



**RWTHAACHEN
UNIVERSITY**



**TRD
GAS Refill**
Version 5, 16th December 2015

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TRD-ACC-TAS SHIFTER: TRD-Gas-Expert Phone Numbers

Gas Expert Telephone Numbers:

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TRD Gas Refill - Preparation

For each Gas Refill a log file has to be created and filled in by hand.

The log files are stored in `~/Gas_Refills`

Create a new directory with name: `yyyy_mm_dd`, e.g.

```
trd@pcpoc25 Gas_Refills$ mkdir 2013_01_23
```

```
trd@pcpoc25 Gas_Refills$ cd 2013_01_23
```

Follow [instructions of automated worksheet](#) for TRD Gas Refill

(still separate in the moment, calculation by hand described on pages 5-11, continue on [page 12!](#))

Take care, not to change the number of lines by adding or deleting text.

TRD Gas Refill - Preparation

Calculate the amount of gas to be filled; check actual gas composition in TRD-PressureMonitor and in text file

~/RUN/COMMANDING/TRDGAS/Gas_Refills/gas_composition_history.txt

Example: 13th June 2013:

Set the date to the one of day 2 of Refill

quit update 01.01.2013 - 00:00 **14.07.2013 - 00:00** set time range reset time range set last week next week print fit results 0 0 set y range save PNG save ROOT files

Pressure and Temperature Manifolds DeltaP Temperatures **Gas Composition**

Gas Composition Calculator

Initial conditions:

day	Xe pressure / mbar	CO ₂ pressure / mbar
19.05.2011	980.	166.43

save table

Changes in rates:

day	total leak / mbar/day
19.05.2011	1.25
24.05.2011	3.16
08.07.2011	4.14
21.08.2011	4.38
14.09.2011	4.16
30.09.2011	4.63
26.10.2011	5.15

add row remove selected row save table

Refills - pressures are partial pressures in mixing vessel:

day	CO ₂ / bar	Xe / bar	fudge factor
14.03.2013	2.84	10.26	1.015
10.04.2013	3.21	10.44	1.0
10.04.2013	3.0	9.8	1.01
10.05.2013	2.858	10.142	1.0
10.05.2013	3.125	10.3	1.0
13.06.2013	3.0	10.9	1.0
13.06.2013	3.57	9.5	1.01

add row remove selected row save table compare

Date converter

165 corresponding date: 14.06.2011

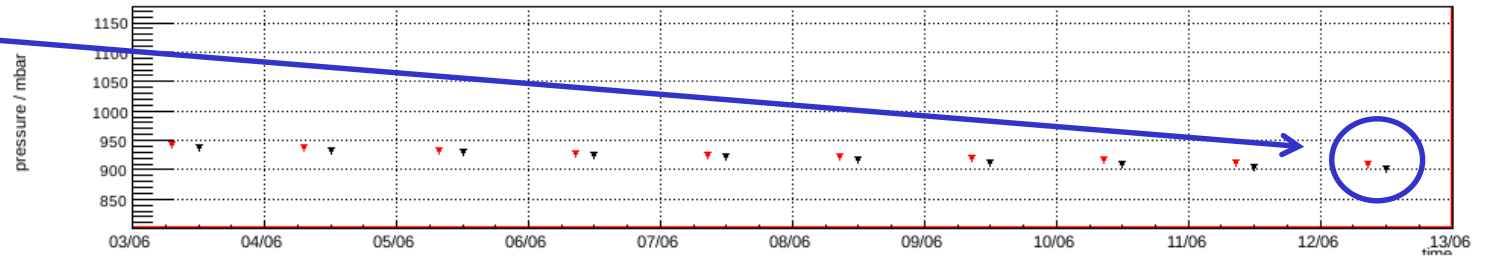
The figure consists of four vertically stacked line graphs sharing a common x-axis representing time from 15/01/13 to 14/07/13. The y-axes represent different pressure and fraction metrics:

- Top Graph:** Total pressure in mbar, ranging from 850 to 1150. It shows a sawtooth pattern with periodic increases followed by gradual decreases.
- Second Graph:** Xe pressure in mbar, ranging from 700 to 1000. It also shows a sawtooth pattern similar to the total pressure.
- Third Graph:** CO₂ pressure in mbar, ranging from 60 to 200. It shows a sawtooth pattern.
- Bottom Graph:** CO₂ fraction, ranging from 0.06 to 0.2. It shows a sawtooth pattern.

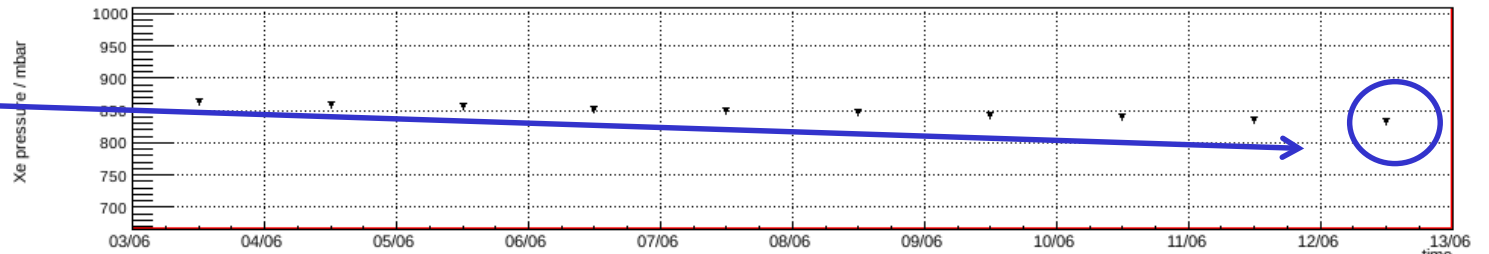
TRD Gas Refill - Preparation

TRD-PressureMonitor: check actual gas composition; **Example: 13th June 2013:**

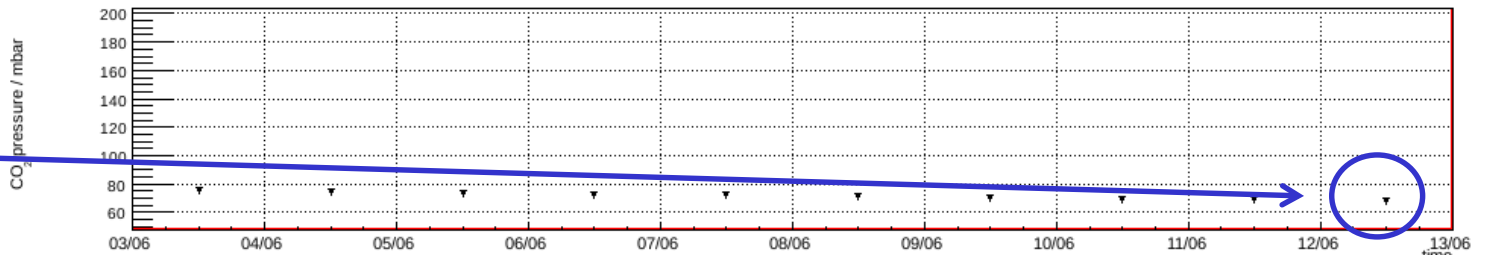
Measured total
pressure: 905 mbar



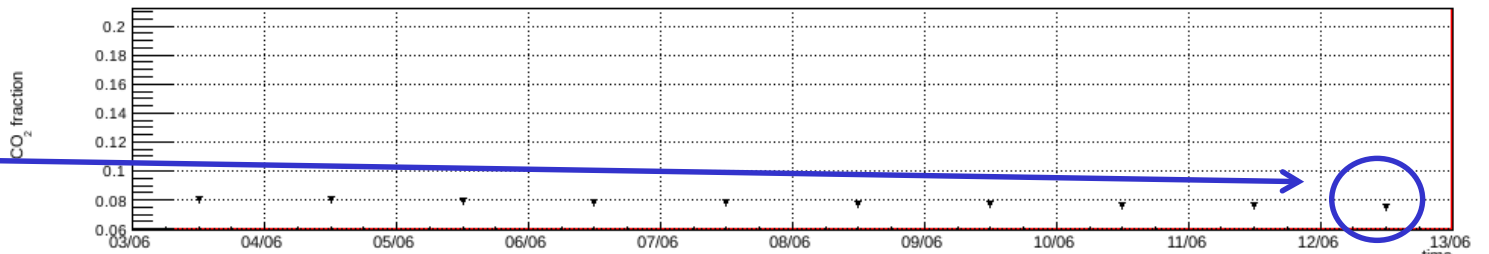
Xe @ 835 mbar,
(in TRD, calculated)



CO₂ @ 68 mbar,
(in TRD, calculated)



7.51% CO₂
(in TRD, calculated)



TRD Gas Refill - Preparation

Calculate the amount of gas to be filled using TRD-PressureMonitor

Example: 13th June 2013:

Refills - pressures are partial pressures in mixing vessel:

day	CO2 / bar	Xe / bar	fudge factor
14.03.2013	2.84	10.26	1.015
10.04.2013	3.21	10.44	1.0
10.04.2013	3.0	9.8	1.01
10.05.2013	2.858	10.142	1.0
10.05.2013	3.125	10.3	1.0
13.06.2013	3.0	10.9	1.0
13.06.2013	3.57	9.5	1.01

add row remove selected row save table compare

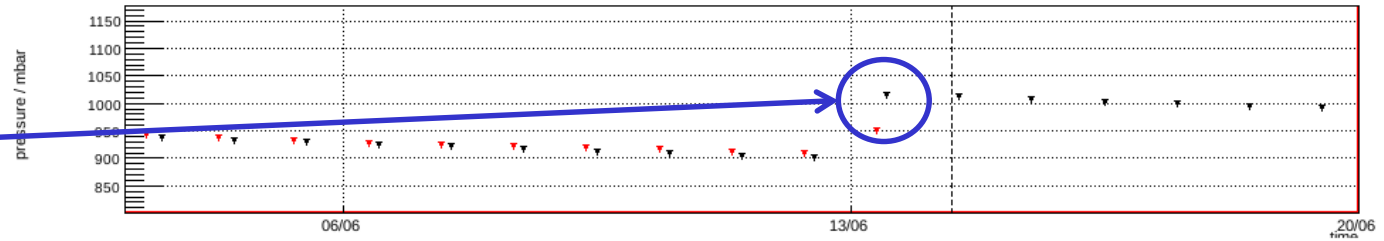
Date converter
 day of the year: 165 corresponding date: 14.06.2011

- Add two rows
- Edit rows to date of injections
- Edit CO₂ / Xe to target values (usually 3/10)
- Edit fudge factor to be 1.0 for first injection and 1.01 for second (to make black curve match red one)
- Save table
- Use updated predicted values (black points) in plots to find new partial pressures (like on previous slide for actual status)

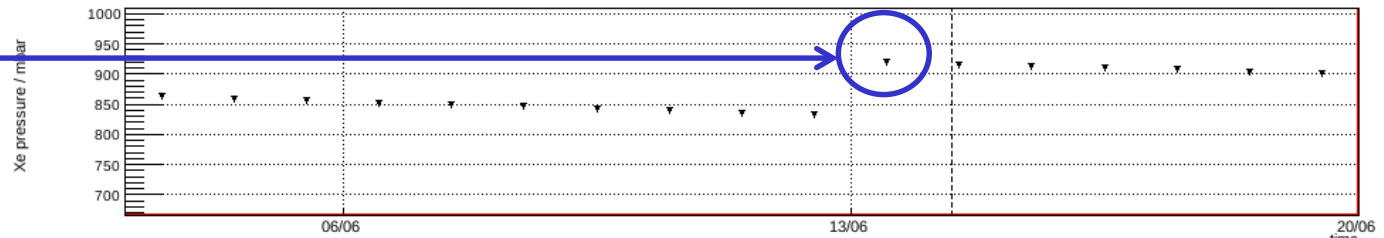
TRD Gas Refill - Preparation

Example: 13th June 2013: Use updated predicted values (black points) to find new partial pressures

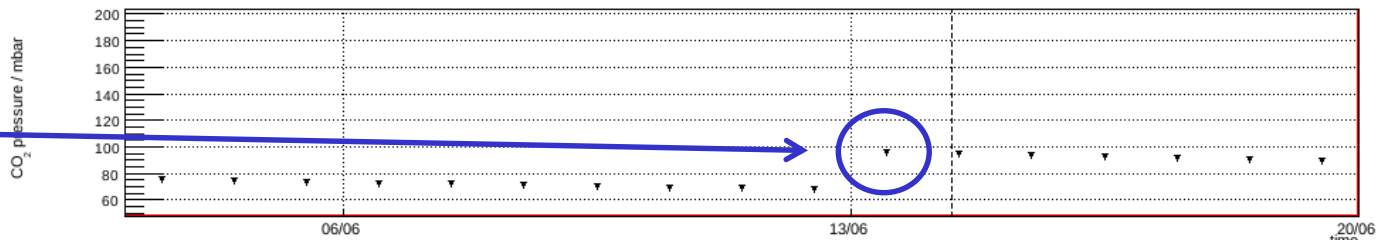
Predicted total pressure:
1019 mbar



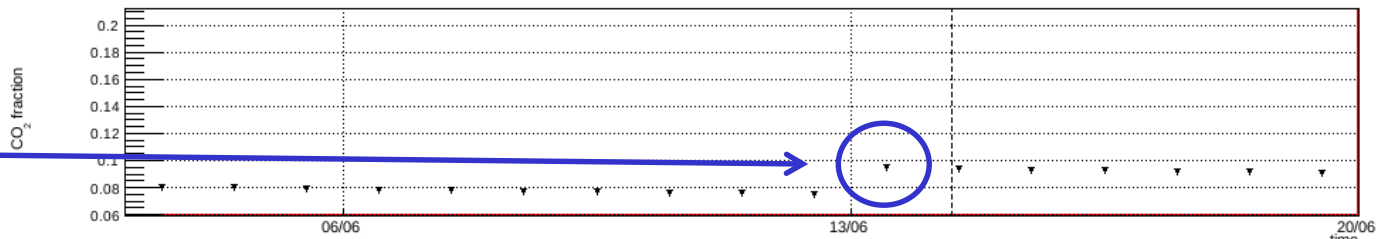
Xe @ 927 mbar,
(in TRD, calculated)



CO₂ @ 92 mbar,
(in TRD, calculated)



9.03% CO₂
(in TRD, calculated)



TRD-PressureMonitor: **Example:** 13th June 2013:

Total pressure in TRD 905 mbar @ 7.51% CO₂ (Xe @ 835 mbar, CO₂ @ 68 mbar)

- Using previous slide, find new partial pressures:
Xe @ 927 mbar, CO₂ @ 92 mbar → 1019 mbar @ 9.03 % CO₂ in TRD
- How to get the predicted values in TRDPressureMonitor Calculator:

For each injection:

$$\text{Xe} = \text{Fudge Factor} \cdot (\text{target } P_{\text{Xe}} - (\text{Xe-fraction} \cdot P_{\text{tot in } V_{\text{mix,Vess}} \text{ after injection}})) / (V_{\text{TRD}} + V_{\text{Mix,Vess}})$$

$$\text{Xe} = 1.15 (10000 \text{ mbar} - ((10/13) \cdot 1000 \text{ mbar})) / (230 + 1) \text{ L} = 46 \text{ mbar}$$

$$\text{CO}_2 = (\text{target CO}_2 \text{ pressure} - (\text{CO}_2\text{-fraction} \cdot P_{\text{tot in } V_{\text{mix,Vess}} \text{ after injection}})) / (V_{\text{TRD}} + V_{\text{Mix,Vess}})$$

$$\text{CO}_2 = (3000 \text{ mbar} - ((3/13) \cdot 1000 \text{ mbar})) / (230 + 1) \text{ L} = 12 \text{ mbar}$$

Amount to be transferred in 2 refills: Xe = (835 + 2 · 46) mbar = 92 mbar,

$$\text{CO}_2 = (68 + 2 \cdot 24) \text{ mbar} = 24 \text{ mbar}$$

TRD-PressureMonitor: **Example:** 13th June 2013:

- Get CO₂ fraction out of total pressure in mixing vessel after last refill:

CO₂ fraction = 23.3 % in V_{MixVes} (see page 4 of previous refill worksheet day 2)

Calculate rest partial pressures in V_{MixVes} before starting mixing

10th May 2013: Total pressure in V_{MixVes} = 1300 mbar (use TRDGas-M)

→ Xe: $1300 \text{ mbar} \cdot (1.0 - 0.233) = 997 \text{ mbar}$,

CO₂: $1300 \text{ mbar} \cdot 0.233 = 303 \text{ mbar}$

Want 10 bar of Xe and 3 bar CO₂ to be injected twice, so need to add,

13th June 2013:

Xe: $(10000 - 997) \text{ mbar} = 9003 \text{ mbar}$

CO₂: $(3000 - 303) \text{ mbar} = 2697 \text{ mbar}$

- If target values reached after first injection and end up with 1000 mbar in the mixing vessel, → Xe: $10/13 (1000 \text{ mbar}) = 769 \text{ mbar}$; CO₂: $3/13 (1000 \text{ mbar}) = 231 \text{ mbar}$

To reach again 10 / 3 ratio in the mixing vessel, the amount of Xe & CO₂ pressure:

Xe: $(10000 - 769) \text{ mbar} = 9231 \text{ mbar}$

CO₂: $(3000 - 231) \text{ mbar} = 2769 \text{ mbar}$

- In reality target values will never be reached, so after first injection recalculate everything using actual values. **Example:** 13th June 2013

Xe: $(997 + 9900) \text{ mbar} = 10897 \text{ mbar}$; CO₂: $(303 + 2700) \text{ mbar} = 3003 \text{ mbar}$

→ CO₂ fraction = 21.6 % and $P_{\text{MixVes}} = 1000 \text{ mbar}$

→ Xe: 784 mbar; CO₂: 216 mbar

Amount which was transferred to the TRD:

Xe = $1.15 (10897 \text{ mbar} - 784 \text{ mbar}) / (230 + 1) \text{ L} = 50 \text{ mbar}$

CO₂ = $(3003 \text{ mbar} - 216 \text{ mbar}) / (230 + 1) \text{ L} = 12 \text{ mbar}$

The goal was to transfer 10/3 + 10/3, in first mixing got 10.897/3.003 so for next injection it is needed:

Xe: $(20000 - 10897) \text{ mbar} = 9103 \text{ mbar}$

CO₂: $(6000 - 3003) \text{ mbar} = 2997 \text{ mbar}$

Since gas still remains in the mixing vessel, the amount to be added is:

Xe: $(9103 - 784) \text{ mbar} = 8319 \text{ mbar}$

CO₂: $(2997 - 216) \text{ mbar} = 2781 \text{ mbar}$

TRD Gas Refill - Preparation

- In reality target values will never be reached, so after 2nd injection re-calculate everything using actual values for record keeping purposes.

Example: 13th June 2013

Xe: (784 + 8700) mbar = 9484 mbar; CO₂: (216 + 3350) mbar = 3566 mbar

→ CO₂ fraction = 27.3 % and $P_{\text{MixVes}} = 1075$ mbar

→ Xe: 782 mbar; CO₂: 294 mbar

Amount which was transferred to the TRD:

Xe = $1.15 (9484 \text{ mbar} - 782 \text{ mbar}) / (230 + 1) \text{ L} = 43 \text{ mbar}$

CO₂ = $(3566 \text{ mbar} - 294 \text{ mbar}) / (230 + 1) \text{ L} = 14 \text{ mbar}$

So after both mixings/injections, the total amount in TRD was:

Xe: (835 + 50 + 43) mbar = 928 mbar

CO₂: (68 + 12 + 14) mbar = 94 mbar

→ 1022 mbar @ 9.2 % CO₂ total in the TRD



TRD Gas Refill - Preparation

The name of the text file you generated should look like this:

TRD_Refill_##_Day#.txt. Below, {filename} = ##_Day#

E.g. April 1 2014: TRD_Refill_26_Day1.txt

Transform the text file into postscript format with

```
trd@pcpoc25 yyyy_mm_dd $ ../refill2ps {filename}
```

Check the result with ghostview (is paging o.k.?)

```
trd@pcpoc25 yyyy_mm_dd $ gv TRD_Refill{filename}
```

Print the file and fill in where marked during the refill process.

On the following pages the actions are described, too.

If any deviation appears between the file TRD_Refill{filename} and this description, call expert.

If no expert is available stick to the file TRD_Refill{filename}.

TRD-Gas: Preparation of Gas Refill

Requirements:

TRD-SidePanel and Box-C Temperature > 5°C

| TXe vessel - Tmix vessel | < 5 degrees C

(Note: TXe vessel is plot 90, red/magenta, Tmix vessel is plot 94, brown)

Call Thorsten (phone ##s on pg. 2)

Step 0:

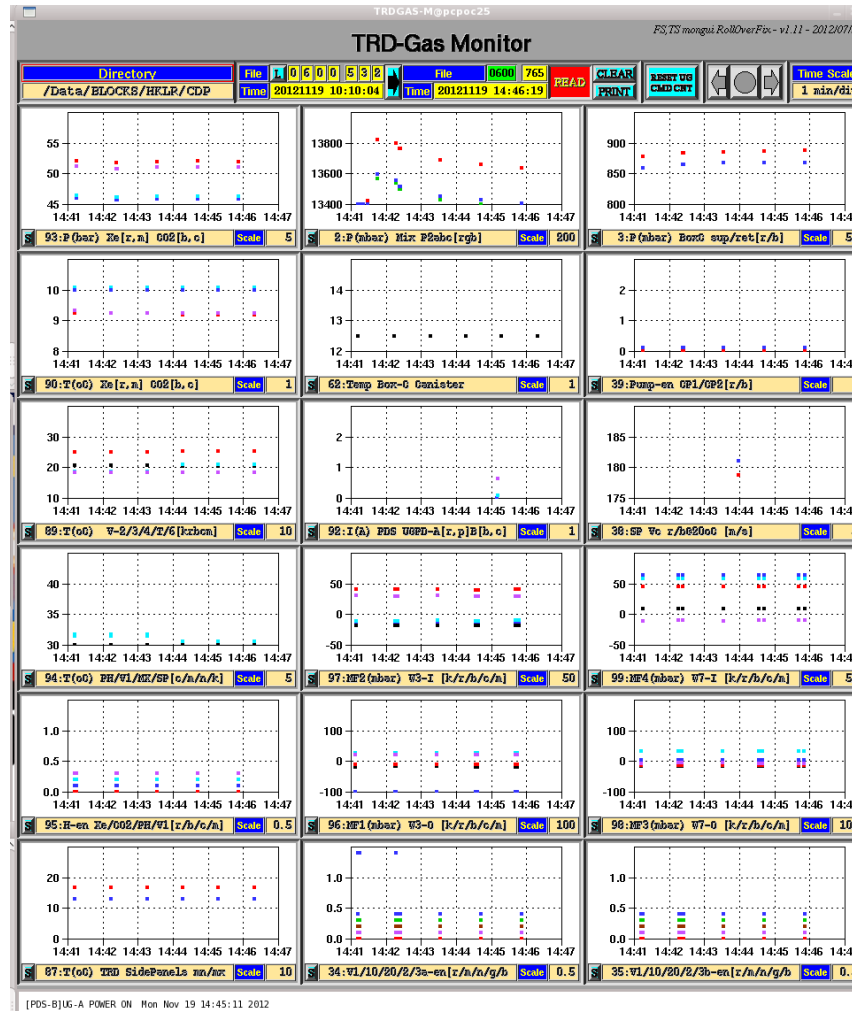
- Prepare Commanding for TRDGAS from GUI (TRDGAS-C)
 - `[trd@pcppc24 example_dir] cd ~/RUN`
 - `[trd@pcppc24 example_dir] Gas_Refill_Start.sh`
 - **DO NOT TOUCH THE MOUSE OR KEYBOARD UNTIL IT'S FINISHED!!!**

This will start all the programs you need. However, the next few pages show the individual commands in case something fails.

- Start TRDGAS-M with option "C" ("C" forces command file replies to ~/RUN/OUTPUT/TRDGAS-M/UGcmdLog/UnixTime_CmdFile.log)

• `trd@pcpoc25 RUN$ TRDGAS-M-GasRefill C`

Check (ls -l) that TRDGAS-M-GasRefill is writing CmdFile replies to ~/RUN/OUTPUT/TRDGAS-M/UGcmdLog/UnixTime_CmdFile.log



TRD Gas Refill – Step 0

Start TRDGAS-C:

```
trd@pcpoc25 ~$ cd RUN
```

```
trd@pcpoc25 RUN$ set-command-path eas:hosc feplr
```

```
trd@pcpoc25 TRDGAS$ TRDGAS-C eas:hosc feplr
```

Ask LEAD to get commanding from TRD station for TRD refill

Check command path

Set UG-Side to A

Interface	Server	Timeout [s]	Side [A/B]
eas:hosc	feplr	Default	a



TRD Gas Refill – Step 0

TRD-Gas: Preparation of Gas Refill

Prepare 4 terminals for commanding and monitoring

1st terminal (this terminal is used for commanding you need to do during refill):

```
trd@pcpoc25 ~$ cd ~/COMMANDING/TRDGAS/
```

2nd terminal (to watch all commands sent to JMDC affiliated with the refill):

```
trd@pcpoc25 ~$ cd ~/COMMANDING/TRDGAS/
```

```
trd@pcpoc25 TRDGAS$ cmds_mon -m hosc | grep "TAG:F7A"
```

3rd terminal (to watch all ground commands sent to JMDC):

```
trd@pcpoc25 ~$ cd ~/COMMANDING/TRDGAS/
```

```
trd@pcpoc25 TRDGAS$ cmds_mon -m hosc -g
```

4th terminal (to watch for replies):

```
trd@pcpoc25 ~$ cd ~/COMMANDING/TRDGAS/
```

```
trd@pcpoc25 TRDGAS$ tail -f ~/RUN/OUTPUT/TRDGAS-M/UGcmdLog/UnixTime_CmdFile.log
```




TRD Gas Refill: Screenshot right screen



TRDGas Operation

COMMAND PATH: Interface: Server: Timeout: Side: A/B

ess:hosc Fep1r Default a

FLIPPER VALVES: CLOSE OPEN AC OPEN BD

PUMP: ID Speed START STOP

HEAT: VESSELS MIXING OFF

CO2 LINE OPEN: V1B V2B V3B

XE LINE OPEN: V1A V2A V3A

MIX: 1 SHOT CO2 1 SHOT Xe Transfer MIX Disable MV

VENT: MIX Box-C Xe CO2

1st terminal: workspace

```

00 00 00 00 0A 42 9F 02 07 00 00 00 00 1F 40 00 09 0F 54 00 00 8F C8 F
00 0F 54 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 0A
00 00 00 00 0E 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 0E 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 0F 5 07 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 06
09 0F 54 00 0E 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 09
00 00 00 CD 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 C8 48 00 E
ST: [0] R0 W NA=00F DT=1F0591 DC=0 Tag=0785 Err=0000
0F54 0000 00C8 C000 0000 0009 0F54 0000 0081 4F00 0000 0009 0F54 0000 00
00 0000 0009 0F54 0000 0088 4820 0000 0009 0F54 0000 0088 4000 0000 0009 0
000 00C5 4853 0000 0009 0F54 0000 008F C8FE 0000 008A 429F 0207 0000 0000
0009 0F54 0000 00CE C000 0000 0009 0F54 0000 0089 C000 0000 0009 0F54 0000
C000 0000 000A 429F 0207 0000 0000 03E8 0009 0F54 0000 008F C8FE 0000 0000
F 0207 0000 0000 0064 0009 0F54 0000 00CE C000 0000 0009 0F54 0000 0089 C0
00 0009 0F54 0000 00CD C000 0000 000A 429F 0207 0000 0000 07D0 0009 0F54 0
08F C8FE 0000 000A 429F 0207 0000 0000 0064 0009 0F54 0000 00CE C000 0000
0F54 0000 0089 C000 0000 0009 0F54 0000 00CD C000 0000 000A 429F 0207 0000
0FA0 0009 0F54 0000 008F C8FE 0000 000A 429F 0207 0000 0000 0064 0009 0F5
0 00CE C000 0000 0009 0F54 0000 0089 C000 0000 0009 0F54 0000 00CD C000 00
0A 429F 0207 0000 0000 1F40 0009 0F54 0000 008F C8FE 0000 000A 429F 0207 0
000 0064 0009 0F54 0000 00CE C000 0000 0009 0F54 0000 0089 C000 0000 0009
0000 00CD C000 0000 000A 429F 0207 0000 0000 3E80 0009 0F54 0000 008F C8FE
000A 429F 0207 0000 0000 0064 0009 0F54 0000 00CE C000 0000 0009 0F54 000
0 C000 0000 0009 0F54 0000 00CD C000 0000 000A 429F 0207 0000 0000 7D00 00
0A 429F 0207 0000 0000 0064 0009 0F54 0000 00CE C000 0000 0009 0F54 0000
0009 0F54 0000 0089 C000 0000 0009 0F54 0000 00CD C000 0000 0009 0F54
0088 4000 0000 0009 0F54 0000 00C8 4800 0000 0009 0F54 0000 0088 4000 0000
[0] RP W NA=00F DT=1F0591 DC=0 Tag=0785 Err=0000
pcpoc25 TRDGAS] $

```

2nd terminal: ground to JMDC

```

home/trd/RUN
DT=14 DC=9 } Exec LeCroy
DT=1F0207 DC=0 } JMDC Wait
TAG: F7A } [RP W NA=00F=JMDC-3 DT=1F0207 DC=0 } JMDC Wait
TAG: F7A } [RP R NA=078-USCH-UG-A DT=14 DC=9 } Exec LeCroy
TAG: F7A } [RP W NA=00F=JMDC-3 DT=1F0207 DC=0 } JMDC Wait
TAG: F7A } [RP R NA=078-USCH-UG-A DT=14 DC=9 } Exec LeCroy
TAG: F7A } [RP R NA=078-USCH-UG-A DT=14 DC=9 } Exec LeCroy
TAG: F7A } [RP R NA=078-USCH-UG-A DT=14 DC=9 } Exec LeCroy
TAG: F7A } [RP R NA=078-USCH-UG-A DT=14 DC=9 } Exec LeCroy
TAG: F7A } [RP W NA=00F=JMDC-3 DT=1F0207 DC=0 } JMDC Wait
TAG: F7A } [RP R NA=078-USCH-UG-A DT=14 DC=9 } Exec LeCroy
TAG: F7A } [RP R NA=00F=JMDC-3 DT=1F0207 DC=0 } JMDC Wait

```

3rd terminal: JMDC executes

```

trd@pcpoc25/nfs_mnt/pocchome/trd
-- sub: [11-19(324) 14:19:25] GRND: [STS:OK TAG:290] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:19:39] GRND: [STS:OK TAG:289] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:21:06] GRND: [STS:OK TAG:290] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:22:49] GRND: [STS:OK TAG:289] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:24:26] GRND: [STS:OK TAG:290] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:27:31] GRND: [STS:OK TAG:289] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:27:43] GRND: [STS:OK TAG:290] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:27:57] GRND: [STS:OK TAG:289] [RP R NA=00F=JMDC-3 DT=1F0631 DC=4 } DAQ Procedure Status
[11-19(324) 14:28:17] GRND: [STS:OK TAG:72B] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:28:17] GRND: [STS:OK TAG:493] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:29:54] GRND: [STS:OK TAG:431] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:32:15] GRND: [STS:OK TAG:58F] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:35:08] GRND: [STS:OK TAG:287] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:36:41] GRND: [STS:OK TAG:63C] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:37:54] GRND: [STS:OK TAG:23C] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:39:02] GRND: [STS:OK TAG:785] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)
[11-19(324) 14:41:12] GRND: [STS:OK TAG:785] [RP W NA=00F=JMDC-3 DT=1F0591 DC=0 } (Block as Command File)

```

4th terminal: replies (the ones you'll be counting)

```

trd@pcpoc25/nfs_mnt/pocchome/trd
36 12-11-19 14:41:29 0F7A USCH-UG-A R 14 LeCroy 00 R UGBS Read_P2c 3317 mV
37 12-11-19 14:41:29 0F7A MNC 3 W 1F0207 Wait n/a
38 12-11-19 14:41:45 0F7
39 12-11-19 14:41:45 0F7
40 12-11-19 14:41:45 0F7
41 12-11-19 14:41:45 0F7
42 12-11-19 14:41:45 0F7
43 12-11-19 14:42:17 0F7
44 12-11-19 14:42:17 0F7
45 12-11-19 14:42:17 0F7
46 12-11-19 14:42:17 0F7A USCH-UG-A R 14 LeCroy 00 R UGBS Read_P2c 3370 mV
47 12-11-19 14:42:17 0F7A USCH-UG-A R 14 LeCroy 00 R UGBS Read_P2b 3402 mV
48 12-11-19 14:42:17 0F7A USCH-UG-A R 14 LeCroy 00 R UGBS Read_P2c 2000
49 12-11-19 14:42:17 0F7A USCH-UG-A R 14 LeCroy 00 R UGBS MVenable 0000
50 12-11-19 14:42:17 0F7A USCH-UG-A R 14 LeCroy 00 W UGBS MVenable 0000
51 12-11-19 14:42:17 0F7A USCH-UG-A R 14 LeCroy 00 R UGBS MVenable 0000

```

TRD-Gas Monitor

Directory: /Data/ELOCRES/HLR/CDP

File: 0600 765

Time: 20121119 10:10:04

Time: 20121119 14:46:19

Time Scale: 1 min/div

93: P(bar) Xe[r,n] CO2[b,c] Scale 5

2: P(mbar) Mix P2abc[r/gb] Scale 200

3: P(mbar) BorC sup/ret[r/b] Scale 50

90: T(°C) Xe[r,n] CO2[b,c] Scale 1

62: Temp BorC Canister Scale 1

39: Pump-en GP1/GP2[r/b] Scale 1

89: T(°C) V-2/3/4/T/6[kzbcn] Scale 10

92: I(A) PDS UGPD-A[r,p]B[b,c] Scale 1

38: SP Vc r/b02000 [m/s] Scale 5

94: T(°C) PR/V1/VR/SP [c/m/n/k] Scale 5

97: MP2(mbar) W3-I [k/r/b/c/n] Scale 50

99: MP4(mbar) W7-I [k/r/b/c/n] Scale 50

95: R-en Xe/CO2/PR/V1[r/b/c/n] Scale 0.5

96: MP1(mbar) W3-0 [k/r/b/c/n] Scale 100

98: MP3(mbar) W7-0 [k/r/b/c/n] Scale 100

87: T(°C) TRD SidePannels mn/nx Scale 10

34: V1/10/20/2/3a-en[r/n/n/g/b] Scale 0.5

35: V1/10/20/2/3b-en[r/n/n/g/b] Scale 0.5

[PDS-B]UG-A POWER On Mon Nov 19 14:45:11 2012



TRD Gas Refill – Step 0

Continue Step 0: Open AOSLOS monitor on left-hand screen:

- To start the AOSLOS monitor:

```
cd ~/RUN
```

```
trd@pcpoc25 RUN$ AOSLOS-OPTIMIS eas:hosc feplr
```

AOSLOS - OPTIMIS Controller

Server Info: HOSC Time: 2015/349:12:51:15, Commanding: ENABLED

Key Data for AMS		Message Type 9		Message Type 7		Command Statistics	
Commanding	ENA	Clear To Send	GAR	Non EHS Enablement	YES	AMS Block Cnt	5
ERIS Connection	YES	GAR Enabled	YES	Remote Enablement	YES	NASA Cmd Cnt	5
CDP Connection	YES	FSV Enabled	YES	POIC Connection	YES	AMS Blocks Queued	0
Activity	Flight	CRRenabled	YES	POIC Enablement	YES	CDP Cnt	196109
Message Time		CMD Delay ms	125	MCC Connection	YES	GSE Cnt	0
Coarse	349 12:51:16	GAR Timeout ms	30	MCC Enablement	YES	HK Cnt	19249
Fine	00000000	FSV Timeout ms	30	Uplink Path	S-Band High Rate (GCS)	HOSC Cmd Errors	0
		Retries	3	AOS	YES		
				ISS Mode	Standard		

AOSLOS Table (from OPTIMIS)					
Band	AOS/LOS	Begin	Duration	Time Left	Status
S	AOS	2015/349:13:23:00	00:46:43	-00:31:44	AOS
	LOS	2015/349:13:22:40	00:00:20	-00:31:24	
Ku	AOS	2015/349:13:23:00	00:42:38	-00:31:44	AOS
	LOS	2015/349:13:22:40	00:00:20	-00:31:24	

Year: 2015 Day: 349

Buttons: GET AOSLOS TABLE FROM NASA, CHECK AOSLOS TABLE, GET AOSLOS TABLE FROM A FILE

Time Based TQ-List

START	STOP	R	GET SHORT TQ-LIST	GET LONG TQ-LIST	Items from AOSLOS table	first	PB ON	PB OFF	WRITE
					10	10	0	0	



TRD Gas Refill – Step 0

Click until you have the proper year and GMT day and click [GET AOSLOS TABLE]

If you have ANY kind of LOS (KU band or S band) as indicated by the RED squares.

Do not send commands for the gas refill.

Once you have the proper table loaded:
MOVE THE AOSLOS Controller **DOWN** in the desktop until just the top half is visible to **AVOID PUSHING EXTRA BUTTONS! THIS WOULD BE VERY BAD!!!**

AOSLOS-OPTIMIS@pcpoc25 via EAS:HOSC@feplr:61010 A.Lebedev 12-Dec-15

AOSLOS - OPTIMIS Controller

Addr		Name	
00F	JMDG-3		

Server Info

HOSC Time	2015/349:12:51:15	Commanding	ENABLED
------------------	-------------------	-------------------	---------

Key Data for AMS		Message Type 9		Message Type 7		Command Statistics	
Commanding	ENA	Clear To Send	CAR	Non EHS Enablement	YES	AMS Block Cnt	5
EHIS Connection	YES	CAR Enabled	YES	Remote Enablement	YES	NASA Cmd Cnt	5
CDP Connection	YES	FSV Enabled	YES	POIC Connection	YES	AMS Blocks Queued	0
Activity	Flight	CRRenabled	YES	POIC Enablement	YES	CDP Cnt	196189
Message Time		CMD Delay,ms	125	MCC Connection	YES	GSE Cnt	0
Coarse	349.12:51:16	CAR Timeout,ms	30	MCC Enablement	YES	HK Cnt	19249
Fine	00000000	FSV Timeout,ms	30	UpLink Path	S-Band High Rate (GCS)	HOSC Cmd Errors	0
		Retries	3	AOS	YES		
				ISS Mode	Standard		

AOSLOS Table (from OPTIMIS)

Band	AOS/LOS	Begin	Duration	Time Left	Status
S	AOS	2015/349:13:23:00	00:46:43	-00:31:44	AOS
	LOS	2015/349:13:22:40	00:00:20	-00:31:24	AOS
Ku	AOS	2015/349:13:23:00	00:42:38	-00:31:44	AOS
	LOS	2015/349:13:22:40	00:00:20	-00:31:24	AOS

```

0: 2015/348 23:29:36-2015/349 00:10:40 = 20151214 23:29:36-20151215 00:10:40 = 00:41:04 TDRS=171
1: 2015/349 00:11:00-2015/349 00:53:33 = 20151215 00:11:00-20151215 00:53:33 = 00:42:33 TDRS=041
2: 2015/349 01:06:23-2015/349 01:11:10 = 20151215 01:06:23-20151215 01:11:10 = 00:04:47 TDRS=171
3: 2015/349 01:12:33-2015/349 01:49:40 = 20151215 01:12:33-20151215 01:49:40 = 00:37:07 TDRS=171
4: 2015/349 01:50:00-2015/349 02:36:48 = 20151215 01:50:00-20151215 02:36:48 = 00:46:48 TDRS=041
5: 2015/349 02:49:47-2015/349 03:24:40 = 20151215 02:49:47-20151215 03:24:40 = 00:34:53 TDRS=171
6: 2015/349 03:25:00-2015/349 04:10:31 = 20151215 03:25:00-20151215 04:10:31 = 00:45:31 TDRS=041
7: 2015/349 04:26:53-2015/349 04:28:14 = 20151215 04:26:53-20151215 04:28:14 = 00:01:21 TDRS=171
8: 2015/349 04:30:01-2015/349 04:39:26 = 20151215 04:30:01-20151215 04:39:26 = 00:09:25 TDRS=171
9: 2015/349 04:44:17-2015/349 04:45:24 = 20151215 04:44:17-20151215 04:45:24 = 00:01:07 TDRS=171
10: 2015/349 04:48:37-2015/349 04:51:02 = 20151215 04:48:37-20151215 04:51:02 = 00:02:25 TDRS=171
11: 2015/349 04:53:17-2015/349 04:58:00 = 20151215 04:53:17-20151215 04:58:00 = 00:04:43 TDRS=171
12: 2015/349 05:02:09-2015/349 05:48:46 = 20151215 05:02:09-20151215 05:48:46 = 00:46:37 TDRS=041
13: 2015/349 06:12:50-2015/349 06:48:40 = 20151215 06:12:50-20151215 06:48:40 = 00:35:50 TDRS=171
14: 2015/349 06:49:00-2015/349 07:28:06 = 20151215 06:49:00-20151215 07:28:06 = 00:39:06 TDRS=041
15: 2015/349 07:49:58-2015/349 07:53:12 = 20151215 07:49:58-20151215 07:53:12 = 00:03:14 TDRS=171
16: 2015/349 07:53:57-2015/349 08:10:40 = 20151215 07:53:57-20151215 08:10:40 = 00:36:43 TDRS=171
17: 2015/349 08:31:00-2015/349 09:11:48 = 20151215 08:31:00-20151215 09:11:48 = 00:40:48 TDRS=041
18: 2015/349 09:26:20-2015/349 10:04:40 = 20151215 09:26:20-20151215 10:04:40 = 00:38:20 TDRS=171
19: 2015/349 10:05:00-2015/349 10:52:48 = 20151215 10:05:00-20151215 10:52:48 = 00:47:48 TDRS=041

```

Year	2015	Day	349	GET AOSLOS TABLE FROM NASA	CHECK AOSLOS TABLE
GET AOSLOS TABLE FROM A FILE					

Time Based TQ-List

START	STOP	R	GET SHORT TQ-LIST	GET LONG TQ-LIST	Items from AOSLOS table	first	PB ON	PB OFF	WRITE
					10		0	0	



TRD Gas Refill – Step 1

Step 1: Heat PreHeater to prepare gas-mixing

Requirement: +35°C for Mixing Operation to satisfy NASA safety thermal interlock implemented in USCM-UG

(if temperature falls below +35°C, commands will fail with a reply that says ABORT)

PreHeater temperature limited to +54°C by thermostats

Time to reach +35°C from +20°C is approx. 30 minutes

Heat during steps 2-6 to reduce overall time for operations

TRD Gas Refill – Step 1

Step 1: Heat PreHeater to prepare gas-mixing

TRDGAS-C: Switch on Heaters for Mixing

4th terminal: UGcmdLog: Check for 9 replies in 1s

TRDGAS-M: Reset UG CMD CNT after 9 replies

94: Temp. PH & V1 (cyan/magenta) rise from ambient

95: H-En PH & V1 from 0 to 1

TRDGAS-C@pcpoc25 via EAS:HOSC@feplr:61010 FS, CC - v1.12 - 2013/12/06

TRDGas Operation

COMMAND PATH	Interface	Server	Timeout [s]	Side [A/B]
	eas:hosc	feplr	Default	a

FLAPPER VALVES: CLOSE, OPEN AC, OPEN BD

PUMP: ID: GEE, Speed: h, START, STOP

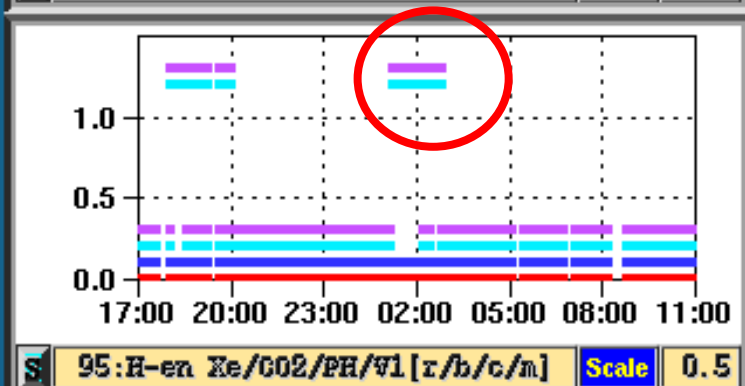
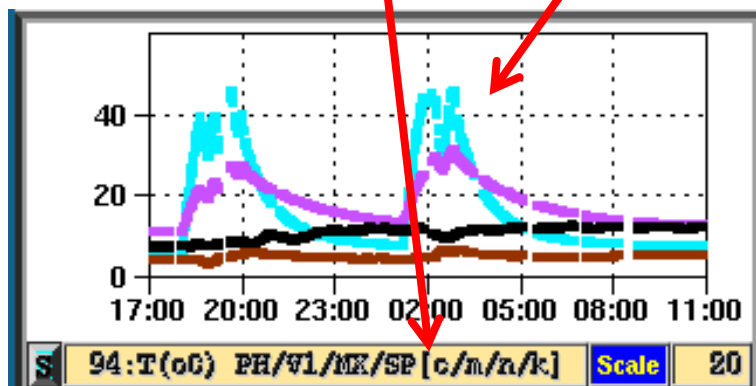
HEAT: VESSELS, MIXING, OFF

CO2 LINE OPEN	t[s]	V1B	t[s]	V2B	t[s]	V3B
	2		2	60		

XE LINE OPEN	t[s]	V1A	t[s]	V2A	t[s]	V3A
	2		n/a	60		

MIX: 1 SHOT CO2, 1 SHOT Xe, Transfer MIX, Disable MV

VENT: MIX, Box-C, Xe, CO2



AS-M@pcposp0 (on pcposp0) FS, TS 08-Jul-20

TRD-Gas Monitor

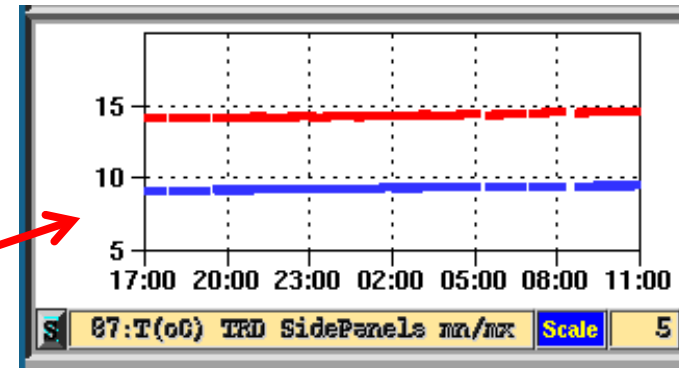
6 File 0062 290 READ CLEAR RESET UG CMD CNT Time Scale 3 h/div

59 Time 20110707 08:01:37 PRINT

Step 2-5: Assure that Flipper Valves are open:
(Flipper valves see p. 73-76, TRD-ACC-TAS-Shifterguide)

Step 2: Open AC Flipper Valves

TRDGAS-M: 87: TRD SidePanel Temperatures > 0°C



TRDGAS-C: FLIPPER VALVES: [OPEN AC]

4th terminal:

UGcmdLog: Check for 77 replies in 6s

and TRDGAS-M: Reset UG CMD CNT

TRD Gas Operation FS, CC - v1.12 - 2013/12/06

Interface	Server	Timeout [s]	Side [A/B]
eas:hosc	feplr	Default	a

FLIPPER VALVES CLOSE OPEN AC OPEN BD

PUMP ID: GP2 Speed: h START STOP

HEAT VESSELS MIXING OFF

CO2 LINE OPEN	t [s]	V1B	t [s]	V2B	t [s]	V3B
	2		2	60		

XE LINE OPEN	t [s]	V1A	t [s]	V2A	t [s]	V3A
	2		n/a	60		

MIX 1 SHOT CO2 1 SHOT Xe Transfer MIX Disable MV

VENT MIX Box-C Xe CO2

TRDGAS-M@pcposp0 (on pcposp0) FS, TS 08-Jul-2011

TRD-Gas Monitor

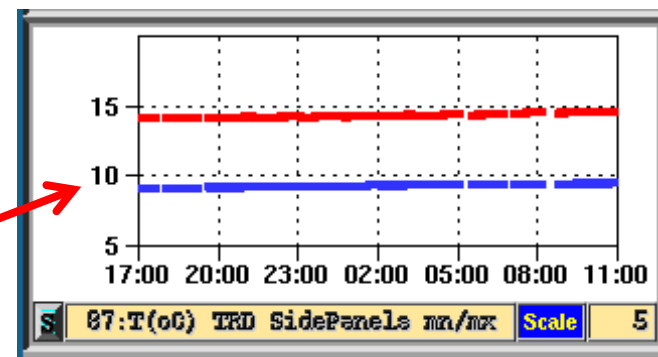
1 7 6 File 0062 290 READ CLEAR RESET UG CMD CNT Time Scale 3 h/div

01:59 Time 20110707 08:01:37 READ PRINT

Step 3: Open BD Flipper Valves

(Flipper valves see p. 73-76, TRD-ACC-TAS-Shifterguide)

TRDGAS-M: 87: TRD SidePanel Temperatures > 0°C



TRDGAS-C: FLIPPER VALVES: [OPEN BD]

4th terminal:

UGcmdLog: Check for 77 replies in 6s

and TRDGAS-M: Reset UG CMD CNT

TRD Gas Operation FS, CC - v1.12 - 2013/12/06

COMMAND PATH	Interface	Server	Timeout [s]	Side [A/B]
	eas:hosc	feplr	Default	a

FLIPPER VALVES	CLOSE	OPEN AC	OPEN BD

PUMP	ID	Speed	START	STOP
	GP2	h		

HEAT	VESSELS	MIXING	OFF

CO2 LINE OPEN	t[s]	V1B	t[s]	V2B	t[s]	V3B
	2		2	60		

XE LINE OPEN	t[s]	V1A	t[s]	V2A	t[s]	V3A
	2		n/a	60		

MIX	1 SHOT CO2	1 SHOT Xe	Transfer MIX	Disable MV

VENT	MIX	Box-C	Xe	CO2

TRD-Gas Monitor FS, TS 08-Jul-2011

File	0062	290	READ	CLEAR PRINT	RESET UG CMD CNT	Time Scale
01:59	20110707	08:01:37				3 h/div



TRD Gas Refill – Step 4

Step 4: Start Circulating Gas to verify all FVs are open

TRDGAS-M: 94: Spiro Temperature > +5°C

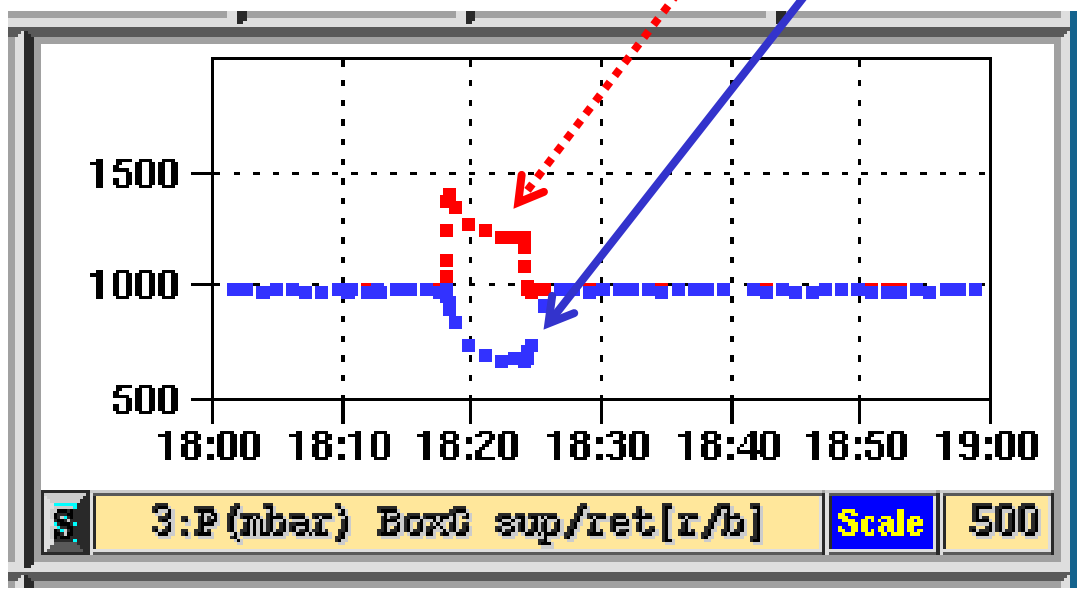
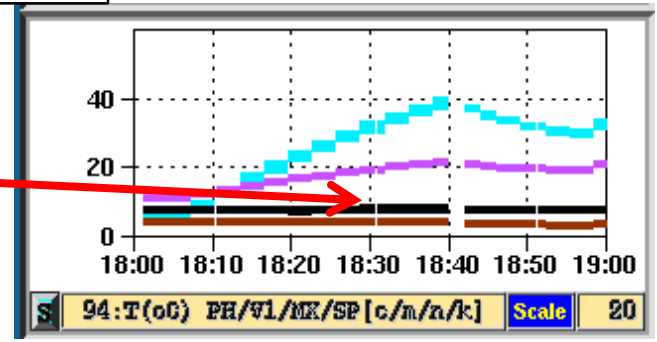
TRDGAS-C: PUMP: {CP2} {h} [START]

(Pump @ Half Speed)

4th terminal: UGcmdLog: Check for 58 replies in 20s

TRDGAS-M: Reset UG CMD CNT

- 3: Psup increase by 250 mbar
- 3: Pret decrease by 250 mbar



TRDGAS-C@pcpoc25 via EAS:HOSC@feplr:61010

TRDGas Operation

FS, CC - v1.12 - 2013/12/05

COMMAND PATH	Interface	Server	Timeout [s]	Side [A/B]
	eas:hosc	feplr	Default	a

FLIPPER VALVES: CLOSE, OPEN AC, OPEN BD

PUMP: CP2, h, START, STOP

HEAT, VESSELS, MIXING, OFF

CO2 LINE OPEN	t [s]	V1B	t [s]	V2B	t [s]	V3B
	2		2		60	

XE LINE OPEN	t [s]	V1A	t [s]	V2A	t [s]	V3A
	2		n/a		60	

MIX: 1 SHOT CO2, 1 SHOT Xe, Transfer MIX, Disable MV

VENT: MIX, Box-C, Xe, CO2

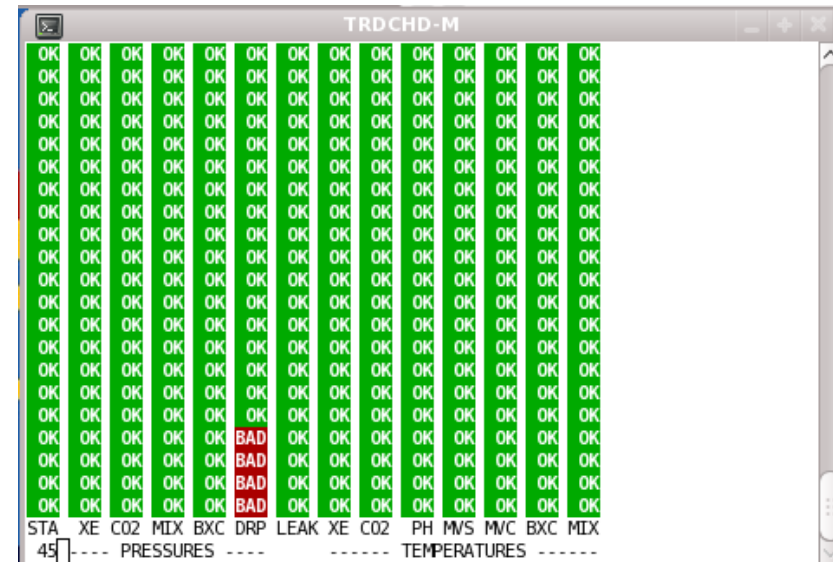
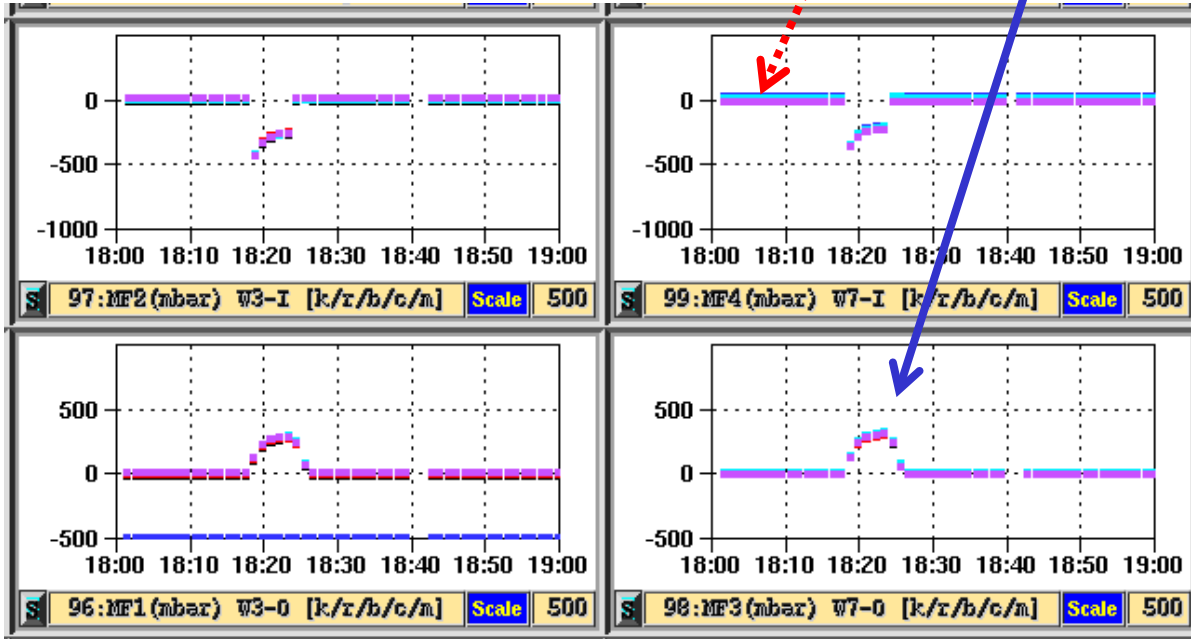
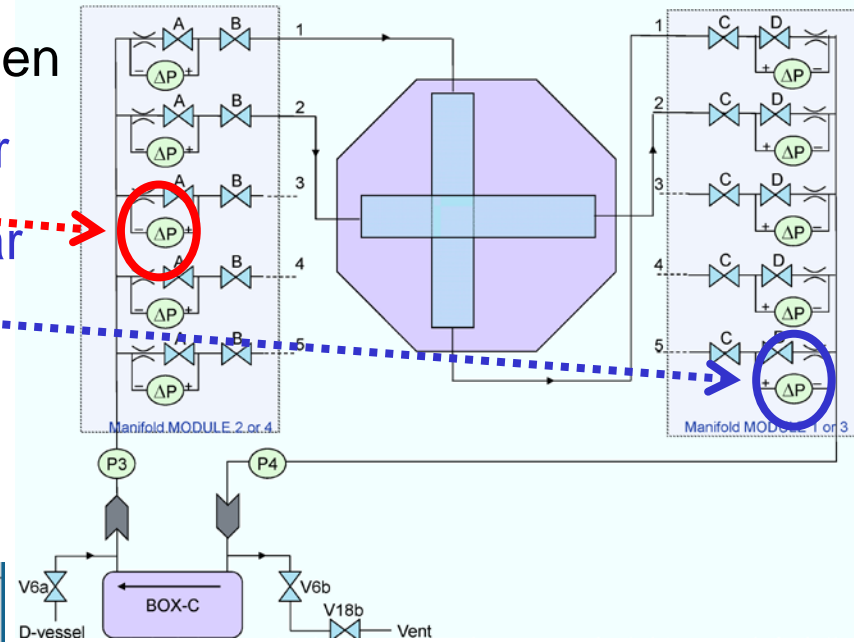
Step 4: Start Circulating Gas to verify all FVs are open

TRDGAS-M: 97, 99: Inlet MFdPs drop to -250 mbar

96, 98: Outlet MFdPs rise to +300 mbar

Wait until pressure stable (5-10 minutes)

TRDCHD-M: DRP will turn red "bad" until
pressure stable





TRD Gas Refill – Step 5

Step 5: Stop Circulating Gas

TRDGAS-C: PUMP: [STOP]

4th terminal:

UGcmdLog: Check for 60 replies in 20s

TRDGAS-M: Reset UG CMD CNT

3: Psup, Pret back to values before pumping

96, 97, 98, 99: all MFdPs back to 0 (± 50) mbar

TRDCHD-M: DRP will turn red "bad" until

pressure stable

TRDGAS-C@pcpoc25 via EAS:HOSC@feplr:61010

TRDGas Operation

FS, CC - v1.12 - 2013/12/06

COMMAND PATH	Interface	Server	Timeout [s]	Side [A/B]
	eas:hosc	feplr	Default	a

FLIPPER VALVES	CLOSE	OPEN AC	OPEN BD
----------------	-------	---------	---------

PUMP	ID	Speed	START	STOP
	GP2	h		

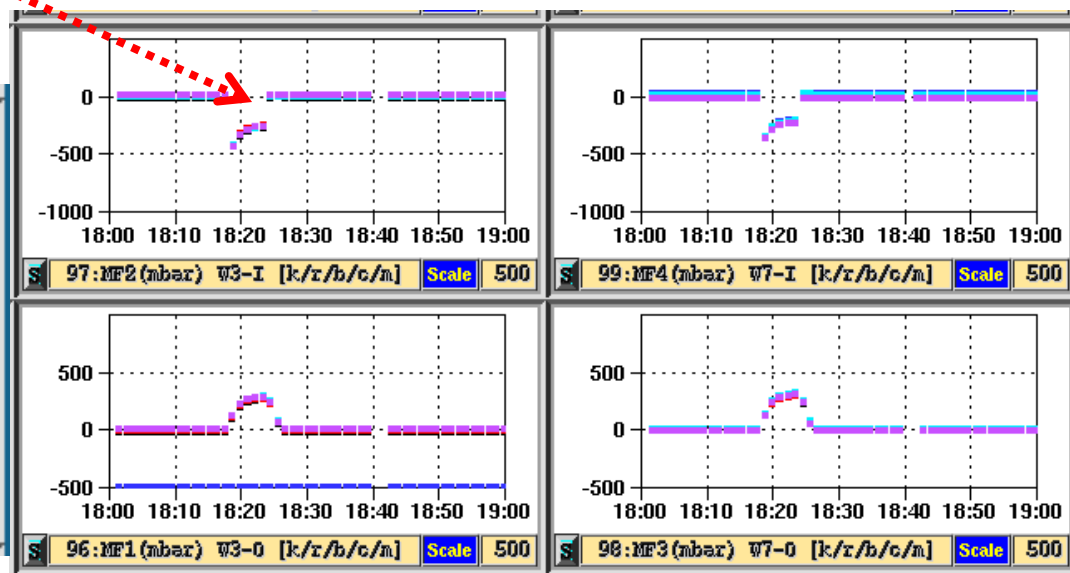
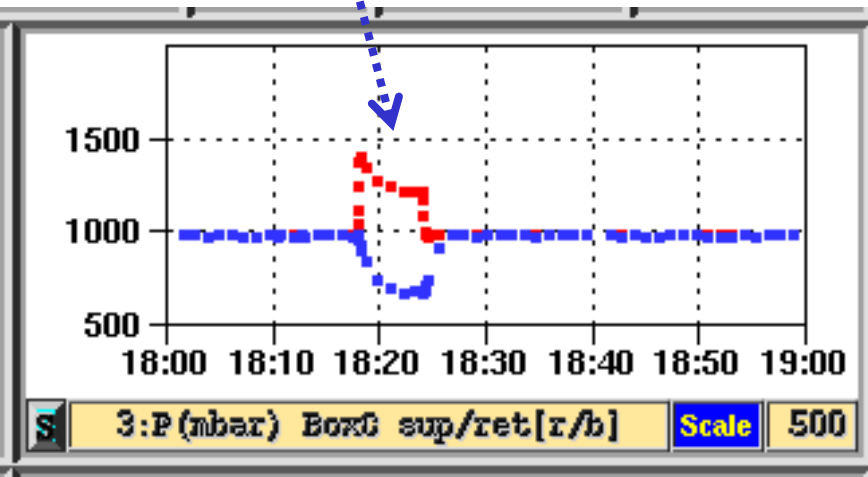
HEAT	VESSELS	MIXING	OFF
------	---------	--------	-----

CO2 LINE OPEN	t[s]	V1B	t[s]	V2B	t[s]	V3B
	2		2	60		

XE LINE OPEN	t[s]	V1A	t[s]	V2A	t[s]	V3A
	2		n/a	60		

MIX	1 SHOT CO2	1 SHOT Xe	Transfer MIX	Disable MV
-----	------------	-----------	--------------	------------

VENT	MIX	Box-C	Xe	CO2
------	-----	-------	----	-----





TRD Gas Refill – Step 6

Step 6: Heaters for Mixing

If Temp.PH has dropped below 35 DegC

Heater ON: TRDGAS-C: HEAT: [MIXING]

UGcmdLog: Check for 9 replies in 1s

Heater OFF: TRDGAS-C: HEAT: [OFF]

UGcmdLog: Check for 3 replies in 1s

TRDGAS-M: Reset UG CMD CNT

ON: 95: H-En PH & V1 from 0 to 1

94: Temperatures PH & V1 rise

OFF: 95: H-En PH & V1 from 1 to 0

94: Temperatures PH & V1 drop

TRDGAS-C@pcpoc25 via EAS:HOSC@feplr:61010 FS, CC - v1.12 - 2013/12/06

TRDGas Operation

COMMAND PATH	Interface	Server	Timeout [s]	Side [A/B]
	eas:hosc	feplr	Default	a

FLIPPER VALVES: CLOSE, OPEN AC, OPEN BD

PUMP: ID (GP2), Speed (h), START, STOP

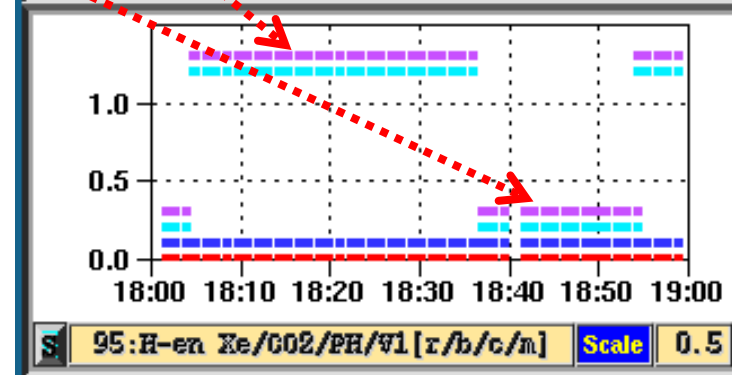
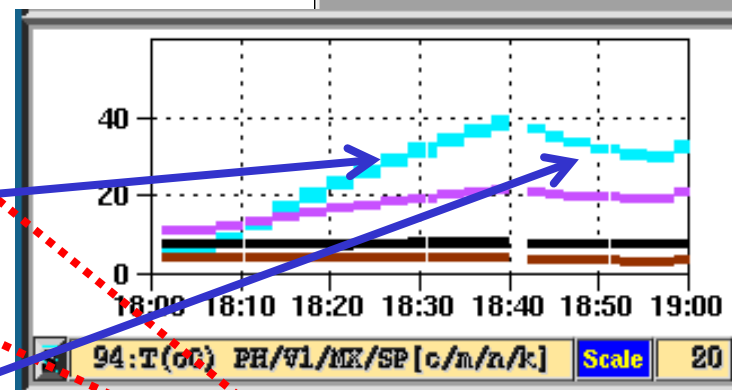
HEAT: VESSELS, MIXING, OFF

CO2 LINE OPEN	t[s]	V1B	t[s]	V2B	t[s]	V3B
2		2		60		

XE LINE OPEN	t[s]	V1A	t[s]	V2A	t[s]	V3A
2		n/a		60		

MIX: 1 SHOT CO2, 1 SHOT Xe, Transfer MIX, Disable MV

VENT: MIX, Box-C, Xe, CO2



Step 7: Filling of Mixing Vessel with Xe & CO₂

There are two ways to fill the mixing vessel:

a) Use the GUI

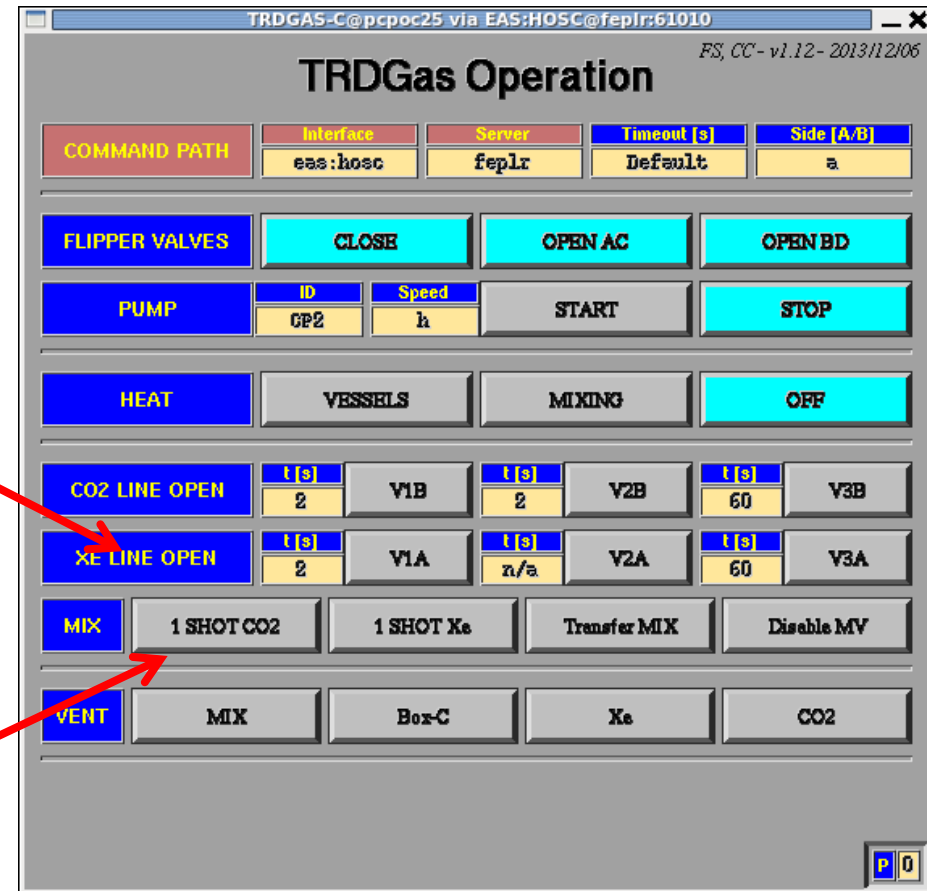
for Xe use: fill buffer volume

Half Shot {2} [V1A] {10} [V3A]

{60} [V3A]

Long Shot {10} [V1A] {10} [V3A]

{60} [V3A]



for CO₂ (Full Shot) use

for CO₂ (Half Shot) use commands, see next page

Step 7: Filling of Mixing Vessel with Xe & CO₂

b) Send commands (BETTER TO USE THE GUI):

```
> cd ~/RUN/COMMANDING/TRDGAS
```

```
> set-command-path eas:hosc feplr
```

For CO₂:

```
> ./UG_EXEC.csh A HSHC_20S (half shot)
```

Only for completeness, only needed if there is no GUI

```
> ./UG_EXEC.csh A 1SHC_60S (full shot)
```

```
> ./UG_EXEC.csh A OV1B_2S (open first valve for 2 s)
```

```
> ./UG_EXEC.csh A OV2B_2S (open second valve for 2 s)
```

```
> ./UG_EXEC.csh A OV3B_60S (open third valve for 60 s)
```

For Xe (remember, the second valve is stuck open → **don't touch it! Use the GUI!**):

```
> ./UG_EXEC.csh A OV1A_2S (open first valve for 2 s)
```

```
> ./UG_EXEC.csh A OV3A_3S (open third valve for 3 s)
```

```
> ./UG_EXEC.csh A OV3A_10S (open third valve for 10 s)
```

```
> ./UG_EXEC.csh A OV3A_60S (open third valve for 60 s)
```

With Xenon we usually start with a shot of 2--3-60, and then continue with shots of 2--60, until the end.₂₉

TRD Gas Refill – Step 7

Step 7: Filling of Mixing Vessel with Xe & CO₂

Using the GUI:

a) Start with CO₂:

1 Shot CO₂

P_{mix} increases from value before mixing till desired value. **Example 23rd January 2013:**

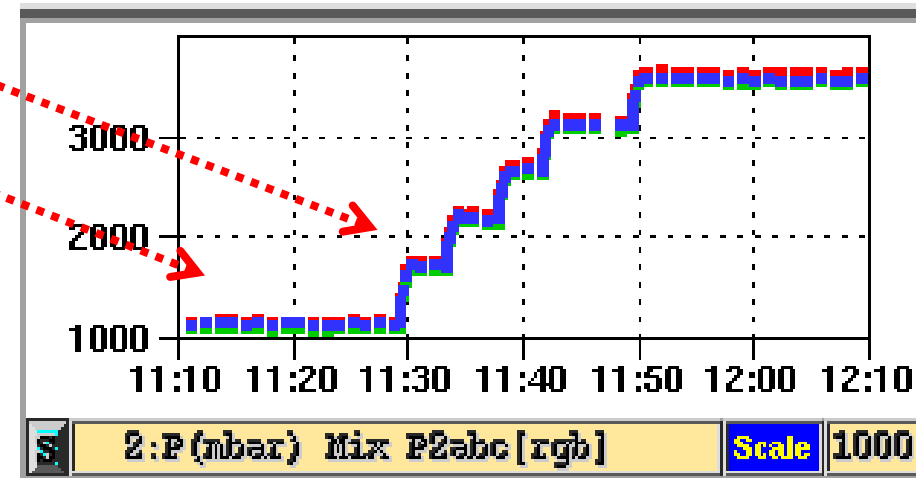
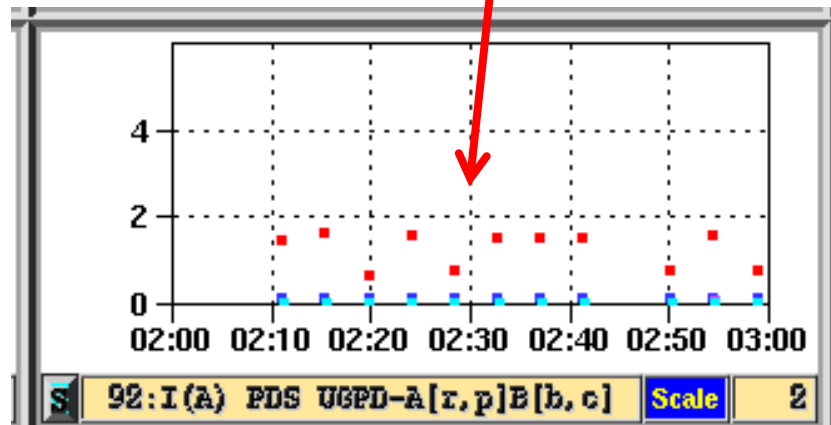
TRDGAS-M:

2: P_{mix} increase from 1 bar to 1.8 bar

92: PDS-UGPD at 1.5 A (only read every 5 min)

TRDGAS-M GUI Screenshot:

- Window Title: TRDGAS-C@pcpoc25 via EAS:HOSC@feplr:61010
- Version: FS, CC - v1.12 - 2013/12/06
- COMMAND PATH: Interface: eas:hosc, Server: feplr, Timeout [s]: Default, Side [A,B]: a
- FLIPPER VALVES: CLOSE, OPEN AC, OPEN BD
- PUMP: ID: GP2, Speed: h, START, STOP
- HEAT: VESSELS, MIXING, OFF
- CO2 LINE OPEN: t[s]: 2, V1B: t[s]: 2, V2B: t[s]: 60, V3B
- XE LINE OPEN: t[s]: 2, V1A: t[s]: n/a, V2A: t[s]: 60, V3A
- MIX: 1 SHOT CO2, 1 SHOT Xe, Transfer MIX, Disable MV
- VENT: MIX, Box-C, Xe, CO2



CO₂ mixing:

Repeat Step 7a) until P_{mix} at desired value and document steps in log file:

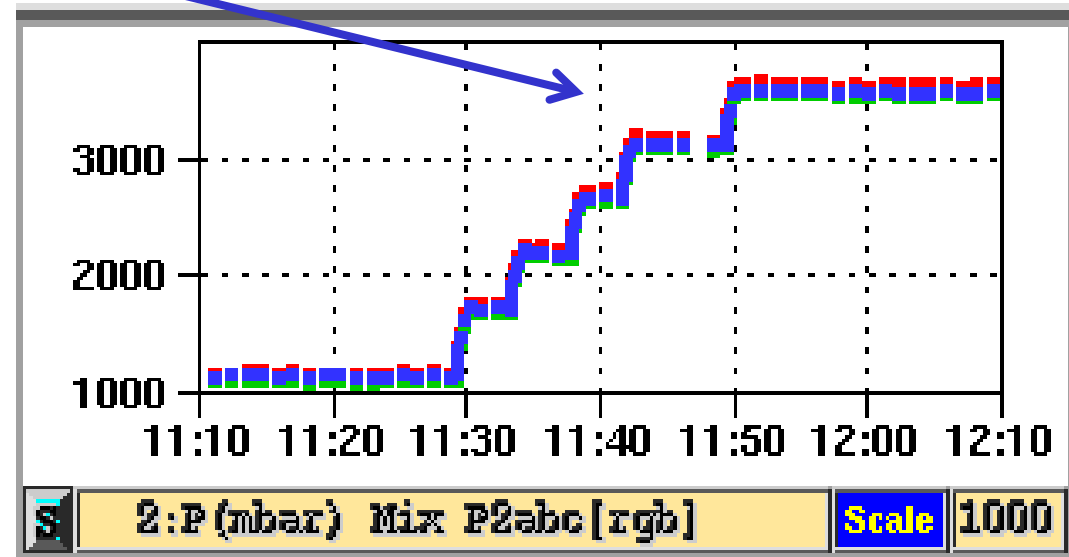
Example 23rd January 2013:

P_{mix}_{CO₂} = 3.5 bar after 5 times 1 Shot CO₂

TRDGAS-M:

2: P_{mix} increase from 1.8 bar to 3.5 bar

92: PDS-UGPD at 1.5 A



Step 7: b) Filling of Mixing Vessel with Xe

(Vessel valves see p. 75-76, TRD-ACC-TAS-Shifterguide)

Using the GUI :

Use only valve V1A and V3A due to the problem of valve V2A (stuck open)

1st step: Open V1A for 2s

2nd step: Open V3A for 10s and then for 60 s

For bigger steps (cold case), open V1A for 10 s and V3A for 10s followed by 60s.

P_{mix} increases from value before mixing till desired value. **DO NOT EXCEED 14 bar!!!**

Example 23rd January 2013:

TRDGAS-M:

2: P_{mix} increase from 3.5 bar to 13.5 bar

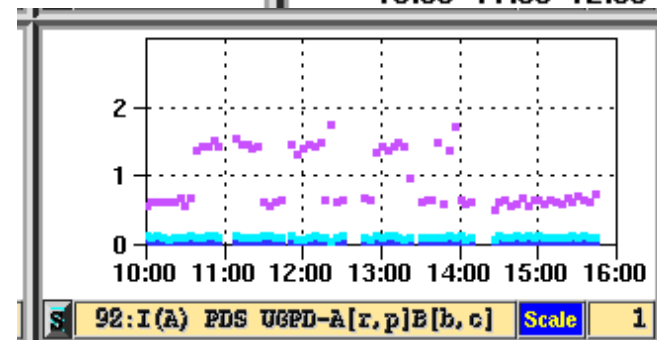
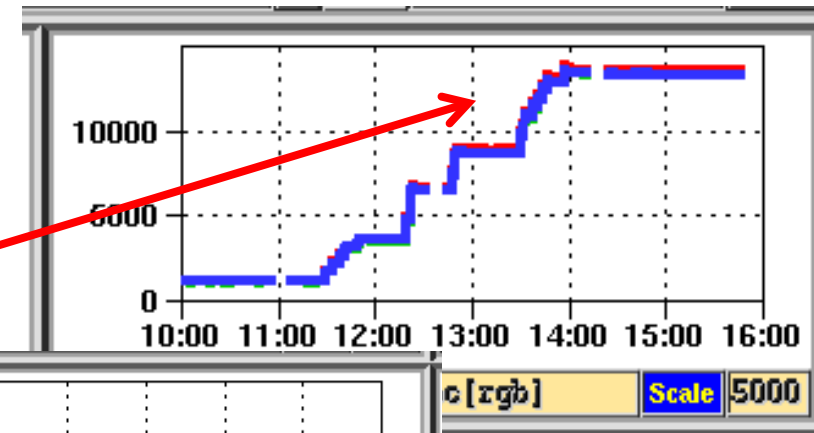
92: PDS-UGPD at 1.5 A

Interface	Server	Timeout [s]	Side [A,B]
eas:hosc	feplr	Default	a

ID	Speed	START	STOP
GP2	h		

t[s]	V1B	t[s]	V2B	t[s]	V3B
2		2	60		

t[s]	V1A	t[s]	V2A	t[s]	V3A
2	n/a		60		



Xe mixing:

Repeat Step 7b) until P_{mix} at desired value and document steps in **log file**:

Example 23rd January 2013:

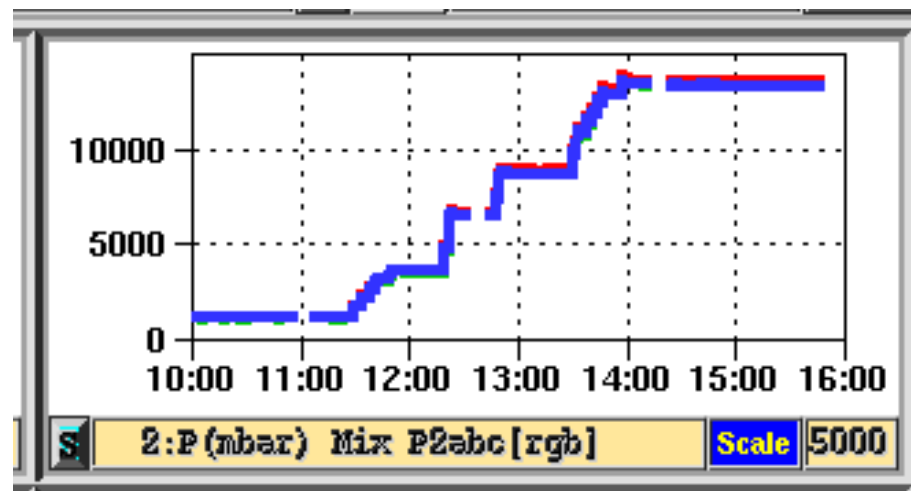
$P_{mix_{Xe}} = 13.5$ bar after

3 times: V1A open for 10 s and

V3A for 10s followed by 60s

2 times: V1A open for 2s, V3A open for 10s followed by 60s

1 times V1A open for 2s, V3A open for 10s





TRD Gas Refill – Step 7

Fill in the log file:

initial Xe: _____ CO2: _____ _____ _____ _____

Rpt	Gas	P/bar	VLV-OPEN-TIME/s, Exec-Time			----P-MIX/mbar----			CMD Replies
			V1	V2	V3	P2a	P2b	P2c	
# 1	_____	_____	____/____	____/____	____/____	_____	_____	_____	_____
# 2	_____	_____	____/____	____/____	____/____	_____	_____	_____	_____
# 3	_____	_____	____/____	____/____	____/____	_____	_____	_____	_____
.									
.									

Calculate the final partial pressures:

CO2 _____ + _____ = _____ bar

Xe _____ + _____ = _____ bar

And update history file:

~/COMMANDING/TRDGAS/Gas_Refills/gas_composition_history.txt

And update ELOG and Pressure Monitor



Step 8: Initiate Transfer Sequence

Ask LEAD to Get JMDC flash directory (“Get Directory” button in JMDC-C controller).

Terminal Output from TRDGAS-M:



JMDC-0F Flash-Directory UG-entries from Sat Apr 30 14:44:22 2011

BoF	--FileName--	Length	crc
39	UGA_GCCL.cmd	1744	+
102	UGB_GCCL.cmd	1744	+
121	UGA_HVXE.cmd	100	+
131	UGA_TMX0.cmd	1320	+
186	UGA_TMX4.cmd	1320	+
239	UGA_TMX7.cmd	1320	+
276	UGA_TMX2.cmd	1320	+
277	UGA_TMX3.cmd	1320	+
311	UGA_TMX5.cmd	1320	+
373	UGA_TMX6.cmd	1320	+
382	UGA_HVES.cmd	112	+
393	UGA_TMX9.cmd	1848	+
453	UGA_TMX1.cmd	1320	+
471	UGA_HMIX.cmd	112	+
485	UGA_TMX8.cmd	1320	+



TRD Gas Refill – Step 8

Step 8: Initiate Transfer Sequence

- a) (this step can be skipped when you are sure that JMDC is ok, i.e. if UGA command files exist -- see previous page)

Upload Command-Files to JMDC-MCT-Flash (one by one):

```
trd@pcpoc25 TRDGAS$ Write_UG_CmdFile_to_MCT_JMDC_Flash.csh A TMX#
```

(where this command must be issued 10 times, replacing # with the corresponding number 0..9)

```
trd@pcpoc25 TRDGAS$ Write_UG_CmdFile_to_MCT_JMDC_Flash.csh A HMIX
```

Check to make sure that the command files ended up in the JMDC flash (see previous slide)

b) Ask LEAD to “Get Short TQ-List” to read content of Time-Based-Qlist on JMDC-MCT:

When there is AOS, ask LEAD to “Get the SHORT TQ LIST”. They will push the [SHORT] button in the bottom right and this list will update.

What you want to check is if the items 20-35 are already taken. The item number is on the far left side. In this example, 28+ are used, so we would have to use different item numbers. The point is to be careful not to write over something which is currently scheduled.

Time Based Q-List (TQ-List)

+00	114.01:14:56	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
+01	114.00:05:24	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
+02	114.00:28:34	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
+03	114.00:51:44	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
-05	114.00:15:00	00:30:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	6473...
+06	114.00:00:00	00:30:00	RQ	R	NA=013=JMDC:MCT	DT=1F0380	AMS Envelope	DC=72	000C...
07	114.00:05:00	00:30:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	6770...
+08	113.23:53:16	00:02:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	6770...
-09	113.23:53:00	00:00:01	RQ	R	NA=013=JMDC:MCT	DT=1F0380	AMS Envelope	DC=6	0004...
+10	113.23:53:00	00:00:02	RQ	R	NA=013=JMDC:MCT	DT=1F0380	AMS Envelope	DC=6	0004...
-14	114.00:07:42	00:15:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	5547...
-15	114.00:07:35	00:15:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	5547...
+28	114.00:01:05	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+29	114.00:09:27	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+2A	114.00:41:42	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+2B	114.01:03:04	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+2C	114.01:40:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+2D	114.01:46:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+2E	114.02:25:10	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+2F	114.02:44:51	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+30	114.03:18:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+31	114.03:24:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+32	114.04:00:08	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+33	114.04:26:25	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+34	114.05:11:05	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+35	114.05:17:10	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+36	114.05:35:51	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+37	114.06:03:41	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+38	114.06:40:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+39	114.06:45:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+3A	114.07:17:34	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+3B	114.07:42:16	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+3C	114.07:42:56	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+3D	114.07:49:36	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+3E	114.08:21:42	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+3F	114.08:34:54	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+40	114.08:56:57	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+41	114.09:20:14	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+42	114.10:00:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+43	114.10:06:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+44	114.10:41:57	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+45	114.10:58:24	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+46	114.11:36:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+47	114.11:42:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+48	114.12:23:08	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+49	114.12:37:38	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+4A	114.13:13:13	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+4B	114.13:18:33	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+4C	114.13:52:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+4D	114.14:20:21	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+4E	114.14:44:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+4F	114.14:49:47	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+50	114.14:50:43	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+51	114.14:57:27	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+52	114.15:22:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+53	114.15:27:20	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+54	114.15:29:19	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300

Item Begin End W DELETE SHOW ENA DIS Get List SHORT LONG

c) Choose a command file that does not overlap with the currently used item numbers. The current options are (where the item numbers will be 20-35, 40-55, etc):

UGA_TRD_REFILL_TQ_20_35_HMIX.cmd
UGA_TRD_REFILL_TQ_40_55_HMIX.cmd
UGA_TRD_REFILL_TQ_60_75_HMIX.cmd
UGA_TRD_REFILL_TQ_80_95_HMIX.cmd
UGA_TRD_REFILL_TQ_A0_B5_HMIX.cmd
UGA_TRD_REFILL_TQ_C0_D5_HMIX.cmd
UGA_TRD_REFILL_TQ_E0_F5_HMIX.cmd

Note that for the second injection we don't use the steps to turn the heaters on, so those options are:

UGA_TRD_REFILL_TQ_20_31.cmd
UGA_TRD_REFILL_TQ_40_51.cmd
UGA_TRD_REFILL_TQ_60_71.cmd
UGA_TRD_REFILL_TQ_80_91.cmd
UGA_TRD_REFILL_TQ_A0_B1.cmd
UGA_TRD_REFILL_TQ_C0_D1.cmd
UGA_TRD_REFILL_TQ_E0_F1.cmd

d) Upload Commands into Time-Based_QList:

TRDGAS-M: 94: Spiro Temperatures > +5°C

Ask LEAD to:

-stop the Run

-set RunTag for “TRD Non-Nominal”

-restart the Run

```
trd@pcpoc25 TRDGAS$ UG_EXEC.csh A TRD_REFILL_TQ_20_35_HMIX
```

```
(or for second injection: trd@pcpoc25 TRDGAS$ UG_EXEC.csh A TRD_REFILL_TQ_20_31 )
```

Write down T0: T0 is time when TRD-REFILL was sent

d) Check if all 18 items are entered

Correctly in TBQL:

ASK LEAD to “Get Short TQ-List”

to read content of Time-Based-Qlist on JMDC-MCT

In this case we asked for Items: 17 ... 28 with Start-Times +10 min, +22 min, ... , +3h 22 min

If entries are not correct ask LEAD to delete them and repeat from Step 8c

Time Based Q-List (TQ-List)

+00	114.01.14:56	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
+01	114.00:05:24	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
+02	114.00:28:34	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
+03	114.00:51:44	01:32:42	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	2020...
-05	114.00:15:00	00:30:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	6473...
+06	114.00:00:00	00:30:00	RQ	R	NA=013=JMDC:MCT	DT=1F0380	AMS Envelope	DC=72	000C...
+07	114.00:05:00	00:30:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	6770...
+08	113.23:53:16	00:02:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	6770...
-09	113.23:53:00	00:00:01	RQ	R	NA=013=JMDC:MCT	DT=1F0380	AMS Envelope	DC=6	0004...
+10	113.23:53:00	00:00:02	RQ	R	NA=013=JMDC:MCT	DT=1F0380	AMS Envelope	DC=6	0004...
-14	11.00:07:42	00:15:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	5547...
-15	11.00:07:35	00:15:00	RQ	W	NA=014=JMDC-itself	DT=1F058B	Execute Command File	DC=14	5547...
+28	11.00:01:05	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+29	11.00:09:27	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+2A	11.00:41:42	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+2B	11.01:03:04	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+2C	11.01:40:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+2D	11.01:46:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+2E	11.02:25:10	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+2F	11.02:44:51	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+30	11.03:18:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+31	11.03:24:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+32	11.04:00:08	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+33	11.04:26:25	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+34	11.05:11:05	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+35	11.05:17:10	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+36	11.05:35:51	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+37	11.06:03:41	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+38	11.06:40:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+39	11.06:46:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+3A	11.07:17:34	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+3B	11.07:42:16	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+3C	11.07:42:56	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+3D	11.07:49:36	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+3E	11.08:21:42	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+3F	11.08:34:54	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+40	11.08:56:57	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+41	11.09:20:14	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+42	11.10:00:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+43	11.10:06:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+44	11.10:41:57	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+45	11.10:58:24	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+46	11.11:36:40	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+47	11.11:42:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+48	11.12:23:08	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+49	11.12:37:38	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+4A	11.13:13:13	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+4B	11.13:18:33	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+4C	11.13:52:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+4D	11.14:20:21	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+4E	11.14:44:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+4F	11.14:49:47	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+50	11.14:50:43	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+51	11.14:57:27	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+52	11.15:22:00	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300
+53	11.15:27:20	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0301
+54	11.15:29:19	00:00:00	RQ	W	NA=010=JMDC:HRDL	DT=1F05A5	JBUX Tasks Control	DC=2	0300

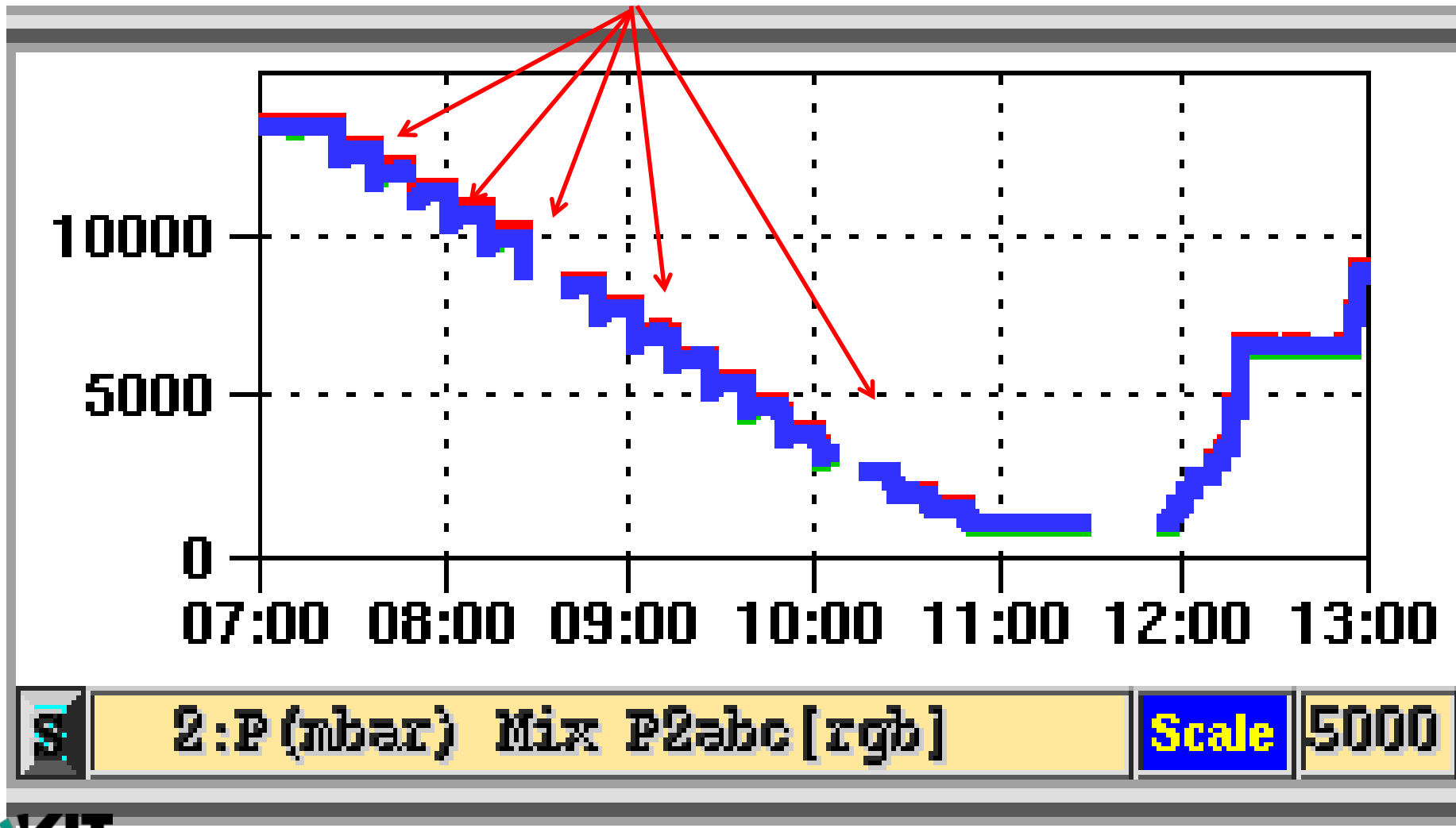
Item Begin 001 00 00 00 W DELETE SHOW ENA DIS Get List SHORT LONG

TRD Gas Refill – Step 8

Watch the pressure drop in the mixing vessel with

TRDGAS-M: 2: Pmix decreasing

(18 Transfers)



TRD Gas Refill – Step 9&10

Step 9: Hand back control to LEAD for next 3.5h

Step 10: Check replies (every 12 min 110 CommandFile replies for TMX0.....8; 154 for TMX9)

If pressure drop is less than required, repeat step TMXi manually

> UG_EXEC.csh A TMXi with “i” replaced by 0..8

Pmix has to be below 1.8 bar before Step TMX9 (last one) is executed,
 (if not, have LEAD disable TMX9 and repeat TMX8 by hand then do TMX9)

CMD	Time	#Replies	Pmix	Ref. Val. (bar)	
			_____	13.7	
TMX0	_____	_____	_____	13.0	reset UG CMD CNT
TMX1	_____	_____	_____	12.2	reset UG CMD CNT
.
.
.
TMX9	_____	_____	_____	0.9	reset UG CMD CNT

Step 11: Increase TRD HV

Increase TRD HV by XXX V and check Gain Stability

Calculate HV step for signal adjustment (the worksheet does this automatically now, but for reference we'll keep this here):

HV adjustment: 1000 mbar / 880 mbar = +13.6 % Density increase

→ Gain / (1.04)^(13.6) = Gain / 1.74

CO₂ – fraction +1.2%

→ Gain / (1.08)^(1.2) = Gain / 1.10

Total Gain drop: 1.88 → HV: $\ln(1/1.88)/\ln(0.99) = 62.8$ V

NOTE: the 0.99 is because you get 1% per Volt, the 1.04 is for 1% density change, and 1.08 is for 1% CO₂ fraction change.

So if the calculated adjustment is ~63V, one then needs to adjust that number by two things:

- (a) +8 for the pump running at half speed (since we will leave the pump on overnight)
- (b) X, which is whatever the normal HV adjustment would be at that moment (use the GainMonitor to fit the plot, as usual: (let's use -2V here, just for example).

So the HV adjustment by $62.8 \text{ V} + (8 \text{ V} - 2 \text{ V}) = 68.8 \text{ V}$

(For Step 15) When the pump is turned off on Day 2 we subtract the same $(8-2)V - ZV$ where Z is however much the adjustment is at THAT point (like step b)—there have been at least 12h since the previous adjustment. So for example say the new adjustment is now -1V, we'd adjust by $-(8-2)V - 1V = -7V$.

After first Mix & Transfer:

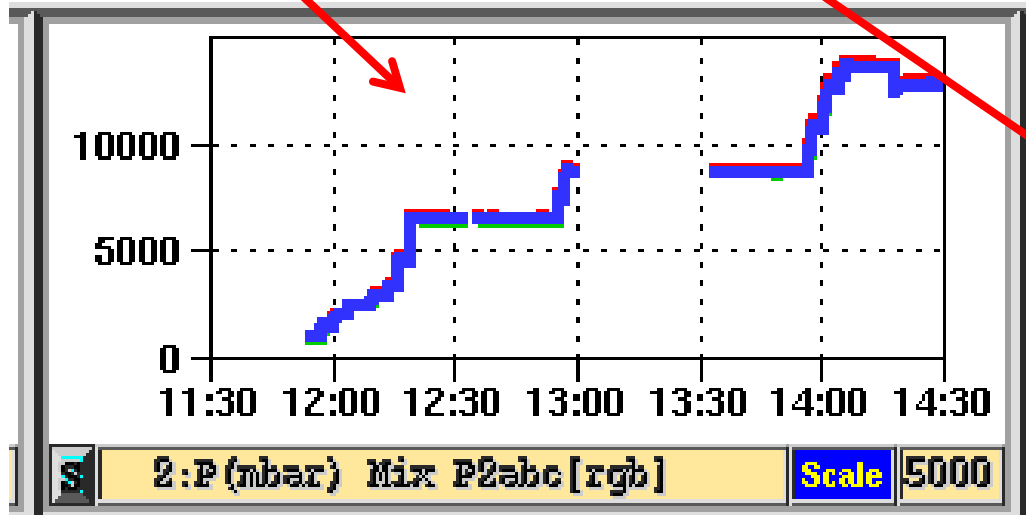
For second Mix & Transfer wait for 12 minutes of pumping after TMX9

REPEAT Step 5 – 10

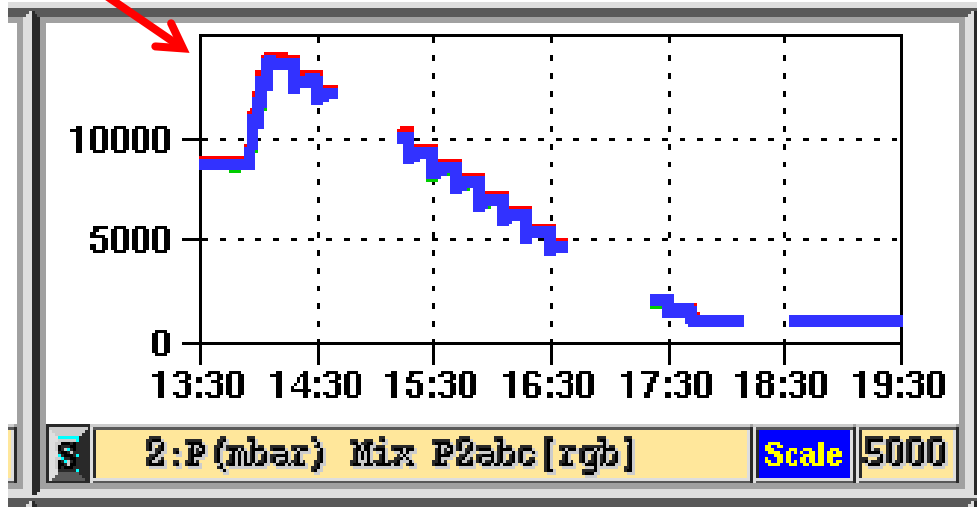
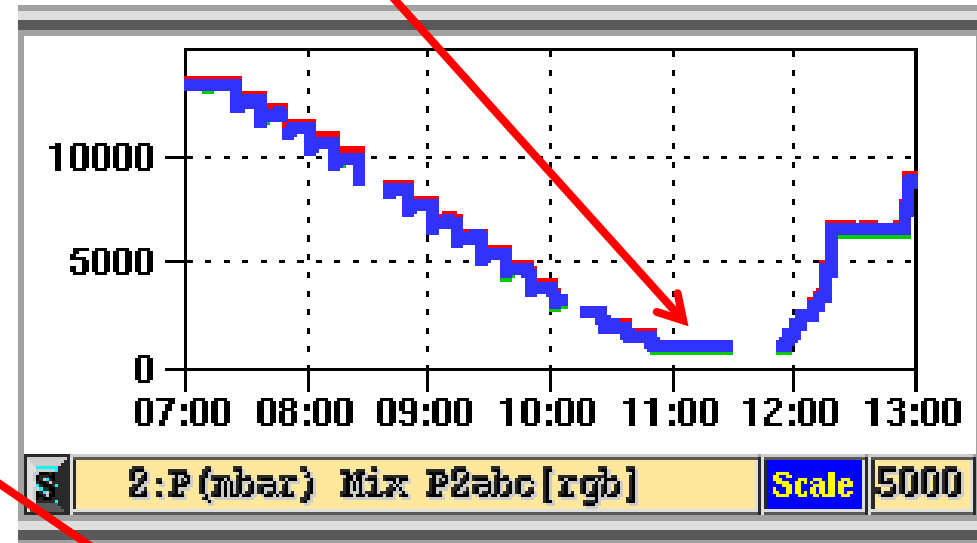
Transfer of x liters

2nd Mixing

2nd transfer



After second Mix & Transfer continue with step 12



Step 12: Circulate gas at full speed to assure closing of BoxC-Relief-Valve, Wait until pressure is stable (5 min)

TRDGAS-M: 94: Spiro Temperature $> +5^{\circ}\text{C}$

TRDGAS-C: PUMP: {CP2}{f}{START}

4th terminal:UGcmdLog: check for

58 replies in 20s

TRDGAS-M: Reset UG CMD CNT

3: P_{sup} increase by 300 mbar

3: P_{ret} decrease by 400 mbar

97,99 Inlet: MFDPs drop to -300 mbar

96,98 Outlet: MFDPs increase to 400mbar

COMMAND PATH	Interface	Server	Timeout [s]	Side [A/B]
	eas:hosc	feplr	Default	a

FLAPPER VALVES: CLOSE, OPEN AC, OPEN BD

PUMP	ID	Speed	START	STOP
	CP2	h		

HEAT, VESSELS, MIXING, OFF

CO2 LINE OPEN	t[s]	V1B	t[s]	V2B	t[s]	V3B
	2		2	60		

XE LINE OPEN	t[s]	V1A	t[s]	V2A	t[s]	V3A
	2		n/a	60		

MIX: 1 SHOT CO2, 1 SHOT Xe, Transfer MIX, Disable MV

VENT: MIX, Box-C, Xe, CO2

Step 13: Continue gas circulation at half speed for 12h to homogenize gas gain

TRDGAS-M: 94: Spiro Temperature $> +5^{\circ}\text{C}$

TRDGAS-C: PUMP: {CP2}{h}{START}

4th terminal:UGcmdLog: check for

58 replies in 20s

TRDGAS-M: Reset UG CMD CNT

COMMAND PATH	Interface	Server	Timeout (s)	Side (A/B)
	eas:hosc	feplr	Default	a

FLIPPER VALVES: CLOSE, OPEN AC, OPEN BD

PUMP	ID	Speed	START	STOP
	GP2	h		

HEAT: VESSELS, MIXING, OFF

CO2 LINE OPEN	t (s)	V1B	t (s)	V2B	t (s)	V3B
	2		2		60	

XE LINE OPEN	t (s)	V1A	t (s)	V2A	t (s)	V3A
	2		n/a		60	

MIX: 1 SHOT CO2, 1 SHOT Xe, Transfer MIX, Disable MV

VENT: MIX, Box-C, Xe, CO2

Step 13: Continue gas circulation at half speed for 12h
to homogenize gas gain

TRDGAS-M: Reset UG CMD CNT

3: P_{sup} increase by 200 mbar

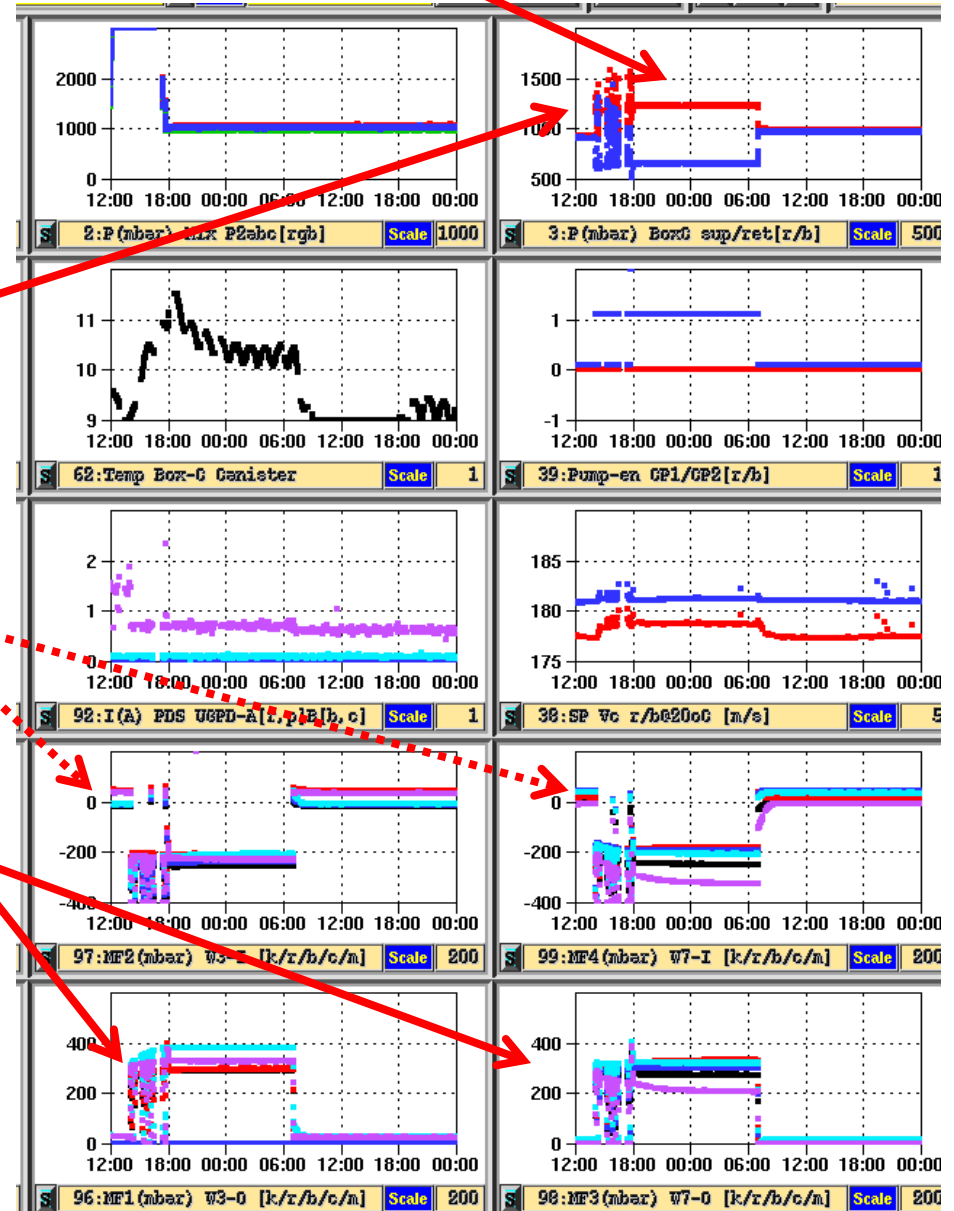
3: P_{ret} decrease by 300 mbar

97,99 Inlet:

MFDPs drop to -200 mbar

96,98 Outlet:

MFDPs increase to 300mbar





TRD Gas Refill – Step 14

Step 13 cont.: Inform LEAD that TRD Gas Refill commanding is complete,

RunTag to be changed to “Science Run (with pump on)”

Circulation of gas will continue (pump running @ half speed)
for \approx 12h

Step 14:

Update information in file

`~/COMMANDING/TRDGAS/Gas_Refills/gas_composition_history.txt`

Step 15: Stop Gas-Circulation

TRDGAS-C: PUMP: [STOP]

4th terminal: UGcmdLog:

Check for 60 replies in 20s

TRDGAS-M:

Reset UG CMD CNT

3: P_{sup}, P_{ret} back to values before pumping

96, 97, 98, 99: all MFdPs back to 0 (± 50) mbar

TRDCHD-M: DRP will turn red “bad” until

pressure stable

Step 15: Stop Gas-Circulation

3: P_{sup}, P_{ret} back to values before pumping

96, 97, 98, 99: all MFdPs back to 0 (± 50) mbar

TRDCHD-M: DRP will turn red “bad” until pressure stable

adjust HV by ~ -7 V (See pg 43, step 11) so that MPV ≈ 60 ADC

When turning DAQ back on after HV adjustment, ASK LEAD to increment RunTag to “Science Run (nominal)”

Inform LEAD that TRD Gas Refill commanding is complete

