Science & Technology
Facilities Council

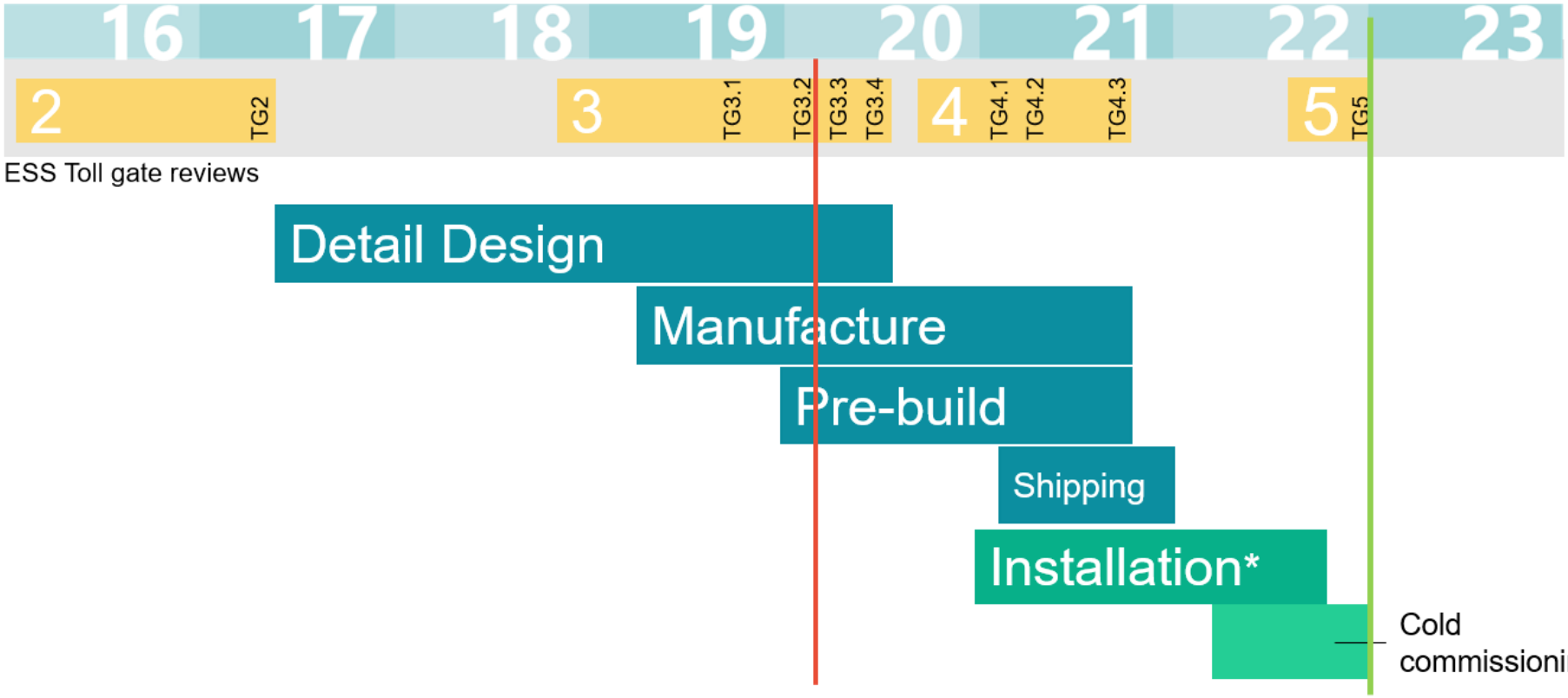
Loki Update

ESS

Agenda

- Schedule
- Update on progress
- Highlight 3 current challenges
  - Hazard Analysis
  - Motion Safety
  - TG3 schedule

Schedule



Project completion: 23/12/2022

* Carried out by ESS with advice from ISIS

Science & Technology Facilities Council

Pre-Build at ISIS

- 90% of Loki will be built and tested at ISIS
- ESS installation technicians will be invited to ISIS to learn
- Loki will then be disassembled and shipped to ESS
- ESS technicians will then re-build Loki at ESS

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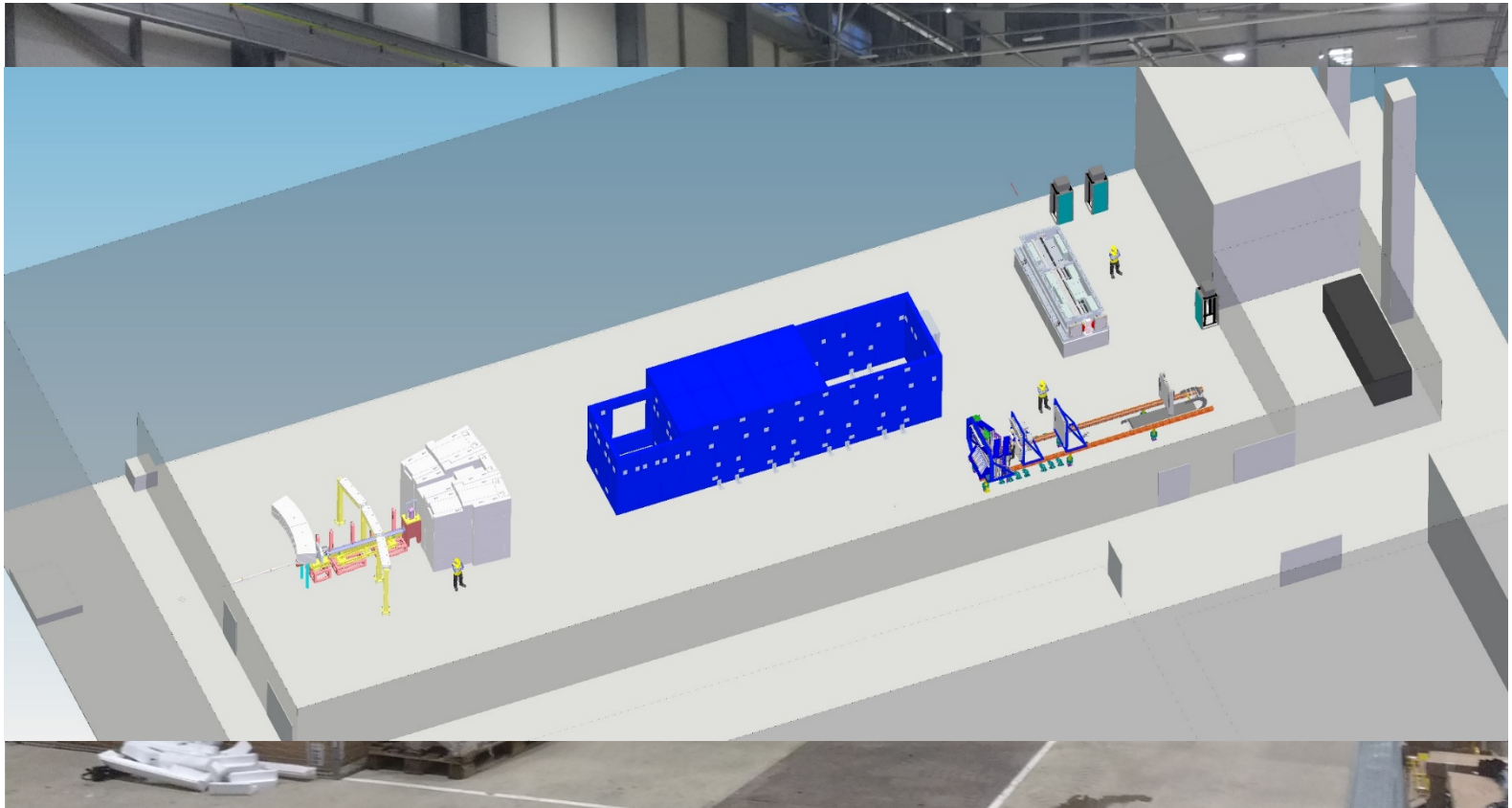
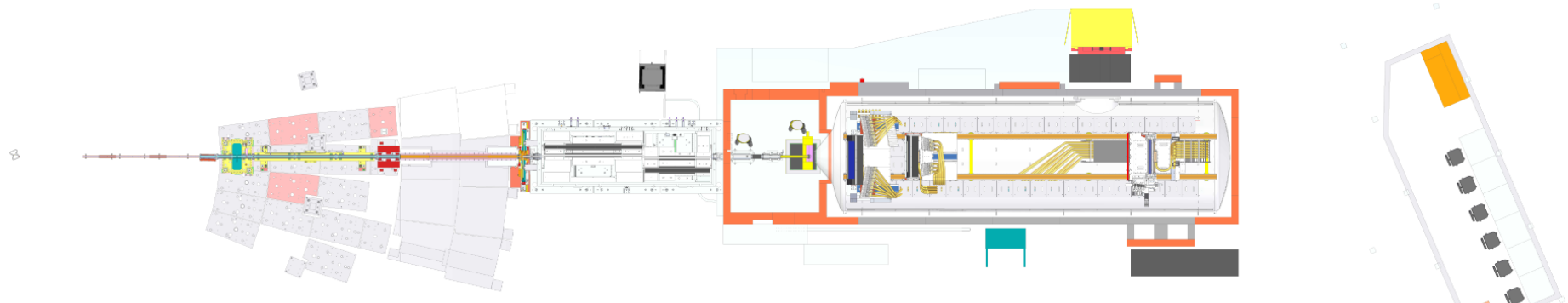


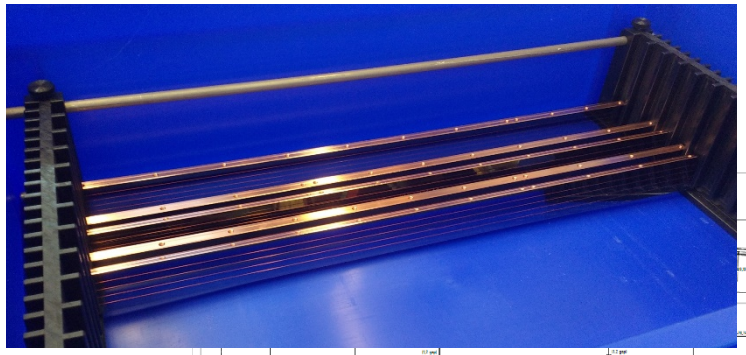
Status Update

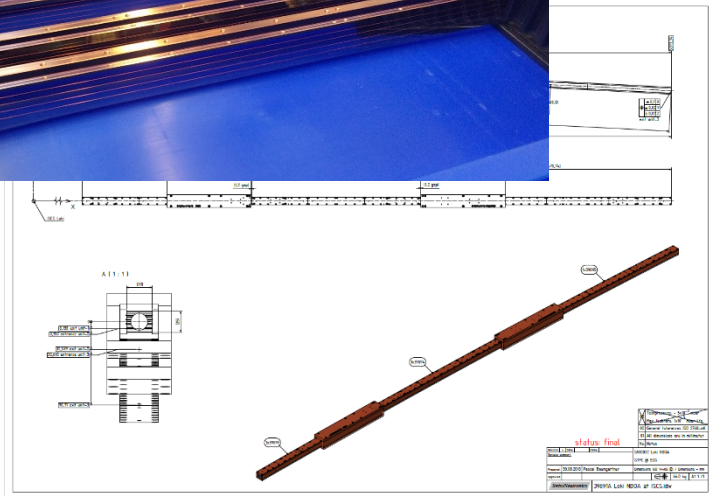
- Component by component

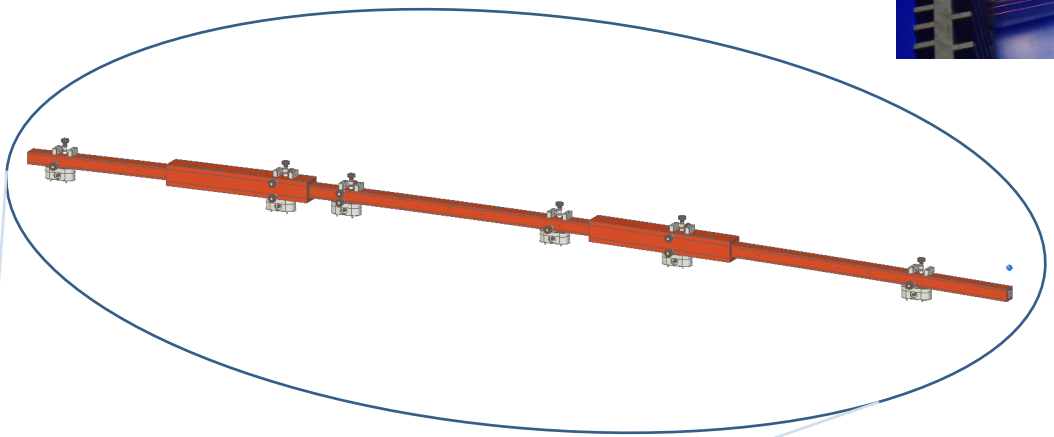


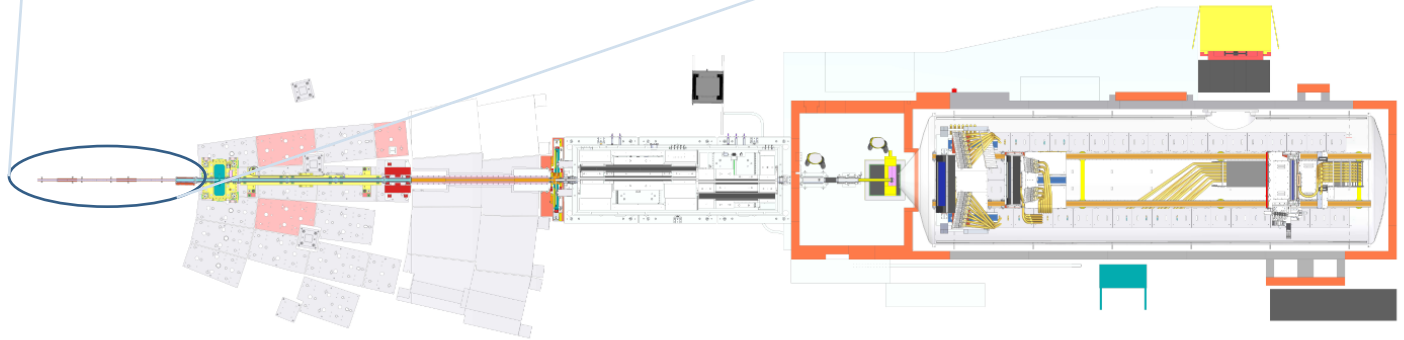
NBOA

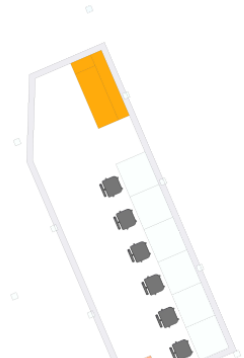
- Design & Manufacture outsourced to Swiss Neutronics
- Design Complete
- Manufacture underway
  (completion est. May 2020)





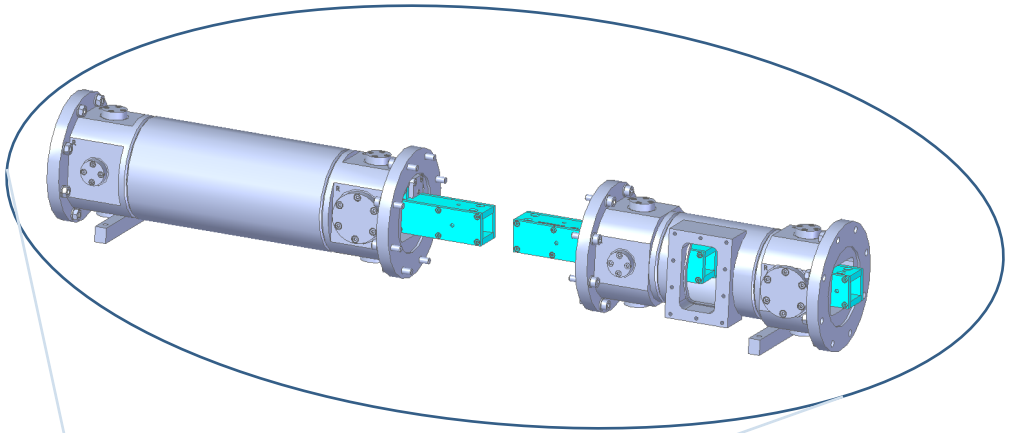


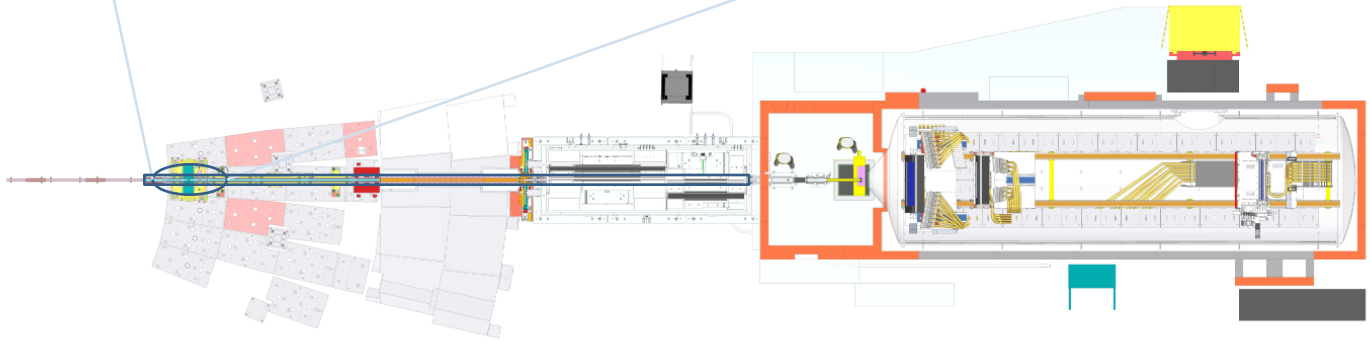




Guide and Vacuum Vessels

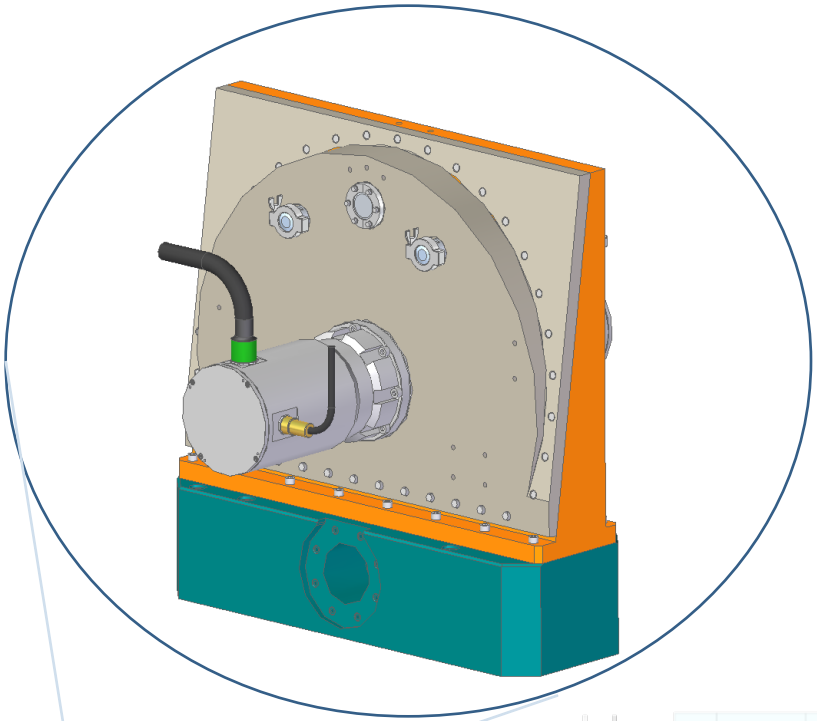
- Design & Manufacture outsourced to Swiss Neutronics
- Design underway

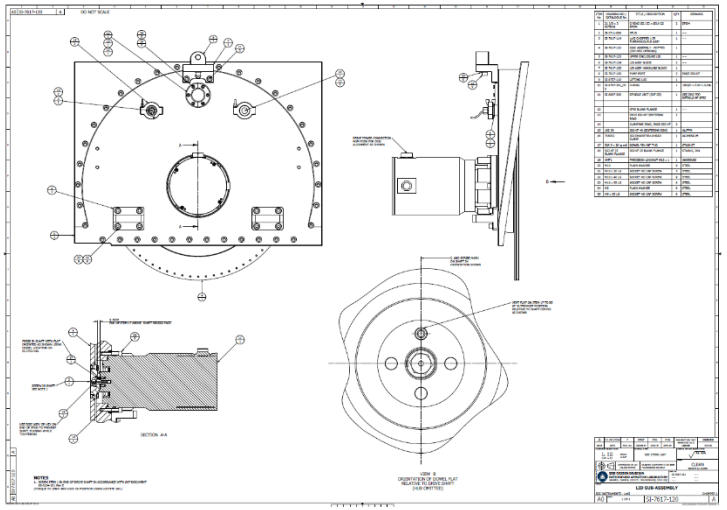


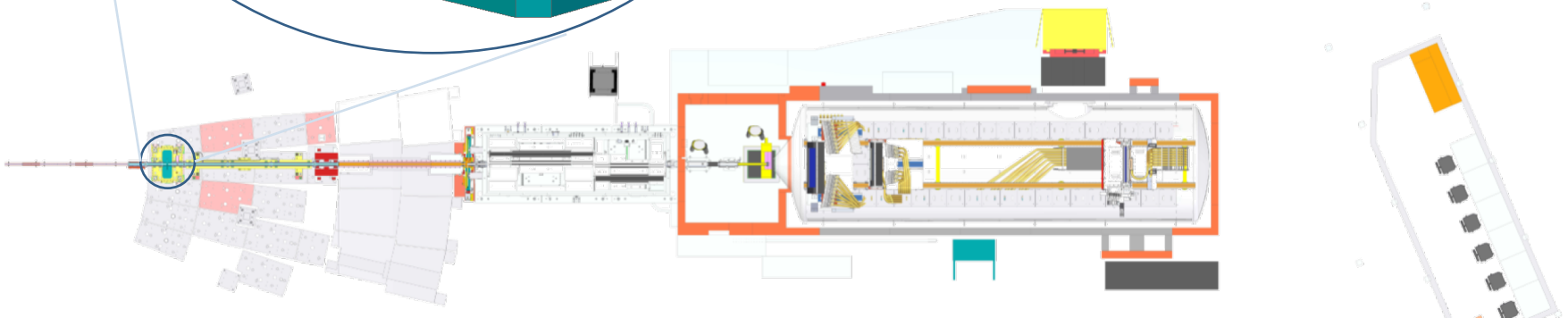


Chopper 1

- Design Completed (ISIS Design)
- Manufacture underway

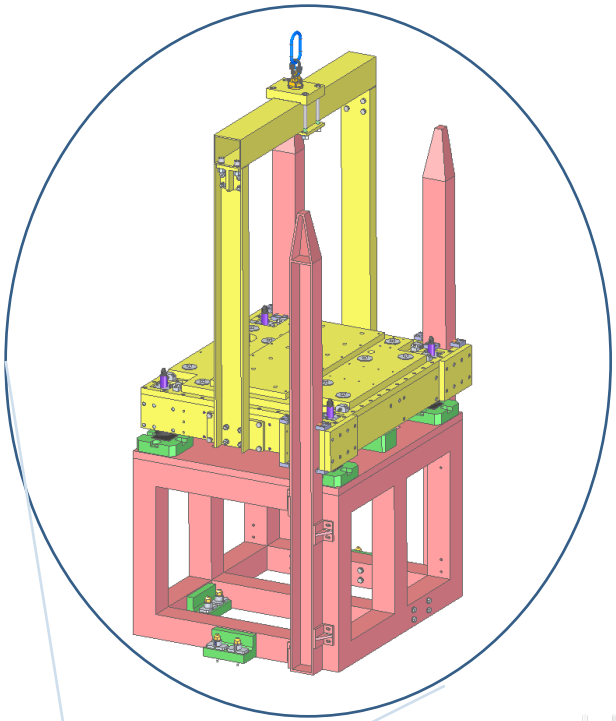


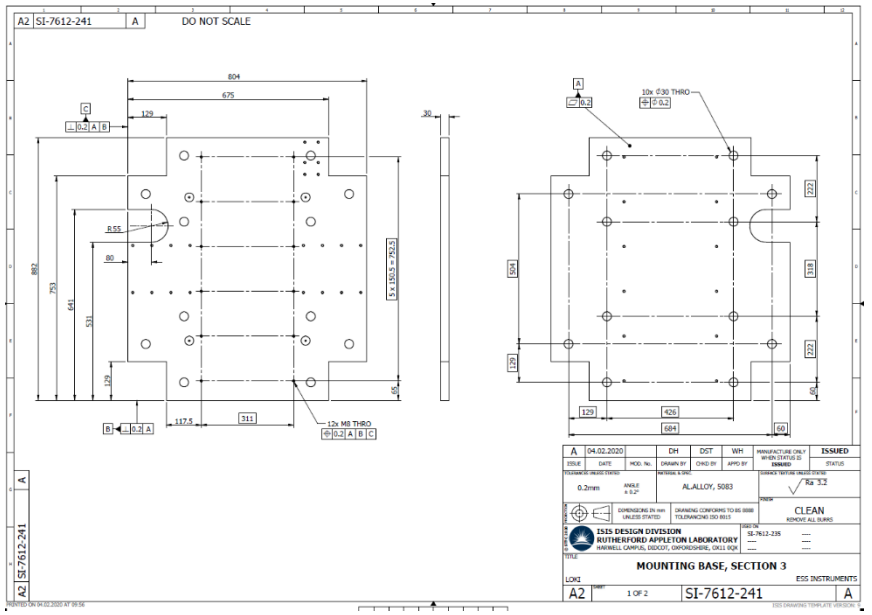


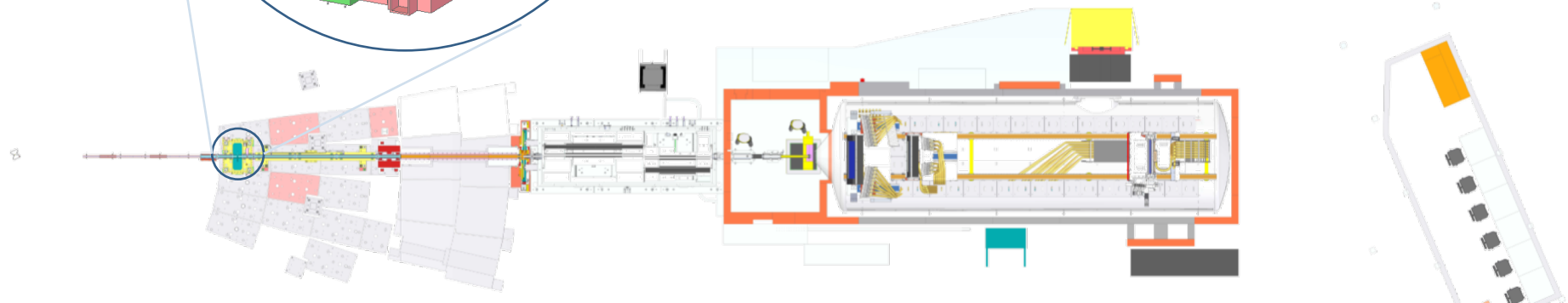


In-Bunker RH Structures

- Design Completed (ISIS Design)
- Manufacture out for quotation







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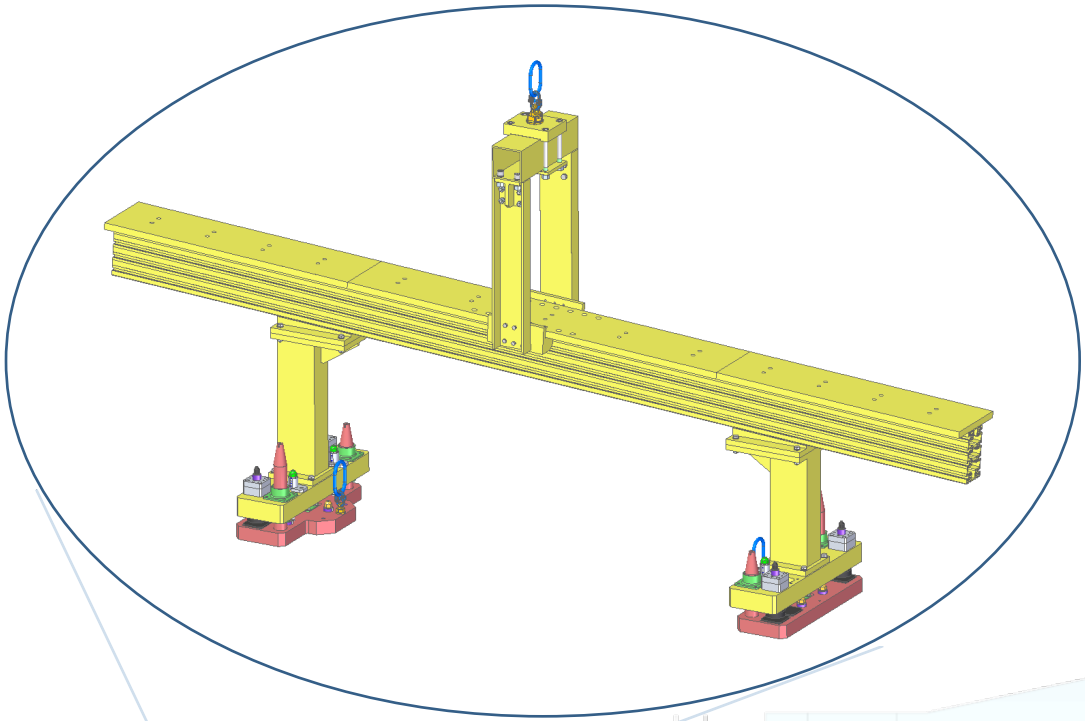
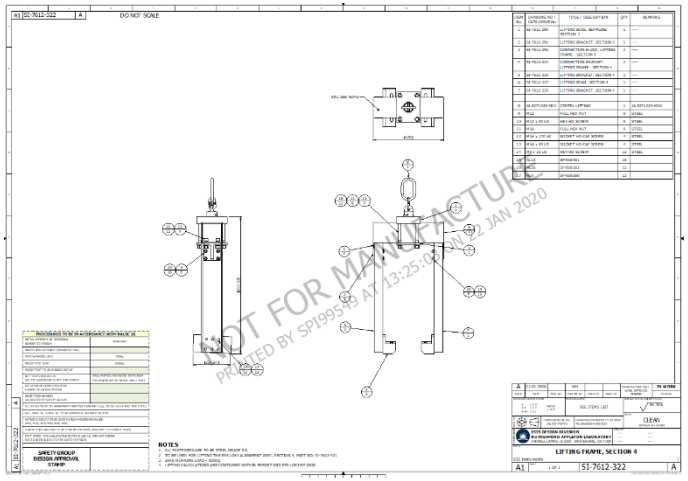
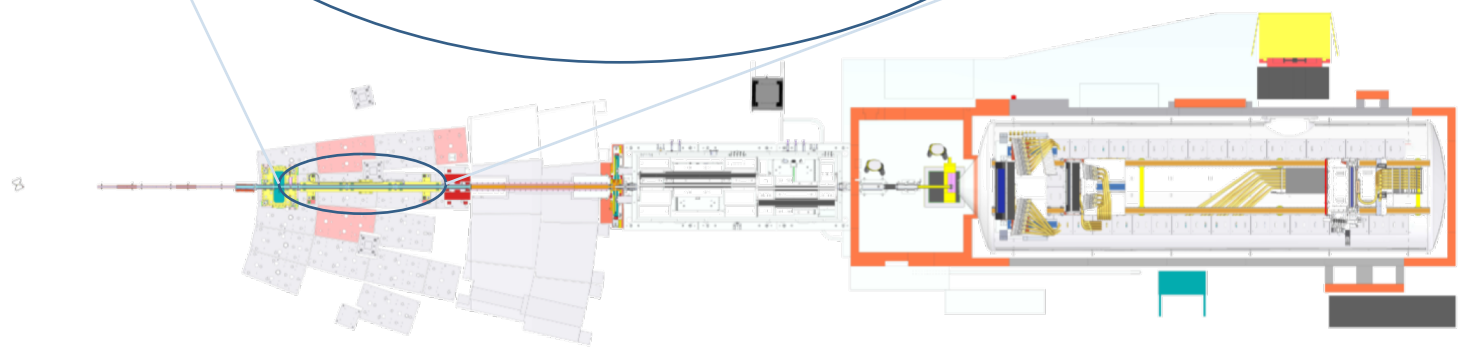
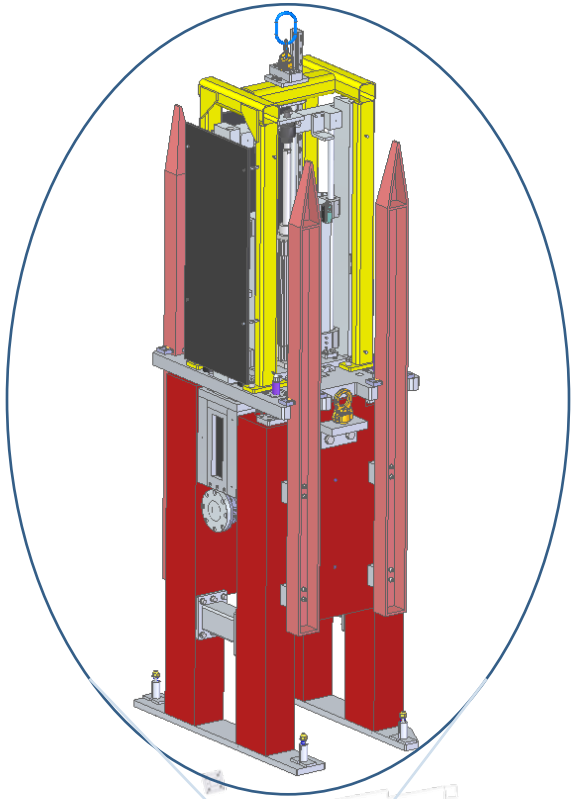


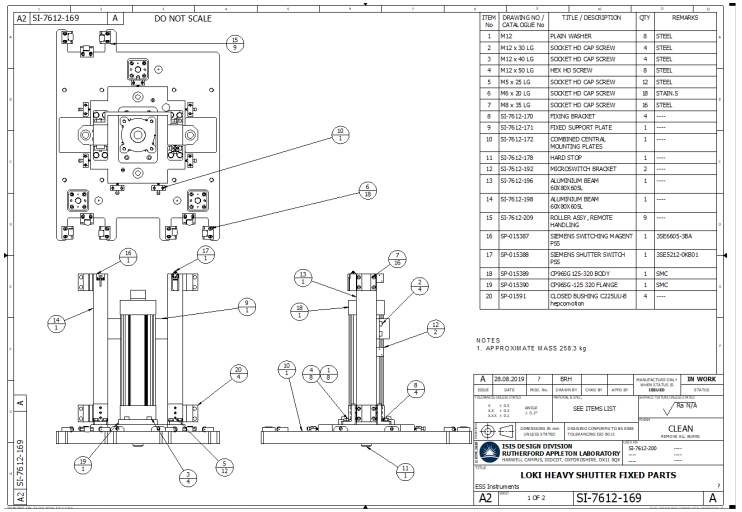


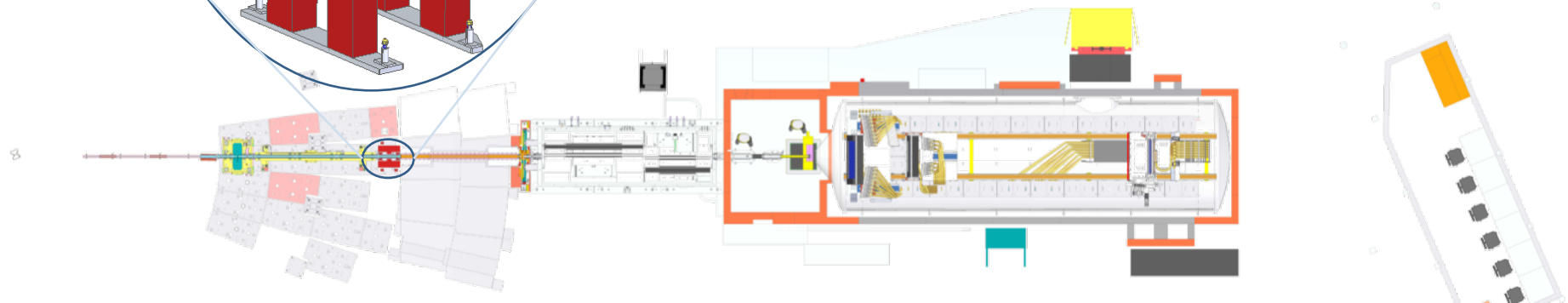


Heavy Shutter

- Design Completed (ISIS Design)
- Manufacture underway

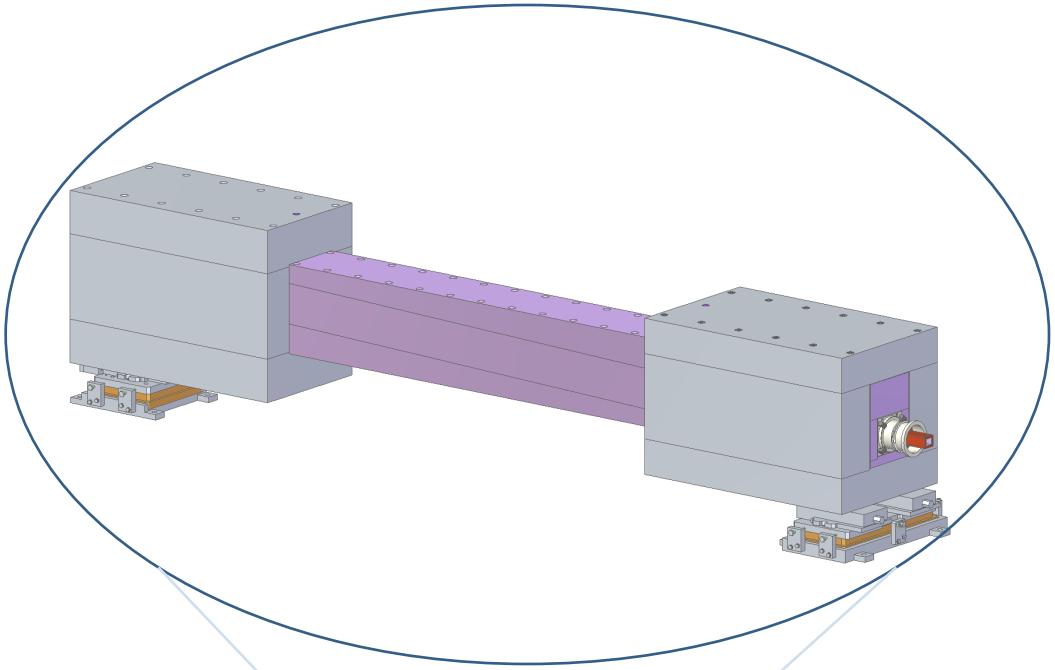


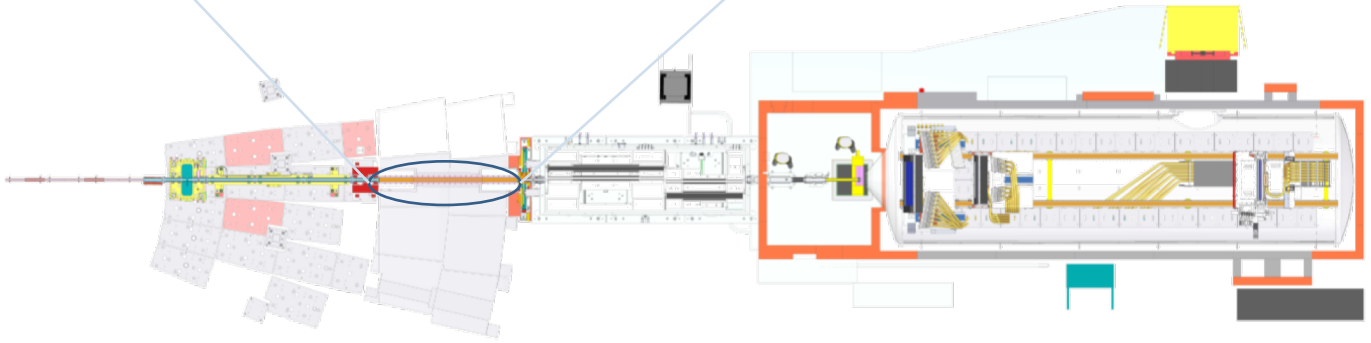




Bunker Wall Feedthrough

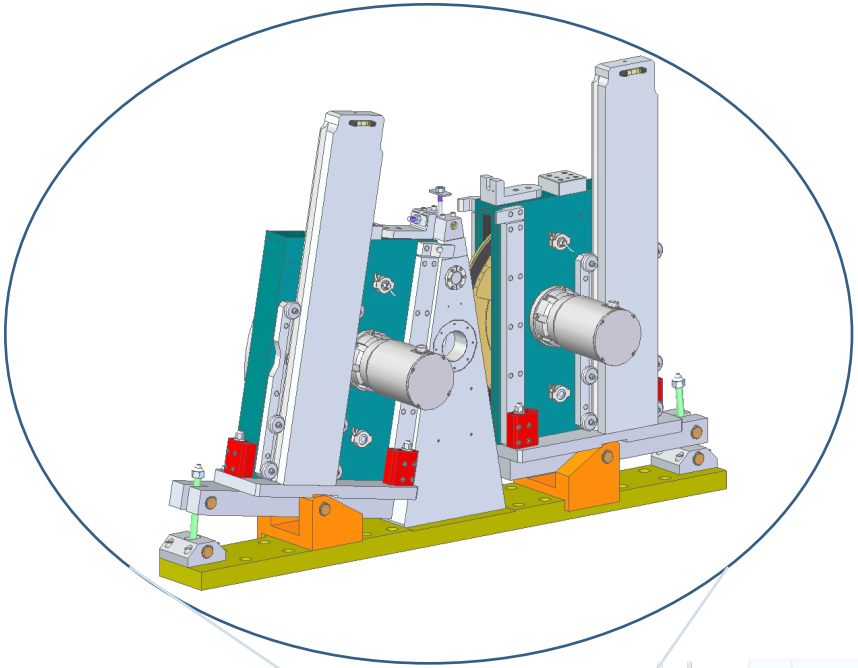
- Requirements defined
- Design Underway (ISIS/SNAG Design Collaboration)

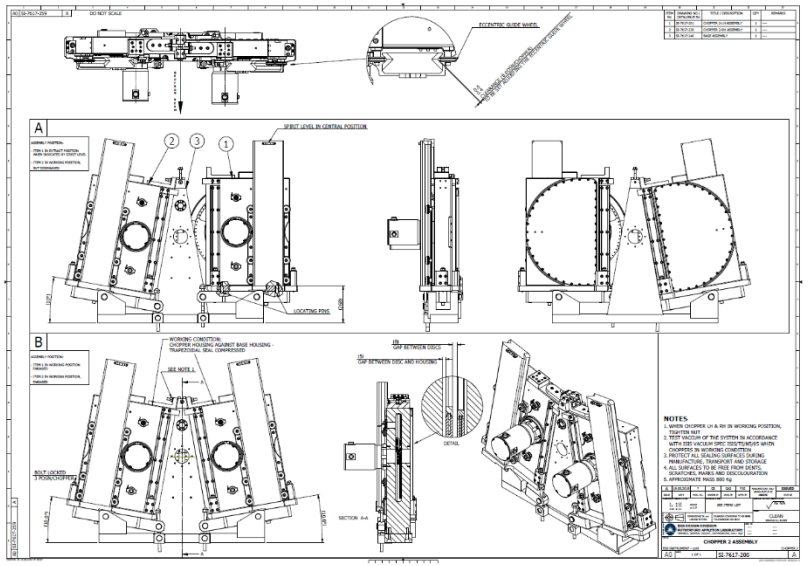


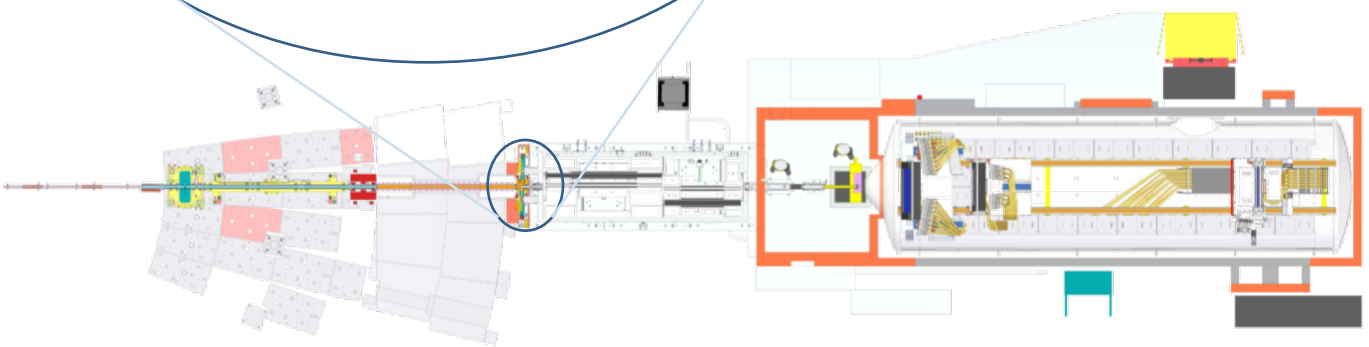


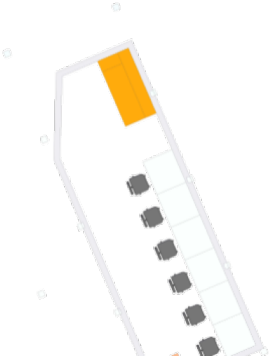
Chopper 2

- Design Completed (ISIS Design)
- Manufacture Underway



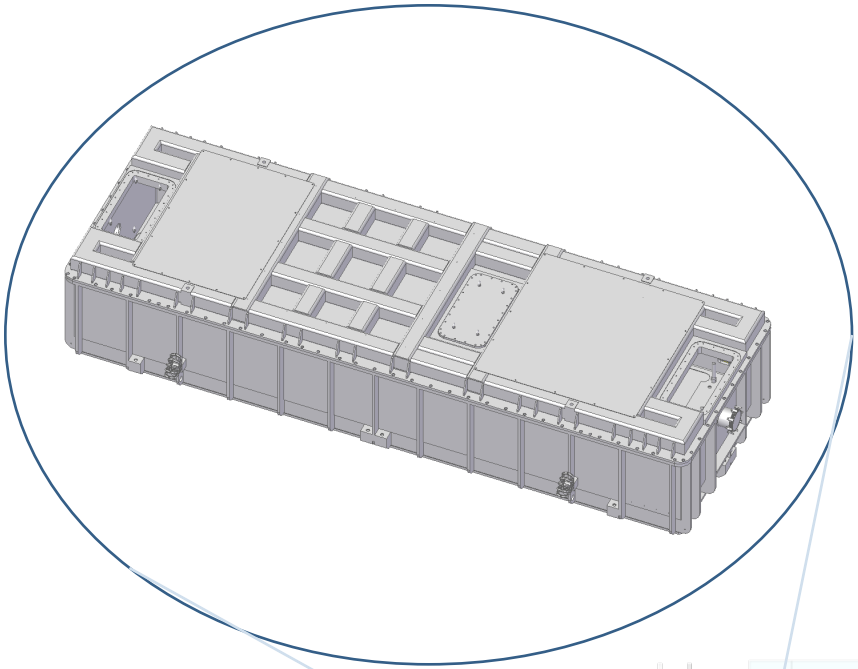


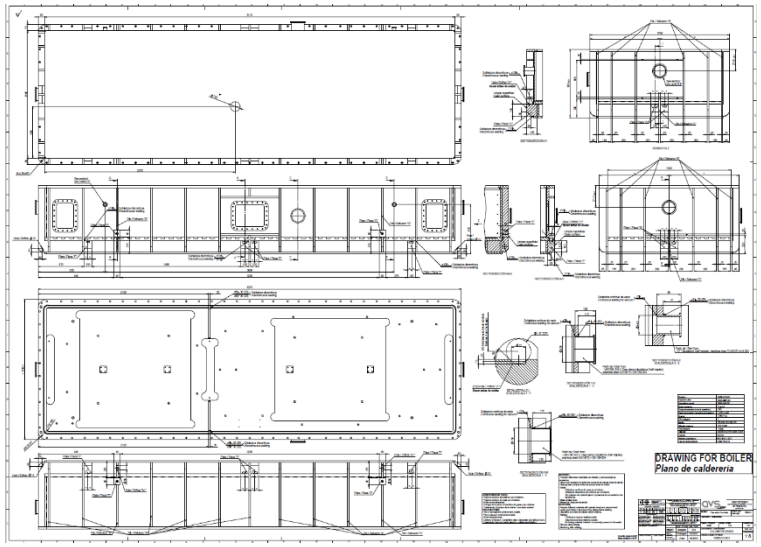


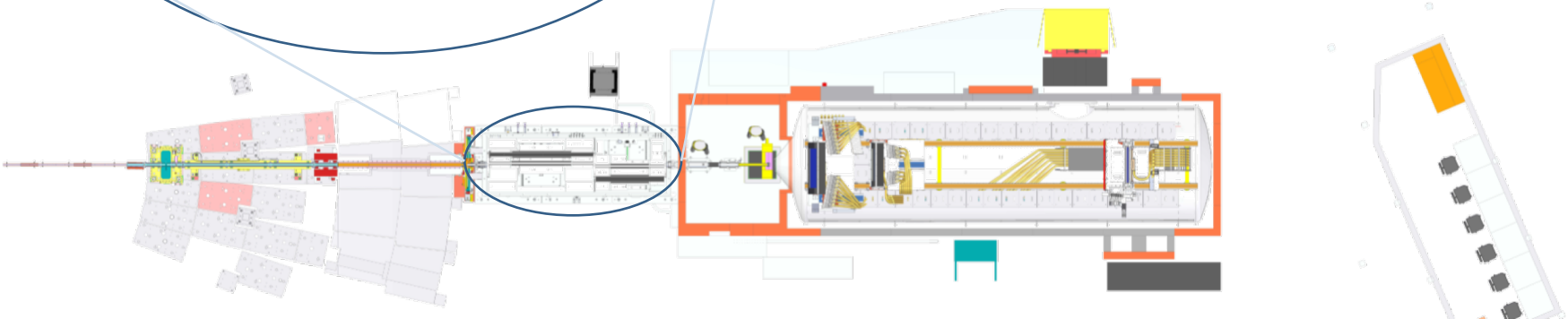


Collimation Selector Vessel

- Design Completed (AVS Design)
- Manufacture commencing ~now

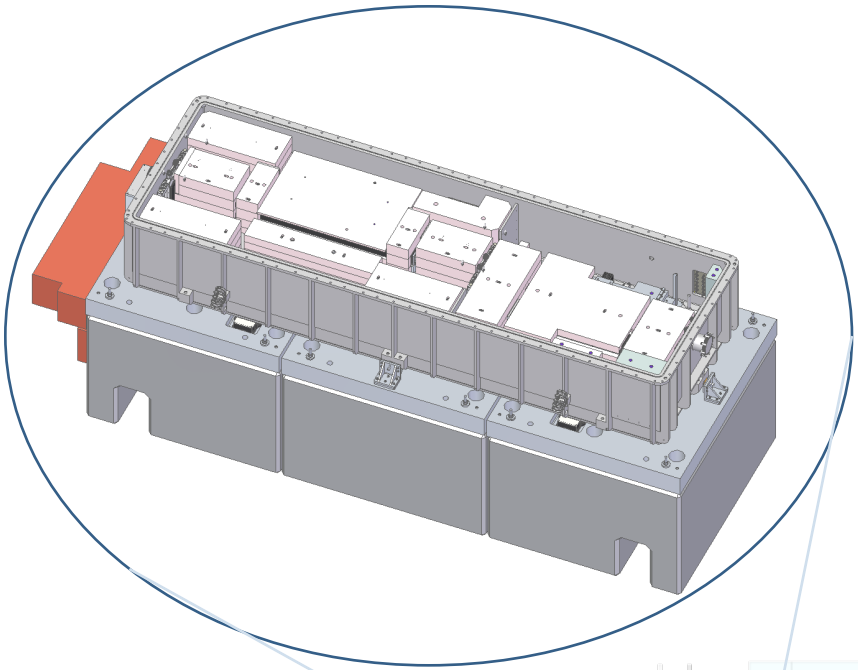


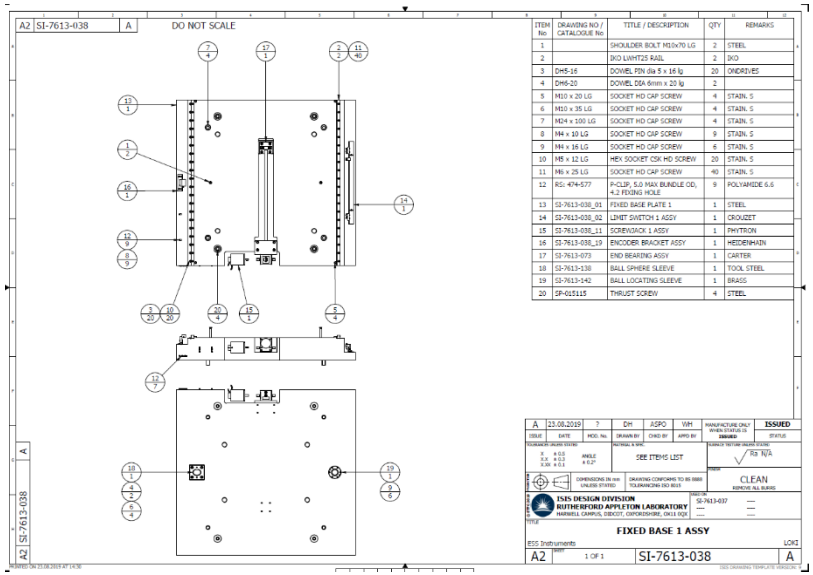


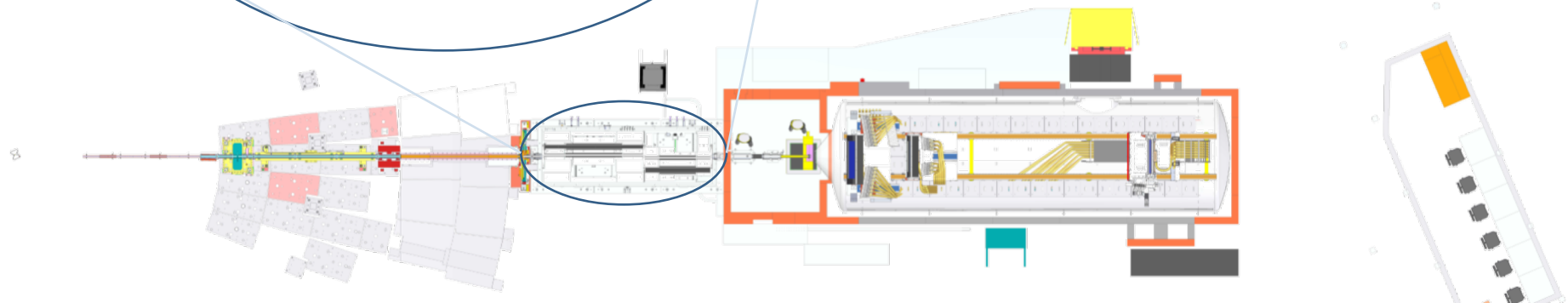


Collimation Selector

- Design Completed (ISIS Design)
- Manufacture out for quotation

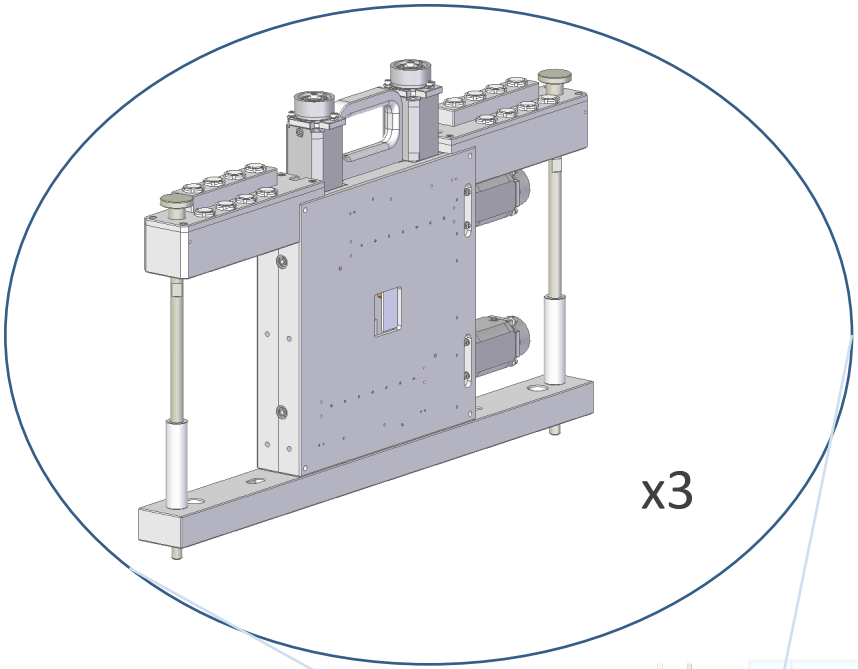


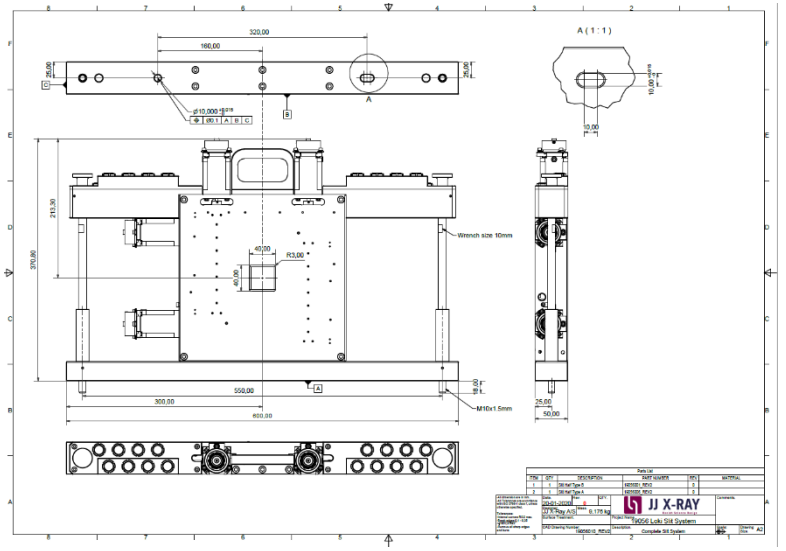


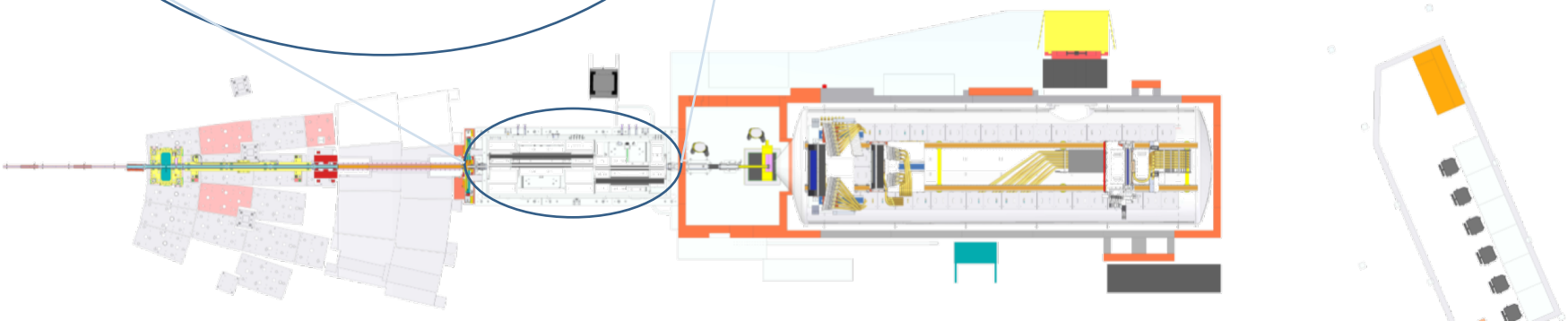


Jaw Sets

- Design Completed ~Now (Outsourced to JJ X-Ray)

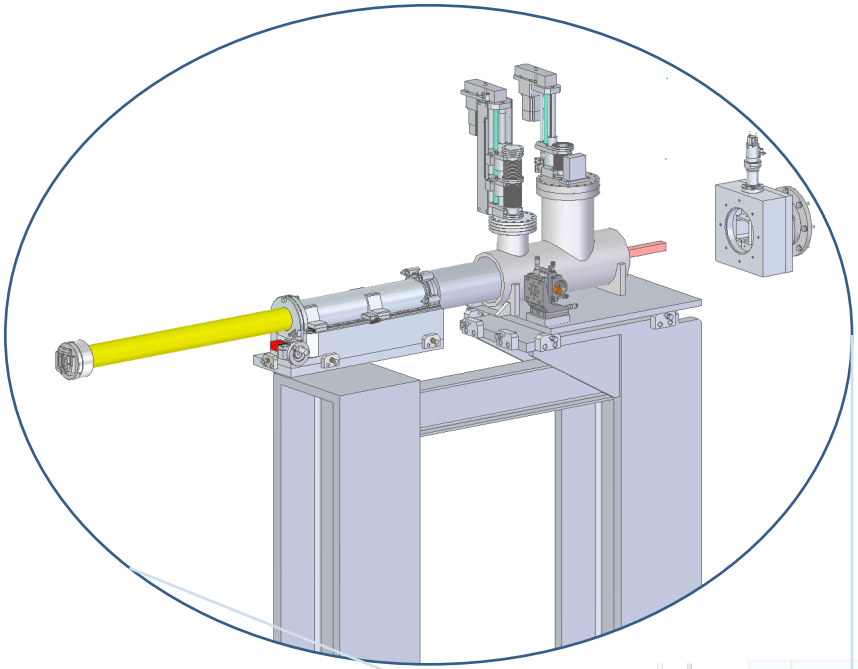


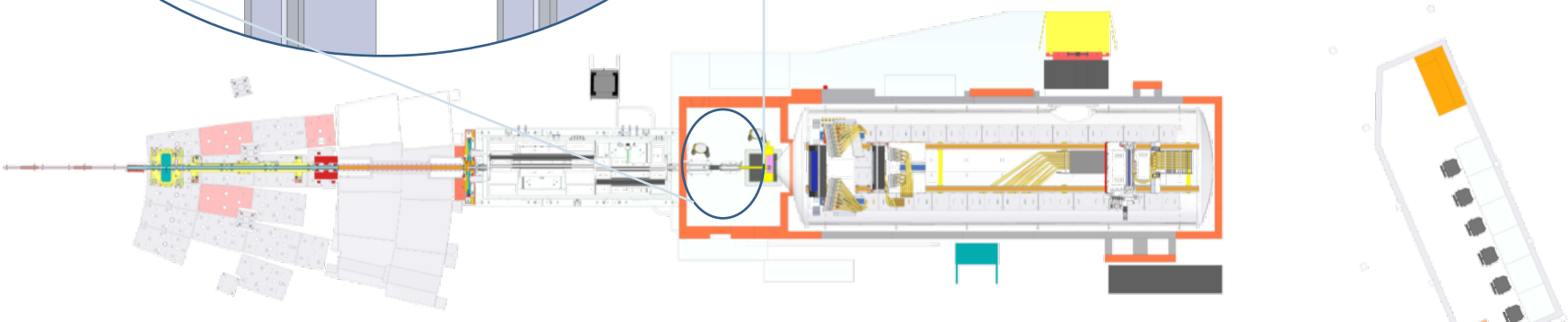




Sample Snout

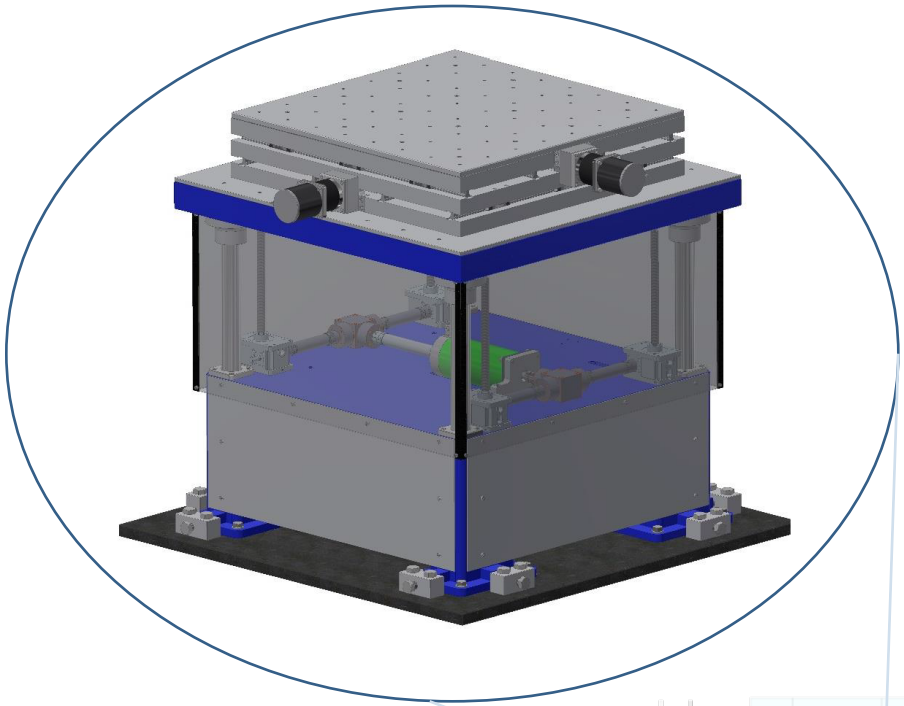
- Requirements defined
- Design Underway

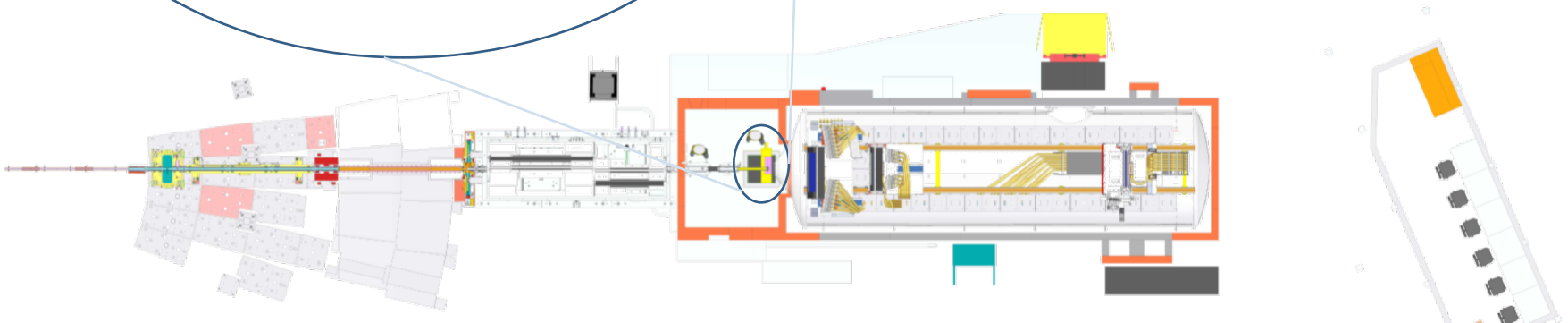




Sample Stack

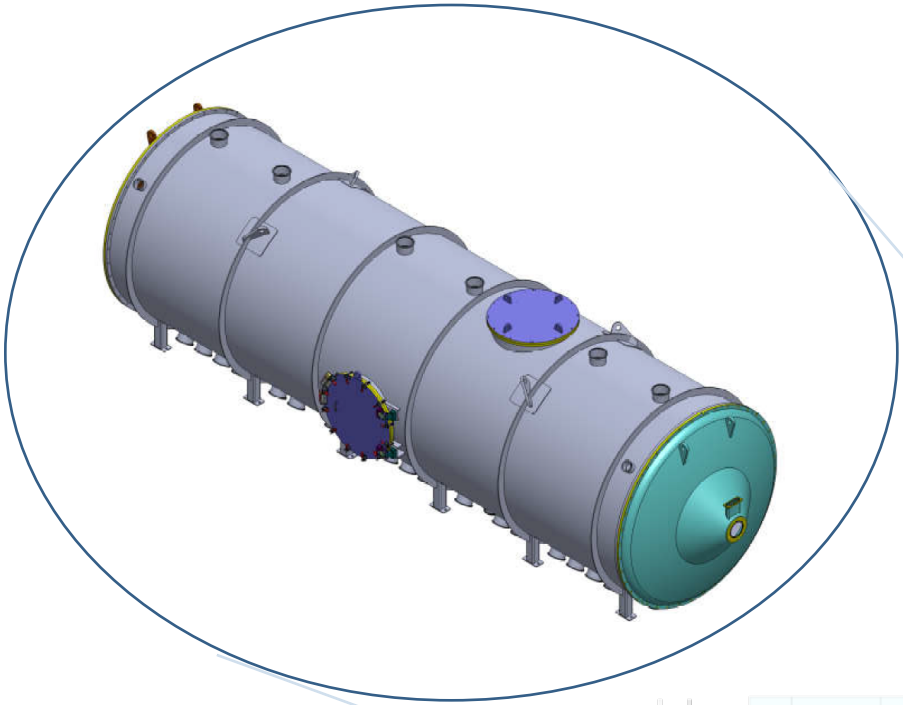
- Design & manufacture outsourced to JJ X-Ray
- Order placed, detailed design not yet started

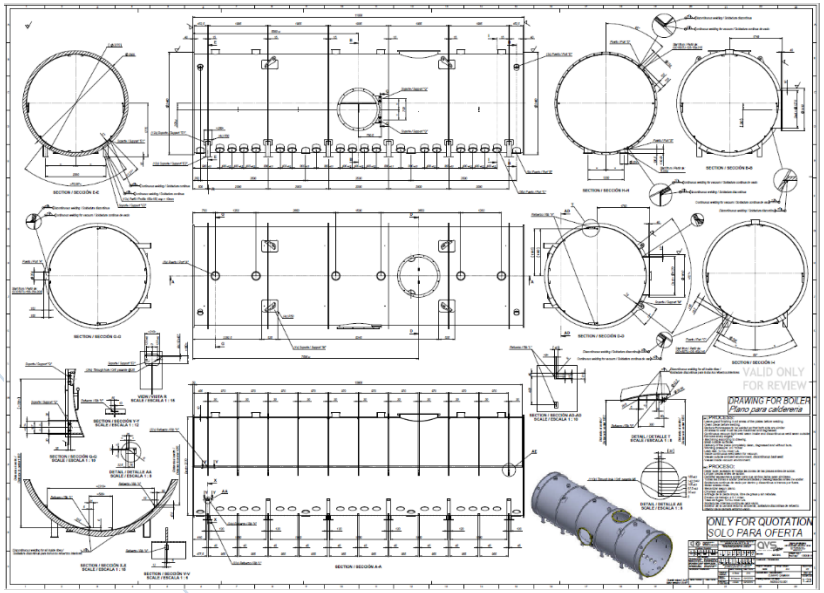


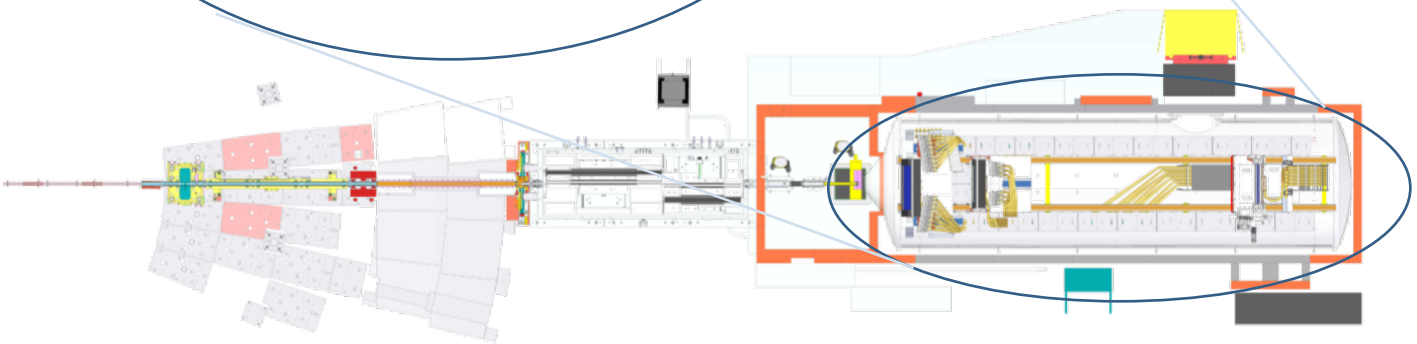


Detector Vessel

- Design complete (Outsourced to AVS)
- Manufacture commencing ~now

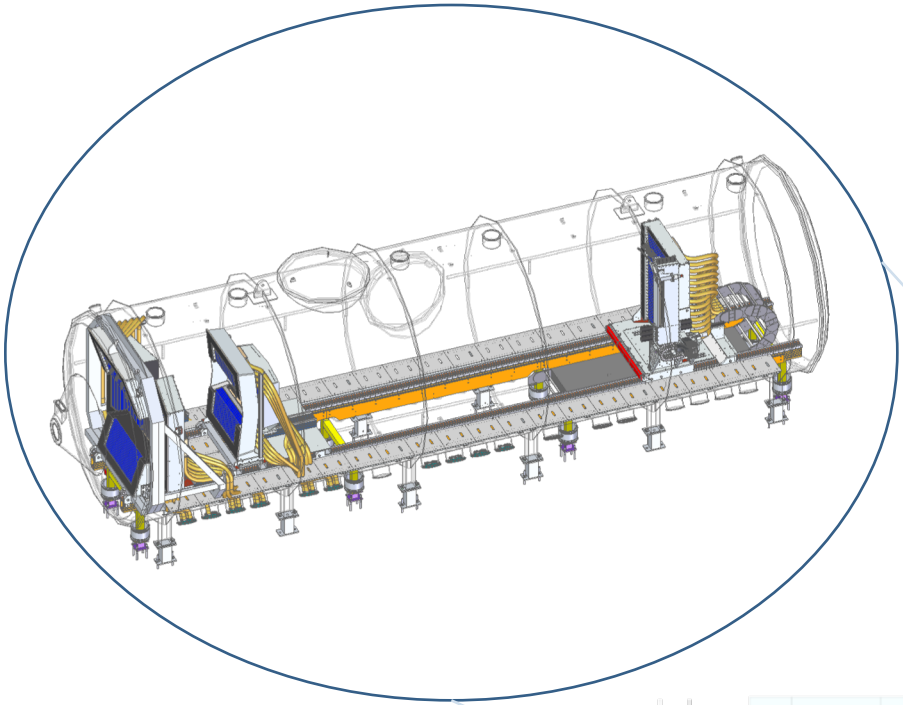


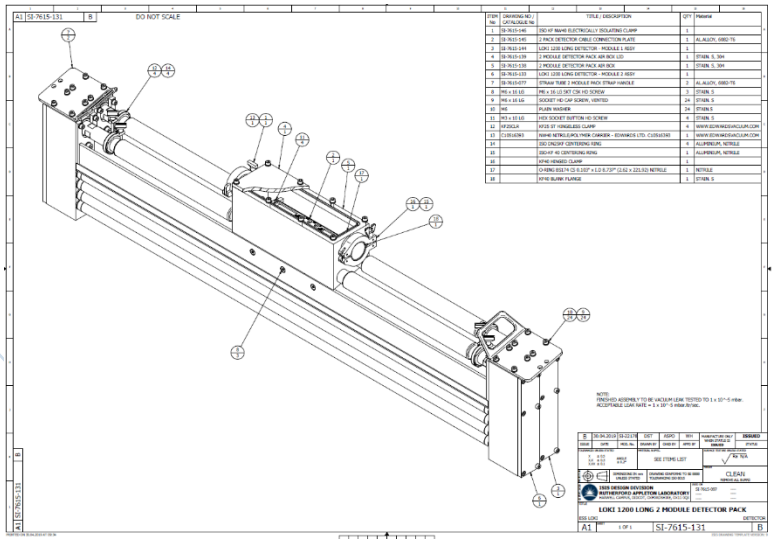


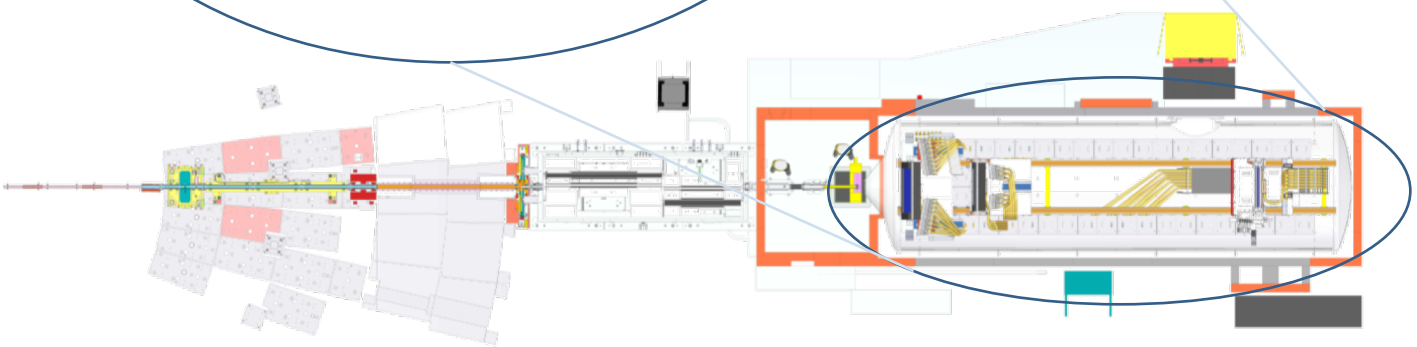


Detector Systems

- Design complete (ISIS Design)
- Manufacture underway

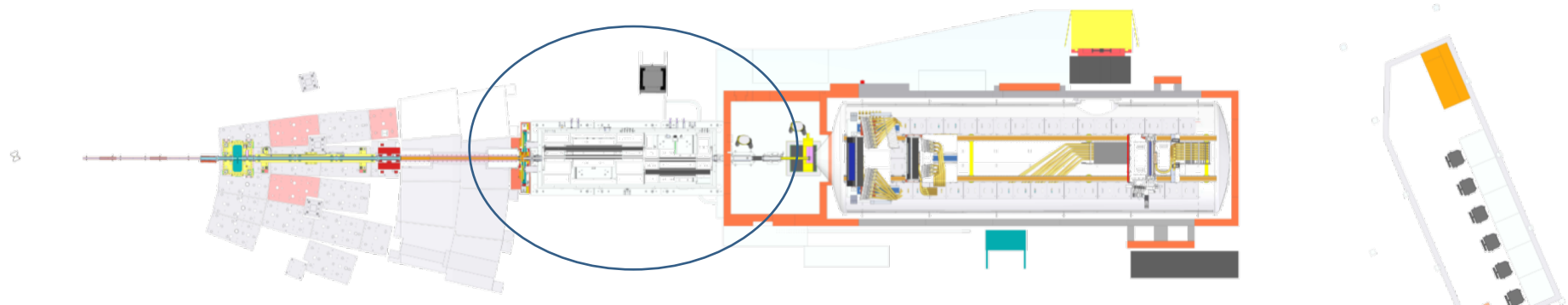






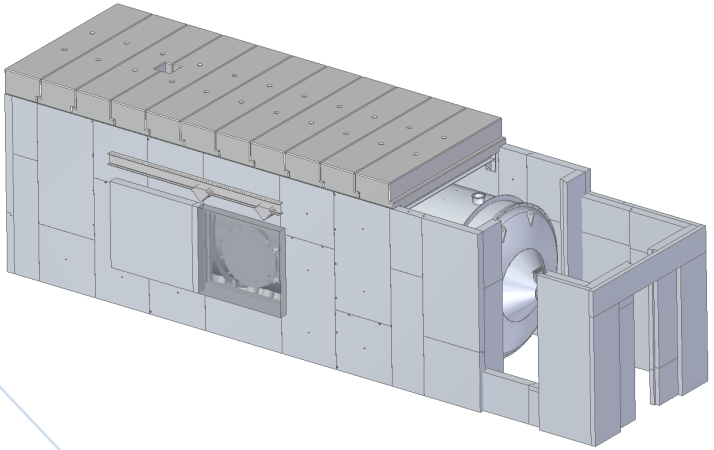
Bunker to Cave Shielding

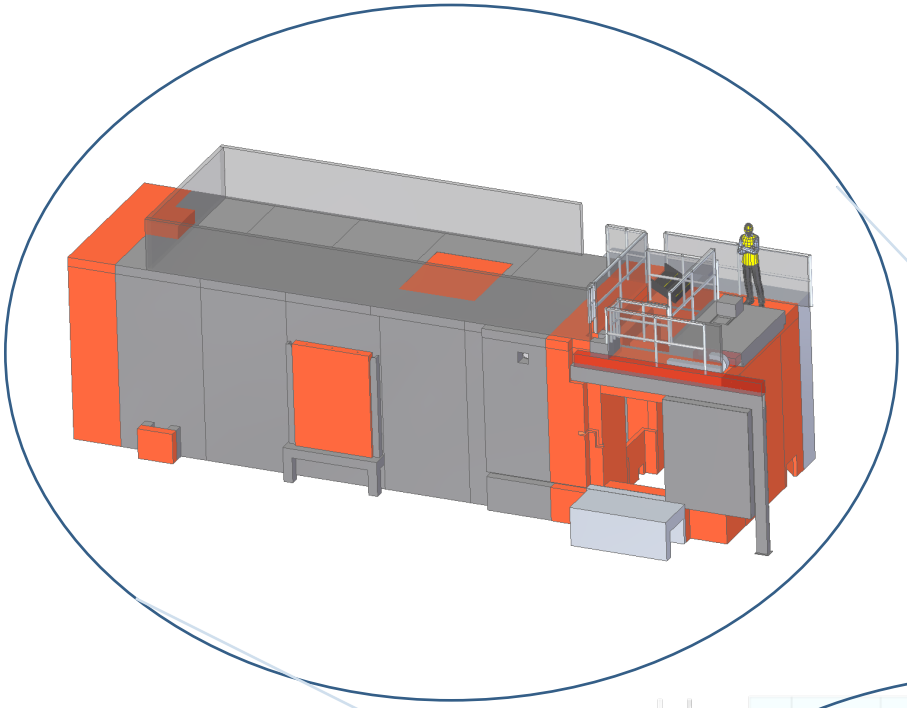
- Neutronics 1st pass completed
- Design not yet started

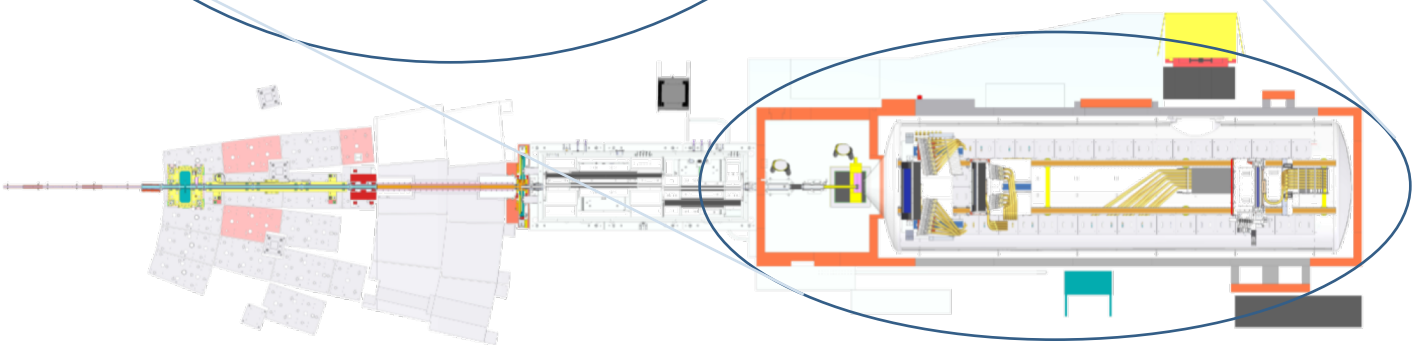


Cave Shielding

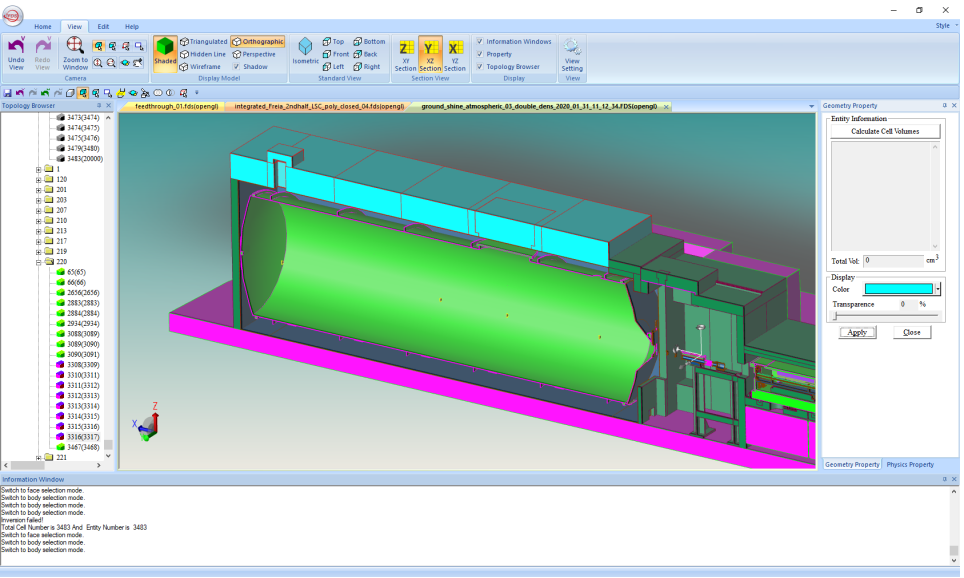
- Neutronics completed
- Design underway (ISIS Design)

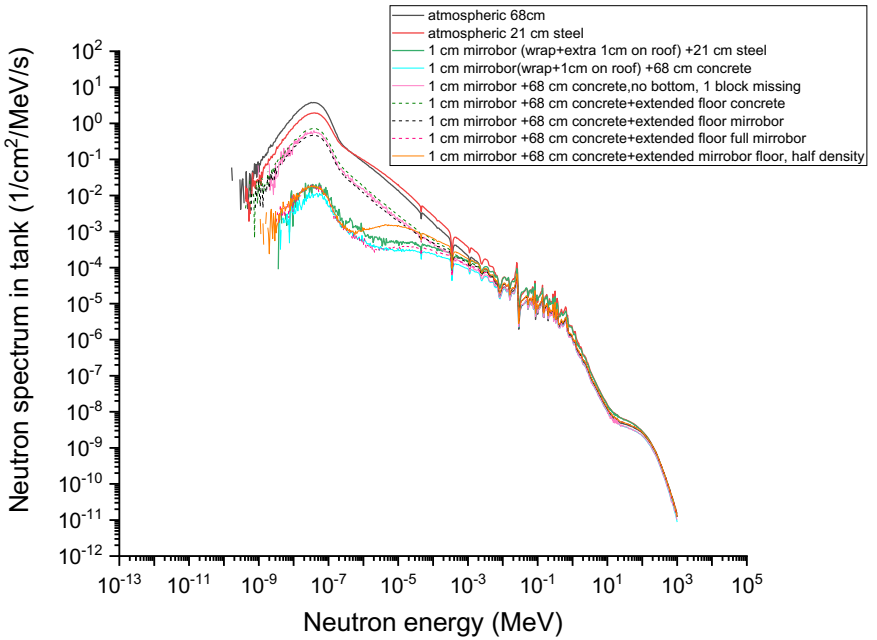


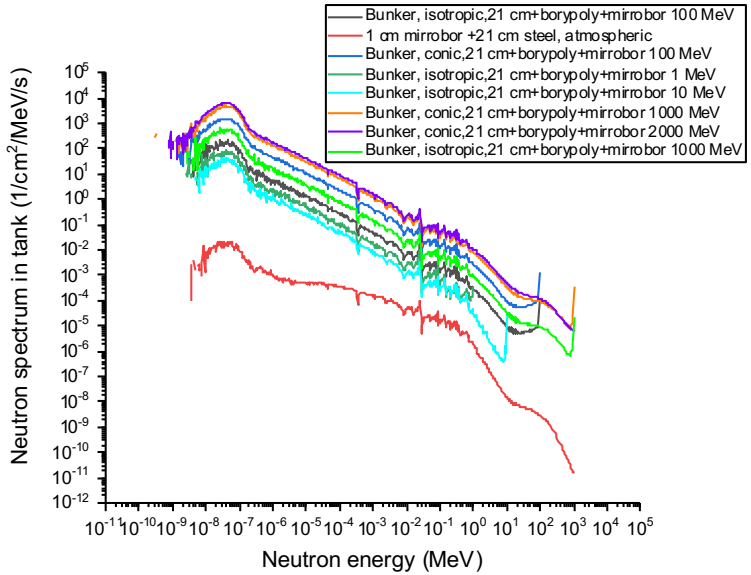


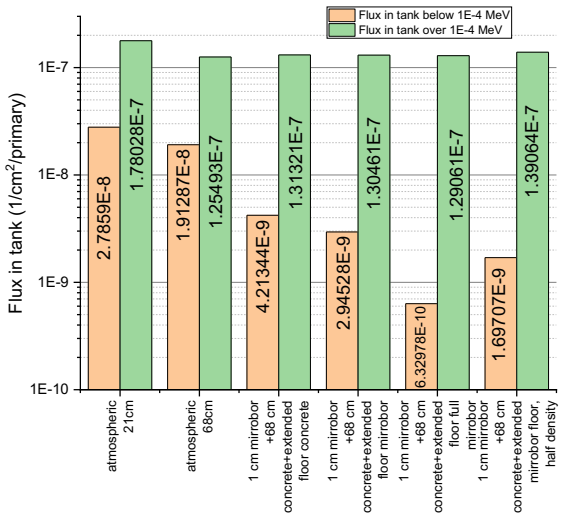


Shielding for Background



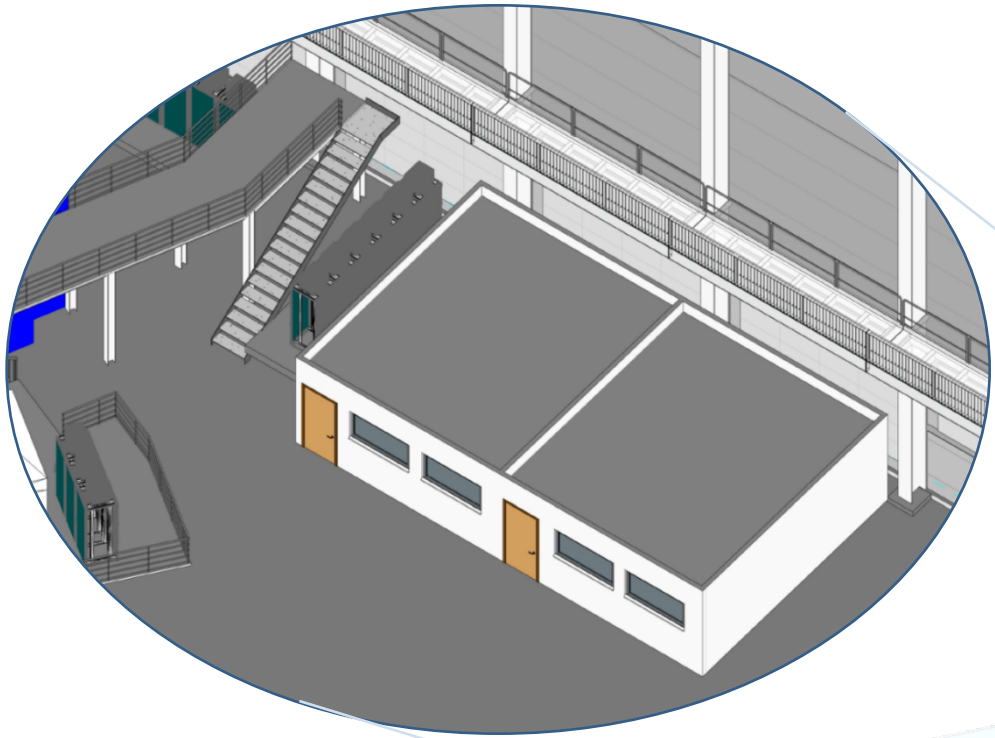


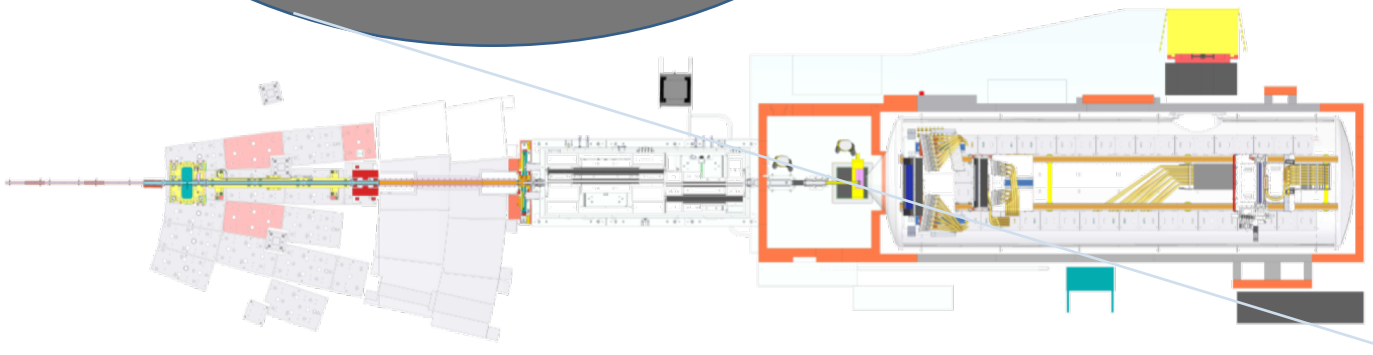


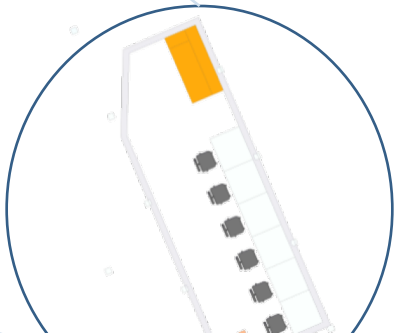


Hutch

- Tender underway

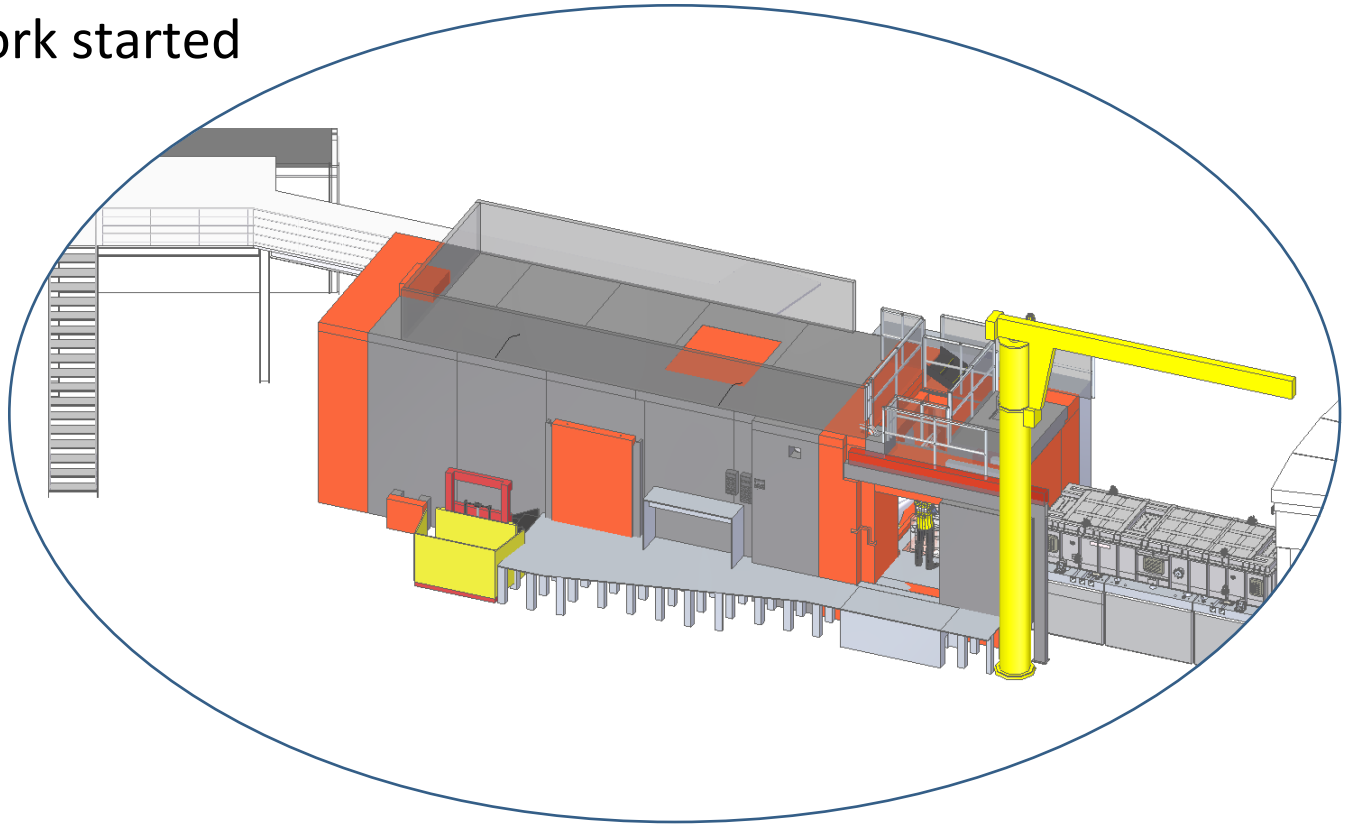


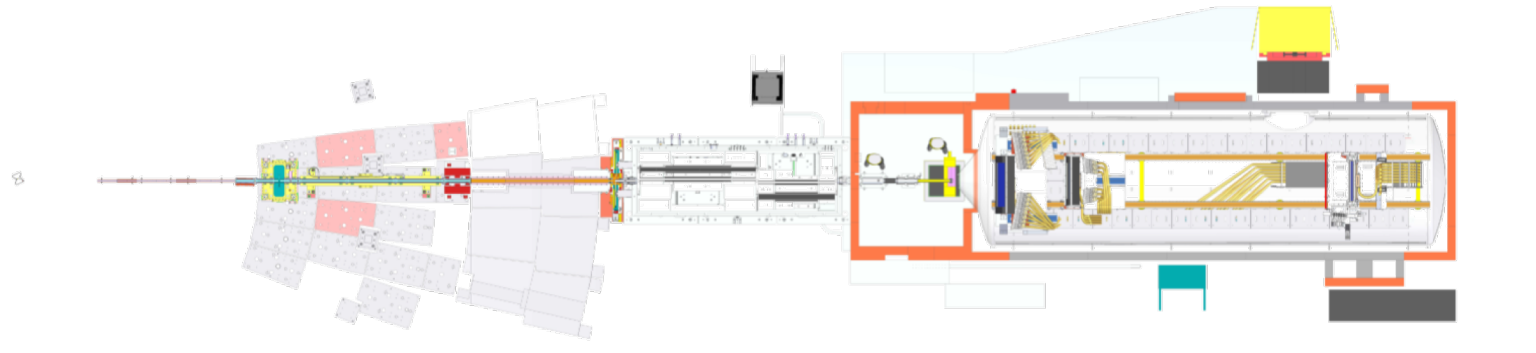




External Access & Supporting Systems

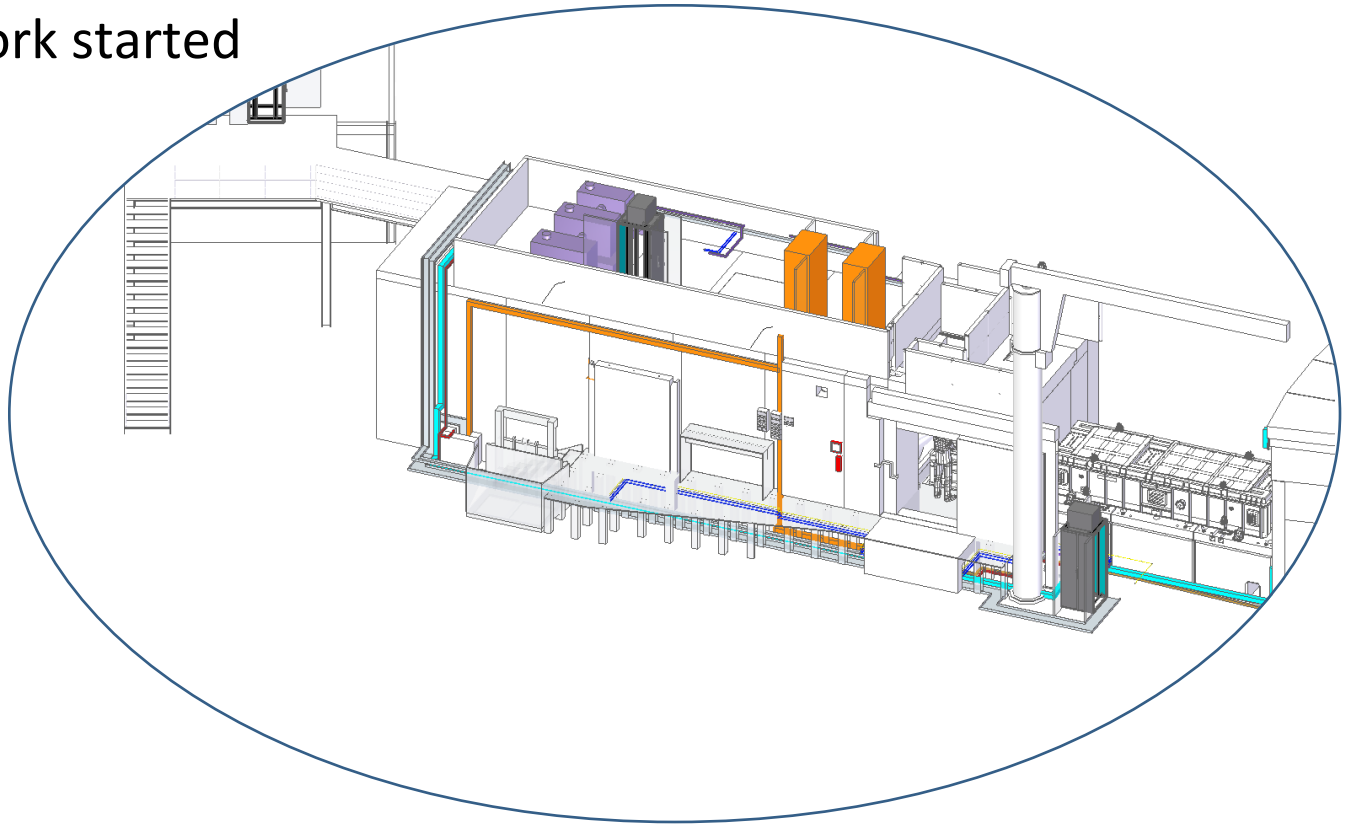
- Concept work started

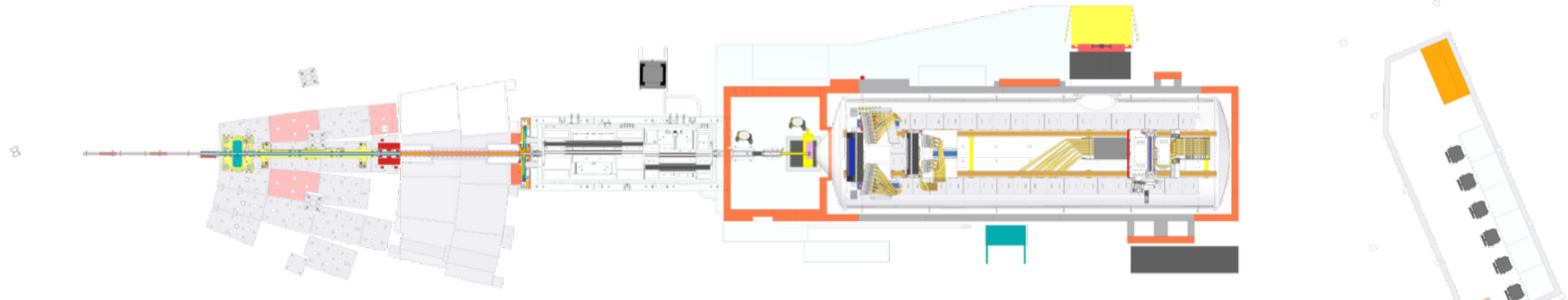




Service Routes & Racks

- Concept work started





Hazard Analysis & safety

- Status:
  - 1st draft of complete risk assessment for the Loki generated
  - 2x reviews with ESS safety stakeholders carried out

    Apr 2019 collaborative discussion to determine if the approach is correct

    Jan 2020 review to agree ESS 'owned' mitigations & associated scoring

- Challenges
  - Perspective & expectations of review team 'too broad'
  - ESS owned mitigations are not defined or are not understood by stakeholders
  - Complexity of the system, and so the hazard analysis, is very high

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Hazard Analysis & safety

#	Hazard Identification											Unmitigated Risk Estimation			Fatal Hazard?	Mitigating Factors	Control Measures	Residual Risk Estimation			Not implemented yet	PSS	ESS Tasks	ISIS Tasks	Escalte to Global
Part	Type	Equipment	Hazardous Component	Hazardous Area	Hazardous Situation or Event	Potential Consequence	Lifecycle Phase	Infrast.	Trains	Staff	Visitors	Likelihood	Severity	Risk	[Include justification if Severity is Major, i.e. slow moving, noisy, etc.]	[i.e. speed, torque, etc.]	[include by who and when, should be continued examples and RM updated]	Likelihood	Severity	Risk	[i.e. ESS procedure, ESS award engineer, STFC equipment and qtd design]		Notice Required by ESS	Notice Required by ISIS	Risks that are not eliminated, Risks that are operative in Pre-build activities at ISIS
1	Mechanical Hazard	Heavy Shutter	Heavy shielding walls & shutter material	R106	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken limb or fingers: Crushing, severing, impact, trapping	Pre-build			x		1	C	Unacceptable			Locking pin will ensure actuation can be blocked CDM area rules RAMS Signage - finger trap	3	C	Tolerable	Shut-off valve added to actuator to allow actuator to be isolated E-stop to be configured to ensure safe state Flow restriction			Yes	
2	Mechanical Hazard	Heavy Shutter	Heavy shielding walls & shutter material	Bunker & Maintenance Area	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken limb or fingers: Crushing, severing, impact, trapping	Maintenance when fixed			x		2	C	Tolerable		Slow moving	Locking pin will ensure actuation can be blocked Signage - finger trap Supplied maintenance manual will specify use of locking pin	5	C	Acceptable	Shut-off valve added to actuator to allow actuator to be isolated E-stop to be configured to ensure safe state Flow restriction		Yes	Yes	Yes
3	Mechanical Hazard	Heavy Shutter	Heavy shielding walls & shutter material	Bunker & Maintenance Area	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken limb or fingers: Crushing, severing, impact, trapping	Maintenance when required moving			x		2	C	Tolerable		Slow moving	Signage - finger trap	2	C	Tolerable	Shut-off valve added to actuator to allow actuator to be isolated E-stop to be configured to ensure safe state Flow restriction		Yes	Yes	Yes
4	Mechanical Hazard	Heavy Shutter	Heavy shielding walls & shutter material	Bunker	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken limb or fingers: Crushing, severing, impact, trapping	Installation of Fries or alike			x		2	C	Tolerable		Slow moving	Locking pin will ensure actuation can be blocked Maintenance instruction will dictate isolation when possible Signage - finger trap	5	C	Acceptable	Shut-off valve added to actuator to allow actuator to be isolated E-stop to be configured to ensure safe state Flow restriction		Yes	Yes	Yes
5	Mechanical Hazard	Heavy Shutter	Heavy shielding walls & shutter material	Bunker	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken limb or fingers: Crushing, severing, impact, trapping	Operation	x	x	x	x	2	C	Tolerable			Bunker will form a complete barrier, no other controls required. We will escalate the residual risk to ESS on the global HazID	5	C	Acceptable	Bunker must form complete barrier		Yes		Yes
6	Mechanical Hazard	Heavy Shutter	Rail attachement bar & static parts	R106	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken fingers: Crushing, severing, impact, trapping	Pre-build			x		1	C	Unacceptable			Locking pin will ensure actuation can be blocked CDM area rules RAMS Signage - finger trap	3	C	Tolerable	Shut-off valve added to actuator to allow actuator to be isolated E-stop to be configured to ensure safe state Flow restriction			Yes	
7	Mechanical Hazard	Heavy Shutter	Rail attachement bar & static parts	Bunker & Maintenance Area	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken fingers: Crushing, severing, impact, trapping	Maintenance			x		2	C	Tolerable		Slow moving	Locking pin will ensure actuation can be blocked Signage - finger trap Supplied maintenance manual will specify use of locking pin	5	C	Acceptable	Shut-off valve added to actuator to allow actuator to be isolated E-stop to be configured to ensure safe state Flow restriction		Yes	Yes	Yes
8	Mechanical Hazard	Heavy Shutter	Heavy shielding walls & shutter material	Bunker & Maintenance Area	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken limb or fingers: Crushing, severing, impact, trapping	Maintenance when required moving			x		2	C	Tolerable		Slow moving	Signage - finger trap	2	C	Tolerable	Shut-off valve added to actuator to allow actuator to be isolated E-stop to be configured to		Yes	Yes	Yes
9	Mechanical Hazard	Heavy Shutter	Rail attachement bar & static parts	Bunker	Moving element with exposed trap hazards: -Unexpected loss of pressure - Actuated intentionally (remote control) - Actuates due to Controls failure state	Broken fingers: Crushing, severing, impact, trapping	Installation of Fries or alike			x		2	C	Tolerable		Slow moving	Lock can b Maintenance instruction will dictate isolation when possible Signage - finger trap	5	C	Acceptable	to be isolated E-stop to be configured to ensure safe state Flow restriction		Yes	Yes	Yes
	Mechanical Hazard	Heavy	Rail attachement	Bunker	Moving element with exposed trap hazards: -Unexpected loss of pressure	Broken fingers: Crushing,	Operation	x	x	x	x	2	C	Tolerable			Bunker will form a complete barrier, no other controls required.	5	C	Acceptable	Bunker must form complete		Yes		Yes

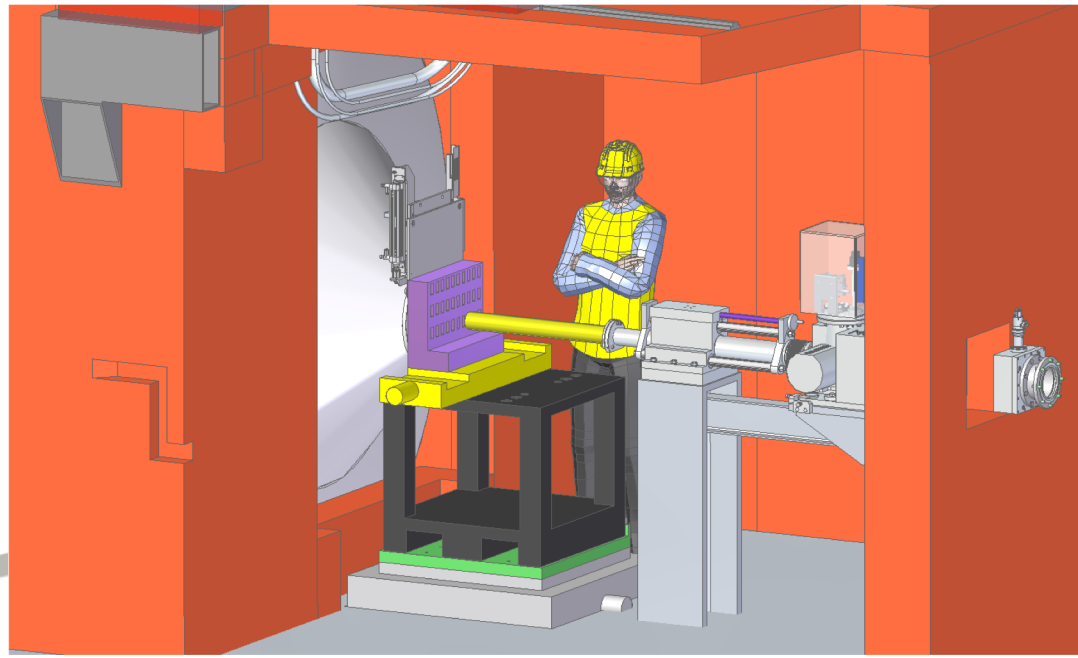
Currently ~450 lines

Consideration | Compiled Design Risk Assessment | IHA July 2019 Update | Scoring Criteria | Event Frequencies | OBSOLETE 1st Draft April Review

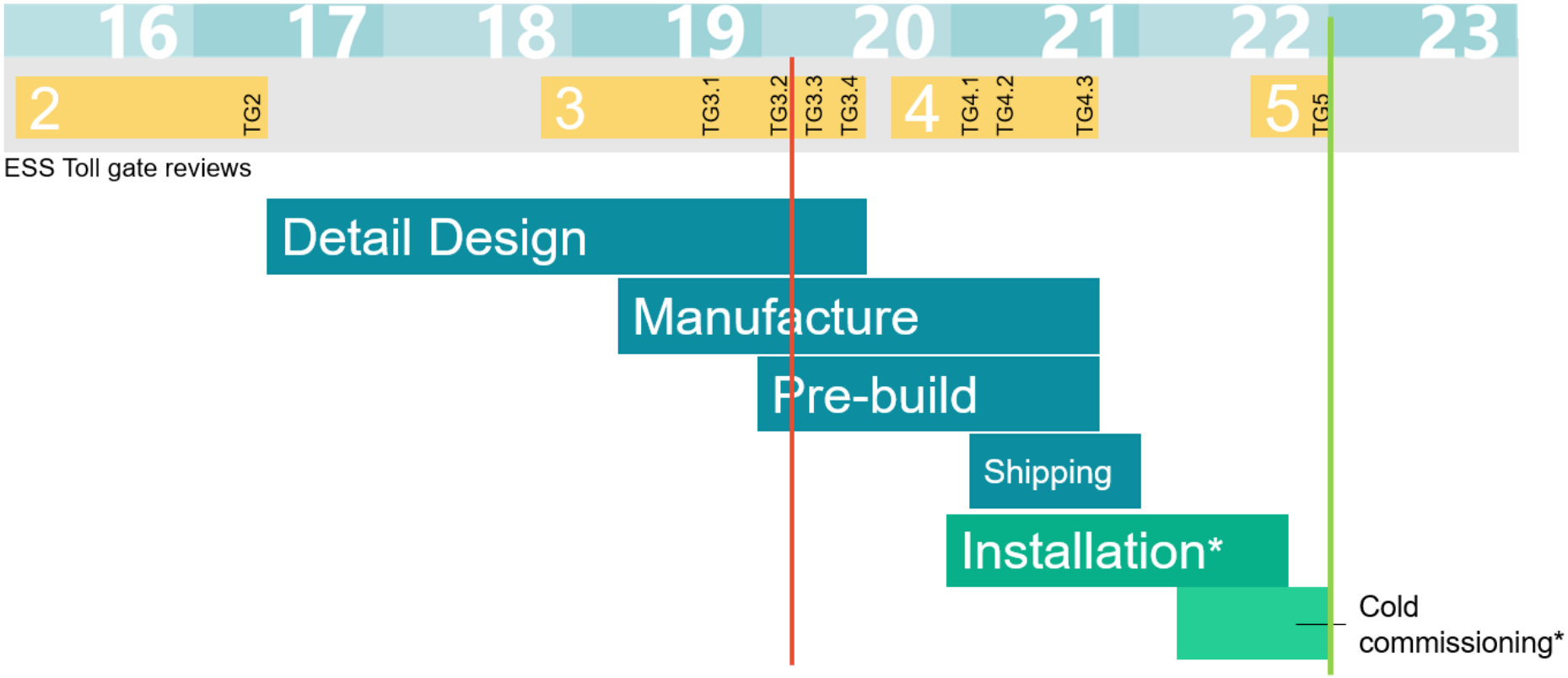
Motion Safety in Sample Area

- Sample area motion can cause fatal injury
- Sample area motion can be remotely controlled
- Sample area motion must be move-able with scientist in touching distance

- Safety system required:
  - Disable remote control
  - Provide local control



TG3 Schedule



Project completion: 23/12/2022

* Carried out by ESS with advice from ISIS

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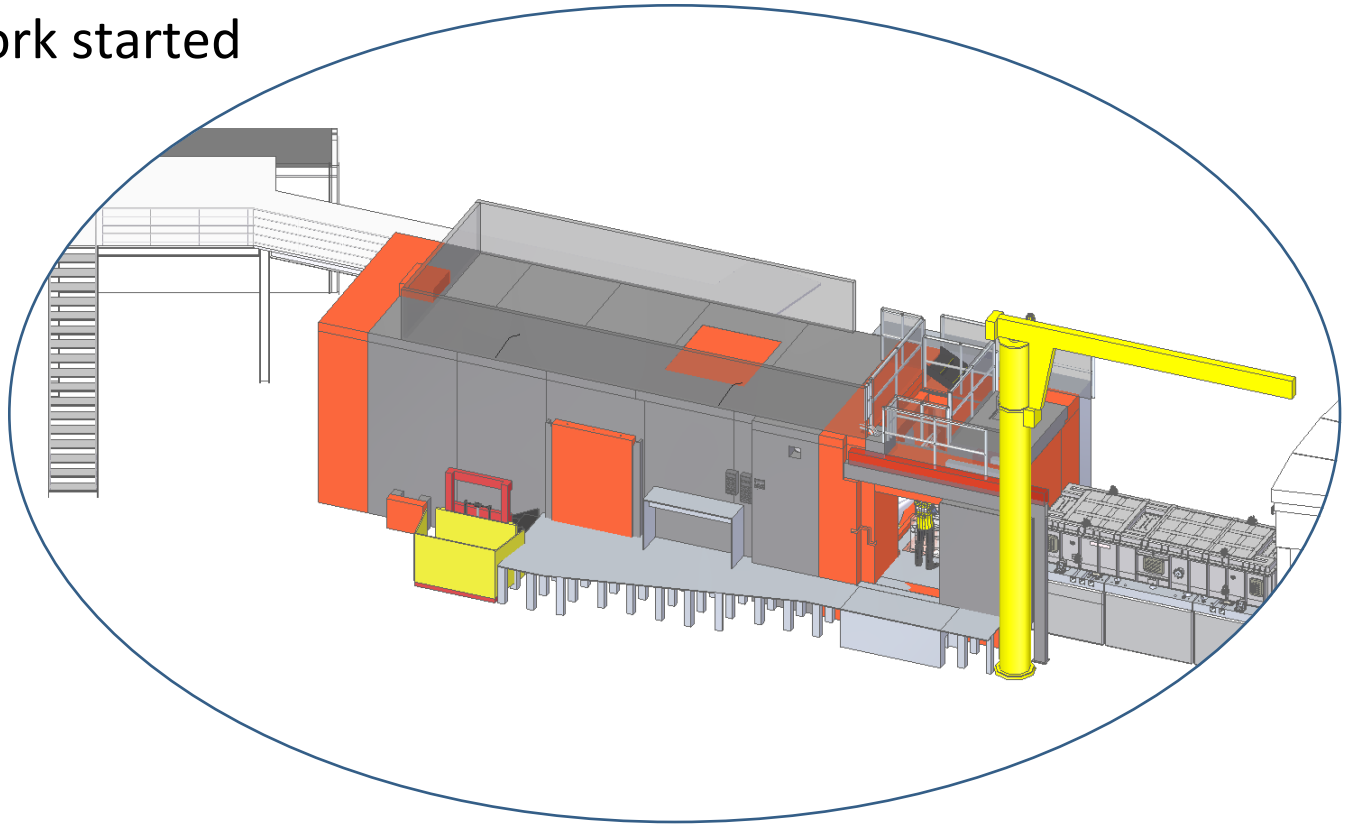
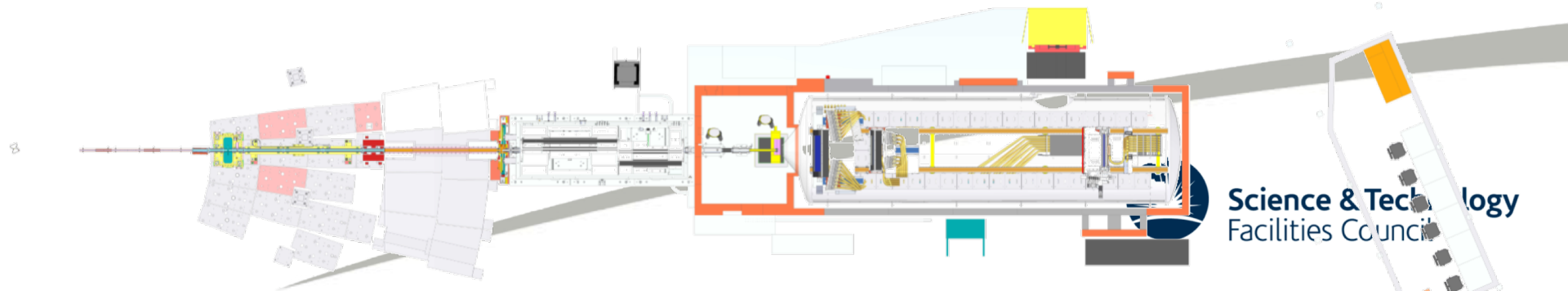
External Access & Supporting Systems

- Concept work started





TG3 Schedule

- Some work packages are not ready for TG3
- Designs for these elements are not needed for another 1yr
  - Crane
  - Goods lift
  - Access flooring outside the cave

- Get on with it anyway?

People Working On Loki Design

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Federico Masi
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James Prince
Peter Galsworthy
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Simon Cooper

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SNAG
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AVS

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Thank You For Listening

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