



News from the LASA test facility

2nd International WORKSHOP of the Superconducting Magnets Test Stands



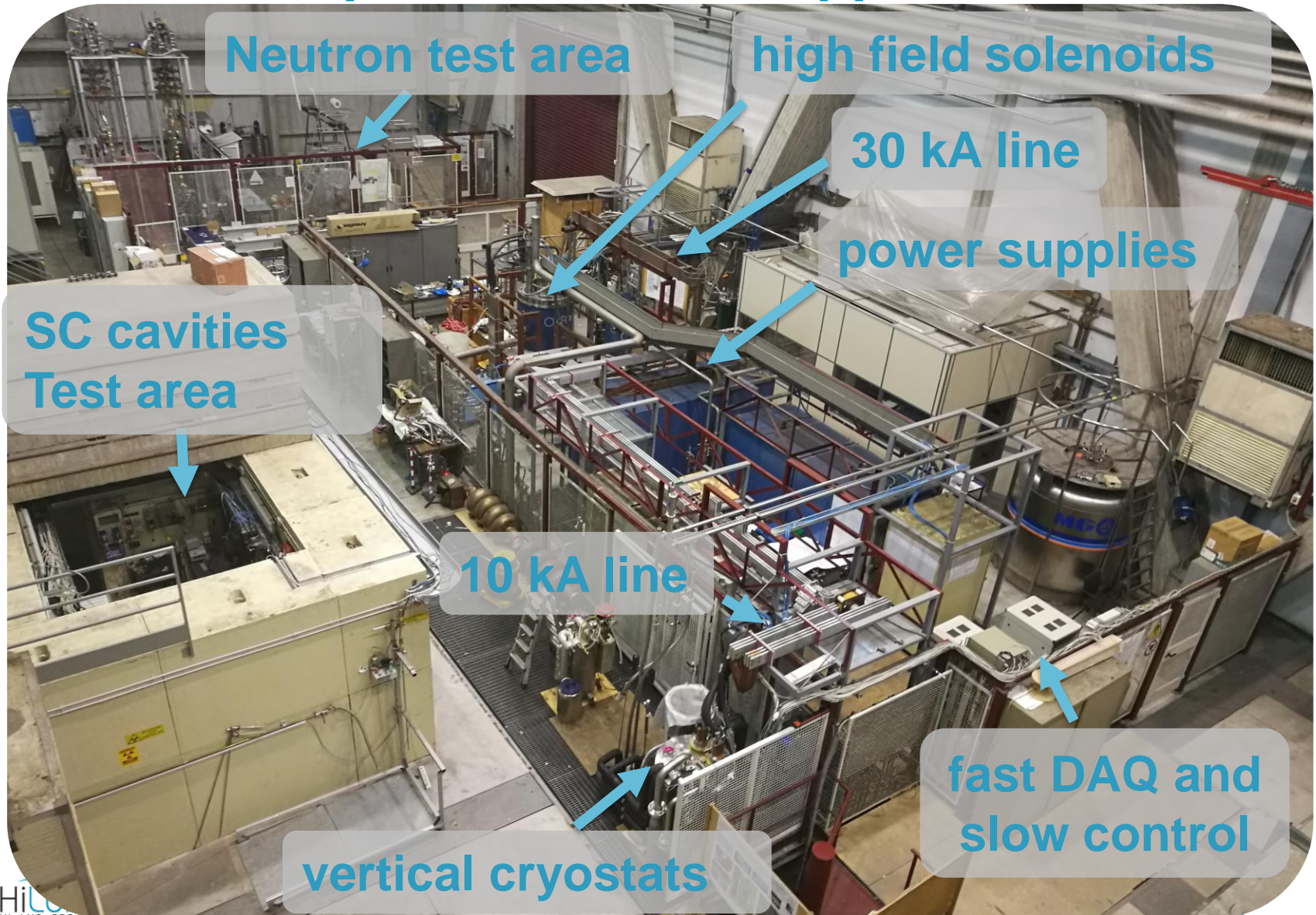
Marco Statera and Massimo Sorbi
on behalf of the LASA team
INFN Milano - LASA



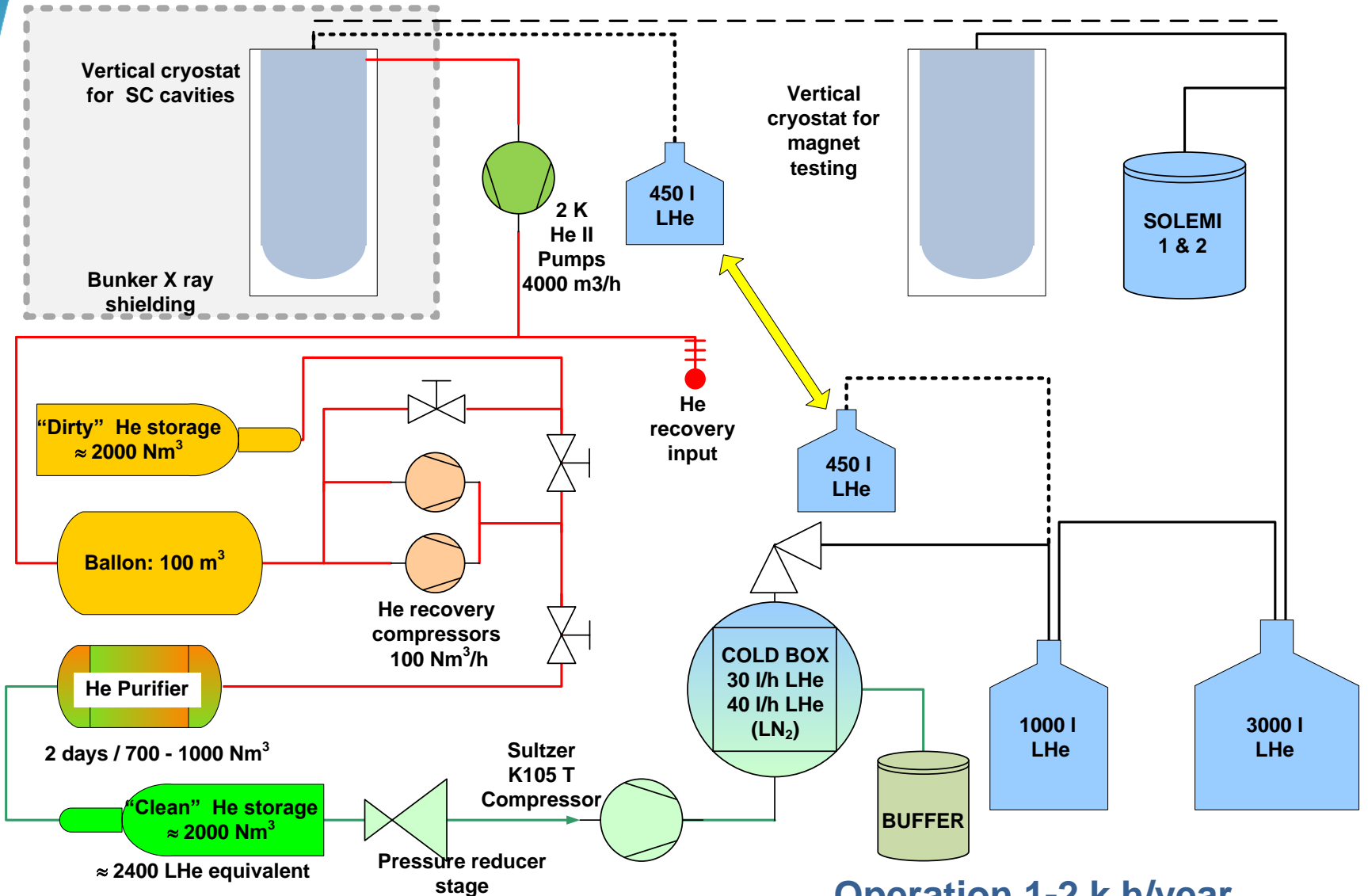
UNIVERSITÀ
DEGLI STUDI
DI MILANO

BNL, May 8th 2018

LASA Laboratorio Acceleratori Superconduttività Applicata



Cryoplant layout



Operation 1-2 k h/year
Production ~2000 LHe/year

M. Statera- 2018/05/08

SC cavities testing facility

- Bunker with vertical cryostat, ϕ 700 mm, **4500 mm depth**, can hold large SC cavities as 500 MHz
- Sub-cooling system for superfluid helium, up to 1.5 K. **Cooling power 17 W a 1.8K**
- **2 Cold inserts for cavity testing**
- RF generators: 700 MHz, 1.3 and 3.9 GHz

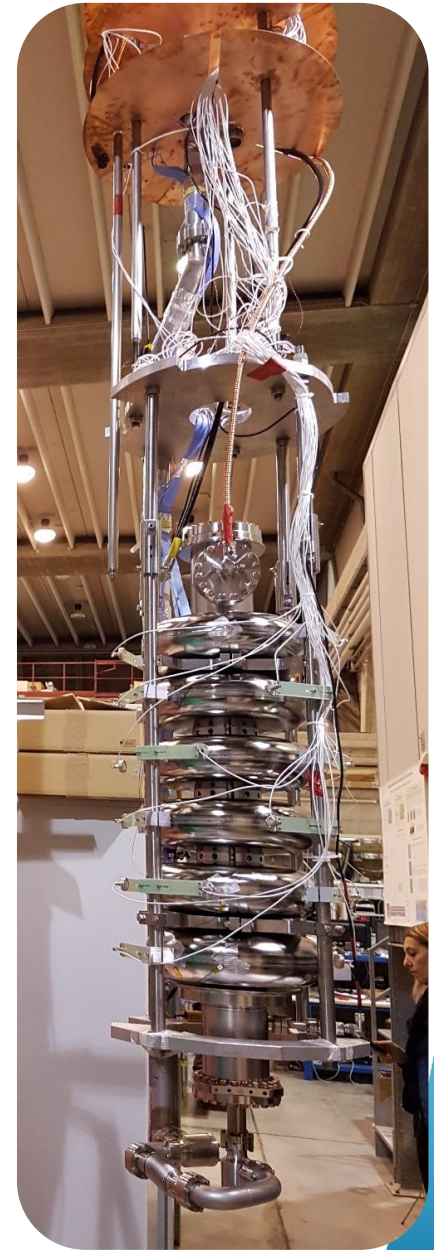
European Spallation Source – ESS Proton Improvement Plan – II – PIP-II FNAL



Associated infrastructures

- ISO4 clean room (9 m²)
- High Pressure Rinsing facility
- Slow pumping Slow venting system
- UP water production plant (100 l/h)

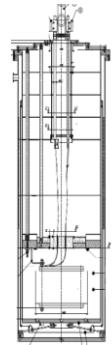
Courtesy of R. Paparella



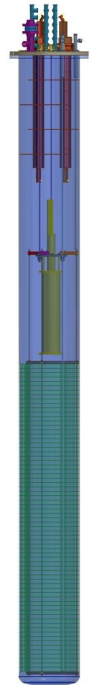
SC magnet test area

- Small Magnets test cryostat
 - HO correctors prototypes
 - 6P **MCSXFP** (MCSXF/MCSSXF)
 - 8P **MCOXFP** (MCOXF/MCOSXF)
 - 10P **MCDXFP** (MCDXF/MCDSXF)
- High Current Test Station
 - DISCORAP and HTS magnets
 - HO correctors
 - 12P **MCTXFP**
 - 4P **MQSXFP**
 - HiLumi HO correctors series

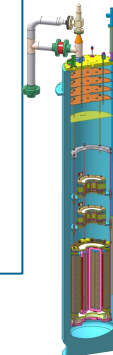
MAGIX
D 480 mm
h 1200 mm
4.2 K and 2.17 K
500 A



DISCORAP
D 695 mm
h 7200 mm
4.2 K
10 kA



HiLumi
D 515 mm
H 2950 mm
4.2 K
500 A



LASA High Current Test Station

10 kA test station

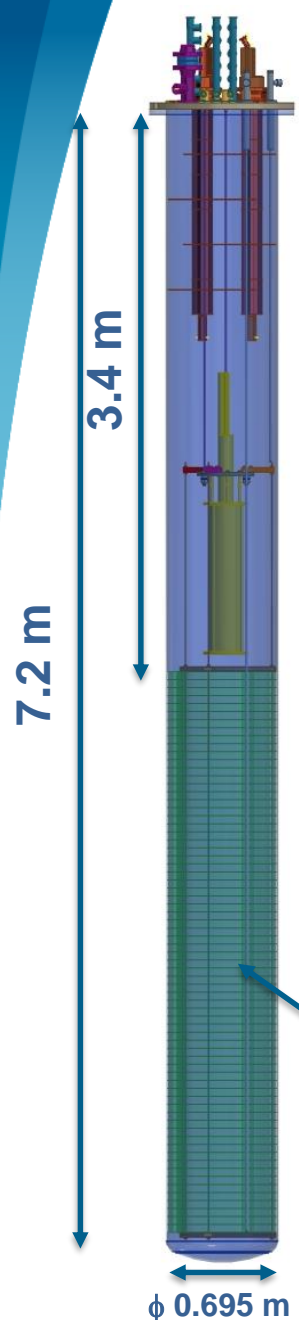
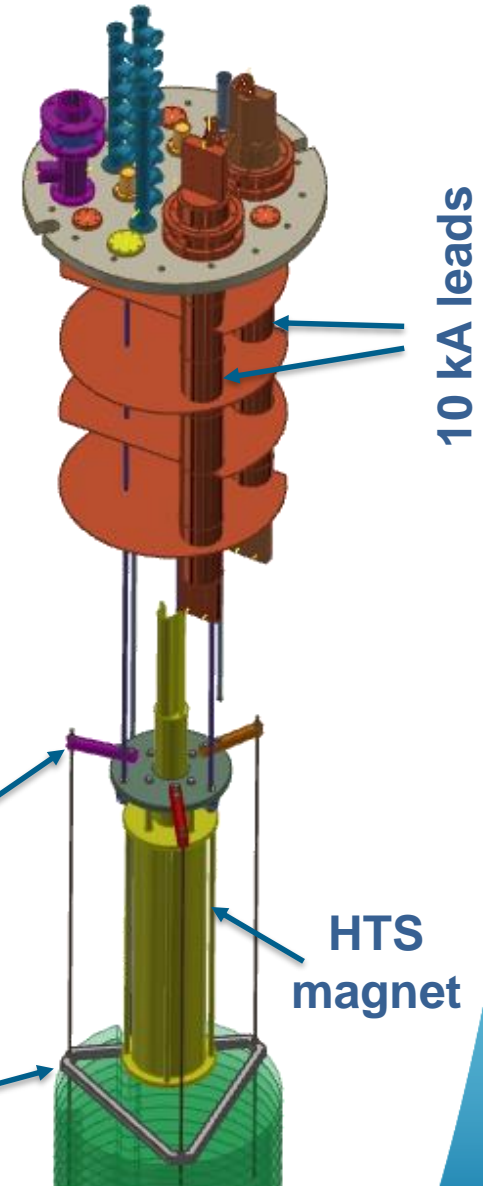
- three 6V 10 kA power supplies
- 10 kA current leads
- 7.2 m cryostat

DISCORAP cryostat for HTS magnets test

- mechanical interface **designed**
- zero uplift filler **delivered**
- fast switch **commissioned**
- electrical connections
- temperature controlled by G-He heat exchanger or cryocooler

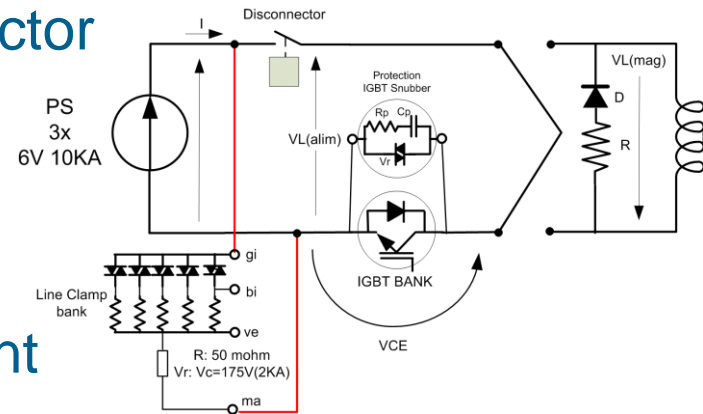
1.4 m³
ethylene-vinyl
acetate disks

φ 0.695 m

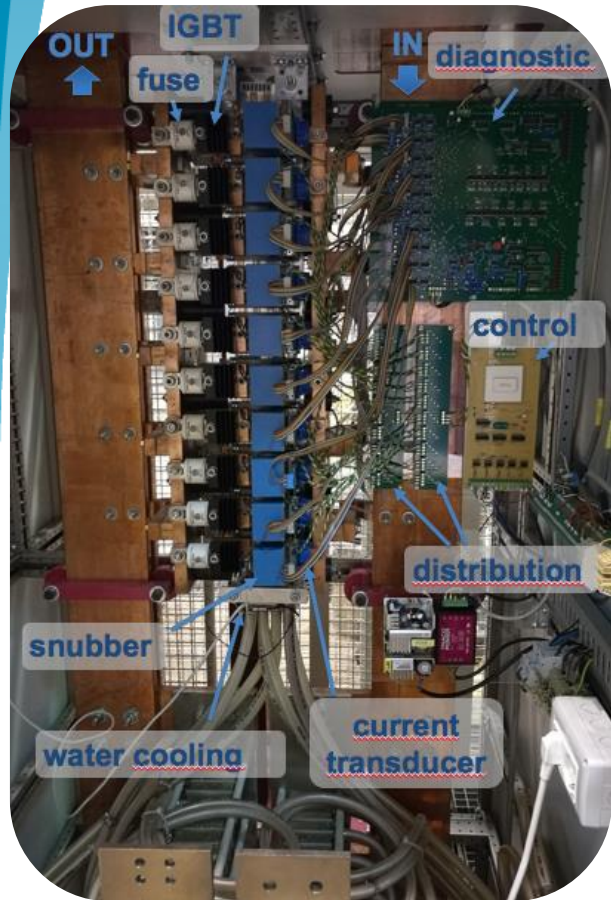
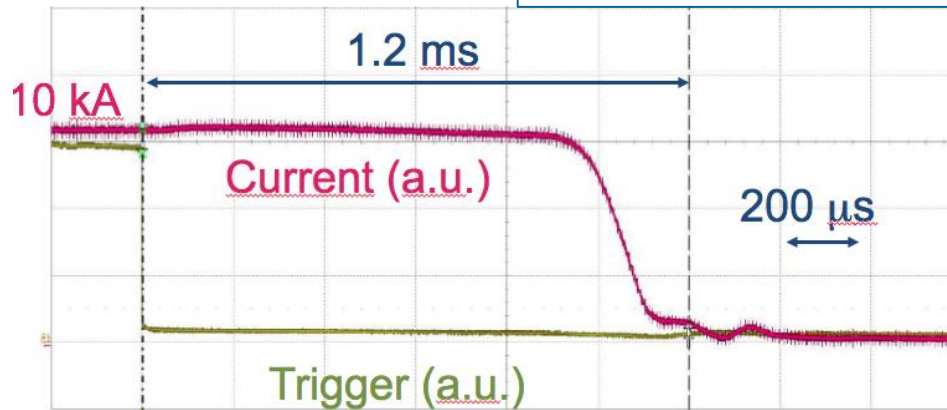


10 kA IGBT switch

- line clamp
- mechanical disconnector
- IGBT bank (20)
 - IGBT 1000 A
 - fuse 800 A
 - snubber
- current measurement controller
- monitor



- 1.2 ms to open
- 220 μ s opening time
- water cooling 17 kW



HiLumi CRYOSTAT

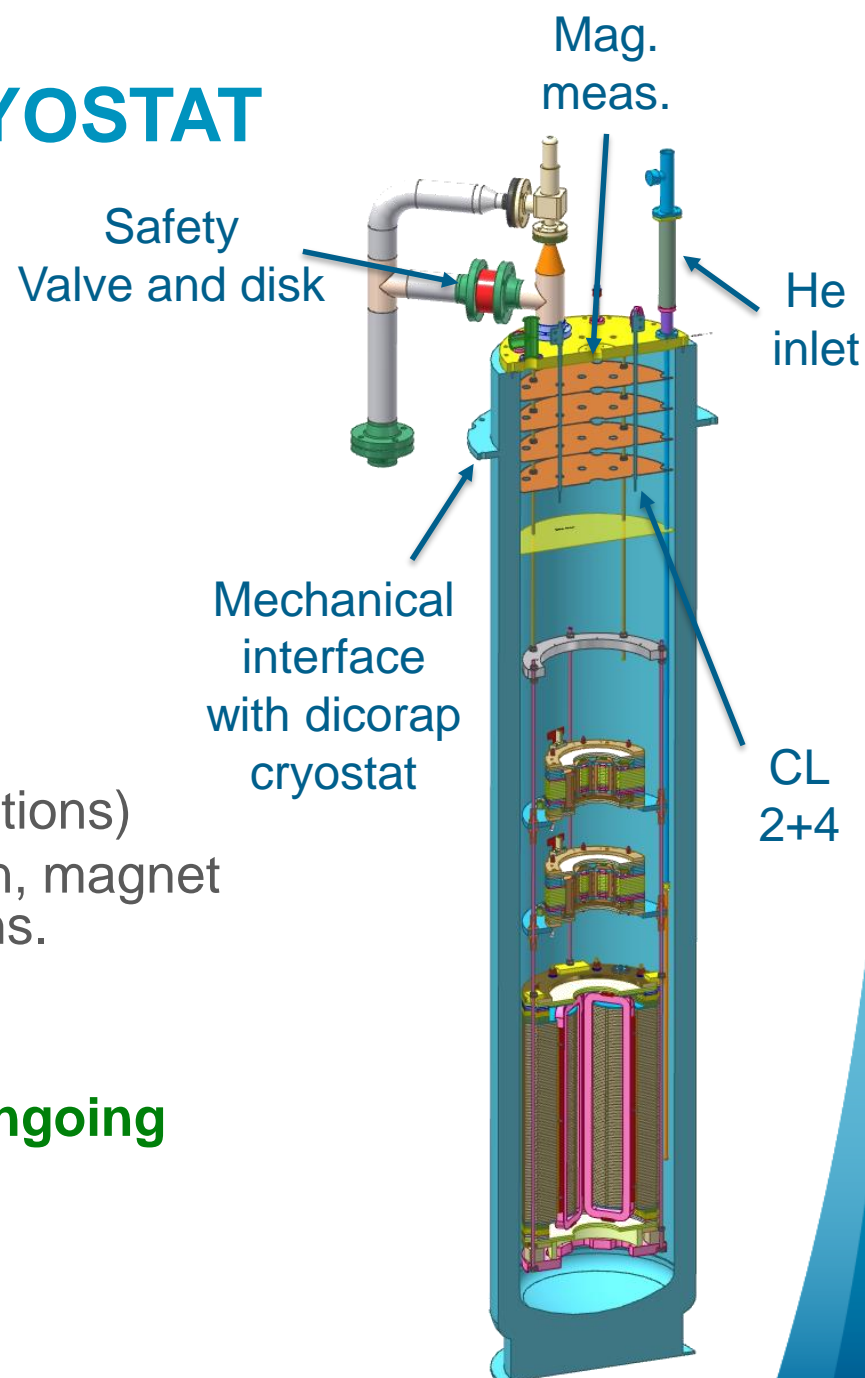
- Cryostat for testing MCTXFP1 (12P), MCQSXFP1 (4P) and series magnets
- 4 K operation
- 515 mm inner diameter
- Hosted within DISCORAP cryostat (which acts as a support)
- About 3 m high
- Up to 4 magnets (3 possible configurations)
- Flange modification, thermal insulation, magnet support, room temperature connections.

Ordered end 2017

Delivery April 2018

Cabling and certification ongoing

Cold test June 2018



Measurements

HO correctors' measurements at 4 K

- Stability 1h @ ultimate
- One magnet at a time
- Field quality at 4K (1 magnet per cooldown)

Data Acquisition Architecture

- **QDS** (MSS Magnet Safety System)

Initiates a fast discharge or switches off the power supply incase some voltage thresholds on the magnet or on its electrical connection are exceeded. Includes a capacitor bank for firing quench heaters.

- **Fast Acquisition**

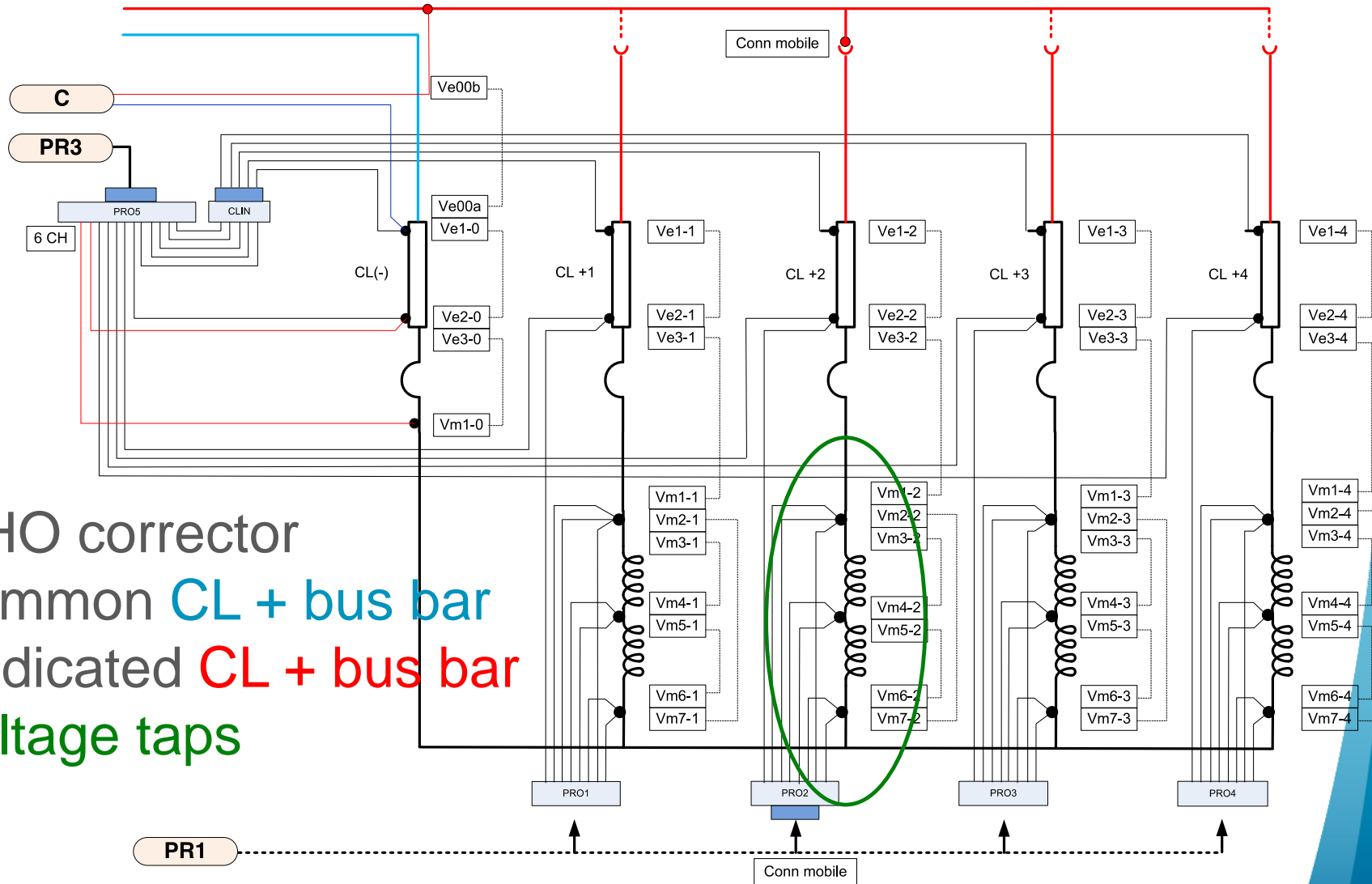
Records voltages across the magnet under test with 1 kHz sampling frequency, in coincidence with a fast discharge

- **Current Control & Slow Control**

Two different functions, implemented in the same hardware & software system.

Slow acquisition monitors and records most important data (temperatures, current, voltage along critical items) from the cooldown to the operation. Data are available to the operator and recorded at about 1 Hz.

Quench Protection



Each HO corrector

- 1 common **CL + bus bar**
- 1 dedicated **CL - bus bar**
- 3 voltage taps

Test configurations

Prototypes

- Single magnet test

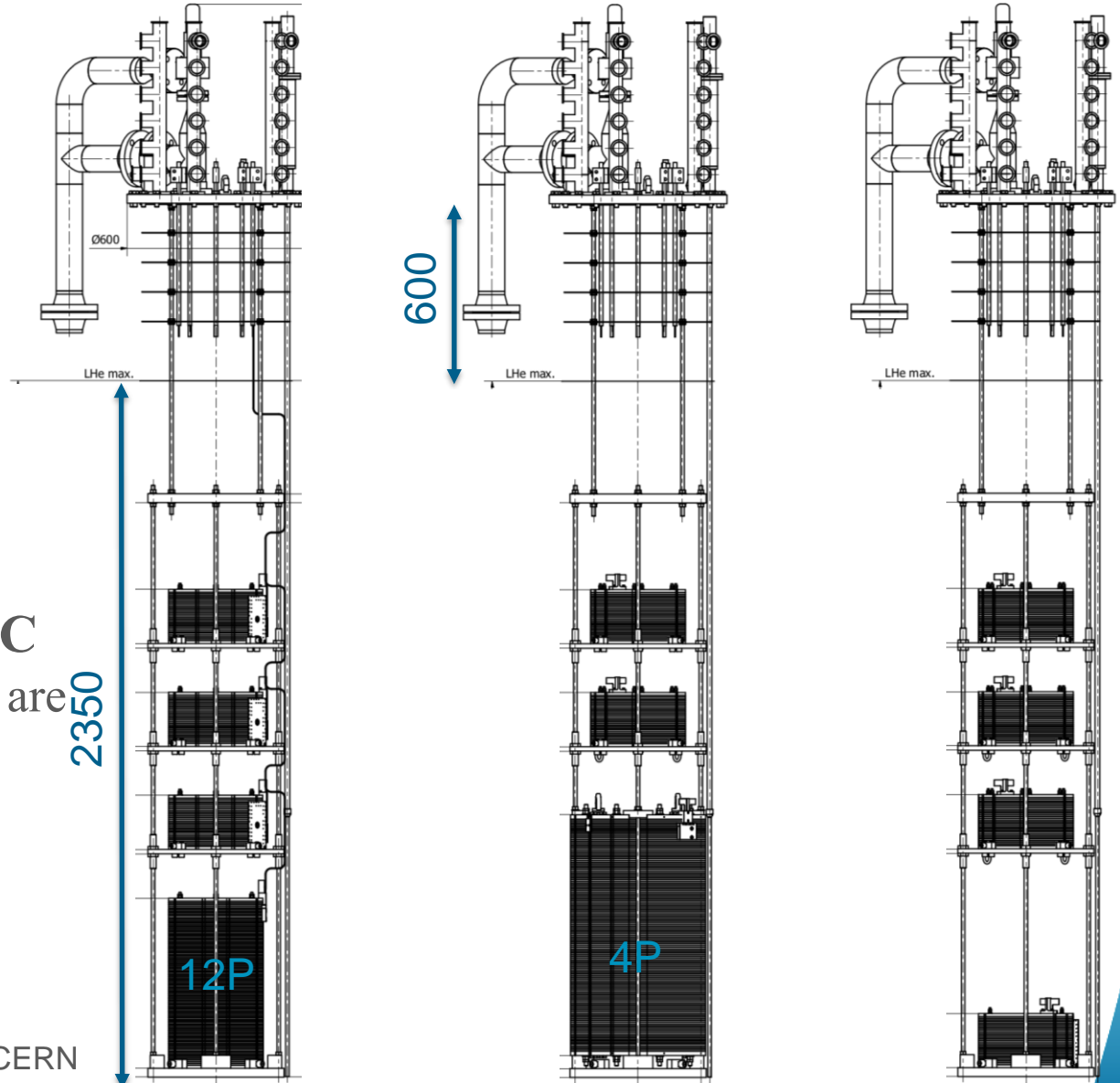
Series production

- 3 batches

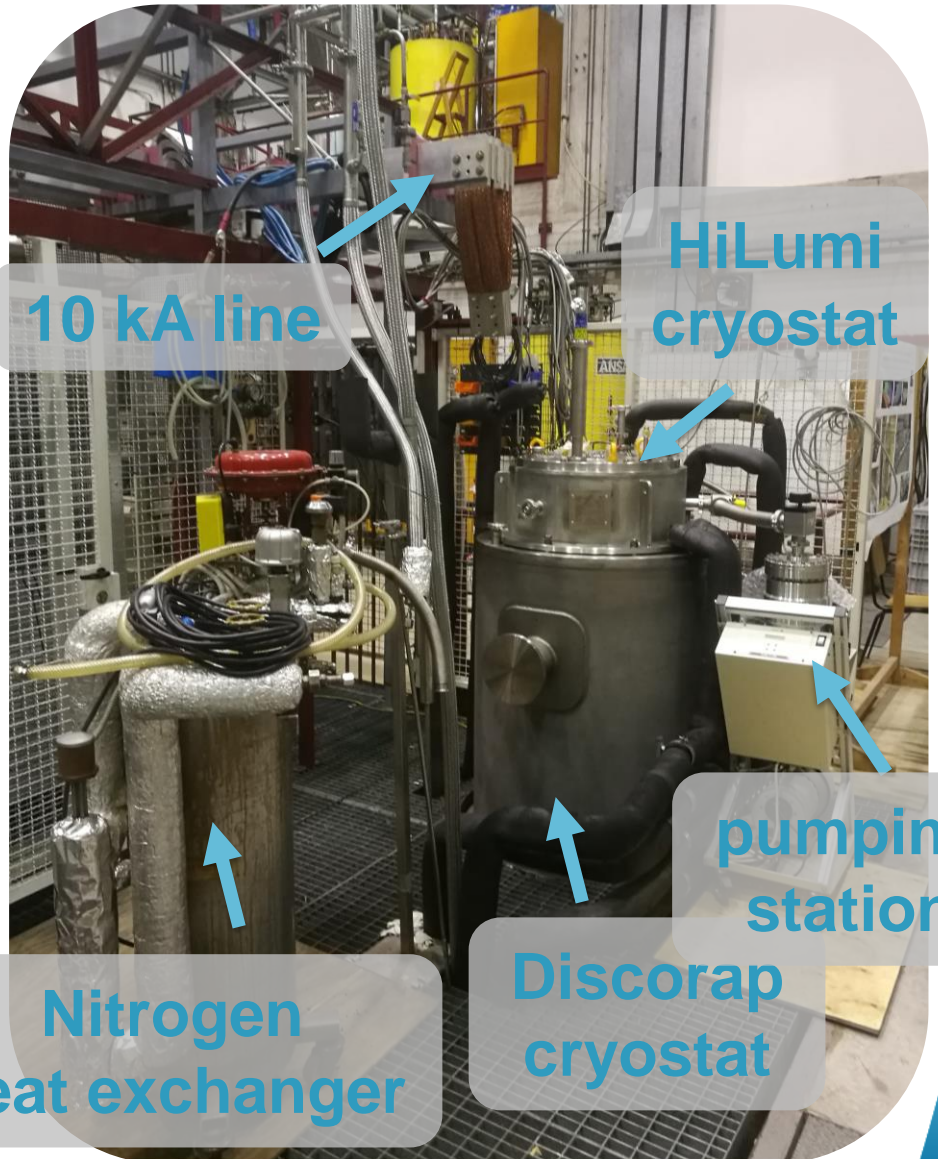
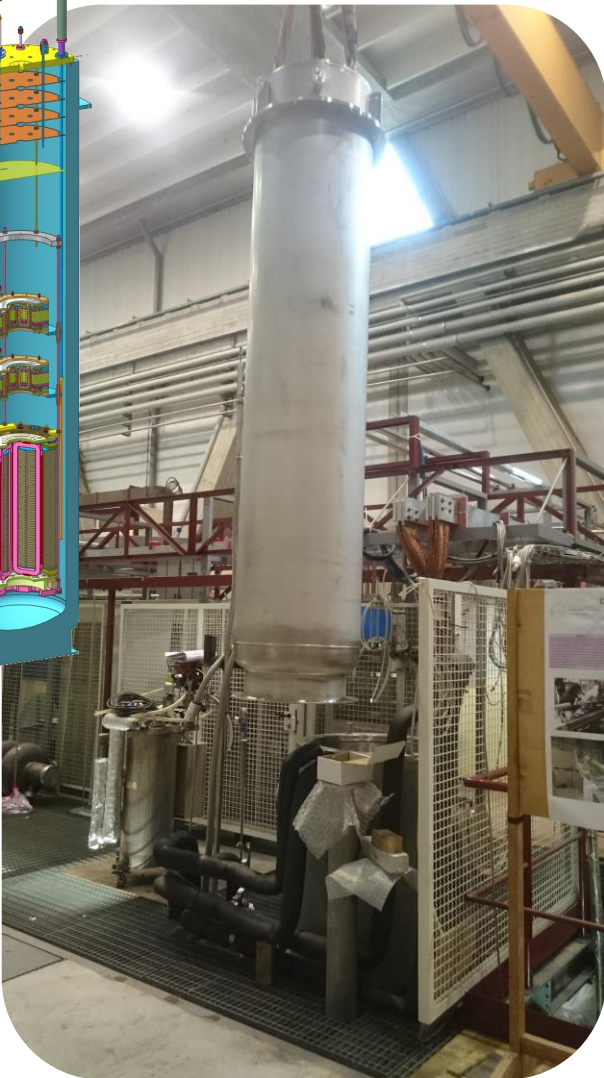
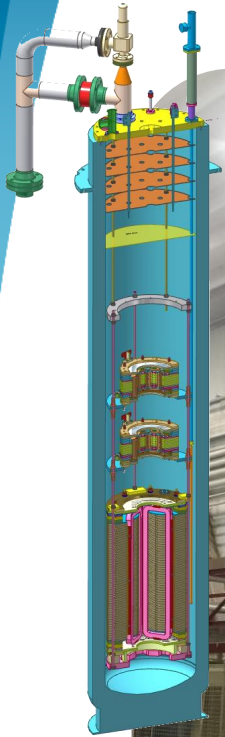
- 18 magnets
- 2X12P 2X4P
- 5 cooldowns

Documentation QA/QC

- All produced prototypes are in MTF/EDMS
- Workflow - MIPs
- Acceptance procedures (INFN)
- Test reports and test summaries



Status of installation



10 kA line

HiLumi cryostat

pumping station

Nitrogen heat exchanger

Discorap cryostat

TEST STATION UPGRADE

- New cryostat components delivered
- New main switch for power supply (fast solid state switch, $\Delta t \sim 1$ ms) DONE
- New power supply for magnet test (+-200 A, 50 V) ORDER IN 2018
- New acquisition system for test monitoring AT LASA
- Automatization of the cooling by an Nitrogen heat exchanger ongoing
- Installation of system for magnetic measurement at low temperature (supplied by CERN)

Conclusion

Updates on the activity of the LASA high current test station

- HTS magnets at variable temperature
- Commissioning of the system for HiLumi
 - Test the 'long' HO prototypes
 - Test the HO corrector series magnets



THANK YOU

Ph. by G. Fornasier

LASA team

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