



# NSS Project Update

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NSS Project Division

- IKON19, 28 September 2020

# Neutron Bunker



Bunker R6 section complete – June 2020



Steel structure D03 ready for installation



West wall pre-build:  
third layer of blocks in place



# Cave Installation



# Heavy Shutters



1<sup>st</sup> of 4 heavy shutters delivered and SAT complete – Sept '20

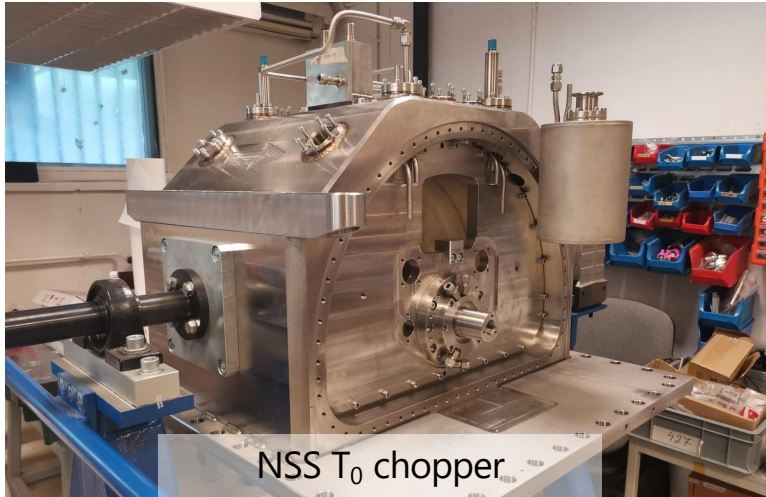


# Chopper Systems

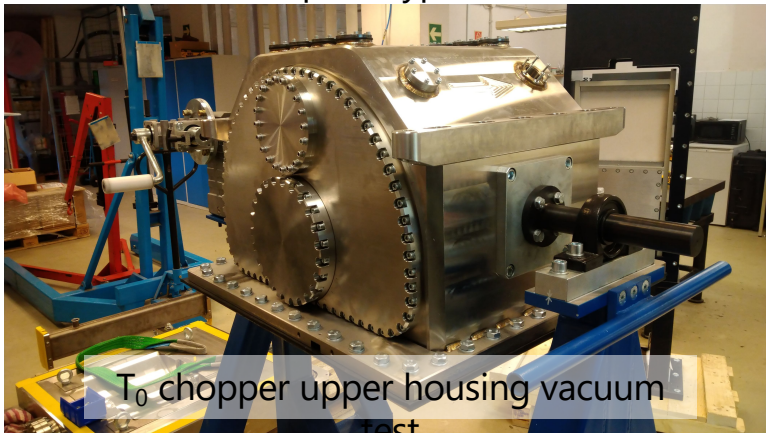
## Common Chopper Project

*Potential scope: Slow choppers, control racks, assemblies &*

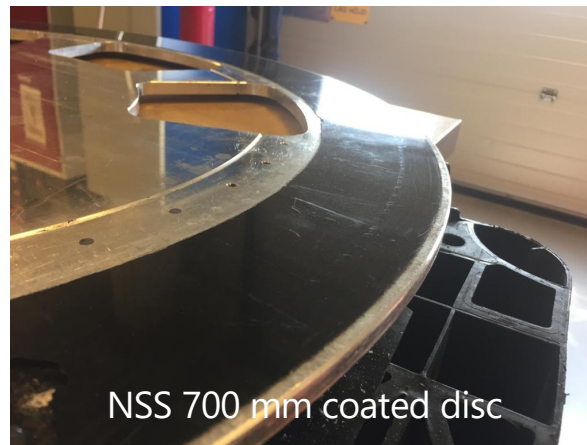
Instrument	Basic scope	Kick-off	CDR	IRR	Completion
MAGIC	Full System	2019-12-10	2020-04	2020-11	2021-11
LOKI	Rack	2020-01-20	N/A*	N/A*	2021-11
FREIA	Racks	2020-01-20	N/A*	N/A*	TBD
NMX	Racks, Assemblies	2020-03-06	2020-11	2021-03	2022-10
ESTIA	Rack and Spindle	2020-03-26	N/A*	N/A*	TBD
HEIMDAL	Full System	2020-09-20	TBD	TBD	TBD
DREAM	Racks	2020-05-20	N/A*	N/A*	2021-09
SKADI	Racks	2020-05-15	N/A*	N/A*	2023-06
MIRACLES	Racks	2020-06-10	N/A*	N/A*	TBD



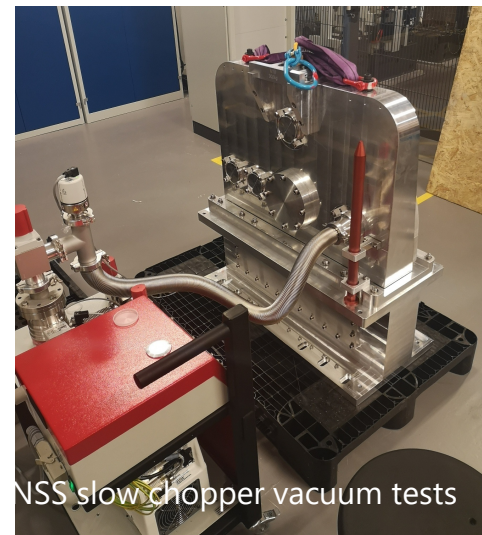
NSS T<sub>0</sub> chopper prototype



T<sub>0</sub> chopper upper housing vacuum test



NSS 700 mm coated disc



NSS slow chopper vacuum tests

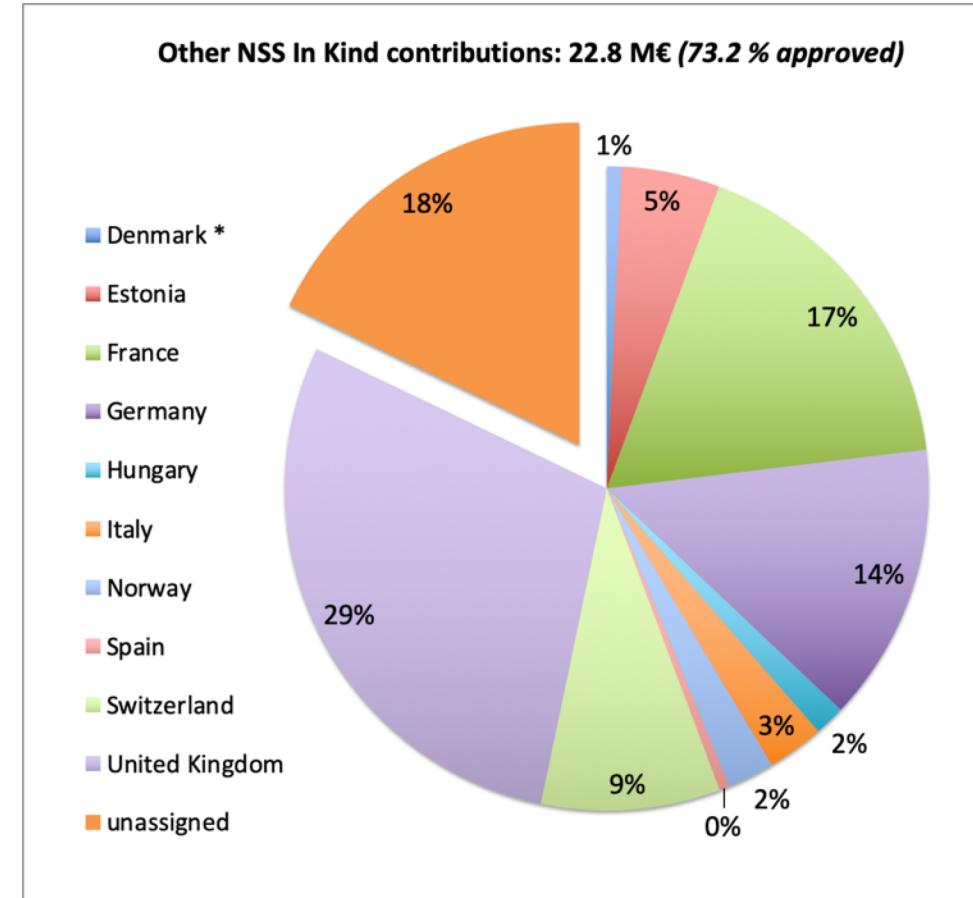
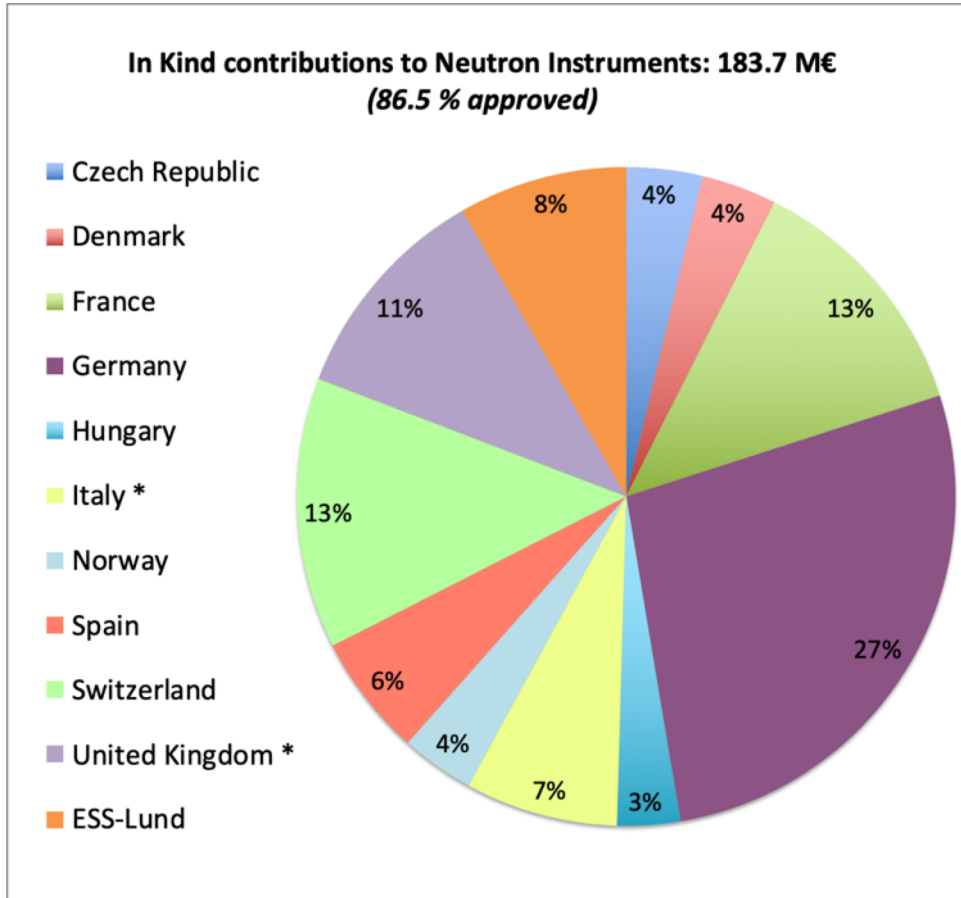


ISIS 700 mm coated disc

# In-Kind Contributions: Summary by Country



IKC constitutes 60 % of NSS scope



Total IK contributions (approved, planned & potential): 209.4 M€ (92 % of the NSS IK target)

\* Nominal split of IT (90%) & UK (10%) contributions to VESPA under review - could shift delivery further to UK & ESS

# The NSS Project Neutron Instruments

Including contribution common shielding and common chopper projects



**86.7 %** of Instrument IK scope is in signed TAs

- Confirmed (racks only)
- Potential

ESS Common Shielding saves time and > 2.5 M€

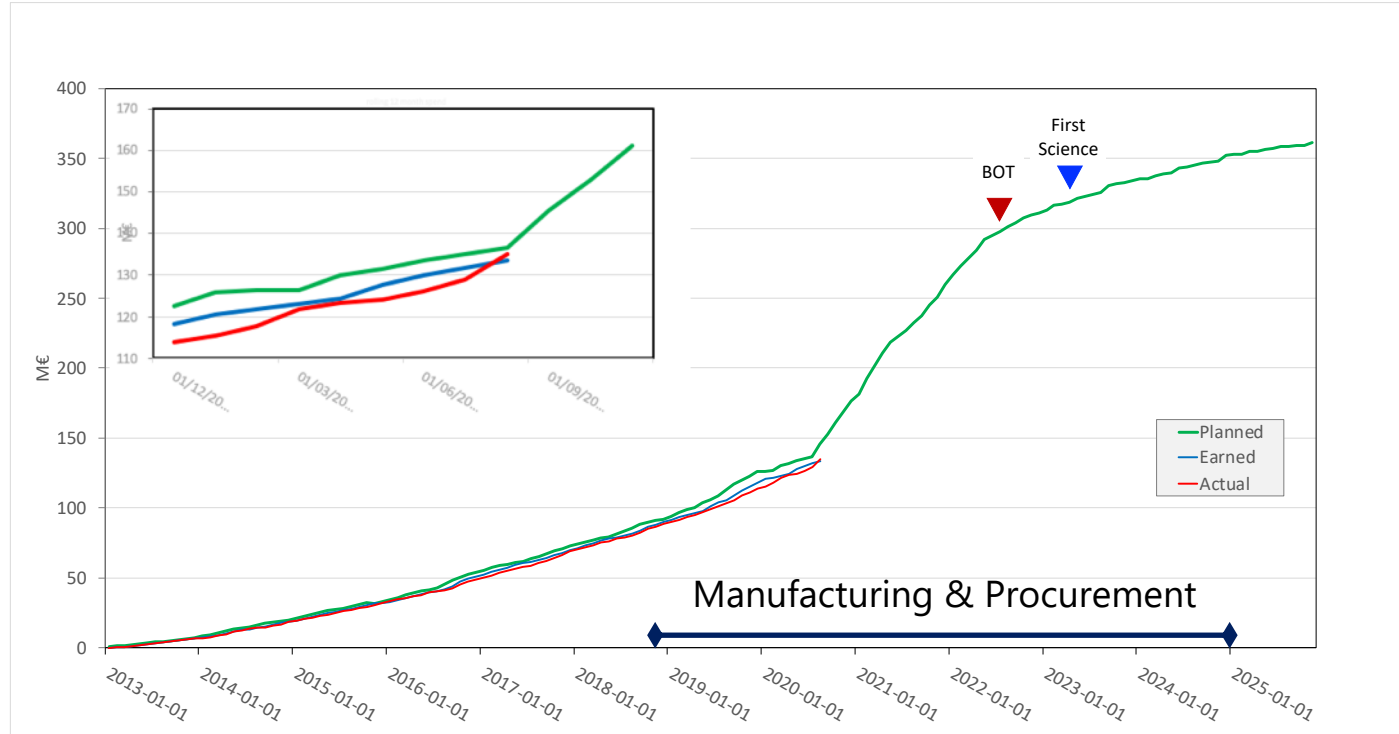
ESS Common Choppers saves time and ~ 1.5M€

Neutron Instrument	Common Shielding Project		Common Chopper Project		Partners (% includes ESS common projects)
	Budget (M€)		Budget (M€)		
LOKI (Broad band SANS)	12.85	<span style="color: green;">●</span>			ISIS (81%) + ESS (19%)
SKADI (General Purpose SANS)	11.50	<span style="color: green;">●</span>			FZJ (50%) + LLB (50%)
ESTIA (Focusing Reflectometer)	11.80	<span style="color: green;">●</span>			PSI (100%)
FREIA (Liquids Reflectometer)	13.20	<span style="color: green;">●</span>			ISIS (78%) + ESS (22%)
DREAM (Bispectral powder diffractometer)	13.66	<span style="color: green;">●</span>	<span style="color: green;">●</span>		FZJ (76%) + LLB (20%) + ESS (4%)
HEIMDAL (Hybrid diffractometer)	13.55	<span style="color: green;">●</span>	<span style="color: green;">●</span>		Åarhus U. (30%) + PSI (35%) + IFE (25%) + ESS (10%)
MAGIC (magnetism single xtal diffraction)	13.10	<span style="color: green;">●</span>	<span style="color: green;">●</span>		LLB (52%) + FZJ (24%) + PSI (16%) + ESS (8%)
NMX (Macromolecular crystallography)	11.67	<span style="color: green;">●</span>	<span style="color: green;">●</span>		ESS (24%) + WI/IER(53%) + Bergen (22%) + LLB (7%)
BEER (Engineering diffractometer)	14.99	<span style="color: green;">●</span>	<span style="color: yellow;">●</span>		NPI (50%) + HZG (50%)
ODIN (multi-purpose imaging)	11.76	<span style="color: green;">●</span>			TUM (60%) + PSI (36%) & ESS (4%)
BIFROST (extreme environment spectro.)	13.45	<span style="color: green;">●</span>	<span style="color: yellow;">●</span>		DTU/KU (23%) +PSI (27%) +IFE(14%) +LLB (20%) +ESS (16%)
C-SPEC (cold chopper spectrometer)	16.50	<span style="color: green;">●</span>	<span style="color: yellow;">●</span>		TUM (50%) + LLB (40%) + ESS (10%)
T-REX (bispectral chopper spectrometer)	16.85	<span style="color: yellow;">●</span>	<span style="color: yellow;">●</span>		FZJ (75%) + Perugia U. (25%)
VESPA (vibrational spectroscopy)	12.00	<span style="color: green;">●</span>	<span style="color: yellow;">●</span>		CNR (100%)
MIRACLES (backscattering spectrometer)	13.4	<span style="color: green;">●</span>	<span style="color: green;">●</span>		ESS-Bilbao (89%) + KU (2%) + ESS (9%)
	<b>200.28</b>				



# Construction project

- NSS performance progress (Aug 2020)



Planned	Earned	Actual	SV	CV	SPI	CPI*
136,576,182	133,533,794	135,186,046	-3,042,388	-1,652,252	0.98	0.99

SV -3 M€ & SPI = 0,98  
CV -1,6 M€ & CPI = 0,99

NSS budget = 361 M€

NSS Project is 38,6 % complete  
i.e. 43,3 % towards First  
Science

(+0,5 since July 2020)

~ 209 M€ by IK partners  
- In part treated as cash IK

IK status:  
14/15 instruments have IK TA's  
endorsed by IKRC

BEER needs signed TAs.

\* In kind included through EV





# NSS – Top 5 Risk Mitigation Status

Event	Potential Impact	Probability	Mitigation measures	Due date
<b>Lack of key personnel (ID 11)</b> <i>NSS needs to grow with 5 positions in 2020, and 20 for 2021 in order to meet our schedule. Lack of confidence in ESS IO fund levels have made PMT reluctant to approve recruitments.</i>	0,935 M€	5	Secure approval from PMT for critical recruitments 2020 Secure approval from PMT for critical recruitments 2021 Create a register of key tasks and key personnel. Identify cross training of other staff that can cover	201030 210731 221222
<b>NSS will not meet construction project scope within assigned budget (15 instruments, 361M€).</b> (ID 1)	2,1 M€	3	Agree on costs for remaining in-kind contracts. Negotiate with IK partners on scope or methods of delivery to limit the costs, including scope transfer from IK to NSS	201221 201221
<b>Scientific support infrastructure is inadequate</b> (ID 29)		2	Clear requirements Prioritization of Instruments followed by SSS resources	201222 211222
<b>Failure to obtain license to operate in line with ESS Integrated Schedule</b> (ID 20)	0,165 M€	2	Establish NSS Task Force on Licensing, deliver application Ensure good communication with ES&H, review and provide feedback on ES&H proposals, ensure that requested information is supplied promptly. Alert as soon if ES&H requirements will impact instruments.	200731 220707
<b>IK partner installation teams fail to complete onsite installation on time</b> (ID 3)	1,536 M€	3	Ensure mature instrument installation plans are provided by IK partners (prioritize First 8 instruments) Recruit 2 Installation technicians (done - start Sept 2020)	210422 200630

Expected Value of NSS cost risk = **7,29M€** to end of project  
 Last workshop Aug 2020. Next workshop is planned for October 2020



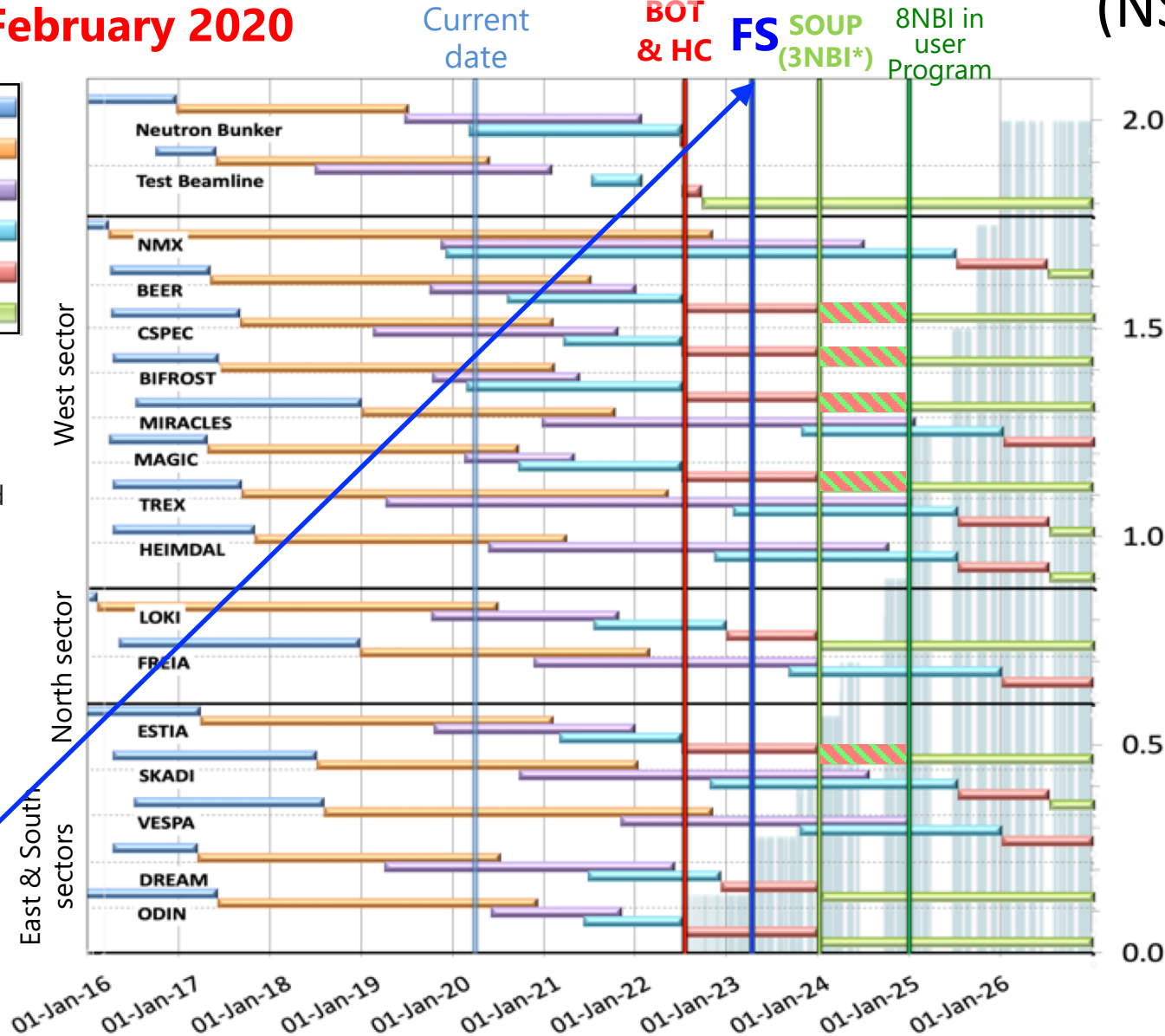
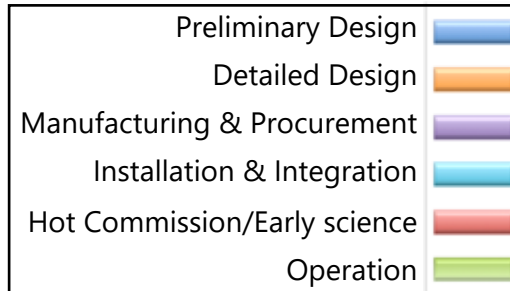
# NSS Project Schedule & Milestone performance

# Baseline schedule for Neutron Beam Instruments



**No change to NSS Master Schedule since February 2020**

(NSS MS V4.3)



- **First 3 NBI selected for SOUP: DREAM, LOKI & ODIN** (best chance for early impact, as agreed by NSS, SAC and ESS Council)
- **Back-up instruments:** (in case one or all of first 3 are delayed) BEER, CSPEC, MAGIC or BIFROST, ESTIA

*March 2023:*

- **First Science (FS)** with expert teams on some of instruments above
- Review progress of first 3 NBI\* for SOUP, implement backup plan if needed.

- Refinement of milestones for instruments through negotiation on TAs
- ESS Major Milestones (BOT, FS, SOUP) have not changed since rebaselining (May 2018)
- NSS R-BOT currently has negative float of 8 weeks
- Access to instrument areas is according to baseline. No delays foreseen.

\* NBI = Neutron Beam Instrument

# High level installation chart for first 8 instruments – Current Baseline

(NSS MS V4.3) February 2020



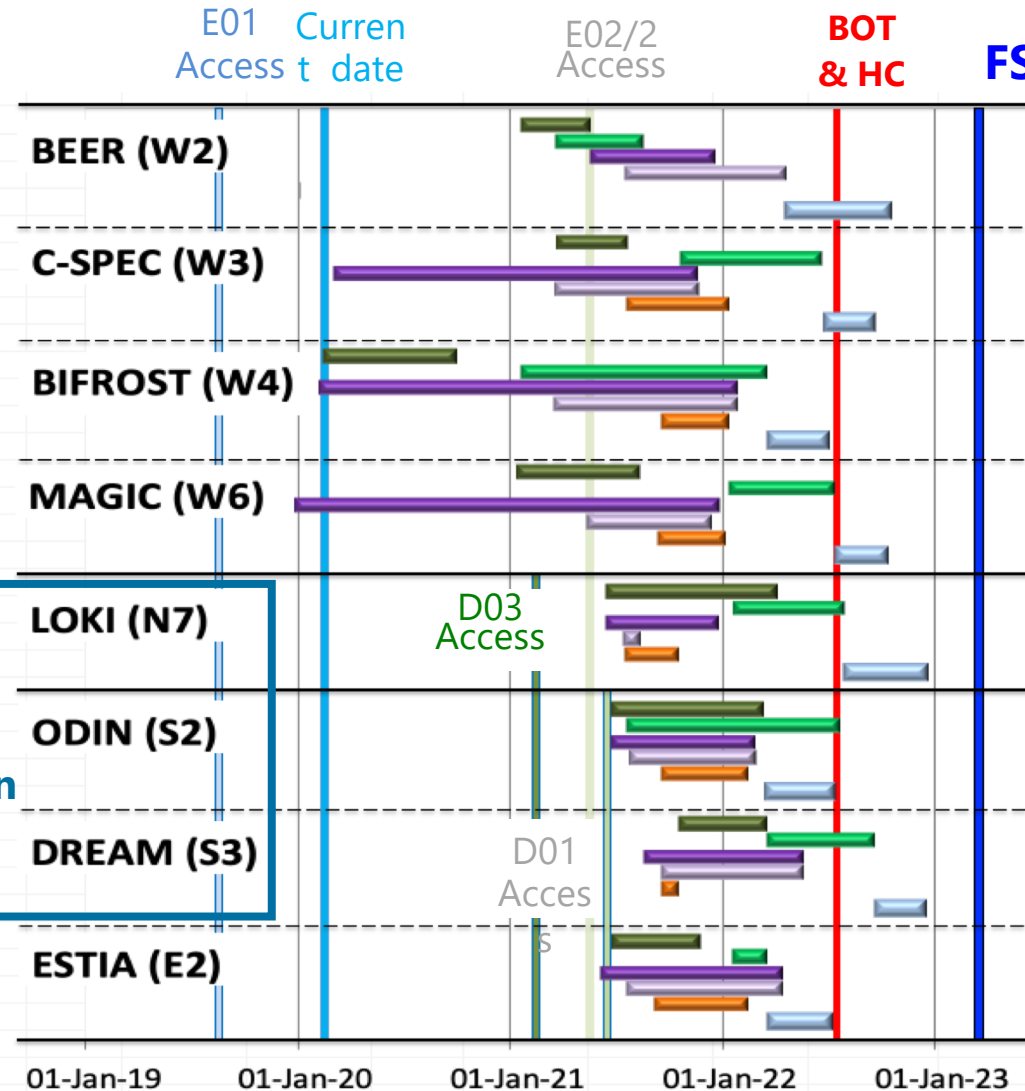
*Ready for Hot Commissioning*

West sector

North & South sectors

**First 3 instruments**

East sector



### Information from:

- Signed Instrument TAs
- Monthly Progress Reports from IK Instruments
- Approved CRs

*All info is in P6 project plan*

- ESS Major Milestones (BOT, FS, SOUP) have not changed since re-baselining (May 2018)
- ODIN, BIFROST, ESTIA ready for BOT, all others by end 2022
- NSS R-BOT currently has negative float of 8 weeks (*from July -> Sept*)
- We are seeing some pressure on bunker access dates from instruments (*~ 1 month*)

# High level schedule – access for Instruments



## 1. Buildings are NOT delayed !

*Hall access for Instruments according to baseline schedule*

*– plan to start installations outside Bunker area as soon as you get access.*

*First installation (and binder!) takes time.*

*Cranes are confirmed to be available from point of instrument access.*

## 2. Target delays -> impacting in-bunker access

- *Vessel, inner shielding, portblocks etc (need to be installed before the insert installations)*  
*deliveries are foreseen Q4-20 / Q1*
- *Light shutter system*                      *forecasted deliveries Q2-Q3 2021*
- *Blindplugs*                                      *confirmed deliveries Q4202-Q1 2021*
- *NBPI*    *forecasted deliveries between June-21 and Feb-22*

# In bunker access plan as of August 2020

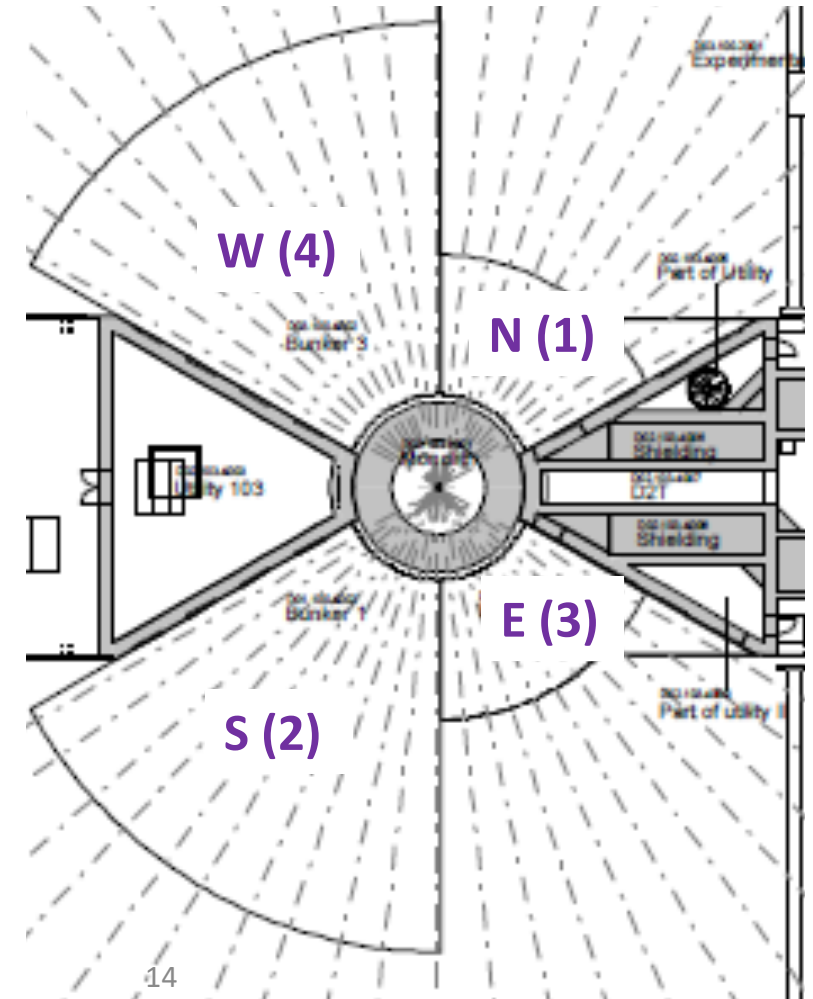
based on today's plan (rolling wave schedule)

Section 1 = NORTH	start Sep 2021
Section 2 = SOUTH	start Oct 2021
Section 3 = EAST	start Nov 2021
Section 4 = WEST	start March 2022

*(status TD rolling wave plan 31 Aug 2020)*

Section 1 = NORTH	<b>LOKI, TBL, FREIA</b>
Section 2 = SOUTH	<b>ODIN, DREAM</b>
Section 3 = EAST	<b>ESTIA, SKADI, VESPA</b>
Section 4 = WEST	<b>CSPEC, BIFROST, MAGIC, BEER, NMX, TREX, MIRACLES, HEIMDAL</b>

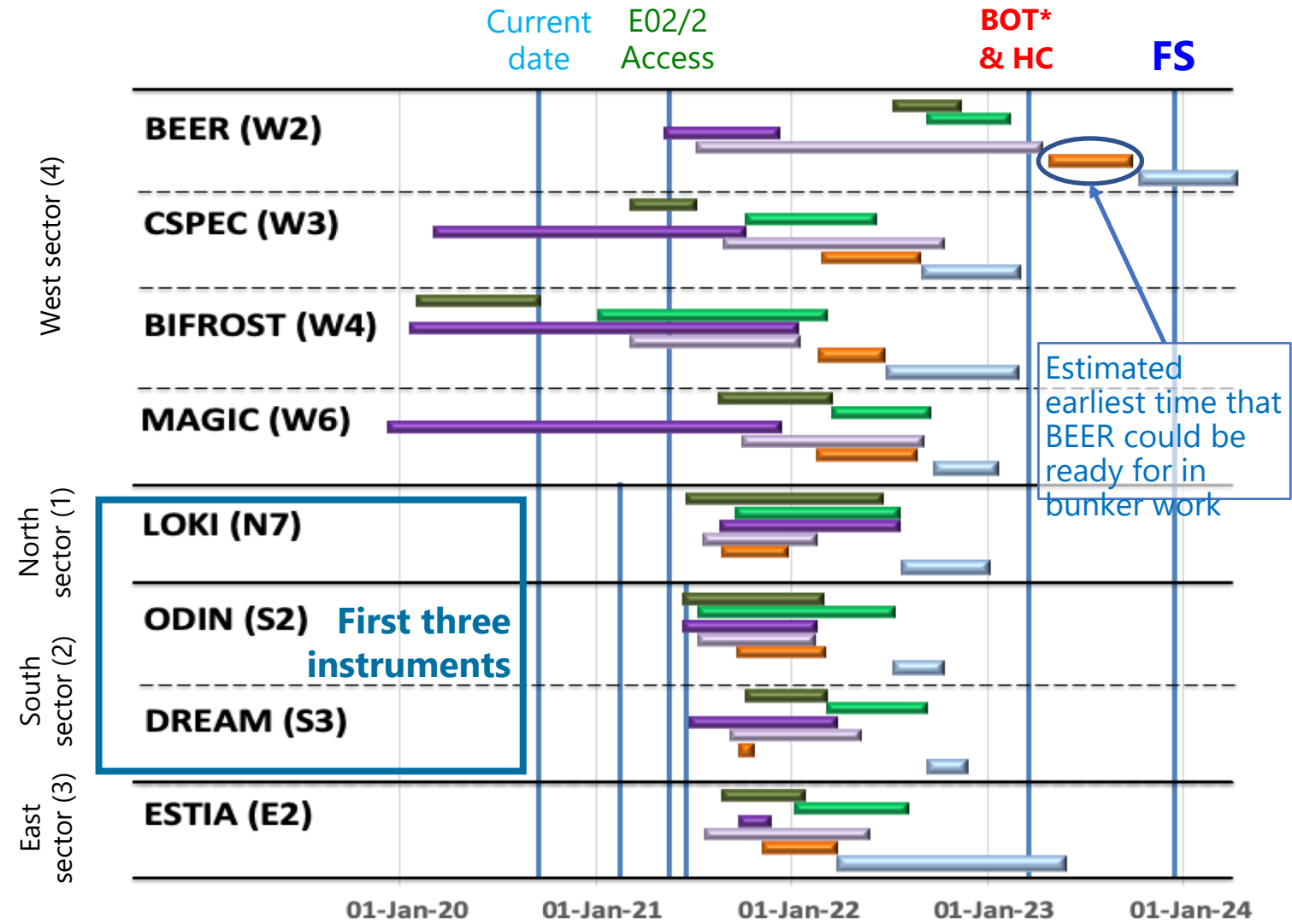
**BOLD** = First 8



# High level installation chart for first 8 instruments: Current forecast: based on ESS rolling wave plan



- Instrument TG5 dates from Critical path map and IK Partner workshop (August)
- BOT & FS dates aligned with Project Office's Rolling Wave plan
- Assume shift of 18 months for BEER for all in bunker & cave installation & commissioning (SJK assessment)
- MAIN messages:**
  - NSS RBOT<sup>1</sup> is 23 Jan 2023 (8 weeks float to BOT)**
  - 6 instruments (ODIN, DREAM, LOKI, BIFROST, CSPEC & MAGIC<sup>2</sup>) plan to make BOT.**
  - TG5 date range (excl. BEER, ESTIA) Oct '22 -> Mar '23**
  - 7 Instruments could potentially make FS milestone**



1. NSS RBOT is defined as Bunker & Test Beamline ready for Beam on Target  
2. MAGIC still has high manufacturing schedule risk

\*BOT in rolling wave plan is 17 March 2023

# Forecast Dates for Key Milestones\*: First Science



Description	Baseline date	Pre-Covid	Forecast / actual	Float (days)
Instrument Hall E01 Handover - DONE	15 Aug 2019	15 Aug 2019	15 Aug 2019	110
Start installation of 3 instruments (NMX, CSPEC, MAGIC) - DONE	3 Feb 2020	19 Dec 2019	19 Dec 2019	103
Instrument Parallel Access Hall D03 (FULL handover 17 Aug 2021)	18 Jan 2021	18 Jan 2021	22 Feb 2021	-26
Instrument Parallel Access E02.2 (FULL Handover 14 Sep 2021)	10 May 2021	10 May 2021	10 May 2021	0
Instrument Parallel Access Hall D01 (FULL Handover 31 Jan 2022)	3 June 2021	3 June 2021	3 June 2021	0
Complete design of "First 3" instruments (LOKI, DREAM, ODIN)	12 Jun 2020	22 Dec 2020	23 April 2021	-84
Start installation of "First 3" Instruments (LOKI, DREAM, ODIN) <i>aligned with first access to buildings</i>	15 June 2021	15 June 2021	15 June 2021	0
<b>Bunker R-BOT</b>	<b>7 July 2022</b>	<b>2 Sept 2022</b>	<b>23 Jan 2023</b>	<b>-142</b>
Start commissioning first instruments	7 Jul 2022	Sep 2022	17 March 2023	-182
Complete cold commissioning of "First 3" instruments (LOKI, DREAM, ODIN) <i>due to Target delay -&gt; impact on in-bunker installations</i>	20 Dec 2022	20 Dec 2022	20 Jan 2023	-22
<b>First Science (FS)</b>	<b>31 Mar 2023</b>	<b>31 May 2023</b>	<b>14 Dec 2023</b>	<b>-182</b>
<b>SOUP</b>	<b>31 Dec 2023</b>	<b>31 Jan 2024</b>	<b>13 Sep 2024</b>	<b>-182</b>
<b>End Of Construction</b>	<b>31 Dec 2025</b>	<b>31 Dec 2025</b>	<b>31 Dec 2025</b>	<b>0</b>

*Pre-Covid dates from IPR for Feb (ie just before COVID)*

\* Based on rolling wave plan





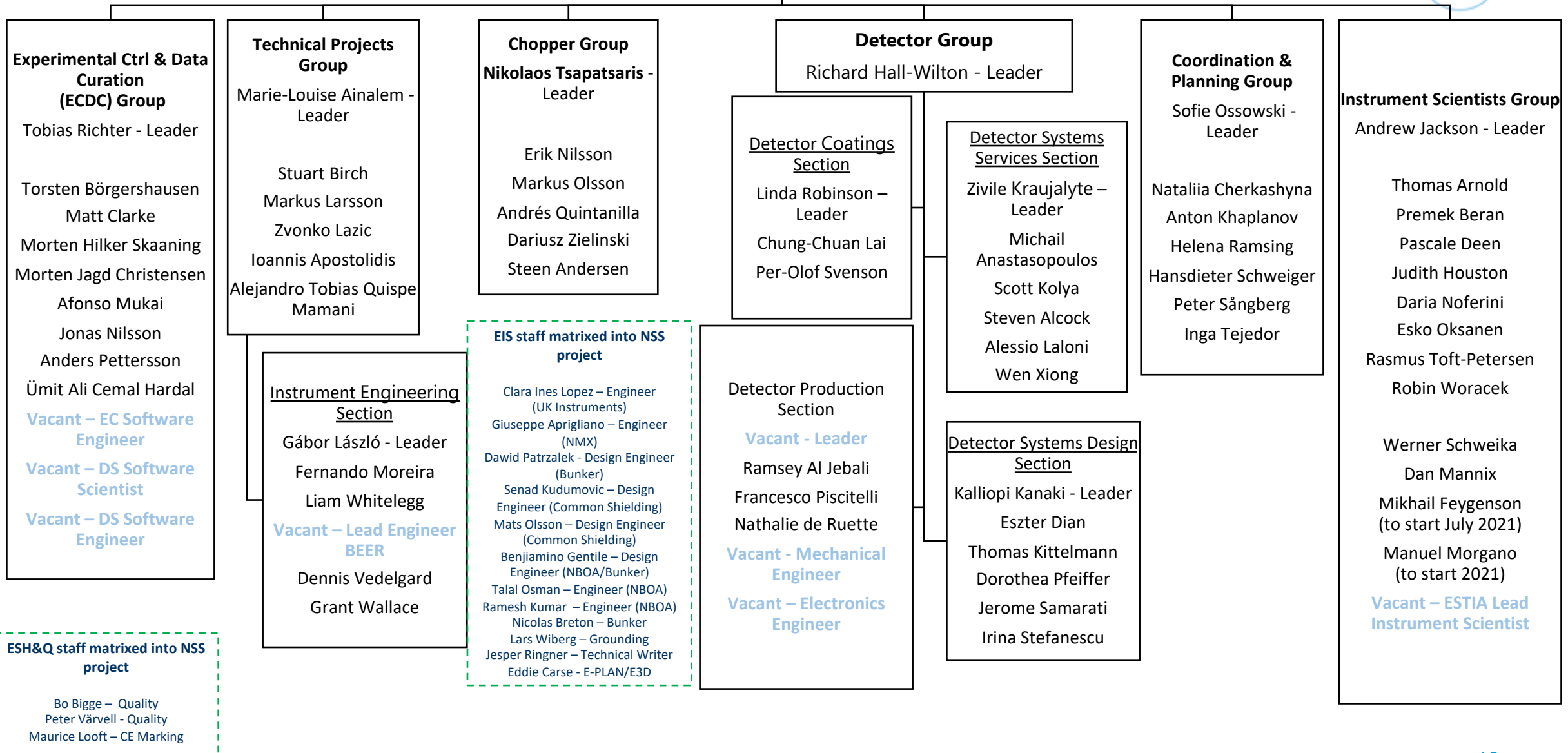
# The NSS Organizational Structure

# NSS-PD Org chart

Sept 2020



**Shane Kennedy**  
 Head of NSS Division  
 Iain Sutton, Zsuzsa Helyes



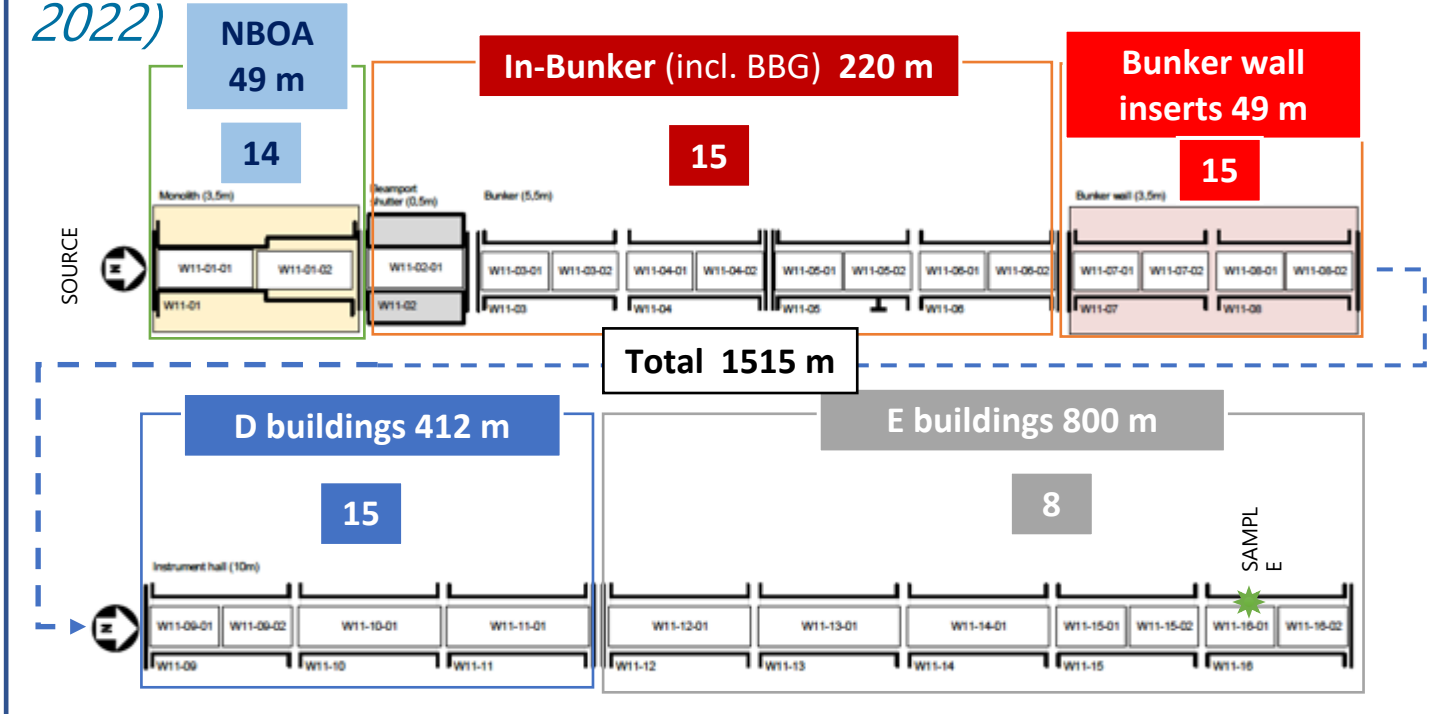


- Delivery of critical systems & next 6 months

# Progress on neutron guide manufacturing



ESS Project scope (*exceeds supplier capacity from 2019-2022*)



NBOA (Neutron Beam Optical Assembly) scope is with IK Partners. All NBOA need to be delivered in time for installation with portblocks in 2021. NSS co-ordinates NBOA manufacturing and pre-installation (into NBPI) centrally to ensure compatibility with NBPI and timely delivery;

Apart from (NBOA) manufacturing of all NBOA scheduled for delivery in 2021, 707 m) was placed on hold until sufficient progress was made with Instruments 1-8

section	NBOA		In-Bunker			Bunker wall			Out of bunker			Total % in contract
	Progress MS	Contract	scope	Tender	Contract	scope	Tender	Contract	scope	Tender	Contract	
Length*	49 m		117 m	102 m	88 m	24.5 m	18.4 m	15.4 m	618 m	618 m	471 m	
Completion*	100 %		-	87 %	75 %	-	75 %	63 %	-	100 %	76 %	77 %
<i>forecast completion* by 31 December 2020</i>	100 %		100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %

NSS approved procurements for #9 - #15 from 1 July 2020

\* For Instruments 1-8 + all NBOA



# Critical components mapping

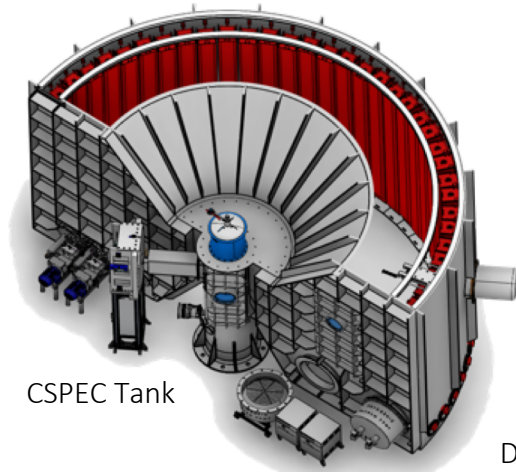
Tracked against rolling wave schedule (BOT March 2023)

subject for monthly review	TG5	Choppers				Detectors		Guides							
	Current forecast	Current forecast				Current forecast		Current Forecast							
		in-bunker		out of bunker				NBOA		BWI		in-bunker		out of bunker	
	TG5	contract signed	Delivery to site	contract signed	Delivery to site	contract signed	Delivery to site	contract signed	Delivery to site	contract signed	Delivery to site	contract signed	Delivery to site	contract signed	Delivery to site
LOKI (Tom)	2023-01-13 (COVID)	2020-01-29 ✓	2021-07-14 COVID delays.	2020-01-29 ✓	2022-04-28 COVID delays.	2020-02-01 ✓	2022-04-28 COVID delays.	2019-Q3 ✓	Nov 2020 COVID delays.	2019-04-23 ✓	2021-06-15 COVID delays.	2019-04-23 ✓	2021-09-01 COVID delays.	2019-04-24 ✓	2022-04-28 COVID delays.
ESTIA (Tom)	2023-05-05	2018-10-01 ✓	2021-09-01	NA	NA	Q4 2020	2021-06-01	2019-Q4 ✓	Dec 2020 COVID delays	NA (Selene1...)	NA (Selene1...)	2020-07 ✓	2021-08-15	2020-08 ✓	june 2022?
DREAM (Werner)	2022-11-31	2019-10-21 ✓	Install. June 2022 (special Bunker slot)	NA	NA	2020-08 ✓	2022-06-15 (not high res.??)	2019-Q4 ✓	Dec 2020 COVID delays.	2020-06 ✓	2021-05-15	2020-06 ✓	2021-09-15 (install Oct 2021)	2020-06 ✓	2022-04-15
ODIN (Robin)	2022-10-15	2019-05-31 ✓ TO: 2020-05-01	2021-06-01 TO: 2021-10-10	2019-05-31 ✓	2021-06-01	Q4 2020	2021-12-01	2019-Q4 ✓	Dec 2020 COVID delays	2020-Q3 (offer exist)	2021-06-08	2019-12-19 ✓	2021-10-12	2019-12-19 ✓	2021-10-12
BEER (Robin) no TA	No contract yet 2023 Q3Q4 ?	No contract yet (Exp. Q3Q42020)	April 2022 ?	No contract yet (Exp. Q3Q42020)	April 2022 ?	Jan 2021 ?	Jan 2022?	2019-Q4 ✓	Apr 2021 COVID delays	No contract yet (Exp. Q3Q42020)	April 2022 ?	No contract yet (Exp. Q3Q42020)	April 2022 ?	2018-12-15 ✓	E02.1: 2021-05-15 Rest: 2021-07-15
BIFROST (Rasmus)	Q1 2023 (choppers)	2020-10-15	Q3Q4 2022 (TBC once contract signed)	2020-10-15	Q3Q4 2022 (TBC once contract signed)	2020-11-15	Q1 2022	2019-Q4 ✓	Jan 2021 COVID delays.	2020-06 ✓	2021-08-15	2020-06 ✓	2022-02-15	2020-06 ✓	2022-02-15
CSPEC (Pascale)	Q1 2023	2020-10-15	Q1 2022	2020-10-15	2022-09-15	2020-06-15 ✓	2022-01-15 *tbd in the contract ESS - CSPEC*	2019-Q4 ✓	Q1 2021 COVID delays	2019-10-15 ✓	2020-12-15 COVID delays?	Not applicable	2021-07-15 COVID delays?	Not applicable	2021-Sep E02.1 2021-Q4?
MAGIC (Werner)	Q2Q3 2023 (without PA - 2025 with PA)	2019-10-01 ✓	Q1 2022	2019-10-01 ✓	2021-06-15	2019-07-09 ✓	2021-10-15	2019-Q4 ✓	NA	No contract yet (Exp. Q42020) Tender out.	?	No contract yet (Exp. Q42020) Tender out.	Q3 2022	No contract yet (Exp. Q42020) Tender out.	No contract yet (Exp. Q42020) Tender out.

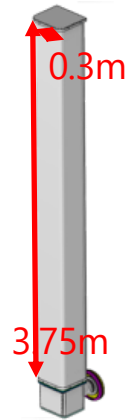


# The Multi-Grid detector for C-SPEC

Under construction

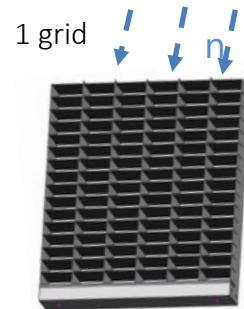
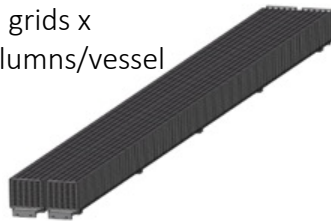


CSPEC Tank

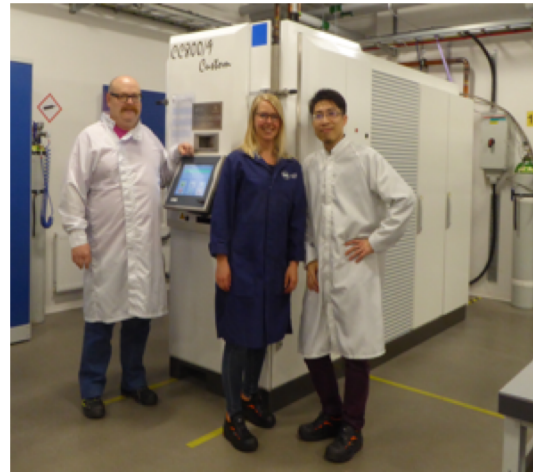


Detector Module  
18 x vessels in total

140 grids x  
2 columns/vessel



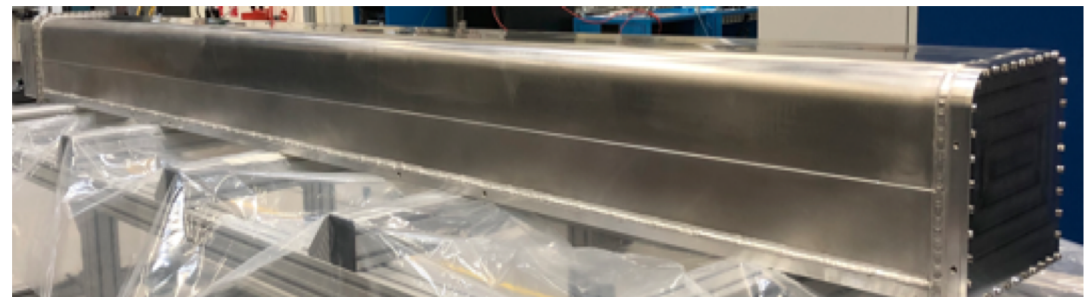
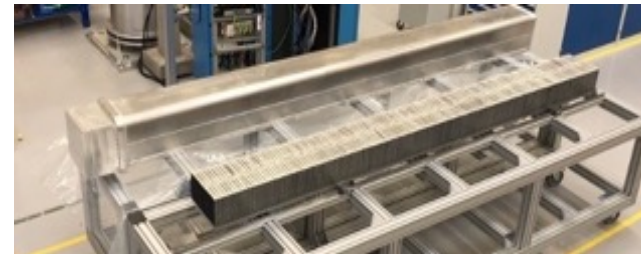
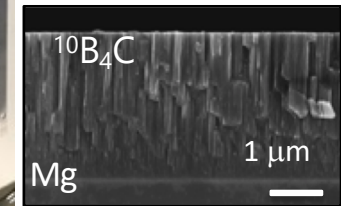
- Cost: 4.3 M€ (including installation)
- Delivery agreement b/n TUM & NSS signed in June 2020



ESS Assembly workshop (*Utgård, Lund*)



ESS Coating facility  
(*Linköping*)

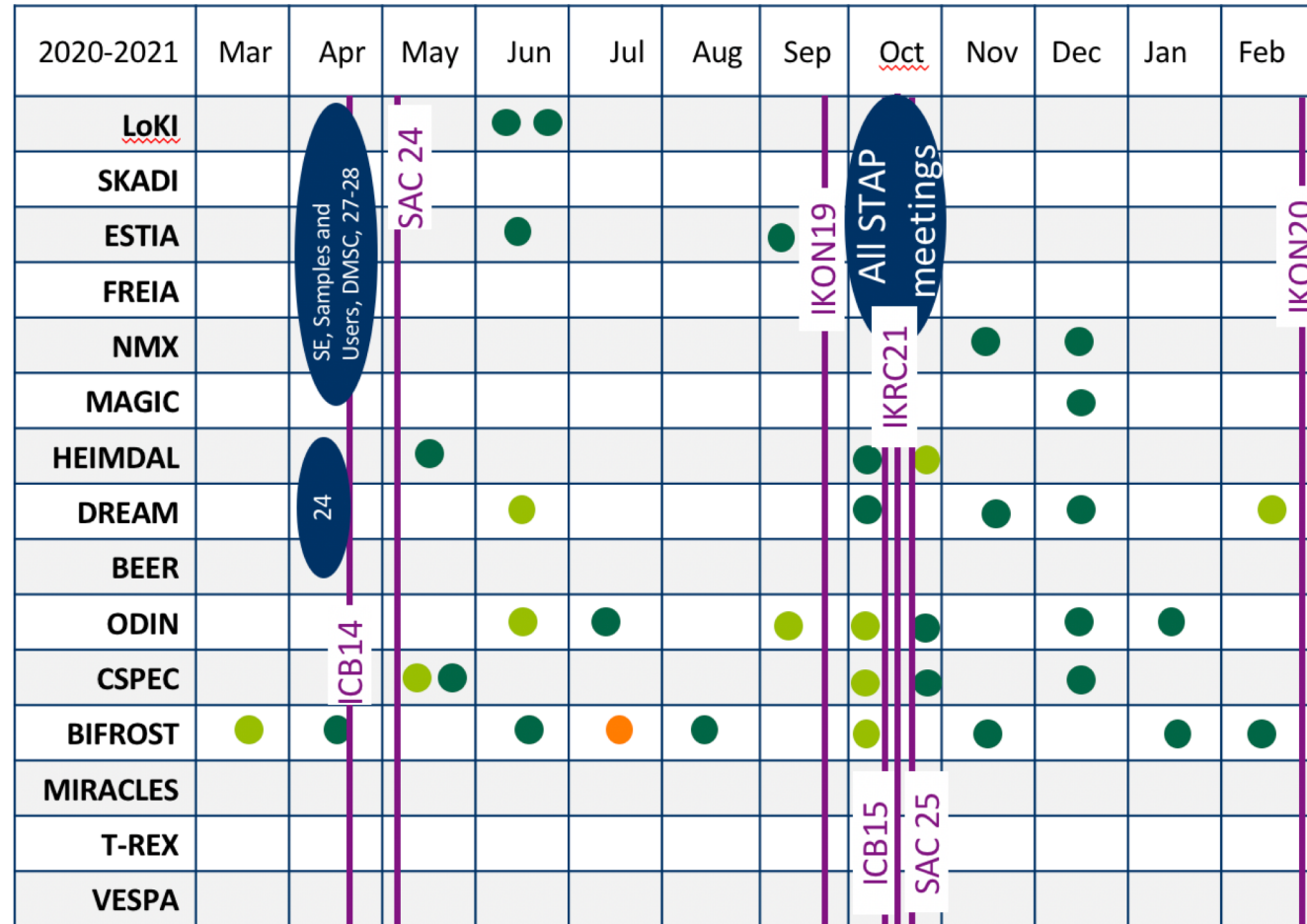


# Next Six Months:

Manufacturing progressing for First 8 Instruments  
 Further Installation in E01 & E02,  
 prepare for installation in D03 & D01



- Intermediate Design Review
- Subsystem TG3 (intermediate)
- TG4
- STAP – 19-21 October – All at the same time



September 2020