DMSC STAP - April 2019
Project Update

Jonathan Taylor

Welcome & Charge

- CHARGE:
  - Provide feedback, advice and recommendations on the progress of DMSC in respect of planning, key technologies and risks.
  - Specific advice and recommendations are requested for the following:
  - The annual review recommends that DMSC prioritise data reduction, can the STAP comment and advise on our current priorities in the context of that recommendation?
  - DMSC will complete its core construction phase scope in 2019, can the STAP comment on our verification plans for demonstrating completion?
  - We request advice and recommendations on our procedures to identify core hardware technologies specifically storage technologies.
  - Are the processes and planning in place with resources at the correct level to deliver the required scope for Instrument Commissioning and First Science at ESS? (DMSC scope including Beam line Controls Team activities)
  - A number of core IT activities have been identified that will be delivered as central services at ESS. Are the proposals credible for success of scientific computing at ESS?

SAC 21 & Annual Review 2018

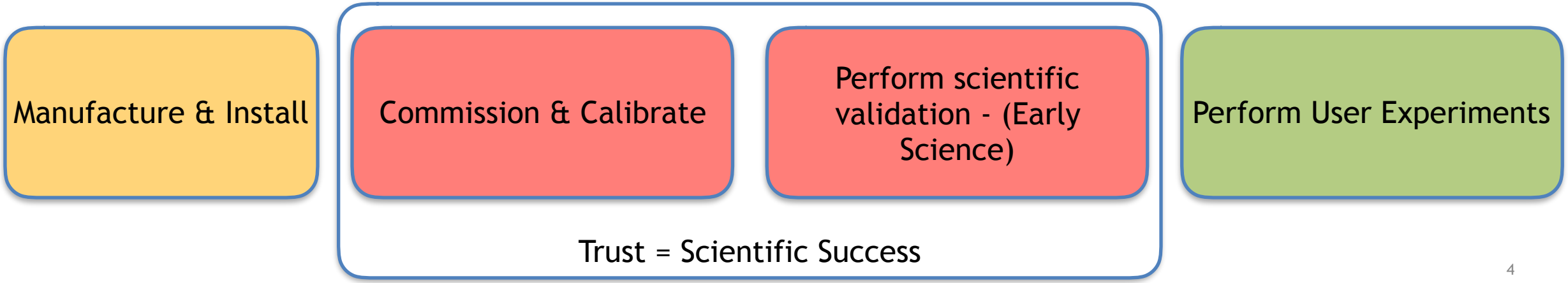
- Presentation of cold and hot commissioning plan
  - Early Science milestone added at BOT + 9m
    - Early science is experiments with instrument team / expert users.
  - Instruments tranched in 8 + 7
- NSS - ICS interfaced discussed in the context of a beam line controls team

Scientific Advisory Committee 21 (October 2018)

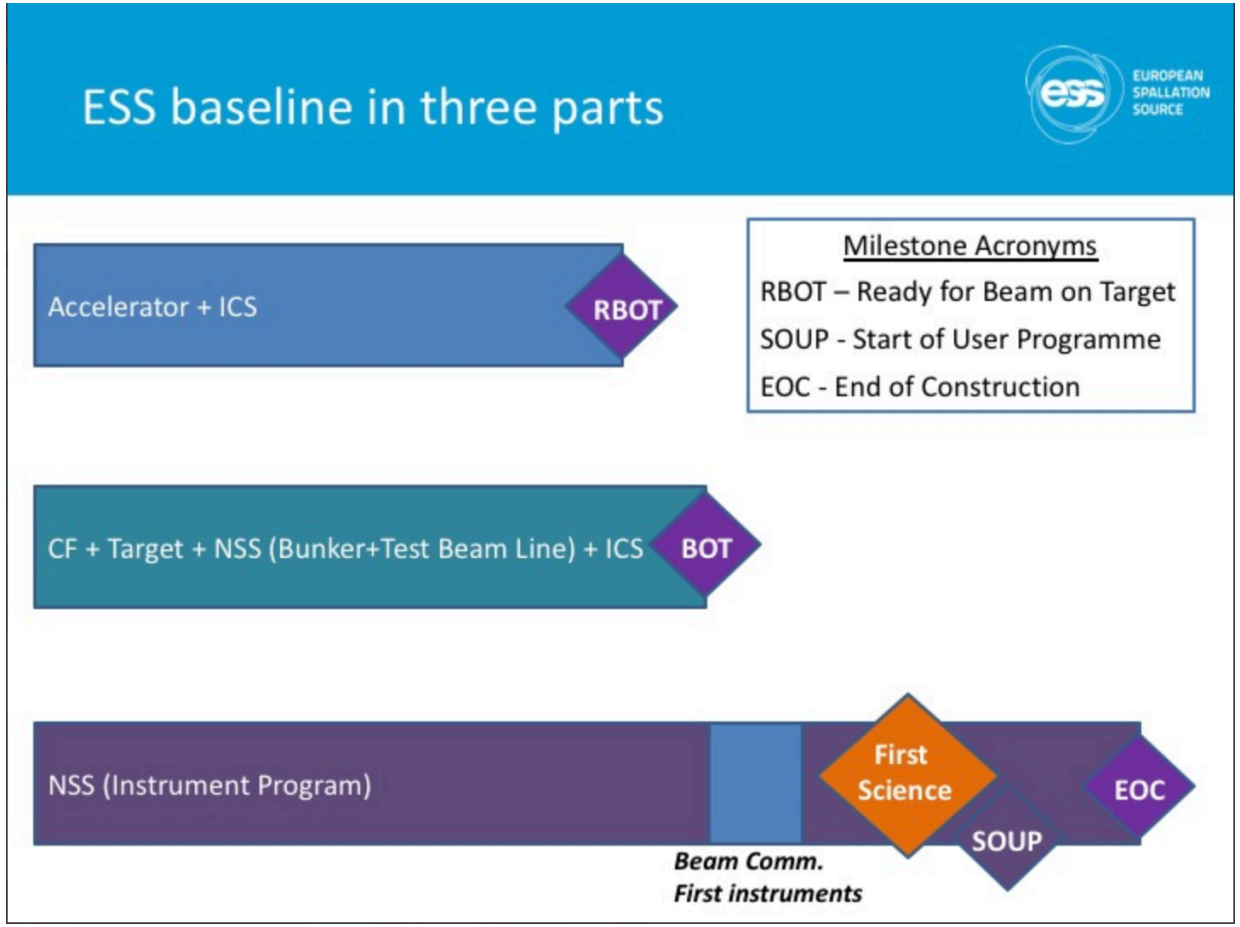
Producing scientific results as a part of hot commissioning

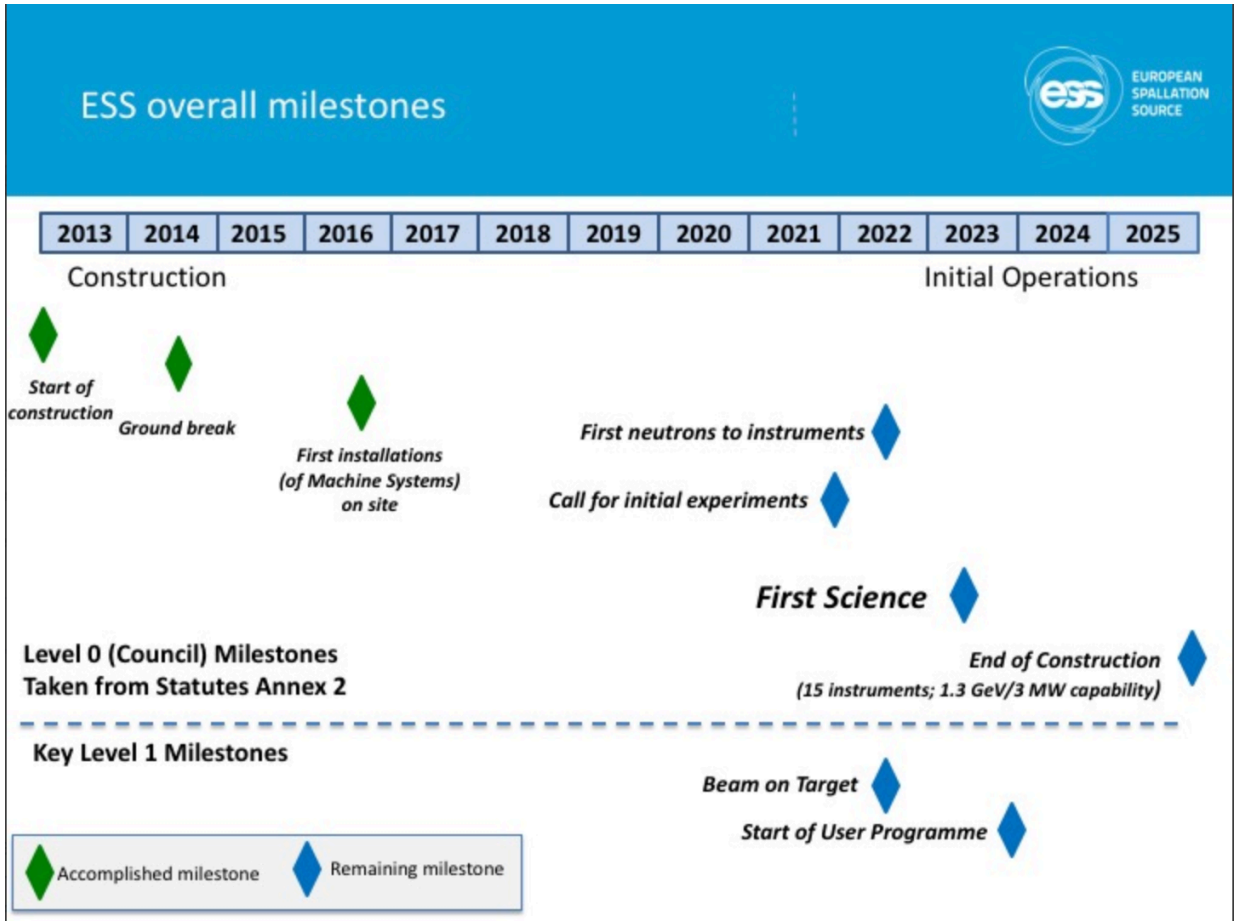
Considering the advice from the external Schedule Review (May 2018) in respect to producing scientific results during the commissioning phase, the SAC recommends that the hot commissioning phase must support early scientific success. For the hot commissioning phase this means:

Early Scientific Success = trusting your instrument



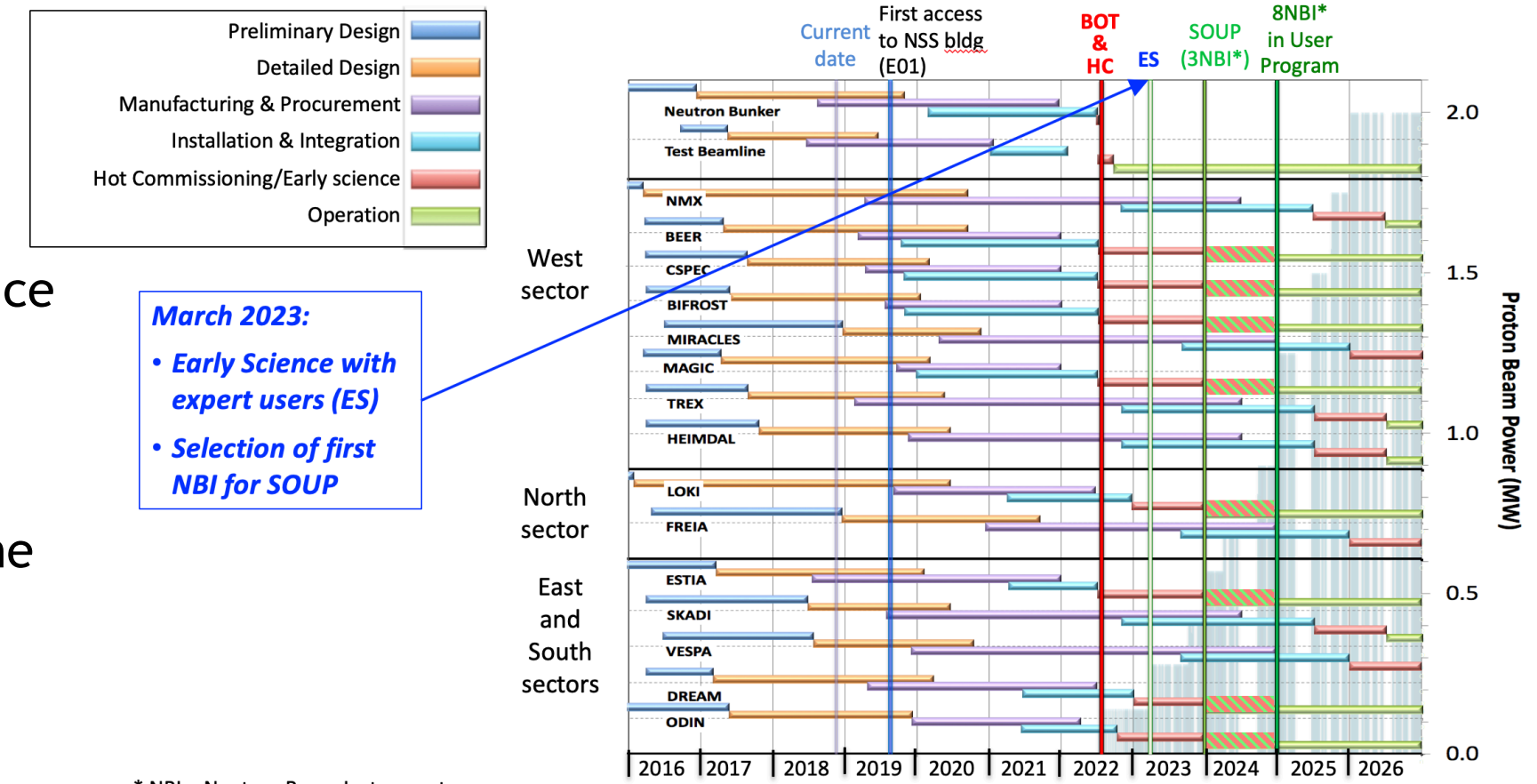
ESS schedule and high level milestones





NSS Schedule v4.1

- Tranche approach to instrument build
- Push to produce Early Science soon (9m) after BOT
- Post BOT Schedule is compressed after re baseline



* NBI = Neutron Beam Instrument

ESS update

- Project is ~57% complete
- Currently tracking the 2018 baseline

- Initial operations has begun:
  - Ion Source and LEBT commissioning

- Project contingency is low
- Initial operations funding secured through to Q2 2020

- NSS is 25% complete
  - Instruments TAs now being signed
  - In monolith optics in manufacture
  - Instrument projects are running through the TG3 process
    - Tender verification
    - Review of subsystems - light via VC
      - DMSC is included as stakeholders in these reviews.

Annual Review Recommendations

Recommendations

DMSC should prioritize instrument controls, data acquisition, data reduction and visualization over data analysis to ensure early science.

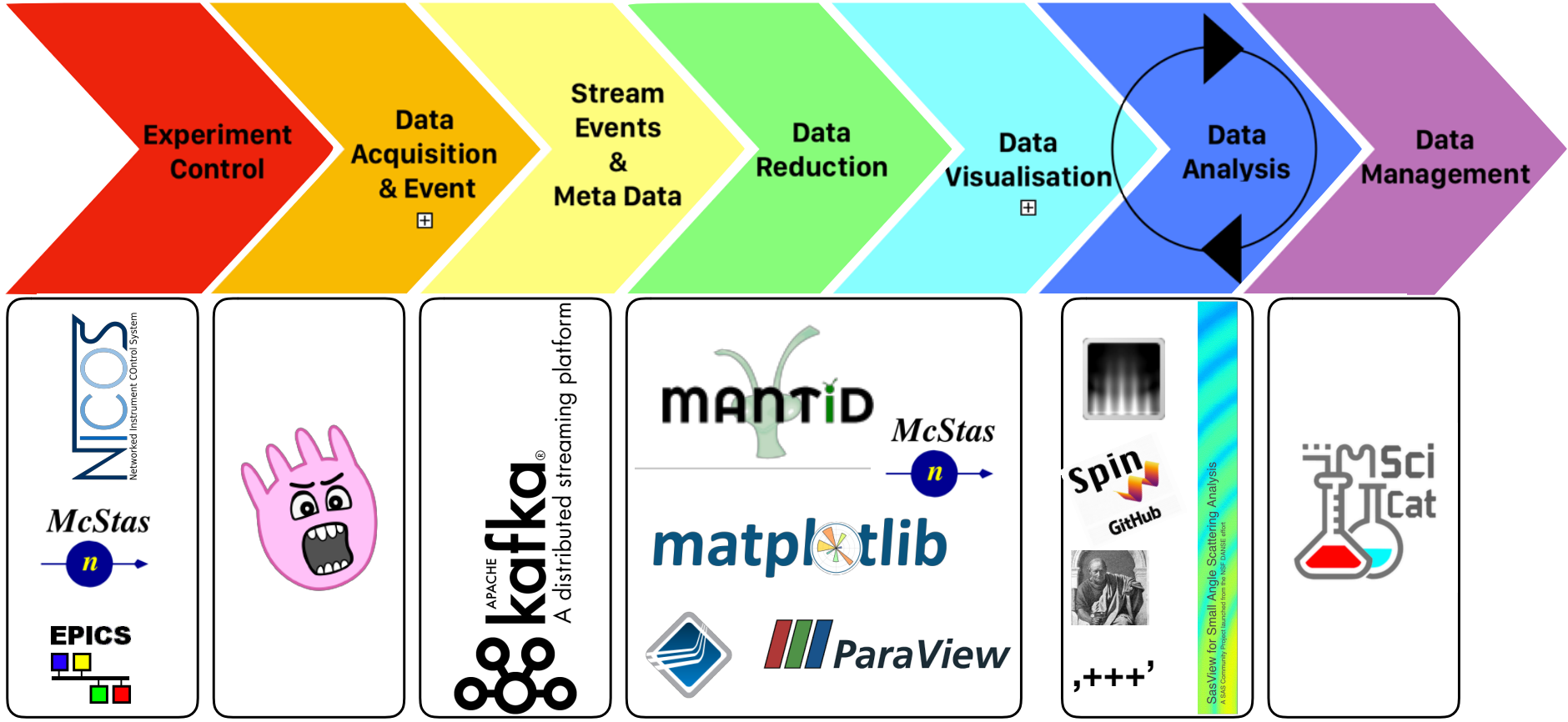
NSS should work with ICS in the creation of the beam controls team led by NSS and with personnel from both NSS and ICS to ensure that the necessary instrument controls are functional on schedule.

Response to review

- Our view is that controls, DAQ & data reduction are the day one priority
  - Communicated to instruments through the service levels
- We do currently provide resources to specific data analysis activities
  - Analysis is not over allocated wrt controls and data reduction
  - We believe it is essential that we maintain a credible data analysis capability
    - Aligned with requirements from instruments and the overall NSS schedule
- DRAM plan to train all staff to a suitable level for mantid development
  - Would provide a large & flexible development team
  - Including a core set of mantid FW developers
- Setting up the BCT formally is proving difficult.
  - We are convinced and management is aligned that the BCT is the best way to proceed
  - ICS require an atomic level description of the NSS installation schedule before allocating resources
  - Instrument installation schedules are still at a high level
  - As of Q2 2019 only some device procurements are issued for initial instruments.

Scientific Computing Pipeline

- Neutron Instruments Division 15x Instrument projects
- Detector group
- Motion Control & Automation
- Chopper Group
- Scientific Activities Division
- Integrated Controls System Division
- Accelerator



DMSC update

- 2019 is last year of construction phase
- Recommendations from last STAP actioned
- **Project Progress is excellent**
- **Engagement with Local stakeholders is good**
  - **Danish ministry have a clearer picture of the DMSC mission and work to help improve links with DK Universities**
- DMSC tracks the planned P6 plan within the required bounds
- Well on track to demonstrate Ready for Beam on Instruments
- Considerable challenges ahead
  - Some Interfaces with key stakeholders are concerning
  - Tracking instrument schedule & high level milestones depends heavily on:
    - Level of effort available.
    - Ambition and level of completeness expected.

Sub-Project/Organizational Unit: NSS

Milestone Title: DMSC Ready for Beam on Instruments

Milestone ID in P6: A2146887130

Definition: Data Management and Software Centre (DMSC) operational and Ready for Beam on Instruments

Rationale: Data acquisition system operational at required rate specification to allow data collection during hot commissioning of instruments. Experiment control system operational and integrated with ICS to allow cold and hot commissioning operations. Data Management system operational to allow data to be archival saved from instrument commissioning runs. Data reduction and data correction system core development complete to allow live data reduction from instruments during hot commissioning. Data Analysis packages developed to allow interpretation and analysis from early science experiments.

Demonstration/Proof: Data acquisition and control system is demonstrated at a test beam line facility. Stored data is verified as compatible with data reduction framework. Live data reduction system is verified on a test data set from MC instrument simulations. Data correction routines verified as correct. Live data analysis package integration with data reduction verified in software test suite. Data analysis packages verified by comparison with test data sets from other facilities.

Hand over: Staff and operational costs associated with DMSC

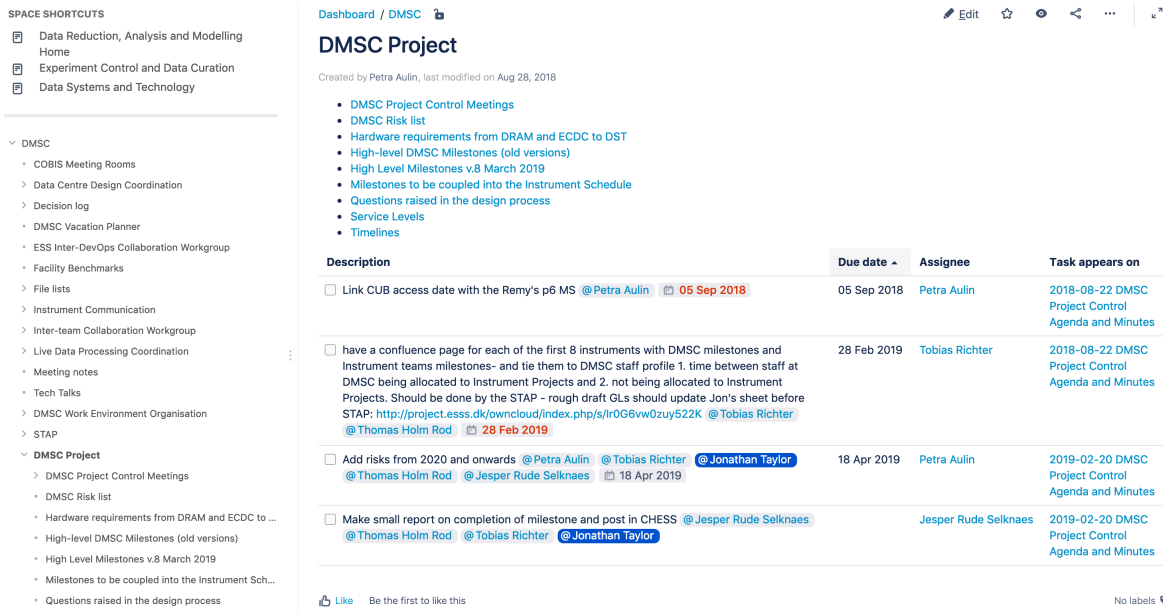
DMSC update

- DAQ Architecture event formation to File writer
  - Pipeline tested at V20
  - Components tested for performance
  - Utgard lab environment to include storage system test
- Core Data reduction development is well resourced
  - Instrument specific reduction development starts 2020
- Data analysis areas have specific staff / InKind
  - SANS
  - Inelastic magnetism / SCES
  - Powder and Xtal diffraction
  - Imaging (InKind)
  - Reflectometry (InKind)
- Data management
  - Meta data catalogue in production
  - Additional effort from PaNOSC
- User office
  - Prototypical proposal system developed for Deuteration platform
  - Recruitment for UO team in progress (Section lead starts in May)
- Construction started for Copenhagen Server room
- Contracts signed for Nordunet managed Link
- Research network connection to Cobis through DEIC - contract with ESS procurement

DMSC Construction phase & Initial Ops Phase

- Monthly Project control meeting
  - Milestones, progress and risks
  - Considerable recent effort towards planning for controls
  - In coordination with NSS planning team

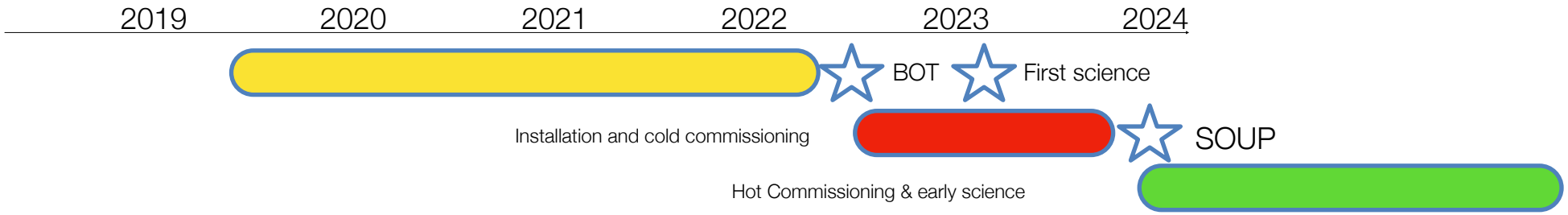
- 2019 Prioreties
  - Complete DMSC construction phase.
  - Begin Installation in E buildings / site (Science directorate objective)
    - Network & testing Comms rooms -> CUB Server room
  - Start user office development after Demax prototype
  - Develop instrument specific project plans and coordinate with instrument installation planning



Completion MS

- We should define our own readiness review
- Results and system specification documented in CHESS
- Document & system review by STAP Q4 2019

Schedule



DMSC end of construction activities
Baseline architecture and software ready

ESS infrastructure installed
H01 server room & network

DMSC construction InKind for core data reduction & analysis

Considerable coordinated effort & planning required for installation, integration & commissioning.

Support and development

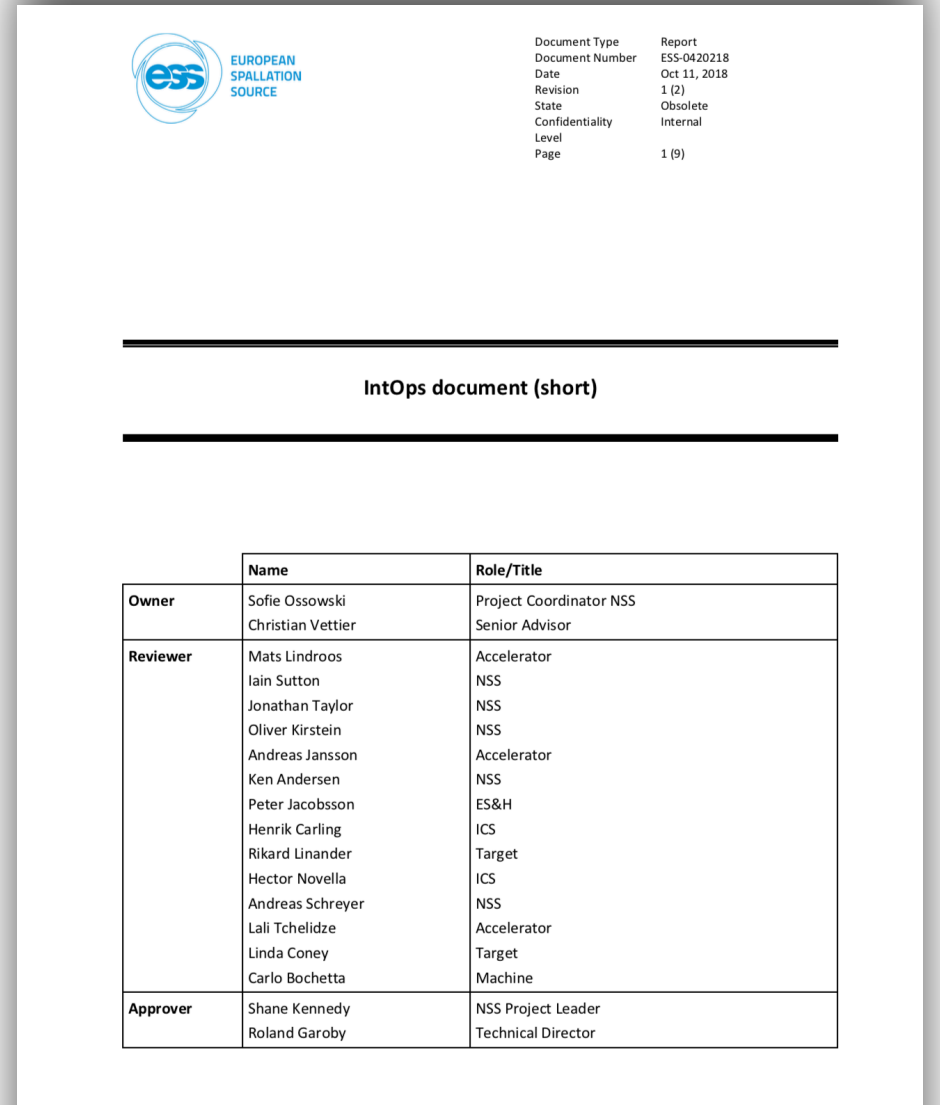
Training activities
Users and Staff

Hot Commissioning and early science support

Instrument projects Instruments 9- 15
Commissioning systems along with installation
Development of Instrument & technique specific Control, reduction & analysis.

Initial Operations of ESS instruments

- Agreed schedule for accelerator from BOT to SOUP & 2024 - 2025.
- Accelerator parameters agreed.
- Delivery schedule and power ramp up agreed.
- Agreed preference to maximise availability.
- 14Hz and 2.86ms baseline for Neutron production.
- BOT - First Science 76 days
- BOT - SOUP 690 Shifts 230 days
- BOT - SOUP 100kW ramping to 500kW
- 2025 1.25MW



EUROPEAN SPALLATION SOURCE

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IntOps document (short)

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	Roland Garoby	Technical Director

Overview on staff resources required to meet SOUP schedule

- Scientific computing scope delivered from DMSC
  - ICS are vital to a lot of commissioning activities
  - NSS will operate a beam line controls group
- For the initial instruments and first two open bunker periods only
- Two DMSC groups **100% utilised** in 2022 against our current initial operations plan

- SOUP instruments allocated extra resources at UP start

- Instrument data scientists hired 2020

	2019				2020				2021				2022				2023				2024			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
west sector																									
BEER	0.0	0.0	0.0	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
CSPEC	0.0	0.0	0.0	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
TREX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.0	1.0				
HIEMDAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.0	1.0				
NMX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.0	1.0				
BIFROST	0.0	0.0	0.0	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
MAGIC	0.0	0.0	0.0	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
North Sector																									
LOKI	0.0	0.0	0.0	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
FREIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.0	1.0			
SOUTH & East Sector																									
ODIN	0.0	0.0	0.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
DREAM	0.0	0.0	0.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
ESTIA	0.0	0.0	0.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	2.5	2.5	2.5	3.0	2.0	2.0	1.5	1.0	0.5	0.5				
SKADI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0	1.0	1.0			
Total FTE allocated to instruments	0	0	0	4	4	4	7	8	8	8	8	20	20	20	24	16	16	15	13	9	9				

Role	2019		2020			2021				2022				2023				2024			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
ECDC control	C	C	C	C	C		0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5						
ECDC DAQ	C	C	C	C	C							0.5	0.5	0.5	0.5	0.5	0.5				
RAG ID Sci				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
RAG reduction	C	C	C	C	C						0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
RAG Analysis	C	C	C	C	C									0.5	0.5	0.5	0.5	0.5	0.5		
DST										0.5	0.5	0.5	0.5	0.5	0						
Total				0.5	0.5	0.5	0.5	1	1	1.5	2	2.5	2.5	2.5	2.5	2	2	1.5	1.5	0.5	0.5

Beam Line Controls team

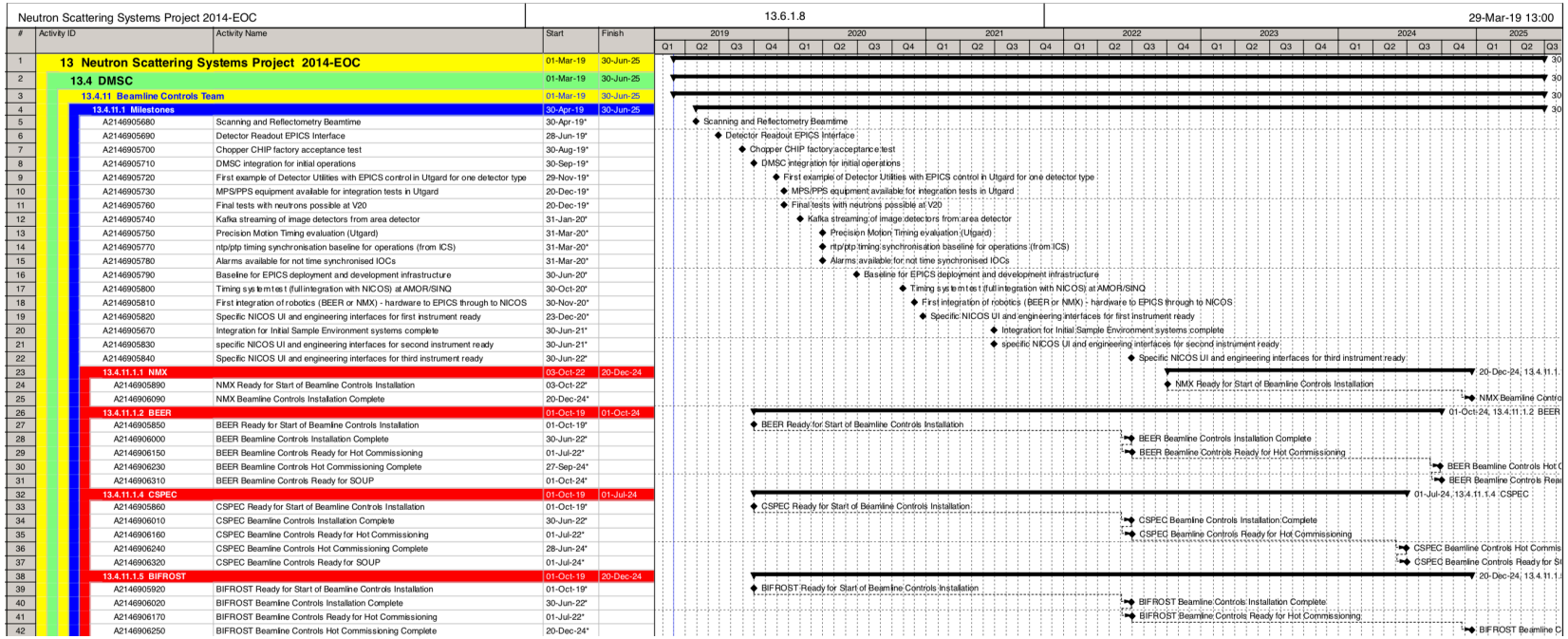
- Staff matrixed from NSS & ICS
- Provide a single entity for communication, prioritisation and delivery
- Led by NSS
- NSS owns scope and controls activities
- Resources requirements reviewed regularly
- This is not a service delivery model for ICS

- Requires careful planning to match instrument installation to match available LOE.
- Awaiting formal agreement from ICS on this delivery model for instrument integration
- 10 FTE required 2019 6FTE allocated
- 20 —>23 increases to around 13 FTE for any quarter

We know considerable effort ~5fte is required from ICS.
Getting agreement on LOE and schedule is frustrating.

		2019				2020				2021				2022				2023				2024			
																						Q1	Q2	Q3	Q4
BEER																									
	Sample environment Integration																						0.3		0.1
	Neutron chopper integration					0.0	0.2	0.5	0.2	0.2	0.5	0.2	0.0	0.0	0.5										0.1
	Detector system controls integration					0.1	0.2	0.5	0.2	0.0		0.0	0.5	0.5	0.5	0.5									0.1
	Motion control integration									0.5	0.5			0.0	0.5	0.5									
	Innstrument control (HMI) and DAQ integration								0.2	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	0.5	0.5					0.1
	Network and infrastructure integration					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
CSPEC																									
	Sample environment Integration							0.1	0.2	0.2	0.2	0.5	0.5	0.1				0.2					0.3	0.1	0.1
	Neutron chopper integration					0.0	0.2	0.5	0.2	0.2	0.5	0.2	0.0	0.0	0.5									0.1	0.1
	Detector system controls integration					0.1	0.2	0.5	0.2	0.0		0.0	0.5	0.5	0.5	0.5								0.1	0.1
	Motion control integration									0.5	0.5			0.0	0.5	0.5									
	Innstrument control (HMI) and DAQ integration								0.2	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	0.5	0.5				0.1	0.1
	Network and infrastructure integration					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1

BCT II



#	Activity ID	Activity Name	Start	Finish
1		13 Neutron Scattering Systems Project 2014-EOC	01-Mar-19	30-Jun-25
2		13.4 DMSC	01-Mar-19	30-Jun-25
3		13.4.11 Beamline Controls Team	01-Mar-19	30-Jun-25
4		13.4.11.1 Milestones	30-Apr-19	30-Jun-25
5	A2146905680	Scanning and Reflectometry Beamtime	30-Apr-19*	
6	A2146905690	Detector Readout EPICS Interface	28-Jun-19*	
7	A2146905700	Chopper CHIP factory acceptance test	30-Aug-19*	
8	A2146905710	DMSC integration for initial operations	30-Sep-19*	
9	A2146905720	First example of Detector Utilities with EPICS control in Utgard for one detector type	29-Nov-19*	
10	A2146905730	MPS/PPS equipment available for integration tests in Utgard	20-Dec-19*	
11	A2146905760	Final tests with neutrons possible at V20	20-Dec-19*	
12	A2146905740	Kafka streaming of image detectors from area detector	31-Jan-20*	
13	A2146905750	Precision Motion Timing evaluation (Utgard)	31-Mar-20*	
14	A2146905770	ntp/ptp timing synchronisation baseline for operations (from ICS)	31-Mar-20*	
15	A2146905780	Alarms available for not time synchronised IOCs	31-Mar-20*	
16	A2146905790	Baseline for EPICS deployment and development infrastructure	30-Jun-20*	
17	A2146905800	Timing system test (full integration with NICOS) at AMOR/SINQ	30-Oct-20*	
18	A2146905810	First integration of robotics (BEER or NMX) - hardware to EPICS through to NICOS	30-Nov-20*	
19	A2146905820	Specific NICOS UI and engineering interfaces for first instrument ready	23-Dec-20*	
20	A2146905670	Integration for Initial Sample Environment systems complete	30-Jun-21*	
21	A2146905830	specific NICOS UI and engineering interfaces for second instrument ready	30-Jun-21*	
22	A2146905840	Specific NICOS UI and engineering interfaces for third instrument ready	30-Jun-22*	
23		13.4.11.1.1 NMX	03-Oct-22	20-Dec-24
24	A2146905890	NMX Ready for Start of Beamline Controls Installation	03-Oct-22*	
25	A2146906090	NMX Beamline Controls Installation Complete	20-Dec-24*	
26		13.4.11.1.2 BEER	01-Oct-19	01-Oct-24
27	A2146905850	BEER Ready for Start of Beamline Controls Installation	01-Oct-19*	
28	A2146906000	BEER Beamline Controls Installation Complete	30-Jun-22*	
29	A2146906150	BEER Beamline Controls Ready for Hot Commissioning	01-Jul-22*	
30	A2146906230	BEER Beamline Controls Hot Commissioning Complete	27-Sep-24*	
31	A2146906310	BEER Beamline Controls Ready for SOUP	01-Oct-24*	
32		13.4.11.1.4 CSPEC	01-Oct-19	01-Jul-24
33	A2146905860	CSPEC Ready for Start of Beamline Controls Installation	01-Oct-19*	
34	A2146906010	CSPEC Beamline Controls Installation Complete	30-Jun-22*	
35	A2146906160	CSPEC Beamline Controls Ready for Hot Commissioning	01-Jul-22*	
36	A2146906240	CSPEC Beamline Controls Hot Commissioning Complete	28-Jun-24*	
37	A2146906320	CSPEC Beamline Controls Ready for SOUP	01-Jul-24*	
38		13.4.11.1.5 BIFROST	01-Oct-19	20-Dec-24
39	A2146905920	BIFROST Ready for Start of Beamline Controls Installation	01-Oct-19*	
40	A2146906020	BIFROST Beamline Controls Installation Complete	30-Jun-22*	
41	A2146906170	BIFROST Beamline Controls Ready for Hot Commissioning	01-Jul-22*	
42	A2146906250	BIFROST Beamline Controls Hot Commissioning Complete	20-Dec-24*	

- Detailed P6 plan from now until TG5
- Covers Instrument specific controls and core technology development.
- Aligned with the current NSS baseline

- NSS plan is not at sufficient level of detail for ICS to plan provisioning resource

Instrument installation and BOT

- Working from a well engineered set of core systems
- Considerable planning is still required for instrument installation and construction
- Currently instruments are in end of detailed design & start of procurement
- Installation planning is ramping up
  - Currently developing plan for network installation
  - A very detailed per instrument plan does not exist right now.
- Aim for cold commissioning verification at TG5 - 3m

DMSC Structure & planned staff for 20 - 23

	Data Systems & Technologies	Experiment control Data curation	WebTeam Section (User office support)	Data reduction and data analysis	Scientific modelling and simulation	Project admin (Petra Aulin)
	5 staff 1 PaNOSC	7 Staff 1 PaNOSC 5 FTE IK	1 Staff (1/5) 1 (C)	10 Staff 1 PaNOSC 5.5 FTE IK	0 Staff (Starts 2020)	3 Staff
2023 SOUP 3 Instruments 8 Instruments total	8FTE	15FTE	4FTE	15FTE	6 TE	3 staff

Development of a credible baseline provision for analysis, reduction and control
Next generation analysis provision remains the overall objective for ESS

- SL 0 - Control of instruments and acquisition of data, archive and curation of collected data
- SL 1 - Framework for manual data reduction, Data analysis packages manual operation
- SL 2 - Automated reduction workflows, automated analysis - experiment control feedback
- SL 3 - Support for advanced analysis and simulation

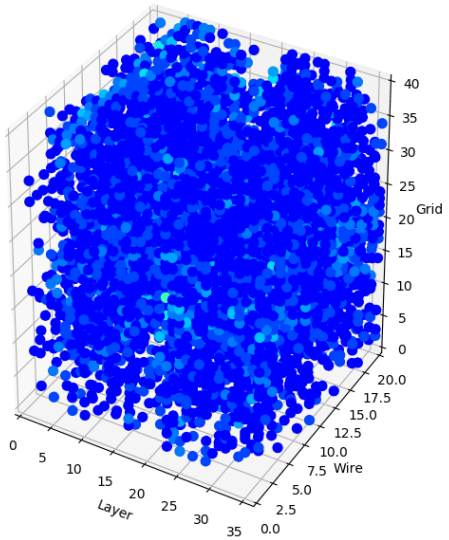
We are considering creating a group that merges the Instrument Data scientists Analysis expertise and modelling and simulation to support the user program

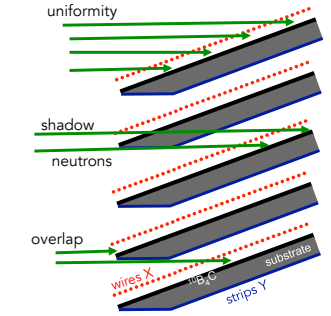
Technology Choices

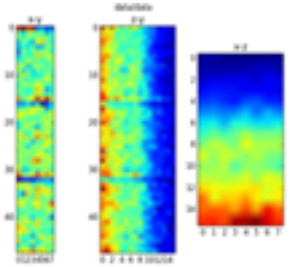
- Server room in Copenhagen and Lund Complete September 2019
- Procurement envisaged to install early systems
- For storage we have to make a choice of technology
  - IBM lends a Spectrum Scale test set up
- What should guide our decision making process for core technology

Neutron Detectors & neutron monitor project

- Considerable progress tasing prototypes.
  MultiGrid - CNCS & Sequoia (ORNL)
  MultiBlade - Armour (SINQ) CRISP (ISIS)

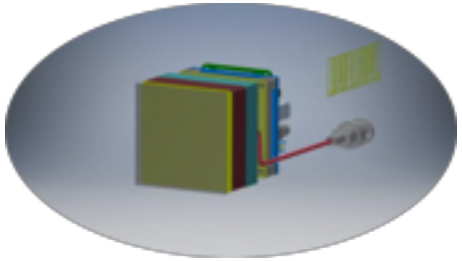






Neutron Monitors
- Common project

- Defines required monitor positions



- Funds activities for technology development

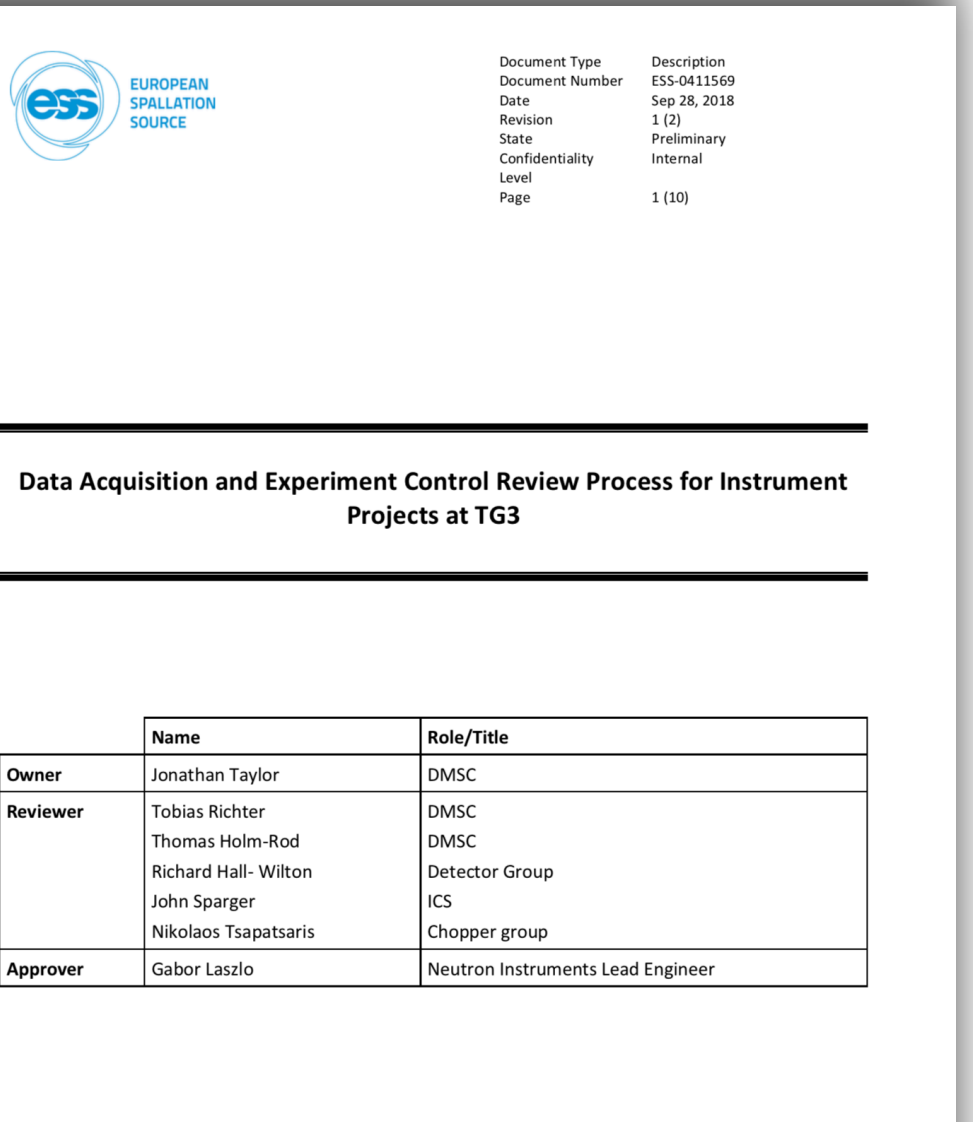
- ESS 00419542 defines use cases & monitor positions for each instrument

ESS instrument construction looking towards commissioning

- Instruments proceed through staged TG3

- Review of :
  Commissioning
  controls and integration
  data processing DMSC ESS 00411569

- Focus on commissioning plan & data processing aspects that effect design.



EUROPEAN SPALLATION SOURCE

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Data Acquisition and Experiment Control Review Process for Instrument Projects at TG3

	Name	Role/Title
Owner	Jonathan Taylor	DMSC
Reviewer	Tobias Richter Thomas Holm-Rod Richard Hall- Wilton John Sparger Nikolaos Tsapatsaris	DMSC DMSC Detector Group ICS Chopper group
Approver	Gabor Laszlo	Neutron Instruments Lead Engineer

Cost reduction & initial operations budget

- Construction phase contingency is estimated to be too low
  - ESS is evaluating cost reduction possibilities
  - NSS remains with the ring fence with an internal value engineering exercise
    - Common shielding project
    - Common beam monitor project
    - Beam-line Controls team
- Initial operations budget is not commensurate with the currently planned staff profile
  - Current internal review on initial operations
  - Considerable scope for DMSC was shifted from construction phase to initial operations.
    - 2M hardware
    - All instrument specific scope for data reduction and experiment control
    - User office software
  - Recovery of this scope is essential and leads to a front load of staff from 2020
  - NSS is part construction part initial operations
  - There is considerable pressure on the NSS ring fence for the construction phase.

IT Synergy

- Working group for 2 years
- There is an assumption that there are too many FTEs in the plan for IT scope

- Developing plans to centralise certain areas of common scope between IT, ICS & DMSC

- What has been decided:
  - Central service team for Network infrastructure (inc 1fte from DMSC)
    - Led by ICS infrastructure group

- What has been decided as a synergy but is still being planned
  - Central service team for data centre storage / compute
  - Enterprise Architecture workflow & governance

- How can we ensure that this is successful

Photon & Neutron Open Science Cloud project

EUROPEAN SPALLATION SOURCE

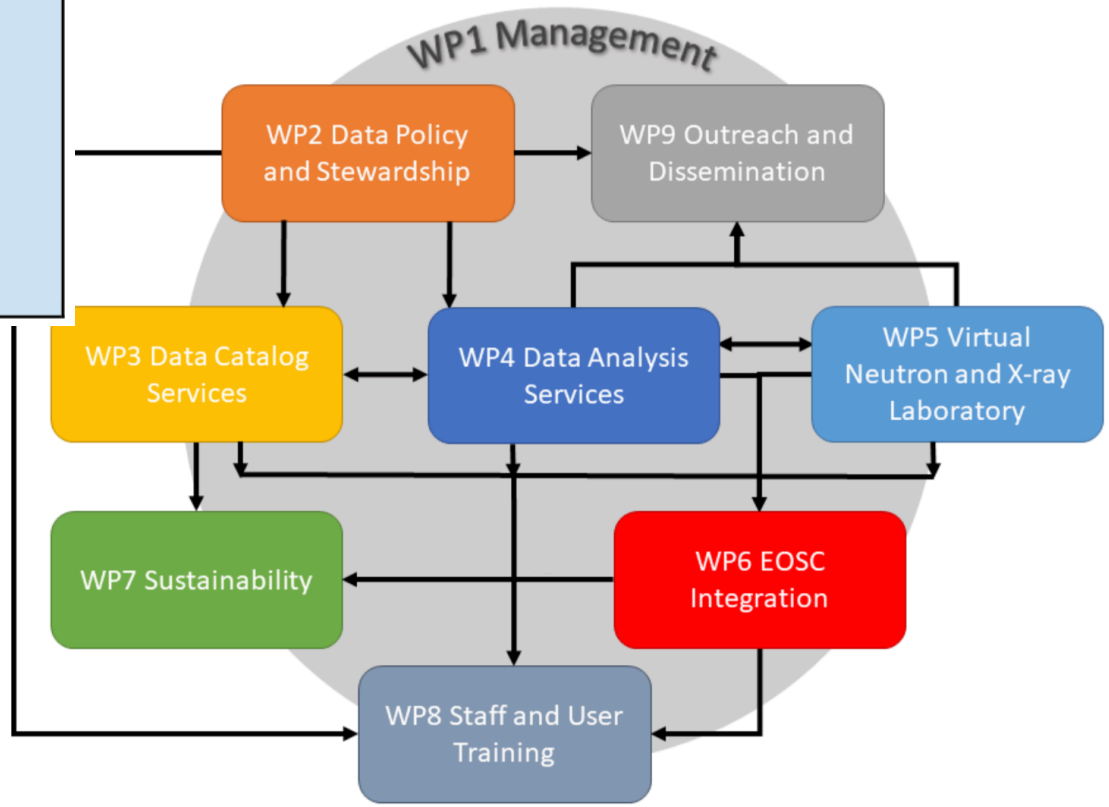
Make Fair data a reality for Photon and Neutron **ESRFI** facilities.

FAIR - PaNOSC will comply with the FAIR principles in the following ways:

Findable	- all data will have a doi, rich metadata, common api for federated search
Accessible	- api will support open protocol, metadata accessible even without data
Inter-operable	- metadata to follow community standards (NeXus), register metadata
Reusable	- follow community standardise metadata, clear licence (CC-BY)

Objectives

1. **Participate** in the construction of the EOSC by linking with the e-infrastructures and other ESFRI clusters.
2. **Make** scientific data produced at Europe's major Photon and Neutron sources fully compatible with the FAIR principles.
3. **Generalise** the adoption of open data policies, standard metadata and data stewardship from 15 photon and neutron RIs and physics institutes across Europe
4. **Provide** innovative data services to the users of these facilities locally and the scientific community at large via the European Open Science Cloud (EOSC).
5. **Increase** the impact of RIs by ensuring data from user experiments can be used beyond the initial scope.
6. **Share** the outcomes with the national RIs who are observers in the proposal and the community at large to promote the adoption of FAIR data principles, data stewardship and the EOSC.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 823852

Photon & Neutron Open Science Cloud project

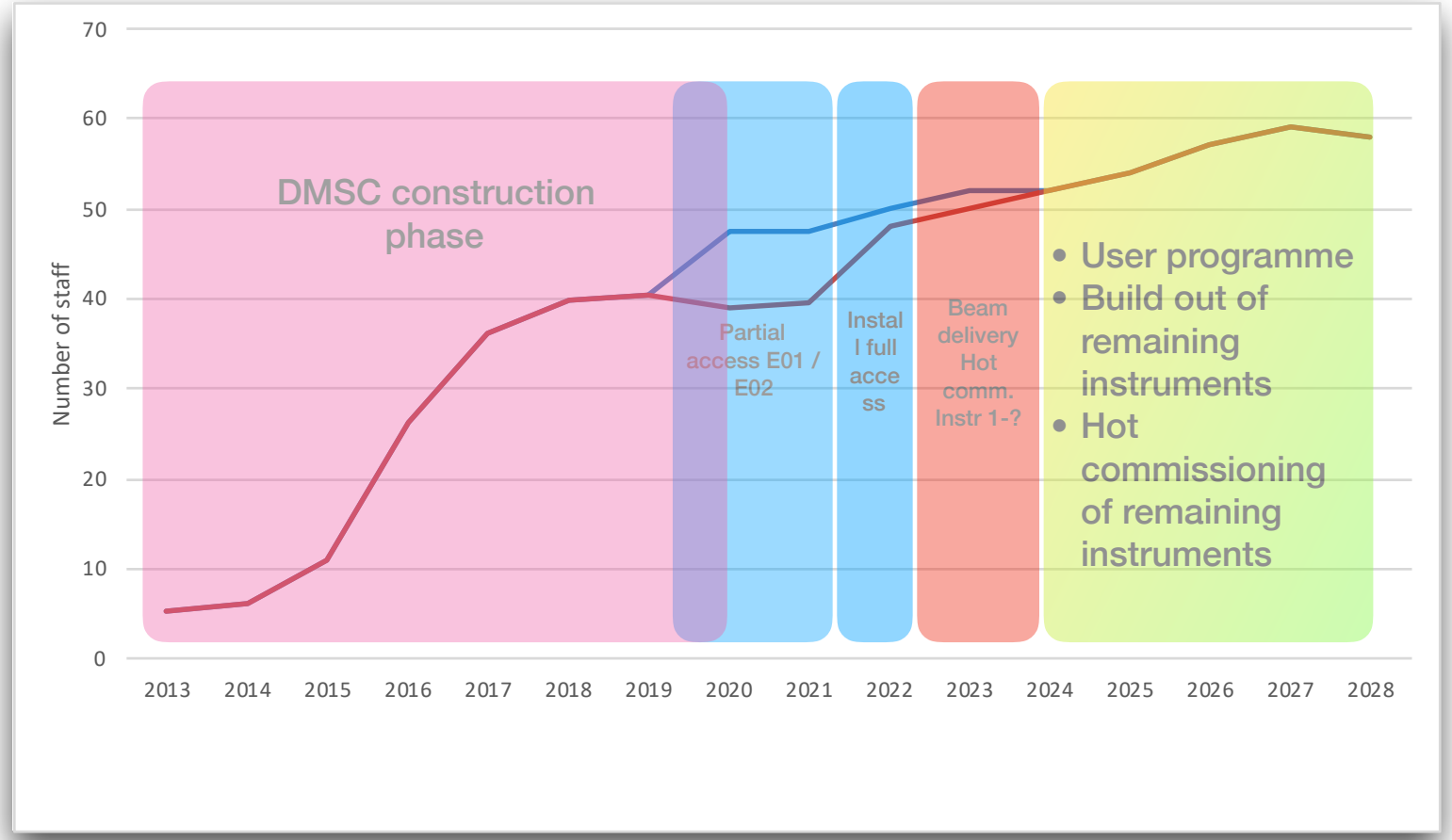
- Leading Data Catalogue & Staff and User Training WPs
- Project has the ambition to shape user access to data and data services
- Effort around both jupyter and RDC interfaces
- This has implications for our systems and for ESS users
- What are the STAPs thoughts about this type of development

Any questions?

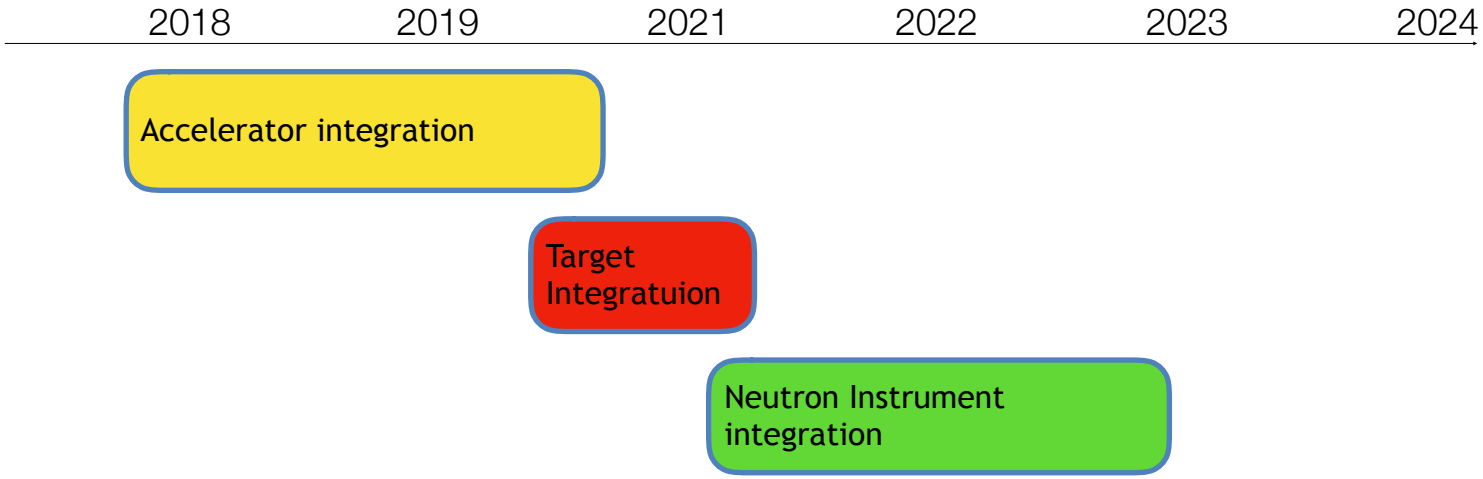
DMSC staff profile and ESS high level plan

- **DMSC scope Service level 0 - essential for operations**
  1. Detector readout linked with Detector group
  2. Experiment control linked with ICS
  3. Data acquisition linked with #1 & 2
  4. data management

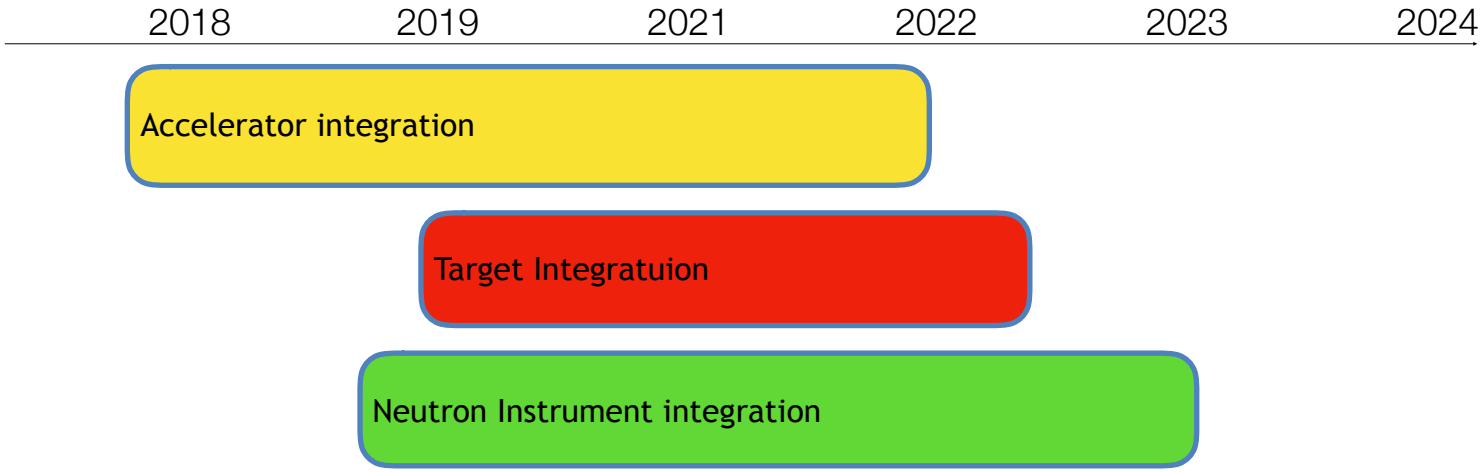
- **DMSC scope Service level 1 - essential for science delivery**
  1. Data reduction (SL 2 fully automatic)
  2. Data analysis (SL 2 fully automatic for standard runs)
  3. Simulation and modelling - essential for impact.



Integrated Controls System



Original ESS integration strategy
Based on linear progression (and expectation from ICS)
Organisation expected a service delivery model



Current requirements from key stakeholders for integration requires a parallel approach.

ICS under considerable pressure
80% of activities directed toward Accelerator

Q4 19 - Q2 18 Resources requirement

Scope for the team

- NICOS (Scientific User Interface)
- Engineering Interfaces
- Timing system integration
- IOCs for NSS devices
- detector slow control
- area detector interfaces
- choppers
- sample environment
- motion control inc. robotic systems
- EPICS Infrastructure
- PVaccess
- IOC factory
- configuration control
- network infrastructure
- archiver integration
- alarms, logging
- deployment

Scope	Total FTE required	NSS staff	ICS staff
Management and coordination	0.5 FTE	.5 FTE	
Sample environment Integration	1 - 2 FTE	.5 - 1 FTE	.5 - 1 FTE
Neutron chopper integration	1 FTE	.5 FTE	.5 FTE
Detector system controls integration	2 FTE	0 FTE	2 FTE
Motion control integration	1 - 2 FTE	.5 - 1 FTE	.5 - 1 FTE
Experiment control infrastructure (HMI) and neutron instrument DAQ integration	2 FTE	2 FTE	0 FTE
Network and infrastructure integration	0.5 - 1 FTE	0 FTE	.5 – 1 FTE
Total	10.5 FTE	5 FTE (Actual 5 FTE)	5.5 FTE Actual (3 FTE)

Neutron technology staffing initial operations

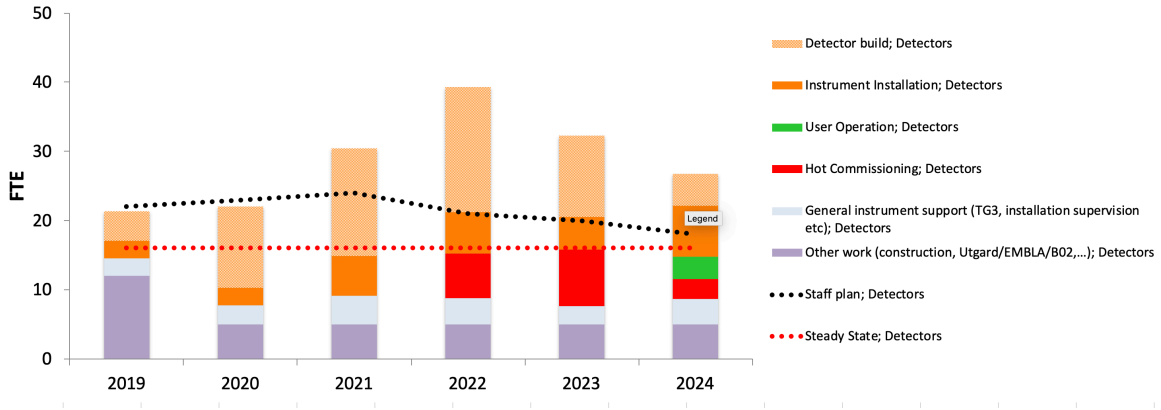
Neutron technologies

All aspects considered i.e. detector construction

Matched to Install schedule

Matched to installation LOE estimates.

Hot commissioning resources covered by ESS initial operations budget



Neutron Detector Group LOE

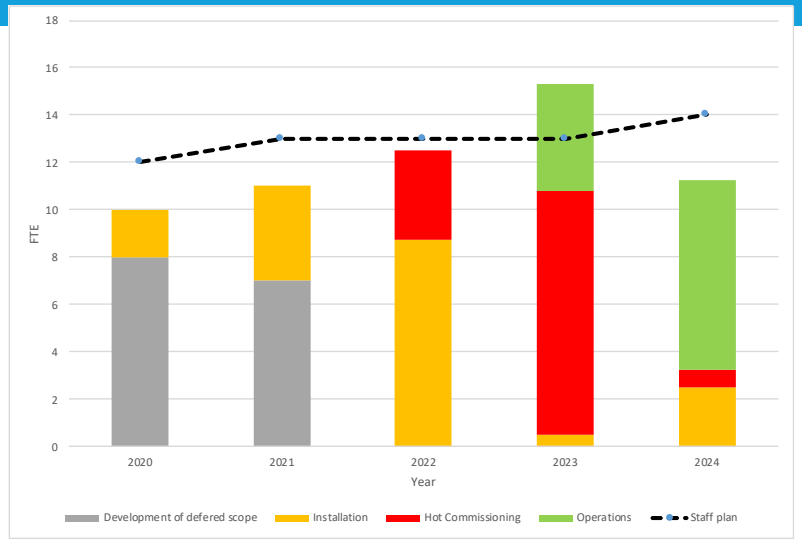
			2019				2020				2021				2022				2023				2024			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
West Sector	BEER																									
		Optics&Shield	0.1	0.1	0.1	0.0	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5
		Detectors	0.1	0.1	0.1	0.0	0.5	0.5	0.5	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	0.5
		Choppers	0.1	0.1	0.1	0.4	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.8
		MCA	0.1	0.1	0.1	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	CSPEC																									
		Optics&Shield	0.1	0.1	0.1	0.0	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5
		Detectors	0.1	0.1	0.1	0.0	0.0	0.5	0.5	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	0.5
		Choppers	0.1	0.1	0.1	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.8	0.5
		MCA	0.1	0.1	0.1	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Resources for installation & commissioning

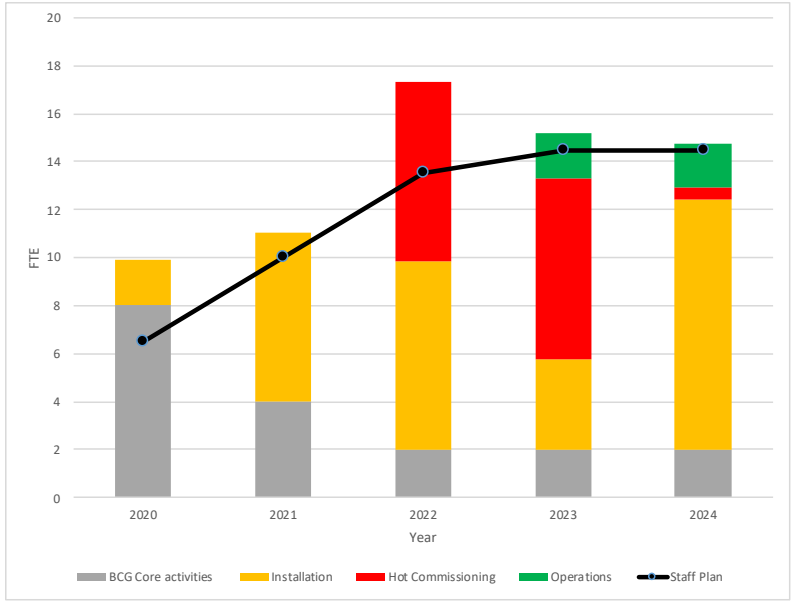
- 2 scientists for each Instrument

- 0.5 Instrument data scientist from DMSC
- Data reduction and analysis from DMSC
- Beamline controls team matrixed from NSS and ICS
- Staffing seems aligned with other facilities

- Changes in staff profile will effect project



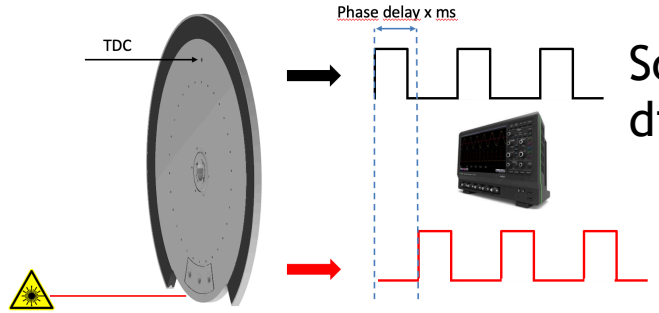
Staffing from DMSC covering data reduction and analysis Including Instrument Data Scientist



Staffing required for Beamline controls Assuming an slight uplift in ICS staff NSS staff allocated as per staff plan for NT and DMSC for controls and DAQ

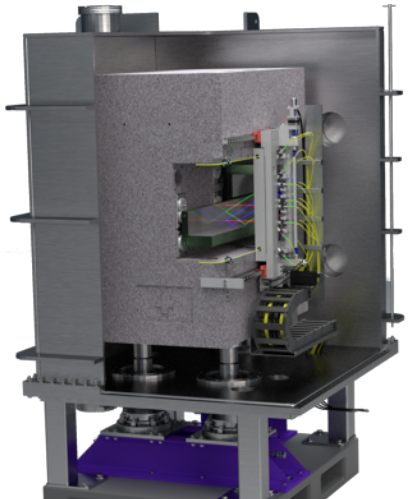
Commissioning

- Cold commission and integrate key components during installation.
- Scope, resources and framework are defined to execute.
  - BeamLine Controls Team
  - NT groups
  - Chopper group SAT includes calibration of axis geometry
- Instrument teams resources pre - builds and significant prototyping projects
  - Minimising / Mitigating future delays
- Hot commissioning plans are being developed, and reviewed at TG3
- Workshops with instruments teams to maintain schedule alignment, priorities and tasks.



Schematic of chopper disc laser alignment

Selene Guide prototype Build at PSI and fully integrated into control system



Construction of R106 where STFC will pre-build LOKI and FRIEA

Commissioning - Calibration

Considerable complexity for ESS Instruments with multiple axis chopper systems

Detector Geometry is challenging

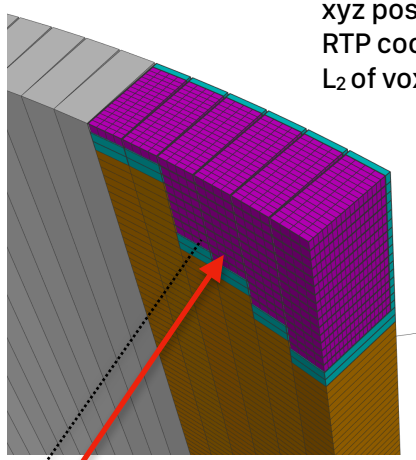
A number of methods of defining T_0 will be available

Calibration of chopper cascade will be aided by diagnostics

Neutron monitor project led by ESS

Detector List mode DAQ
offsets from Wall clock
:05
:06
...
+Pixel ID

xyz position
RTP coordinates
L_2 of voxel



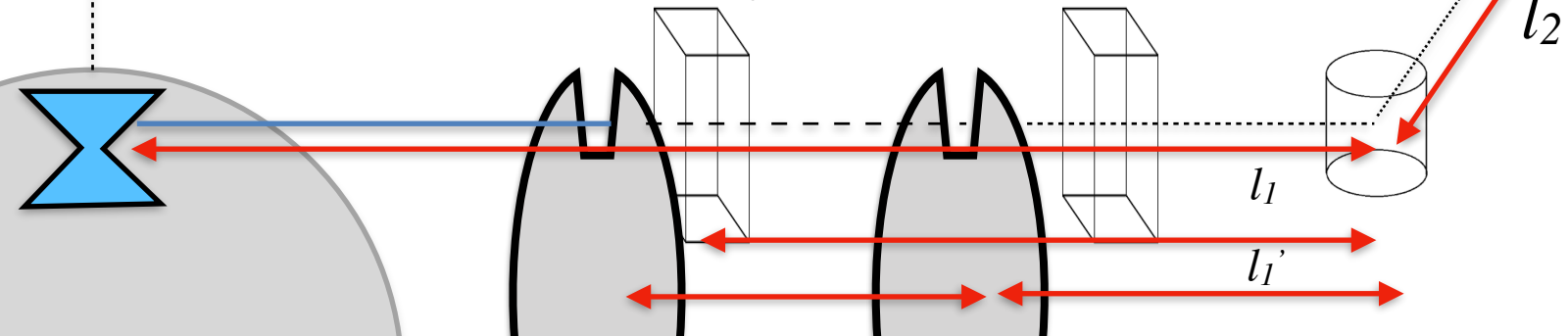
$$\lambda = \frac{h}{p} = \frac{h \,.\, tof}{m_N \,.\, L_{tot}} = 2d\sin\theta$$

$$tof = t - t_0$$

$$L_{tot} = L_1 + L_2$$

Monitor List mode DAQ
offsets from Wall clock
:01
:02
...
+ ID
(Can histogram if required)

Wall clock time proton pulse
11:10
Proton Pulse ID



Calibration required for:
Motion axis
chopper offsets and transmission
Flight paths
Detector voxel / pixel positions

Challenges for Hot Commissioning

- Normalisation of individual frames of data.
  - Each frame is extracted from a different region of the pulse
- Defining T_0 and T_0 for each frame
- Target segment and moderator coupling
- Current activities aimed understanding these key complexities