

# Target Overview

## TAC 19

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- Target Project Performance
- Project Accomplishments
- Issues
- In-kind Status
- Concluding Remarks

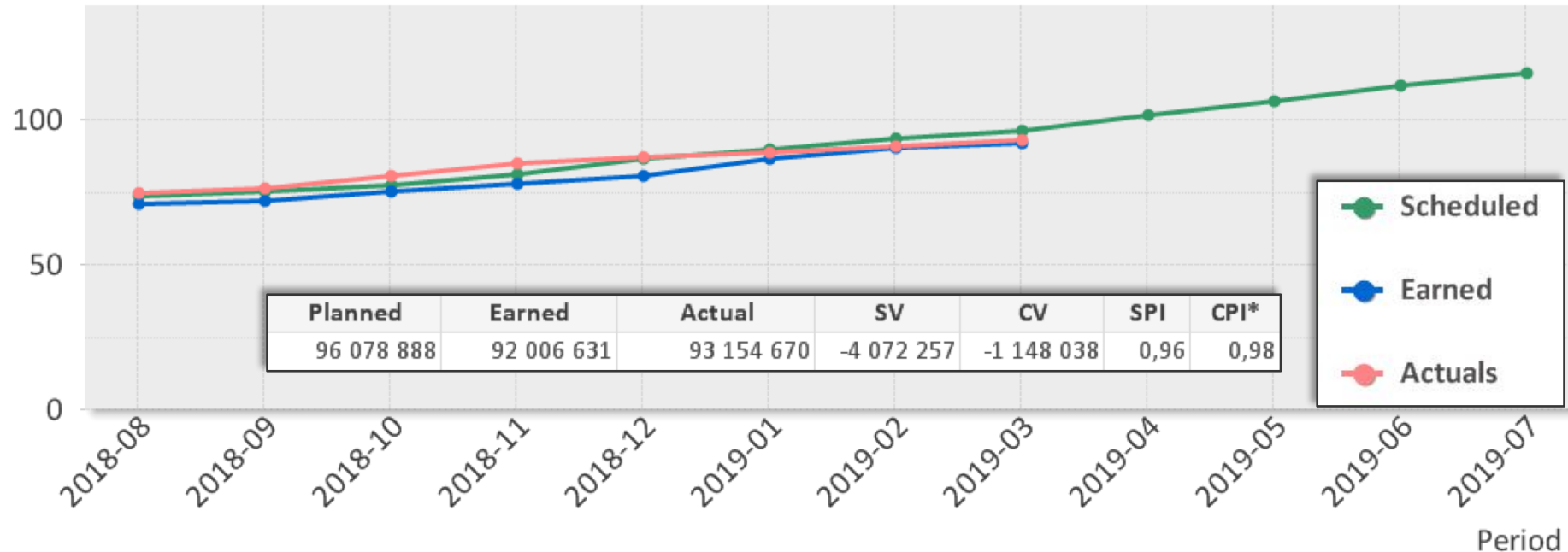
# Target Performance

- Project is 44% complete
- Current budget at completion for the ESS Target Sub-project is 211.1M€
- Earned value end of March 2019 is 92M€
- $SV = -4.1M€$ , Cumulated Schedule Performance Index is 0.96
- $CV = -1.1M€$ , Cumulative Cost performance index 0.98
- Preliminary Design Phase is 96% completed, only 2 remaining
- 45 of 81 CDRs have been conducted in total, several are waiting until design is confirmed by manufacturer.

# EV Graph

M EUR (Cumulative)

(\* No InKind included)



## Current Status

- Cumulative Cost Variance (CV) for Target is -1.1M€. Increase in CV primarily due to invoice timing for Port Blocks (-600k€) and NBEX (-100k€), & additional Licensing support (-200k€)
- Cumulative Schedule Variance (SV) is -4M€; 3.5M€ SV is In-Kind related and rest due to Port Blocks.

# Project Accomplishments

- Deliveries, Installation, and commissioning
  - The civil works continues in all parts of the D02 target station building, Skanska successfully completed the second part of the Monolith high bay slab. This was a massive 420 m<sup>3</sup> concrete casting, using two pumps in parallel.
  - Installation of Stainless Steel Liner for Roof in ACF continues good progress.
- Components
  - CASKs – feasibility studies completed, tender bids due back May 6, award May 20.
- Analysis
  - NSS provided 2 NBPI NBOA designs MAGIC and TBL (test beam line)
  - PDR for Monolith pressure relief, and NBPI He and H<sub>2</sub>O cooling systems completed
  - CDR for ACF electrical packages, Proton Beam Drift room, TSS #2 completed
  - TSS mockup: Test bench for simulating one channel of TSS is now finished and testing begun.
  - ICS resource situation issue at last TAC, has improved.

# Project Accomplishments

- WP2;
  - **Target Monitoring Plug** – PDR conducted successfully, and now contract signed with Julich, CDR planned end of May
  - **Helium cooling system** – CDR conducted successfully, on track overall, filter design was delayed
  - **Target Wheel** –CDR planned in June, prototyping completed, cassettes and tungsten bricks delivered to ESS Bilbao
  - **Monolith Inner Shielding** – Mockup completed, CDR completed, contract awarded to Industeel and ,
  - **Tuning Beam Dump** –Delivery Pushed until October, and installation November 2019
  - **Target Monitoring Plug** - The final design has reached above 40% and will be ready for the CDR on 27th of May.
- WP3;
  - **Moderator & Reflector systems** – On track, Machined Beryllium delivered from Moscow to Jülich
  - **Neutron beam extraction system** – Large system has been divided in several smaller packages, pre-CDR complete, working with Julich to build prototype. Contract for material of the Inserts and Plugs are agreed and signed with InduSteel
  - **Neutron Beam Port Inert Cooling System** – PDR conducted successfully, CDR May 15
  - **NBOA atmosphere system** – PDR conducted successfully
  - **Proton Beam Drift Room** – Preliminary Design phase completed. CDR conducted successfully.
- WP4;
  - **Monolith Vessel, Proton Beam Window, Proton Beam Instrumentation Plug** – vessel awarded, Raw material for the Monolith Vessel is ordered from Outtokompu.
  - **Neutron Beam Port Blocks** - Contract signed with Industeel for material, and contract signed with ENSA for manufacturing.
- WP5;
  - **Fluid systems** – CDRs completed, procurements in progress, deliveries begin late 2019
  - **Drainage vessels** - All documents approved by ESS & AIB for manufacturing
  - **Monolith Relief System** – Preliminary design review conducted successfully, CDR September 2019.

# Project Accomplishments

- WP6;
  - **Active Cells Facility (ACF)** –Electrical Distribution ,Machining Station & Confinement and Shielding (Storage Pit Lids)  
– Final Designs phase completed, >50% of the systems have passed CDR
  - **ACF Liner package** – cast-in items are manufactured and delivered to site as needed for installation
  - **Mock-Up and Test Stands** –CDR completed, Released open call for tender, bids back and award end of May
  - **Shielded Transfer Casks** – feasibility study completed, in progress with 3 suppliers, will award contract End of May
- WP7;
  - **Target Safety System TSS** – Coordinated updating of accident analyses, update of several accident analyses for operations are on-going, maintenance accident analyses have been initiated
  - TSS Mock-up lab is operational
  - TSS classification completed, including mechanical components
  - TSS CDR2 covering system design conducted successfully, final CDR end of May
  - External safety review of TSS system design with respect to SSM conditions has started
  - PSAR for NC LINAC released with updated system descriptions (Chpt 4) and radiation hazards and analyses (Chpt 5)
  - 90% of all 1<sup>st</sup> and 2<sup>nd</sup> order PSAR references are reviewed and released
- WP8;
  - **Target Physics** – Volumetric heat loads, radionuclide inventories, shielding and radiation streaming
  - **Material handbook** – continuously updated based on knowledge acquired through collaborations with partner labs
  - **Tungsten release factors** – Final results reported in April, accepted by the regulator.
  - Review of the ES&H the updated of ESS-0001786 (Definition of supervised and controlled zones)

# Project Accomplishments



Liner for ceiling  
of process cell in  
ACF



# Project Accomplishments



Process Cell ceiling start of HB slab rebar installation on top of liner plates

Forms for  
Technical  
Gallery  
walls



# Project Accomplishments



Confinement penetration in Process Cell ceiling



# Project Accomplishments



A2T



# Project Accomplishments

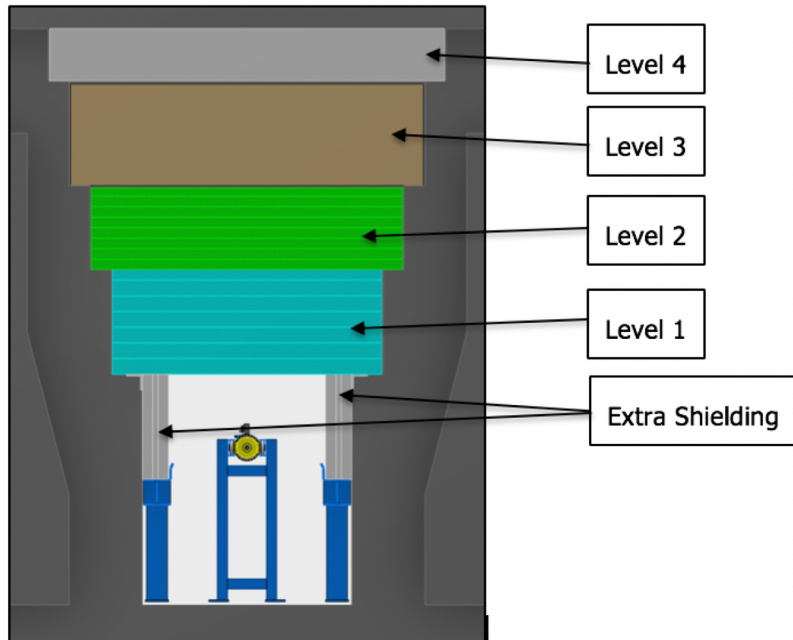


Figure 4 – Cross section through PBDR Shielding

About 520 tons of steel

About 166 psc of steel plates

About 26 trucks



## D2T (install June)

# Project Accomplishments

- More HVAC Shipments arriving (Czech Inkind)



# Project Accomplishments

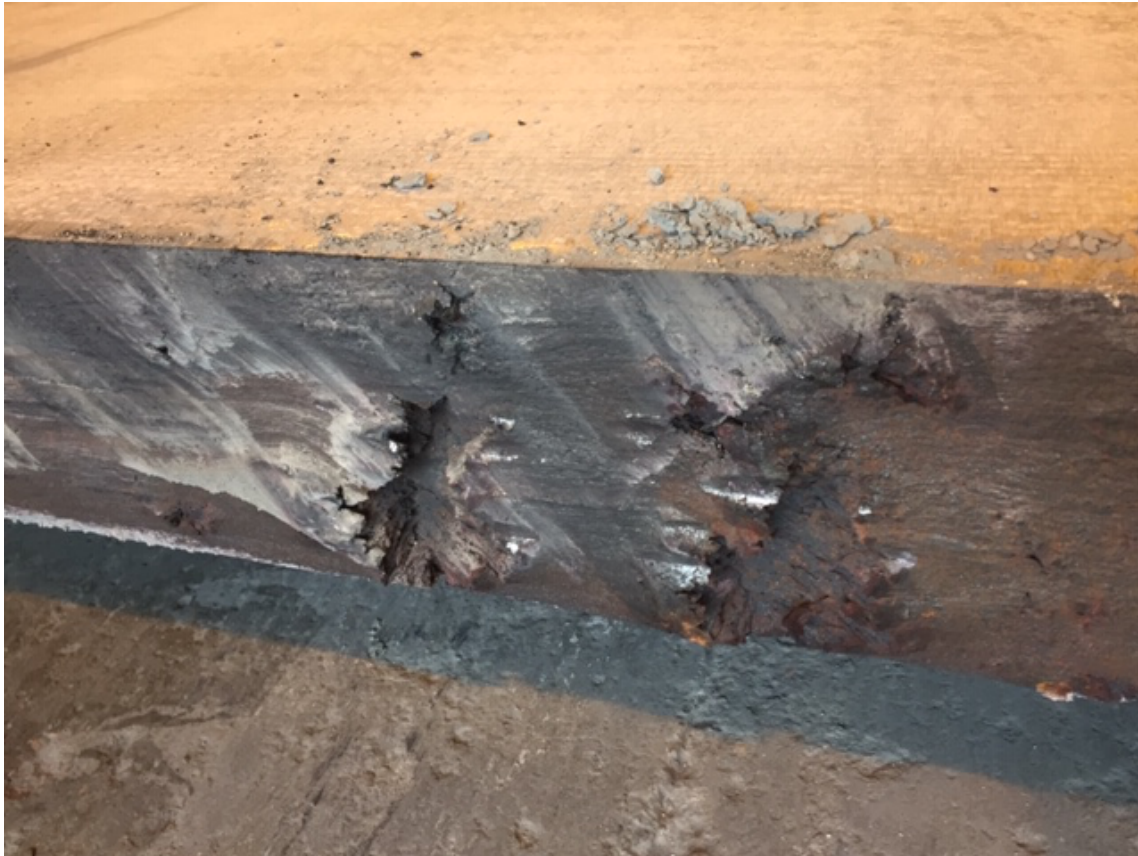
- Puck for under wheel and Inner Shielding Mockup in storage at RATs



Port Block Material Delivery to ENSA is delayed, (initial difficulty finding a capable supplier), now manufactured plates from Ingot #26 failed, overall results in a 5-6 month push to RBOT, mitigation steps are in progress,

- Industeel meeting April 4th resulted in
  - Double shifts and OT, 24x7
  - Manufacturing another Ingot to oversize dimensions and grinding
  - Manufacturing process changes directed by suppliers research center
  - Delayed some inner shielding material
  - Shipping multiple loads to ENSA, get NNBar material shipped week 18
- ENSA discussions are ongoing
  - Additional machining capacity, adding another subcontractor
- TD installation
  - Installation re-sequence with vessel and portblocks
  - individual port tube installation and alignment
  - Work 2 shifts, all welding 24x7
  - Ongoing work with NSS on NBPI's to minimize impact to BOT

# Industeel – R24 Ingot





# Industeel – R24 Ingot





# Target L1 Milestones

| Name   | Baseline   | Current Forecast | $\Delta$<br>since<br>last<br>month | Total<br>Float | Status<br>(R, Y, G) | Impact/Action  |
|--|------------|------------------|------------------------------------|----------------|---------------------|--|
| Delivery on Site - Monolith Vessel                 | 2019-07-09 | 2019-12-18       | -                                  | 26             |                     | ESS Bilbao slip, start of installation now Jan 8 <sup>th</sup> .     |
| Delivery On Site - Cold Moderator Assembly         | 2019-02-11 | 2020-01-13       | -                                  | 120            |                     | Will store at Julich   |
| Installation Complete - Target Cryoplant (Helium ) | 2018-11-16 | 2019-06-12       | -                                  | 416            |                     |  |
| Delivery - Complete Target Wheel to ESS Site       | 2019-11-08 | 2020-09-21       | -25                                | 5              |                     | Prototype 3 testing results ok to move forward                       |
| Tuning Beam Dump Ready for Proton Beam             | 2019-07-26 | 2019-08-16       | -60                                | -              |                     | AD need date Dec 1 2019  |
| Installation - 1st Survey of TCS                   | 2020-08-19 | 2021-02-16       | -20                                | -102           |                     | Driven by Port Blocks  |
| WP3 System Test complete – Cryo + LH2              | 2021-11-02 | 2022-03-01       | -20                                | -87            |                     | Driven by Port Blocks, pushed connection of final piping in monolith |
| Target ready for BOT                               | 2022-03-09 | 2022-09-22       | -104                               | -104           |                     | Represents 5 month delay, Driven by Port Blocks                      |

# Target In-Kind Packages

Target Sub-Project has 22 in-kind work elements

– TA or CA signed for 10 work elements

– Partner selected for another 4 work elements

– Completed 2

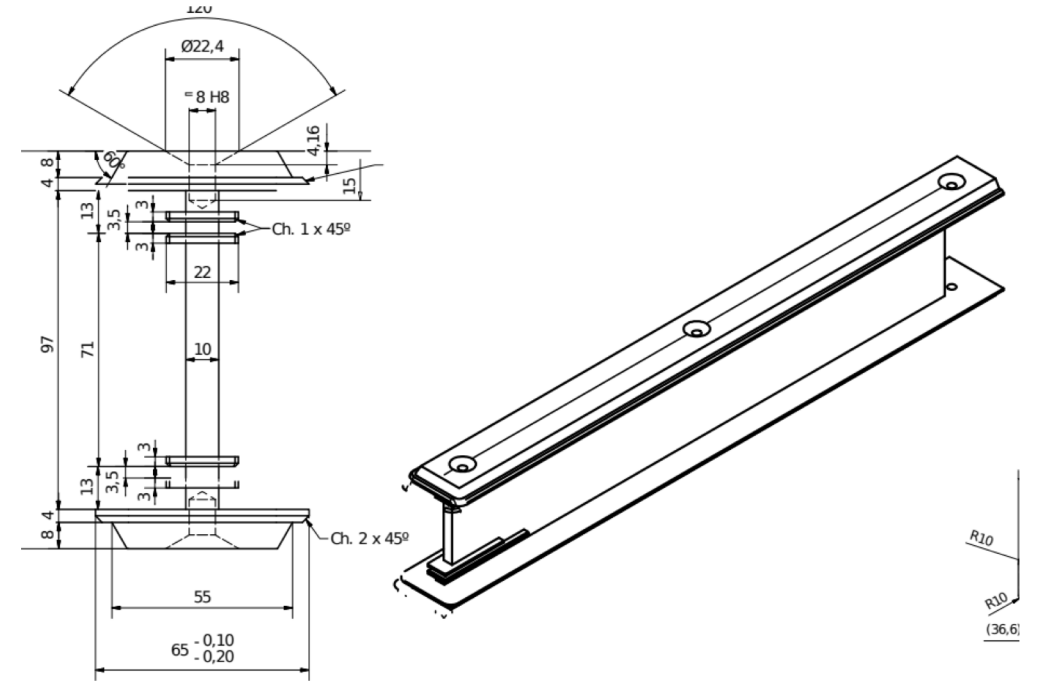
– Self Performing 6 work elements

| In-Kind ID | In-Kind Contribution                           | Cost Book Value (M€) |
|------------|--|----------------------|
| TIK.2.1    | Target Wheel                                   | 8,4                  |
| TIK.2.2    | Target He Cooling system                       | 5,6                  |
| TIK.3.1    | Moderator & Reflector Plugs                    | 4,7                  |
| TIK.3.2    | Cryogenic Moderator System (LH2)               | 4,3                  |
| TIK.3.3    | Cryoplant                                      | 11,4                 |
| TIK.4.1    | Target Monitoring Plug                         | 0,9                  |
| TIK.4.2    | Proton Beam Instrumentation Plug               | 0,5                  |
| TIK.4.3    | Irradiation Module                             | 0,3                  |
| TIK.4.4    | Proton Beam Window                             | 0,9                  |
| TIK.4.5    | Monolith Vessel                                | 6,7                  |
| TIK.4.6    | Neutron Beam Windows                           | 0,5                  |
| TIK.4.7    | Monolith Atmosphere System                     | 1,2                  |
| TIK.4.8    | Monolith Shielding Systems (incl. Port Blocks) | 14,2                 |
| TIK.4.9    | Tuning Beam Dump                               | 2,5                  |
| TIK.4.10   | Neutron Beam Extraction System NBEX            | 5,1                  |
| TIK.5.1    | Primary Water Cooling Systems                  | 2,5                  |
| TIK.5.2    | Intermediate Cooling Systems                   | 2,6                  |
| TIK.5.3    | Ventilation & Confinement                      | 7,6                  |
| TIK.6.1    | Active Cells                                   | 25,4                 |
| TIK.6.2    | Internal Casks and Handling Devices            | 3,6                  |
| TIK.6.7    | Remote Handling Support                        | 1,0                  |
| TIK.8.1    | Tungsten Release Factors                       | 0,2                  |

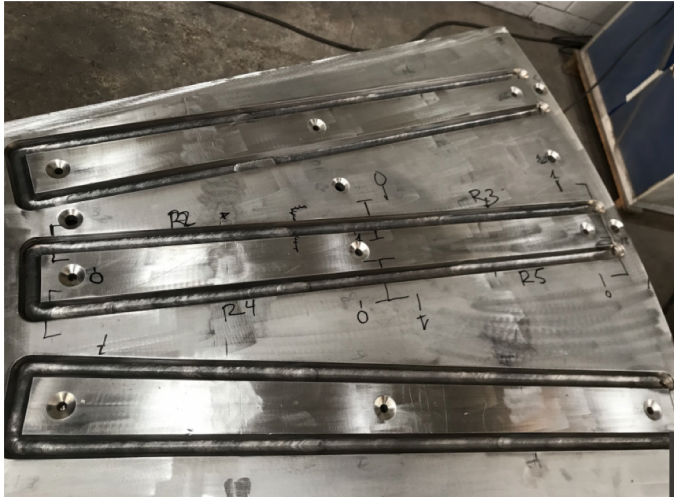
78.2M€ total Inkind achieved, this represents 37% of the overall Target Budget

- Of the 4.0M€ SV there is 3.5M€ derived from Inkind schedule delays.
  - Czech - He Cooling Circulators and Hx's, Some HVAC components, and water cooling components.
  - ESS Bilbao – Wheel, Tuning beam dump
- ESS Bilbao will push Tuning Beam Dump delivery to 7<sup>th</sup> October, leaves 2 months to install.
- Target wheel prototype 3 completed, much better results than previous designs, some weld distortions exist, however we will proceed with this design. Design will be reviewed at T-TAC subcommittee

# Wheel - Prototype #3



# Wheel Prototype #3



# Budget

|                      |          |
|----------------------|----------|
| New approved budget: | 211.1 M€ |
| New Forecast:        | 24.1 M€  |
| New Risk exposure:   | 31.2 M€  |
| Schedule Variance:   | 4.0 M€   |
| Cost Variance:       | 1.2 M€   |



# Concluding remarks

# Concluding Remarks

- Project is progressing well, site access dates remain unchanged with respect to the rebaseline.
- Target and the Inkind Partners are in a heavy procurement and manufacturing phase, a lot of self perform scope in Target.
- Significant efforts have been spent on support for license application to the Swedish Radiation Safety Authority.
- Target is also in the installation phase, mainly for ACF, embedded and cast-in items, TSS and front end bldg.
- Forecast for RBOT is Q3 2022, delayed by Port Blocks contract delays and technical problems at the mill.
- Responses to TAC-18 recommendations can be found in separate presentation, uploaded to Indico.

# Tomorrows T-TAC Agenda

- t1) - Update on Target Wheel Design and manufacturing challenges.
- t2) - Neutron Beam Port Inserts and Optics, design, mockup, and interface Target to NSS.
- t3) - Update on the plant areas (water cooling plant, filter areas, etc.) and the active handling.
- t4) - Follow up on the inner shielding, including the selected design, mockup test results and overall progress.