

DMSC STAP - September 2019 Project Update

Jonathan Taylor

Welcome & Charge



- Charge :
- Provide feedback, advice and recommendations on the progress of DMSC in respect of our planning, key technologies and risks.
- We request:
- Advice and recommendations on how we can ensure the new organisational structure of the science and technical directorate will have a positive impact on scientific computing at ESS.
- An evaluation of our resource request the initial operations period (2019 2025) for staff effort and capital investment.
- Advice and recommendation regarding our strategy for milestone planning for 2020-2025.
- Evaluation of our current level of completeness against our construction scope and advice / recommendation on how to best progress with instrument specific development and commissioning.





- ESS project update
- Initial Operations planning and budget
- BCT update
- Reorganisation for installation and cold Commissioning Phase
- DMSC status

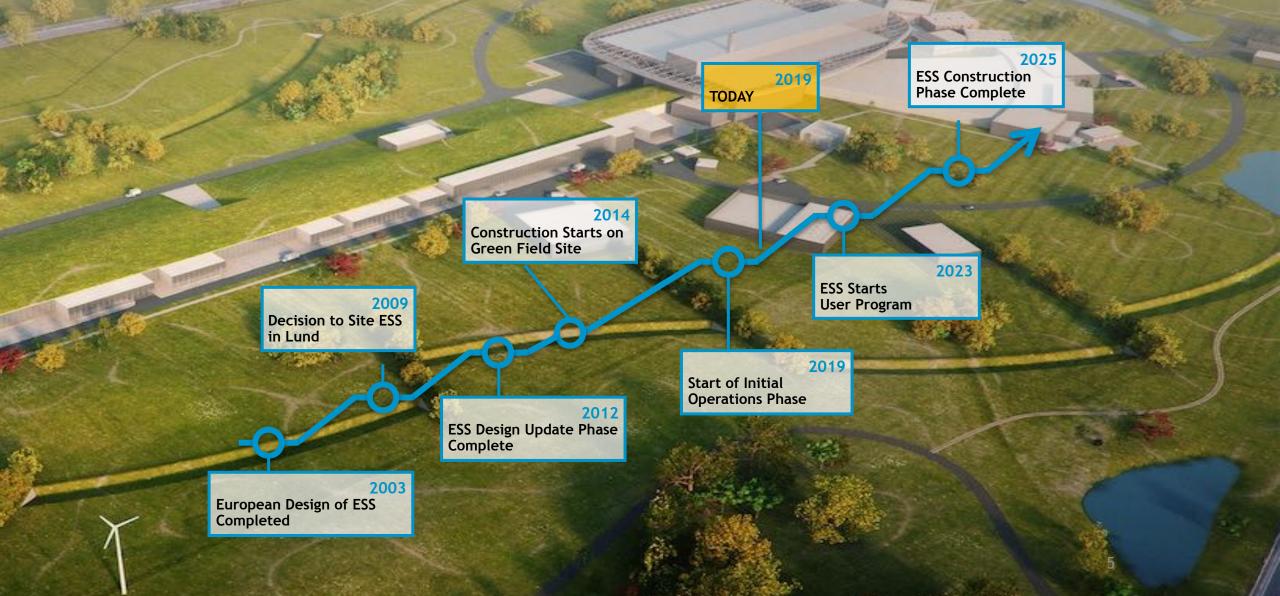


ESS status



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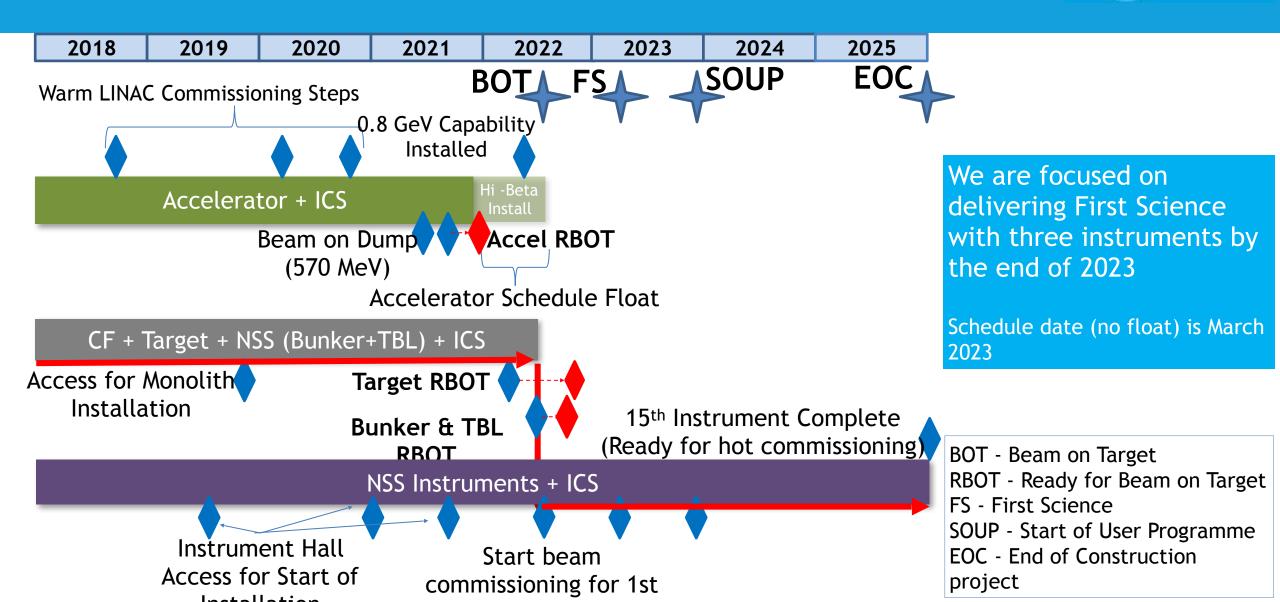
ESS update

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- Project is 60% complete
- Currently tracking the 2018 baseline
 - Some delays 3-6m possible on BOT
- Initial operations has begun:
 - Accelerator installation making rapid progress
 - Ion source and LEBT commissioned
 - MEBT installed
 - DTL received and being integrated
 - RFQ delayed, but final components expected this week
 - Cryo-test stand permit received
- Project contingency is low
- Initial operations funding expected to be 810M
- Organisational structure changing to address installation and integration.

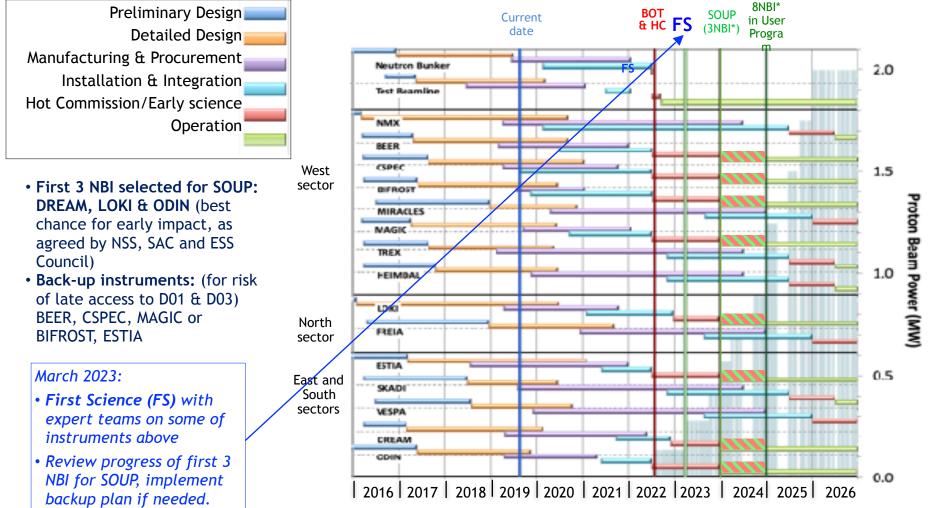
The ESS Critical Path



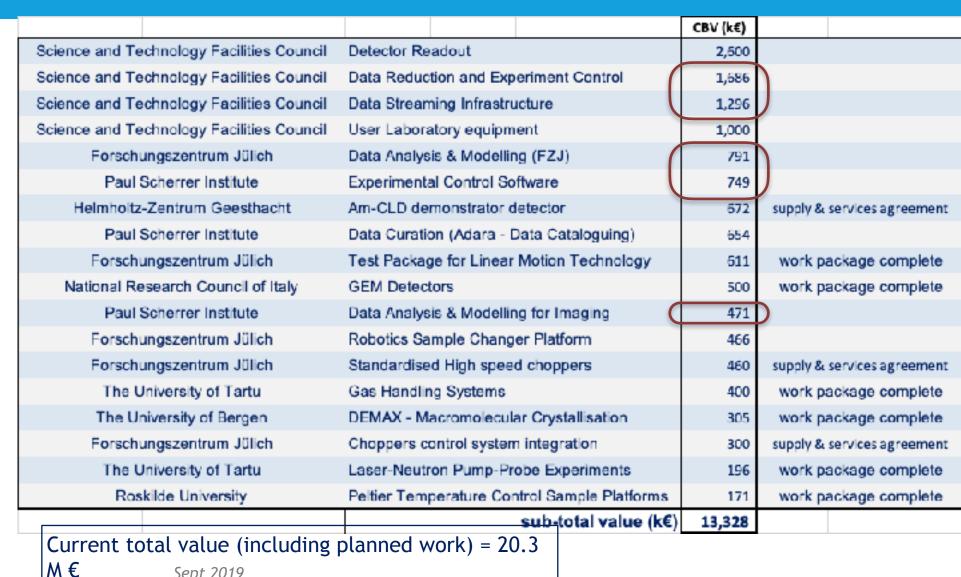


Baseline schedule for Neutron Beam Instruments (NSS MS V4.2)





NSS major non instrument IK work packages: (total value 20.3 $M \in$)



Sept 2019

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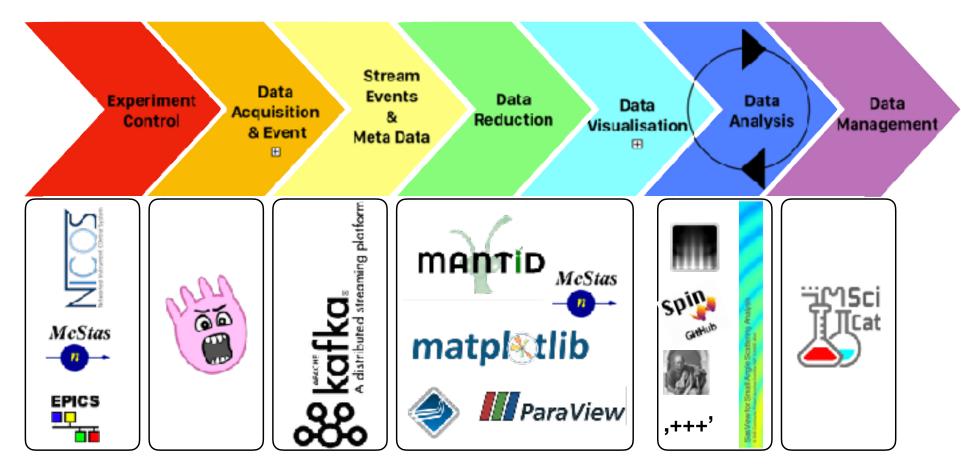
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DMSC inkind Ends • 2021 (q1)

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 Construction phase & Initial Ops Phase

- 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

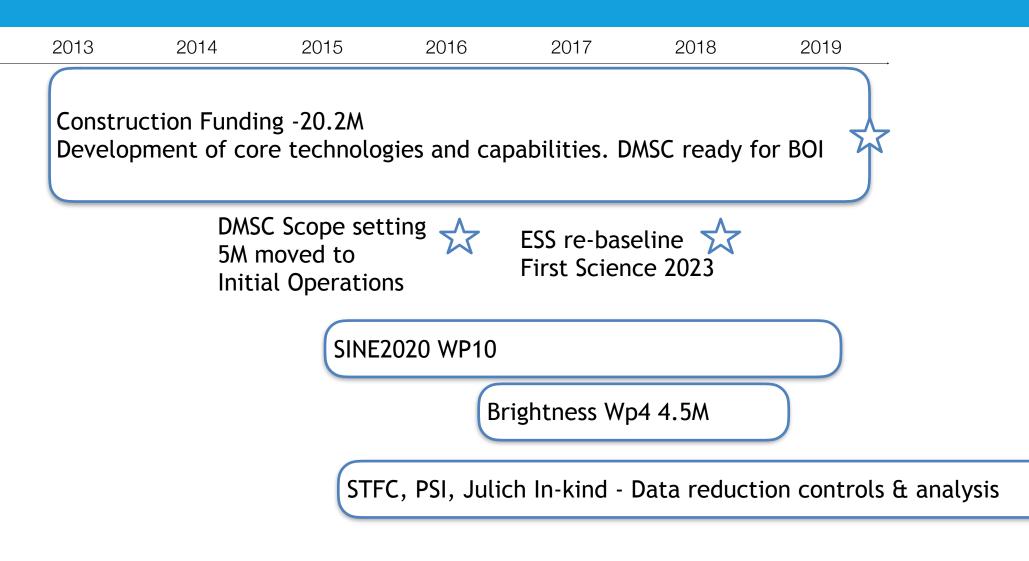
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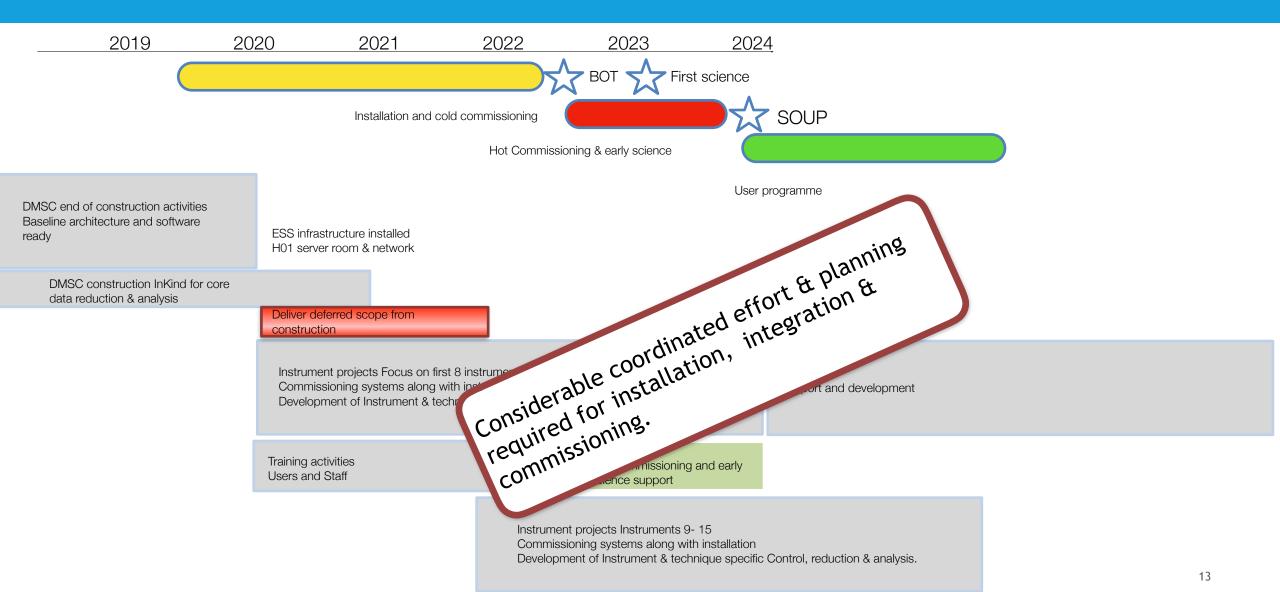
Schedule I





Schedule II

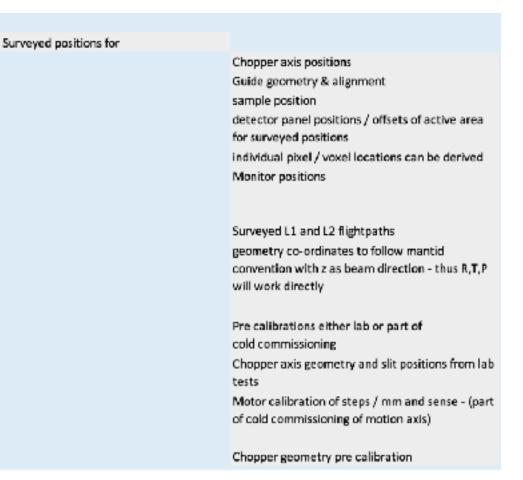




2020 onwards Milestone strategy

Integration of DMSC activities with Instrument Construction.

- Generic Milestone list generated.
 - Motion, Choppers, detectors
 - Covers the installation requirements and upstream dependencies
- Schedule will be centrally developed & Managed by NSS planning team and fed into P6
- Requirements from DMSC on instruments developed.
- Points of contact were to be instrument data scientists.
 - DMSC point of contacts depend on hiring and STAP advice.



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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

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MAGIC	0.0	0.0	6.0	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
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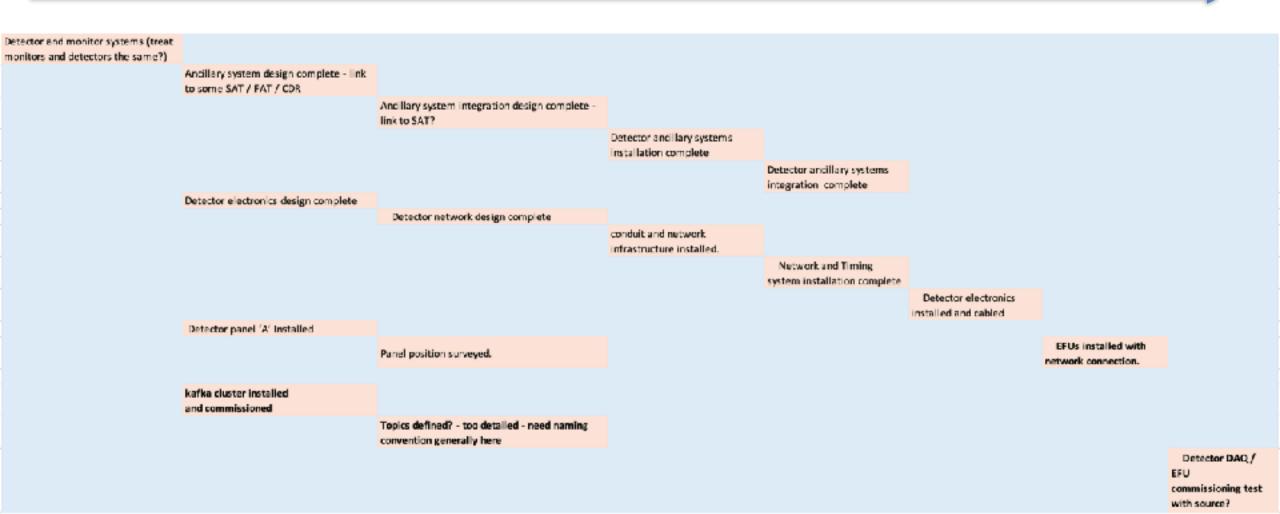
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ECDC control	С	с	с	с	с		0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5						
ECDC DAQ	С	С	с	с	С							0.5	0.5	0.5	0.5	0.5	0.5				
RAG ID Sci				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
RAG reduction	с	с	с	с	с						0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
RAG Analysis	С	С	с	с	С										0.5	0.5	0.5	0.5	0.5		
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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

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Generic milestones (just for detectors)

Coordination of milestones with installation schedule made by central planning team.



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Instrument requirements refresh

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- Information to be held on the instrument confluence pages
- https://confluence.esss.lu.se/pages/viewpage.action?pageId=311646930

Current planned staff resources

- Deferred scope from 2016 front loaded
- All instrument specific development

	2020	2021	2022	2023	2024	2025
TOTAL FTE						
ex Admin &	39.5	40.75	44	47	47	48
Mangament						
DRAM	15.5	15.75	18	20	20	21
ECDC	11	12	13	14	14	14
SWAP	5	5	5	5	5	5
DST	8	8	8	8	8	8
Instruments in construction	4	9	6	7	7	3
Hot Commisioning /Early Science at EOY	0	0	6	8	0	4
Instruments User programme at EOY	0	0	0	0	8	8
	4	9	12	15	15	15
staff per instrument	9.875	4.52777778	3.66666667	3.13333333	3.13333333	3.2
	Staff cost per y	/ear				
	2020	2021	2022	2023	2024	2025
	4977	5134.5	5544	5922	5922	6048
deferal FTE	10.5	6.75	5			
defreal value	1323	850.5	630			

Initial operations funding

- 'Instrument specific development' for all scope moved into initial operations period 2019 -2025.
- Capital investment for instrument computing (including for instrument control cabins)
- Sum of staff resources is
 - Per instrument scheduled at ~20py effort for each instrument including hot commissioning for instru. 1-8.
 - 7.5 py for installation
 - Total across division (to include core development maintenance / support xx
- 12 hires scheduled for 2020 to include
 - Instrument data scientists
 - Additional effort for ECDC
 - Additional effort for SWAP already moved from original plan of hiring in 2019

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DMSC Structure & planned staff for 20 - 23



	Data Systems & Technologies 5 staff 1 PaNOSC	Experiment control Data curation 6 Staff 1 PaNOSC 5 FTE IK	Scientific Web Applications 3 Staff (1/5) 1 ©	DRAM(s) 10 Staff 1 PaNOSC 5.5 FTE IK	Project admin (Petra Aulin) 3 Staff	
2023 SOUP 3 Instruments	8FTE	14FTE	5FTE	15 FTE (20FTE inc Planned Simulation)	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 Data Analysis Service support for advanced analysis and simulation

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

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	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 D.1	0.1	0.1	D.1	0.1	0.1	0.5	0.5	0.0	0.D	0.0	0.0	0.D	0.0	D.1	0.0	0.0	0.1
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	Sample and contract integration					0.1	0.2	0.2	0.2	0.5	0.5	0.1				0.2				C.3	0.1	0.1
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- 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

BCT Current Status

- Awaiting comment and / or approval of the steering document
- BCT works effectively in-spite of intransigence of ICS management.
- Status could be resolved as part of the re-organisation

Document Type Organisation Document Number 255-1273000 Date Jun 27, 2015 Revision 1 (2) State Review Confidentiality Lawal Instantal Page 1 (9)

Description of the Beamline Controls Team

	Name	Role/Title
Owser	Jonathan Taylor	Head of DMSC
Reviewer	Oliver Kirstein	Head of Instrument Technologies Division
	Arno Hess	Head of Scientific Instruments Division
	Ken Andersen	Head of Neutron Instruments Division
	Shane Kennedy	NSS project leader
	Henrik Carling	Head of ICS
Approver	Andreas Schreyer	Director for Science Directorate
	Carlo Bocchetta	Deputy Director for Machine Directorate









Focus on organisational priorities (Build the facility AND ESS' operational capacity)

Agile decision-making process

Better integration and coordination using common processes

Achieve First Science 2023



NSS Project work packages (Essential for first science):

- Neutron bunker: BOT
- Test beamline: BOT
- All Neutron Instruments (15): each Tollgate 5 (Hot commissioning)
- NSS Infrastructure (electrical and services): Tollgate 5 on 3 instruments
- Common guide shielding: Tollgate 5 on 3 instruments
- Common slow choppers: Tollgate 5 on 3 instruments
- Detectors: Completion and acceptance of detectors for CSPEC, ESTIA; and Tollgate 5 on 3 instruments
- DAQ and Beamline Controls: Tollgate 5 on 3 instruments
- Safety and Licensing: obtain license to operate facility

Scope that remains with the Science Directorate until onset of Hot Commissioning (TG5):

- Scientific Advocacy and Programme Development
- Prepare for First Science and Start of User Program
- Scientific Activities including User Program
- DMSC activities not related to Data Acquisition
- Sample Environment Equipment: first science (or SOUP) on 8 instruments
- MCA systems
- Laboratory Facilities

Summary of Concepts

- Project, installation and integration is moved into a single organisational unit
- Key concepts.
 - Some SD staff move into TD Line management SK and KJ
 - Some SD staff move into Installation and Field Support Line MA
 - Some SD staff remain in SD Line AS
- Scope and responsibility transfers back to SD at TG5 for 3 instruments.
 - Coincides with BOT

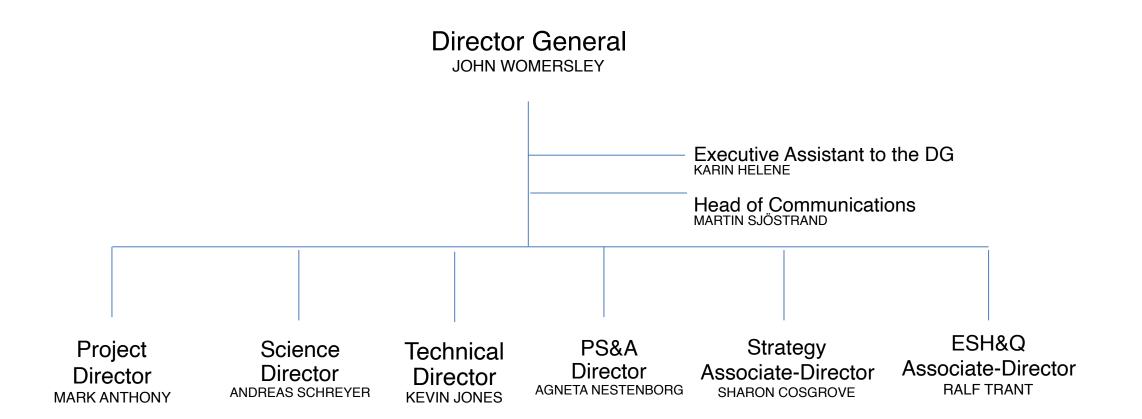
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SDALL ATION

Future organization negotiated and agreed:

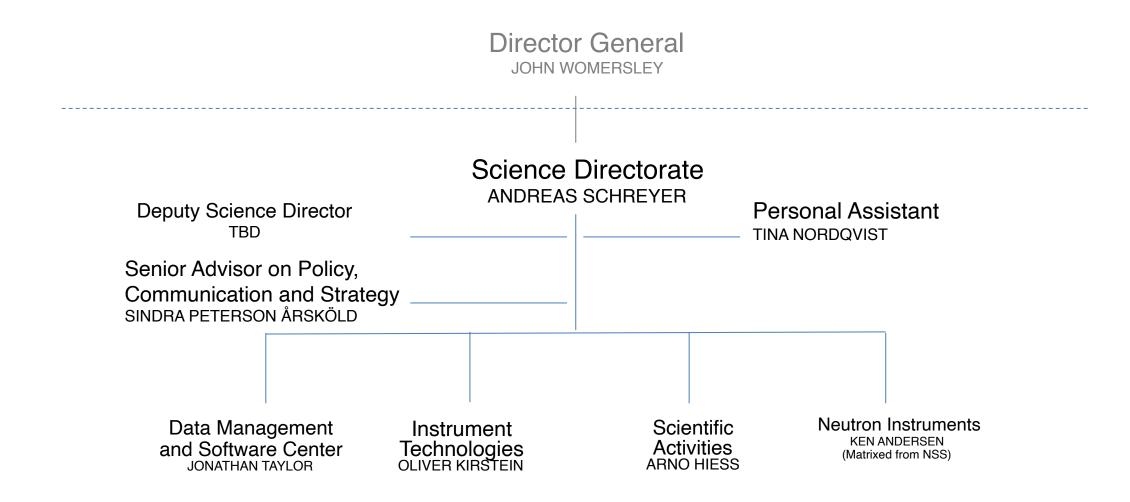
ESS Executive Team





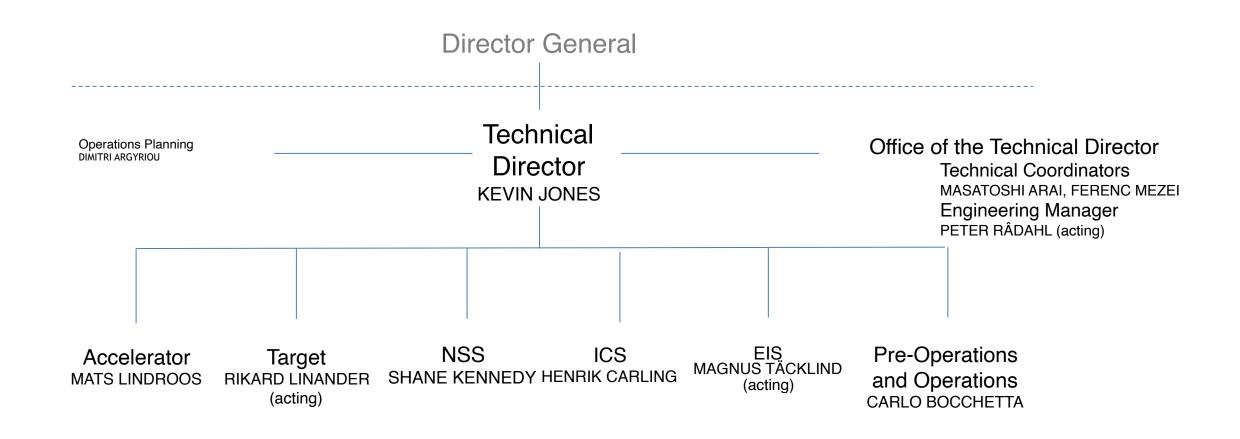
Future organization to negotiate Science Directorate (overview)





Future organization negotiated and agreed: ESS Technical Directorate

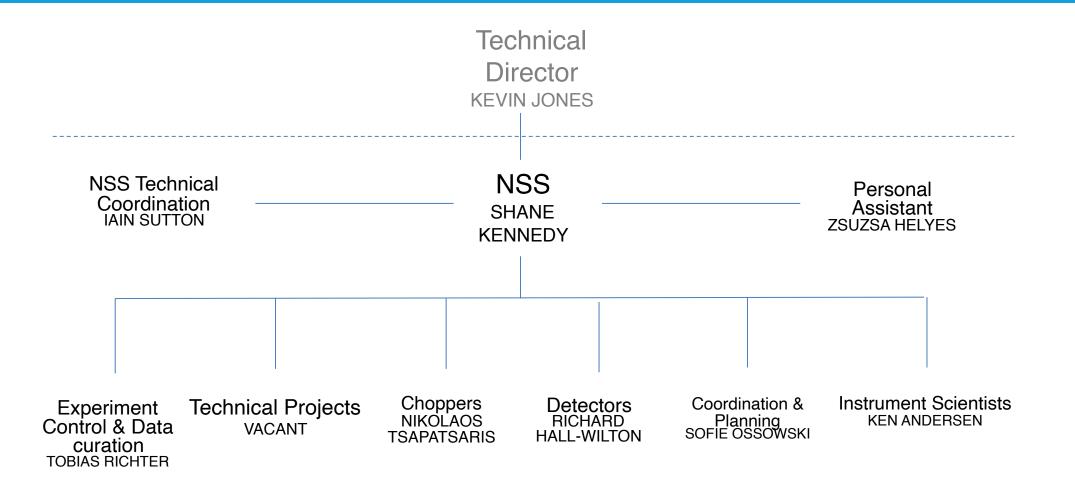




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Future organization to negotiate NSS





DMSC update



- Huge amount of progress has been made in the last 6m.
- BCT & data pipeline verified on V20
- Utgaard test area now a 'virtual beam-line'
- Spectrum scale testing
- User office development started
- Development of
 - Imaging software
 - Diffraction software
 - Data reduction & visualisation development of SCI++
- Server room build completed
- Link in place (pending some tests)

Any questions?



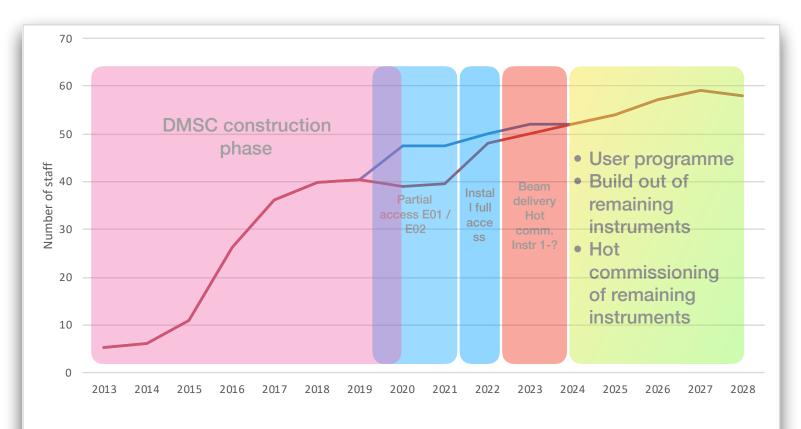




DMSC staff profile and ESS high level plan

- 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

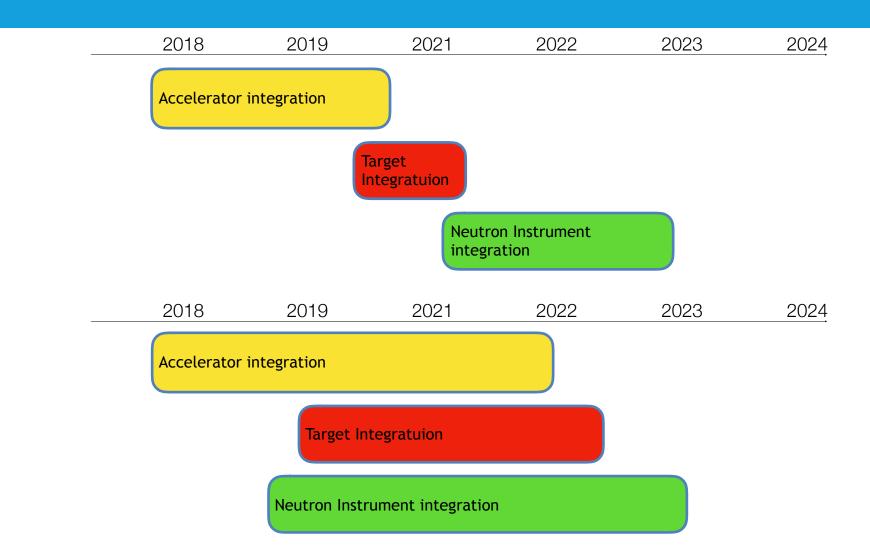
[•]DMSC scope Service level 1 - essential for science delivery
1. Data reduction (SL 2 fully automatic)
2. Data analysis (SL 2 fully automatic for standard runs)
3.Simulation and modelling - essential for impact.



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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.

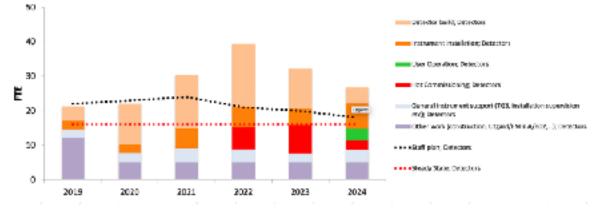
ICS under considerable pressure 80% of activities directed toward Accelerator

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				2	020			2	021			2	022		1	2	025		2024			
			Q1	Q2	Q3	Q4	Q1.	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	qı	qız	Q3	Q4	Q1	Q2	Q3	Q4
West Sector	BEER						_	_	_	_																
		Optics@Shield	01	01	01	0.0	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	10	10	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 8 Shield	01	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	01	01	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	01	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

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Resources for installation & commissioning



g from DMSC

- 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

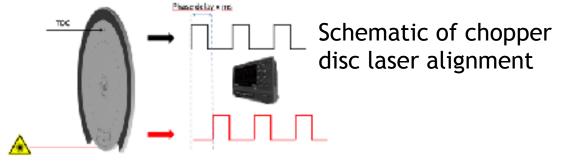
Construction of R106 where STFC will pre-build LOKI and FRIEA

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.

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

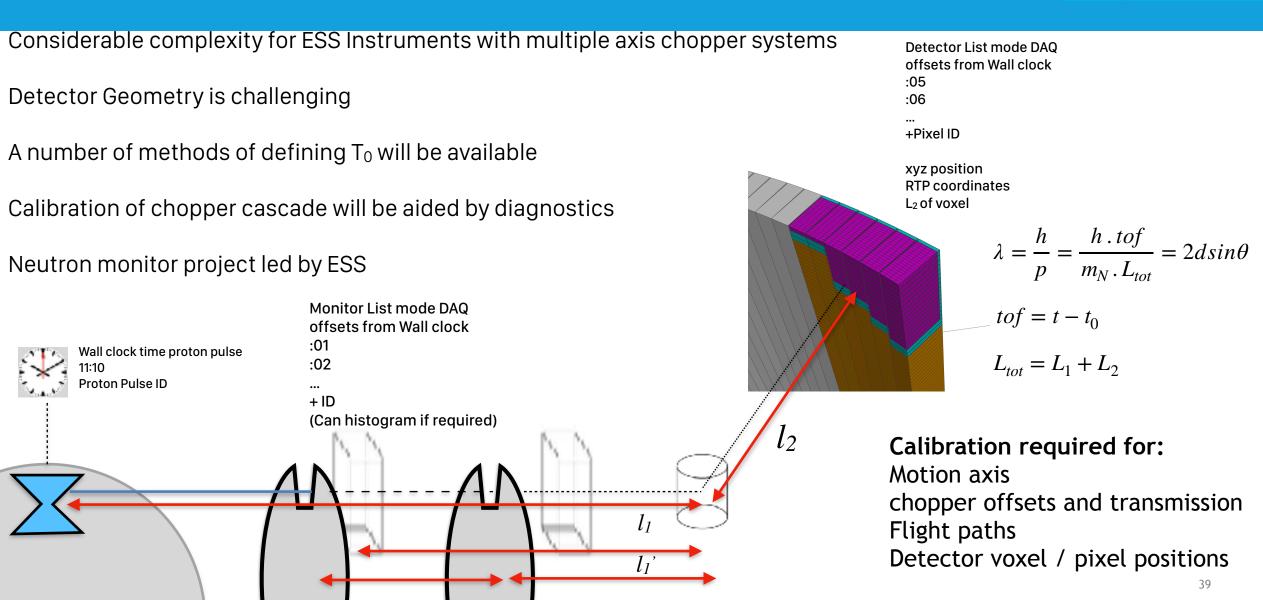






Commissioning - Calibration





Challenges for Hot Commissioning

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- 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

