

# NSS project update and integrated schedule

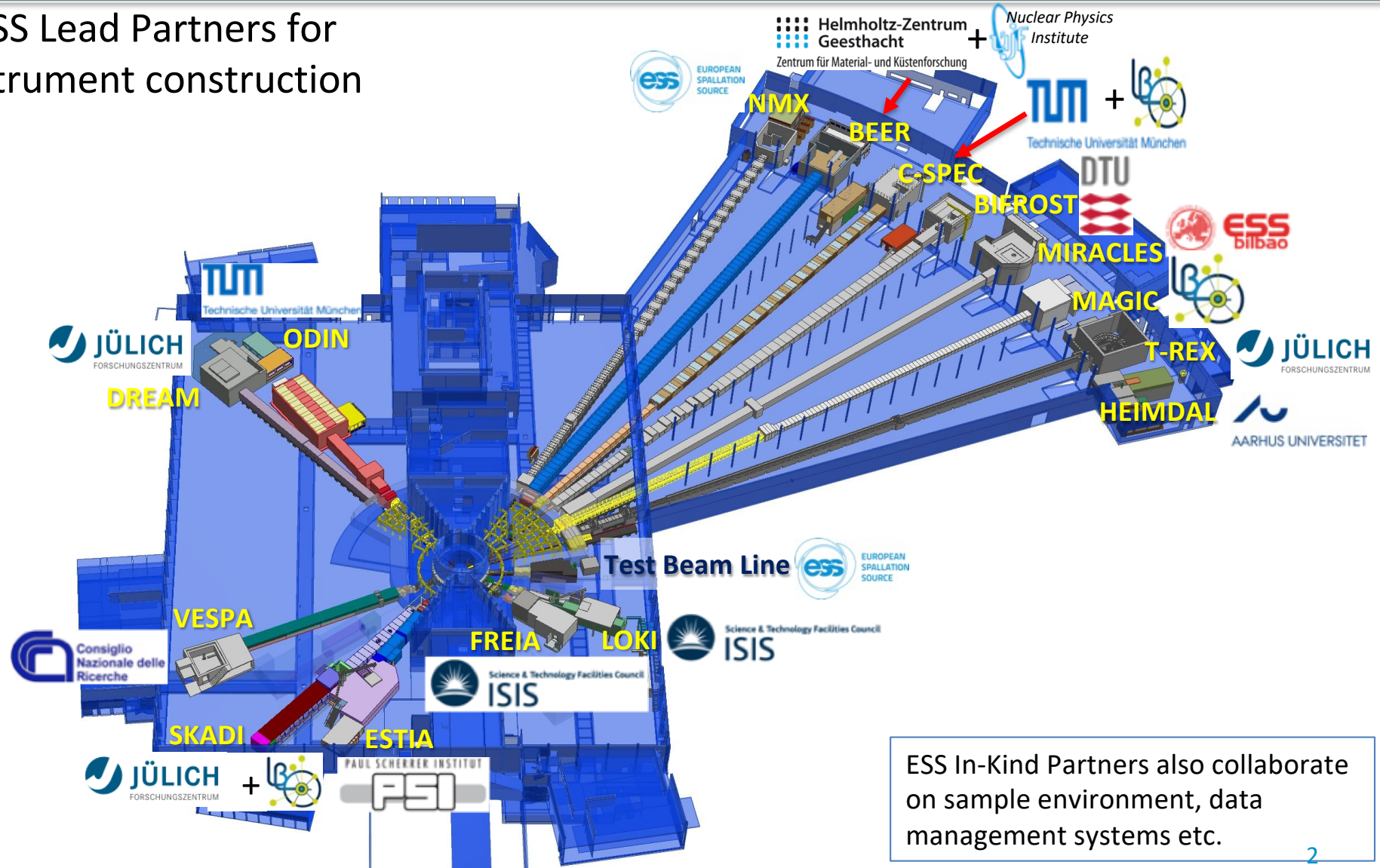
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[www.europeanspallationsource.se](http://www.europeanspallationsource.se)

IKON-14, 13 February 2018

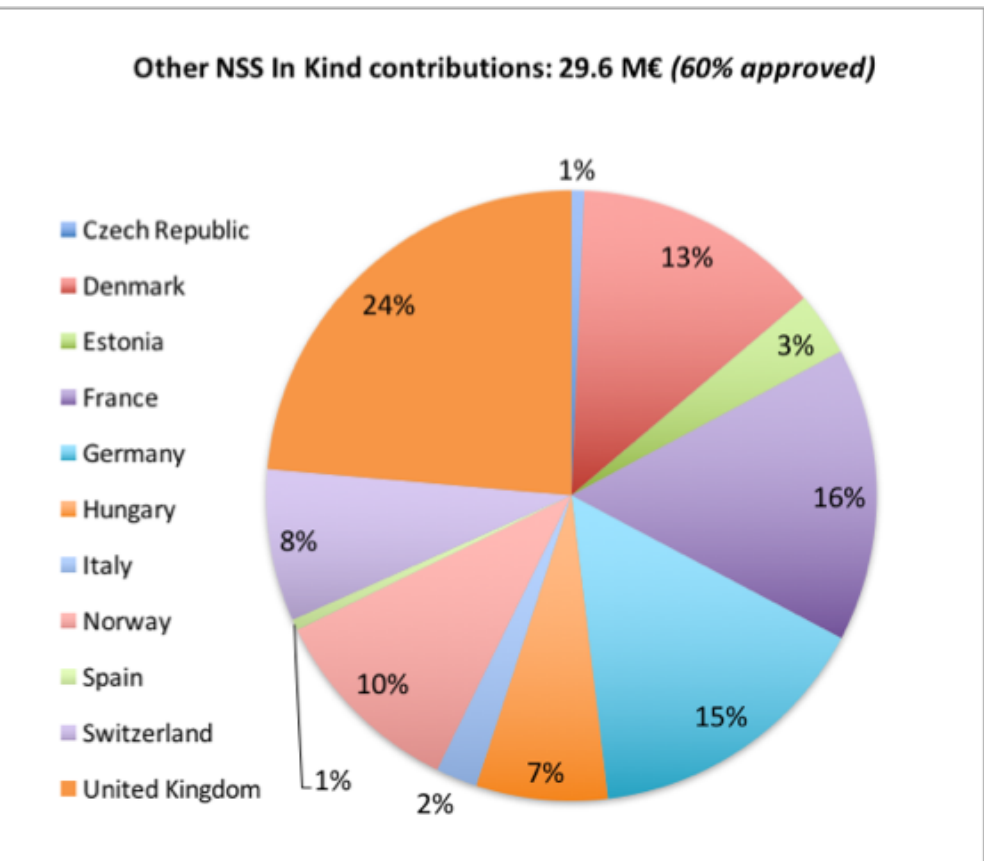
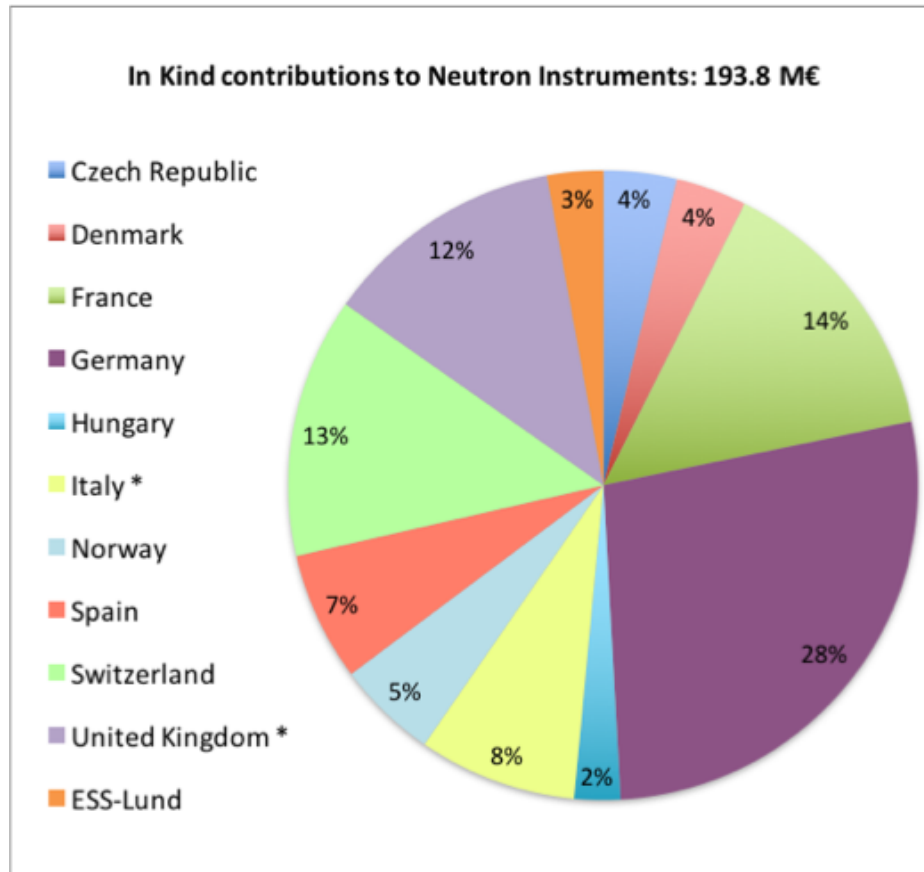
# NSS Neutron Instruments: *Project scope -15 instruments + test beamline*

ESS Lead Partners for  
instrument construction



ESS In-Kind Partners also collaborate  
on sample environment, data  
management systems etc.

# NSS In-Kind Contributions Country Summary (p. 1/2)

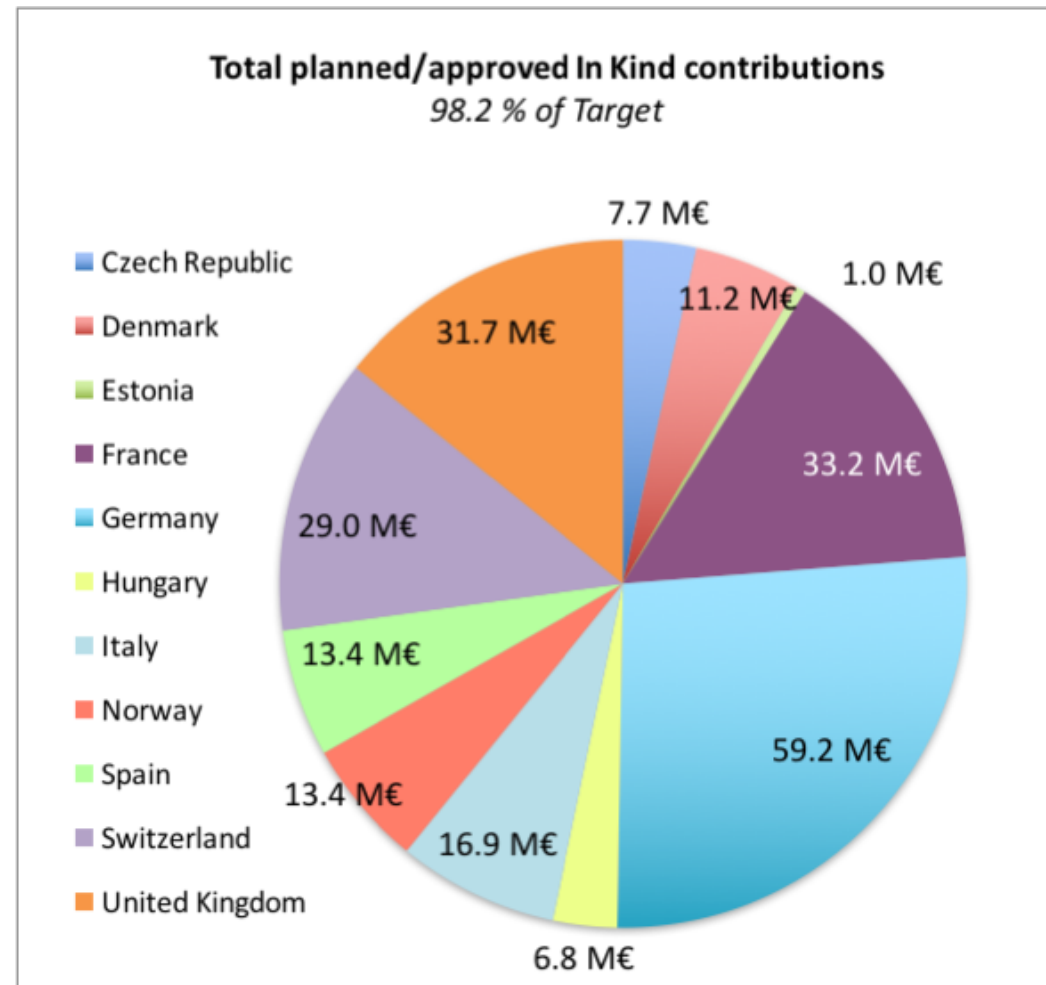


All Phase 1 Technical Annexes (6.4 M€) endorsed by IKRC

17.7 M€ endorsed by IKRC or in contracts (DK & DE),  
the rest is in preparation

# NSS total In-Kind Contributions Country Summary (p. 2/2)

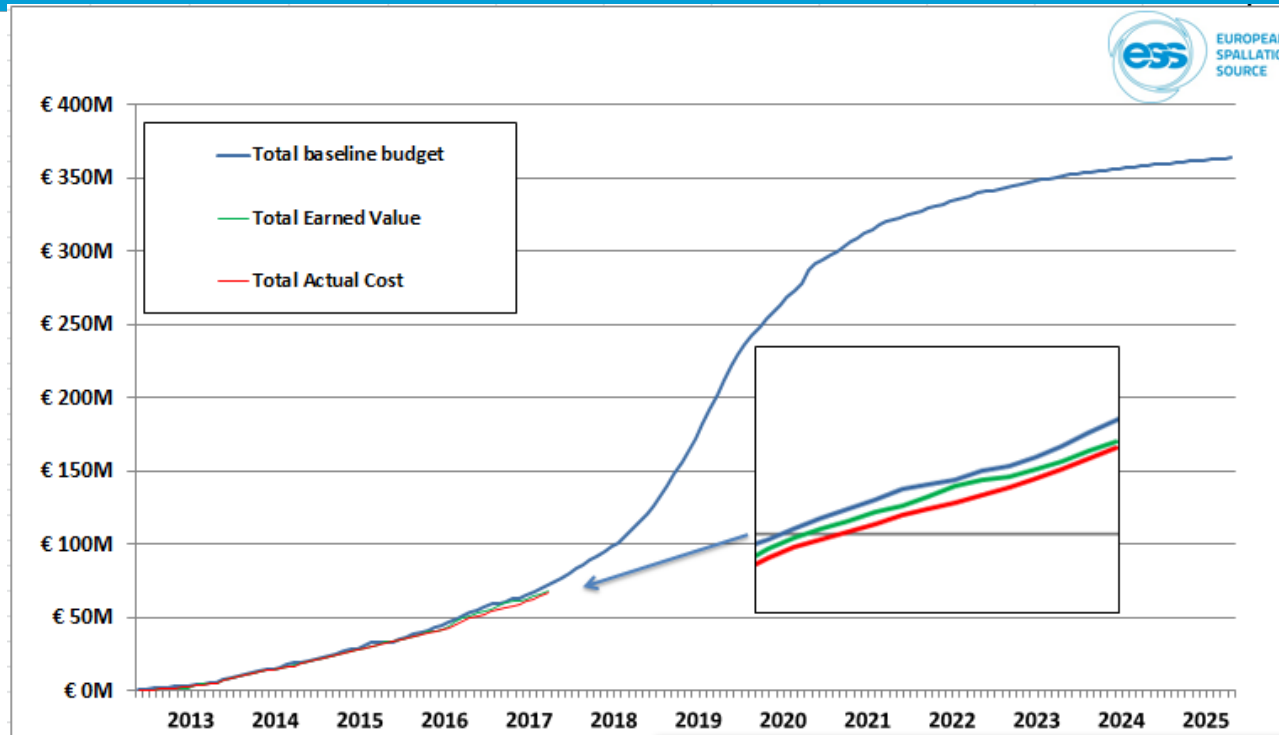
Partner Country	potential value (M€)	Committed to NSS (M€)	% of potential commitment to NSS
Czech Republic	11.25	7.7	68%
Denmark	11.16	11.2	100%
Estonia	0.9	1.0	111%
France	35	33.2	95%
Germany	93	59.2	64%
Hungary	8	6.8	85%
Italy	20.05	16.9	84%
Norway	17	13.4	79%
Spain	32.5	13.4	41%
Switzerland	41	29.0	71%
United Kingdom	31.4	31.7	101%
<b>total</b>	<b>301.3</b>	<b>223.4</b>	



Assigned value for instruments = 193.8 M€  
 “ of other contributions = 29.6 M€  
**Total In-Kind Value assigned = 223.4 M€**

\* Split of IT & UK contributions to LOKI, FREIA & VESPA to be confirmed

# NSS performance 2017 progress



**NSS Project is 19,1 % complete**  
Cash Spent = 61.1 M€ (45 % of cash)  
In kind Spent= 8.0 M€ (3 % of Inkind)

> 220 M€ by I-K partners,  
I-K Spent: ~ 60 M€ by end 2018

Central contingency:  
(as % of cost to complete):  
10 % for non-NBI,  
5.6 % for NBI

Planned Value (PV)	Earned value (EV)	Actual cost (AC)	SV	CV	SPI	CPI*
74 712 915	69 797 367	69 099 006	-4 915 548	698 361	0,93	1,01

- SV -4.9 M€ & SPI 0,93
  - IK instrument projects progressing without signed TA. Actual 1,8 M€ above reported EV
- CV 0,7 M€ & CPI 1,01
  - Progress with Phase 1 on German instruments – not yet invoiced
- CPI of ‘cash’ components are within variance reporting thresholds

# Planned order of commencement of operation of first 8 instruments (August 2023)

Matching early success in delivery of scientific outputs with the capacity of Lead In-Kind partners to deliver on schedule (ISIS, PSI, FZJ, LLB, HZG/NPI, TUM/PSI, TUM/LLB & DTU lead consortium).

Instrument Class	Sub-class	Candidates
Large Scale Structures	Small Angle Scattering	<b>LOKI (ISIS)</b> or <i>SKADI</i> (FZJ)
	Reflectometry	<b>ESTIA (PSI)</b> or FREIA (ISIS)
Diffraction	Powder Diffraction	<b>DREAM (FZJ)</b> or HEIMDAL (ÅU)
	Single crystal diffraction	<b>MAGIC (LLB)</b> or <i>NMX</i> (ESS)
Engineering	Strain scanning	<b>BEER (HZG/NPI)</b>
	Imaging and tomography	<b>ODIN (TUM/PSI)</b>
Spectroscopy	Direct Geometry	<b>C-SPEC (TUM)</b> or <i>T-REX</i> (FZJ)
	Indirect Geometry	<b>BIFROST (DTU)</b> , MIRACLES (Bilbao), VESPA (CNR)

Instruments in **bold** type to be operational by Aug 2023

*Italic:*  
backups in case of delays

# Next steps on project schedule (by IKON-14)

- NSS master schedule depends critically on the progress completion of “up-stream” projects,  
*i.e. Conventional Facilities (CF), Accelerator, Target and ICS projects*
- NSS project maintains close contact with those projects to be able to adapt the NSS schedule to mitigate impact of slippage of those projects.
- Before next IKON Accelerator project schedule will be re-baselined, and more will be known about risk of slippage of CF & Target projects.
- **NSS intend to issue a revised schedule for the neutron instruments in time for discussion at the *next IKON-14* meeting (in February 2018).**

**What we said at IKON13**

In fact our advice from SKANSKA in December forecast longer delays to access for NSS project than we were anticipating & the new dates could still change, so we are unable to issue a new NSS schedule at this time

# Internal\* Neutron Beam Instrument Schedule

For NSS project planning only - not for distribution



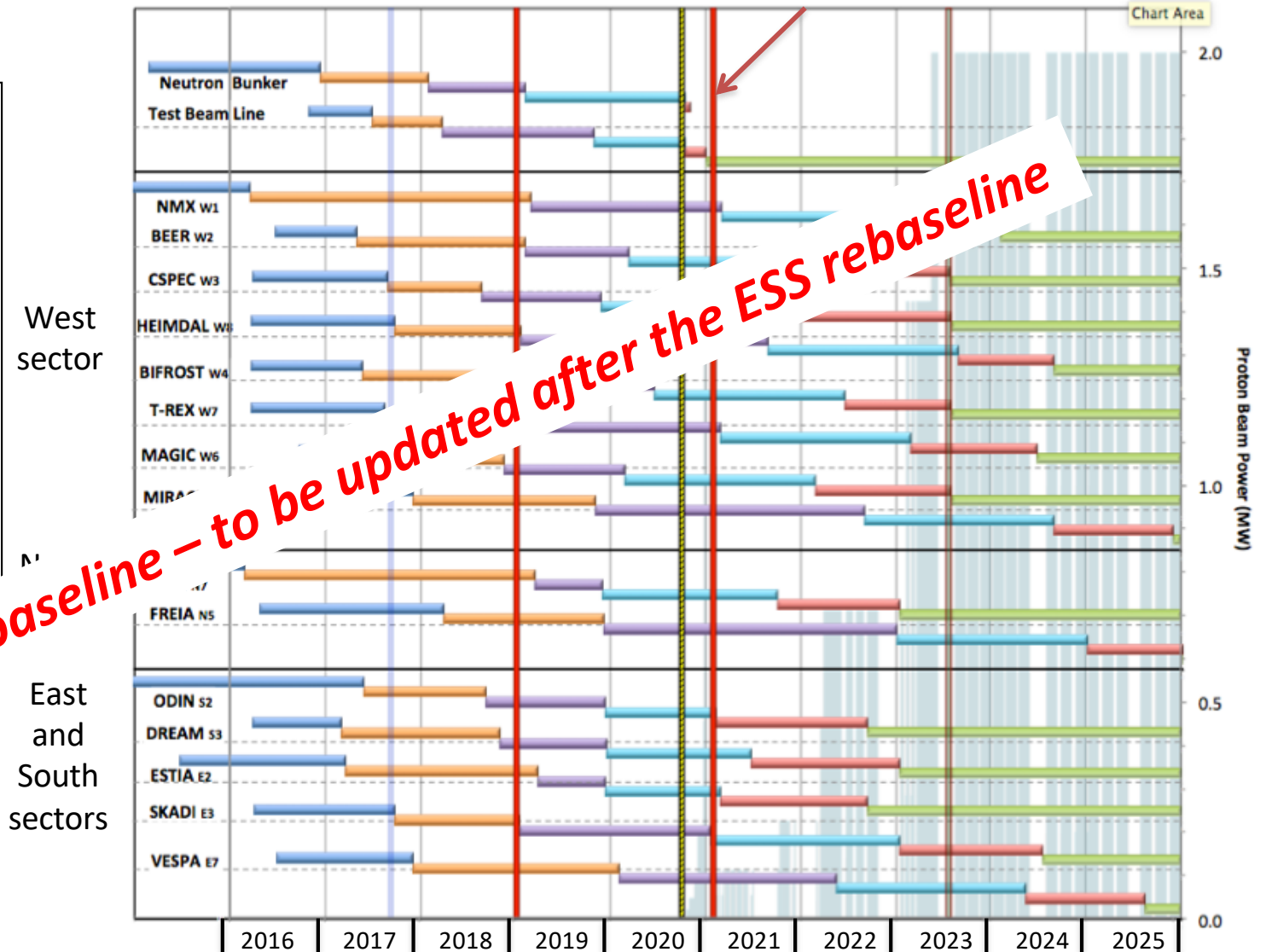
**Draft for Discussion** V3.4, 25<sup>th</sup> October 2017

\* still under discussion with ESS-ERIC Council

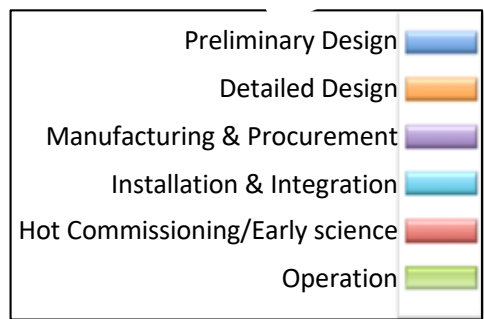
## NOTES:

- Assumes 2MW maximum power until end 2025
- Phases aligned with TG2 reviews on 1<sup>st</sup> 10 NBIs
- Installation & Integration (TG4) + Hot Commissioning (TG5) for first 8 NBIs aligned with draft BOI plan (*schedule match typically within 1 month*)

Current date    First access to NSS areas    Beam on Target    Hot Comm. instruments    Start User Program



**Current baseline - to be updated after the ESS rebaseline**

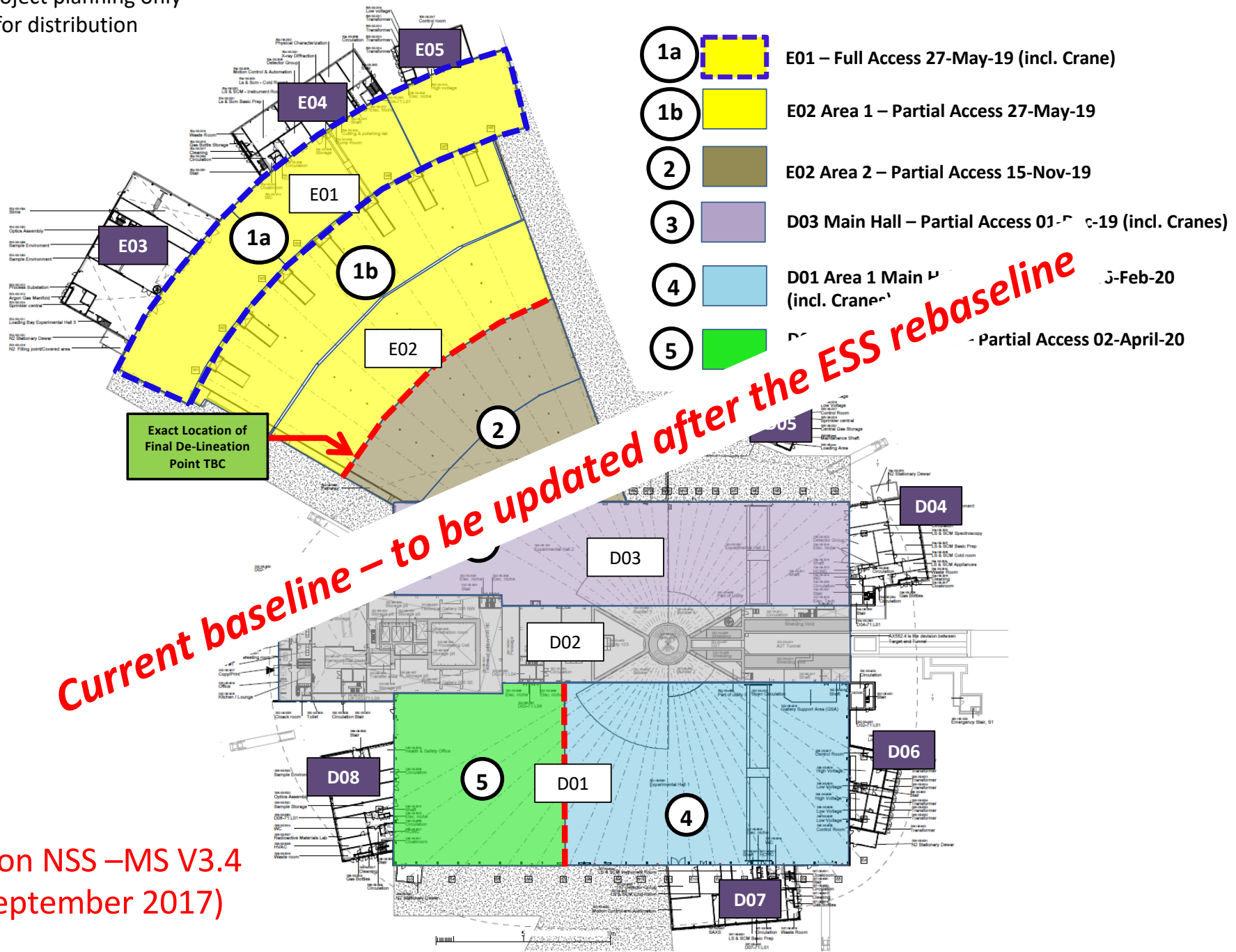




# Access Dates for NSS IK partners

For NSS project planning only -  
not for distribution

## Hand-over dates from NSS Project to Instrument teams



Based on NSS –MS V3.4  
(15 September 2017)

# Order and dates for the 15 Instruments

*with critical access dates for on-site installation*

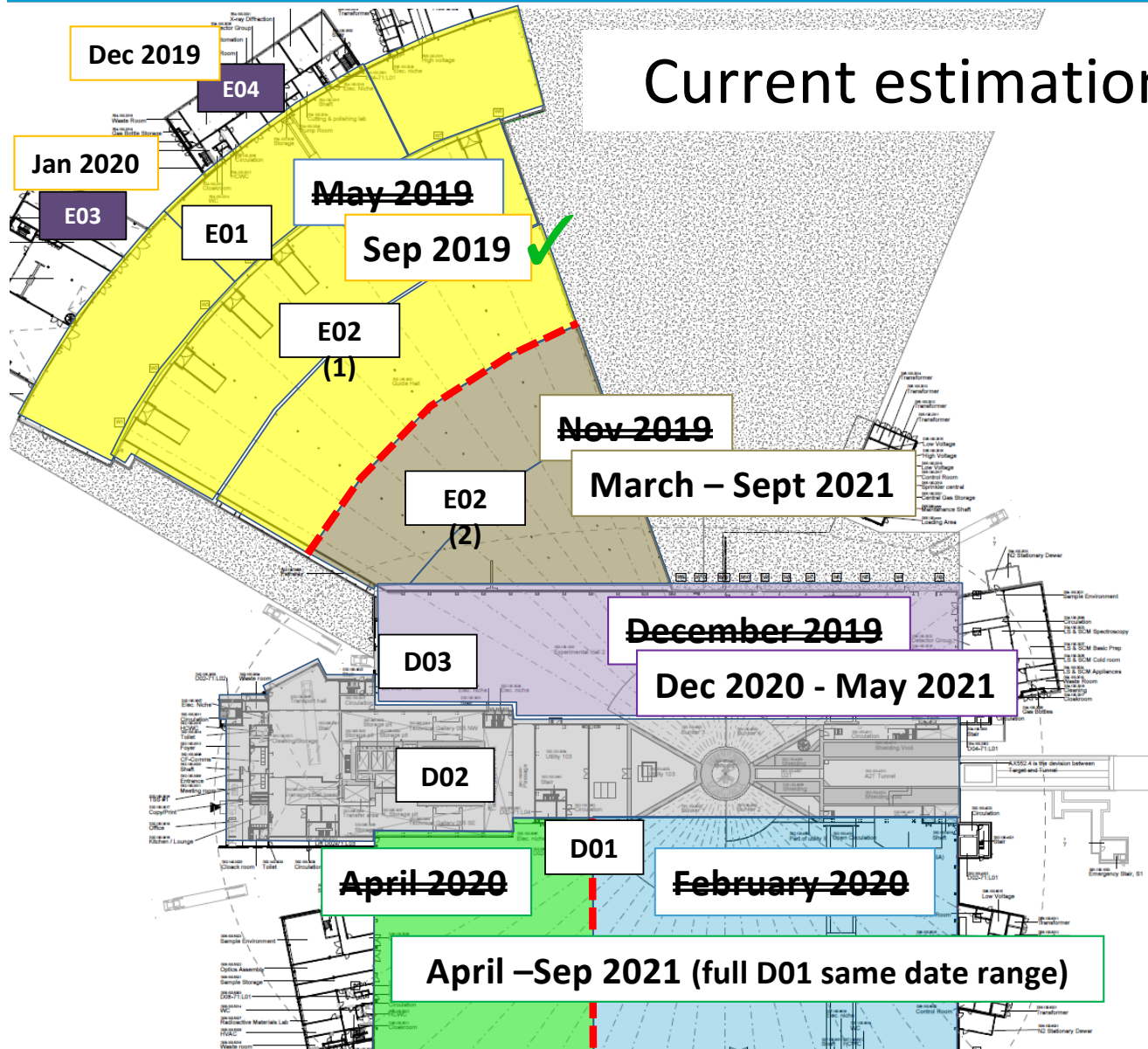
(from V3.4, 12<sup>th</sup> October 2017)

Neutron Instrument	Order for Hot Comm. (TG5)	Final mfg. approval (TG3)	first access to D & E bldgs	First Bunker access	Priority Bunker	Hot Comm. (TG5)
ODIN (S2)	1	Sep-18	Apr-20	Feb-20	Dec-19	Feb-21
ESTIA (E2)	2	Mar-19	Feb-20	Feb-20	Dec-19	Mar-21
DREAM (S3)	3	Nov-18	Feb-20	Feb-20	Dec-19	Jun-21
LOKI (N7)	4	Mar-19	Feb-20	Feb-20	Jun-21	Oct-21
CSPEC (W3)	5	Nov-19	Feb-20	Feb-20	Jun-21	Nov-21
MAGIC (W6)	6	Nov-19	Feb-20	Jun-21	Dec-21	Feb-22
BEER (W2)	7	Nov-19	Mar-20	Jun-21	Dec-21	Mar-22
BIFROST (W4)	8	Dec-18	Jun-20	Jun-21	Dec-21	Jun-22
SPICA (W5)	9	Jan-19	Jan-21	Dec-21	Oct-22	Jan-23
... (W7)	10	Feb-19	Mar-21	Dec-21	Oct-22	Feb-23
... (W7)	11	Oct-18	Feb-21	Dec-21	Oct-22	Feb-23
... (W8)	12	Jan-19	Sep-21	Oct-22	Jun-23	Sep-23
VESPA (E7)	13	Feb-20	May-22	Oct-22	Jun-23	May-24
MIRACLES (W5)	14	Nov-19	Sep-22	Jun-23	Jun-24	Sep-24
FREIA (N5)	15	Dec-19	Jan-23	Jun-23	Jun-24	Jan-25

**Current baseline – to be updated after the ESS rebaseline**

*TG3 dates updated after input from Instrument teams at IKON13.  
Subject for discussion.*

# First *out-of-bunker* access dates for Instrument Installation



Current estimation 30<sup>th</sup> Jan 2018

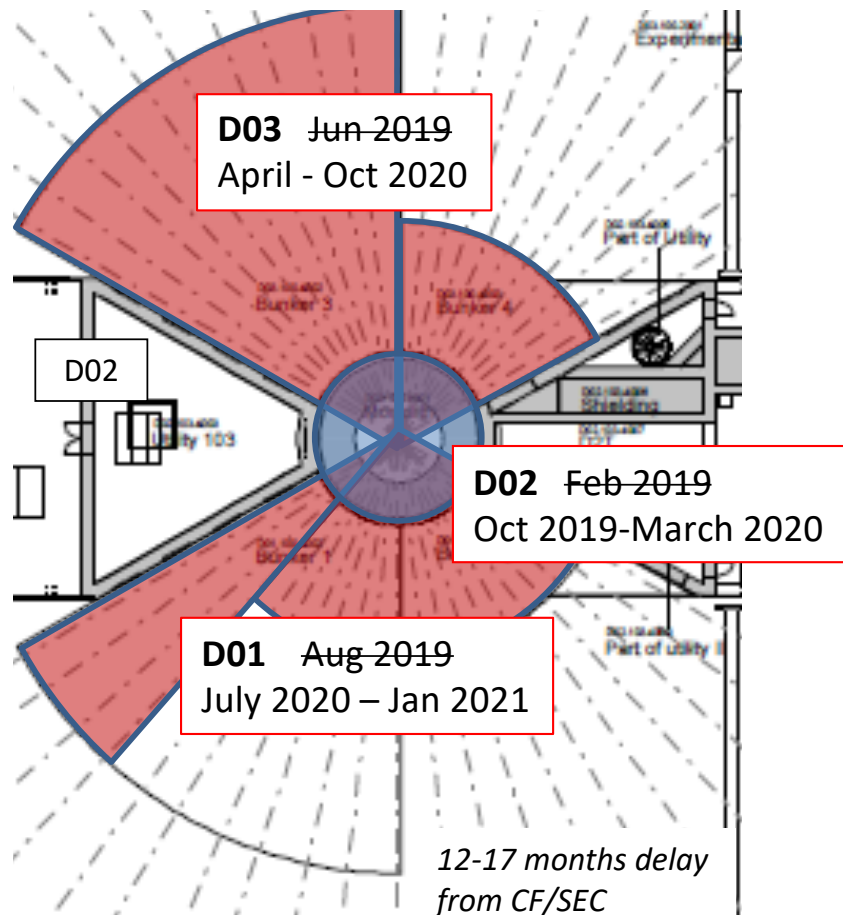
*Re-baseline dates due  
from CF/SEC late Feb -18*

# First *in-bunker* access dates for Instrument Installation

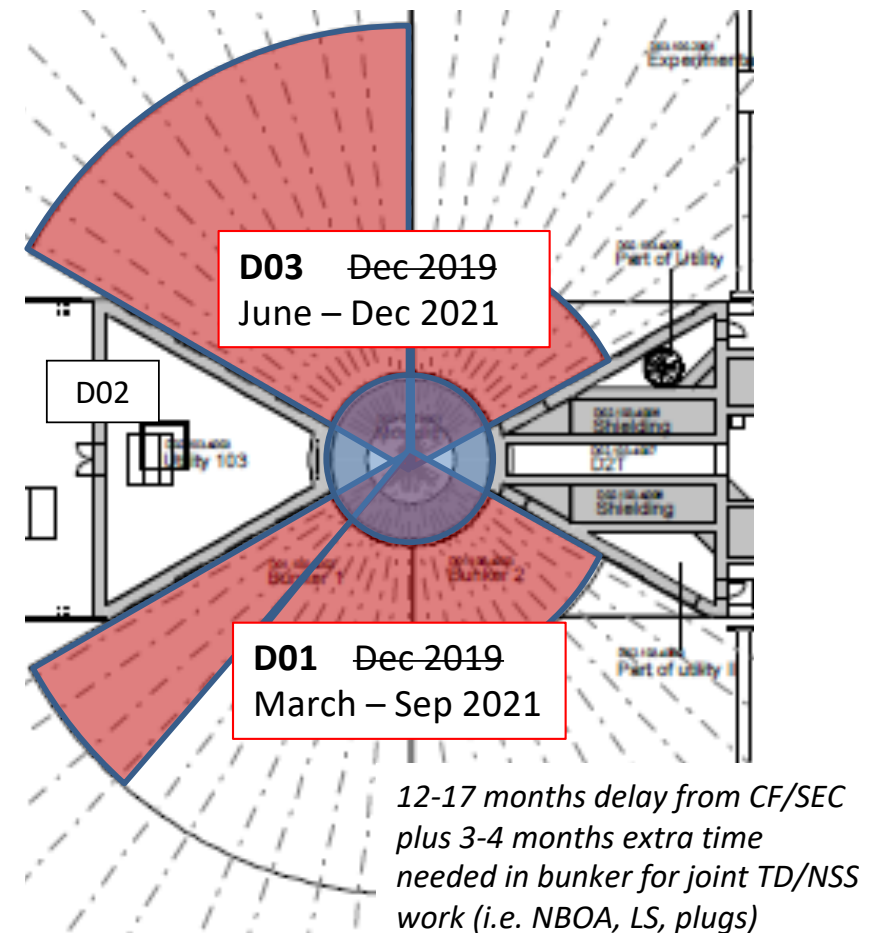
Draft dates - Schedule optimization still ongoing

## Current estimation 30<sup>th</sup> Jan 2018

1. Start of joint work with Target in D02  
(R6, NBOA & LS etc.)  
Start of bunker work in D01 & D03



2. Start of first in-bunker access for  
Neutron Instrument construction



# Principles for re-baselining NSS MS (30<sup>th</sup> Jan 18)

1. Early science success is the primary driver i.e. start of User Program with **several** instruments **fully** tested and debugged for day 1 science scope
2. Over the first few years beam power and availability will increase, as the first suite of neutron instruments start hot commissioning, with a goal of reaching 2 MW source power by the time all 15 neutron instruments have entered the User Program.
3. NSS project to be ready for Beam on Target (BOT) by summer 2022
4. Maintain the possibility for all of the set of first 8 instruments to be included in start of the User Program (not necessarily in current order)
5. Complete as much in-bunker installation of the first 8 instruments as possible before BOT (in order to achieve 4).
6. Make best use of “relatively” early access to E01 & far end of E02.

# Tentative assumptions for drafting of NSS MS V4 (30<sup>th</sup> Jan 18)

- Assume negotiated joint TD/NSS installation schedule from Nov 2017 still applies
- Assume SKANSKA's current predicted access dates for NSS access (+/- 3 months)
- Assume Accelerator/Target need same amount of time (3 months) for commissioning before reaching a threshold reliability level of neutron production for instrument commissioning.



# Further work for new NSS Master Schedule

1. NSS MS Schedule after BOT to be developed in consultation with IK partners through IKON workshops and after (in preparation for CCB (April), for Annual Review (May) and for ERIC-Council (June).
2. Internal Review of NSS/Target joint schedule to try to identify some float through 'dovetailing' of activities (in Feb-March)
3. Internal review with Accelerator/Target of time required for commissioning before reaching a threshold reliability level for neutron production (in Feb-March)
4. Prepare new NSS MS by end of March for presentation to ESS Change Control Board (mid April)

# Information for further work *(slide 1/3)*

- Input from Instrument Projects on “in-bunker” installation schedules (7<sup>th</sup> Feb):

Sector	Neutron Instrument	In-bunker time (weeks)
West	NMX	7
	<b>BEER</b>	22 (5d/w)
	<b>C-SPEC</b>	8
	<b>BIFROST</b>	7
	MIRACLES	26(?)
	<b>MAGIC</b>	13
	T-REX	7
	HEIMDAL	16

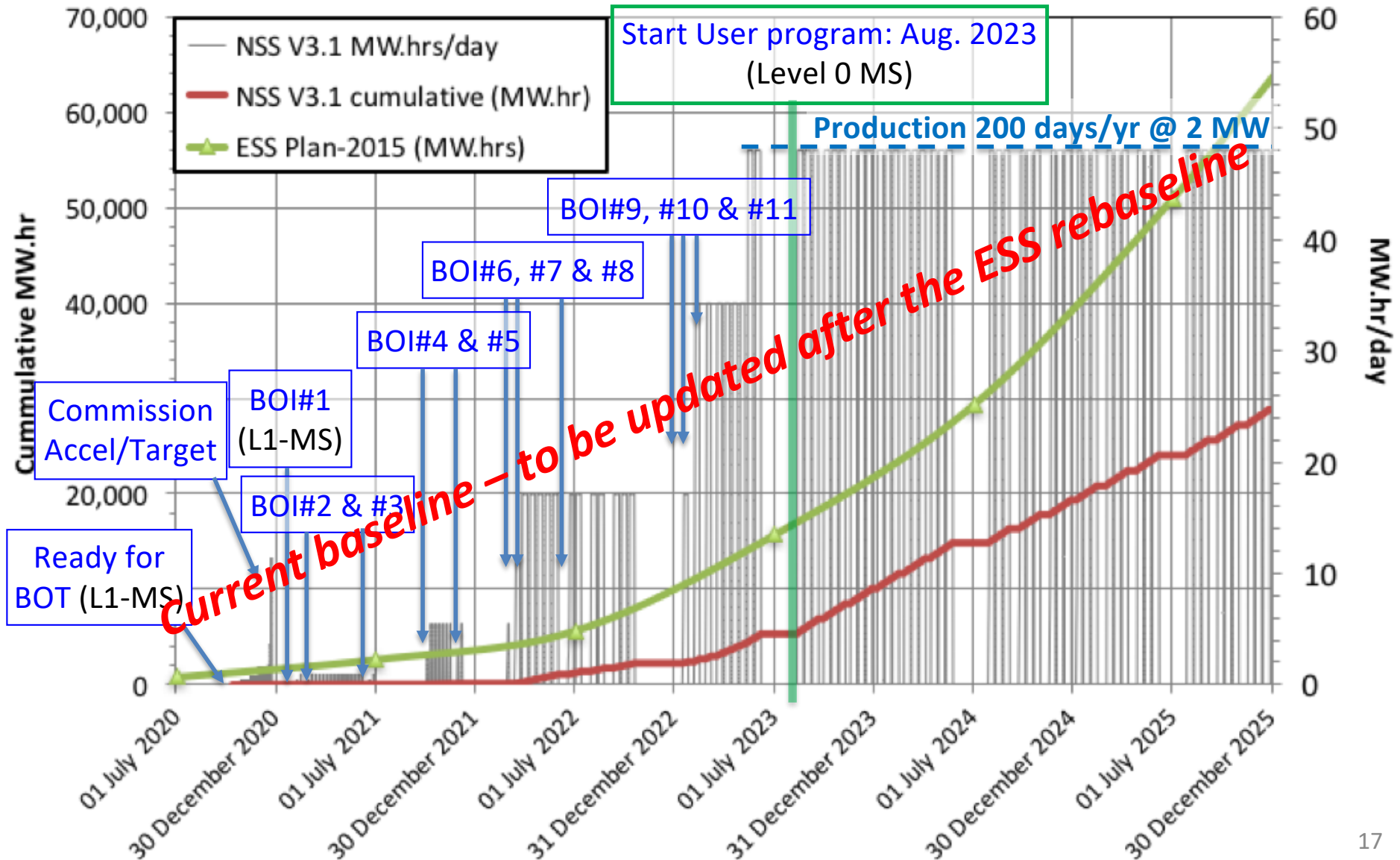
Sector	Neutron Instrument	In-bunker time (weeks)
North	<b>LOKI</b>	13 +break (8)+4
	FREIA	26 (?)
East	<b>ESTIA</b>	3
	SKADI	8
	VESPA	11 +break (2)+5
South	<b>ODIN</b>	16
	<b>DREAM</b>	4

*N.B. Are estimates of ‘in-bunker’ installation from MIRACLES & FREIA teams based on our earlier plan (NSS-MS V3.4) to make 6 months available?*



# Information for further work (slide 3/3)

ESS Proton Production Schedule **DRAFT FOR DISCUSSION (29 June 2017)**



# Key integration MS for instruments

(5 Feb 18)

Area / WP	Milestone	Current MS date (V3.4)	New MS date (5 Feb 2018)	Milestone Level
<b>Instrument integration</b>				
A2146885740	Instrument Baseplate design freeze (NSS)	30-Nov-17	<b>30-Apr-18</b>	Level 2
A180220	Instrument baseplates delivered to site (NSS)	30-Nov-18	<b>15-Nov-19</b>	Level 2
A180210	Definition of BBGOA (Bridge beam guide optical assembly) - first 8	04-Dec-17	<b>15-Jun-18</b>	Level 2
A180220	Definition of BBGOA - instrument 9-15	22-Jan-18	<b>15-Sep-18</b>	Level 2
<i>new</i>	Delivery of BBGOA (first 8) to site		<b>15-Nov-19</b>	Level 2
A180160	NBOA order placement (post NSS approval) group A	09-Feb-18	<b>04-Jul-18</b>	Level 1b
A180170	NBOA order placement (post NSS approval) group B	23-Feb-18	<b>25-Jul-18</b>	Level 2
A180180	NBOA order placement (post NSS approval) group C	16-Mar-18	<b>15-Aug-18</b>	Level 2
A180190	NBOA order placement (post NSS approval) group D	06-Apr-18	<b>13-Sep-18</b>	Level 2
A2146884580	Delivery of all in-monolith optics (NBOA) to site	30-Nov-18	<b>15-Nov-19</b>	Level 2
A2146885750	All in-monolith inserts ready for installation (NSS)	01-Mar-19	<b>15-Mar-20</b>	Level 2
A2146890820	Bunker wall insert optics design freeze (PDR) - first 8 instr.	15-Apr-18	<b>15-May-18</b>	Level 2
A180230	Bunker wall insert order placement - first 8 instr.	15-Jun-18	<b>15-Aug-18</b>	Level 2
A180240	Bunker wall inserts delivered to site - D01 (at least first 8 !)	01-Jun-19	<b>15-Apr-20</b>	Level 2
<i>new</i>	Bunker wall inserts delivered to site - D03 (at least first 8 !)	01-Jun-19	<b>15-Jan-20</b>	Level 2
A2146885760	Bunker ready for first In-bunker instrument installations D01 (NSS)	15-Dec-19	<b>15-Mar-21</b>	Level 2
<i>new</i>	Bunker ready for first In-bunker instrument installations D03 (NSS)	15-Dec-19	<b>15-Jun-21</b>	Level 2
A2146885770	In-bunker instrument installations done - close Bunker D01 (NSS)	15-Jul-20	<b>15-Sep-21</b>	Level 2
<i>new</i>	In-bunker instrument installations done - close Bunker D03 (NSS)	15-Jul-20	<b>15-Dec-21</b>	Level 2

# Desired outcome of re-baselining

- All of the first 8 instruments given a chance to plan for “early” Hot Commissioning: i.e. asap after BOT (Summer 2022).
- 4-8 instruments (plus ESS-TBL) complete ‘in-bunker’ work before BOT
- User program may start when those 4-8 instruments are commissioned\*
- Date of Start of User Program determined by this process

*\*Early science success is the primary driver i.e. start of user program with **several** instruments **fully** tested and debugged for day 1 science scope*

# Workshop on Integrated Schedule at IKON- 14 (Tuesday 13:45 – 15:15)

**Purpose:** to explore how we can work most efficiently to prepare for start of the ESS User Programme. The focus of the workshop will be how to create success based on the known constraints.

**Attendance:** 1-2 representatives of the teams building the first 8 instruments

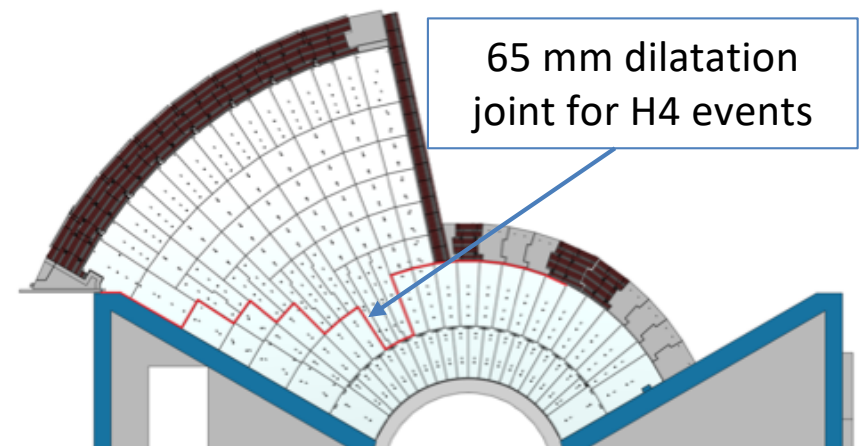
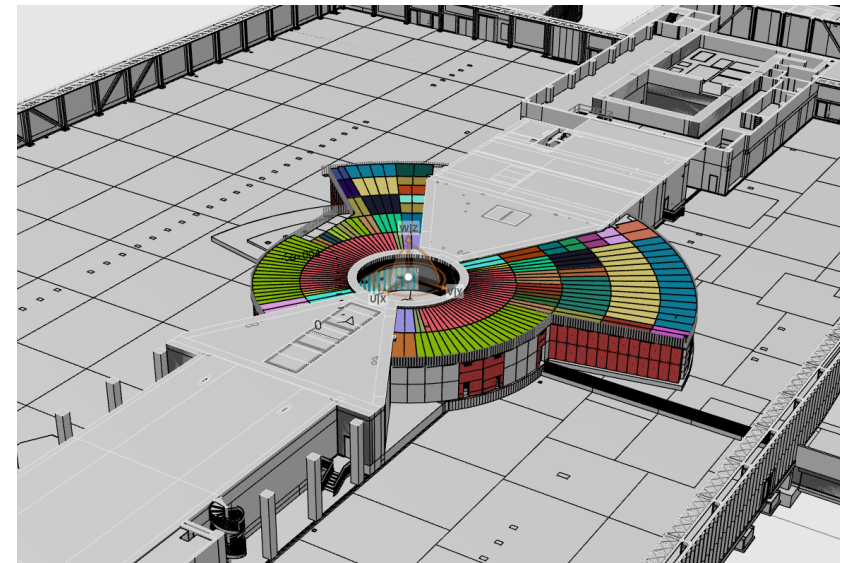
## **Topics:**

- 1. estimates on the duration required for installation & integration*
  - a. in-bunker assembly and alignment,*
  - b. cave assembly and fit out, and*
  - c. assembly & alignment of neutron guide and shielding between bunker & cave*
- 2. installation order needs (e.g. do we need to install neutron guides from cave to source to ensure correct alignment or can we build independently in the different areas?)*
- 3. what sub-systems can be “pre-assembled” at a host laboratory to save time, and*
- 4. what human resources the instrument team plans to provide for on-site installation and commissioning.*

# Current status of bunker project

Bunker CDR (December 2017) identified several issues to be resolved before manufacturing:

1. Seismic requirements not compatible with skyshine requirements
  - Resolution relax seismic requirements –remove dilatation joints
2. Fire safety requirements not defined
  - now working with consultant to define & document.
3. Neutronics design not complete – value engineering not complete
  - new calculations indicate walls made of heavy concrete are better. Now modifying wall design accordingly.
  - Still investigating best roof design & how to reach skyshine limits



# Revision of Bunker Project Schedule

milestone	Plan date	New date
Document fire safety requirements	June 2017 ?	March 2018
Agree & document seismic requirements	?	February 2018
Complete requirements	October 2017	March 2018
Complete Value Engineering	November 2017	May 2018
Complete mechanical design	November 2017	May 2018
Critical Design Review	December 2017	June 2018
Release manufacturing tender	January 2018	August 2018
Close of manufacturing tender	March 2018	September 2018
Award manufacturing contract	April 2018	October 2018
First delivery to site (R6 pillars)	October 2018 (3 months float)	<b><i>Not needed before 2020</i></b>

Manufacturing/delivery of bunker project will not be on the critical path (*due to delays to CF schedule*)