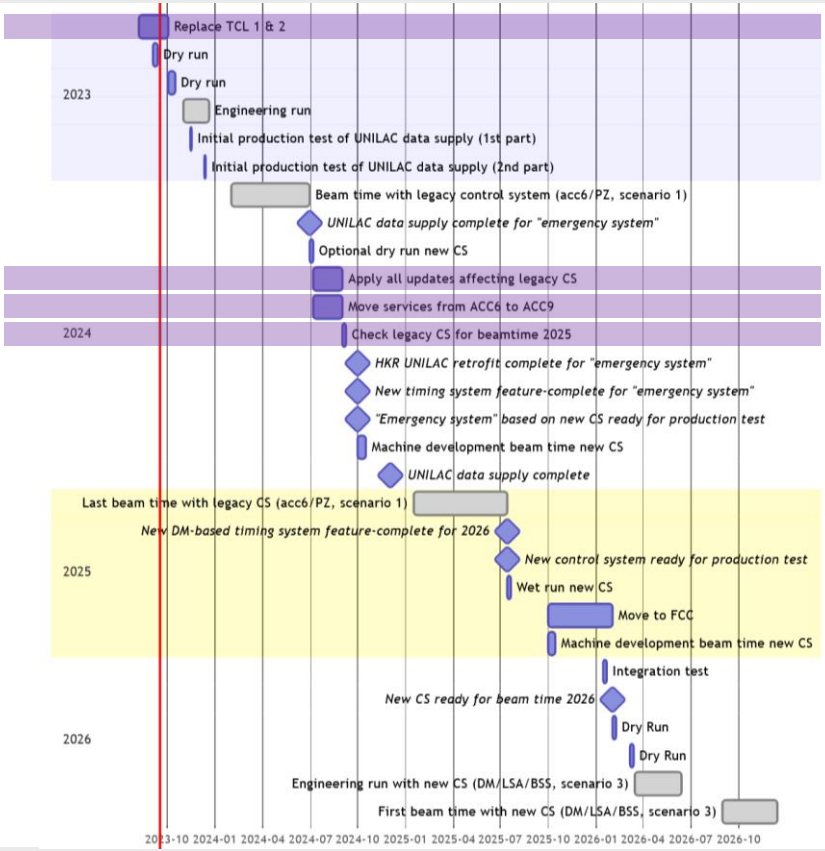
Testing periods



UNILAC Controls Transition

Timeline until 2026

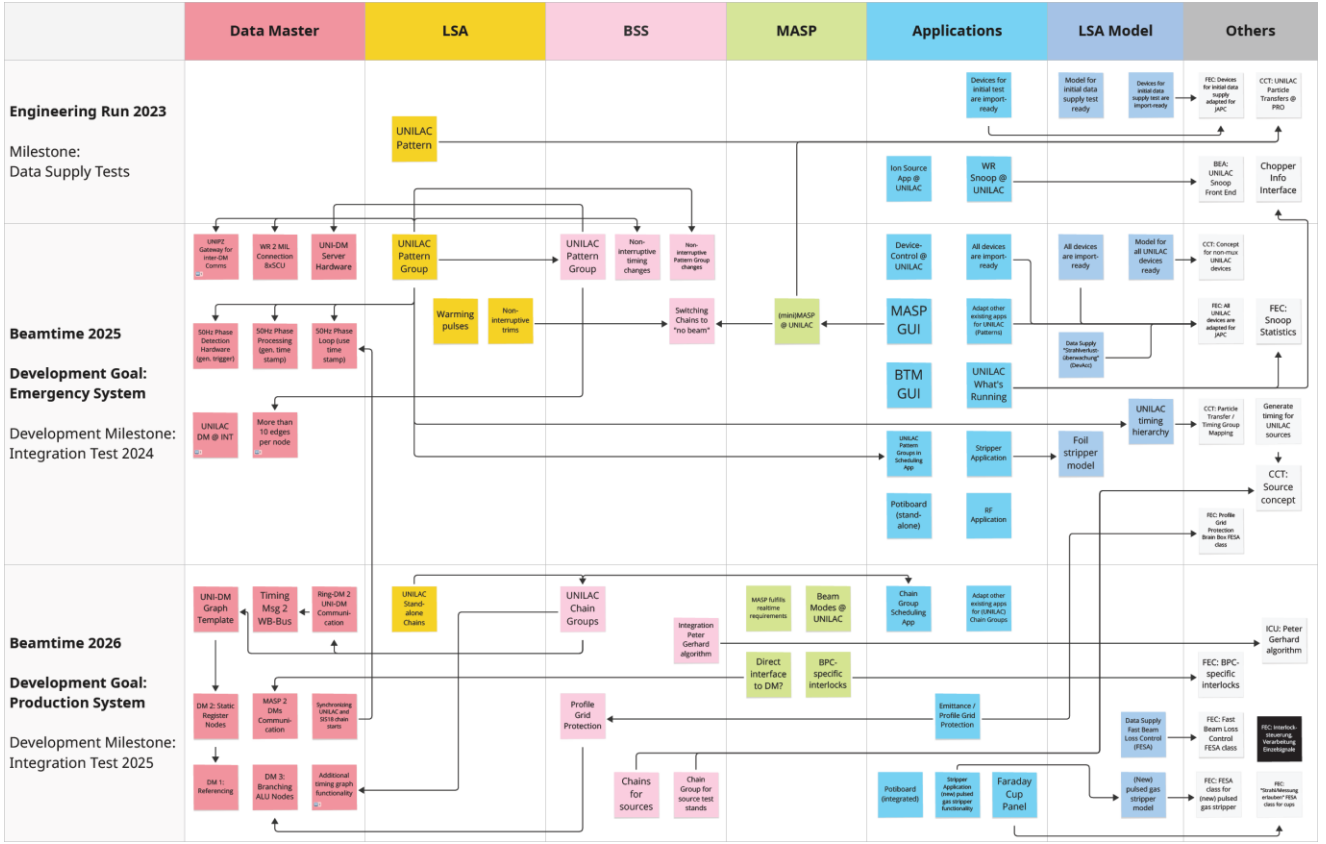
Legacy system maintenance



UNILAC Controls Transition

Milestone Overview until 2026

- Stepwise adaptation, extension and development of existing control system
- Support of other departments essential (BEA, SYS, OPE)
- APP development effort exceeds capacity

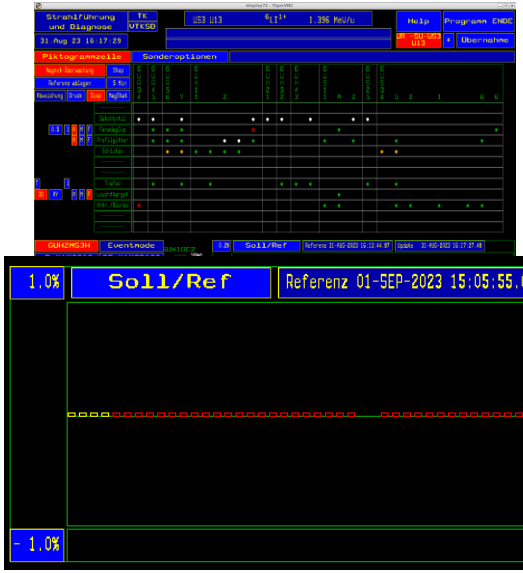


UNILAC Controls Transition

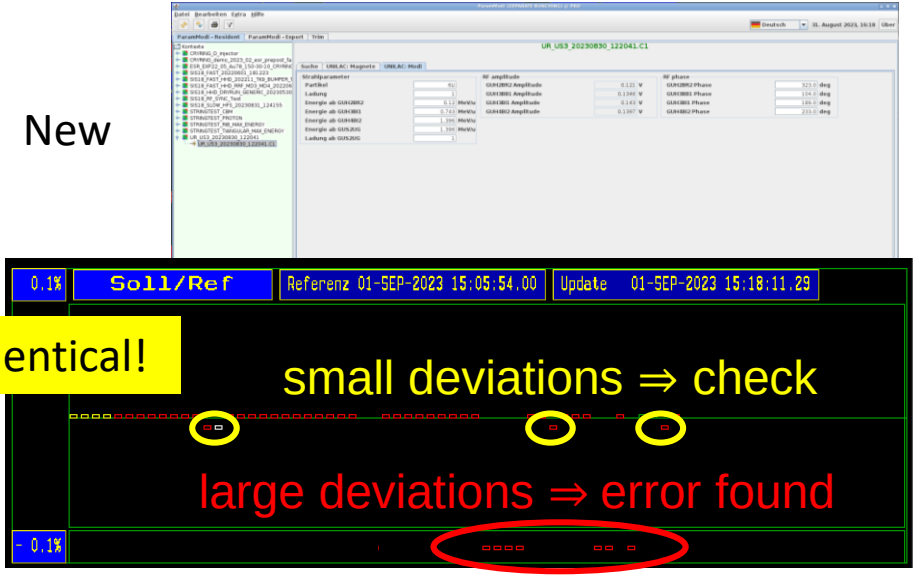
Highlight: First LSA@UNILAC Test in Dry-run 08/2023

- LSA setting supply of 47 magnets of 3 device types @HSI
- Supply settings for identical beams from both old and new control system

Old



New



Should be identical!

small deviations ⇒ check

large deviations ⇒ error found

- Also tested for different beams from new control system (not shown)

UNILAC Controls Transition

Strategy and Challenges

- Extend operation of legacy control system
  - Software: end of life ⇒ use extended support, check availability after patching
  - Hardware: obsolete
    - short-term: maintain or exchange where necessary
    - long-term: upgrade path to new technologies, go as soon as possible
  - Maintenance: loss of experts
- Migration, development of new control system
  - Short time, few development cycles → request additional testing possibilities, concentrate on basic operability, new features later
  - Loss of experts and expertise of the legacy system
- Commissioning of new control system for beamtime 2026
  - Learn and benefit from commissioning experience at SIS18 and ESR
  - Close coordination with OPE and users in preparation of the beamtime 2026

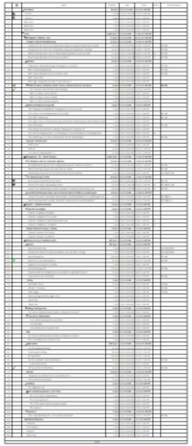
Controls Upgrade for UNILAC

Control Room Applications (1)

BEAM TIME RETREAT 2023

- List of Applications / Mapping of Functionality exists
- First rough planning done
- Detailed planning in work

Existing Program	Console(s)	Description	Future place of functionality	Responsible	Status	Milestone
BIF	U1,U3,TK	Beam Induced Fluorescence Monitor (letzter: GTK6DF2GH, GTK6DF2GV, GTK6DK2, GTK6DK2A,GTK6DT2,TK6MS2H)		BI Rainer		
B-VIEW	U1,U3,TK	Beam View		BI Rainer		
DEFAST	EM	Emittanz Messprogramm (schneller?)	ProEMeas	ACO-APP	Restarbeit + Teste	Mrz 20
DEMI	HO,EM	Emittanz Messprogramm (Schrittmotor/Schlitze, Profilgittermessung) (j	ProEMeas	ACO-APP	Restarbeit + Teste	Mrz 20
DPX	U1	Phasensonden mit Positionsmessung: Sondensignale und Tanksignale	Tanksignale darstellen, Energiemessung (BI): Digitizer? Neues Programm? Servicefkt.?		open/Klärung	
EIS	EQ	Programm f. EZR-Quellenteststand	Quellenprogramm		ready	
ESEL	EM	Emittanzmessstelle auswählen	ProEMeas	ACO-APP	Restarbeit + Teste	Mrz 20
DEVUTI/Prophelper		Device Access Geräte Zugriff	ist bereits neu	ACO-FEC	ready	
HF		HF-Steuerprogramm	new HF-App, zusätzliche Funktionalität: Übersicht? Referenz ableg	ACO-APP	ready / todo	tbd
HFU		Nodalbedienung HF	new HF-App		ready	
HF_LSB	U2	Hochfrequenzsteuerung UNILAC und HLI	new HF-App		ready	
IBHS		Inbetriebnahme Hochstrom	LSA Settings Management		todo (Modell)	
IL	TK	Interlock: Übersicht Anlage, Auswirkungen auf eingerichtete VAccs, His	MASP, Konfiguration für Unilac nötig		?	
IPD			Scheduling App		evtl. Kleinigkeiten?	
IQ		Quellenprogramm Operatingprogramm	Java Quellenprogramm	ACO-APP	in progress	
IQDRIV		Quellen-An- und Abfahrprogramm, Gerätetest	Sequencer Task	ACO-APP	finished	
IQMAGN		Magnete einzeln oder gemeinsam setzen für die Magnete im Bereich (	LSA Settings Management		todo (Modell)	
IQGITT		Profilgitterprogramm, auf einem Draht einzeln anzeigen	Profilgitterprogramm	ACO-APS	in Arbeit	
IQSPEK		Spektrumprogramm: Scanfunktion, Massenspektrum, Ladungsspektrum	new Spektrum App	ACO-APP	in Arbeit	tbd
IQLOG		Messwerte, Schalt- und Fahrbefehle wegschreiben	Persistenz? oder Archiving?	ACO-APP		tbd
IQWRITE		Schreibt Stromwerte weg	Archiving	ACO-SER	finished	
IQ-HKR	T2	Quellenoszi HKR ????? Oszi Screenshots?				
IQNORD	T2	Quellenoszi rechts	bringen Webinterface mit, sind remote bedienbar			
LEBL	HL,U2,EQ,U3	Low Energy Beamline				
L-M	UI	Poti			todo (Modell)	
OS-UL	T2	Quellenoszi links	bringen Webinterface mit, sind remote bedienbar			
OS-LSB		Quellenoszi LSB	bringen Webinterface mit, sind remote bedienbar			
PHAS	U1,U3,U2,HI	Phasensondenanwahl				
POTI	U	Potiboard				
PROEMI		Emittanz Auswertung	ProEmi Java	ACO-APP	ready	Mrz 20
R-M	UI	Poti	LSA Settings Management		todo (Modell)	
SCREENSHOT		Screenshot incl Ausdruck	Screenshot Applikation	ACO-APP	ready	
SBL	TK	Strahlwegumschaltung Unilac-EH - Magnete teilen sich ein Netzgerät	Sequencer Task?		open/Klärung	
SD		SD	Device Control	ACO-APP	todo (Gerätetypen)	
SPEK	U3/TK	Ladungsspektrum und Auswertefunktionen, Spektren Abspeichern und	new Spektrum App	ACO-APP	in Arbeit	Nov 20
TBO	TK,U1,U2,HL,U3	Transversale Strahloptimierung				
UNIABC	U	Unilac Einstellhilfen		M.Ohlig	ready	
UNILAC-PZ		Unilac Pulszentralenprogramm	BSS Control		ready	



- New Applications
  - IonSource → in work
  - Spectrum → started
  - UNILAC What's Running → 2025 (first mock-ups started)
  - Profile Grid Protection App → 2025
  - BTM GUI (2 step approach) → 2025
  - HF App → 2024/25
  - Faraday-Cup-Panel App → 2024/25
- Adaptation of existing new Apps
  - MASP GUI for UNILAC → 2024
  - Snoop GUI for UNILAC → 2024
- LSA Data Supply
  - UNILAC Machine Model → Peter Gerhard, S. Jülicher (in work)
  - SVÜ (Fast beam loss control) Data Supply → 2025

Controls Upgrade for UNILAC

Control Room Applications (2)

- Work started
- Test use of first applications targeting the Ion Sources already in the Engineering Run:
  - IonSource Application for HLI, Profile Grid Application, IonSource sequences, Emittance App
- Lots of upgrade tasks, new applications as well as adaptations of existing applications
- Tight resource constraints
  - Estimates exceed capacity of the team
  - Mitigations
    - FAIR "urgent items support contract" (Cosylab), work started
    - Labour leasing (Arbeitnehmerüberlassung/Ferchau) → no candidate yet
    - Early re-staffing of open position for the early retirement → urgently needed, blocked