Cryogenic Heaters Review

Operation use and wishes

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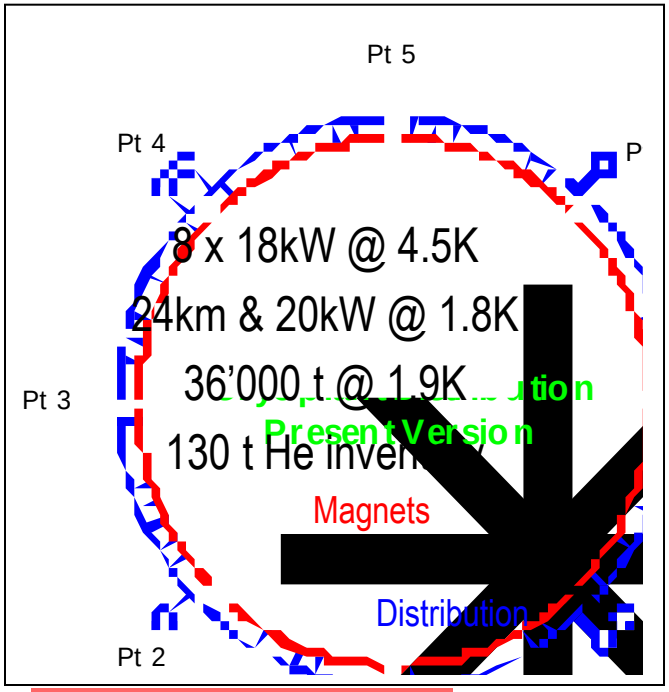
LHC Cryogenic Operation

Content

- Introduction
- Why/how we use heaters
- What we would like to have
- Summary

Introduction to LHC Cryogenics



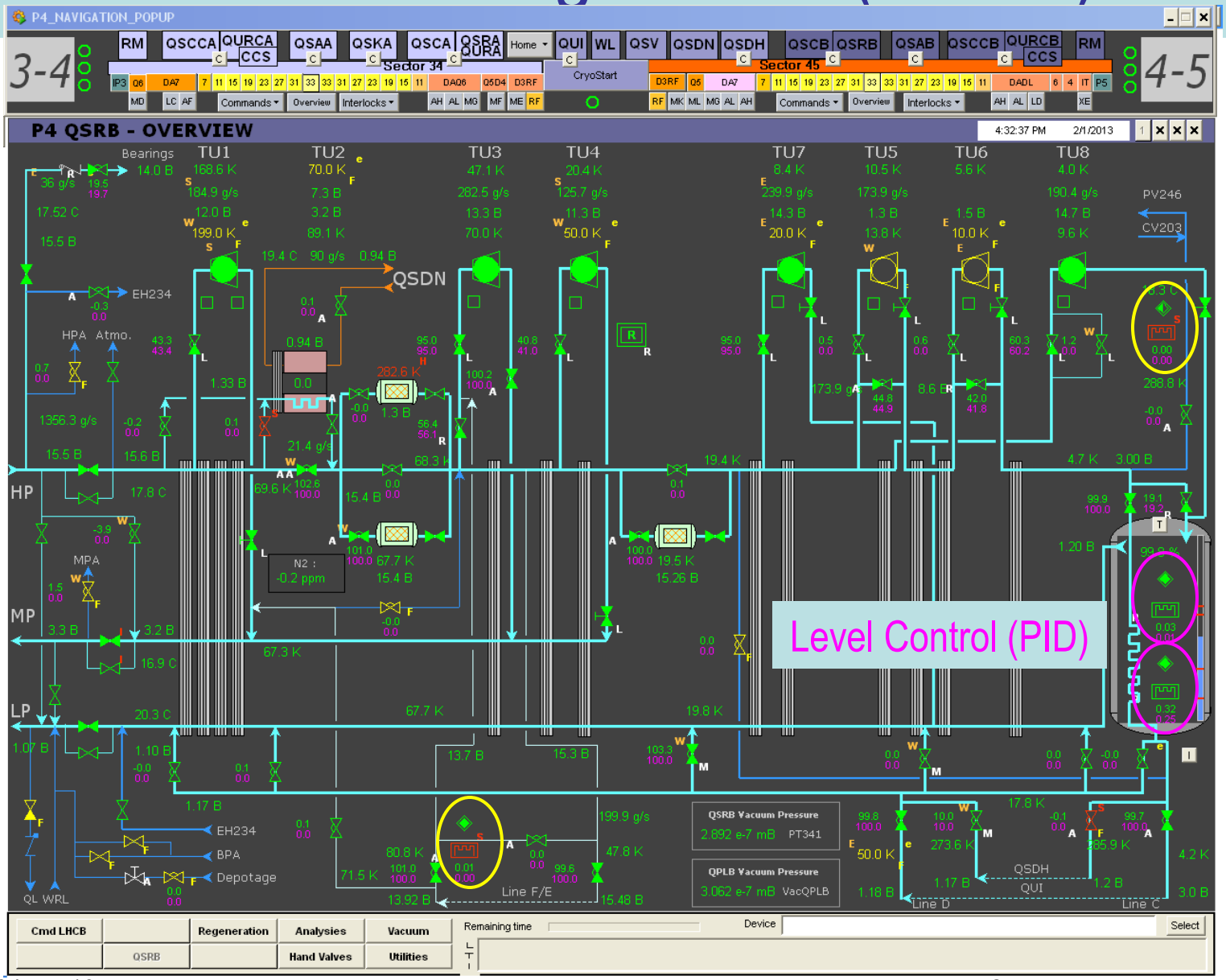
Heaters:

10-30 kW

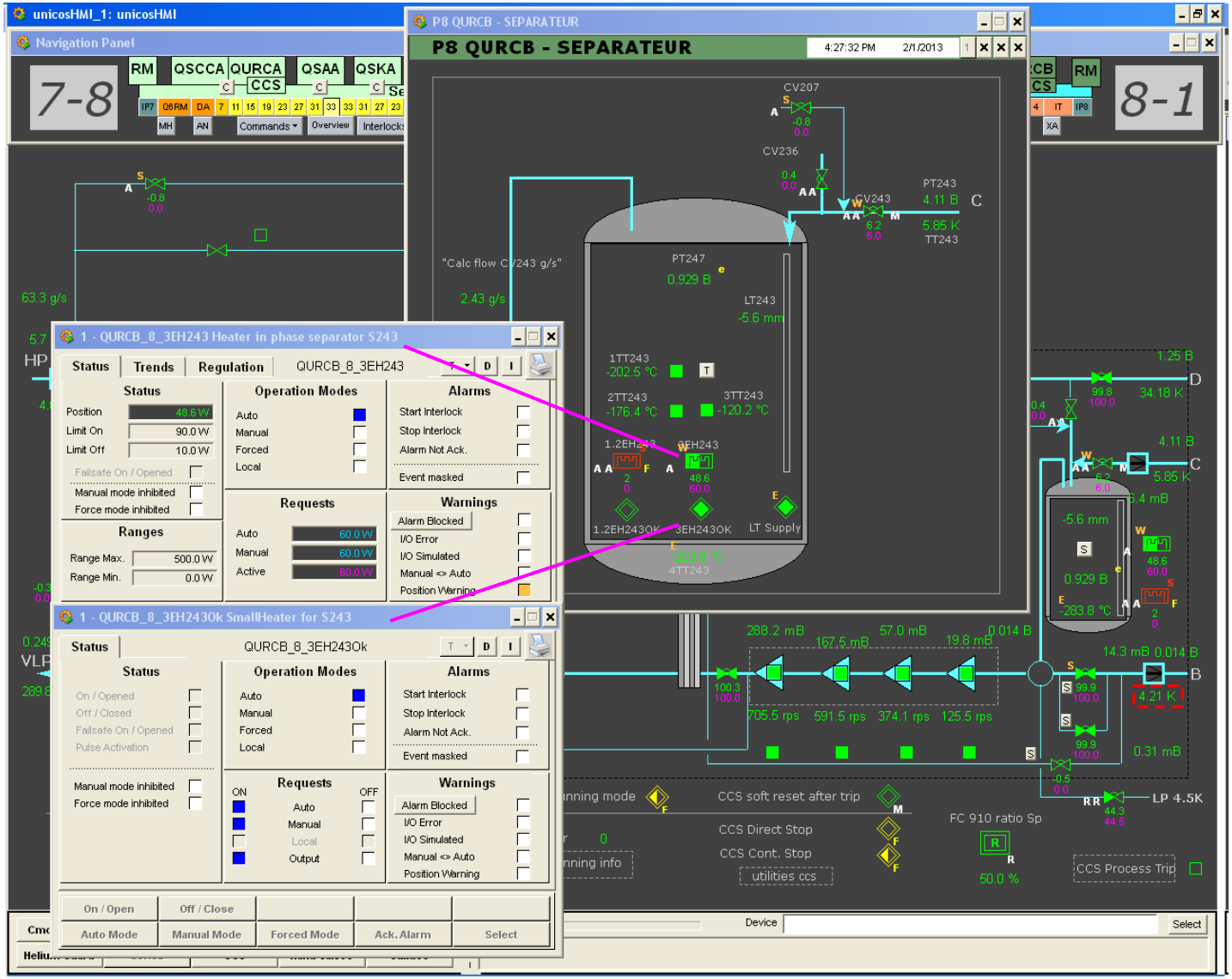
600 kW

25 - 100 W - 1 kW

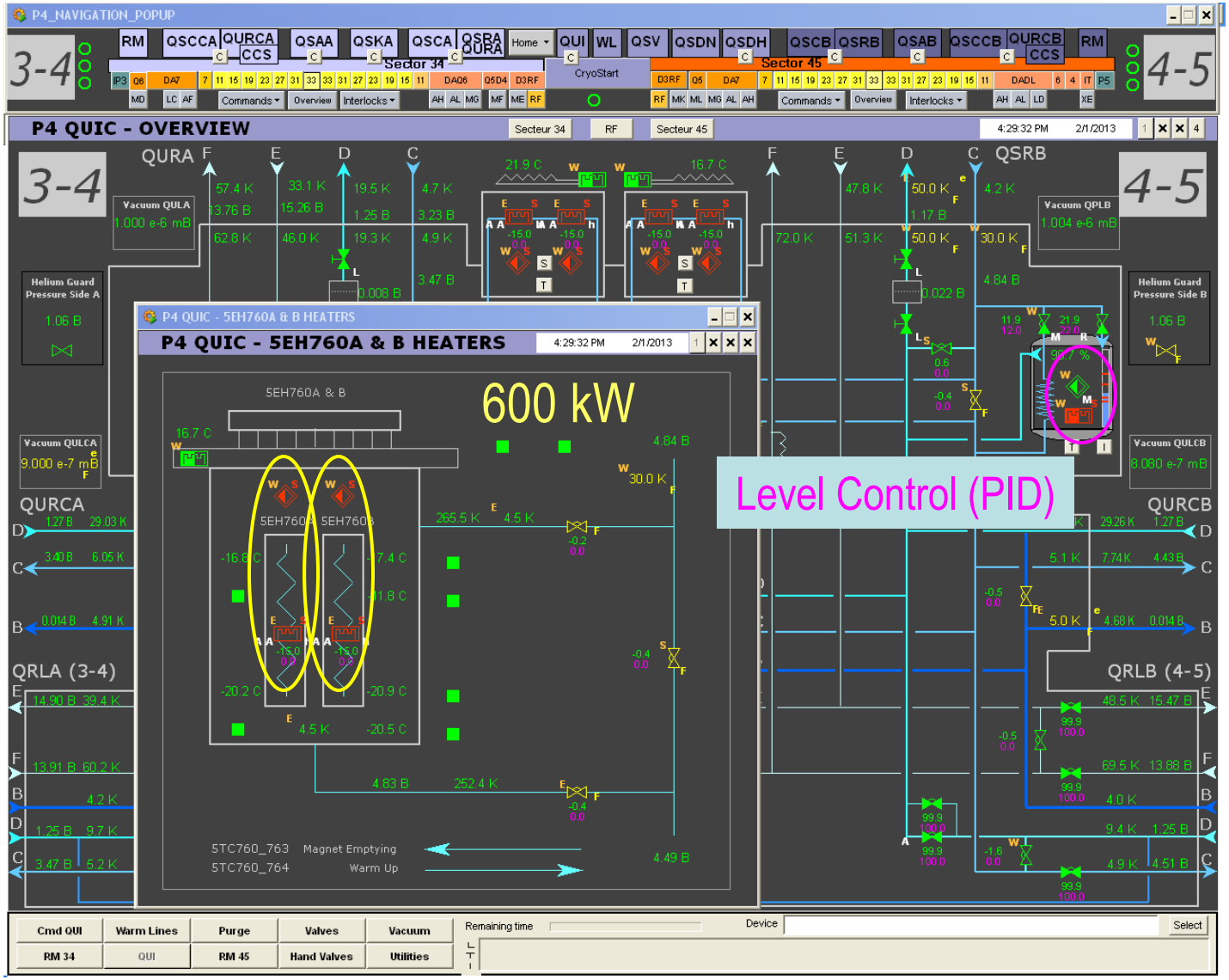
4.5K Refrigerators (QSRB)



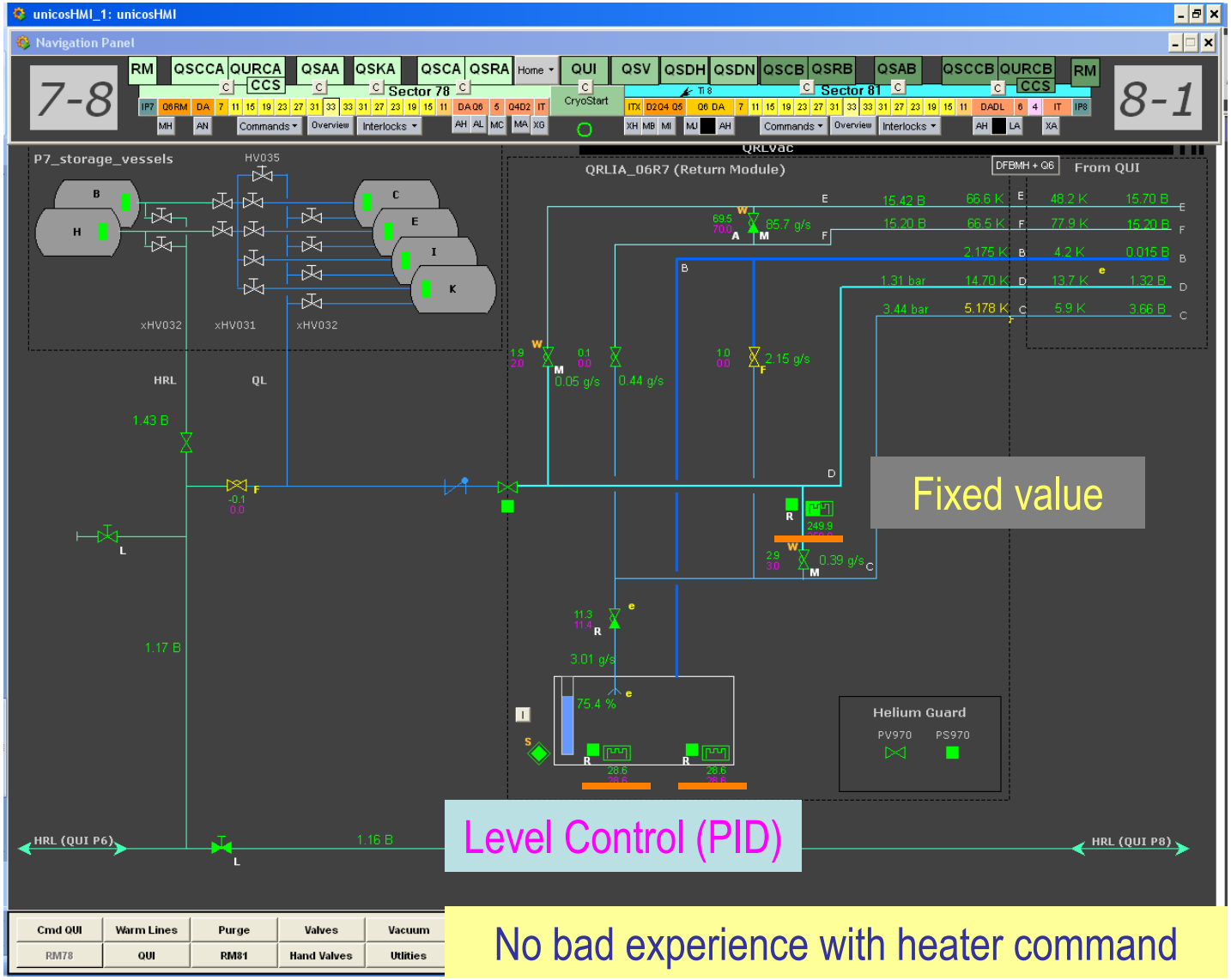
1.8K units (QURC)



Interconnecting Box (QUI)



Cryogenic Line (QRL)



No bad experience with heater command

Electrical Feed Boxes (DFBs)

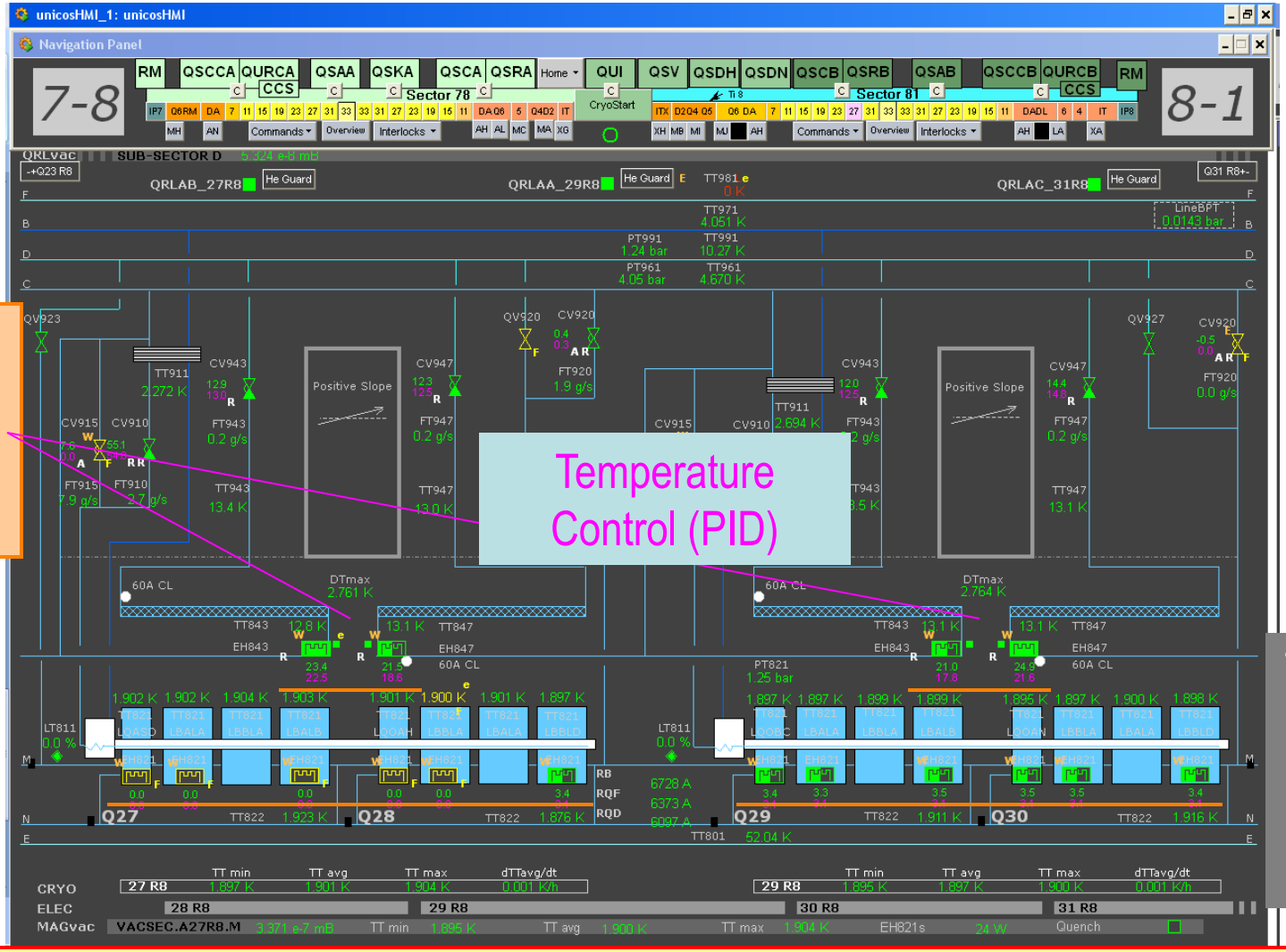
or Stand-alone magnets

No bad experience with heater command

Standard cells (magnets + beam screens)

So far 25 W,

Later on for bake-out (200W)



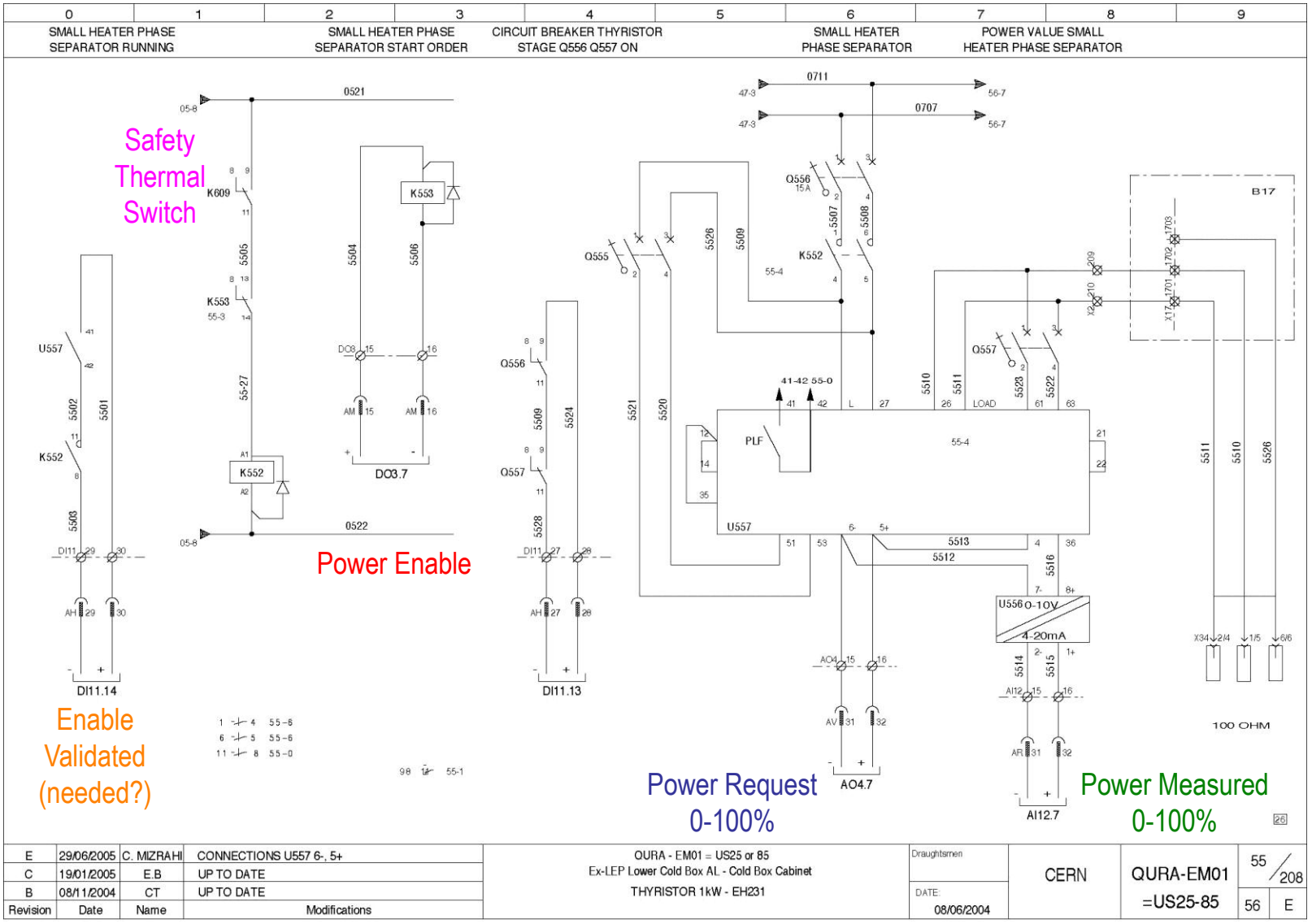
To provide minimum flow to CCs

Few mishaps with power kept ON, local intervention by specialists required !!!

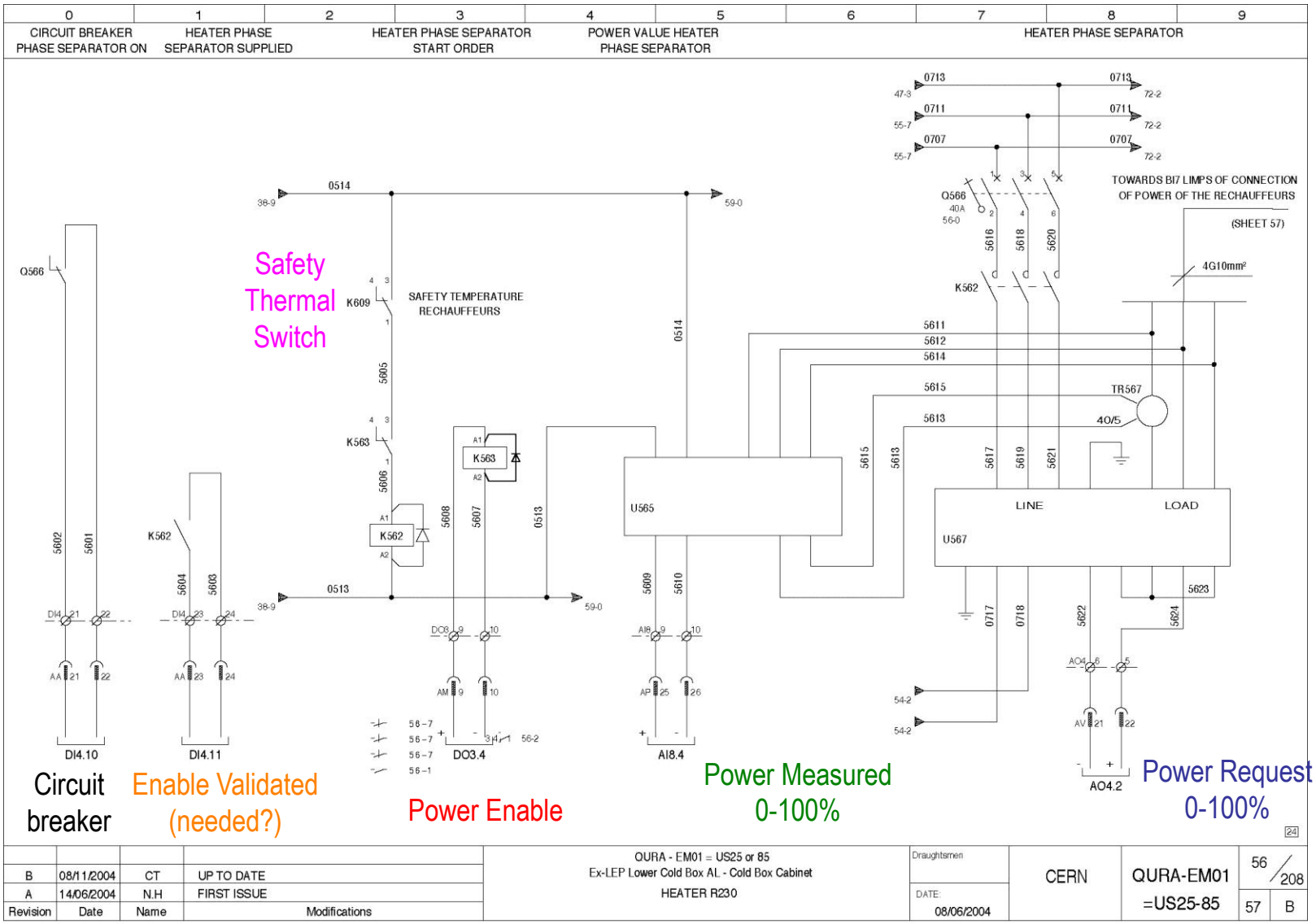
What we would like to have

- DO: ON-OFF independent from Analog request (New)
  - Logic conditions to switch it ON/OFF (operators for special cases)
- DI: Safety switch ON/OFF (setting tuned by referent specialist)
  - If it comes once, temporary stop for both DO and AO
  - If it comes 3 times in less than 2 hours, full stop
- AO: Analog request for power
  - As done now
- *AI: Analog measured power [AI]*
  - *Feedback of dissipated power (if it exists)*
- + Regulation switch or value (independent from safety)
  - HW (iron-like) or SW(PID controler), tuned by operators or logic

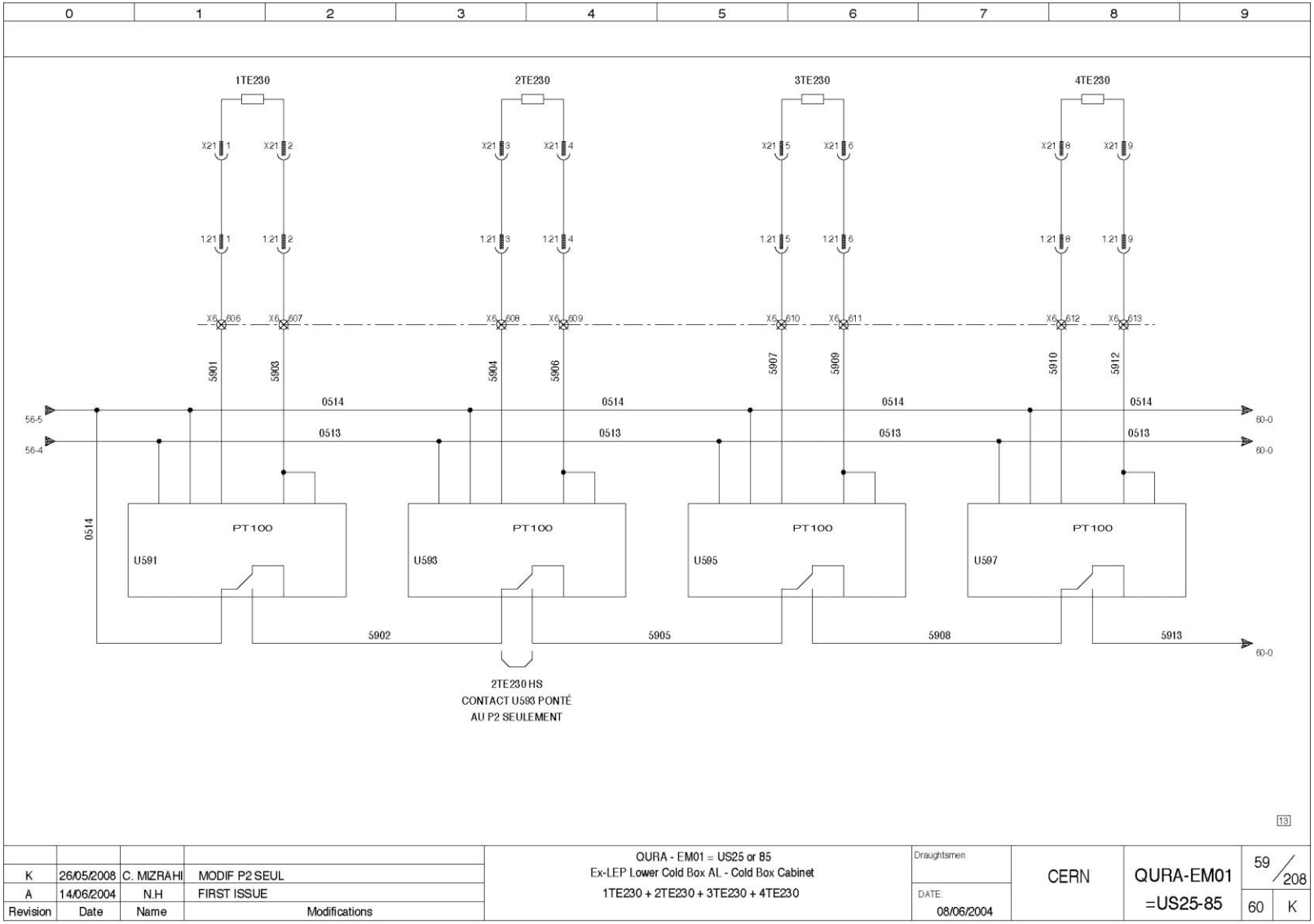
Example No1


0 SMALL HEATER PHASE SEPARATOR RUNNING
1
2 SMALL HEATER PHASE SEPARATOR START ORDER
3
4 CIRCUIT BREAKER THYRISTOR STAGE Q556 Q557 ON
5
6 SMALL HEATER PHASE SEPARATOR
7 POWER VALUE SMALL HEATER PHASE SEPARATOR
8
9
Safety Thermal Switch
Power Enable
Enable Validated (needed?)
Power Request 0-100%
Power Measured 0-100%
DI11.14
DI11.13
DO3.7
AO4.7
AI12.7
100 OHM
U556 0-10V
4-20mA
PLF
LOAD
Revision | Date | Name | Modifications
E | 29/06/2005 | C. MIZRAHI | CONNECTIONS U557 6-, 5+
C | 19/01/2005 | E.B | UP TO DATE
B | 08/11/2004 | CT | UP TO DATE
QURA - EM01 = US25 or 85
Ex-LEP Lower Cold Box AL - Cold Box Cabinet
THYRISTOR 1kW - EH231
Draughtsmen
DATE: 08/06/2004
CERN
QURA-EM01
=US25-85
55 / 208
56 E

Example No2


0 CIRCUIT BREAKER PHASE SEPARATOR ON
1 HEATER PHASE SEPARATOR SUPPLIED
2
3 HEATER PHASE SEPARATOR START ORDER
4 POWER VALUE HEATER PHASE SEPARATOR
5
6
7
8 HEATER PHASE SEPARATOR
9
Safety Thermal Switch
SAFETY TEMPERATURE RECHAUFFEURS
K609
Q566
0514
0513
K562
K563
U565
U567
TR567
40/5
LINE
LOAD
TOWARDS BI7 LIMPS OF CONNECTION OF POWER OF THE RECHAUFFEURS
(SHEET 57)
4G10mm²
DI4.10
DI4.11
DO3.4
AI8.4
AO4.2
Circuit breaker
Enable Validated (needed?)
Power Enable
Power Measured 0-100%
Power Request 0-100%
QURA - EM01 = US25 or 85
Ex-LEP Lower Cold Box AL - Cold Box Cabinet
HEATER R230
Draughtsmen
DATE: 08/06/2004
CERN
QURA-EM01 =US25-85
56 / 208
57 B
B 08/11/2004 CT UP TO DATE
A 14/06/2004 N.H FIRST ISSUE
Revision Date Name Modifications

Safety switches part1



Revision	Date	Name	Modifications
K	26/05/2008	C. MIZRAHI	MODIF P2 SEUL
A	14/06/2004	N.H	FIRST ISSUE

QURA - EM01 = US25 or 85
Ex-LEP Lower Cold Box AL - Cold Box Cabinet
1TE230 + 2TE230 + 3TE230 + 4TE230

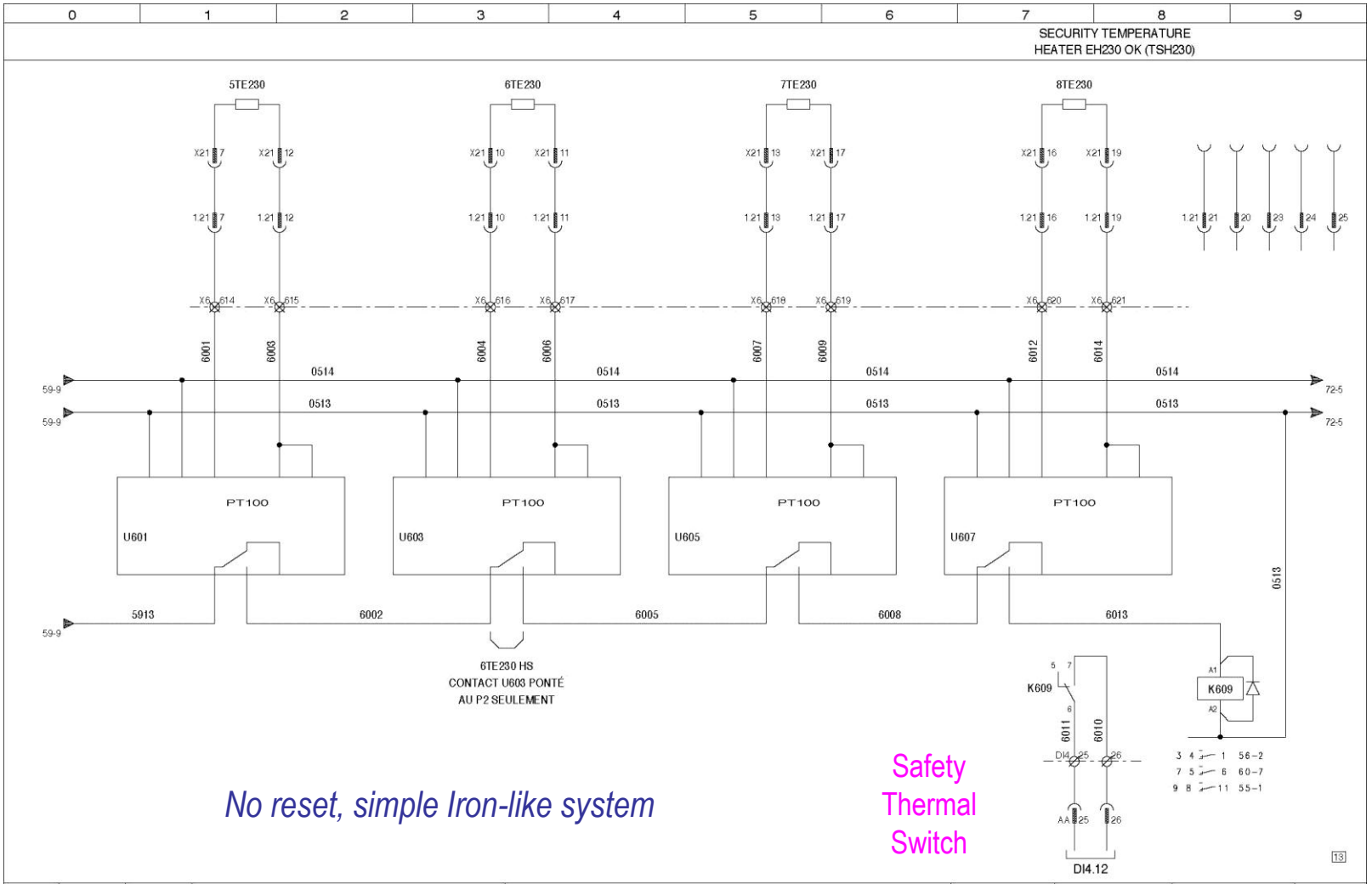
Draughtsmen
DATE: 08/06/2004

CERN

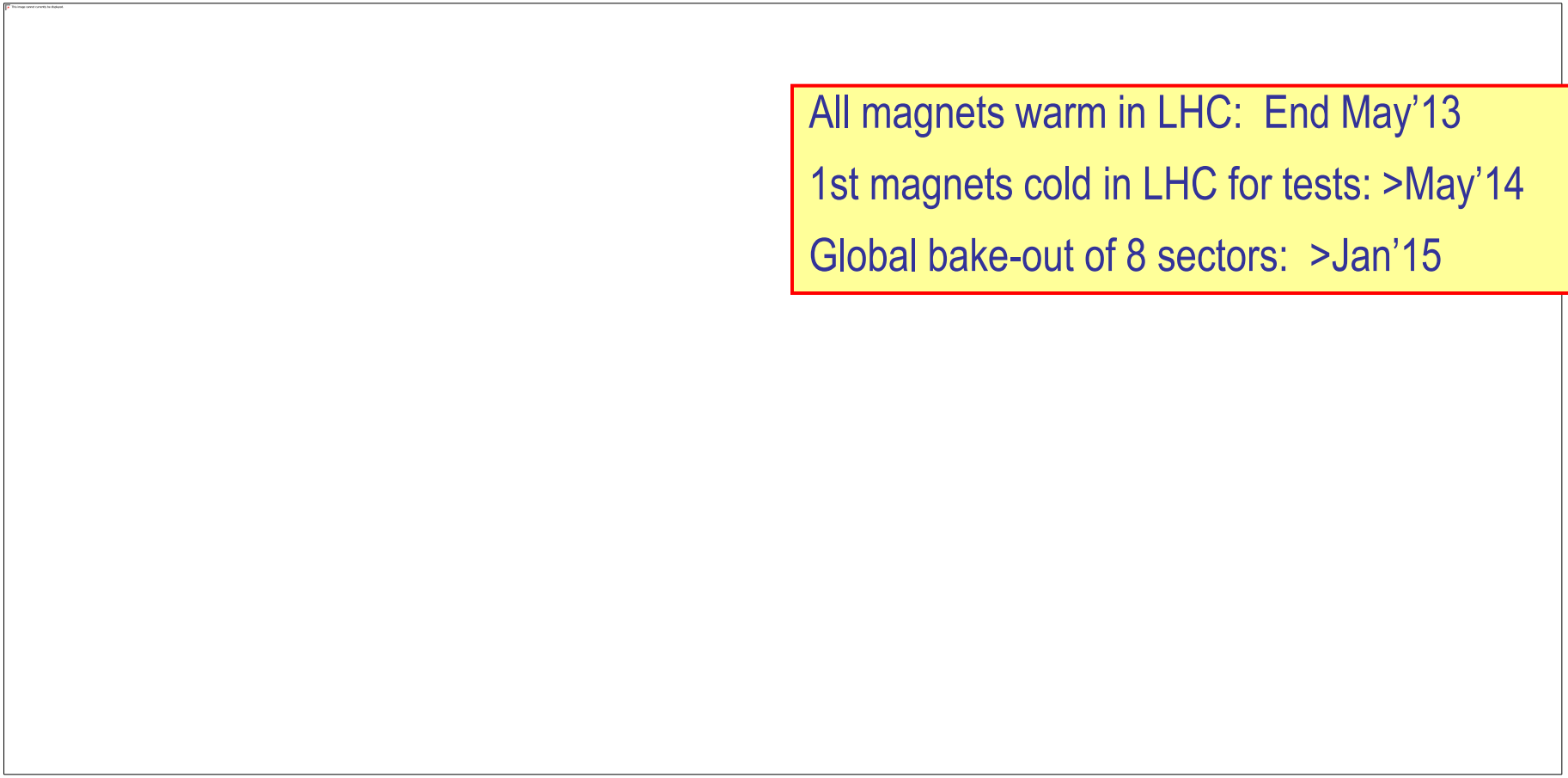
QURA-EM01
=US25-85

59 / 208
60 K

Safety switches part2



Key dates for cryogenics



All magnets warm in LHC: End May'13

1st magnets cold in LHC for tests: >May'14

Global bake-out of 8 sectors: >Jan'15

Summary

- Large variety of heaters used in the cryogenic system
  - Some with PID loops with active control (beam-screens)
  - Some to empty liquid helium or warm-up

- Few mishaps with some heaters ON and out of control !
- Strong wish to have an independent ON/OFF button for each heater (at least > 100W)

- Internal needs for summer'14, for beams early 2015