Business opportunities related to CERN electrical network

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Agenda

1. Introduction to CERN electrical network
2. Equipment, activities and contracts
3. Foreseen projects
4. Conclusions

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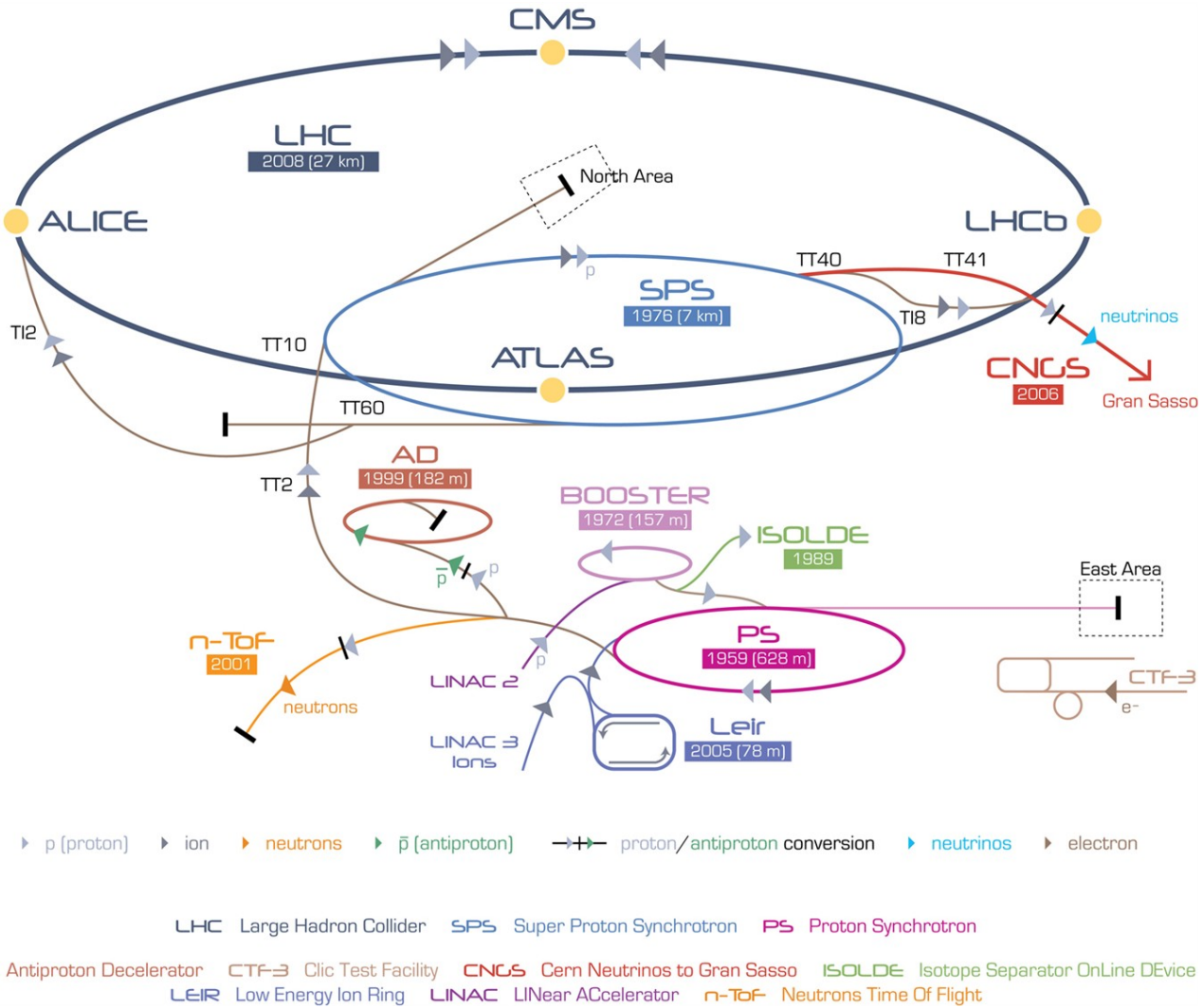
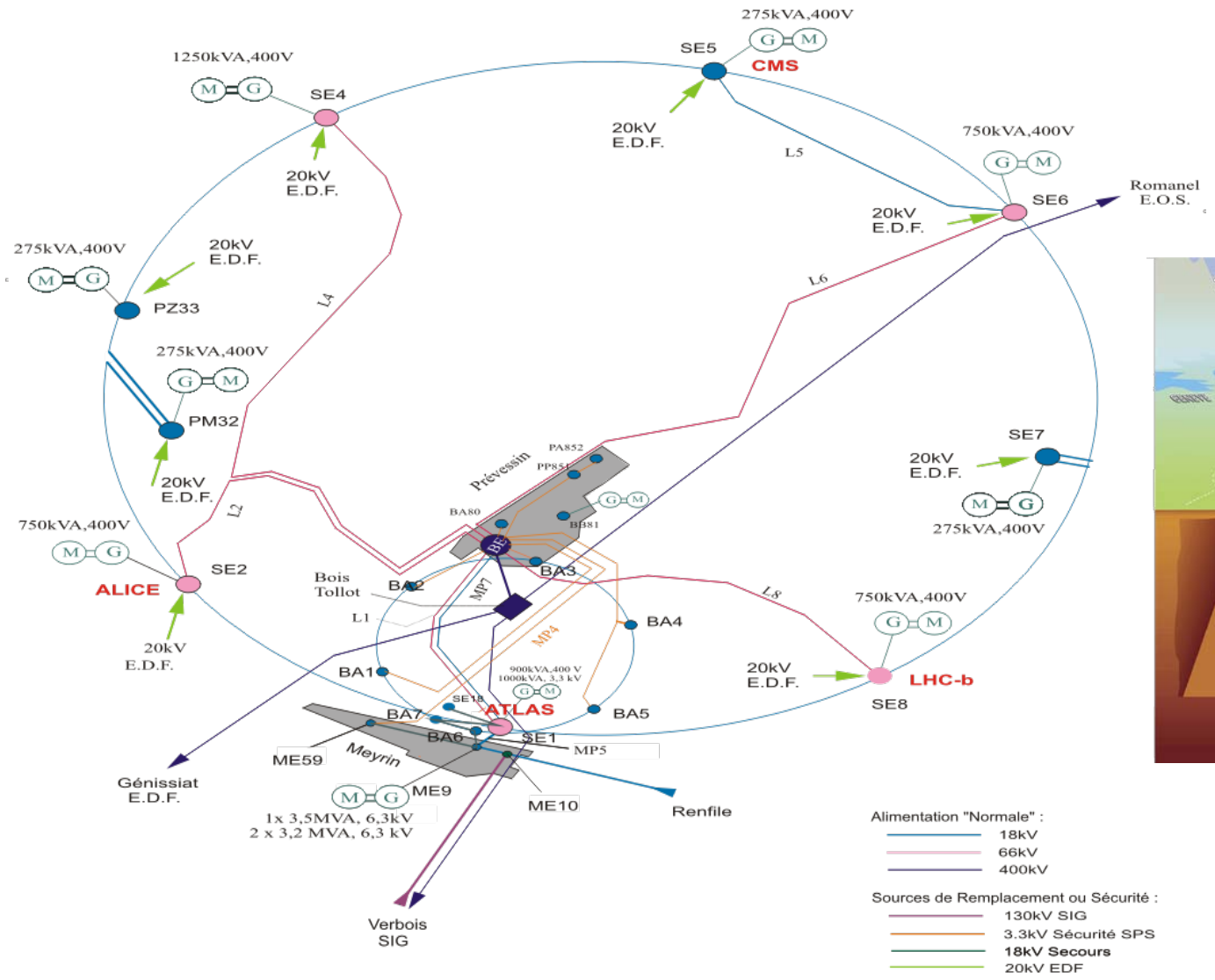
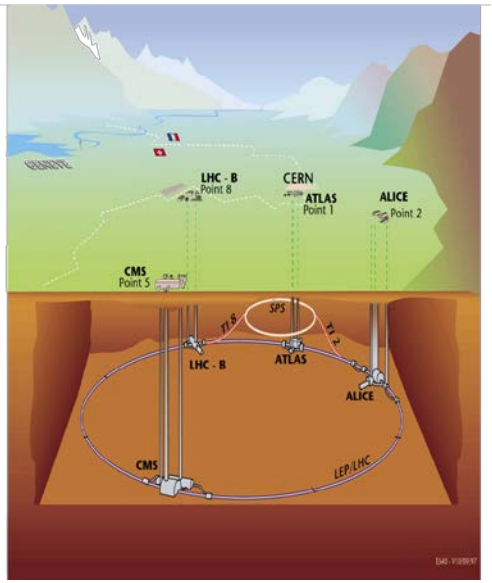
CERN accelerators complex

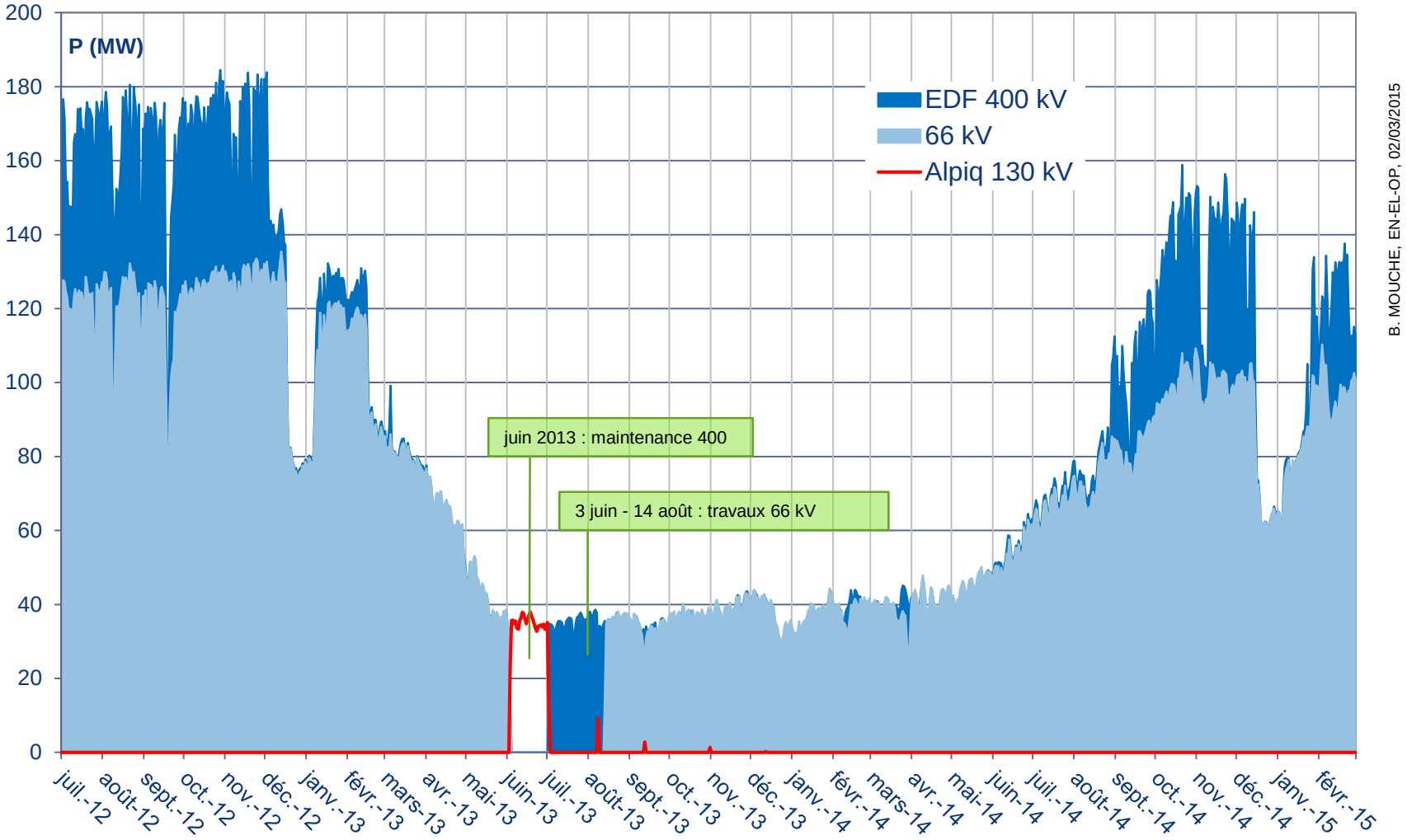


Electrical network: geographical extension





CERN daily average power

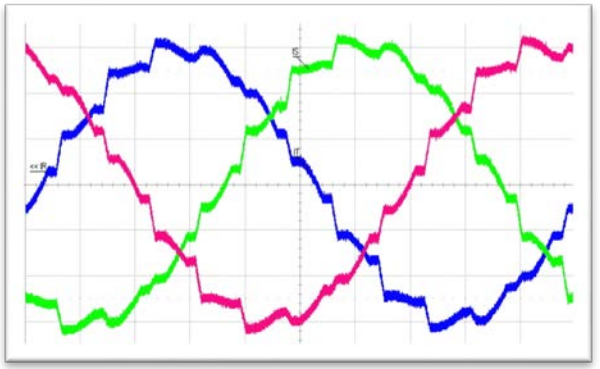


B. MOUCHE, EN-EL-OP, 02/03/2015

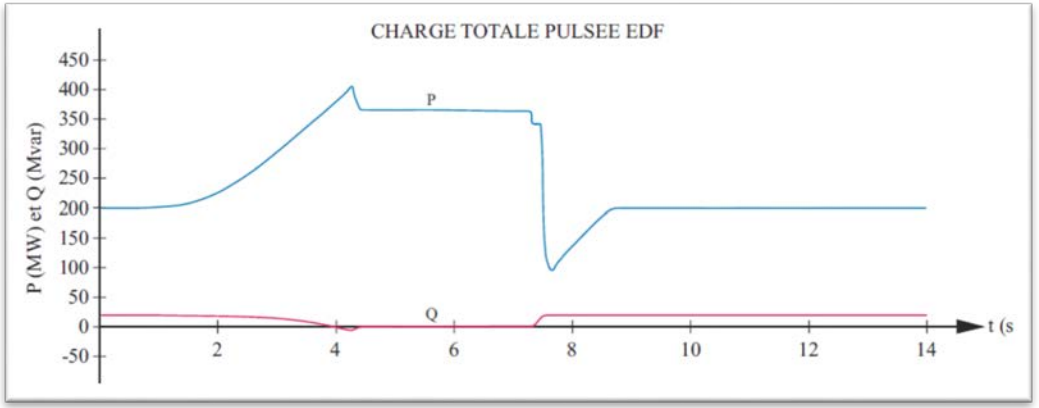
Electrical network: voltage levels

French source	400 kV
Swiss source	130 kV
Transmission	66 kV
Distribution	18 kV
Diesel generators	6.3 / 3.3 / 0.4 kV
Compressors and Pumps	3.3 kV
Consumers	400 / 230 V
Electrical equipment control	48 V_{DC}

Electrical network: type of loads



- Power converters
- Klystrons radio frequency
- Cryogenics compressors
- Pumps (vacuum, cooling towers, chilled water…)
- Ventilation systems
- Fire/Smoke/Gas detection and extraction
- Electronic racks
- Heating
- Lifts
- Lighting



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“Components” of the network

Can be classified in 5 groups:

HIGH VOLTAGE

- Transformers
- MV Cables
- Switchgears
- Gensets

LOW VOLTAGE

- 48 V_{DC} systems
- UPS
- Switchgears and switchboards
- LV Cables
- Gensets

CONTROL

- Supervision system
- PLC

CABLING

- Control cables
- Coaxial cables
- Water cooled cables
- Optical fibers
- Connectors

ENERGY

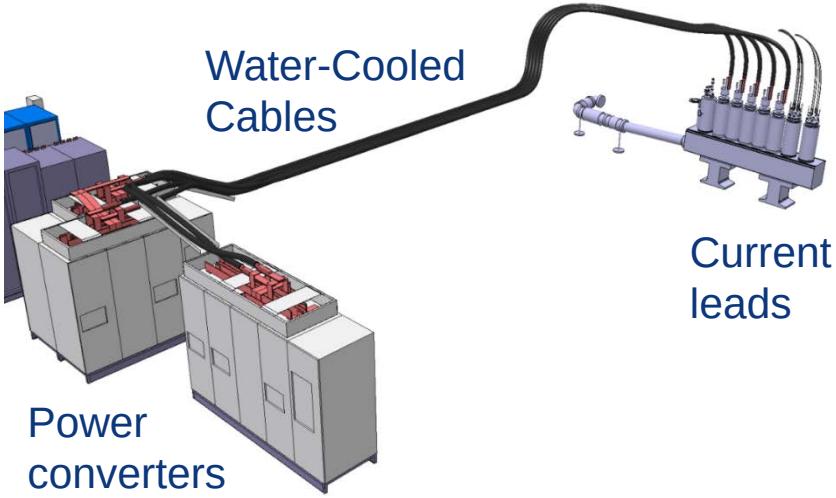
- Supply of energy

The activities related to the electrical network target companies with experience in these five sectors

Water-cooled cables: applications

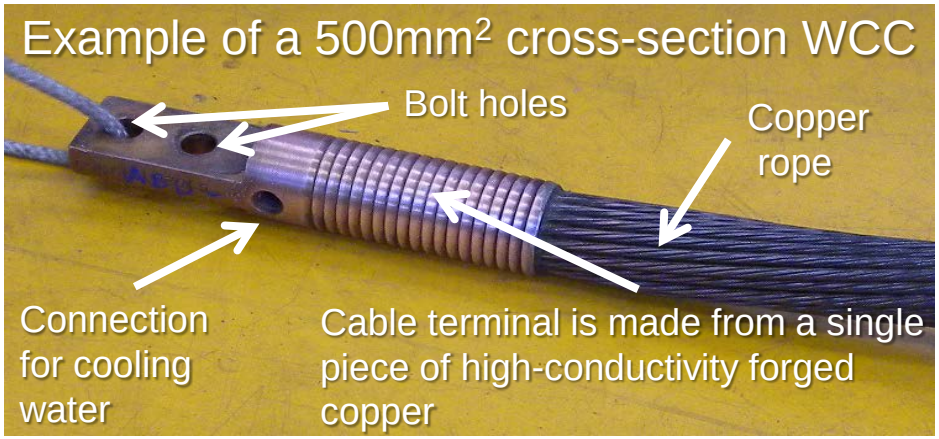
These flexible water-cooled cables or “WCC” are used for transporting high DC current from power converters to superconducting current leads

Cross-section (mm2)	Direct Current Intensity (kA)		Cable quantity	Total Length (Km)
	Nominal	Maximum		
500	3.5	5	192	1.53
800	6	8	133	1.50
1000	8	10	154	2.46
1300	8	10	38	0.79
2000	13	20	169	1.17



Water-cooled cables

Constitution



Characteristics

- Flexibility
- Simple concept
- High cooling performance
- High DC current-transfer efficiency (up to 6-10 A/mm² following section)

How activities are structured

- In general:
  - Blanket contracts for the supply of equipment
  - Service contracts for installation
- In some cases:
  - One contract for supply + installation
- For big projects:
  - Turn-key contracts
- Maintenance
  - Service contracts for maintenance

Example 1 – Procurement of non-standard cables

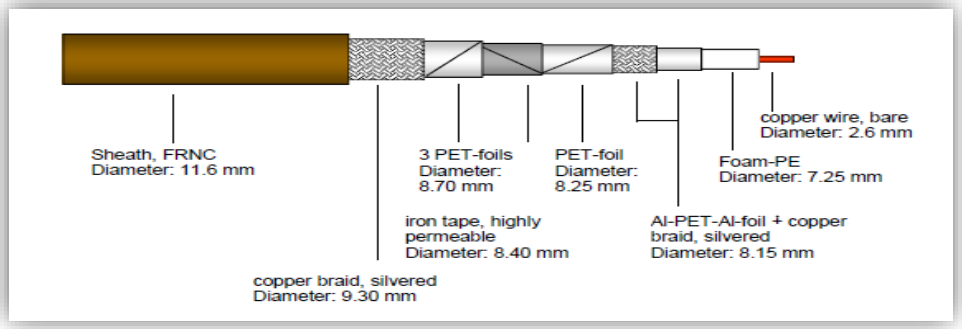
Buy to order for installations

Cable types

- Coaxial (3/8” and 7/8”)
- Low voltage (0.6/1.1 kV)
- High voltage (≥ 1.8 kV ≤ 66 kV)
- Multi wire (data, control, signal)

High voltage

Coaxial (triaxial)

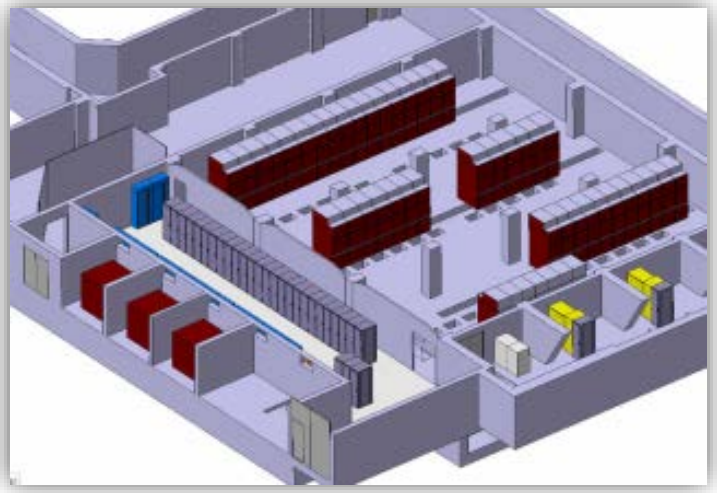


Cable specifications

- Fire resistant (IEC 60331)
- Low/high voltage (IEC 60502)
- Radiation resistant materials
  - Insulation/sheath materials with a Radiation Index of 5.7 (IEC 60544-4)
  - Special radiation resistant 5 x 10^7 Gy (Kapton®)

Example 2 – Renovation substations

Integration by CERN, equipment provided via blanket contracts, installation on site via a service contract



Example 3 – Turn key contract

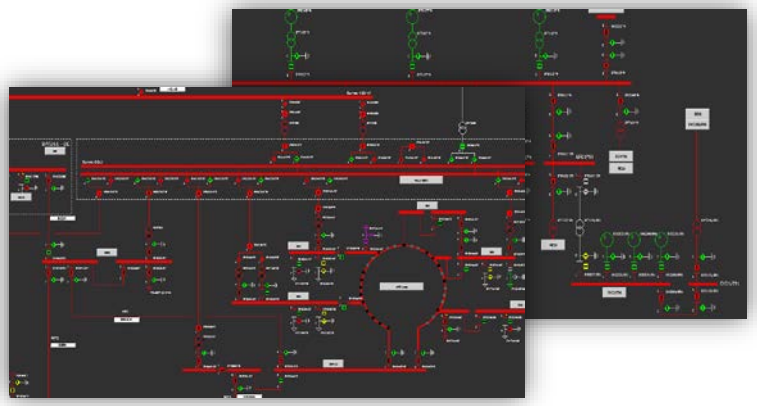
Diesel generator power station for the Prevessin site:
design of the building and electrical systems, civil engineering, supply and commissioning gensets…

Example 4 – Cables pulling & blowing

Organized in various ways, depending on the type of cables, type of activities and environment

Example 5 - Maintenance

400 kV equipment, transformers, PLCs, LV switchboards…
And corrective maintenance



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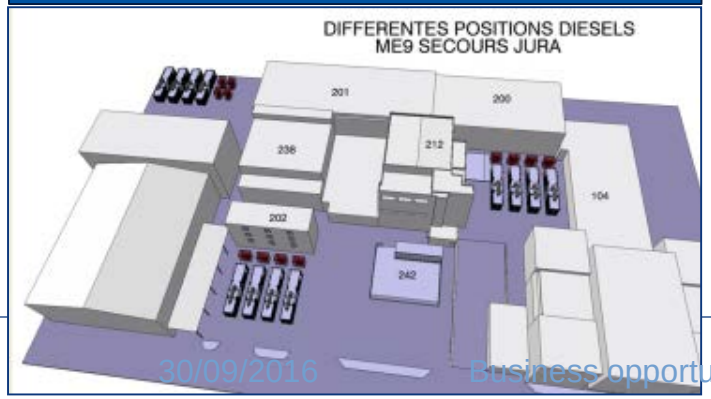
Main foreseen projects or contracts

- New substation 400 kV / 66 kV 220 MVA (ongoing)
- New diesel generator power station Meyrin (ongoing)
- Renovation 400 kV protection system (ongoing)
- Supply of protection relays (tendering)
- Supply and installation of high voltage cable accessories
- Maintenance HTB transformers (> 50 kV)
- …

Meyrin diesel power station (feasibility study)



New 400 kV power source (feasibility study)

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Conclusions

- The electrical network plays a central role in CERN accelerators complex
- The electrical network is evolving permanently thanks to consolidations and upgrades
- Maintenance is mandatory to keep reliability high

Industrial partners are fundamental to have a state-of-the art power distribution system

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Questions?


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