



MAX-PLANCK-GESELLSCHAFT



Status of MARCO

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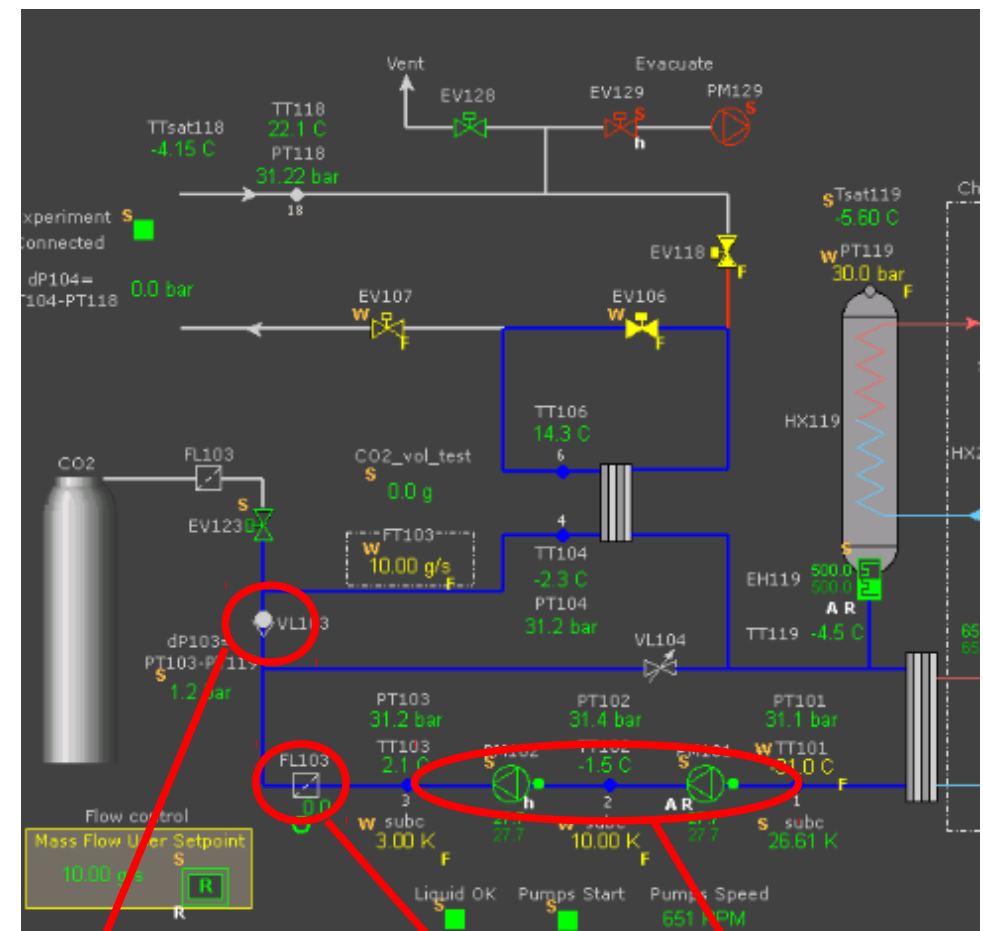
13th International Workshop on
DEPFET Detectors and Applications
Ringberg Castle, 14th June 2013



Status

Few hardware problems during the last period of commissioning

- Pressure increase at the filter
 - Filter covered with black powder
 - Filter replaced 3 times
- One way valve not working
 - Flux inversion during filling procedure
 - CO2 mass measurement not reliable
- Pumps problem
 - Degradation of the gears



One-way valve

Filter

Pumps

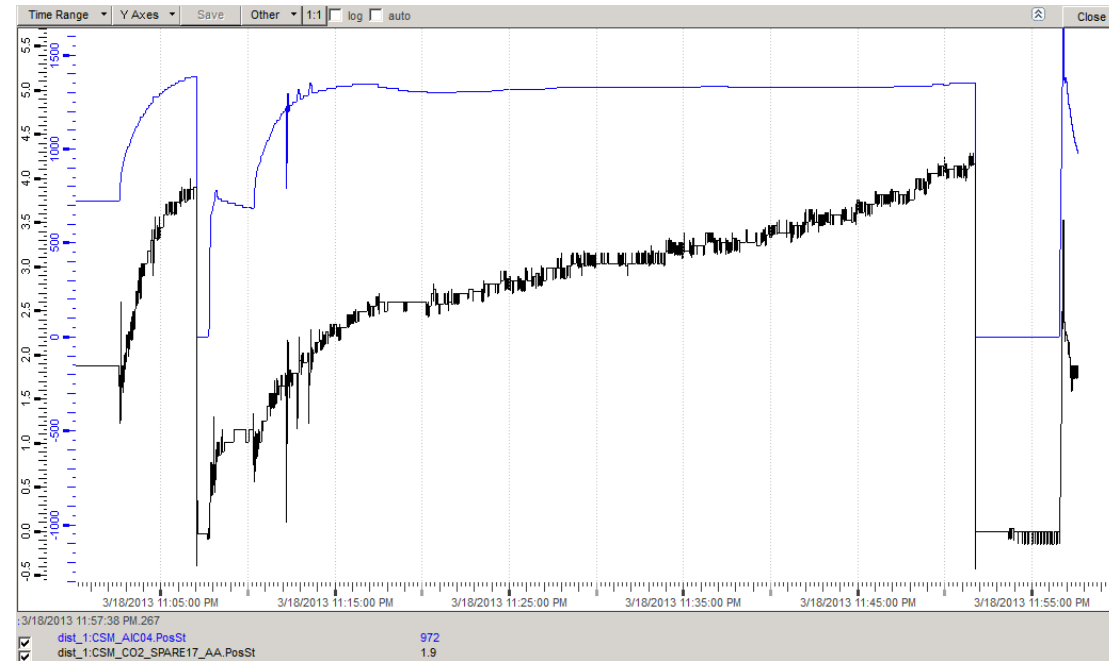
Filter replacement: December 12

- During testing in December, a big pressure drop (around 10 bars) was observed across the filter
- Filter has been opened and cartridge was found covered with black powder
 - Analysis: mainly Silicon and Oxygen.
- New cartridge (40 μm pores instead of the 15 μm) has been installed.
- A new alarm has been created
 - “if $\Delta P_{\text{filter}} > 5\text{bar}$ then STOP”



Filter replacement: March 13

- ΔP across the filter increased again up to 4.0 bar (0 bar when the filter is clean) during normal operation
- Filter and pumps were opened
 - ➔ Filter covered with a thick layer of black powder
 - ➔ Pumps bearings and case looks fine
 - ➔ Very small scratches starts to appear on the gears
- The analysis of the powder shows:
 - ➔ Still a significant fraction of Si, O and C
 - ➔ A large fraction of Ni and a lower fraction of Cr, Mo (molybdenum), Sn (tin)
- After this filter replacement a pump characteristics measurement was done to check the pumps performances
 - ➔ Compared to the same measurement done in December, the pump showed even better performances



Pumps:

- Nickel alloy (W88) for the gears
- Antimony impregnated carbon for the bearings

Filter replacement: April 13

- Few days after the filter replacement in March (and the pump scan...), the ΔP across the filter was again critical (4-5 bar)
- Same black powder was found on the filter
- This time, a clear degradation is visible on the gears



Pumps failure

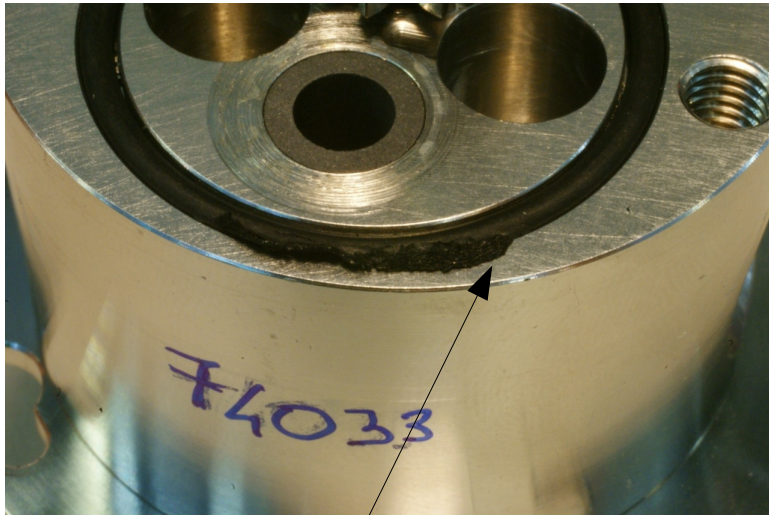
The analysis of the powder shows:

- Some evidences of the degradation of the gears
 - Presence of a large fraction of Ni
- In a smaller proportion a degradation of the bearings
 - Presence of C in the analysis
 - But no antimony (Sb).
- And a contamination of MARCO with Si and O
 - Not yet understood
- Comparison with the pumps in other systems, failure experience doesn't show a clear pattern of the failure mode
 - The pump's characteristics measurement (done twice on MARCO) could be an accelerating factor of the pump's failure
- To prevent further failure, a new filter will also be installed this week in front of the pumps.
 - The leaking one-way valve (could be responsible of a back flow bringing filter dust to the pumps when filling) changed to a manual valve.

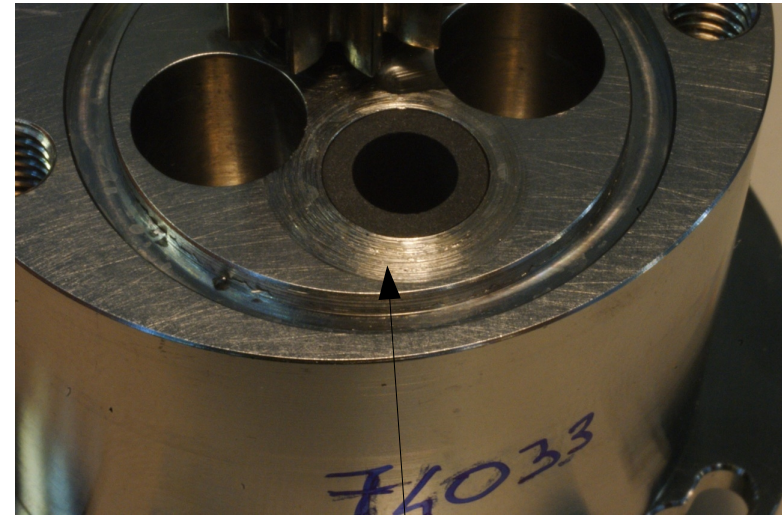
Marco Cleaning

- Because of this pumps failure, MARCO's piping has been polluted with dust
 - ➔ All the piping is covered with a thin layer of black powder
- The circuit was cleaned before new pump installation
- First cleaning was done with a high flow of nitrogen
 - ➔ A lot of dust came out from the supply line
- Second step was done by circulating alcohol in the different parts of the circuit
 - ➔ Dirtiest part was again the supply line

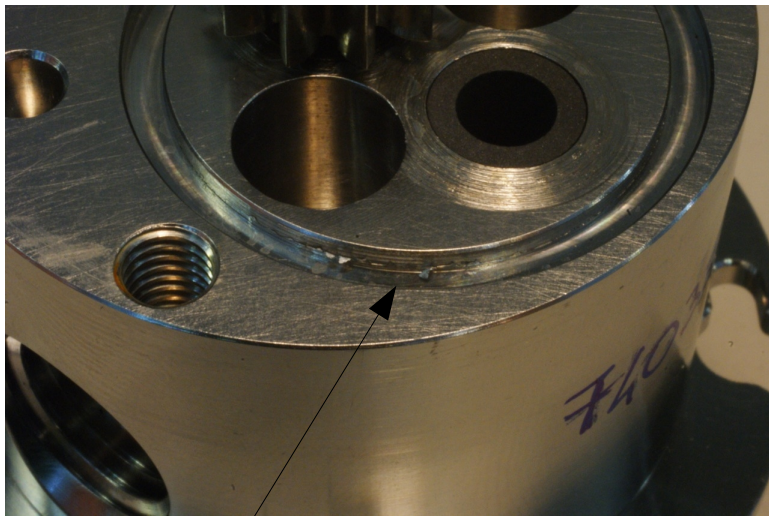
New pumps heads



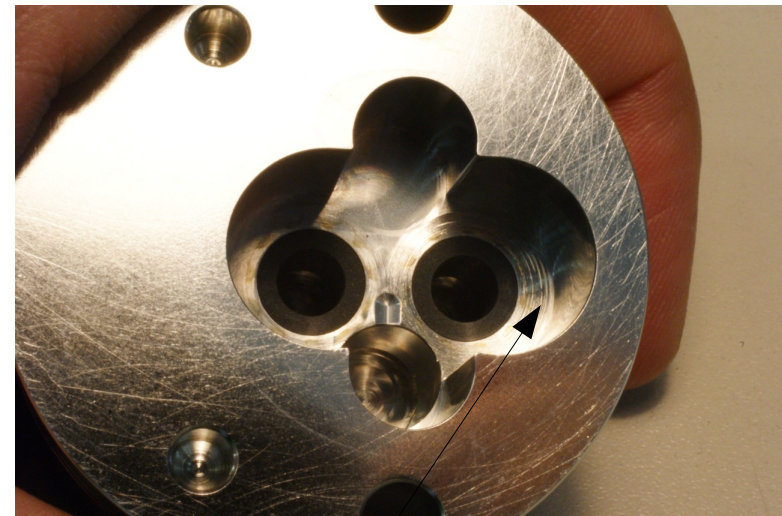
Gasket crushed



Surface scratched



Metal flakes



Surface scratched

Status

New heads installed

New filter installed before the pumps

Chiller:

- Leak found
- Problem solved after external intervention

Filters:

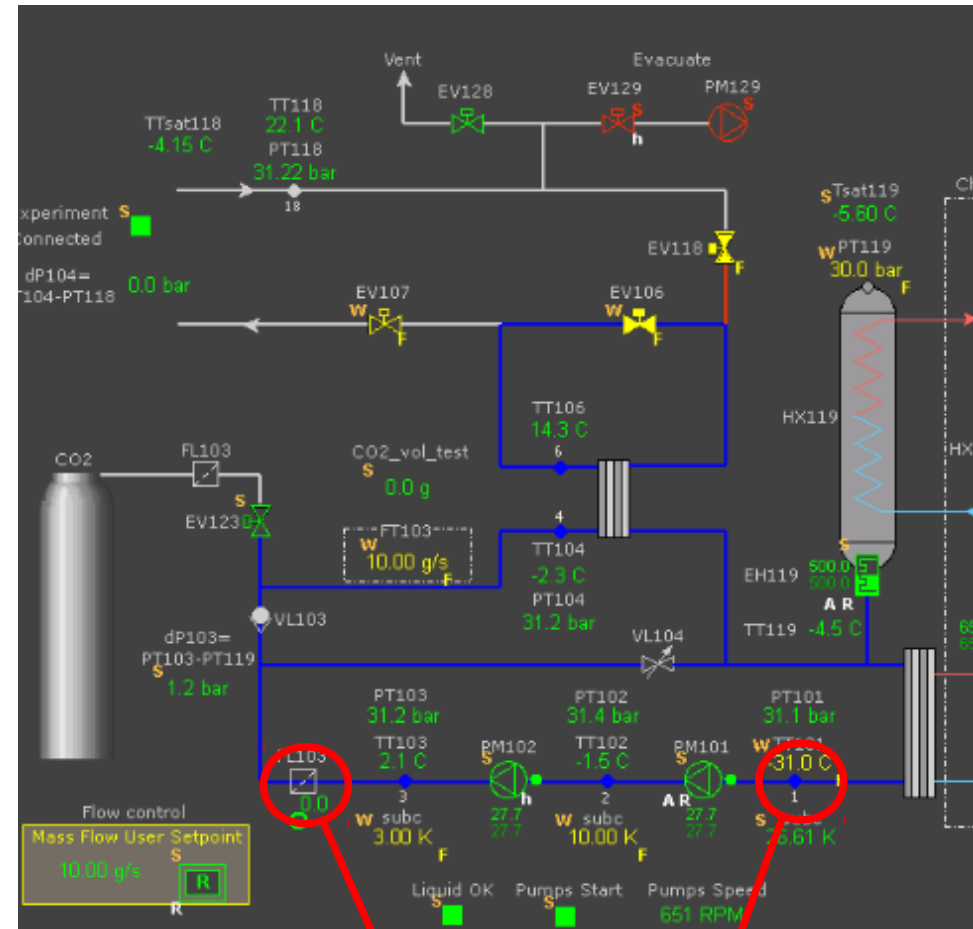
- 15mm and 40 mm
- Some powder on the filters
- Pressure drop: 3 bar

Source of the powder not completely understood

- Test during last weeks: connected with other pumps of the same type (LHCb setup)
- Could have collected some dust

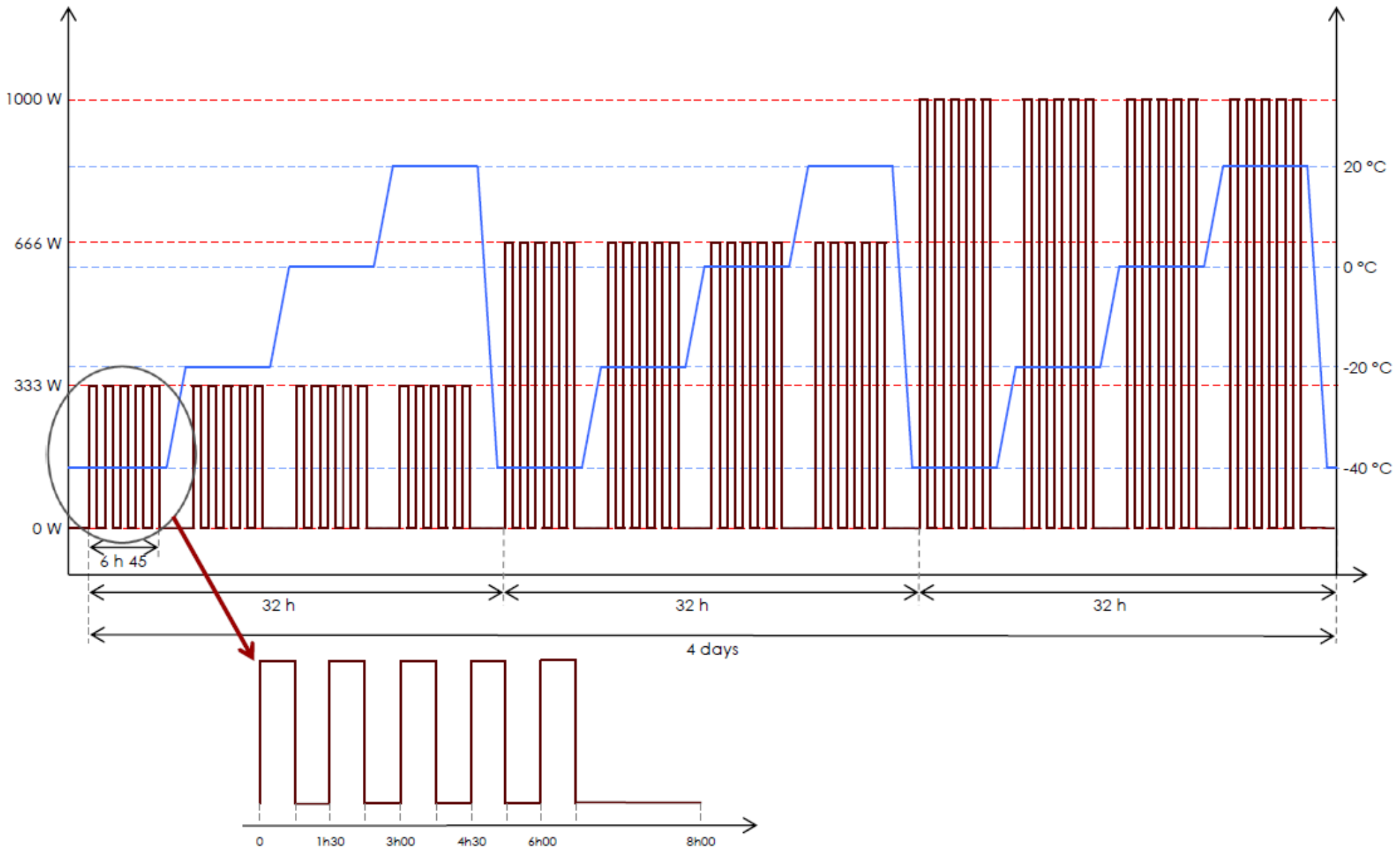
Plan for the next weeks:

- Clean the filters one more times
- Start with the automatic tests

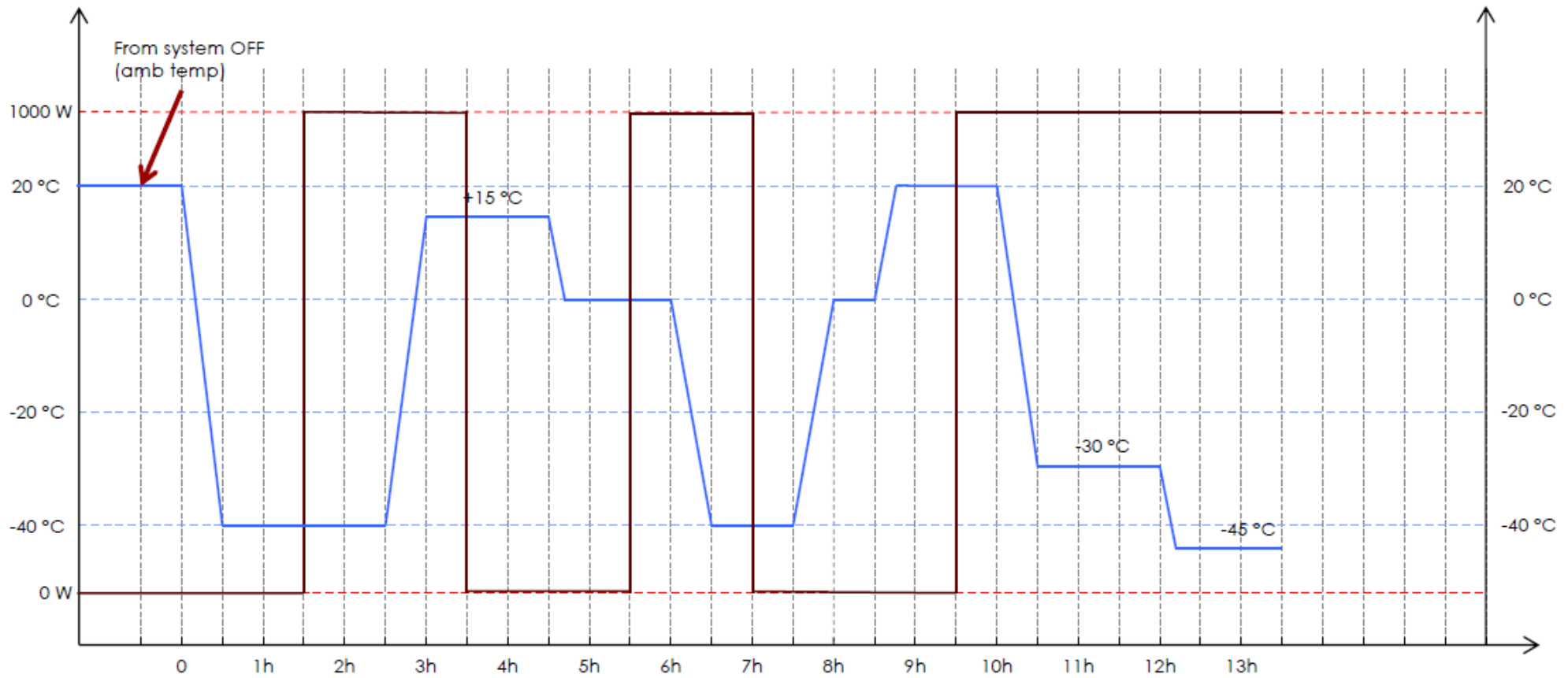


Filters: pressure drop

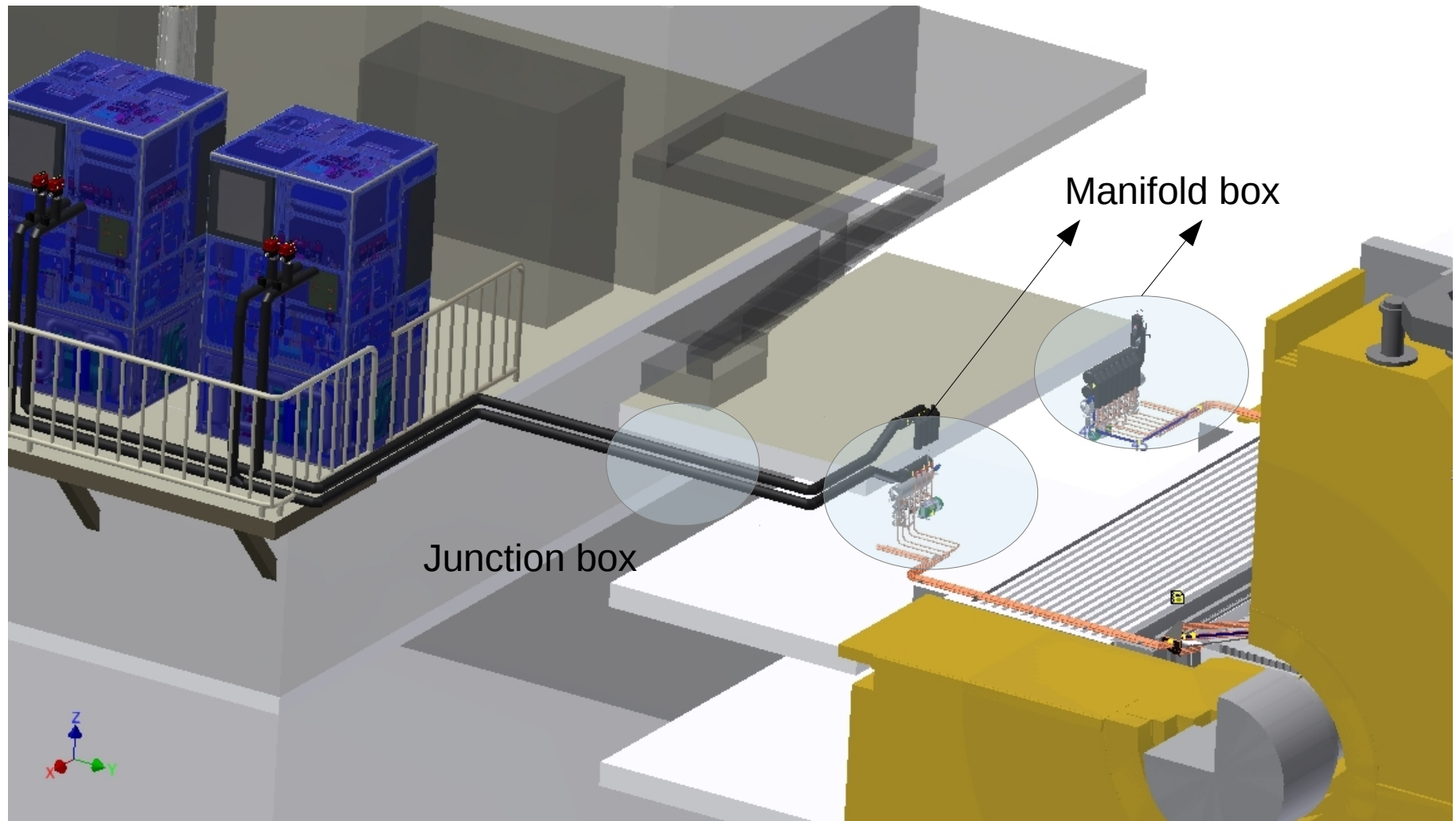
General performance test



Real condition test

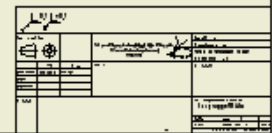


Location

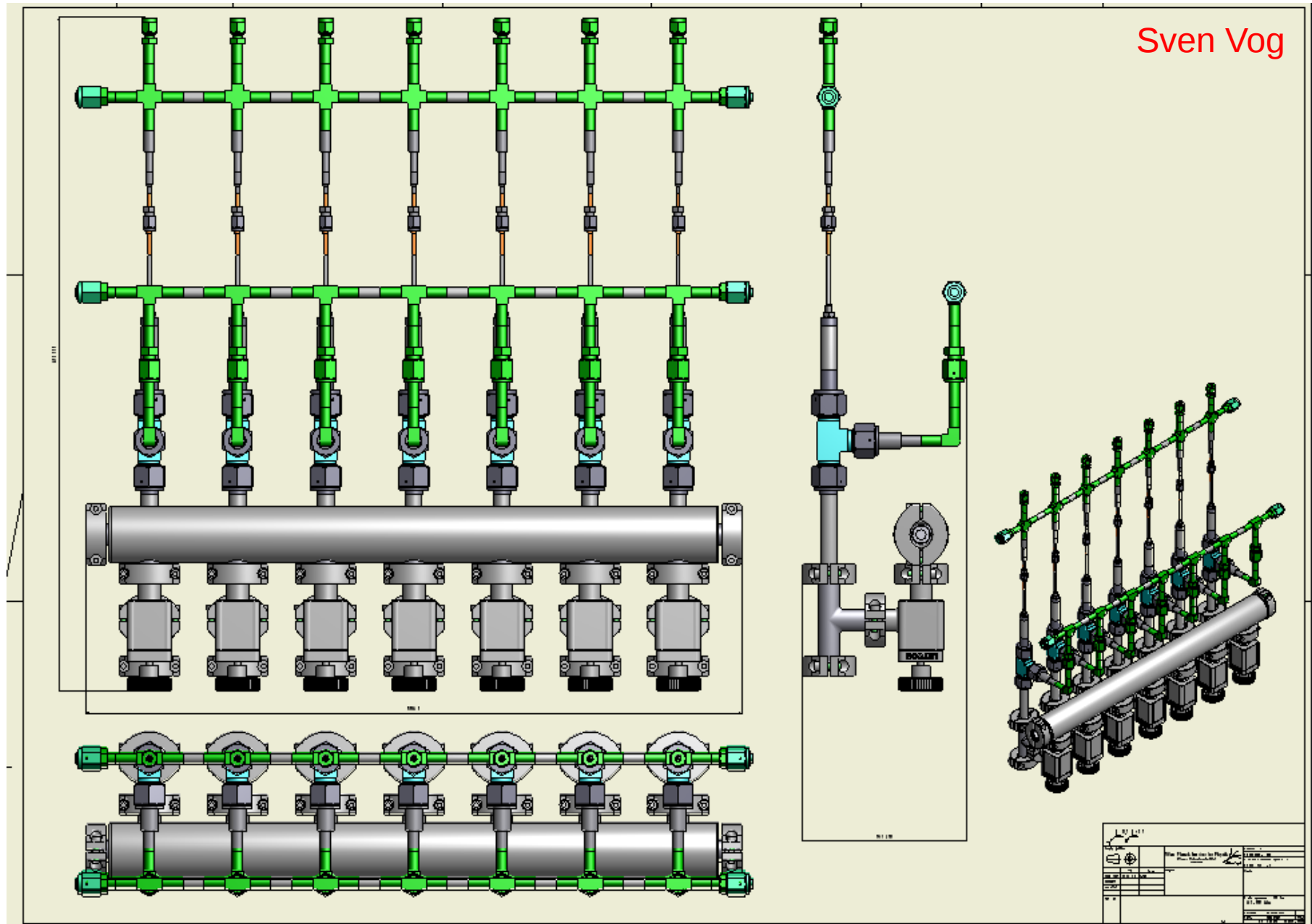


Karlheinz Ackermann

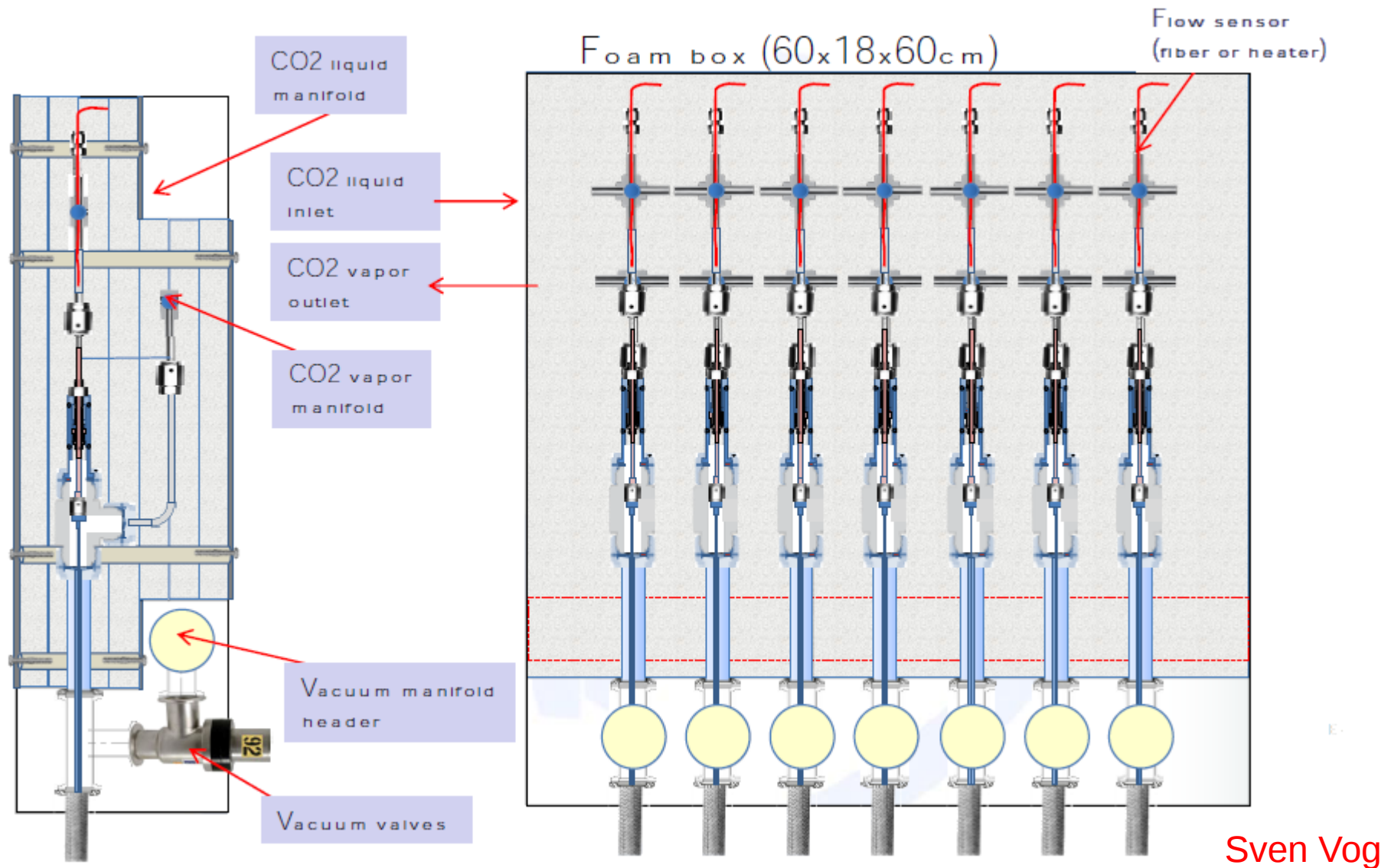
Sven Vog



Manifold box design (I)



Manifold box design (II)



[illegible]

Summary

- Work ongoing to recover from the pumps failure
 - Pipes cleaned
 - New filter before the pumps
 - One-way valve replaced with a manual valve
- New heads of the pumps installed
 - Problem with pressure drop at the filters not completely understood
 - Lifetime of the new heads cannot be determined
 - Spare heads and filters will be needed for the DESY test next winter.
- At the moment a schedule for MARCO delivery to DESY is not possible
 - A decision will be taken at the end of the next series of tests
- Preparation of MARCO for transport (packaging) will be done by an external company
 - CERN will take care of the offer request and all the organization of the transport
 - Temporary expedition so no paperwork required
 - MARCO will be certified by TÜV in DESY
- Junction box and manifold box development in common with ATLAS