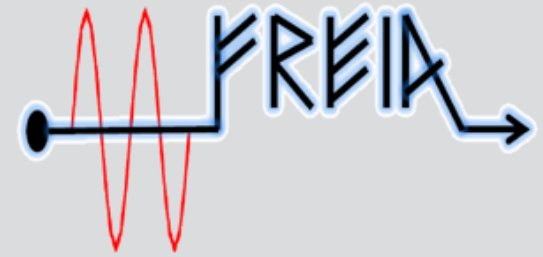




UPPSALA
UNIVERSITET



ESS weekly meeting (2021 W50)

A. Miyazaki et al.



General planning



| FREIA Planning | | 2021-12-08 | | | | | | | | | | | 2022 | | | | | | | | |
|---------------------|-------------|------------|----------|---------|----------|--------|----------|----------|----------|----------|----|---------|------------|----------|---------|--------|----------|----------|---------|----------|--|
| | | November | | | | | | December | | | | | January | | | | | February | | | |
| Equipment | Responsible | 25 | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | |
| | | week # | # | # | 46 | 47 | # | 49 | 50 | 51 | # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Liquefier & 2K pump | Esat | [Blue bar] | | | | | | | | | | | [Blue bar] | | | | | | | | |
| RF power stations | Mykhailo | | [Green] | | [Green] | | | [Green] | | | | | [Green] | | [Green] | | [Green] | | [Green] | | |
| Cryomodule test sta | Akira | [Blue] | [Yellow] | [Green] | [Yellow] | [Blue] | [Yellow] | [Blue] | [Yellow] | [Yellow] | | [Green] | [Blue] | [Yellow] | [Green] | [Blue] | [Yellow] | [Green] | [Blue] | [Yellow] | |

We are here

Restart

- CM06 has been shipped to ESS
- CM07 is under preparation
- CM08 has just arrived



W49 & W50 progress & W51 plan (?)



| week | | W49 | | | | | | | | | | | | |
|--------------|------|-----------------------|---|-----------------|------------------|--------------------|---|--------------------------------------|----------------------|--------|---|--------|--------|--|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN | |
| | | 06-dec | | 07-dec | | 08-dec | | 09-dec | | 10-dec | | 11-dec | 12-dec | |
| | | m | a | m | a | m | a | m | a | m | a | | | |
| present CM | CM06 | RF conditioning of FE | | heat load again | start warming up | warming up | | break insulation vacuum | warming up completed | | | | | |
| next CM | CM07 | | | | | VNA reception test | | doorknob mounting & water leak check | | | | | | |
| next next CM | CM08 | preparation at Orsay | | | | | | | | | | | | |

| week | | W50 | | | | | | | | | | | |
|-------------|------|----------------------------|------------------------------------|------------------------------------|----------------------|--------------------|-------------------------------------|------------------------------------|----------------|---------------------------|---|--------|--------|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN |
| | | 13-dec | | 14-dec | | 15-dec | | 16-dec | | 17-dec | | 18-dec | 19-dec |
| | | m | a | m | a | m | a | m | a | m | a | | |
| previous CM | CM06 | disconnect cryogenic lines | swap modules, doorknob dismounting | filling dry N2, outgoing LEMO test | | out-going VNA test | shock sensors activated, box closed | departure to ESS / publish reports | | arrival at ESS | | | |
| present CM | CM07 | | | connect cryogenic lines | vacuum pump mounting | | | | vacuum pumping | | | | |
| next CM | CM08 | departure from Orsay | | | | | | reception at UU morning | | reception test LEMO / VNA | | | |

We are here

| week | | W51 | | | | | | | | | | | |
|------------|------|----------------------|---|------------------------|---|------------------------|---|---------------|---|--------|---|--------|--------|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN |
| | | 20-dec | | 21-dec | | 22-dec | | 23-dec | | 24-dec | | 25-dec | 26-dec |
| | | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM07 | fix flange | | connect cryogenic line | | beam vacuum connection | | closed valves | | | | | |
| next CM | CM08 | Beckhoff driver test | | | | | | | | | | | |

Is the driver coming to us?



New year planning

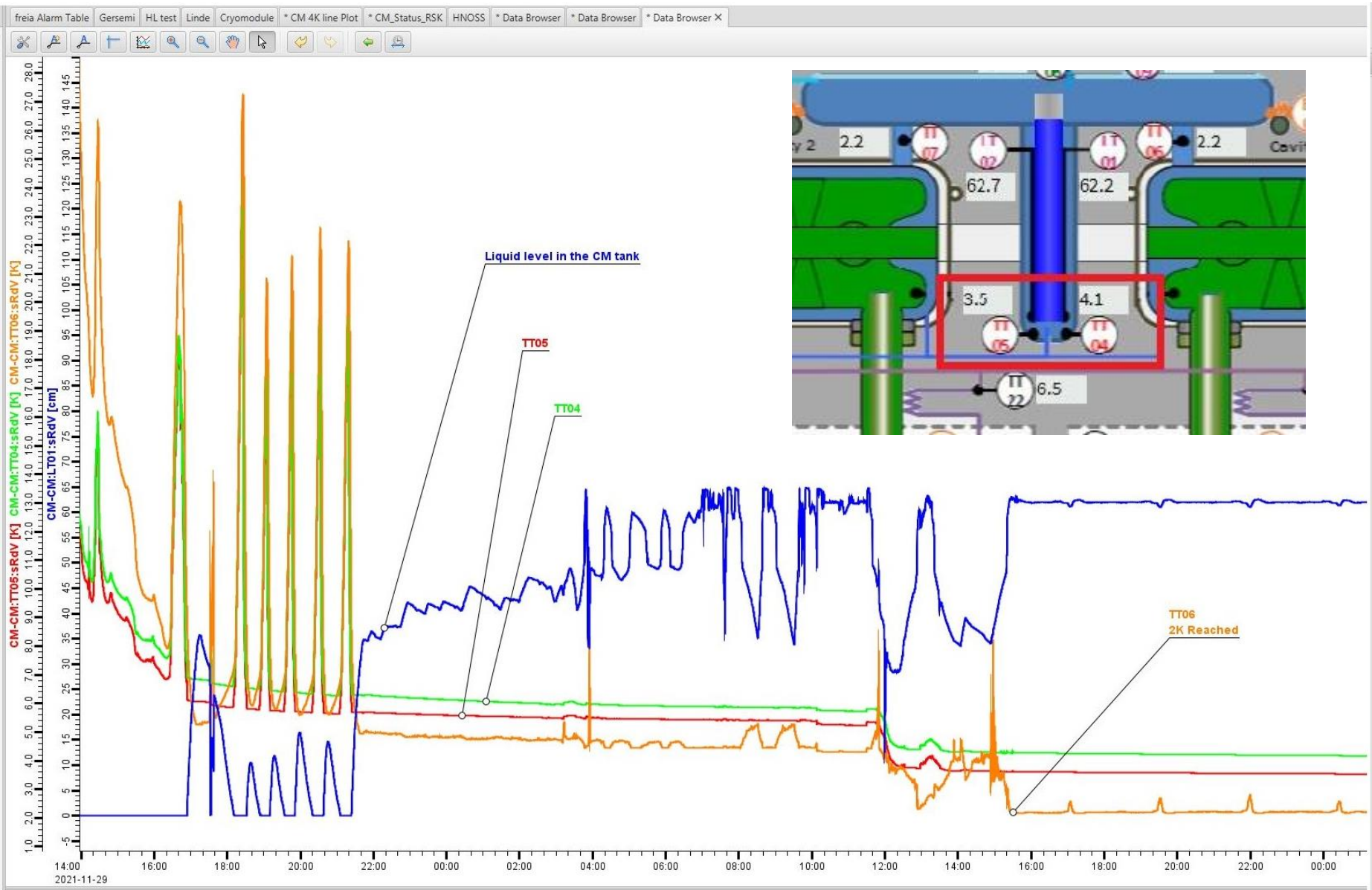


| week | | W01 | | | | | | | | | | | |
|------------|-------------|--------|---|--------|---|--------|---|--------|---|--------|---|--------|--------|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN |
| | | 03-jan | | 04-jan | | 05-jan | | 06-jan | | 07-jan | | 08-jan | 09-jan |
| | | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM07 | | | | | | | | | | | | |
| next CM | CM08 | | | | | | | | | | | | |

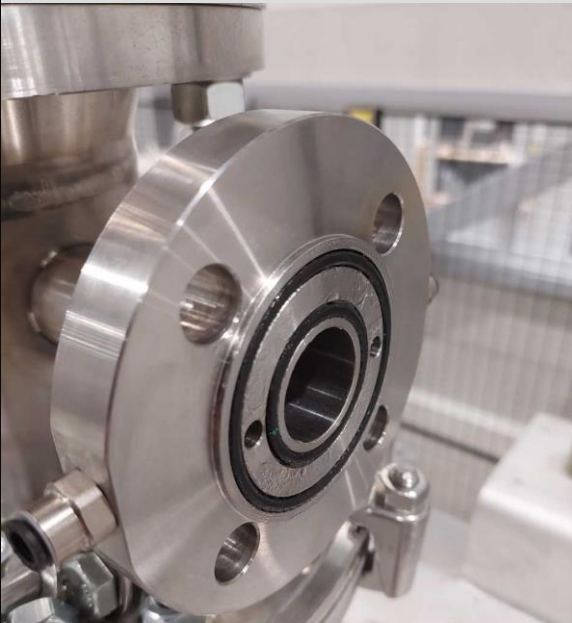
| week | | W02 | | | | | | | | | | | |
|------------|-------------|--------------------------------------|---|---------------------------|---|--------|---|--------|---|--------|---|--------|--------|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN |
| | | 10-jan | | 11-jan | | 12-jan | | 13-jan | | 14-jan | | 15-jan | 16-jan |
| | | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM07 | restart power station, water cooling | | coupler warm conditioning | | | | | | | | | |
| next CM | CM08 | | | | | | | | | | | | |

| week | | W03 | | | | | | | | | | | |
|------------|-------------|------------|---|-------------|------------|--------|---------------------------|------------|--------------------------------|-----------------|---|-----------------------|--------|
| date | | MON | | TUE | | WED | | THU | | FRI | | SAT | SUN |
| | | 17-jan | | 18-jan | | 19-jan | | 20-jan | | 21-jan | | 22-jan | 23-jan |
| | | m | a | m | a | m | a | m | a | m | a | | |
| present CM | CM07 | N2 cooling | | LHe cooling | 4K filling | | coupler cold conditioning | 2K pumping | RF calibration interlock setup | MP conditioning | | thermalization of CTS | |
| next CM | CM08 | | | | | | | | | | | | |

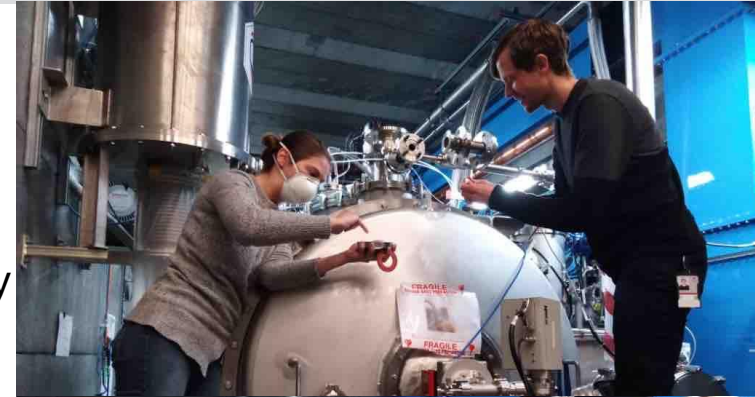
CM06: doubt in TT04 and TT05 → Any answers?



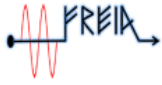
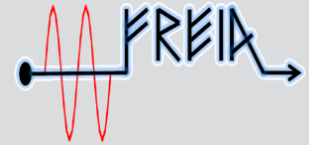
Grease and flange...any answers?



- The grease on the module is as received
- We do not add grease there because it is too much from the beginning
- We added grease on safety valve section when we investigated leak there
- Small amount of grease too keep O-rings fresh unavoidably exist in our 2K infrastructure



CM06 reports: ready for publishing



FREIA
Department of Physics and Astronomy
Uppsala University

Summary of CM06 test


Report time: 20211216

Vacuum

| date | 2021-11-11 | 2021-12-06 | 2021-12-14 |
|-------------------------|------------|------------|------------|
| Temperature (K) | 300 | 2 | 300 |
| Beam vacuum (mbar) | 5.1e-3 | 4e-10 | <5e-4 |
| Isolating vacuum (mbar) | 1000 | 3.2e-7 | 1000 |


Cavity performance

| | CAV_IN | CAV_OUT | Target | | |
|---|-------------------------------|--|-------------------|-----------------|-----------------|
| Cavity name | DSPK-18 | DSPK-22 | - | | |
| f_0 at warm (MHz) | 351.545 | 351.551 | - | | |
| f_0 at 2K (MHz) @ without CTS engaged | 352.098 | 352.113 | 352.090 - 352.174 | | |
| Q_{int} | 1.82e5 | 1.77e5 | 1.75e5 - 2.85e5 | | |
| Q (from Orsay) | 2.10e11 | 1.55e11 | - | | |
| Max E_{acc} (MV/m) | 12 | 12 | >9 | | |
| Field emission onset (MV/m) | - | 9 | - | | |
| Q_e @9MV/m | >1.63e9 | >1.63e9 | >1.5e9 | | |
| P_e @9MV/m (W) | <2.0 | <2.0 | 2.5 | | |
| Dynamic heat load for CM@9MV/m (W) | 15.25+/-1.0 | | | | |
| Static heat load for CM (W) | 16.85+/-1.0 | | | | |
| df/dP (Hz/mbar) | -16.06 | -16.27 | <20 | | |
| CTS | Stepper motor ³ | motor steps | 875200 | 755200 | - |
| | setting for nominal frequency | motor position (mm) | 1.71 | 1.48 | - |
| | | driving current (A) | 0.6 | 0.6 | 0.6 |
| | | Limit switch position (steps) | -7880 | -6060 | - |
| | | Stepper motor tuning (Hz/ step) | 0.161 | 0.170 | 0.145 +/- 0.027 |
| | | sensitivity in linear region (kHz/ mm) | 82.6 | 87 | - |
| | | Piezo1 tuning range (Hz) | unipolar 555.923 | bipolar 612.720 | >640 |
| | | Piezo1 tuning sensitivity (Hz/V) | 2.780 | 3.221 | - |
| | | Piezo2 tuning range (Hz) | unipolar 489.099 | bipolar 484.610 | >640 |
| | | Piezo2 tuning sensitivity (Hz/V) | 604.728 | 603.520 | - |
| | LFD@9MV/m in open loop (Hz) | 360 | 230 | - | |



Cables verification

| Cables verification CM06 at UCLab | | | | | | Cables verification CM06 at UIU | | | | | |
|-----------------------------------|------------------------|----------|---------------|--|--------|---------------------------------|------------------------|----------|---------------|--|--------|
| Socket name | Socket / Actuator type | PID name | Serial number | Electrical value (Ω) (before shipping) | C / RC | Socket name | Socket / Actuator type | PID name | Serial number | Electrical value (Ω) (before shipping) | C / RC |
| L001 | | | | | | L001 | | | | | |
| L002 | | | | | | L002 | | | | | |
| L003 | | | | | | L003 | | | | | |
| L004 | | | | | | L004 | | | | | |




Performances

ATRIUM-43000
Date: 27/09/2021

| CM06 Configuration | | | |
|--------------------|-------------|-----------------------------------|-------------|
| RF cavity | SPK-DSPK-18 | OUT | SPK-DSPK-22 |
| Coupler | SPK-CPL-11 | Out cavity | SPK-CPL-20 |
| Double wall tube | SPK-DWT-16 | Double wall tube | SPK-DWT-20 |
| Tuning System | SPK-TUN-XX | Tuning System <td>SPK-TUN-XX</td> | SPK-TUN-XX |

| Specification or measured value @ 2K (before shipping) | Measured value @ UIU | C / RC | Measured value @ Lund | C / RC |
|--|----------------------|--------------------|-----------------------|--------|
| External Q | | | | |
| Quality factor | 1.75e+05 | | 1.82e+05 | C |
| Quality factor | 1.75e+05 | | 1.77e+05 | C |
| Frequency shift @ 2K (tuning system OFF) | | | | |
| Quality factor | >32.588 | | 352.098 | C |
| Quality factor | >32.113 | | 352.113 | C |
| Beam loss | | | | |
| Quality factor | ≤12 | | 12 | C |
| Quality factor | ≤12.4 | | 12.4 | C |
| Beam losses | | | | |
| Beam losses (RF OFF) | W | <0 | 18.85 +/- 1.0 | NC |
| Beam losses (RF ON) | W | <13 | 15.26 +/- 1.0 | NC |
| Pressure sensitivity | | | | |
| Quality factor | Hz/mbar | <20 | 16.28 | C |
| Quality factor | Hz/mbar | <20 | 16.27 | C |
| Linear fluxes detuning factor | | | | |
| Quality factor | Hz/Watt | <2 | -4.44 | C |
| Quality factor | Hz/Watt | <2 | -3.84 | C |
| Tuning sensitivity | | | | |
| Quality factor | Hz/step | 0.145 +/- 0.027 | 0.161 | C |
| Quality factor | Hz/step | 0.145 +/- 0.027 | 0.170 | C |
| Phase detuning for KLM-HighModulator | | | | |
| Quality factor | Hz | <640 | 1178 | C |
| Quality factor | Hz | <640 | 1241 | C |
| Resonance | | | | |
| Beam vacuum (single pipe) of cavity | mbar | <10 ⁻¹⁰ | 3.20E-07 | C |
| Beam vacuum (double pipe) of cavity | mbar | <10 ⁻¹⁰ | 4.90E-10 | C |
| Beam vacuum (double pipe) of cavity | mbar | <10 ⁻¹⁰ | 1.20E-09 | C |



Coupling test

ATRIUM-43000
Date: 27/09/2021

| Cryomodule | CONFIG | | | |
|---|---|--|--|--|
| | Hall 106 @UCLab | UIU | | CM06 |
| Location | 2021-08-05 | 2021-10-26 | 2021-12-01 | 2021-12-15 |
| VNA model | R&S ZV86 | Agilent PNA | Agilent PNA | Agilent PNA |
| T ₀ (K) | 2K | not measured | 2K | 20.9 |
| Pressure (mbar) | 1A | 4.0E-03 | 1.50E-09 | UR -5e-4 |
| Pressuring vacuum (mbar) | 1A | 1.00E+03 | 2.00E-07 | 1.00E+03 |
| RF measurements @ T=300K before testing | RF measurements @ T=300K before testing | RF measurements @ T=300K during the test | RF measurements @ T=300K after testing | RF measurements @ T=300K after testing |
| Cavity location | Cavity IN | Cavity OUT | Cavity IN | Cavity OUT |
| Coupler | SPK-DSPK-18 | SPK-DSPK-22 | SPK-DSPK-18 | SPK-DSPK-22 |
| Manchette | SPK-DWT-28 | SPK-DWT-26 | SPK-DWT-28 | SPK-DWT-26 |
| S11 (dB resonance) | -0.18 | -0.95 | -0.7 | -0.97 |
| S21 (dB resonance) | -84.9 | -82.9 | -84.1 | -82.52 |
| Frequency (MHz) | 351.543 | 351.550 | 351.545 | 351.553 |
| Shift (MHz) | 352.126 | 352.139 | 352.098 | 352.113 |
| Classical | 8877 | 8832 | 9054 | 8982 |
| For information S11 pick-up cable (measurement @ reception) | -1.85 | -1.85 | - | - |
| S11 pick-up cable (measurement @ CM) | -1.77 | -1.82 | -3.43 | -3.5 |
| Q (calculated) | 3.00E+11 | 3.00E+11 | -2.07 | -1.92 |
| Q (measurement vertical test @ 2K) | 2.10E+11 | 1.55E+11 | - | - |
| Results (under coupled) | Results (under coupled) | Results (over coupled) | Results (under coupled) | Results (under coupled) |
| S11 (corrected) | -0.79 | -0.73 | -0.7 | -0.9 |
| S21 (corrected) | -83.9 | -81.9 | -82.4 | -81.5 |
| Qent (measured on CM @ 300K) | 2.29E+05 | 2.19E+05 | 240472 | 228272 |
| Qent (measured on CM @ 2K) | 2.19E+05 | 2.05E+05 | 170275 | 165387 |
| Qent (calculated with CST Studio) | 2.19E+05 | 2.05E+05 | 2.38E+11 | 1.70E+11 |
| Qent (measured on CM) | 3.39E+11 | 2.20E+11 | 2.12E+13 | 8.45E+12 |
| Qent (measured on CM @ 2K) | 925 | 503 | 8408 | 8073 |
| Q (CVM) | 131 | 131 | 134 | 133 |

VACUUM GAUGE OF CAVITY STRING AT UIU

| Date | Time | Pieffer TPG2020 (mbar) | Limit | Name of controller |
|------------|-------|------------------------|----------|--------------------|
| 2021-10-21 | 10:00 | 4.40E-03 | 1.00E-01 | C Svanberg |
| 2021-10-22 | 09:15 | 4.40E-03 | 1.00E-01 | C Svanberg |
| 2021-10-25 | 09:00 | 4.80E-03 | 1.00E-01 | C Svanberg |
| 2021-10-26 | 08:50 | 4.80E-03 | 1.00E-01 | C Svanberg |
| 2021-10-27 | 09:00 | 4.80E-03 | 1.00E-01 | C Svanberg |
| 2021-10-28 | 08:50 | 4.70E-03 | 1.00E-01 | C Svanberg |
| 2021-10-29 | 12:05 | 4.70E-03 | 1.00E-01 | C Svanberg |
| 2021-11-01 | 08:00 | 4.80E-03 | 1.00E-01 | C Svanberg |
| 2021-11-02 | 09:00 | 4.90E-03 | 1.00E-01 | C Svanberg |
| 2021-11-03 | 09:30 | 4.90E-03 | 1.00E-01 | C Svanberg |
| 2021-11-04 | 09:00 | 4.90E-03 | 1.00E-01 | C Svanberg |
| 2021-11-05 | 09:05 | 4.90E-03 | 1.00E-01 | C Svanberg |
| 2021-11-08 | 09:30 | 5.00E-03 | 1.00E-01 | C Svanberg |
| 2021-11-09 | 17:00 | 5.00E-03 | 1.00E-01 | C Svanberg |
| 2021-11-10 | 09:30 | 5.00E-03 | 1.00E-01 | C Svanberg |
| 2021-11-11 | 10:30 | 5.10E-03 | 1.00E-01 | C Svanberg |
| 2021-12-14 | 10:30 | UR | 1.00E-01 | A Miyazaki |
| 2021-12-15 | 11:15 | UR | 1.00E-01 | A Miyazaki |

To be circulated after this meeting,



CM06 departure & CM08 arrival



The CM07 flange does not fit the bellow's supporting flange (originally with CM02 and used for all the other modules)

The CM07 flange seems like distorted to be an elliptical shape 0.5-1 mm in diameter

We need to slightly mil the ring flange to fit CM07

