lucasz.

Light Use Cooling Appliance for Surface Zones

LUCASZ for LHCb UT

CERN, 6 December 2017

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LUCASZ performance overview

- The LUCASZ project has been presented in this years mechanical forum in Marseille.
- For details about the performance please go the forums indico:
  - https://indico.cern.ch/event/590227/contributions/2614157/attachments/1488191/2312099/Lucaszforum2017-V3.pdf

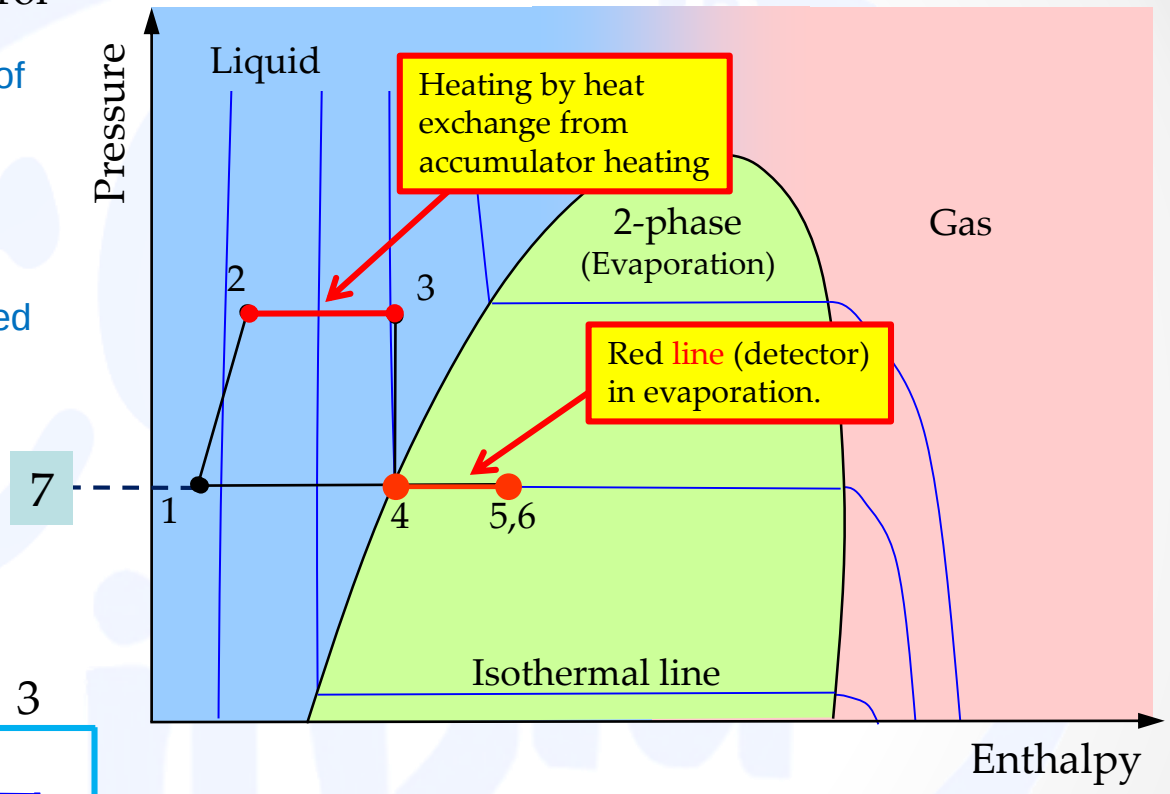
Patented I-2PACL cycle

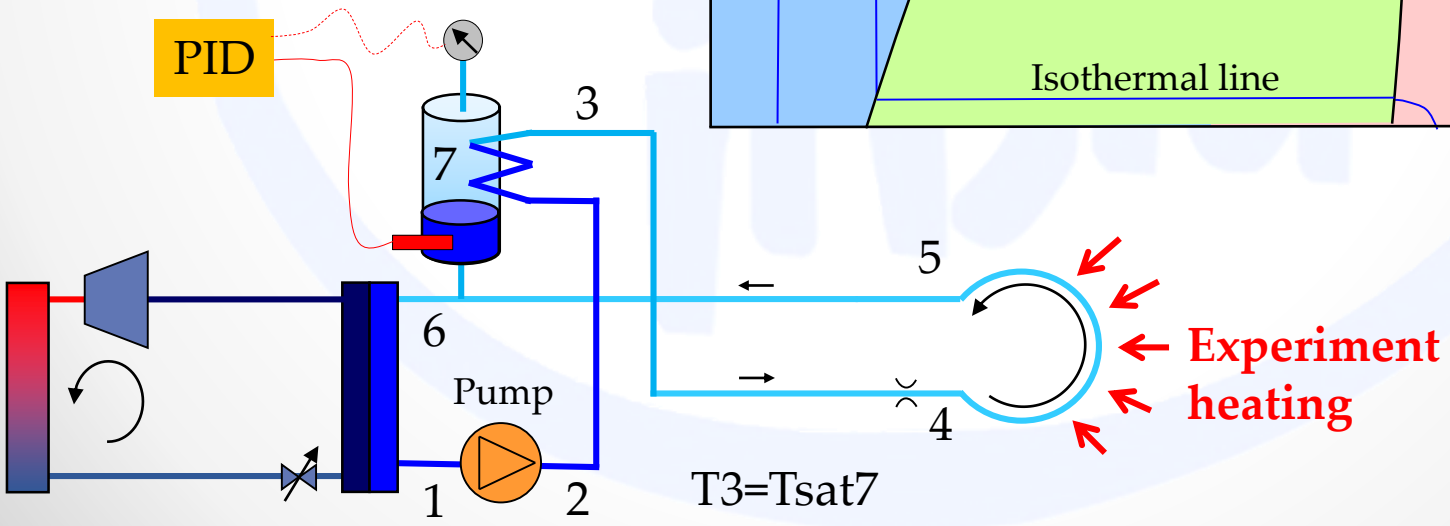
Integrated 2-Phase Accumulator Controlled Loop

- Advantages:
  - Simple design
  - Modular (strict separation of chiller and CO2 system)
  - 1 controller for both saturation and liquid temperature
  - No long transfer line needed
- Disadvantage:
  - Less power efficient

(Constant heating against cooling)

Where the transfer line functionality is integrated in the accumulator control





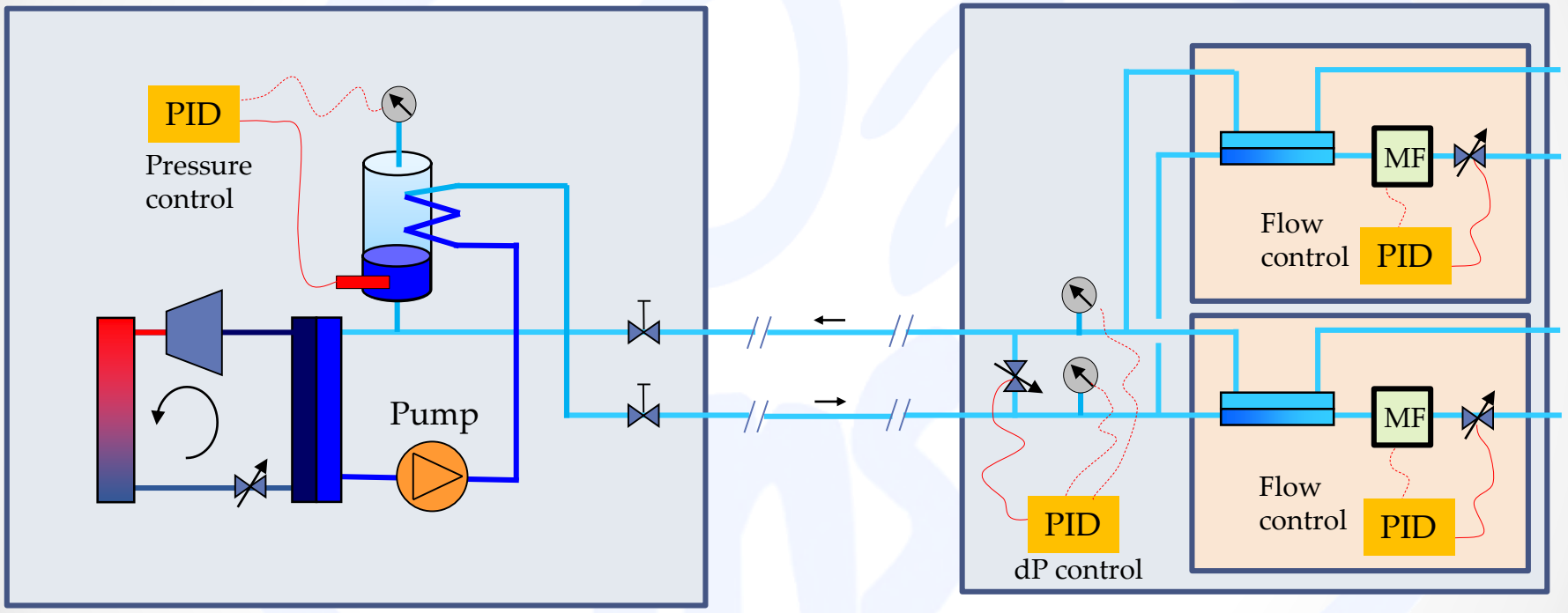
LUCASZ plant configuration

LUCASZ^{lite} Cooling Plant

- *Can be used stand alone*
- *Expert use needed*

LUCASZ Local Boxes

- *Providing 2 cooling branches with a controlled flow*
- *Providing automatic procedures for connecting and disconnecting experiments*
- *Designed for unexperienced users*



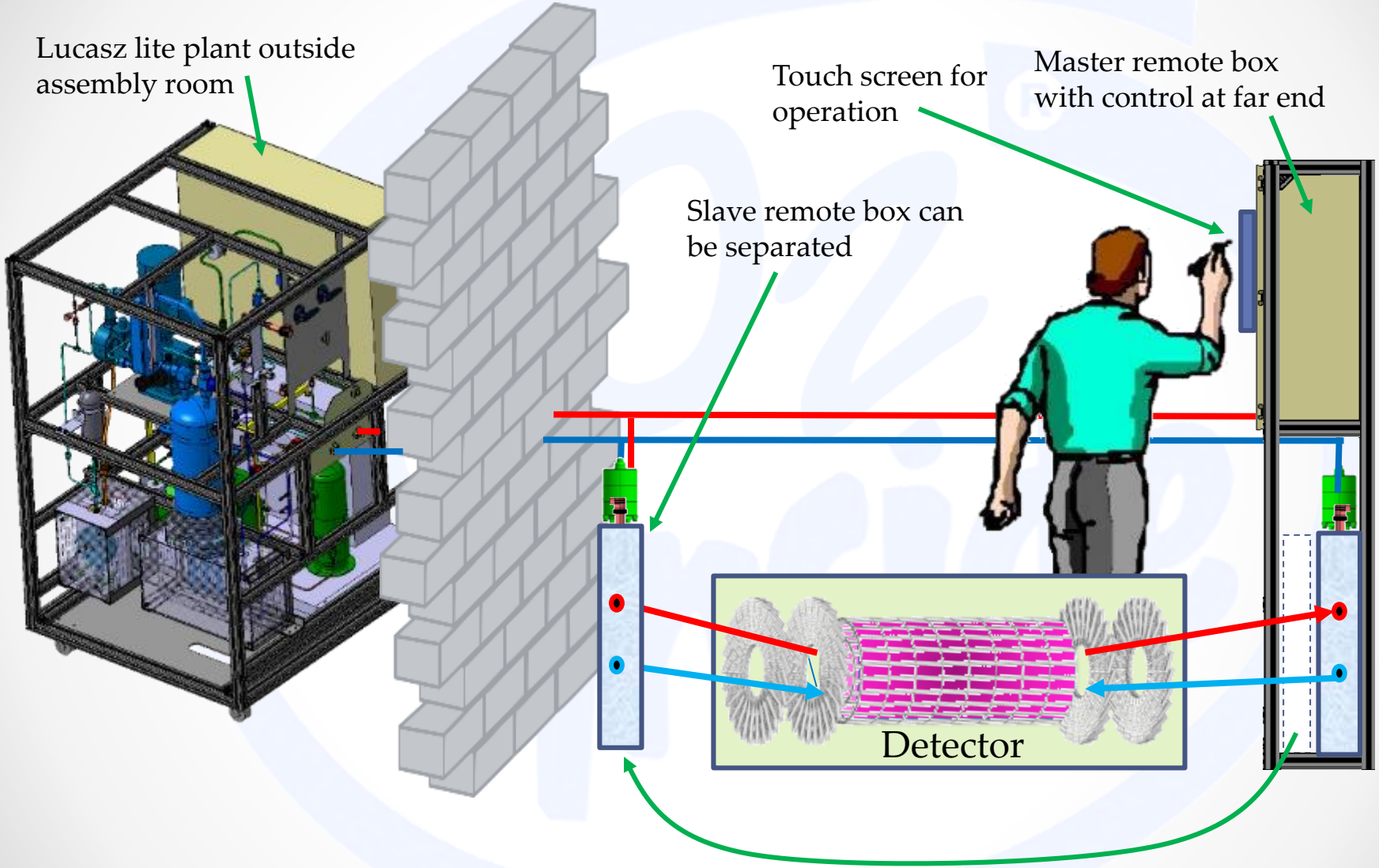
Fixed mass flow
(Manual setting)

Controlled temperature
(Liquid feed and 2-phase evaporation return)

- Pressure drop regulation in by-pass
- 2x mass flow controlled out put

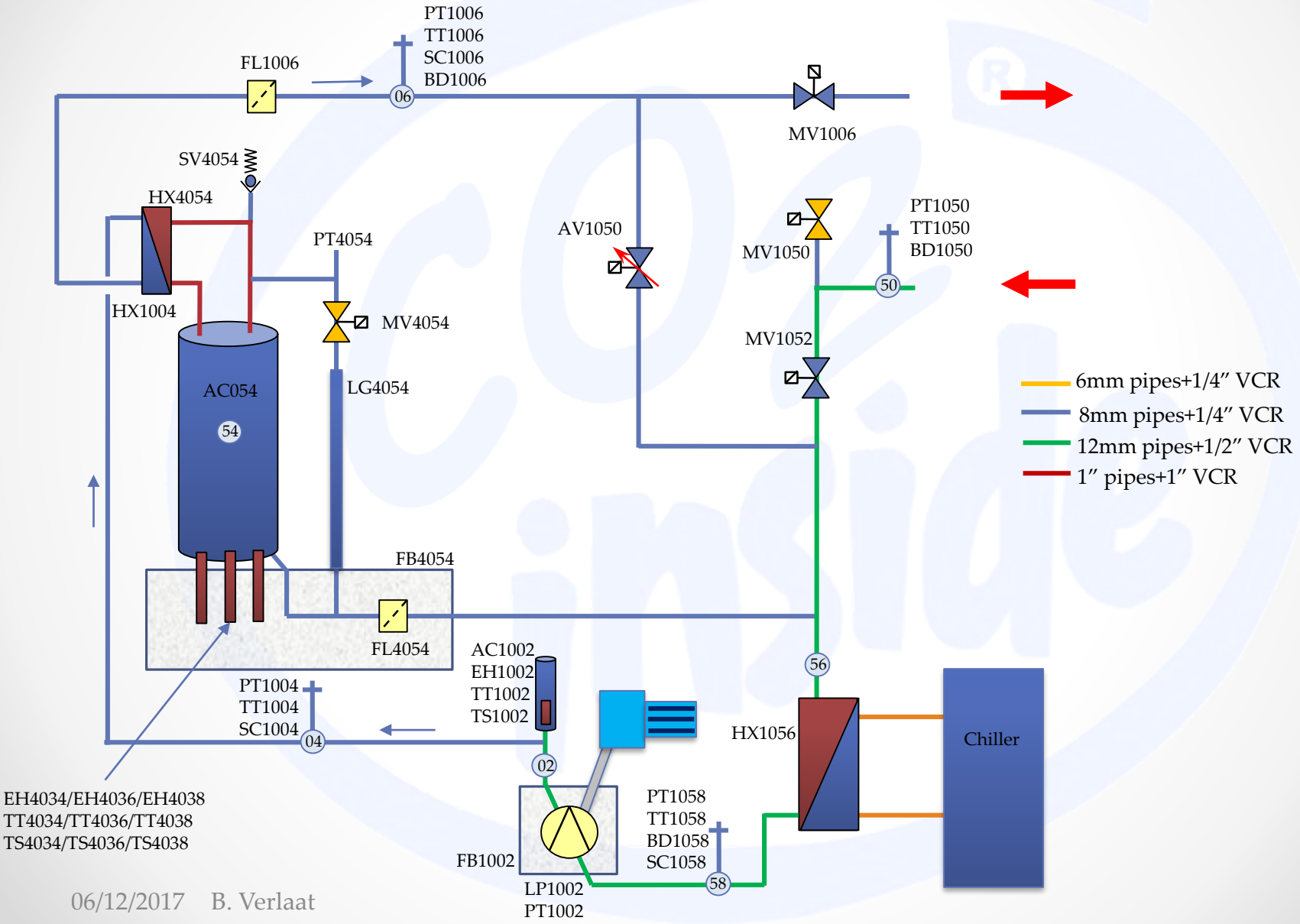
No local box have been build so-far for the UT

LUCASZ remote configuration



LUCASZ*lite* plant P&ID

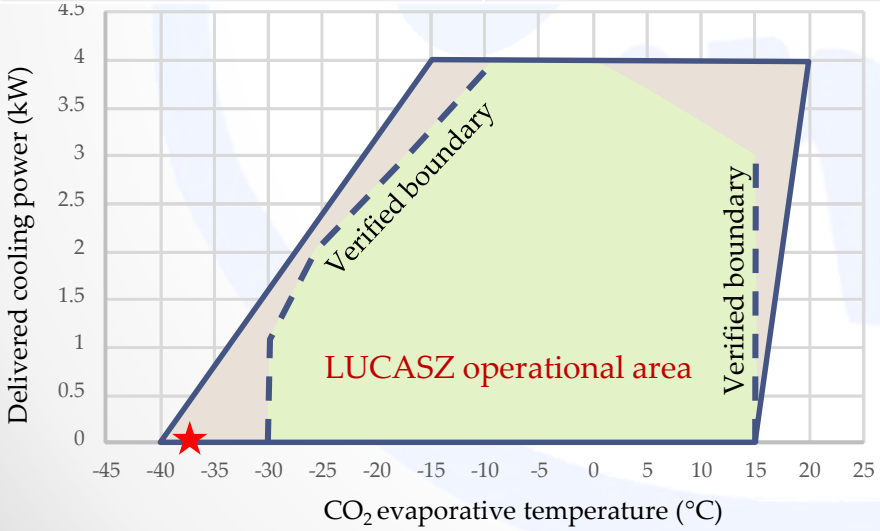
As build for the UT



Design Specifications and Verification of the Lucasz full version

Feature	Performance
Cooling loop maximum flow	10g/s per loop
Total plant flow	20g/s
Min evaporating T	-30°C, depending on heat load, see graph
Max evaporating T	+18°C
Number of cooling loops	#2
Max DP across cooling loop	<15 Bar
Cooling loop max power	2000 W
Dimensions (LxWxH)	1125/1475* x 1300 x 1820 *Lite/Full version

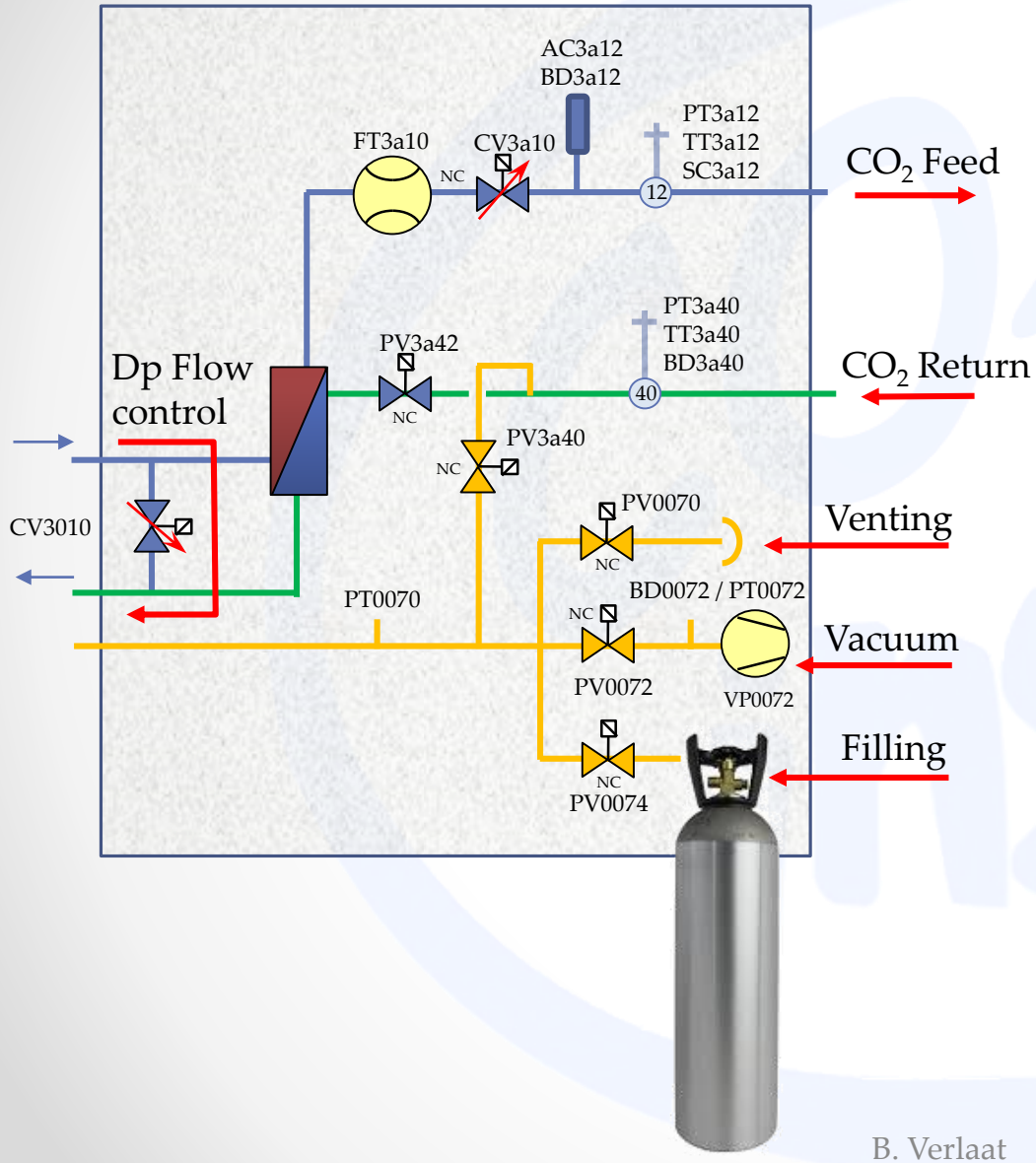
The minimum temperature performance is not (yet) met in Lucasz-V1a (some modifications needed). 1st tests with V1b showed better performance (-38.5'C, no load)



The LUCASZ commissioning was successful, measured performance close to design performance

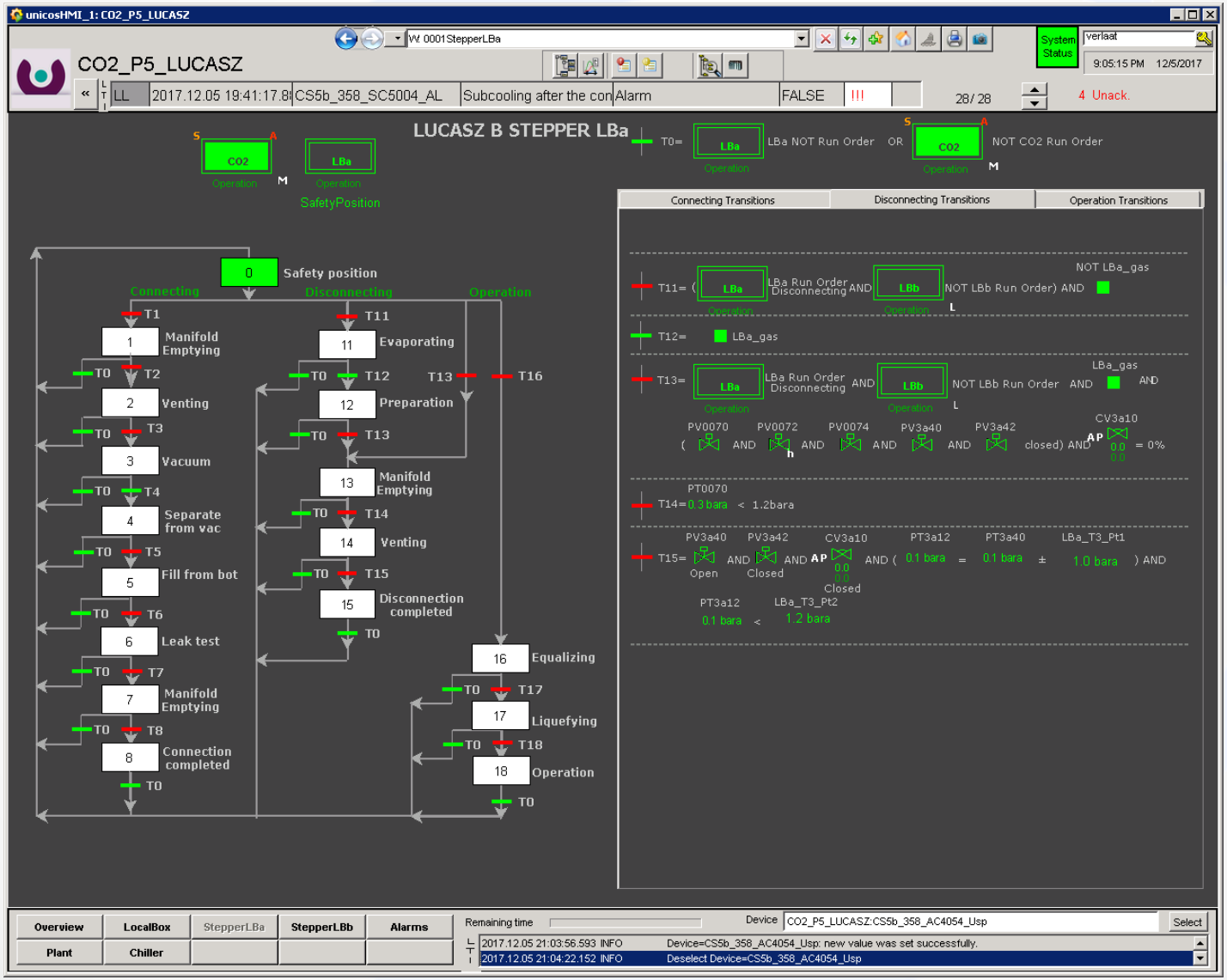
LUCASZ local boxes

Lucasz full version has 2 local boxes

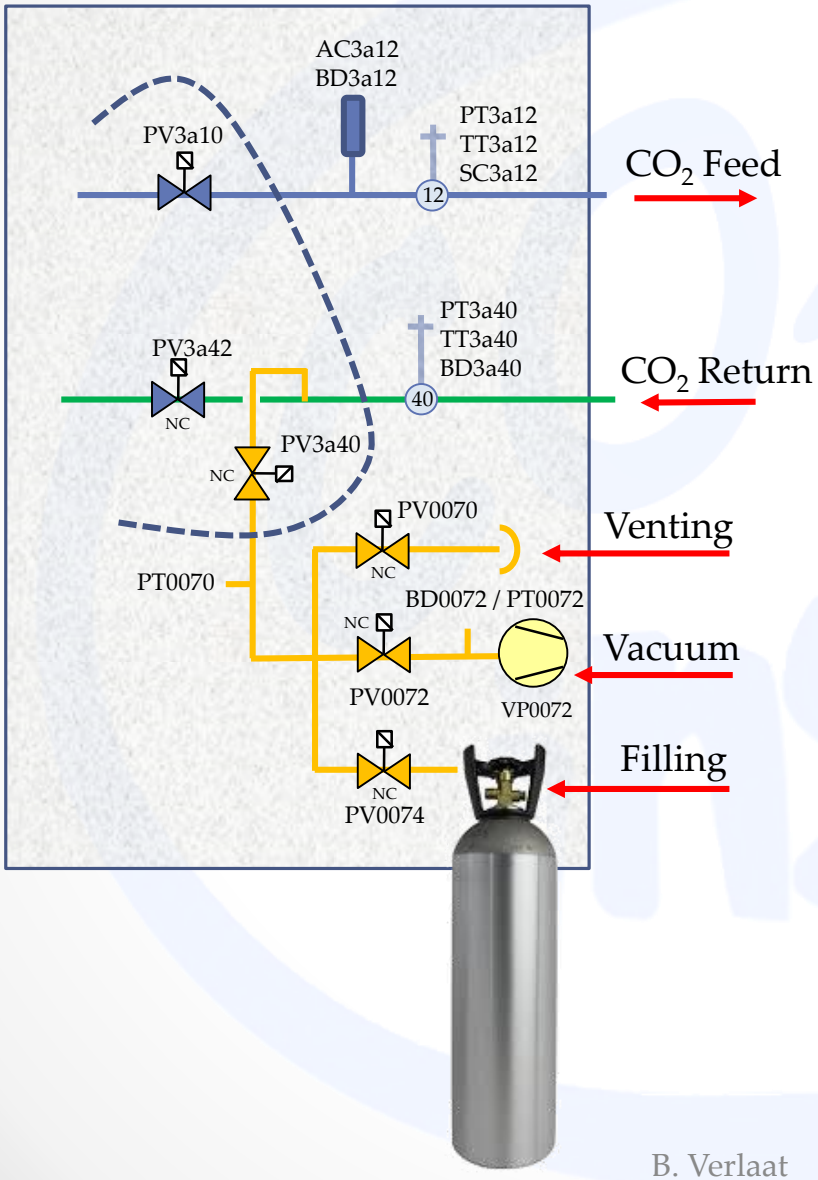


- Flow control per local box
- dP control of plant flow
- Heat exchanger to pre cool arriving liquid
- Touch screen operation
- Possibility to install the 2 boxes remote from plant and from each other
- Connection procedure
  - Vent
  - Vacuum
  - Fill gas from bottle
  - Open valves to system
  - Ready
- Disconnecting procedure
  - Close inlet valve / open return valve
  - Cool accu to -20 °C (20 bar)
  - Experiment is emptied by evaporation
  - Once empty remaining 20 bar gas is vented
  - Ready
- A damper vessel is present at inlet
  - Acts as expansion vessel for liquid trap (2x NC valves)
  - Flush the experimental lines from eventual liquid during vent

Connecting and disconnecting fully automatic



Simplified LUCASZ local box (The advised minimum need)



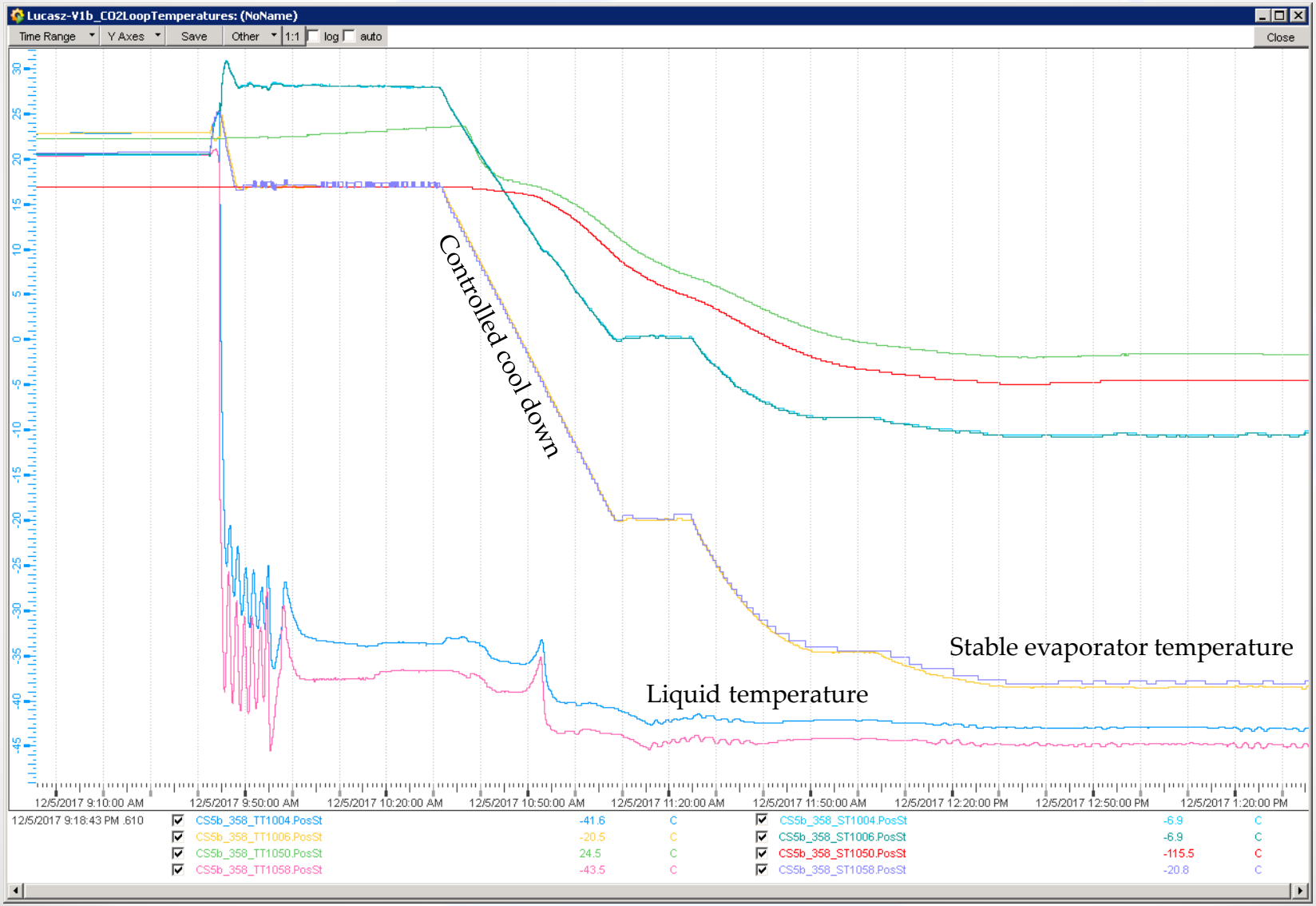
- 1 branch, flow fixed by pump stroke (manual adjustable)
- Valves can be made manual, but good step by step instructions are needed
- Costs of the simple box or manual box need to be evaluated
- 3 valves in the dashed area are also on the plant. If the connection is short they can be used as such.

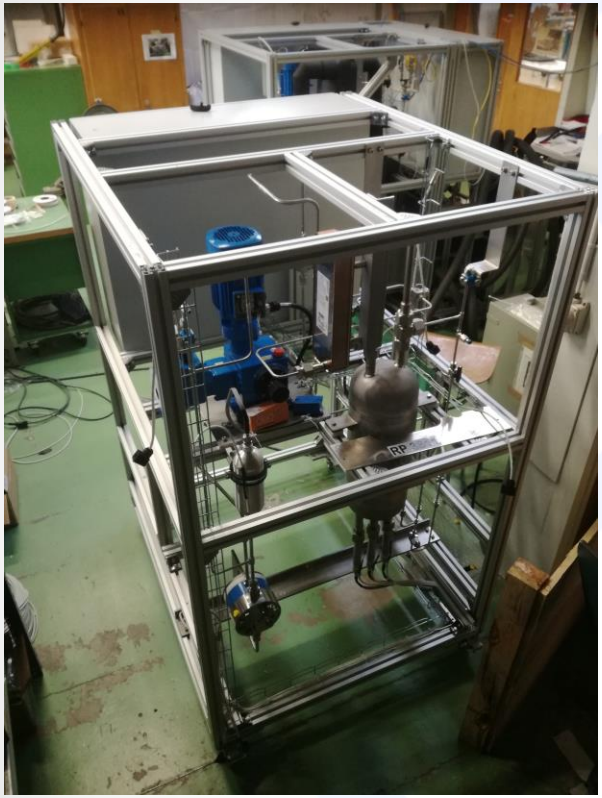
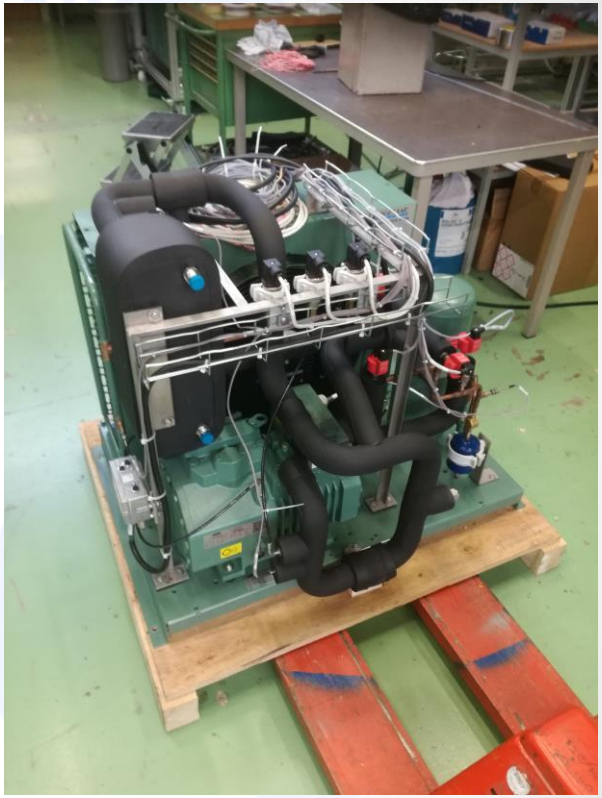
Lucasz factory

- CMS unit
  - Fully constructed
  - Insulated
  - Under testing
- LHCb-Velo unit
  - Mechanically ready
  - Cabling on going
- LHCb-UT unit
  - Mechanically ready except from chiller installation
  - Cabling on going
- Foreseen finalization of the construction end 2017
- Testing of 2 LHCb units start in January
- Due to the sudden urgency of the CMS unit (unforeseen pixel extraction), we had to focus fully on the CMS unit.

CMS Lucasz under testing

LUCASZ operation for LHCb UT



LHCb-VELO Lucasz

LHCb-UT Lucasz