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Target Overview TAC 19

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10 April 2019

Outline



- 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



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.



- 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 m3 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 H2O cooling systems completed
 - CDR for ACF electrical packages, Proton Bean 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.



- 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 Insert 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.



- 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 1st and 2nd 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)



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Project Accomplishments



Liner for ceiling of process cell in ACF



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

Forms for Technical Gallery walls





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Confinement penetration in Process Cell ceiling





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A2T





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Figure 4 – Cross section through PBDR Shielding

About 520 tons of steel

About 166 psc of steel plates





D2T (install June)



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• More HVAC Shipments arriving (Czech Inkind)







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





Major Issue



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





Industeel Schedule



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2	ESS-001	First Part	101	1323978	10	-	5400	2290	100	15143,4	1.4306	W28		10	W09	R23		0	A190905	103133			W13	W14	W15	W10	WIG	W17	W18	W18 W19	W20 W21	-/
	ESS-001	First Part	101	1323978	10		5400	2290	120	15143,4	1.4306	W28		16	W09	R23			A190905	103134			W13	W19	W15	W10	WIO	W1/	w18	W18 W19	W20 W21	
4	ESS-001	First Part	101	13234/8	20		5400	2290	150	15143,4	1.4306	W29		16	W09	R23		1	A190906	163134		W13	W14	W15	W16	W17	W17	W18	W19	W19 W20	W21 W22	-/
2	ESS-001	First Part	101	1323478	20		5400	2290	156	15143,4	1.4306	W29		16	W09	R23		0	A190906	163135		W13	W14	W15	W16	W17	W17	W18	W19	W19 W20	W21 W22	-/
6	ESS-001	First Part	101	1323478	20	1	5400	2290	156	15143,4	1.4306	W29		16	W09	R23	1	0	A190906	163136		W13	W14	W15	W16	W17	W17	W18	W19	W19 W20	W21 W22	-7
7	ESS-002	First Part	102	1323478	30	1	4895	1655	195	12400,95	1.4306	W20		16	W03	R24	1	1	A190308	156155	162421.11						W12	W13	W14	W14 W15	W16 W17	-3
8	ESS-002	First Part	102	1323478	30	1	4895	1655	195	12400,95	1.4306	W20		16	W03	R24	1	0	A190308	156156	162423.11						W13	W14	W15	W15 W16	W17 W18	-2
9	ESS-002	First Part	102	1323478	30	1	4895	1655	195	12400,95	1.4306	W20		16	W03	R24	1	0	A190308	156157	162425.11						W13	W14	W15	W15 W16	W17 W18	-2
10	ESS-002	First Part	102	1323478	40	1	4895	1655	195	12400,95	1.4306	W21		16	W03	R24	1	1	A190406	157124	162427.11							W14	W15	W15 W16	W17 W18	-3
11	ESS-002	First Part	102	1323478	40	1	4895	1655	195	12400,95	1.4306	W21		16	W03	R24	1	0	A190406	157125	162429.11						W13	W14	W15	W15 W16	W17 W18	-3
12	ESS-002	First Part	102	1323478	40	1	4895	1655	195	12400,95	1.4306	W21		16	W03	R24	1	0	A190406	157126	162431.11							W14	W15	W15 W16	W17 W18	-3
13	ESS-002	First Part	102	1323478	50	1	4895	1655	195	12400,95	1.4306	W22		16	W07	R24	1	1	A190701	160132	167174				W13	W14	W14	W15	W16	W16 W17	W18 W19	-3
14	ESS-002	First Part	102	1323478	50	1	4895	1655	195	12400,95	1.4306	W22		16	W08	R24	1	0	A190701	160133	167176				W13	W14	W14	W15	W16	W16 W17	W18 W19	-3
15	ESS-002	First Part	102	1323478	50	1	4895	1655	195	12400,95	1.4306	W22		16	W08	R24	1	0	A190701	160134	167178				W13	W14	W14	W15	W16	W16 W17	W18 W19	-3
16	ESS-002	First Part	102	1323478	60	1	4895	1655	195	12400.95	1.4306	W23		16	W09	R24	1	1	A190807	161842		W13	W14	W15	W16	W17	W17	W18	W19	W19 W20	W21 W22	-1
17	ESS-068	NN Bar	318882	1323478	70	1	2720	1515	126	4153.77	1.4404	W23	BottomPlateNNBar	14	4	R21	1	0	A190604	159377	166920				W13	W14	W15	W16	W17	W18 W19	W20 W21	-2
18		And a search										W16			-		<u> </u>				157121.11					W15	W15	W16	W17	W18 W19	W20 W21	5
			1									W16	1								157121.12					W15	W15	W16	W17	W18 W19	W20 W21	5
			1									W16	1 1								157121.13					W15	W15	W16	W17	W18 W10	W20 W21	
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	ESS-069	NN Bar	318899	1323478	80	7	2640	415	126	1104,36	1.4404	WIX	WideWedge	14	5	D14	1	1	A190405	157121	157121.19					W15	W15	W16	W17	W18 W19	W20 W21	
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10	100.050	N.N. 75	110001	1002400	<u>~</u>	-	2010	210	192	014.04	1 4 4 5 4	W10	75.1.117	14	11/00	D14	<u> </u>	0	A 100300	160100	15/121.24			11/12	11/2.4	W15	W15	W 10	W17	w18 W19	W20 W21	- 2
19	ESS-070	NN Bar	318901	1323478	90	7	2640	310	126	824,95	1.4404	W16	I hmWedge	14	W03	D14		0	A190309	156180	136180			W13	w14	W15	W15	w10	W17	W18 W19	w20 w21	- 2
20	ESS-0/1	NN Bar	318903	13234/8	100	3	2670	1515	132	42/1,57	1.4404	W28	AdaptTopPlate3NNBar	14	W07	R21		0	A190513	158549	168311			W13	W13	W14	W15	W 16	W17	w18 W19	W20 W21	-7
	ESS-071	NN Bar	318903	1323478	100	3	2670	1515	132	4271,57	1.4404	W28	AdaptTopPlate3NN	14	W07	R21	1	0	A190513	158549	168312			W13	W13	W14	W15	W16	W17	W18 W19	W20 W21	-7
22	ESS-072	NN Bar	320644	1323478	110	1	1840	1300	216	4133,38	1.4404	W24	Tripple WindNNBar	16	W08	R24	1	0	A190603	159368	166283.11					W13	W13	W14	W15	W15 W16	W17 W18	-6
23	ESS-062	NN Bar	321247	1323478	120	1	2810	1920	126	5438,36	1.4404	W22	FrameBottomPlateNNBar	14	4	R21	1	1	A190513	158547	158547.11				W13	W14	W15	W16	W17	W17 W18	W19 W20	-2
24	ESS-064	NN Bar	321248	1323478	130	1	2825	1920	101	4382,59	1.4404	W16	FrameTopPlateNNBar	12	W06	D14	1	0	A190604	159377	166919.11				W14	W15	W15	W16	W17	W17 W18	W19 W20	4
25	ESS-063	NN Bar	321248	1323478	140	1	2810	1920	126	5438,36	1.4404	W22	FrameTopPlateNNBar	14	5	R21	1	0	A190513	158547	158547.21				W13	W14	W15	W16	W17	W17 W18	W19 W20	-2
26	100.000		221240	1000400	150	-	2200	1000	124	2011.01	1.4404	W23			-					100040	166281.11				W12	W12	W13	W14	W15	W15 W16	W17 W18	-5
	ESS-065	NN Bar	321249	1323478	150	2	2/00	1090	120	2900,54	1.4404	W23	Prame Side Plate N N Bar	14	1	D14		0	A190513	158548	166281.12				W13	W12	W13	W14	W15	W15 W16	W17 W18	-5
27												W23									166281.21				W13	W14	W15	W16	W17	W17 W18	W19 W20	-3
	ESS-066	NN Bar	321249	1323478	160	2	980	955	126	943,39	1.4404	W21	Frame Side Plate NNBar	14	5	R21	1	0	A190513	158548	166281.22				W13	W14	W15	W16	W17	W17 W18	W10 W20	
20								<u> </u>				11/22			<u> </u>						1660201.22				W13	114	W14	1116	W16	W16 W17	W19 W10	-
20	ESS-067	NN Bar	321249	1323478	170	2	1090	1090	136	1292,65	1.4404	W23	FrameSidePlateNNBar	14	7	R21	1	0	A190604	159377	166021.12				W13	3014	W14	W15	W16	W16 W17	W18 W19	-4
20	1202-074	NN Bee	BE220201	1222428	180	0	2660	200	126	1462.26	1.4404	W23	Defferent (Deserve	16	11/12	0.24		0	A 101004	167864	100921.12	11/16	11/16	11/12	W13	W19	W19	W15	W10	W10 W17	W18 W19	
20	ESS-074	NN BIT	P12/9291	1323978	180	9	2000	390	1/3	1432,30	1,4404	W20	BottomUBeam	16	W13	824			A191004	103304		W15	W16	W17	W18	W19	W19	W20	W21	W21 W22	W23 W24	
30	ESS-074	NN Bar	P12/9291	1323978	180	9	2000	390	1/5	1452,30	1.4404	W20	BottomUBeam	10	W13	R24		-	A191110	165737		W15	W16	W17	W18	W19	W19	W20	W21	W21 W22	W23 W24	- 2
31	ESS-074	NN Bar	P12/9291	13234/8	180	10	2660	390	175	1452,36	1.4404	W26	BottomUBeam	16	W13	R24		1	A191110	165738		W15	W16	W17	W18	W19	W19	W20	W21	W21 W22	W23 W24	-2
32	ESS-0/4	NN Bar	P12/9291	13234/8	190	9	2660	390	175	1452,36	1.4404	W27	BottomUBeam	16	W13	R24		0				W15	W16	W17	W18	W19	W19	W20	W21	W21 W22	W23 W24	
33	ESS-074	NN Bar	P1279291	1323478	190	9	2660	390	175	1452,36	1.4404	W27	BottomUBeam	16	W13	R24	-	1			1000010	W15	W16	W17	W18	W 19	W19	w20	W21	W21 W22	W23 W24	-3
34			1									W16	TopUBeam								165681.11					W13	W13	W14	W15	W15 W16	W17 W18	2
35												W16					1 1				165681.12					W14	W14	W15	W16	W16 W17	W18 W19	3
36			1									W16									165681.13					W14	W14	W15	W16	W16 W17	W18 W19	3
37			1									W16									165681.14					W14	W14	W15	W16	W16 W17	W18 W19	3
38			1									W16									165681.15					W14	W14	W15	W16	W16 W17	W18 W19	3
39			1									W16									165681.16					W14	W14	W15	W16	W16 W17	W18 W19	3
40			1									W16									165681.21					W14	W14	W15	W16	W16 W17	W18 W19	3
41	ESS. 075	NN Bar	000000	1222429	200		2660	330	160	1053.36	1.4404	W16		16	11/06	824	,		A100512	169647	165681.22					W14	W14	W15	W16	W16 W17	W18 W19	3
42	1.33-013	an bif	212/9292	1323478	200		2000	330	150	1003,30	1.000006	W16		10	100	0.24	· · ·		A150512	100043	165681.23					W14	W14	W15	W16	W16 W17	W18 W19	3
43			1			1						W16									165681.24					W14	W14	W15	W16	W16 W17	W18 W19	3
44			1									W16									165681.25					W14	W14	W15	W16	W16 W17	W18 W19	3
45			1									W16									165681.26					W14	W14	W15	W16	W16 W17	W18 W19	3
46			1									W16									165682.11				W13	W14	W14	W15	W16	W16 W17	W18 W19	3
47			1									W16									165682.12				W13	W14	W14	W15	W16	W16 W17	W18 W19	3
48			1			1						W16									165682.13				W13	W14	W14	W15	W16	W16 W17	W18 W19	3
49			1									W16									165682.22				W13	W14	W14	W15	W16	W16 W17	W18 W10	3
50			1			1		l				W16	TopUBeam								161179.11					W13	W13	W14	W15	W15 W1A	W17 W19	2
51			1									WIK	ropotseam								163379.11					W14	W14	W15	W16	W16 W17	W18 W10	
51			1			1						W16									163379.12					W14	W14	w15	W16	W16 W17	W18 W19	
52			1			1						W16									163379.13					W19 W14	1014	w15	w 10 W16	W10 W17	W10 W19	
23			1									W10									163379.14					W19	W19	w 12	W10	W10 W17	W18 W19	- 3
24			1									W10									103379.15					W14	W14	w 13	W10	w10 W17	W18 W19	3
25	ESS-075	NN Bar	PT279292	1323478	200	11	2660	330	150	1053,36	1.4404	W10		16	W06	R24	1	0	A190512	158544	1633/9.16					W19	W14	w 13	W10	w10 W17	W18 W19	3
56						1						W16	I								163379.21					W14	W14	w15	W16	W16 W17	W18 W19	3
57			1									W16									163379.22					W14	W14	W15	W16	w16 W17	W18 W19	3
58			1									W16									163379.23					W14	W14	W15	W16	W16 W17	W18 W19	3
59			1									W16	L								163379.24					W14	W14	W15	W16	w16 W17	W18 W19	3
60			1									W16									163379.25					W14	W14	W15	W16	W16 W17	W18 W19	3
61			1	1		1	1	1	1			11/14									163330.36					11/14	11/1.4	11/16	11/14	11/16 11/17	11/19 11/10	1



Target L1 Milestones



Name	Baseline	Current Forecast	∆ since last mont h	Total Float	Status (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 th .
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



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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 7th 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



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R10

R10 (36,6)

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€



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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



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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.