ODIN: Optical and Diffraction Imaging with Neutrons at the ESS

Status of the ODIN Project

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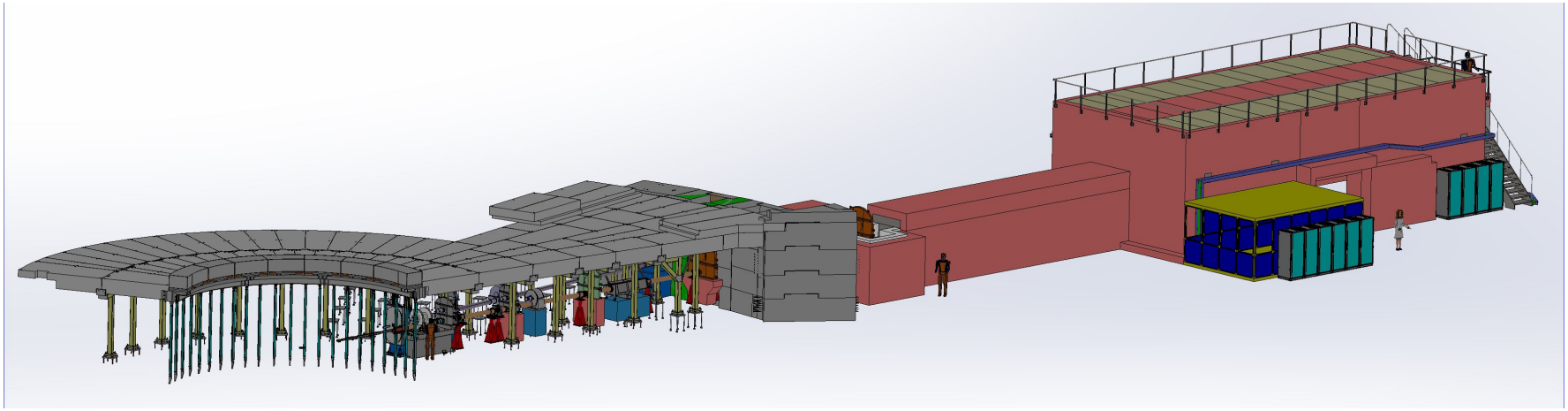
TUM: E. Calzada, M. Lerche, M. Schulz

Outline

- ODIN Project update
  - General update
  - Update TUM-WUs
  - Update PSI-WUs

General update

Overview



- 54-64m Moderator-Sample
- Cave: ~14x6x5.5m^3
- Beam Conditioning
  - bi-spectral extraction
  - ballistic guide
  - chopper system (2 moveable+ 8 stationary discs+ T_0)

Installation Plan

- Detailed Installation plan integrated in MS Project
- All 40+ Resources implemented as proposed/required by ESS
  - resources still have to be reassigned
- Communication with ESS (Antonio Bianchi)
  - ODIN project plan can be integrated in ESS plan
  - Resource limitation will lead to re-iteration(s)
- Currently the timeline seems quite doable

Installation

Task Name	Duration	Start	Finish
ODIN Instrument Installation	169 days	Thu 03.06.21	Tue 25.01.22
ODIN Instrument Installation (In Bunker)	120 days	Wed 11.08.21	Tue 25.01.22
Prepatory Tasks	5 days	Fri 27.08.21	Thu 02.09.21
Baseplate Installation	3 days	Fri 03.09.21	Tue 07.09.21
Beam Transport and Conditioning System Installation	87 days	Wed 11.08.21	Thu 09.12.21
NBOA Installation, Light Shutter Installation	12 days	Wed 11.08.21	Thu 26.08.21
Neutron Guide Installation	45 days	Wed 08.09.21	Tue 09.11.21
Heavy Shutter Installation	35,25 days	Fri 17.09.21	Fri 05.11.21
Chopper Installation	67 days	Wed 08.09.21	Thu 09.12.21
Beam Monitor Installation	2 days	Thu 18.11.21	Fri 19.11.21
Installation tests	[illegible]	Mon 22.11.21	Tue 25.01.22

■ ■ ■

Cold Commissioning

- Choppers:
  - Rotation, synchronization with source signal
  - change phases for BP1+2 (+- 0.5 guide width) and T0
- BM and Cd shutter in and out
- Heavy Shutter:
  - in out re-measure guide position
- All motors (incl. WFMC motion)
  - motion, backlash and calibration (direction and movement)
- PSS functionality:
  - water, oxygen sensors, search buttons HV safety etc.
- Utilities:
  - test of water, air, power

Hot Commissioning (no “early science”)

- Choppers:
  - Synchronization with source signal incl. phase adjustment
  - test all 10 modes (six frame, 3 frame (4), natural (1+4))
- All BMs (incl. with Cd shutter in and out)
- Heavy Shutter:
  - shielding (closed) and transmission repeatability (open)
- PSS functionality:
  - warnings
  - inhibits
  - beam dump?
- Detectors
  - test, test, test…

Early Science

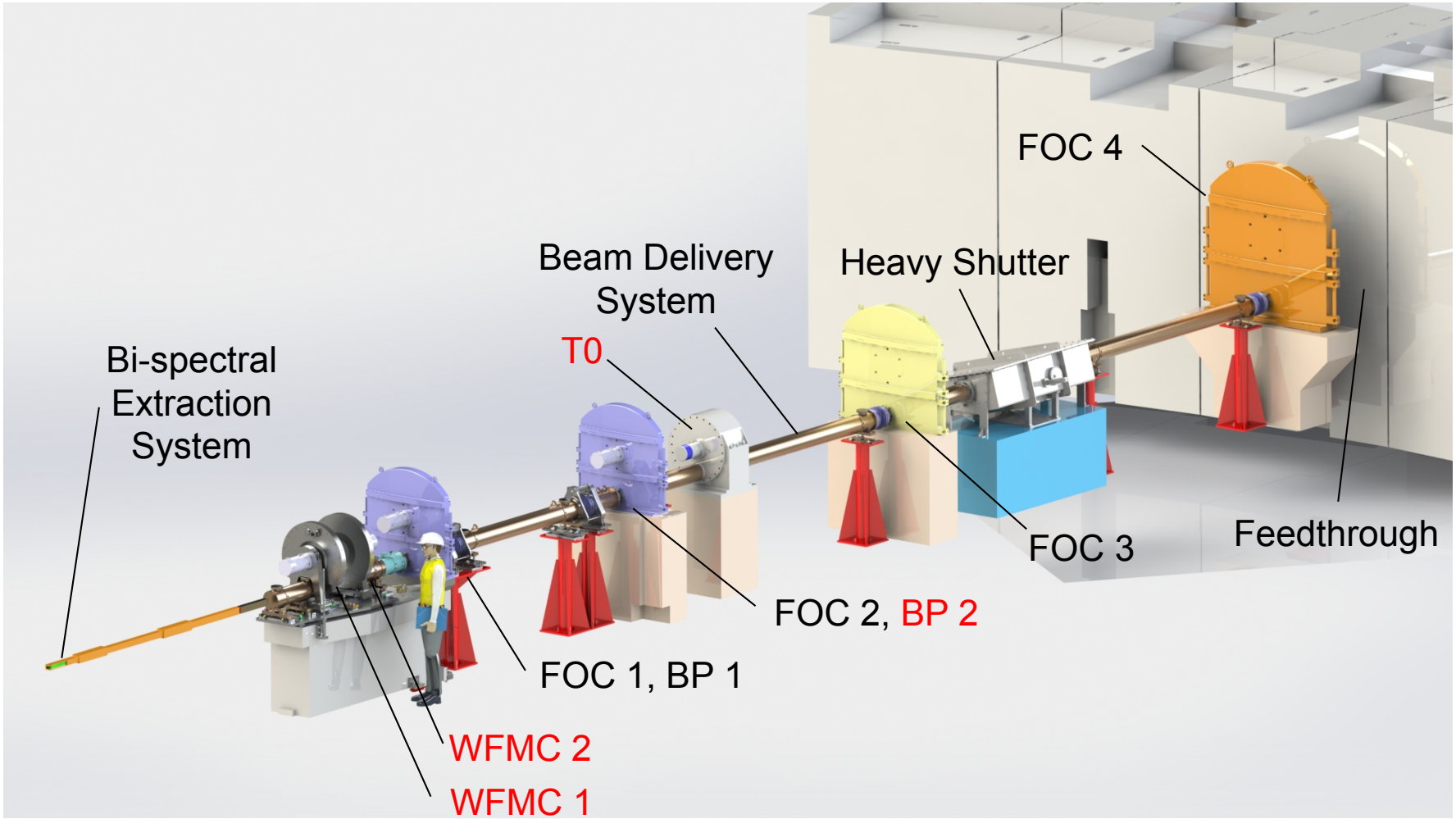
- Too early to state a concrete experiment, but
- Has to demonstrate ODIN's capabilites
  - Show its advantage over steady state sources
  - Show its flexibility
- Not only has to show ODIN's potential but also have:
- High societal impact (e.g. Life Science, Cultural Heritage, Energy Storage, Additive Manufacturing)

TUM update

TUM Update

- ESS-TUM contract signed, Jan 24th 2019 !
- TAs (PSI and TUM each!) under discussion (now @ ESS)
- Shielding simulations started (incl. T0, heavy shutter)
  - Also part of common shielding project, contribution via personnel
  - most likely continued participation
- Chopper tender issued (pre-call for competition) and executed
  - two companies replied (only one qualified)
  - VAT issue now resolved
  - invitation to participate i.e. prepare a bid now executed by ESS (Thanks to: Mirko, Niko, Shane, Wiebke…)
- TG 3 Documentation under way (Risks, Hazards, PSS, Quality, etc.)

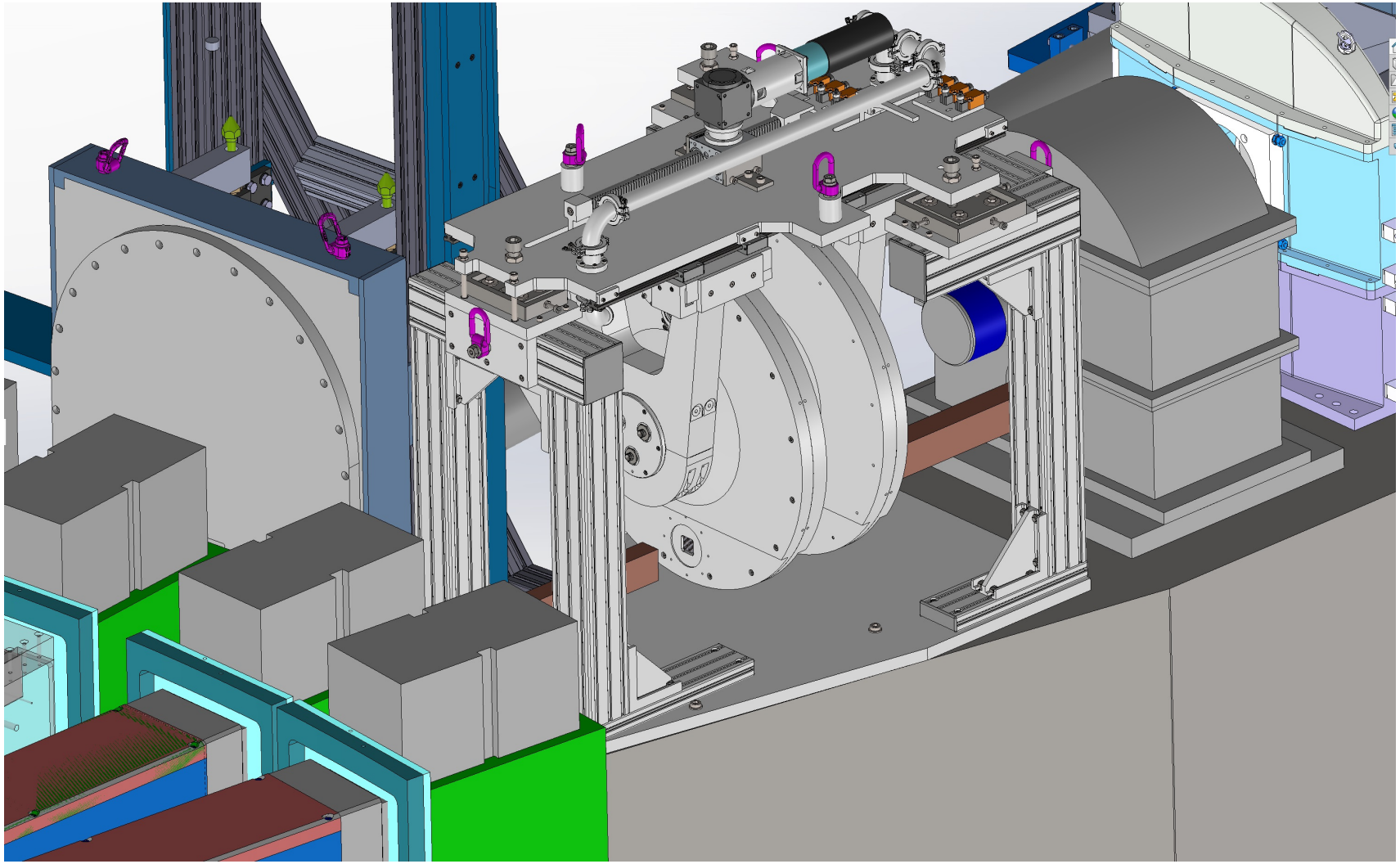
In Bunker: WFMC, BP added, T0 position



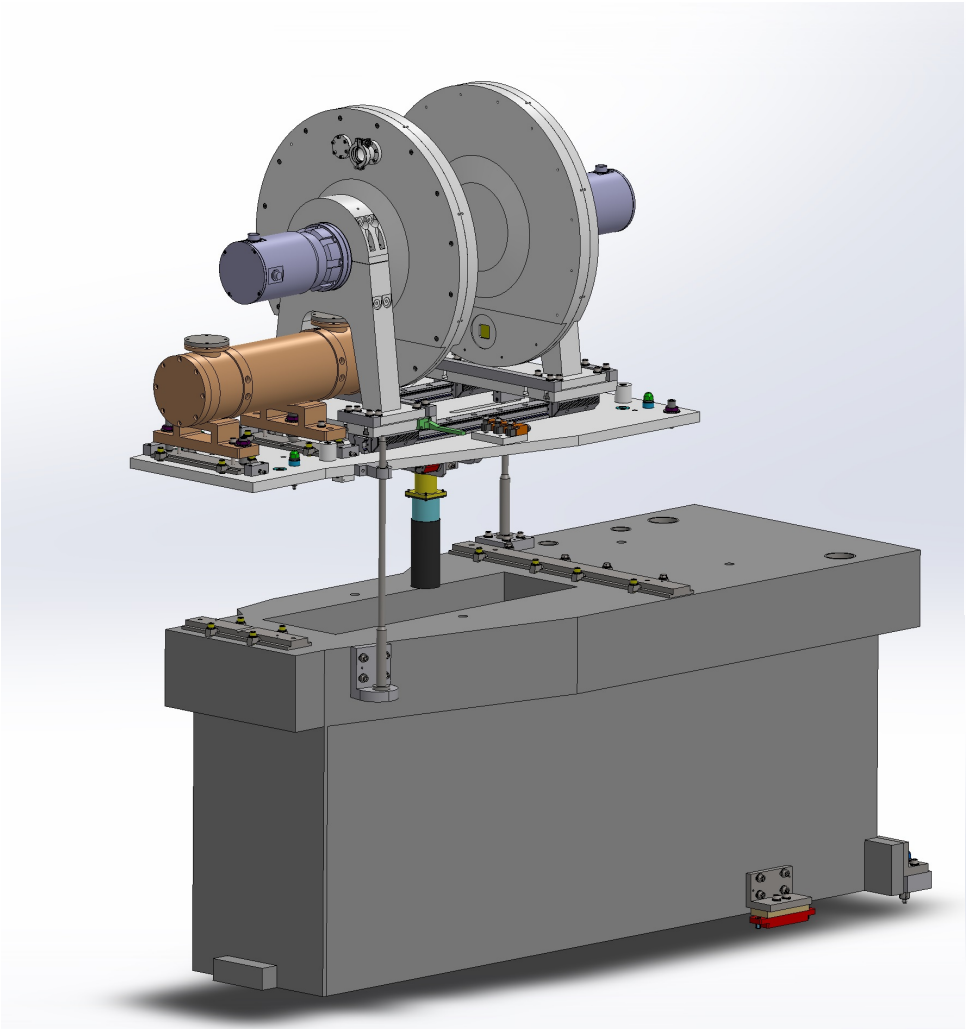
T0 position change, motivation

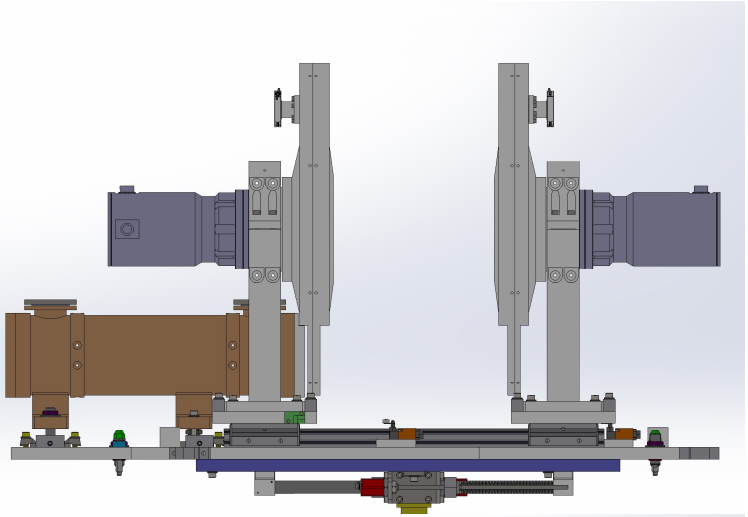
- Move out of the 11m zone
  - will not have to be removed for insert change (e.g. S1 installation)
- Move away from high m-value guide
  - flux increase up to ~15% possible (simulation pending)
- Move out of busy WFMC, FOC1 + BP1 area
  - much easier installation
  - potential vibration can be addressed easier

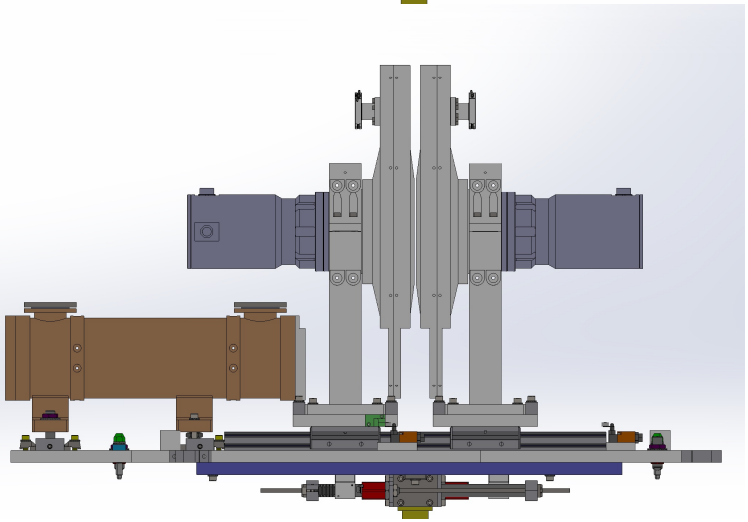
WFMC re-re-design, integration w/ DREAM



Conflict w/ DREAM resolved







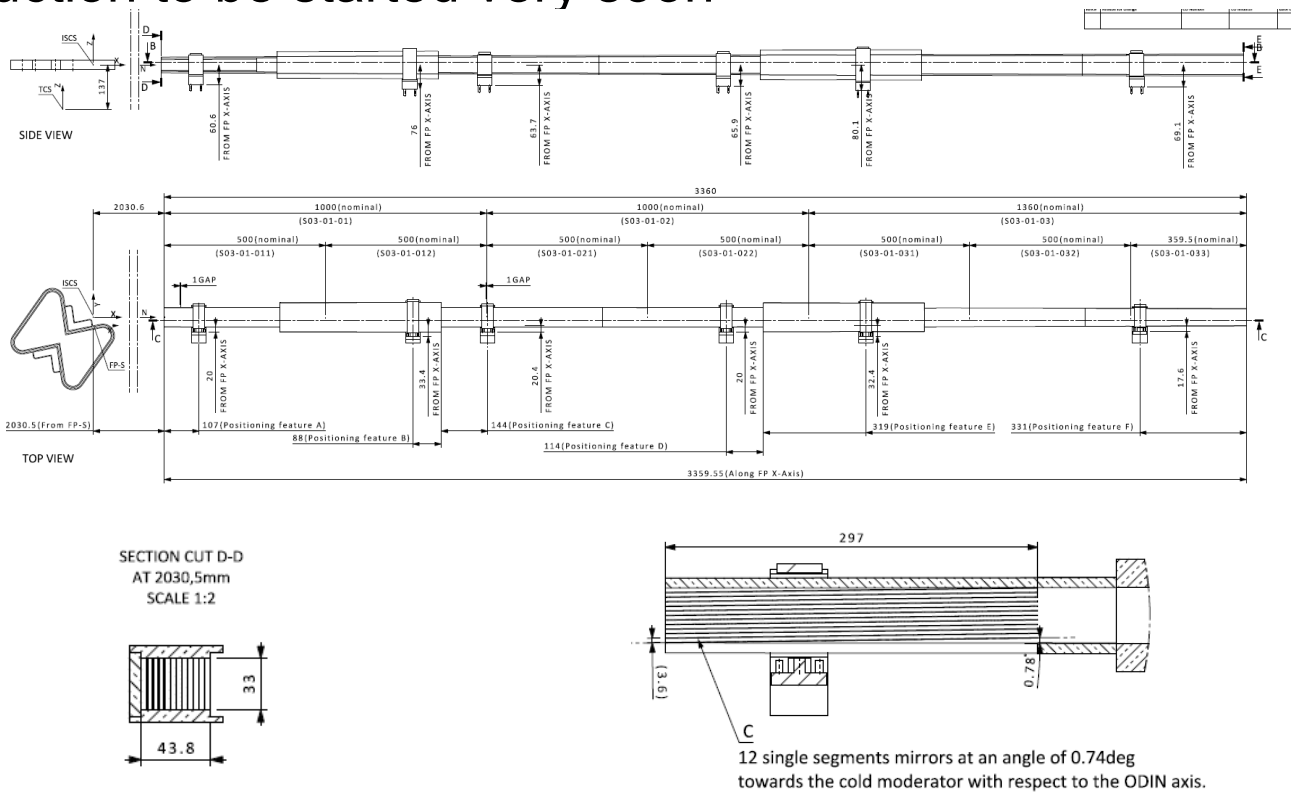
PSI update

PSI Update

- ESS-PSI in kind agreement ready to be signed (same text as for ESTIA)
- TAs (PSI and TUM each!) under discussion (now @ ESS)
- PSI-TUM-ESS memorandum of understanding is at an advanced stage

PSI Update - NBOA

- NBOA manufacturing contract signed
- Production to be started very soon



PSI Update – Neutron Guide

- CTV for the guide system passed last week
- Tendering process starting this week (WTO open tender)

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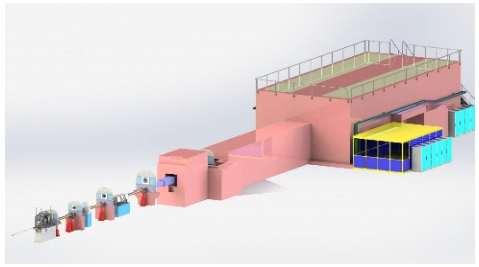
		Project: ESS
System name	**Neutron guide system for the ODIN instrument**	Document identification: **PSI-ESS-MU33-0**
Type of document	Requirement specification	
Author	Manuel Morgano (PSI) *Peter Fischer (PSI), Peter Ming (PSI)*	Revision index (Alfresco): **2.3**

Summary

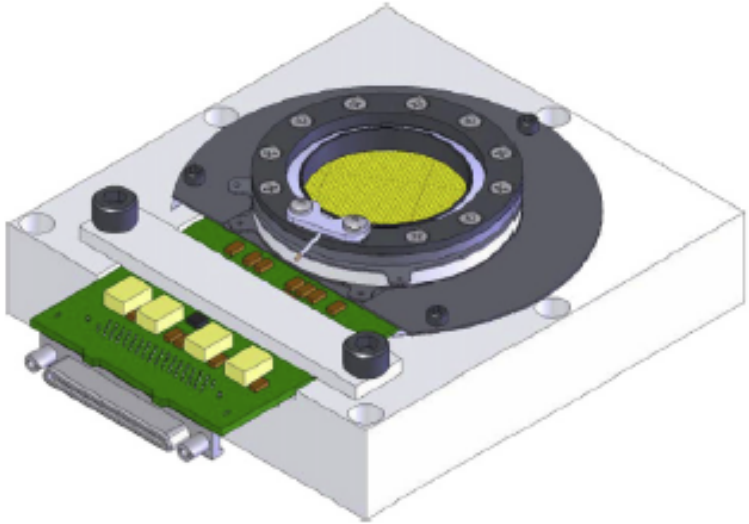
This document specifies the requirements for the detailed technical desig manufacturing and installation of a sub-systems of the neutron beam delivery system f the ESS instrument that are being specified and acquired by PSI as Swiss In-Ki partner. The relevant components represent the neutron optics of the instrument, mo specifically the neutron guides, their housings, interfaces and supports, which are locat outside the monolith. This includes also the Bridge Beam Guide (BBG) situated in t moving light shutter just outside the monolith.



The ODIN team, through PSI, has provided general guide geometries, coating requirements and envelope. The contractor will be responsible for the detailed design and production of the optics components as well as the vacuum vessel containing them. On the ESS site, the optics will be installed and aligned by the contractor consistently with the access plans provided by the ESS. The BBG and the feedthrough in the bunker will be installed by t relevant ESS personnel, so the contractor only has to provide the optics and t alignment.

PSI Update – ToF detector

- Detector from UC Berkeley acquired and tested
- GP2 detector from ISIS tested
- Data analysis chain better defined
- Collaboration on software suite started between
  PSI-TUM-ISIS-JPARC-ORNL



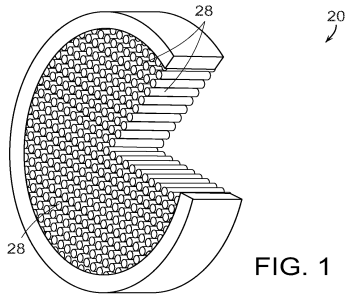
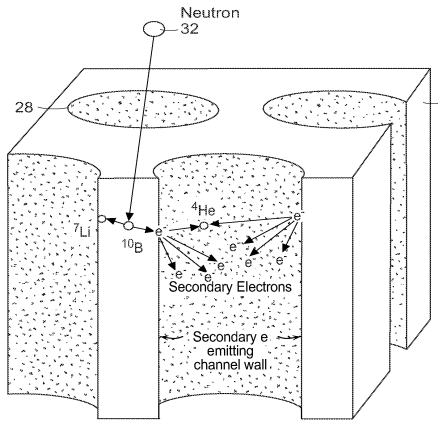
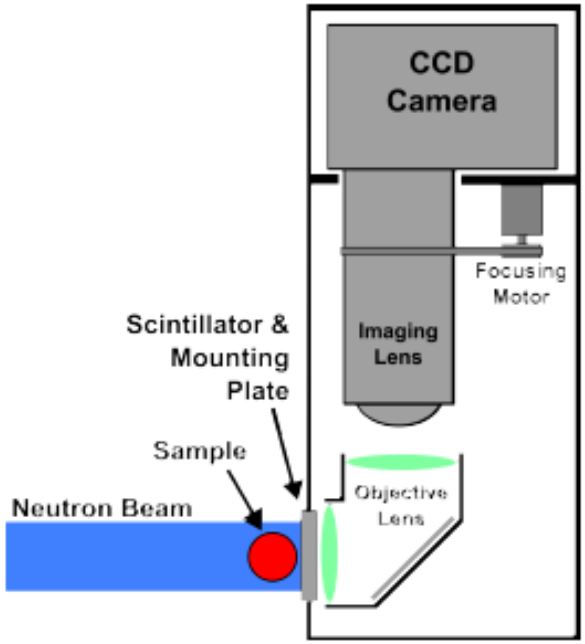


FIG. 1



PSI Update – White beam detectors

- Not time critical
- Extensive experience with camera and camera boxes
- Documentation on data-rate and volume submitted, discussion with DMSC ongoing



Detector	Technique	file size (MB)	exposure time per file	number of file per hour	data rate (GB/h)	typical exposure time / experiment	data volume (GB) / experiment
Camera	**White beam radiography**	8	10 s	360	2.8	1 h	3
	White beam tomography/time series	8	10 s	360	2.8	10 h	28
	Fast white beam tomography	8	0.01 s	360000	2812.5	10 min	469
	Fast white beam time series	8	0.01 s	360000	2812.5	10 s	8
MCP	**ToF radiography**	0.5	30 min	6000	2.9	2 h	6
	ToF tomography	0.5	20 min	9000	4.4	24 h	105
	ToF time series	0.5	2 min	90000	43.9	5 h	220
	ToF NGI	0.5	15 min	10800	5.3	10 h	53

Summary

- ODIN is making significant progress:
  - Most Paperwork is signed or close to signing
  - Projects in all major WU are moving
    - Choppers
    - Shielding (incl. Guide, Cave, Shutter)
    - Guide (incl. NBOA, Feedthrough)
  - TG 3 Documents in preparation (Hazards, Risks, H1-H2…)
  - Installation Plan is firming up
  - Cold and Hot Commissioning Plan under discussion

Issues: In light of recent events

- During the last NID and Instrument meetings it became apparent that communication between NSS and other ESS departments is lacking
- E.g. Craning requirements and safety requirements (Cave sprinkler-system,…)
- The partner institutes and thus NSS have decades of experience, no need to re-invent the wheel

- We urge other ESS departments to invite NSS to comment on and participate in ALL discussions that affect the instruments

Thank You!