Nitrogen release from the TT2A cryogenic solenoid systems

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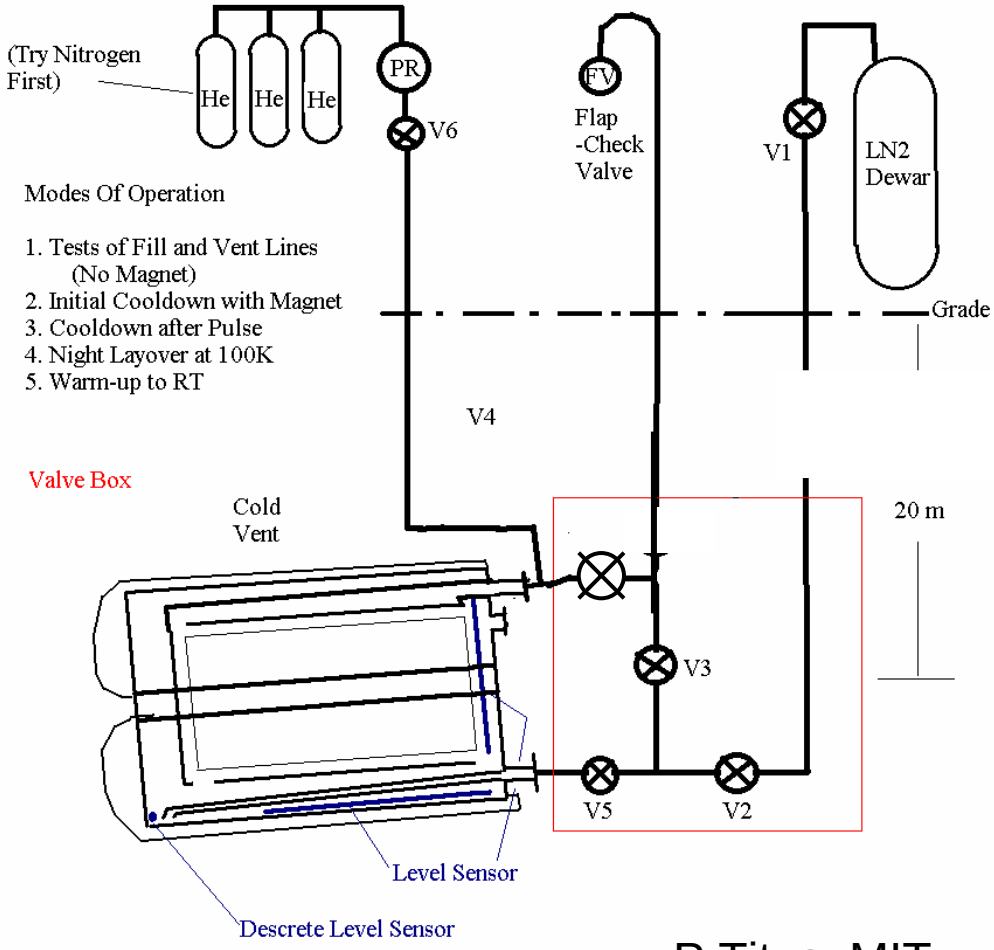
Videoconference, 3rd May 2005

LN2 circuit (old)

Old scenario

- 100 % exhaust to surface/atmosphere



P.Titus, MIT

Restrictions to nitrogen release

MEMORANDUM

To: A. Fabich, AB-ATB

cc: Ch. Hill, RSO AB, P. Cennini, DSO AB, P. Carbonez, SC-RP

From: Th. Otto, M. Silari, SC-RP

Conc.: Release of N_2 from nTOF 11

The experiment nTOF 11 envisages to irradiate a mercury jet target in a liquid nitrogen cooled solenoid with 100 pulses of protons from the PS. The liquid nitrogen in the cryostat will be activated during the irradiation, evaporated and released to the environment.
Via this pathway, a total release from the experiment of 37 GBq of short-lived beta-emitters (^{11}C, ^{13}N...) shall not be exceeded. This figure presents 1% of the emissions from the operation of other accelerators and experiments on the Meyrin site.
The activation of liquid nitrogen in the cryostat by the proton pulse has been estimated by a Monte-Carlo calculation. After a waiting time of 60 s after the proton pulse, an activity of 33 MBq/l would be released to the environment. Longer waiting times would further reduce this figure.
The baseline scenario of nTOF 11 foresees to drain the cryostat from liquid nitrogen before the proton pulse. A residual of not more than 1 litre of N_2 would remain in the cryostat. In this scenario, a total of 3.3 GBq of short-lived beta-emitters would be released during the 100 proton pulses. The baseline scenario is feasible from the viewpoint of radioactive releases.
An alternative scenario, where 120 litres of N_2 remain in the cryostat before the proton pulse, are activated and released, is not compatible with the ceiling on releases.

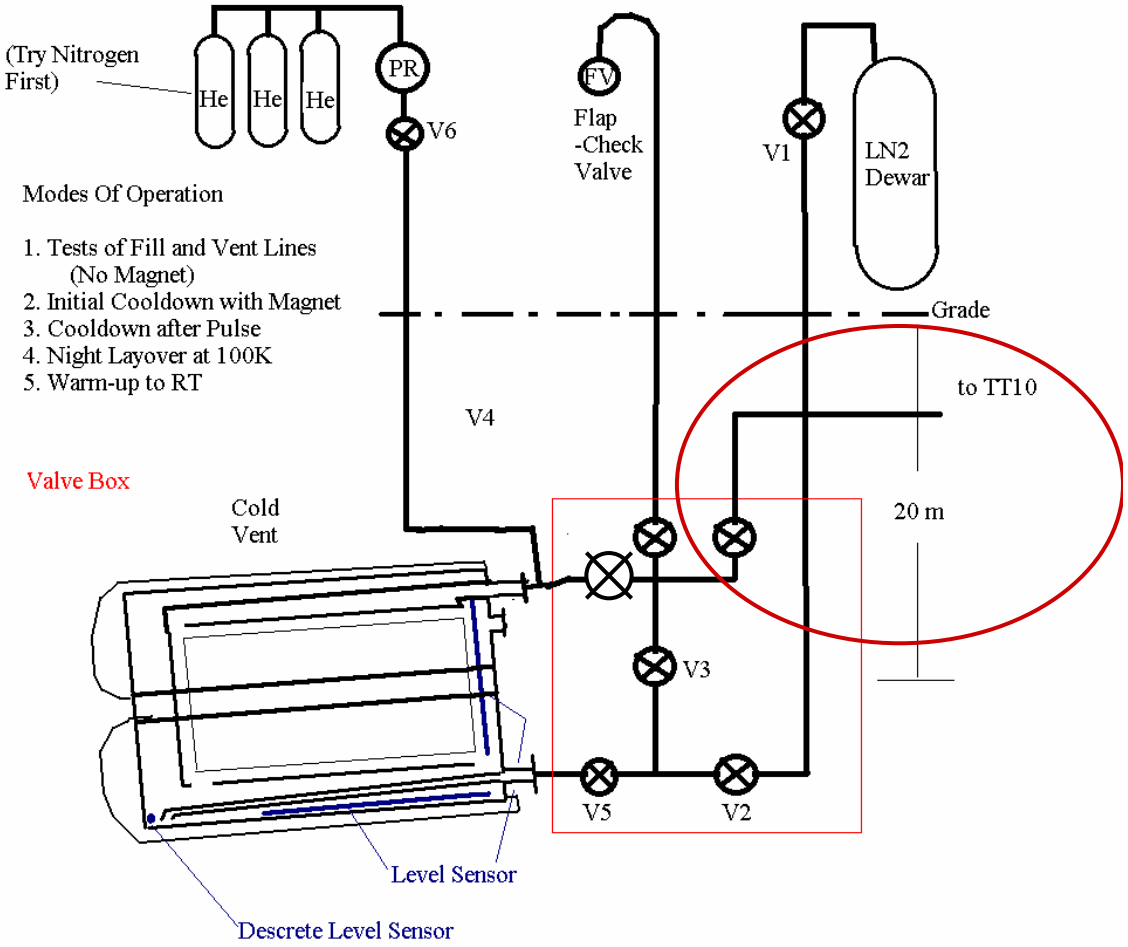
One modification is required to the baseline scenario: the activated N_2 gas shall be released via a filtered and monitored stack, either by the n-TOF target area ventilation, or, if this is unavailable at the time of the experiment, via transfer tunnel TT10.

Memo available: at homepage

- NO release of activated LN2 directly to atmosphere
- Release of activated nitrogen to TT10
  - See memo
- Minimize activated LN2
  - Remove LN2 previous to beam extraction
  - <1 liter remaining in cryostat

LN2 circuit (new)

- Additional line to TT10
  - Activated LN2 to TT10
  - Other to surface

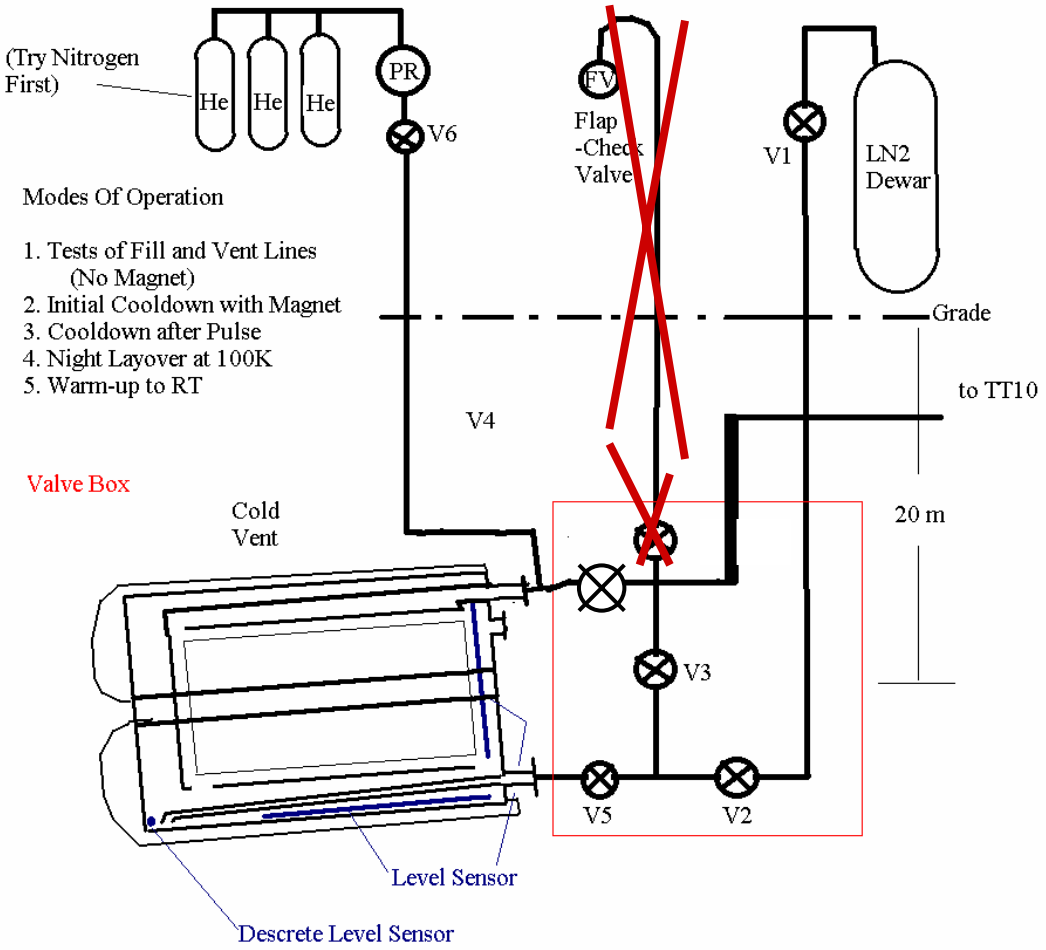


LN2 circuit (new)

Minimum LN2 rests in cryostat

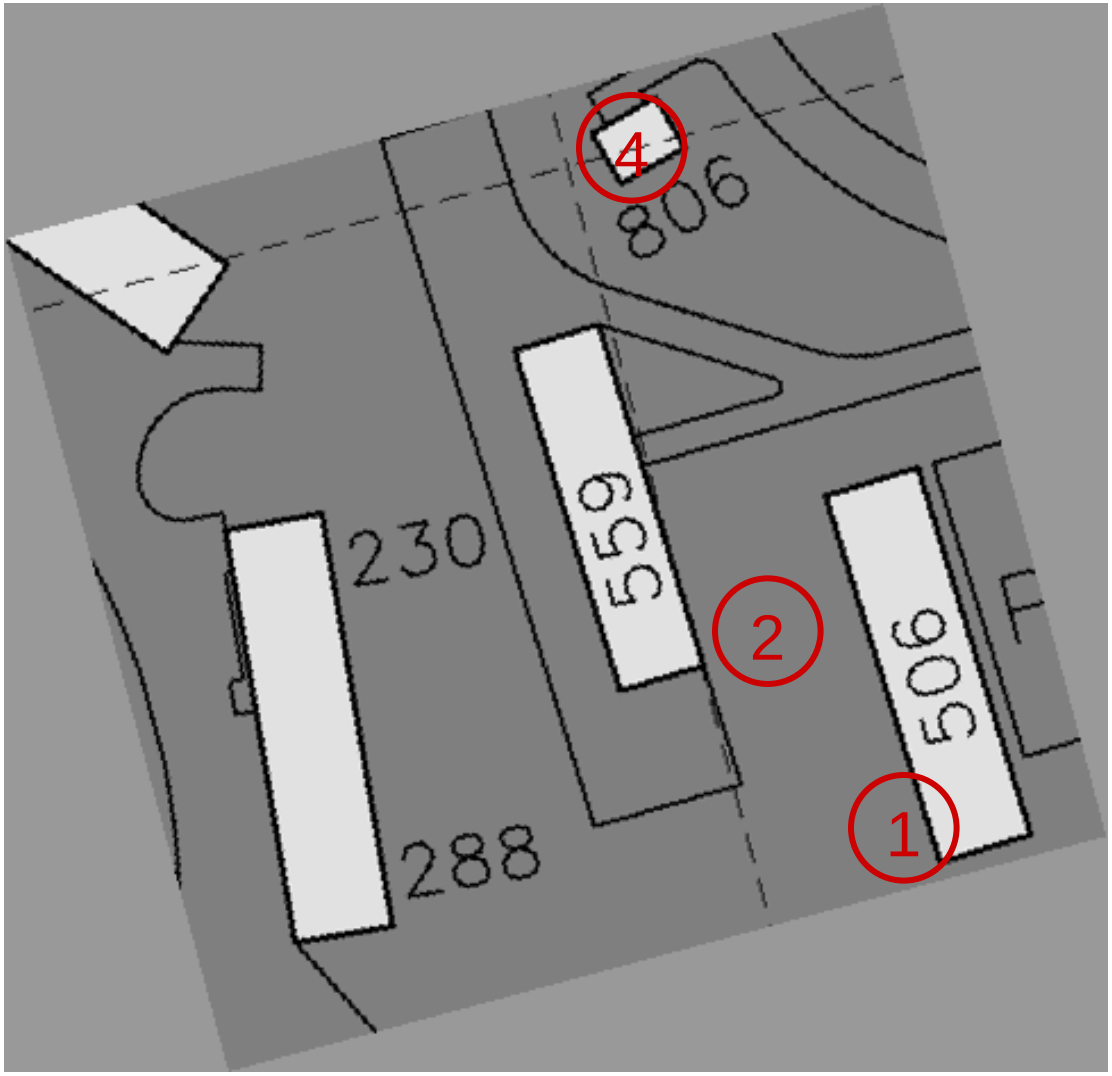
- < 1 liter
- Activated by proton beam
- Not vaporized by solenoid
- Mixes with new cooling cycle

- Release of ALL LN2 to TT10
  - ODH?



surface at access shaft to TT2

1. nToF11
2. Access pit
3. Control room
4. TT10 Ventilation shaft

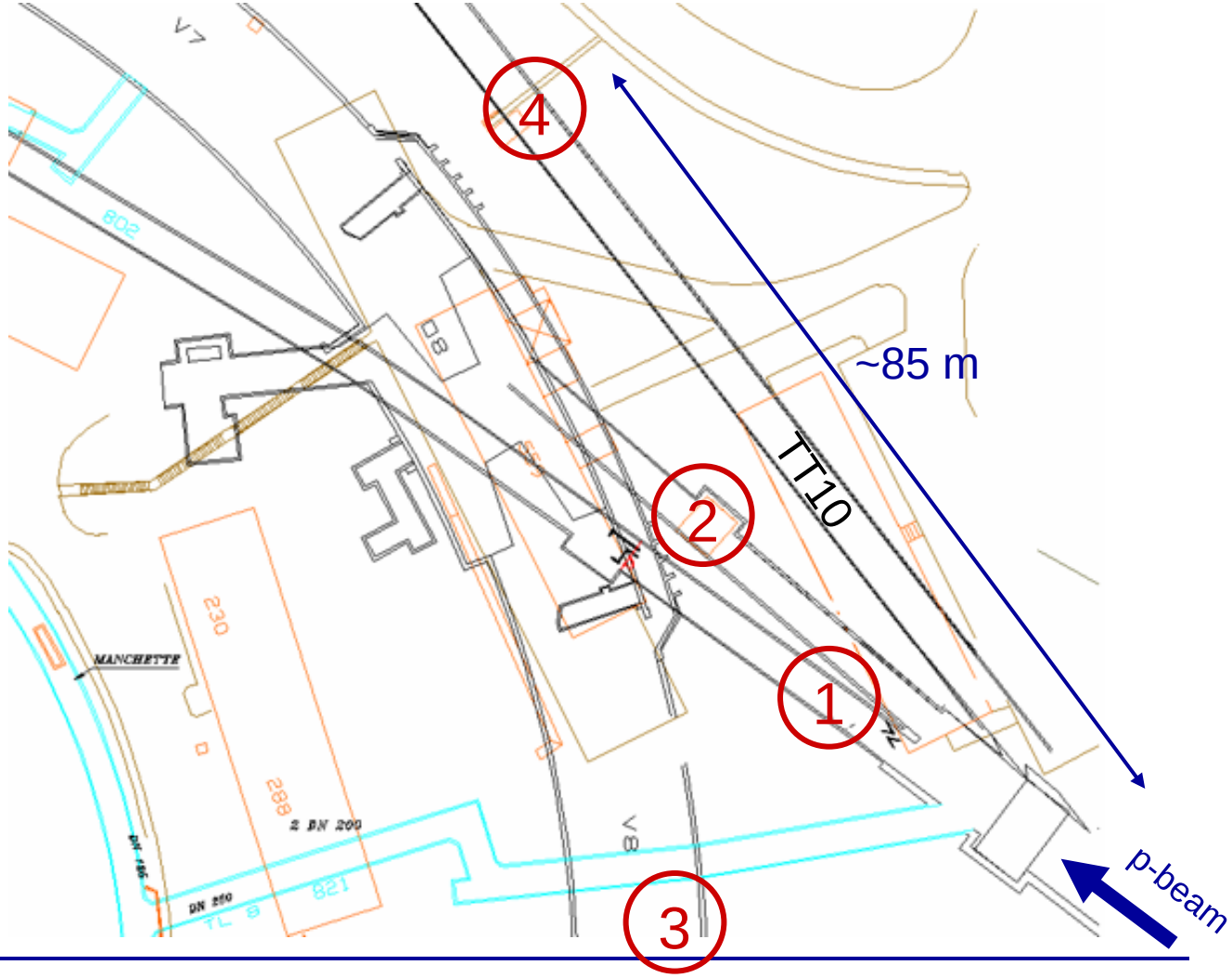


underground ↔ surface (2)

beige/orange =
= surface
black/blue =
= underground

- nToF11
- Access pit
- Control room
- Ventilation shaft

Distance 1 to 4
nToF11 to ventilation
~ 120 m
(85 m within TT10)



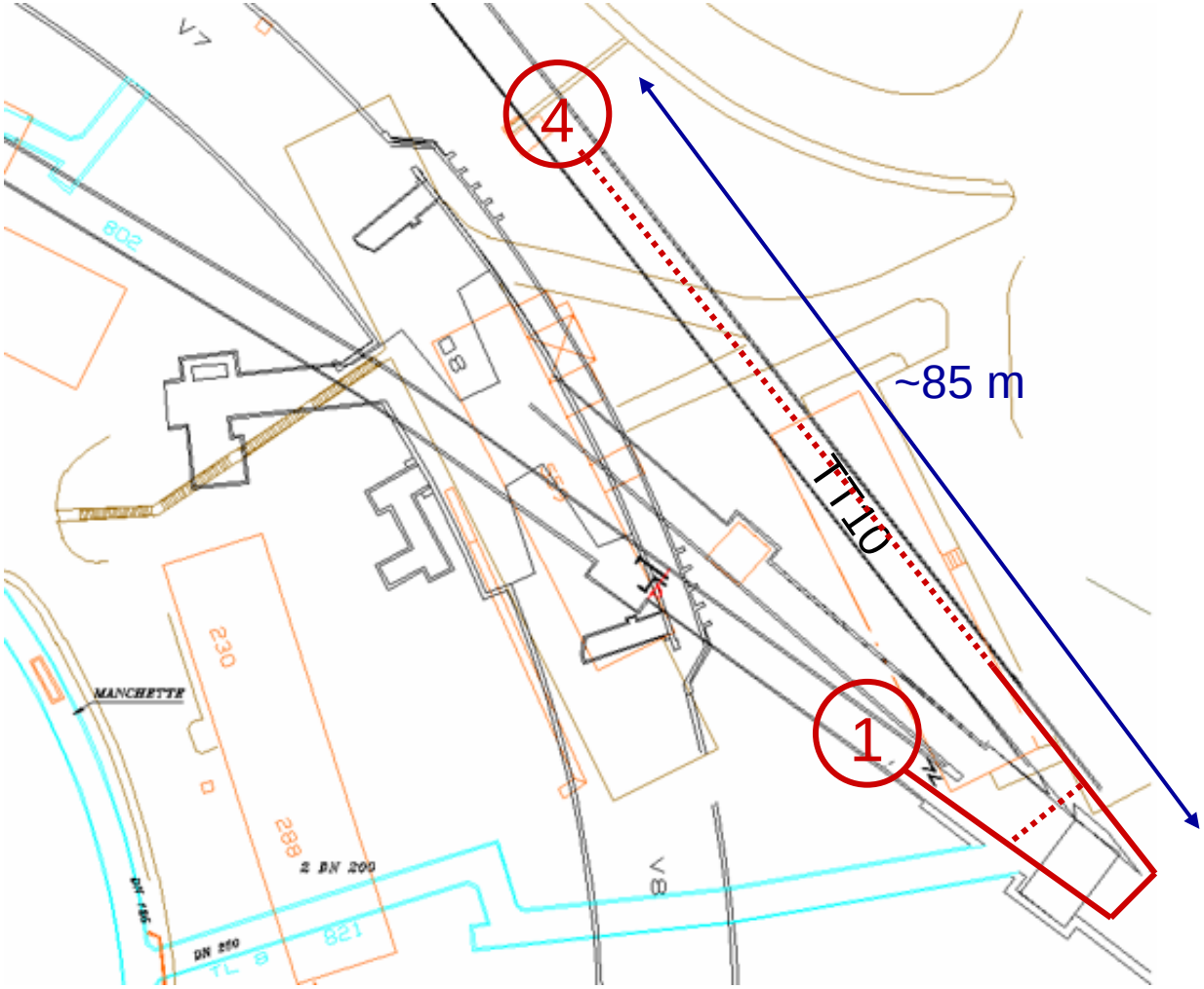
Ventilation line

CERN staff is investigating

- best line feed
- hole drilling (also for optics)

Long path in TT10

- Avoid cold pipe installation
- install temporarily some fans to push nitrogen gas through TT10 towards ventilation shaft



Ventilation performance

- Extraction at building 806
  - Additionally pushing at BA2 (in SPS)
- Ventilation for TT10 and a SPS sector

- Max. debit 27000 m^3/h
  - 150 liter LN2 = 1000 m3
  - ventilated within 2 minutes = simultaneous to release
- Flow in TT10: 0.5 - 1 m/s

- Next steps:
  - contact with safety/cryogenics
  - confirm safe operation of 100 % release to TT10