The challenge for 2016: Matching instrument scope with budget

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ESS Project Scope on Instruments (NSS)

NSS Scope: 22 "public" instrument suite by 2028 together with a technical and scientific support infrastructure that enables scientific excellence and high quality scientific user service.

Ideas (Proposals)

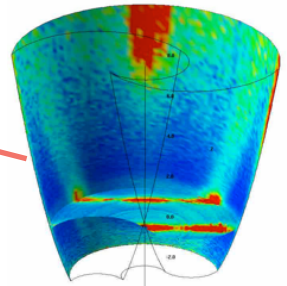
Sample Environment

Science (Publications)

Science Support Laboratories

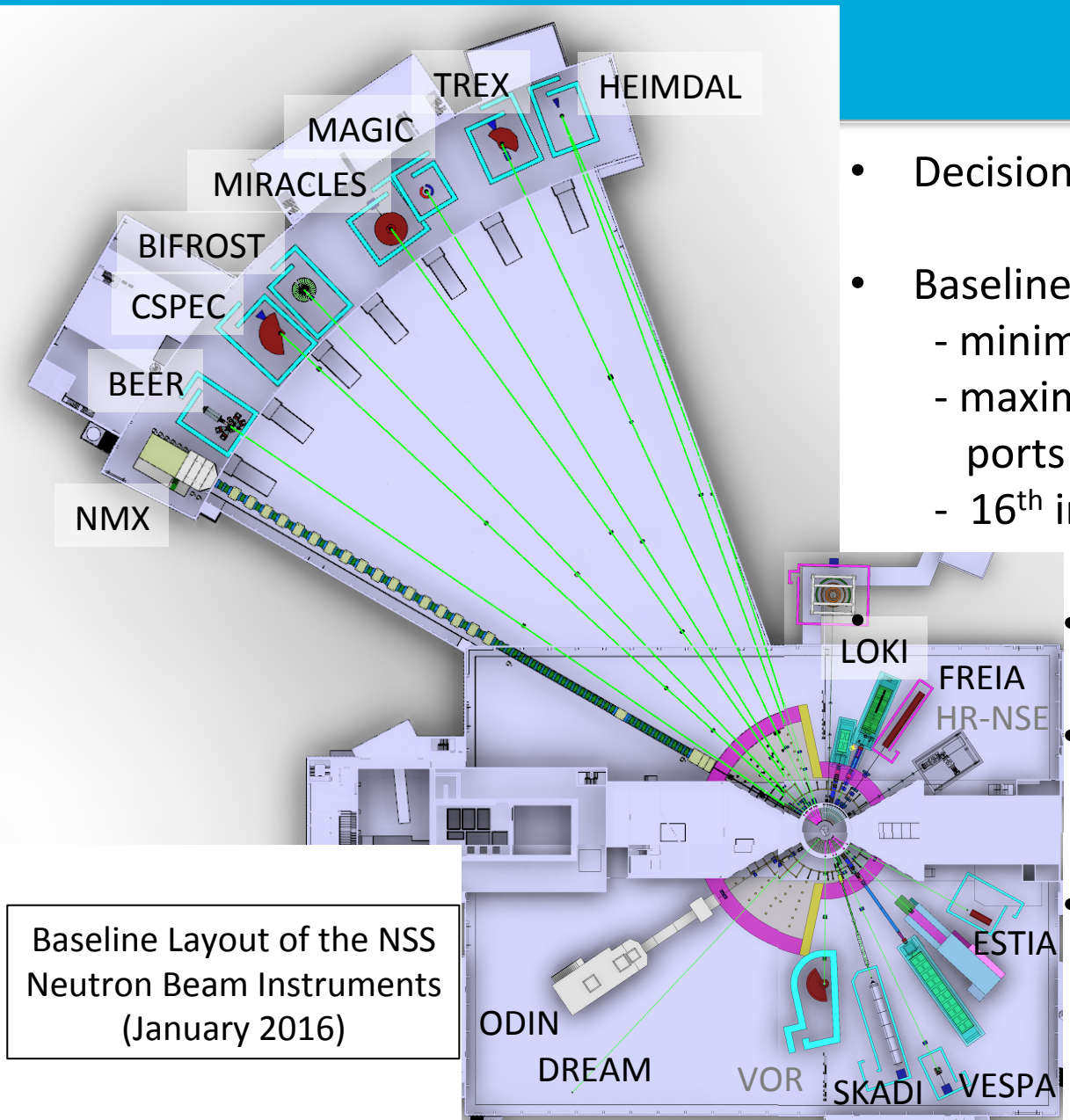
22 Instruments

Analysis and Visualisation Software



Construction Budget: 16 Instruments

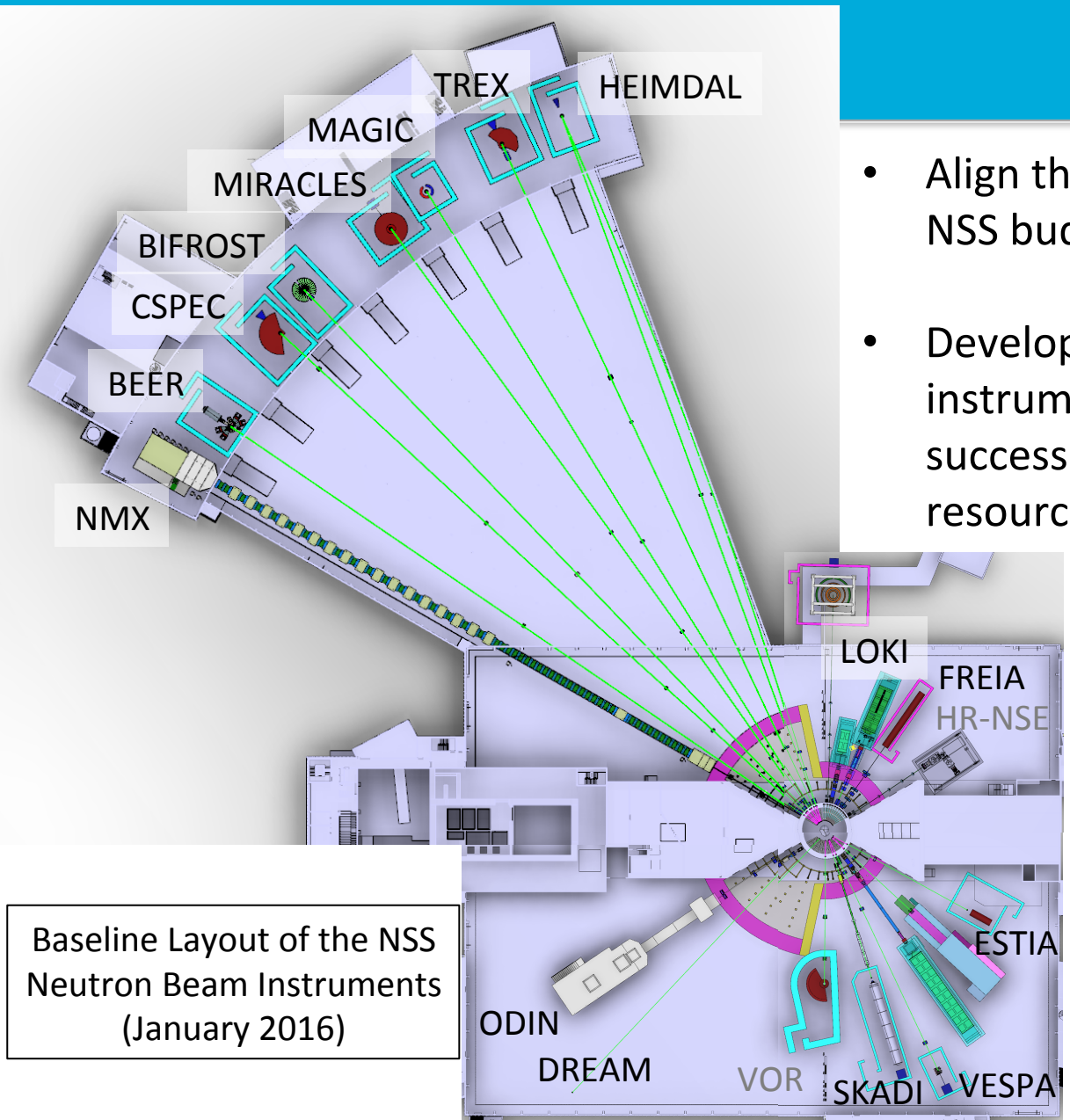
NSS: Where we stand today



Baseline Layout of the NSS Neutron Beam Instruments (January 2016)

- Decisions on the first 16 instruments
- Baseline where to place 15 instruments
  - minimize mechanical interfaces
  - maximize number of usable beam ports in the future
  - 16th instrument (HR-NSE, VOR)
- Bunker design advancing fast
- Funding delays for some in-kind partners (65% in kind)
- Working on entering several new instruments into phase1 (prel. engineering design)

NSS: Priorities for 2016



Baseline Layout of the NSS Neutron Beam Instruments (January 2016)

- Align the instrument budgets with the NSS budget
- Develop a realistic schedule for all instruments ensuring early science success in line with available in-kind resources and partner capabilities
- Propose which instruments are to be operational first
- Proposal to Council in December 2016 on how to fund instruments plus everything else required for early science success within budget of 350 MEUR

Annual Review 2015: Presentation by an external partner on in-kind contribution of instruments

"Serious worries:

- With the current instrument budget it will not be possible to build what was proposed
- The resulting version of the BEER may only be a „shadow“ of the proposed instrument, which may not be the world leading materials science diffractometer anymore.
- If this happens to all instruments the success of ESS endangered"

Recommendation of the Review Committee:

“Prioritize the choice of the first eight instruments and ensure that their scope is sufficient to deliver world class science from the first few years of user operations"

Why eight instruments?

The instrument budget challenge

- Instrument proposals were optimized for scientific quality to convince SAC/ STAP
- Instrument proposals: visionary, no incentive to design to budget
- Not enough funds available to cover the full scope of all 16 instruments within the ring-fenced NSS construction budget of 350 Mio EUR (65% in-kind)
- Sum of the “as proposed” budget for all 16 instruments: ≅ 250 Mio EUR
- Current NSS budget for instruments: 188.9 Mio EUR
- Pressure to increase instrument budget
- Scenario: increase up to 202 Mio EUR would require cuts of approx. 20% for sample environment, DMSC, technology groups,…

⇒ still 48 Mio EUR missing (19 % of proposed budget for 16 instruments)

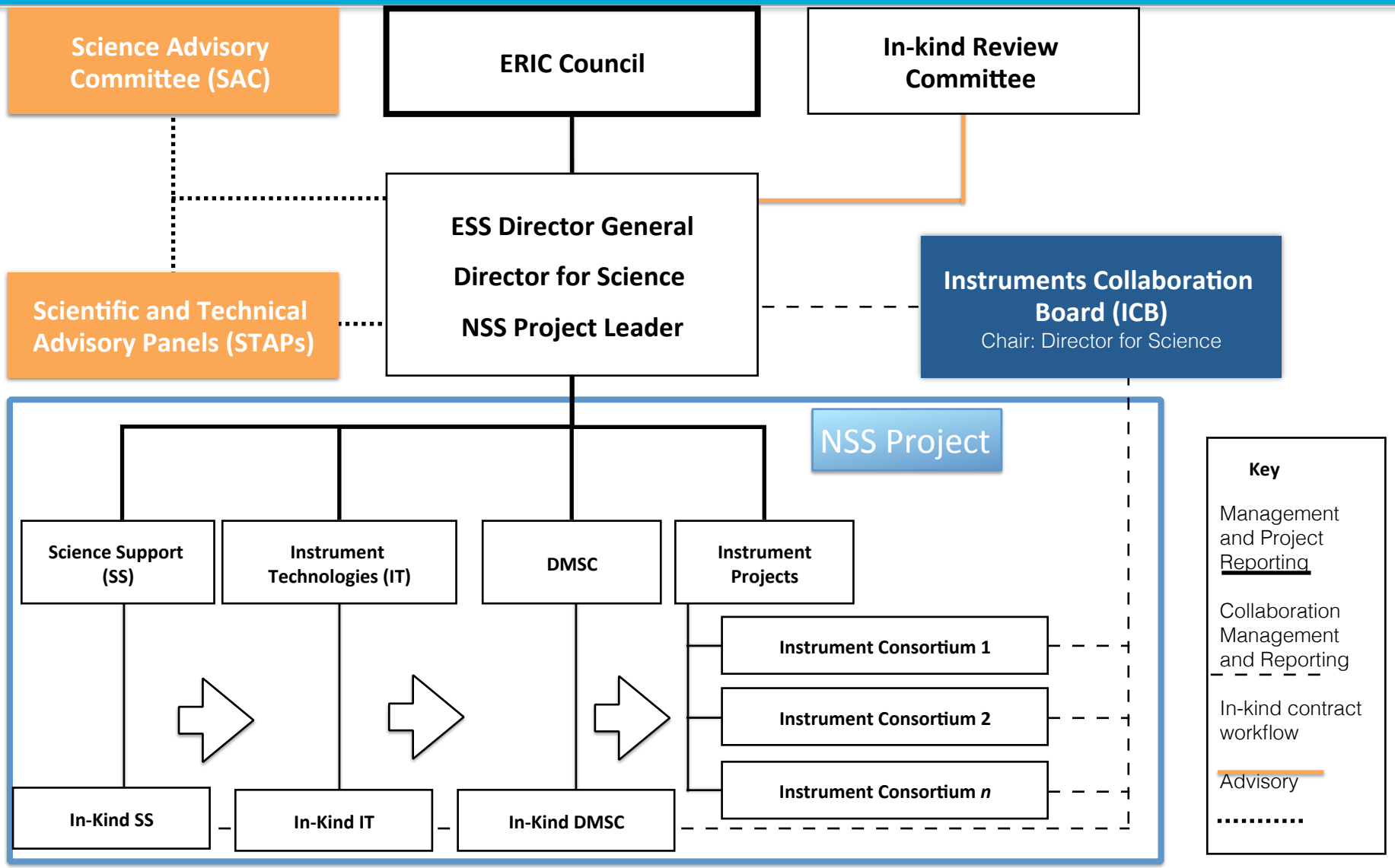
(certain costs for shielding, vacuum, etc. have been moved into the central NSS budget)

Decrease individual instrument budget AND increase NSS instrument budget

The way forward

- In general the day one version of any instrument does not need to contain all “bells and whistles" as proposed: day one scope < full scope
- Requires intense discussions with all partners on the budget for the day one version (phase 1, scope setting meetings before Dec. 2016)
- Instrument budget estimates require better understanding of the shielding requirements (phase 1)
- We must make sure that the day one version of any instrument delivers early scientific success (even if the accelerator is not yet at full power)
- Early scientific success also requires good sample environment, data analysis tools, detectors etc.
- We must also ensure that we have the funds for scope upgrades of instruments as we go along (pre-operations budget)

The NSS Instruments Collaboration



NSS Project; Neutron Instrument project phases

Proposal and Planning

Instrument Proposal

Deliverables

- Science case covering scientific relevance, impact and usage
- Conceptual design with credible estimates of performance
- Preliminary costing.

Phase 0 Preparation for Design

Deliverables

- Conceptual design updates
- Prototyping
- Definition of facility requirements and interfaces
- Clarification of institutional responsibilities
- Resource planning

Phase 1 Preliminary Design

Deliverables

- Scientific and technical requirements
- Technical design concept
- Delivery plan for all phases (including hot commissioning)
- Delivery Schedule covering all phases
- Resource plan
- Staging plan for later enhancements
- Budget with contingency at 10% of cost to complete

Design and Construction

Phase 2 Detailed Design

Deliverables

- Complete definition of all major technical components
- Completion of detailed plan for Phase 3
- Refined plan for phase 4
- Refined Resource plan
- Refined delivery schedule, with critical path items and dependencies
- Refined budget with contingency at 10% of cost to complete

Phase 3 Manufacturing and Procurement

Deliverables

- Procurement and manufacture of all major technical components
- Completion of detailed plan for phase 4
- Site preparation
- Refined plans for phase 5 and for staging
- Refined Resource plan
- Refine instrument delivery schedule
- Maintain budget with contingency at 10% of cost to complete

Installation and Commissioning

Phase 4 Installation and Integration

Deliverables

- Construction of physical infrastructure on site.
- Assembly and installation of technical components
- Integration and testing of technical components
- Installation, integration and testing of Personnel Safety System
- Submission of application for approval to hot commission
- Formal project completion

Phase 5 Hot Commissioning

Deliverables

- Verification of performance of Personnel Safety System
- Proof of compliance with radiation dose limits
- Critical performance demonstration of basic functionality
- Scientific performance demonstration
- Friendly user experiments
- Completion of technical and user manuals

Tollgate 1

- STAP review
- SAC recommendation
- NSS recommendation
- STC approval

Tollgate 2 (PDR)

Preliminary Design Review

- STAP review
- NSS
  - scope review
  - assign cost book value
  - approval

Tollgate 3 (CDR)

Critical Design Review

- STAP review
- ICB review
- NSS approval

Tollgate 4 (IRR)

Installation Readiness Review

- ICB review
- NSS approval

Tollgate 5 (SAR)

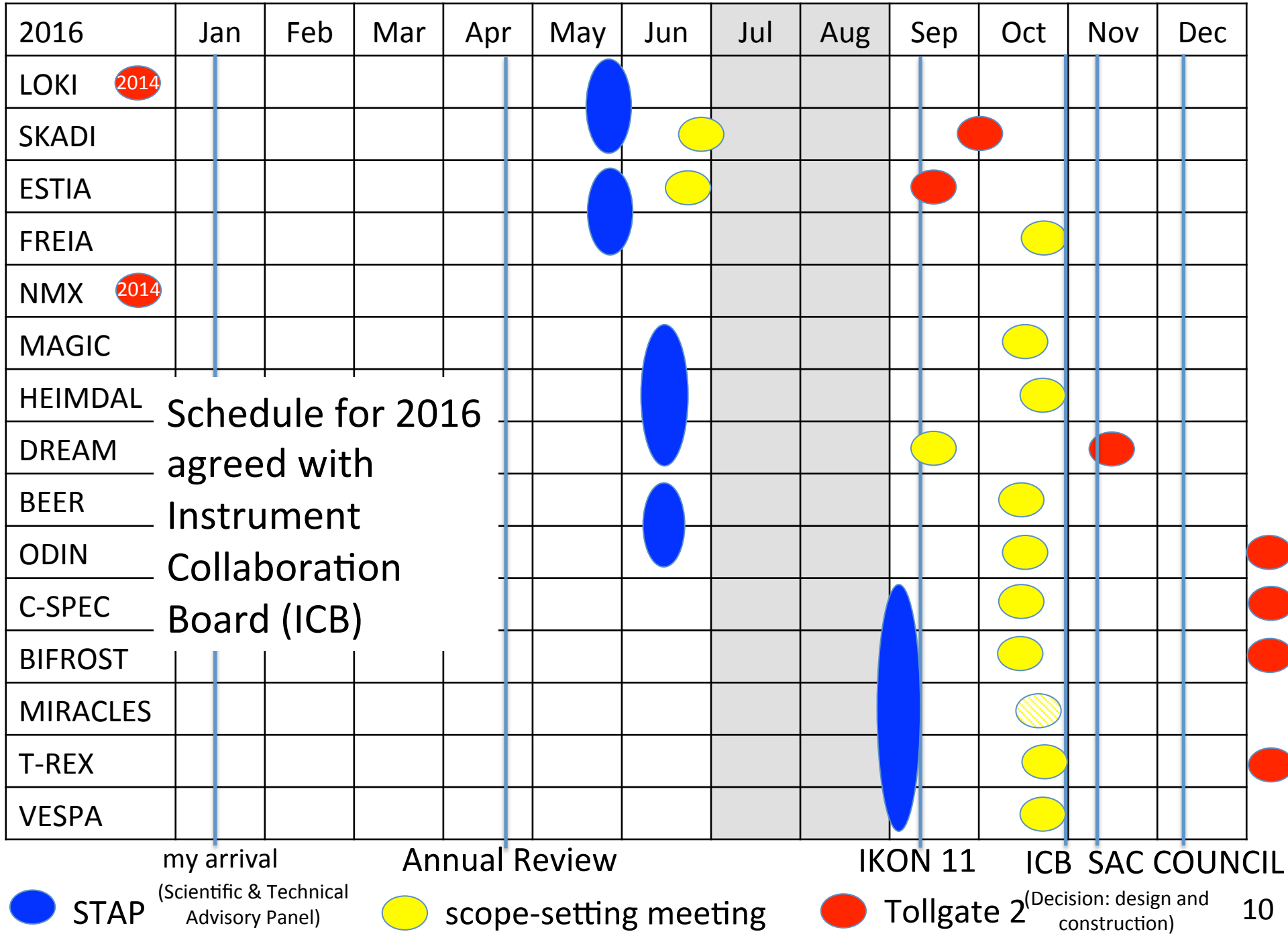
Safety systems acceptance review

- NSS approval

Tollgate 6 (ORR)

Operations readiness review

- NSS approval


2016
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
LOKI
2014
SKADI
ESTIA
FREIA
NMX
2014
MAGIC
HEIMDAL
DREAM
BEER
ODIN
C-SPEC
BIFROST
MIRACLES
T-REX
VESPA
Schedule for 2016 agreed with Instrument Collaboration Board (ICB)
my arrival
Annual Review
IKON 11
ICB
SAC
COUNCIL
STAP
(Scientific & Technical Advisory Panel)
scope-setting meeting
Tollgate 2
(Decision: design and construction)

2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LOKI 2014												
SKADI												
ESTIA												
FREIA												
NMX 2014												
MAGIC												
T-REX												
VESPA												

my arrival (Scientific & Technical Advisory Panel)

Annual Review

IKON 11

ICB

SAC

COUNCIL

STAP

scope-setting meeting

Tollgate 2 (Decision: design and construction)

Potential order of commencement of operation of first 8 instruments (August 2023)

2nd Annual Review Recommendation (0.5)

Prioritisation of instruments within budget must ensure that the first tranche of instruments (8) is ready to deliver world-class science at the start of user operations (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	**LOKI (ISIS)** or SKADI (FZJ)
	Reflectometry	**ESTIA (PSI)** or FREIA (ISIS)
Diffraction	Powder Diffraction	**DREAM (FZJ)** or HEIMDAL (ÅU)
	Single crystal diffraction	**MAGIC (LLB)** or NMX (ESS)
Engineering	Strain scanning	**BEER (HZG/NPI)**
	Imaging and tomography	**ODIN (TUM/PSI)**
Spectroscopy	Direct Geometry	**C-SPEC (TUM)** or T-REX (FZJ)
	Indirect Geometry	**BIFROST (DTU)**, MIRACLES (Bilbao), VESPA (CNR)

Instruments in Bold type to be operational by Aug 2023

Neutron Beam Instrument Draft Schedule

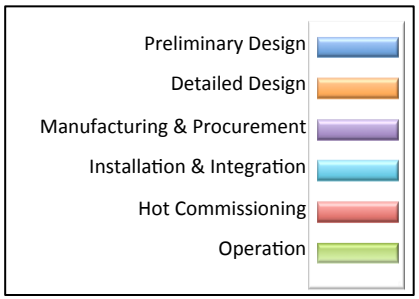
V1.6, 7th April 2016

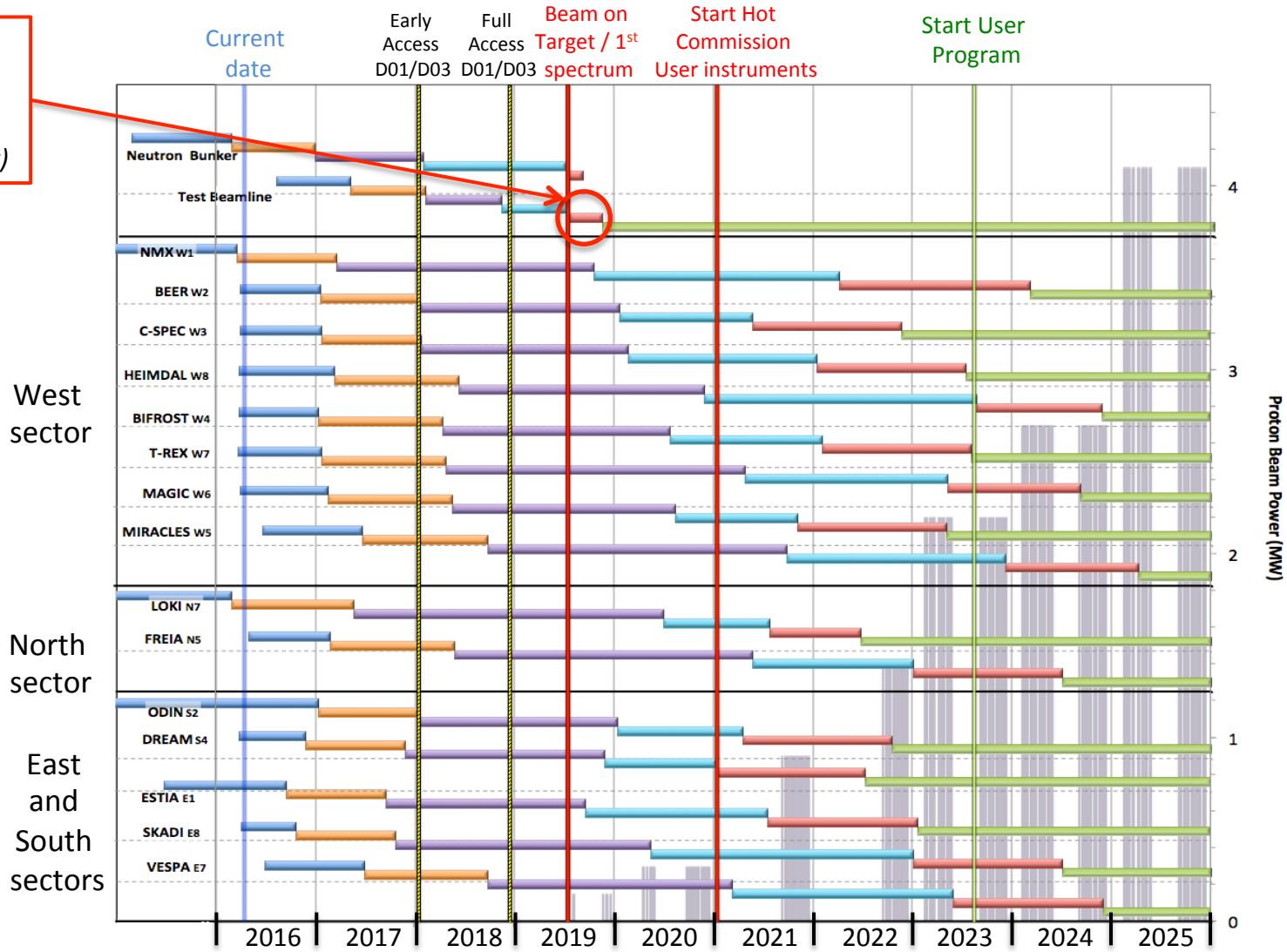
Commissioning of test beam – to demonstrate performance and inform instrument projects

(test beamline not yet in budget)

Notes;

- The order of completion 1- 8 chosen for science and deliverability
- Shift 9-16 to focus on 1-8 for early science success
- HC start;
  - E ≥ 200 MeV
  - P ≥ 200 kW
  - January 2021





NSS Project Instruments MOU Status

MOU Current Status (April-2016)

- MOU Signed
- MOU Can be Signed
- Partners waiting for funding

EUROPEAN SPALLATION SOURCE

class	Instrument	In-kind Partners (% contribution)	Cost Book (M€)	Cost Target (M€)
Large scale structures	LOKI broadband SANS	**UK (ISIS)**	12.2	
	SKADI general-purpose SANS (note 1)	**DE(FZJ 50%) + FR(LLB 50%)**		12
	ESTIA focusing reflectometer	**CH(PSI)**		9
	FREIA liquids reflectometer	**UK (ISIS)**		9
Diffraction	NMX macromolecular crystallography	**ESS (<30%) +** HU (Wigner and Centre for Energy Research) + FR (LLB) + NO (Bergen Uni)	11.7	
	DREAM powder diffractometer (bispectral)	**DE(FZJ 75%) +** FR(LLB 25%)		12
	HEIMDAL hybrid diffractometer	**DK(AU 30%)** +CH(PSI) +NO (IFE)		12
	MAGIC magnetism single-crystal diffractometer	**FR (LLB 65%)** + DE (FZJ 20%) + CH (PSI 15%)		12
Engineering	BEER engineering diffractometer	**DE (HZG 50%), CZ (NPI 50%)**		12
	ODIN multi-purpose imaging	**ESS** -> DE(TUM 50%) +CH (PSI 50%)		9
Spectroscopy	C-SPEC cold chopper spectrometer	**DE(TUM 50%) + FR(LLB 50%)**		15
	BIFROST extreme-environments spectrometer	**DK(DTU/KU 30%)** +CH(PSI) + HU(Wigner) +NO (IFE) + FR(LLB)		12
	T-REX bispectral chopper spectrometer	**DE (FZJ 75%)** + IT (CNR 25%)		15
	VESPA vibrational spectroscopy	**IT** (CNR) + UK (ISIS)		12
	MIRACLES backscattering spectrometer	ES(Bilbao) +FR(LLB) +HU (Wigner) + ESS		12
	16th Spectrometer **(VOR or Spin-Echo, Decide 2018)**	Wigner Institute (HU) for VOR *or* Juelich and TUM for Spin-Echo		12
	16 instruments	**cost**	**188.9**	
	neutron guide bunker	CZ, IT, D, F,…		14.6
		total cost (with bunker)		**203.5**

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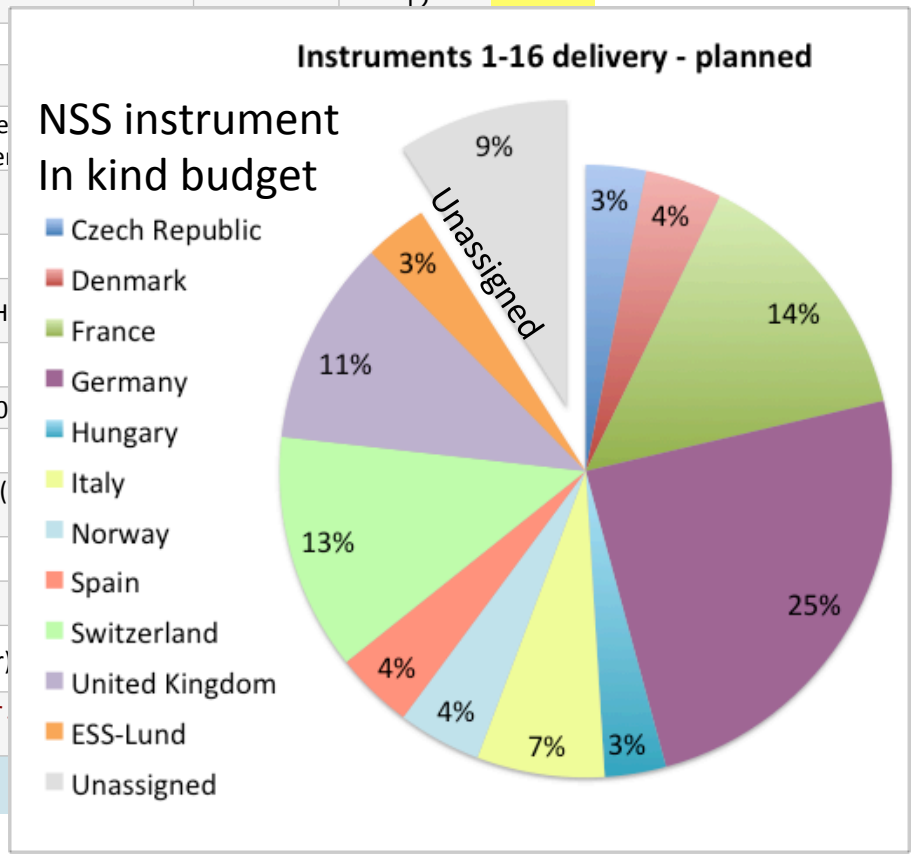


Conclusions I

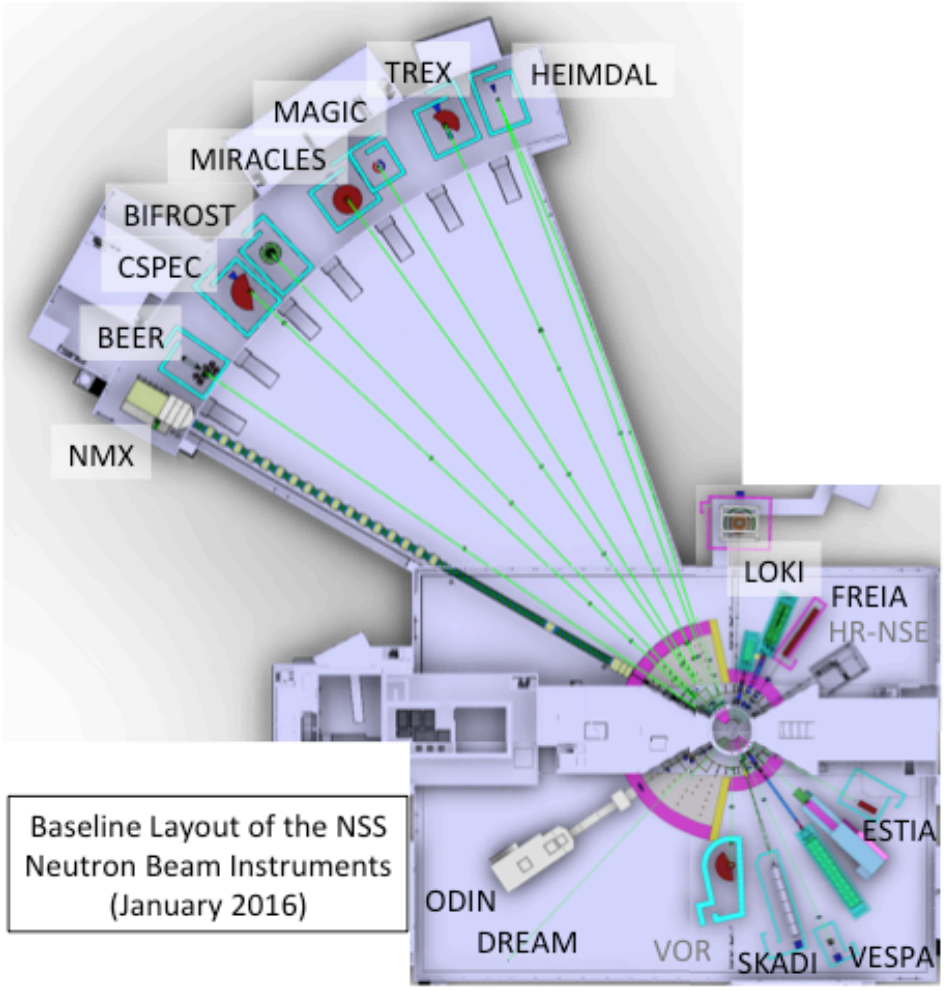
- Decisions on the first 16 instruments
- For all remaining instruments: scope setting meetings before November 2016 agreed with ICB
- Critically revise NSS budget
- Requires hard work by NSS and in-kind partners to meet the deadlines
- After involvement of ICB and SAC

⇒ Proposal to council on

  - updated overall budget
  - sequencing of instruments
  - how to **insure early science success**

⇒ **Strategic decision by council on instrumentation at ESS in December 2016**

Conclusions II:



Baseline Layout of the NSS Neutron Beam Instruments (January 2016)

- ESS plans foresee funding for upgrading instruments 1-16 to their full scope and for the instruments 17-22 in the pre-operations and operations budget
- Council has instituted an *Operations Working Group* which will report to council by the end of the year
- Proposal to council on the pre-operations and operations budget as well as on models how to share the cost (=> presentation D. Aryriou)
- This initiative comes at the right time to ensure that funding is available for 22 instruments