FLASH

WP2

Mechanical design and cryogenics

Carlo Ligi

INFN - LNF

FLASH layout

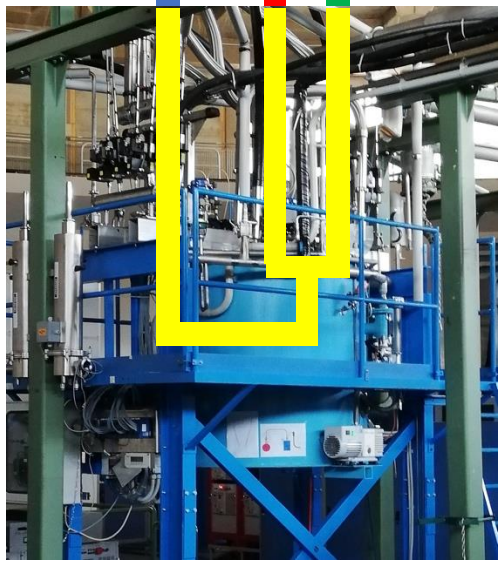
3bar/5.2K SCHe

5bar/70K GHe

New Transfer Line

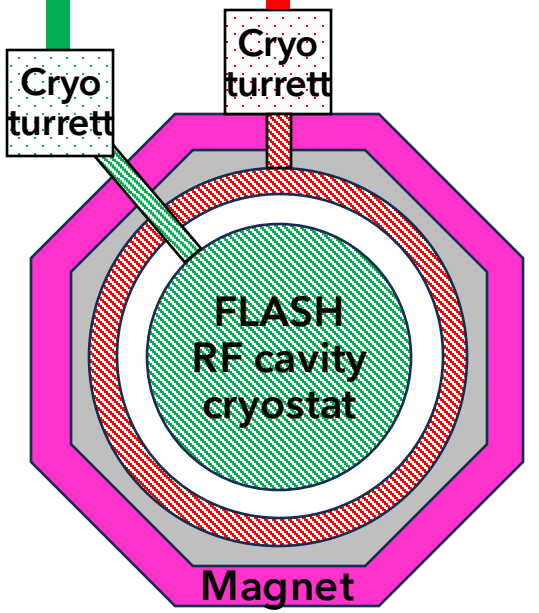
Cryogenic hall

LINDE He refrigerator/liquefier

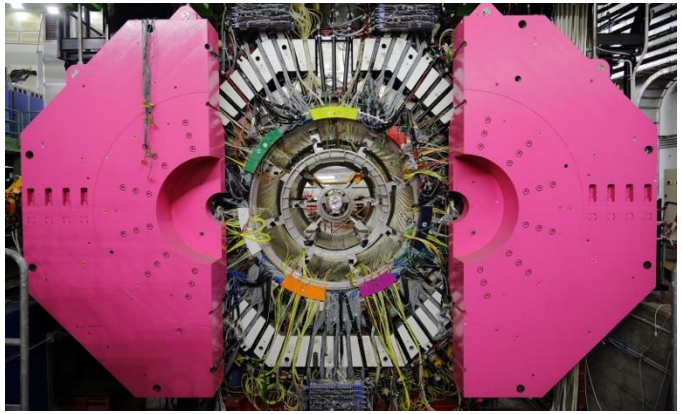


Valve Box

possibly 2 Kelvin

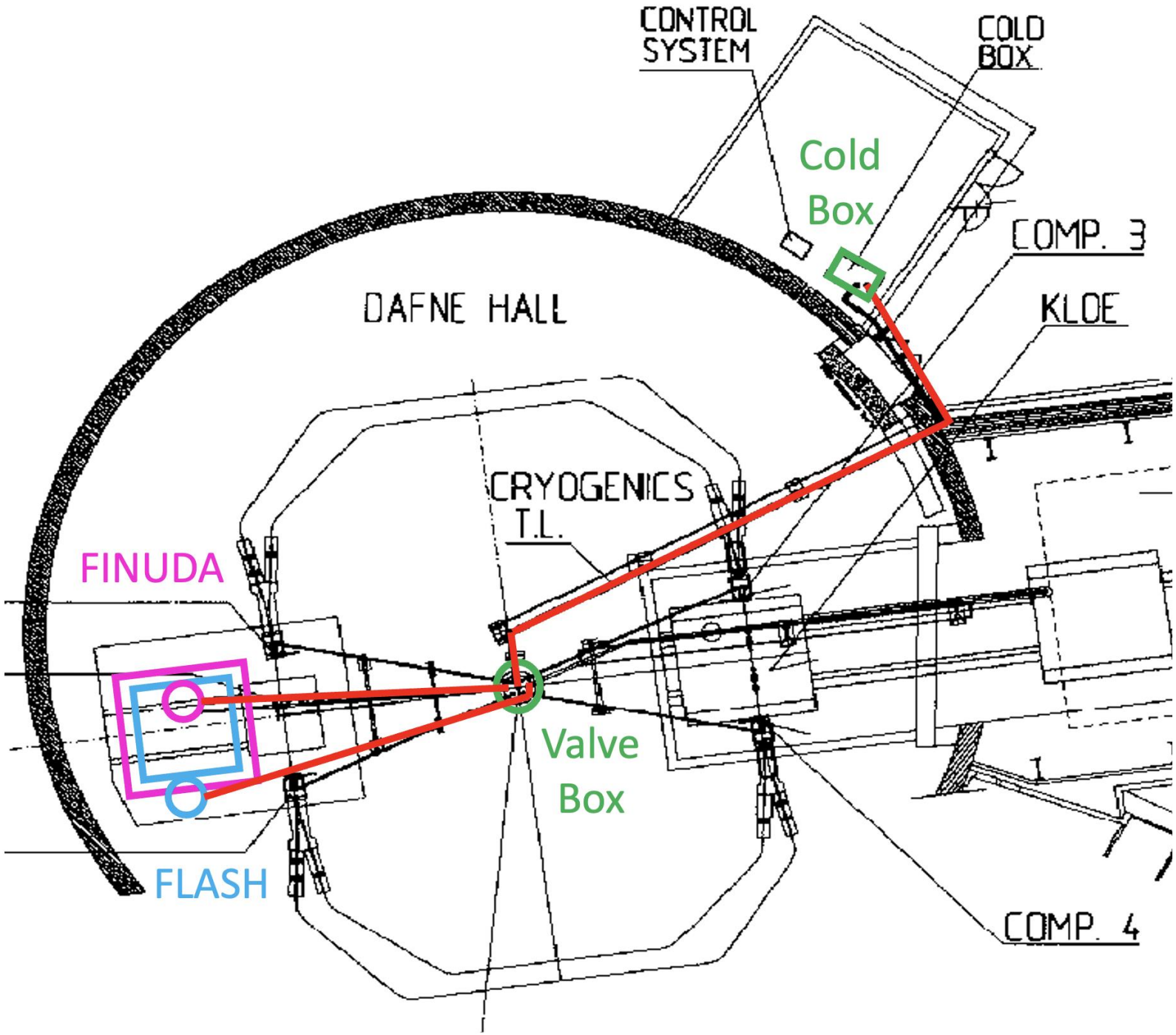


DAΦNE hall



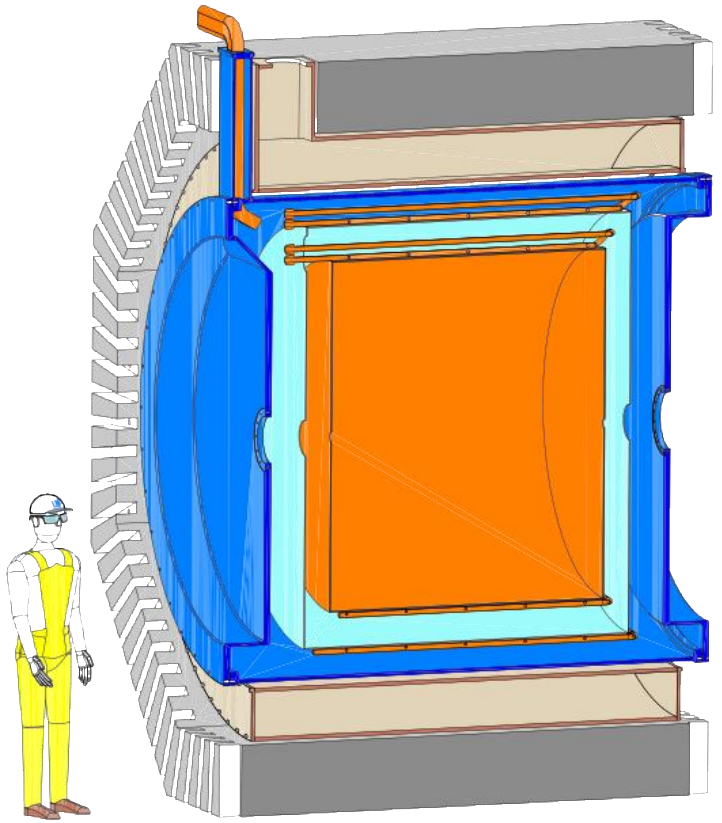
FINUDA magnet

FLASH layout

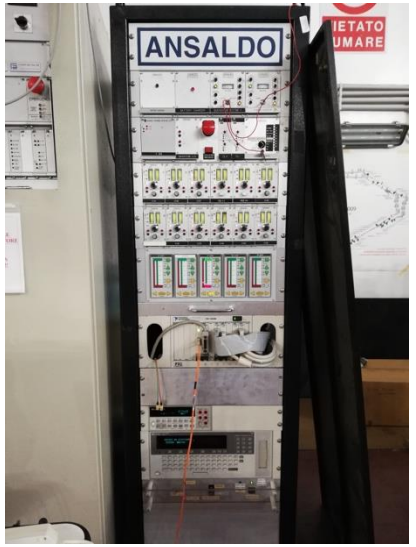


Work to do

- FLASH Cryostat cryo/mechanical design and procurement
  - vacuum vessel
  - 70 K radiation shield
  - RF cavity
  - cryogenic turret (1.9 or 4.5 K cooling choice)
  - cryogenic transfer lines Valve Box ↔ FLASH
  - 300mK ^{3}He fridge for SQUID (?)

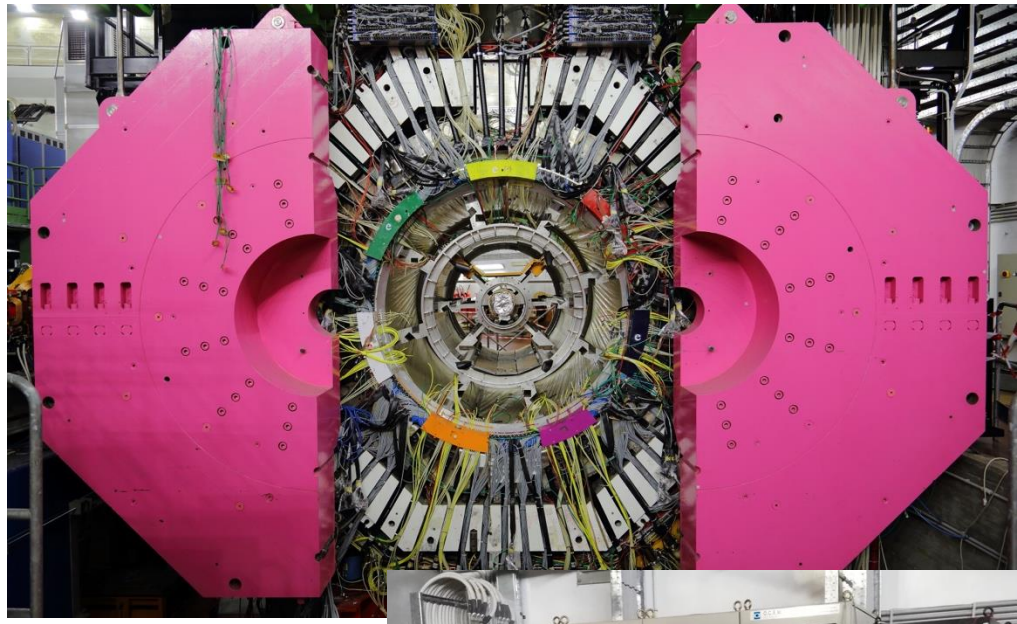


- FLASH cryogenic control system design and procurement
  - new PLC for sensors measurement and valves control
  - new (Labview) software for the slow control



Work to do

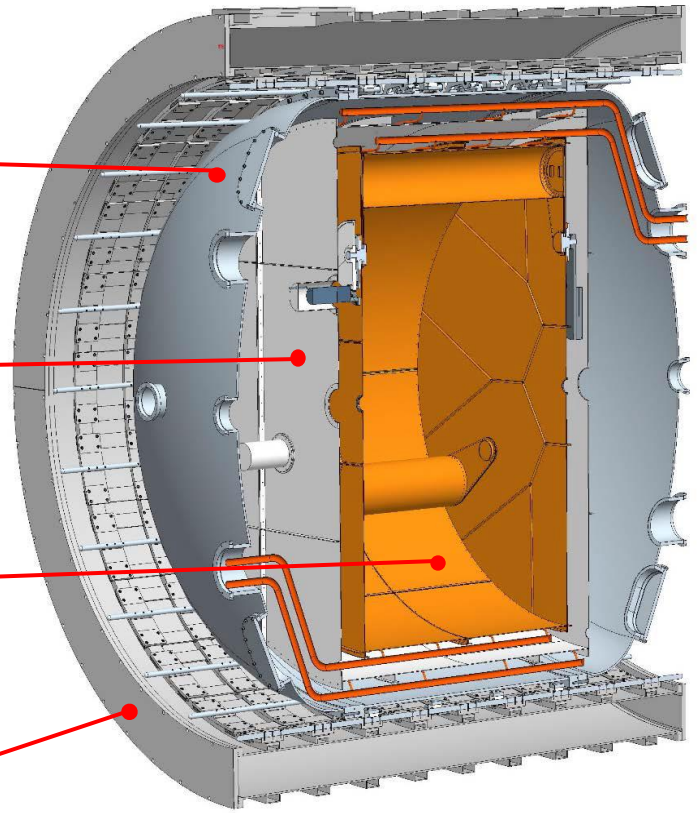
- FINUDA works:
  - cryogenic control system refurbishment
  - new power supply + quench detector procurement
  - cooling water for the power supply



- DAΦNE cryogenic plant extraordinary maintenance
  - cryoplant maintenance
  - cryoplant new chiller
  - Helium compressor maintenance
  - new compressor's dry cooler

Cryostat 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*

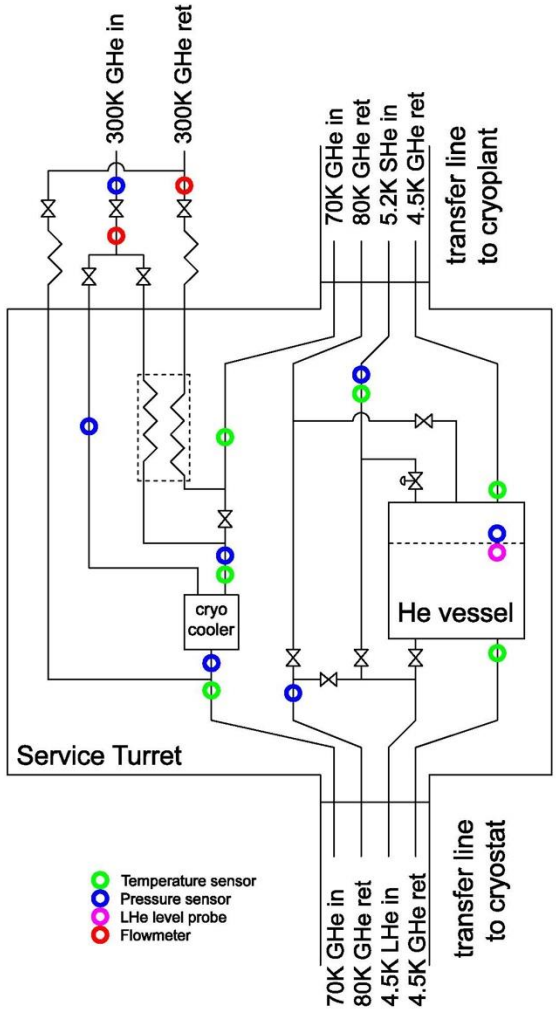


Drawings by Fantini Sud S.p.A.

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

Cryogenic turret design

a similar turret
(from the web)



FLASH turret P&ID
(4.5K scheme 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 (4.5K/1.3bar) must be done just before the user, inside a dedicated *service turret,* which must be designed.

For the 1.9K refrigeration solution, a different scheme with additional cryogenic pumps must be considered

WP2 People

- LNF Cryogenic plant service (DAFNE cryoplant, FINUDA cryogenics)
- S. Tomassini (cryostat design/mechanical tooling)
- G. Di Pirro (FINUDA/FLASH control systems)
- LNF DA electrical engineering service (FINUDA power supply/quench detector)
- LNF DR mechanical engineering service (cryostat design/mechanical tooling)
- LNF DT fluid systems service (water cooling, compressed air)
- *We are looking for a young scientist to follow the cryogenic design of the FLASH cryostat*

Cost estimation *(in progress)*

- FLASH cryostat design and construction: about 1.7 M€
  - vacuum vessel
  - 70K shield
  - RF cavity
  - cryogenic turret
  - design, mounting tools, trasportation, mounting
  - control system

- FINUDA refurbishment: about 300 k€
  - cryogenic turret refurbishment
  - new power supply+quench detector+water cooling

- DAFNE cryogenic plant: about 300 k€
  - cryoplant+compressor maintenance
  - new cryoplant chiller + new compressor dry cooler
  - PED certification