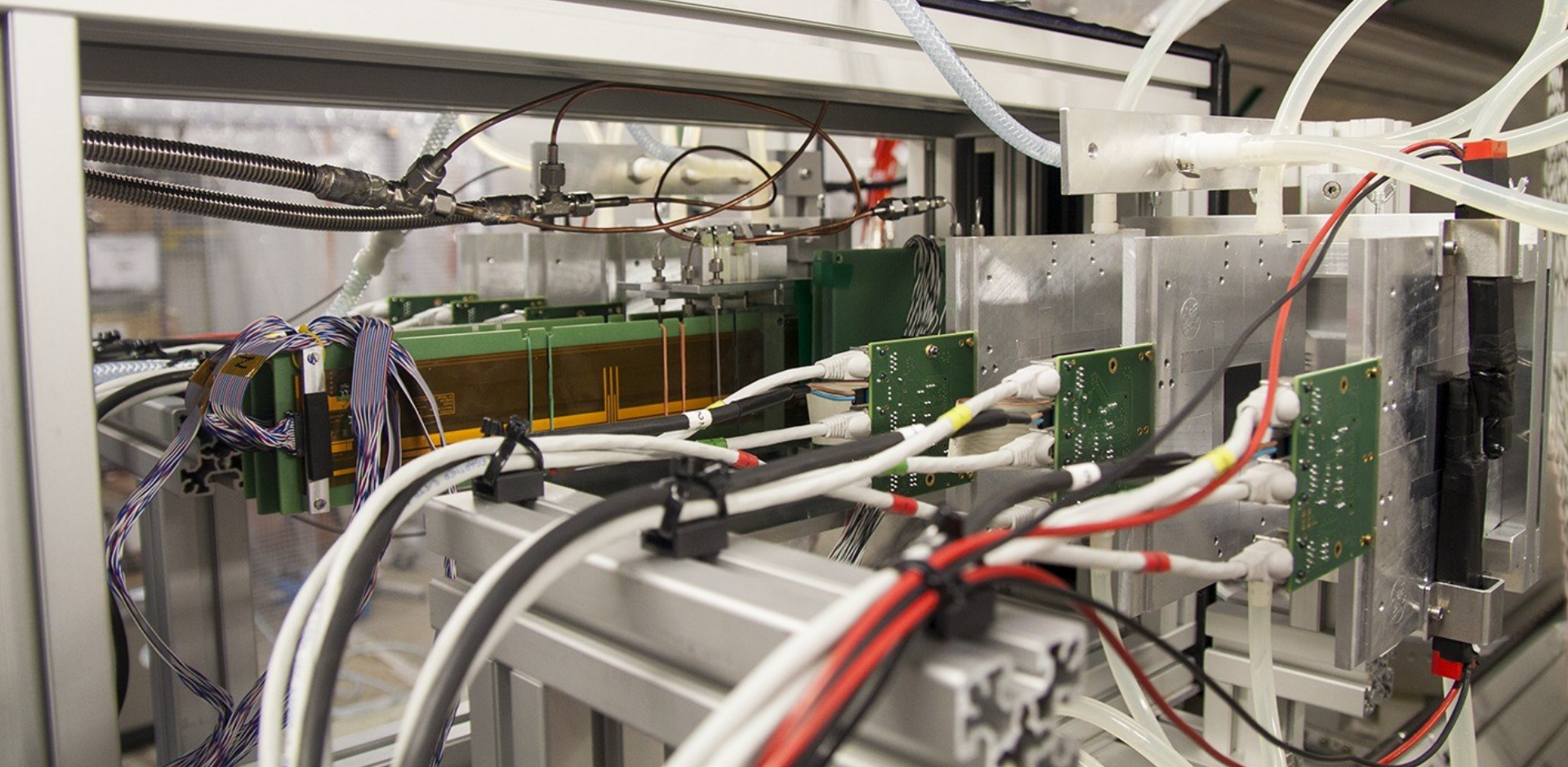


Cooling @ Test beam Status and prospect



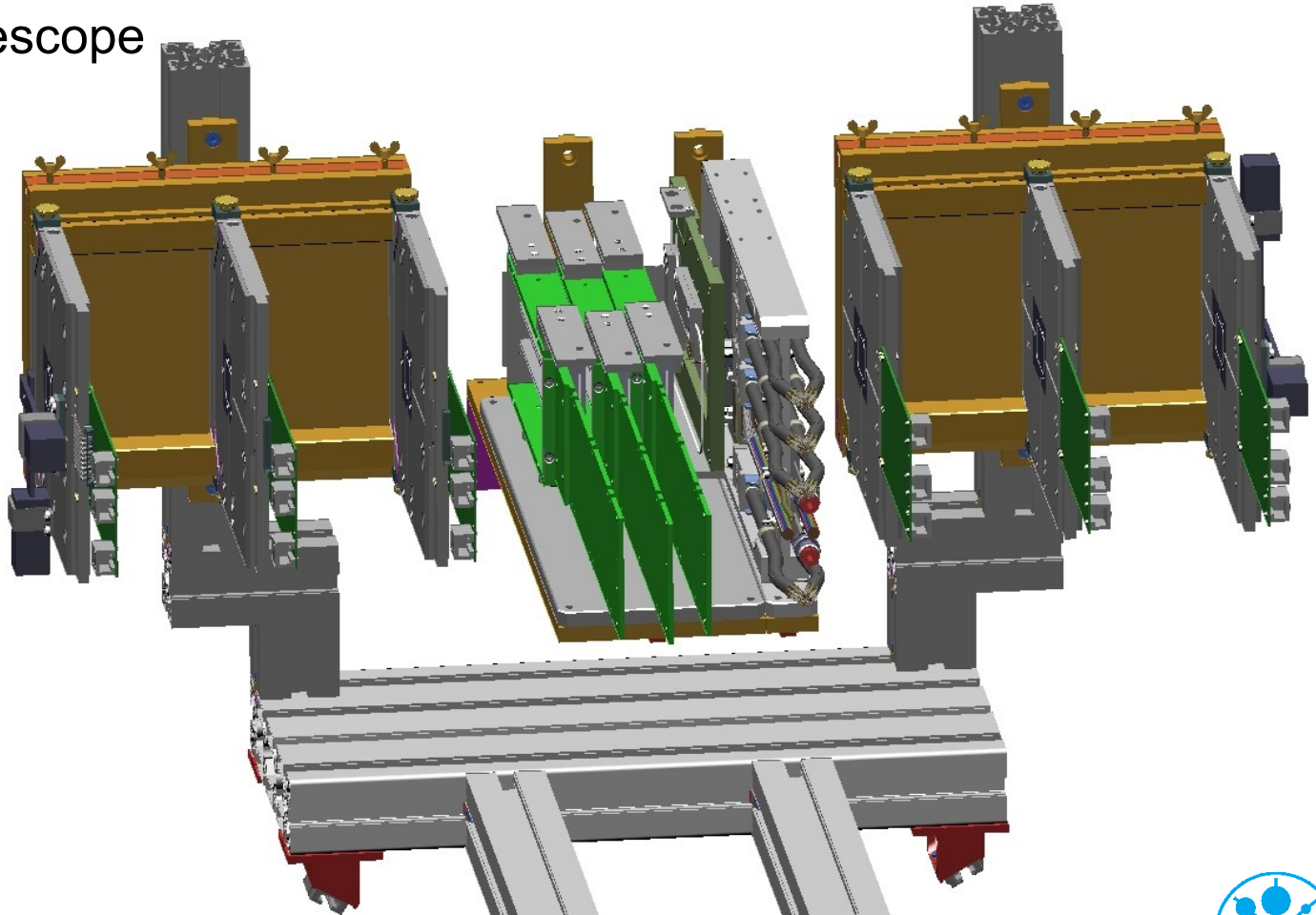
Cooling @ TB: Outline

- Recipients to be cooled
- Cooling Setup
- Concentric Copper Transfer Lines
- MARCO Operation Window
- Lowering Temperature Set point
- pressure and temperature drop
- Weekend run
- Filter cleaned
- Restricted service



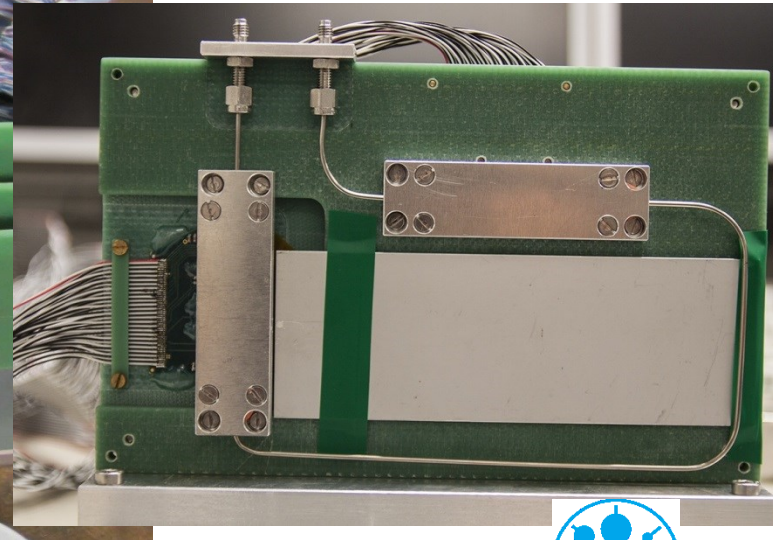
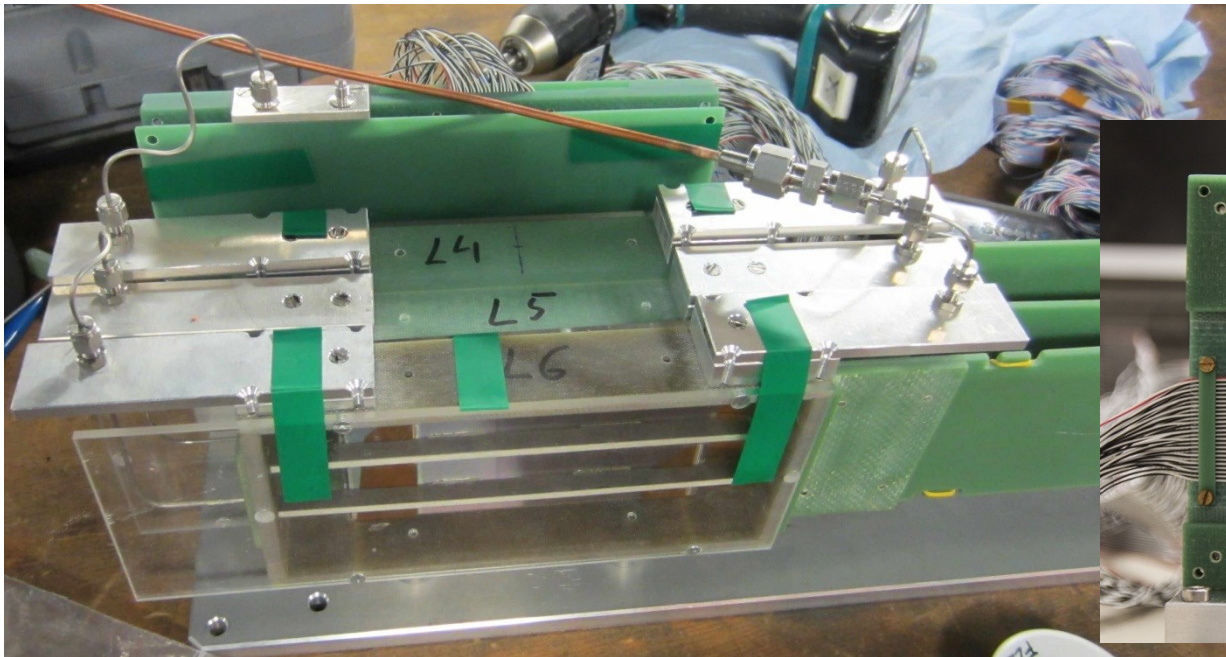
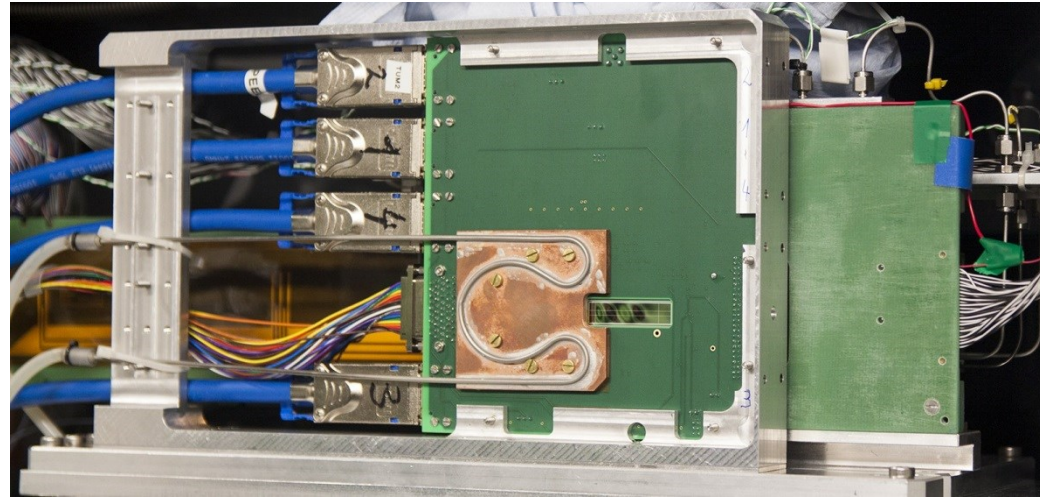
Recipients to be cooled

- PXD-Section
- SVD-Section
- EUDET-Telescope



Recipients to be cooled

- Telescope and
- PXD were water cooled
- only SVD profits of CO₂ cooling

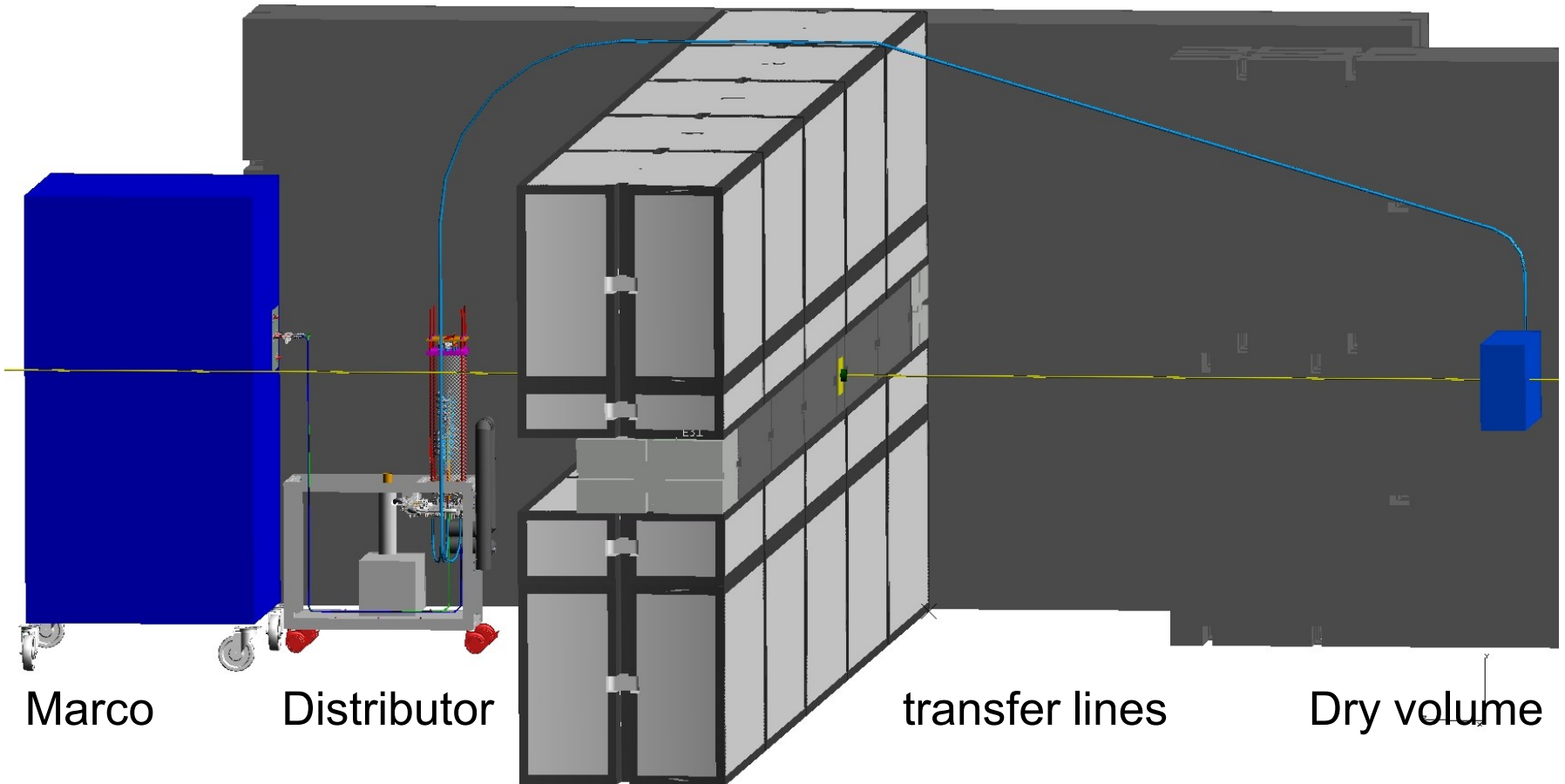


Cooling Setup

TB24

TB24/1

Solenoid



Marco

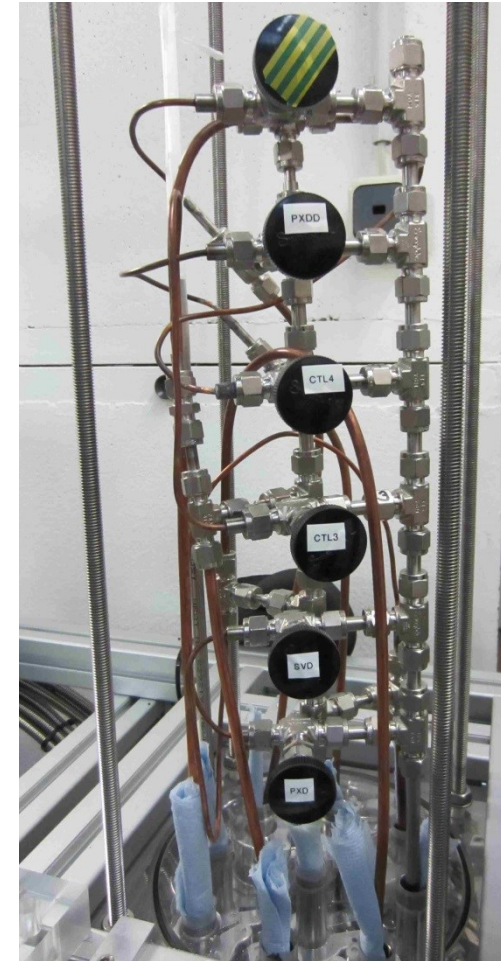
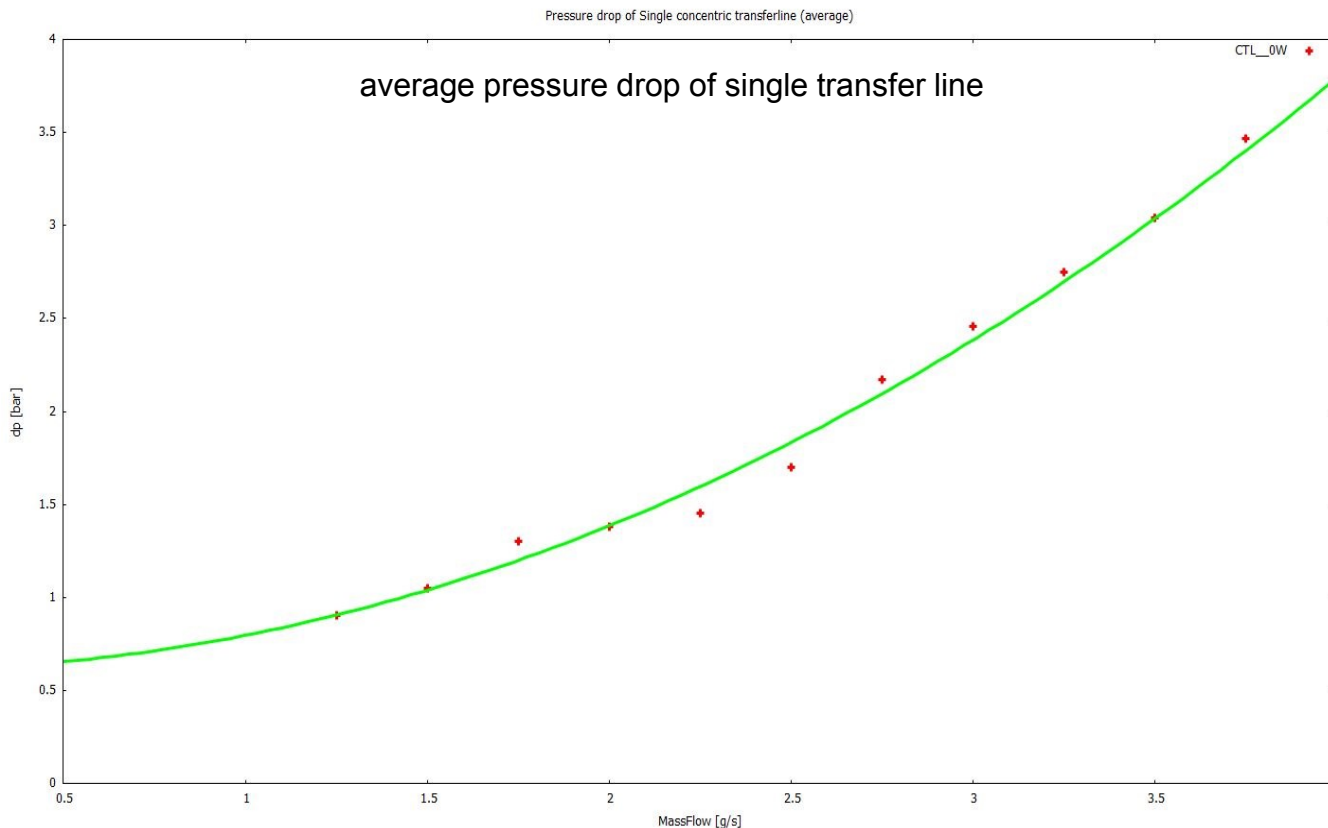
Distributor

transfer lines

Dry volume

Concentric Copper Transfer Lines

- 6 Transfer lines of 11m
- inner tube: 3.2x0.6mm Cu
- outer tube: 6x1mm Cu
- Vac.iso. : 12mm flex tube St



MARCO Operation Window

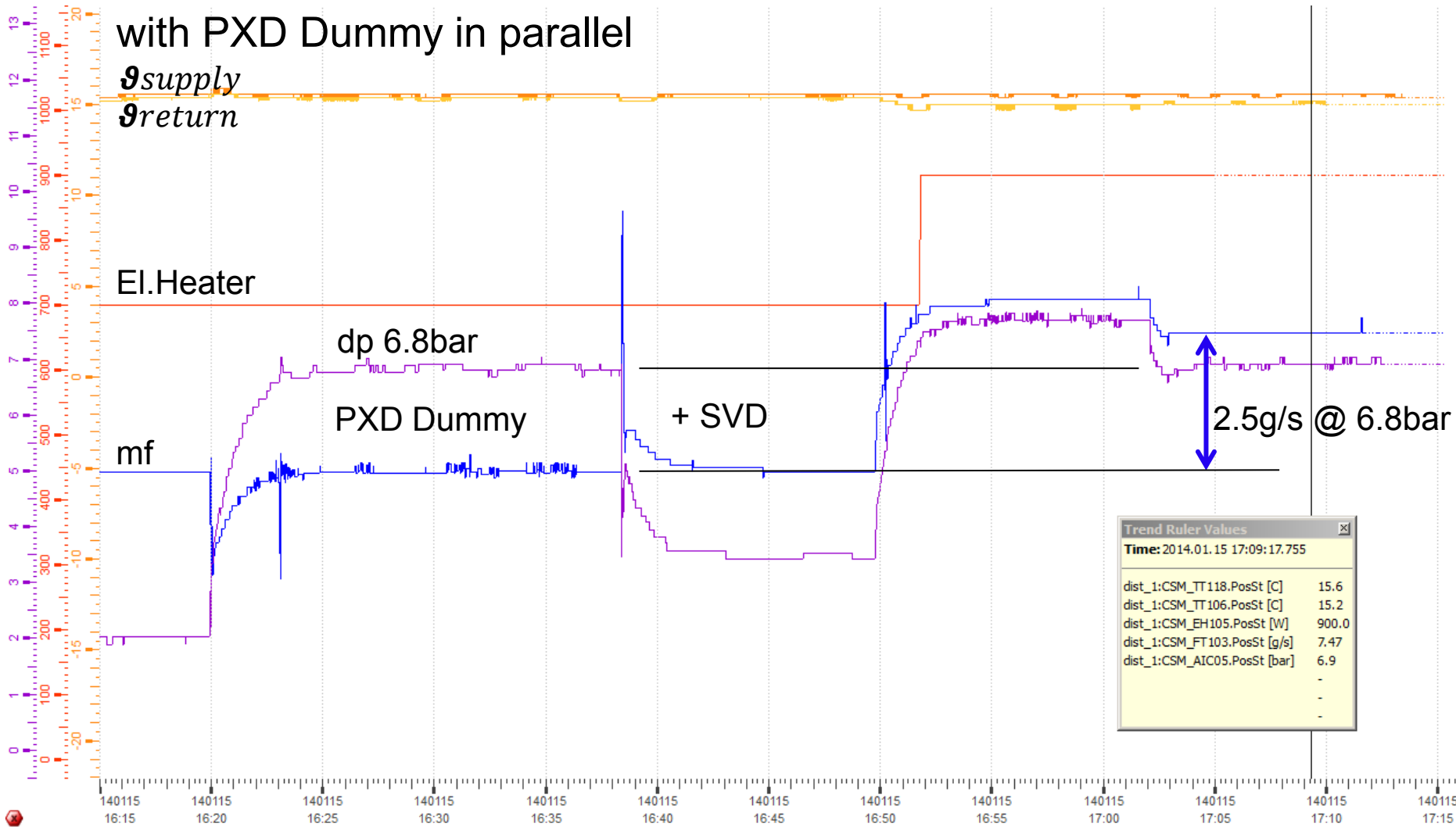
- > minimum mass flow: 5g/s
- > with only one transfer line and SVD cooling tube 1.6mm x 0.2mm 2m long
- > pressure drop over the experiment: greater than 10bar
- > the limit for Marco control to the stop the pumps.

Solution:

- > second transfer line and spare PXD cooling block added as a bypass



mass flow through SVD

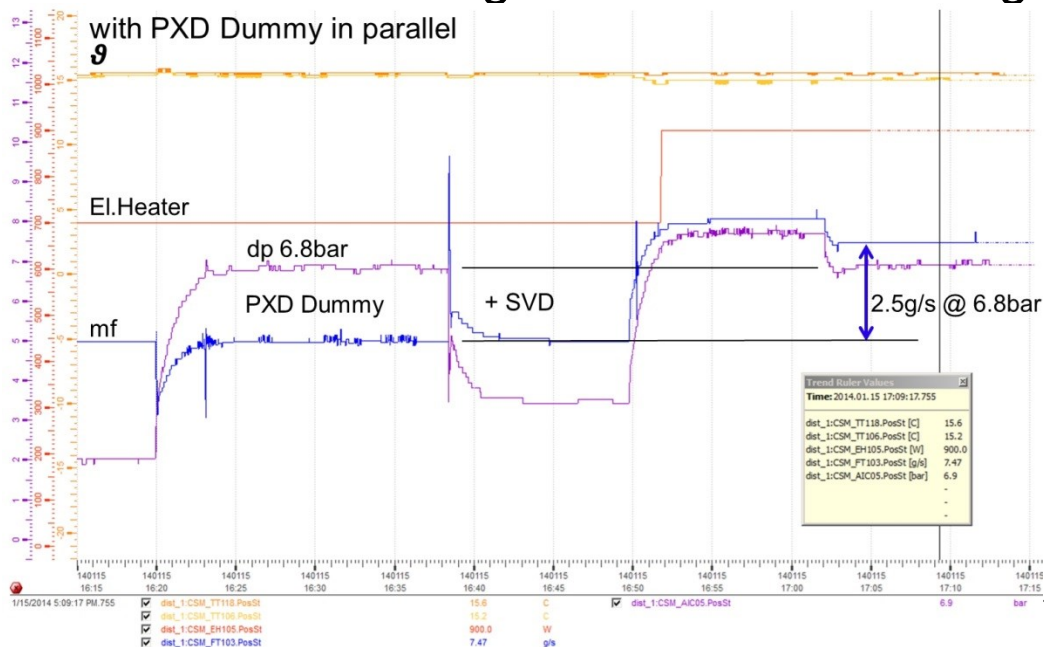


1/15/2014 5:09:17 PM.755	<input checked="" type="checkbox"/> dist_1:CSM_TT118.PosSt	15.6	C	<input checked="" type="checkbox"/> dist_1:CSM_AIC05.PosSt	6.9	bar
	<input checked="" type="checkbox"/> dist_1:CSM_TT106.PosSt	15.2	C			
	<input checked="" type="checkbox"/> dist_1:CSM_EH105.PosSt	900.0	W			
	<input checked="" type="checkbox"/> dist_1:CSM_FT103.PosSt	7.47	g/s			



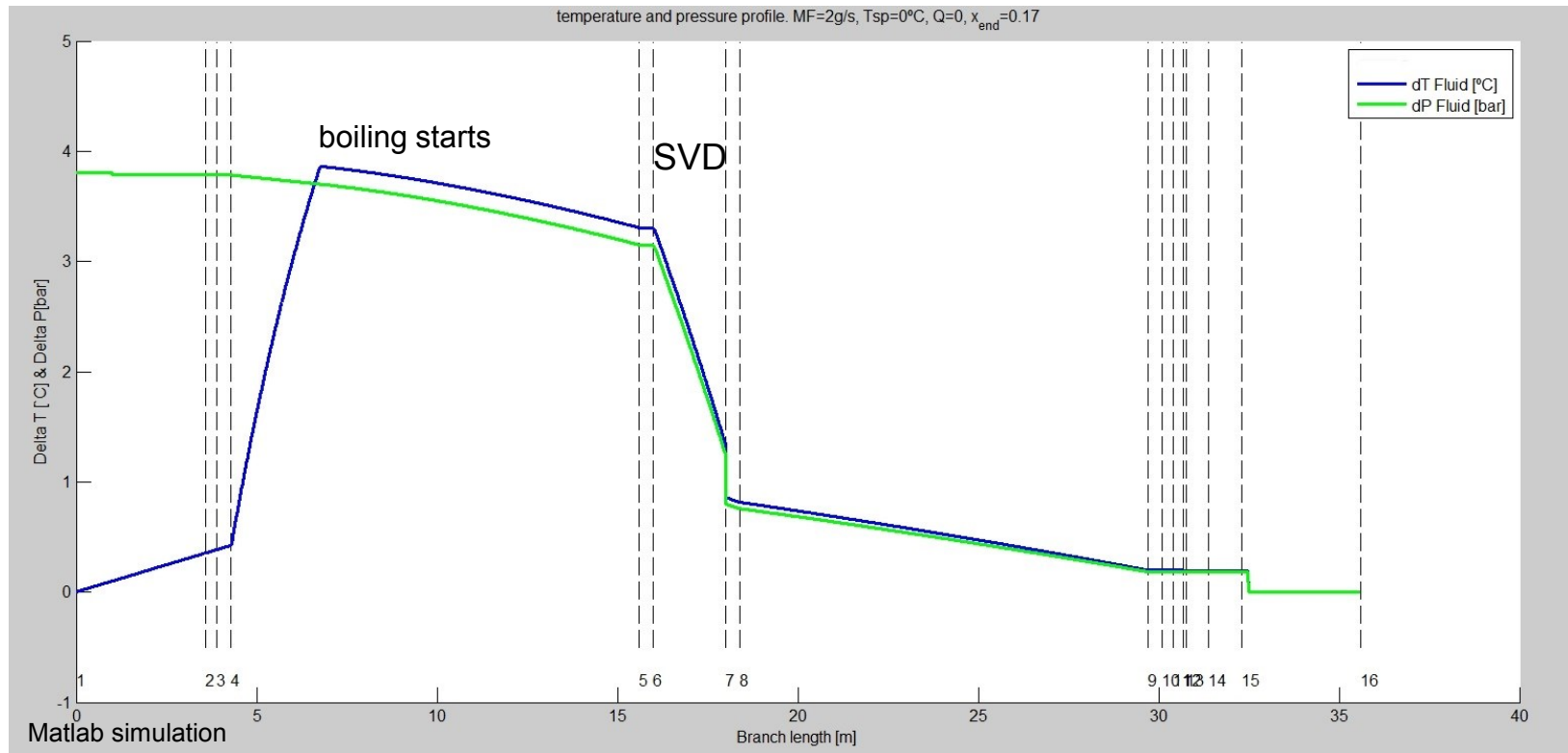
mass flow through SVD

- Run Marco at 15`C with 1 separate PXD cooling block connected and heater running at 700W.
- Pressure drop 6.8bar at mf 5g/s.
- Opened additional SVD loop: pressure dropped to 3.5bar.
- Increased the mass flow to 7.5g/s to reach again 6.8bar pressure drop. Also the heater power needed an increase to 900W.
- The additional 2.5g/s are the mass flow going through the SVD loop.



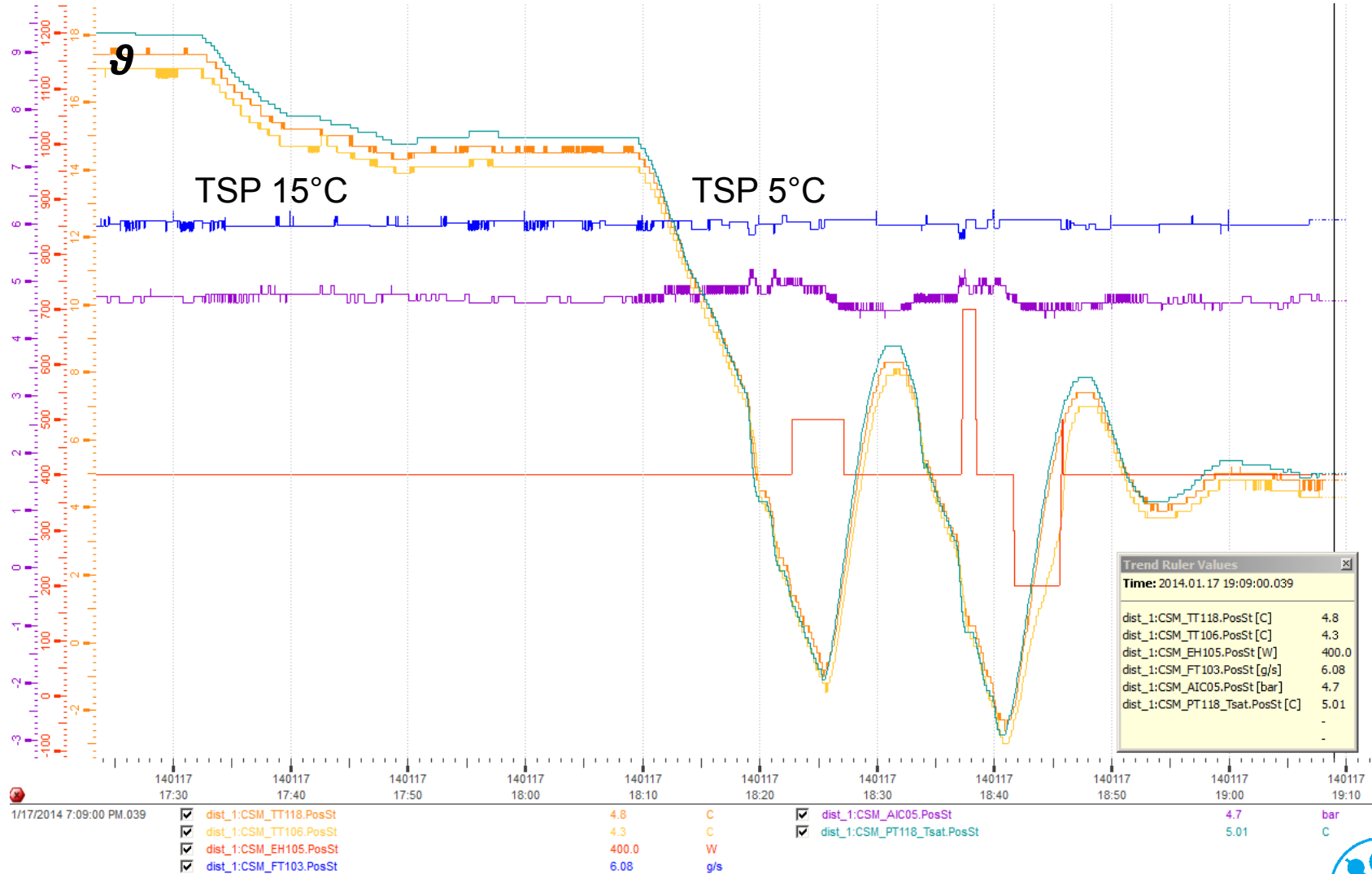
pressure and temperature drop

- Even if the return temperature equals the supply temperature
- there is a pressure drop along the thin SVD cooling tube
- leading to a corresponding temperature drop in the 2-phase region



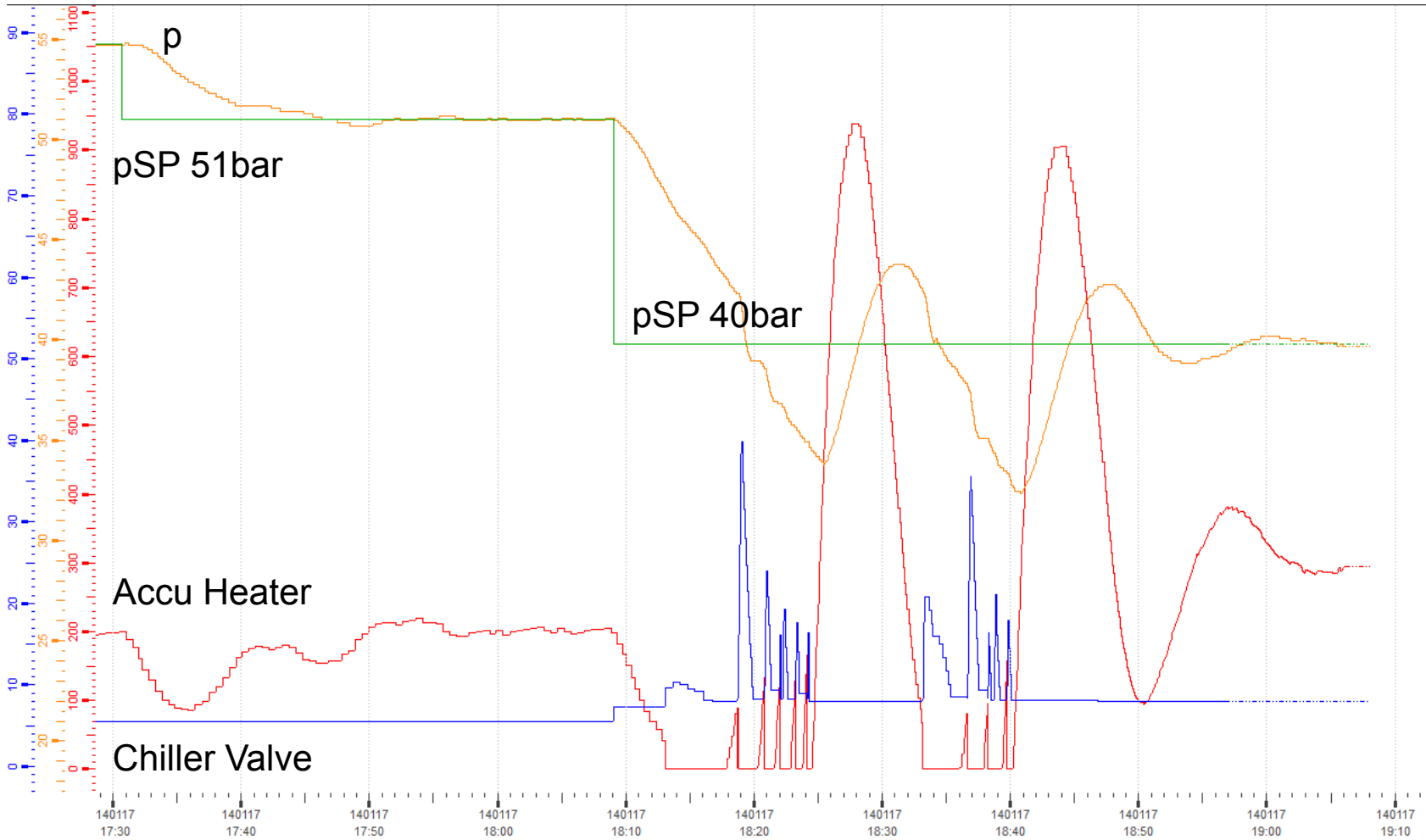
Lowering Temperature Set Point

➤ Overshooting at larger change



Lowering Temperature Set point

➤ Overshooting at larger change



1/17/2014 7:08:01 PM.442

dist_1:CSM_EH119.PosSt
 dist_1:CSM_PT119.PosSt
 dist_1:CSM_AC119_PRSP.PosSt
 dist_1:CSM_CV210.PosSt

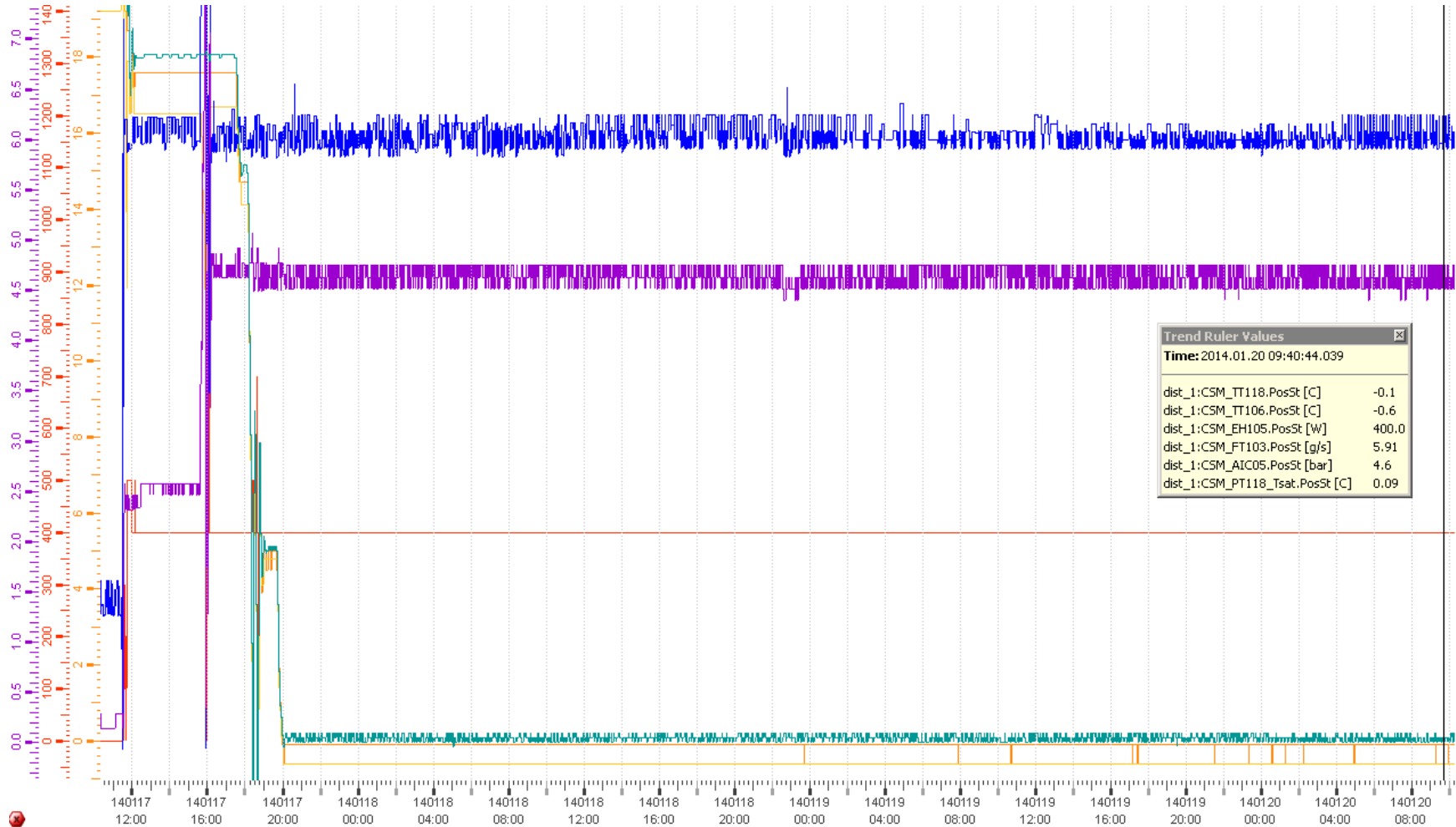
294.7
39.7
39.8
8.0

W
bar
bar
%



Weekend run

Stable conditions during 63h run



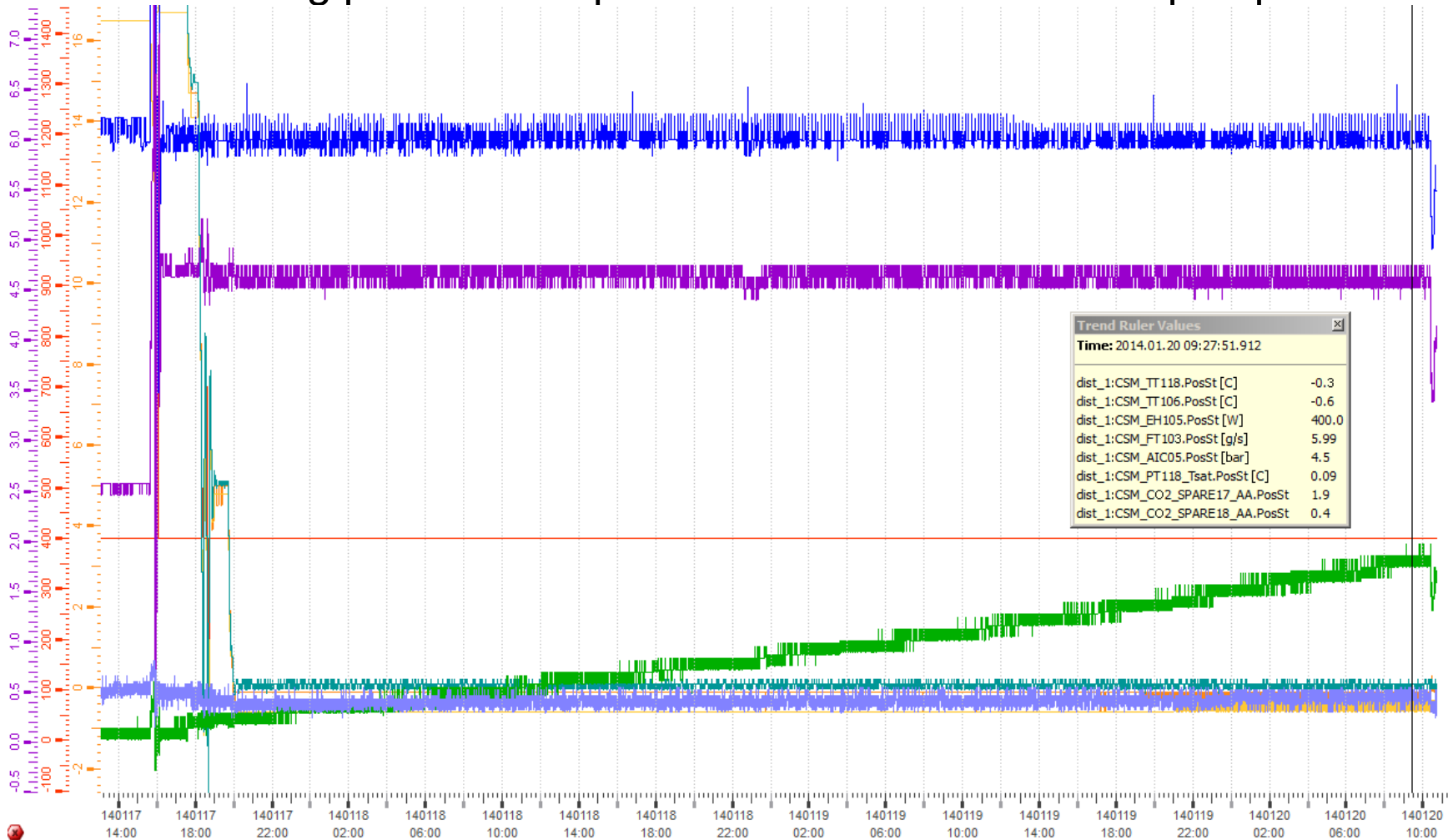
1/20/2014 9:40:44 AM.039

<input checked="" type="checkbox"/>	dist_1:CSM_TT118.PosSt	-0.1	C
<input checked="" type="checkbox"/>	dist_1:CSM_TT106.PosSt	-0.6	C
<input checked="" type="checkbox"/>	dist_1:CSM_EH105.PosSt	400.0	W
<input checked="" type="checkbox"/>	dist_1:CSM_FT103.PosSt	5.91	g/s
<input checked="" type="checkbox"/>	dist_1:CSM_AIC05.PosSt	4.6	bar
<input checked="" type="checkbox"/>	dist_1:CSM_PT118_Tsat.PosSt	0.09	C
<input type="checkbox"/>	dist_1:CSM_CO2_SPARE17_AA.PosSt	1.7	
<input type="checkbox"/>	dist_1:CSM_CO2_SPARE18_AA.PosSt	0.4	



Weekend run

but increasing pressure drop over filter FL103 after CO2 pumps



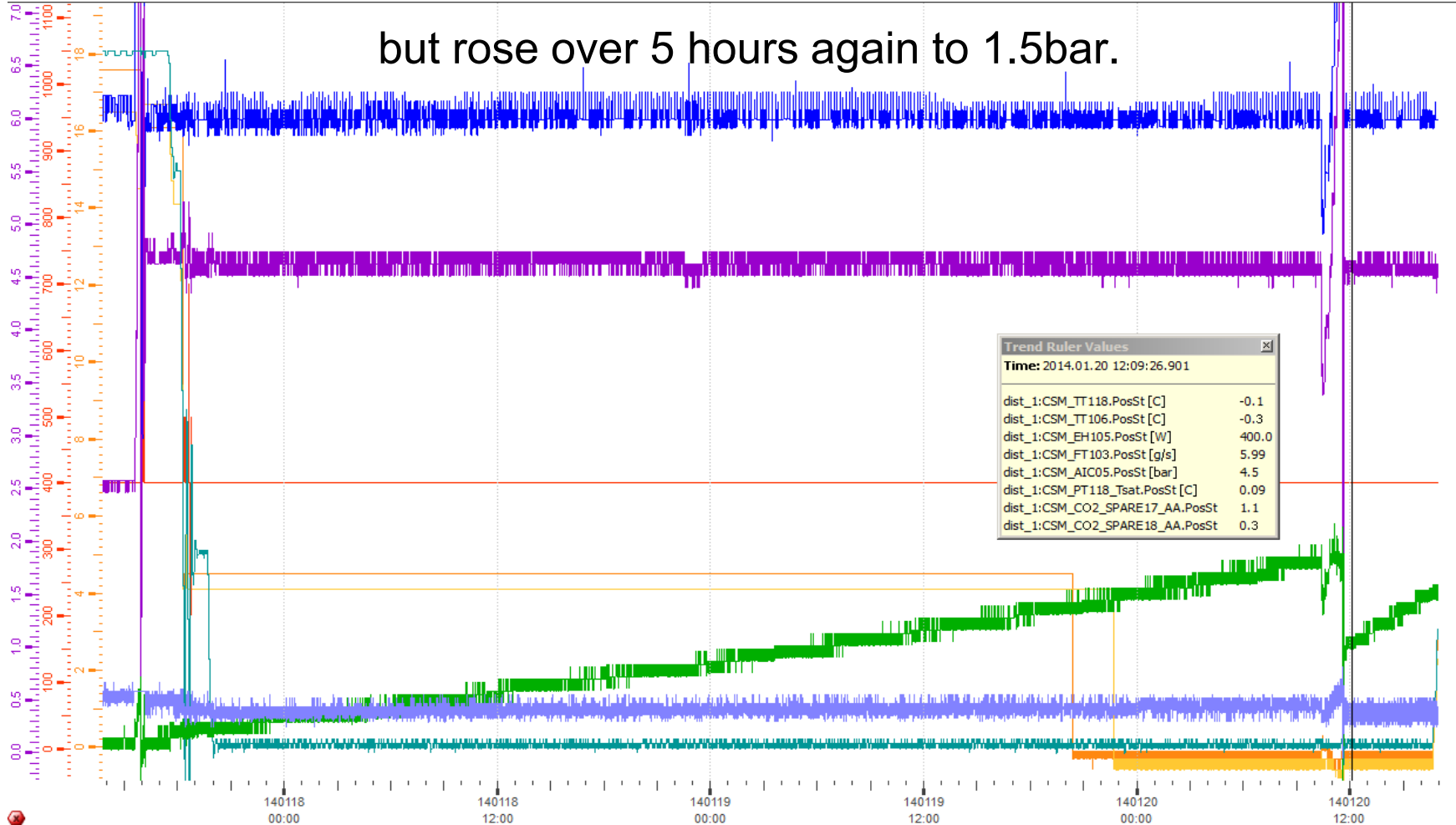
1/20/2014 9:27:51 AM.912	<input checked="" type="checkbox"/>	dist_1:CSM_TT118.PosSt	-0.3	C	<input checked="" type="checkbox"/>	dist_1:CSM_AIC05.PosSt	4.5	bar
	<input checked="" type="checkbox"/>	dist_1:CSM_TT106.PosSt	-0.6	C	<input checked="" type="checkbox"/>	dist_1:CSM_PT118_Tsat.PosSt	0.09	C
	<input checked="" type="checkbox"/>	dist_1:CSM_EH105.PosSt	400.0	W	<input checked="" type="checkbox"/>	dist_1:CSM_CO2_SPARE17_AA.PosSt	1.9	
	<input checked="" type="checkbox"/>	dist_1:CSM_FT103.PosSt	5.99	g/s	<input checked="" type="checkbox"/>	dist_1:CSM_CO2_SPARE18_AA.PosSt	0.4	



Filter filled

➤ After pumps stopped for short filter pressure drop falls to 1bar

but rose over 5 hours again to 1.5bar.

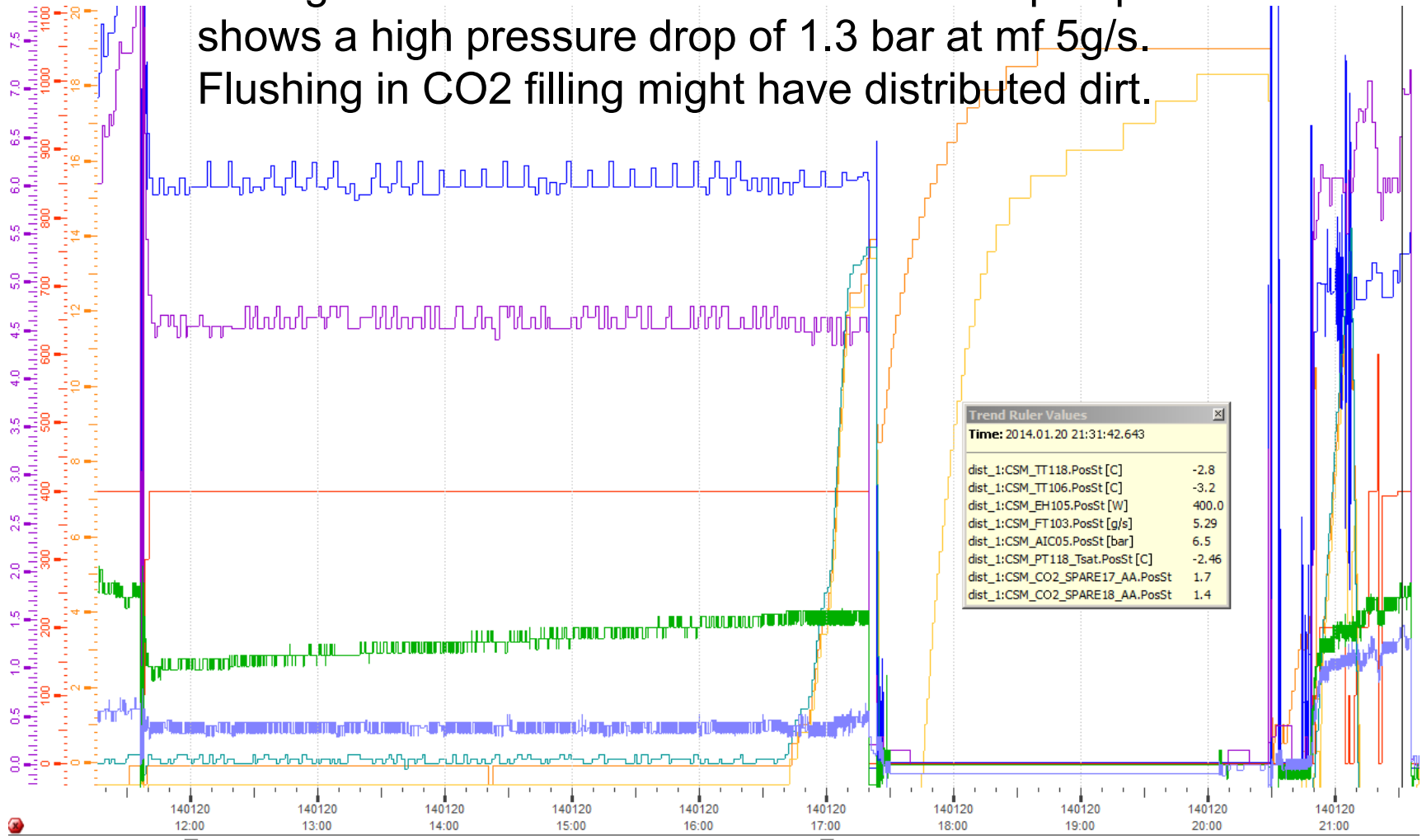


1/20/2014 12:09:26 PM.901	<input checked="" type="checkbox"/> dist_1:CSM_TT118.PosSt	-0.1	C	<input checked="" type="checkbox"/> dist_1:CSM_AIC05.PosSt	4.5	bar
	<input checked="" type="checkbox"/> dist_1:CSM_TT106.PosSt	-0.3	C	<input checked="" type="checkbox"/> dist_1:CSM_PT118_Tsat.PosSt	0.09	C
	<input checked="" type="checkbox"/> dist_1:CSM_EH105.PosSt	400.0	W	<input checked="" type="checkbox"/> dist_1:CSM_CO2_SPARE17_AA.PosSt	1.1	
	<input checked="" type="checkbox"/> dist_1:CSM_FT103.PosSt	5.99	g/s	<input checked="" type="checkbox"/> dist_1:CSM_CO2_SPARE18_AA.PosSt	0.3	



Filter cleaned ...

- After cleaning the filter also filter FL101 in front of pumps shows a high pressure drop of 1.3 bar at mf 5g/s. Flushing in CO2 filling might have distributed dirt.



1/20/2014 9:31:42 PM.643	<input checked="" type="checkbox"/> dist_1:CSM_TT118.PosSt	-2.8	C	<input checked="" type="checkbox"/> dist_1:CSM_AIC05.PosSt	6.5	bar
	<input checked="" type="checkbox"/> dist_1:CSM_TT106.PosSt	-3.2	C	<input checked="" type="checkbox"/> dist_1:CSM_PT118_Tsat.PosSt	-2.46	
	<input checked="" type="checkbox"/> dist_1:CSM_EH105.PosSt	400.0	W	<input checked="" type="checkbox"/> dist_1:CSM_CO2_SPARE17_AA.PosSt	1.7	
	<input checked="" type="checkbox"/> dist_1:CSM_FT103.PosSt	5.29	g/s	<input checked="" type="checkbox"/> dist_1:CSM_CO2_SPARE18_AA.PosSt	1.4	



Restricted service

- > Until filters and probably pump heads are changed and tubes cleaned

Marco could be used

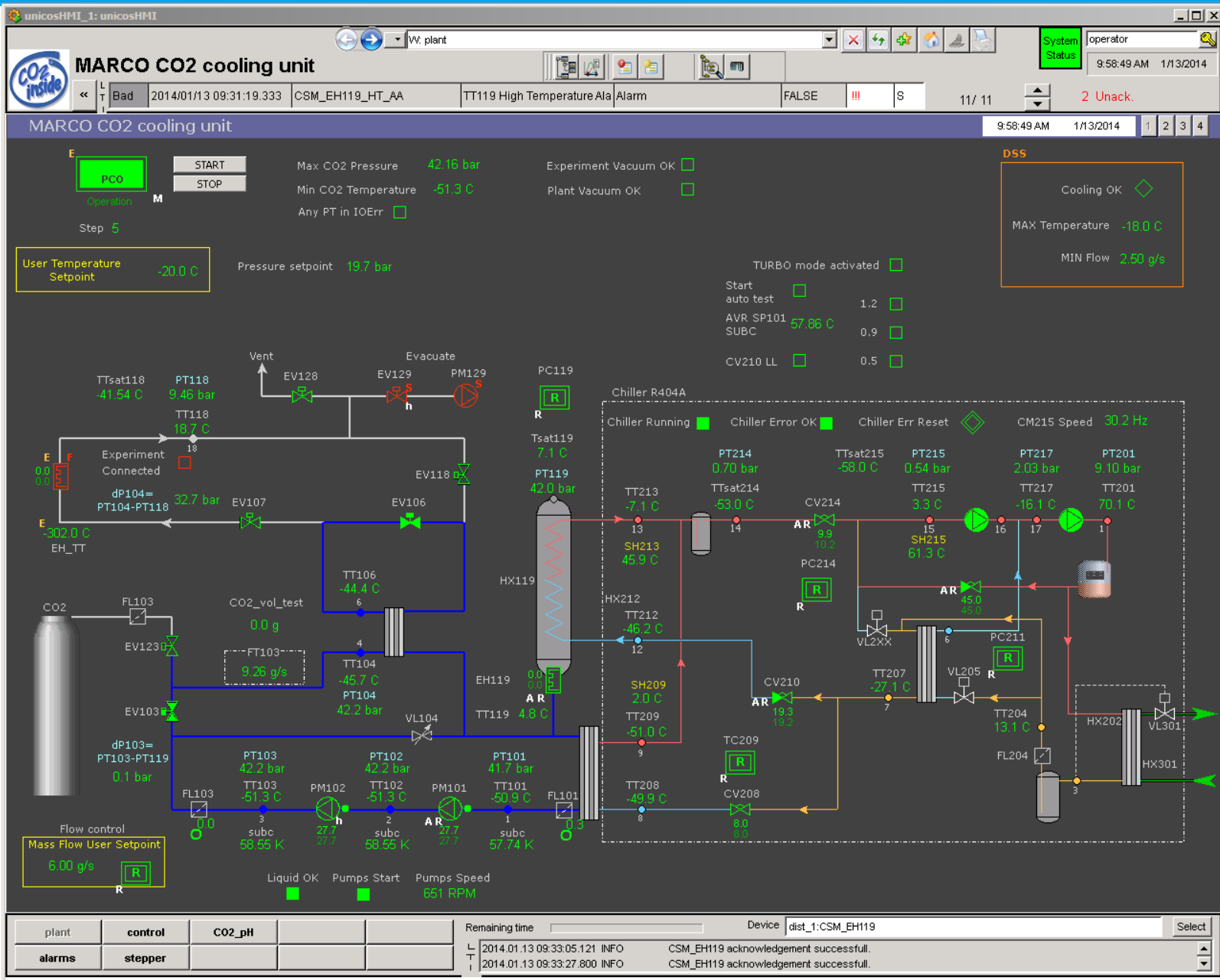
- > for a timespan of hours
- > till the filters pressure drop reaches 2.5bar
- > an interrupt of the mass flow might bring a relieve



- > Thank You
- > for your attention!



Backup



CO2 p-h diagram

