Update on Cryogenic Infrastructure

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Outline:
- update on PID
- list of open issues
- summary

(see also latest version of technical proposal)

Piping and Instrumentation Design (PID)

pressure control & safety devices

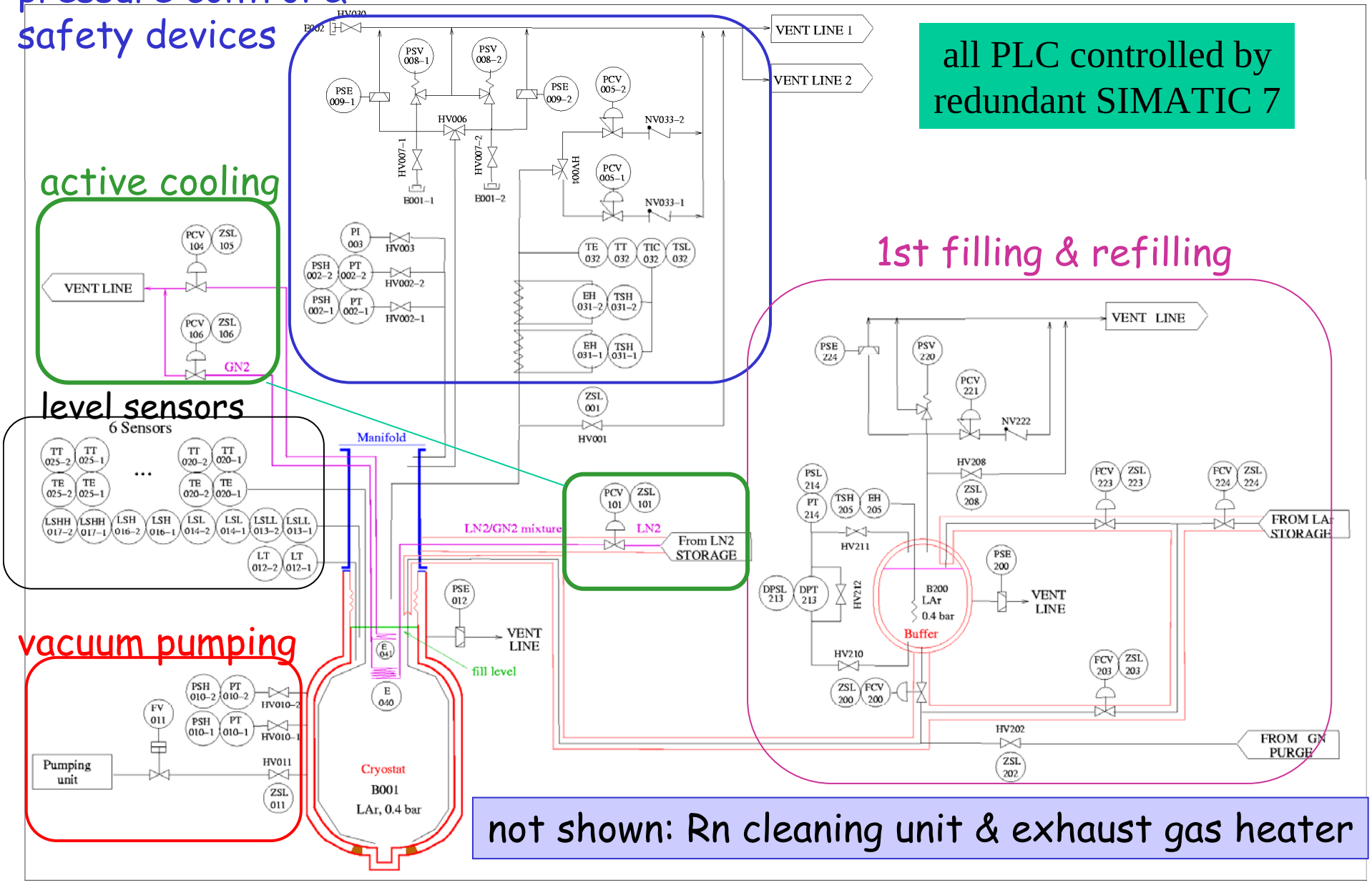
active cooling

level sensors

vacuum pumping

1st filling & refilling

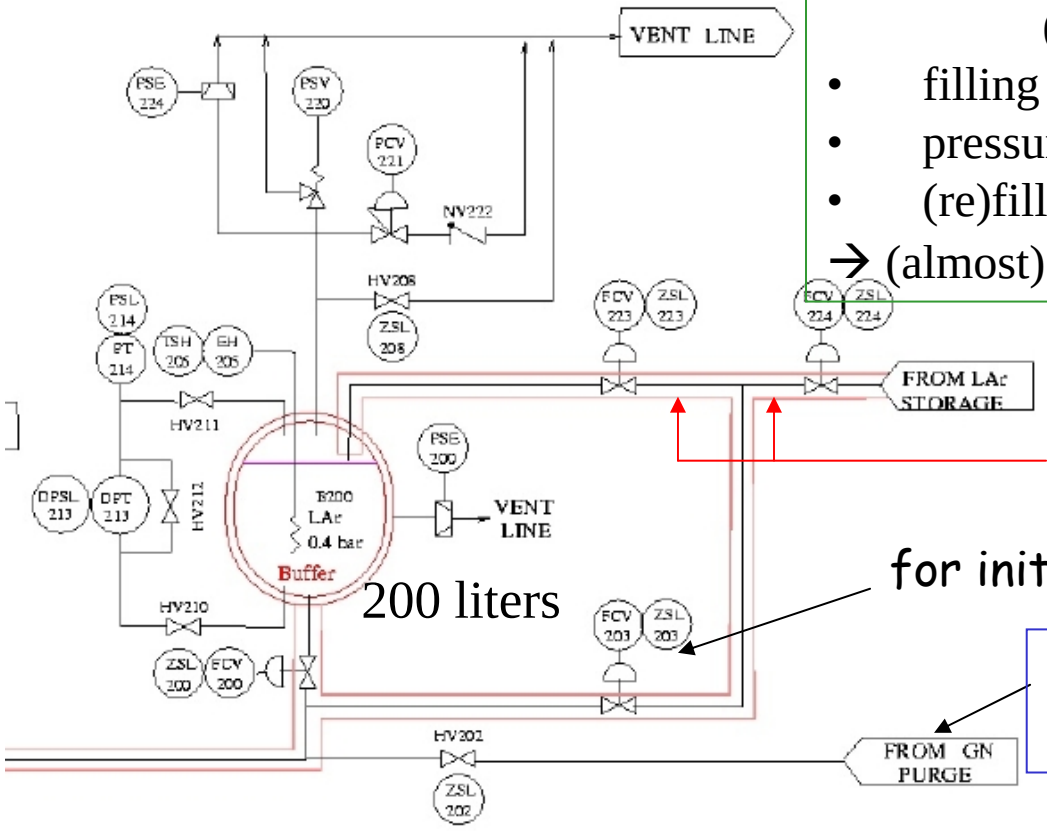
all PLC controlled by redundant SIMATIC 7



not shown: Rn cleaning unit & exhaust gas heater

Filling and Emptying

exhaust gas of buffer can be used for purging



(re)filling procedure:

- filling of buffer from LAr storage
- pressure reductíon to cryostat pressure
- (re)filling of cryostat, flow due to gravity

→ (almost) no flash losses and microphonics

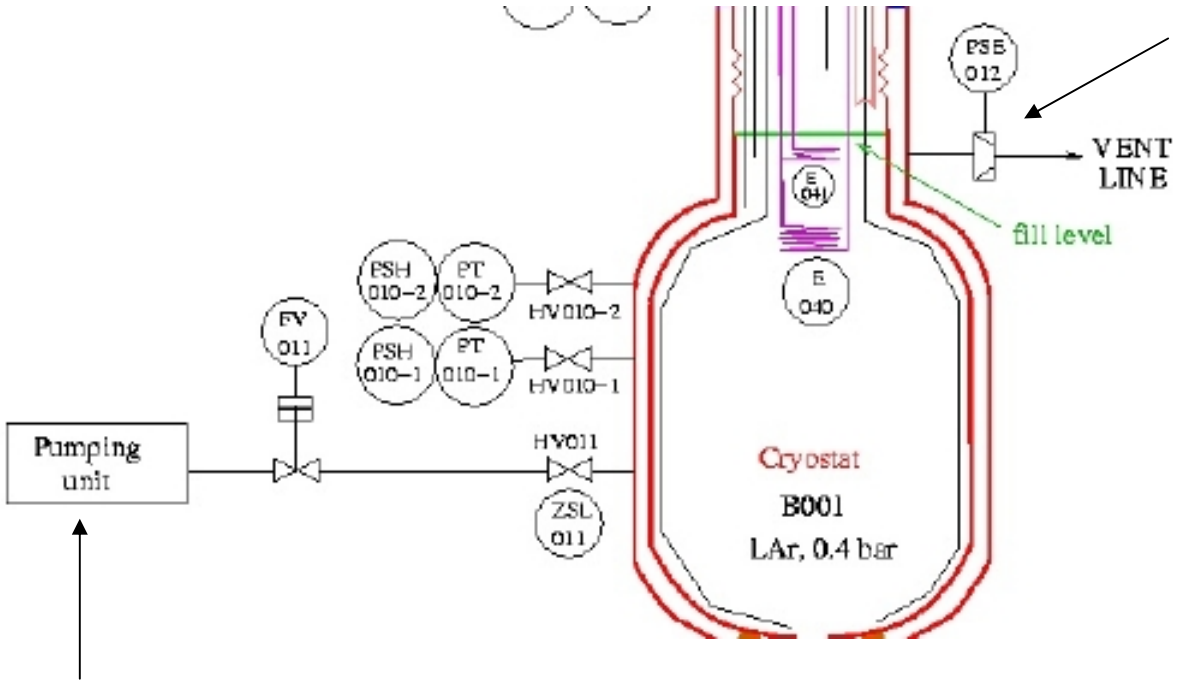
Rn reduction plant goes here

for initial filling, filling time not crucial

for gas purge before filling,
better: evacuation of everything

emptying: i) evaporation with heater: 2 weeks for 10 kW
ii) pressure increase and pipe to bottom of cryostat, need ~1.2 bar
iii) LAr pump

Vacuum pumping



rupture disk: in case of a leak in the inner container

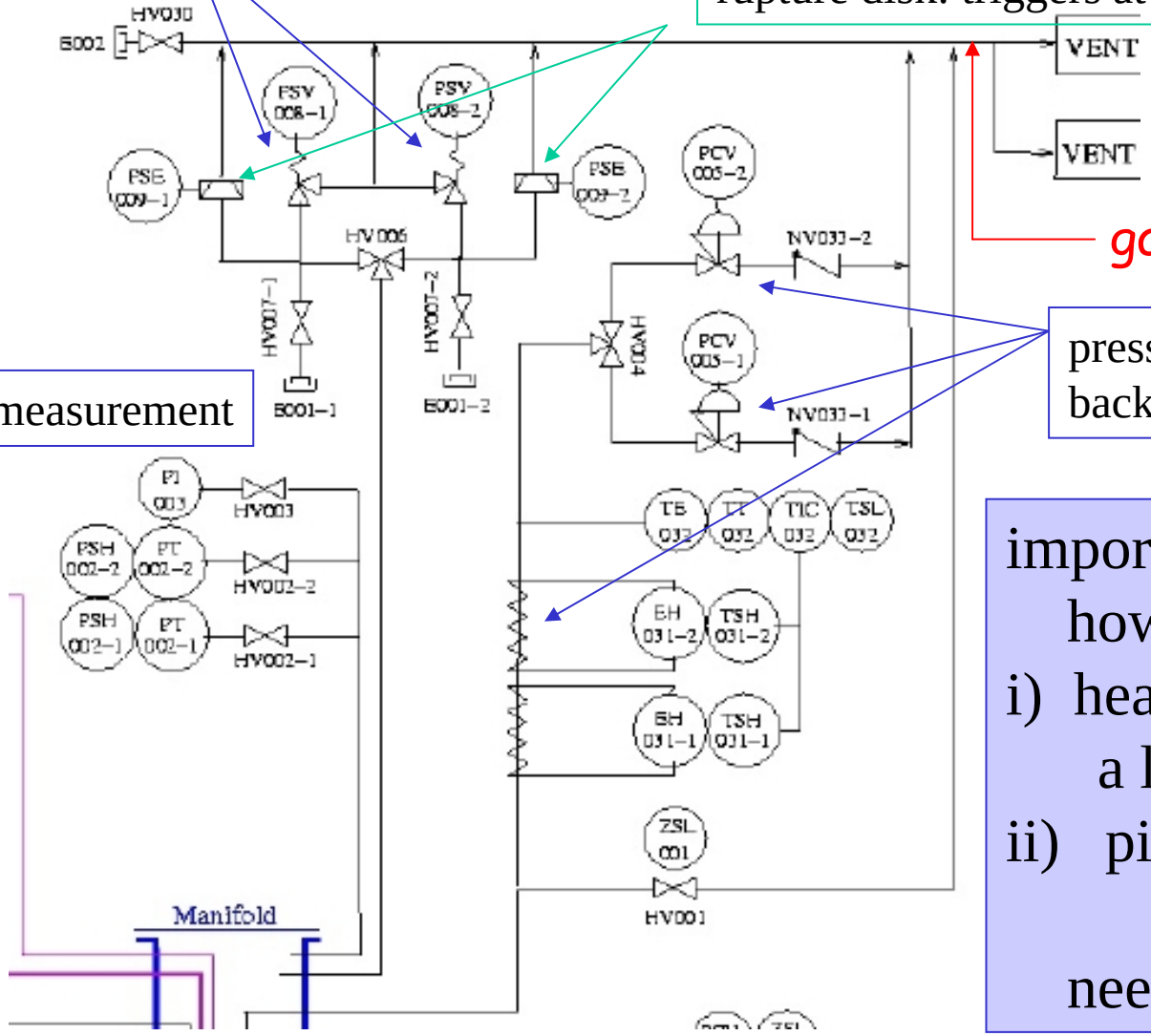
turbo pump with oil-free prepump, pumping on demand (FV011 open/closed)

measurement of vacuum pressure is most sensitive probe for leaks

Safety devices and pressure control

safety valve: triggers at 0.9 bar, Ø for loss of insulation vacuum

rupture disk: triggers at 1.3 bar, Ø for a leak in a wall



gas heater goes here

pressure control valve with backflow valve and heater

P measurement

important open issue:

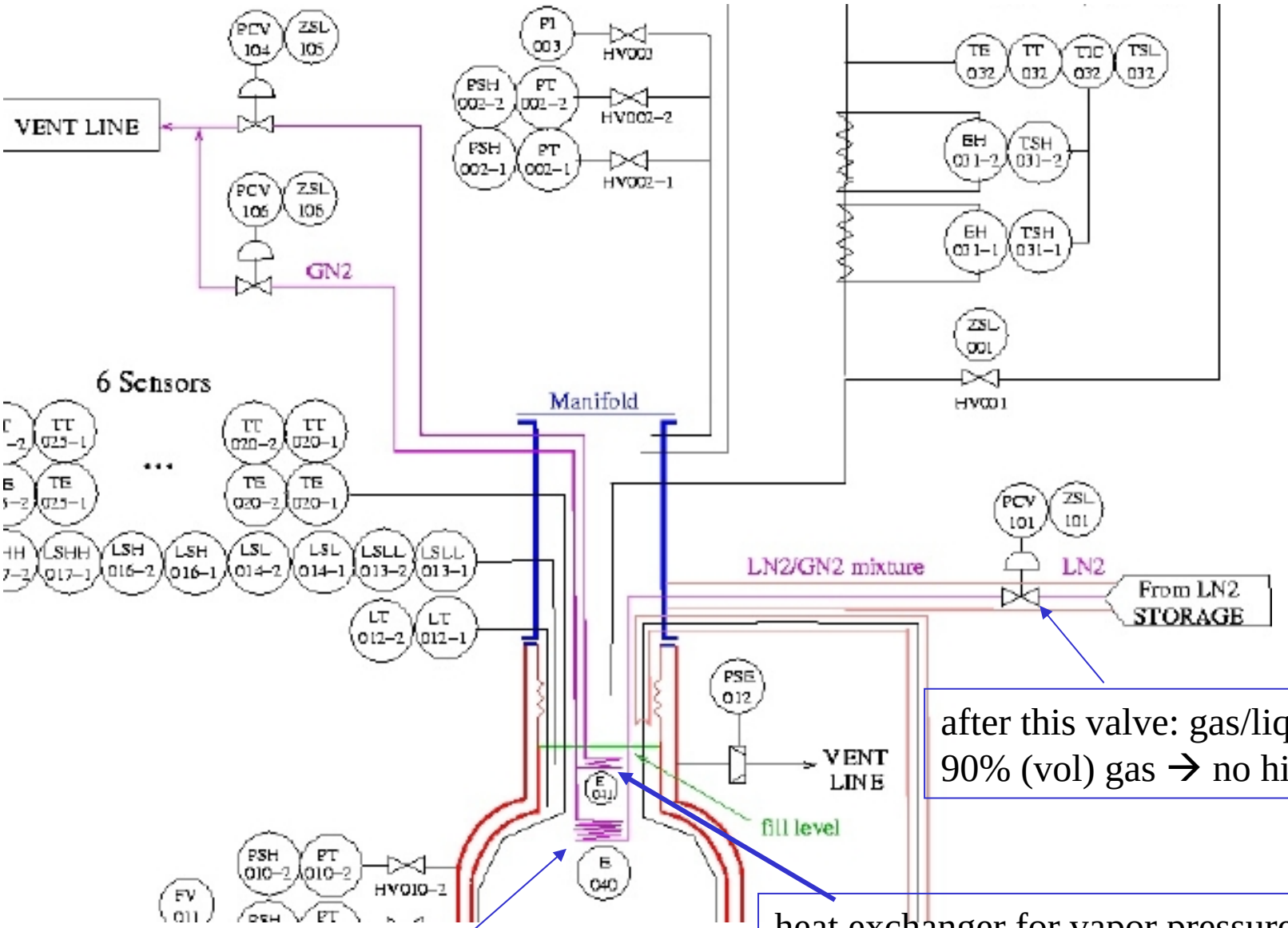
how to heat exhaust gas?

i) heated steatite mineral a la ICARUS

ii) pipe through water tank

need dimensioning first

Active cooling: no evaporation of LAr/LN2



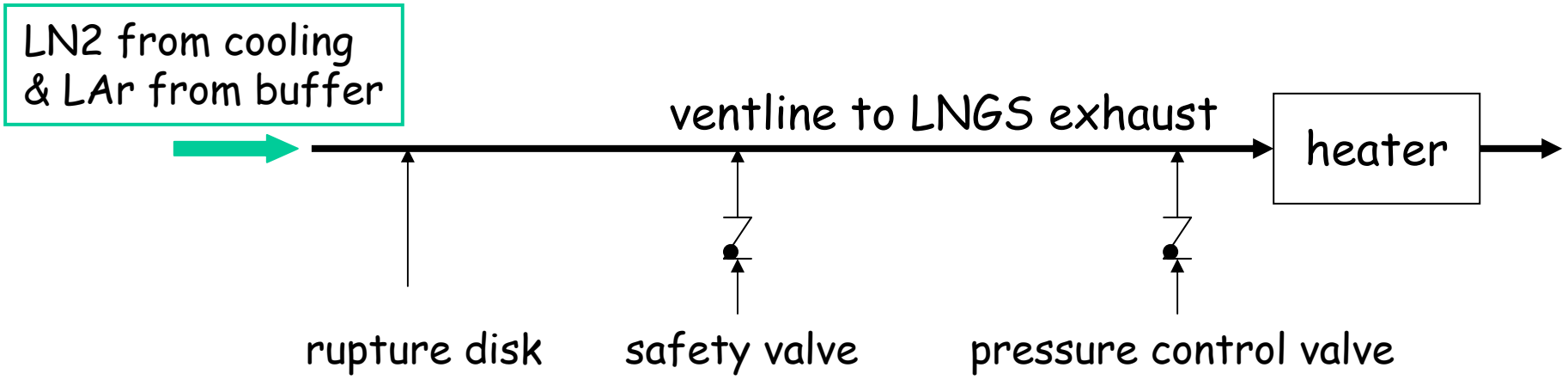
Rn cleaning unit

options:

1) large facility a la Borexino:
   only needed if we have no active cooling,
   company which produced the existing unit does not "exist" any longer
2) small facility:
   cleans only the LAr/LN2 for refilling
3) no Rn cleaning at all:
   active cooling avoids all losses unless warm material enters LAr

No decision made at the moment, but option 1) strongly disfavored

Ventline purge to avoid Rn back flow



Summary

- (final) solution for active cooling of LAr/LN2
- make decision on heating of exhaust gas soon, need dimensioning of heater
- no large Rn reduction plant
- prepare tendering document

→ start tendering in September