



EUROPEAN
SPALLATION
SOURCE

The challenge for 2016: Matching instrument scope with budget

Andreas Schreyer

European Spallation Source ERIC

IKON10

Düsseldorf/Jülich

February 17, 2016

ESS Project Scope on Instruments (NSS)



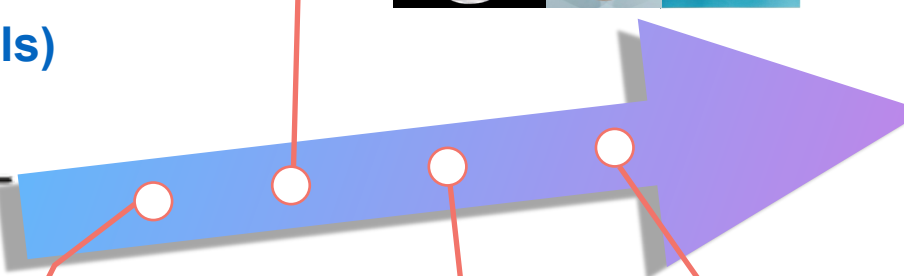
NSS Scope: 22 “public” instrument suite of ESS together with a technical and scientific support infrastructure that enables scientific excellence and high quality scientific user service.

Science (Publications)

Sample Environment



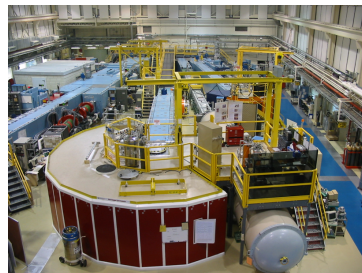
Ideas (Proposals)



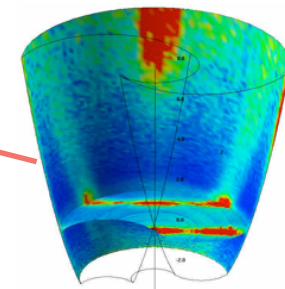
Science Support Laboratories



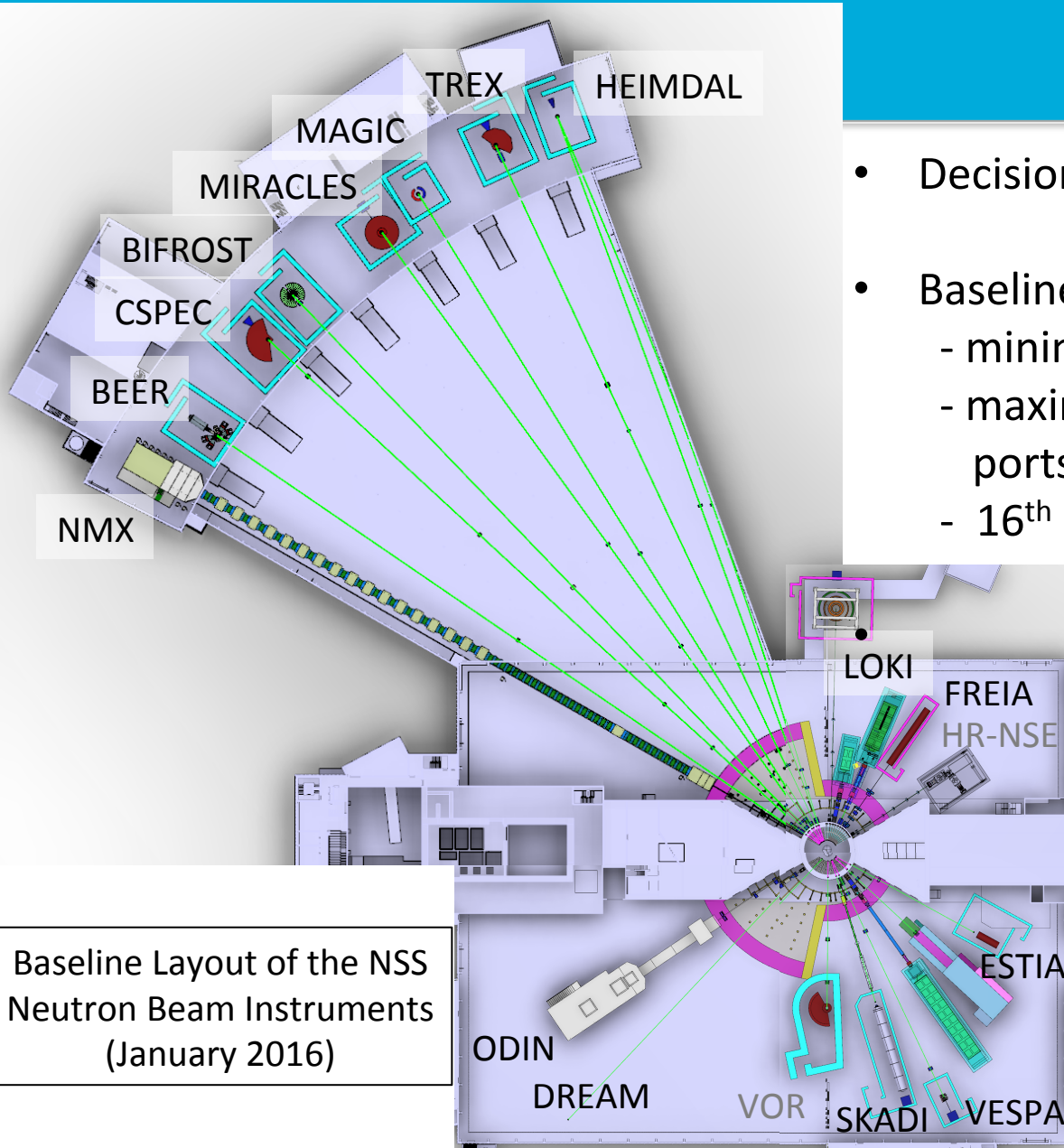
22 Instruments



Analysis and Visualisation Software



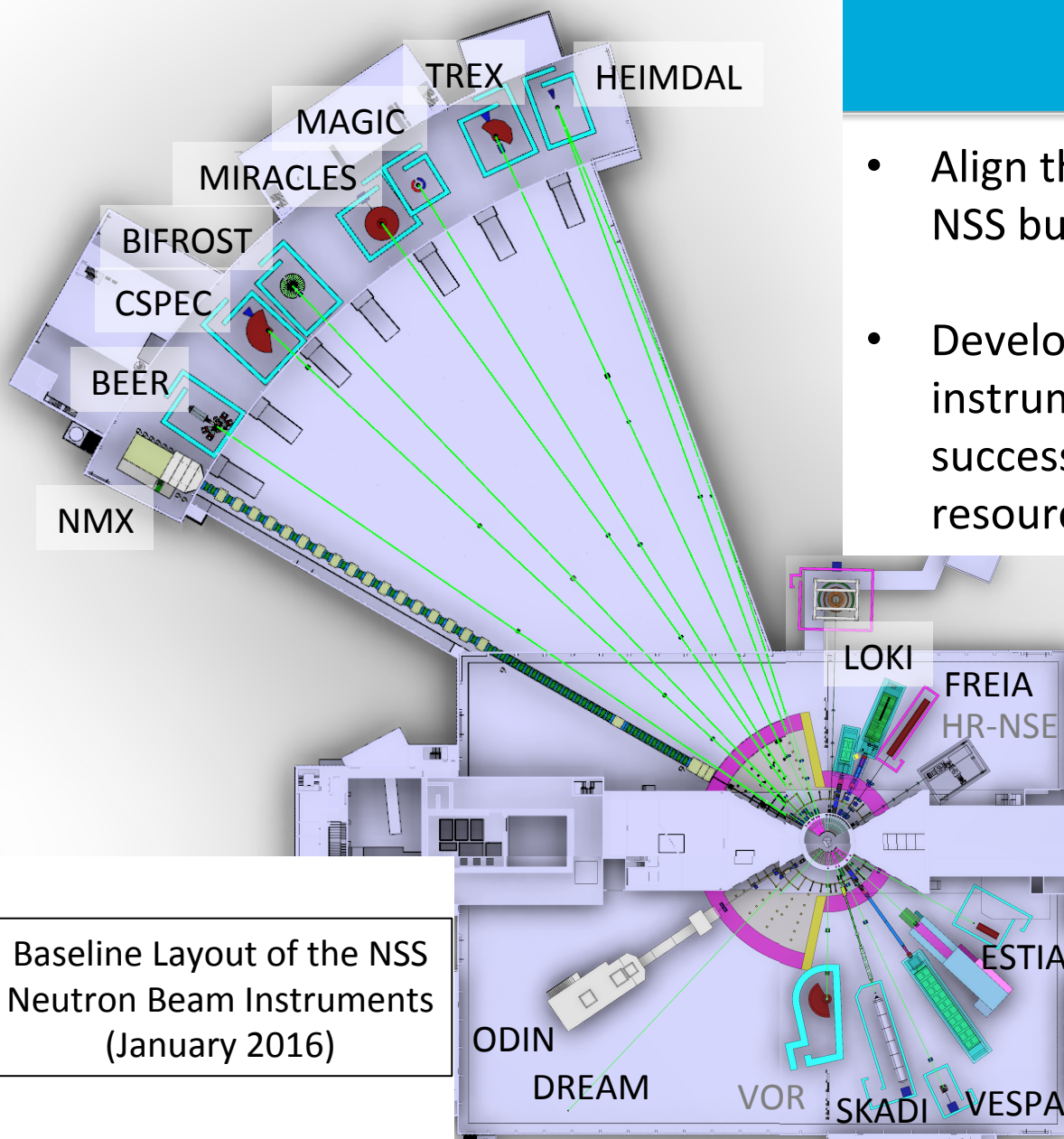
NSS: Where we stand today



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
- Working on entering several new instruments into phase 1 (prel. engineering design)
- Software integration (DMSC with all internal and external partners, test lab)

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

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: no incentive to design to budget
 - Instrument proposals were optimized for scientific quality to convince SAC/STAP
 - There are not enough funds available to cover the full scope of all 16 instruments within the current NSS budget:
 - Sum of the “as proposed” budget for all 16 instruments: \cong 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)

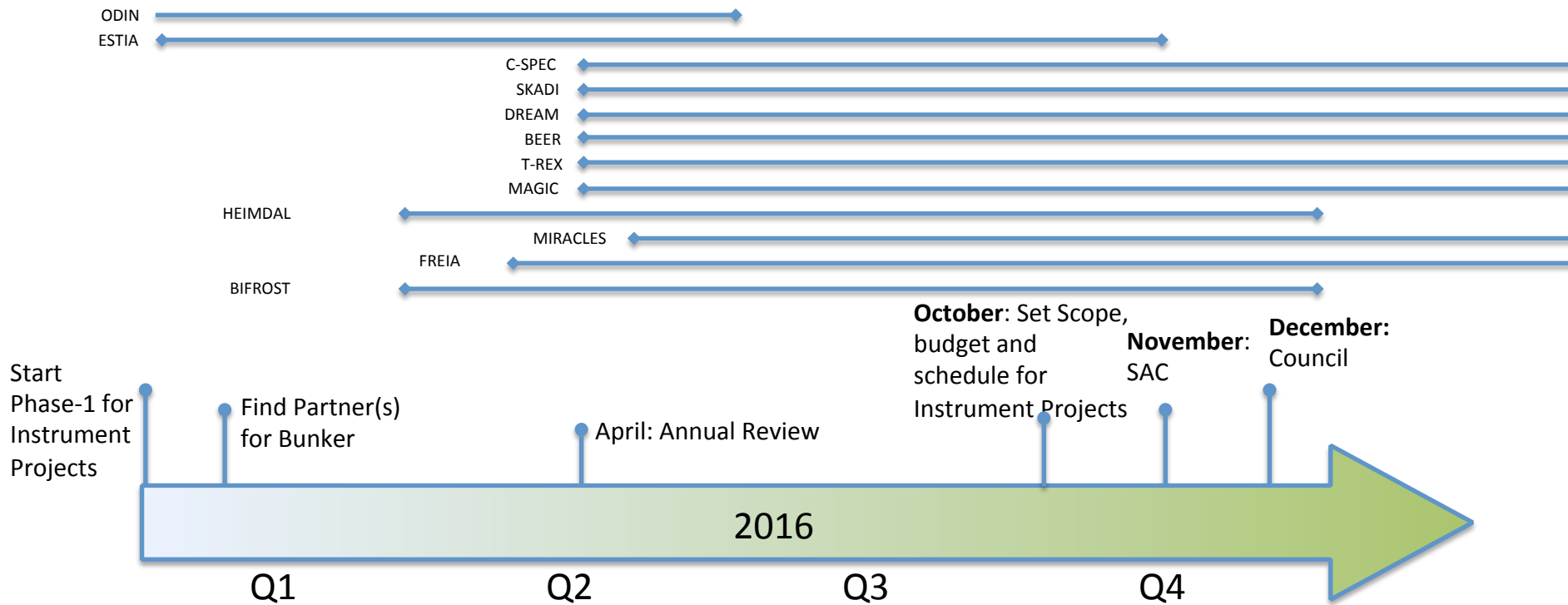
Decrease individual instrument budget AND increase NSS instrument budget

The way forward

- In general the day one version of any instrument does not need to contain all bells and whistles as proposed
- Requires intense discussions with all partners on the budget for the day one version (phase 1, scope setting meetings before Dec. 2016)
- 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 to bring the instruments to their full scope as we go along (pre-operations budget)

Schedule until December 2016

- Begin phase 1 on more instruments to arrive at an affordable instrument budget
- Scope setting meetings for many more instruments before Dec 2016

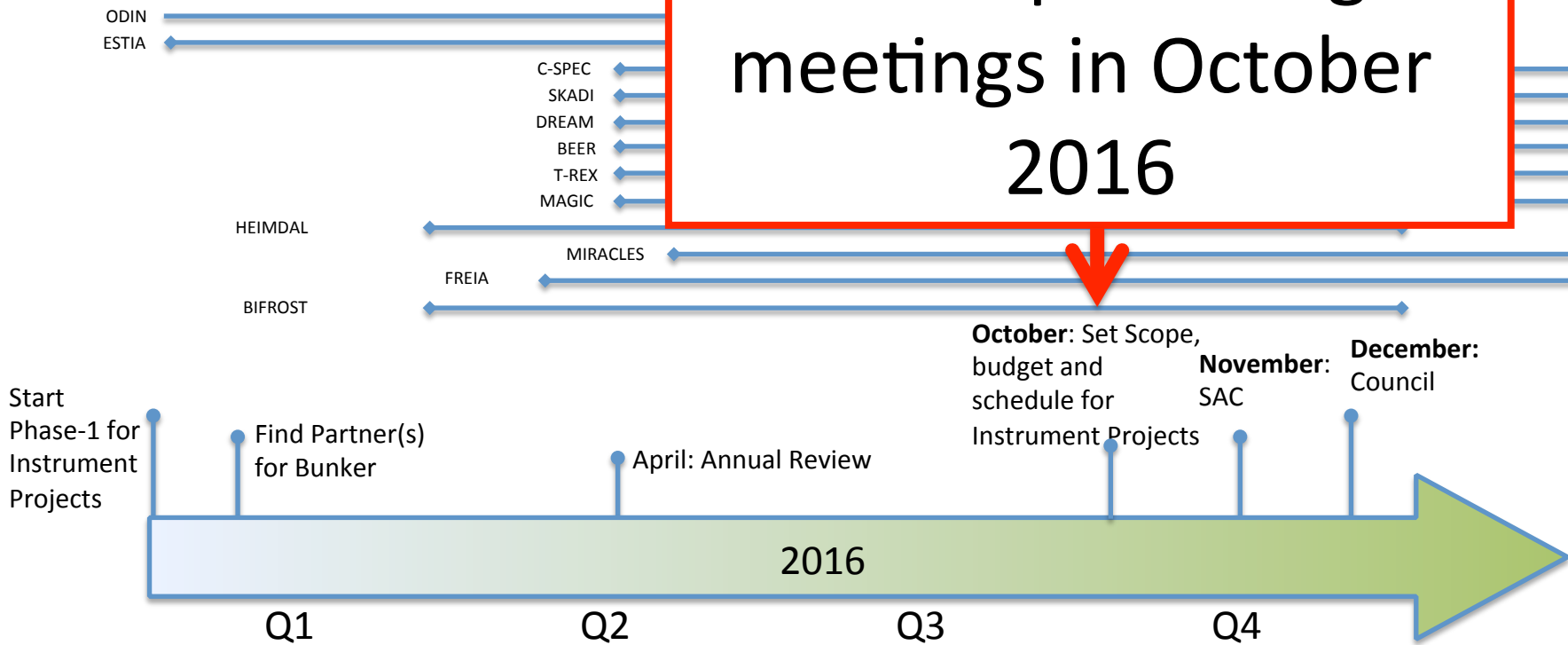


- The completeness of the proposal we can present to council on Dec 2016 will critically depend the availability of in-kind resources for phase1

Schedule until December 2016

- Begin phase 1 on more instruments within budget
- Scope setting meetings for more instruments

Please propose dates for scope setting meetings in October 2016



- The completeness of the proposal we can present to council on Dec 2016 will critically depend the availability of in-kind resources for phase1

Candidate Neutron Instruments for early delivery to address recommendations of 2nd Annual Review



- Review the schedule for initial operation from Dec 2019 through 2022, with the goal of optimising scientific success from the start of user operation in 2023.
- Prioritisation of instruments within budget must ensure that the first tranche of instruments (8±2) is ready to deliver world-class science at the start of user operations (2023)

| Instrument Class | Sub-class | Candidates |
|------------------------|----------------------------|----------------------------|
| Large Scale Structures | Small Angle Scattering | LOKI or SKADI |
| | Reflectometry | ESTIA or FREIA |
| Diffraction | Powder Diffraction | DREAM or HEIMDAL |
| | Single crystal diffraction | MAGIC or NMX |
| Engineering | Strain scanning | BEER |
| | Imaging and tomography | ODIN |
| Spectroscopy | Direct geometry | C-SPEC or T-REX |
| | Indirect geometry | BIFROST, MIRACLES or VESPA |

Neutron Beam Instrument Schedule;

S J Kennedy V1.4, 10th Feb 2016

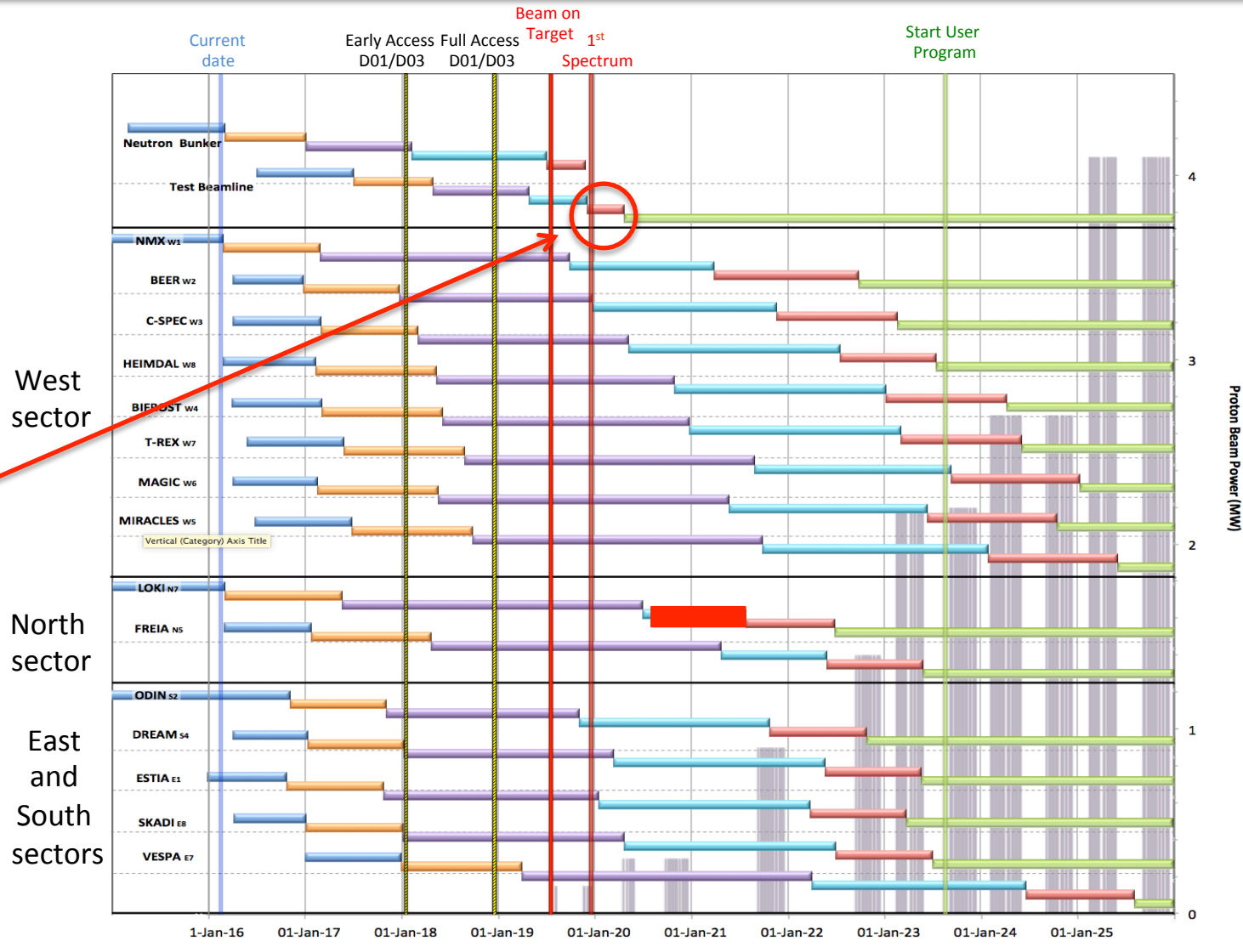


Notes;

- The order of completion here is still notional
- For discussion at ICB on 7th March
- Actual schedule critically depends on in-kind partners
- Agreements with in-kind partners pending

ESS would like to start Hot Commissioning of the first Neutron Instrument here.

- It should be capable of producing high impact science quickly (e.g. NPD, SANS, Imaging)



Possible order of commencement of operation

- Review the schedule for initial operation from Dec 2019 through 2022, with the goal of optimising scientific success from the start of user operation in 2023.
- Prioritisation of instruments within budget must ensure that the first tranche of instruments (8±2) is ready to deliver world-class science at the start of user operations (2023)

| Instrument Class | Sub-class | Candidates |
|------------------------|----------------------------|----------------------------|
| Large Scale Structures | Small Angle Scattering | LOKI (2) or SKADI (8) |
| | Reflectometry | ESTIA (5) or FREIA |
| Diffraction | Powder Diffraction | DREAM (6) or HEIMDAL |
| | Single crystal diffraction | MAGIC or NMX (1) |
| Engineering | Strain scanning | BEER (4) |
| | Imaging and tomography | ODIN (3) |
| Spectroscopy | Direct geometry | C-SPEC (7) or T-REX |
| | Indirect geometry | BIFROST, MIRACLES or VESPA |

Order of commencement of operation in the Gantt chart on the previous slide

Possible criteria for selection:

- Review of scientific goals of the user community
 - Prioritisation of instruments for early operation
- Scientific relevance, chances for early impact
 - Prioritize one instrument per key partner
 - Use of established technologies
 - Availability of design and production resources
 - Availability of funding
 - Availability of skilled personnel
 -

2, with the
in 2023.

tranche of
of user

| Instrument Classification | | |
|---------------------------|----------------------------|----------------------------|
| Large Scale Structures | Small Angle Scattering | LOKI (2) or SKADI (8) |
| | Reflectometry | ESTIA (5) or FREIA |
| Diffraction | Powder Diffraction | DREAM (6) or HEIMDAL |
| | Single crystal diffraction | MAGIC or NMX (1) |
| Engineering | Strain scanning | BEER (4) |
| | Imaging and tomography | ODIN (3) |
| Spectroscopy | Direct geometry | C-SPEC (7) or T-REX |
| | Indirect geometry | BIFROST, MIRACLES or VESPA |

NSS Project Instruments

MOU Status

MOU Current Status (Dec-2015)



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) + 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) + HU (Wigner) | | 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) | | 12 |
| | T-REX bispectral chopper spectrometer | DE (FZJ 75%) + IT (Perugia ~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 <u>or</u> Juelich and TUM for Spin-Echo | | 12 |
| | 16 instruments | cost | 188.9 | |
| | neutron guide bunker | CZ (Envinet?), IT | | 14.6 |
| | | total cost (with bunker) | | 203.5 |

NSS Project Instruments

MOU Status

MOU Current Status (Dec-2015)

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



| class | Instrument | In-kind Partners (% contribution) | Cost Book (M€) | Cost Target (M€) |
|------------------------|---|---|----------------|------------------|
| Large scale structures | LOKI broadband SANS | UK (ISIS) | | |
| | SKADI general-purpose SANS (note 1) | DE(FZJ 50%) + FR(LLB 50%) | | |
| | ESTIA focusing reflectometer | CH(PSI) | | |
| | FREIA liquids reflectometer | UK (ISIS) | | |
| Diffraction | NMX macromolecular crystallography | ESS (<30%) + HU (Wigner) + FR (LL Uni) | | |
| | DREAM powder diffractometer (bispectral) | DE(FZJ 75%) + FR(LLB 25%) | | |
| | HEIMDAL hybrid diffractometer | DK(AU 30%) + CH(PSI) + NO (IFE) + I | | |
| Spectroscopy | VESPA vibrational spectroscopy | IT (CNR) + UK (ISIS) | | |
| | MIRACLES backscattering spectrometer | ES(Bilbao) + FR(LLB) + HU (Wigner) | | |
| | 16th Spectrometer (VOR or Spin-Echo, Decide 2018) | Wigner Institute (HU) for VOR <u>or</u> J for Spin-Echo | | |
| 16 instruments | | cost | 188.9 | |
| | neutron guide bunker | CZ (Envinet?), IT | | 14.6 |
| | | total cost (with bunker) | | 203.5 |

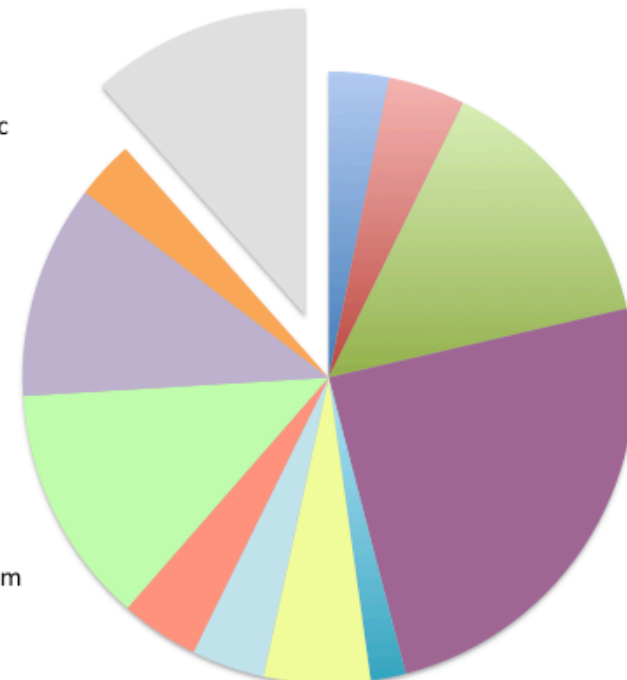
Main unassigned scope

6th Spectrometer (16th NBI), 50% VESPA, 25% MIRACLES, 6% NMX

+ Neutron Guide Bunker (~12-14 M€)

Instruments 1-16 delivery - under discussion

- Czech Republic
- Denmark
- France
- Germany
- Hungary
- Italy
- Norway
- Spain
- Switzerland
- United Kingdom
- ESS-Lund
- Unassigned



Conclusions I

- Phase 1 (preliminary engineering design) for as many instruments as possible => scope setting meetings in October 2016
- Please propose dates for scope setting meetings in October 2016 **now**
- Critically revise NSS budget
- Requires hard work by NSS and in-kind partners to meet the deadline

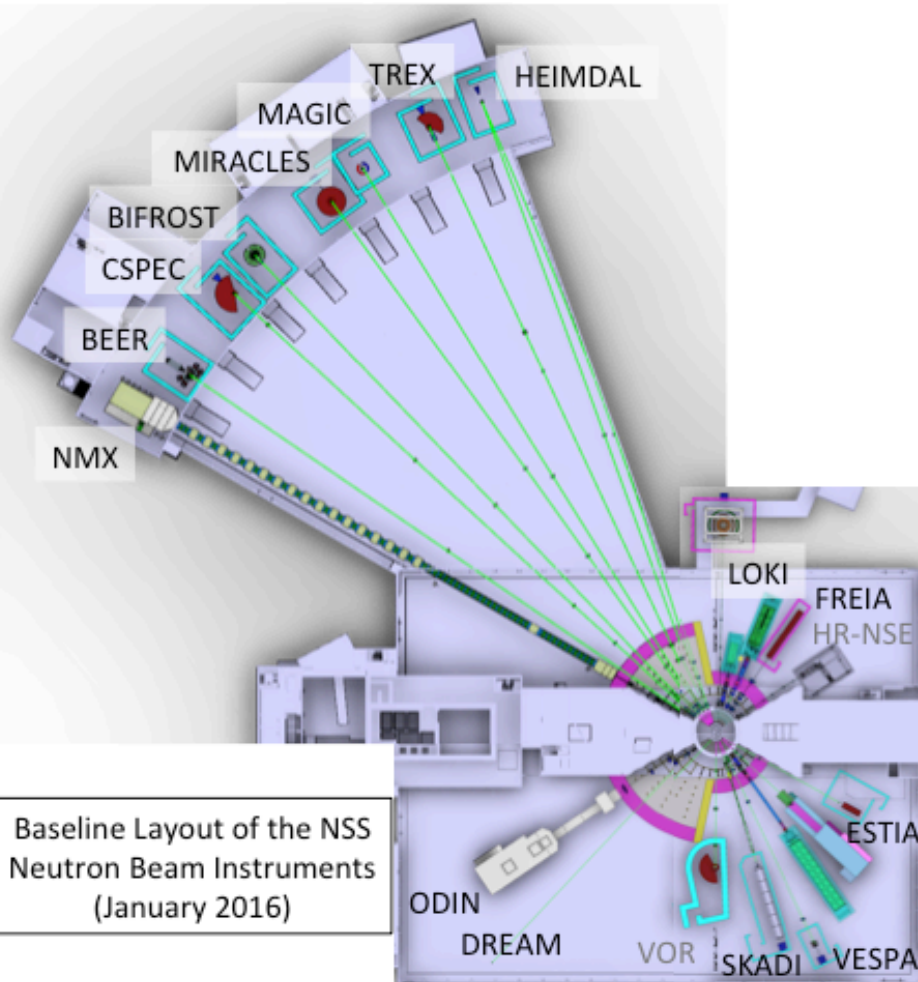
⇒ Proposal to council on

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

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



Conclusions II



- 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
- This initiative comes at the right time to ensure that funding is available for 22 instruments

ESS construction site on Jan 18, 2016



ESS construction site on Jan 18, 2016

