

Update on ESS Construction Project

Shane Kennedy NSS Project Leader European Spallation Source ERIC

Agenda



- 1 NSS Project Status
- 2 Managing ESS scope for instruments
- 3 Managing ESS budget & schedule

2021-04-14 PRESENTATION TITLE/FOOTER



NSS project status

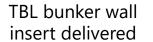
Jan - Mar 2021

instrument distribution boards for E01 delivered



Electrical infrastructure (cable trays / raceways) in D-building galleries

Bunker West wall blocks installation ongoing









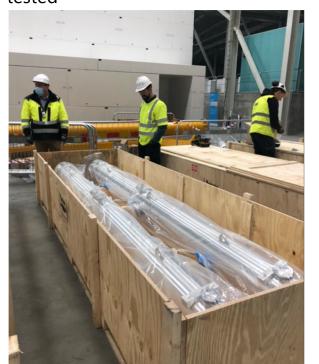


Feb 2021

First Guide shielding blocks for CSPEC ready to be shipped (arrived at ESS early March)



CSPEC vacuum housings Delivered. Currently being tested









March 2021





Bunker south Wall installation started mid March

BIFROST Detector tank delivered to site



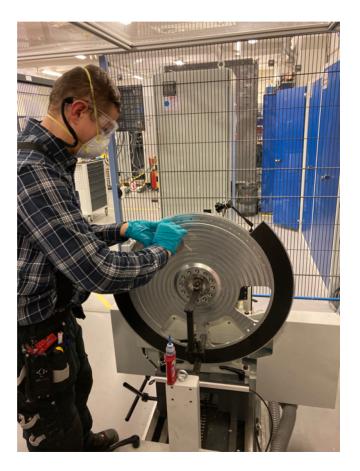


Common Choppers



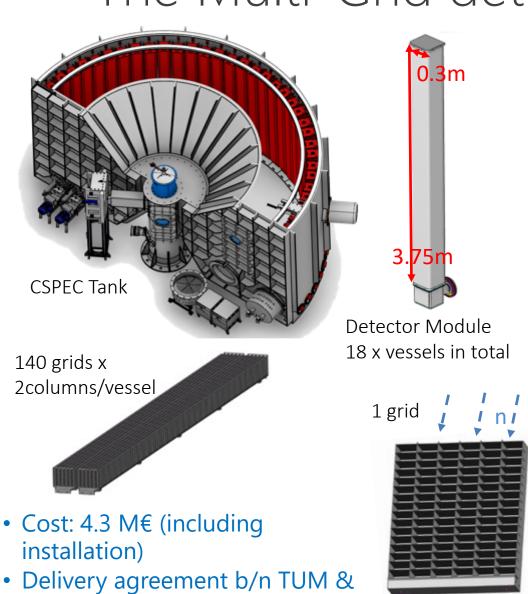


Prototype T0 chopper design speed of 31Hz reached



New NCG coated disc. Balanced and ready for high speed tests

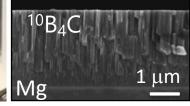
The Multi-Grid detector for CSPEC (& T-REX)



NSS signed in June 2020



ESS Coating facility (Linkoping)









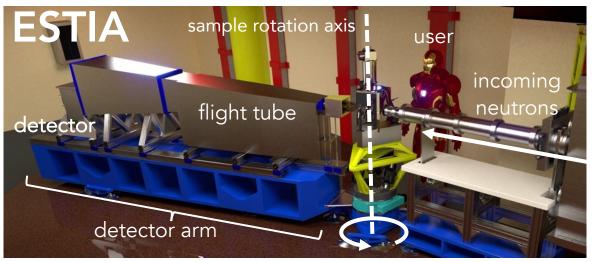


27/08/20

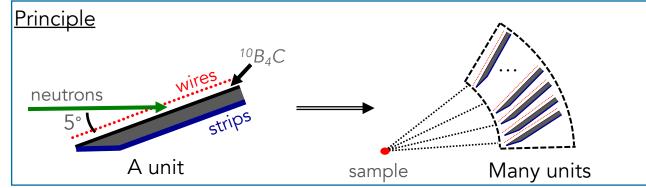


The Multi-Blade detector for ESTIA (& FREIA)

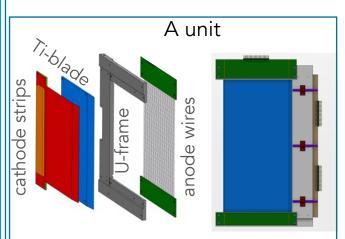


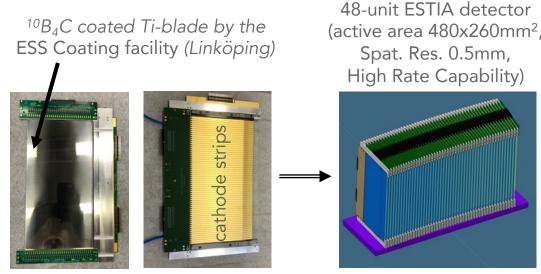


Cost: 790 kEUR (incl. installation and cold commissioning) Delivery agreement soon to be signed b/n PSI and NSS



ESTIA Detector





Assembly at the ESS workshop (Utgård, Lund)

The AMOR reflectometer (PSI) uses the same principle of neutron focusing guides as ESTIA.



A MB prototype permanently installed at AMOR since Sept 2020 for the commissioning of the beam line and for friendly user operations.

NSS Highlights – detector group





Shelves and fume extractions points installed in E04 Detector area



Back End Electronics - 5 Master Module readout crates in assembly as prototypes



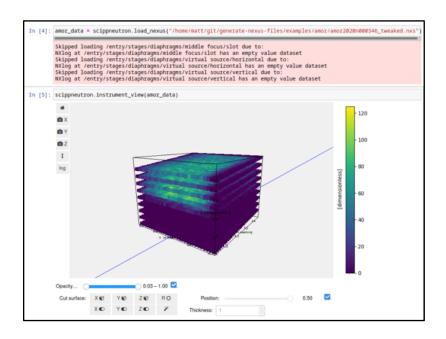
Detector workshop being established in B02

ECDC





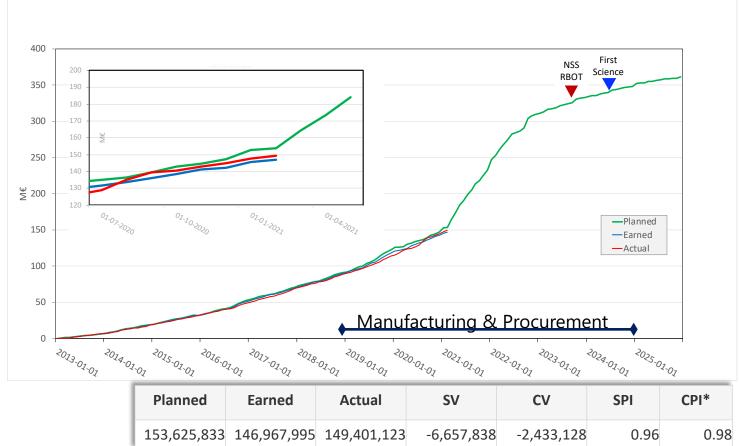
Demo at YMIR (instrument test-bed in Utgård Labs)



AMOR (PSI) files loadable in scipp

EV graph - Construction project:

NSS performance progress (Feb 2021)





NSS budget = 361 M€

NSS Project is 41,9 % complete

(+0,3 since Jan 2021)

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

CV -2,4 M€ & CPI = 0,98

SV -6,6 M€ & **SPI = 0,96**

^{*} In kind estimated from EV

Instrument critical components check list First 8 neutron instruments – manufacturing and delivery to ESS site



subject for	TGS Choppers			Choppers Detectors e Vacum vessel // or other instrument spe						Guides									
monthly review	Current forecast		Current f			Cum	nt fore cast		Curren	t forecast					Current Forecast				
	TG5	in-bur contract signed D			bunker Delivery to site	contract signed	Delivery to site	H	contract signed	Delivery to site		NB contract signed	Delivery to site	contract signed	Delivery to site	in-bu contract signed	Delivery to site	out of contract signed	bunker Delivery to site
								懵											i i
LOKI (Tom)																			
(10.11)								Ш			L				1				
ESTIA (Tom)																			
								는											
DREAM																			
(Wemer)																			
								╬											
ODIN (Robin)																			
											Ī								
BEER																			
(Robin)																			
BIFROST					1														
(Rasmus)																			
CSPEC								1											
(Pascale)																			
MAGIC																			
(Wemer)																			
NMX (Esko)																			
(ESNO)																			
									T	CC: - 1: -	4.								

Components tracked:

- Choppers
- Detectors
- Large vacuum vessels
- Neutron guides

Milestones tracked:

- Mfg contract signed
- Delivery to site

Traffic lights: Indicate status for BOT in Sept. 2023



February 2021

14

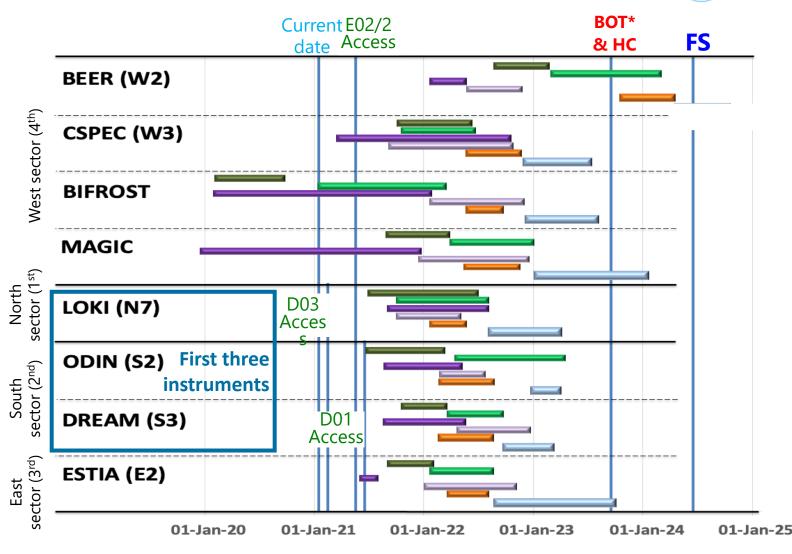
High level installation chart for first 8 instruments:

based on ESS Rolling Wave Plan with BOT* in Sept 2023





- Instrument TG5 dates adjusted according to December Critical path map
- BT and FS dates aligned with Project Office's Rolling Wave plan
- Assume BEER in-bunker components miss
 West sector open-bunker slot
- MAIN message:
 - NSS RBOT is July 2023 (2 months longer open bunker in West & 2 months float to BOT)
 - 6/8 instruments (excl. BEER, MAGIC) should make BOT milestone
 - MAGIC should be complete by FS milestone
 - If BEER agreements signed in Feb, they may still make west sector open-bunker slot



^{*} BOT in Rolling Wave plan has now moved to October 2023

Installation Plan (Next 12 months, March 2021)



E01, E02, D02 and D03

	Mod							binder	date	
0		NSS Intgerated Installation plan	636 days	Fri 16/08/19	Mon 28/03/2					
1	-4	E02 and E01	506 days?	Mon 02/09/19	Fri 01/10/21					
2	-4	NSS GENERAL TASKS	432 days?	Mon 02/09/19	Fri 28/05/21					
9	-3	NBOAs delivery	90 days	Mon 18/01/21	Fri 28/05/21					
10	-4	NSS GUIDE SHIELDING	362 days	Thu 19/12/19	Wed 09/06/21					
14	-4	Bifrost support blocks (E01)	6 days	Mon 22/03/21	Mon 29/03/21		E01			Senad Kudumovic
15	-3	Cspec support blocks (E01)	6 days	Tue 30/03/21	Thu 08/04/21	14	E01			Senad Kudumovic
16	-3	Cspec lower blocks (E02.2)	5 days	Mon 24/05/21	Fri 28/05/21	15	E02			Senad Kudumovic
17	-6	Bifrost lower (E02.2) and upper blocks E02 (empty b	8 days	Mon 31/05/21	Wed 09/06/21	16	E02			Senad Kudumovic
18	-4	NMX	380 days	Mon 02/12/19	Wed 16/06/21					
21	-4	Control Hutch	40 days	Mon 19/04/21	Wed 16/06/21	20	E01			Esko Oksanen
22	-9	CSPEC	20 days	Mon 06/09/21	Fri 01/10/21					
23	-4	Beamline vacuum housing	20 days	Mon 06/09/21	Fri 01/10/21		E02			Fernando Moreira
24	-4	BIFROST	296 days	Mon 10/02/20	Tue 20/04/21					
27		Spectrometer vessel	10 days	Thu 01/04/21	Fri 16/04/21		E01	ib378	22.01.2021	Liam Whitelegg
28	-9	Local crane	2 days	Mon 19/04/21	Tue 20/04/21	27	E01	ib328		Liam Whitelegg
29	4	NSS ELECTRICAL INFRASTRUCTURE (CEP)	142 days?	Mon 03/08/20	Fri 26/02/21					
33	*3									
36	*2									
37	-4	D02 and D03	496 days?	Thu 05/03/20	Mon 28/03/22					
38	-9	NEUTRON BUNKER	365 days	Thu 05/03/20	Wed 15/09/21					
44	-4	West sector wall completion (W0 elements)	3 days	Tue 06/04/21	Thu 08/04/21	42	D03	n.a.	n.a.	Dawid Patrzalek
46	-6	Asssembly of steel structure (D02)	45 days	Fri 22/01/21	Thu 25/03/21		D02	ib345	15.01.2021	Dawid Patrzalek
47	-9	North sector wall (P3)	30 days	Thu 15/04/21	Mon 31/05/21	46,79	D03			Dawid Patrzalek
48	-3	Side wall (P5)	10 days	Mon 17/05/21	Fri 28/05/21		D03			Dawid Patrzalek
49		First layer of the roof (P6)	20 days	Thu 12/08/21	Wed 08/09/21	48	D03			Dawid Patrzalek
50	-4	Partial (?) reopening of the first layer of the roof -North and West	5 days	Thu 09/09/21	Wed 15/09/21	49	D03			?
51	-4	NSS GUIDE SHIELDING	13 days	Thu 16/09/21	Mon 04/10/21					
52	-4	BWIs support blocks (CSPEC and BIFROST)	3 days	Thu 16/09/21	Mon 20/09/21	50	D03			Senad Kudumovic
53		CSPEC other support blocks	5 days	Tue 21/09/21	Mon 27/09/21	52	D03			Senad Kudumovic
54		BIFROST other support blocks	5 days	Tue 28/09/21	Mon 04/10/21	53	D03			Senad Kudumovic
55	-4	CSPEC	10 days	Tue 05/10/21	Mon 18/10/21					
56	-4	Beamline vacuum housing	10 days	Tue 05/10/21	Mon 18/10/21	23,53,54	D03			Fernando Moreira
57	-,	LOKI	55 days	Mon 14/06/21						
58	-4	Bunker to cave: cast in place structure out of bunker	25 days	Mon 14/06/21	Mon 09/08/21	47,48	D03			Clara Lopez
59	-4	Delivery and test of the detector vessel	5 days	Mon 21/06/21	Mon 28/06/21		D03			Clara Lopez
60		Control hutch (including Freia)	30 days		Mon 20/09/21	58	D03			Clara Lopez
61		TBL	30 days	Mon 18/10/21						
62	-,	Detector cave	30 days	Mon 18/10/21		49	D03			Gabor Lazslo
63	-5	NSS ELECTRICAL INFRASTRUCTURE (CEP)	236 days	Mon 23/11/20						
65		In-bunker electrical infra North + West	40 days	Mon 04/10/21		EO	D02			Stuart Birch

D02, D01, D04 and D08

72	*?									
73	-4	D02 and D01	474 days?	Wed 18/03/20	Wed 09/03/22					
74	-3	NEUTRON BUNKER	373 days	Wed 18/03/20	Fri 08/10/21					
77		Baseplates (instruments and bunker-pillars) in D02	45 days	Fri 22/01/21	Fri 26/03/21		D02	ib381	12.11.2020	Hansdieter Schweiger
78	-4	Asssembly of steel structure (D01)	20 days	Thu 11/03/21	Fri 09/04/21		D01	ib349	01.03.2021	Dawid Patrzalek
79	-3	South sector wall (P2)	15 days	Mon 15/03/21	Tue 06/04/21	42	D01	ib516	05.03.2021	Dawid Patrzalek
80	-3	Assembly of steel structure (D02)	25 days	Mon 12/04/21	Wed 19/05/21	78	D02			Dawid Patrzalek
81	-4	East sector wall (P4)	30 days	Thu 01/07/21	Wed 01/09/21	80,47	D02			Dawid Patrzalek
82	-3	Side wall (P7)	10 days	Mon 30/08/21	Fri 10/09/21		D01			Dawid Patrzalek
83	-3	First layer of the roof (P8)	15 days	Mon 13/09/21	Fri 01/10/21	82,49	D01			Dawid Patrzalek
84	=;	Partial (?) reopening of the first layer of the roof - East and South	5 days	Mon 04/10/21	Fri 08/10/21	83	D01			?
85	-3	NSS ELECTRICAL INFRASTRUCTURE (CEP)	252 days	Mon 11/01/21	Fri 04/02/22					
87	-4	In-bunker electrical infra South + East	40 days	Wed 01/12/21	Fri 04/02/22	65,84	D01			Stuart Birch
88	-3	ESTIA	143 days	Thu 08/07/21	Wed 23/02/22					
89	-3	Selene guide 1 placement	10 days	Thu 08/07/21	Wed 11/08/21	8155+5	D01	ib412		Sven Schuetz
90	-5	Experimental cave	50 days	Mon 06/12/21	Wed 23/02/22		D01			Sven Schuetz
91	4	ODIN	155 days	Tue 06/07/21	Wed 09/03/22					
92	-3	Experimental cave	155 days	Tue 06/07/21	Wed 09/03/22		D01			Virginia Martinez
93	-9	Control hutch	45 days	Mon 16/08/21	Fri 15/10/21		D01			Virginia Martinez
94	-4	DREAM	60 days	Mon 15/11/21	Tue 15/02/22					
95	-3	Experimental cave	60 days	Mon 15/11/21	Tue 15/02/22		D01			Mikhail Feygenson
96	-3	INSTRUMENT BWIS	20 days	Tue 04/01/22	Wed 02/02/22					
97	-9	BWIs South sector	20 days	Tue 04/01/22	Wed 02/02/22		D01			Hansdieter Schweige
98	4	TARGET DIVISION	40 days?	Tue 04/01/22	Wed 02/03/22					
99	-3	NBPI South sector	20 days	Tue 04/01/22	Wed 02/02/22	97SS	D02			Target Division
100	-3	NBPI East sector	20 days	Thu 03/02/22	Wed 02/03/22	99	D02			Target Division
101	*?									
102	-3	D04	20 days?	Tue 06/04/21	Tue 04/05/21					
103	4	Chemistry laboratories - Part A (installation above suspended ceiling)	20 days	Tue 06/04/21	Tue 04/05/21		D04	ib121	29.01.2021	Monika Hartl
104	*3									
105	-3	D08	20 days	Mon 26/04/21						
106		Chemistry laboratories - Part A (installation above suspended ceiling)	20 days	Mon 26/04/21	Wed 26/05/21		D08	ib121	29.01.2021	Monika Hartl
107	*									
108	*?	Schedule date: 17.03.2021								
109	*3	High level integrated schedule with Installation packages, IRRs review dates, Partners and Inst. Package								
110	*?	Detailed plans resource-loaded are included into the specific installation binders								

2021-04-14 PRESENTATION TITLE/FOOTER 16



Managing ESS scope for instruments

Neutron Instrument Construction Matrix (NSS + IKP)

Instrument delivery is the joint responsibility of NSS Staff and IK Partners -> non-separable

111361 411		terivery is the joint responsible	<u> </u>		Juli di		<u> </u>	- 110	ii sepi	<u> </u>		1
		Contributing Partners (%)		NSS co	ommon	projects	charge	ed to Inst	rument	bude	gets	
Neutron				NICC	Project	ı t Divisio	n	Dete	ctor	Sci	Dir.	
Instrument	(IVI€)	In-Kind	NSS					Electronics	Monitors		MCA ^b	
LOKI	12.85	ISIS(81%)	19%			0	0			0	0	N
SKADI	11.50	FZJ(50%), LLB (50%)				0			0			۱ د
ESTIA	11.80	PSI ¹ (100%)				0	0			0	0	C
FREIA	13.20	ISIS (78%)	22% 2			O			0		0	lı
DREAM	13.66	FZJ(76%), LLB(20%)	4%		Ö	0	0					b
HEIMDAL	13.55	Åarhus U. (30%), PSI(35%), IFE(25%)	10%		Ö	0	0					•
MAGIC	13.10	LLB(52%), FZJ(24%), PSI(16%)	8%	0		0	0					
NMX	11.67	WI/IER(53%), Bergen(22%), LLB(7%)	24%			0	0					
BEER	14.99	NPI(50%), HZG(50%)		0	0	0	0		0			
ODIN	11.76	TUM ⁵ (60%), PSI(36%)	4%			0	0				0	•
BIFROST	13.45	DTU/KU(23%),PSI(27%),IFE(14%),LLB(~12%)	~24%	0		0	0		O		0	
C-SPEC	16.50	TUM ³ (50%), LLB(~ 33%)	~17%	0		0	0		0		0	
T-REX	16.85	FZJ ⁴ (75%), Perugia U. (25%)		0	0	0	0		0			
VESPA	12.00	CNR (100%)		0	O	0			_			
MIRACLES	13.40	ESS-Bilbao(89%), KU(2%)	9%			0	0		0			

NSS/SD scope outside Instrument budgets;

- Expt. Ctrl. (ECDC),
- Data Mgmt. (DMSC),
- pooled SEE (SAD)

Total value 200.28

1. minus NSS MB detector ~7% Detector

2. incl. NSS MB detector ~6% Production 3. minus NSS MG detector ~20%

ninus NSS MG detector ~20%
minus NSS MG detector ~7% Section

5. All purchasing by ESS

Confirmed (costed & committed)
Planned (incl. agreed & in costing)

a. SEE = Sample environmentequipmentb. MCA = Motion control &

b. MCA = Motion control & automation

NSS-PD Org chart

Shane Kennedy Head of NSS Division

Iain Sutton, Zsuzsa Helves



Experimental Ctrl & Data Curation (ECDC) Group

Tobias Richter - Leader

Torsten Börgershausen Matt Clarke Morten Hilker Skaaning

Morten Jagd

Christensen

Afonso Mukai

Jonas Nilsson

Anders Pettersson

Ümit Ali Cemal Hardal

Ebad Kamil

Kenan Muric

Vacant – DS Software Engineer

ESH&Q staff matrixed into NSS project

Bo Bigge - Quality Peter Värvell - Quality Maurice Looft – CE Marking

Technical Projects Group

Marie-Louise Ainalem -Leader

Stuart Birch

Markus Larsson

Vacant# - Electrical **Engineer**

Zvonko Lazic Ioannis Apostolidis Tobias Quispe Mamani

Instrument Engineering Section

Gábor László - Leader

Fernando Moreira

Liam Whitelegg

Vacant# - Lead **Engineer BEER**

Dennis Vedelgart Grant Wallace

Vacant# - 2 **Instrument Support Technicians**

Chopper Group

Nikolaos Tsapatsaris - Leader

Erik Nilsson Markus Olsson Andrés Quintanilla

Dariusz Zielinski Steen Andersen

EIS staff matrixed into NSS project

Clara Ines Lopez - Engineer (UK Instruments) Giuseppe Aprigliano - Engineer

Dawid Patrzalek - Design Engineer

(Bunker) Senad Kudumovic - Design Engineer (Common Shielding) Mats Olsson - Design Engineer (Common Shielding) Benjiamino Gentile - Design

Engineer (NBOA/Bunker) Talal Osman - Engineer (NBOA) Ramesh Kumar - Engineer (NBOA) Nicolas Breton - Bunker

Jesper Ringner - Technical Writer Lars Weberg – Electrical/Grounding Tahere Rostami* - E-PLAN/E3D Gustav Svendsen - E-PLAN

Detector Group

Richard Hall-Wilton - Leader

Detector Coatings Section

Linda Robinson – Leader

Chung-Chuan Lai

Per-Olof Svenson

Detector Production Section

Vacant# - Leader

Ramsey Al Jebali Francesco Piscitelli

Nathalie de Ruette

Vacant# - Mechanical **Engineer**

Vacant* – Electronics Engineer

Detector Systems Services Section

Zivile Kraujalyte – Leader

Michail Anastasopoulos

Vacant# - Electronics **Engineer**

Steven Alcock Alessio Laloni

Wen Xiong

Detector Systems Design Section

Kalliopi Kanaki -Leader

Thomas Kittelmann Dorothea Pfeiffer

Irina Stefanescu

Planning & **Coordination &** Group

Sofie Ossowski -Leader

Nataliia Cherkashyna Anton Khaplanov Helena Ramsing Hansdieter Schweiger

> Peter Sångberg Inga Tejedor

NSS-PD plans

to recruit 8

more staff in

2021

Group

Andrew Jackson - Leader

Instrument Scientists

Thomas Arnold Premek Beran Pascale Deen Judith Houston Daria Noferini Esko Oksanen Rasmus Toft-Petersen Robin Woracek

Werner Schweika Dan Mannix

Mikhail Feygenson (to start July 2021)

Manuel Morgano (to start June 2021)

Alessandra Luchini

(to start Jan 2022)

Eszter Dian

Jerome Samarati

NSS – Top 5 Risk Mitigation Status



Event	Potential Impact	Proba- bility	Mitigation measures	Due date
Lack of key personnel (ID 11) NSS needs to grow with 15 positions in 2021 in order to meet our schedule.	3.36 M€ 2.81 M€	4	Secure approval from PMT for critical recruitments in 2021 Guaranteed delays to instrument delivery	2021-12
Delayed delivery of T0 choppers for DREAM, ODIN & HEIMDAL (ID 58)	0,1 M€	4	Innitiate new procurment for ODIN Installing temp guide piece for ODIN Using prototype to DREAM	2021-05 2021-05 2021-05
Resourcing of MCA engineering to Instrument projects below agreed level or delayed (ID 40)	0,1M€	4	Pursue hiring process for 2 temporary MCA engineers Reach agreements with those instruments concerned Replace engineer on permanent position	ASAP ASAP Q2 2021
NSS will not meet construction project scope within assigned budget (15 instruments, 361M€). (ID 1)	2,1 M€	3	Negotiate with IK partners on scope or methods of delivery to limit the costs, including scope transfer from IK to NSS where appropriate	Q2 2021 201221
Failure to receive NSS installation license before installation of active radiation safety related systems (ID 20)	0,33M€	3	Ensure submission quality Increase NSS effort on licensing	2021-09 2022-07

Expected Value of NSS cost risk = **12.8 M€ 8.9 M€** to end of project Workshop held March 16th, updates in Exonaut done (captured above) Next workshop in June 2021



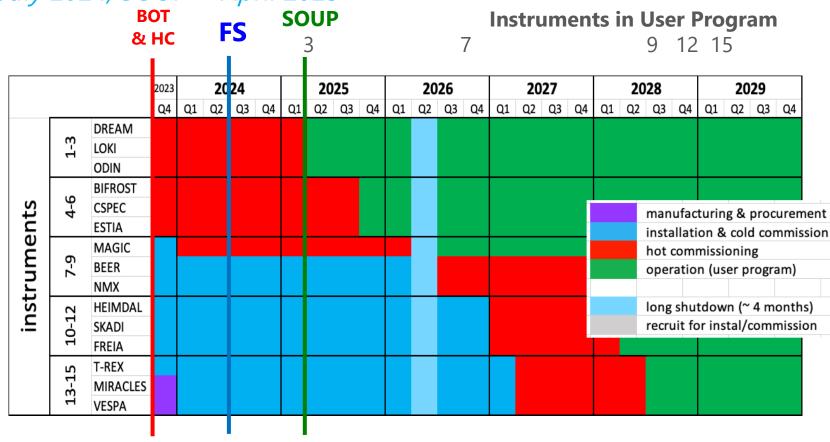
Managing ESS budget and schedule

NSS Master Schedule V4.4 – Simplified Version



Based on Rolling wave plan – no schedule float

BOT = October 2023, FS = July 2024, SOUP = April 2025



NSS tipping-point plan: (basis for Scenario 1 at ERIC Council March meeting)

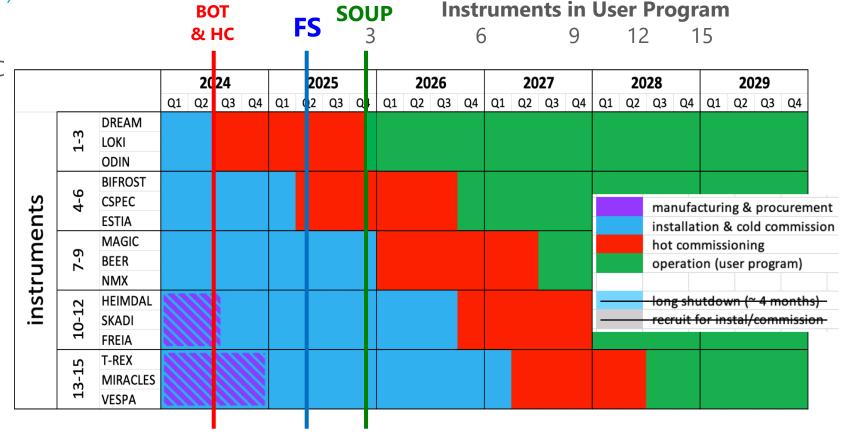


Balance science (FS+SOUP), instrument completion and schedule risk

BOT = July 2024, FS = May 2025, SOUP = Nov 2025

Outcome/impact

- 3 instruments to operations before EOC
- + 3 in 2026
- + 3 in 2027
- + remaining instruments in 2028
- 80% installation complete; more than current plan (MS V4.4)
- 9 months float from rolling wave plan
- 6 last instruments rescheduled to allow construction to continue into 2027
- incentive for late instruments (8-15) to complete manufacturing early
- No long shutdown needed



NSS Scenario 2C-A: (basis for Scenario 3 at ERIC Council March meeting)



BOT with 3 instruments, EOC in 2027, continuous ramp to 15 in user program

BOT = Dec 2024, FS = Oct 2025, SOUP = July 2026

Outcome/impact

- **SOUP** delayed beyond **EOC**
- First 3 instruments to operations in 2026
- + 6 more in 2027
- + remaining instruments in 2028
- 85 % installation complete; *more than* current plan (MS V4.4)
- 15 months float from rolling wave plan
- 6 last instruments rescheduled to allow construction to continue through 2026
- incentive for late instruments (8-15) to accelerate manufacturing early
- No long shutdown needed

