

TE-MPE-MP section

Main achievements of 2021



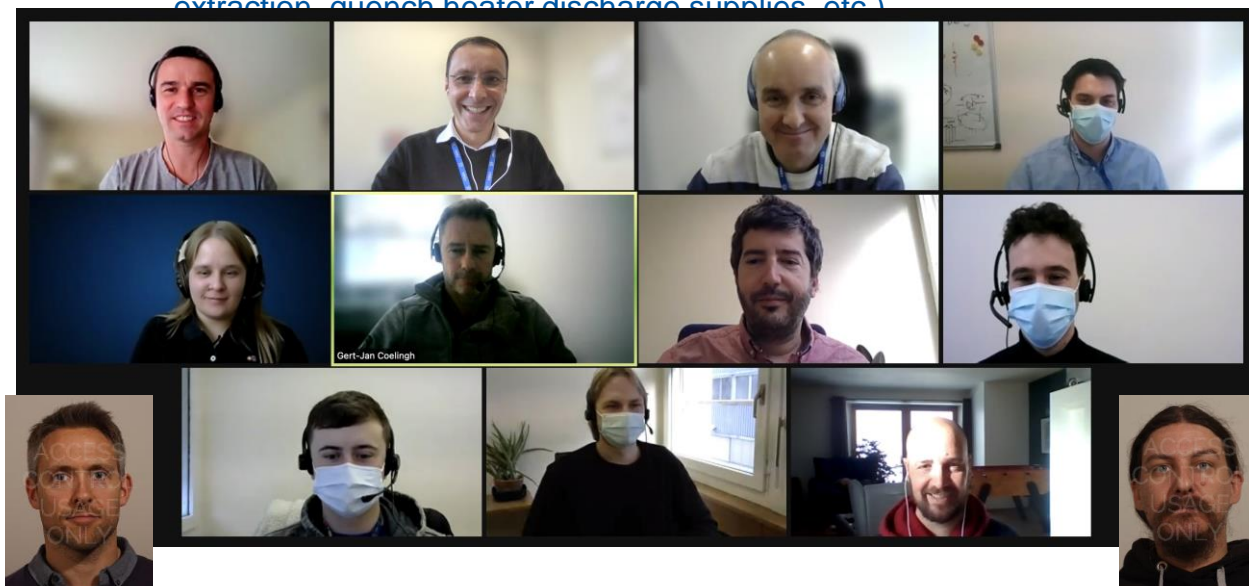
TE-MPE Annual Meeting 2021

09/12/2021

Mirko Pojer on behalf of the section

The team and the mandate

- The Magnet Protection Systems section (MP) is responsible for the R&D, design, production, installation, operation and maintenance of hardware using state-of-the-art technologies applied to the protection of superconducting magnets and circuits. The responsibilities of the team include amongst others:
 - Support to the LHC operation by assuring the correct function and maintenance of the section's installed protection systems (energy extraction, quench heater discharge supplies, etc.)



Preparation for Run 3

Coming out of LS2, towards operation

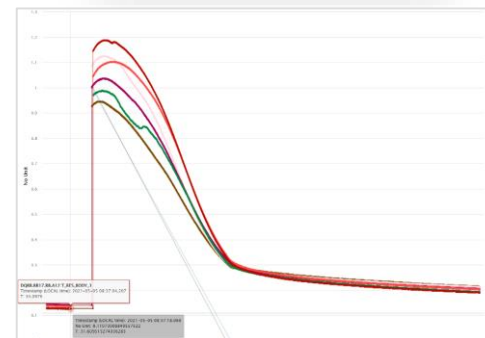
Qualification of the conical joints finalized, together with the heat runs of the warm parts of the circuits.

Active contribution to the hardware commissioning campaign and magnets training (13 kA and 600 A EES, DQHDS)

solid and reliable performance – very few issues registered



Conical joint measurement



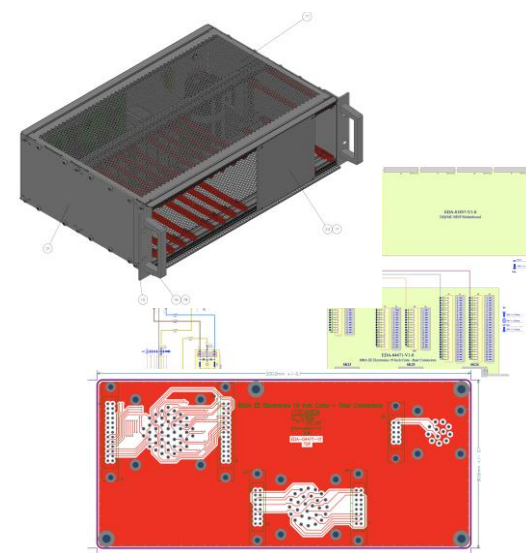
RB dump resistors thermal performance

80% of preventive maintenance of the 13 kA was completed in advance. The remaining part will be done during YETS(2021-2022)



Spare for EES and DQHDS

- Refurbishment of the spare 13 kA switches
- Upgrade of the DJPC
- Construction of 20 spare crates for 600 A
- Testing of spare DQHDS
 - DQLIM
 - DLCT



R&D and Projects

13kA EES consolidation project

Mechanical parts

- Arcing contacts of non-ferromagnetic material were produced in collaboration with MME.
- Validation is currently ongoing in IHEP collaborating institute.
- Mechanical durability was successfully proved.



New contacts under validation



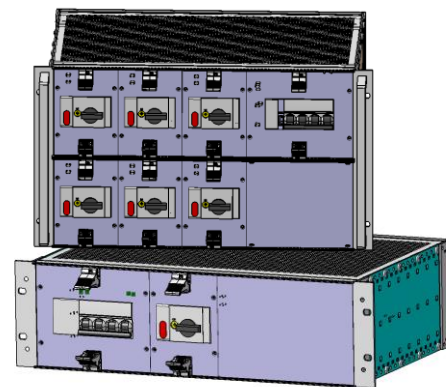
Arcing contact validation

Control hardware

- DJRB/Q fan control units were designed. Prototypes produced and successfully tested.



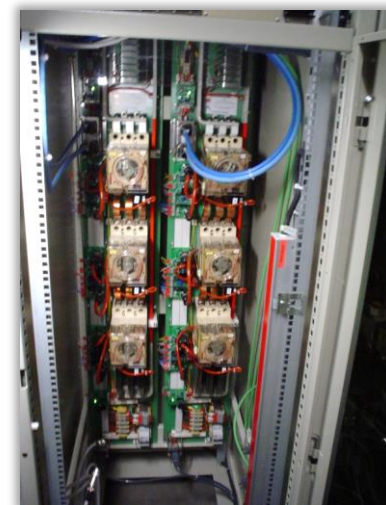
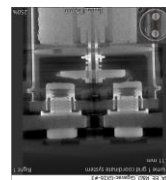
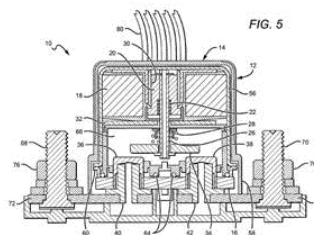
Existing breaker control module



DJRB and DJRQ units

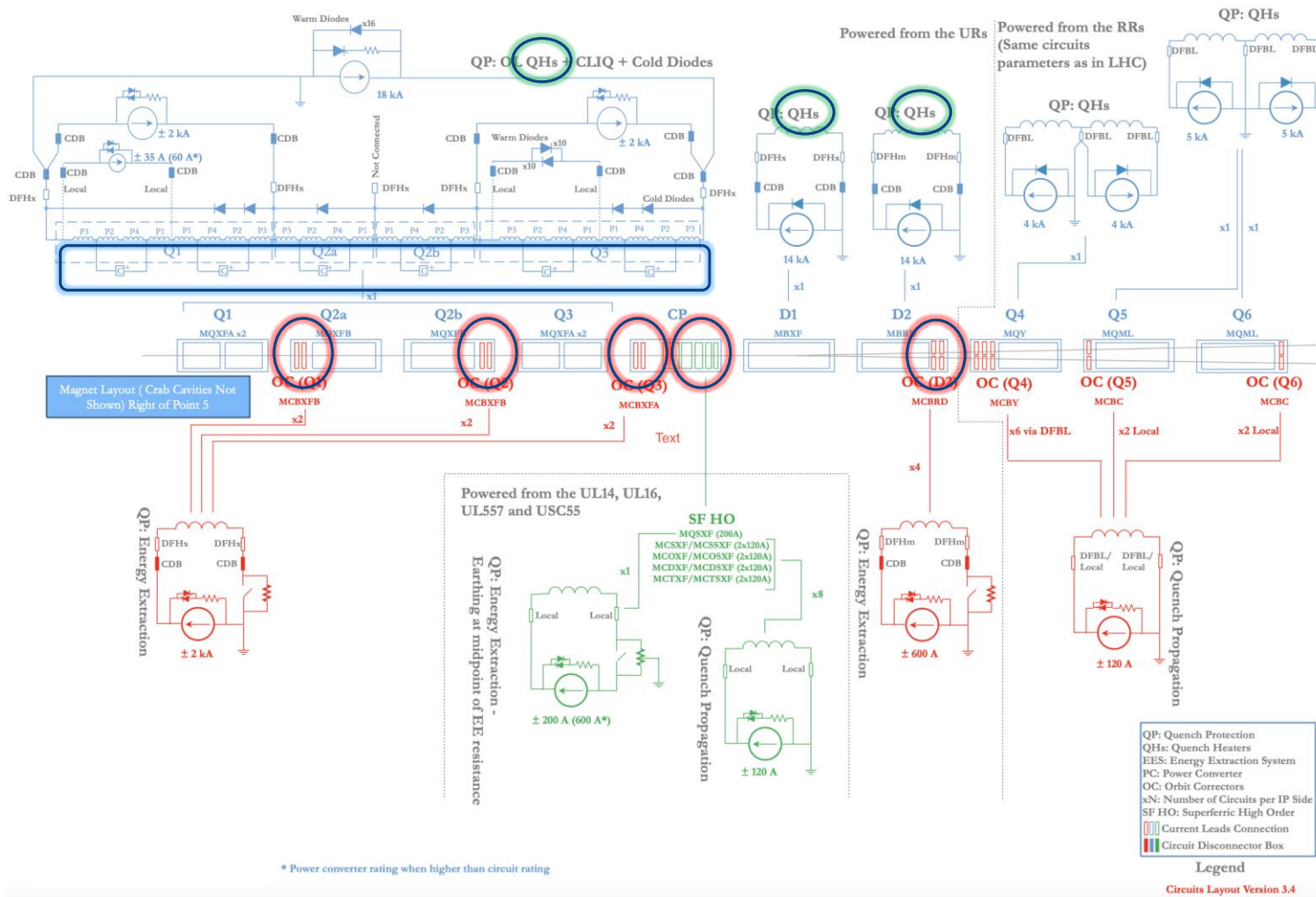
R&D on DC contactors

(600 A EES)



- **Gigavac:**
 - 600A type: GX 16 - 6 pieces tested > 30.000 cycles
 - 1000 A type: GX 110 - 6 pieces tested > 35.000 cycles
- **Kilovac**
 - 600A type: EV600 - 6 pieces tested > 35.000 cycles
- **Dongya DHC600P (ordered) - 6 pieces ordered: start in 2022**

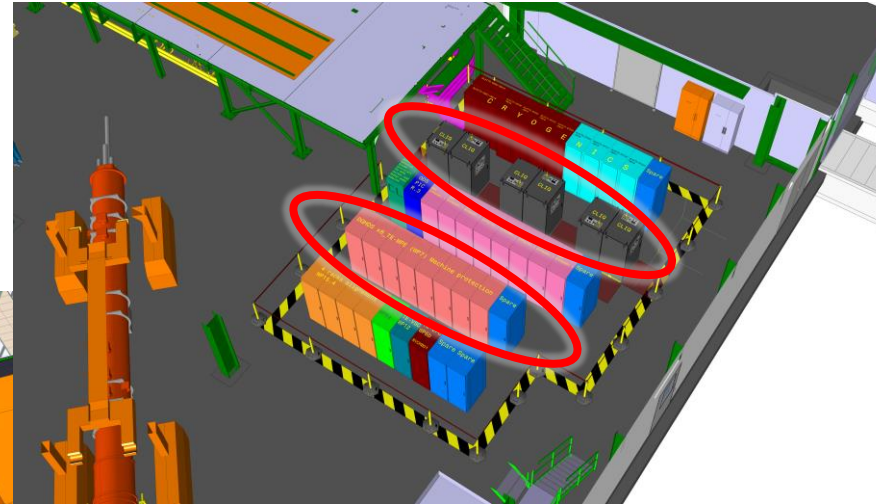
HL-LHC



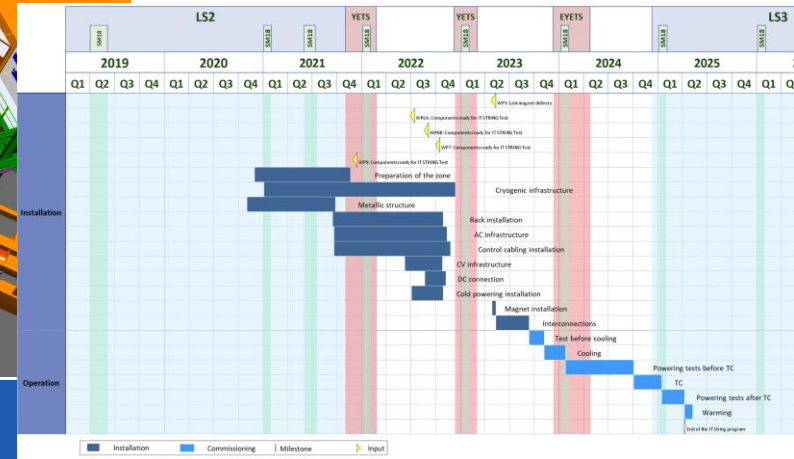
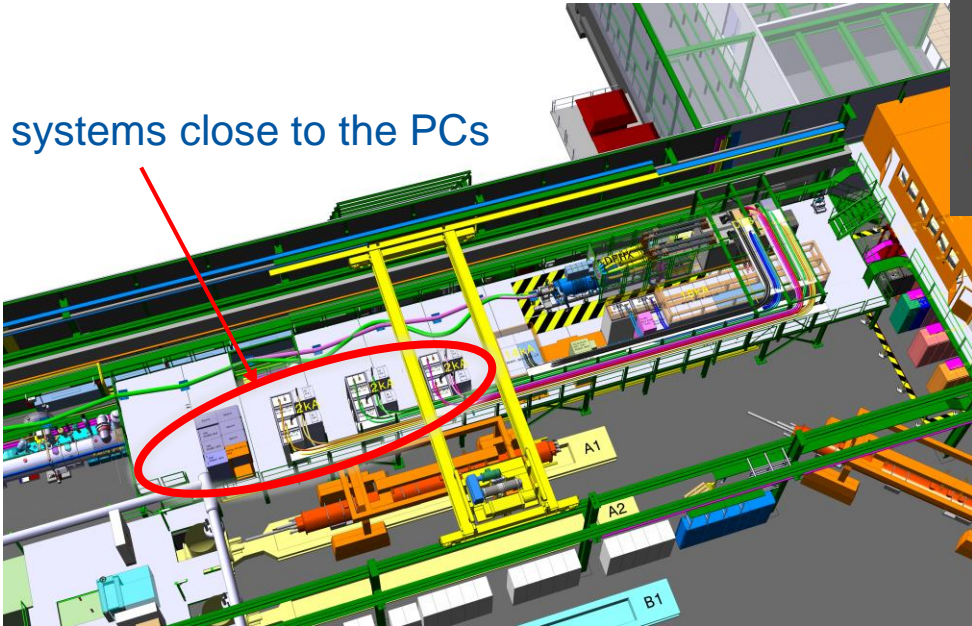
HL and the IT String facility in SM18



DQHDS and CLIQs units under the control room

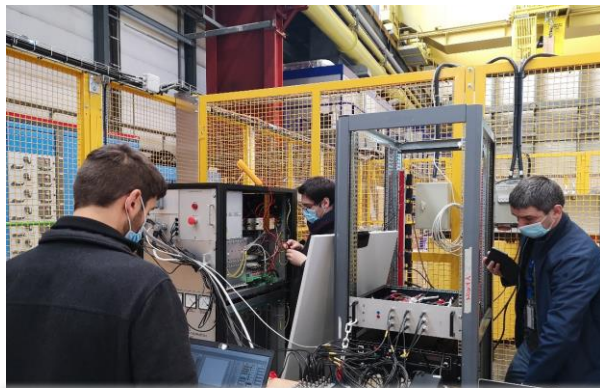


EE systems close to the PCs



CLIQ project in 2021

Innovative quench protection method based on a discharge resulting in high inter-filament and inter-strand coupling losses



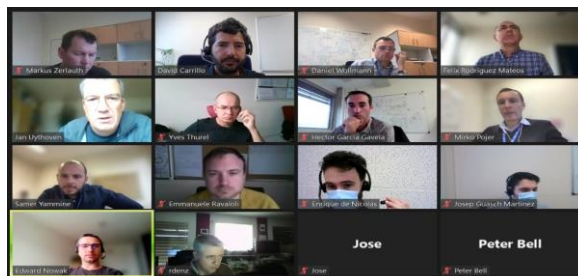
CLIQv2 Reliability Run (> 8000 cycles)



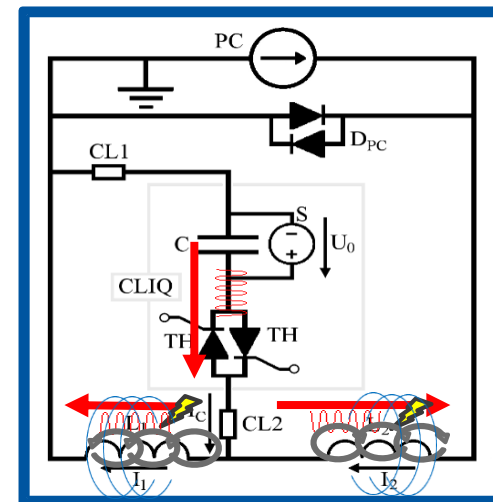
Prototype CLIQv3 qualified



Contract signed: Supply of CLIQ capacitors



CLIQ Production Readiness Review



Current change

Magnetic field change

Coupling losses (Heat)

Temperature rise

QUENCH



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

EDMS No. 2387649

HL-LHC Document Ref. LHC-DQ-CI-0003

The High Luminosity LHC

Group Code: TE-MPE

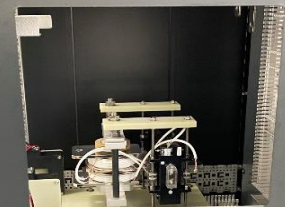
IT-4569/TE/HL-LHC

Invitation to Tender

Technical Specification Supply of CLIQ units

Abstract

This Technical Specification concerns the supply of Loss Induced Quench (LIQ) units for the High Luminosity LHC. Each CLIQ unit includes, among other components, a polypropylene film capacitor. The capacitors are not part of the supply of the Contractor. The delivery is foreseen over three years. The first delivery is expected to take place in 2023.



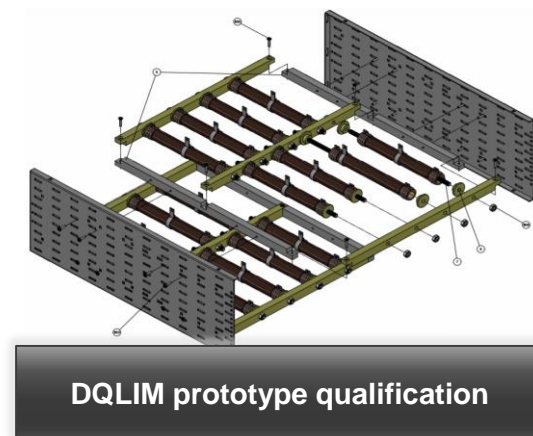
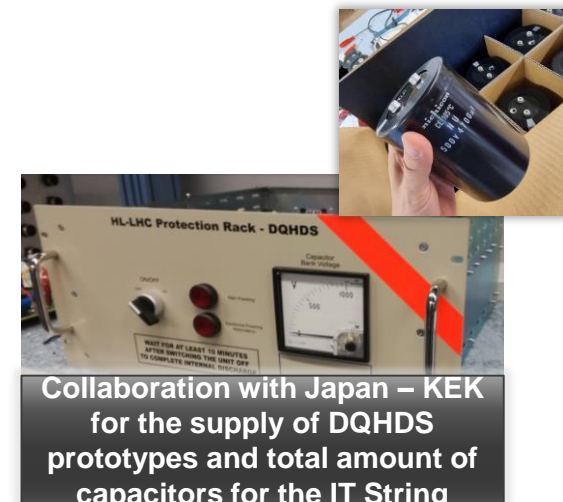
Contract signed: Supply of CLIQ units
Pre-series unit production ongoing



TE-MPE-MP

MPE Group Plenary Meeting

Heater Discharge Power Supplies for HL-LHC in 2021

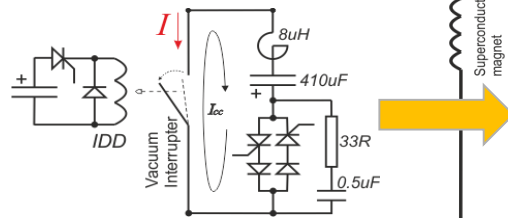


“In-house” production of the STRING units

Vacuum-switch-based EES

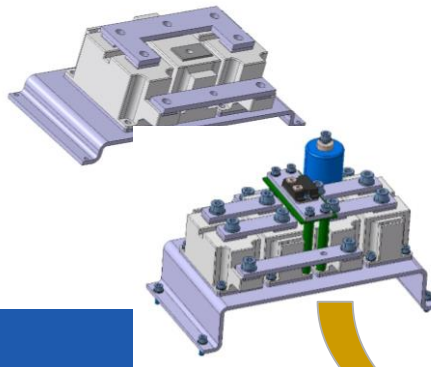
Novel DC switching technology which uses off-the-shelf vacuum interrupters, able to transfer the circuit current to the dump resistors in less than 2 ms.

Developed with the University of Lodz (PL).
Full redundancy implemented for Power SCRs and trigger channels.

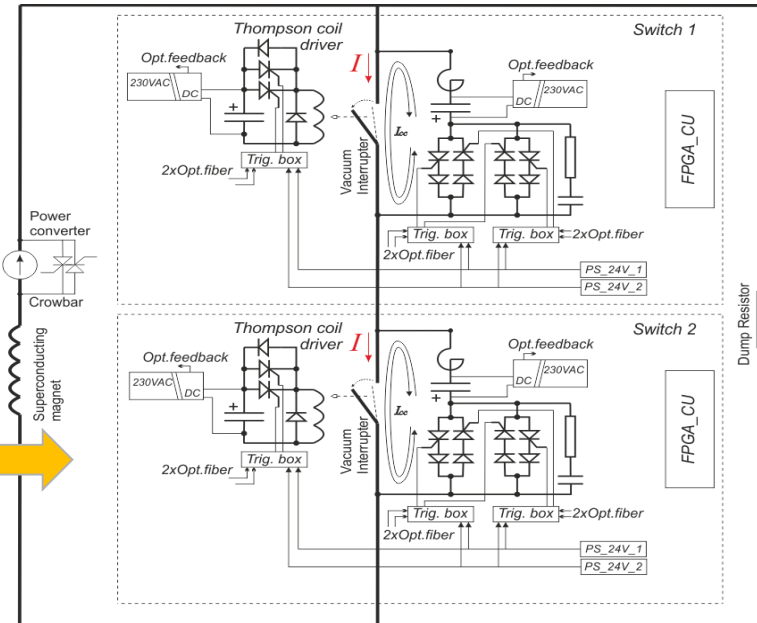


SCRs modules

Trigger board



Power-electronics upgrade



Vacuum-switch-based EES_cont

IT-String EE systems

IT-4653: Market survey and invitation for tender were successfully carried out. Contract with the winning company is made. Delivery is in autumn 2022. Electronics is ordered and it is currently in production.

Test bench

The test station was moved from b.180 to b.272. All main parts were successfully re-installed and set. Soon the test bench will become operational.



Bld.180



Bld.272



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

EDMS No. 2392237

HL-LHC Document Ref. LHC-EE-CI-0005

The High Luminosity LHC

Group Code: TE-MPE

IT-4653/TE/HL-LHC

Invitation to Tender

Technical Specification Supply of Energy Extraction Systems for HL-LHC Superconducting Magnet Circuits Based on Vacuum Switches

Abstract

This Technical Specification concerns the supply of ten Energy Extraction Systems, each rated at 2 kA and 600 A, based on DC vacuum switches, for the HL-LHC Project. The supply is expected to take place within nine months from the date of the Contract.

Other facilities

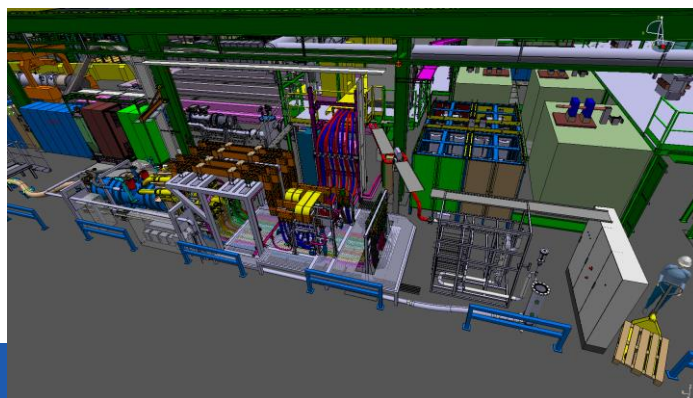
SM18

Maintenance of the energy extraction system on cluster G

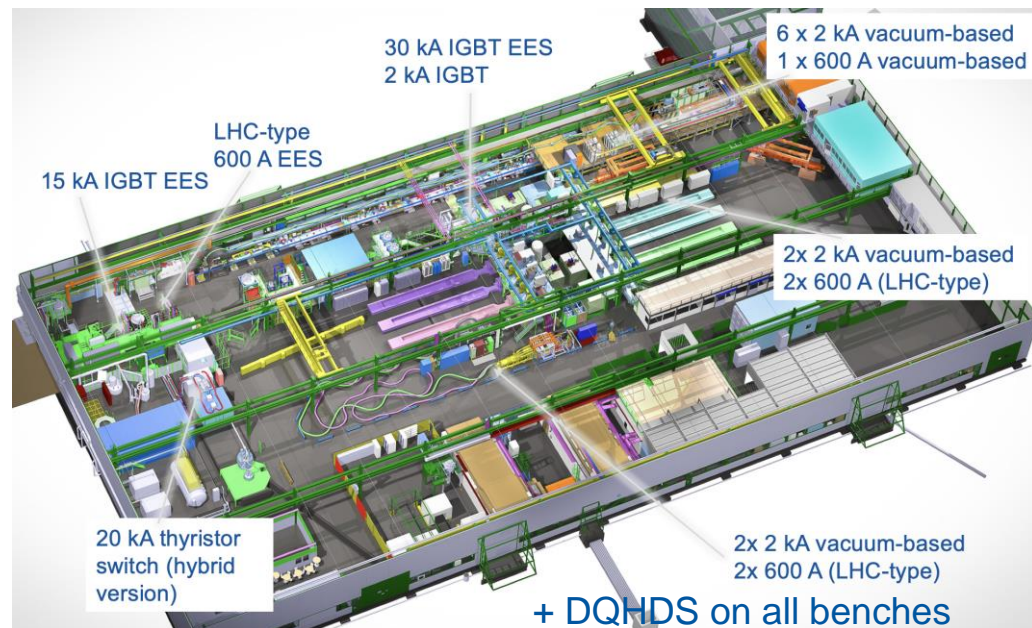


6 electromechanical breaker dismantled from the energy extraction system, sent to Secheron for refurbishment and reinstalled

Upgrade of test bench F1 (and A)



TE-MPE-MP



Interventions on IGBT switches

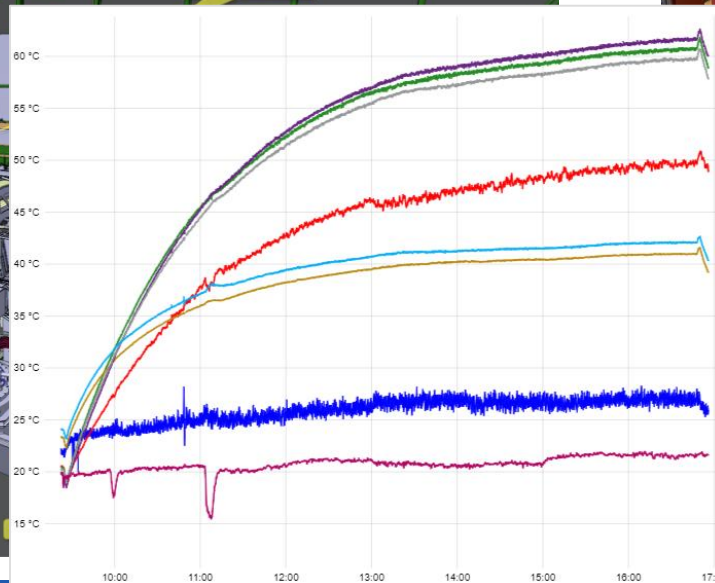
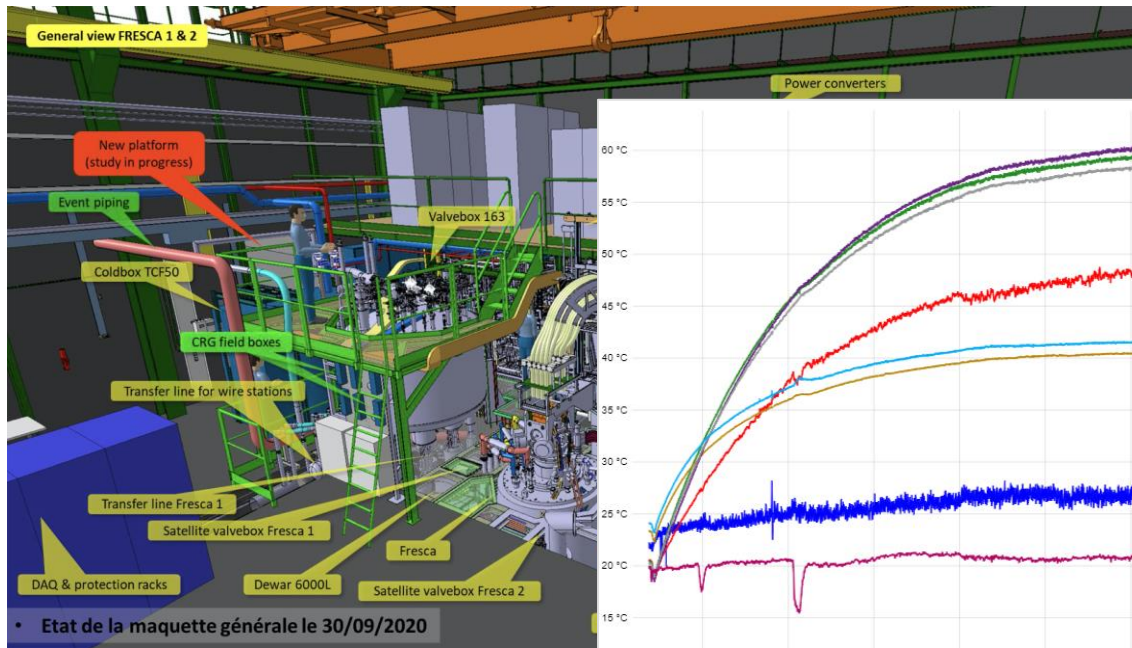


FRESCA in bldg. 163

Facility for the electrical characterization of superconducting cables at temperatures of 1.9 K and 4.3 K in liquid helium bath as well as in gas flow of 6 K to 77 K in fields of up to 13 T.

DC electromechanical circuit breakers from Secheron were installed, for a current rating of 13 kA and stored energy of 1-6 MJ.

**All qualification tests were successfully completed.
Final commissioning with magnet is remaining.**

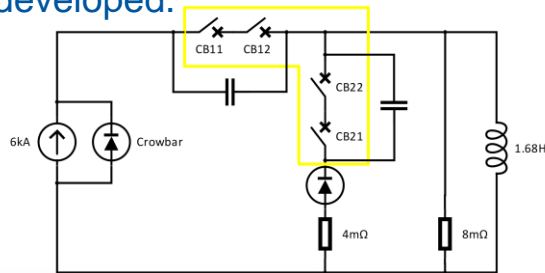


Thermal performance test

NA consolidation project

Protection of three experimental magnets in the North Area.

Circuit topology study and energy extraction concept were developed.



ATLAS

$I_{\text{nom}} = 5000 \text{ A}$
At I_{nom} , $U = 3.45 \text{ V}$
For 2 A/s , $U = 5.64 \text{ V}$

VERTEX 1

$I_{\text{nom}} = 5013 \text{ A}$
 $L = 1.68 \text{ H}$
 $I = 3820 \text{ A}$, $U = 1.17 \text{ V}$
 $I = 5013 \text{ A}$, $U = 1.71 \text{ V}$
For 3 A/s , $U = 4.3 \text{ V}$

VERTEX 2

$I_{\text{nom}} = 3820 \text{ A}$
 $L = 1.68 \text{ H}$
 $I = 500 \text{ A}$, $U = 0.19 \text{ V}$
 $I = 3820 \text{ A}$, $U = 1.37 \text{ V}$



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

EDMS No. 2480768

The NA Facility

Market Survey Technical Description

Supply of 12 Electromechanical DC Circuit Breakers for the North Area Consolidation

Abstract

This Technical Description concerns the supply, test, installation, commissioning and maintenance of 12 high speed electro-mechanical circuit breakers for the consolidation of the energy extraction system of three experimental magnets in the North Area (NA) facility. This Market Survey will be followed by an Invitation to Tender planned to be issued in Q2-2021.



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

EDMS No. 2591856

The NA Facility

Group Code: TE-MPE
IT-4680/TE/NA

Invitation to Tender

Technical Specification Supply of 12 Electromechanical DC Circuit Breakers for the North Area Consolidation

Abstract

This Technical Specification concerns the supply of DC electro-mechanical circuit breakers with their cubicle, to commutate a DC current of 6 kA into a dump resistor for the purpose of quench protection of the North Area superconducting magnets VERTEX 1, VERTEX 2 and ATLAS/Morpugo. It concerns the production, qualification and delivery of twelve DC electro-mechanical circuit breakers to be put in operation in the North Area experiments at CERN. The document describes the functions that shall be implemented and states the requirements towards the design and operation of the system. The delivery is foreseen over 5 months from notification of the Contract.

Bulletin for the CERN Community

Updates Opinion Official communications Announcements Events Staff Association

MADMAX AND CERN'S MORPUGO MAGNET

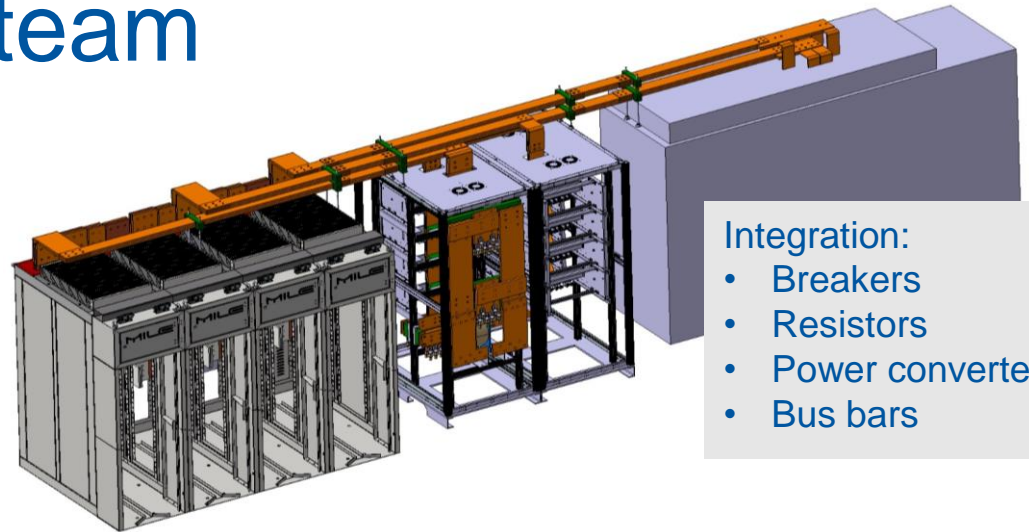


A new collaboration, MADMAX, will seize the chance to use a CERN magnet named Morpugo to test their dark-matter prototype

NA cons. at full steam



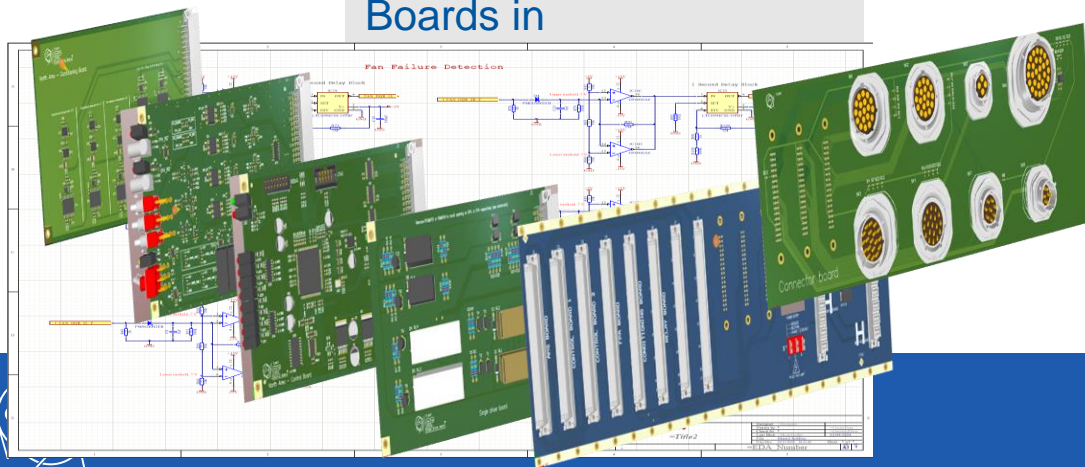
Dump resistor rack assembly ongoing



Integration:

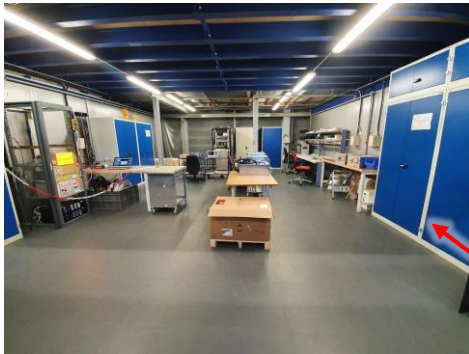
- Breakers
- Resistors
- Power converter
- Bus bars

Control electronics:
Boards in



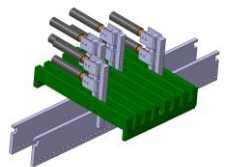
High-speed DC circuit breaker for 8kA installed on withdrawable trolley

Test facilities



Former test area in bldg 180

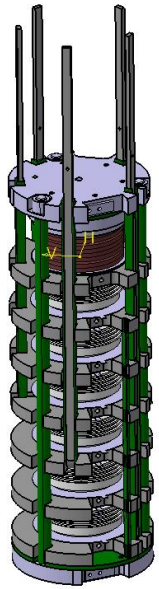
“New” 272



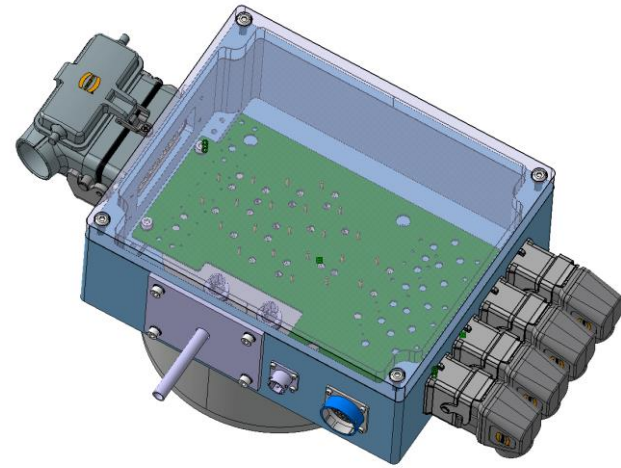
377 EE test bench



Contribution to MPE projects

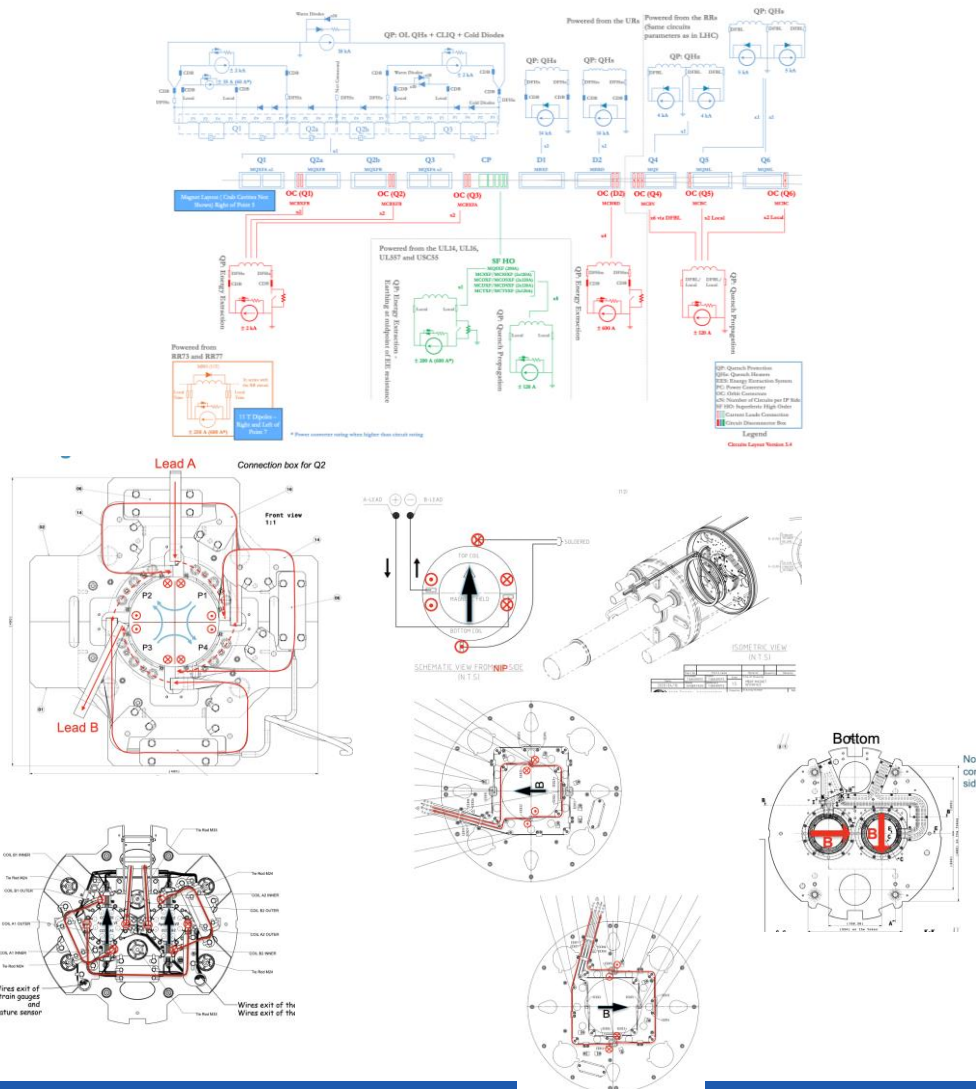


Modification of the HL-LHC diodes stack prototype for a version 2 and assembly finished.



Design of the HL-LHC IFS box on going.

HL-LHC circuits polarity verification



CERN
CH-1211 Geneva 23
Switzerland

the Large Hadron Collider project

HLHC Project Document No.
LHC-DC-ES-0001 rev 3.2
CERN Div./Group or Supplier/Contractor Document No.
AB/CO, LHC/TCP, AT/MEL
EHMS Document No.
90041

Date: 2005-08-09

Engineering Specification

LHC MAGNET POLARITIES

Abstract

The aim of this document is to specify the current magnets. It defines the resultant field for a current set of rules is given followed by diagrams demonst

Prepared by :

Paul Proudlock
LHC/TCP
Stephan Russenschuck
AT/MEL
Markus Zerlauth
AB/CO

Checked by :

M. Buzio
L. Bottura
O. Bruning
J.-L. Perinet-Marq
R. Ostojic
G. De Rijck
L. Rossi
R. Schmidt
T. Tortchanoff
L. Walckiers
R. Wolf

Dipole

Quadrupole

approved by:
Rudiger Schmidt
Oliver Bruning

Safety first

COVID-19: WHAT'S NEW THIS WEEK
COVID-19: ACTUALITÉS DE LA SEMAINE



EDMS
2470706

Vers.
3

Statut
Voir EDMS

Visibilité : RESTRICTED

UNITE DE LA SANTE ET DE LA SECURITE AU
TRAVAIL ET DE LA PROTECTION DE
L'ENVIRONNEMENT

Santé et sécurité au travail

RAPPORT

Inspection of the CLIQ reliability test run

Rédigé par:

Igor NEUHOOLD HSE-OHS

Vérifié par:

Click or tap here to enter text.

Approuvé par:

Click or tap here to enter text.

à Delphine Letant-Delrieux (TE-RAS), Alexis Vidal (TE-VSC), David
Irkko Pojer (TE-MPE), Olivier TISON (HSE-OHS), Igor NEUHOOLD (HSE-
OHS), Jean-paul JULLIEN (HSE-OHS)



TE-MPE-MP

MPE Group

MP moved





Merry Christmas

**STAY
SAFE!**