





Target Systems ventilation system integration

1st Beam Dump Facility (BDF) Targetry Systems Advisory Committee (TSAC)

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HI ECN3

<https://hiecn3.web.cern.ch>

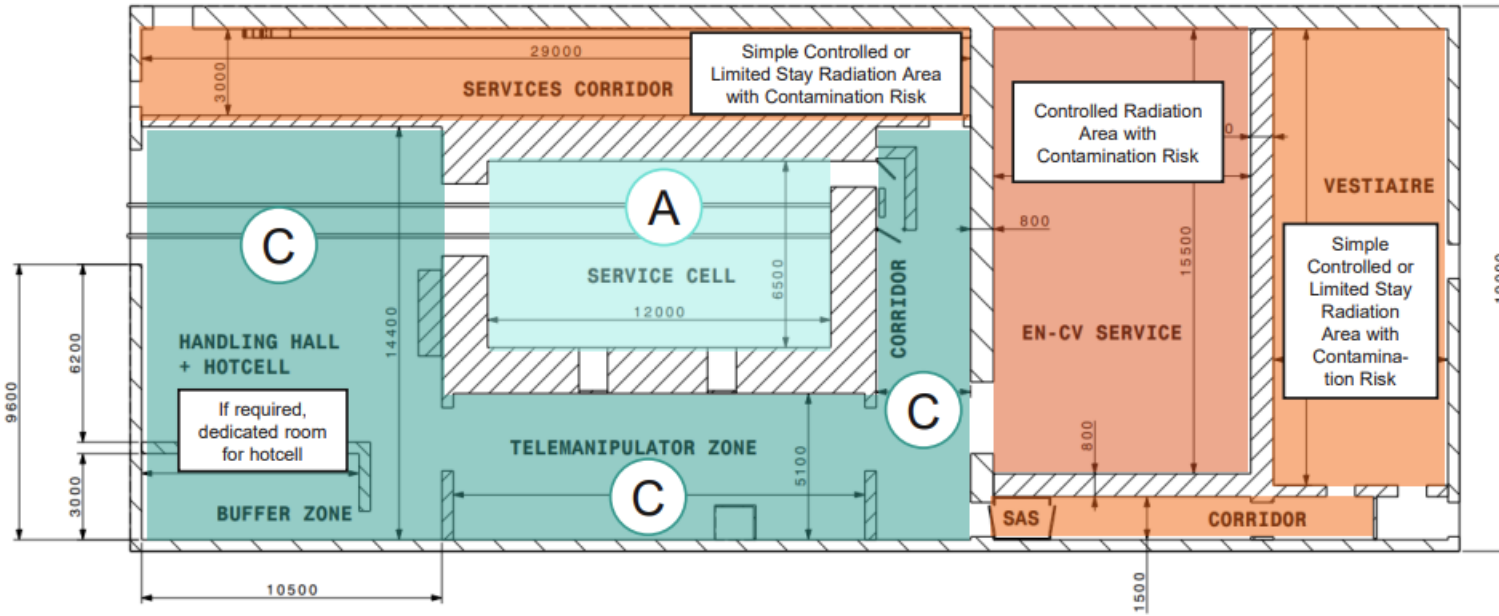
Agenda

- **Review of confinement consumptions in ventilation systems**
 - Reference documents
- **New service building**
 - Ventilation systems & pressure cascade
 - Preliminary failure modes and impacts
- **Underground area**
 - Ventilation systems

New service building – ventilation system

- RP input document: EDMS 3237086

A-A - GROUND FLOOR



Class A and C working areas will in addition have a Controlled Radiation Area classification with contamination risk (Limited Stay or High Radiation Area)

Work sector	Maximum Activity
Normal	LA
Type C	1E+02 LA
Type B	1E+04 LA
Type A	Depending on authorization

Area	Annual dose limit (year)	Ambient dose equivalent rate		Airborne activity concentration (CA) and surface contamination (CS)		Sign
		permanent occupancy	low occupancy			
Non-designated	1 mSv	0.5 µSv/h	2.5 µSv/h	0.05 CA	-	
Supervised	6 mSv	3 µSv/h	15 µSv/h	< 0.1 CA	< 1 CS	
Simple Controlled	20 mSv	10 µSv/h	50 µSv/h	< 0.1 CA	< 1 CS	
Limited Stay	20 mSv	-	2 mSv/h	< 0.1 CA	< 1 CS	
High Radiation	20 mSv	-	100 mSv/h	< 0.1 CA	< 1000 CA < 40000 CS	
Prohibited	20 mSv	-	> 100 mSv/h	> 1000 CA	> 40000 CS	

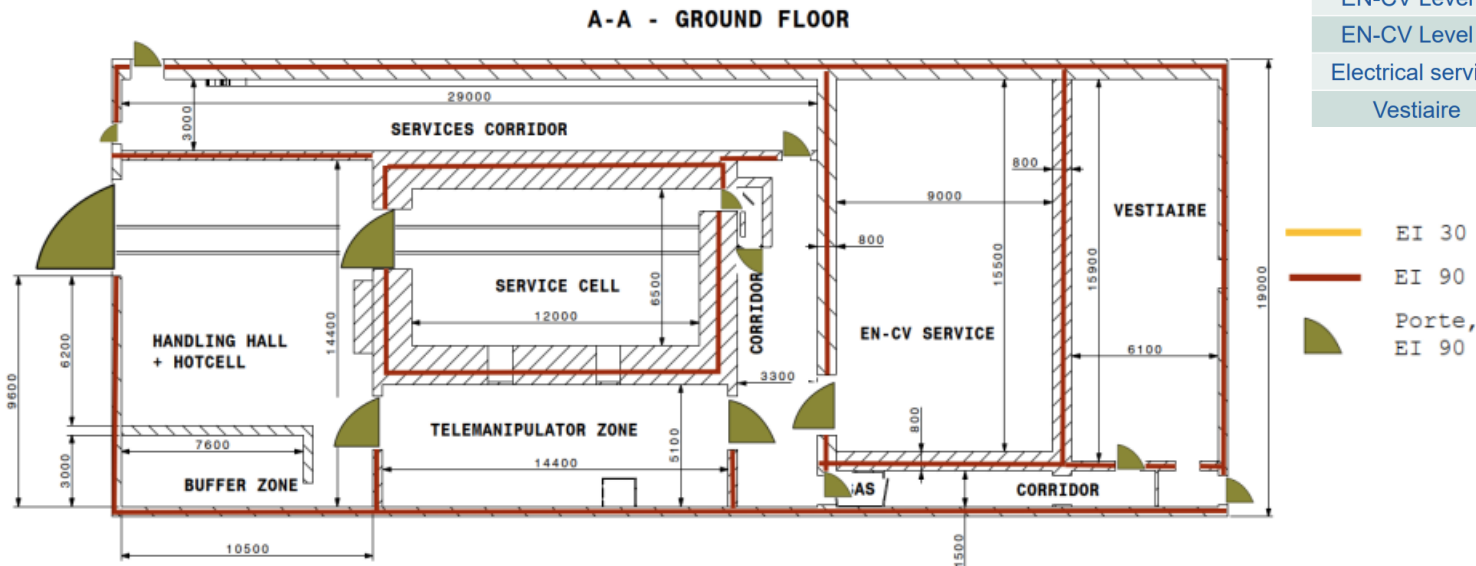
New service building – ventilation system

- **RP input document: EDMS 3237086**
 - Class A requirements:
 - min. fresh air: 5 ach
 - min. ΔP : -50Pa
 - extraction must be guaranteed in case of power cut → Redundant power supply
 - Class C requirements:
 - no min. fresh air requirements
 - needs for underpressure level, but no min. requirements
 - no needs for redundant power supply

New service building – ventilation system

- **FIRIA input document: EDMS 3237086**
 - Fire compartments
 - Smoke extraction zones
 - Filtration needed for CLASS A (service cell)

Compartment	Surface area (m ²)	Openings	Smoke extraction	Conflict of Interest
Telemanipulator zone	73.5	NO	(Not) required, depends on radionuclide inventory	
Handling hall (+buffer zone)	142.5	NO	Required	
Service cell	78.0	NO	Required	
EN-CV Level 0	139.5	NO	Required	
EN-CV Level 1	160.2	NO	Required	
Electrical service	108.5	POSSIBLE	(Not) Required	
Vestiaire	97.0	POSSIBLE	Not Required	



New service building – ventilation system

FIRIA input document: NANOLAB example

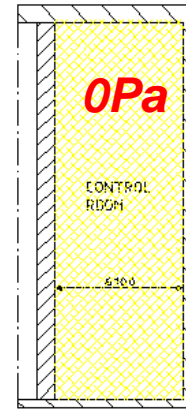
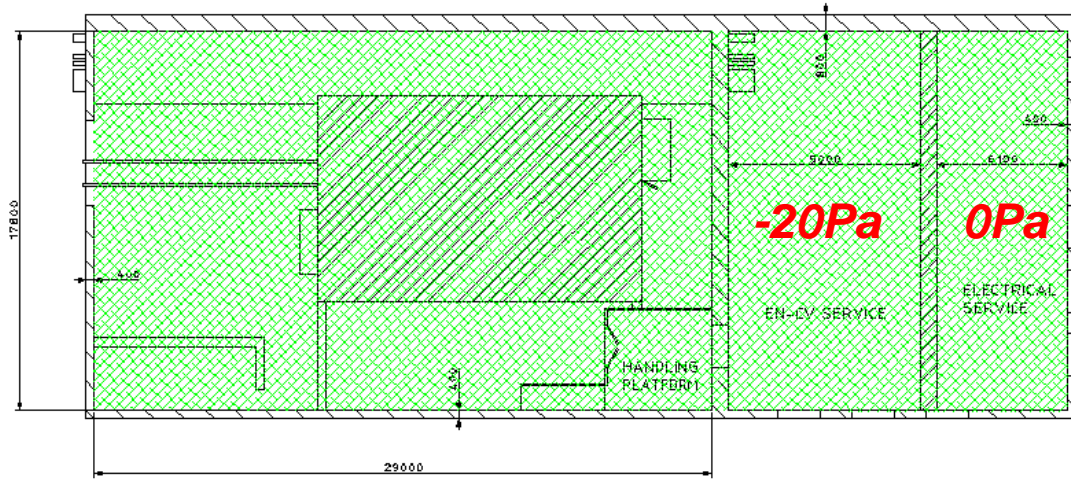
	<p>Fire Mode: Only single detector triggered. No action on ventilation (Supply and Extraction maintained). Evacuation of whole building (Nanolab & Medicis) is triggered and fire alarm sent to FB.</p>
	<p>Fire Mode: Supply stopped (ADS) $T1 < 200^\circ\text{C}$ Filters at 1st level of filtration not clogged. Extraction maintained.</p>
	<p>Fire Mode: Supply stopped (ADS) $200^\circ\text{C} < T1 < 300^\circ\text{C}$ Filters at 1st level of filtration are clogged or destroyed by high temperature, by-pass valve is opened. Extraction maintained.</p>

	<p>Fire Mode: $T1 > 300^\circ\text{C}$ Extraction of concerned fire sector stopped and related fire dampers are closed.</p>
	<p>Fire Mode: $T2 > 120^\circ\text{C}$ OR Smoke detected after the ultimate level of filtration. Ventilation of entire facility stopped and all fire dampers are closed</p>

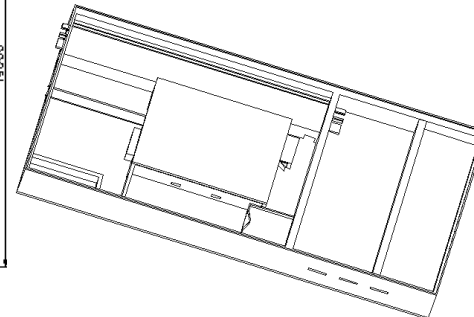
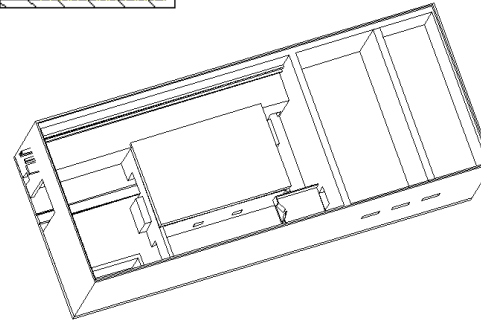
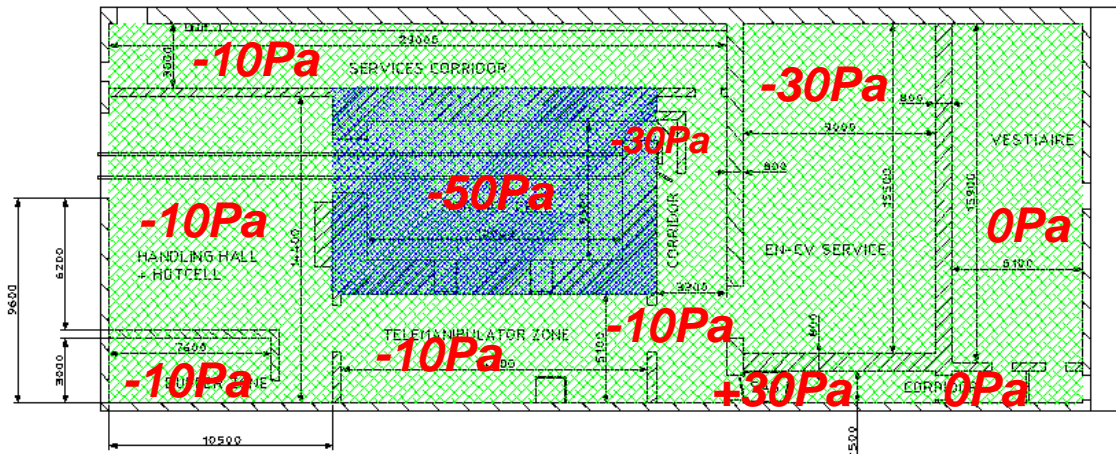
New service building – ventilation system

B-B - FIRST FLOOR

C-C - SECOND FLOOR



A-A - GROUND FLOOR

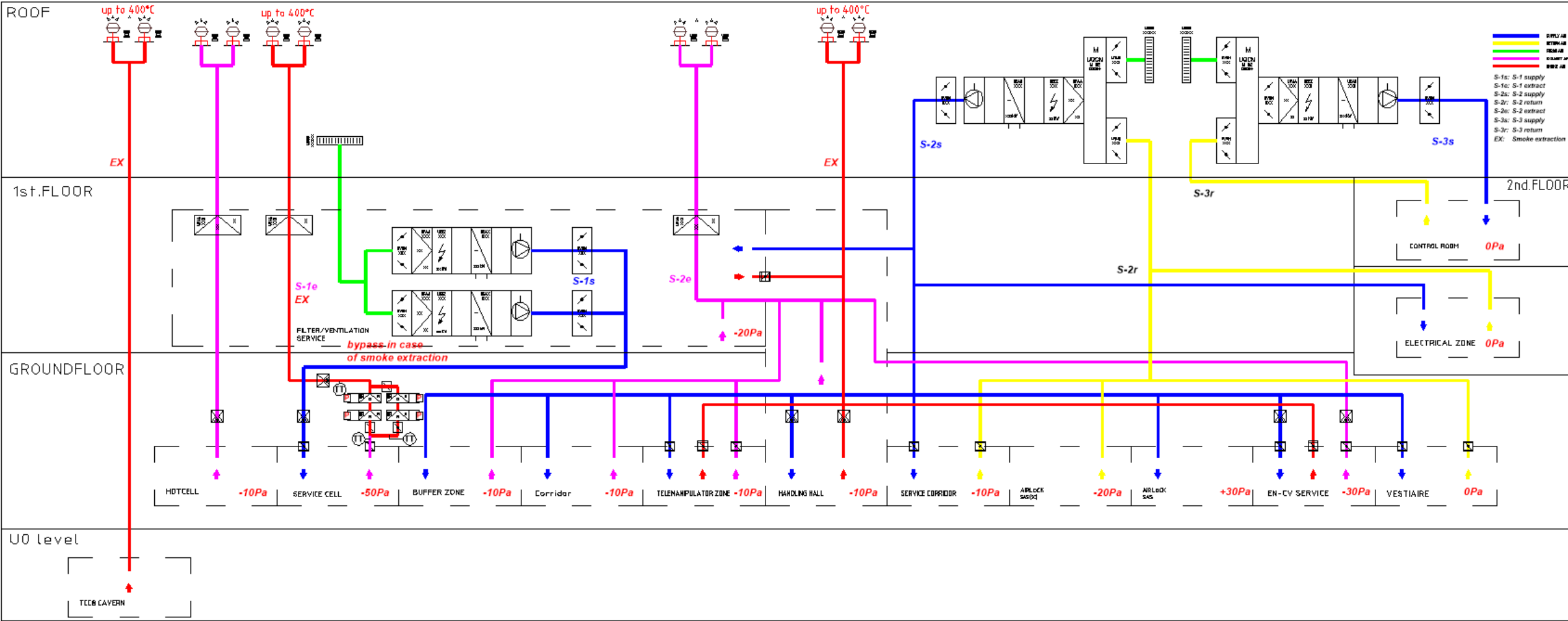


- **S-1 Zone**
- Full fresh air ~ 2,300 m3/h
- N+1 redundancy
- Filters nearby Service Cell and in filter room

- **S-2 Zone**
- Full fresh air ~ 12,660 m3/h
- No redundancy
- Filters in filter room

- **S-3 Zone**
- ~ 1,000 m3/h
- No redundancy

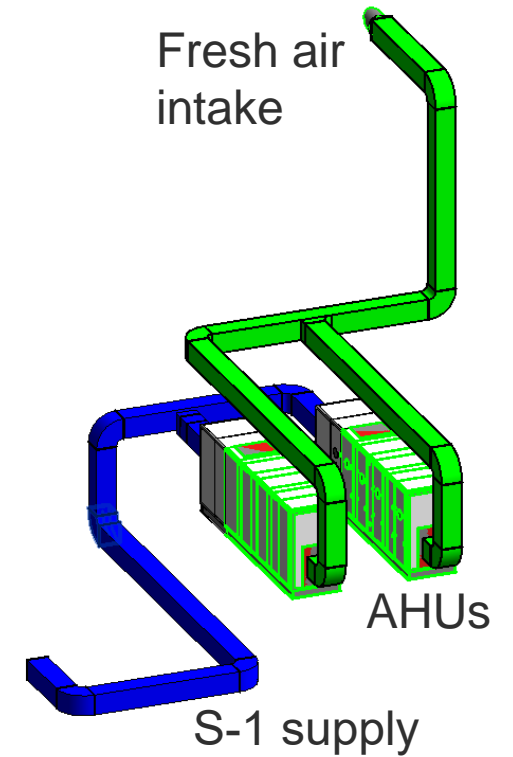
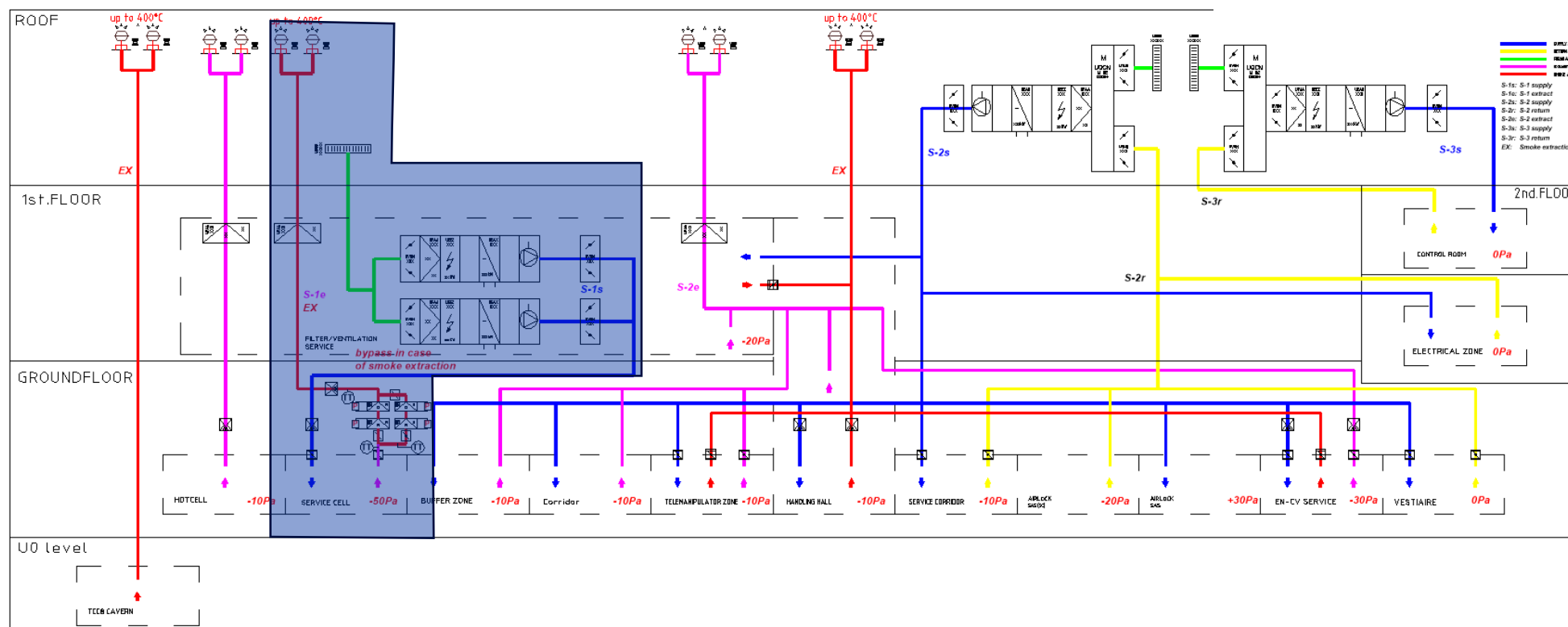
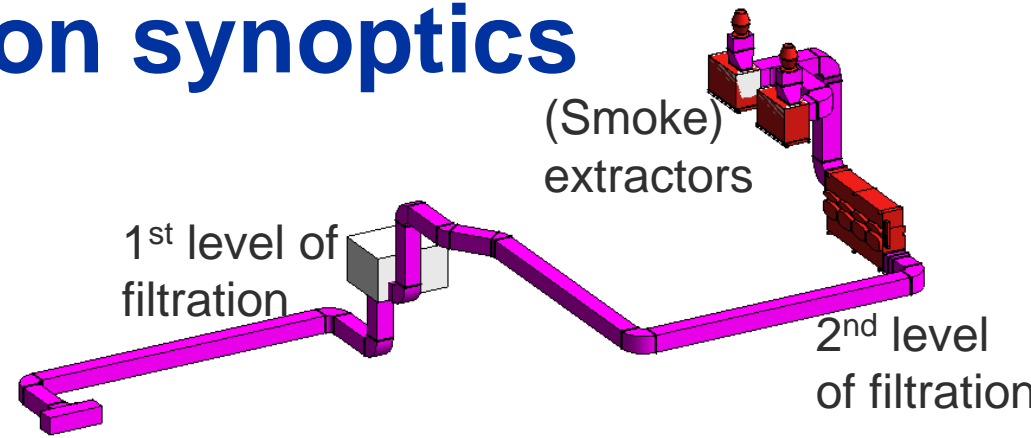
New service building – ventilation synoptics



New service building – ventilation synoptics

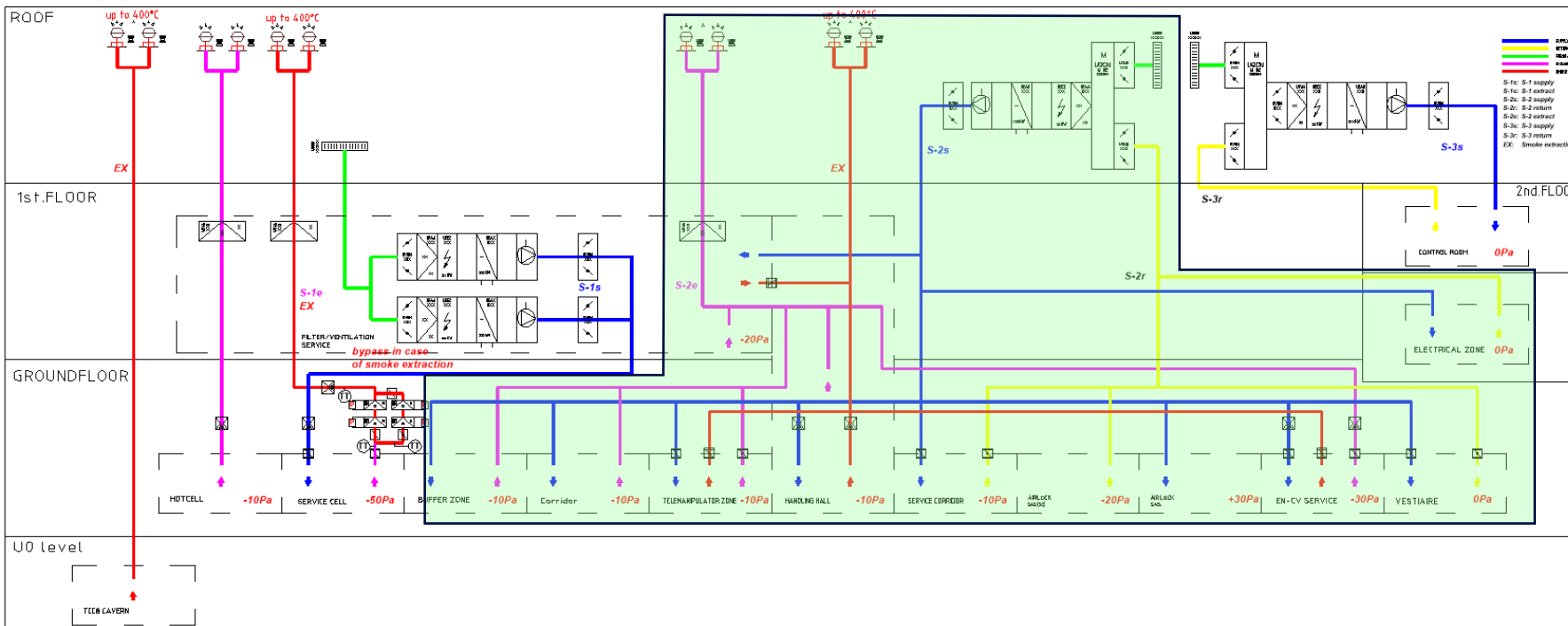
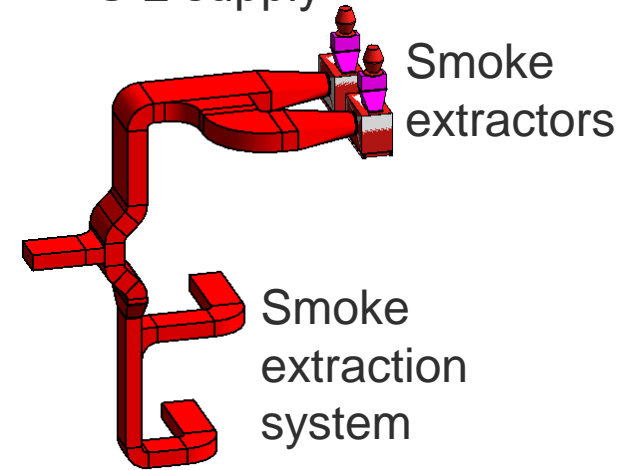
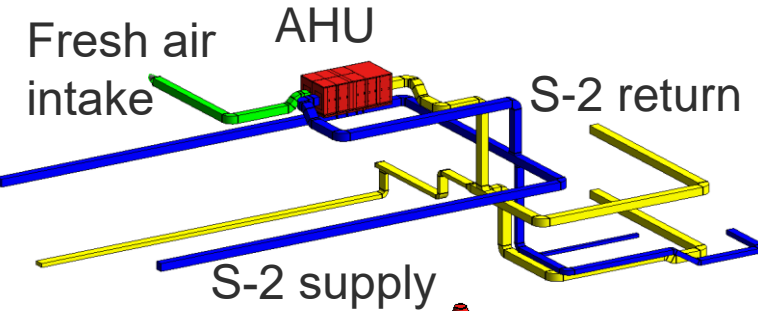
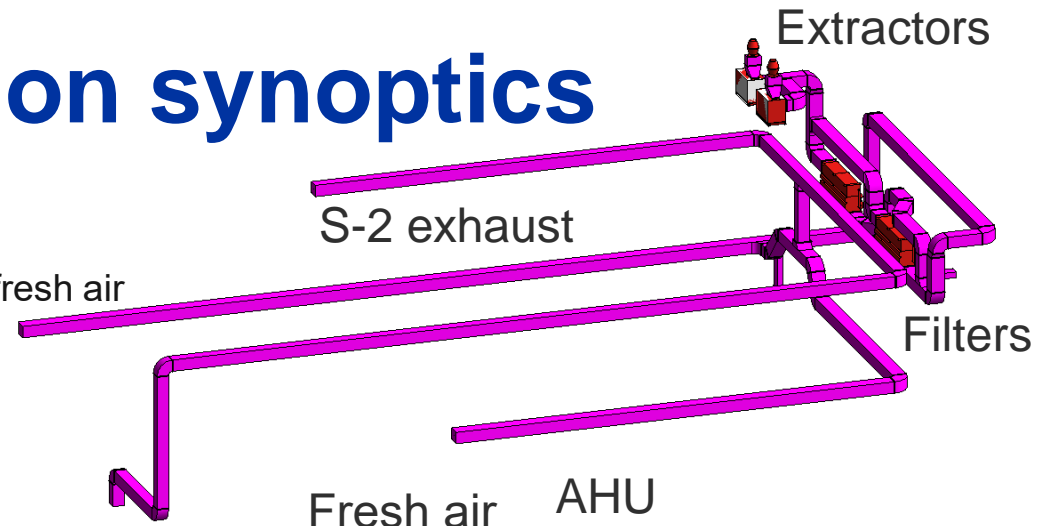
- **Service Cell**

- 2,300 m³/h full fresh air supply unit
- Extractor rated at 400 °C /2h + → maintenance of -50 Pa as required
→ this system will be on Redundant power supply
- Two level of exhaust air filtration



New service building – ventilation synoptics

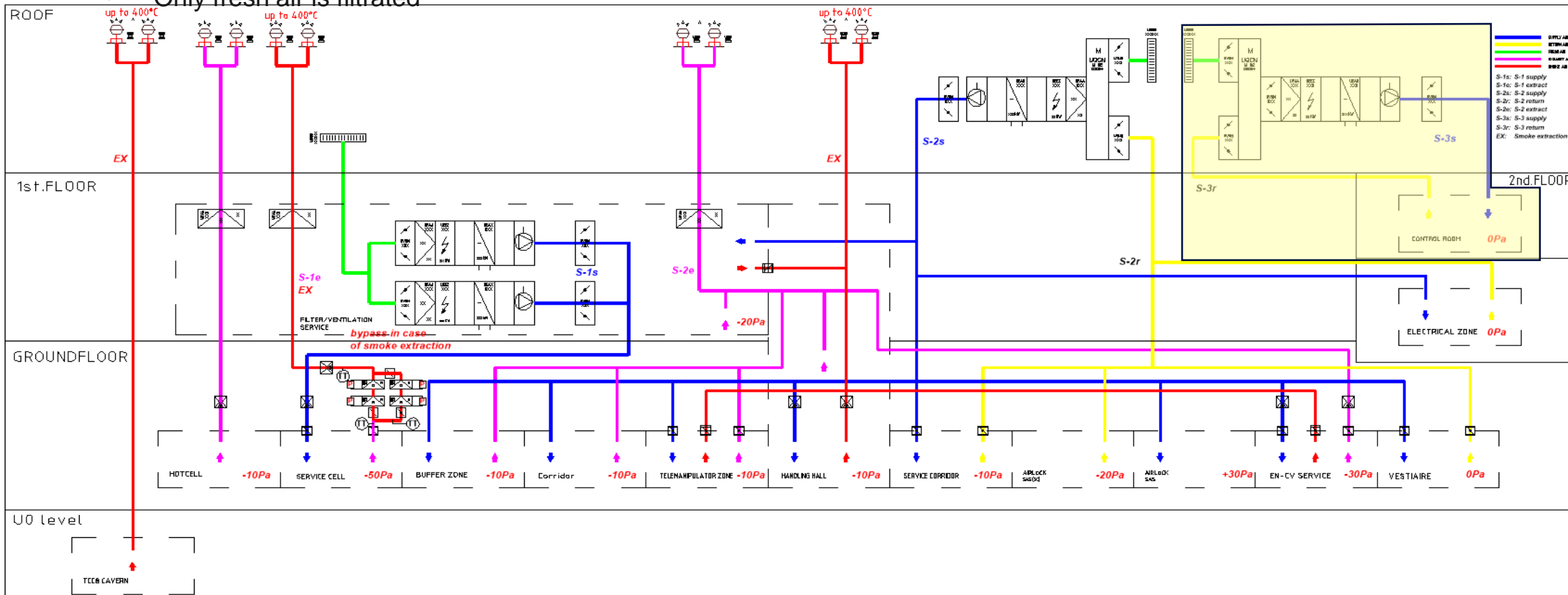
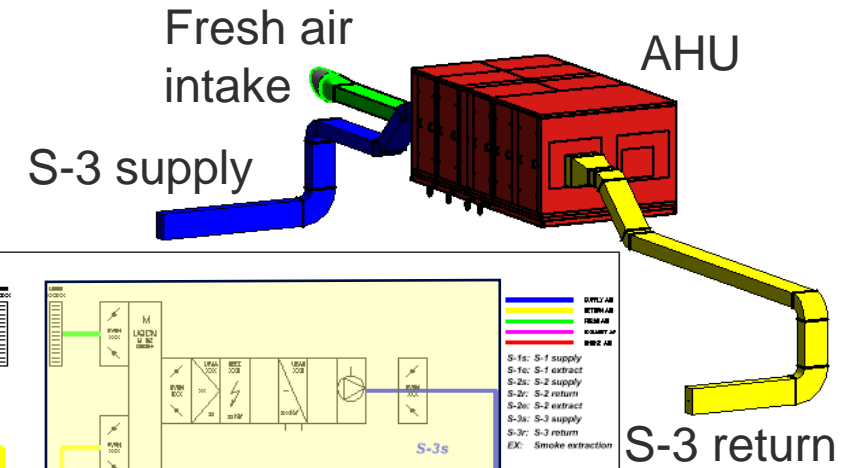
- ALL OTHER ROOMS except Control room
 - 12,660 m³/h full fresh air unit
 - Recirculation of air possible for some rooms → using less energy for treating fresh air
 - Smoke extraction for some zones, extractors rated at 400 °C /2h
 - One level of exhaust air filtration



New service building – ventilation synoptics

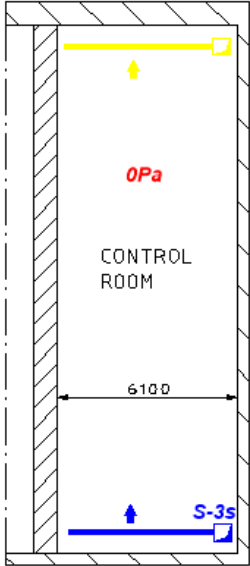
- Control room

- 1,000 m³/h unit
- Recirculation of air → using less energy for treating fresh air
- No needs for mechanical smoke extraction
- Only fresh air is filtrated

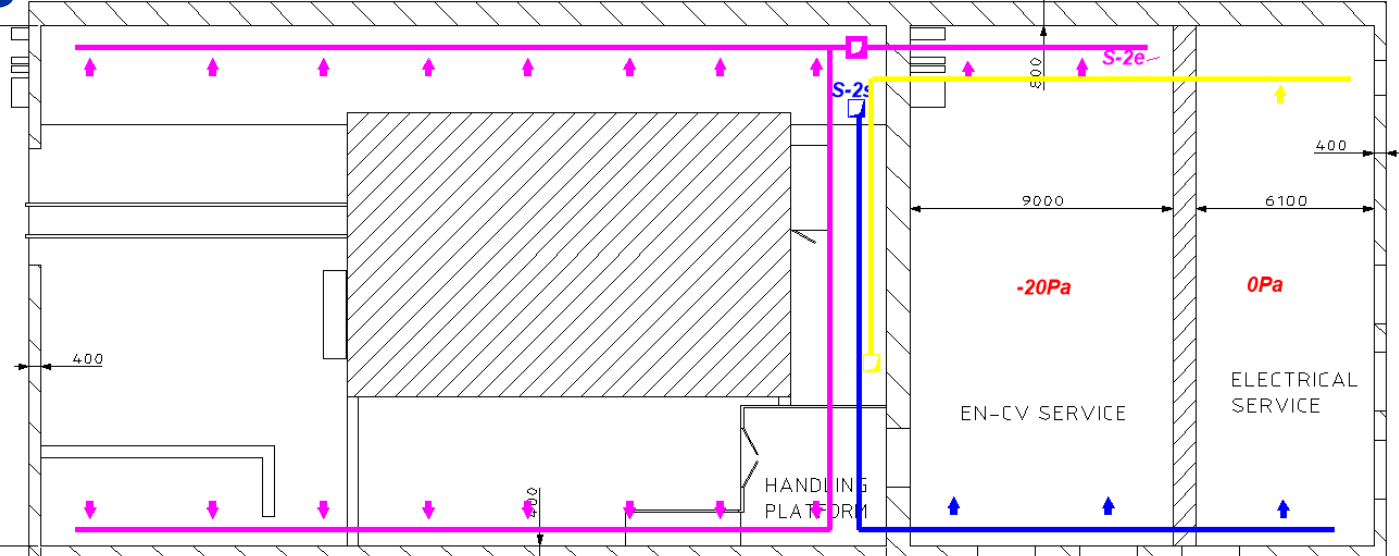


New service building – ventilation ductwork and integration

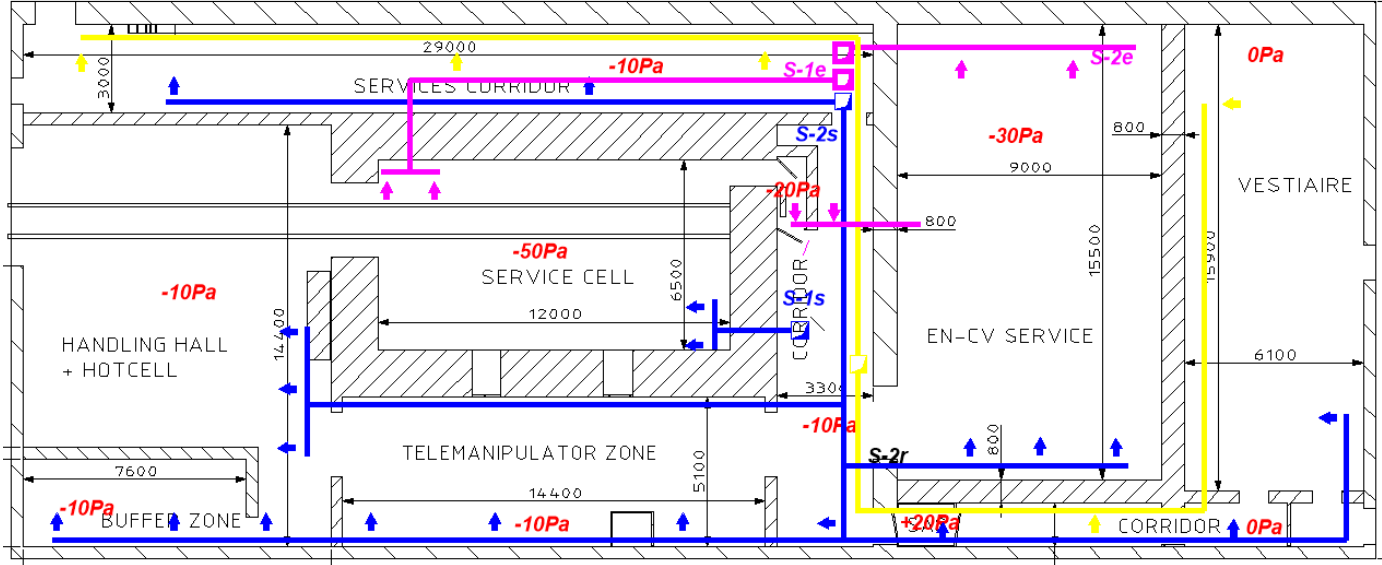
2nd floor



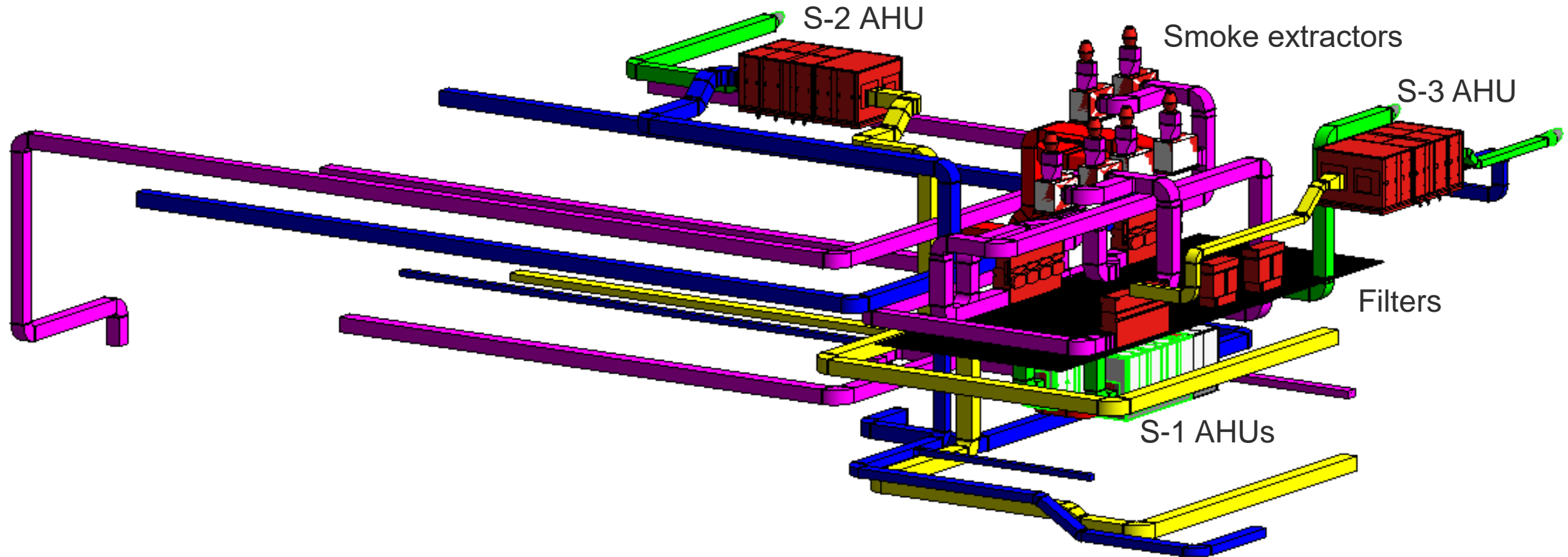
1st floor



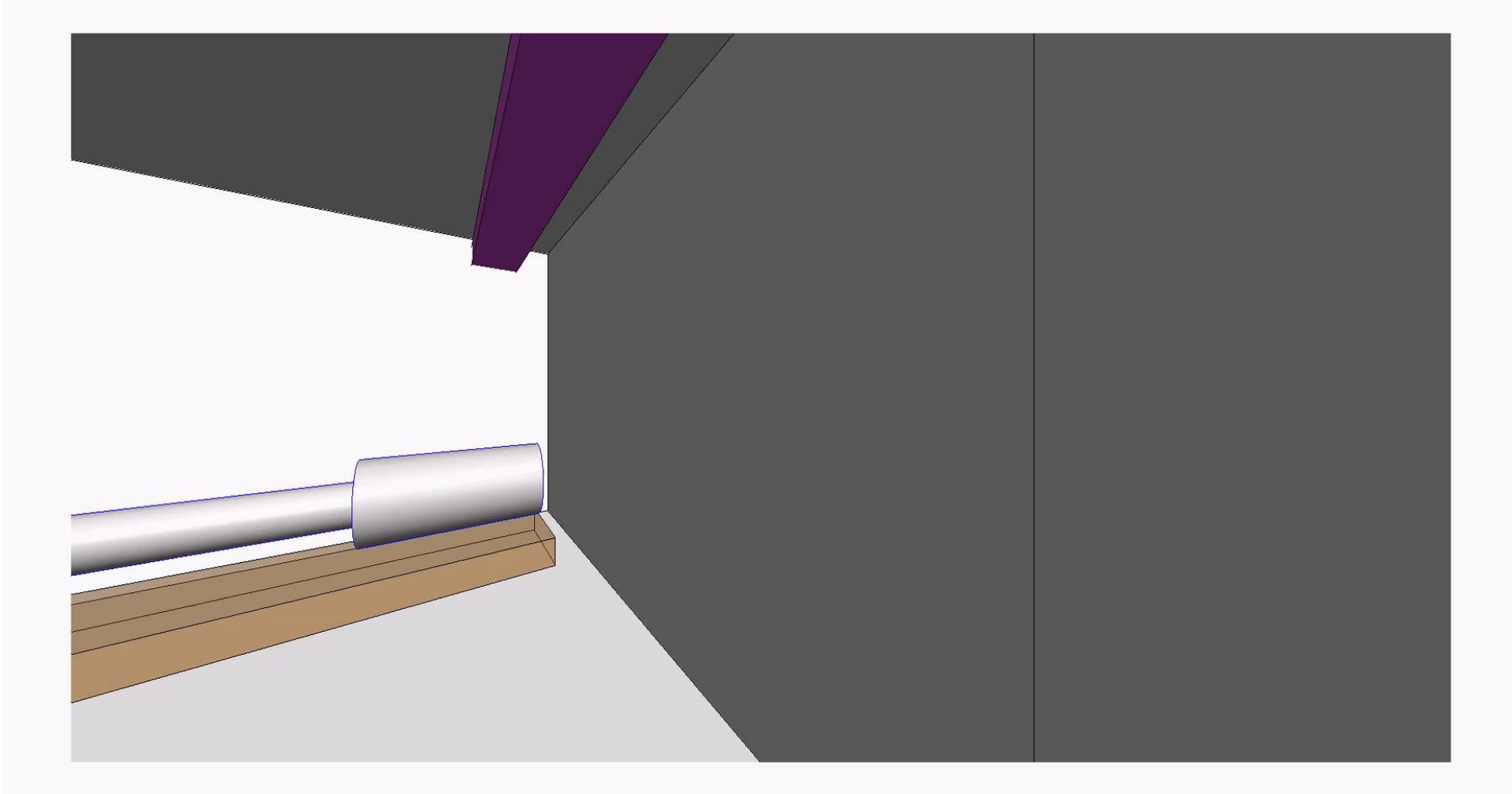
Groundfloor



New service building – ventilation ductwork and integration

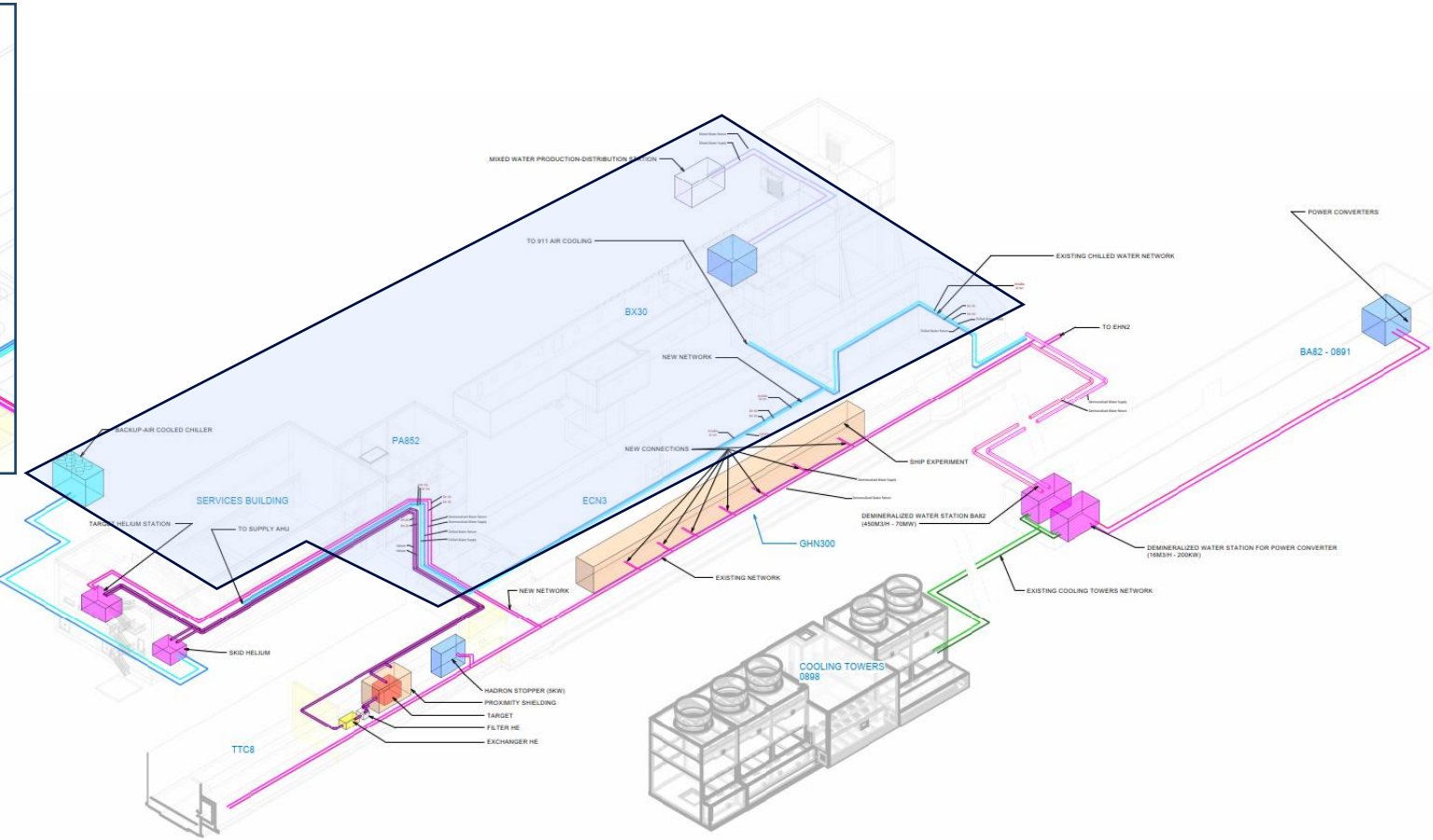
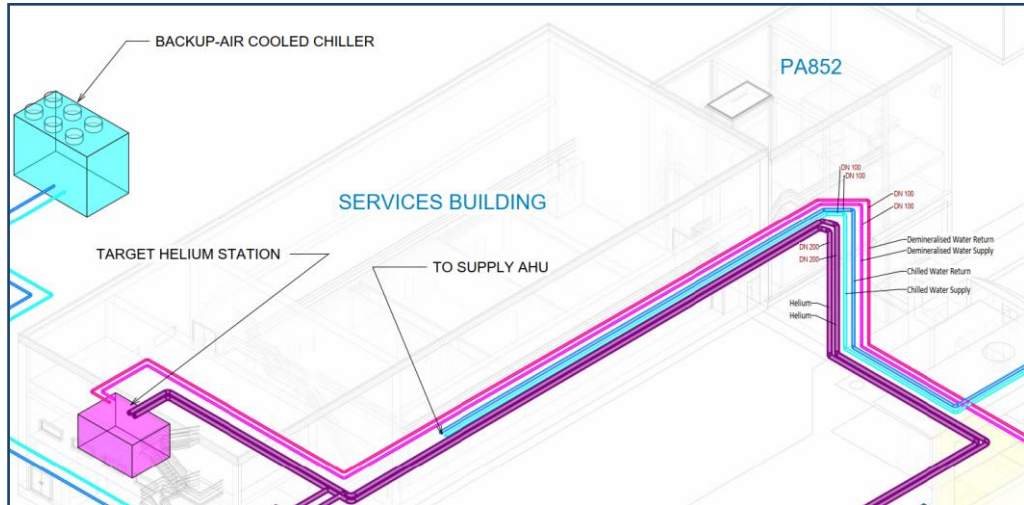


New service building – ventilation ductwork and integration



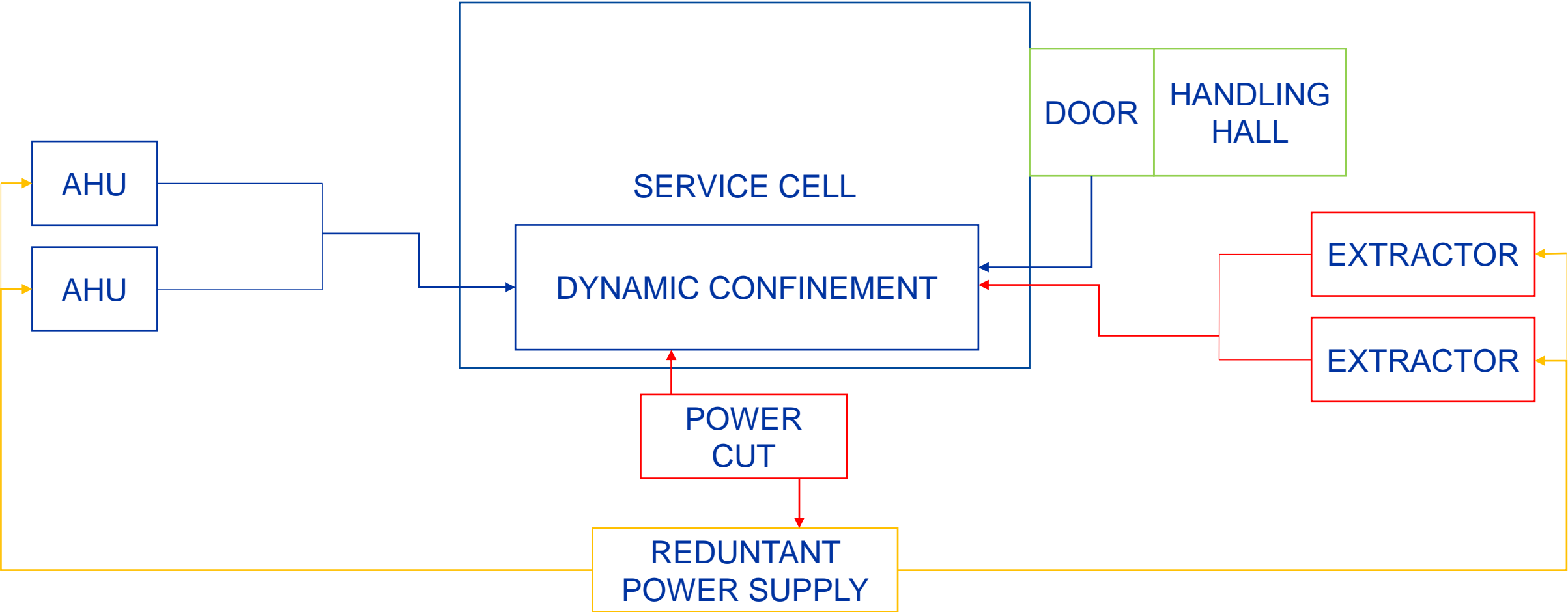
Demineralized & Chilled water synoptics

- New service building: 250 kW load on chilled water for AHUs



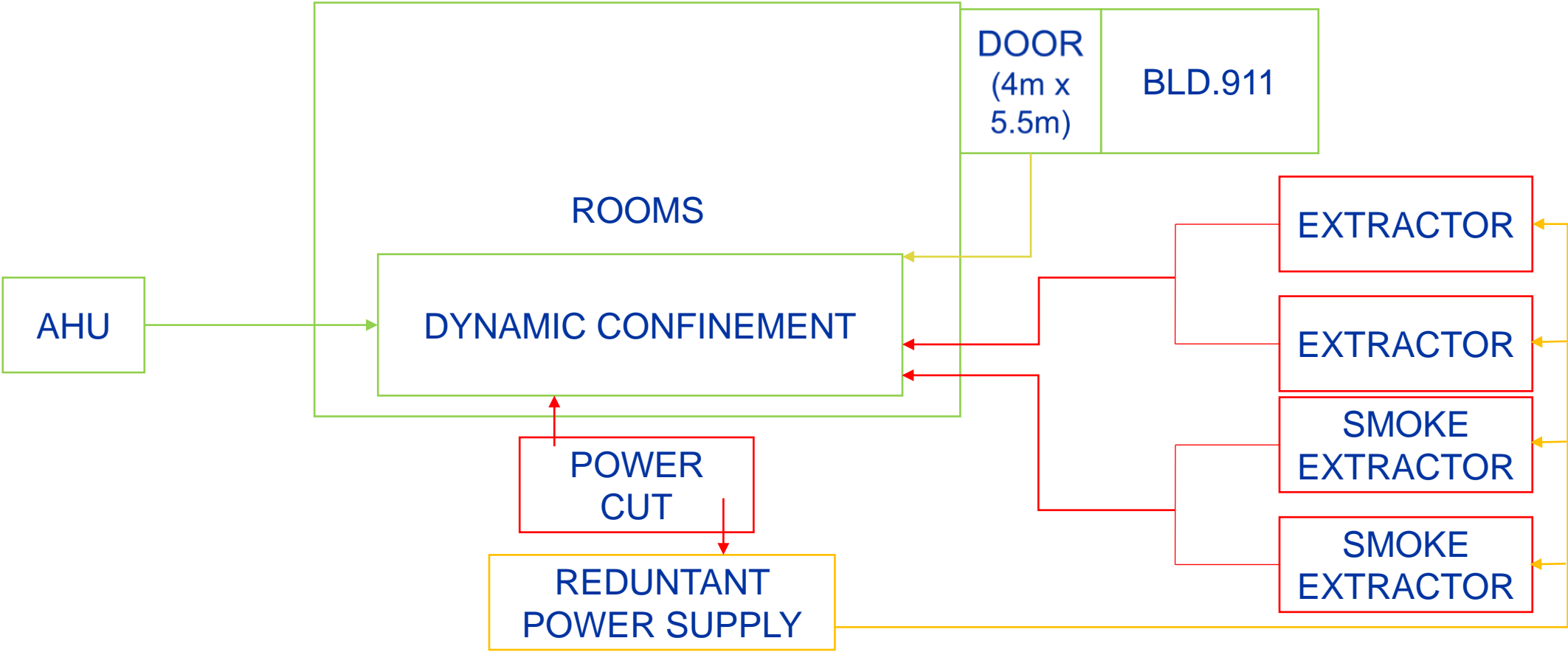
New service building – ventilation system

Preliminary failure modes and impacts – Service cell



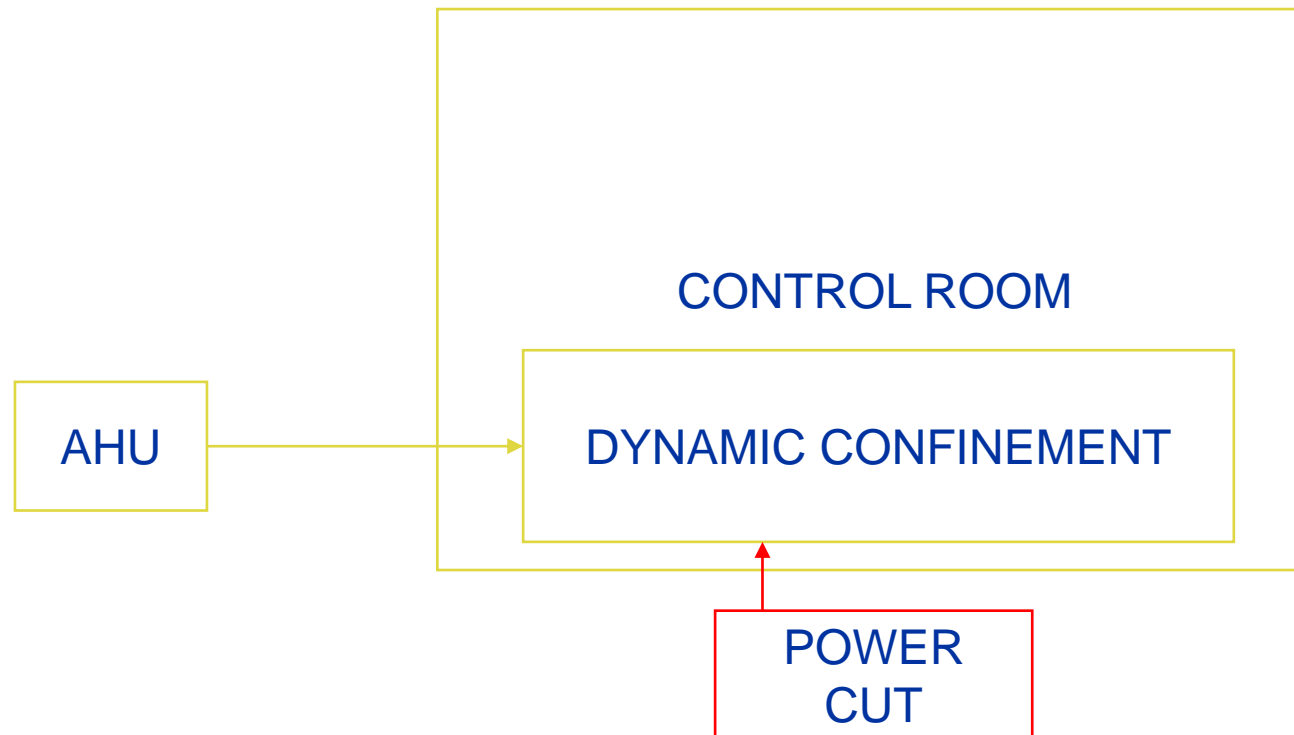
New service building – ventilation system

Preliminary failure modes and impacts – ALL OTHER ROOMS except Control room



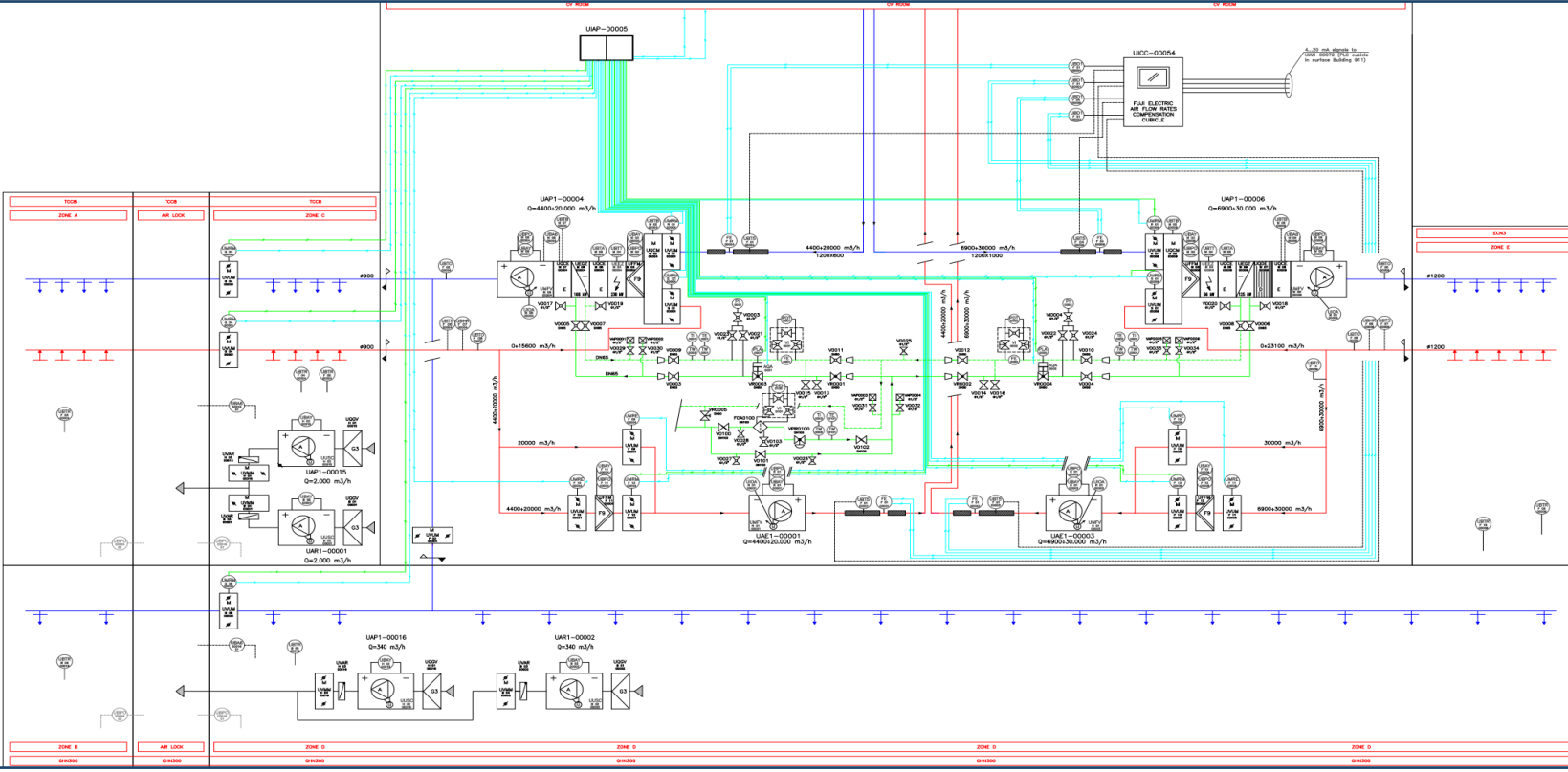
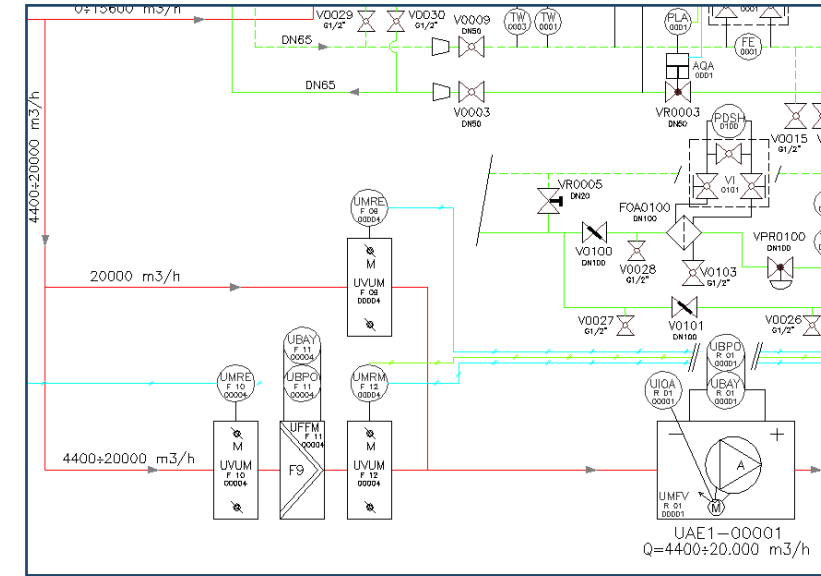
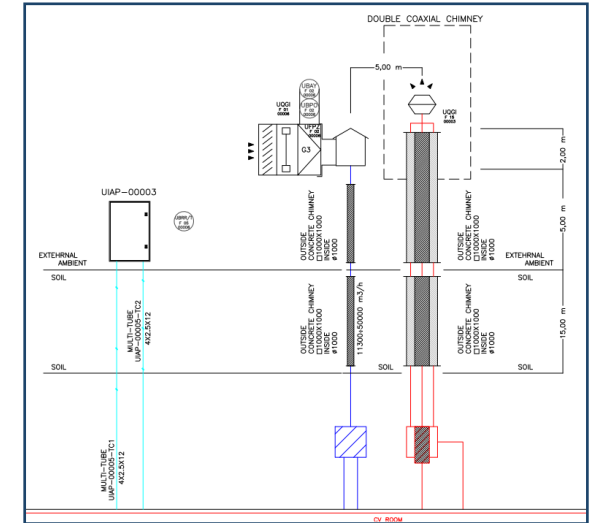
New service building – ventilation system

Preliminary failure modes and impacts – Control room

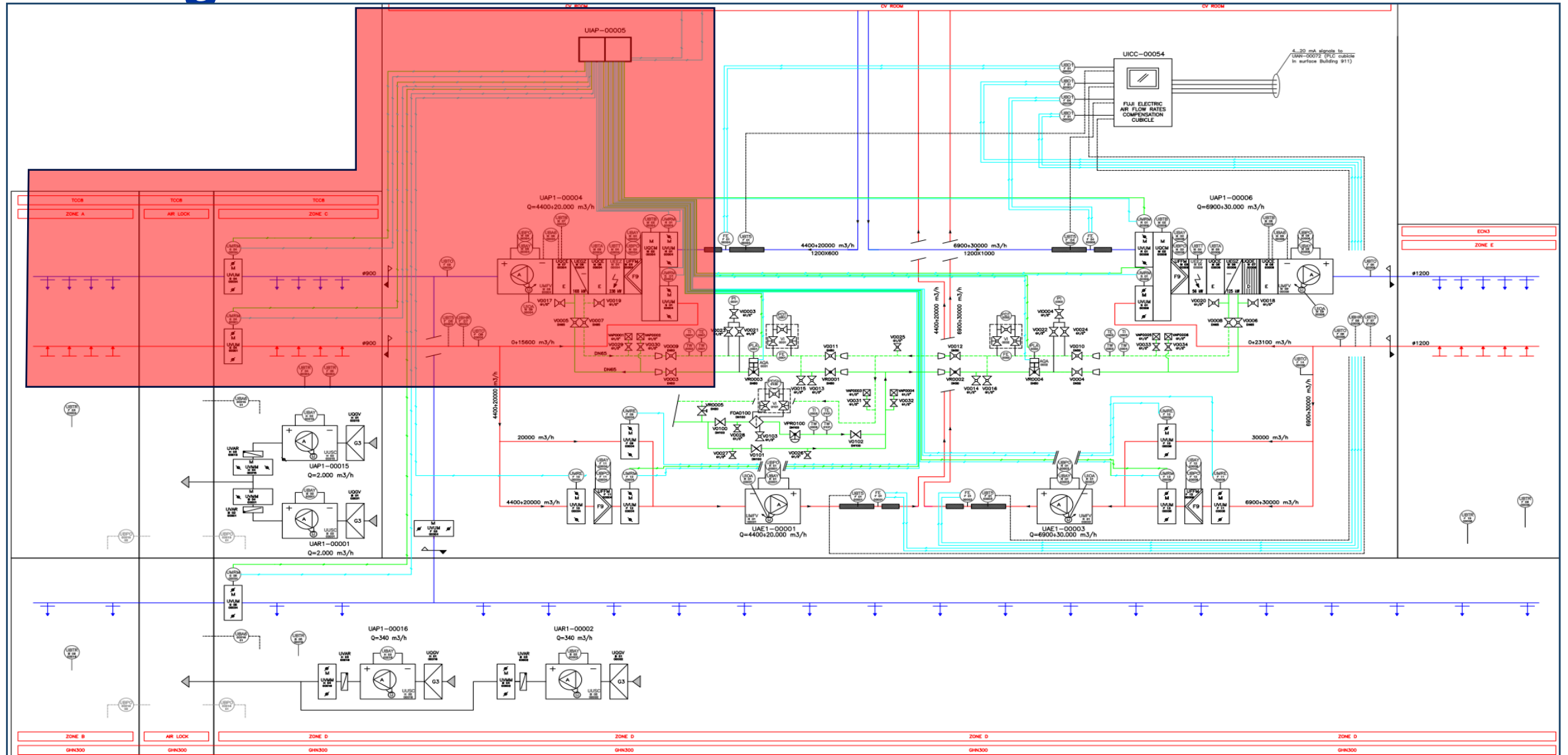


Underground cavern – TCC8 & ECN3

- ECN3: Cooling capacity: 125kW
Flow rate: 30.000m³/h
- TCC8: Cooling capacity: 168kW
Flow rate: 20.000m³/h

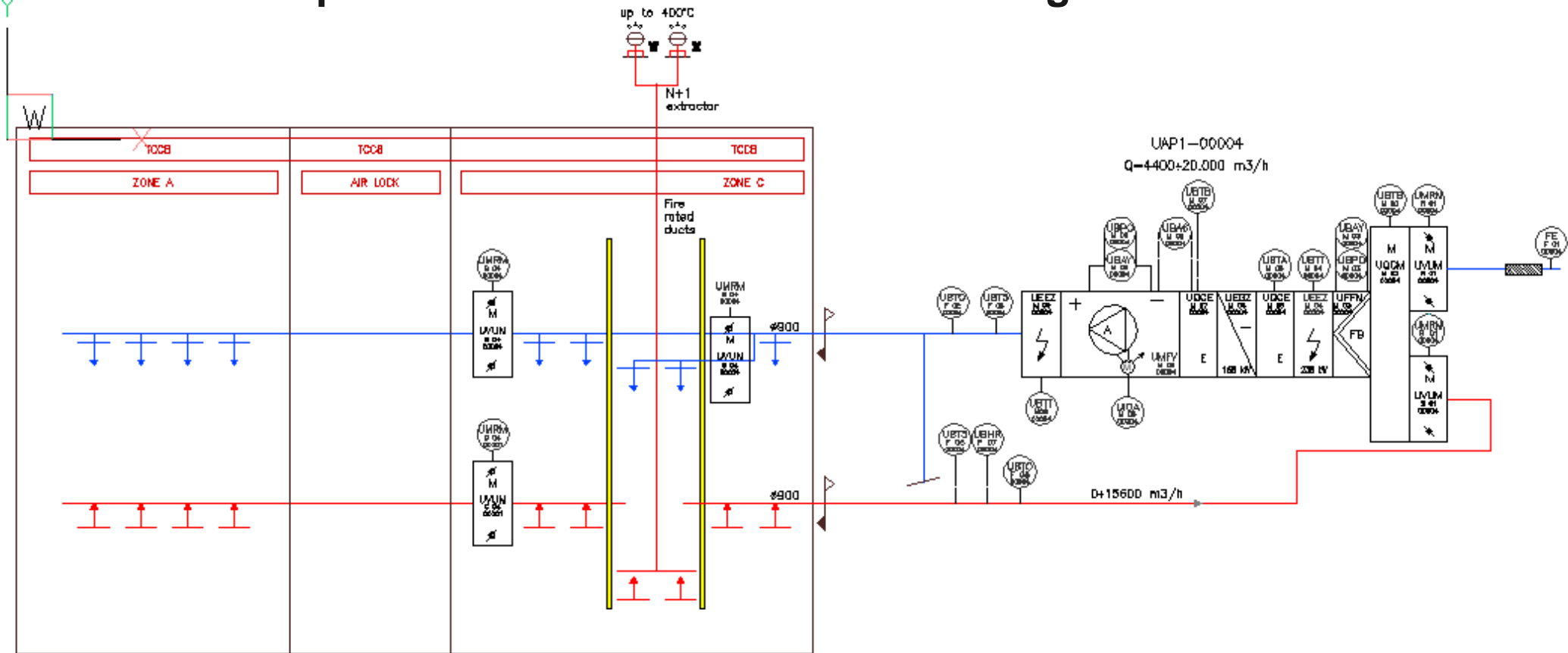


Underground cavern – TCC8 & ECN3



Underground cavern – TCC8

- Fire rated smoke extraction ducts, up to 240 min
- Class “D” leakage rate ducts
- Extractors will be placed on the roof of service building





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