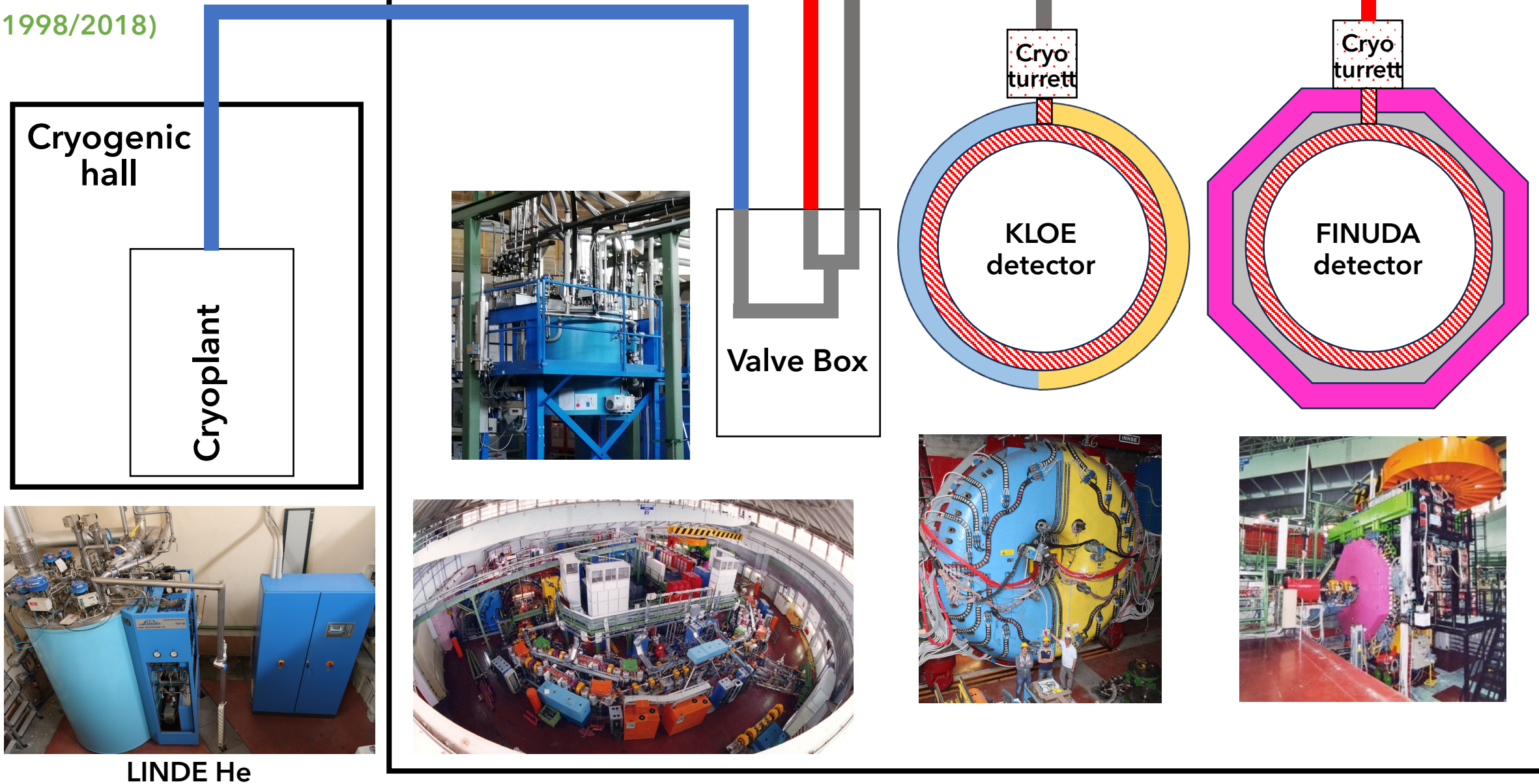
The FLASH Cryostat

Carlo Ligi

INFN - LNF

DAΦNE CryoPlant Operating Layout

(1998/2018)



LINDE He refrigerator/liquefier

Present layout

(FINUDA test Jan 2024)

DAΦNE hall

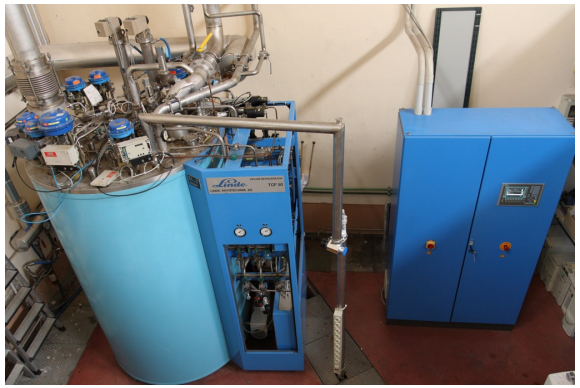
Cryogenic hall

Cryoplant

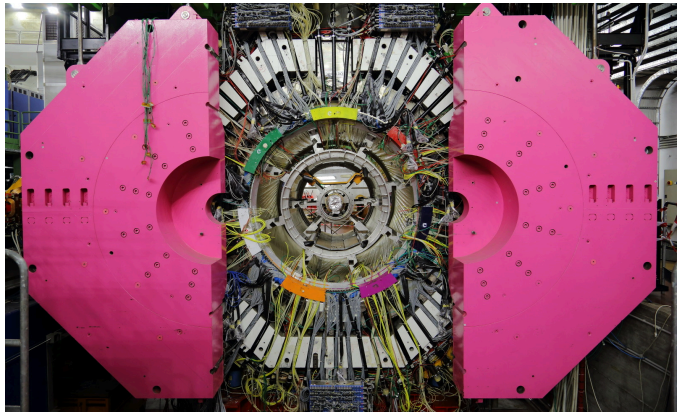
Valve Box

Cryo turrett

Magnet

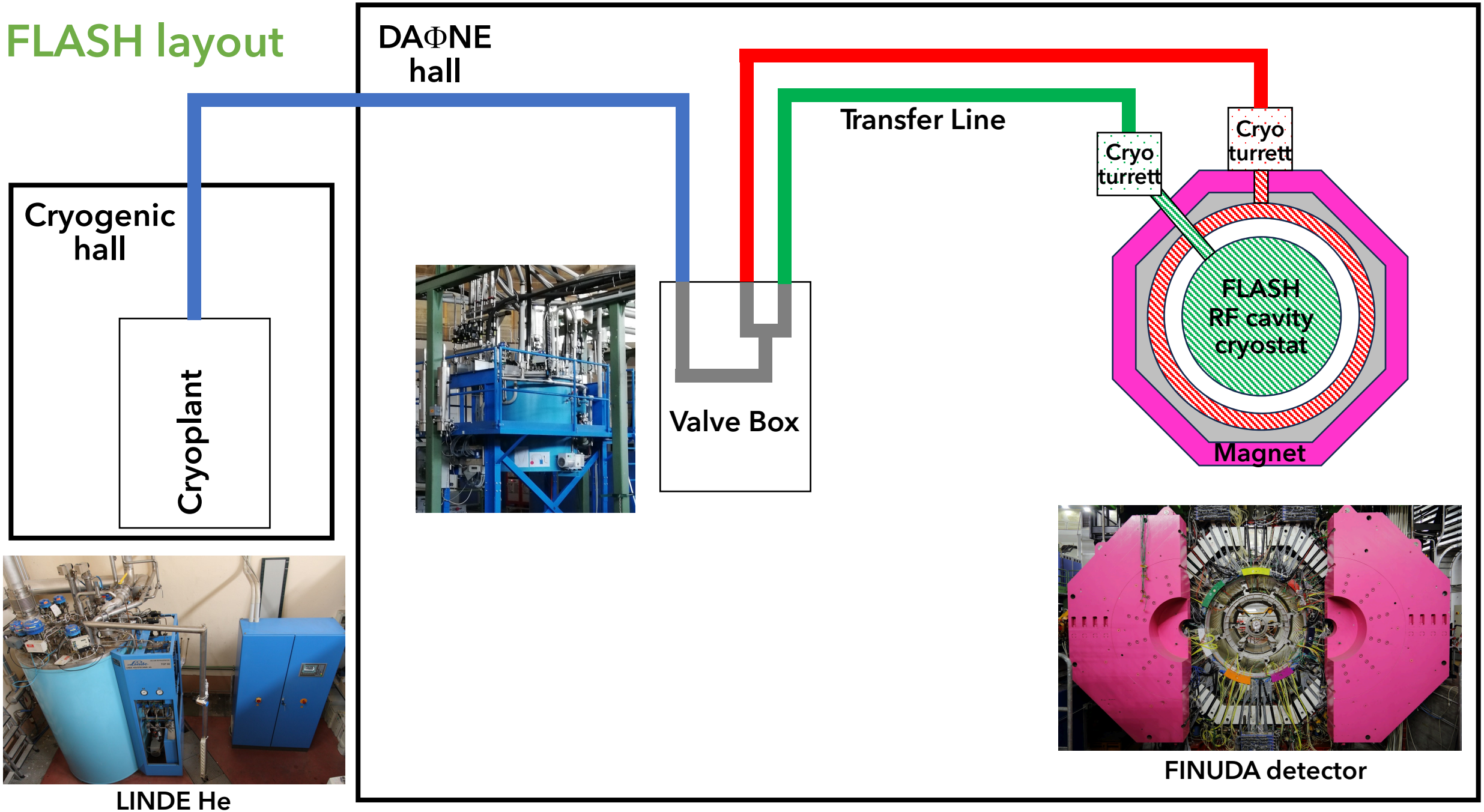


LINDE He refrigerator/liquefier



FINUDA magnet

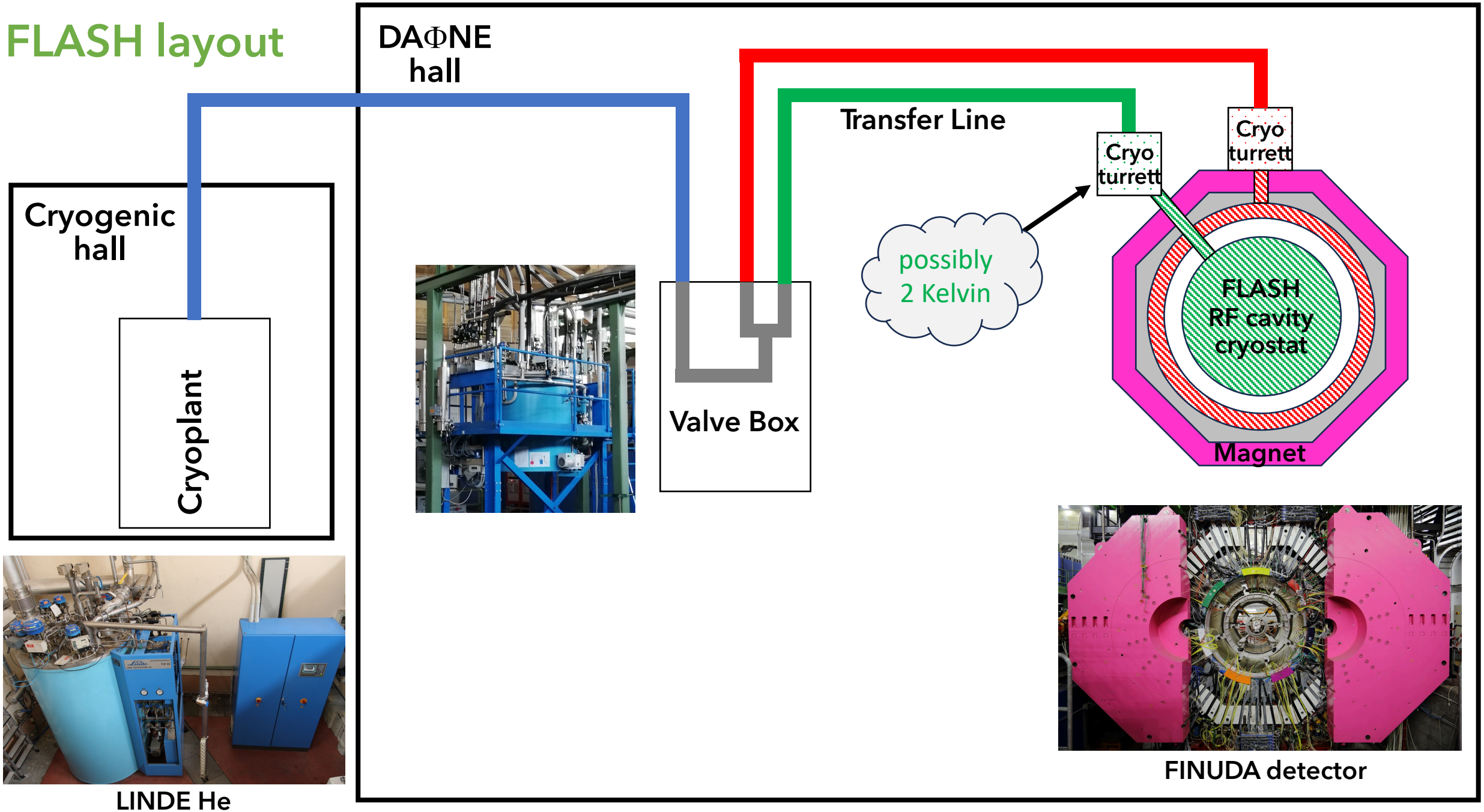
FLASH layout



LINDE He refrigerator/liquefier

FINUDA detector

FLASH layout



LINDE He refrigerator/liquefier

FINUDA detector

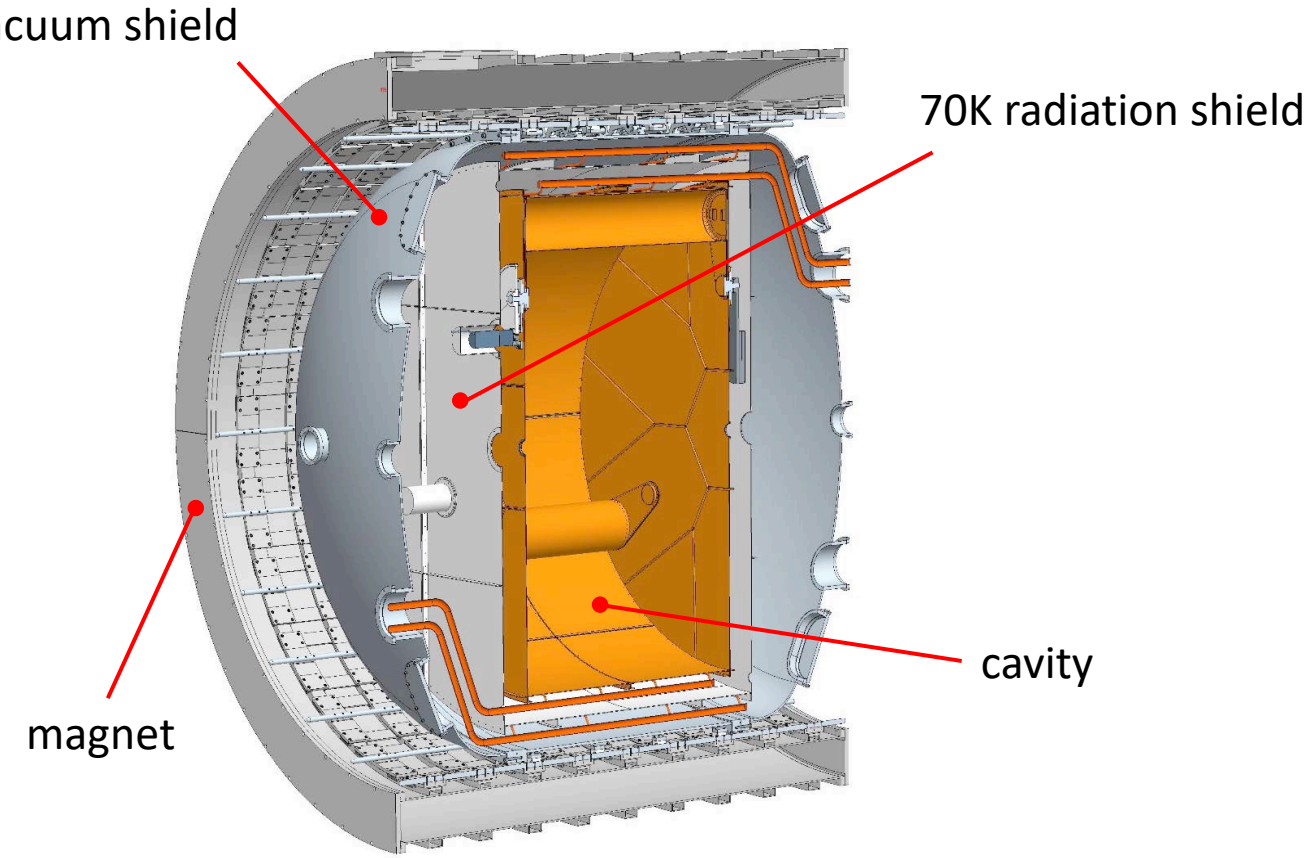
Work to do

- Definition of the cryostat general layout details
- Cryostat cryo/mechanical design (vacuum shield + 70 K radiation shield)
- Cryogenic turret cryo/mechanical design
- Cryogenic transfer lines design *(similar to the KLOE/FINUDA old TLs)*
- RF cavity mechanical design with tuning system
- Cryogenic control system design and procurement
- FINUDA cryogenic control system refurbishment

Timescale

- 2024/25 TDR Preparation
- 2025/26 – Cryostat and RF cavity design
- Project approval by INFN
- 2026/28 – Tender and construction

Cryostat cryo/mechanical design



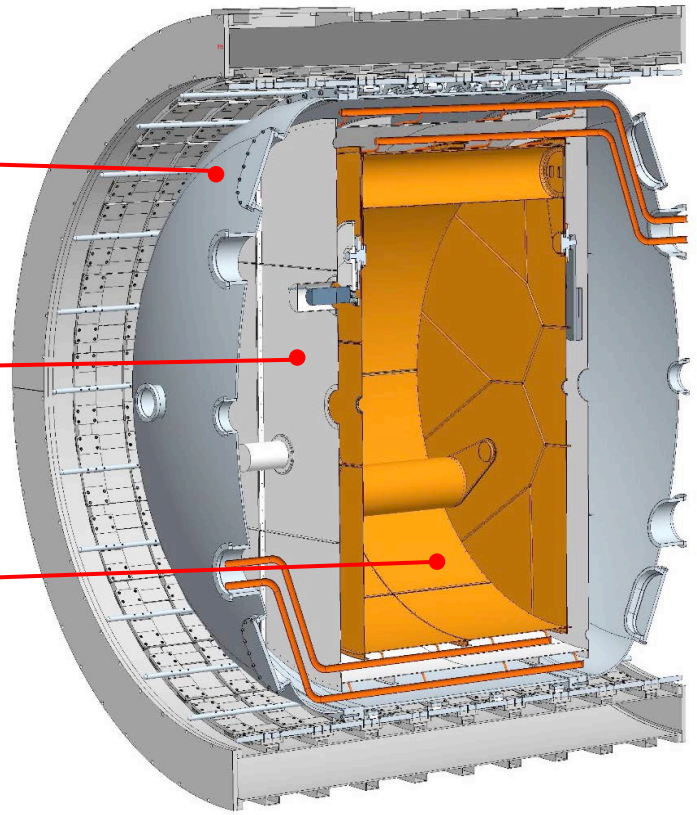
Drawings by Fantini Sud S.p.A.

We can partly take advantage of the work done by Fantini Sud s.p.a. for the KLASH cryostat (see pictures above)

- The design must be adapted to the new constraints (FINUDA in place of KLOE)
- it should be re-scaled down by a factor > 2 to fit the FINUDA magnet
- we need to re-think the support system (FINUDA support structure is different from the KLOE's one)

Cryostat cryo/mechanical design

- Vacuum Shield (300 K):
  - *INOX stainless steel*
  - *Vacuum tight*
- Radiation Shield (70 K):
  - *Aluminium*
  - *Suspended with tie rods*
- Cavity (4 K):
  - *OFHC copper*
  - *Suspended with tie rods*



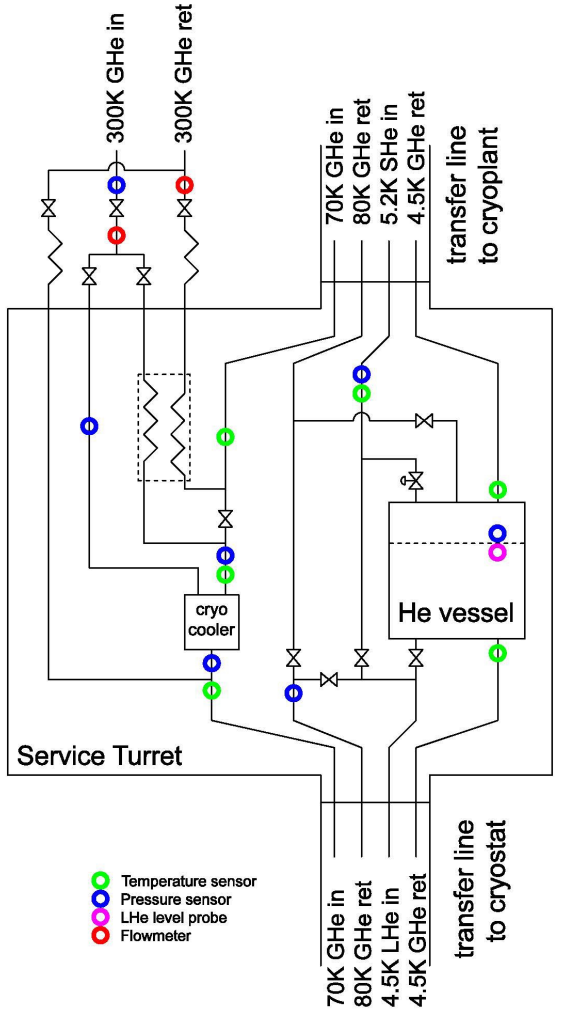
Drawings by Fantini Sud S.p.A.

We can partly take advantage of the work done by Fantini Sud s.p.a. for the KLASH cryostat (see pictures above)

- The design must be adapted to the new constraints (FINUDA in place of KLOE)
- it should be re-scaled down by a factor > 2 to fit the FINUDA magnet
- we need to re-think the support system (FINUDA support structure is different from the KLOE's one)

Cryogenic turret cryo/mechanical design

a similar turret
(from the web)



FLASH turret P&ID
(proposal)

Cryogenic turret is needed for:

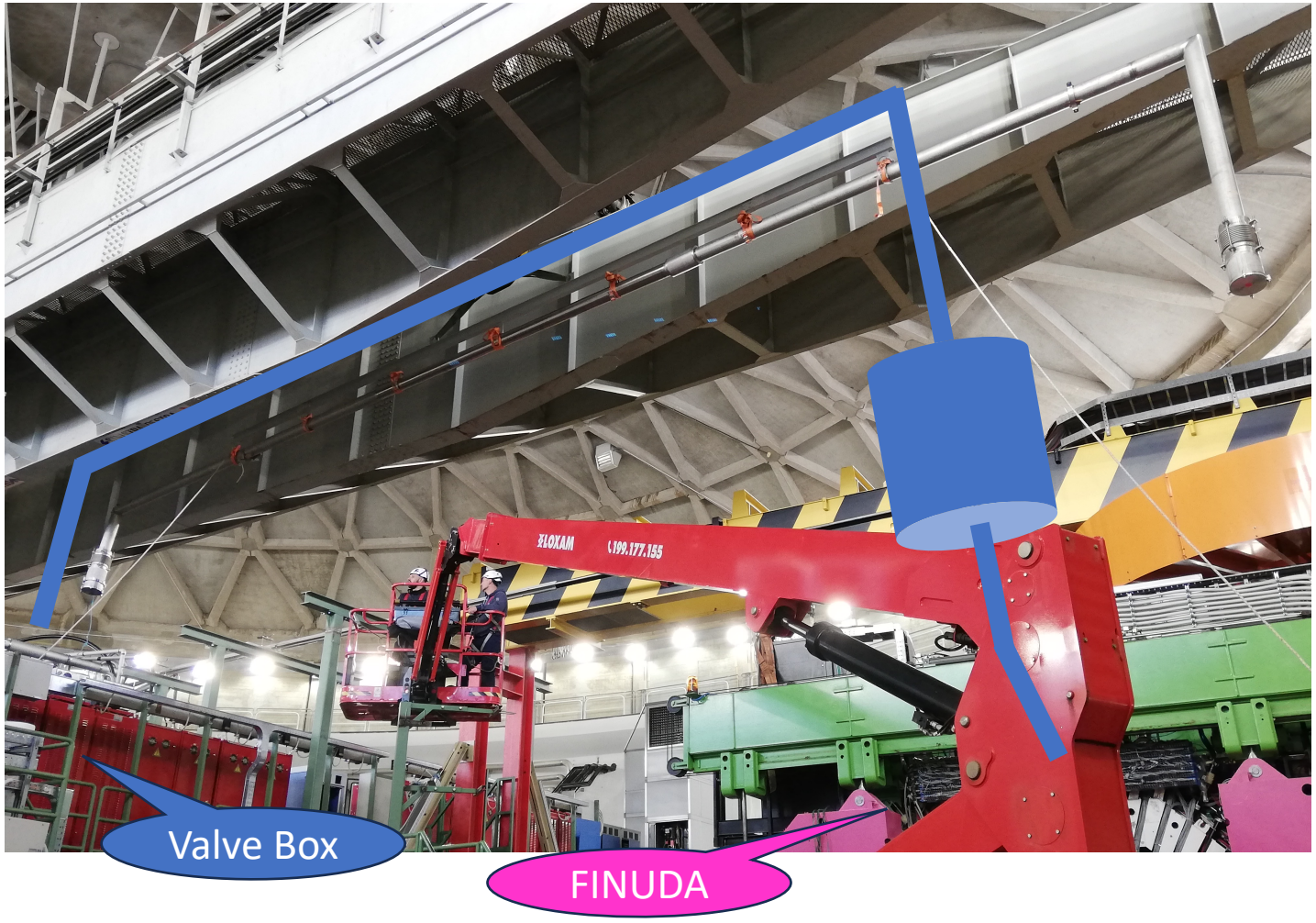
- ✓ Helium liquefaction
- ✓ cooling/warming operations

Cryogenic Transfer Lines carry only supercritical He (5.2K/3bar), so the He liquefaction (4.4K/1.2bar) must be done just before the user, inside a dedicated *service turret,* which must be designed. We can take as a reference the FINUDA or the KLOE turrets

Cavity cryostat He transfer lines design

Cryogenic Transfer Lines is composed by 4 pipes (4 K send/return lines + 70 K send/return lines). It must be designed but we can take advantage from the existing drawings of the KLOE and FINUDA existing lines

Cavity cryostat He transfer lines design



Cryogenic Transfer Lines is composed by 4 pipes (4 K send/return lines + 70 K send/return lines). It must be designed but we can take advantage from the existing drawings of the KLOE and FINUDA existing lines

How CERN PCB can help us

Physics Beyond Colliders Study Group (*https://pbc.web.cern.ch/)*

- Definition of the general layout in terms of both cryogenic and mechanic layout about all the components.
- Consultancy about the cryogenic design:
  - ✓ choice of the working T (4.5 or 2.2 K) and related components (pump)
  - ✓ cryo turret design
  - ✓ dimensioning of pipes
  - ✓ dimensioning of valves
  - ✓ choice of the right materials
- Help in fluidodynamic and thermo-mechanical simulations.
- Consultancy about the RF cavity mechanical and tuning design.