EUROPEAN
SPALLATION
SOURCE

ESS Vacuum System needs

Neutron Instruments

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VACUUM GROUP LEADER - ESS ERIC

2020-11-26

Agenda

1 Introduction: ESS Vacuum System

2 Neutron Instruments

3 Examples of experimental chambers

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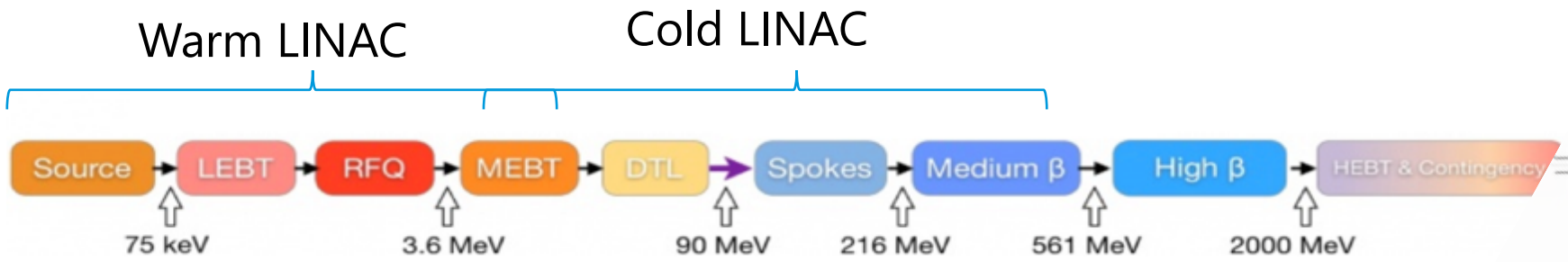
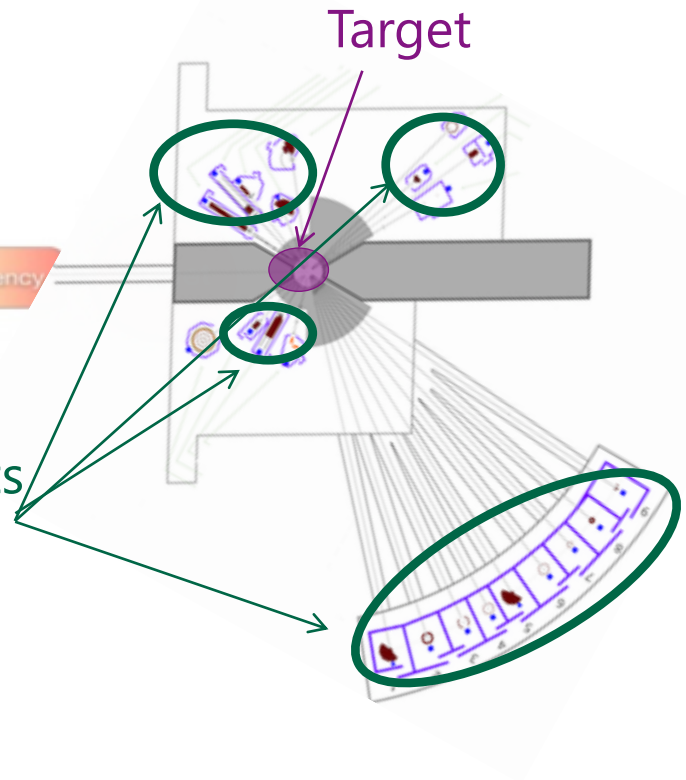
Introduction: ESS Vacuum System

ESS Vacuum System

A challenge together our partners





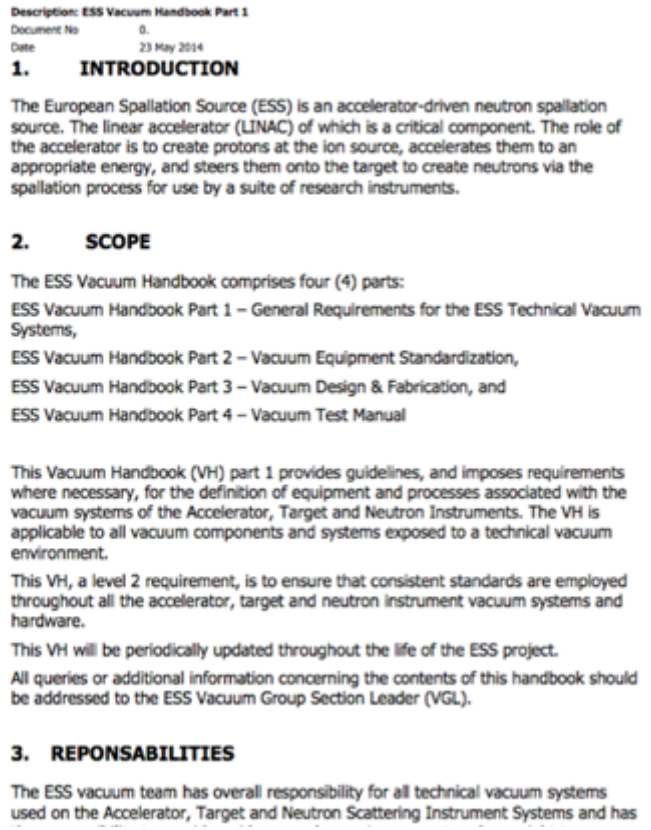
The **ESS Vacuum Group** is **responsible** for **all ESS vacuum systems**. This includes the Accelerator, Target, and the Neutron Instruments.

The main task of the team is to support the in kind contributions on the vacuum system and the **integrated vacuum design** of the ESS complex.

Vacuum Standardization

an Integrated Approach

- Working closely with our partners across the project: our **primary goal** is to promote the use of **common vacuum solutions, equipment and standards**. As a result a Vacuum Standardization meeting was held in February 2014 where equipment suitable for Standardization was agreed and reflected in the **ESS Vacuum Handbook**.
- An important element is the **Standardization of Procurement Policy** applied for the procurement of all "major" vacuum equipment. This policy ask the partners to participate on a single **Framework Agreement**.
- The **ESS Vacuum documents** (handbooks, rules or interfaces documents) are the majors documents that covers the requirements for the accelerator, target and instruments and is applicable to all ESS in kind Partners.



Description: ESS Vacuum Handbook Part 1
Document No 0.
Date 23 May 2014

1. INTRODUCTION

The European Spallation Source (ESS) is an accelerator-driven neutron spallation source. The linear accelerator (LINAC) of which is a critical component. The role of the accelerator is to create protons at the ion source, accelerates them to an appropriate energy, and steers them onto the target to create neutrons via the spallation process for use by a suite of research instruments.

2. SCOPE

The ESS Vacuum Handbook comprises four (4) parts:

ESS Vacuum Handbook Part 1 – General Requirements for the ESS Technical Vacuum Systems,

ESS Vacuum Handbook Part 2 – Vacuum Equipment Standardization,

ESS Vacuum Handbook Part 3 – Vacuum Design & Fabrication, and

ESS Vacuum Handbook Part 4 – Vacuum Test Manual

This Vacuum Handbook (VH) part 1 provides guidelines, and imposes requirements where necessary, for the definition of equipment and processes associated with the vacuum systems of the Accelerator, Target and Neutron Instruments. The VH is applicable to all vacuum components and systems exposed to a technical vacuum environment.

This VH, a level 2 requirement, is to ensure that consistent standards are employed throughout all the accelerator, target and neutron instrument vacuum systems and hardware.

This VH will be periodically updated throughout the life of the ESS project.

All queries or additional information concerning the contents of this handbook should be addressed to the ESS Vacuum Group Section Leader (VGL).

3. REPONSABILITIES

The ESS vacuum team has overall responsibility for all technical vacuum systems used on the Accelerator, Target and Neutron Scattering Instrument Systems and has

https://europeanspallationsource.se/accelerator/specialized-technical-services#vacuum

Vacuum Group

What we do

- Design of the Vacuum components and systems following specific performances for Accelerator, Target and Neutron Instruments :
  - Vacuum “state of art”, (experienced team and internal development),
  - Simulations codes (Monte Carlo/deterministic),
  - Vacuum standards (participation on ISO committees) including safety standards,
  - Long life-cycle and cost effective (minimize maintenance and down time),
- Procurement of Vacuum Components (pumps, gauges and valves) – Vacuum Equipment Standardization
- Installation of Vacuum components and systems for in kind contributions
- Provide the Vacuum Control System (following ESS Electrical standards and ICS guide line),
- Approval and test of all material exposed to vacuum (ESS Vacuum Handbook policy),
- Perform factory and site acceptance test and leak test (requirements and procedure agreed previously).

ESS Vacuum System

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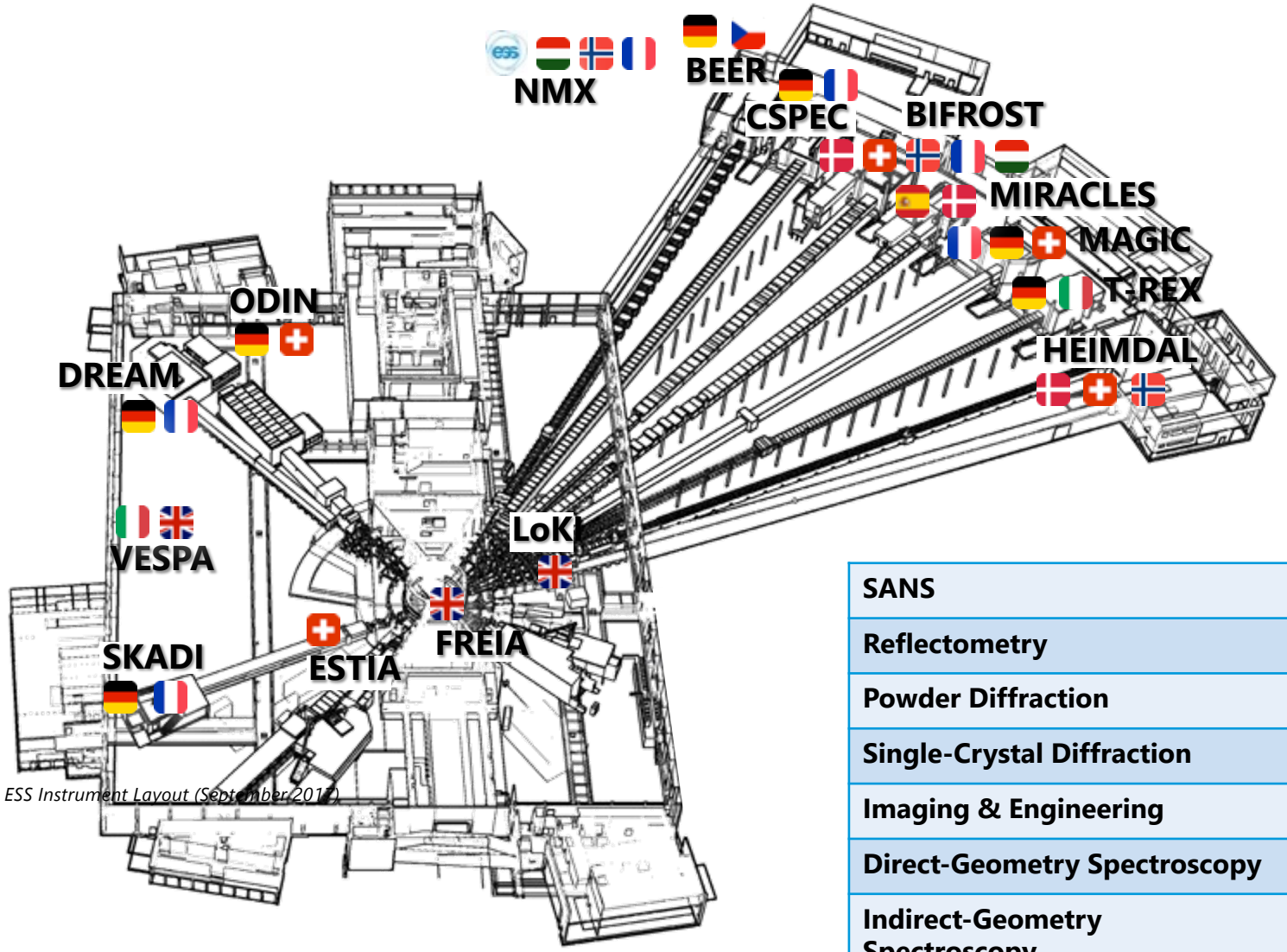
Neutron Instruments

Neutron Instrument Suite

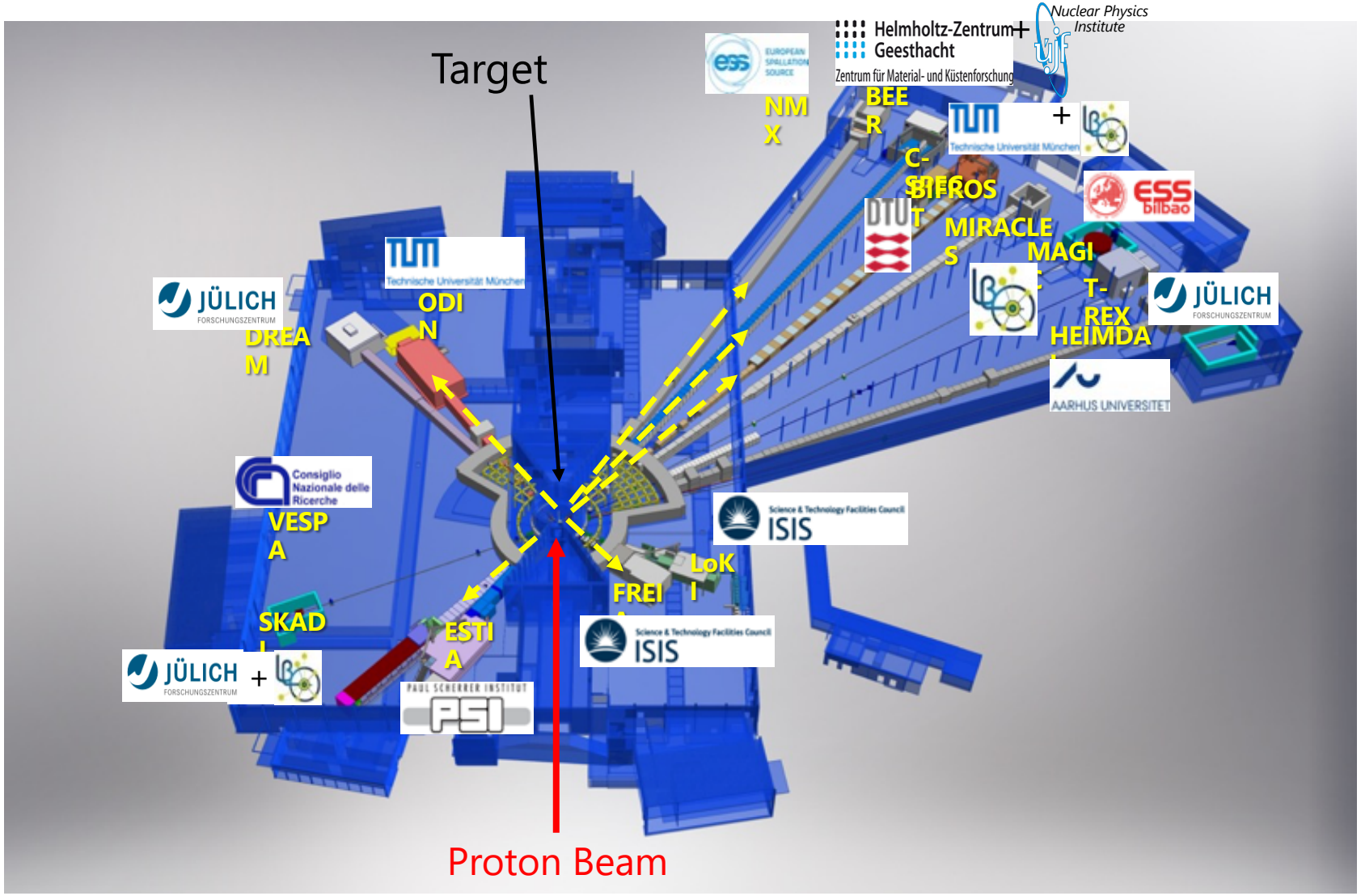


ESS Instrument Layout (September 2017)

SANS	**LOKI,** *SKADI*
Reflectometry	**ESTIA**, FREIA
Powder Diffraction	**DREAM**, HEIMDAL
Single-Crystal Diffraction	**MAGIC**, *NMX*
Imaging & Engineering	**ODIN**, **BEER**
Direct-Geometry Spectroscopy	**CSPEC**, *T-REX*
Indirect-Geometry Spectroscopy	**BIFROST**, MIRACLES, VESPA

Neutron Instruments

ESS lead partners for Instruments constructions



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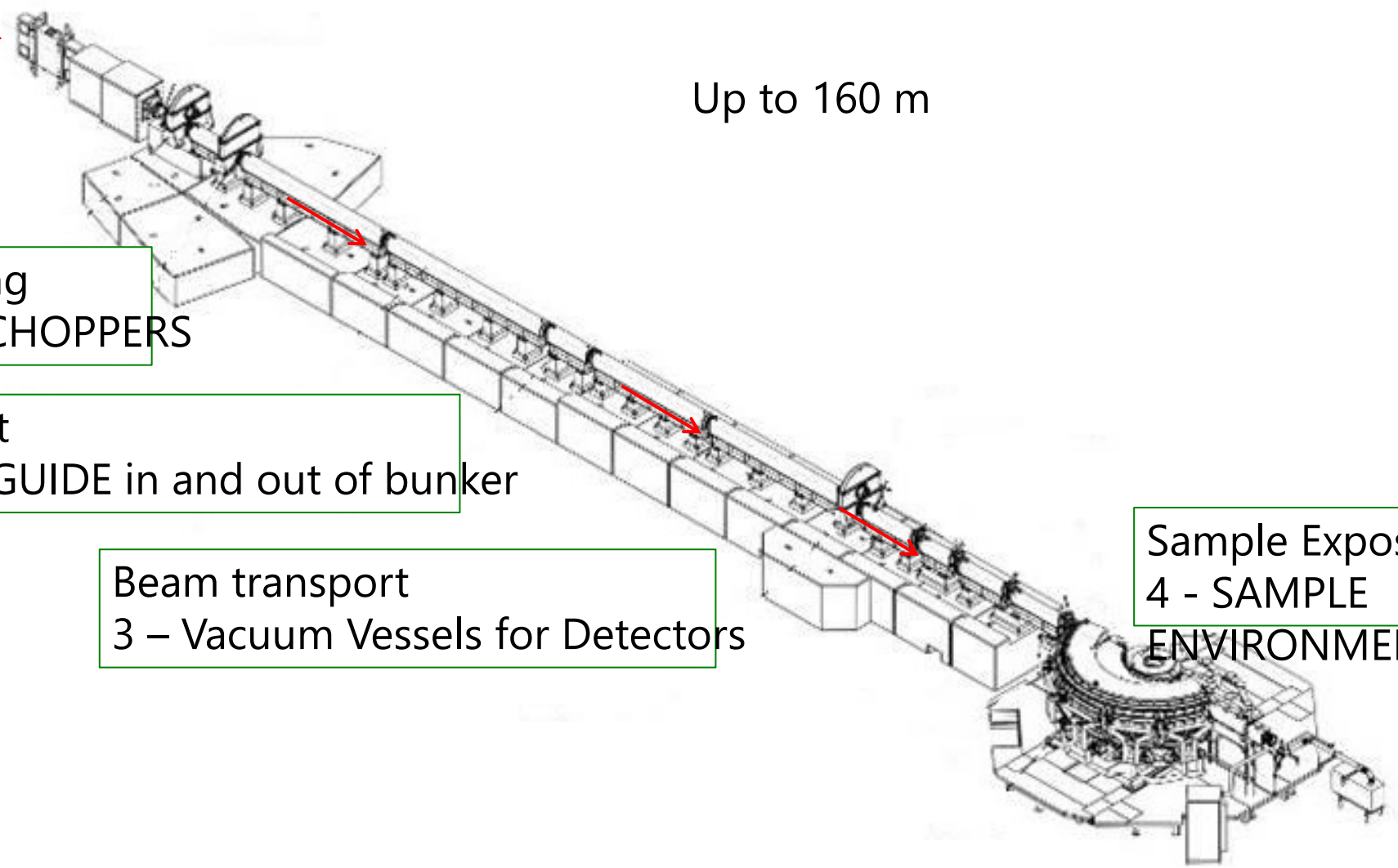
Examples

Typical vacuum system Instruments

Sub-headline to strengthen the headline above

Neutrons from Target



Up to 160 m

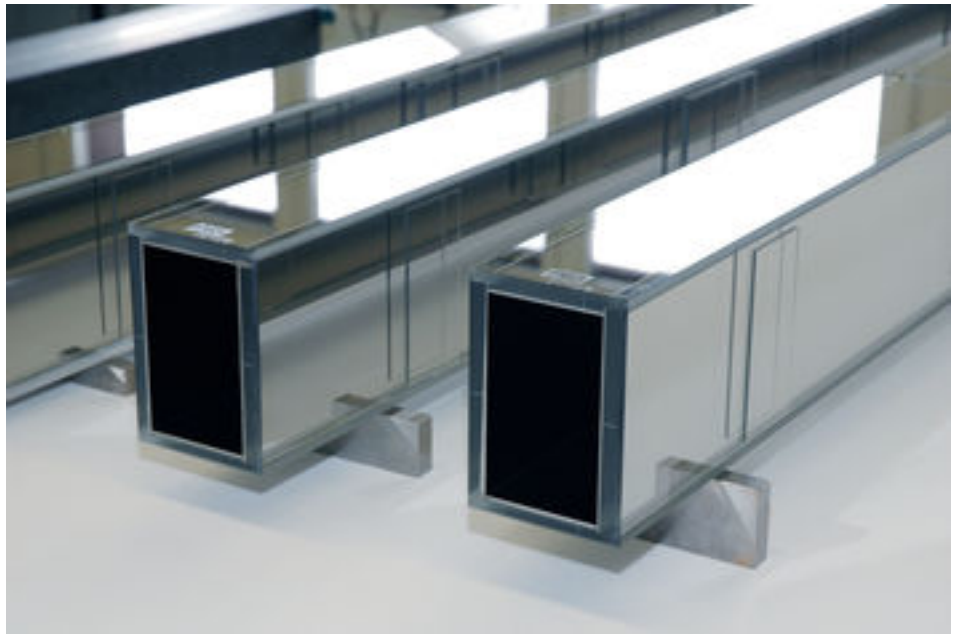
Beam conditioning
1 - HIGH SPEED CHOPPERS

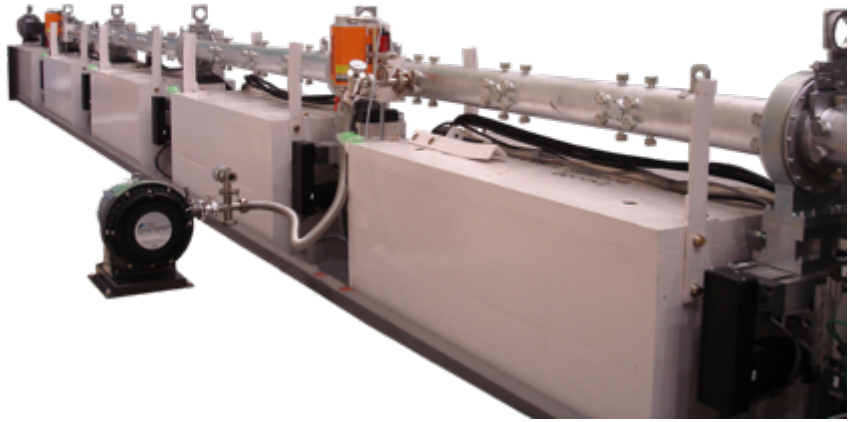
Beam transport
2 - NEUTRON GUIDE in and out of bunker

Beam transport
3 – Vacuum Vessels for Detectors

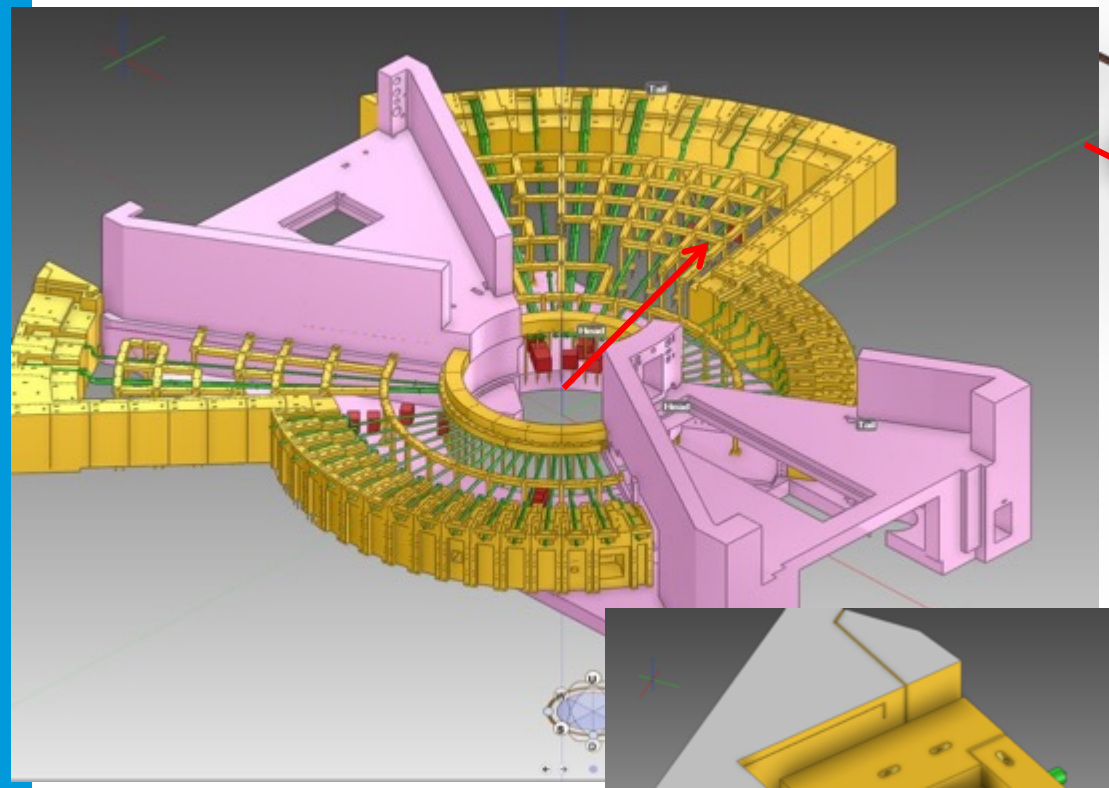
Sample Exposure
4 - SAMPLE ENVIRONMENT

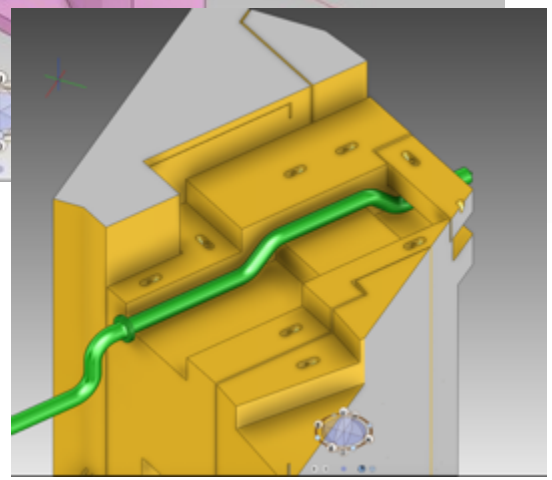
Neutron Guides

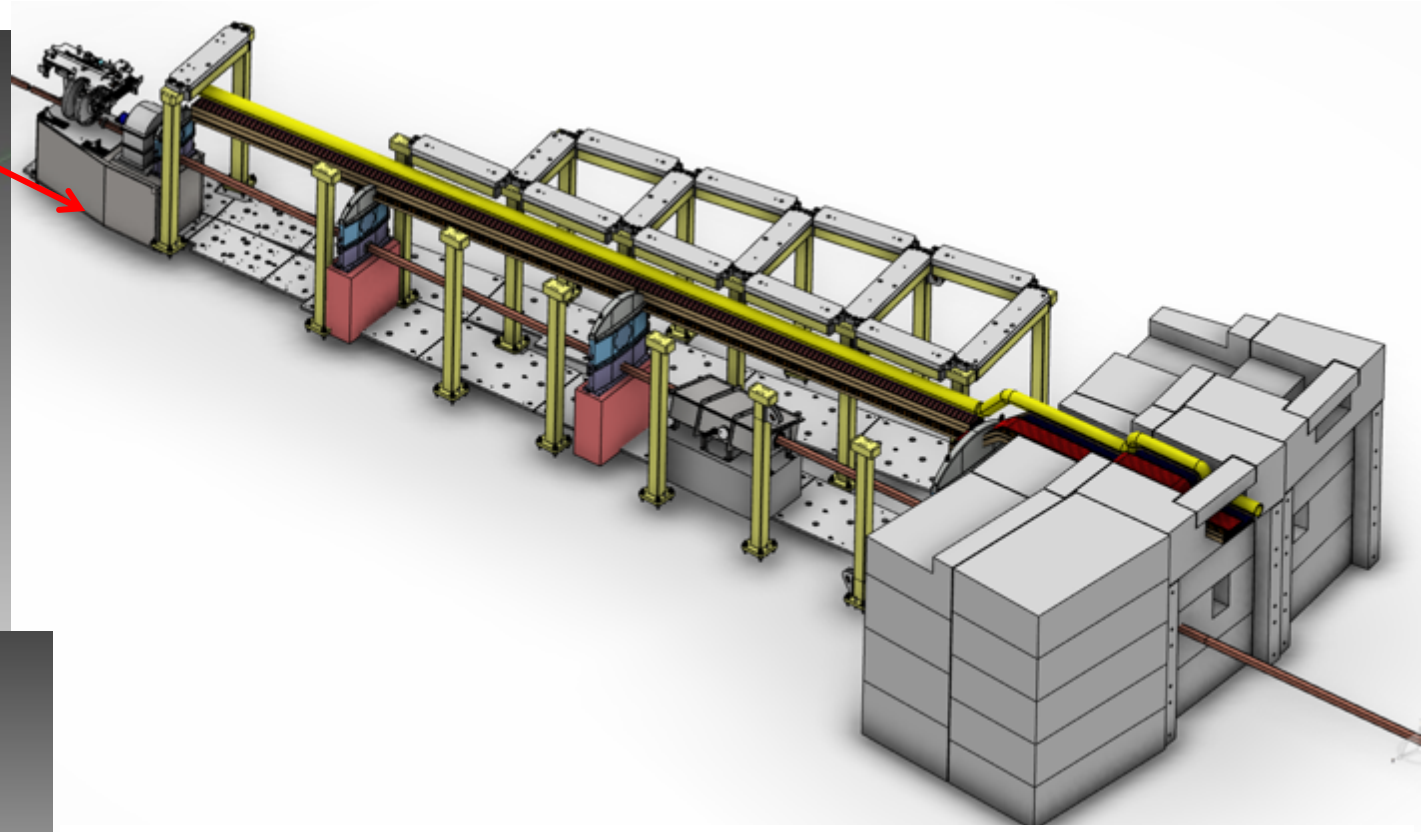




Vacuum Modeling Bunker



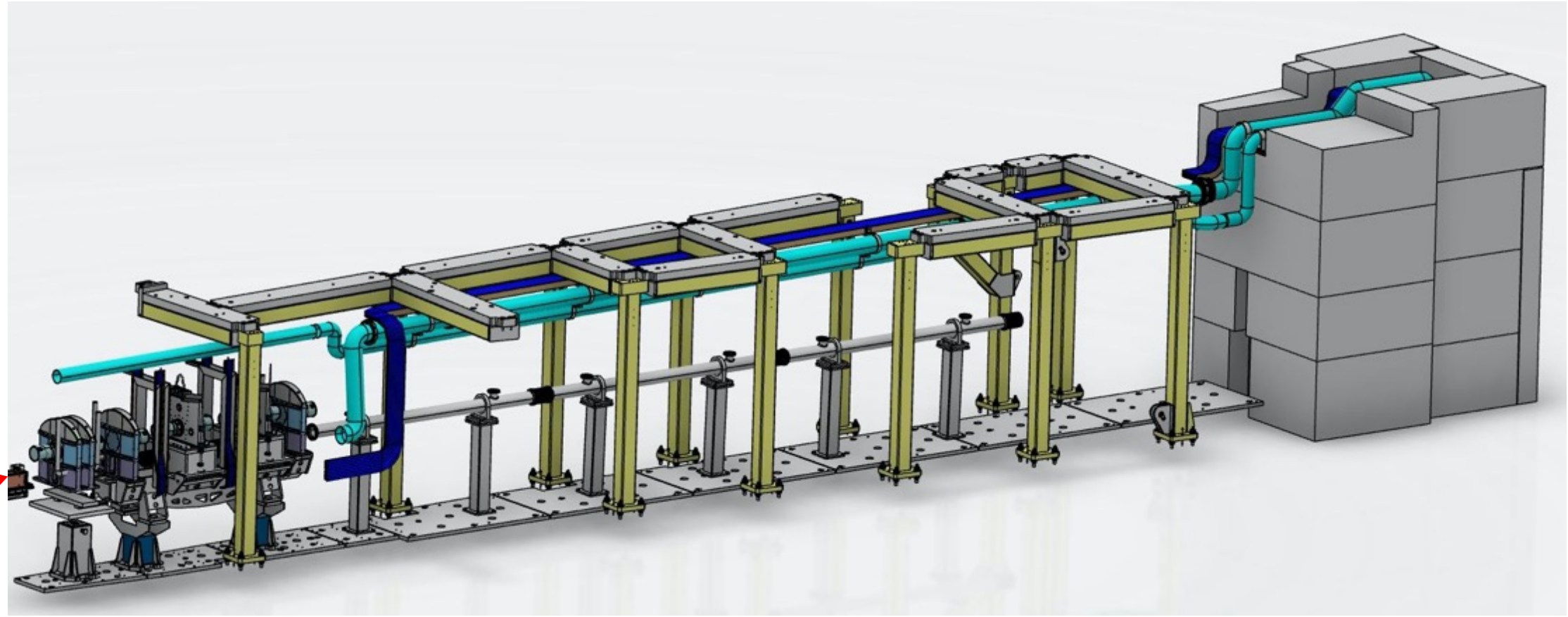




Main problem is conductance. Vacuum pumps are up to 24 m away from neutron beam pipe. A Vacuum manifold has limited space to go through the bunker wall. Vacuum specification equivalent to UHV, same as particle accelerators including material limitations on the chambers sealing due high activation by neutrons.

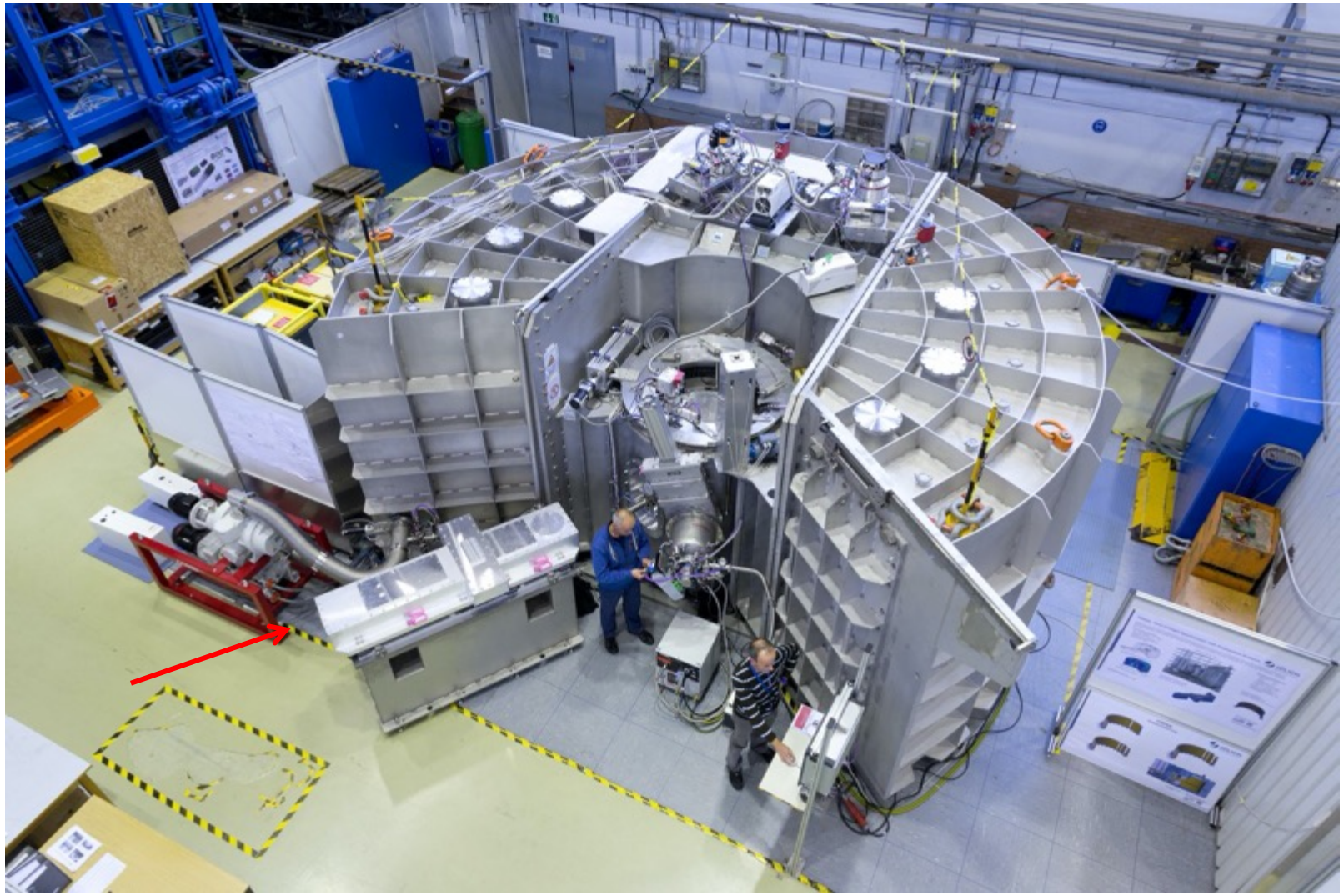
Vacuum Modeling Bunker

BEER instrument



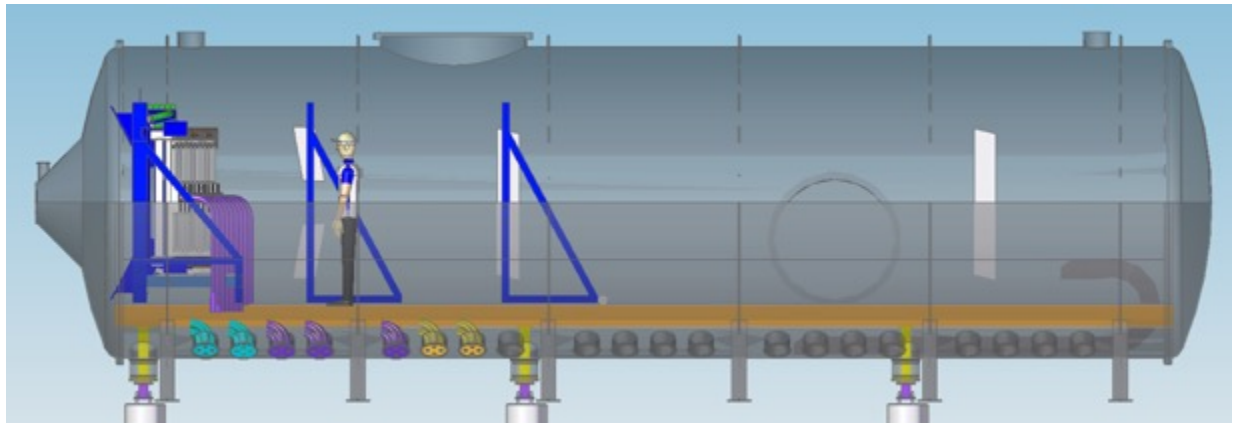
Vacuum Modeling Bunker

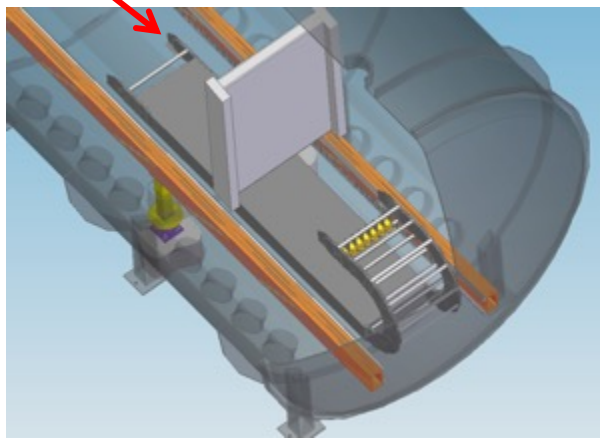
TOPAS vessel for FRMII, similar to T-Rex 90 m^3 instrument



Vacuum Modeling Experiment

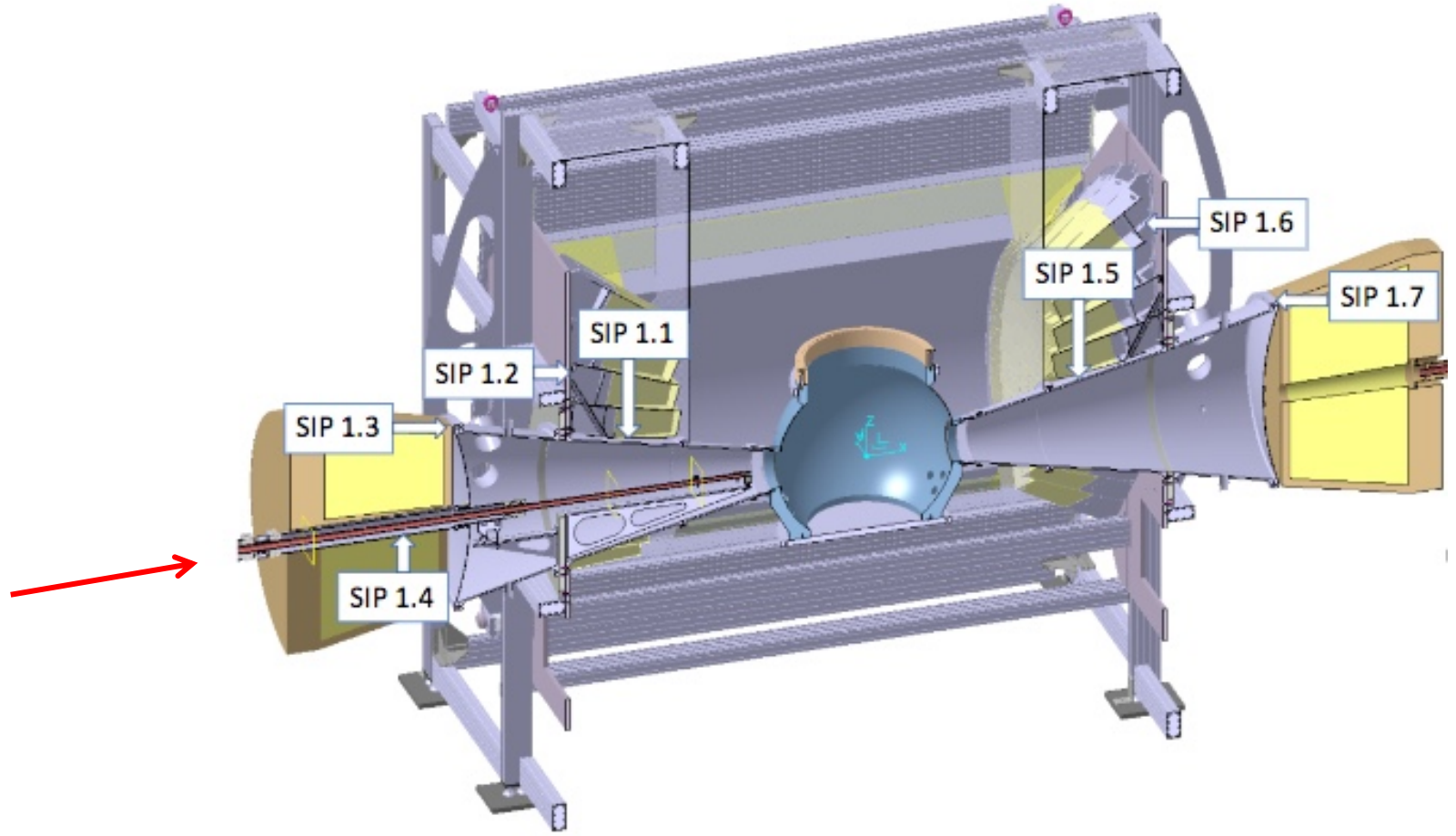
LOKI instrument, similar to SANS at PSI





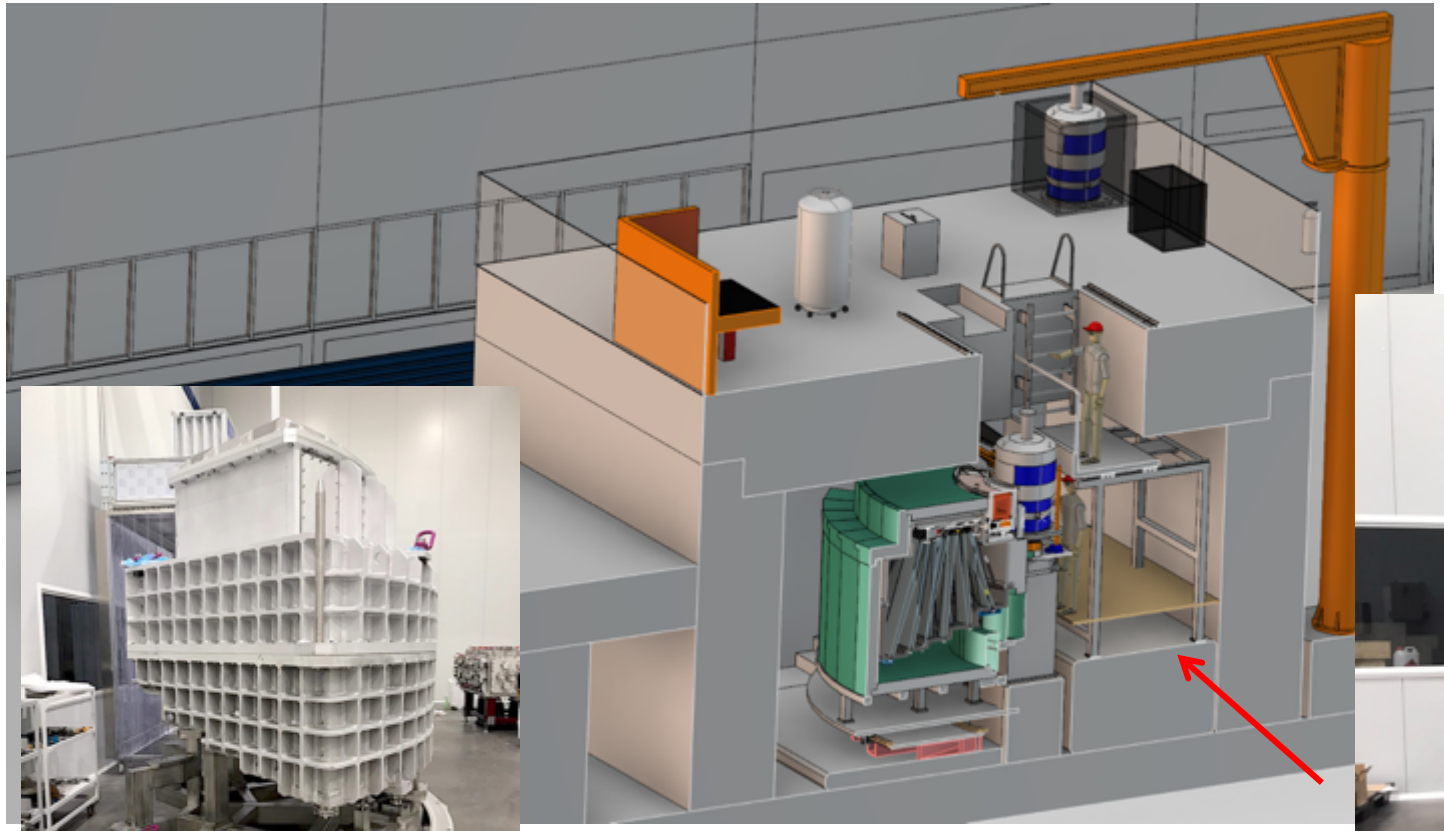
Vacuum Modeling Experiment

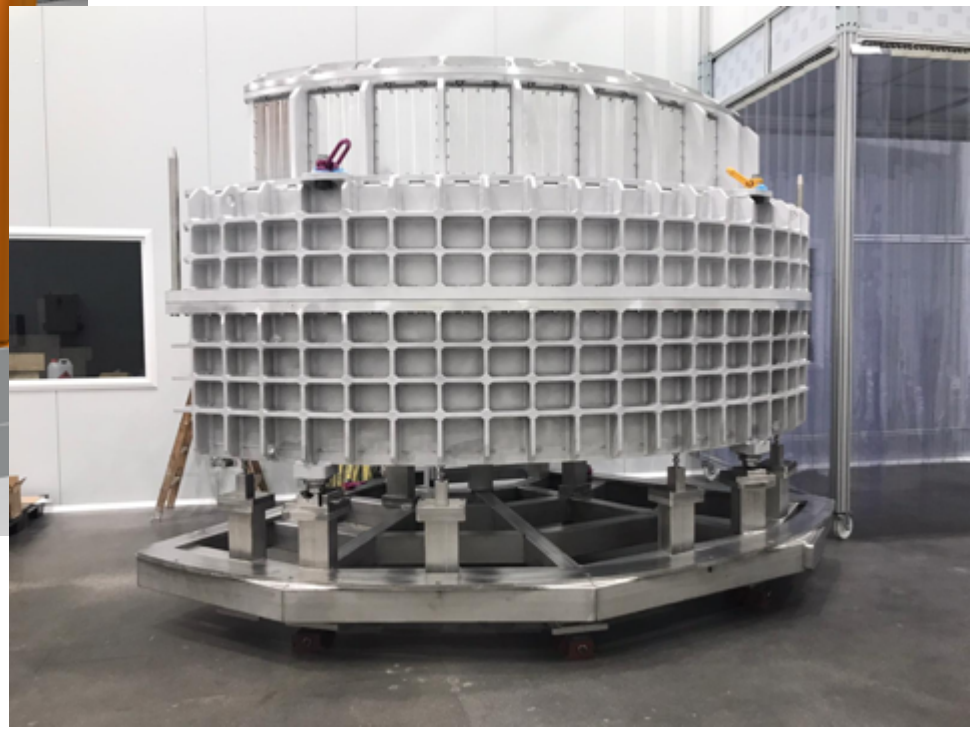
DREAM Vacuum Vessel



Vacuum Modeling Experiment

BiFrost instrument





Tack.
Thank you.

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