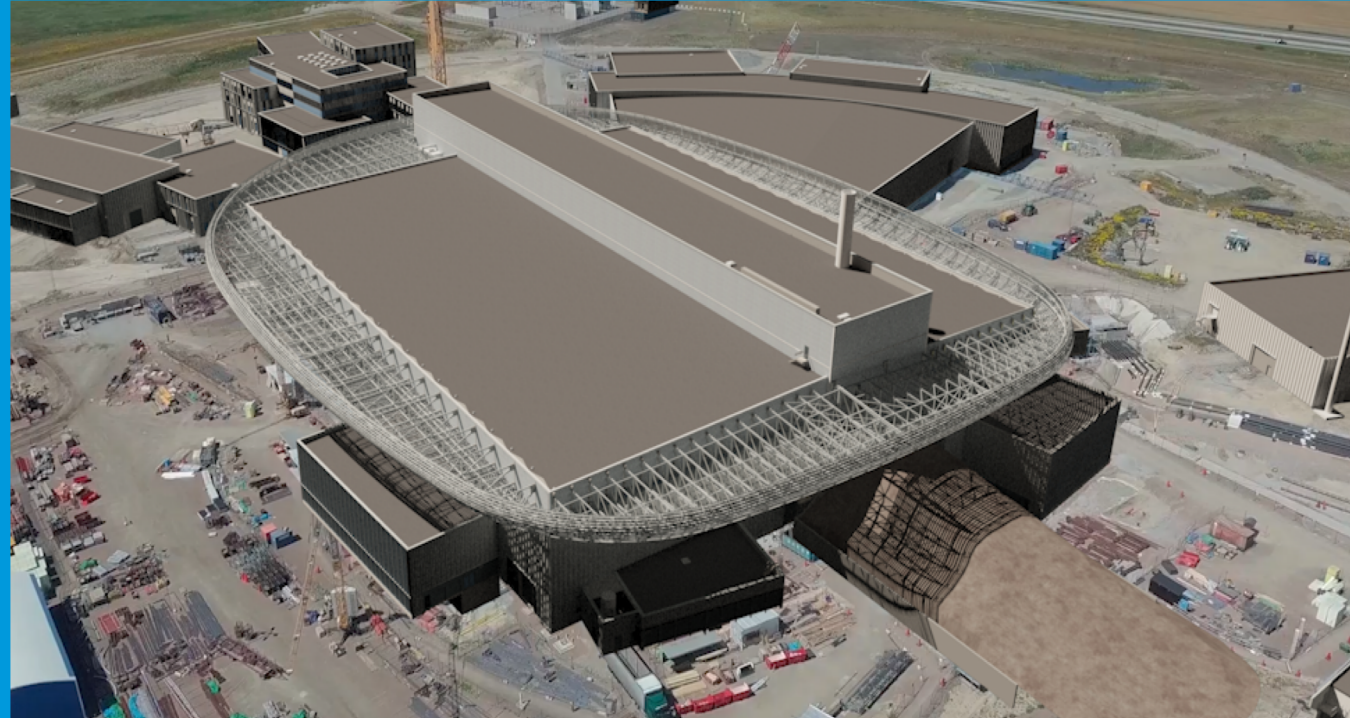




**EUROPEAN
SPALLATION
SOURCE**

ESS Project Update – IKON #19



PRESENTED BY <MARK ANTHONY>

2020-09-28



Outline

1 Project Highlights (short)

2 Schedule Performance with Covid-19

3 Critical Path Schedule and Corrective Measures

4 In-kind Feedback from Template

5 Rebaseline Assessment

6 Concluding Remarks

Project Highlights



Project Highlights - CF



D03 Main Control room, and Highbay enclosed
The last of the iconic **tower cranes** was dismantled and the very last heavy concrete casting on our construction site was poured – a defining moment for the project.



Roof works completed in H09 Radwaste



D03 Experimental Hall 2, roof is on and panel walls almost complete
Erection of cantilever roof started

Back to 85-90% staffing, some material delays continue

Project Highlights - Accelerator



Ready for spoke CDS



Spoke RFDS



First Spoke RF station at TS3, already operating at 350 kW
All of MB waveguide runs have been tuned, DTL4 & 5 in Gallery
Electrical installation (cable pulling) started in SPK and MBL

Project Highlights - **Target**



Monolith Vessel, lower & mid parts – in final machining steps, Delivery Oct 1



Target wheel ribs in place and tack welded. Tested with dummie cassette



Neutron Beam Port Blocks – 20 of 39 tubes have passed pressure and leak tests

Project Highlights - NSS



R6 bunker system installed in D01 and D03, Electrical infrastructure installation started in E01. Labs and workshops in E03, E04 – work started again.

2020-09-16 PROJECT STATUS REPORT_2020/02



NMX cave completed construction, **Bifrost** started, **Bunker** manufacturing preparing for pre-assembly of West wall in Hungary.

Project Highlights - ICS



- Development of standardised EPICS (E3) environment has matured



- Activities in 8 ongoing projects are progressing according to plan



- SAT completed, and energization of one of the server room's switch gear was conducted



Schedule Performance



Major Milestones



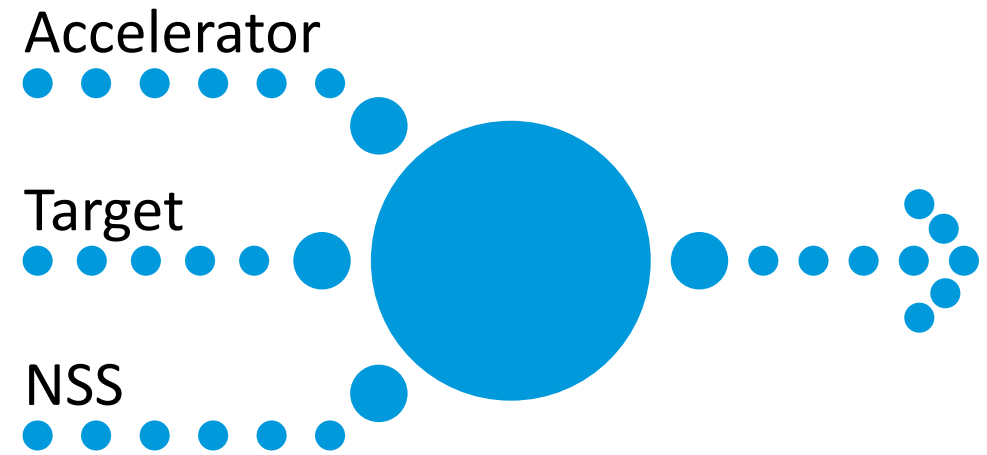
Name	Baseline Date	Pre-corona Forecast Date	New forecast date
Ready for Delivery On Site - Cold Moderator Assembly	2019-02-11	2020-09-15	2020-11-01
Ready For Installation (RFI) DTL1	2019-02-11	2020-05-11	2020-12-08
MB CM series testing starts at LTS2	2019-03-04	2020-04-09	2020-11-01
Spoke CM testing starts at Uppsala	2019-04-15	2020-04-08	2020-11-01
Delivery on Site – Monolith Vessel	2019-10-11	2020-05-06	2020-09-25
Start RFQ commissioning	2019-10-28	2020-10-16	2021-01-28
Beam commissioning completed for ISRC-LEBT-RFQ-MEBT-DTL1	2020-02-03	2021-03-30	2021-07-23
Delivery on ESS Site - Lower Part - Monolith Inner Shielding Second part	2020-06-26	2020-12-04	2020-12-04
Beam commissioning completed for NCFE but DTL5	2020-08-17	2021-10-08	2021-11-09
D03 Parallel Access Experimental Hall – Bunker Access	2020-09-15	2020-10-02	2020-11-03
Delivery on ESS Site - Proton Beam Window	2020-12-03	2020-12-08	2021-06-22
D01 Parallel Access Experimental Hall – Bunker Access	2021-01-07	2020-11-20	2021-02-25
Accelerator Ready for Beam on Target - RBOT, 570 MeV	2021-05-24	2022-07-07	2022-12-16
11 High Beta Cryomodules installed	2021-06-02	2022-10-14	2023-04-25

Major Milestones

Name	Baseline Date	Pre-corona Forecast Date	New forecast date
Accelerator installed for 0.8 GeV and 2 MW – EOC	2021-12-22	2023-07-24	2023-12-18
Test Beam Line ready for BOT (NSS)	2022-02-21	2022-05-21	2022-12-02
21 High Beta Cryomodules installed	2022-07-04	2023-06-26	2023-12-18
First Instrument ready for Hot Commissioning	2022-07-07	2022-09-02	2023-02-28
BOT / TD RBOT	2022-07-22	2022-10-03	2023-03-17
First call for initial experiments FS	2023-03-29	2023-05-30	2023-11-30
Start of User Programme SOUP	2023-12-31	2024-02-28	2024-08-31



Critical Path



Equipment Deliveries that are driving Critical Path

Critical Path to Accelerator RBOT (December 2022)

- RFQ (terminations, conditioning and commissioning with Beam) - CEA
- DTL (assembly, installation and conditioning) – INFN
- Spoke CM (Assembly, testing, conditioning and installation) – CNRS/IPNO, Uppsala University/FREIA
- Medium and High Beta CM (assembly, test, conditioning and installation) – CEA, ESS, INFN/LASA, STFC/Daresbury

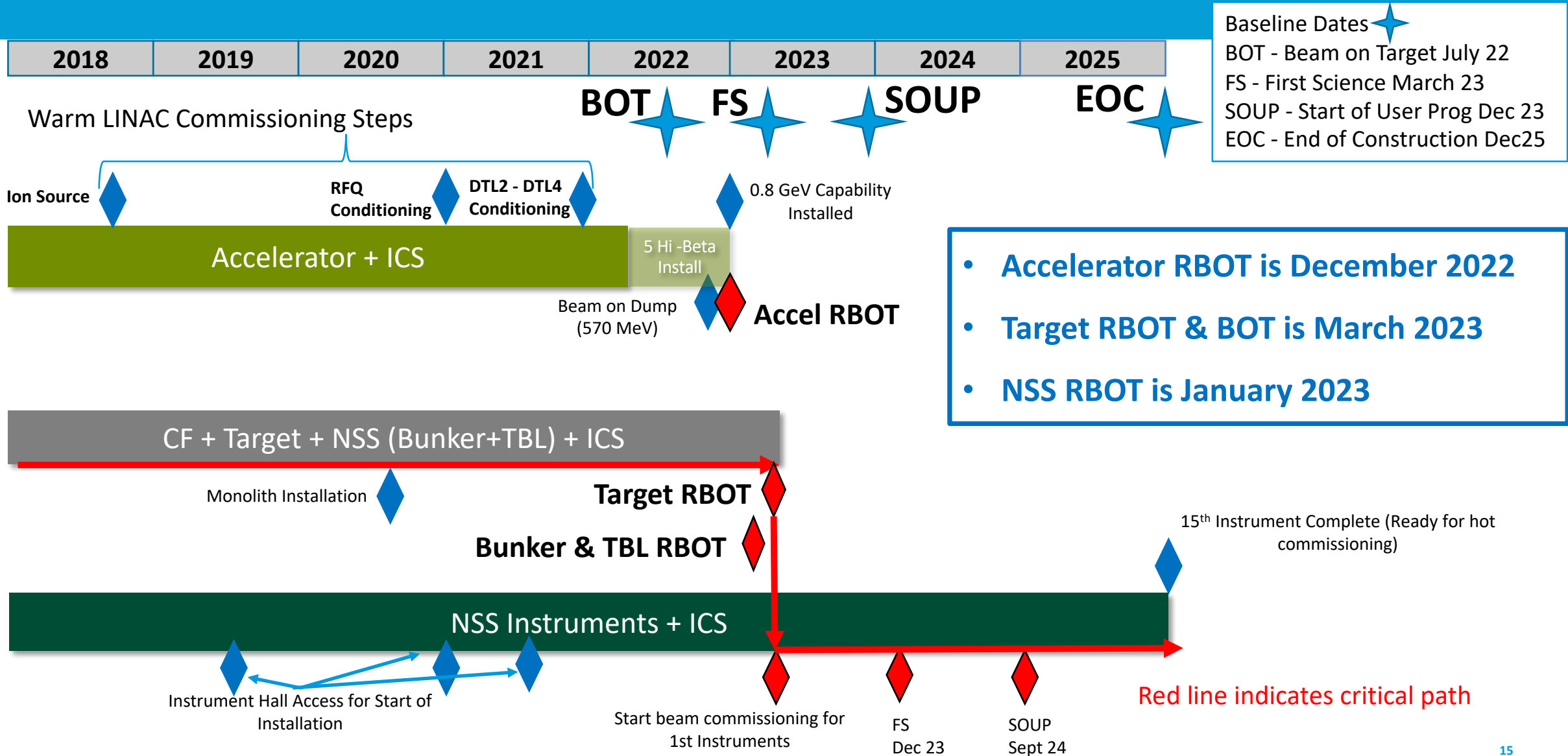
Critical Path to Target RBOT (March 2023)

- Monoliths Vessel – ESS Bilbao, pushed to October now CP
- Monolith Port Blocks (ESS-Lund)
- Assembled Target Wheel - ESS Bilbao

Critical path to First Science, (November 2023)

- Instrument designs, procurement, and installation (LOKI, ODIN, DREAM)

Summary Schedule and Critical Path for Remaining Work



- Accelerator RBOT is December 2022
- Target RBOT & BOT is March 2023
- NSS RBOT is January 2023

5

Corrective Measures

“Manage Schedule Slips over
increases to Budget”



Corrective Measures - General



- We are prioritizing works and thus the workforce based on minimizing the impact on critical and near critical path. For example, A2T was sacrificed by directing resources to the critical D02 and short instrument halls.
- Ensuring a workforce remains available by arranging new travel routes, eg. boat, flying via other countries, chartering private planes, and contracting/using more local suppliers.
- Re-scheduling shifts in order to secure the workforce for longer periods. These actions have reduced the delay on CP by 4 wks. Not using 14 d quarantine rules saves 14 d every 2-3 weeks when there is a shift change by our Trade contractors. (Such a rule would have closed the site.)
- Put a recovery plan in place addressing the issues identified in the independent Project Review on Accelerator, includes a reorganization, and new leadership.
- Scheduled Planning workshops with each WPM throughout October with focus on schedule quality and optimization.
- On the advice of PAC, additional External Project reviews are now scheduled for AD, TD and CF. NSS is being planned for Q1 2021.

Corrective Measures - Inkind



- Working with their suppliers on mitigation actions to recover schedule;
- Piloting ways of working safely within social distancing guidelines that may allow a limited return to on site work;
- Reassessment of the priorities in procurements in coordination with the other Partners;
- Working with main contractors to analyze the feasibility of modifying the production sequence for mitigation purposes;
- Use of video conference tools have increased and has been made easier, but less efficient.
- Quality Issues - enhanced rigor and discipline in acceptance of technical components. Stopped deliveries of poor quality
- IK Collaboration Board and Technical Board meetings continued attendance by PM and TD, project issue/solution focused.
- Continued Special intervention meetings with Problem In-kind Partners and their suppliers to scrutinize recovery plans.
- The External subproject reviews scheduled in Q4 includes Inkind. Reviewing results, performance against schedule and issues and recommends actions.
- ESS engineering now assuring design coordination and systems integration is correctly feed into Inkind Procurement, Installation, test and commissioning Plans. We will receive the necessary documents
- IKRC mandate is under review to determine if they can add more emphasis on addressing performance shortcomings by the Inkind partners.

Corrective Measures – Schedule



- Routinely updating the schedule – re-revised, resequencing, making logic changes, as information is known, rolling wave planning. Several CP schedule changes have been made to minimize Covid delays:
 - Created alternative installations sequences in the Tunnel for cryo system components and infrastructure work,
 - Commissioning of casks is not included before TD-RBOT
 - PBW is removed from its preferred installation sequence
 - Man power curve for parallel welding of portblocks is taken into account (Inkind from ESS Bilbao)
 - NSS impact from Vessel and Portblock delays reanalyzed with Target and found a mitigation strategy that helped gain a few months on NSS R-BOT, by splitting Bunker installations into 4 zones
 - Also assured that all other planned Bunker installation activities in 2020 is proceeding independent from Target installations, inserts and light shutters installations.
- Apply Agile Project Management concepts to construction project in the areas of integrated system testing (2 week sprints), with continuous evaluation and improvement.



In-Kind Template Feedback





Shutdown Events – Inkind

Reminder there were over 184 events being tracked, Partial List Below

- INFN, DTL tanks, Spoke Power Stations
- IFJ PAN, Installation and CM tests
- WUT, Phase Reference Line
- PEG, LLRF Components
- ESS Bilbao, NC linac RF and HV, MEBT
- CEA, MB cryomodules, RFQ skid re-commissioning
- IPNO, Spoke cryomodules
- CEA, RFQ skid re-commissioning
- Uppsala University, Spoke CM test
- STFC, LWU production
- Target Drive Unit (AVS, Spain)
- Target Shaft (Thuneureka, Spain)
- Target Wheel (Nortemecanica, Spain)
- Monolith Vessel (Cadinox, Spain)
- Active Cells Facility (several sub-suppliers)
- LOKI: supplier delays to deliveries, delay to TG3 and Site closure at STFC will slow down prebuild for LoKI
- CSPEC, MAGIC, BIFROST: LLB procurements
- Motion Control: Julich has shut down production and workshop. Impact on for example LOKI & Bifrost.
- Critical Sample Environment Systems: In-Kind partners in Estonia and France and their suppliers have reduced work capacity
- ICS controls work slowed from Italy, Poland, Estonia, France and Spain
- Other listed work elements (FZJ, Germany)
 - Cryogenic Moderator System
 - Neutron Beam Port Inserts
 - Target Monitoring Plug

In order to collect performance recovery data from the Inkind Partners, we developed a template to ensure the data is provided in an uniform and consistent way.

In-Kind Partner Performance Survey – Good Progress



	Survey Sections 1 and 2 (Own Organisation and Key Suppliers)				Survey Section 3 (Key Deliverables)				
	OUT	Days to first complete	BACK	Fully complete (post iterative clarifications with ESS)	OUT	Days to first complete	BACK	Feedback provided to In-Kind Partner (post iterative clarifications with ESS)	
1 to 5	13/05/2020 ✓	18	31/05/2020 ✓	30/06/2020	01/07/2020 ✓	30	31/07/2020 ✓	18/09/2020 in progress	Feeding into Project Wide Scheduling Exercise later in the year in lead up to December Council
6 to 14	27/05/2020 ✓	18	14/06/2020 ✓	30/06/2020	08/07/2020 ✓	30	07/08/2020 17/08/2020 ✓	25/09/2020	
15 to 25	03/06/2020 ✓	18	21/06/2020 ✓	30/06/2020	15/07/2020 ✓	30	14/08/2020 04/09/2020 ✓	02/10/2020	

1st wave of completion covers own Organisation (Section 1) and Suppliers (Section 2) and
2nd wave of completion covers Key Deliverables (Section 3)

Inkind Survey

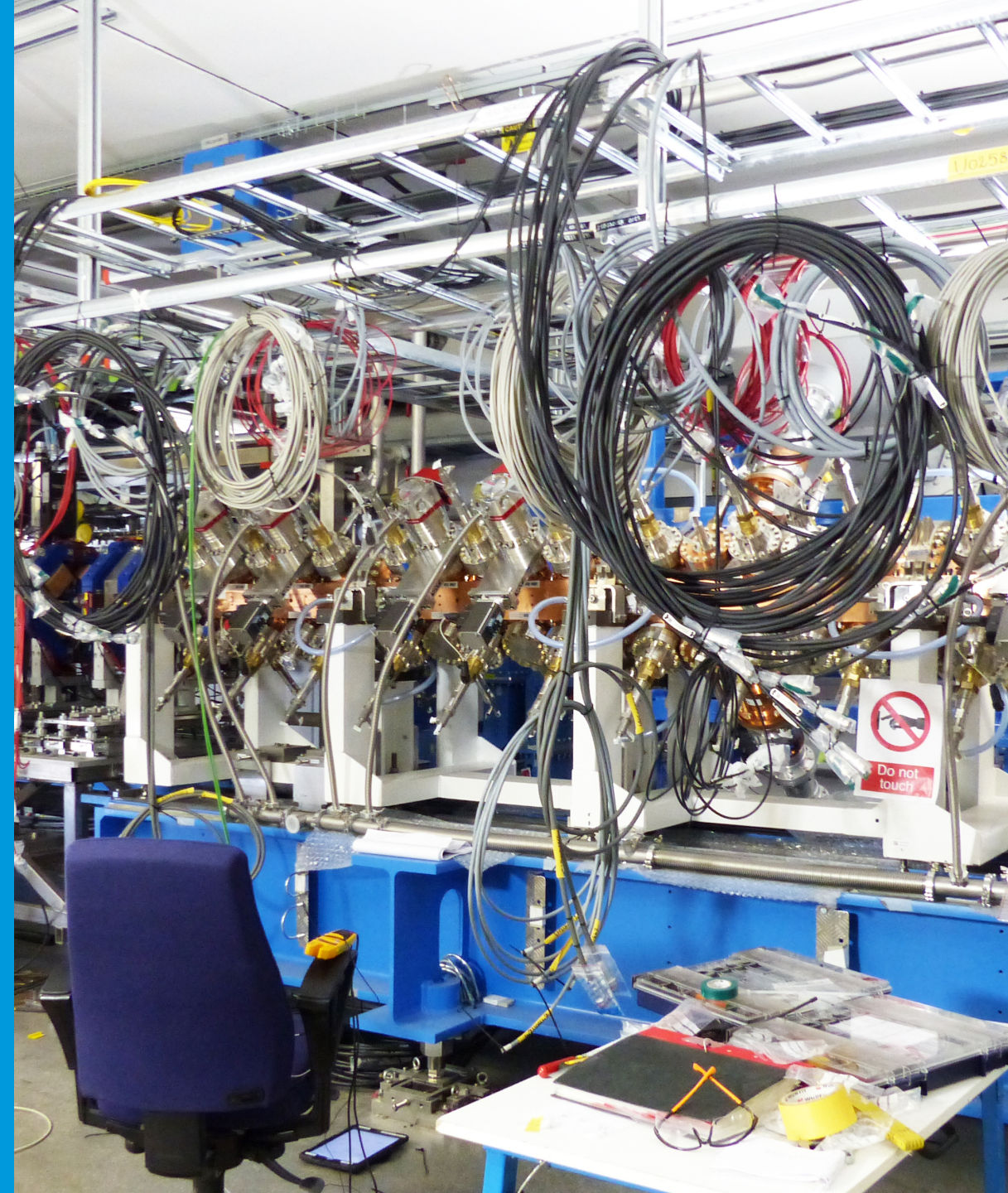
Summary Feedback



- Work in most IK partners is resuming but productivity is still being impacted and things will take longer. Staff whose work cannot be done from home in part or full are gradually starting to return to work.
- Initial analysis shows delays from 2 to 7 months to key deliverables due to Covid-19. These compound the delays to IK deliveries that were already in the system.
- A deeper analysis has only just begun and will include the formulation of joint actions to address the issues the In-Kind partners raise. False expectations / unclear assumptions regarding working with parallel access, PPE, spatial integration need to be responded firmly, factually and on a detailed case-by-case basis. They cannot be left unanswered as In-Kind Partners now have this on the record.
- Mitigating the schedule and cost impacts of Covid-19 are similar and aligned with what ESS is implementing. Traditional mitigations like double shifting, will not generally be feasible due to budget limitations.
- Requests for cost book value increase due to Covid we are not accepting as our responsibility, this is an issue for Council to address
- We know what the current cumulative delay is right now, but we do not have sufficient certainty on the final impact.
- We have a process and path forward working with the In-Kind Partners that will reveal their true positions and gain their commitment to co-own outcomes and deliver on recovery actions.

6

Rebaseline Assessment



Rebaseline - Planning



- Data received thus far from Inkind Partners and our own supply chains is insufficient to to develop a realistic and, importantly, a deterministic schedule for rebaselining of the project.
- We continue to work with the partners to find improvements and settle on new delivery dates.
- Subprojects continue to manage schedule slips over increases to Budget.
- In October the PMO will conduct planning workshops to ensure quality with the latest data is reflected.
- BOT is currently forecasted on March 17 2023, its driven by two delay components in Target.
(Pre-Corona 3 months due to Ingot edge cracking + Corona 5 months = 8 months total)
- ESS will continue with the rolling wave planning technique and hold planning workshops to update the network
- The next likely opportunity to rebaseline will be either in December 2020 or Q1 2021.

6

Concluding Remarks



Concluding Remarks



- Construction Project is at 72% complete, impacts from Corona currently range between 3-7 months, we are maintaining the priorities on the critical path but have postponed some non-critical works.
- ESS has so far maintained SV and CV steady through the Corona period, by implementing many corrective measures and Managing Schedule Slips over increases to Budget.
- Traditional mitigations measures we would normally consider, such as double shifting, are not generally feasible due to budget limitations.
- Civil construction and infrastructure Installation makes progress, now at 85-90% capacity, some access dates have slipped 4-6 weeks.
- ESS staff that can work from home continues to work from home, we have begun a slow and deliberate return to the office via rotations.
- Equipment and Material deliveries have started again and we are seeing easing of earlier supply chain interruptions.
- Productivity is still being impacted and things will take longer. Rebaselining may occur in December.
- We continue to struggle with Inkind deliverables and challenges to maintaining cost book. Good communications remain with Inkind partners and this will be vital for moving work forward and completing ESS.



Thank you