JPARC-ESS commissioning workshop

ODIN commissioning plan

PRESENTED BY MANUEL MORGANO

2022-10-11

ODIN beamline in brief

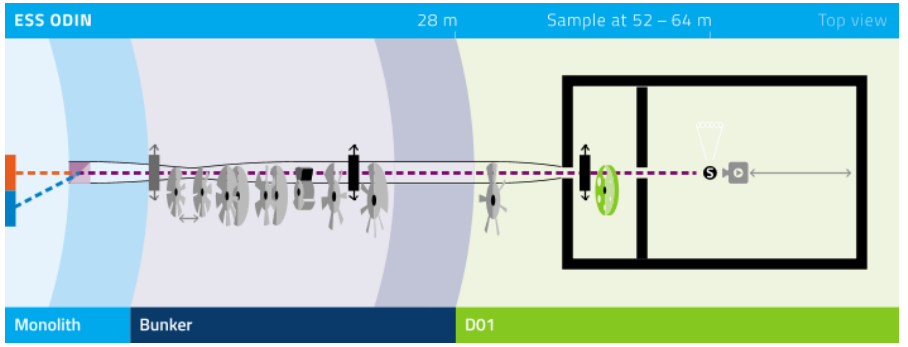
ODIN will be the only imaging instrument installed at ESS initially

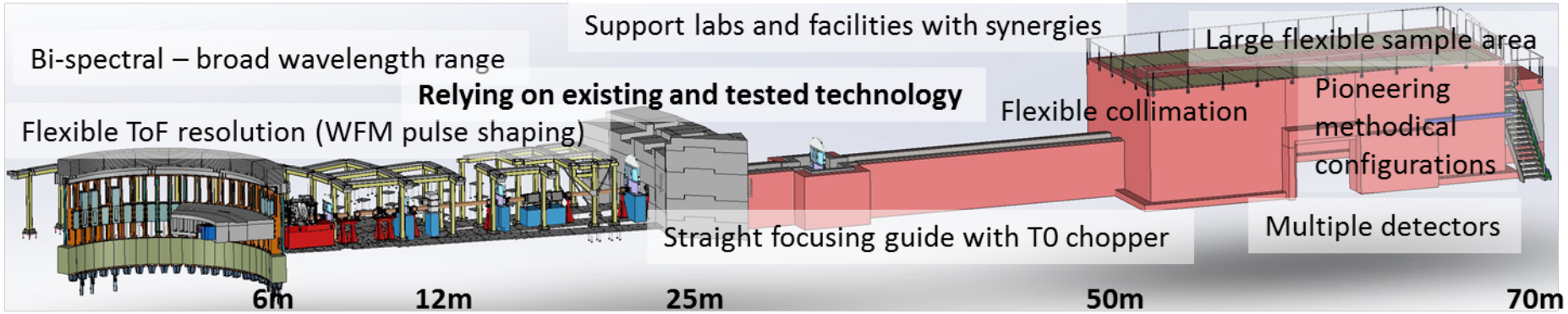
Planned to receive first neutrons in 2025 (day-1 instrument)

Optical and **D**iffraction **I**maging with **N**eutrons: ToF imaging with variable wavelength resolution

Joint project between TUM (A. Tartaglione and E. Calzada, ~65%) and PSI (M. Strobl and M. Morgano, ~35%)

Budget of 11.6M€.





ODIN beamline in brief

It will be placed beamport S2 (medium-length instrument sector) as preferred mainly because of ease of access.

It will feature a bi-spectral extraction system and a 10 choppers cascade to have access to a wide wavelength range with a tunable energy resolution (0.4% to 1%, 10%)

It will be a direct line-of-sight instrument due to spatial and spectral homogeneity beam requirements

ODIN will be capable of white beam as well as energy dispersive imaging experiments both with outstanding performances

ODIN Quick Facts	
Instrument Class	Imaging
Moderator	Bispectral
Primary Flightpath	50 m (to pinhole)
Secondary Flightpath	2 – 14 m (pinhole to detector)
Wavelength Range	1 – 10 Å
Field of View	20 x 20 cm^2
L/D Ratio	Tunable 300 – 10000
Incident Beam Polarisation	Optional
Polarisation Analysis	Optional
Bandwidth at 14 Hz	4.5 Å
White Beam Mode	
Flux at Sample at 2 MW	1.2 x 10^9 n s^{-1} at 10 m, L/D = 300
Spatial Resolution	< 10 µm
TOF Mode without Pulse-Shaping	
Flux at Sample at 2 MW	9 x 10^8 n s^{-1} at 10 m, L/D = 300
Spatial Resolution	< 10 µm
Wavelength Resolution	$\Delta\lambda/\lambda$ = 10% at λ = 2 Å
TOF Mode width Pulse-Shaping	
Flux at Sample at 2 MW	1 x 10^8 n s^{-1} at 10 m, L/D = 300
Spatial Resolution	< 10 µm
Wavelength Resolution	Adjustable <0.5% - 1% (constant for all λ)

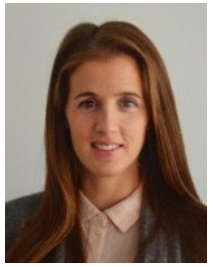
ODIN team

ODIN construction core team

Aureliano Tartaglione
ODIN Scientist

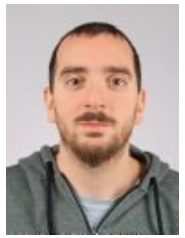
Elbio Calzada
ODIN Lead Engineer

Virginia Martinez Monge
ODIN Installation Engineer

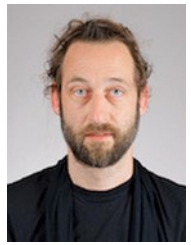


Michael Schulz
Head of Imaging group

Manuel Morgano
ODIN Scientist



Markus Strobl
Head of Imaging group



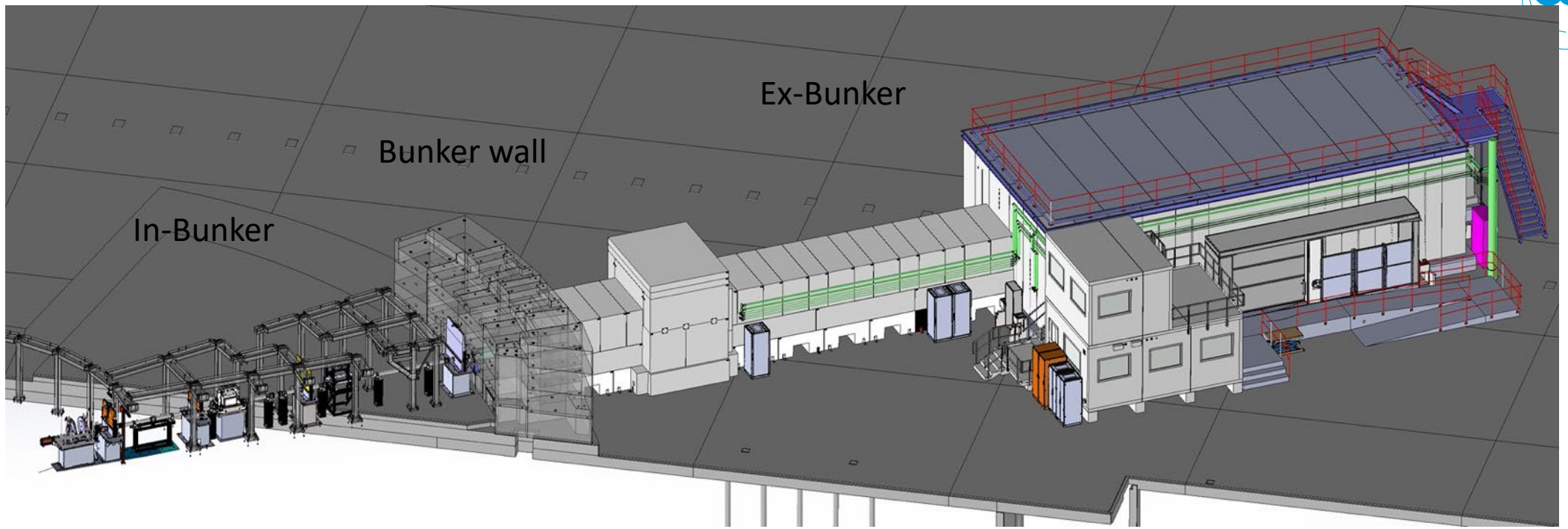
Jan Hovind
Technician of Imaging Group

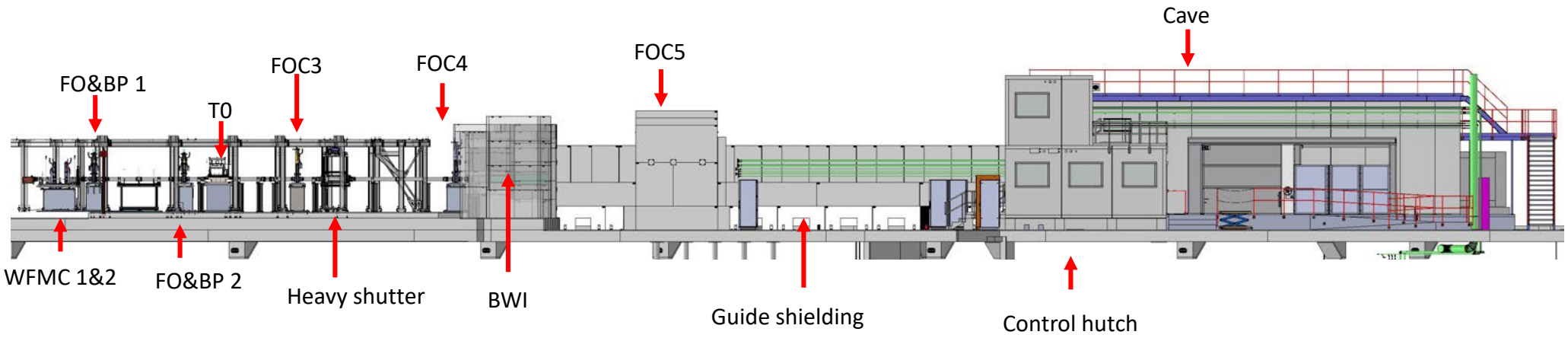
Robin Woracek
Instrument Class Coordinator

Søren Schmidt
Instrument Data Scientist for ODIN, BEER & TBL

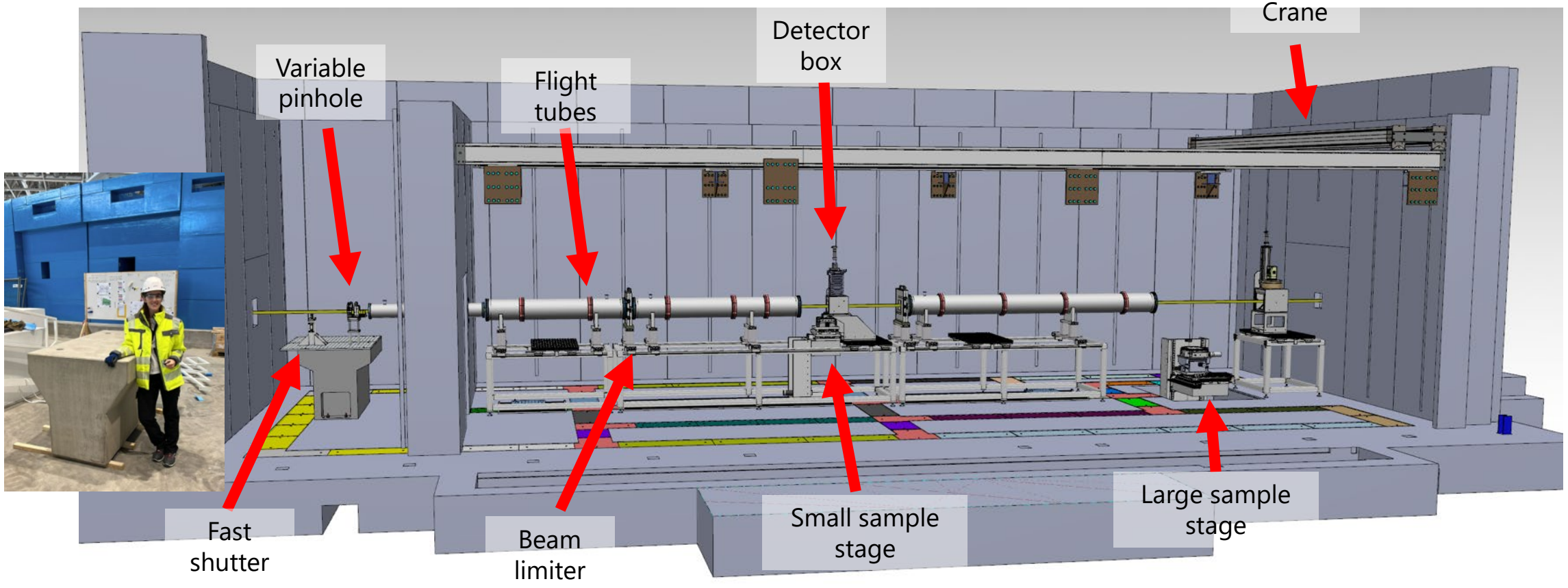
Alexandre Gonçalves Gerk
MCA Engineer for ODIN

ODIN overview



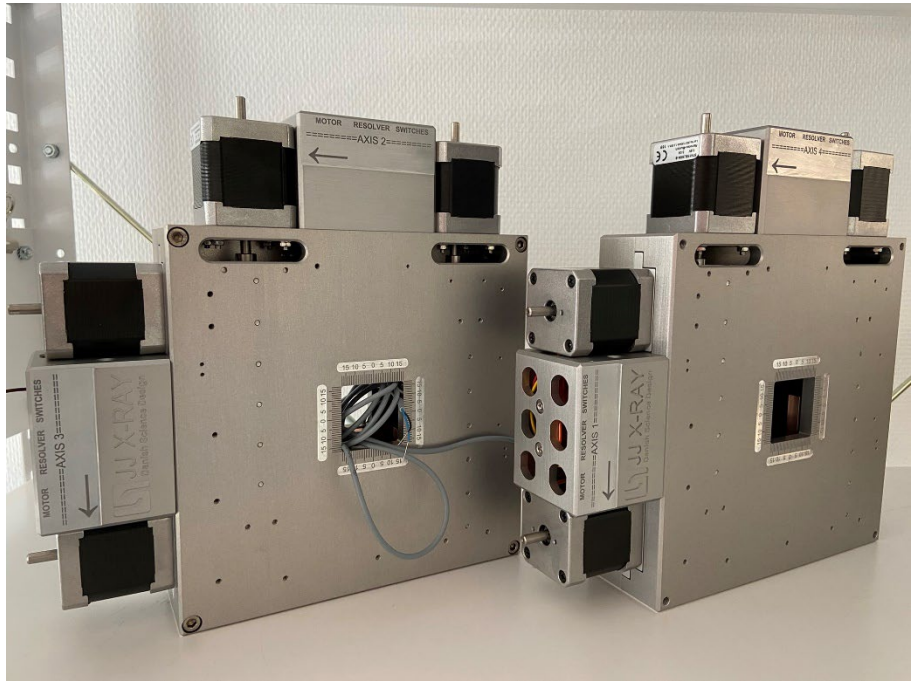


Cave interior



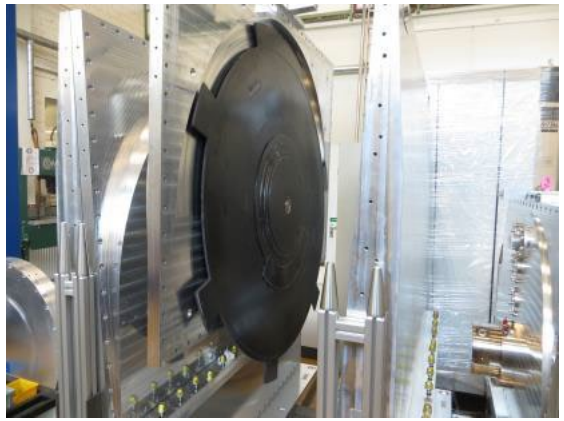
ODIN status

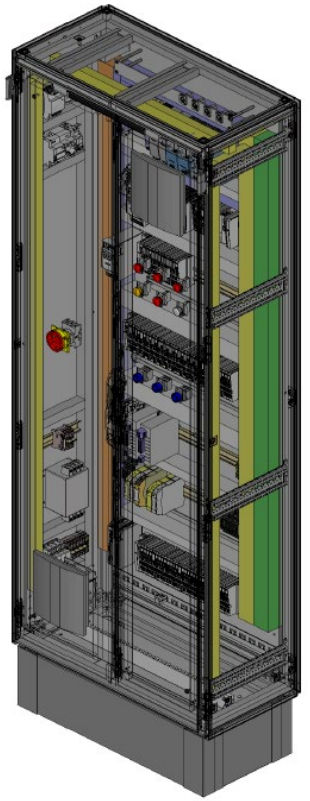

POWER HEAT


MOTOR RESOLVER SWITCHES
AXIS 2
AXIS 3
AXIS 1
JJ X-RAY


B-S-R16.5-2
B-S-R20.5-2
B-S-R22.5-2

ODIN status





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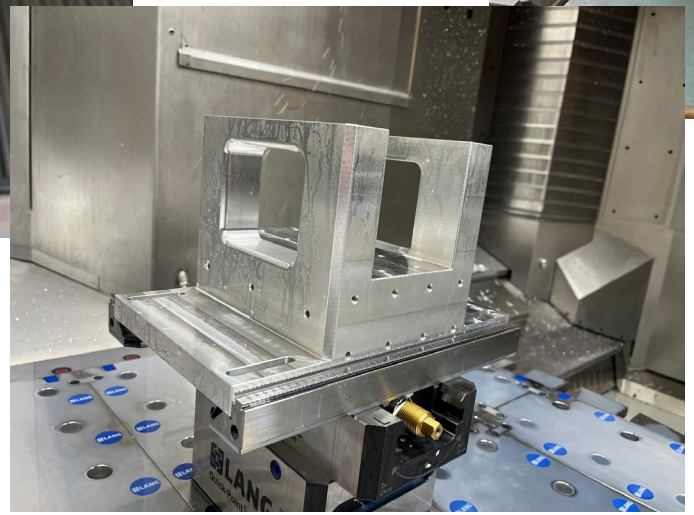
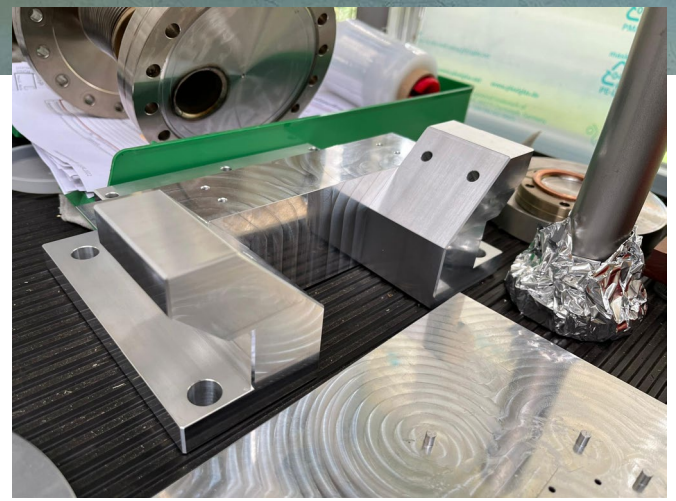
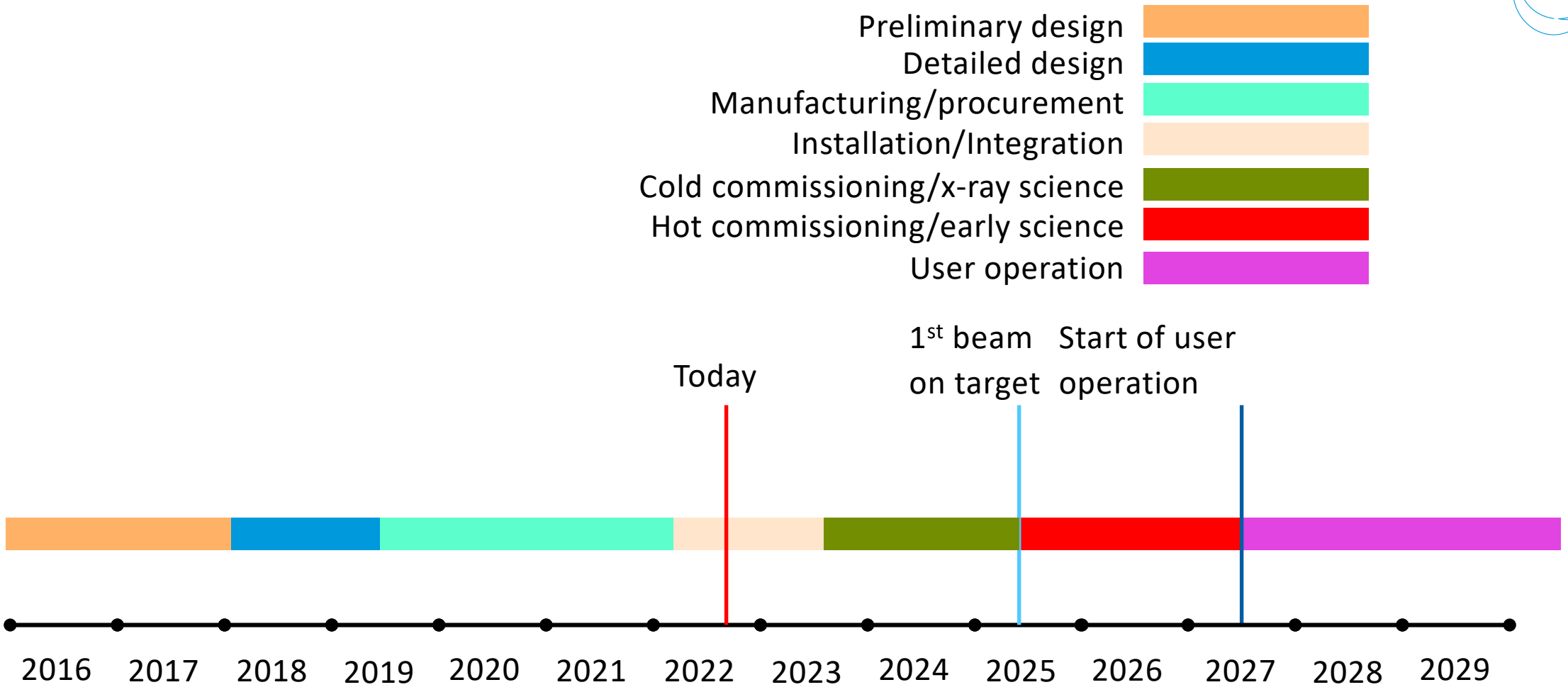




ODIN Timeline



Commissioning plan

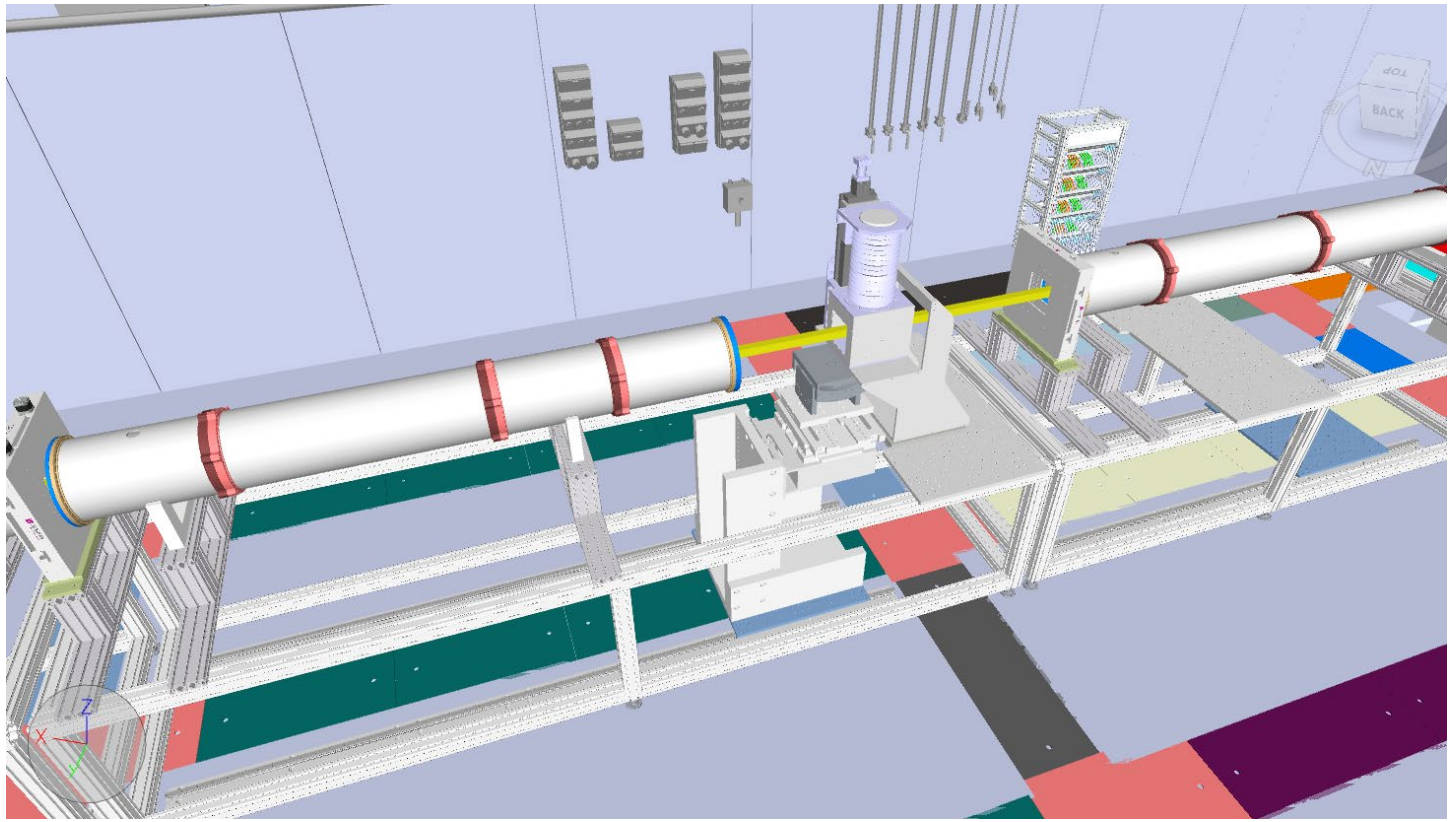
“Warm”commissioning

Data chain with X-rays

Assumption:

Beamline is fully cold commissioned (after FATs and SATs)

We will be able to also look at the data-chain (no ToF) with x-rays



“Warm”commissioning

Data chain with X-rays

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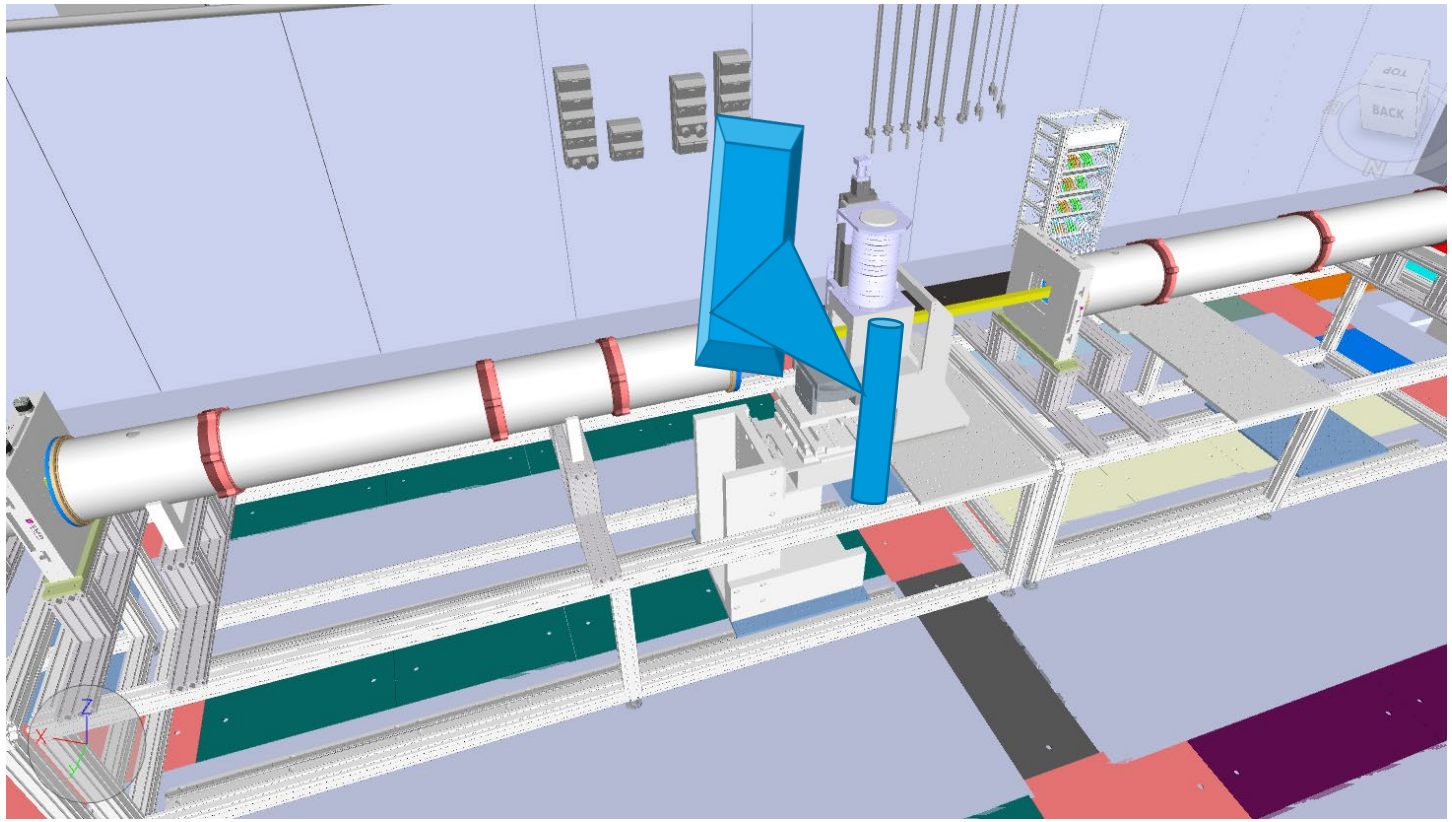
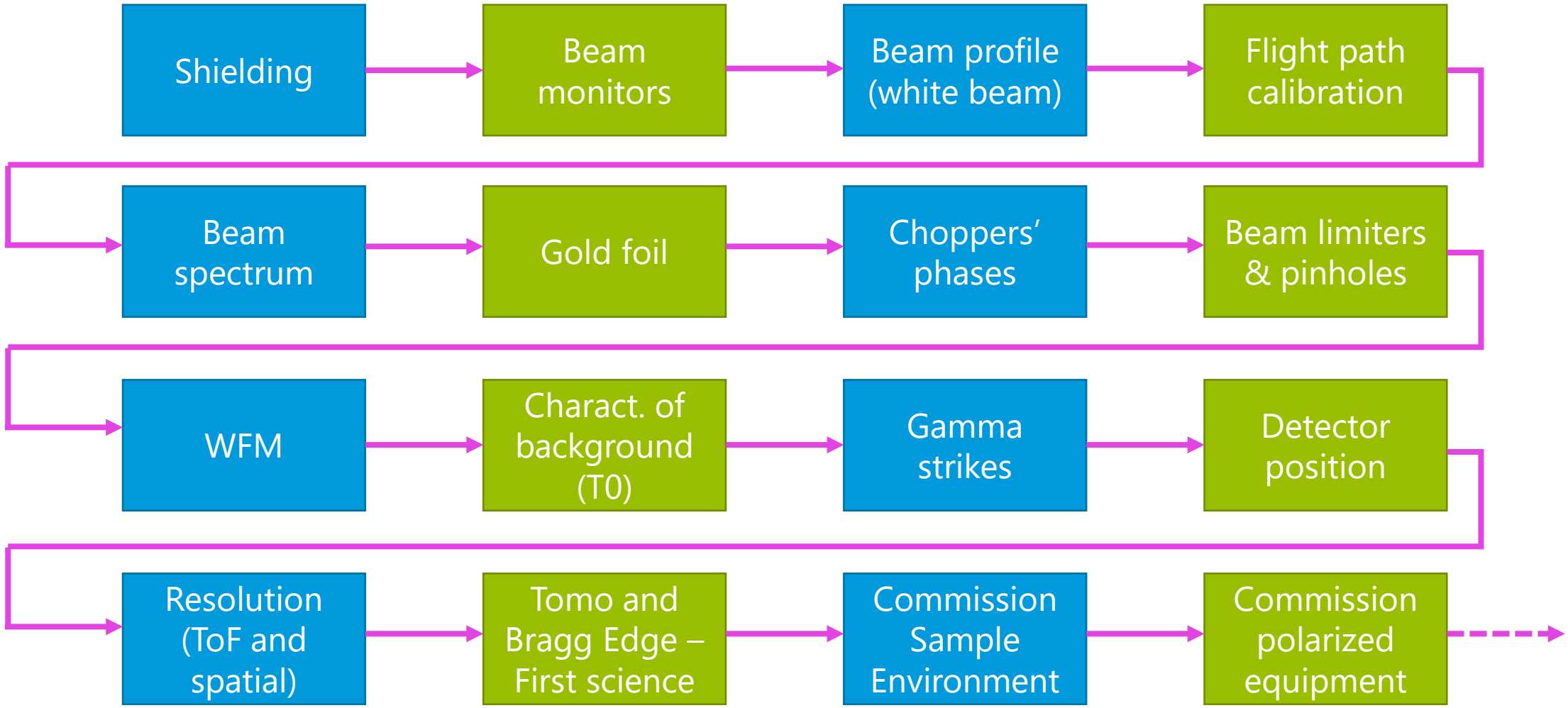
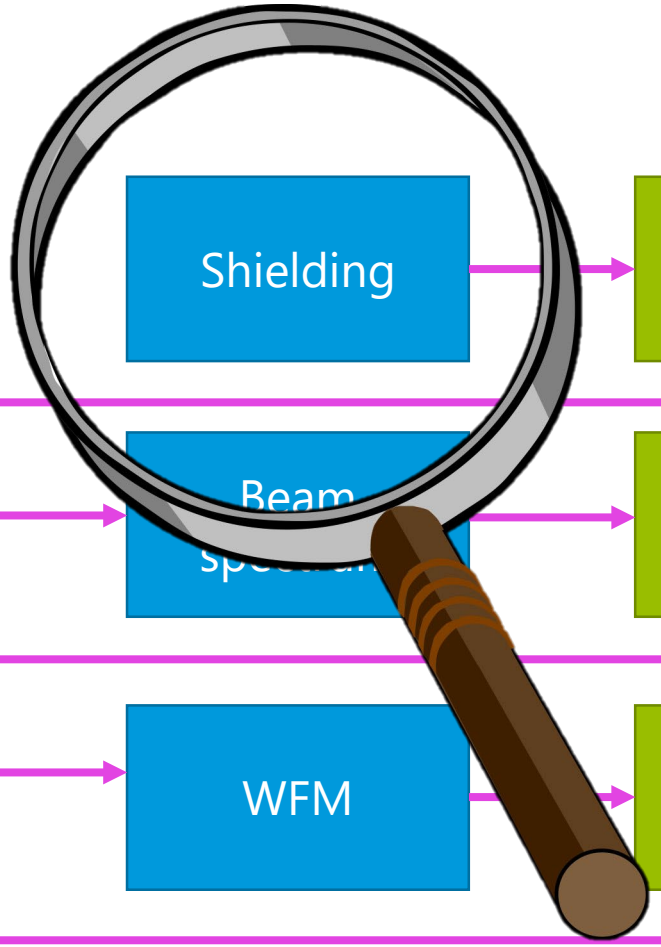
Jump-start to the commissioning activities!



hot commissioning: activities



hot commissioning: activities in detail



Shielding

Beam monitors

Beam profile (white beam)

Flight path calibration

Beam

Gold foil

Choppers' phases

Beam limiters & pinholes

WFM

Charact. of background (T0)

Gamma strikes

Detector position

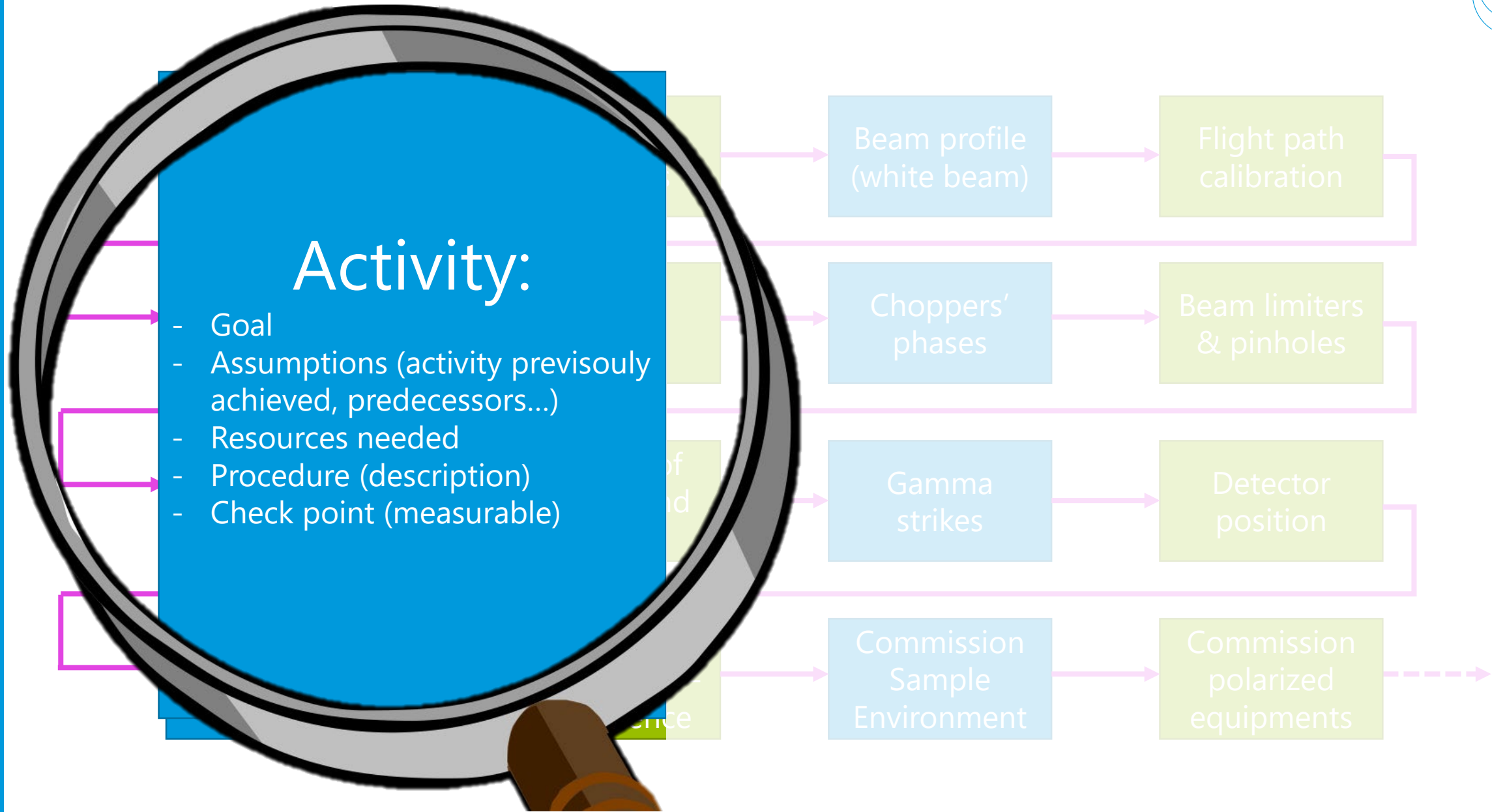
Resolution (ToF and spatial)

Tomo and Bragg Edge – First science

Commission Sample Environment

Commission polarized equipment

hot commissioning: activities in detail



hot commissioning: activities in detail

Example

Shielding:

- **Goal:** verify dose outside the cave < 3uSv/h
- **Assumptions:** beam sufficiently stable
- **Resources needed:** RP and PSS officers, beamline scientist
- **Procedure:**
  - BBG and HS closed, measure the radiation levels
  - BBG open, HS closed …
- **Check point:** dose < 3uSv/h

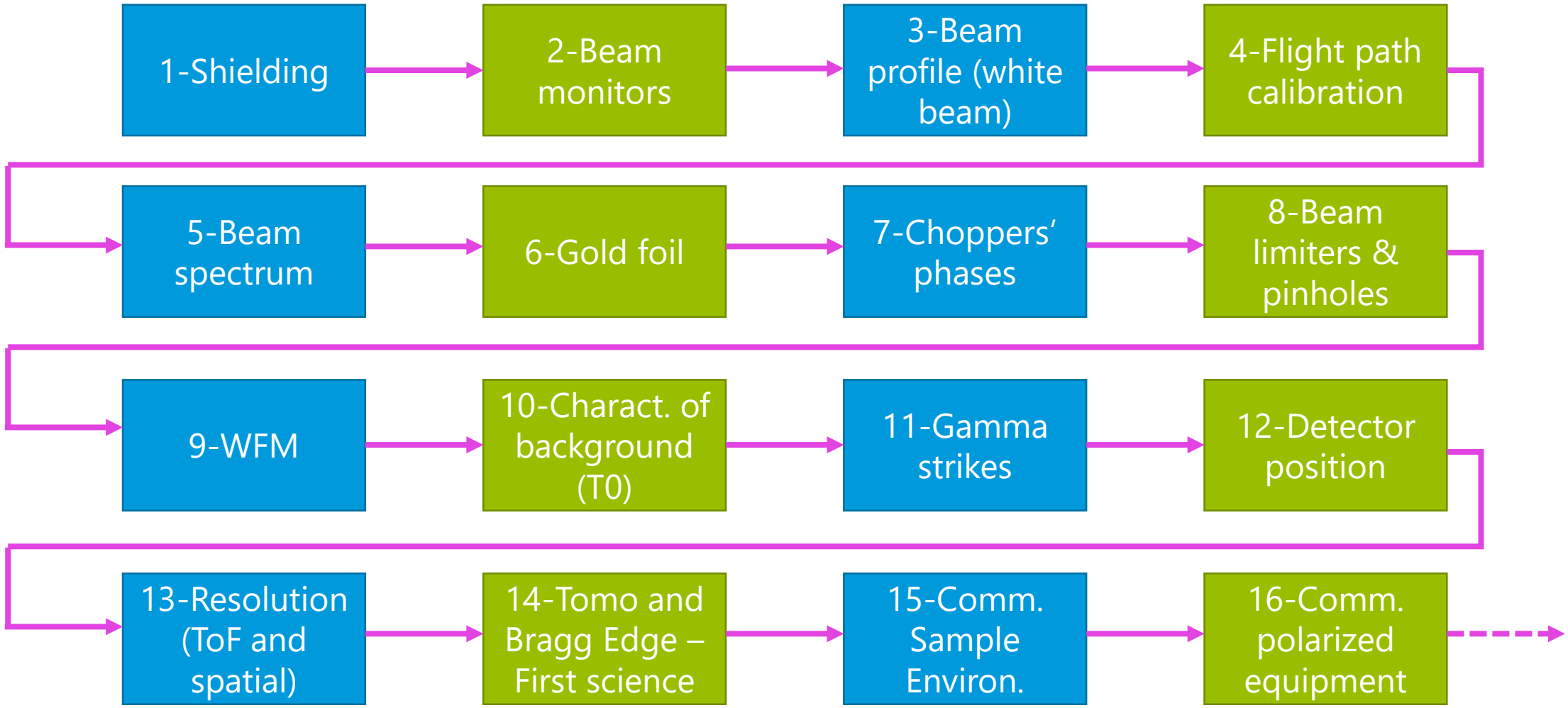
Beam profile (white beam) → Flight path calibration

Choppers' phases → Beam limiters & pinholes

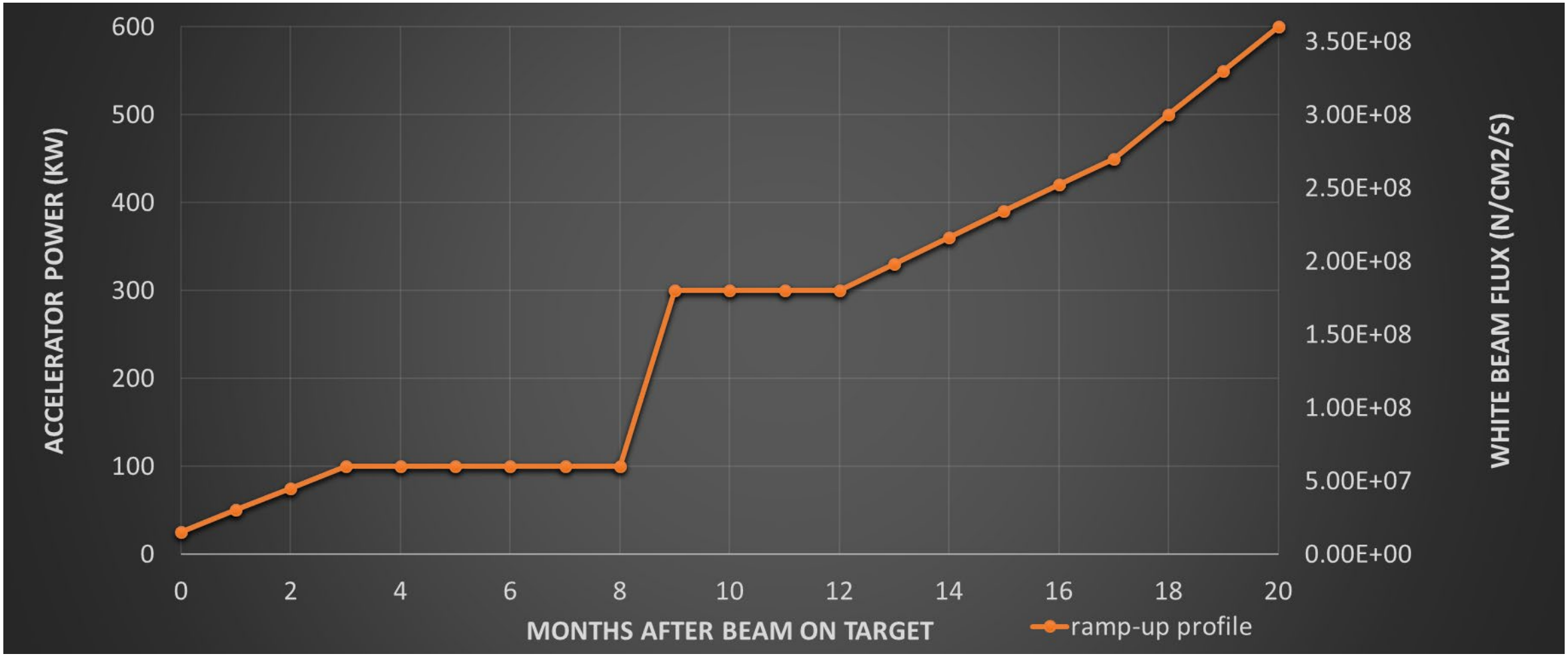
Gamma strikes → Detector position

Commission Sample Environment → Commission polarized equipments

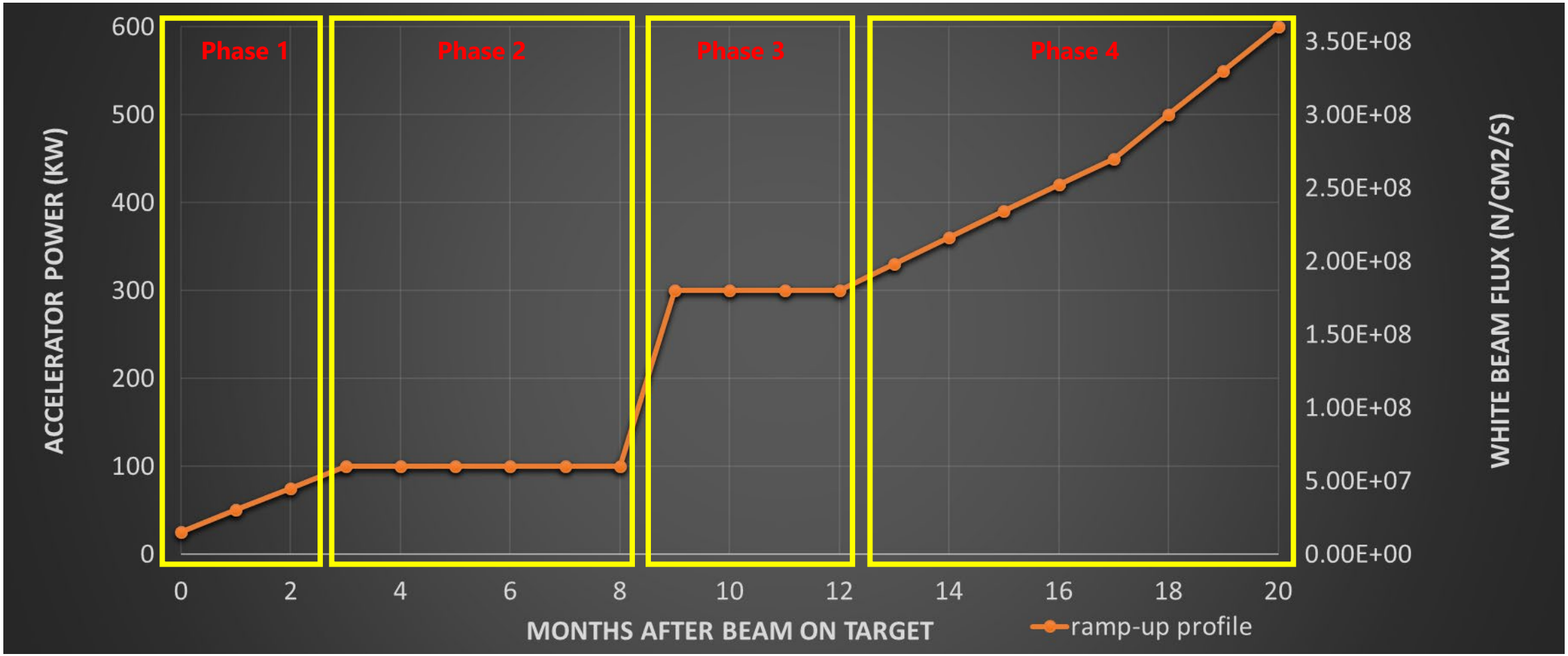
hot commissioning: connection with accelerator



hot commissioning: connection with accelerator



hot commissioning: connection with accelerator



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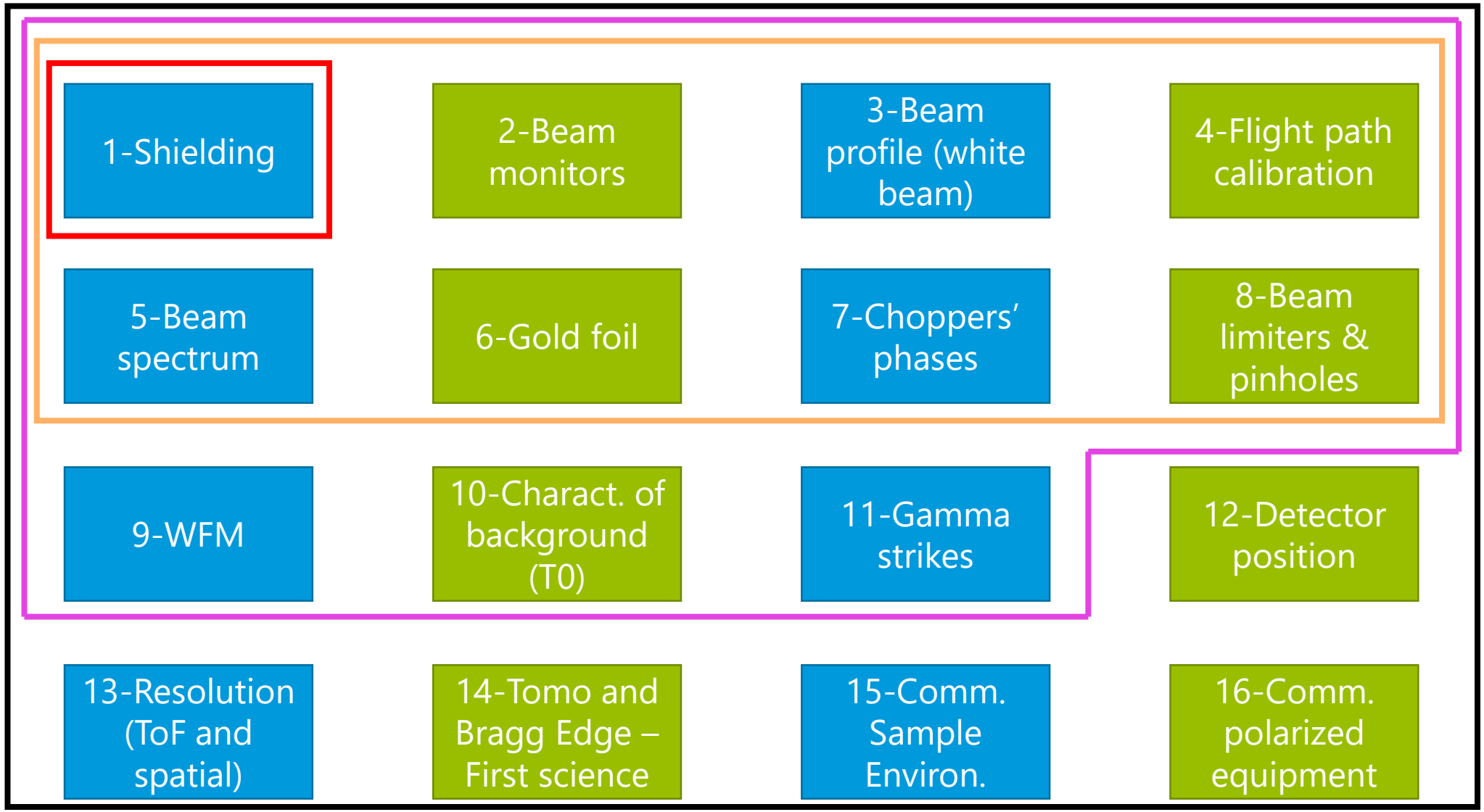

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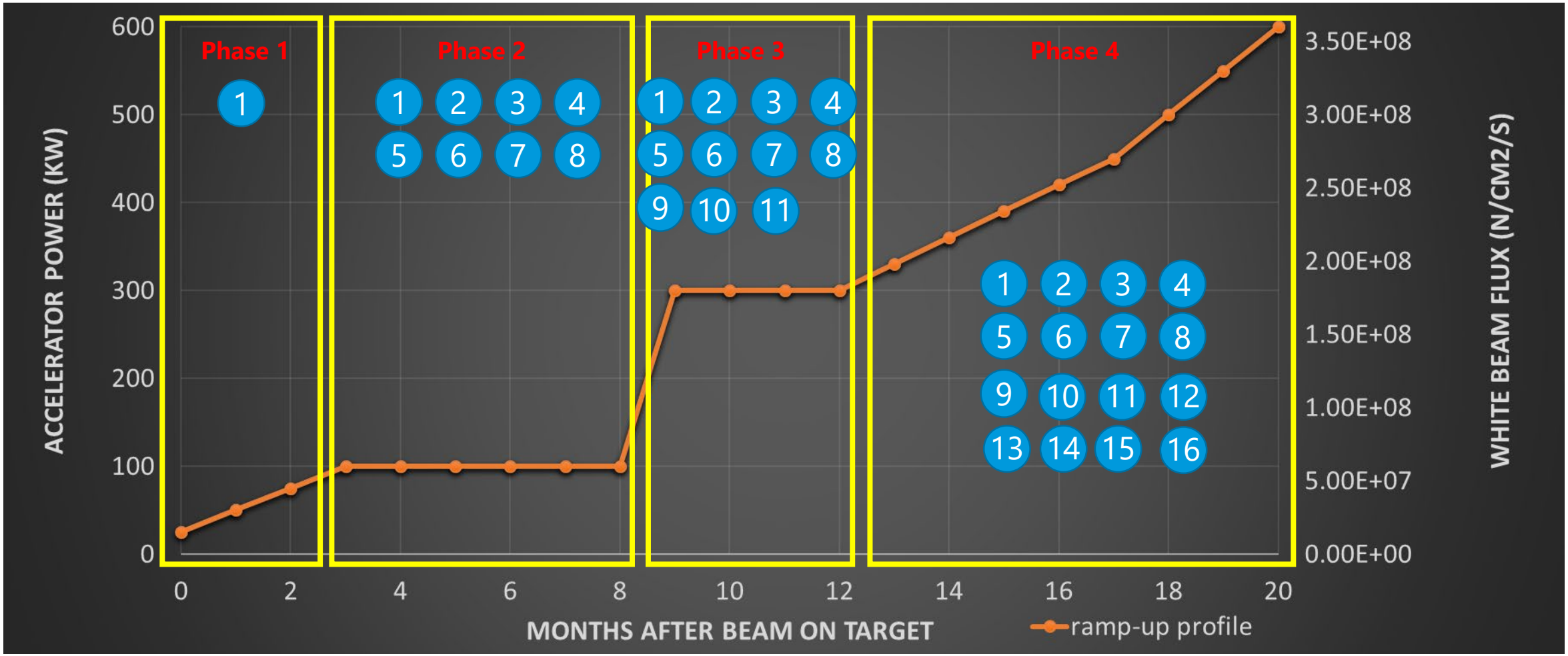
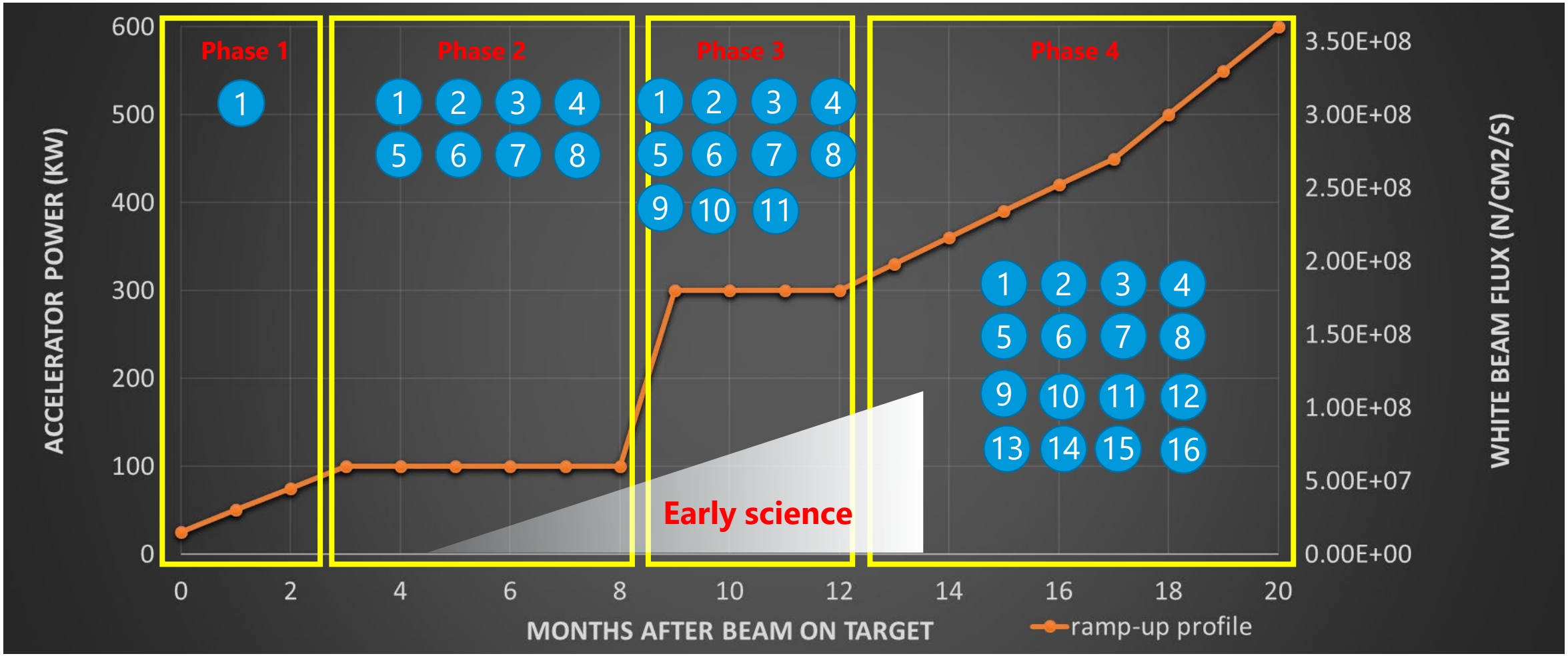
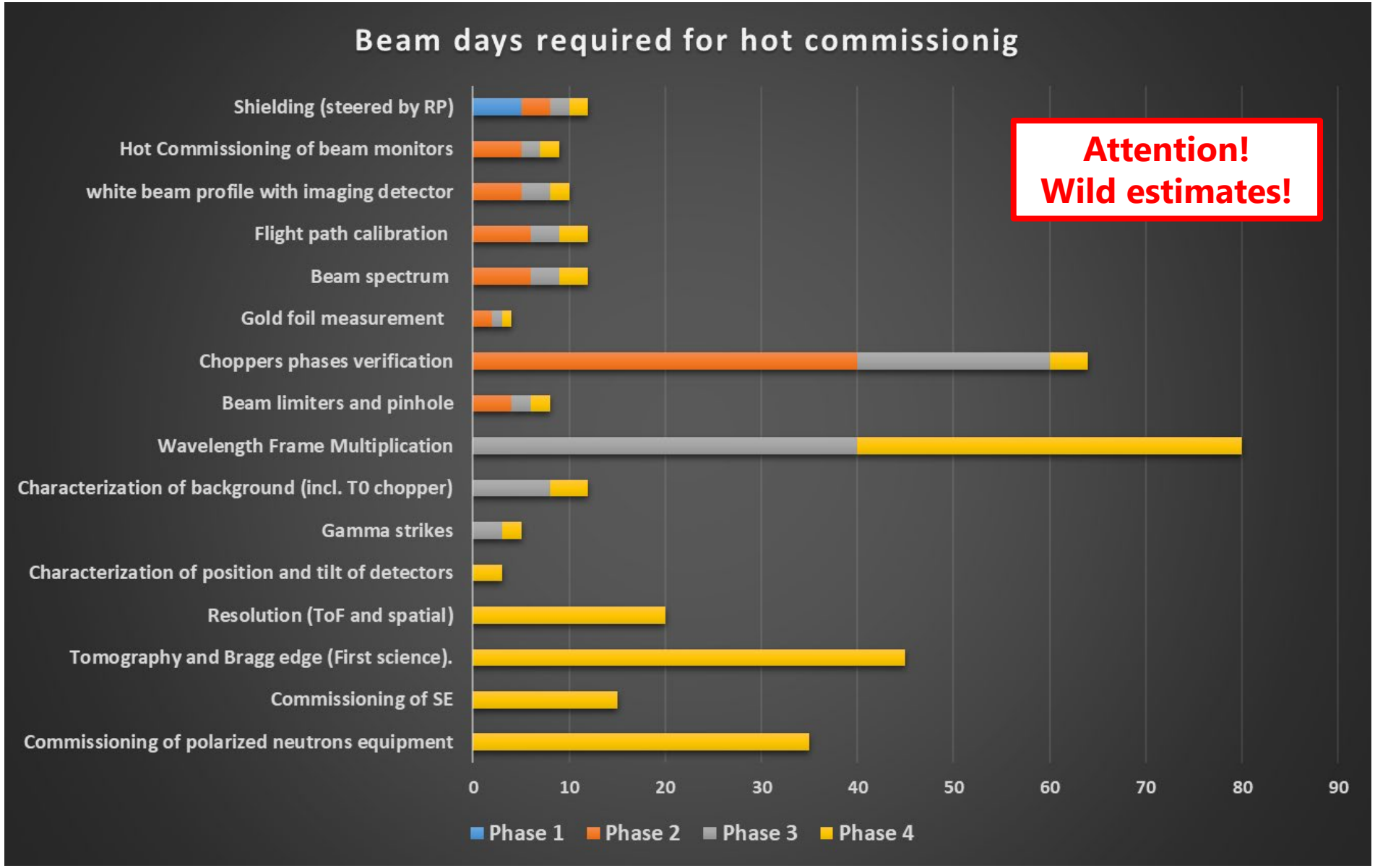


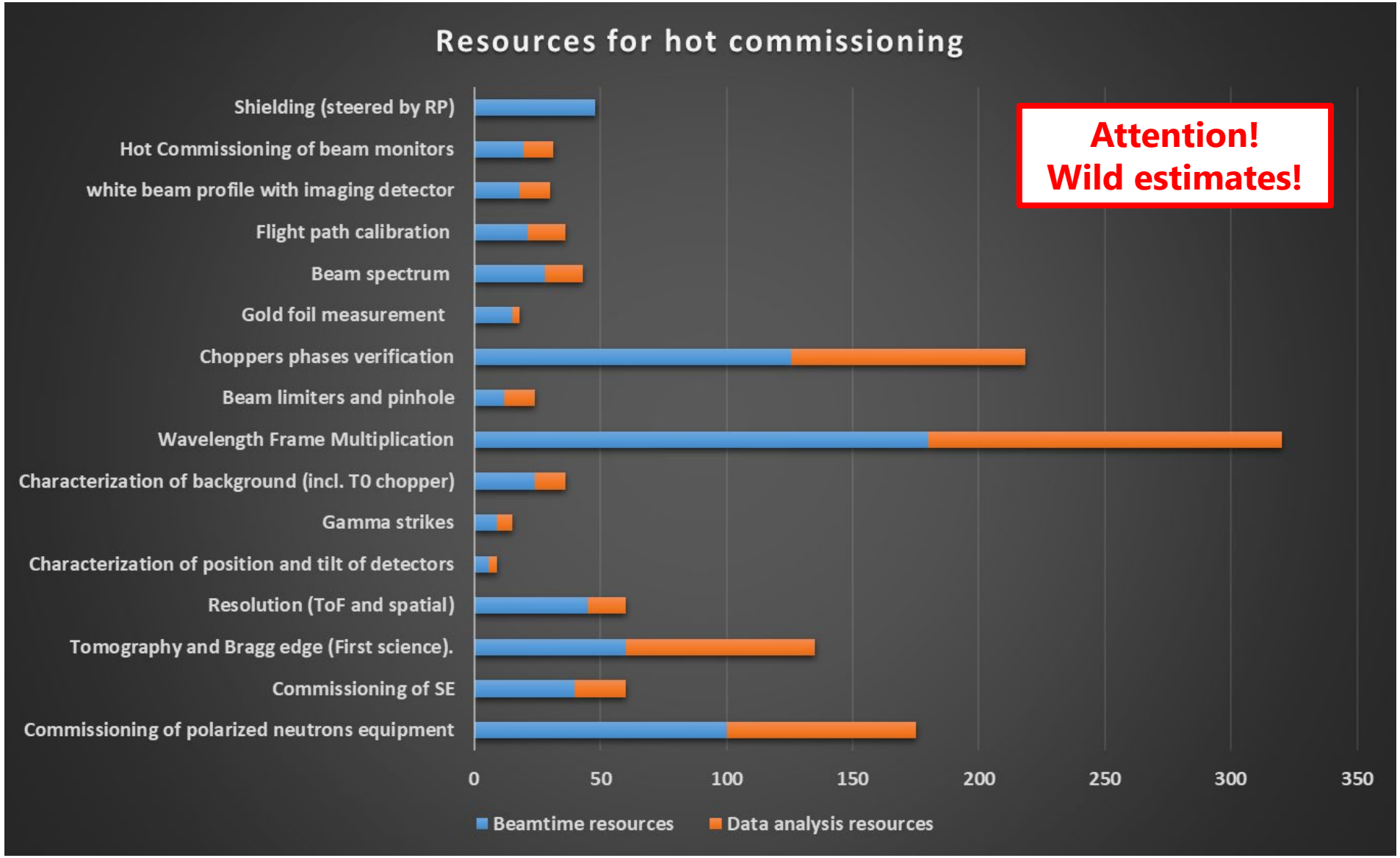
hot commissioning: connection with accelerator



hot commissioning: beamtime needed



hot commissioning: resources needed



Questions?

hot commissioning: resources needed

Period	Accelerator power	projected beam days	#	Activity	required continuous beam days	data analysis days	beam days required in phase	data analysis days required in phase	Resources needed during beamtime	resources needed during data analysis	est. person days
BOT -> BOT+3	<100 kW	~13	1	Shielding (steered by RP)	5	0	5	0			
BOT+3 -> BOT+9	100 kW	~70 (the plan is 48h continuous neutron production a week for the first 3 months and then 3-4 days of continuous beam a week)	1	Shielding (steered by RP)	3	0	38	33			
			2	Hot Commissioning of beam monitors	3	2					
			3	white beam profile with imaging detector / proof of resolution	3	2			3	3	9
			4	Flight path calibration (Nat. res., with monitor)	3	3			3	3	9
			5	Beam spectrum	3	3			4	3	12
			6	Gold foil measurement	1	1			5	3	5
			7	Choppers phases verification (9 axes)	20	20			4	3	80
			8	Beam limiters and pinhole	2	2			3	3	6
BOT+9 -> BOT +12	300 kW	~70 (11 days of continuous neutron production every 2 weeks)	1	Shielding (steered by RP)	2	0	48	39	4	0	8
			2	Hot Commissioning of beam monitors	1	1			4	3	4
			3	white beam profile with imaging detector	2	1			3	3	6
			4	Flight path calibration	2	1			3	3	6
			5	Beam spectrum	2	1			4	3	8
			6	Gold foil measurement	1	0			5	0	5
			7	Choppers phases verification (9 axes), Natural Resolution phasing	10	10			3.5	3	35
			8	Beam limiters and pinhole	1	1			3	3	3
			9	WFM (initial)	20	20			4.5	4	90
			10	Characterization of background (incl. T0 chopper)	5	3			3	3	15
			11	Gamma strikes	2	1			3	3	6

Attention!
Wild estimates!

hot commissioning: resources needed

Period	Accelerator power	projected beam days	#	Activity	required continuous beam days	data analysis days	beam days required in phase	data analysis days required in phase	Resources needed during beamtime	resources needed during data analysis	est. person days
BOT+12 -> BOT+18	<500 kW	~140 (11 days of continuous neutron production every 2 weeks)	1	Shielding (steered by RP)	2	0	104	79			
			2	Hot Commissioning of beam monitors	1	1					
			3	white beam profile with imaging detector	1	1					
			4	Flight path calibration	2	1			3	3	6
			5	Beam spectrum	2	1			4	3	8
			6	Gold foil measurement	1	0			5	0	5
			7	Choppers phases verification	3	1			3.5	3	10.5
			8	Beam limiters and pinhole	1	1			3	3	3
			9	WFM (continued)	20	20			4.5	3	90
			10	Characterization of background (incl. T0 chopper)	3	1			3	3	9
			11	Gamma strikes	1	1			3	3	3
			12	Characterization of position and tilt of detectors	2	1			3	3	6
			13	Resolution (ToF and spatial), including potential spatial dependencies.	15	5			3	3	45
			14	Tomography and Bragg edge (First science).	20	25			3	3	60
			15	Commissioning of SE	10	5			4	4	40
			16	Commissioning of polarized neutrons equipment	20	15			5	5	100
				total	**195**	**151**					**751**

Attention!
Wild estimates!