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WP 5 Fluid Systems – Water Cooling and Target Station HVAC TIK 5.1-5.3

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Outline

- Highlights
- Schedule performance
- Near-term plans
- Risks and issues
- Concluding remarks

Highlights Water Cooling Systems TIK 5.1-5.2

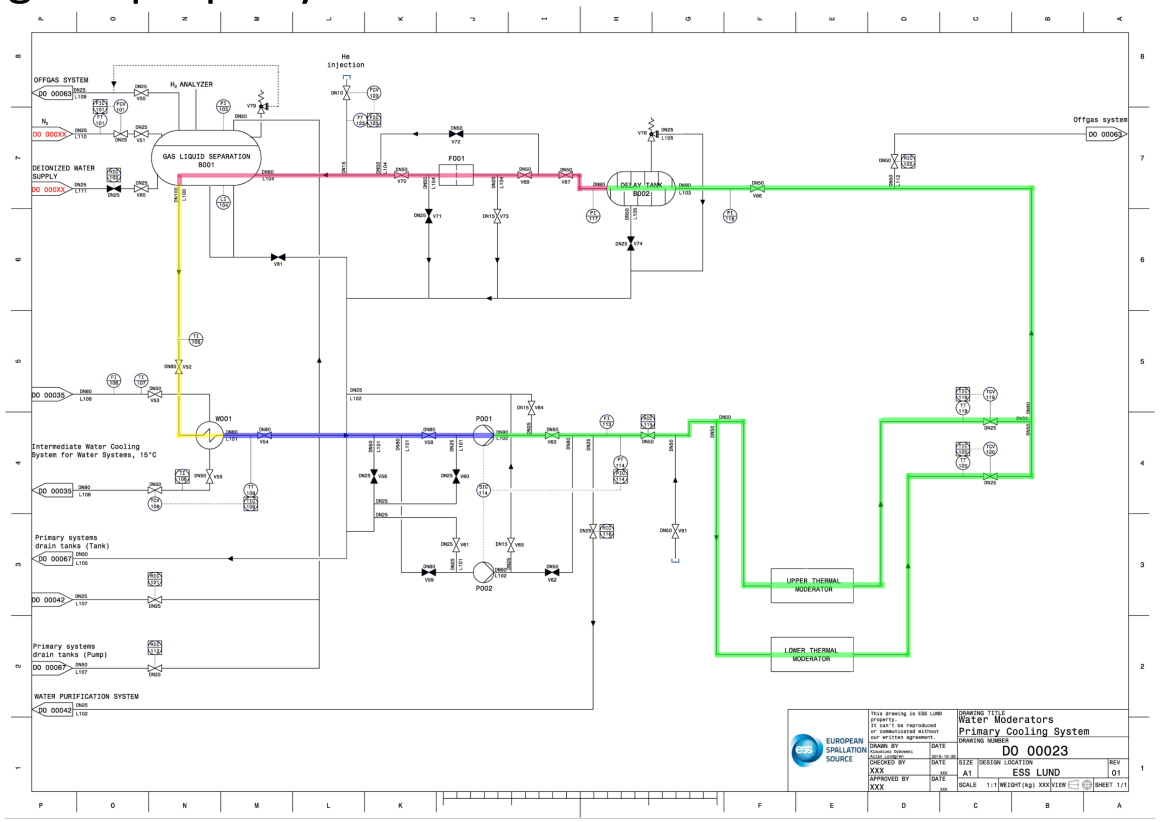
- HAZOP performed according to IEC 61882:2001
  - Thermal Moderator Cooling System
  - Water Purification System
  - P&ID:s updated
- Model Coordination Started with Conventional Facility (CF) and Target Station Model responsible designers
- Component Specifications preliminary – valves, HX, pumps
- 3D-modelling electrical cable trays in Utility Block
- Electrical loads delivered to CF
- Design of embedded plates for extra pillars in Utility Block
- Preliminary Design of Water Purification (Not TIK)
  - Updated PDR Water Purification

Highlights Target Station HVAC TIK 5.3

- Quality Classification of Ventilation System – in review
- Accident analysis – Stopped ventilation in Active Cell (HVAC) in Review
- Penetrations HVAC ducts level 90 delivered to CF
- Preliminary design of water system for fan-coils
- Preliminary design of ducts for connection cell
- Re-arranged ventilation equipment in Technical rooms

HAZOP – Scope (Water Cooling Systems)

- Identify hazard and operability problems, their possible causes and consequences that potentially can cause physical injury or damage to the health of people or damage to property or the environment.
- Flow, Pressure, Temp
- Level, Time …..



Valve Specification – example (Water Cooling Systems)

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VALVE SPECIFICATION

02 Plant	03 Location, Room No	04 System No	05 Component No
D02/TARGET	D02.103.4003	1050	V-001
06 Quantity	**07 Location, Refering to Connection Cell**		**08 Valve Code**
1	Outside ■ Inside ☐		NA
09 Date	**10 Revised; Date, Item**		
2015-12-07			

OPERATING CONDITIONS

11 Medium	12 Operating Pressure	13 Operating Temperature
AIR	0,6 MPa	20 °C
14 Flow	**15 Normal position**	**16 Opening / Closing time**
	Open ☐ Closed ■	Max: / s Min: / s
17 Flow tending to	**18 Operating Freqency**	**19 Transients**
Open ■ Close ☐	2/YEAR	

20 Ambient Conditions	Pressure	Temperature	Humidity	Radiation
Normal	0,1 MPa	20 °C	80 RH%	>1 mSi/h
21 Ambient Conditions	**Pressure**	**Temperature**	**Humidity**	**Radiation**
Abnormal	MPa	5-30 °C	60-100 RH%	mSi/h

VALVE POSITIONS

22 Bore			Stem		
Vertical ■	Horizontal ■		Vertical ☐	Horizontal ☐	Upside-down ☐

DESIGN DATA

23 Valve Type	24 Design Press	25 Design Temp	26 Max Head loss coeff.
CHECK	1,0 MPa	85 °C	Z=
27 Connection Size	**28 Connection type**	**29 Bonnet Relief**	**30 Nozzle for**
DN025	Weld ■ Flange ☐ Thread ☐	Yes ☐ No ■	Body drain ☐ Leakage test ☐

31 Max differential pressure when opening the valve			32 Hard facing
MPa at max pres:	MPa	below disc above disc	Seat ☐ Disc ☐

33 Max differential pressure when closing the valve			
MPa at max pres:	MPa	below disc ☐	above disc ☐

34 Valve is end point of pressure boundary				
YES ☐	NO ■	If yes, no seat leakage shall occur att hydraulic test	MPa	above disc ☐ below disc ☐

35 Stem Sealing Arrangement		
Single Packing ☐	Double Packing with intermediate drain ☐	Bellows with single packing ☐

36 Pivot Pin Sealing Arrangement (check valve)
TBD

37 Body Bonnet Sealing Arrangement	
Single gasket ☐	Single gasket plus provision for seal weld alt. Pressure Seal ☐

38 Electrical Position Indication		39 Mechanical Position Indication	
Open and Closed ☐	Continuous ☐	Yes ☐	No ☐

40 Hydraulic removal of stem packing		41 Back seat		42 Inservice Inspection	
Yes ☐	No ☐	Yes ☐	No ☐	Yes ☐	No ☐

43 Connecting Pipe Dimension / Material / Inlet		44 Connecting Pipe Dimension / Material / Outlet	
DN025	1.4404	DN025	1.4404
45 Valve Length		**46 Max Height**	
TBD	mm	TBD	mm

47 Force on Disc / Stem			
Max pressure	Mpa above disc	tending to open	tending to close N
Max pressure	Mpa below disc, valve	tending to open	N

MATERIAL

48 Body Bonnet	49 Stem
A351 CF8M	NA
50 Disc	**51 Seat**
AISI 316	
52 Gasket, Body Bonnet	**53 Stem Packing**
54 Connection flanges gasket	
N/A	

QUALITY

55 Quality Class	56 Design acc. to:	57 Inspection acc. to:	58 Documentation acc. to
PED 97/23/EG		TBD	EN 10204 3.1
59 Tightness Class	**60 Serialized**	**61**	
	Yes ☐ No ■		

ACTUATOR

62 Pneumatic ☐	Motor ☐	Handwheel ☐

DESIGN DATA ACTUATOR

63 Design Pressure	64 Design Temperature	65 Actuating Medium	66 Actuating Pressure
MPa	°C		Max Min MPa
67 Spring to	**68 Spring Force on Stem**		
Open ☐ Close ☐	Valve Open: N	Valve Closed:	N
69 Total gas force on stem at min actuating pressure (see item 66)			
70 Type	**71 Manufactor**		

MOTOR

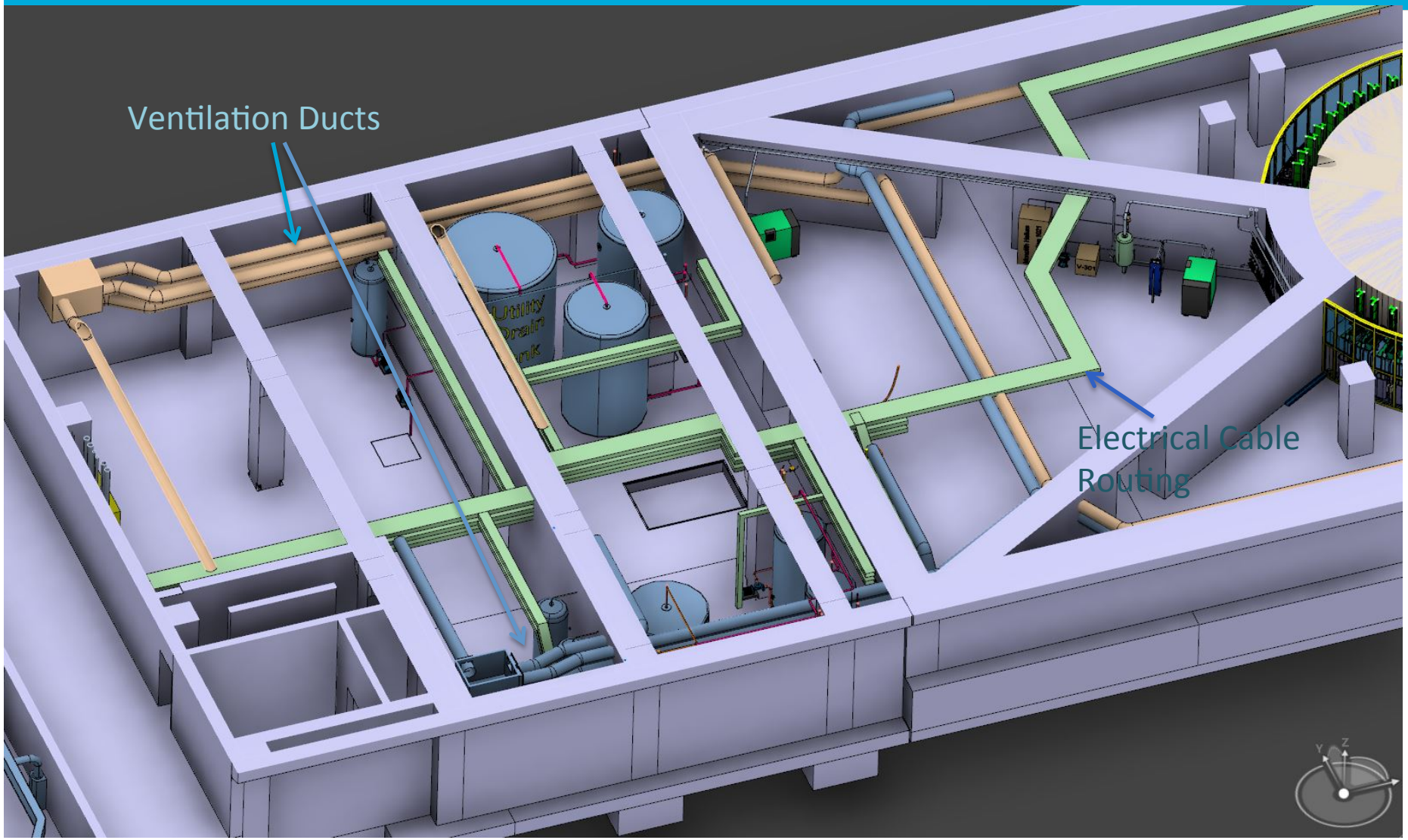
72 Specified Operating Time		73 Voltage
Min s Max: s Normal: s		V
74 Position Indication		
No ☐ Limit Switch ☐	Cont. Indication ☐	Spec:
75 Req. Torque opening / closing		
Start: / During Operation / Nm		Backseating / Nm
76 Max permitted Torque for the valve		
Into open pos:	Into close pos: Nm	During operation: Nm

77 Valve Stem turns per full Stroke	78 Length of Stroke	79 Valve Stem Diameter
		mm
80 Type	**81 Manufacturer**	

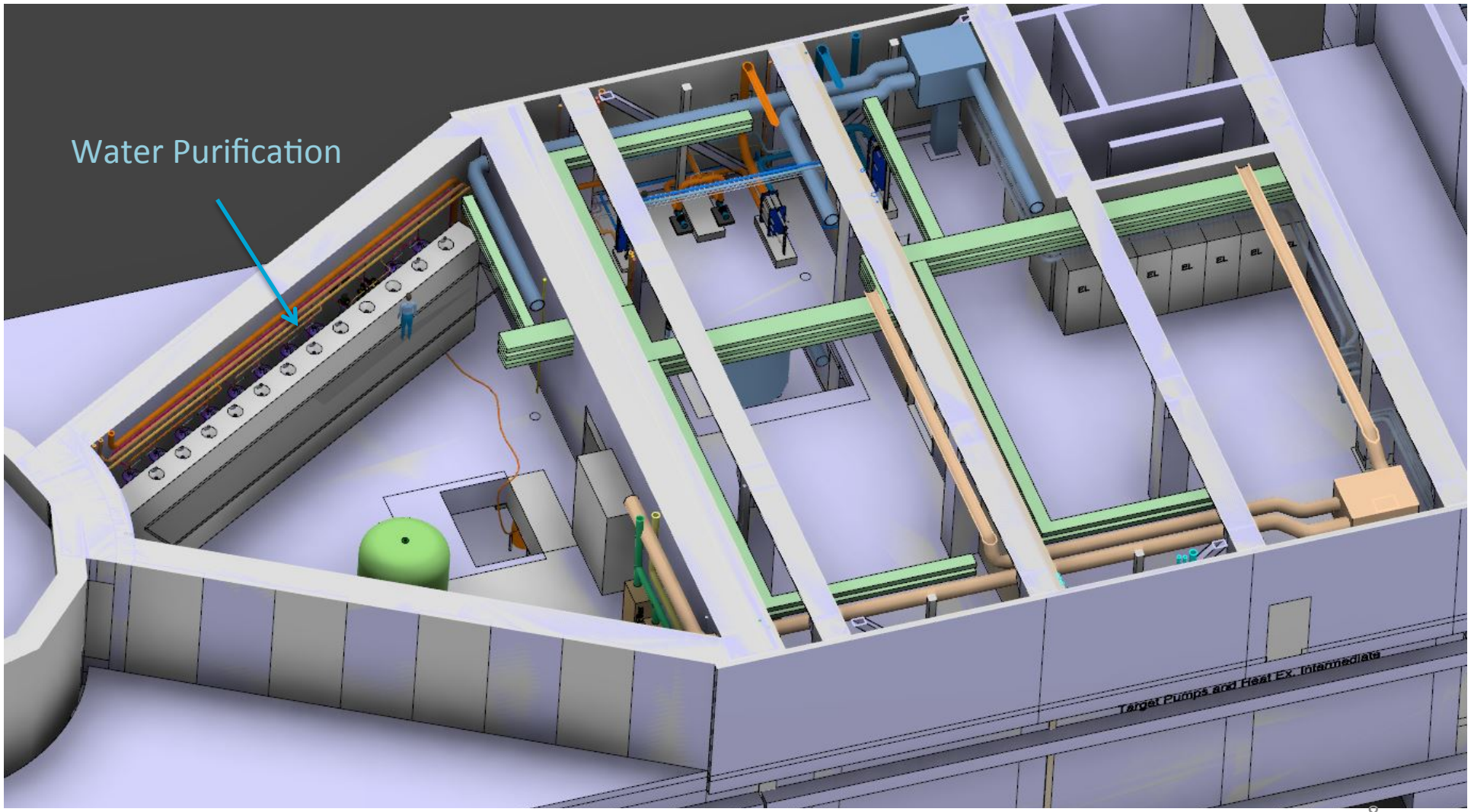
REMARK

82 Manufacturer to fill in item 47, 68, 75, 76, 77, 78 and 79:

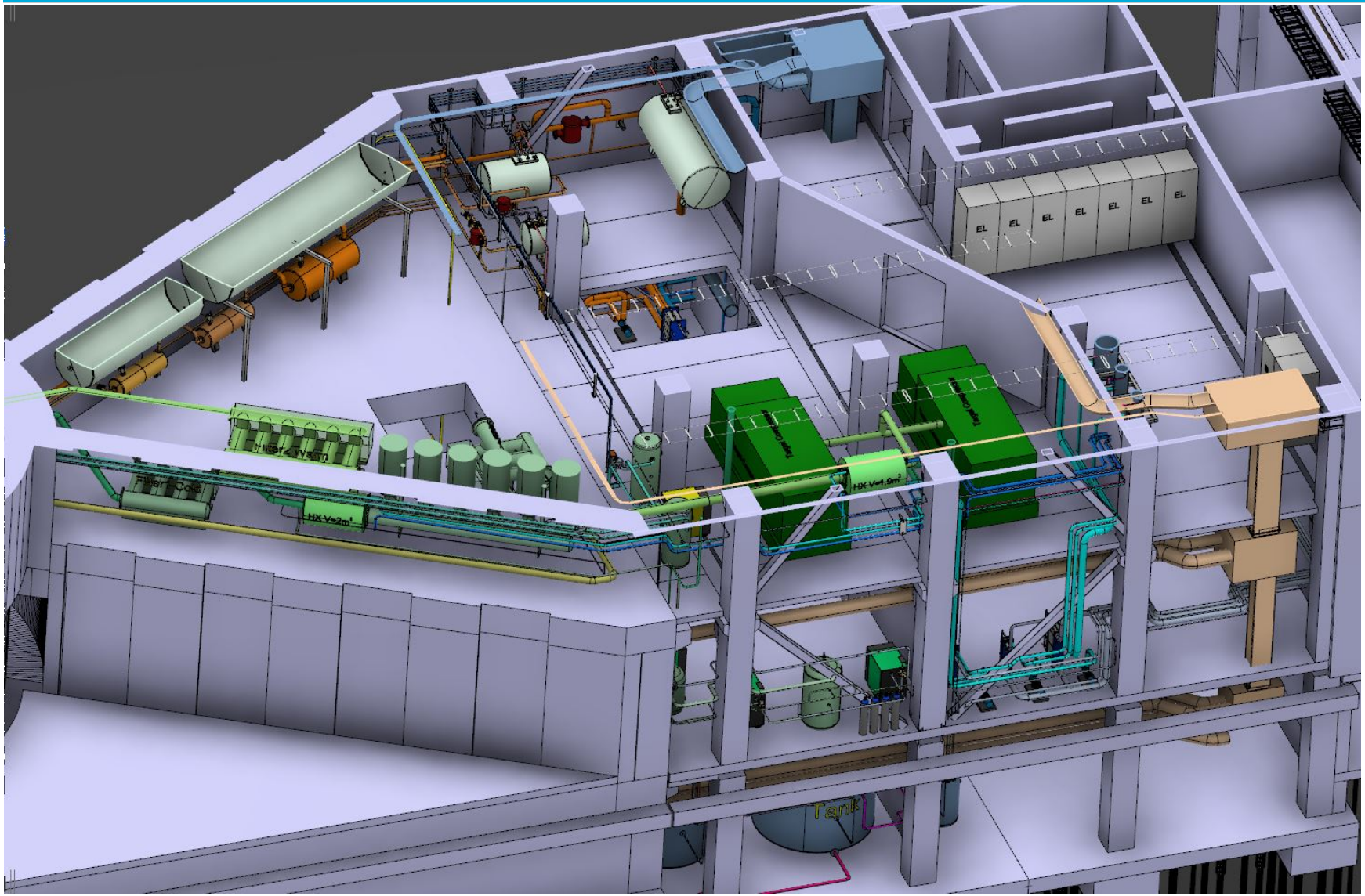
Utility Block – Lay-Out – Level 90



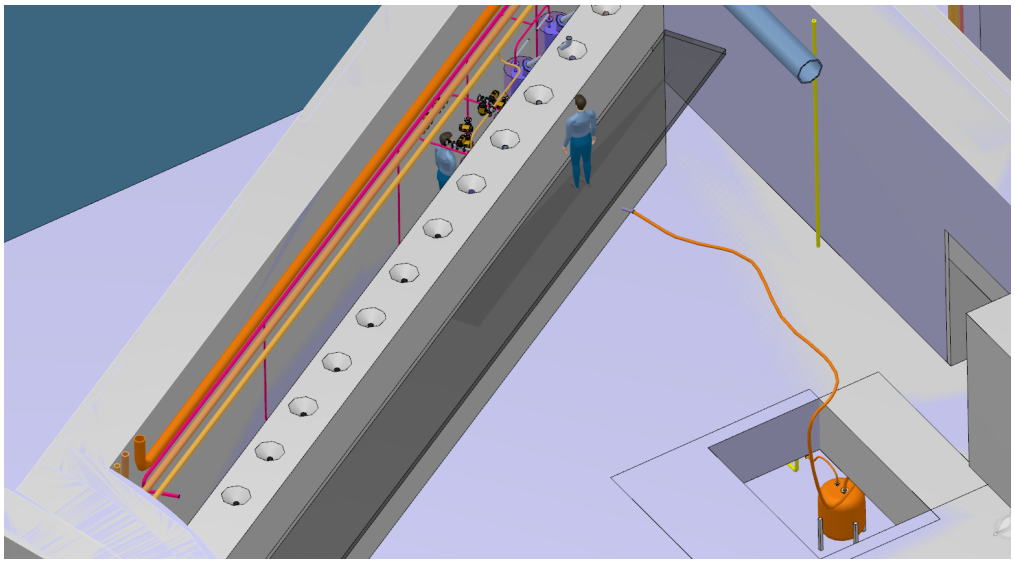
Utility Block – Lay-Out – L100



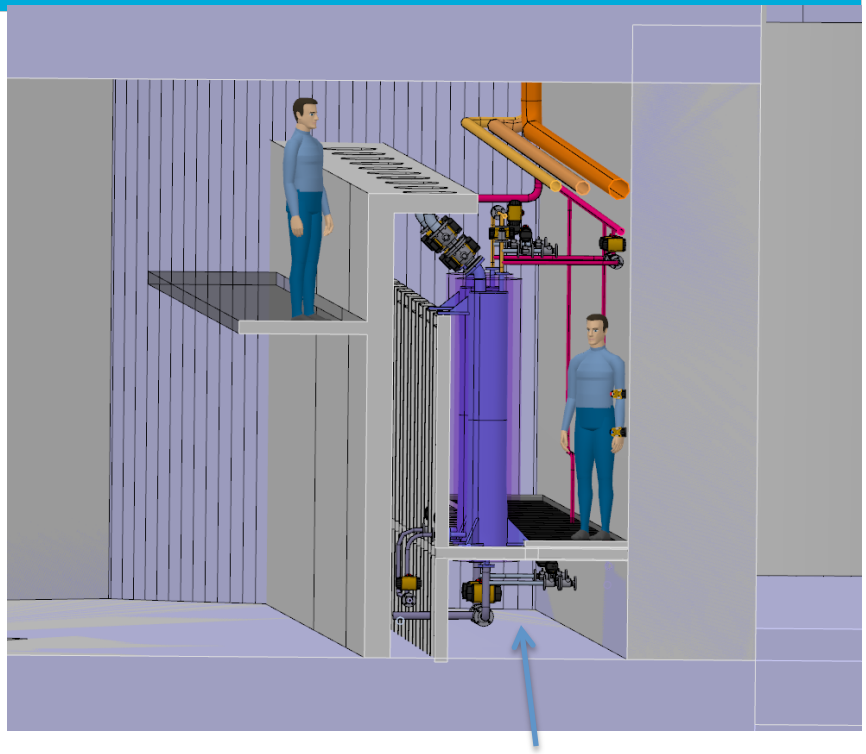
Utility Block – Lay-Out – L110



Water Purification System



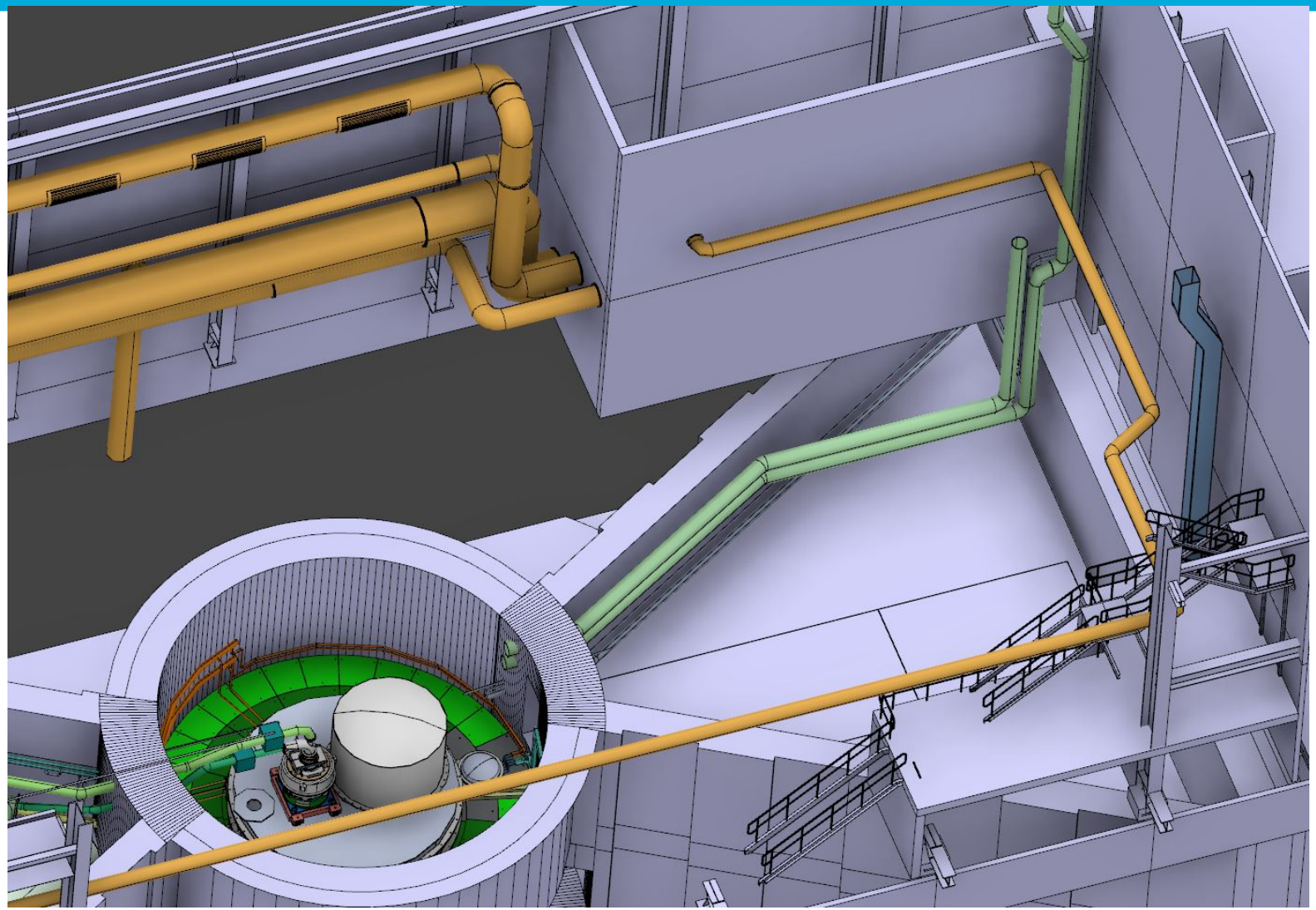
Transport Cask on Level 90



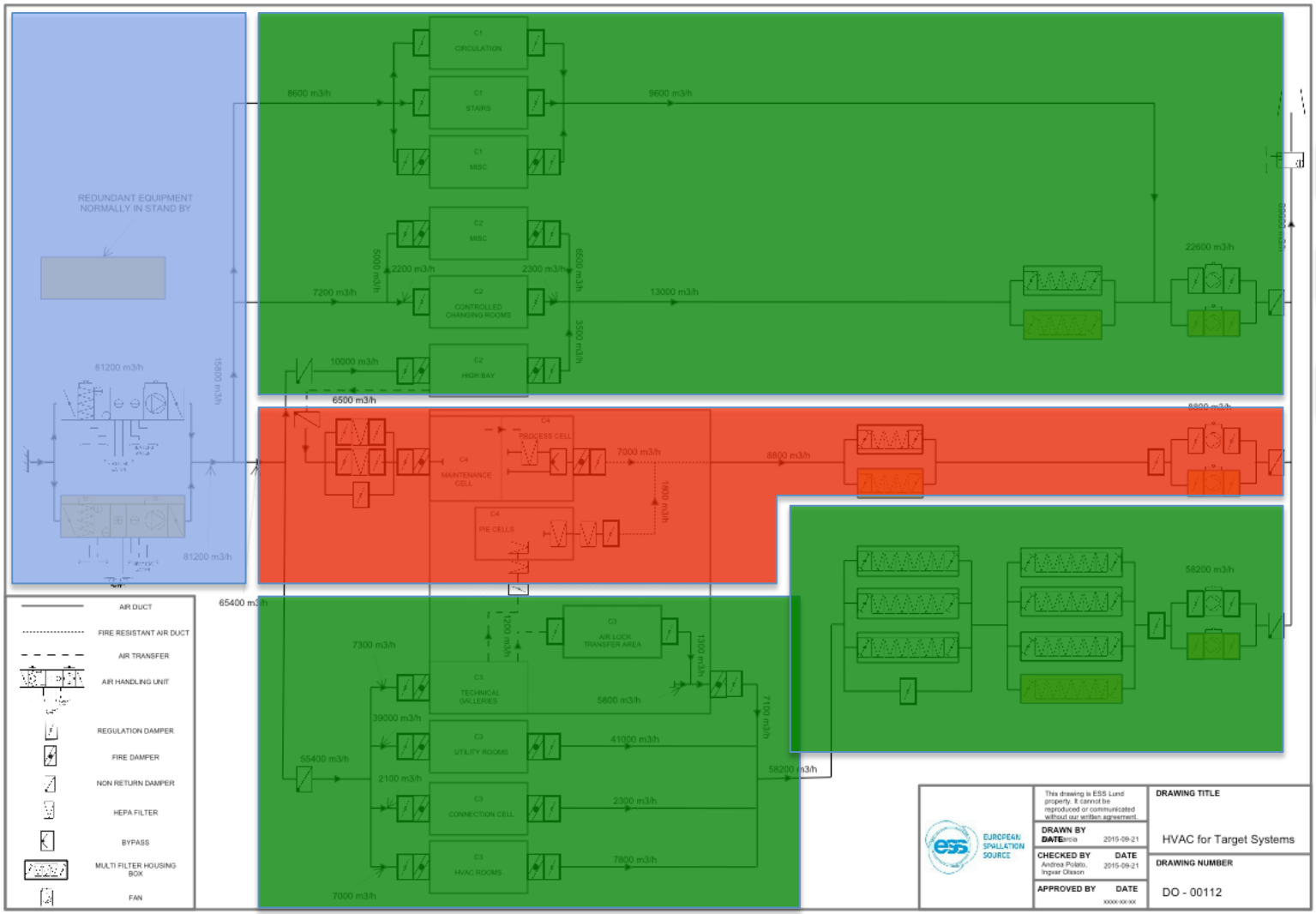
IX-columns on Level 100

Empty the IX columns with water or air
Shielded wall added to protect workers during filling and emptying
Total 12 columns of identical design

Ventilation Ducts – Connection Cell



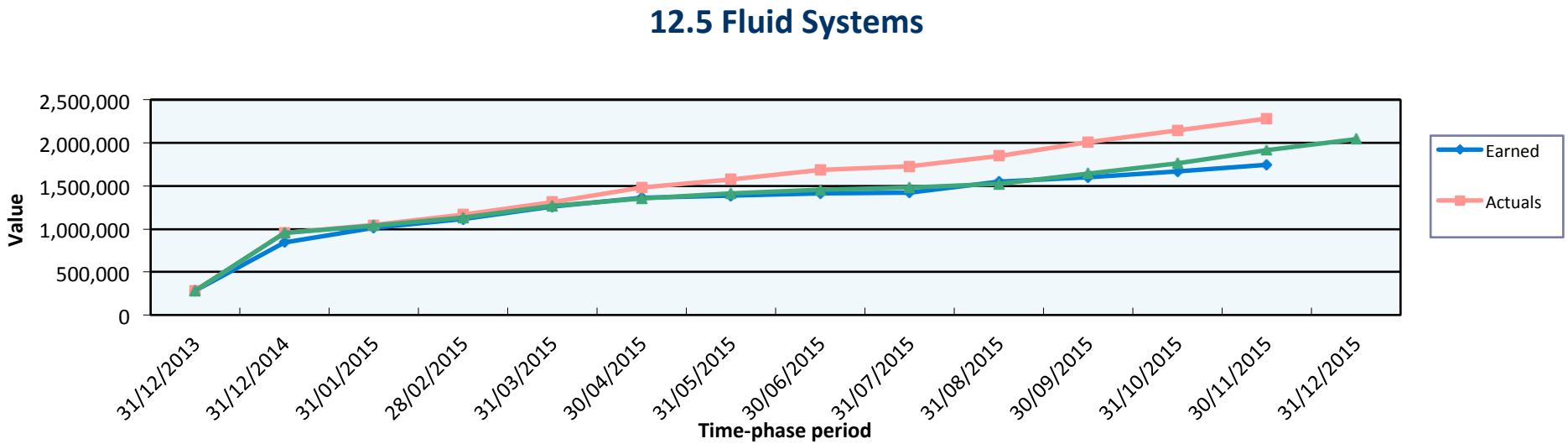
Target Station HVAC – Subsystem



Subsystems

- General
- Process
- Building

Schedule Performance (1 of 2)



Variance Analysis:

- Cumulative SV of -0.17 M€ (SPI = 0.91) is primarily due to:
  - Delays in starting up Final Design activities – In-Kind start-up is late
  - Lack of system/tool/process support due to “green-field”-site

Schedule Performance (2 of 2)

IDs	Name	TIK	Current Forecast or Actual	
A73700	CDR All Intermediate Water Cooling Systems	5.2	2016-12-22	
A73680	CDR All Primary Water Cooling Systems	5.1	2016-11-15	
A38190	Award contract for Primary Water Cooling Systems	5.1	2017-05-29	
A39790	Deliver Primary Water Cooling Systems to ESS site	5.1	2017-11-15	
A38210	Complete Installation Primary Water Cooling Systems	5.1	2018-09-06	
A38220	Complete System Test Primary Water Cooling Systems	5.1	2019-02-07	
A38840	CDR Target Station HVAC	5.3	2016-10-20	
A38870	Award Contract for Target Station HVAC	5.3	2017-05-02	
A38880	Deliver Target Station HVAC	5.3	2017-11-03	
A38900	Complete Installation Target Station HVAC	5.3	2018-09-24	
A38910	Complete System Test Target Station HVAC	5.3	2019-03-25	

Near Term Plans Water Cooling Systems TIK 5.1-5.2 (next 3 months)

- Piping System Structural Analysis
  - Method to be used
  - Structure of reports
- Finalize Component Specifications
- Start Instrument specification
- Define interface towards ICS – interface, signals and controls
- Finalize preliminary design of de-gassing system for Primary Water Cooling
- Perform HAZOP for remaining P&ID:s
  - Shielding & Plugs, Reflector (almost identical to Moderator)
  - Intermediate Water Cooling Loops
  - Update P&ID:s
- Evaluation of piping tool for ESS
- Accident Analysis of Primary Water Cooling Systems
- Kick-off meeting with IK-Partner
- Proton Beam Window Cooling – PDR 5th of April

Near Term Plans Target Station HVAC TIK 5.3 (next 3 months)

- Update of 3D model - ventilation ducts and technical rooms
- P&ID:s for subsystems of TS HVAC
- Finalize Interface Description Documents and update the room book
- Kick-off meeting with IK-Partner

Risks and Issues

- Lack of system/tool/process support due to “green-field”-site
- Coordination of interfaces –WP:s, IK-partners, CF, ICS…..

Concluding Remarks

- In-Kind Partner from Czech Republic