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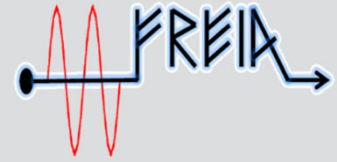
Overview of the Status and Plans for the Build-up of the FREIA Laboratory



EUROPEAN
SPALLATION
SOURCE

WS on ESS Spoke Cavity Testing 20-21 Nov. 2013

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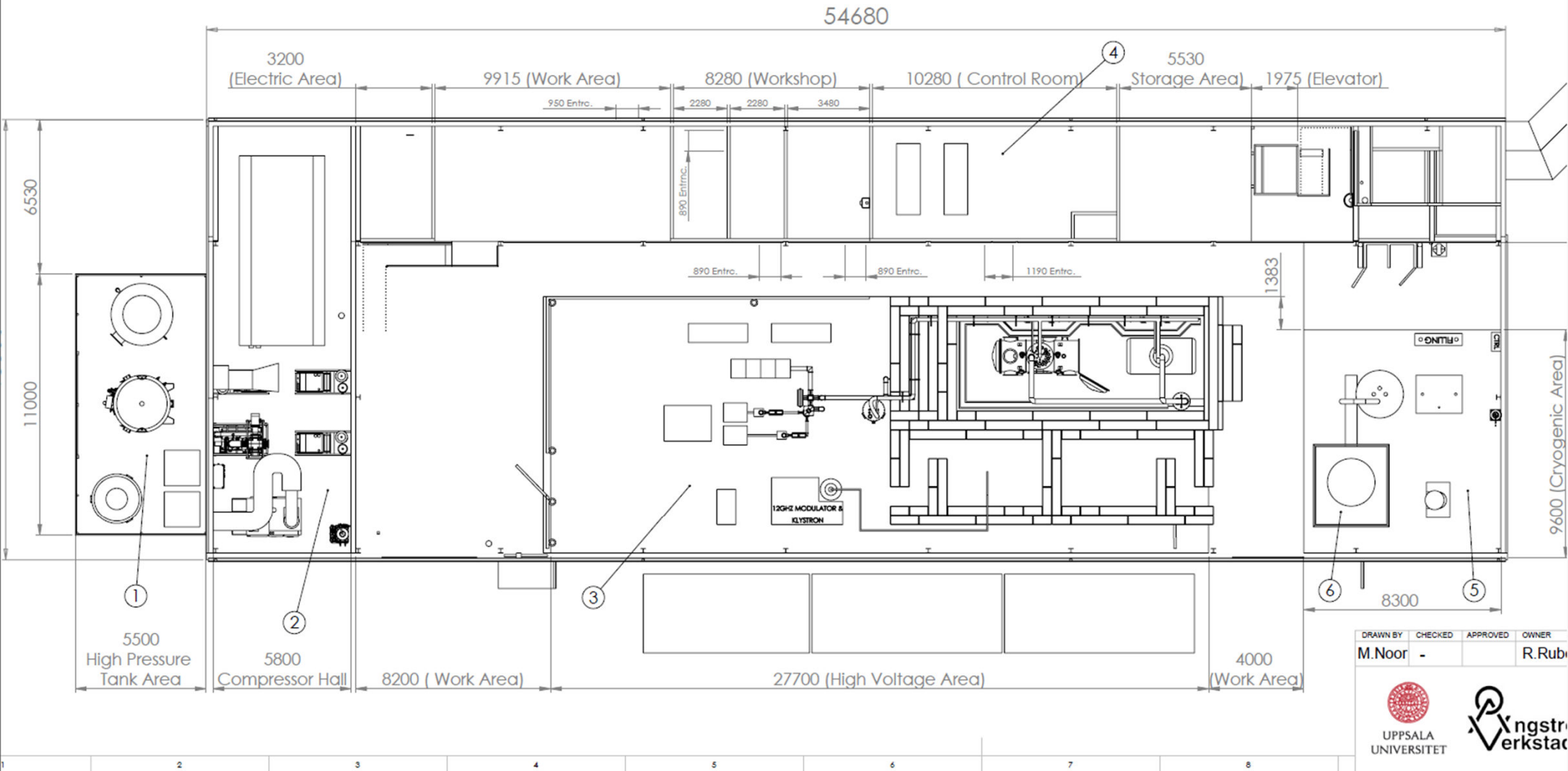


- Size of hall: 54,7 x 18,6 m
- Crane: 6,3 ton
- Installed power: 1200 kVA
- Water cooling capability: 800 kW
- Air cooling: >400 kW
- Radiation shielding:
1200 ton magnetite concrete (3,9 kg/dm³)
- Versatile, horizontal test cryostat
- Liquid Helium production: 140 l/h
- Delivery of liquid N₂ and He to external users



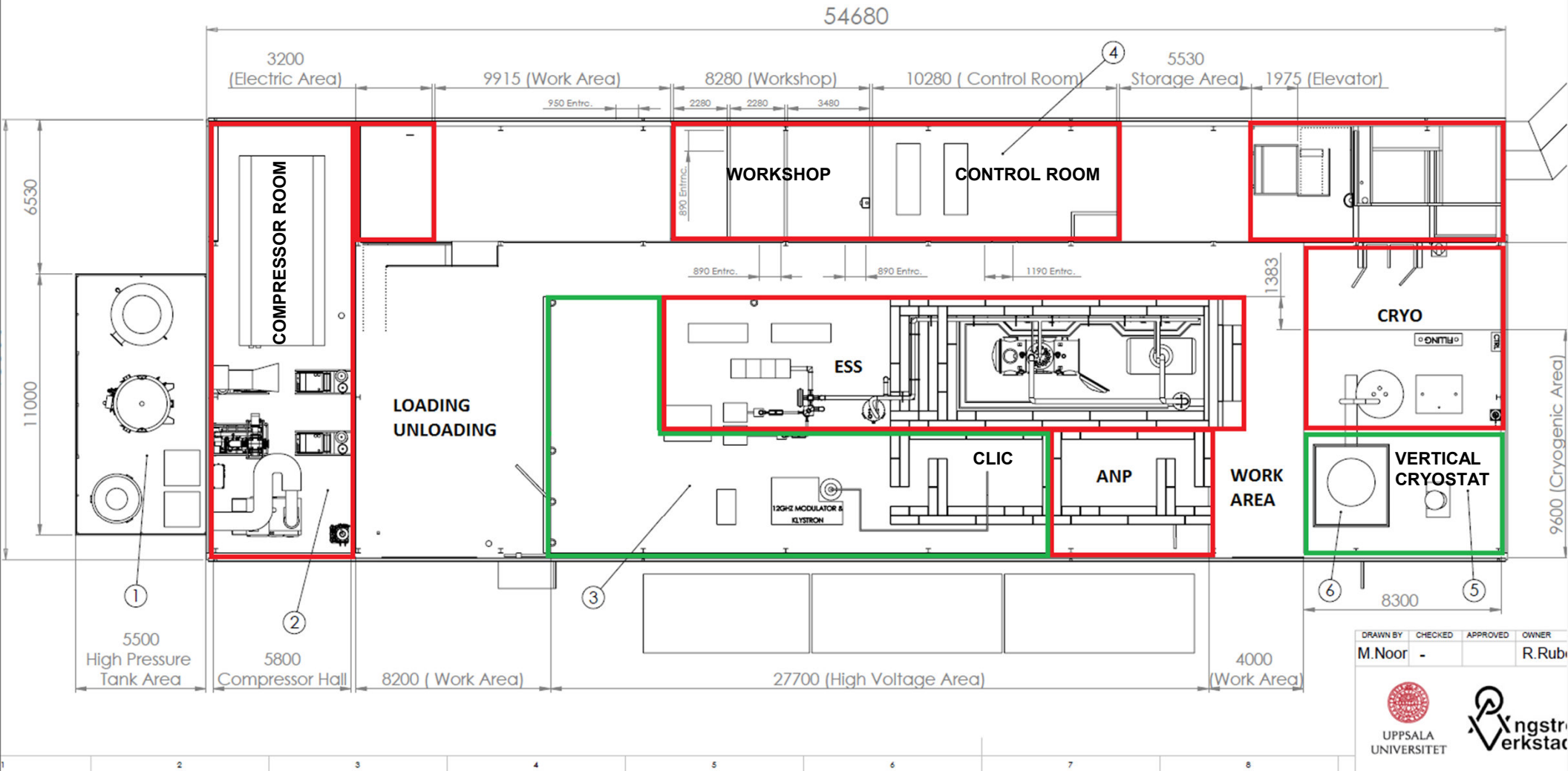


The FREIA Laboratory Layout





Activities at FREIA

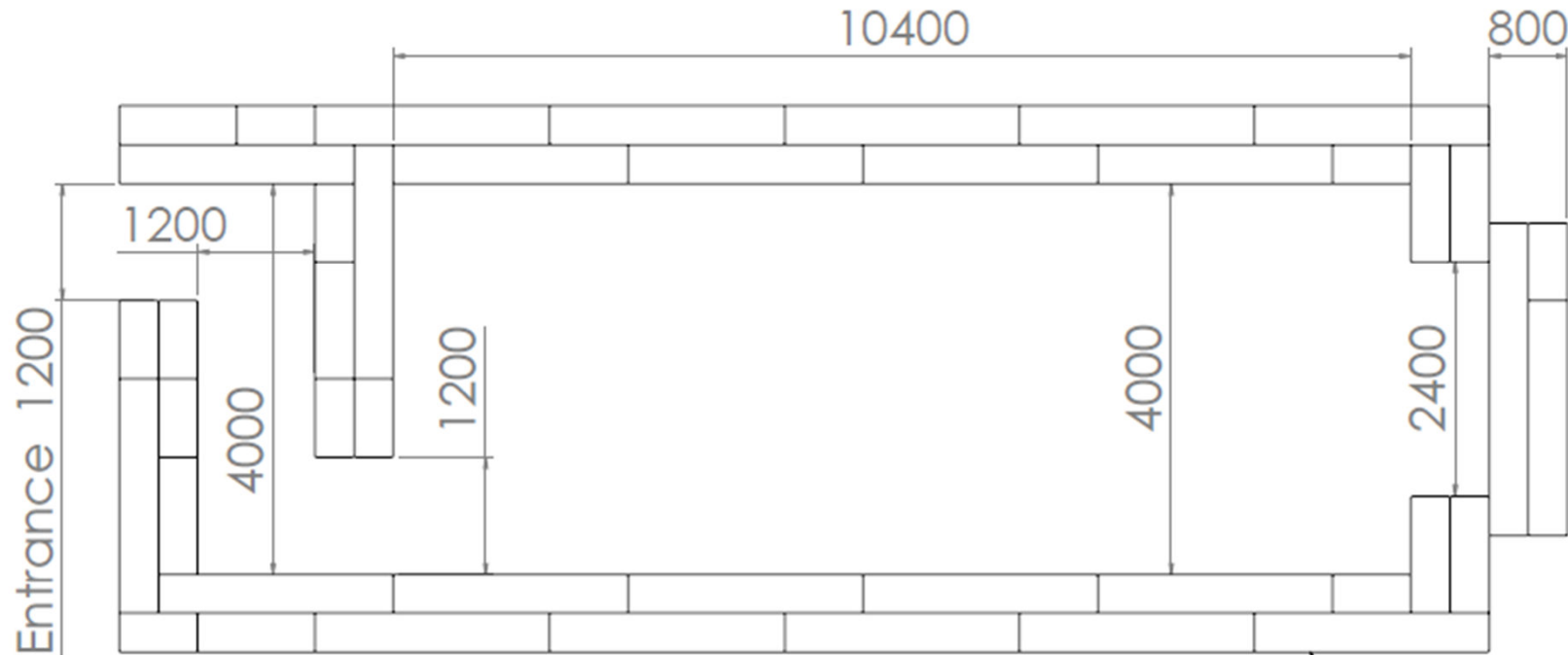


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ESS Bunker Layout



- Magnetite – a.k.a. black ore, Fe_3O_4 from mining in northern Sweden
- Magnetite concrete (88 %) blocks manufactured by Strängbetong AB in Örnsköldsvik
- Totally 312 blocks of 12 different sizes, 2 different heights to eliminate gaps

ITEM NO.	Block Dimension [A X B X L] [cm]	QTY.
1	40 x 40 x 80	7
2	40 x 40 x 120	9
3	40 x 40 x 160	5
4	40 x 40 x 240	18
5	40 x 40 x 480	38
6	40 x 40 x 560	34
7	80 x 40 x 80	10
8	80 x 40 x 120	11
9	80 x 40 x 160	16
10	80 x 40 x 200	25
11	80 x 40 x 240	116
12	80 x 40 x 320	23
Tot.		312

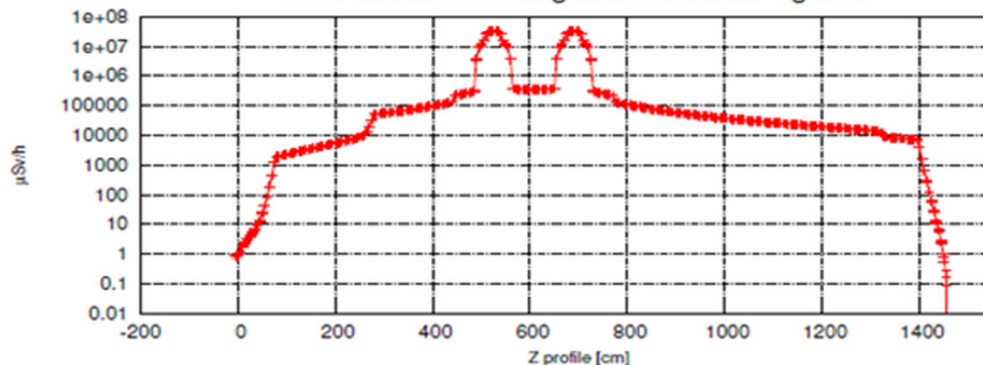
DRAWN BY M.Noor	CHECKED -	APPROVED	OWNER R.Ruber / L.Hermansson	PROJ. TYPE	DO NOT SCALE DRAWING
PROJECT FREIA HALL					
TITLE ESS BUNKER					
SCALE 1:50	DRAWING NO. 0045-0420	REVISION	RELEASE DATE 22.10.13	SHEET 1 of 2	SIZE A2

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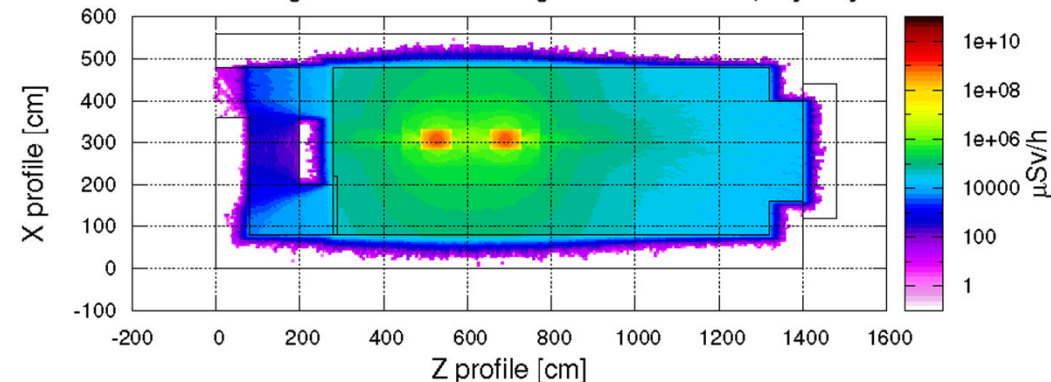
- **Radiation from the cavity tests**
 - Bremsstrahlung from electrons up to ~6 MeV
- **Radiation protection**
 - Bunker of magnetite concrete, 3,9 g/cm³
 - Walls with 2 layers of 40 cm thick blocks
 - Entrance through a maze. Separate maze for waveguide and power
 - Door with two independent interlock systems
- **Simulations**
 - The bunker and cavities were simulated with the program **FLUKA***)
 - A worst case scenario gives average radiation levels < 1 μSv/h outside the bunker
 - High risk regions get < 10 μSv/h
 - Normal running conditions should give a factor of 10 less radiation
- **Radiation monitoring**
 - Gamma detectors will be placed around the bunker
 - Personal dosimeters will be issued

*) Marek Jacewicz, Estimation of radiation levels during high power RF cavity tests in FREIA internal report

ESS bunker with magnetite concrete 4 g/cm³



ESS bunker with magnetite concrete 4 g/cm³ with lead/polyethylene doors





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Delivery of bunker blocks 35 tons/week



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ESS Bunker Construction

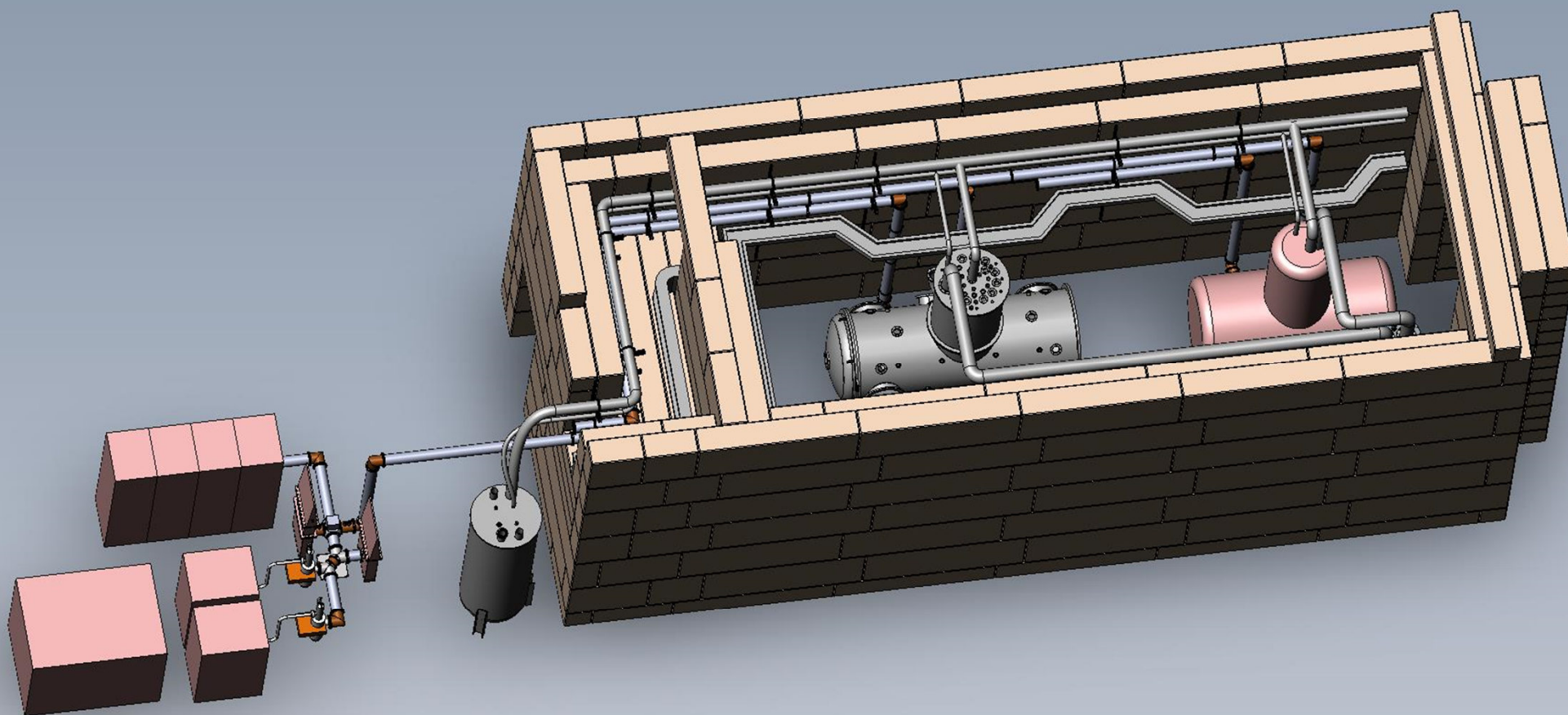


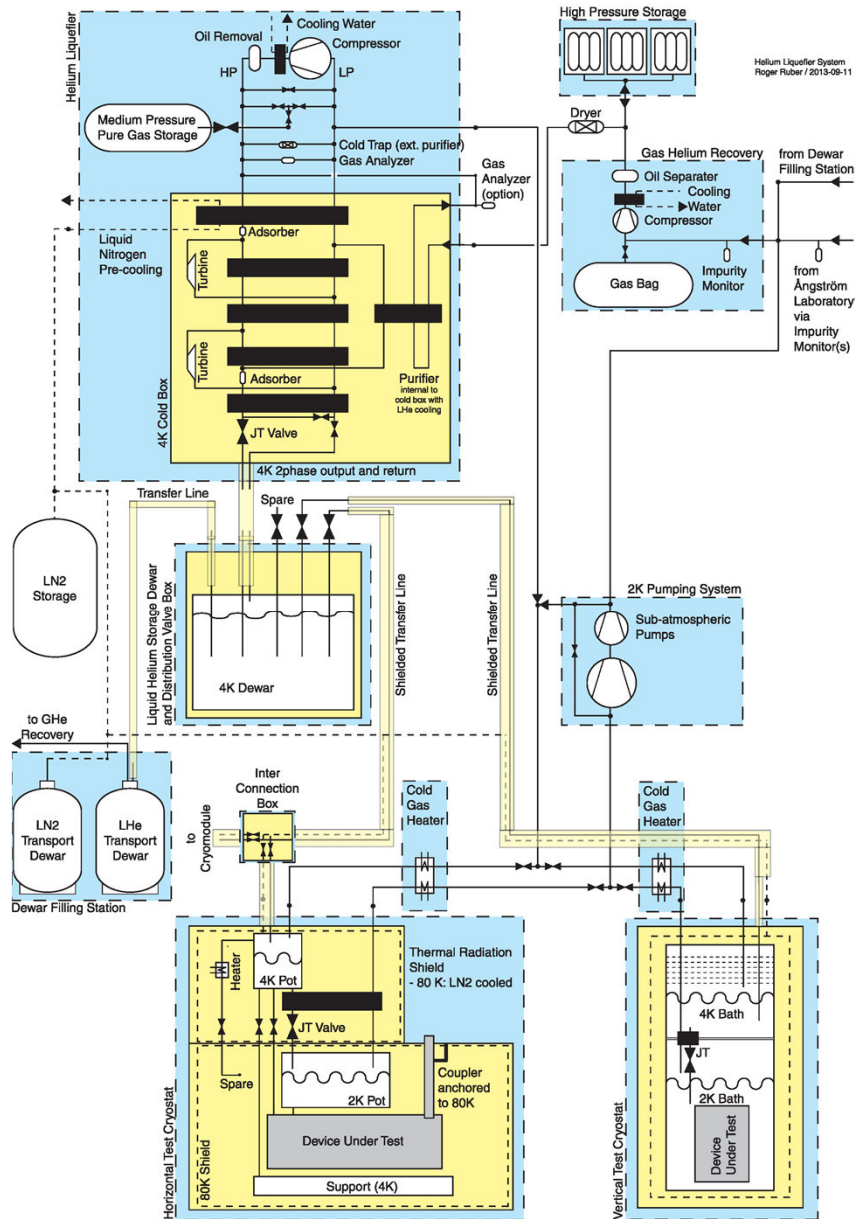
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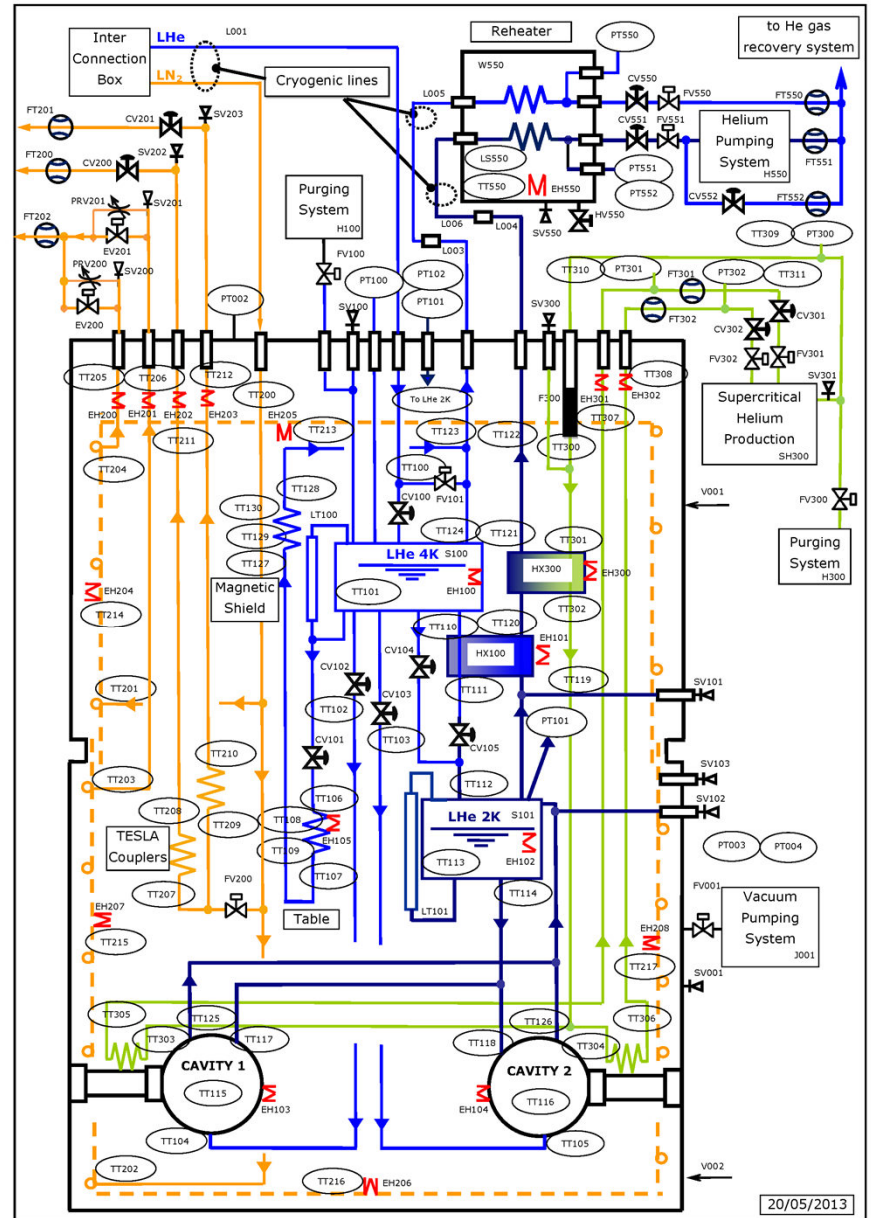


ESS Bunker Components





Accelerators and Cryogenic Systems



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Compressor Room



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Control Room



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Control Room Activities



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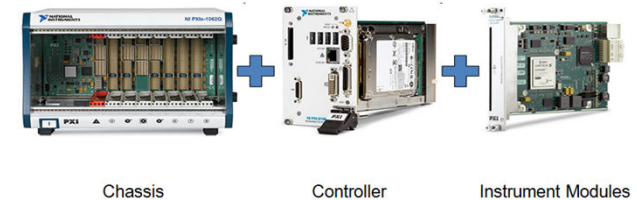
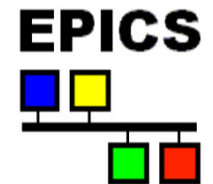


Control System



- Epics based

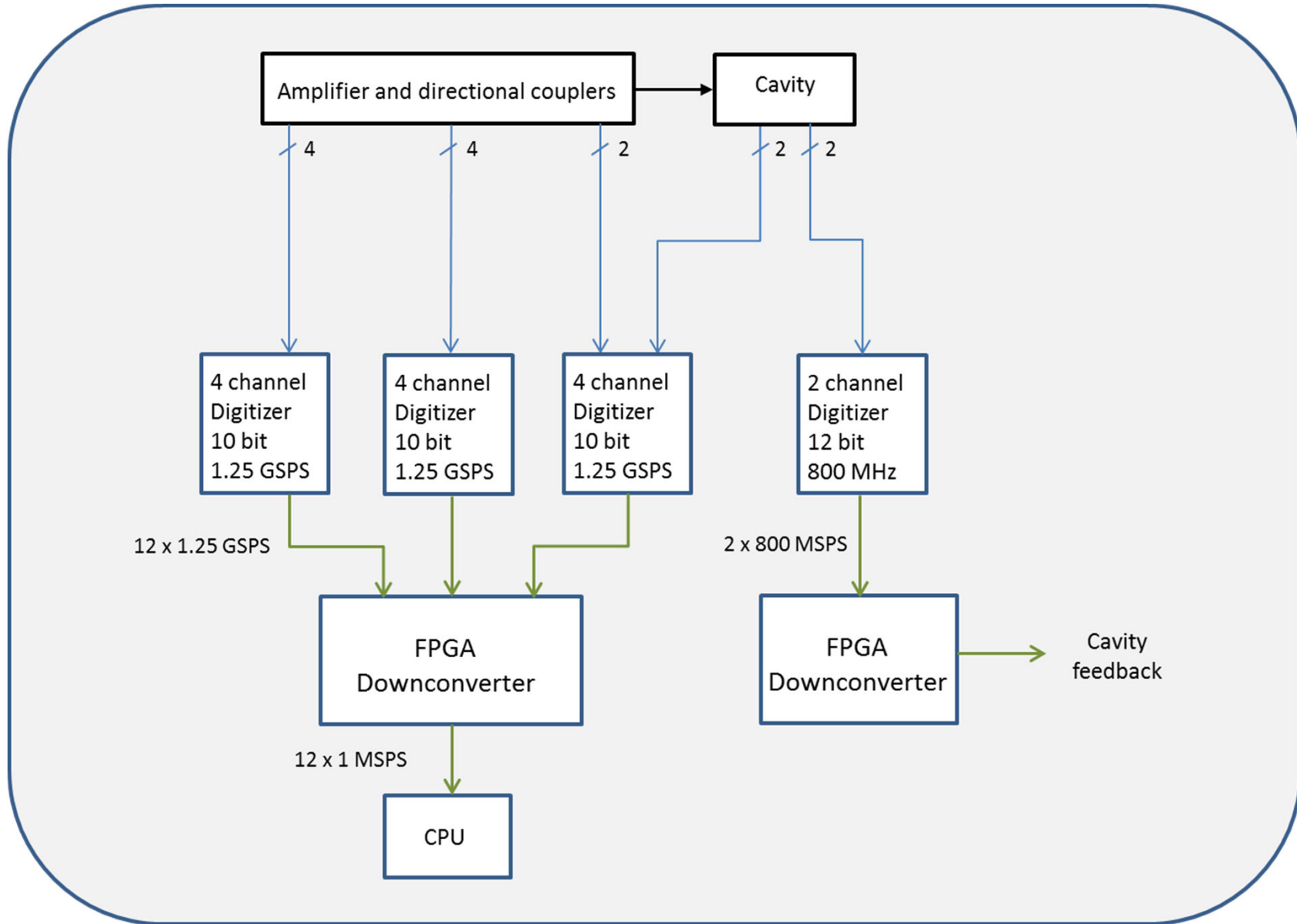
- Integrates all subsystems from different vendors:
 - Cryogenic plant (Linde)
 - RF Power station (Electrosys)
 - Test Cryostat (CryoDiffusion)
- Interface to LabVIEW for instrumentation control
- Slow interlocks, monitoring and control: Siemens PLC
- Fast data acquisition: NI PXIe based system
- Fast interlocks: NI compactRIO
- Timing: Micro-Research Finland



- Current status

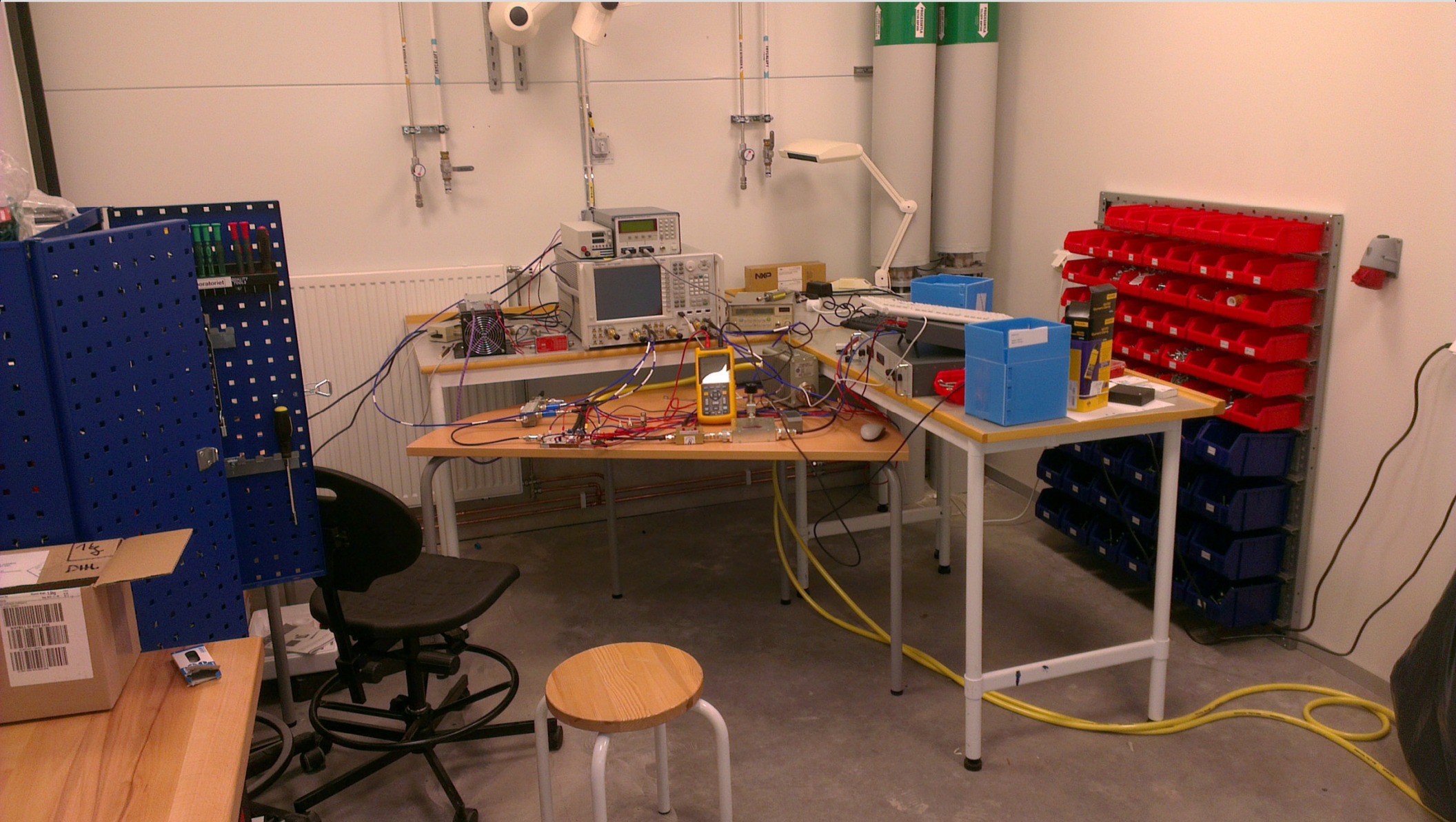
- Epics running on several virtual machines (test set-ups)
- PLC and LabVIEW interface to Epics ready to use
- Ongoing work:
 - Integration of subsystems from the vendors
 - Preparation for placing order for fast data acquisition system

Data Acquisition System





Measurement Test Setup



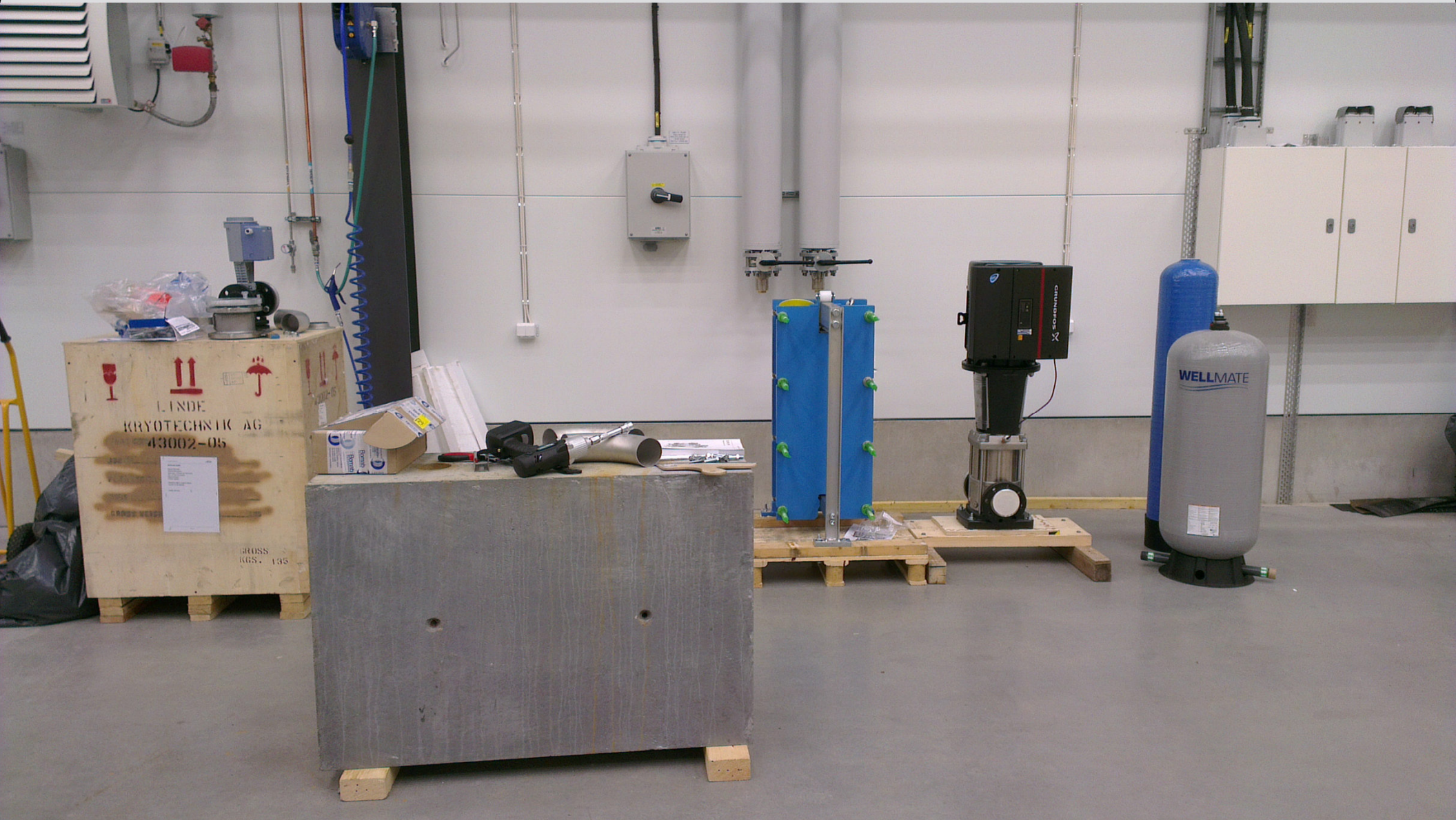


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Deionized Water Cooling System





Time Schedule - Construction



- Bunker blocks from Strängbetong 35 tons/week Ongoing
- Tendering of sub-atmospheric pump system Ongoing
- Tendering data acquisition and interlocks Ongoing
- Arrival of RF loads 2013 Dec
- Arrival of Steady State Amplifier from Siemens 2014 Jan
- Arrival of Tetrode Amplifier from ElectroSys 2014 Feb
- Acceptance tests of cryogenic plant by Linde 2014 Feb
- Arrival of RF circulator 2014 Apr
- Arrival of sub-atmospheric pumps 2014 May
- Arrival of Cryostat from Cryo Diffusion 2014 Jun
- Arrival of Spoke Cavity from INPO Orsay 2014 Jun
- LLRF from ESS ?