



**Accelerators related
activity at AGH- University
of Science and
Technology
Jan Kulka
28-09-2012**

- **AGH-UST teams for LHC construction and operational start**
 - Cryogenic distribution line in the tunnel
 - Quench Protection and Energy Extraction Systems
 - Technical Support for the LHC tunnel access
 - Quality Assurance for spool-pieces lines
 - Cooling and Ventilation Systems
 - Superconducting Magnets Interconnections

AGH-UST staff members working for LHC at CERN 2005-2009

MEL

Bednarek	Mateusz
Ludwin	Jaromir
Prochal	Bogusław
Setkowicz	Józef

QP

Drózd	Adam
Filipek	Wiesław
Gorzawski	Arkadiusz
Nowak	Edward
Nowak	Elżbieta
Seweryn	Grzegorz
Skąła	Aleksander
Skoczeń	Andrzej
Wojanek	Piotr

QRL

Bolewski	Andrzej
Ciechanowski	Marek
Donizak	Jędrzej
Dubert	Paweł
Fluder	Czesław
Gaj	Wawrzyniec
Jodłowski	Paweł
Klisch	Michał
Macuda	Paweł
Malinowski	Paweł
Palica	Jan
Skotnicki	Ryszard
Sosin	Mateusz
Wróbel	Bartłomiej
Zwaliński	Łukasz
Lis	Krzysztof
Wolak	Tomasz

TS

Macuda	Małgorzata
Szkutnik	Jacek

TS/CV

Baran	Krzysztof
Dubert	Anna
Pomocka	Marek
Urbaniec	Bartłomiej
Wienczek	Mateusz

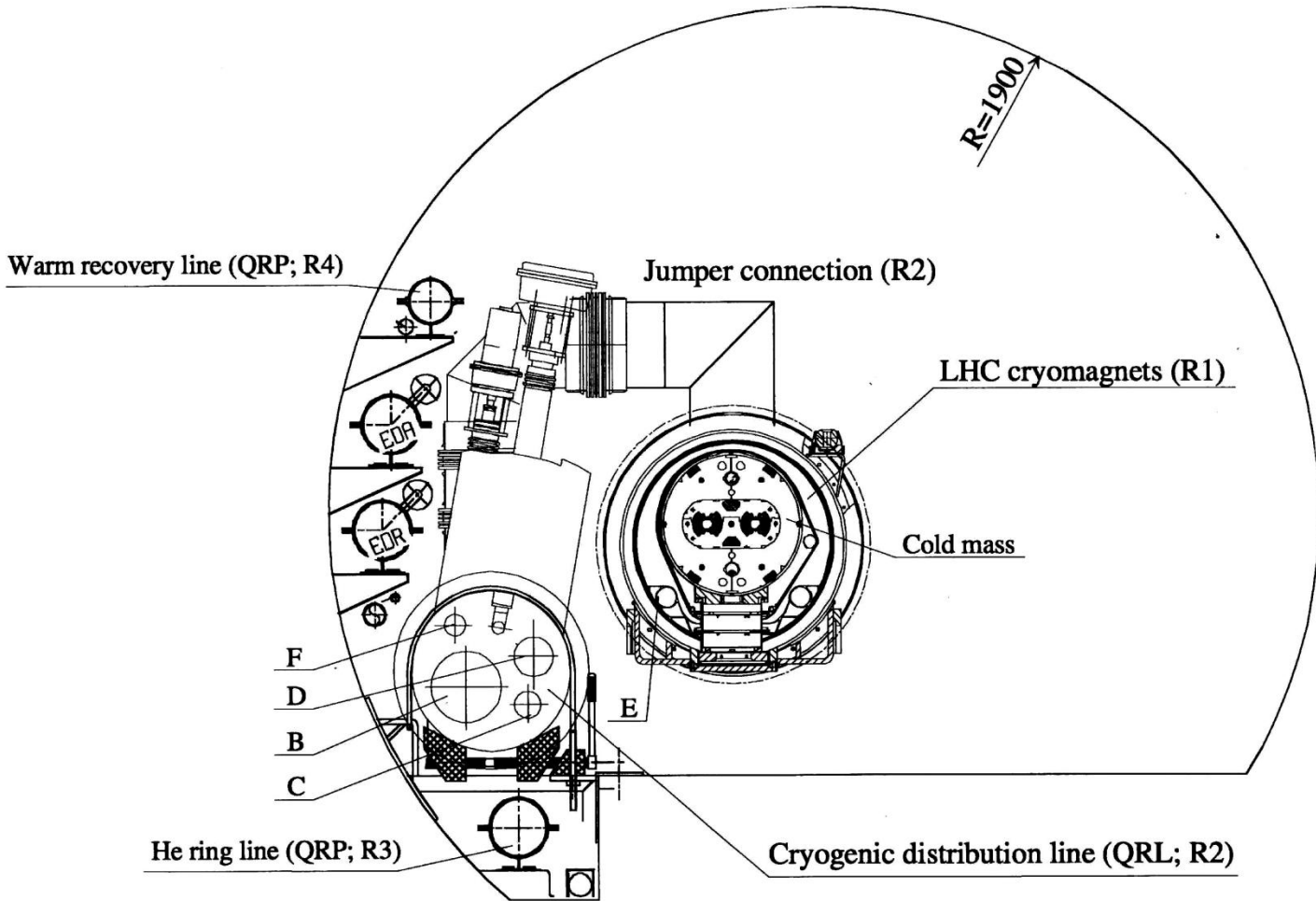
CRI

Kulka	Jan
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Cryogenics Distribution Line (before magnets setting)

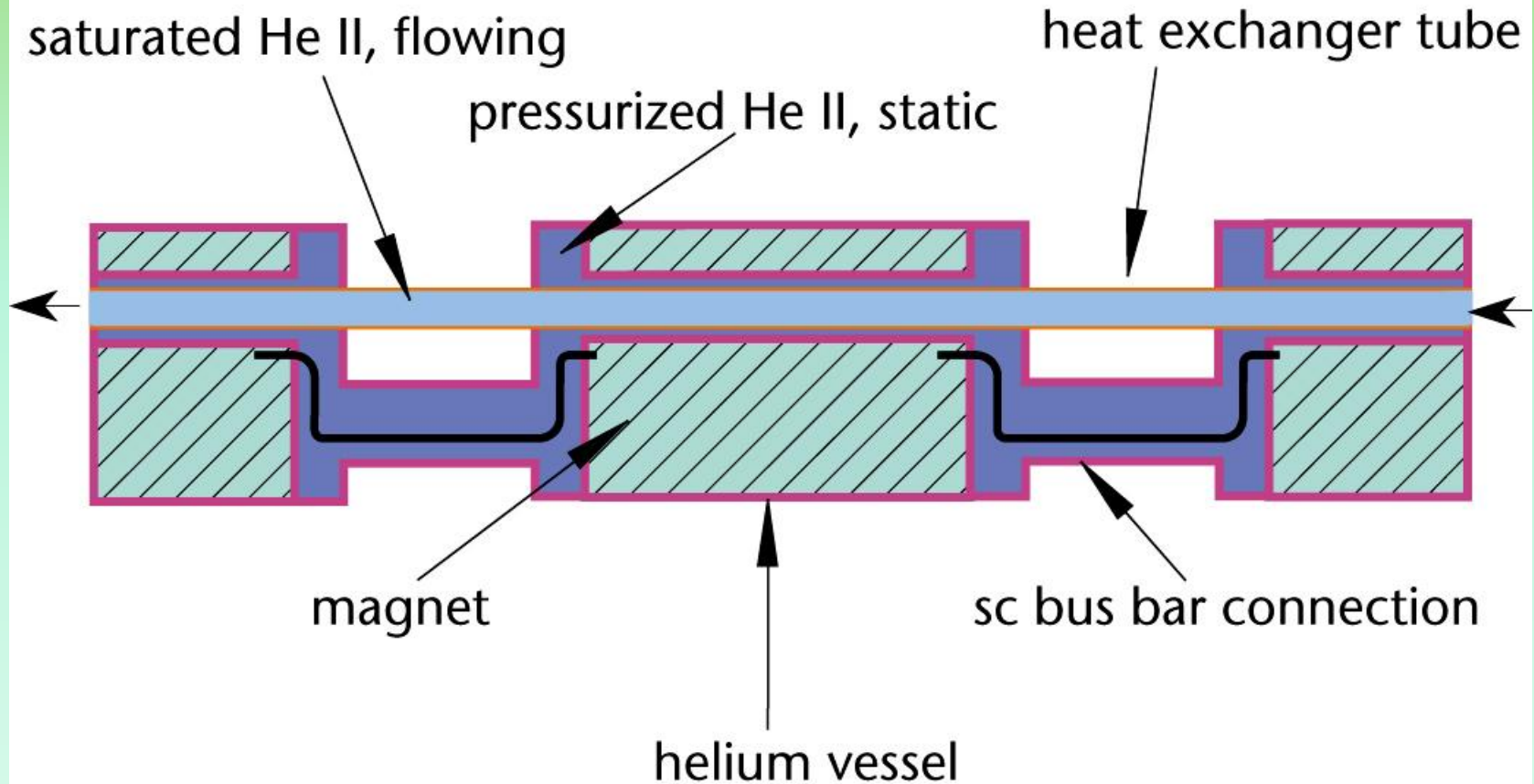


Lines for helium supply

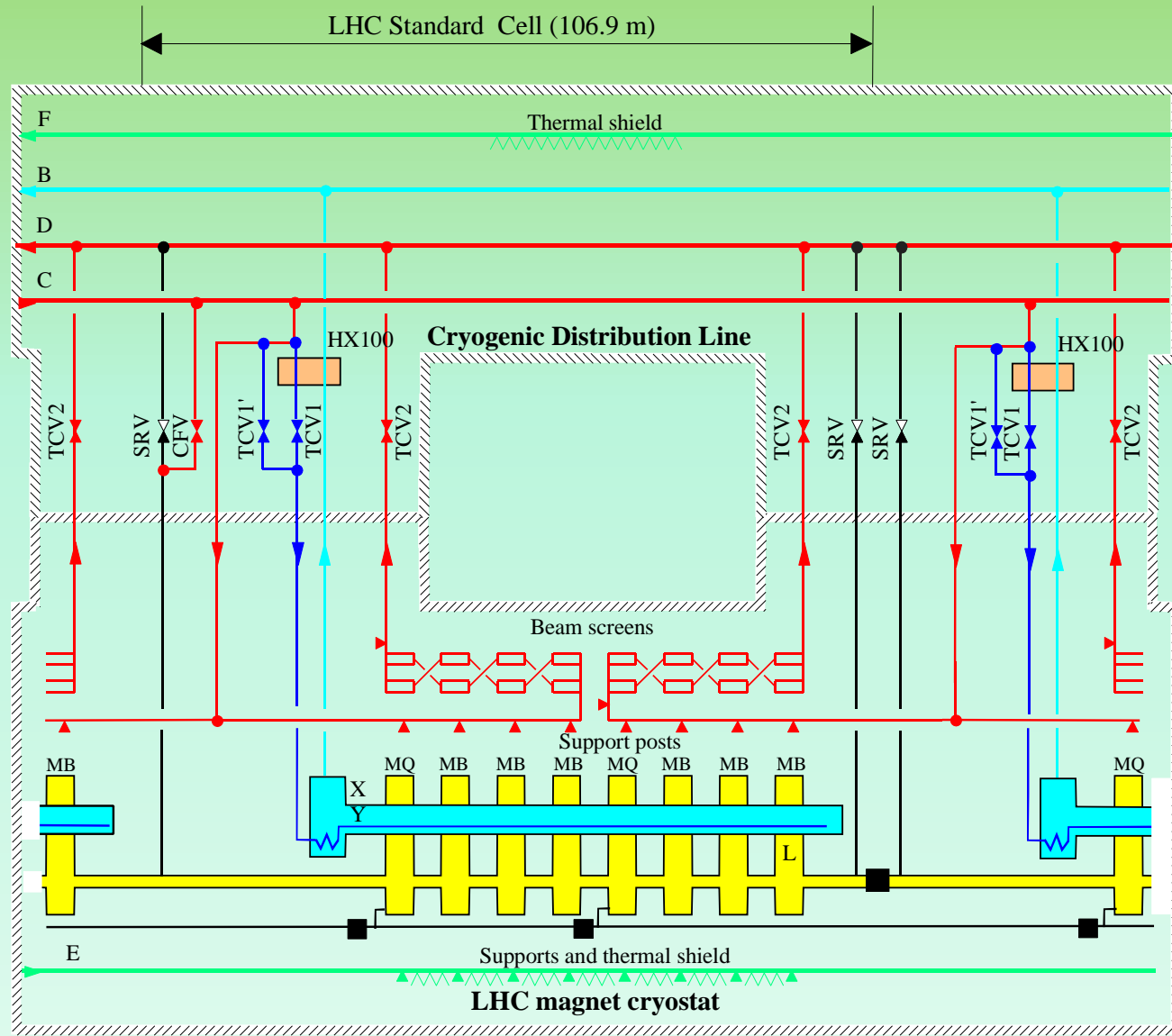


Linear heat exchanger

LHC magnet string cooling scheme



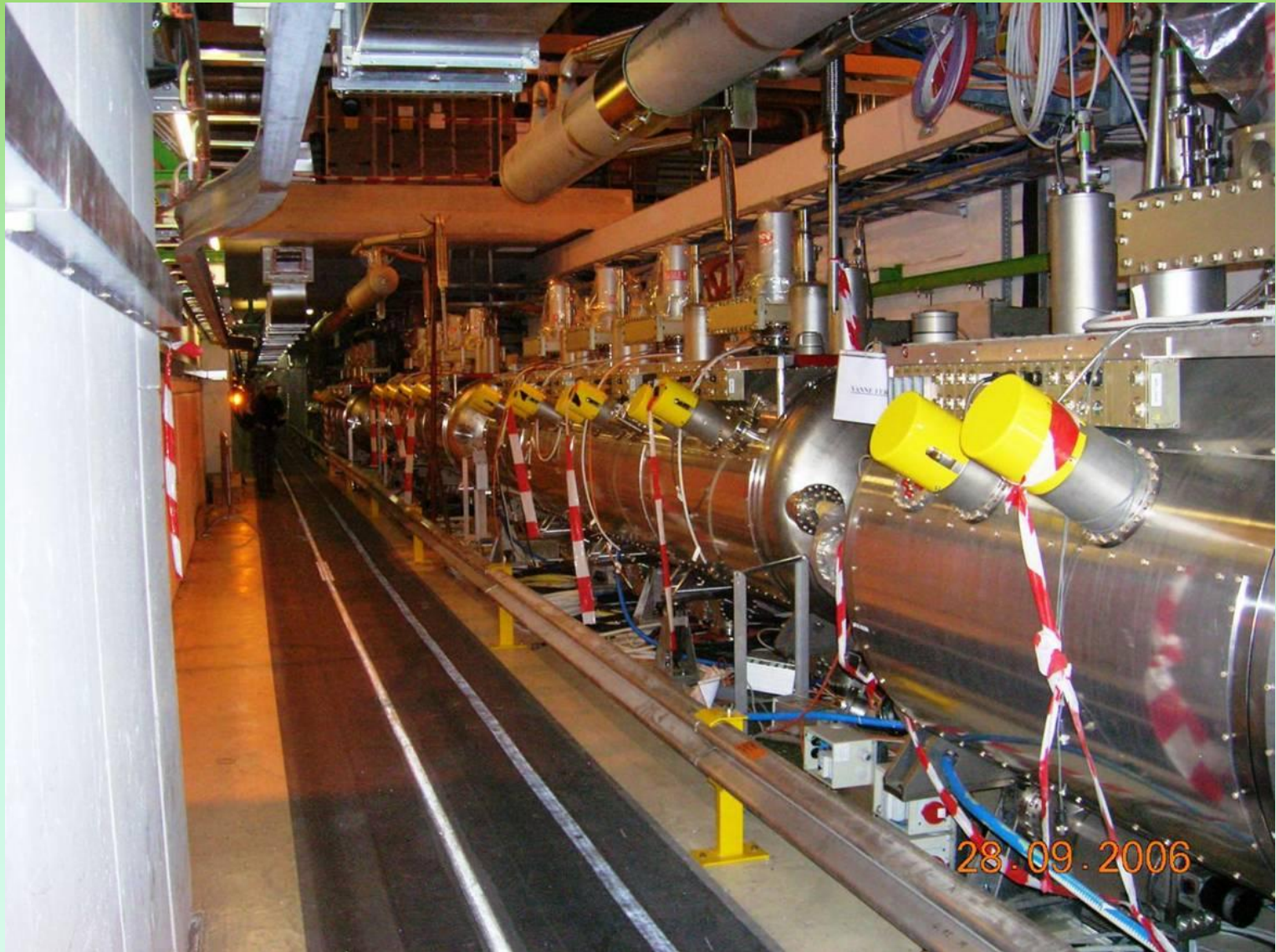
Cryo-cell LHC



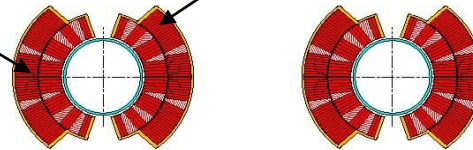
Two 300 kW klystrons with circulators and loads



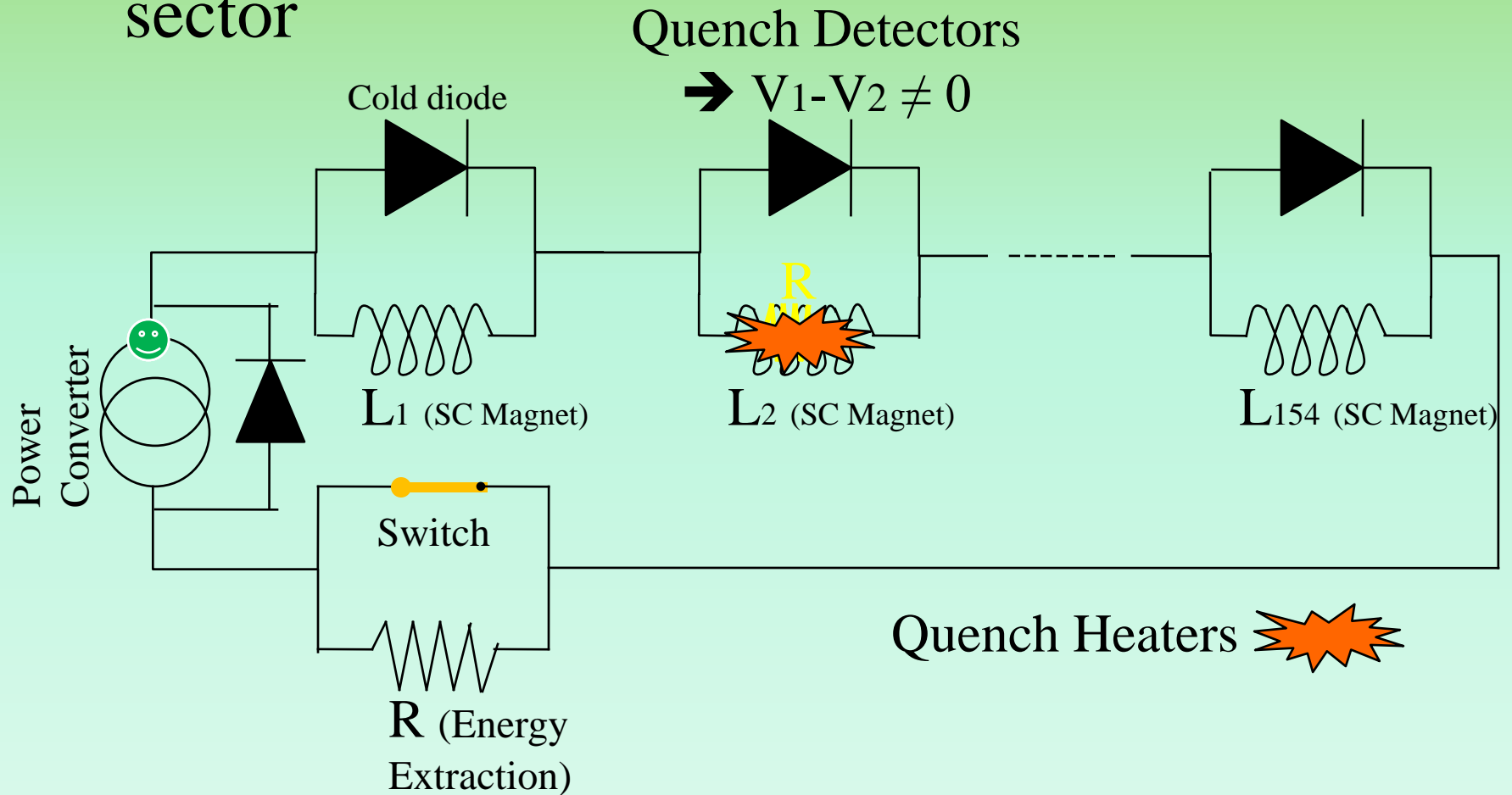
RF cavities



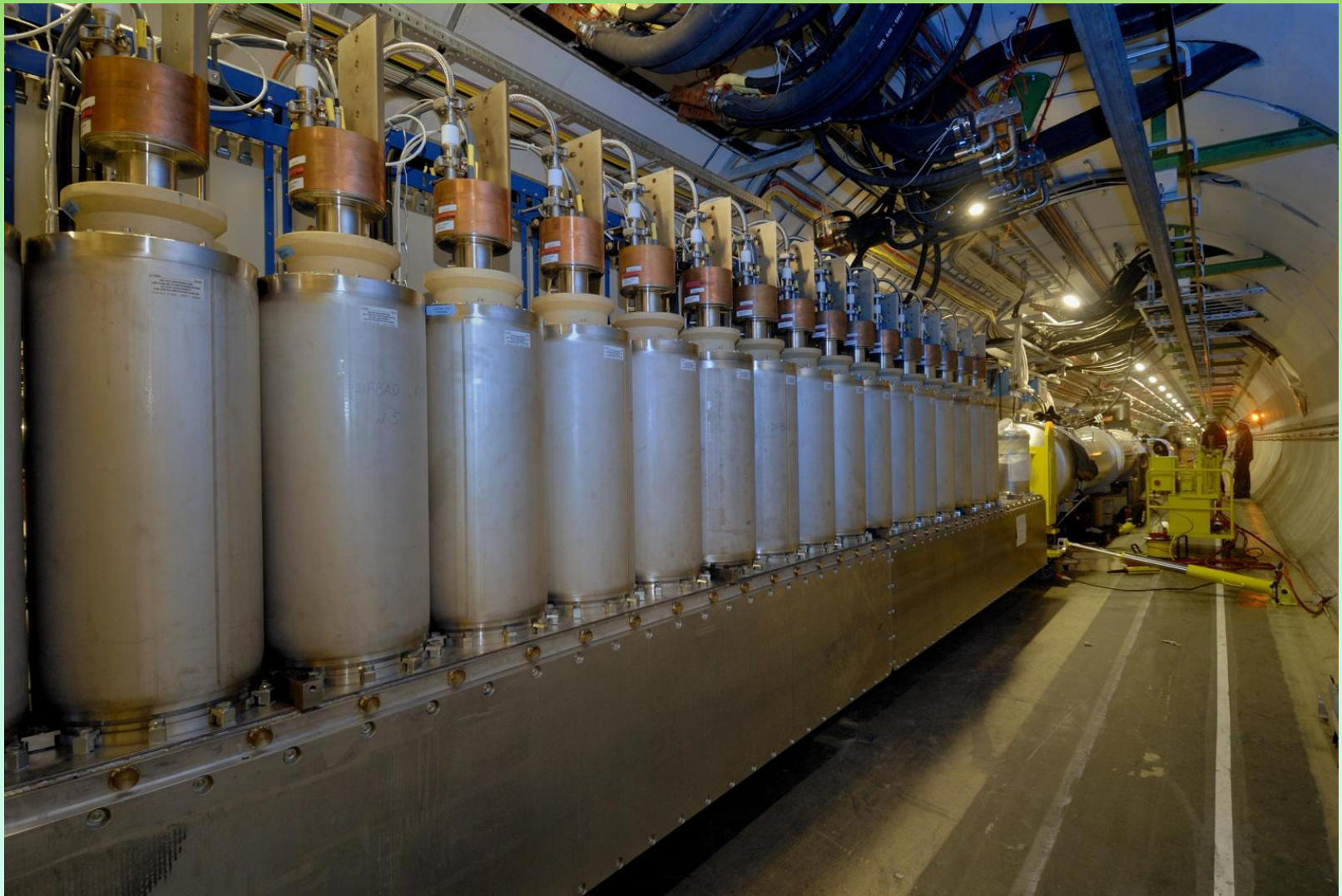
Quench Heater



- Schematics of the QPS in the main dipoles of a sector



DFBAO in Sector 7-8



HTS in the LHC machine

Powering of the LHC magnets

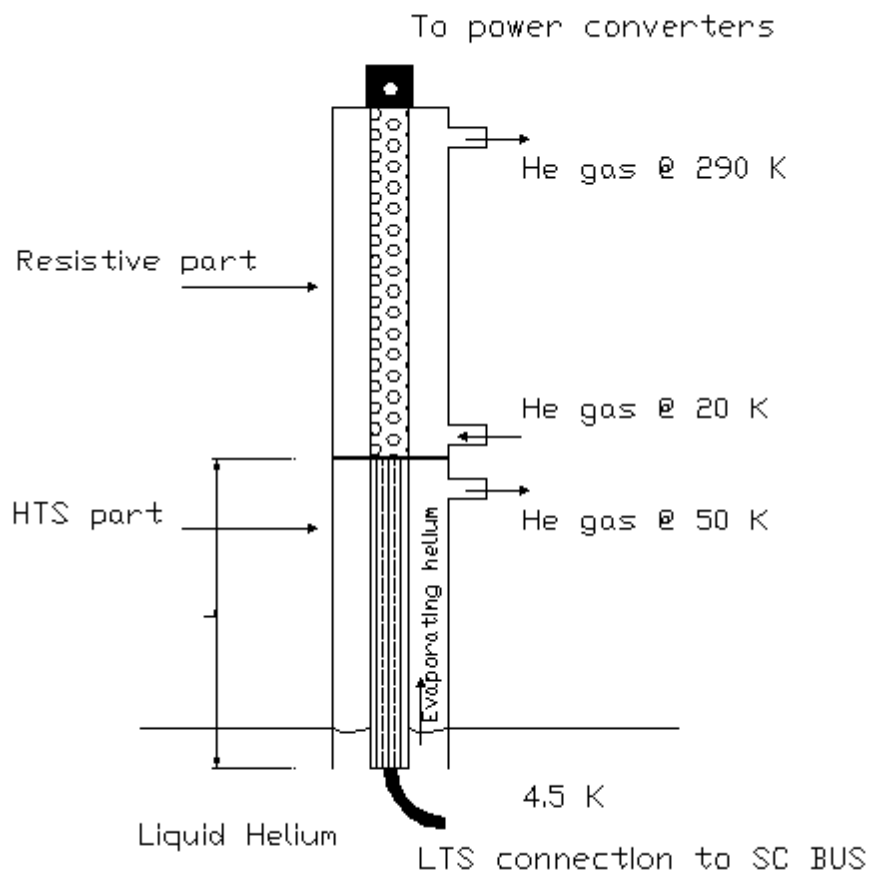
About 3 MA of rated current for
1800 circuits

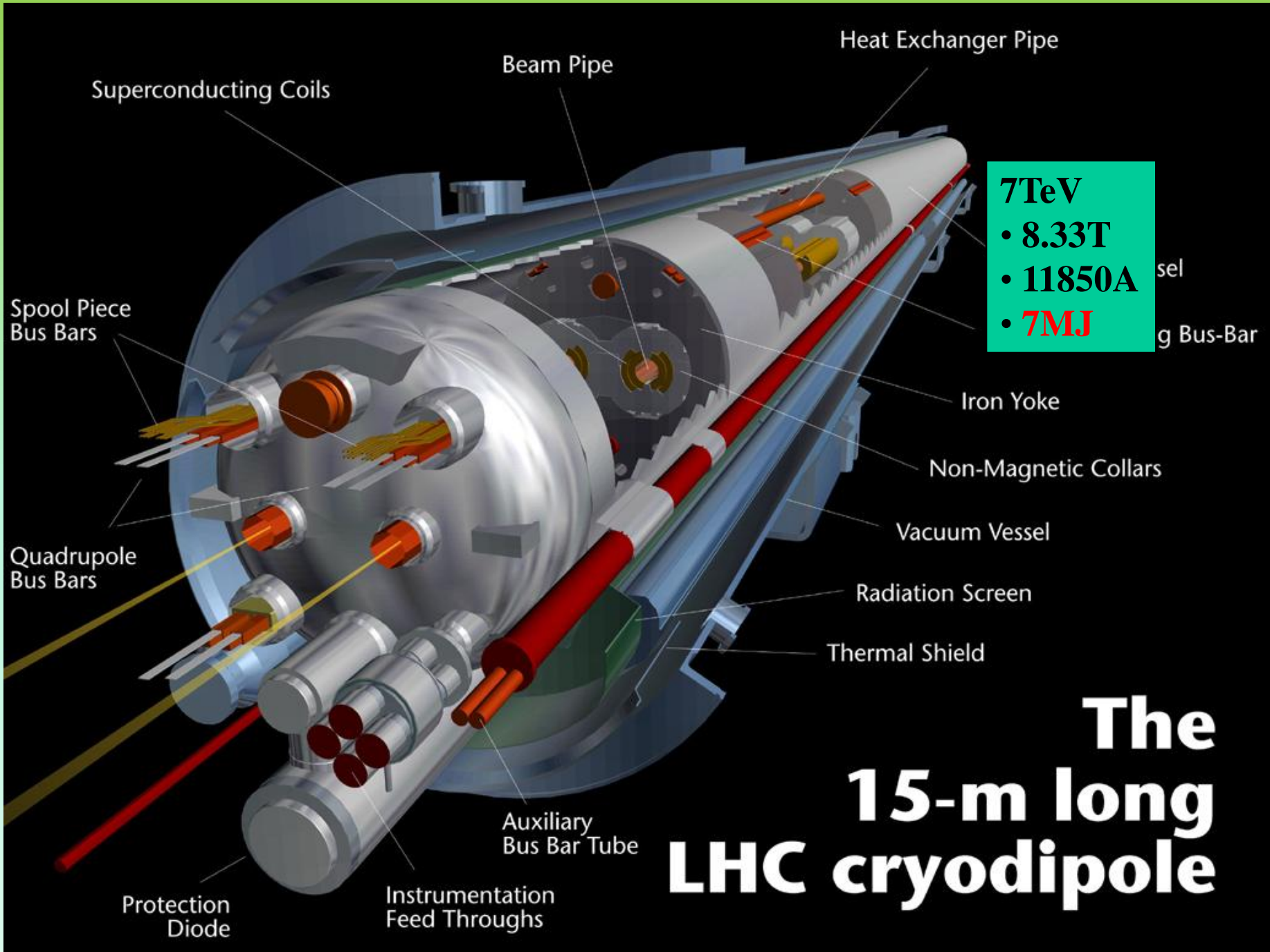
3286 current leads

Quantity	Current rating (A)
64	13000
298	6000
820	600
2104	60-120

HTS







Superconducting Coils

Beam Pipe

Heat Exchanger Pipe

7TeV
• **8.33T**
• **11850A**
• **7MJ**

Spool Piece Bus Bars

Quadrupole Bus Bars

Iron Yoke

Non-Magnetic Collars

Vacuum Vessel

Radiation Screen

Thermal Shield

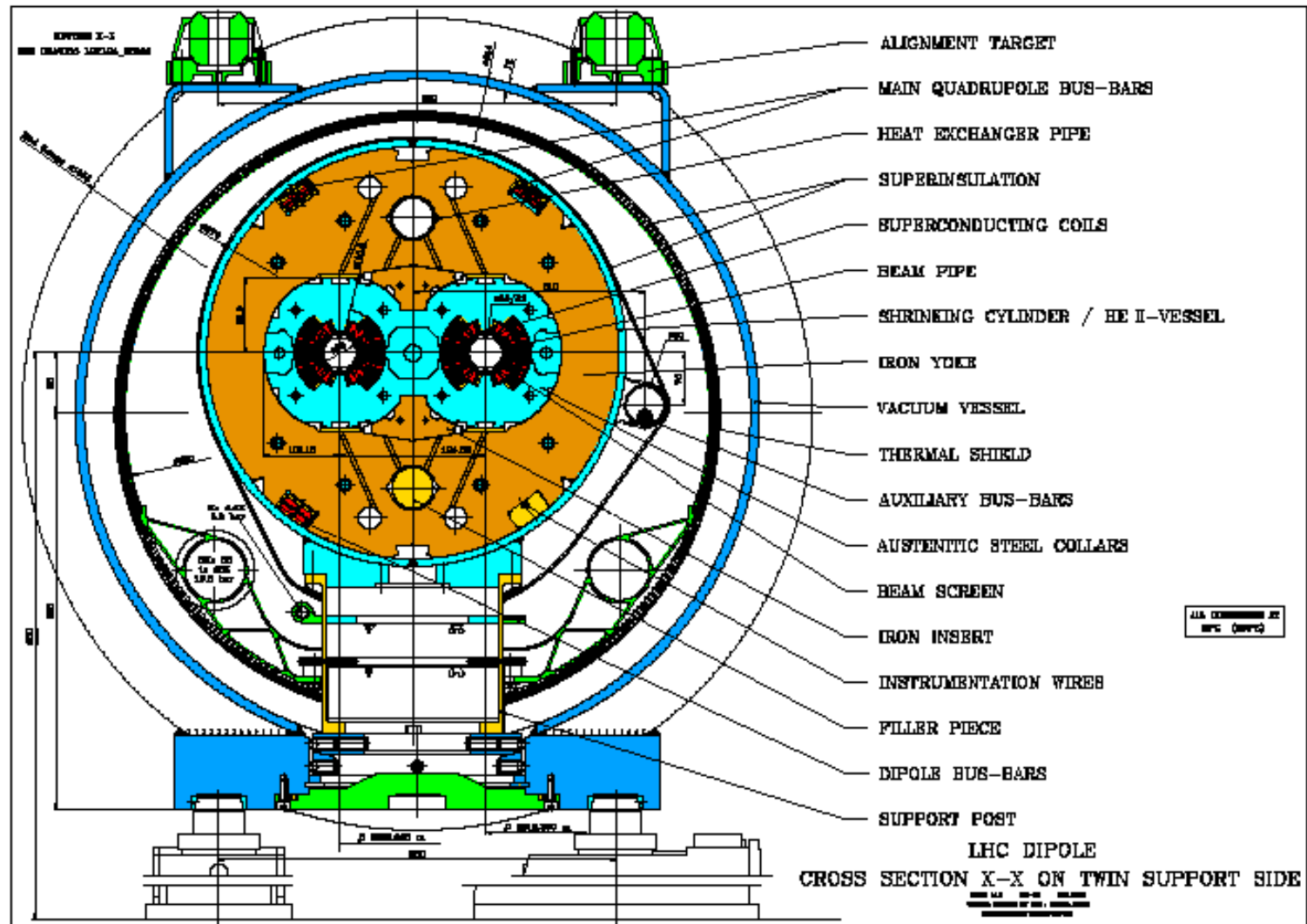
Protection Diode

Instrumentation Feed Throughs

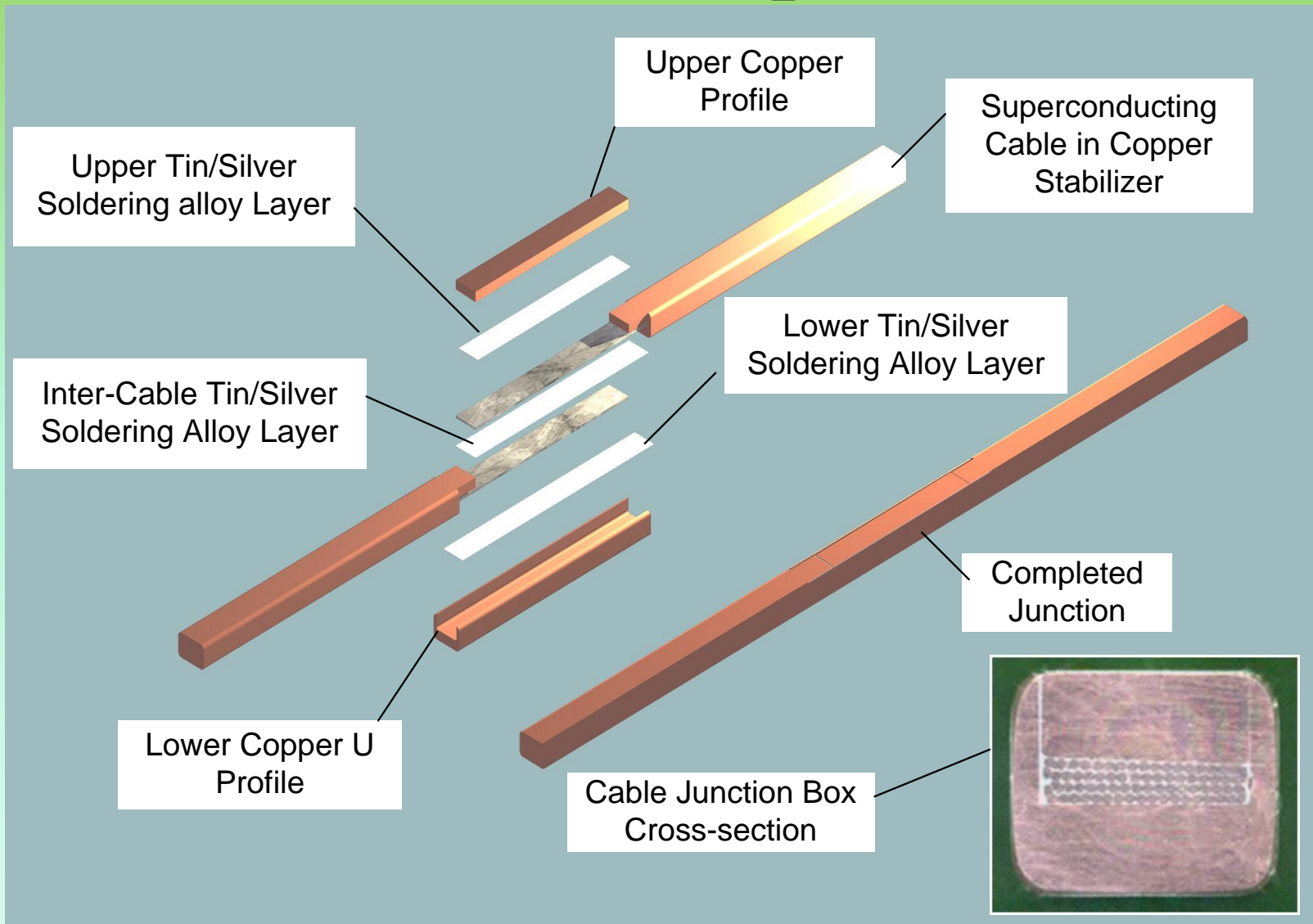
Auxiliary Bus Bar Tube

The 15-m long LHC cryodipole

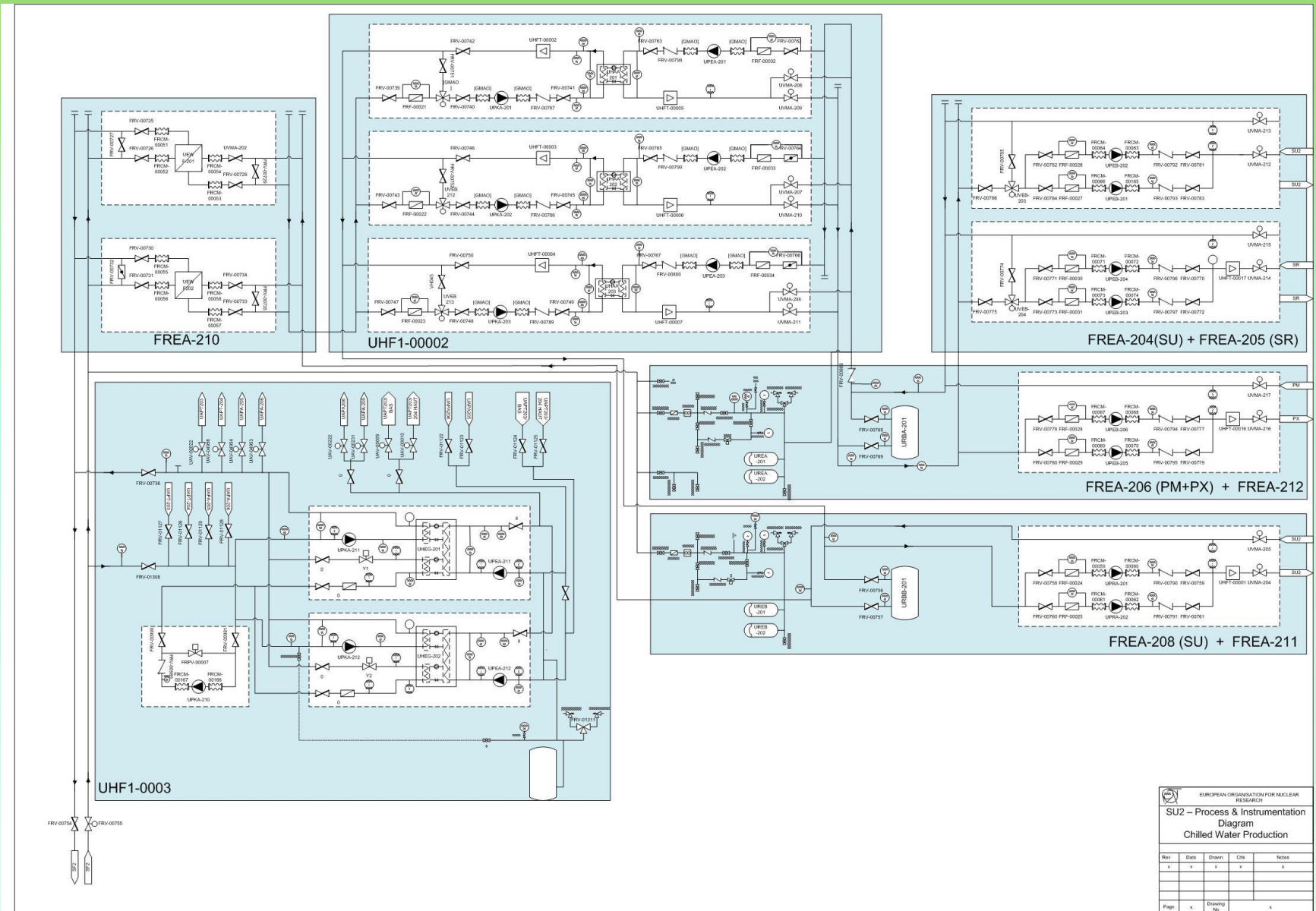
LHC Dipole Crosssection



Bus bar splice

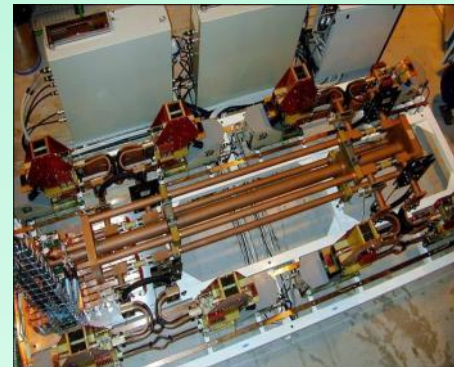


Cooling and Ventilation Systems – Data Base and Documentation



EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH				
SU2 – Process & Instrumentation Diagram Chilled Water Production				
Rev	Date	Drawn	Chk	Notes
x		x		x
Page	x	Drawings	No	x

- **New AGH-UST technical activity at CERN for accelerators since 2011 (22 → 35 persons)**
 - Main Electrical Power Systems
 - Vacuum for future accelerators
 - Geodesy and Survey
 - Documentation for ATLAS (CATIA)

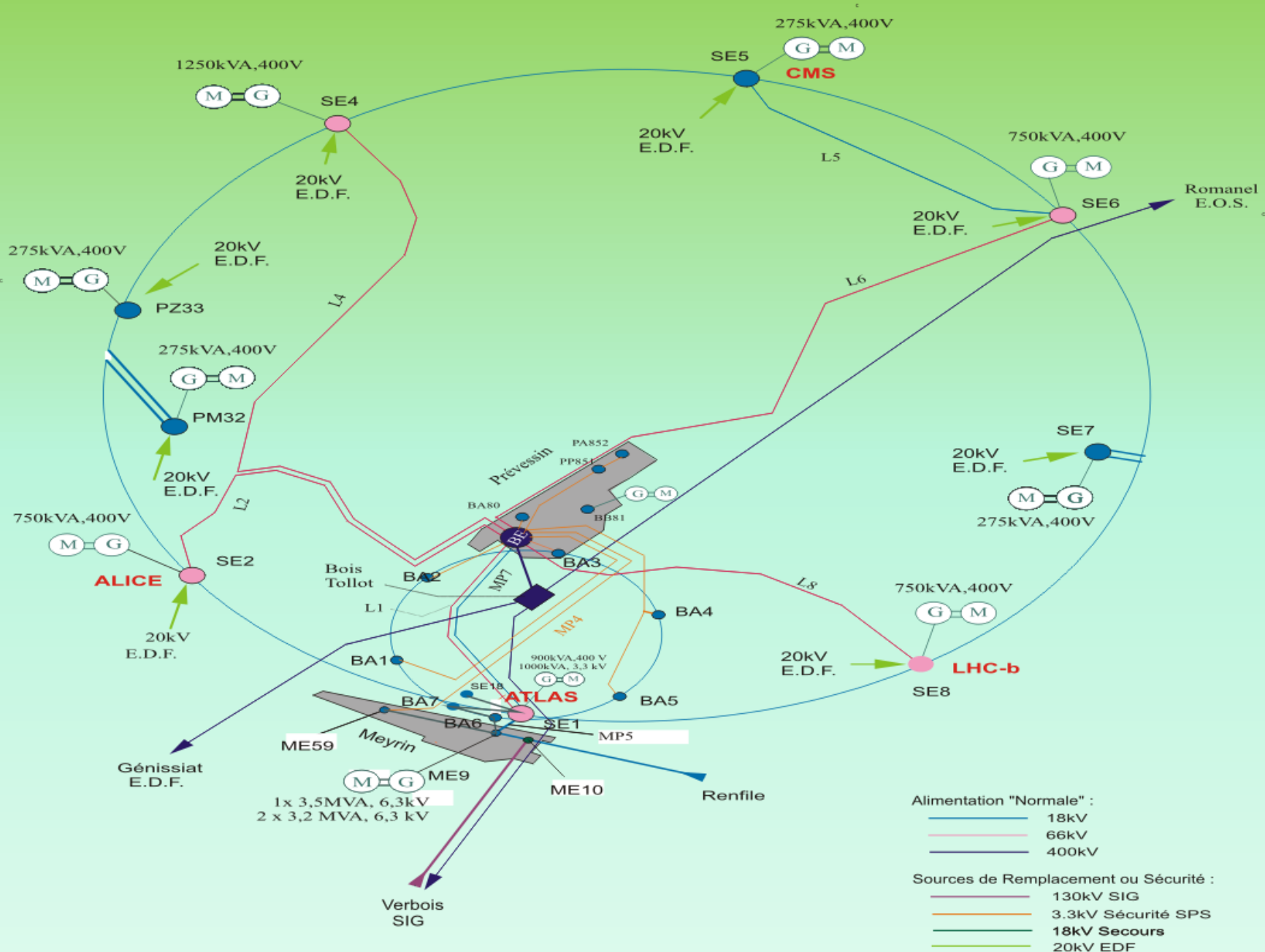


CERN Electrical Network

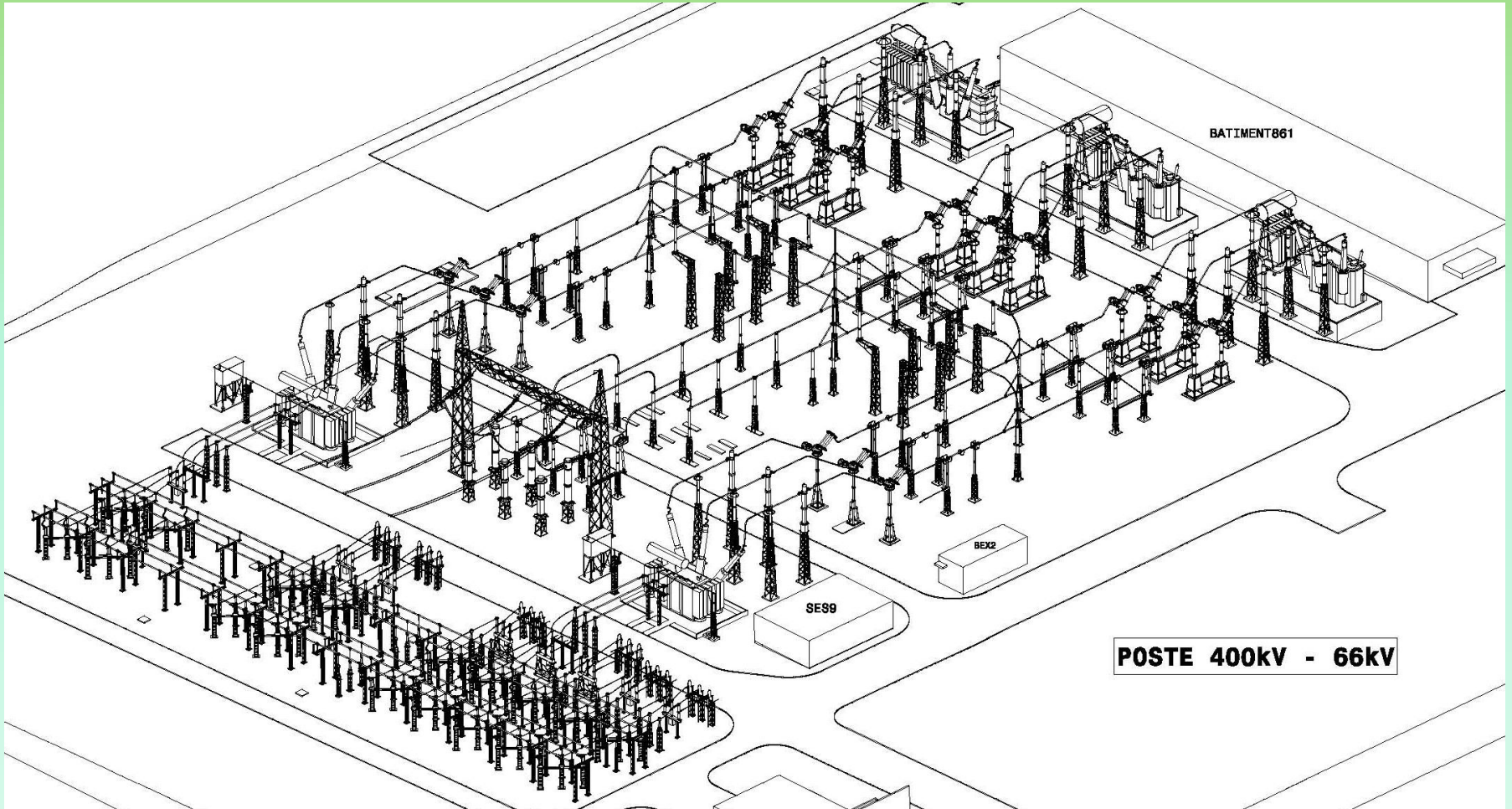


Main Loads

- Power converters
- Klystrons RF
- Magnets
- Cryogenics compressors
- Cooling towers pumps
- Chilled water pumps
- Ventilation systems
- Vacuum pumps
- Fire/Smoke/Gas detection and extraction
- Electronic racks
- Heating
- Lifts
- Lighting



Podstacja CERN - Preveessin



Electrical SCADA supervision

- Electrical alarms interfaced to CCC
- All electrical equipment scanned by electrical SCADA
- Electrical alarms and faults saved in a safe server
- Remote orders available but not used
- Analogue measurements and counters
- 100,000 digital inputs channel for electrical equipment

SUPERVISION and CONTROL

75 installed PLCs

- Auto-transfer system
- Diesel generators
- Switching Regular-Safety networks
- 48Vdc redundancy

Electrical alarms interfaced to CCC

All electrical equipment scanned by electrical SCADA

Electrical alarms and faults saved in a safe server

Remote orders available but not used

Analogue measurements and counters

100,000 digital inputs channel for electrical equipment

Thanks to:

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