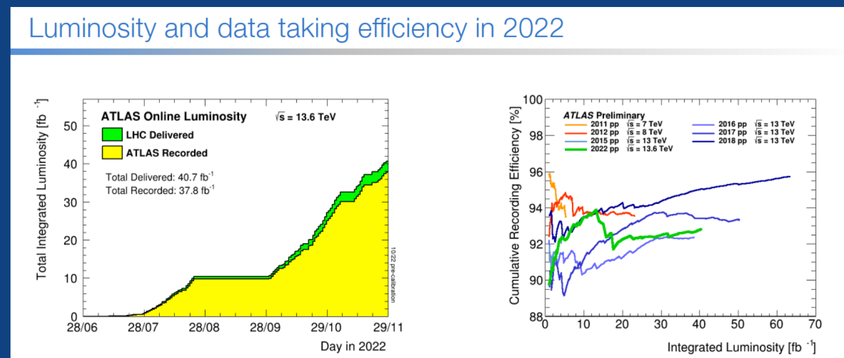
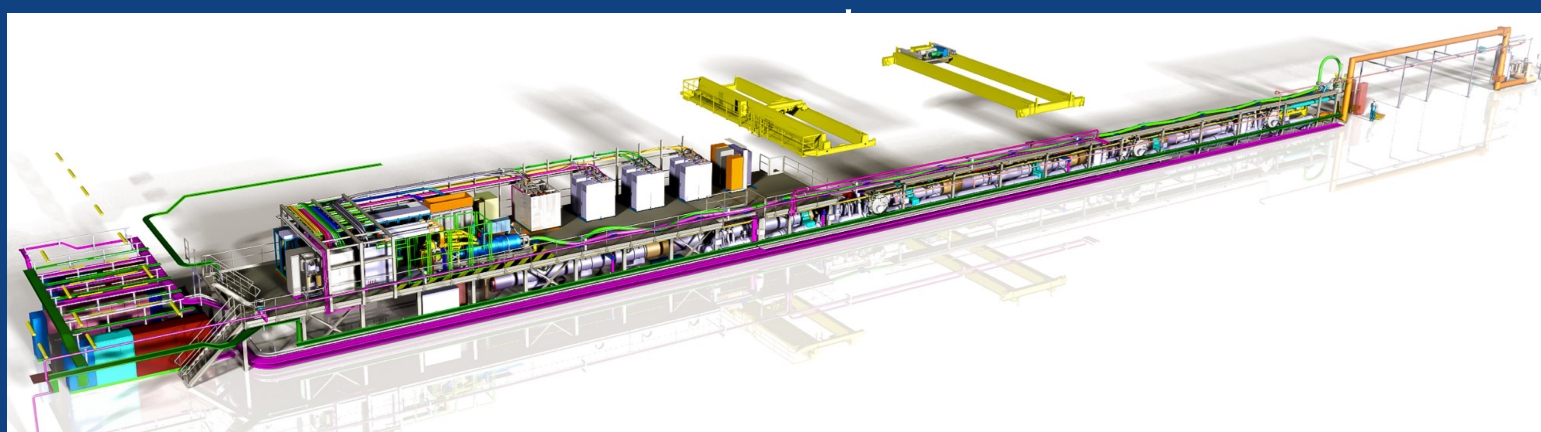
2022 TE-MPE Group Annual Meeting

F. Rodriguez-Mateos with inputs from the Section Leaders



Peak Stable Lumi	2.53×10^{34} cm^{-2} s^{-1}	
Peak <Events>/BX	73.4	
Avg <Events>/BX	44.6	
	Lumi (fb^{-1})	Percent
Physics Beams Del.	40.68	100.0%
ATLAS Ready Del.	40.31	99.1%
ATLAS Ready Rec.	37.77	92.8%
Del. after Warmstop	0.01	0.0%

www.cern.ch



13th December 2022

Outline

- Welcome
- Our Mandate and Group Structure
- General Information of the Group in 2022
- Safety in 2022
- Technical Highlights of the Year
  - General
  - Sections
- Outlook into 2023
- Questions

16:45 Drink at the cafeteria of Bdg. 30, 7th floor

Our Mandate

The MPE group is part of CERN's Technology Department (TE) and is responsible for **the magnet protection systems and machine interlocks for the CERN accelerator complex**. The MPE group **supports the operation of CERN's accelerators** by developing, maintaining and operating **state-of-the art hardware and software technologies for magnet circuit protection, diagnostics and interlock systems** for present and future accelerators, magnet test facilities and several CERN hosted experiments.

The group furthermore includes a section devoted to the technical coordination role in the domain of activities related to the **integration, installation, commissioning and operation** of the **Inner Triplet String Facility** within the framework of the High Luminosity LHC (HL-LHC) Project.

The MPE group is involved in several transversal projects across the accelerator sector, providing expertise in a wide range of areas including **machine protection, electronics and electrical engineering, reliability engineering, controls and software technologies as well as the operation and performance analysis of superconducting magnet circuits.**

https://mpe.web.cern.ch

TE-MPE Organigram (Dec 2022)

TE-MPE
Machine Protection & Electrical Integrity

GL: Felix RODRIGUEZ MATEOS
DGL: Jan UYTHOVEN

- GAO Claudia DUPRAZ
- GLO Daniel CALCOEN *(p.t.)*

TE-MPE-CB
Controls & Beam Studies For Protection

Daniel WOLLMANN

- Andrea APOLLONIO
- Milosz Robert BLASZKIEWICZ
- Claudiu CRACIUN
- Marc-Antoine GALILEE
- David GANCARCIK
- Jean-Christophe GARNIER
- Cedric HERNALSTEENS
- Jack HERON
- Aleksandra MNICH
- Christoph OBERMAIR
- Laura RAYON ROPERO
- Gustavo Enrique SANCHEZ
- Tobias SKARHED
- Balazs SZALAY
- Stefan Dalgaard THOMSEN
- Mariya Georgieva TSVARKALEVA
- Christoph WIESNER
- Philipp Alois ZIEGLER

TE-MPE-EP
Electronics For Protection

Reiner DENZ

- Fabienne BOISIER
- Daniel CALCOEN
- Davide CASAROTTO
- Magnus CHRISTENSEN
- Vincent FROIDBISE
- Adam HOLLOS
- Guzman MARTIN GARCIA
- Maria MURILLO MOYA
- Michael PHAM
- Tetiana PRIDII
- Tomasz PODZORNY
- Jelena SPASIC
- Jens STECKERT
- Vito VIZZIELLO

TE-MPE-MI
Machine Interlocks

Jan UYTHOVEN

- Alain ANTOINE
- Yan BASTIAN
- Samuel Lyndon BOLTON
- Antoine COLINET
- Lukas FELSBERGER
- Josep GUASCH MARTINEZ
- Michal KALINOWSKI
- Christophe MARTIN
- Richard MOMPO
- Ivan ROMERA RAMIREZ
- Raffaello SECONDO

TE-MPE-MP
Magnet Protection Systems

Mirko POJER

- Sebastian Scott BLOWER
- Gert-Jan COELINGH
- David CARRILLO
- Enrique DE NICOLAS LUMBRERAS
- Mathieu FAVRE
- Spyridon GEORGAKAKIS
- Martin GRIGOROV
- Gabriel MEDINA
- Thorbjorn Schou NIELSEN
- Edward NOWAK
- Bozhidar Ivanov PANEV
- Stephen PEMBERTON
- Lucile Ariel Fanny PINARD
- Maren SCHUELE
- Ryder SHARPE

TE-MPE-PE
Performance & Electrical Qa

Arjan VERWEIJ

- Sina ATALAY
- Mateusz Jakub BEDNAREK
- Bernardo BORDINI
- Vijay CHAKRAVARTY
- Zinour CHARIFOULLINE
- Giorgio D'ANGELO
- Per HAGEN
- Marvin JANITSCHKE
- Johanna LIDHOLM
- Daniel MAYR
- Tim MULDER
- Emmanuele RAVAIOLI
- Grzegorz SEWERYN
- Lena Anna SOMMER
- Erik SCHNAUBELT
- Andrea VITRANO
- Mariusz WOZNIAK

TE-MPE-SF
String Facility

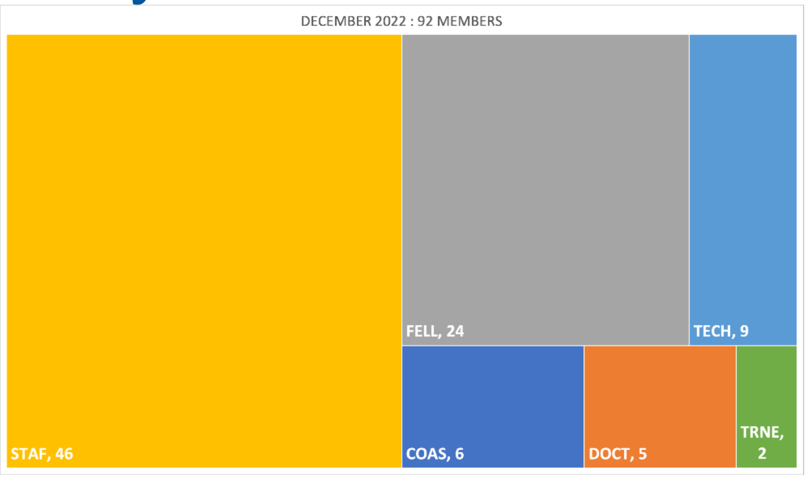
Marta BAJKO

- Sebastien BLANCHARD
- Davide BOZZINI
- Nicolas HEREDIA GARCIA
- Alvaro SANTIAGO FERRER
- Samer YAMMINE
- Julian ZAWILINSKI

MPE Members in numbers

- **Diversity is a core value underpinning our Code of Conduct.**
- **CERN promotes diversity, inclusion and equality at all levels.**

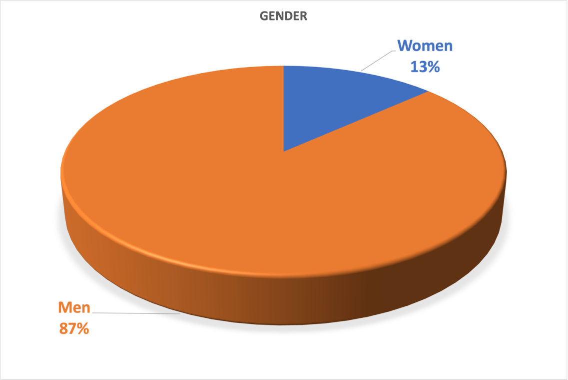
By Status



December 2022 : 92 members

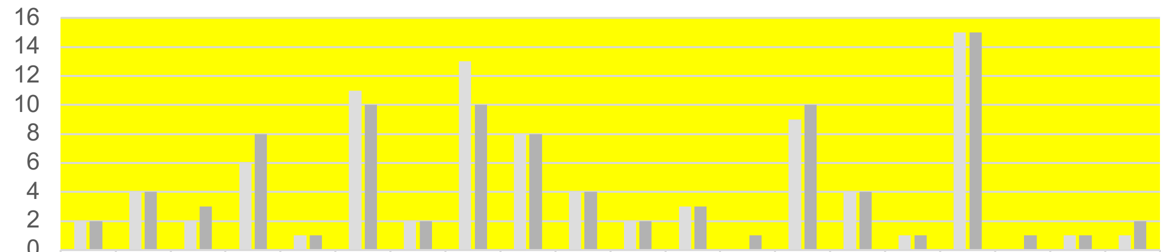
December 2021 : 89 members

By Gender



By Nationality

20 nationalities



	AT	BE	BG	CH	CZ	DE	DK	ES	FR	GB	GR	HU	IN	IT	NL	NO	PL	RO	RS	SE
May	2	4	2	6	1	11	2	13	8	4	2	3	0	9	4	1	15	0	1	1
Nov	2	4	3	8	1	10	2	10	8	4	2	3	1	10	4	1	15	1	1	2

Arrivals in MPE 2022

Welcome

Welcome

Staff

KALINOWSKI Michal Tomasz	TE-MPE-MI
MULDER Tim	TE-MPE-PE
SANCHEZ Gustavo Enrique	TE-MPE-CB
BORDINI Bernardo	TE-MPE-PE

Fellows, PhD

CHRISTENSEN Magnus	TE-MPE-EP	HEREDIA GARCIA Nicolas	TE-MPE-SF
GANCARCIK David	TE-MPE-CB	HERON John Wilfred	TE-MPE-CB
JANITSCHKE Marvin	TE-MPE-PE	MARTIN GARCIA Guzman	TE-MPE-EP
BLASZKIEWICZ Milosz Robert	TE-MPE-CB	MEDINA Gabriel	TE-MPE-MP
CASAROTTO Davide	TE-MPE-EP	PINARD Lucile Ariel Fanny	TE-MPE-MP
GRIGOROV Martin Aleksandrov	TE-MPE-MP	SHARPE Ryder	TE-MPE-MP
GUASCH MARTINEZ Josep	TE-MPE-MI	TSVARKALEVA Mariya Georgieva	TE-MPE-CB

Welcome

Techs, Students and COAS

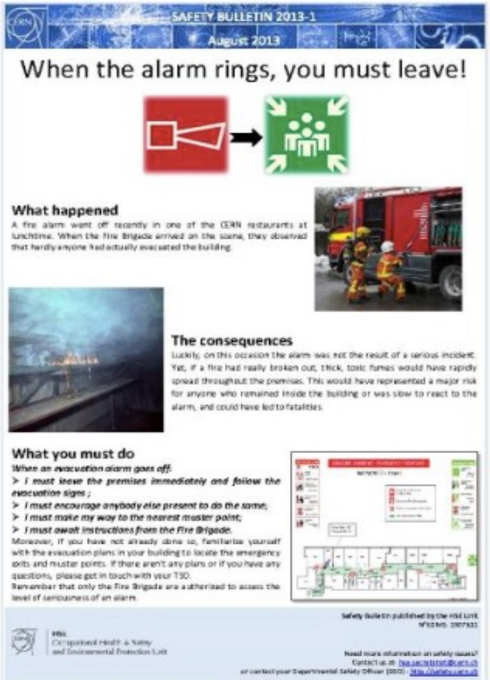
BEDNARSKI Mikolaj	TE-MPE-PE	SKOCZEN Andrzej Jozef	TE-MPE-EP	MAYR Daniel	TE-MPE-PE
EROKHIN Aleksandr	TE-MPE-MP	WOJAS Damian Lukasz	TE-MPE-PE	RAYON ROPERO Laura	TE-MPE-CB
JANIK Grzegorz Michal	TE-MPE-PE	ANDRESEN Jonas Bruesshaver	TE-MPE-EP	SKARHED Tobias Lars	TE-MPE-CB
JAROS Jakub Aleksander	TE-MPE-PE	BUSZYDLIK Aleksander	TE-MPE-CB	SOMMER Lena Anna	TE-MPE-PE
KONDRATEV Kirill	TE-MPE-MP	SUMAN Orwa	TE-MPE-CB	SZALAY Balazs	TE-MPE-CB
PONASENKO Nikolai	TE-MPE-MP	CHAKRAVARTY Vijay	TE-MPE-PE	ZIEGLER Philipp Alois	TE-MPE-CB
RACHWALIK Marek Maciej	TE-MPE-PE	CRACIUN Claudiu	TE-MPE-CB	THOMSEN Stefan Dalgaard	TE-MPE-CB
SAMOYLOV Sergey	TE-MPE-MP	LIDHOLM Johanna	TE-MPE-PE		

Departures 2022

ANDRESEN Jonas Bruesshaver	CARTIER-MICHAUD Thomas	JOHNSON Roland Louis	SANCHEZ SANTANA Jenny Estefania	THALLER Emanuel Milan
APOLLONIO Andrea	CHADAJ Agata Malgorzata	JULLIAN PARRA Olivia	SANTOS SHALAB Raul	THOMSEN Stefan Dalgaard
ARNEGAARD Ola Tranum	COSENZA Alessio	KONDRATEV Kirill	SCHUELE Maren	VANCEA Dragos-Gabriel
BARTH Jonas Fridolin	DELKOV Dimitri	LUDWIN Jaromir Wladyslaw	SKOCZEN Andrzej Jozef	VILLEN BASCO Meritxell
BARTHLOTT Dominic Thomas	DON Jeppe	MIRANDA FONTAN Adrian	SOMMER Lena Anna	ZAWILINSKI Julian Jurand
BENDER Lennard	EROKHIN Aleksandr	PONASENKO Nikolai	SORENSEN William Martin	
BIELEWSKI Jaroslaw	GIERAS Tomasz Grzegorz	REEVES Jonathan Robert	STANISZ Anita	
BUSZYDLIK Aleksander	JAROS Jakub Aleksander	SAMOYLOV Sergey	SUMAN Orwa	

We thank all for the valuable contributions

Safety is a top priority and key responsibility of everyone working in TE-MPE



SAFETY BULLETIN 2013-1
August 2013

When the alarm rings, you must leave!

What happened

A fire alarm went off recently in one of the CERN restaurants at lunchtime. When the Fire Brigade arrived on the scene, they observed that hardly anyone had actually evacuated the building.

The consequences

Luckily, on this occasion the alarm was not the result of a serious incident. Yet, if a fire had really broken out, thick, toxic fumes would have rapidly spread throughout the premises. This would have represented a major risk for anyone who remained inside the building or was slow to react to the alarm, and could have led to fatalities.

What you must do

When an evacuation alarm goes off:

- *I must leave the premises immediately and follow the evacuation signs ;*
- *I must encourage anybody else present to do the same;*
- *I must make my way to the nearest muster point;*
- *I must await instructions from the Fire Brigade.*

Moreover, if you have not already done so, familiarise yourself with the evacuation plans in your building to locate the emergency exits and muster points. If there aren't any plans or if you have any questions, please get in touch with your TSO.

Remember that only the Fire Brigade are authorised to assess the level of seriousness of an alarm.

HSE
Occupational Health & Safety
and Environmental Protection Unit

Need more information on safety issues?

SAFETY BULLETIN 2013-2
October 2013

Protect your head!

What happened

Several accidents have been reported in recent months due to people not wearing protective head-gear in areas where safety helmets are compulsory or in work places where the obligation to wear a safety helmet presents difficulties. The victims sustained impacts to the head from protruding elements (sharp angles, steel plates, etc.) when standing up or moving around in their work place.

The consequences

The injuries associated with these accidents include cuts, lesions and gashes to the scalp, some requiring stitches.

What you must do

When working in or passing through areas wit
safety helmets is compulsory, you must we
CERN stores, compliant with at least one of th
Specification for industrial safety helmets », «
industrial helmets ».

Should the wearing of the safety helmet be phy
the work place, the wearing of bump caps* is pe
objects. Safety helmets therefore remain compu

HSE
Occupational Health & Safety
and Environmental Protection Unit

SAFETY BULLETIN 2013-3
November 2013

Drive with caution!

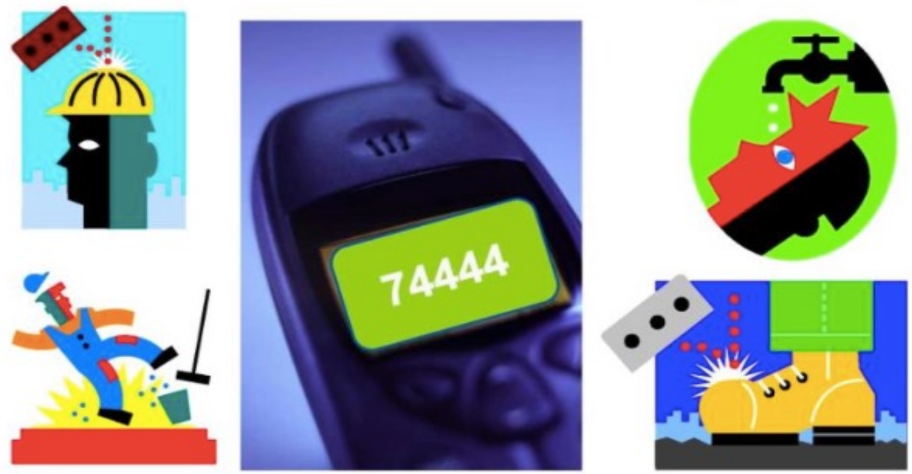
What happened

Many instances of dangerous driving by members of the CERN personnel or contractors' personnel have been observed on the Route de l'Europe linking the Meyrin and Prévessin sites. There have been several accidents and near-misses this year. The latest incident involved a vehicle being driven on the wrong side of the road, forcing drivers traveling in the opposite direction to brake sharply.

The consequences

Fortunately nobody was injured in the latest incident as the other drivers were able to brake in time and the driver of the vehicle concerned veered back onto the right side of the road at the last moment, thereby avoiding a head-on collision, which would have had very serious consequences.

Accident ? Call the Fire Brigade !



Aware and Responsible

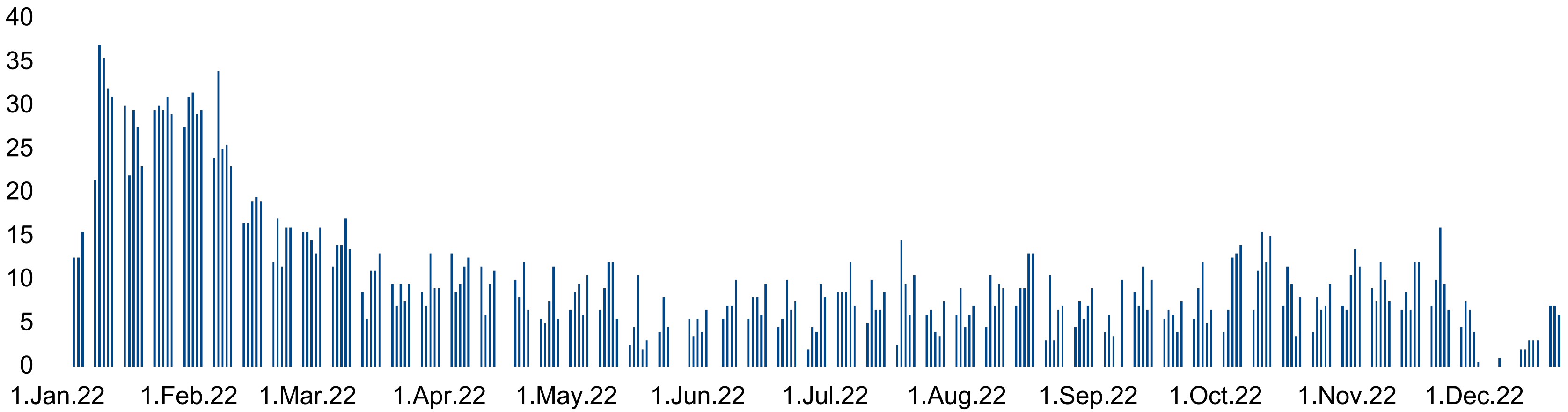
Delphine Letant-Delrieux TE DSO

Safety Numbers – 2022 in MPE

- Number of on-site accidents : 2
  - hand wounded with a cutter
  - Indirect electrical shock when unplugging a multimeter on active circuit (capacitors)
- Number of off-site accidents : 1 (journey to CERN)
- Number of near misses : 1 (journey to CERN)

Please always declare incidents including near misses using EDH

2’552 telework days accumulated in 2022



Safety Roles in TE-MPE

Group Safety Link Person (SLP) : Daniel Calcoen

Big Thanks to all

Work and Service Supervisors (WSS) :

Daniel Calcoen and Giorgio D'Angelo (LHC)

Richard Mompo (Injectors)

Territorial Safety Officers (TSO) :

	TSO	Deputy TSO
30 /TE-*Office and laboratory building*	PEMBERTON,Stephen	GRENU,Brigitte
30.1 /TE-*Office and laboratory building*	PEMBERTON,Stephen	GRENU,Brigitte
272 /TE-*WRB1 - BATIMENT DE STOCKAGE...*	SEWERYN,Grzegorz Jozef	CALCOEN,Daniel
281 /TE-*BATIMENT AUXILIAIRE*	FROIDBISE, Vincent	D'ANGELO,Giorgio
622 /TE-*Electronics workshop*	D'ANGELO,Giorgio	CALCOEN,Daniel

Radiation Safety Support Officer (RSSO) : Vito Vizziello

Mechanical Workshop Supervisors (WS) : Mirko Pojer and Mathieu Favre

Signatories for "attestation de consignations" and "autorisation de travail”:

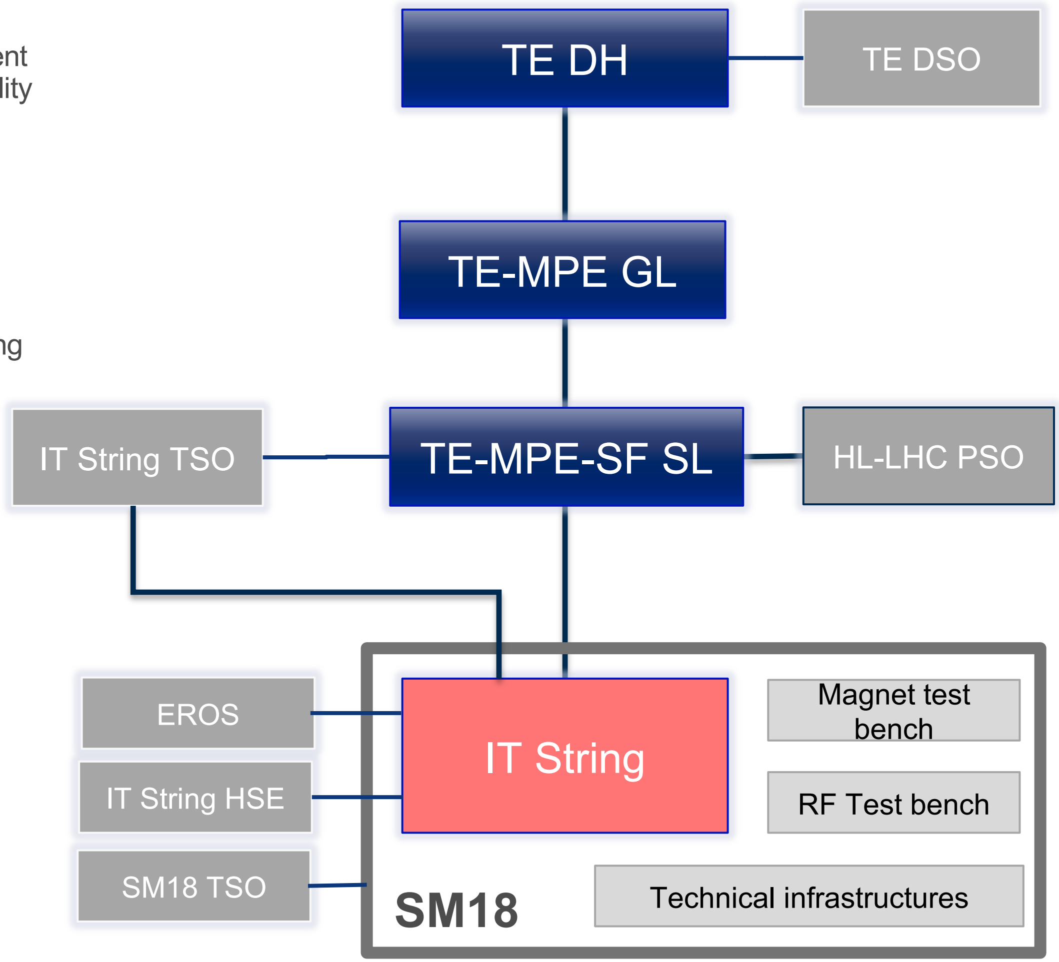
Richard Mompo (Injectors), Giorgio D'Angelo (LHC)

IT String Safety – Roles and responsibilities*

Roles and responsabilities

TE DH	**José Miguel Jiménez**	Line Management Responsibility role
TE-MPE GL	**Félix Rodríguez Mateos**	
TE-MPE-SF SL	**Marta Bajko**	
TE DSO	Delphine Delrieux-Letant	Advisory & Supporting role
SM18 TSO	Patrick Viret	
IT String TSO	Davide Bozzini	
HL-LHC PSO	Thomas Otto	
IT String HSE	Carlos Gascón	
EROS	Emmanuel Paulat	

Important milestone
Big Thanks to all involved



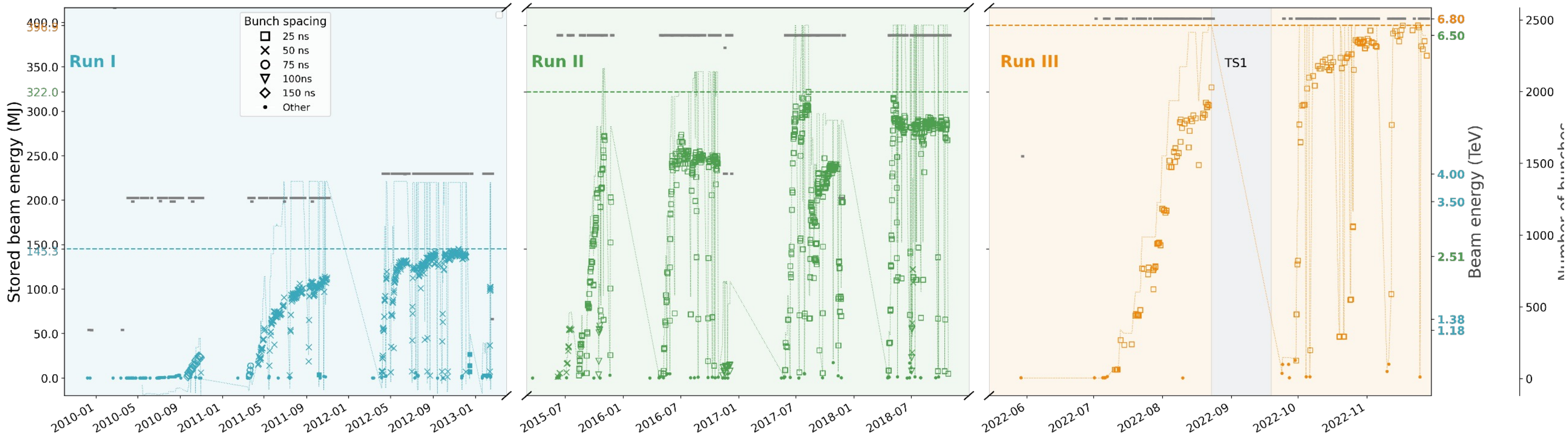
DL	Department Leader
GL	Group Leader
SL	Section Leader
DSO	Departmental Safety Officer
TSO	Territorial Safety Officer
PSO	Project Safety Officer
HSE	Health, Safety & Environmental
EROS	Engineering Referent for Operational Safety

* According to SR-SO ''Responsibilities and organizational structure in matters of safety at CERN''

TE-MPE Highlights 2022

CERN ACCELERATORS – A GREAT PERFORMANCE

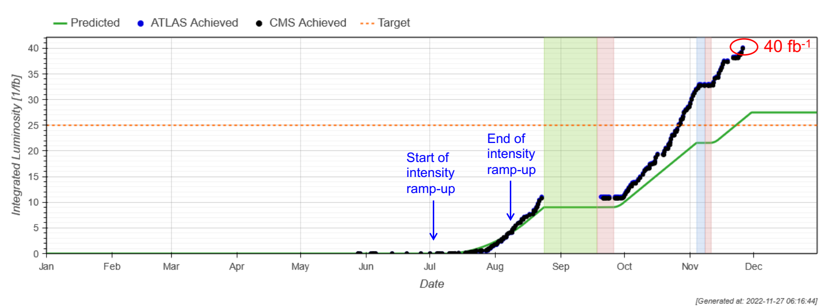
- On 23rd November we reached $1.5E^{11}$ ppb at the start of stable beams, with 2462b circulating
- Corresponds to a milestone of 400MJ of stored beam energy in B1!



Average beam energy for runs 1,2 and 3

Machine Performance: Integrated Luminosity

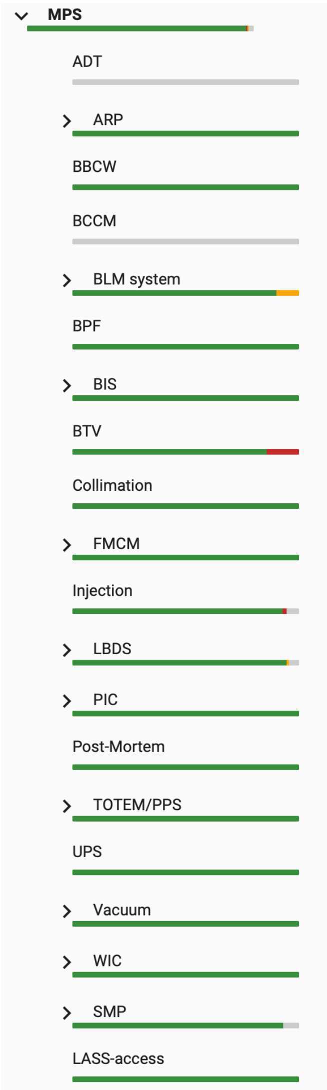
- **Remarkable achievement: delivered >40 fb^{-1} for ATLAS and CMS in 2022**



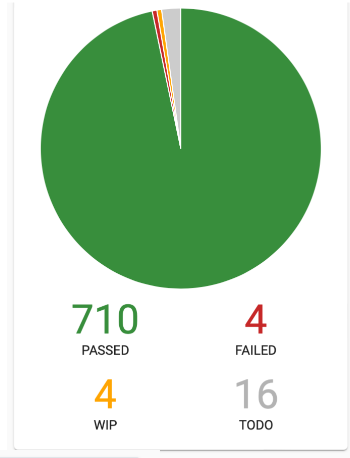
Comments (28-Nov-2022 06:07:12)
No Beam for the next few months!
End of 2022 RUN
40 fb^{-1}
DELIVERED TO ATLAS & CMS in 2022!

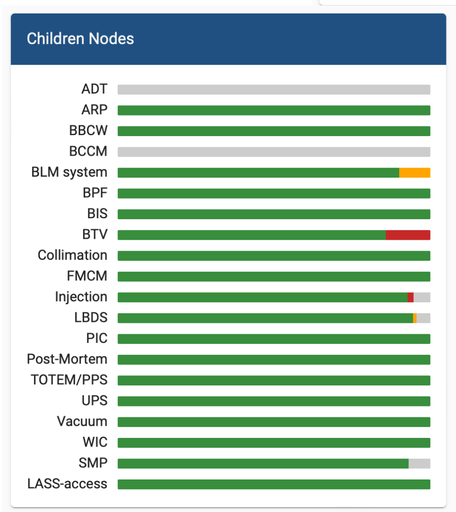
Check list !

MPS re-commissioning & Intensity Ramp-up

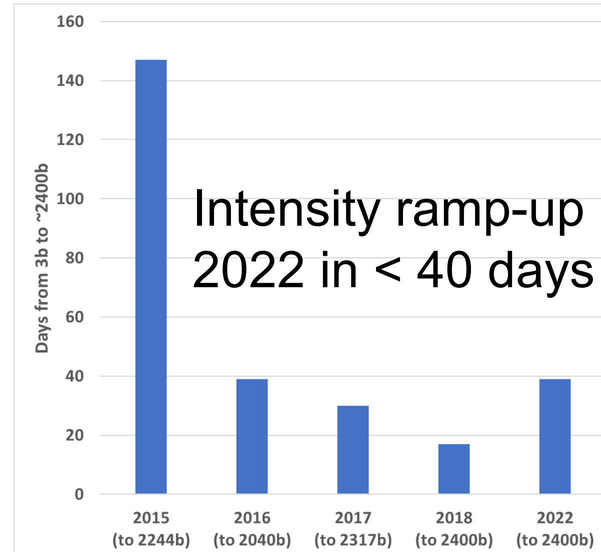


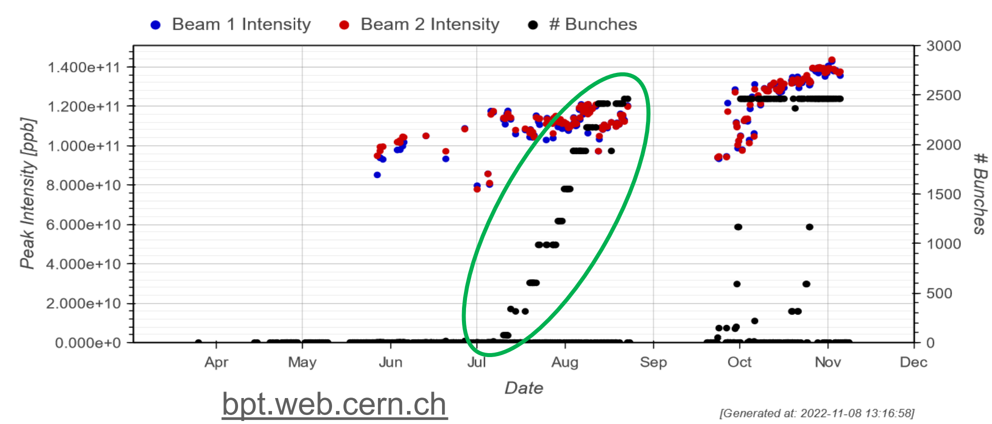
Successful re-commissioning of the MP systems





checklist.cern.ch





bpt.web.cern.ch

MPE On-Call and best effort services

- The TE-MPE Piquet,
- The best effort service for Machine Interlocks,
- The best effort service for Post-Mortem,
- The best effort service by MP3 (MPE and MSC members).

BIG THANKS TO EVERYONE OF THE MEMBERS

- A major and fundamental contribution of the Group to the operation of LHC, injectors and experimental areas
- A common effort across **ALL SECTIONS**
- Interventions must be prepared with continued training and on-the-job rehearsals
- Safety at all times
- Two persons for each intervention

OPERATION SPIRIT !

Transversal contributions by MPE (operation, strategies)

LHC and injectors

- MP3
- MPP
- rMPP

Chairs, co-chairs, scientific secretaries and members from MPE

CTTB (ATS Common Hardware & Software Technologies Technical Board)

- Controls application software development community forum (CF)
- Controls Front-end software development CF
- Electromagnetic compatibility CF
- Electronics CF
- Industrial controls CF
- Machine learning & Data analytics CF
- Reliability and availability studies working group
- Scientific Computing and Simulations CF

- The specific know-how, experience, culture and contributions of the group are instrumental in operation of the accelerators as well as in new projects
- The number of interactions and interfaces with other groups is enormous … and decisive

Main Projects/Studies in MPE

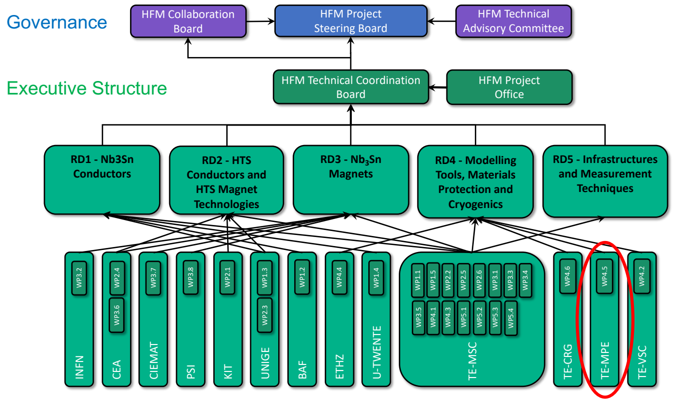
HL-LHC – major contributions from the group, including the responsibility for two work packages (WP7 and WP16) and the coordination of the Magnet Circuit Forum

HFM – WP4.5 Quench detection, protection and diagnostic methods for Nb3Sn and HTS high-field magnets

Muon Collider – studies for quench protection

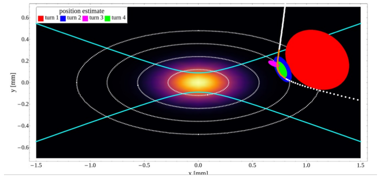
FCC-ee – reliability/availability studies; machine protection studies

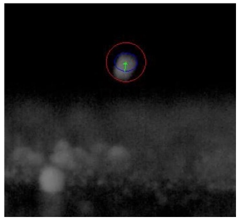
In all of these activities our Group collaborates with many partners inside the Department as well as outside.
E.g. A very close technical collaboration is established with the TE Groups (MSC, CRG, VSC) for HL-LHC and HFM. Our groups work in continuous and efficient contact. Regular meetings are organized with TE-MSC GL.
To all, our appreciation and gratitude.

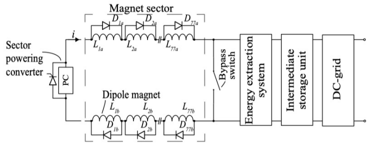


R&D in MPE

- R&D on 600A energy extraction systems (contactors)
- Developments have started for new protection methods like e-CLIQ and fast quench propagation wire, many studies ongoing, within the framework of HFM
- Radiation damage to superconducting materials
- General purpose simulation framework STEAM – continuous R&D
- Electronics for future Quench Detection
- Launching soon a collaboration on studies of interaction between dust and beams
- Continuing extraction systems with energy recovery



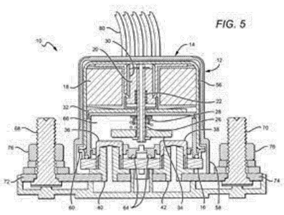


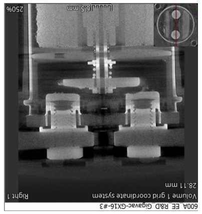


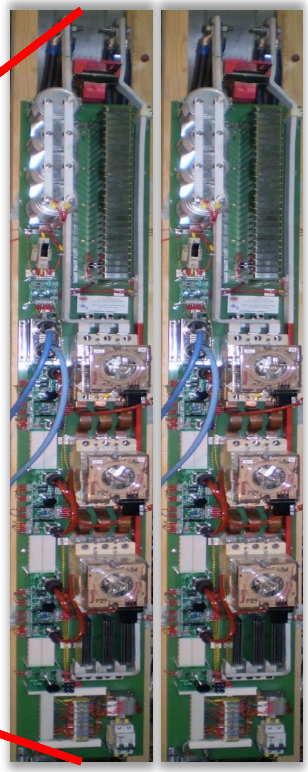
- **We must make efforts to keep our group on the wave of new developments and applications**
- **R&D is an integral part of our future**

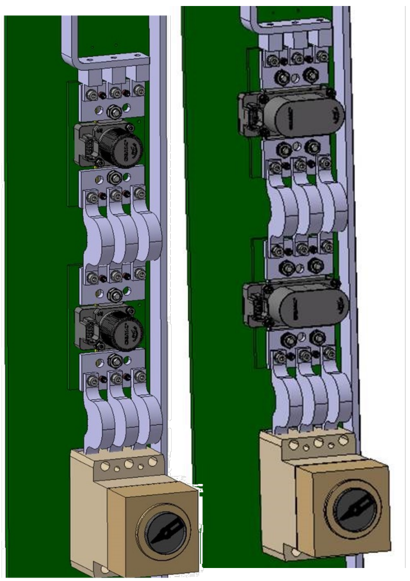
600 A EES upgrade: R&D on DC contactors

Universal electronics (see next)





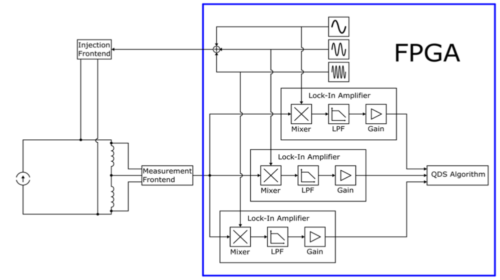


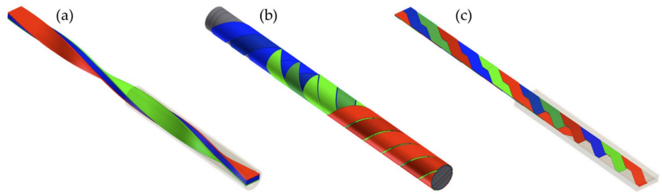


Lifetime tests on-going: > 250.000 cycles performed

Scope of HFM WP4.5

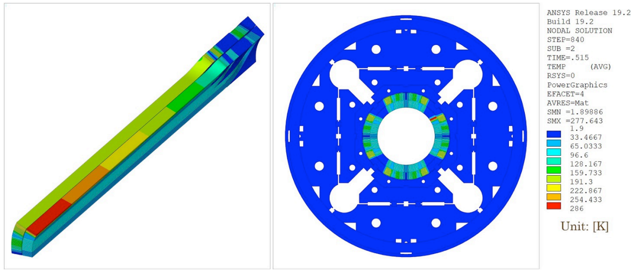
1) Quench Detection Technology Development

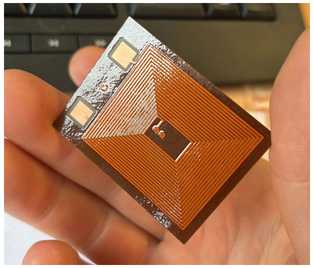




2) Conductors for Protection

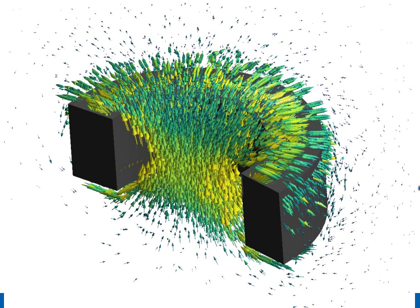
3) Protection Limits Development



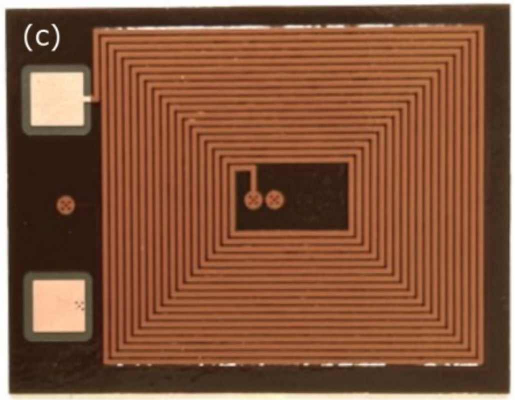


4) Protection Technology Development

5) Models and Simulation Tools Development

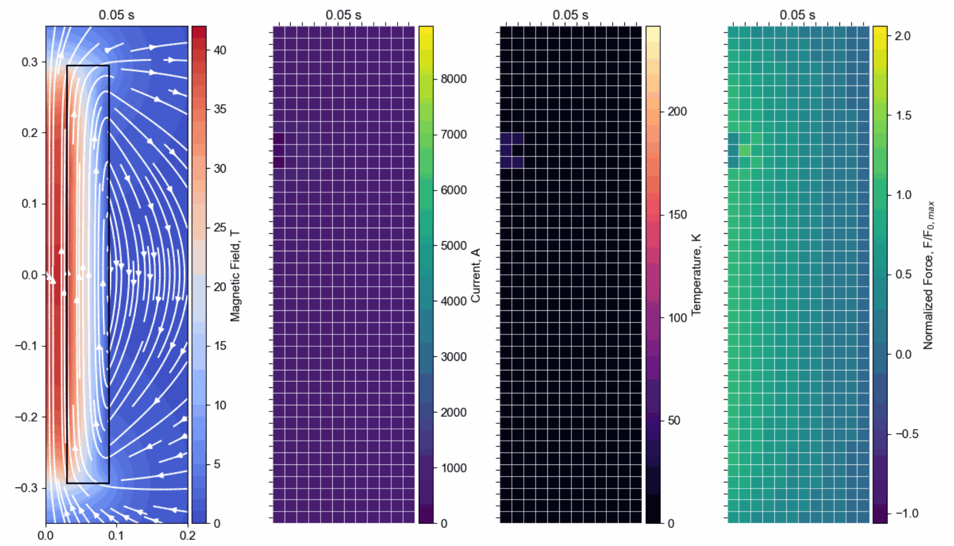


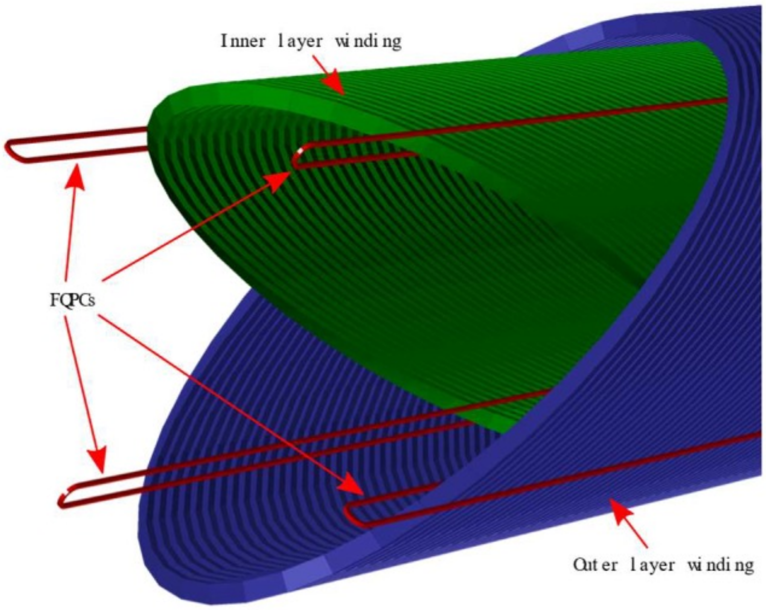
HFM, FCC, MuonCollider: protection concepts



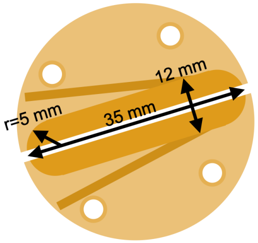
FQPC for CCT:
- ✓ Fast propagation
- ✓ Self-protection, no EE
- ✓ Passive & low cost

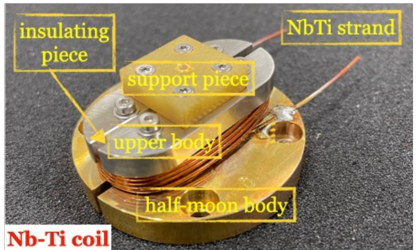
E-CLIQ:
- ✓ Fast as CLIQ
- ✓ Electrically insulated from coil
- ✓ Smaller C
- ✓ Easier redundancy

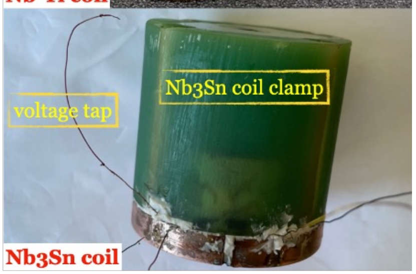


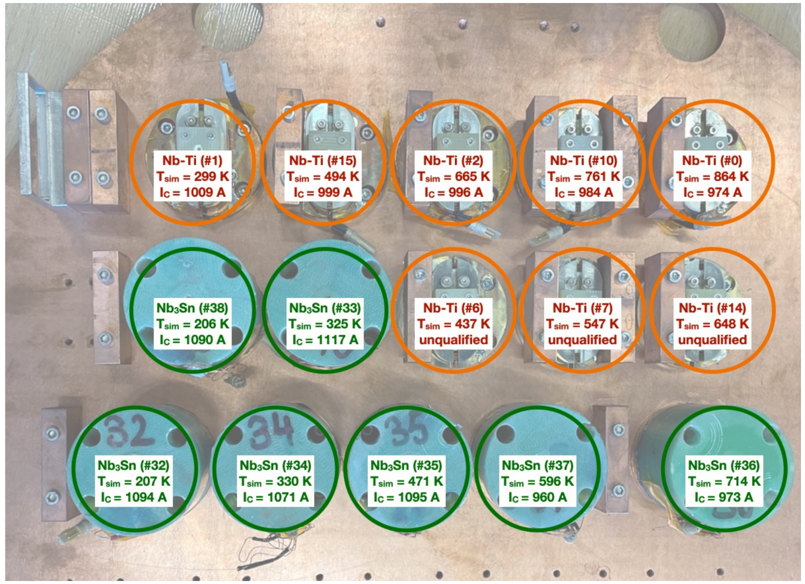


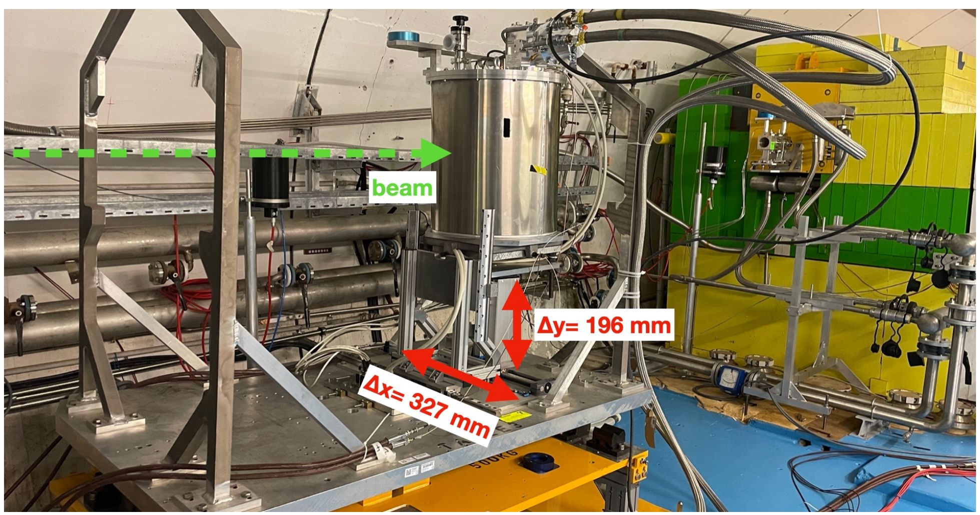
HiRadMat Damage experiment Oct 2022

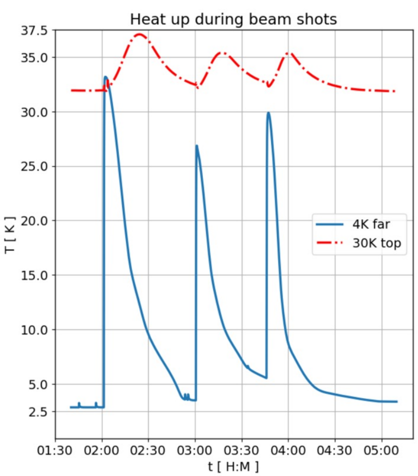


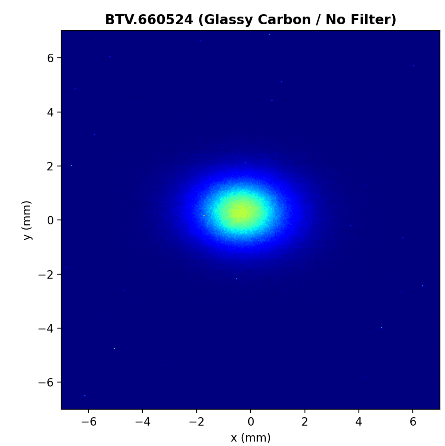






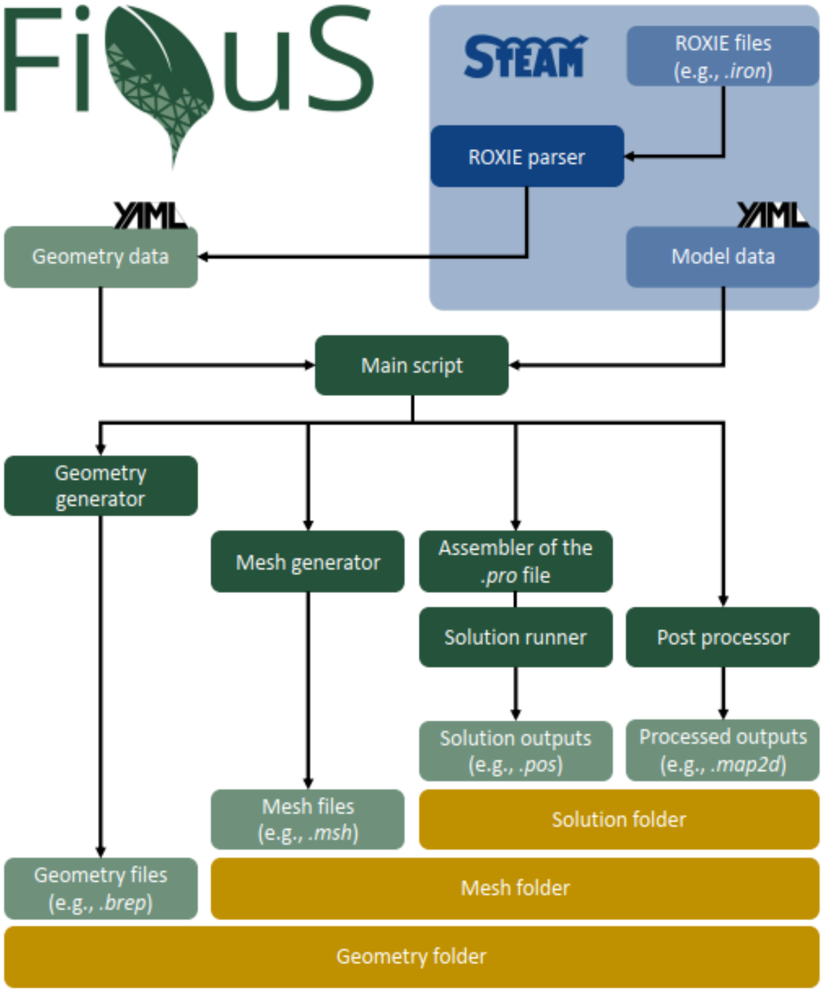


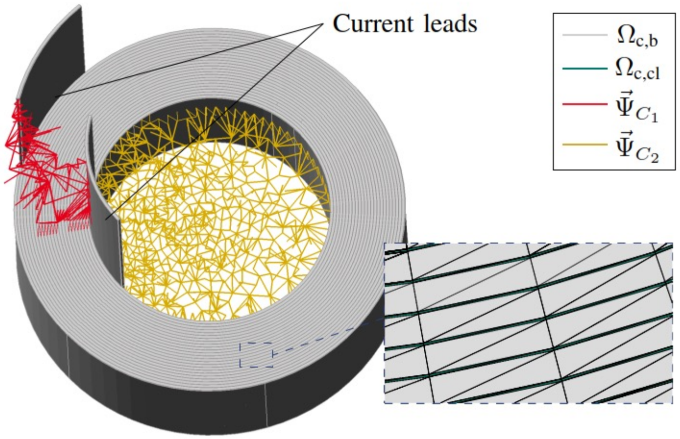




Thin Shell Approximation for FEM

NEW! In STEAM



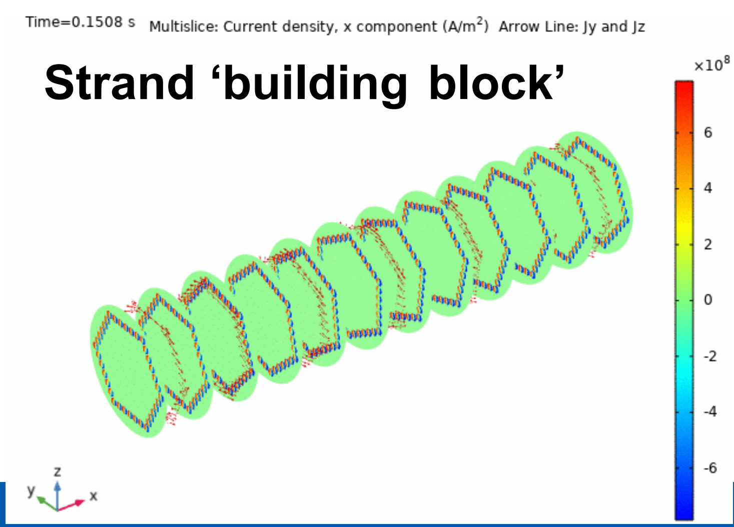


GetDP

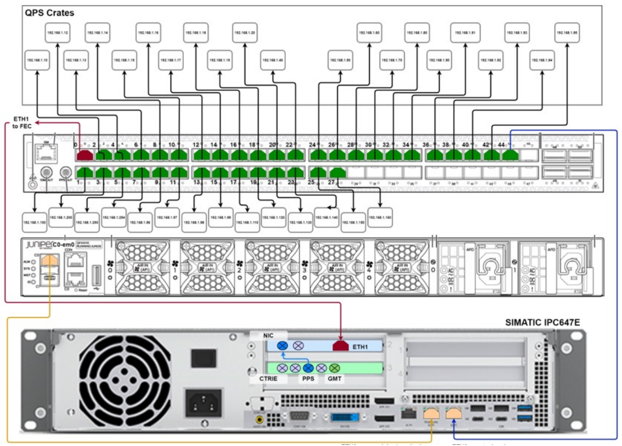
NI HTS coils

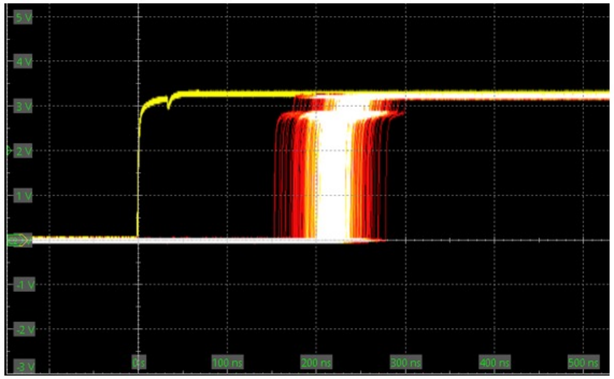
PyBBQ

Strand 'building block'



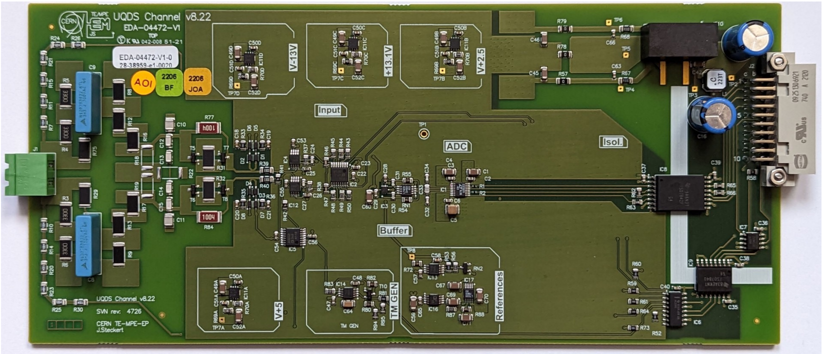
DATA-COMMUNICATION



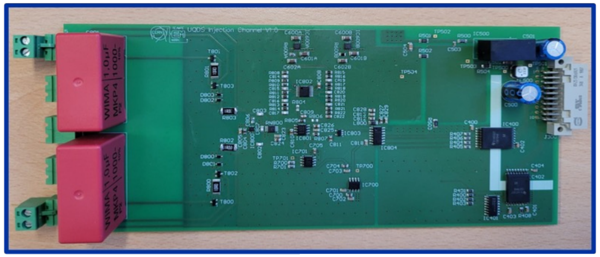


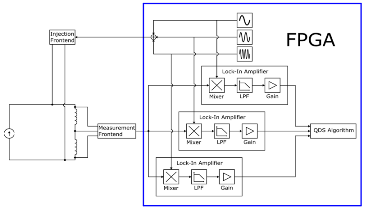
RESEARCH

HIGH-PRECISION



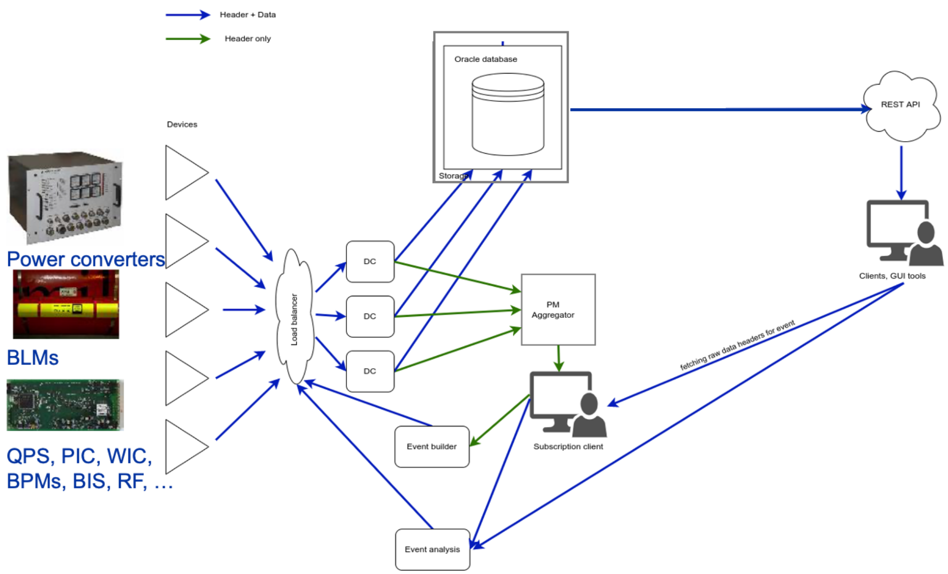
QDS-FOR-FUTURE





CB Section

Post Mortem & SIGMON

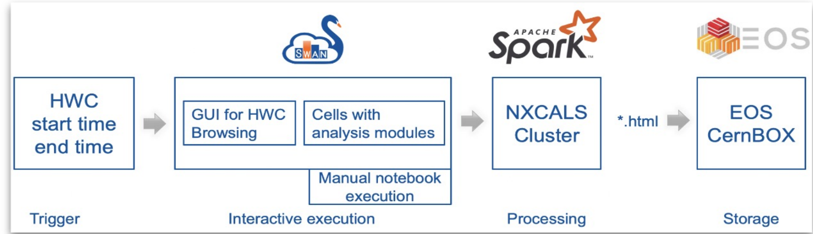


PM end 2022:

- 70’000 events
  - GLOBAL 1’000
  - XPOC 6’000
  - IQC 27’000
  - POWERING 36’000
- 18 Mio raw data entries
- 3.8 TB

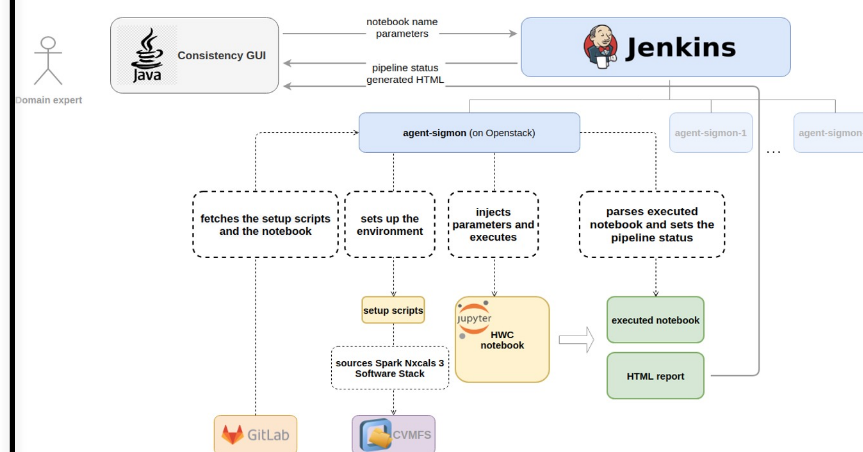
SPSQC:

- 154’000 events per month
- 27 Mio raw data entries per month
- 3.1 TB



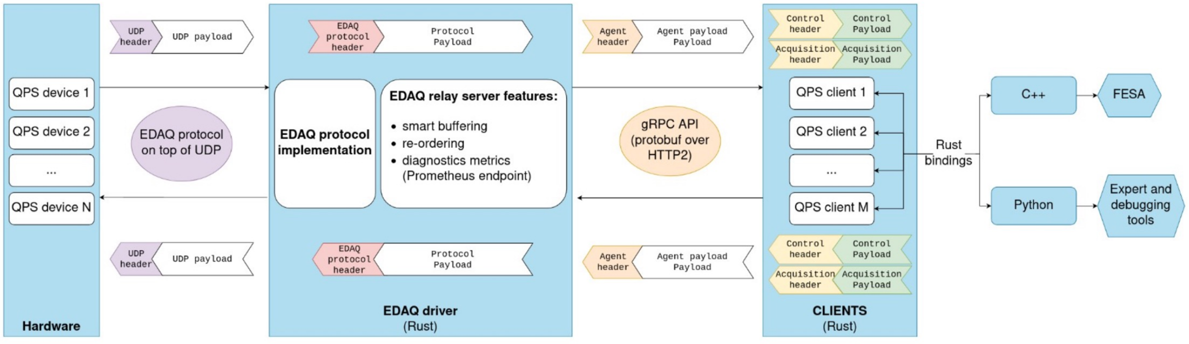
RB	RQD/F	IT	IPQ	IPD	600A	80-120A	60A
PCC	PCC	PCC.T4	PCC.4	PCC.3	PCC	PCC.1	PCC.1
PIC2	PIC2	**PIC2**	**PIC2**	**PIC2**	PIC2	PIC2	
PLI1.a2/b2/d2	PLI1.b3/d2	PNO.d12/d13	PLI1.c3	PLI1.c2	PCS	PNO.d1	PNO.d1
PLI2.s1/b2	PLI2.s1/b3	**PLI3.f6**	**PLI2.f3**	**PLI2.f2**	PLI3.b1	PNO.a1	PNO.a1
PLI2.e2	PLI2.e2	PNO.d14	PLI2.e3	PLI3.c5	PNO.d3	PNO.e1	
PLI2.f1	**PLI2.f1**	PNO.d15	PNO.f4	PNO.a8/c6	PNO.b1*		
PLIM.b2	PLIM.b3	PNO.a9	PNO.a7		PNO.a3		
PLIS.s2	PLIS.s2	PNO.d16	PNO.c4		PNO.x1		
PLI3.a5/d2	PLI3.a5/b3	**PNO.d17**			PNO.x2		
PNO.b2/a6	PNO.b3/a6						
FPA/ **FPA_SNAP**	FPA	FPA	FPA	FPA	3xFPA-EE	**FPA**	**FPA**
QHDA	**QHDA**	**QHDA**	**QHDA**	**QHDA**			

SIGMON No MP3 analysis eDSL LabVIEW



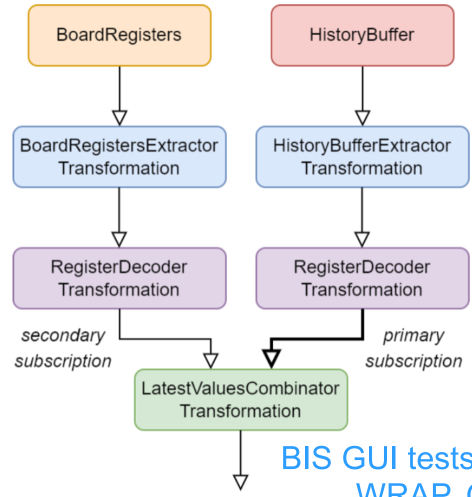
EDAQ & BIS-UCAP & BIS-GUIs

Excellent collaboration between sections



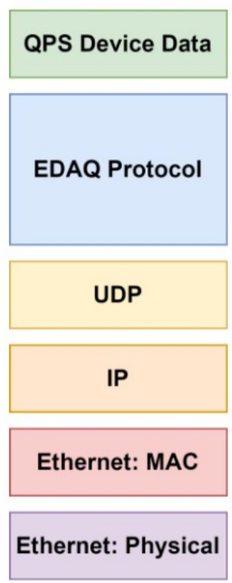
EDAQ

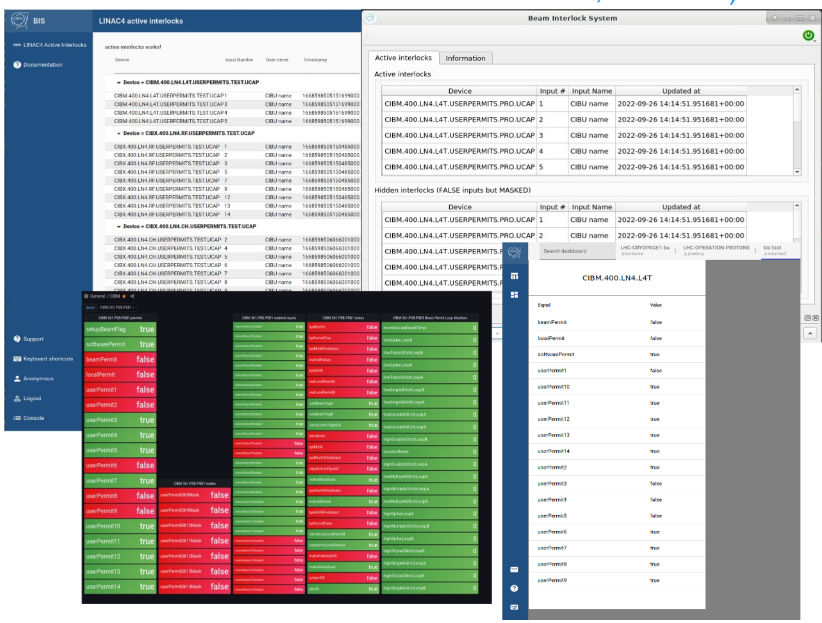
BIS-UCAP PoC



BIS GUI tests (AWC, PyQt, WRAP, Grafana)

- Specs
- Driver
- Client libraries
- CI
- Deployment tools
- FESA class
- PM
- HW configuration
- Deployment



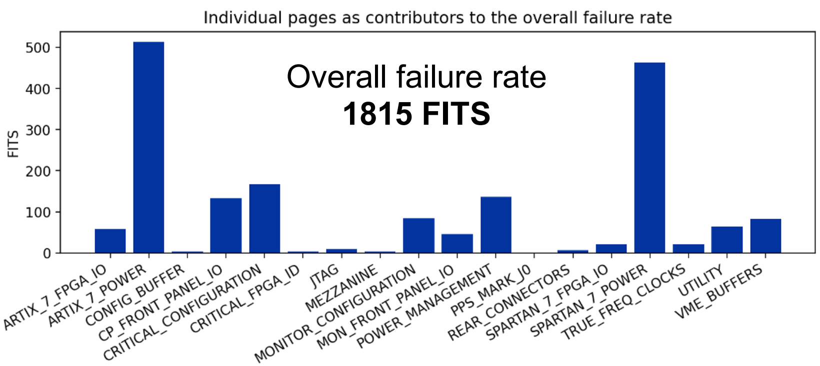


Reliability and Availability

BIS-CIBG

Failure Rate Prediction → **FMECA** → **Fault Tree**

COMPLETED | IN PROGRESS | FUTURE



SMP flags Hazard Chains

Beams enter energy and intensity above Setup Beam Limit

Wrong safe value P_{SMP}

Operator masking a critical input 1.5%

Failure in the masked channel 50%

→ Non-nominal energy deposition

Severe damage to LHC systems

Movable devices set to move in

Wrong safe value P_{SMP}

Beam losses on Roman Pots 50%

Unsafe conditions for Movable Devices 6%

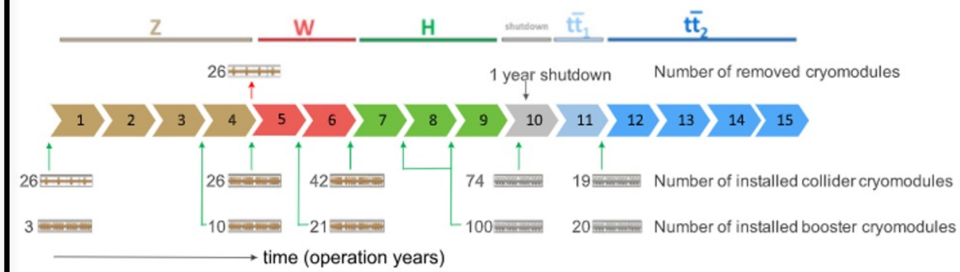
→ Non-nominal energy deposition

Vacuum pollution, replacement of Roman Pots, warm-up required

SPS extracting a high intensity beam to the LHC

Wrong safe value P_{SMP} (stuck to true) → Missed extraction

FCCee availability studies:



Study on RF

- **Assume:** Cavity availability stays constant:

LHC

- $A_{RF} = 98.5\%$
- $N_c = 16$

	No. of Cavities N_c	Availability RF A_{RF}	Availability Total A	Integrated Luminosity L_{int}
Z	116	92.2%	73.9%	-8%
$t\bar{t}$	1260	41.4%	33.2%	-62%

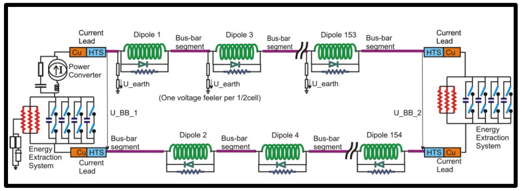
LEP

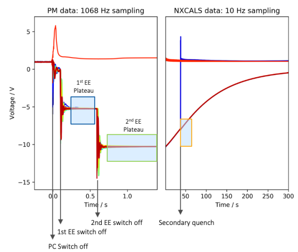
- $A_{RF} = 98.7\%$
- $N_c = 344$

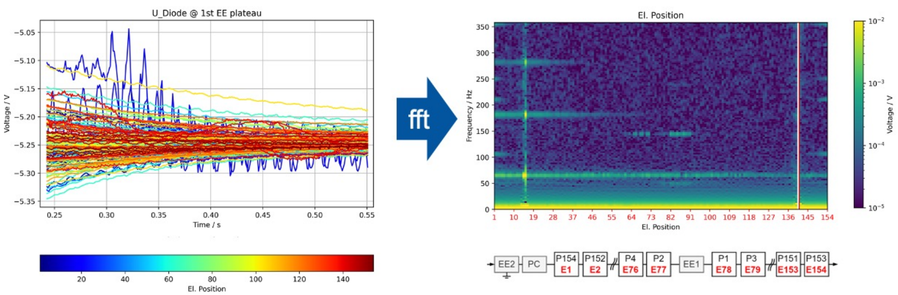
	N_c	A_{RF}	A	L_{int}
Z	116	99.6%	79.9%	-0.1%
$t\bar{t}$	1260	96.3%	77.2%	-4%

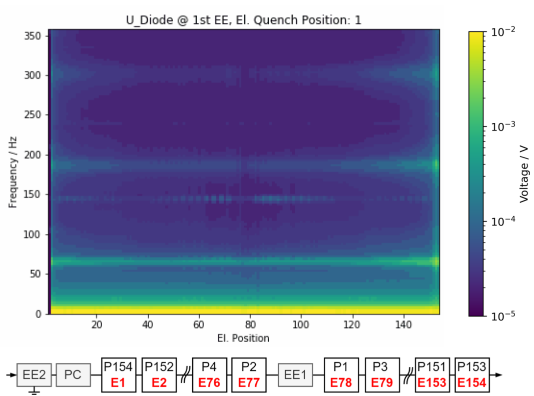
Machine Learning for Protection

RB- Frequency Analysis



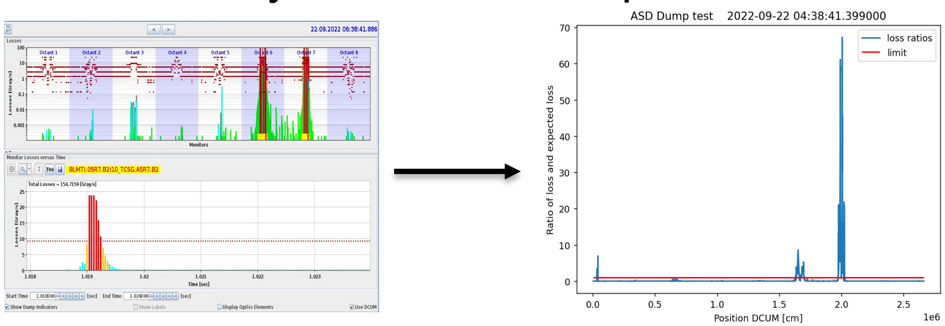






Automatic beam loss classification

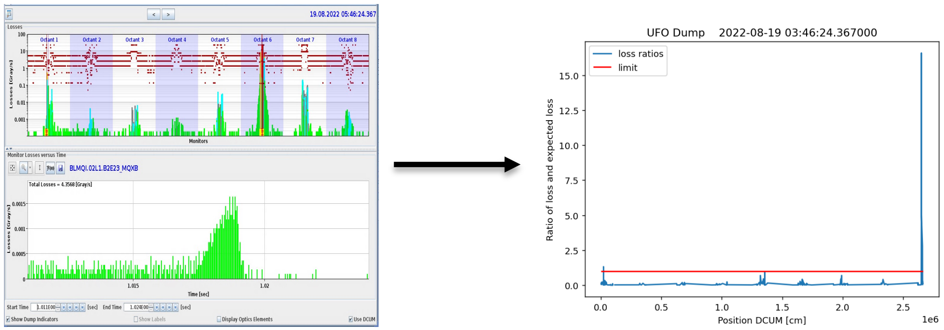
Asynchronous dump test



❌ Expert check required (*Lowloss BLMs*)!

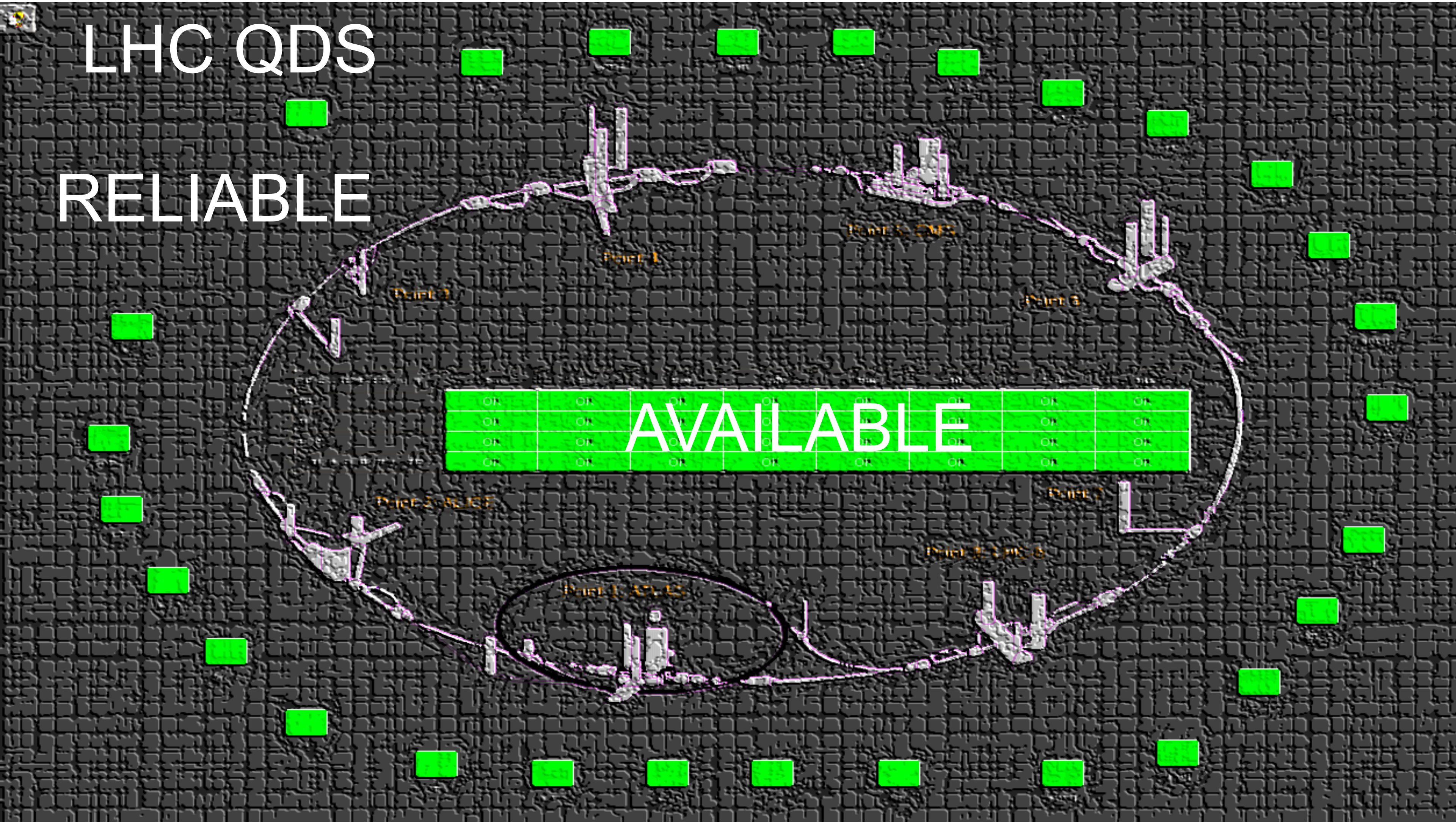
❌ Expert check required (*Correlated BLMs*)!

UFO in 4L1



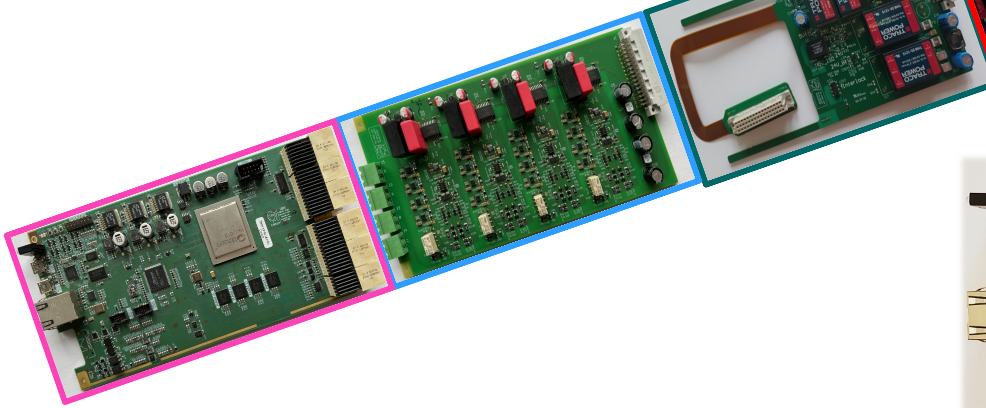
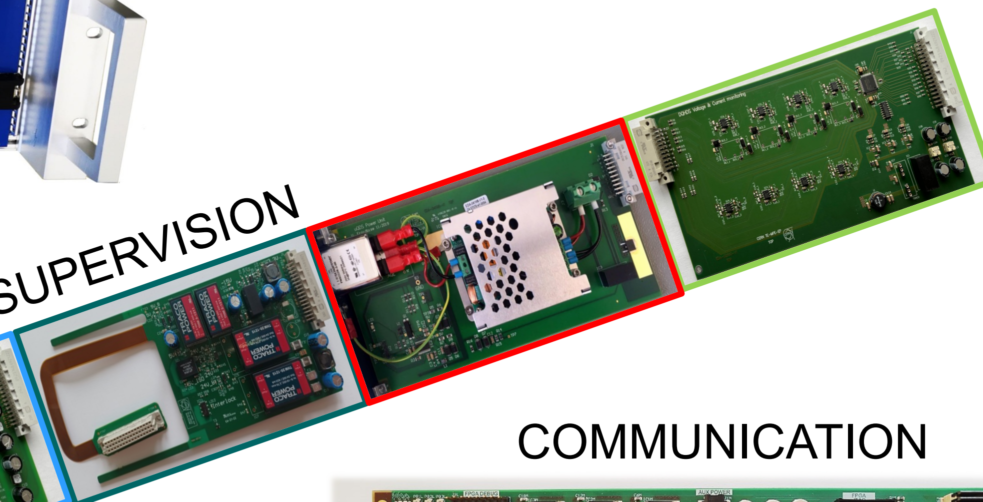
❌ Expert check required (*Lowloss BLMs*)!

EP Section

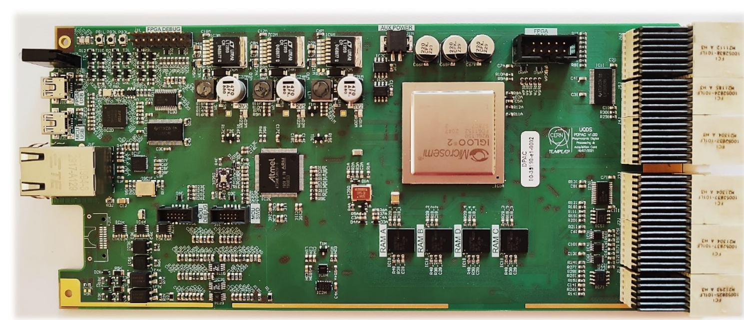

LHC QDS
RELIABLE
AVAILABLE

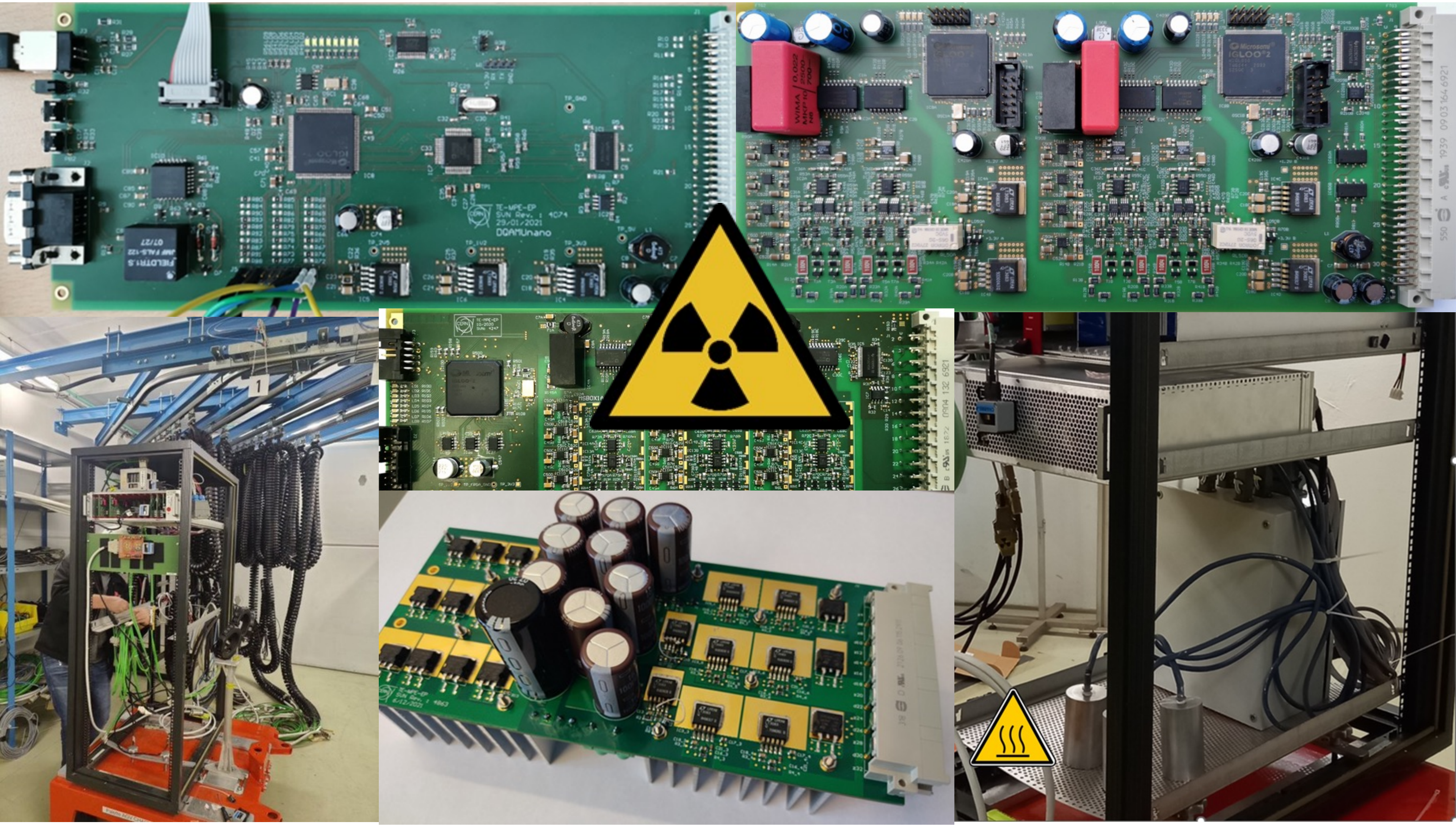
DETECTION

SUPERVISION

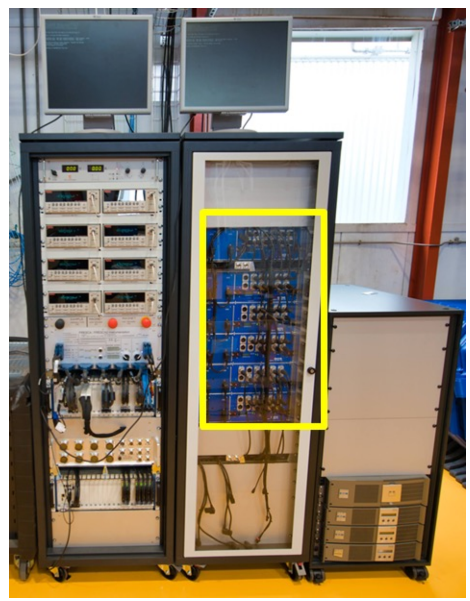



COMMUNICATION





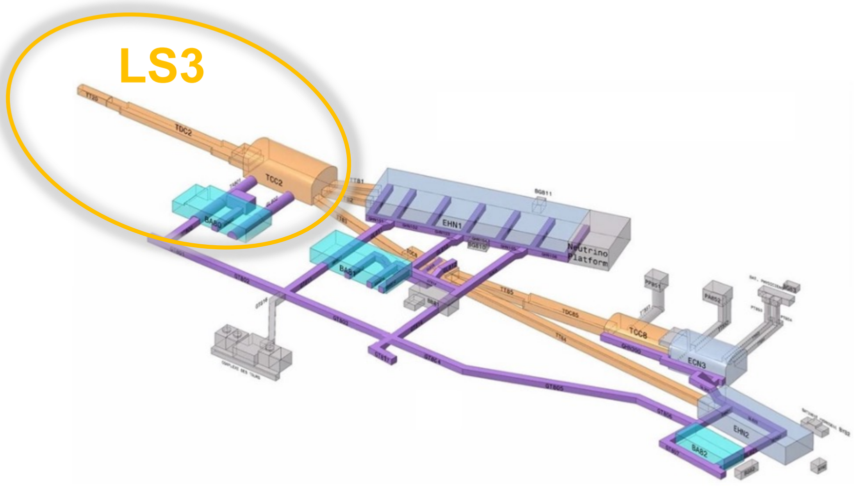
SM18B180FAIRFRESCAMPE272PSIAGHITSTRING



LHC: 2 interventions 4.7 hours

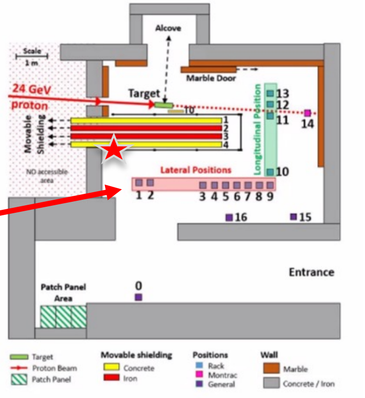
MI Section

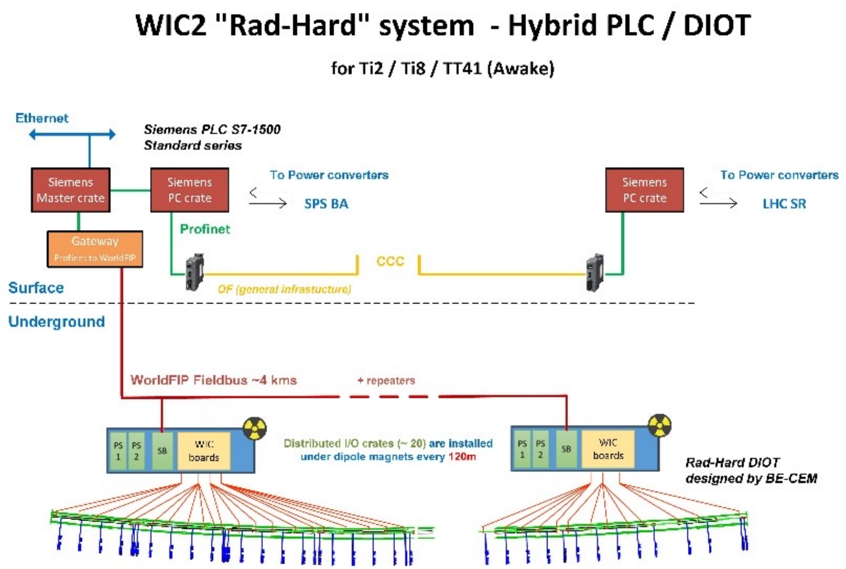
WIC and BIS for the NA



WICv2 TI2 and TI8

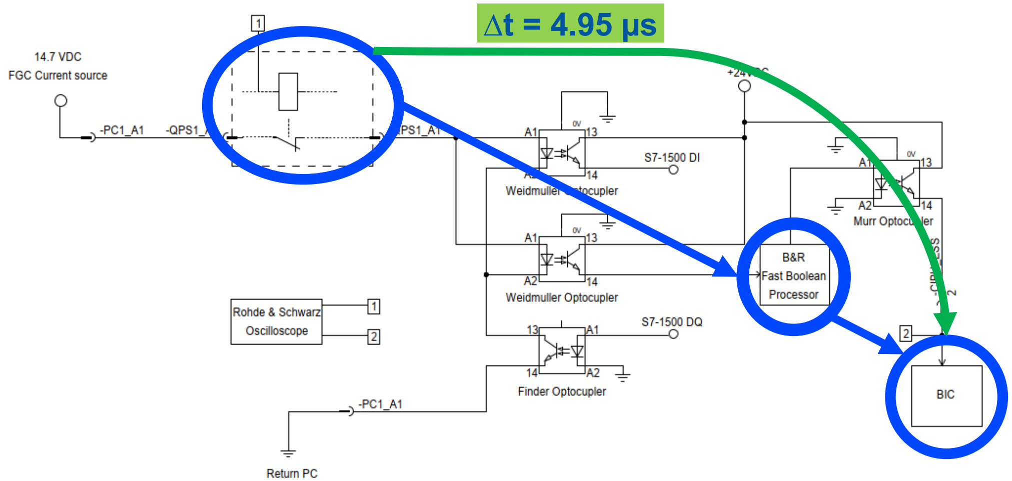
PLC/DIOT System

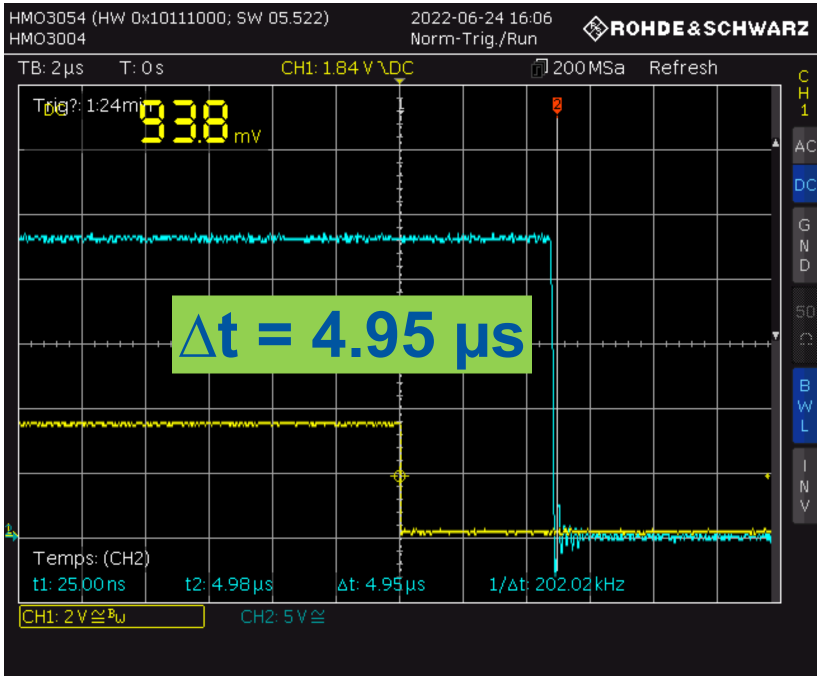


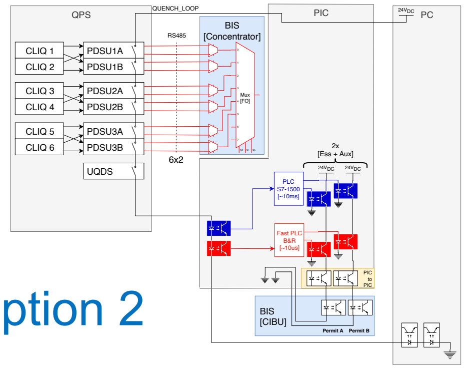


PICv2 Fast Reaction time for CLIQ erratic triggering

- **10 usec maximum** reaction time from a loss of powering condition to a beam dump request.



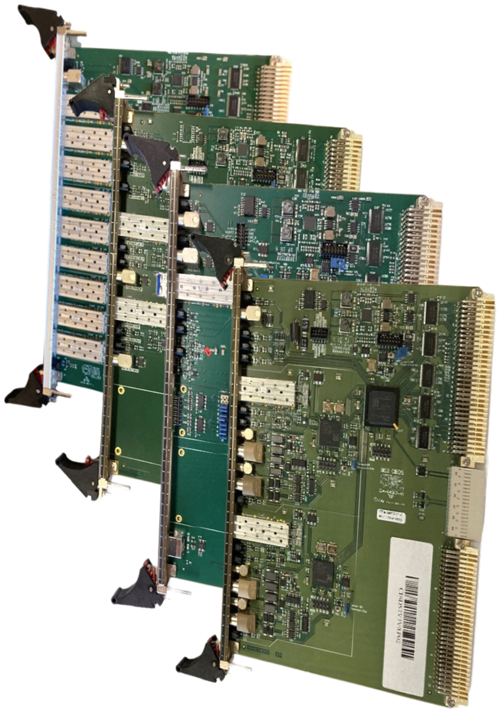




Option 2

Future implementation – IT String

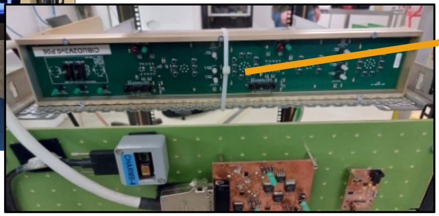
BISv2



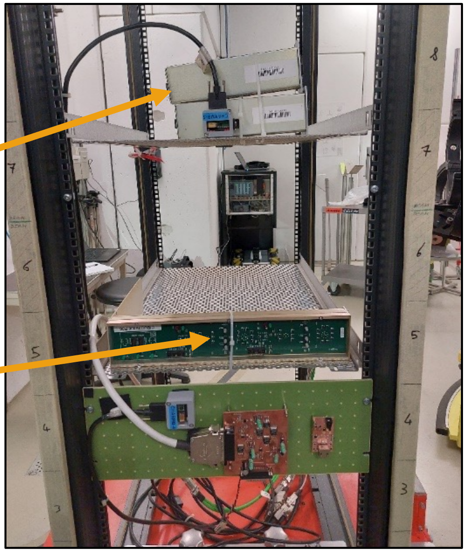
CIBM, CIBG, CIBDS and CIBFI boards

CIBU Power Supply unit (**CIBD**)

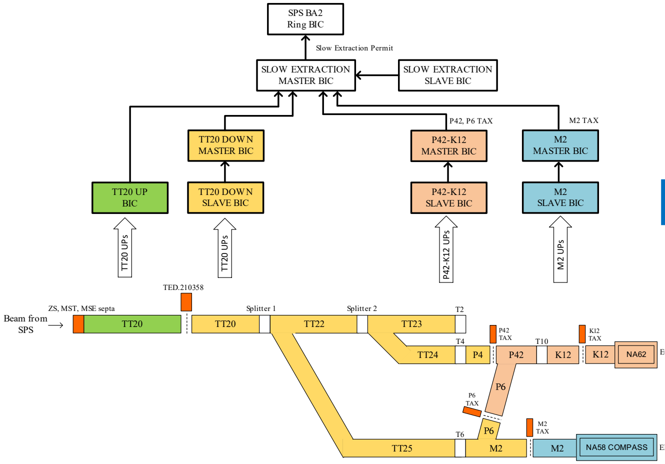
CIBUv2



CHARM **April 2022** Test Campaign setup



CIBUv2 board

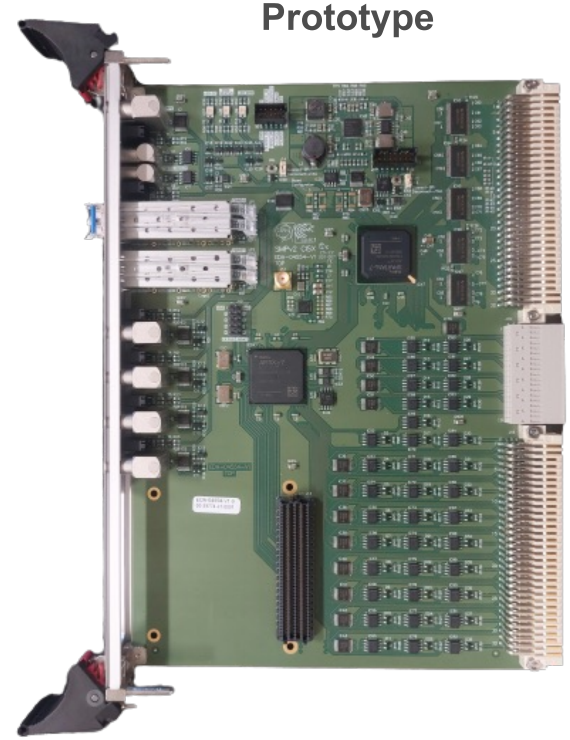


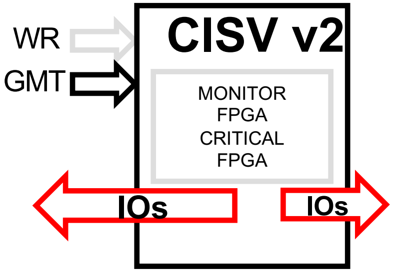
NA

SMPv2

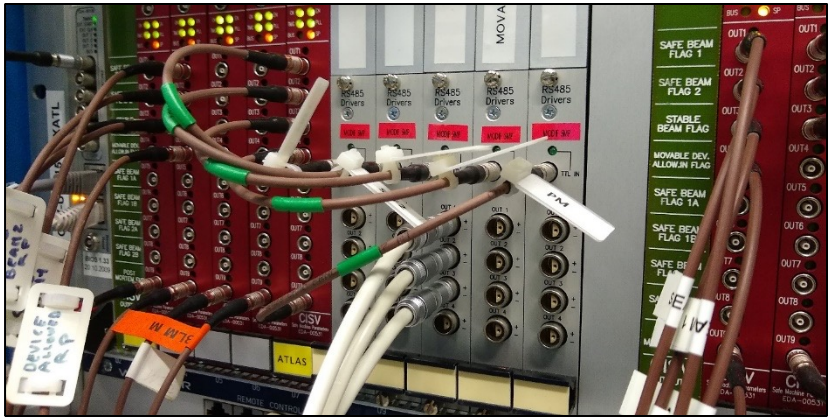
	[1m - 20m)	[20m - 1h)	[1h - 3h)	[3h - 6h)	[6h - 12h)	[12h - 24h)	[24h - 2d)	[2d - 1w)	[1w - 1M)	[1M - 1Y)	[1Y - 10Y)
1/H	U	U	U	U	U	U	U	U	U	U	U
1/Shift	~	U	U	U	U	U	U	U	U	U	U
1/Day	A	~	U	U	U	U	U	U	U	U	U
1/Week	A	A	A	~	U	U	U	U	U	U	U
1/Month	A	A	A	A	U	~	U	U	U	U	U
1/Year	A	A	A	A	A	A	A	U	U	U	U
1/10Years	A	A	A	A	A	A	A	A	U	U	U
1/100Years	A	A	A	A	A	A	A	A	A	U	U
1/1000Years	A	A	A	A	A	A	A	A	A	A	U

CISXv2 Prototype





CISV - ATLAS

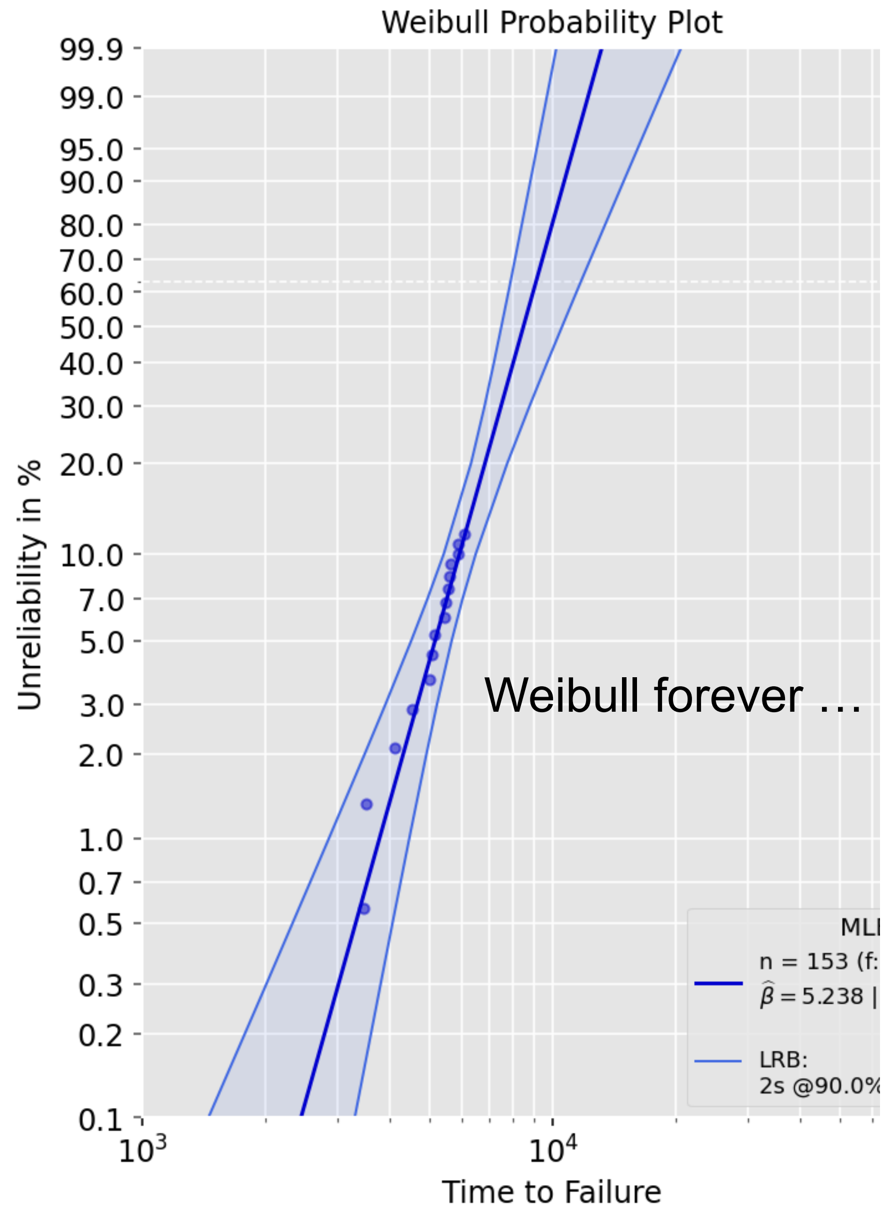


BIS status and SMP flags	B1	B2
Link Status of Beam Permits	false	false
Global Beam Permit	false	false
Setup Beam	true	true
Beam Presence	false	false
Moveable Devices Allowed In	false	false
Stable Beams	false	false

PM Status B1 ENABLED PM Status B2 ENABLED


FAIR finished

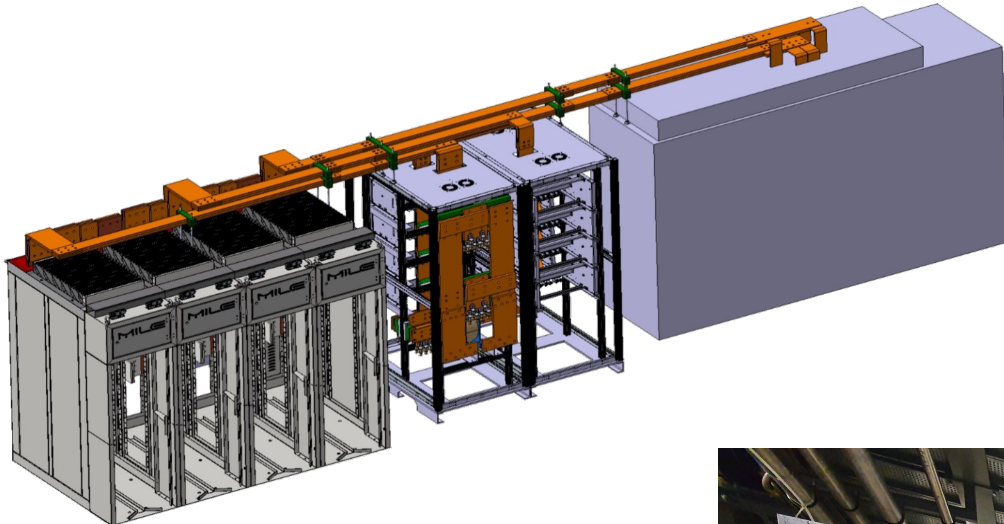

PATRICIA finished

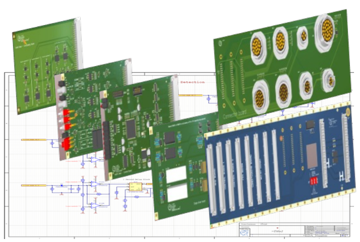

Weibull Probability Plot
Unreliability in %
99.9
99.0
95.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
7.0
5.0
3.0
2.0
1.0
0.7
0.5
0.3
0.2
0.1
10^3
10^4
Time to Failure
Weibull forever …
n = 153 (f:
$\hat{\beta} = 5.238$ |
LRB:
2s @90.0%

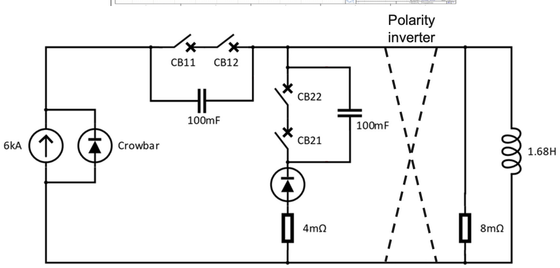
MP Section

NA EES: from design and integration to the real world

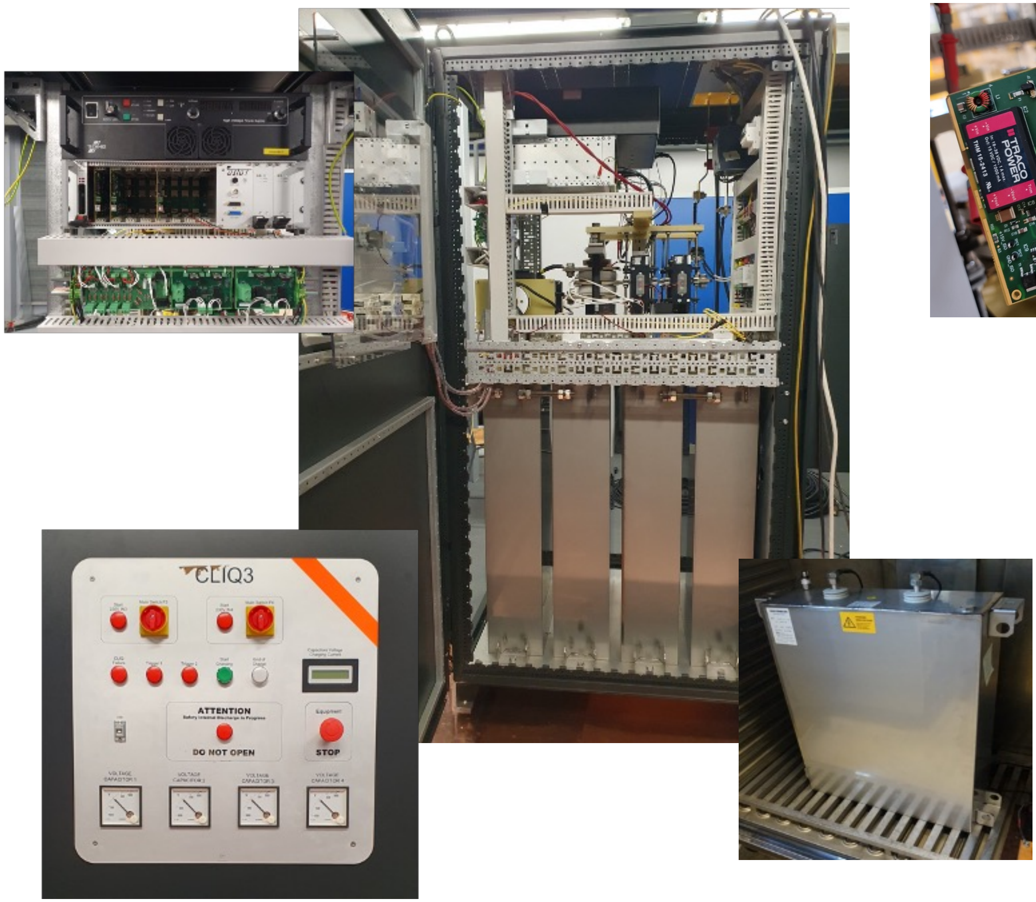
x 3 circuits

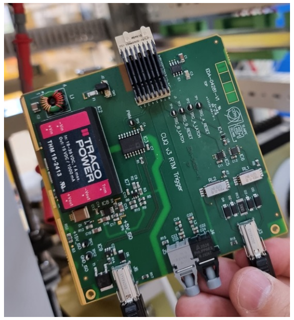






HL-LHC deliverables 1: CLIQ and DQHDS



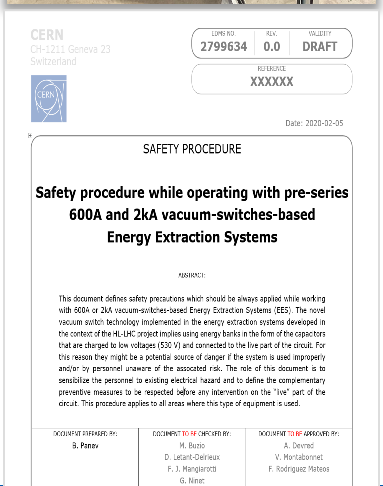


Shortage of components and redesign!

2/8 ready

8/58 produced

HL-LHC deliverables 2: vacuum-switch-based EES



CERN
CH-1211 Geneva 23
Switzerland

EDMS NO.	REV.	VALIDITY
2799634	0.0	DRAFT

REFERENCE
XXXXXX

Date: 2020-02-05

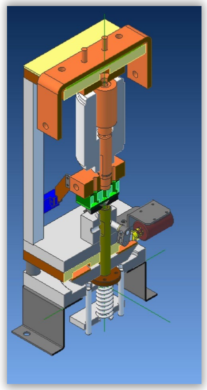
SAFETY PROCEDURE

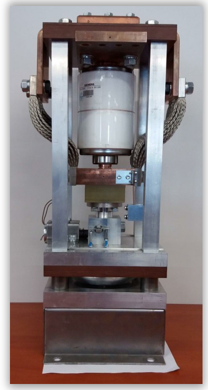
Safety procedure while operating with pre-series 600A and 2kA vacuum-switches-based Energy Extraction Systems

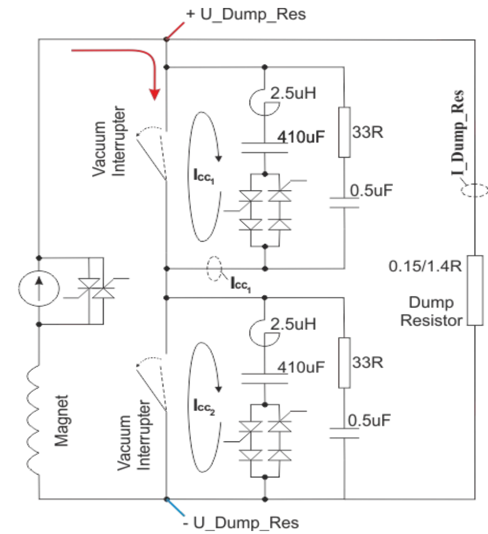
ABSTRACT:

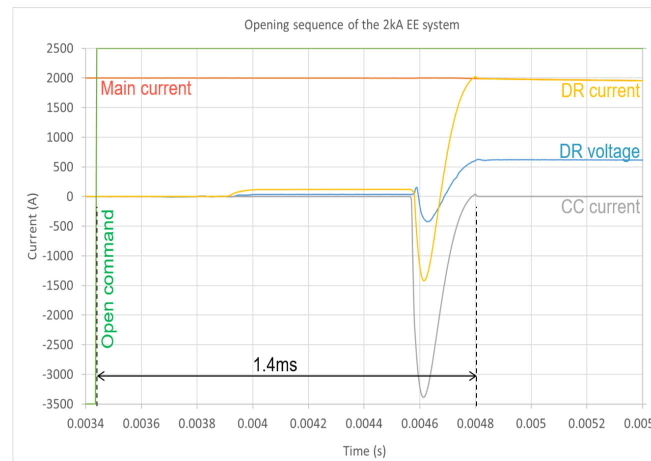
This document defines safety precautions which should be always applied while working with 600A or 2kA vacuum-switches-based Energy Extraction Systems (EES). The novel vacuum switch technology implemented in the energy extraction systems developed in the context of the HL-LHC project implies using energy banks in the form of the capacitors that are charged to low voltages (530 V) and connected to the live part of the circuit. For this reason they might be a potential source of danger if the system is used improperly and/or by personnel unaware of the assocated risk. The role of this document is to sensibilize the personnel to existing electrical hazard and to define the complementary preventive measures to be respected before any intervention on the "live" part of the circuit. This procedure applies to all areas where this type of equipment is used.

DOCUMENT PREPARED BY:	DOCUMENT TO BE CHECKED BY:	DOCUMENT TO BE APPROVED BY:
B. Panev	M. Buzio D. Letant-Delrieux F. J. Mangiarotti G. Ninet M. Pojer	A. Devred V. Montabonnet F. Rodriguez Mateos



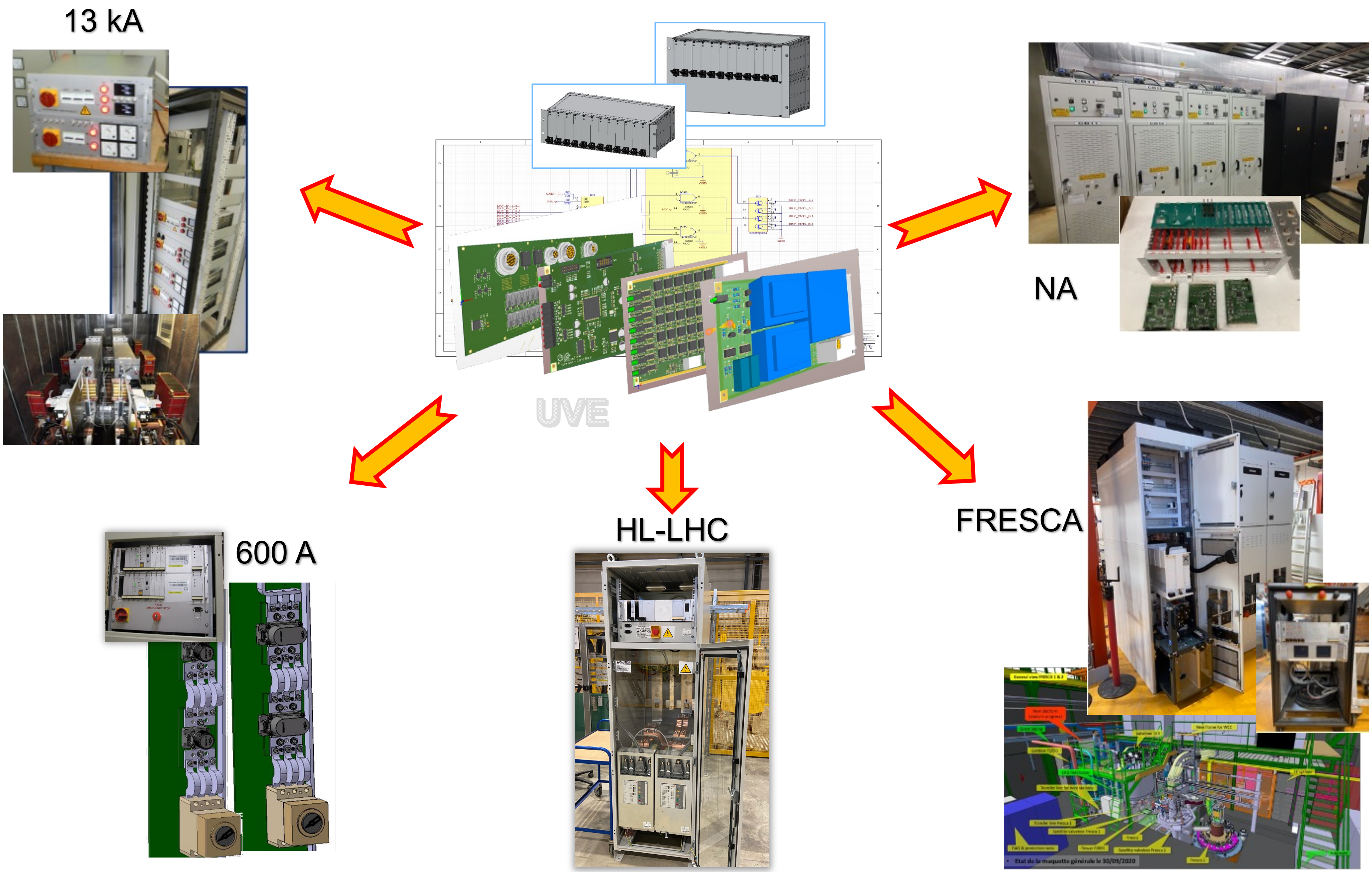






First 2 (oo9) units produced and validated at CERN
Stop press : additional 7 units have been produced and are ready for FAT

Development of a Universal Versatile Electronics for EEs controls

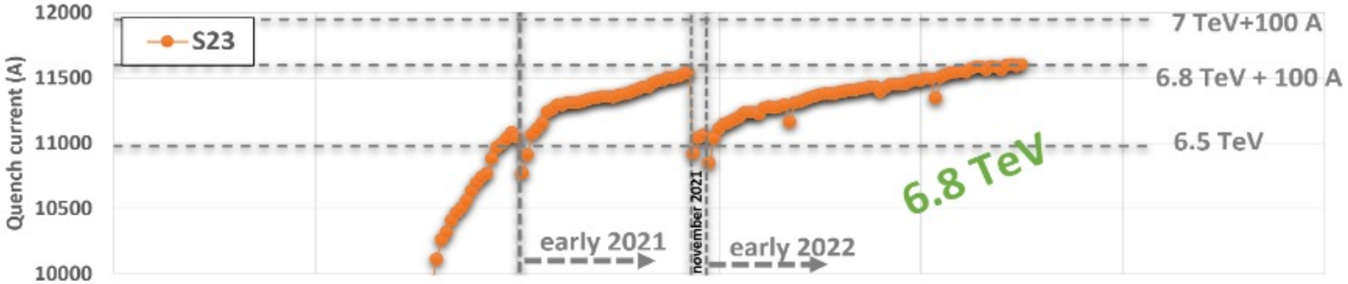


PE Section

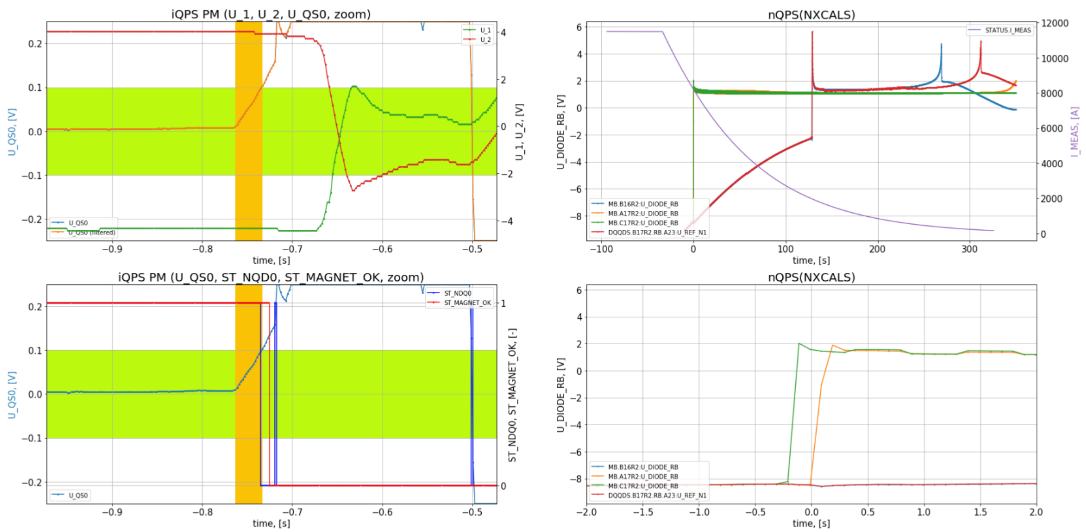
LHC

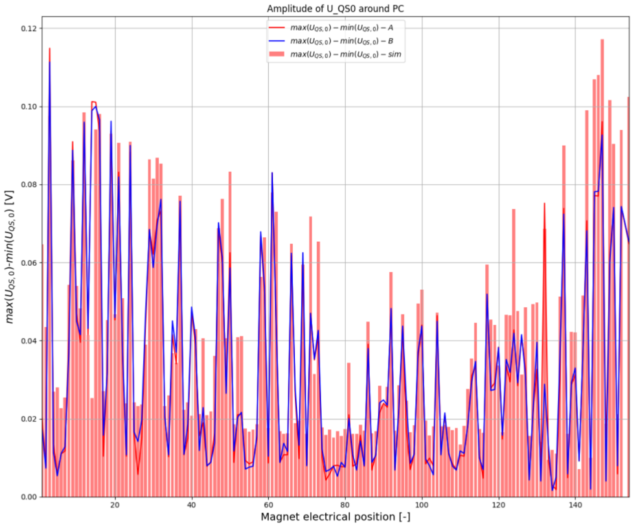
ELQA: S23 (x3)

MP3/HWC: Loooooong dipole training



SigMon: More and better notebooks
-> better test & quench analysis

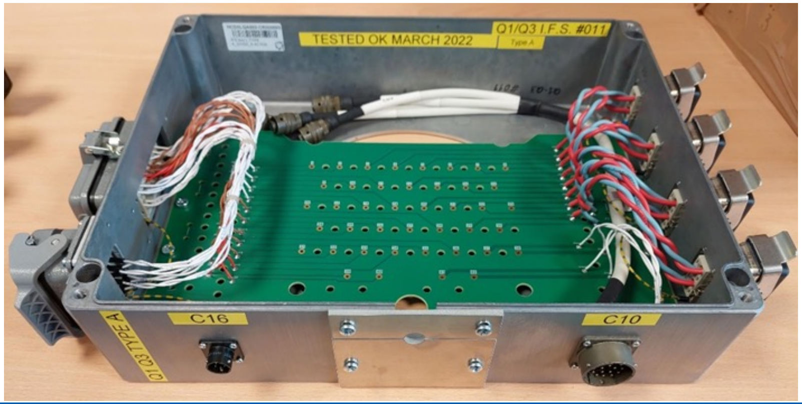


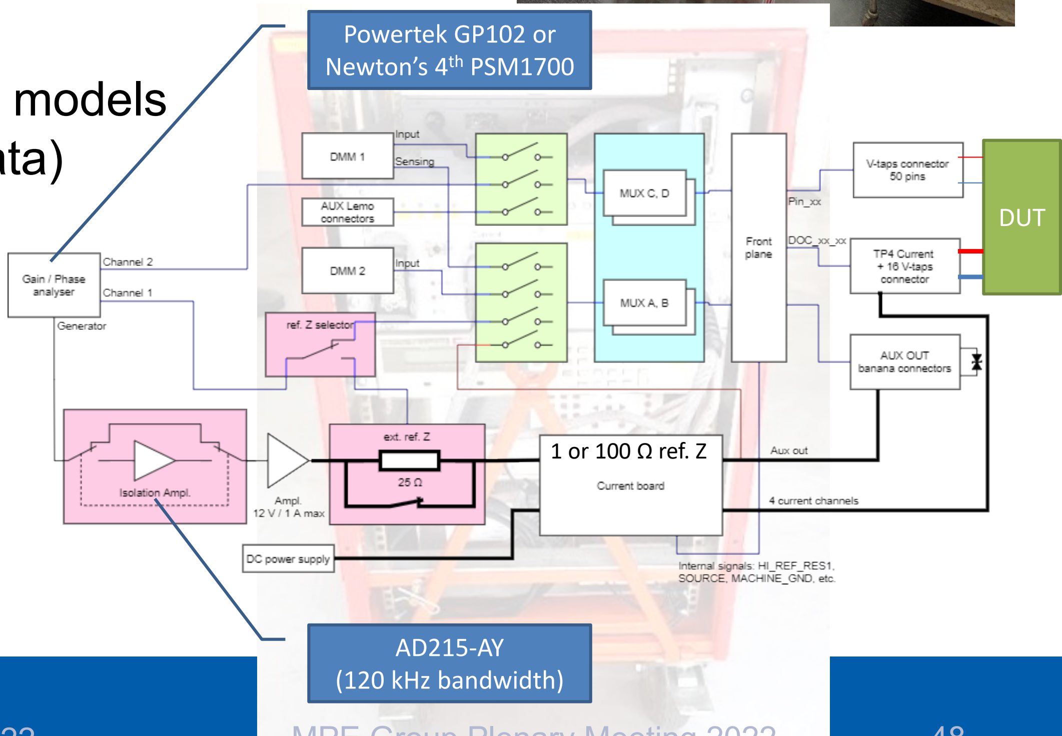


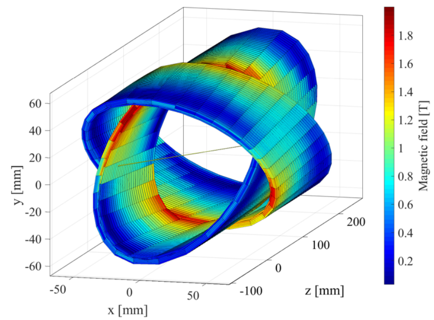
STEAM: More and better simulation models

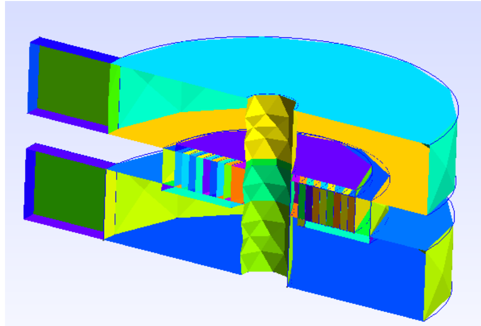
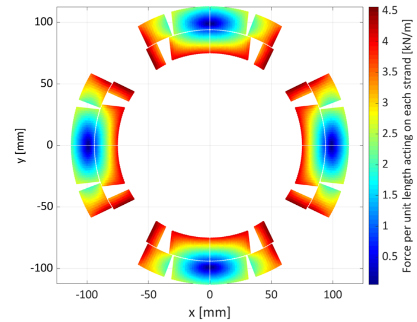
IT String + HL-LHC

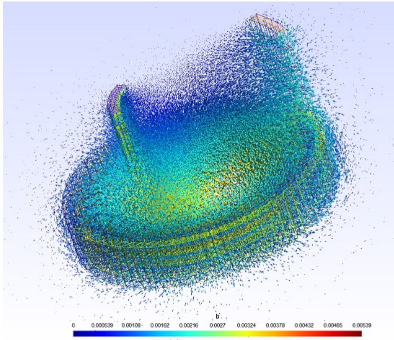
ELQA:	TP4 hardware + software upgrade + diagnostics + MgB2
CLHS:	design
IFS boxes:	in construction
Diode stack:	integration studies
STEAM:	2D & 3D simulation models (vs experimental data)









And lots and lots more….

Triplet task force

WP4.5

Chamonix

Gmsh

CAS

SIGRUM

BuilderDakota

SIS100

NMAS

LEDET-3D

FalconD

HTS'22

KWT

TFM

MP3-day

YAML

40 T HTS

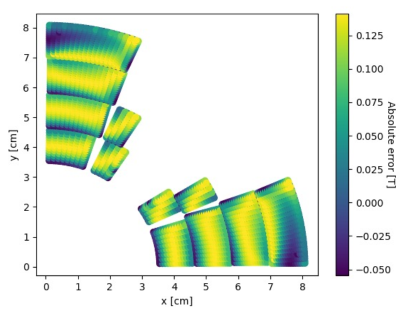
HL Uppsala

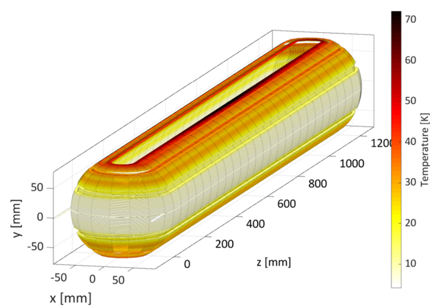
MCBRD

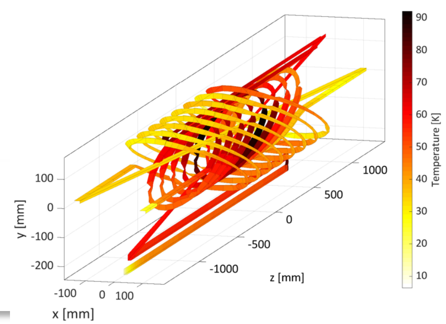
ASC

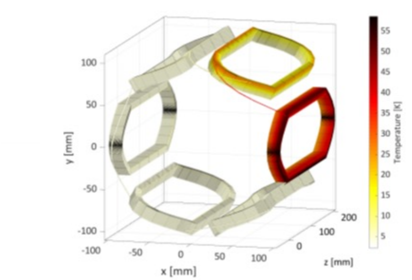
STEAM_SDK

SUST papers



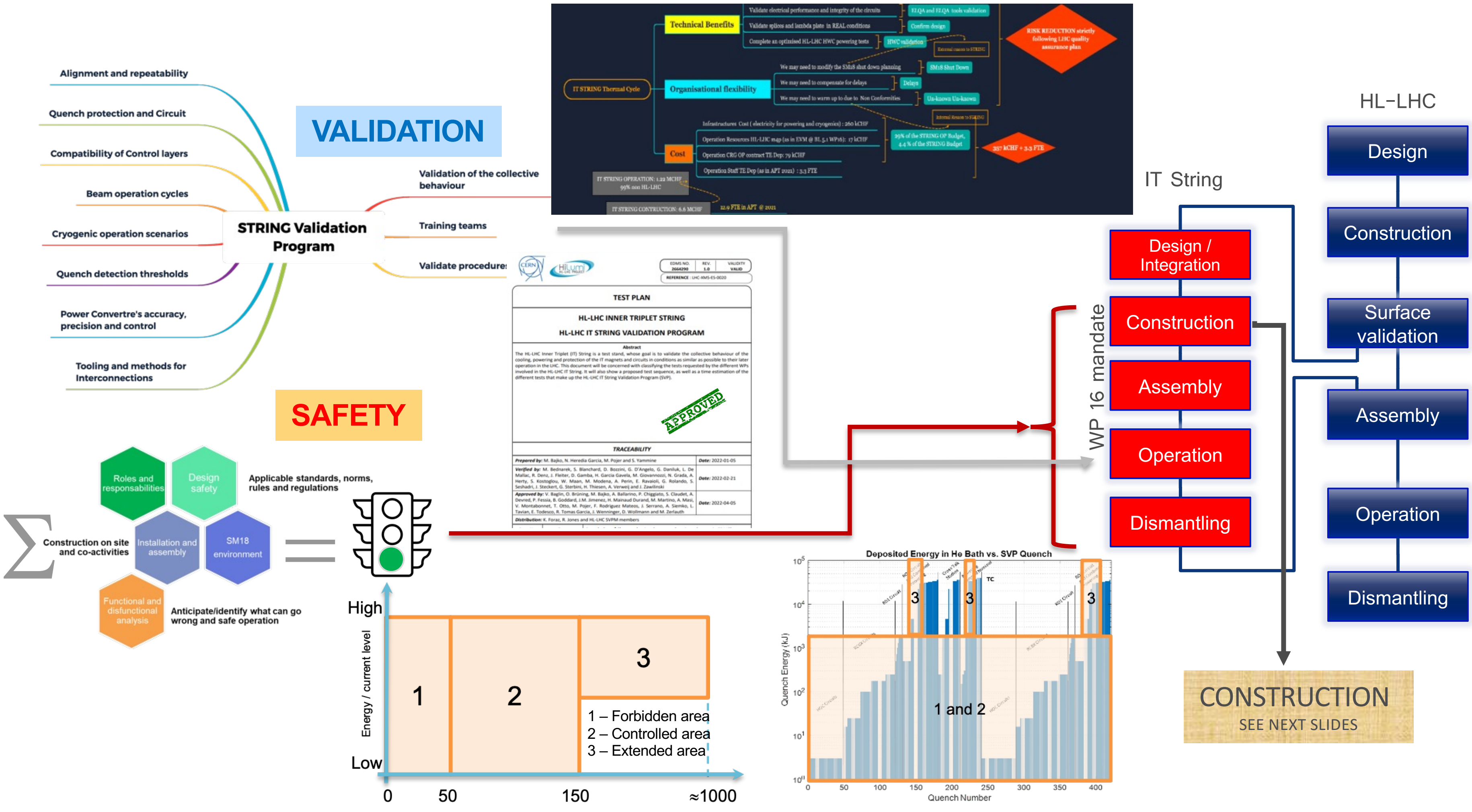




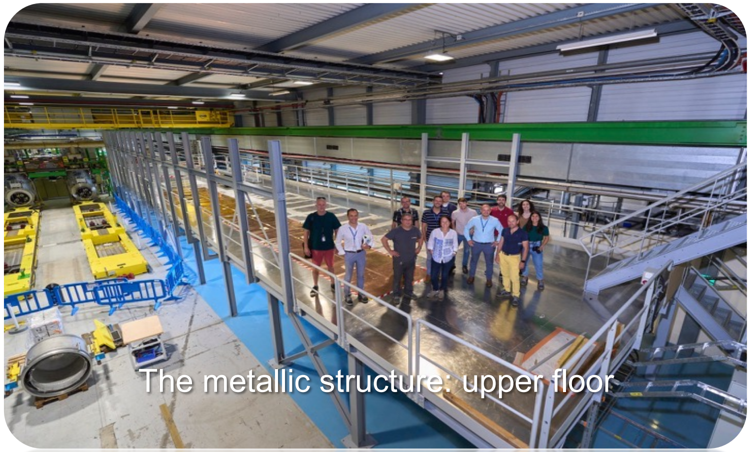


SF Section

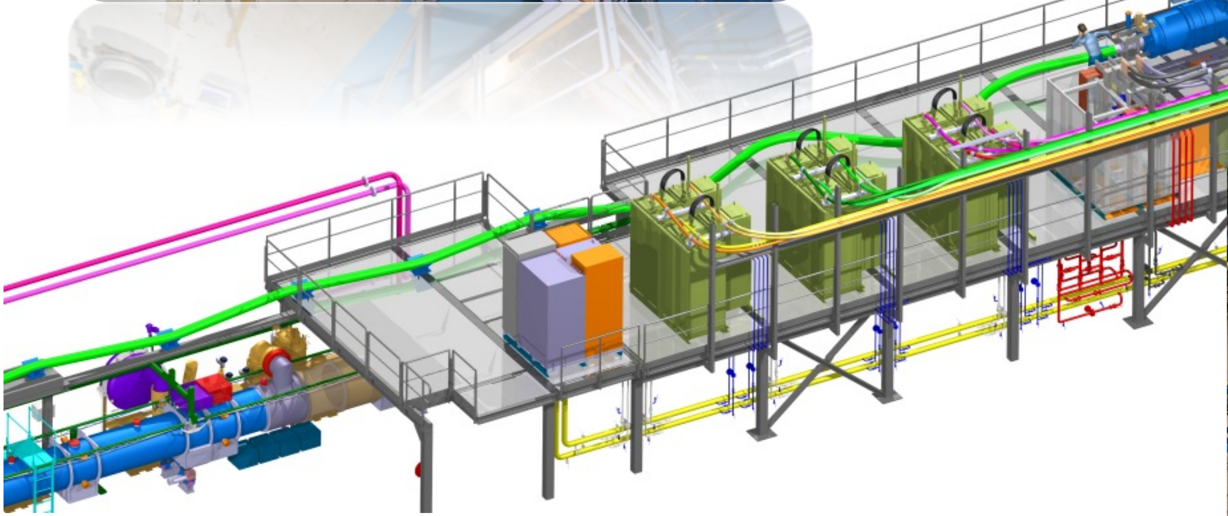
IT STRING Main achievements 2022

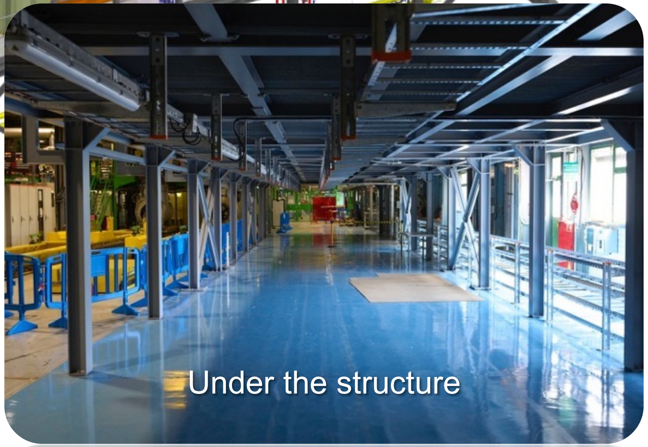


Status of the IT STRING



The metallic structure: upper floor

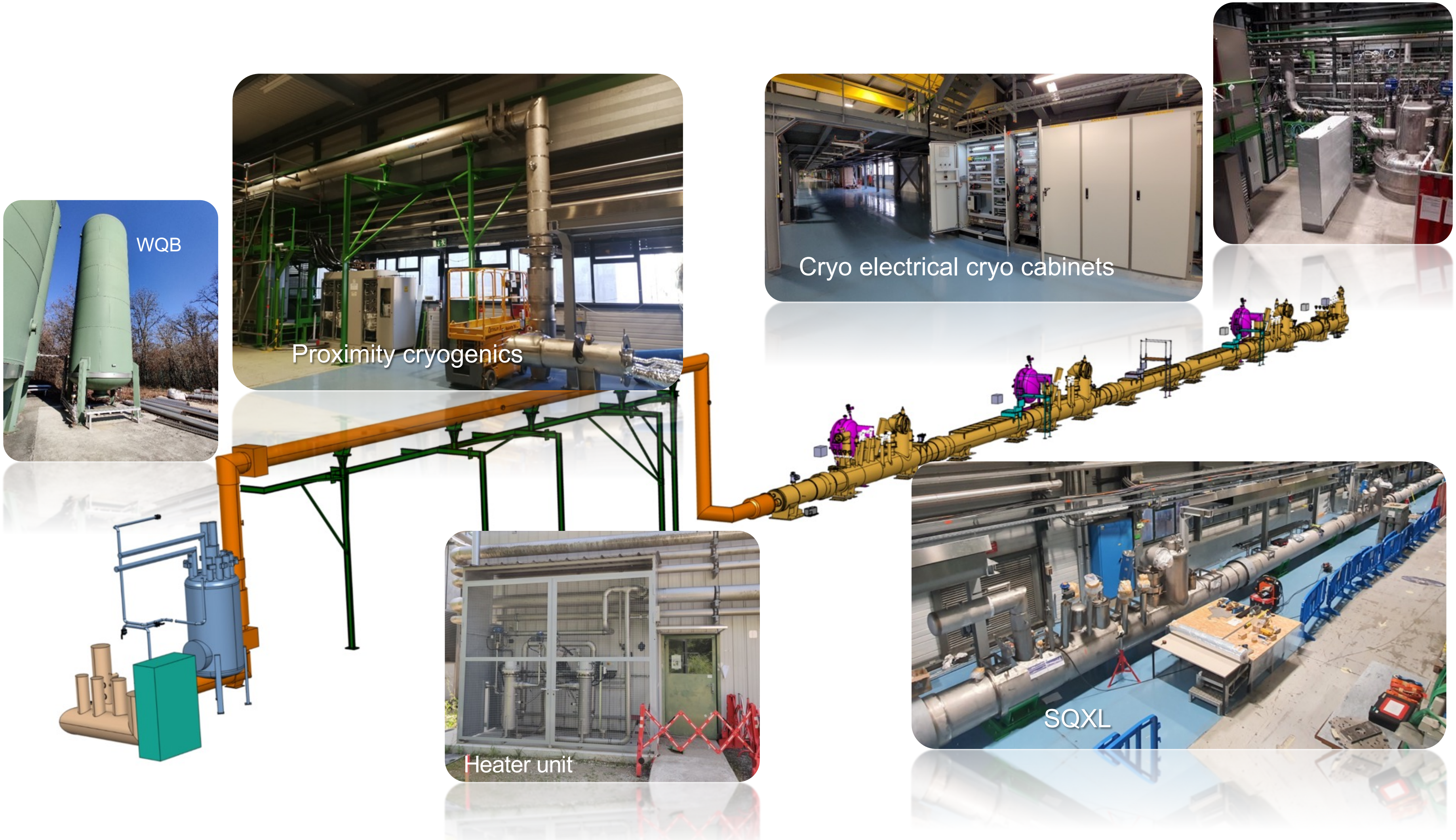




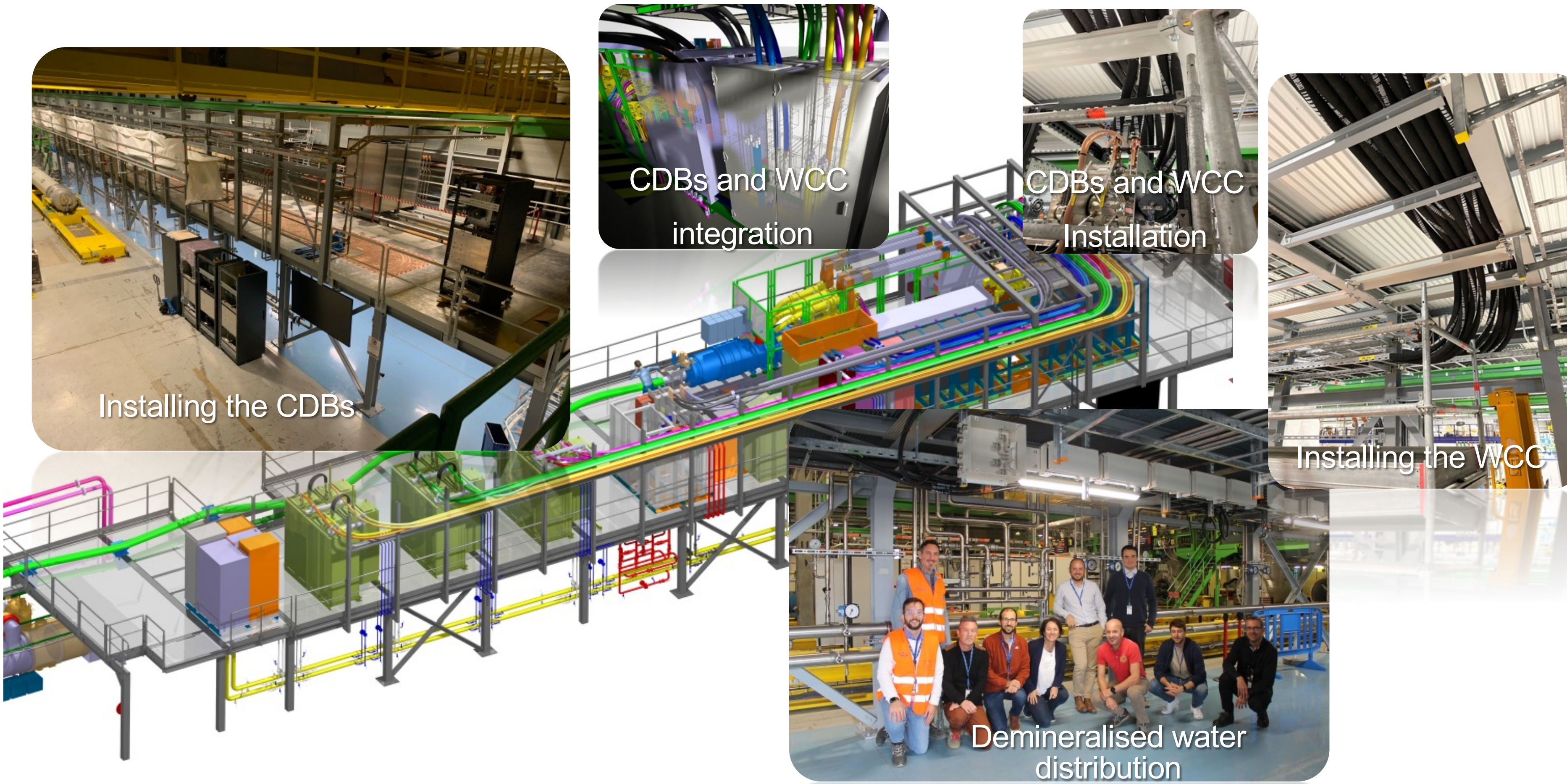
Under the structure

Technical infrastructure for the IT STRING

Cryogenics for the IT STRING



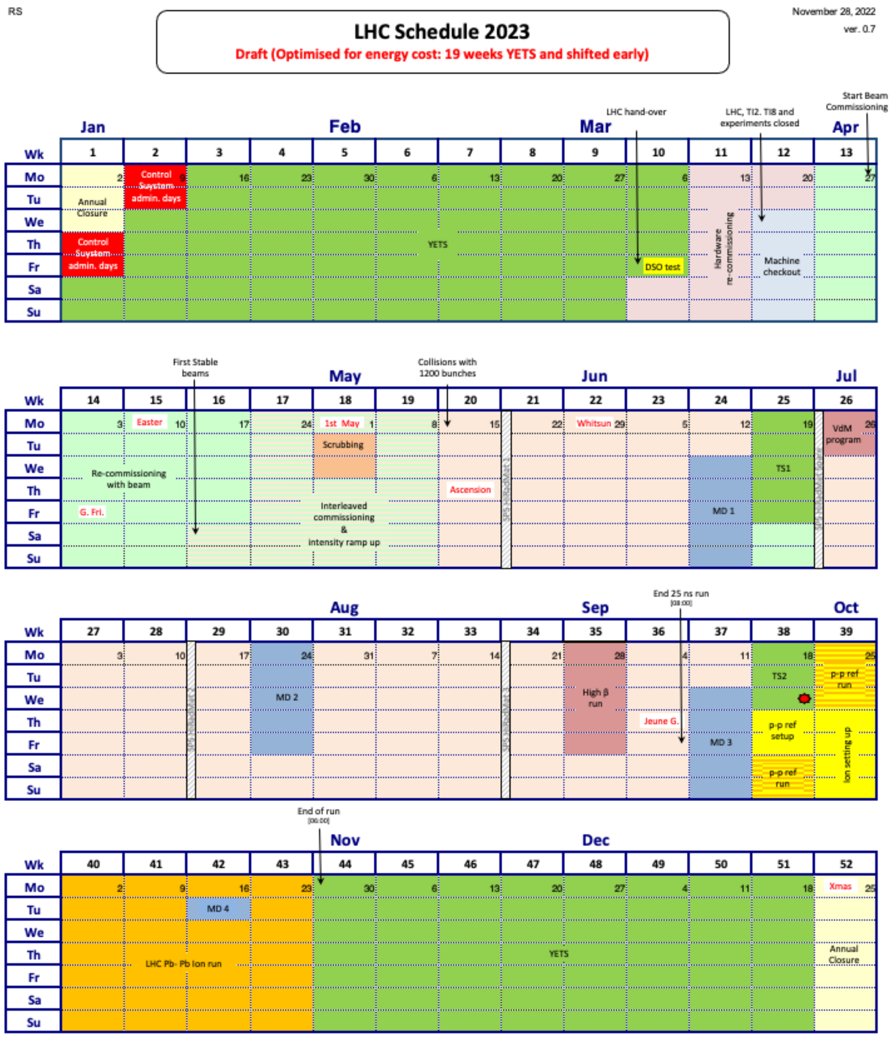
Warm powering system components of the IT STRING



TE-MPE
Outlook
2023

The 2023 Draft LHC Schedule in Numbers

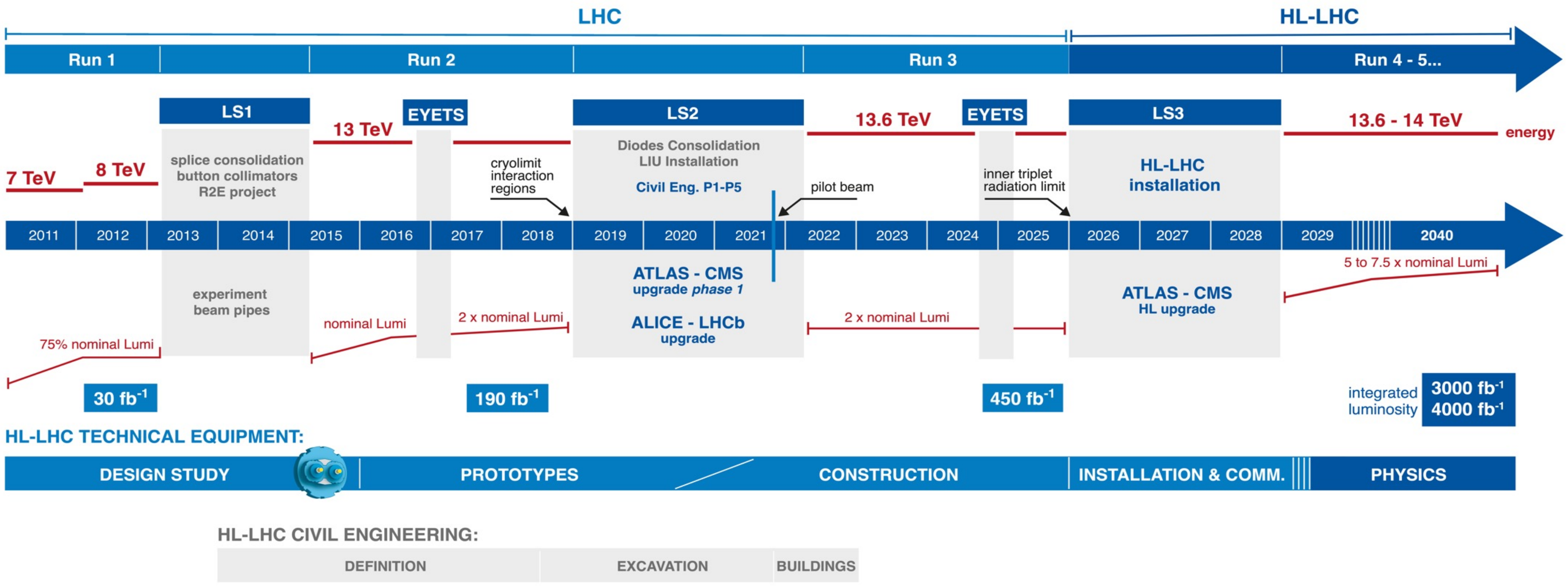
Activity	Duration [days]	Ratio [%]
Beam Commissioning & Intensity ramp-up	47	21.7
Scrubbing	2	0.9
25 ns physics (>1200 bunches)	**97**	**44.7**
Special physics runs (incl. setting-up)	**7**	**3.2**
Pb-Pb ions & p-p ref. setting-up	6	2.8
Pb-Pb ions physics & p-p ref. run	**32**	**14.7**
Technical stop	8	3.7
Technical stop recovery	2	0.9
Machine Development blocks (incl. floating MDs)	16	7.4
Total:	**217**	**100%**



Rende Steerenberg BE/OP at LMC 30/11/2022.

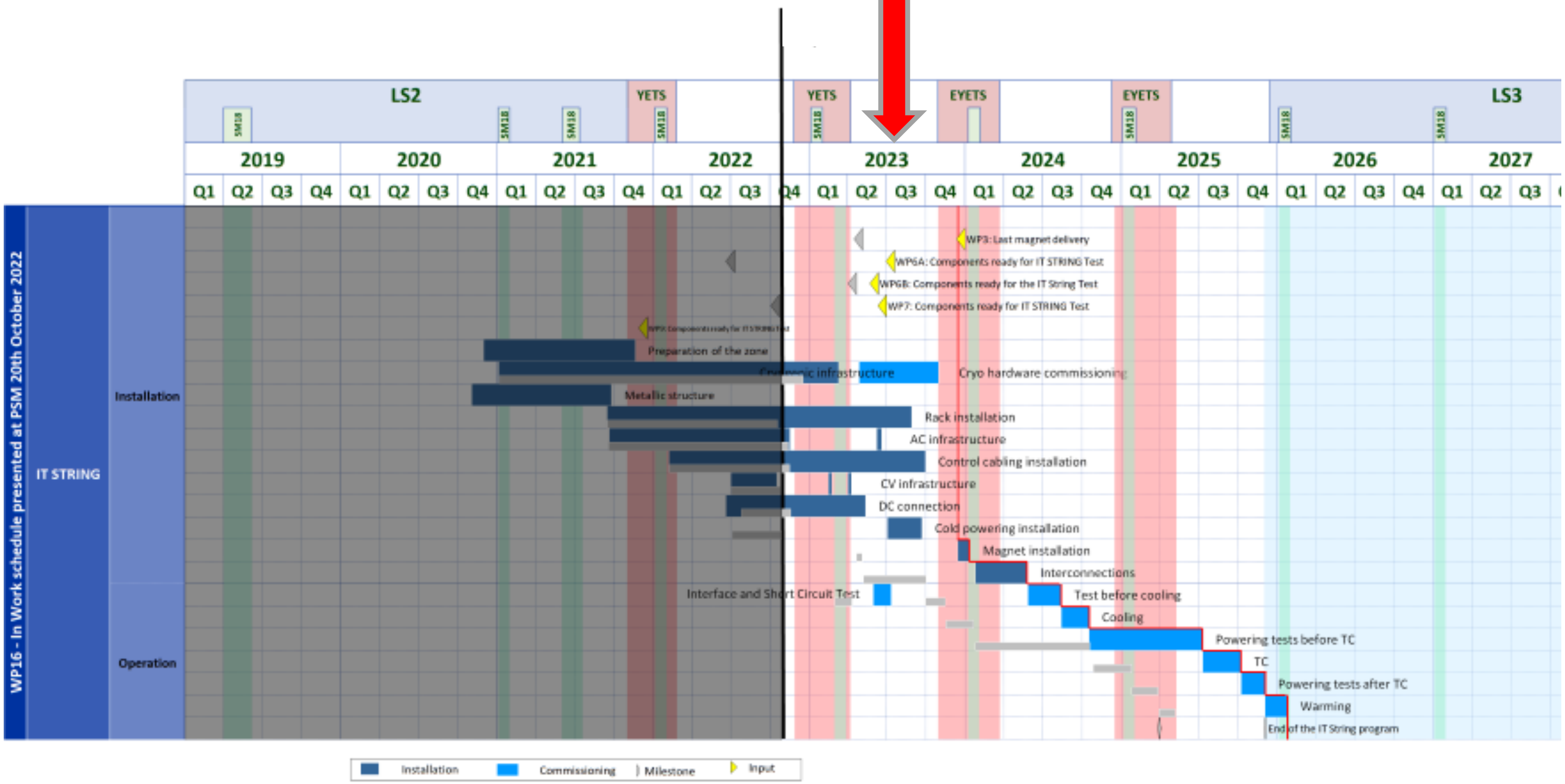
If the beam commissioning goes faster than scheduled, the time gained will be to the benefit of physics time.

LHC / HL-LHC Plan



- Complete specifications for some systems
- Place and follow up of contracts/deliveries
- LS3 preparation: planning of activities, resource allocation, external contracts

IT String installation and first IST and HWC



Our priorities …

- Safety, first
  - In the office, in the labs, in the tunnels and experimental areas, in all installations, in the way to CERN and back home

- We are already within an operational period: operate and maintain safely our systems in the LHC, Injectors and Experimental Areas

- We will continue the consolidation of our equipment, upgrades, new installations – we count on new projects to be soon approved

- HL-LHC requirements with respect to WP7 – production phase, reception of equipment, QA/QC

- HL-LHC requirements with respect to WP16 – IT String in full swing of installation, IST, SCT

- Continue to prepare the future:
  - Engage further into the HFM programme – this is a great opportunity
  - Participate to studies (FCC, muon-Collider)
  - Continuous revision and fostering the Group's R&D plan

thank Each of you

- Claudia (GAO)
- Daniel C. (support to GLO)
- Jan (DGL)
- The Six Section Leaders

Special thanks:

- Miguel
- Valeria and Macarena
- Andrzej
- Anne Laure
- Patricia, Germana, Brigitte, Delphine, Carnita
- Luigi and Ralph
- All the group collaborators and support (in particular the TE-MSC Secretariat as back-up GAO)

I wish you nice and relaxing end-of-the-year holidays, and an excellent 2023, full of health, joy and success for you, your families and your loved ones

And now the drink …

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