T-REX
Instrument Project

75%

Christian Franz, Lead Scientist
Nicolò Violini, Senior Scientist

Marcel Serwe, Lead Engineer
Mario Koenen, Project Engineer
Teddy Kozielewski, Project Engineer

ESS: Mohamed Aouane (Jan. 2025)
Sylvain Desert (Oct. 2025)
Bing Li (data scientist) (Jan 2026)

25%

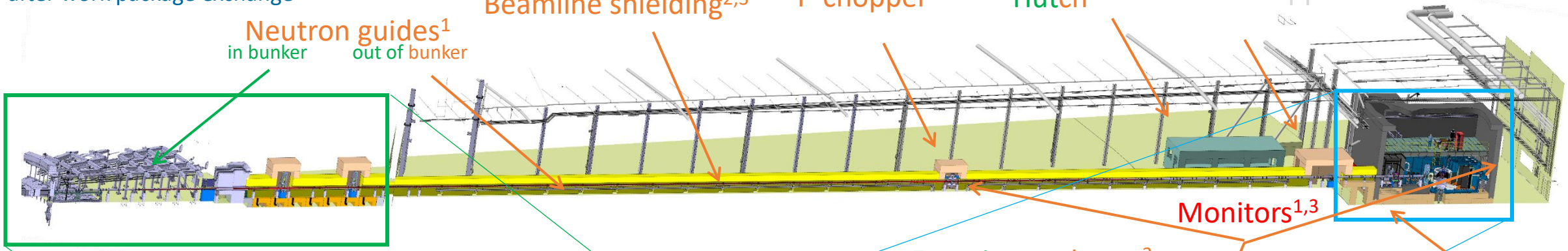
Andrea Orecchini,
CNR Work-package
scientific responsible

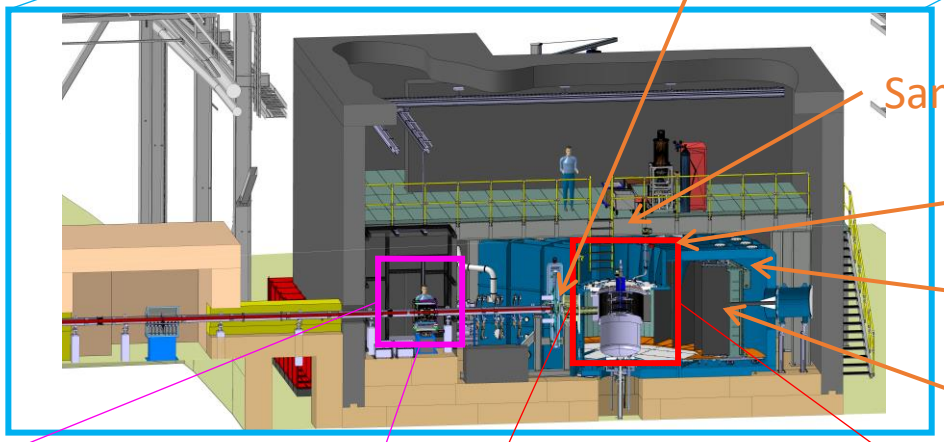
Enrico Zanieri, Project Engineer
Francesco Sacchetti, Senior advisor
Alessio Laloni, Engineer

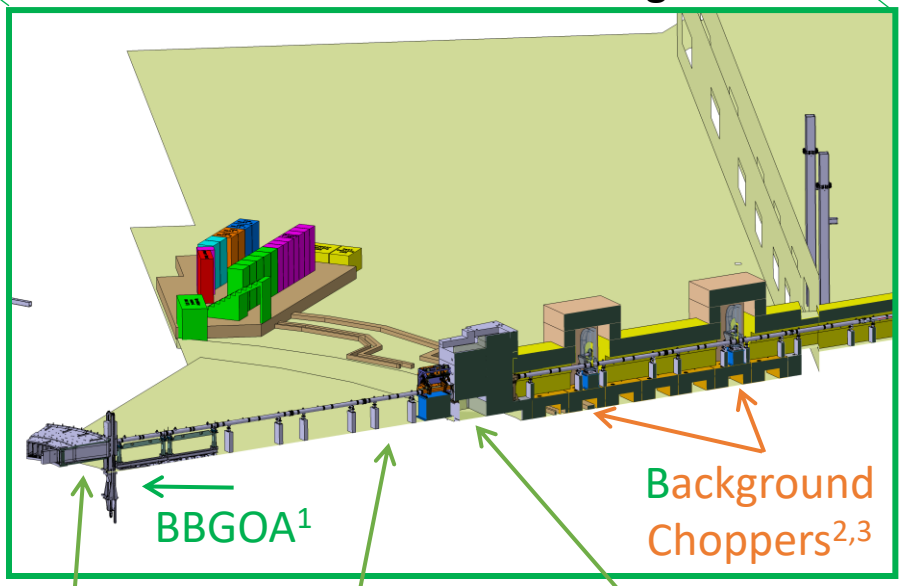
ICEB – 29 Apr 2026

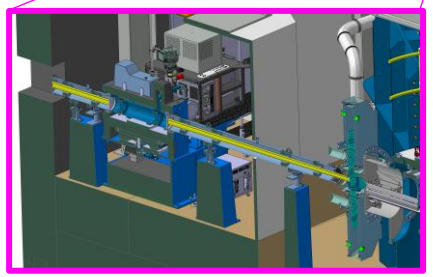
T-REX layout*

* after work package exchange

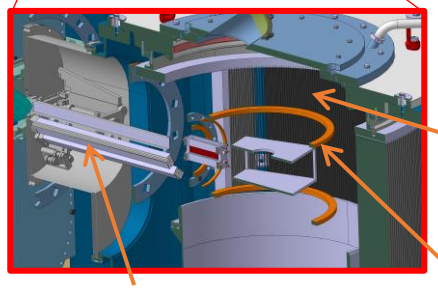








Therm. & cold polariser[1]



Primary collimator[2]

Polarisation Analysis[1,3]

Partner:

[1] FZJ

[2] CNR

[3] ESS

Status:

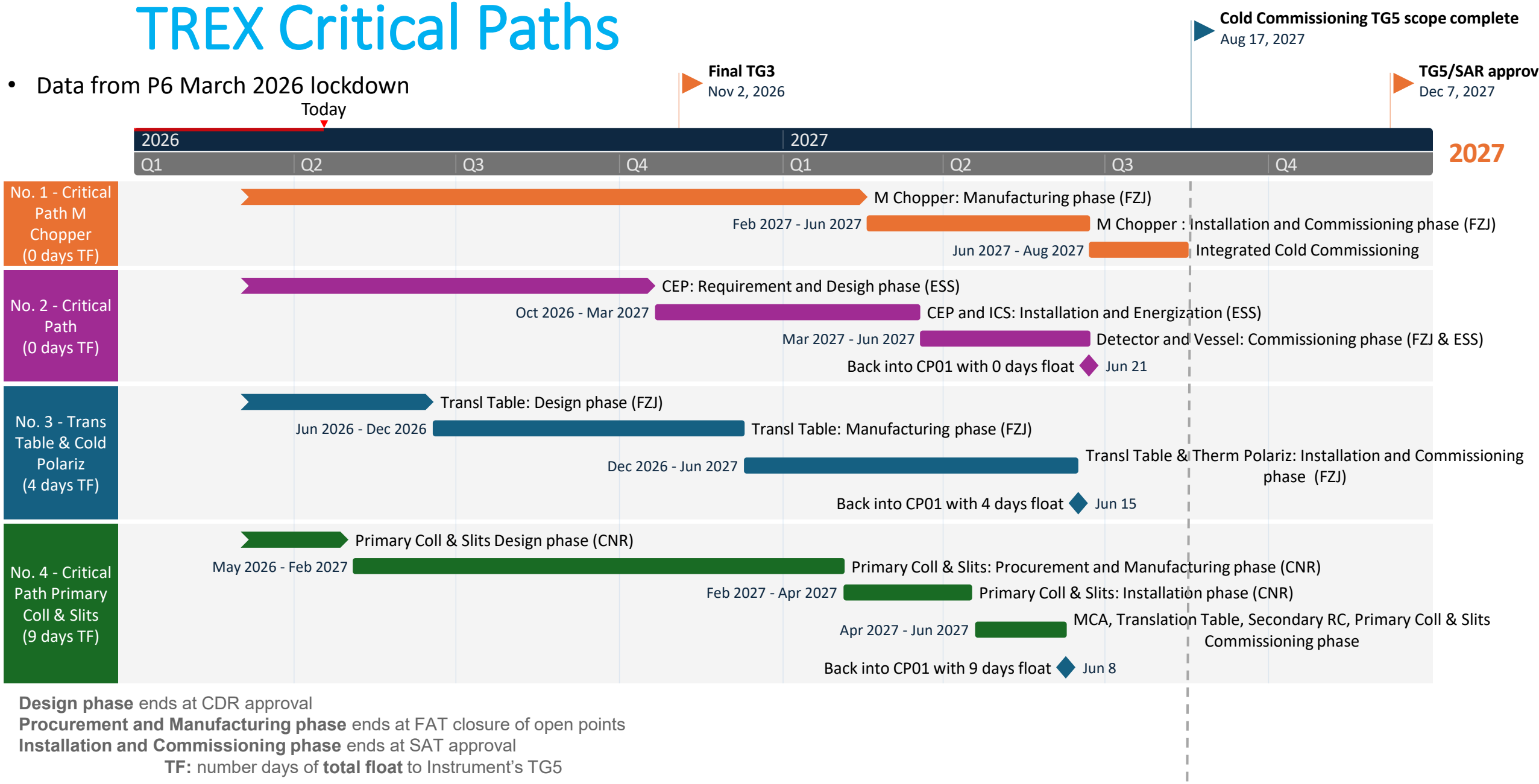
Installed

In manufa.

No subTG3

TREX Critical Paths

- Data from P6 March 2026 lockdown



Design phase ends at CDR approval
Procurement and Manufacturing phase ends at FAT closure of open points
Installation and Commissioning phase ends at SAT approval
TF: number days of **total float** to Instrument's TG5

T-REX project overview and status

by work-packages

Neutron guide system & Heavy shutter

S-DH

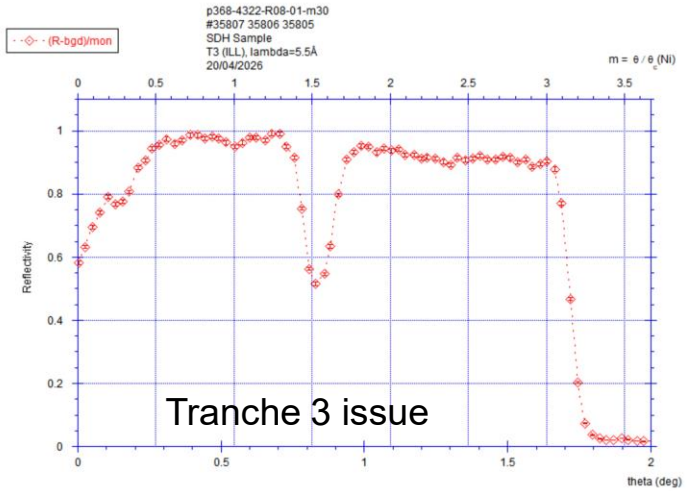
nano optics berlin nob

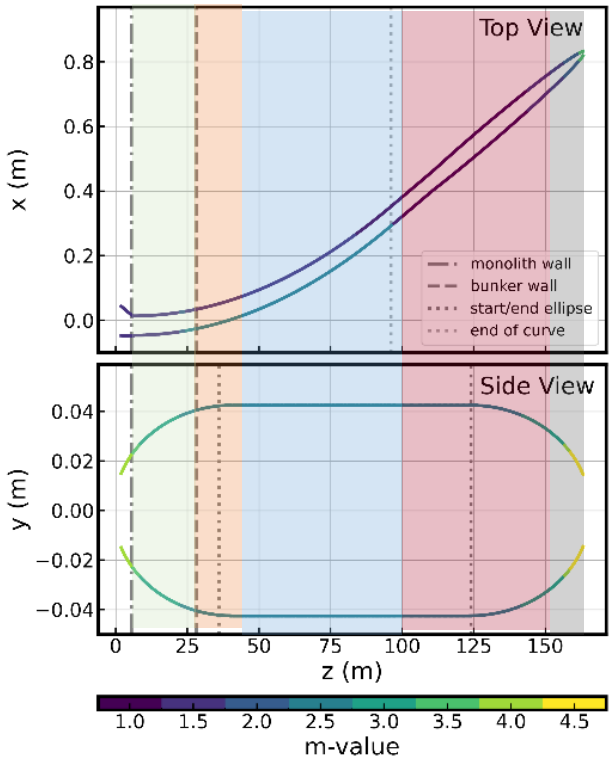
NBOA
- installed ✓

in-bunker & BWI
- Installed ✓

Heavy shutter:
- Installed

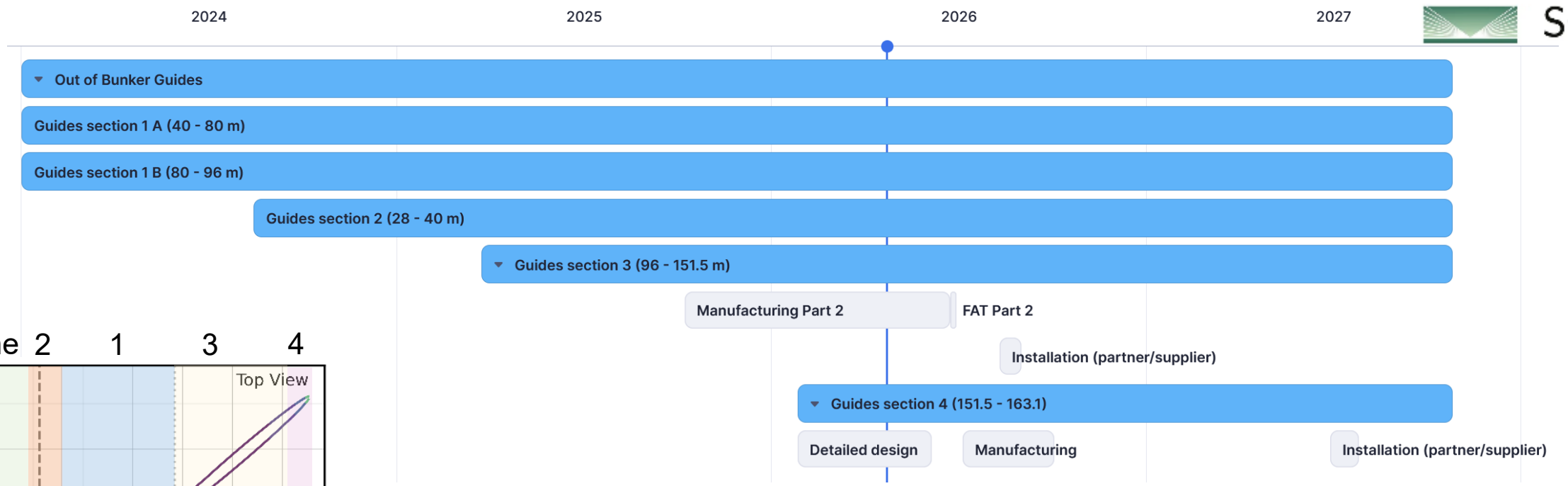
out of bunker guides & BBGOA
- Tranche 1 (40-96m) installed ✓
- Tranche 2 (28-40) in installation
- Tranche 3 (96-151m) in manufacturing delayed 4-7w!
- Tranche 4 in design

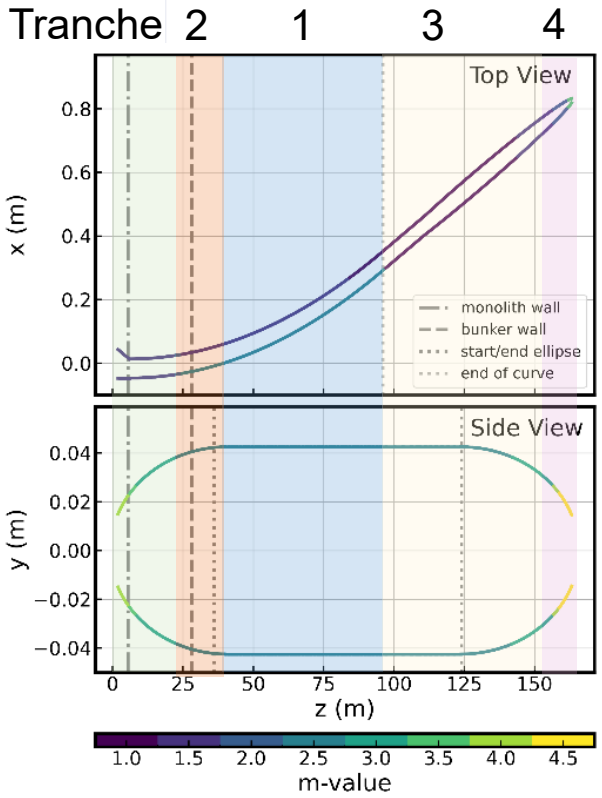




Consiglio Nazionale delle Ricerche

Neutron guide system – out of bunker

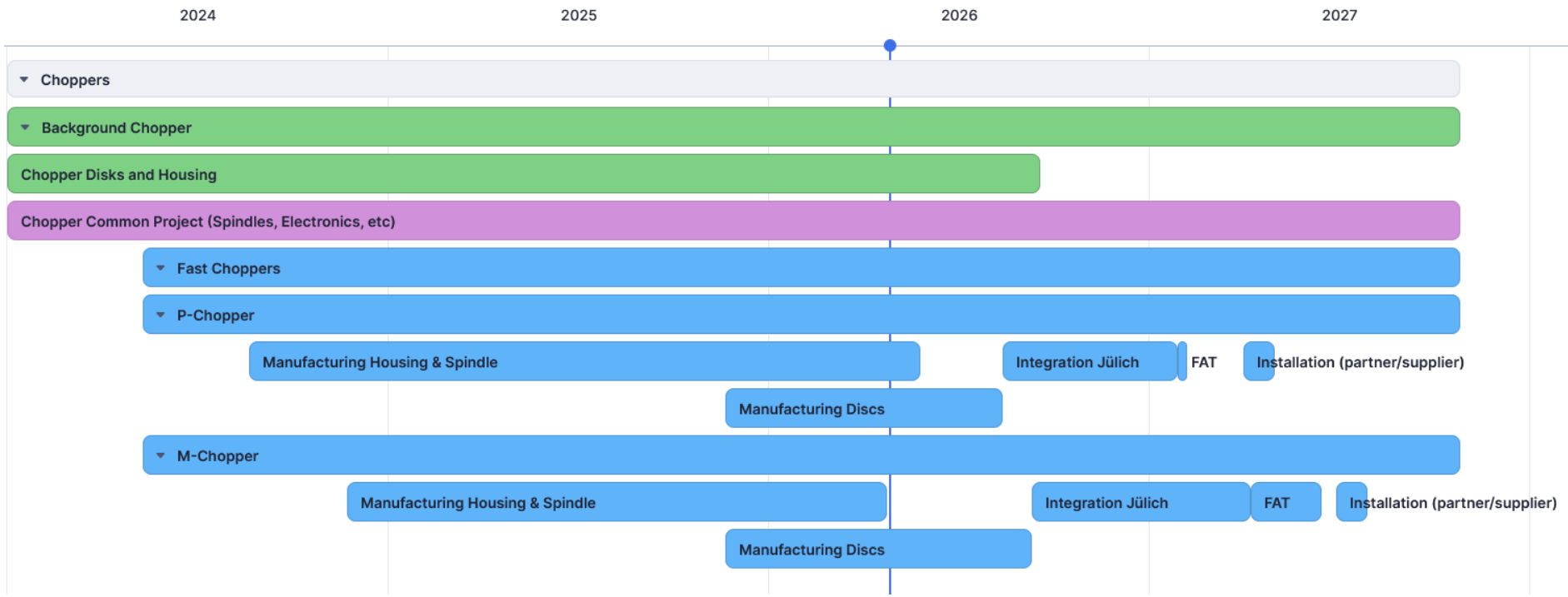




out of bunker guides

- Tranche 1 installed
- Tranche 2 partly installed (BWC 2 missing)
  Tranche 3 in manufacturing
- Tranche 4 in design -> most complex (M-Chopper, primary collimator, polarisation…)

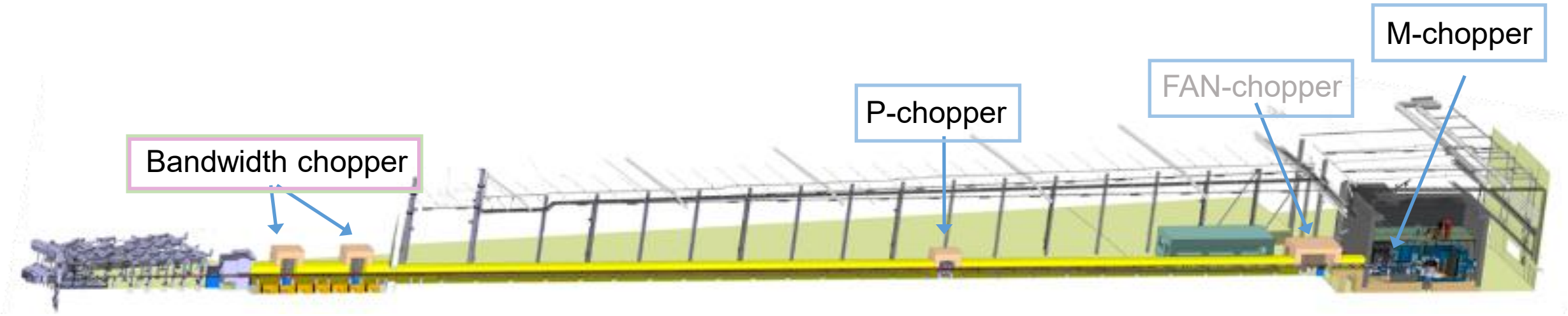
Neutron choppers - Overview



Consiglio Nazionale delle Ricerche

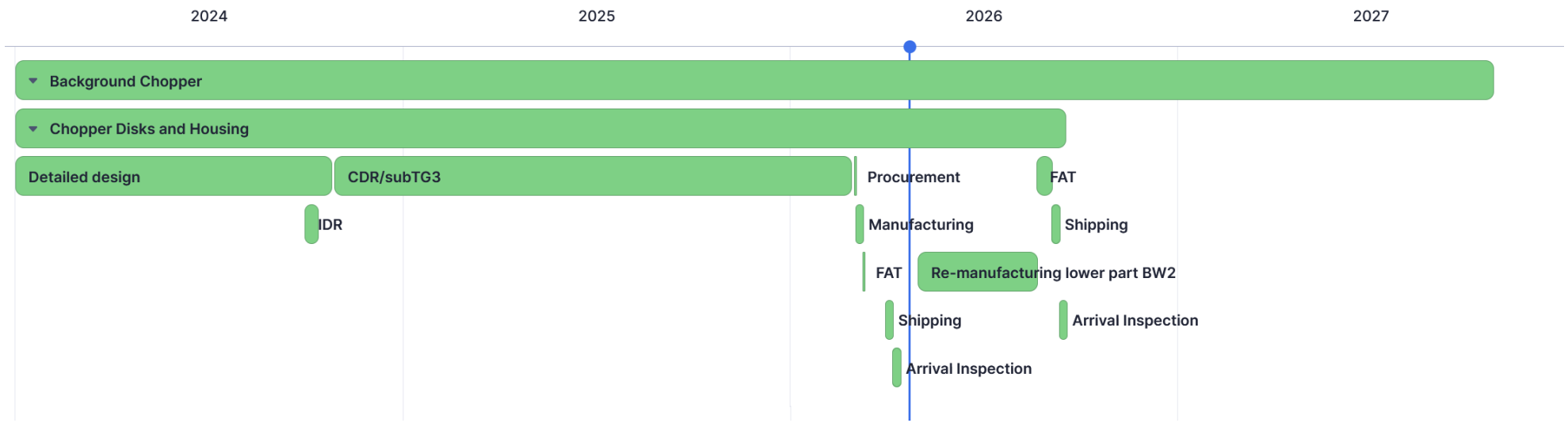
JÜLICH Forschungszentrum

ESS EUROPEAN SPALLATION SOURCE



Slow Neutron choppers

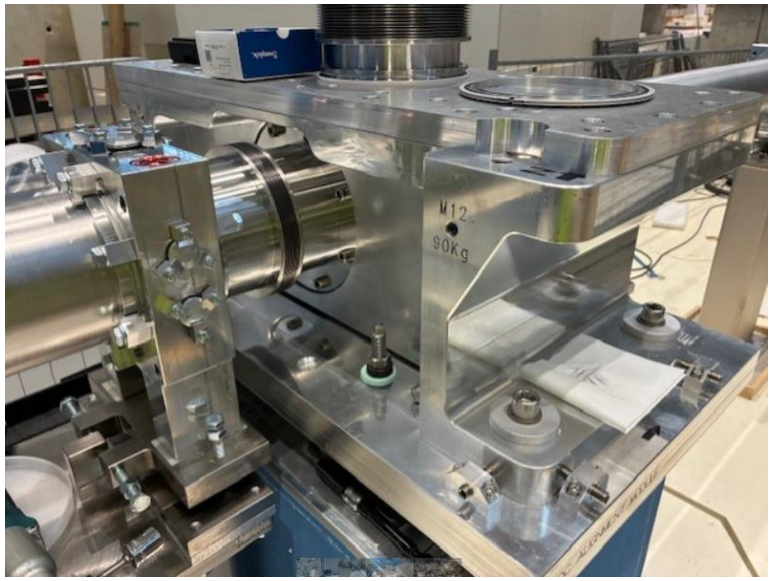
Band Width & CrossTalk Chopper (14Hz)



- Discs and spindles delivered to ESS chopper group
- Housings delivered to ESS, lower parts installed
- **Housing BW2 has a leak, must be re-manufactured**

- **Joined the common project – all documents are signed**
  Hybrid solution with hardware from CNR

Disc



Installed housing

Fast neutron choppers - reminder

P-Chopper (252Hz)

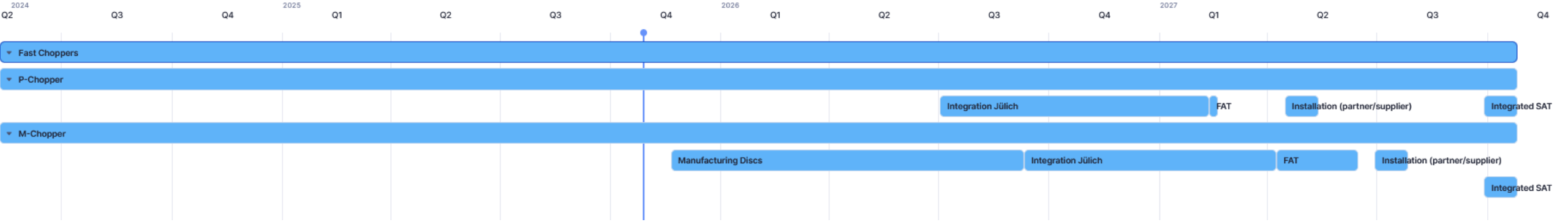
P-01

P-02

M-Chopper (336Hz)

M-01

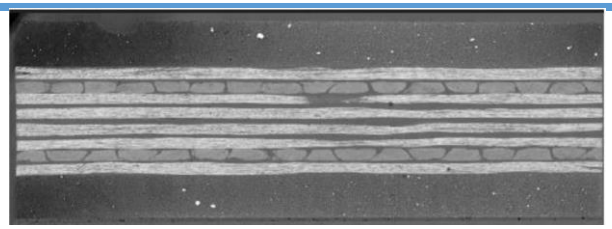
M-02



- Both P-chopper discs were destroyed during first ramp-up in the test stand at high speeds (P-02 higher than operational speed)
- M-02 passed the cycling test (5 cycles at 10% overspeed) and was destroyed during ramp-up at high speeds for long run → possible aging effect?

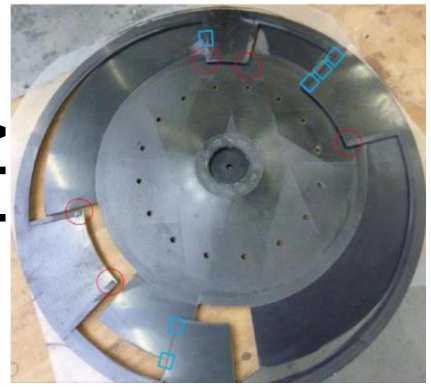
Fast neutron choppers

Sample program at Airbus resulted in a changed production process



P01-II produced

P02-II in production



Airbus

Addtl´M01 disc ordered

Manufacturing M01-II & M02-II

P-discs Speed Test May ´26

M-discs Speed Test June ´26

Delivery of all 4 discs to FZJ Sept ´26

Jülich

Q1 Q2 Q3 Q4 Q1 Q2

2026 2027

Today

Housing and Spindle construction

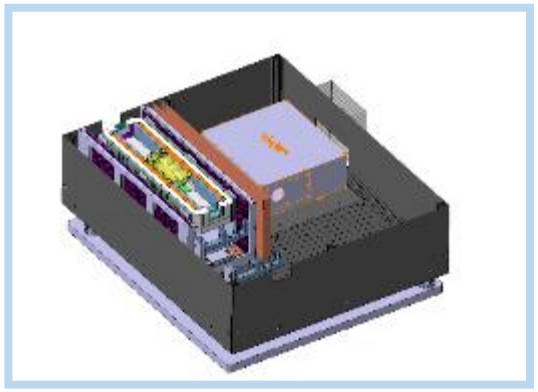
Integration tests with M01-I disc

Final integration at FZJ (8mo)

Integration At ESS (6mo)

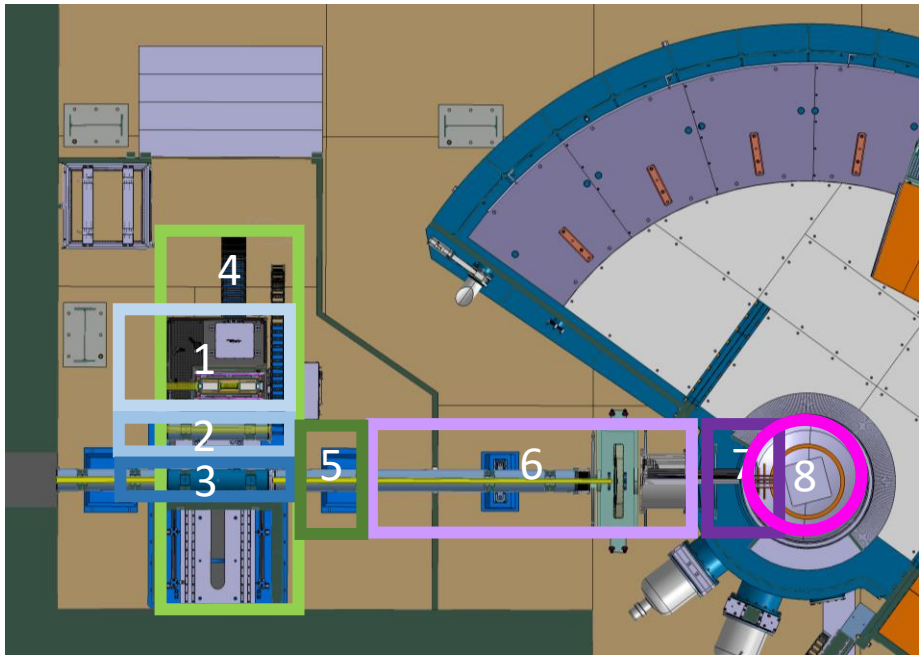
Polarization equipment

1. Thermal polarizer

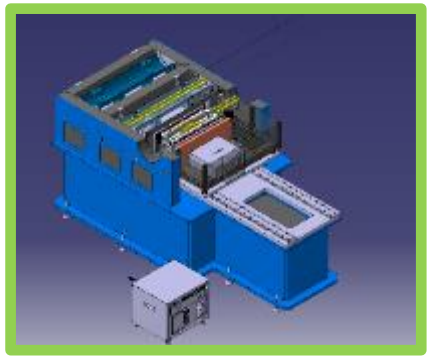


2. Cold polarizer

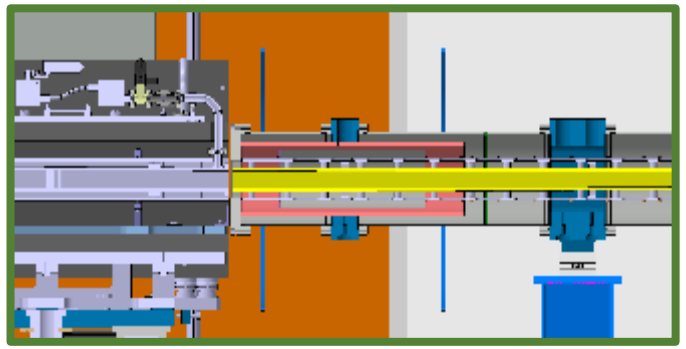
3. Neutron guide



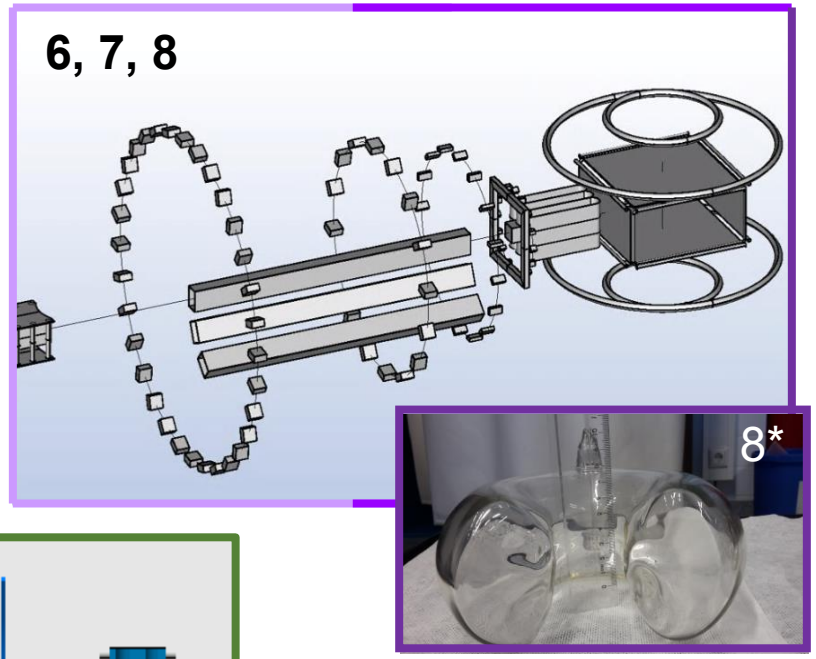
4 Guide exchange unit



5. Spin Flipper

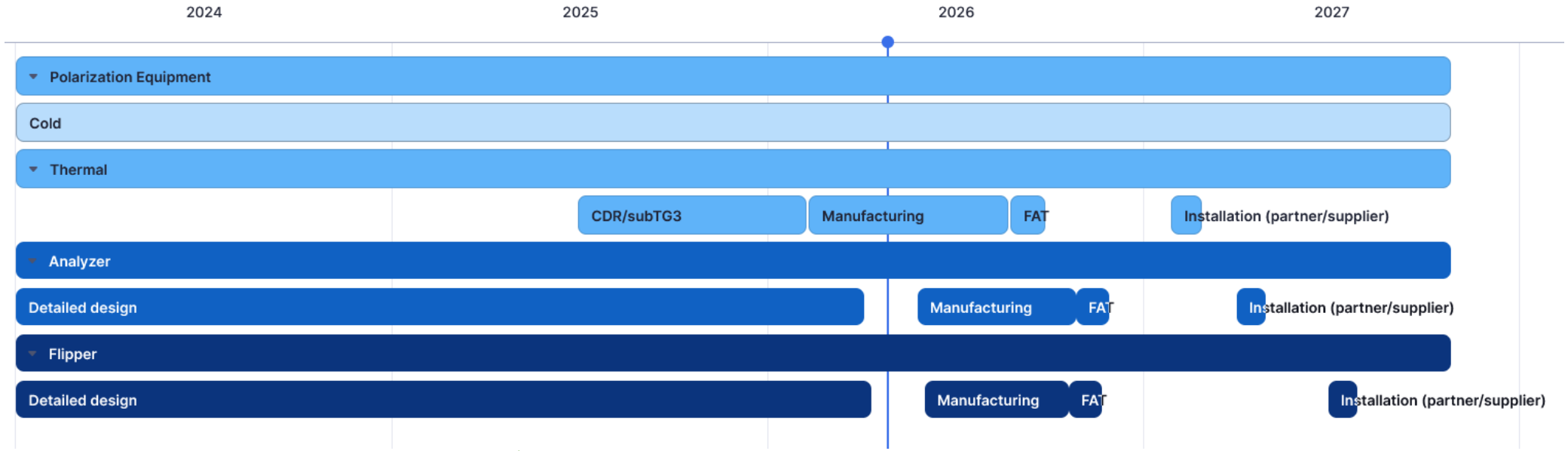


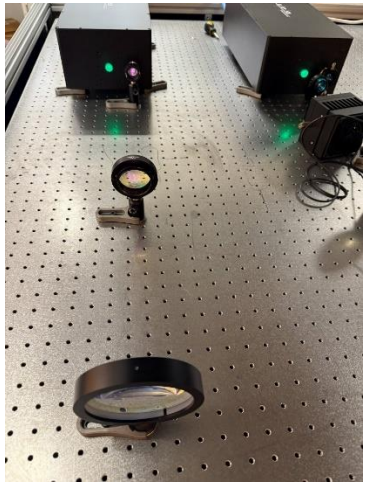
6. Guide field (spin holding)
7. Adiabatic field (spin rotation)
8. PASTIS setup



*Provided by ESS

Polarization equipment

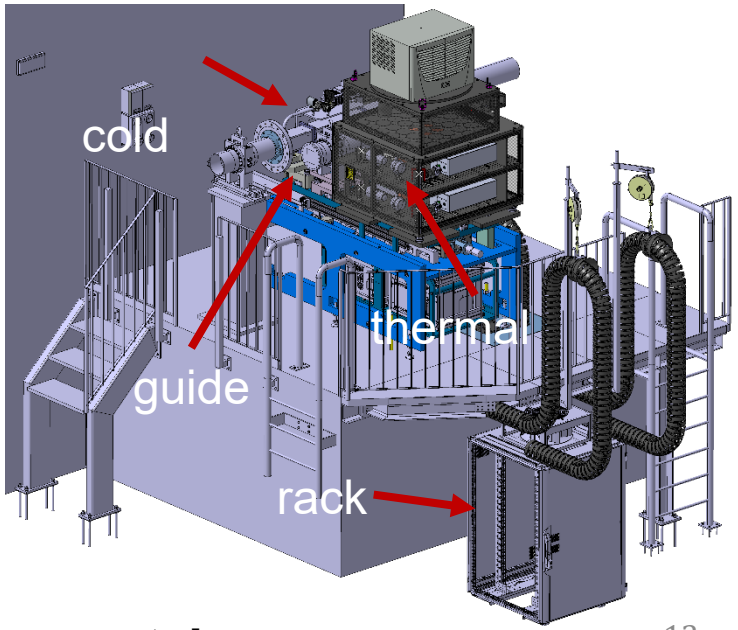




- Cold neutrons polarizer: finished ✓

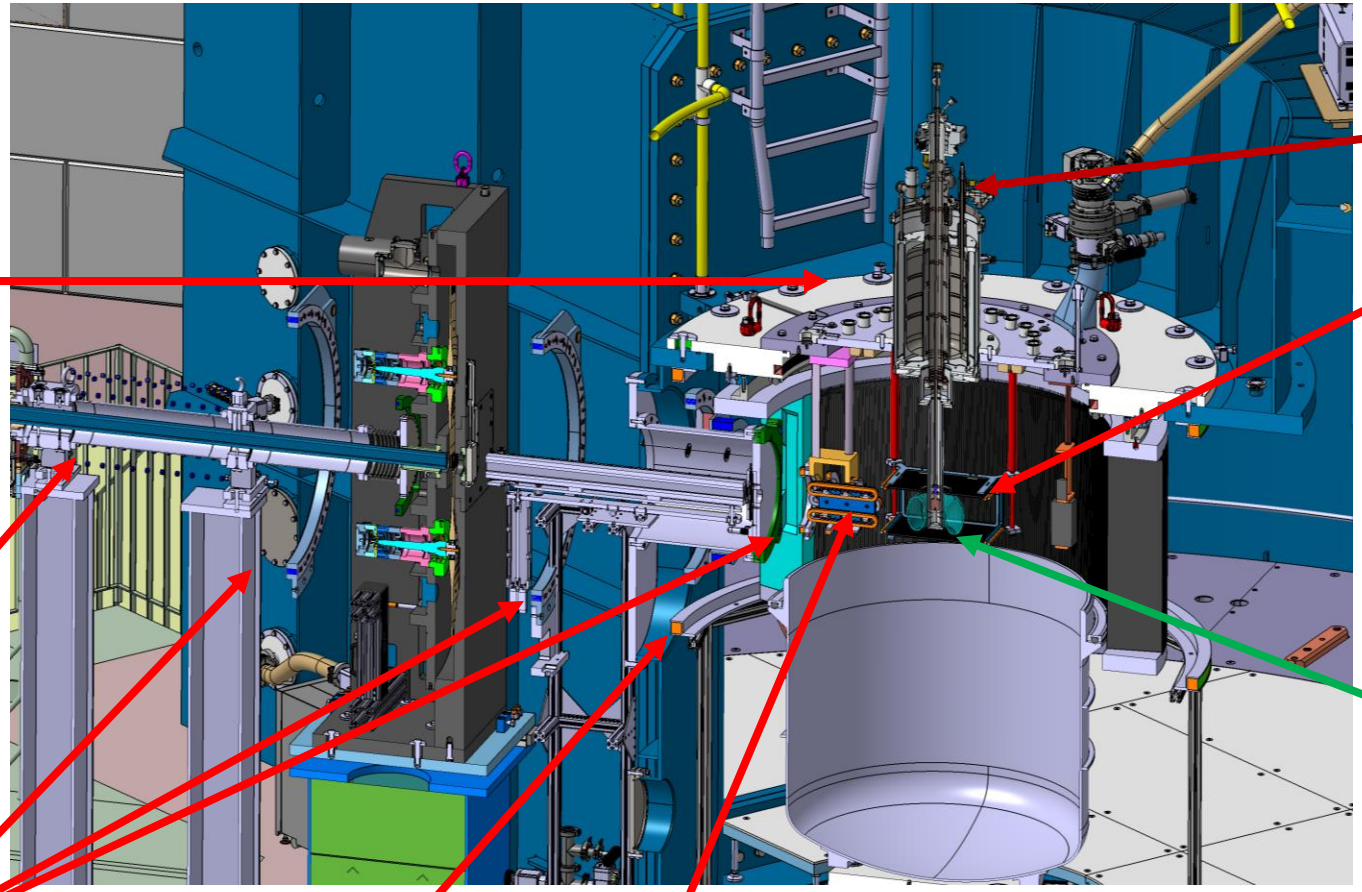
Subsystem status:

- Thermal neutrons pol.: in manufacturing ✓
- Laser system: early procurement done ✓
- Guide field design: update to Halbach rings ✓
- Spin flipper: in design phase o
- Race-track coils: ready ✓
- PASTIS design finished ✓
- PASTIS racks ongoing o
- Electronics: CE certification needed ✗



Need more guidance by ESS on detailed design of components!

Polarization analysis (and dedicated SE)



cryofurnace

L1 flange

Magic pastis
Horizontal field

Dedicated meeting

Guide
field

Hal Lee (ESS): provides in-situ re-filling and ^{3}He cell

Halbach rings
(guide field and rotation)

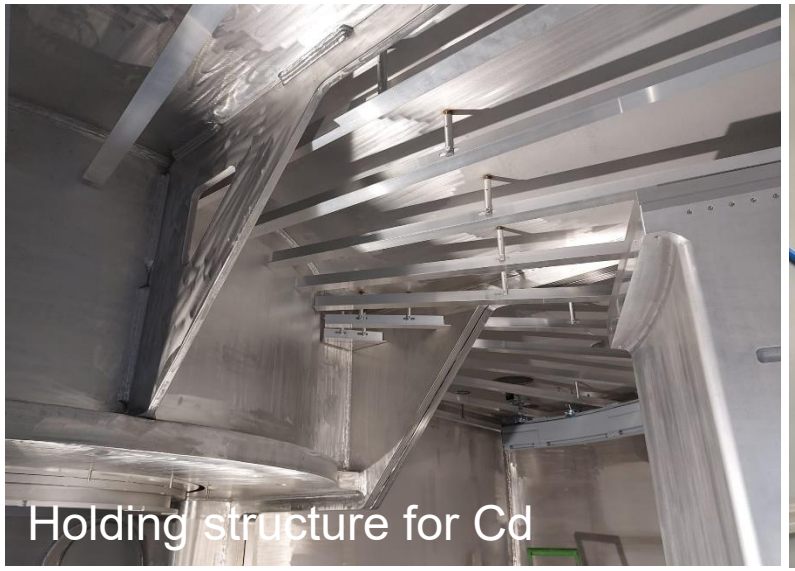
Helmholtz coils
vertical field

Racetrack coils
(spin rotation)

Re-design to make Z^+ method possible

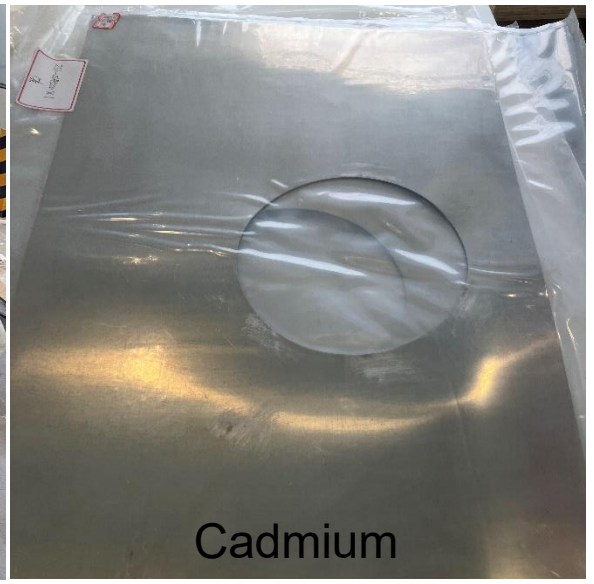
- **FZJ provides** Spin Rotation (Racetrack coils), Magic Pastis and Sample flange with neccessary feedthroughs
- **ESS** Polarisation Group **provides** ^{3}He cell ~~and cryostat with bespoke tail~~

Detector Vessel


Holding structure for Cd

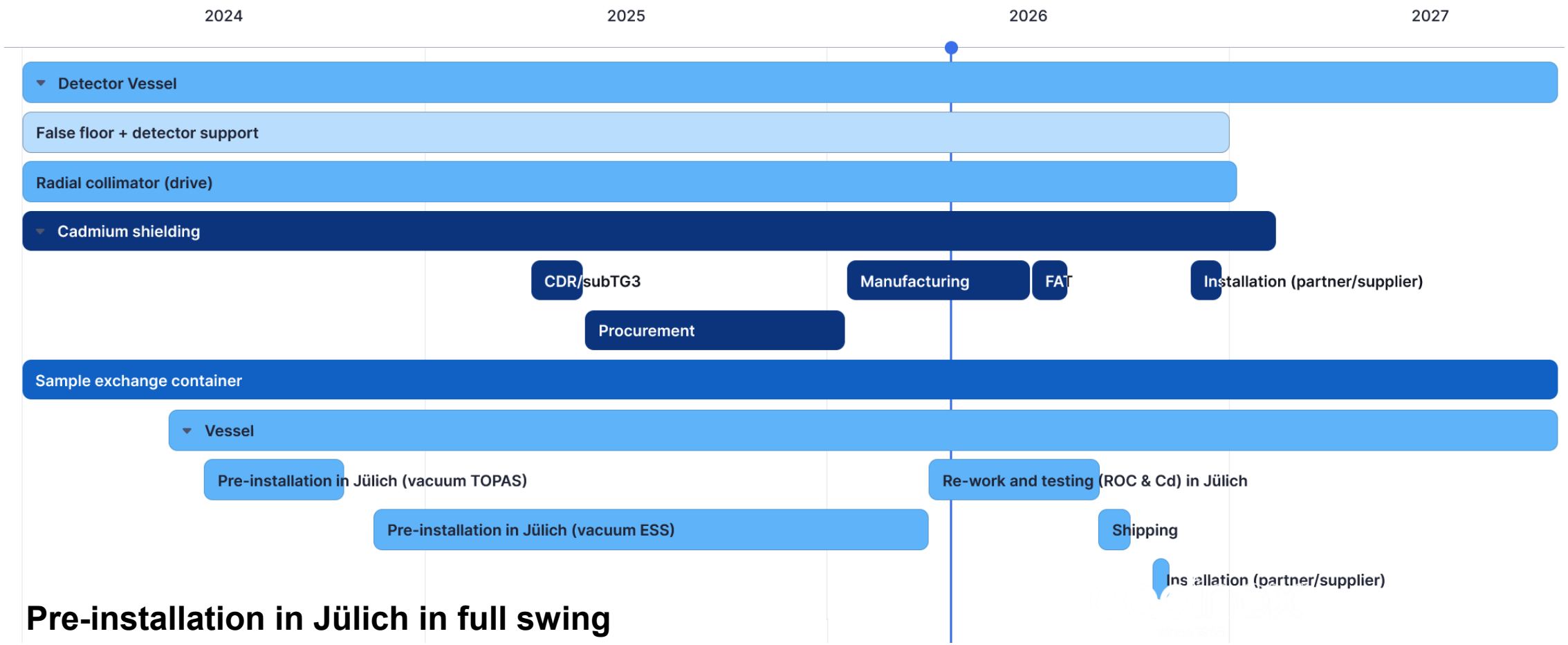

ROC drive


Radial Oscillating Collimator (ROC)


Cadmium

- Pre-installation in Jülich ongoing detector feet and false floor and detector box integrated
- Currently integration of Cadmium shielding, Radial Oscillating Collimator drive, etc.
- Shipping to ESS 1.Oct (arrival)

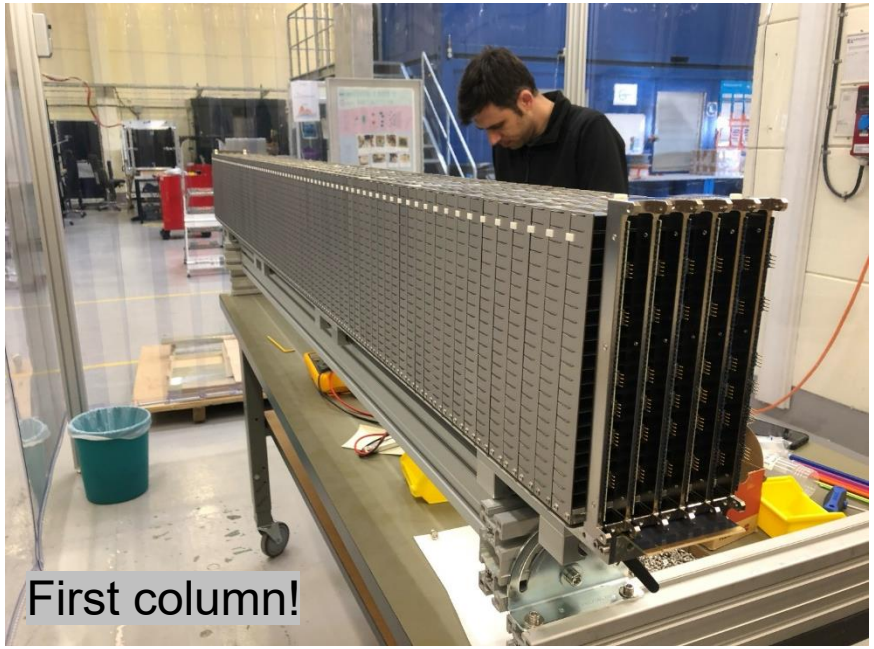
Detector Vessel



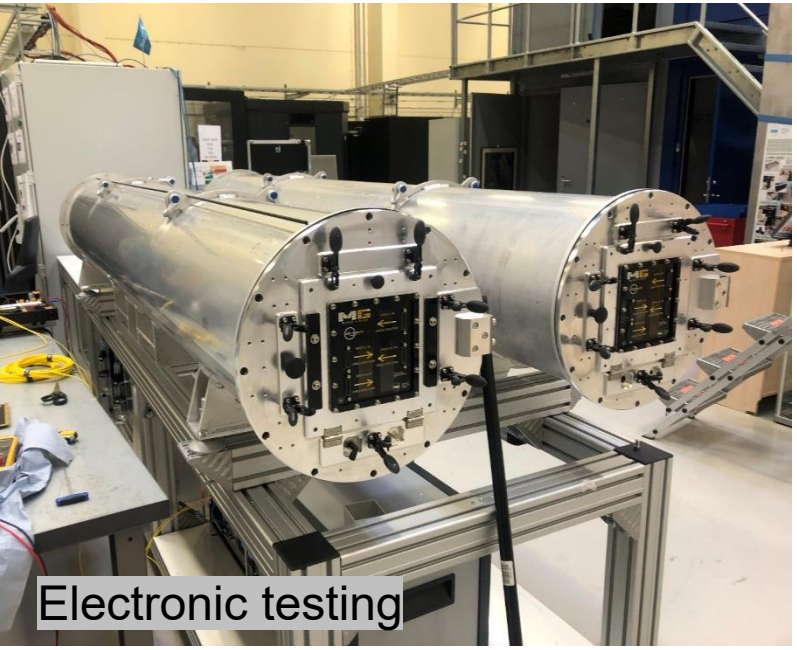
- **Pre-installation in Jülich in full swing**
- ESS vacuum system shipped back to ESS
- Sample exchange container replacement finished
- Cadmium arrived
- ROC currently in integration
- ESS measurement and alignment team visited FZJ

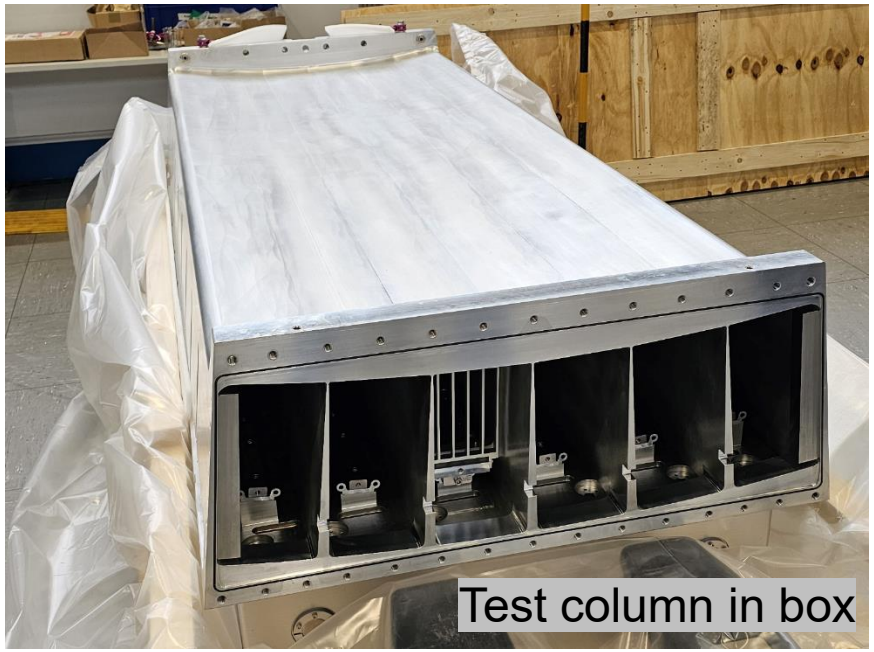
Multi-Grid (MG) Detector

- Grids in production
- First grids assembled into columns
- First column now wired!
- Box will arrive early May in Lund


First column!


Wiring


Electronic testing


Test column in box


Wiring

Neutron Detector (Multi GRID)

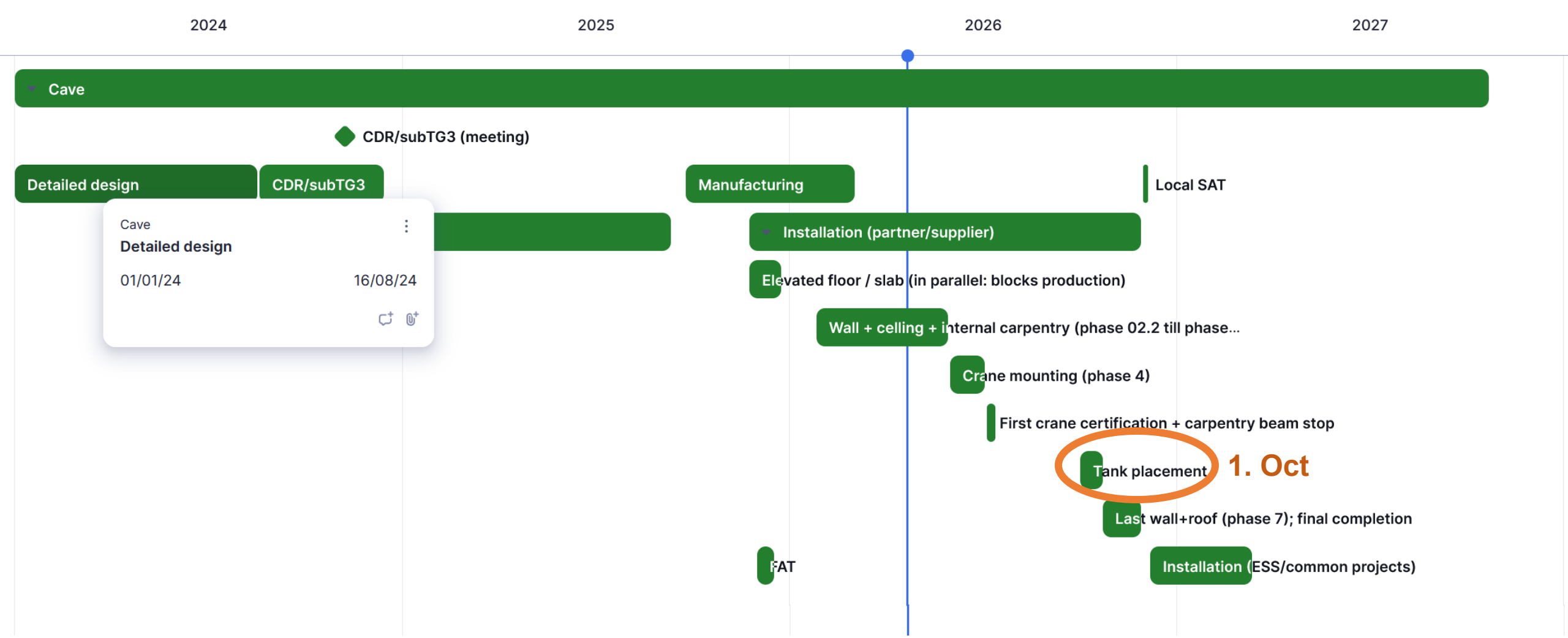
Year	Month		Controls	Electrioncs	Shielding	Production	Building	Testing Individual Colums	Testing Columns in Box
2024	1	Jan							
	2	Feb							
	3	Mar							
	4	Apr							
	5	May		Production MG.EMMA	Shielding Feasibility Evaluation				
	6	Jun							
	7	Jul		Building MG.EMMA					
	8	Aug							
	9	Sep							
	10	Oct		Testing MG.EMMA	Production MG.EMMA2 (MAPS)				
	11	Nov							
	12	Dec		EMMA		Module Box Integration			
2025	1	Jan		Analysis EMMA					
	2	Feb							
	3	Mar							
	4	Apr		EMMA PDR	Building/Testing EMMA2	Procurements, legal, tender			
	5	May							
	6	Jun			EMMA2				
	7	Jul			Analysis EMMA2				
	8	Aug				Prod. Decision			
	9	Sep			EMMA2 PDR				
	10	Oct				Parts Prod MG.TREX			
	11	Nov							
	12	Dec							
2026	1	Jan					Building MG.TREX.1	FAT MG.TREX.1	
	2	Feb							
	3	Mar							
	4	Apr							
	5	May							
	6	Jun					Building MG.T-REX.2	FAT MG.TREX.2	Box 1
	7	Jul							
	8	Aug							
	9	Sep							
	10	Oct					Building MG.TREX.3	FAT MG.TREX.3	
	11	Nov							
	12	Dec							
2027	1	Jan							
	2	Feb							
	3	Mar					Building MG.TREX.4	FAT MG.TREX.4	Box 2
	4	Apr							
	5	May							
	6	Jun							
	7	Jul							
	8	Aug							Box 3
	9	Sep							
	10	Oct							
	11	Nov							
	12	Dec							
2028	1	Jan							
	2	Feb							Box 4
	3	Mar							
	4	Apr							
	5	May							
	6	Jun							
	7	Jul							
	8	Aug							
	9	Sep							
	10	Oct							
	11	Nov							
	12	Dec							

Detector boxes

Box 2-4

- Updated design by ESS detector group
- Assigned to Laro NC
- Waiting for Kick-off
- Try to compress timeline

Experimental cave



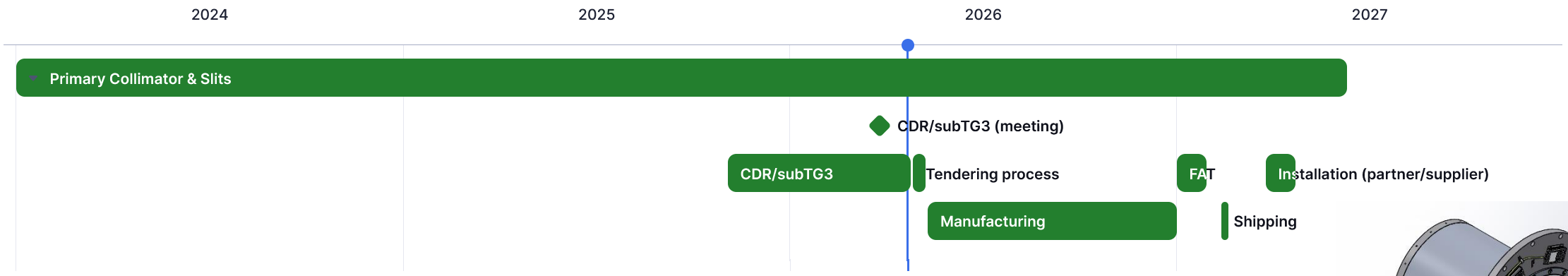
Experimental cave

- Installation started and progressing well
- Walls finished
- Installation of internal crane

- Additional PE under vessel as precaution against floorshine in May
- Installation March-June ´26
- Vessel will come 1.Oct

Elephant in the room: Additonal PE shielding!

Primary collimator and slits



Re-design of component:

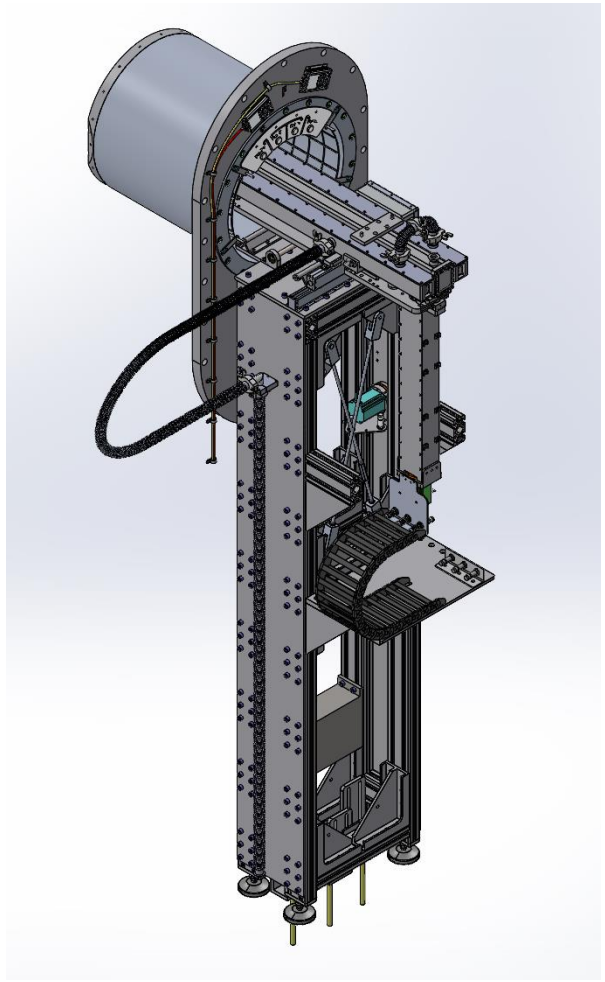
- Goal is to simplify
- Take neutron guides out of vessel vacuum
- Self-evacuated guides
- All motors in air
- Slit system in air
- Beam monitor: ‚old‘ design by CDT

Technically challenging component!

Gather/check requirements:

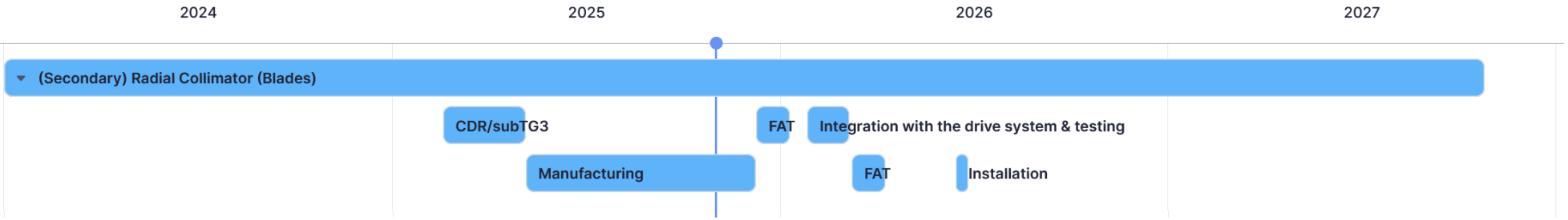
- guide field interface (internal) ✓
- motion control ESS + FZJ for EPICS integration ✓
- metrology group ESS + S-DH alignment strategy ✓
- Sample monitor ✗

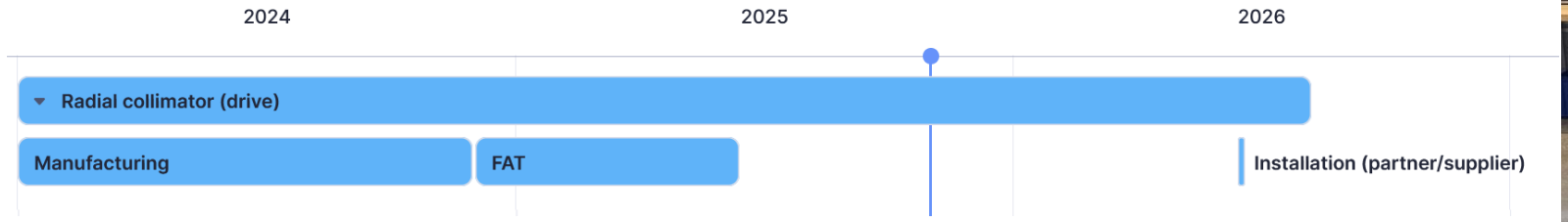
subTG3 passed in April ´26



Radial oscillating collimator

The actual collimator (very similar to CSPEC):





- Collimator arrived in Jülich
- Some foils need replacements
- Now integration into vessel
- Drive: integrated into detector vessel

Beam monitors

Status:
Received offer from CBMP

BM1: Source monitoring and monitoring the cold neutrons bender (to extract neutrons from the cold moderator and bend into the neutron guide)

BM2: Correct functioning of BW choppers

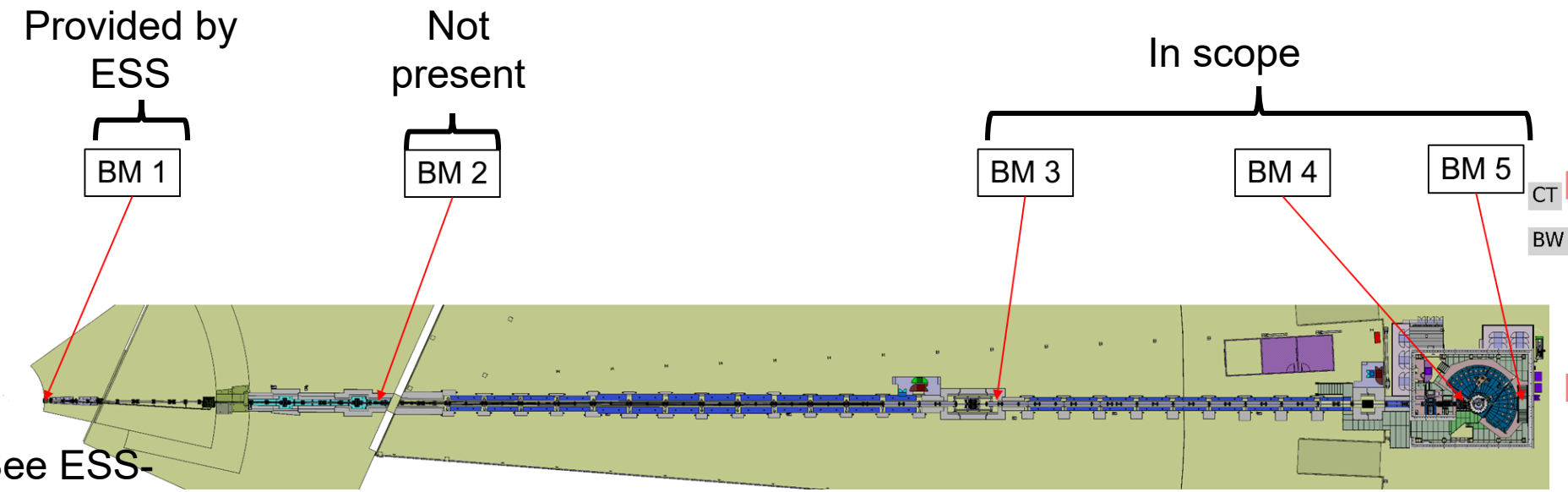
Essential for hot comissioning!

BM3: Monitoring of sub-pulses after P-chopper

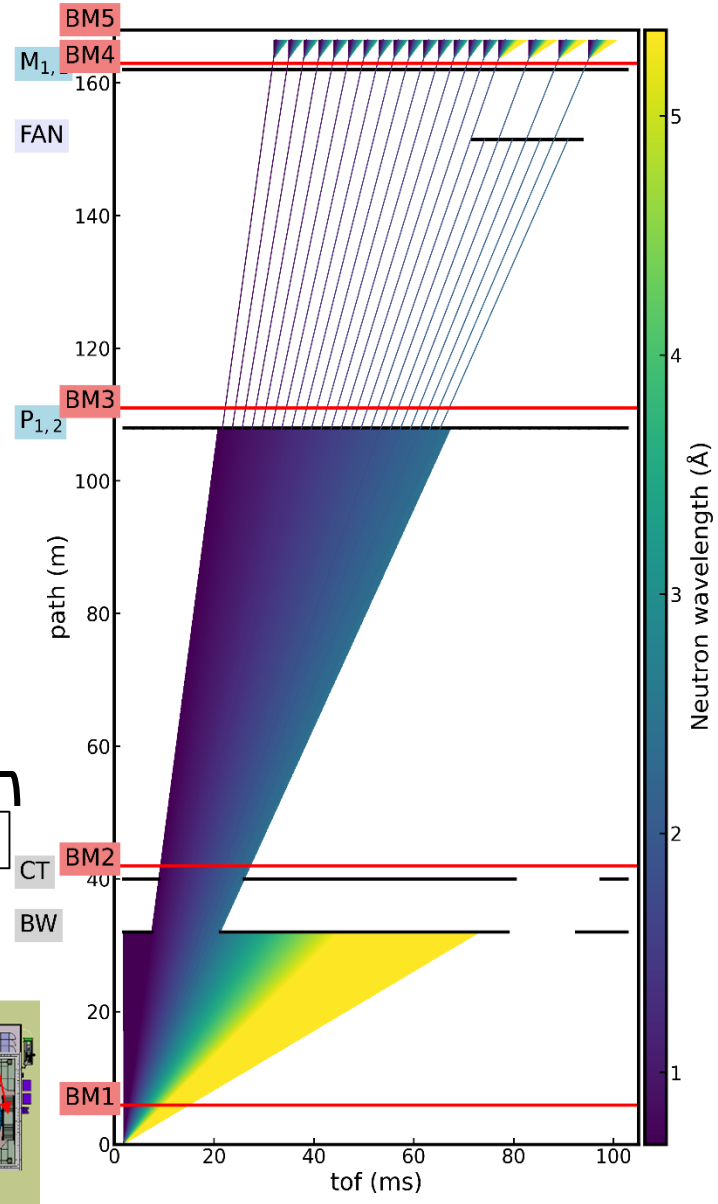
BM4: Monitoring of beam on sample, can be used for data normalisation

Important for PA

BM5: Transmission of direct beam through sample, main purpose is normalisation of transmission of the ^{3}He analyser cell



See ESS-5765522

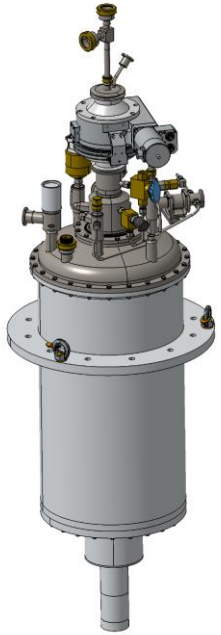


24

Everything else

Experimental hutch

- Installation

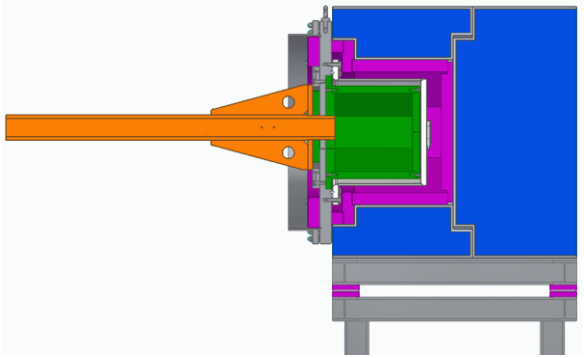


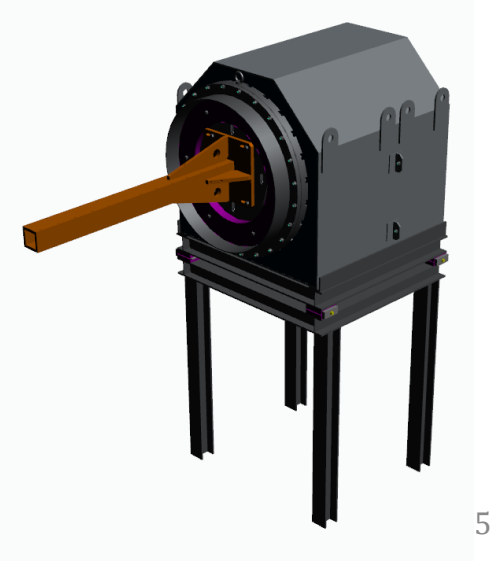
Sample Environment

- Passed subTG3
- In manufacturing
- Compatible with ^{3}He analyser

Beamstop

- In CTV
- Using ESS to speed up procurement process





Acceleration measures (or stay in schedule)

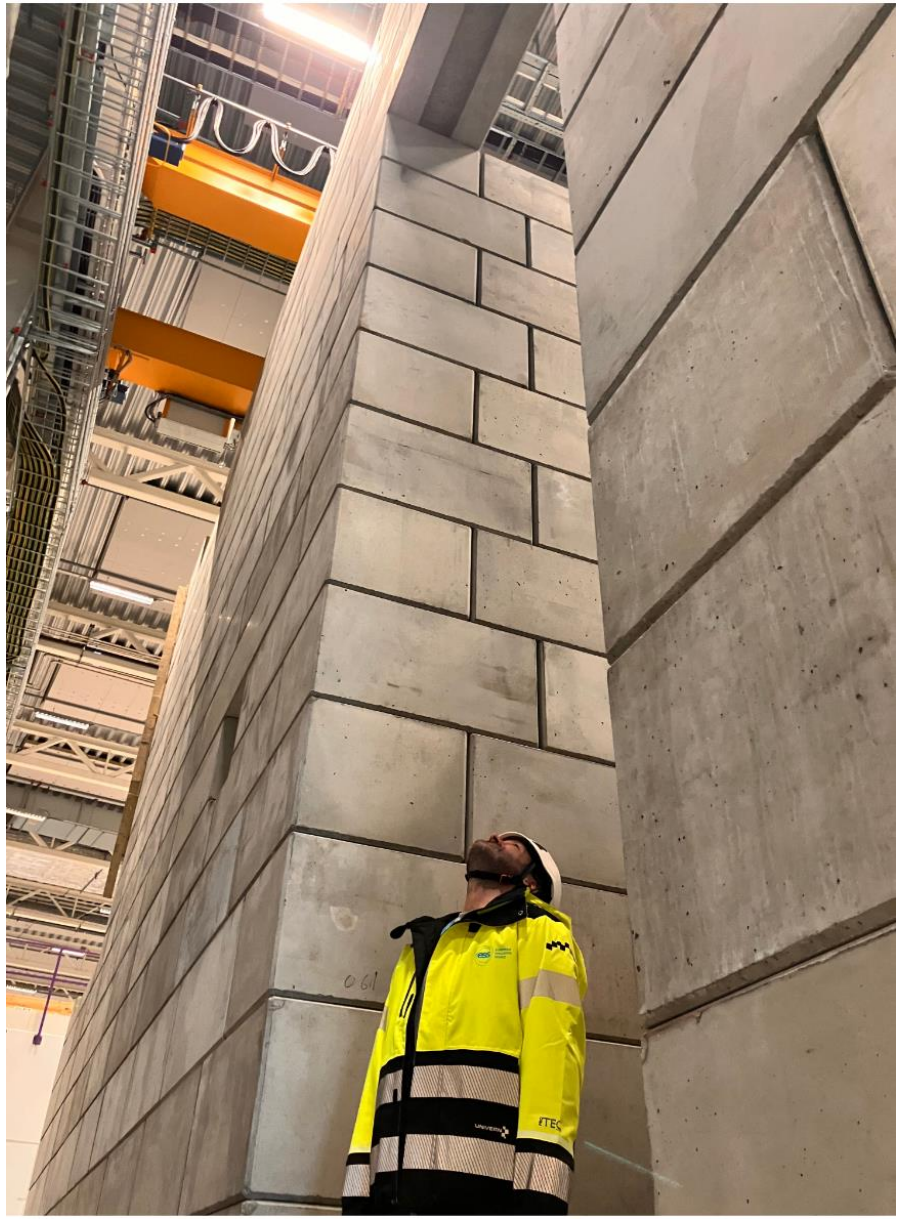
- **Q-gates** get more laborsome, takes away engineers time from engineering tasks (hutch Q-gate was crazy)
- **Q-gates** for ‚in house' components (polarisation, flipper)?
- **Beam monitors:**
  BM1, BM3&4 needed for hot comissioning. BM5 good for commissioning, but strictly needed only for PA
- **Polarisation analysis:**
  Split WP between FZJ and ESS (^{3}He cell), align timelines? Need more advice from ESS, especially on flipper!
- **MG detector:**
  As discussed, can start comissioning with only one box

Top 5 project risks

Top 5 Risks				
Title	Rating	Category	Partner	Treatment
P-chopper disc failure	20	Schedule	FZJ	Avoid
M-chopper disc failure	20	Schedule	FZJ	Avoid
Beam Monitors	16	Schedule	FZJ	Observe
CEP not ready with energization of the crane for installation of the vessel	15	Schedule	ESS Project	Avoid
Final TG3 delayed	15	Schedule	FZJ	Observe

Top 5 Issues						
Title	Rating	Category	Partner	Cost	Delay	Quality
M-chopper disc failure	25	Quality	FZJ	25-100k€	4-6 months	The science case of the instrument/system is jeopardized
P-chopper disc failure	25	Quality	FZJ	25-100k€	4-6 months	The science case of the instrument/system is jeopardized

Summary



Take-home message:

- Guide installation ongoing ✓
- Cave installation going well ✓
- Choppers in critical path, but progressing ✓
- Polarisation is challenging
- Choppers: reduce speed ?