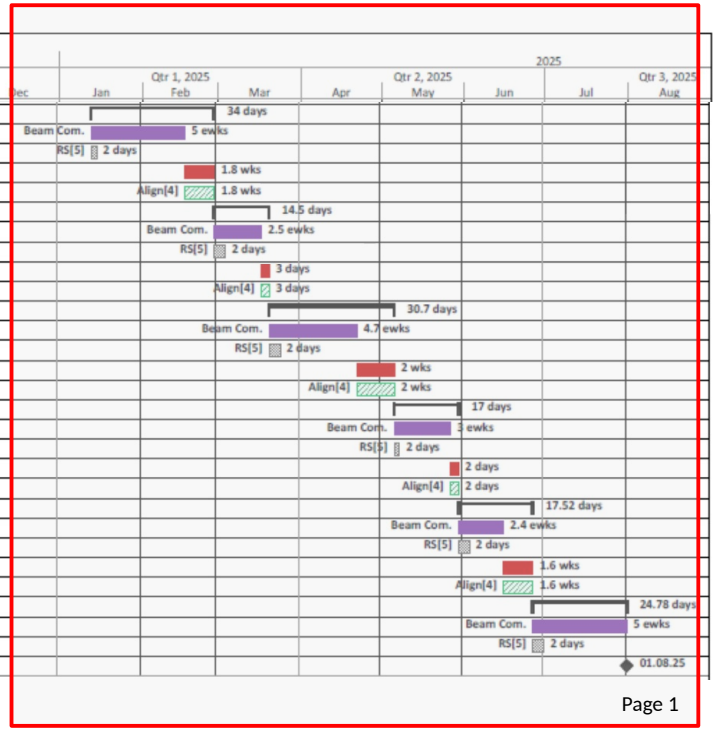
Timeline Storage Ring Commissioning

Timeline for Commissioning from 13.01.25 – 01.08.25
6 Com Slots ~22.5 Weeks → ~16 Com Working Weeks

5 Shutdowns ~6 Weeks

Task Name	Duration	Start	Finish	Resource Names
2nd Period	**34 days**	**Mon 13.01.25**	**Fri 28.02.25**	
Beam Commissioning	5 ewks	Mon 13.01.25	Mon 17.02.25	Beam Com.
Radiation Mapping	2 days	Mon 13.01.25	Wed 15.01.25	RS[5]
2nd Shutdown	1.8 wks	Mon 17.02.25	Fri 28.02.25	
2nd Final Alignment of new Storage Ring	1.8 wks	Mon 17.02.25	Fri 28.02.25	Align[4]
3rd Period	**14.5 days**	**Fri 28.02.25**	**Thu 20.03.25**	
Beam Commissioning	2.5 ewks	Fri 28.02.25	Tue 18.03.25	Beam Com.
Radiation Mapping	2 days	Fri 28.02.25	Tue 04.03.25	RS[5]
3rd Shutdown	3 days	Tue 18.03.25	Thu 20.03.25	
3rd Final Alignment of new Storage Ring	3 days	Tue 18.03.25	Thu 20.03.25	Align[4]
4th Period	**30.7 days**	**Thu 20.03.25**	**Tue 06.05.25**	
Beam Commissioning	4.7 ewks	Thu 20.03.25	Tue 22.04.25	Beam Com.
Radiation Mapping	2 days	Fri 21.03.25	Mon 24.03.25	RS[5]
4th Shutdown	2 wks	Tue 22.04.25	Tue 06.05.25	
4th Final Alignment of new Storage Ring	2 wks	Tue 22.04.25	Tue 06.05.25	Align[4]
5th Period	**17 days**	**Tue 06.05.25**	**Fri 30.05.25**	
Beam Commissioning	3 ewks	Tue 06.05.25	Tue 27.05.25	Beam Com.
Radiation Mapping	2 days	Tue 06.05.25	Thu 08.05.25	RS[5]
5th Shutdown	2 days	Tue 27.05.25	Fri 30.05.25	
5th Final Alignment of new Storage Ring	2 days	Tue 27.05.25	Fri 30.05.25	Align[4]
6th Period	**17.52 days**	**Fri 30.05.25**	**Fri 27.06.25**	
Beam Commissioning	2.4 ewks	Fri 30.05.25	Mon 16.06.25	Beam Com.
Radiation Mapping	2 days	Fri 30.05.25	Tue 03.06.25	RS[5]
6th Shutdown	1.6 wks	Mon 16.06.25	Fri 27.06.25	
6th Final Alignment of new Storage Ring	1.6 wks	Mon 16.06.25	Fri 27.06.25	Align[4]
7th Period	**24.78 days**	**Fri 27.06.25**	**Fri 01.08.25**	
Beam Commissioning	5 ewks	Fri 27.06.25	Fri 01.08.25	Beam Com.
Radiation Mapping	2 days	Fri 27.06.25	Tue 01.07.25	RS[5]
Start Pilot Experiments	0 days	Fri 01.08.25	Fri 01.08.25	



Commissioning Phases

The commissioning can divided into seven phases:

- *Phase 1 – Linac, booster and transfer line commissioning*
- Phase 2 – First-turn in storage ring
- Phase 3 – Second-turn and multi-turn
- Phase 4 – Accumulation, basic feedbacks and linear optics
- Phase 5 – Nominal beam current with advanced settings and feedbacks
- Phase 6 – Insertion device and collimator setup, making first photon beams
- Phase 7 – Finalization

Commissioning - Phase 2: First Turn

What ? Why ? How ?

Timeline

Phase 2: First turn

	Main goal	*What to measure*	*First-time component*	*Main diagnostics*	*Application*	*Status*
Step 0	QP/QPH nominal setting		All magnets+PSs		On-line model	Should be done in dry-run
	Sext, Oct, Corrector magnets on->off		(Current set and read)			
Step 1	Beam at thin septum exit	Beam position/sizes	Screen monitor	Screen monitor	Screen monitor tool	Exp. Completion ~22.12.24
					Beam swing	
Step 2	Beam into storage ring	Kicker timing scan	Kicker bump, K3 and K4	BPM-TBT	Scan tool	
			ARS01-DBPM-n for n<3000		Beam swing	
Step 3	First turn orbit control	First turn trajectory	All BPMs (polarity)	BPM-TBT	First turn tool	
	Soft correction		All QP/QPH (polarity)		Beam swing	
			All correctors (polarity)			
Step 4	BPM offset correction	First turn trajectory	All BPMs (offset)	BPM-TBT	First turn tool	
					Beam swing	
Step 5	First turn orbit control	First turn trajectory		BPM-TBT	First turn tool	
	Hard correction				Beam swing	

Parallel activity

Alarm handler, set-up and testing (will continue to next phases)

Checking interlock system (will continue to next phases)

No of shifts estimated		*Remark*
Best case	1	
Additional	3	Possible hardware troubles in the beginning

Commissioning - Phase 3: Multi Turn

Phase 3: Multi turn

	Main goal	*What to measure*	*First-time component*	*Main diagnostics*	*Application*	*Status*
Step 1	1st and 2nd turn orbit equalization	1st and 2nd turn trajectory		BPM-TBT / BLM	First turn tool	0.5
Step 2	Multi turn (Still sext and oct off)	Beam survival	Kicker bump, K1 and K2 (Timing, kick as in Ph. 2-2)	BPM-TBT / BLM	Scan tool	0.5

No of shifts estimated		*Remark*
Best case	1	
Additional	0	

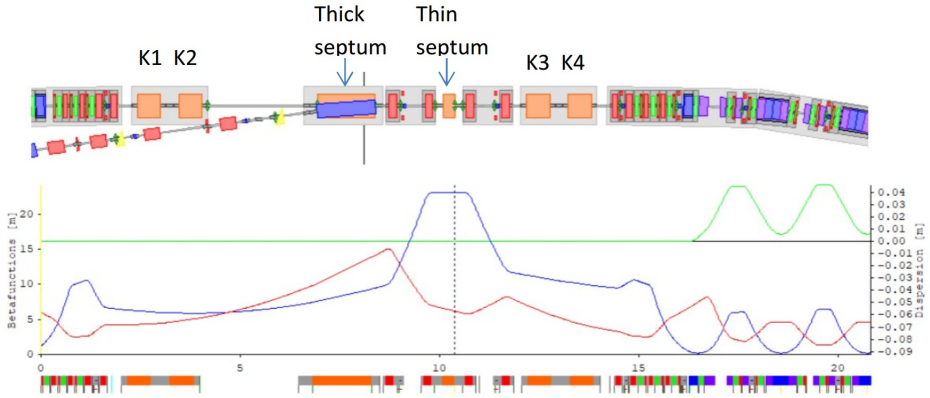
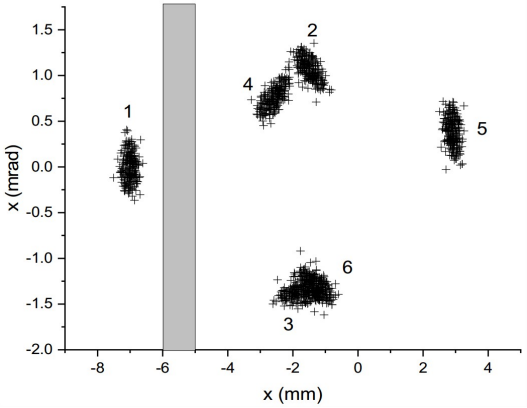


Figure 3. Layout of injection straight and optical functions.



Commissioning - Phase 4: Accumulation, Feedbacks & Linear Optics

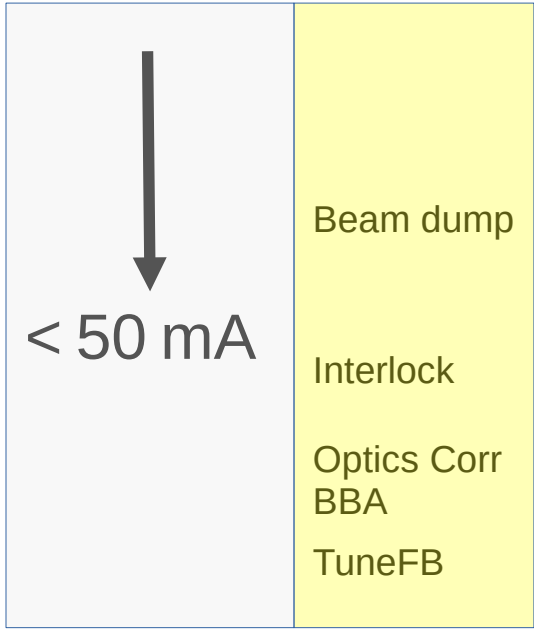
Phase 4: Accumulation, basic feedback, linear optics

	Main goal	*What to measure*	*First-time component*	*Main diagnostics*	*Application*	*Status*
Step 1	Capture and accumulation	Beam survival	Sext and oct magnets	BPM-TBT	On-line model	2 shifts to go
	(Low current only, <50 mA)	Currecnt accumulated	500 MHz RF		RF panel	
	+ Orbit correction	Closed orbit	All BPMs and MCOX/Y	BPM-Orbit	OCO application	
		Injection efficiency	CTs	CTs	Inj. efficiency monitor	
		Tunes, H, V (, L)	Tune monitor (one of BPMs)		Tune panel	
		Optional: Beam loss	BLM	BLM	Beam loss app	
Step 2	Beam dump test at low current	Beam current	Emergency dump system		Emergency dump panel	1
			Normal dump procedure		Normal dump app/panel	
		Optional: Beam loss	BLM	BLM	Beam loss app	
Step 3	Slow orbit feedback	Closed orbit			OCO application	1
	Energy feedback					
Step 4	Orbit interlock test		Interlock system	BPM-Orbit	Interlock panel	1
					(Alram handler)	
Step 5	Linear optics correction	Orbit response	All MQCOs	BPM-Orbit	OCO/LOCO application	1
	(First try, no iteration)	Hor. Dispersion				
Step 6	BPM BBA	Orbit change	MQCOs in scan (not all)	BPM-Orbit	OCO application	1
Step 7	Tune feedback test	Tunes incl synchrotron tune		Tune monitor	Tune panel	1

Parallel activity

Vacuum pressure monitoring, Pressure vs Integrated beam current (will continue to next Phases)
Synch. radiation beam size monitor commissioning
Commissioning of filling pattern feedback (open loop)
Commissioning of fast orbit fedback (open loop)
Commissioning of multi bunch fedback (open loop)
Lifetime measurement tests

No of shifts estimated		*Remark*
Best case	8	
Additional	3	In case, where Step 1 is not successful within one shift



Commissioning - Phase 5: Nominal Current & Advanced Settings

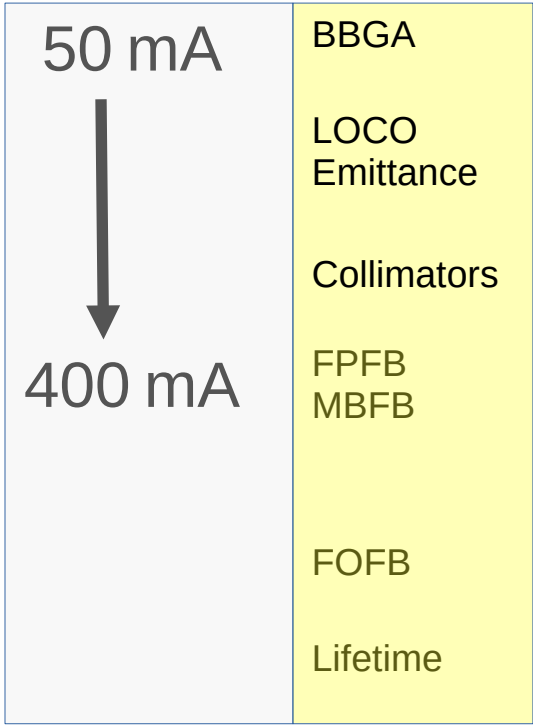
Phase 5: Nominal current, advanced settings and feedbacks

	Main goal	*What to measure*	*First-time component*	*Main diagnostics*	*Application*	*Status*
Step 1	V. remote girder alignment (optional) H. re-alignment in tunnel (if needed)	Corrector	Girder	BPM-Orbit	OCO or separate app	1
Step 2	Vertical emittance control + Coupling correction (First try, no iteration)	Lifetime Dispersion Orbit response Optional: Beam size	All MQSKs	CT BPM-Orbit Beam size monitor	Lifetime panel Eta measurement LOCO application Beam size application	2
Step 3	Chromaticity correction	Tunes	Sextupole (polarity)	Tune monitor	Chromaticity app	2
Step 4	Collimator set up (Rough adjustment)	Beam loss	Collimators	BLM	Collimator panel	1
Step 5	Nominal beam current MBFB closed loop (if unstable)	Beam current Filling pattern Mode coupling	3HC (Including tuning?) Filling pattern feedback MBFB system		3HC panel Filling pattern controller Mode coupling monitor panel	2
Step 6	LOCO correction iteration BBA repeated					3
Step 7	Fast orbit feedback H. corrector change if possible (600->400 urad)	Closed orbit	BPM (FOFB) MCOX (400 urad)	BPM	Feedback panel	3
Step 8	Lifetime optimization	Lifetime		CT Optional: Using BLM	Random optimization Inj. Efficiency monitor	1

Parallel activity

No of shifts estimated		*Remark*
Best case	15	
Additional	5	Realignment in the tunnel might be necessary MBFB essential

* ORM and eta could be done with OCO.
* LOCO application takes them as input.



Commissioning - Phase 6: Insertion Devices & Collimators

Phase 6: Insertion devices and collimators

	Main goal	*What to measure*	*First-time component*	*Main diagnostics*	*Application*	*Status*
Step 1	**ID test one by one**	**Lifetime (deterioration)**	**ID**	**CT**		**4 (Many ORMs)**
		Corrector response (FOFB)		**BPM-Orbit**	**Feedforward application**	
	+ Optics measurement	**Orbit response**			**OCO/LOCO application**	
Step 2	**Collimator fine adjustment**	**Lifetime**		**CT**	**Collimator panel**	**1**
		Beam loss		**BLM**		
						2
Step 3	**Orbit feedforward**	**Closed orbit (w/o FOFB)**				
Step 4	**Beam dump test with ID**	**Beam loss**		**BLM**	**BLM panel**	**1**
Step 5	**Photon beam to user beamline**	**SR/Beamline vacuum**			**Vacuum panel**	**1**

Parallel activity		
No of shifts estimated		*Remark*
Best case	**9**	
Additional		

Commissioning - Phase 7: Finalization & BPM Features

Phase 7: Finalization

	Main goal	*What to measure*	*First-time component*	*Main diagnostics*	*Application*	*Status*
Step 1	MBFB commissioning	Bunch by bunch motions	MBFB full system	MBFB BPMs	MBFB application	2
Step 2	ID feedforward elaboration Possibly extension to linear optics and coupling	Orbit response			Feedforward application OCO/LOCO application	3
Step 3	Machine development with XBPMs	Photon beam position	XBPMs	XBPMs	XBPM panel	2
Step 4	All refinements					
Parallel activity						
	All possible parallel activities					

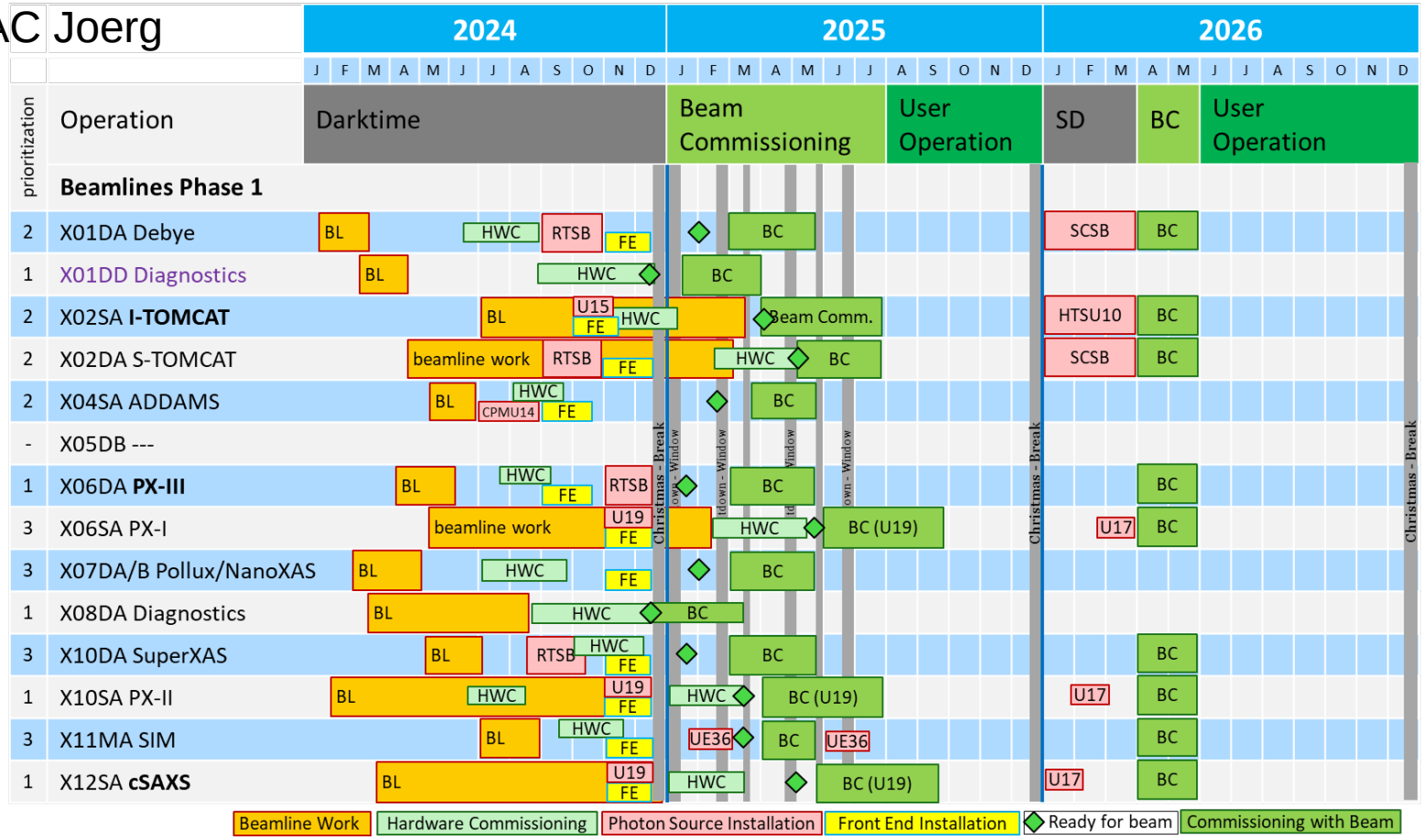
BPM system requirements at the different phases of commissioning →

BPM

Functionality	Required 1st time (opt.)	Status
Turn by turn	Phase 2-2	
Offset	Phase 2-4	
Orbit mode	Phase 4-1	
Slow feedback	Phase 4-3	
BBA / Roll	Phase 4-1	
Fast feedback	Phase 5-3	

SLS 2.0 Overview Timetable (Version 2024/02)

MAC Joerg



Frithjof

Timeline SLS PRC – Pilot and Useroperation

	Jul – Dec 2024	Jan – Jun 2025	Jul – Dec 2025	Jan – Jun 2026	Jul – Dec 2026
Phase I Shutdown					
Phase I: Debye, I-Tomcat, S-Tomcat, ADDAMS, PXI, PXII, PXIII, PolLux, nanoXAS, superXAS, cSAXS		Com machine Com beamline	Aug Starting first beamlines with Pilot, sequence TBD Nov starting with first regular user (selected from Pilot experiments)	Shutdown, com maschine and beamline	Regular user operation, partly not 100%
PRC	Oct: No PRC	Apr (online): Discussion of Categories of pilot experiments	Aug: rolling "call" pilot Oct: discussion pilots and selection of user	Feb regular call Apr regular PRC	Aug regular call Oct regular PRC
Phase II shutdown					
VUV, Phoenix, X-Treme, microXAS, XIL, Opera				Shutdown, com maschine and beamline	Aug Starting first beamlines with Pilot, sequence TBD
PRC				Feb Discussion of Categories of pilot experiments	Aug rolling "call" pilot + regular call Oct: feedback pilot and regular for 2027
Phase II +					
ADRESS, Ultra					

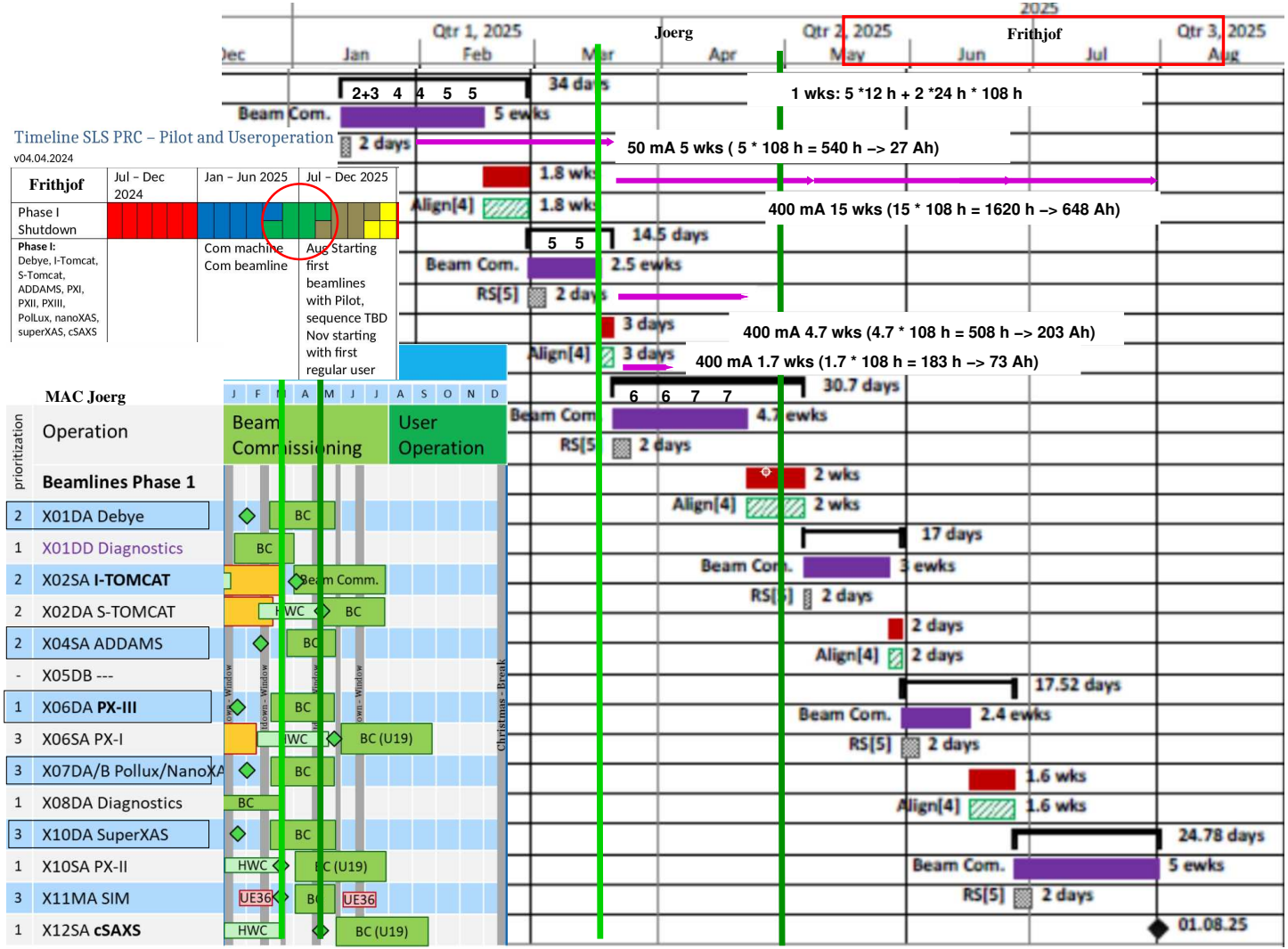
Pilotexperiments aims:

- Aim at specific commissioning of the beamline with a scientific target
- The target must be adapted to the reality at the beamline

- The progress for the beamline has a higher merit than the scientific excellence
- No normal user operation, only experts
- Getting first, beamline external, scientist on board and collect feedback
- Demonstration of new capabilities
- Experiments should not be to complicated in order to have realistic achievements
- A mixture of PSI, Swiss and international users would be good
- Increasing complexity of pilot

Process

- Categories of possible pilot experiments are discussed with the PRC sounding board (April 2025)
- The beamline scientist is in charge
- The beamline proposes Pilot experiments and together with the corresponding laboratory head and after (informal) consultation with SLS 2.0 and ESup, they decide. This process can be rolling process, e.g. not all slots should be assigned from the beginning
- The list of pilotexperiments and the status is discussed at the PRC soundboard (Oct 2025)

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phase 2: 1  +3  1  4
phase 3: 1      2  5   1 w  01/25
phase 4: 8  +6 10 16   3 w  02/25
phase 5: 15 +5 25 36   7 w  03/25
phase 6: 9     34 45   9 w  04/25
phase 7: 7     41 52  10 w  04/25
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6 commissioning slots 22.6 w
5 shutdowns 6 w
================================
commissioning slots:
================================
1. 5   w    5   w 01-02 m
2. 2.5 w    7.5 w 03    m
3. 4.7 w   12.2 w 03-04 m
4. 3.0 w   15.2 w 05    m
5. 2.4 w   17.6 w 06    m
6. 5   w   22.6 w 06-07 m
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