CMS RPC Distribution
Oct 2021

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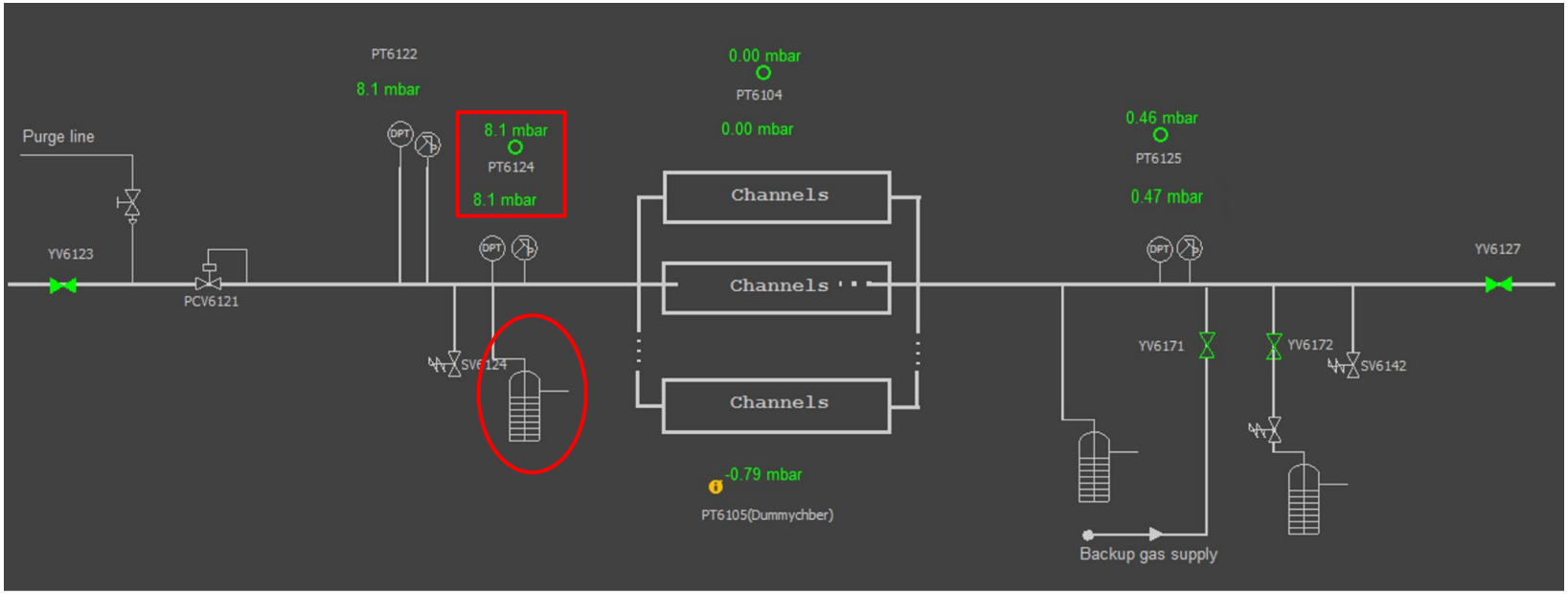
EP-DT
Detector Technologies

Endcap Input status

- Endcap distribution racks have bubblers installed at the input as safety for the input pressure before chambers
- Current bubbler level is 8-10 mbar (max allowed by dimension)
- Input pressure depends on chamber impedance and gas flow



Endcap Input status

With current settings

- Most of the racks are at bubbling limit
- Impossible to set higher flows without gas bubbling
- Bubblers already filled at max level, cannot be filled more (higher pressure)
- Bubblers already of max dimension for the racks, cannot be changed

Position	Rack #	Input Pressure	Flow l/h
RE-1	61	8.1	165
RE-2	62	4.7	181
RE-3	63	9.2	156
RE-4	64	4.5	158
RE-1	65	8.2	145
RE-2	66	6.3	183
RE-3	67	7.4	186
RE-4	68	9.5	312
RE+1	79	9.0	119
RE+2	80	5.2	176
RE+3	81	8.1	171
RE+4	82	5.3	152
RE+1	83	9.5	164
RE+2	84	7.0	167
RE+3	85	5.5	174
RE+4	86	12.7	300

Endcap Input possible actions

- Install safety valves in place of bubblers

  minimum calibration pressure ~ 50 mbar -> already too high for chambers

  the only *safety interlock* for chambers is at software level
- Possible to add normally open quick-connectors at output manifold

  currently connectors are normally closed, if disconnected output is blocked

  risk: increase of chamber pressure without *hardware* interlock

  with normally open quick there is no risk + caps can be put if needed for tests

- Barrel has safety valves in place of bubblers with normally closed connectors!

  Intervention could be done also on these racks to limit risk also there

  -> safety valves are at 85 mbar

Flowcell Status

Deviation from *real* flow

(measured with Red-y)

Legend: error range

0% < err < 10%

10% < err < 20%

20% < err < 30%

err > 30%

Rack 74				Rack 69		
		P input				P input
RB-2		12 mbar		RB-2		6.5
Channel	error % Input	error % Output		Channel	error % Input	error % Output
1	-9.64	7.11		1	26.53	29.59
2	9.09	3.54		2	52.04	46.94
3	12.95	12.95		3	28.51	35.53
4	16.75	15.74		4	17.18	10.13
5	-1.14	39.77		5	44.29	25.71
6	29.51	57.38		6	17.29	7.52
7	11.89	12.43		7	31.74	31.74
8	9.34	16.48		8	47.00	51.00
9	21.51	33.33		9	25.38	24.87
10	8.11	8.65		10	18.85	5.24
11	9.47	7.89		11	18.57	12.66
12	6.95	8.56		12	18.06	14.54
13	24.64	36.23		13	29.31	18.97
14	6.00	26.00		14	37.14	37.14
15	1.45	10.87		15	13.33	15.83
16	5.85	13.45		16	25.00	25.00
17	1.04	25.00		17	37.21	34.88
18	7.73	25.41		18	14.80	17.35
19	5.10	3.06		19	16.15	27.60
20	9.90	24.75		20	24.12	32.02
21	8.11	26.58		21	22.37	23.25
22	3.60	18.02		22	29.70	37.62
23	5.31	31.86		23	21.88	9.38
24	6.59	21.98		24	19.21	27.81
25	5.41	17.30		25	36.79	32.64
26	3.12	14.06		26	15.82	7.34

Flowcell Status

Rack 76			Rack 71			Rack 75			Rack 70		
		P input			P input			P input			P input
RB0		10 mbar	RB0		11 mbar	RB-1		12 mbar	RB-1		12 mbar
Channel	error % Input	error % Output	Channel	error % Input	error % Output	Channel	error % Input	error % Output	Channel	error % Input	error % Output
1	-6.45	-10.22	1	17.68	14.36	1	15.14	3.24	1	-18.18	0.00
2	20.00	22.22	2	17.30	9.73	2	13.29	12.03	2	1.05	13.61
3	14.97	11.76	3	-7.10	10.38	3	31.55	10.70	3	1.02	27.55
4	10.00	15.00	4	18.58	14.21	4	6.99	3.23	4	6.31	10.19
5	17.14	35.71	5	9.63	13.33	5	23.08	18.68	5	8.16	28.57
6	7.14	28.57	6	10.89	10.89	6	20.88	5.49	6	-22.00	30.00
7	7.59	11.03	7	13.33	16.36	7	17.13	14.92	7	-21.93	11.23
8	10.81	24.32	8	18.81	19.80	8	15.03	20.26	8	-3.97	9.93
9	12.64	12.64	9	25.38	24.87	9	12.30	4.28	9	10.27	17.84
10	10.53	23.68	10	21.86	21.31	10	16.22	11.89	10	0.55	17.49
11	16.05	17.28	11	14.59	16.76	11	-3.08	-1.54	11	-11.71	3.90
12	3.23	16.77	12	16.02	16.57	12	9.62	12.02	12	-4.85	20.87
13	9.68	25.81	13	21.78	25.74	13	4.79	-4.79	13	1.05	22.11
14	0.00	17.82	14	18.45	27.18	14	0.00	3.23	14	18.37	16.33
15	6.90	12.93	15	0.99	0.99	15	3.97	2.65	15	14.58	18.75
16	-0.90	-3.60	16	0.00	-1.94	16	-26.72	-9.48	16	19.80	16.83
17	17.13	23.76	17	15.53	7.77	17	-29.66	-4.24	17	17.92	4.72
18	22.22	28.40	18	8.79	5.49	18	3.65	2.08	18	12.04	9.95
19	12.78	14.44	19	13.66	12.57	19	1.58	7.37	19	10.75	4.30
20	13.59	7.77	20	11.60	9.39	20	0.45	12.67	20	20.29	15.46
21	21.36	27.18	21	13.66	10.38	21	1.35	9.91	21	23.90	22.44
22	15.00	16.00	22	33.66	35.64	22	-1.89	11.32	22	21.90	17.14
23	20.00	25.00	23	20.95	19.05	23	-24.21	-4.21	23	26.04	23.96
24	14.84	17.03	24	20.36	10.78	24	2.14	8.56	24	21.88	11.46
25	19.42	19.42	25	14.56	17.48	25	-1.60	4.26	25	20.88	4.40
26	17.48	21.36	26	19.01	13.22	26	1.98	17.82	26	22.92	18.75

Flowcell Status

Rack 78			Rack 73			Rack 77				Rack 72		
		P input			P input			P input				P input
RB+2		34 mbar	RB+2		31 mbar	RB+1		27 mbar		RB+1		35 mbar
Channel	error % Input	error % Output	Channel	error % Input	error % Output	Channel	error % Input	error % Output		Channel	error % Input	error % Output
1	10.16	35.83	1	16.13	17.74	1	0.00	5.77		1	3.85	14.29
2	13.44	22.58	2	25.26	25.26	2	1.31	9.80		2	-1.11	15.56
3	16.34	39.11	3	9.91	16.22	3	5.36	0.00		3	3.31	11.05
4	20.00	23.90	4	26.73	25.81	4	14.50	6.11		4	-20.54	-1.08
5	23.58	14.15	5	9.63	13.33	5	-4.24	-31.36		5	1.45	31.88
6	29.59	38.78	6	16.67	46.67	6	5.26	11.28		6	-6.00	21.00
7	21.43	23.08	7	24.36	25.00	7	14.97	16.77		7	3.78	17.30
8	8.02	10.16	8	14.41	9.01	8	4.07	10.47		8	1.62	22.70
9	19.35	16.13	9	25.38	24.87	9	12.35	32.72		9	2.81	11.24
10	24.27	34.95	10	32.82	31.79	10	11.64	6.85		10	6.63	20.99
11	19.90	39.30	11	23.08	11.31	11	-100.00	-100.00	*noread	11	4.95	42.31
12	13.09	17.80	12	21.97	27.80	12	-100.00	-100.00	*noread	12	-9.47	18.95
13	14.58	18.75	13	4.08	27.55	13	2.20	9.89		13	-4.08	13.27
14	11.58	21.05	14	18.45	27.18	14	6.98	30.23		14	-1.05	17.89
15	3.17	0.79	15	22.31	23.97	15	6.78	11.86		15	-4.65	1.16
16	-9.19	7.03	16	28.45	15.52	16	-5.88	21.18		16	34.65	25.74
17	7.81	10.16	17	29.59	32.65	17	-26.56	32.81		17	0.99	0.99
18	-16.58	8.81	18	15.66	20.71	18	16.13	19.35		18	15.56	20.00
19	-21.58	8.42	19	18.97	20.00	19	10.56	15.00		19	9.89	16.48
20	4.98	6.47	20	18.06	26.43	20	0.55	6.59		20	4.97	6.08
21	8.92	18.78	21	21.68	15.49	21	8.84	18.23		21	9.44	27.22
22	14.00	25.00	22	33.66	35.64	22	10.42	34.38		22	11.46	19.79
23	5.83	30.10	23	28.57	22.45	23	-13.33	26.67		23	-2.22	8.89
24	-8.56	4.81	24	35.26	24.74	24	6.18	14.04		24	11.58	16.84
25	6.59	11.54	25	16.05	12.35	25	12.43	14.69		25	11.73	17.28
26	11	8	26	19.26	14.81	26	22.73	26.14		26	12.50	8.33

Flowcell Status

Rack 78			Rack 73			Rack 77				Rack 72		
		P input			P input			P input				P input
RB+2		34 mbar	RB+2		31 mbar	RB+1		27 mbar		RB+1		35 mbar
Channel	error % Input	error % Output	Channel	error % Input	error % Output	Channel	error % Input	error % Output		Channel	error % Input	error % Output
1	10.16	35.83	1	16.13	17.74	1	0.00	5.77		1	3.85	14.29
2	13.44	22.58	2	25.26	25.26	2	1.31	9.80		2	-1.11	15.56
3	16.34	39.11	3	9.91	16.22	3	5.36	0.00		3	3.31	11.05
4	20.00	23.90	4	26.73	25.81	4	14.50	6.11		4	-20.54	-1.08
5	23.58	14.15	5	9.63	13.33	5	-4.24	-31.36		5	1.45	31.88
6	29.59	38.78	6	16.67	46.67	6	5.26	11.28		6	-6.00	21.00
7	21.43	23.08	7	24.36	25.00	7	14.97	16.77		7	3.78	17.30
8	8.02	10.16	8	14.41	9.01	8	4.07	10.47		8	1.62	22.70
9	19.35	16.13	9	25.38	24.87	9	12.35	32.72		9	2.81	11.24
10	24.27	34.95	10	32.82	31.79	10	11.64	6.85		10	6.63	20.99
11	19.90	39.30	11	23.08	11.31	11	-100.00	-100.00	*noread	11	4.95	42.31
12	13.09	17.80	12	21.97	27.80	12	-100.00	-100.00	*noread	12	-9.47	18.95
13	14.58	18.75	13	4.08	27.55	13	2.20	9.89		13	-4.08	13.27
14	11.58	21.05	14	18.45	27.18	14	6.98	30.23		14	-1.05	17.89
15	3.17	0.79	15	22.31	23.97	15	6.78	11.86		15	-4.65	1.16
16	-9.19	7.03	16	28.45	15.52	16	-5.88	21.18		16	34.65	25.74
17	7.81	10.16	17	29.59	32.65	17	-26.56	32.81		17	0.99	0.99
18	-16.58	8.81	18	15.66	20.71	18	16.13	19.35		18	15.56	20.00
19	-21.58	8.42	19	18.97	20.00	19	10.56	15.00		19	9.89	16.48
20	4.98	6.47	20	18.06	26.43	20	0.55	6.59		20	4.97	6.08
21	8.92	18.78	21	21.68	15.49	21	8.84	18.23		21	9.44	27.22
22	14.00	25.00	22	33.66	35.64	22	10.42	34.38		22	11.46	19.79
23	5.83	30.10	23	28.57	22.45	23	-13.33	26.67		23	-2.22	8.89
24	-8.56	4.81	24	35.26	24.74	24	6.18	14.04		24	11.58	16.84
25	6.59	11.54	25	16.05	12.35	25	12.43	14.69		25	11.73	17.28
26	11	8	26	19.26	14.81	26	22.73	26.14		26	12.50	8.33

Flowcell Status

- Flowcells with deviation > 30% ~ 50 (10% of total#)

  Flowcells with deviation >20% ~ 170 (30% of total#)
- *if input/output is changed, to decide if also pair output/input to be changed

Flowmeter/Drycal Test

- Red-y Voegtlin flowmeter tested in parallel with MFCs from Flowcells calibration stand (calibrated in R134a)
- Dry cal connected at output of flowmeter > two different drycal used to see difference wrt scale

Results:

- in CMS RPC operatin flow (10-25 l/h) the deviation of the Red-y flowmeter wrt nominal MFC flow is around 2-3% (same as Drycal)

Dry Cal range 50/5000 ml/min

	MFC [l/h]	dryCal [l/min]	dryCal [l/h]	error dryCal %	redY [l/min]	redY [l/h]	error redY %
	40	0.65	39	-3	0.655	39.3	-2
	30	0.487	29.22	-3	0.48	28.8	-4
	25	0.406	24.36	-3	0.407	24.42	-2
	20	0.326	19.56	-2	0.323	19.38	-3
	15	0.246	14.76	-2	0.242	14.52	-3
	10	0.164	9.84	-2	0.172	10.32	3
limit MFC	*5*	*0.082*	*4.92*	*-2*	*0.072*	*4.32*	*-14*

Upgrades November (Stop)

- For high flow mode
  - Test needle valve for pump regulation + install on two pumps
  - Barrel + RE4 rotameter glasses to change with higher flows
    > some racks at max reading, blind on higher flows
  - Barrel test 3.0 knob
    > some racks cannot go to requested high flow with current ones
  - Endcap (G1/G5) upgrade of group regulation valve
    > current one already at limit with current flow, cannot go higher
  - Endcap input bubblers/safety valves/output quick norm. open (to decide)
    > with bubblers might not be possible to increase flow
    > not all tested, some tested already at bubbling limit (no higher flow)

Upgrades November (Stop)

- For regulation valves
  - Mechanical installation (welding)
  - Electrical installation
  - New valves were not tested on system > seat selected with simulation
    - Test if chosen seat is correct (good working range)
    - Correct with manual regulation valve if necessary
    - Test and choose optimum PID for regulation

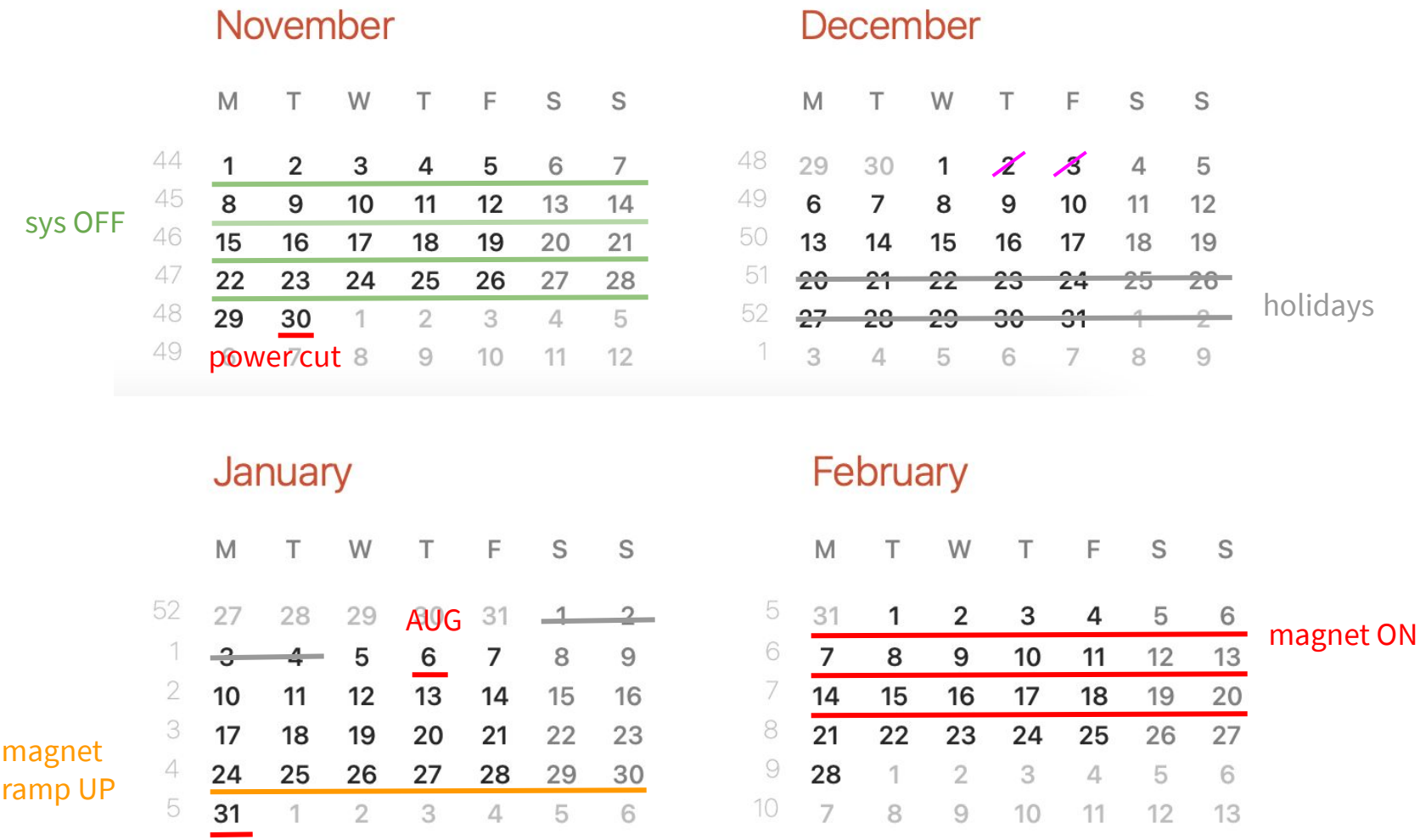
- Other maintenance activities on surface (with system in stop)
  - PLC power supply upgrade
  - IR reading upgrade (on RPC PLC, in exhaust rack - now in CMS AUX)
  - Purifier upgrade to avoid pressure drop during regeneration
  - Exhaust MFC calibration
  - Mixer new MFC Freon to install and test
  - Maintenance all modules

Planning

To keep into account

- 30 November = power cut
- 6 January = AUG test
- 24-28 January = Magnet Ramp Up
- 31 January onward = Magnet ON

Planning


November
M T W T F S S
44 1 2 3 4 5 6 7
45 8 9 10 11 12 13 14
46 15 16 17 18 19 20 21
47 22 23 24 25 26 27 28
48 29 30 1 2 3 4 5
49 6 7 8 9 10 11 12
sys OFF
power cut
December
M T W T F S S
48 29 30 1 2 3 4 5
49 6 7 8 9 10 11 12
50 13 14 15 16 17 18 19
51 20 21 22 23 24 25 26
52 27 28 29 30 31 1 2
1 3 4 5 6 7 8 9
holidays
January
M T W T F S S
52 27 28 29 30 31 1 2
1 3 4 5 6 7 8 9
2 10 11 12 13 14 15 16
3 17 18 19 20 21 22 23
4 24 25 26 27 28 29 30
5 31 1 2 3 4 5 6
AUG
magnet ramp UP
February
M T W T F S S
5 31 1 2 3 4 5 6
6 7 8 9 10 11 12 13
7 14 15 16 17 18 19 20
8 21 22 23 24 25 26 27
9 28 1 2 3 4 5 6
10 7 8 9 10 11 12 13
magnet ON