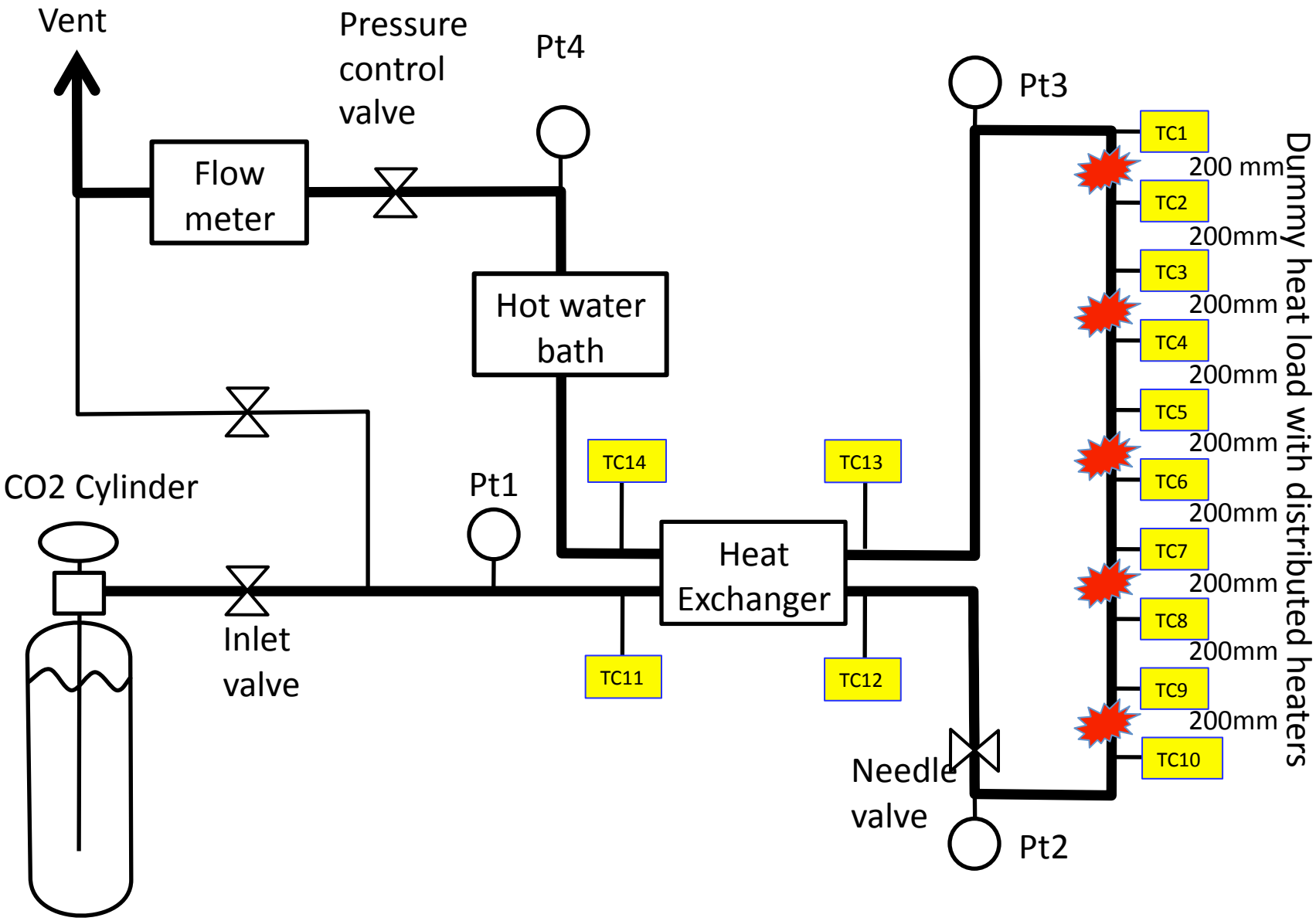

High power test
2011/04/25

Purposes of the experiment

- Apply up to 100 W power to the dummy load.
- Reduce the CO2 flow in order to observe the dry out of liquid CO2 in the tube due to excess heat.

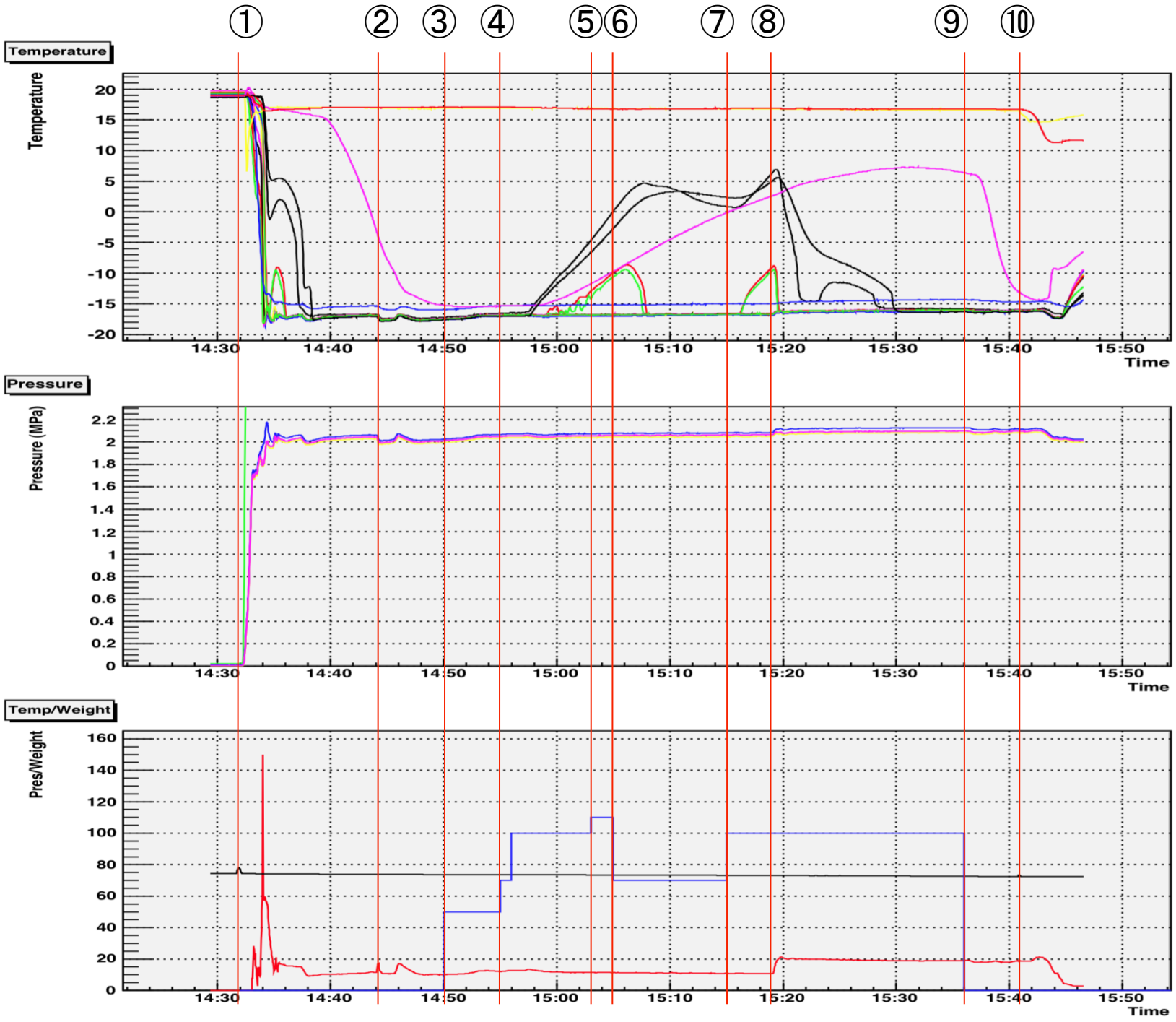
Main components of the test setup

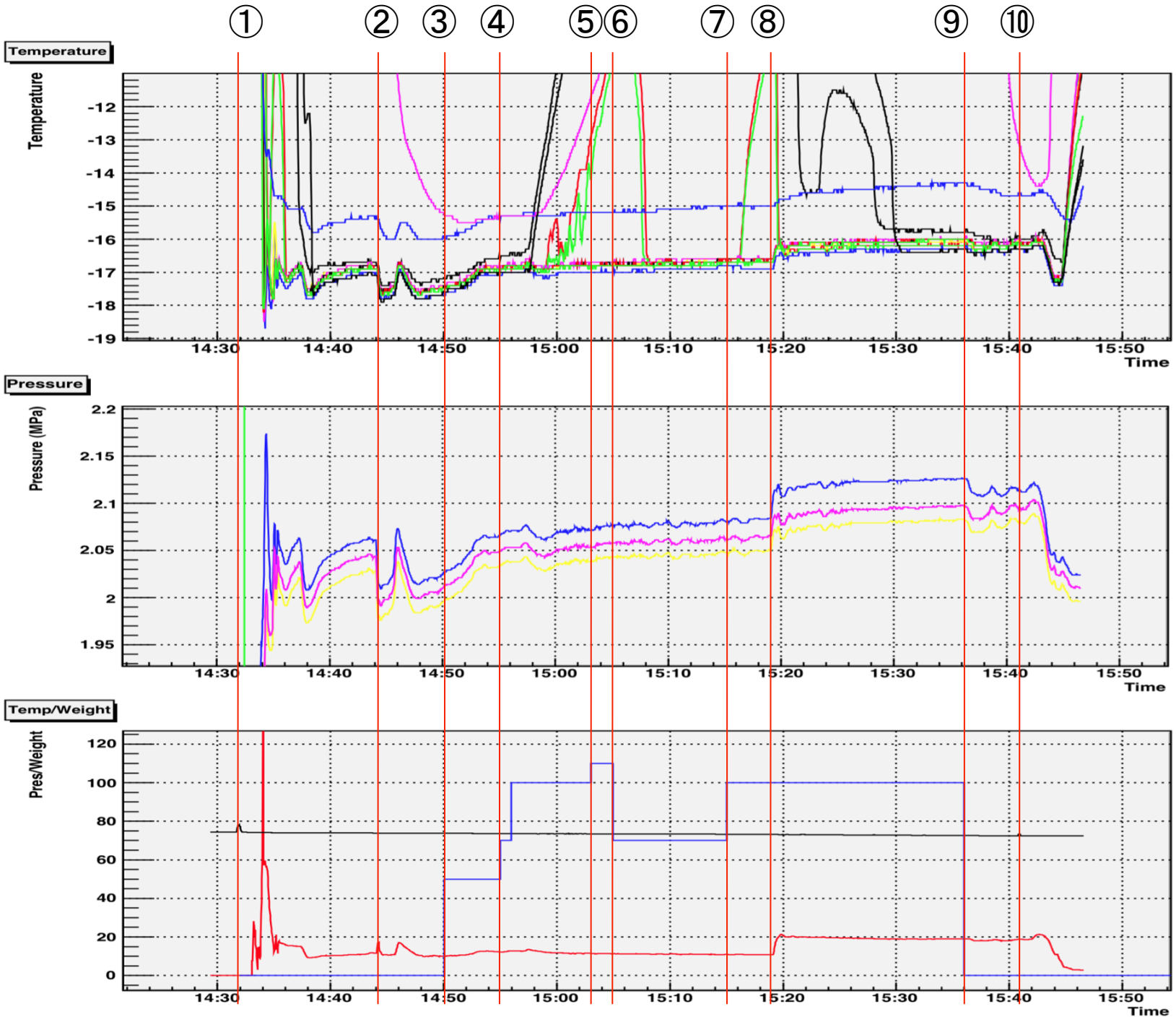
Kasami assembled the system in the difficult condition after the Earthquake all by alone.



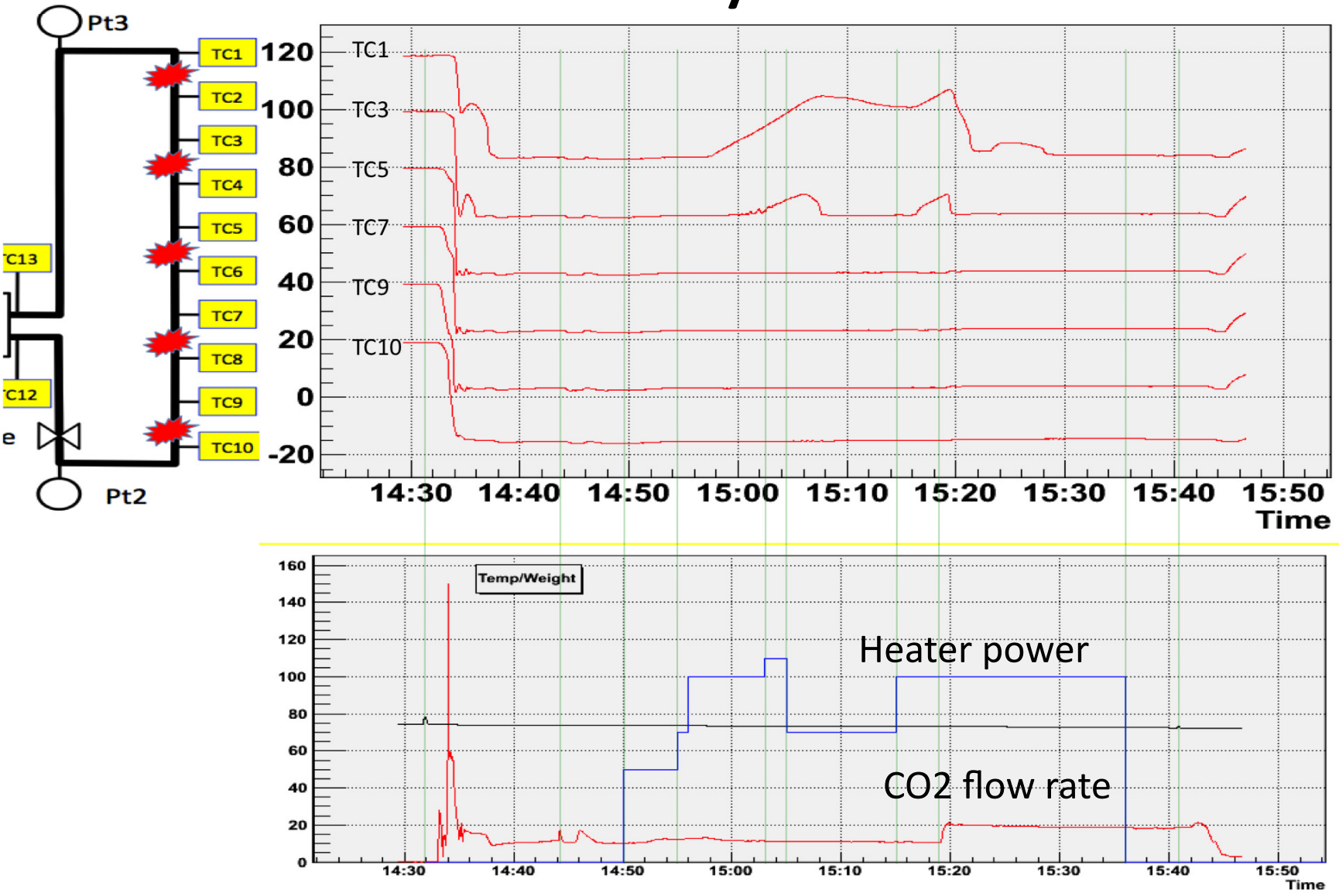
Experiment/Control

Time		Pressure target	CO2 flow target	Heater control (W)	
14:32	①	2.0 MPa	Opened	0 (off)	Start experiment. Pressure valve adjusted.
14:44	②		10 l/min	0	Needle valve adjusted.
14:50	③			50	Turn ON heater.
14:55	④			70 → 100	Increase heater power
15:03	⑤			110	Maximum heat. Dry out is accelerated.
15:05	⑥			70	The heater power decreased. Dry out is solved.
15:15	⑦			100	The heater power is increased. Dry out happened again.
15:19	⑧		20 l/min		CO2 flow increased → Dry out disappeared.
15:36	⑨			0	Turn off heater power
15:41	⑩		Closed		Experiment Finished

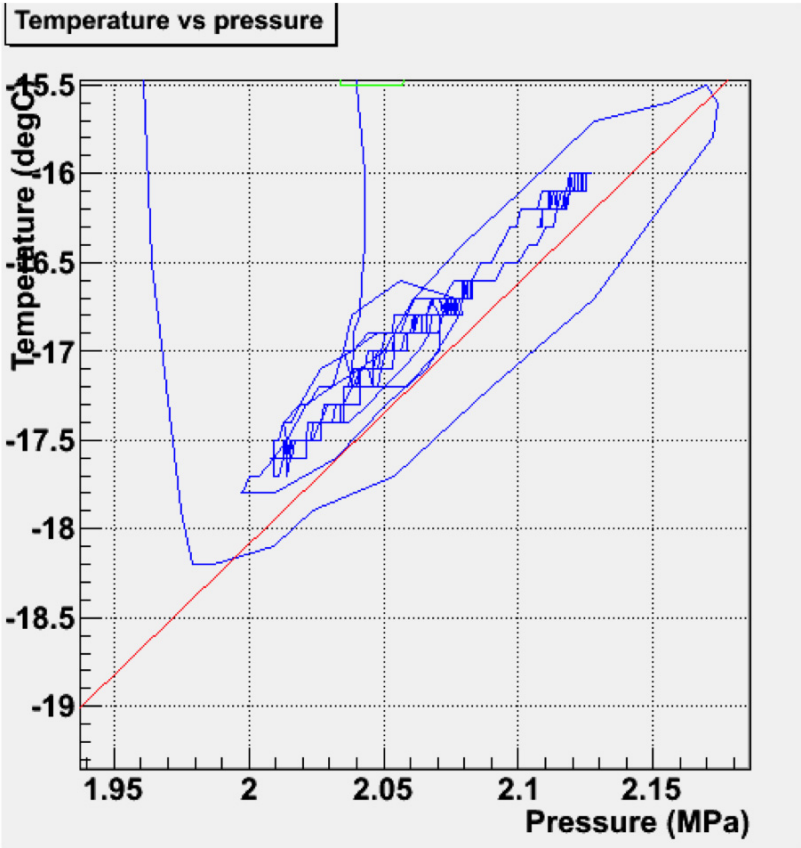

①
②
③
④
⑤⑥
⑦
⑧
⑨
⑩
Temperature
Temperature
20
15
10
5
0
-5
-10
-15
-20
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time
Pressure
Pressure (MPa)
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time
Temp/Weight
Pres/Weight
160
140
120
100
80
60
40
20
0
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time

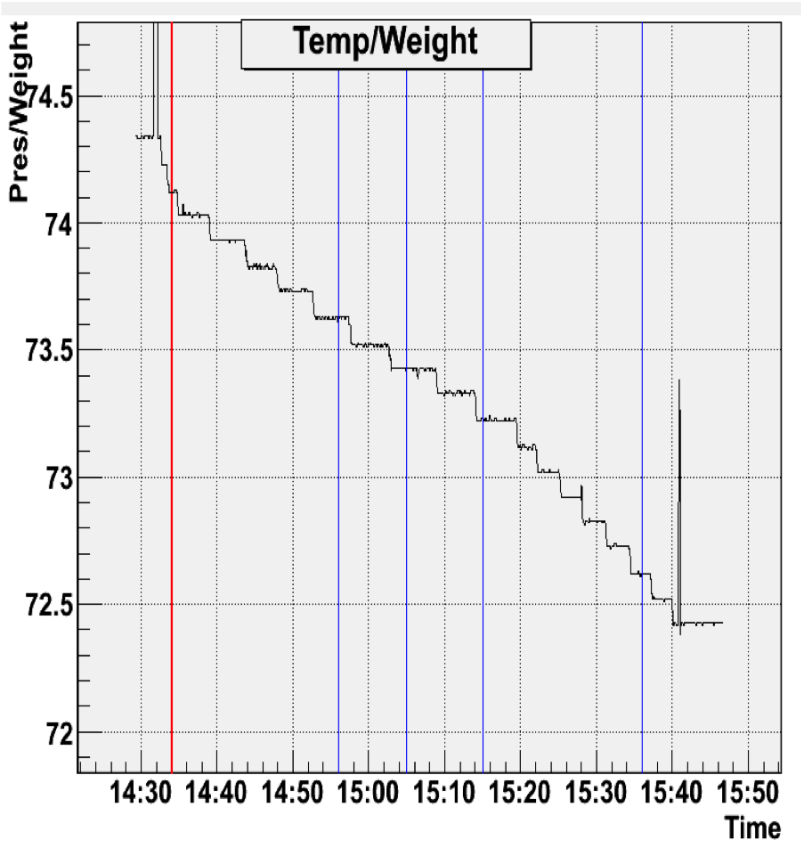

①
②
③
④
⑤⑥
⑦
⑧
⑨
⑩
Temperature
Temperature
-12
-13
-14
-15
-16
-17
-18
-19
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time
Pressure
Pressure (MPa)
2.2
2.15
2.1
2.05
2
1.95
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time
Temp/Weight
Pres/Weight
120
100
80
60
40
20
0
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time

CO2 dry out


Pt3
TC1
TC2
TC3
TC4
TC5
TC6
TC7
TC8
TC9
TC10
C13
C12
e
Pt2
120
100
80
60
40
20
0
-20
TC1
TC3
TC5
TC7
TC9
TC10
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time
Temp/Weight
160
140
120
100
80
60
40
20
0
Heater power
CO2 flow rate
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time

Graphs


Temperature vs pressure
Temperature (degC)
-15.5
-16
-16.5
-17
-17.5
-18
-18.5
-19
1.95
2
2.05
2.1
2.15
Pressure (MPa)

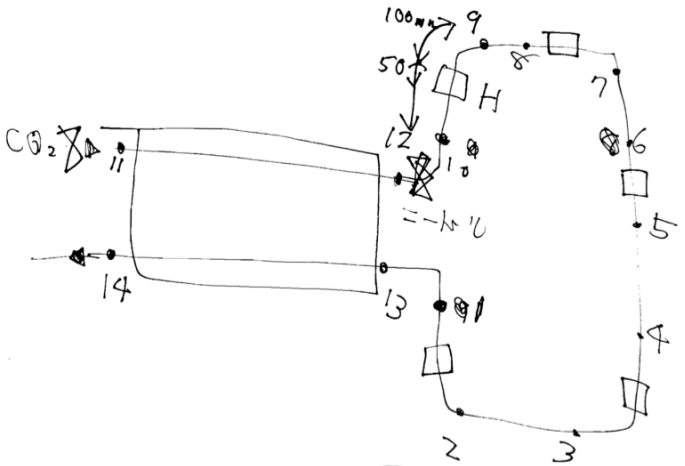

Temp/Weight
Pres/Weight
74.5
74
73.5
73
72.5
72
14:30
14:40
14:50
15:00
15:10
15:20
15:30
15:40
15:50
Time

Log book

4/25
13:40 湯 = ON,
最後のヒーターの TC を別メータで測定
14:30 じゃんぴ OK.
自標 -20°, 2MPa. 10ℓ/min
14:32 おこべあける.
入口弁 あける。
14:44 Needle弁調整

		ヒーターの TC
14:49		-17.0℃
14:50	~~50W~~ ↘ Powerあげ	
14:50	50W	-10.1℃
14:55	50→70W	
14:56	70→100W	±16℃
14:58		516℃
		30℃
15:03	110W	41℃
15:05	70W	
15:15	100W	
15:19	Nadle valve あけ →流量あげる 0→2ℓ/min	
15:36	Heater off	
15:40	Gas 止め	

teroflex



T1~T10
は、200mm カンカク

Hから T2まで

パイプ全長 3/8" パイプ

Heat mass of the HEX

- The heat exchanger (HEX) is made of 8 kg stainless steel (SS).
- Specific heat of SS is 0.6J/g/℃
- Heat mass is 4800 J/℃.
- In order to cool down HEX from 20℃ to -20℃, we need to remove heat corresponding to 192kJ or 640 g of CO2 evaporation.
- As we flew about 1-2 g/sec of CO2, it is natural the temperature of HEX was not stabilized before we finished the experiment.