CERN HV Electrical network in 2025

IEFC 2011 Workshop
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Why ?

- Need to replace aging infrastructure (Meyrin)
- Ongoing consolidation
- Network to be adapted to future CERN requirements

This requires a coherent approach

➔ Long term objective (Towards 2025)

➔ Taking in account the complete network

➔ Coordinated actions

Outline

- Preamble
- Reference documents
- Scope
- Present network status
- 2025 Vision: Main topics
- Ongoing consolidations
- Priority / Schedule
- Further considerations

Preamble

- Limited to HV network (400 kV to 18 kV) and safety network 3.3 kV in Prevessin (SE0)
- Coherent project involving studies already done (See references)
- Taking in account the CERN power demand growth

Reference documents

- Réseaux CERN 1957-2007 [O.Bayard] [EDMS 964582]
- Description of the CERN electrical network [EDMS 559013]
- Plan de consolidation du réseau électrique du CERN [EDMS 855070]
- Note d'exploitation scenarii des reconfigurations du réseau 18 kV en cas de panne majeure [EDMS 1079852]
- LHC power consumption [EDMS 887719]
- Réseaux électrique de secours [EDMS 992475]
- Rapport incident du 29 juillet 2006 [EDMS 1097180]

Scope

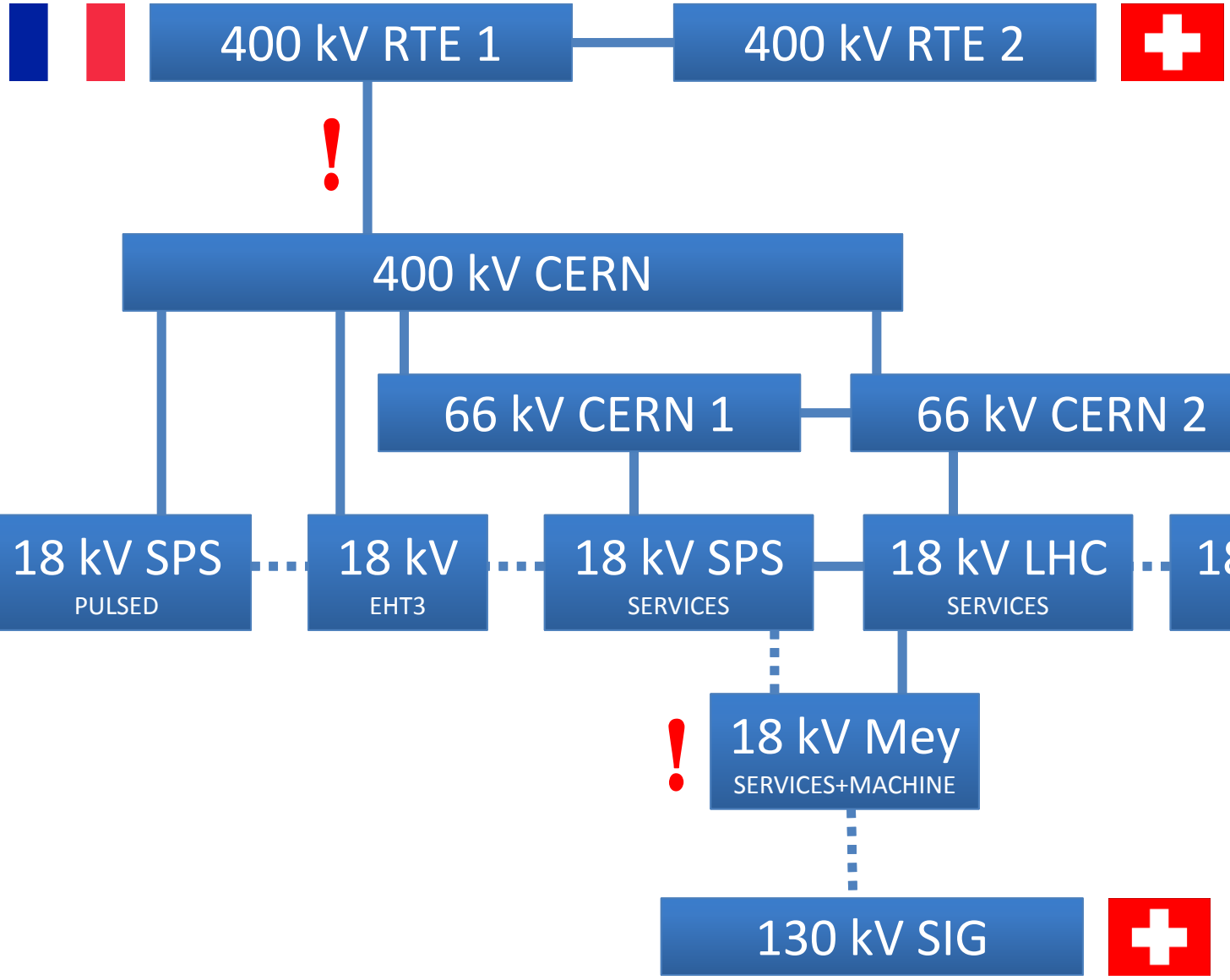
Reliability – Availability – Safety – Evolution

- Removal of obsolete and/or unsafe equipment
- Simplification for better operations and reliable protection systems
- Standardisation (coherence between sites and network types)
- Elimination of identified weak points (during tests & maintenance)
- Redundancy and availability on transport network
- Characteristics adapted to the CERN future projects

Present Network status

- From 50 years of CERN history, the sites and the types of network are not very coherent
- Operational difficulties
- Characteristics not well adapted to CERN future requirements
- Obsolete and unsafe equipment
- Complex protection systems

Present


400 kV RTE 1
400 kV RTE 2
!
400 kV CERN
66 kV CERN 1
66 kV CERN 2
18 kV SPS
PULSED
18 kV
EHT3
18 kV SPS
SERVICES
18 kV LHC
SERVICES
18 kV LHC
MACHINE
!
18 kV Mey
SERVICES+MACHINE
130 kV SIG

2025

400 kV RTE 1

400 kV RTE 2

66 kV RTE

400 kV CERN

66 kV CERN 1

66 kV CERN 2

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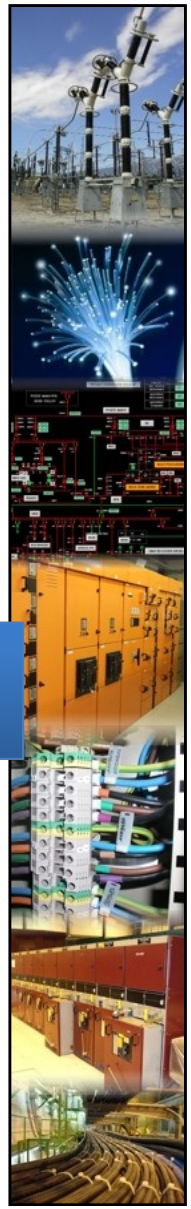
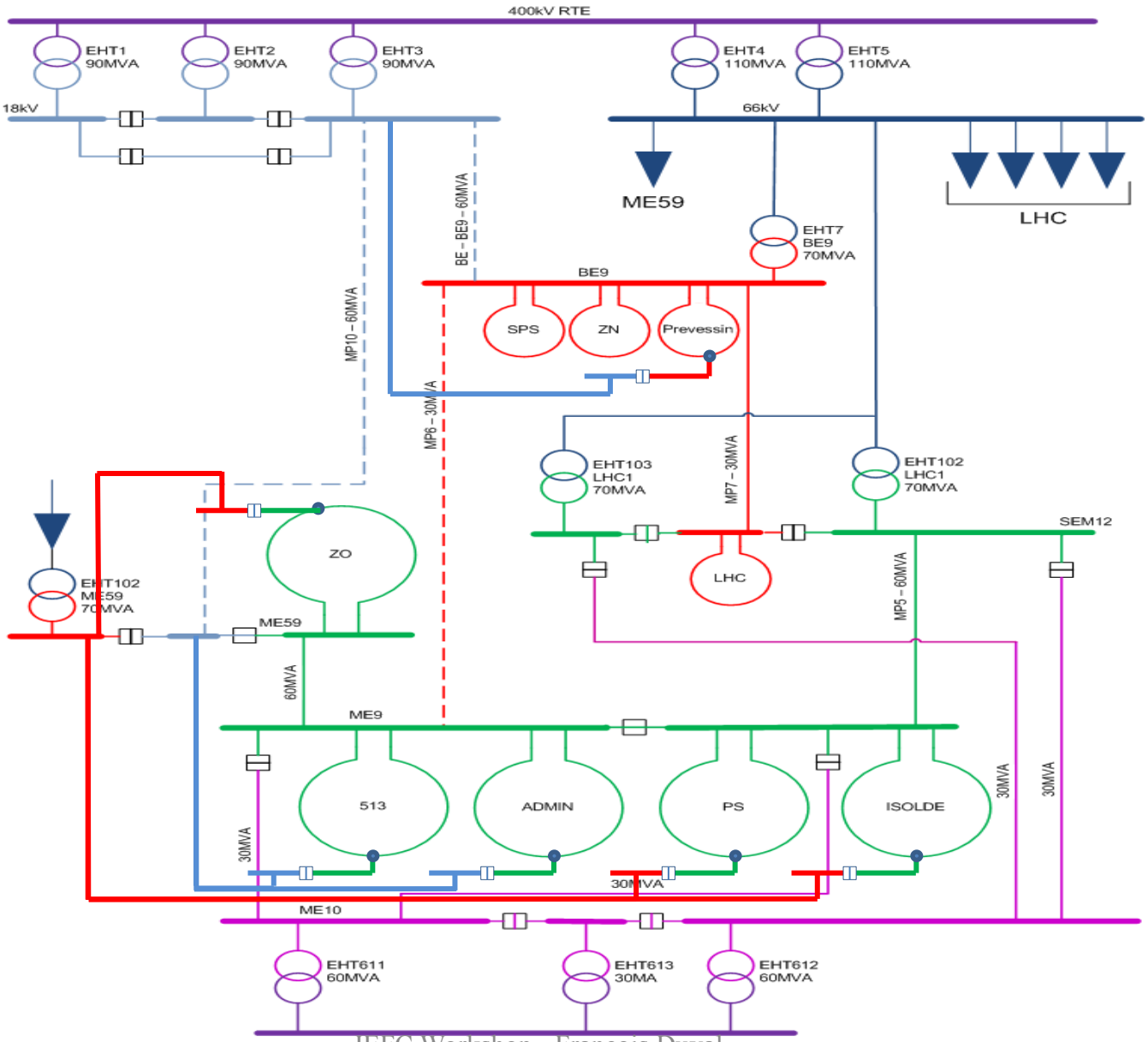


2025 Vision: Loops fed from almost 2 substations



Protection system

Consolidation (End 2010)

- Inter-trips on main inter-site links
- Digital blocks for ME9/SEM12/BE9 links

Development (2011 → 2025)

- Replacement of old relays (66 kV substation and others). Electronic relays installed in the ’80s (life time: 20 years)
- Network and selectivity computer simulation
- Dedicated Ethernet network to be implemented between substation for updated protection functions (standard IEC 61850)

Relay techno.	Installation	Number	Site
Electro./fuses	27-45 years	225	MEY – ZN - SPS
1st electronic gen.	17-27 years	250	LEP
2nd electronic gen.	0-17 years	470	LHC – MEY - SPS

2025 Vision: Main topics

- Have a dedicated transport network (separated from distribution) at 18 kV , 60 MVA. This network will be organized around the following existing substations: ME10 – ME9 – ME59 – SEM12 et BE9
- Segregate “Machine” and “ General services” network in Meyrin
- dedicate loop for IT (B.513).
- Consolidate Diesel safety network 3.3 KV at Prevessin and SPS
- Provide ‘almost’ 3 power sources to the main substations.
- Feed 18 kV loops from ‘almost’ 2 different substations
- Ensure redundancy on 400 kV power transformers
- Minimise number of selectivity levels

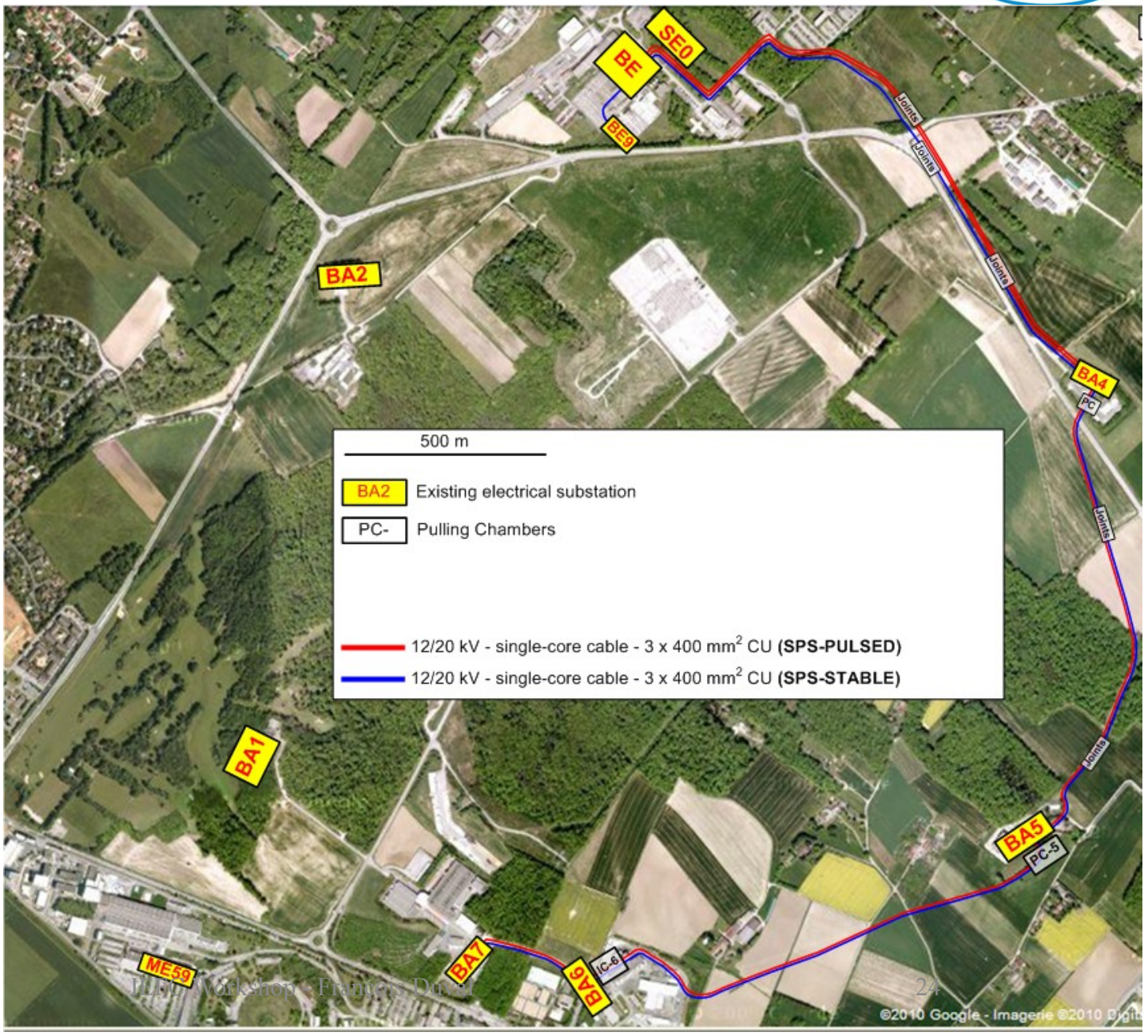
Ongoing consolidation: SPS – Status 12/2010

Done (2003)

- Stable BE9-BA4-BA5
- Pulse BE-BA4-BA5
- Stable BA6-BA7
- Pulse BA6-BA7

Ongoing (03/2011)

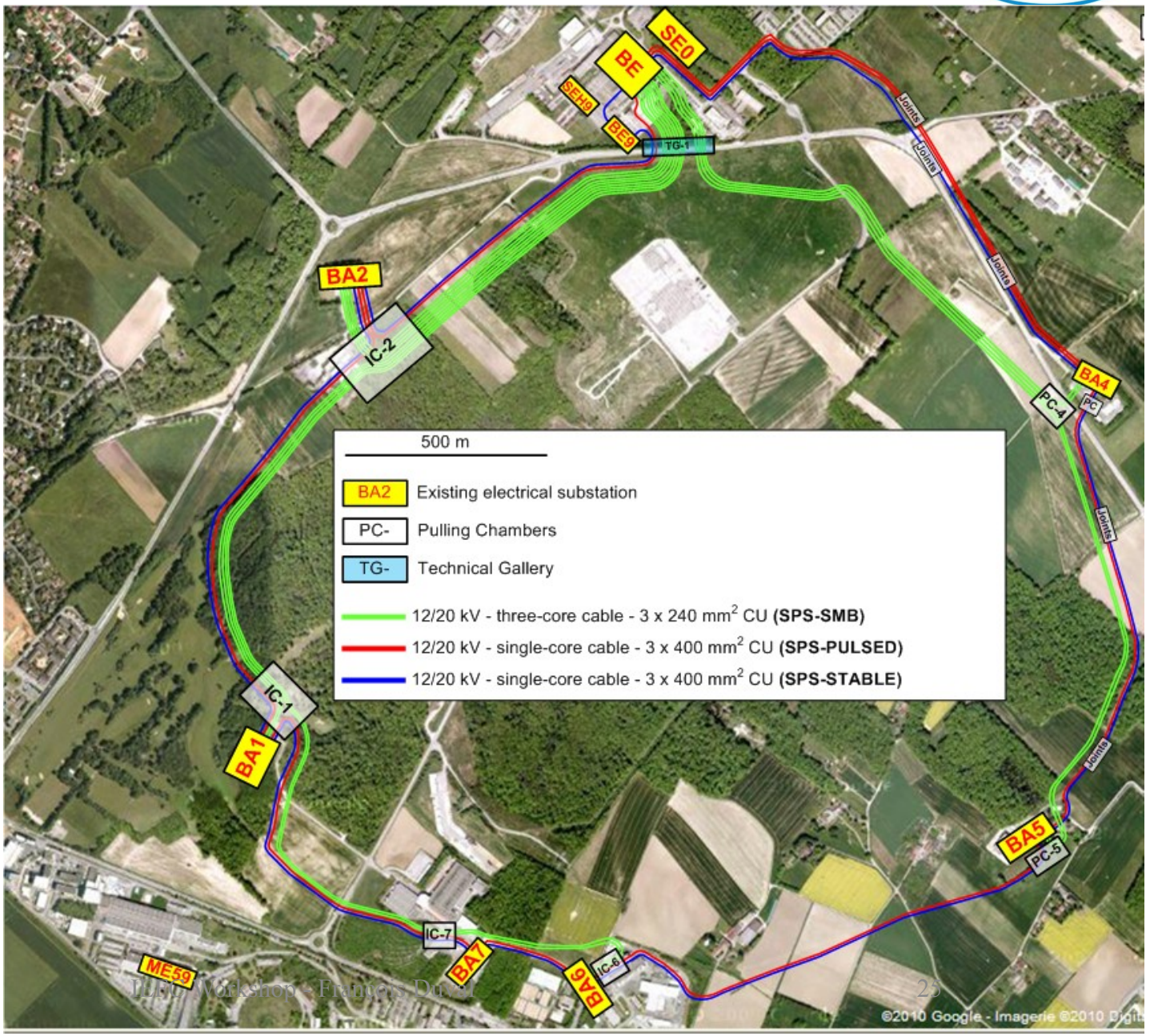
- Stable BA5-BA6
- Pulse BA-BA6



Ongoing Consolidation: SPS –2011-2012

To be done

- Stable BA2-BA1-BA7
- Stable BA2-BA1-BA7
- SMB BE-BA2
- SMB BE-BA1
- SMB BE-BA6
- SMB BE-BA4
- SMB BE-BA5



Ongoing consolidation: SPS –2011-2012

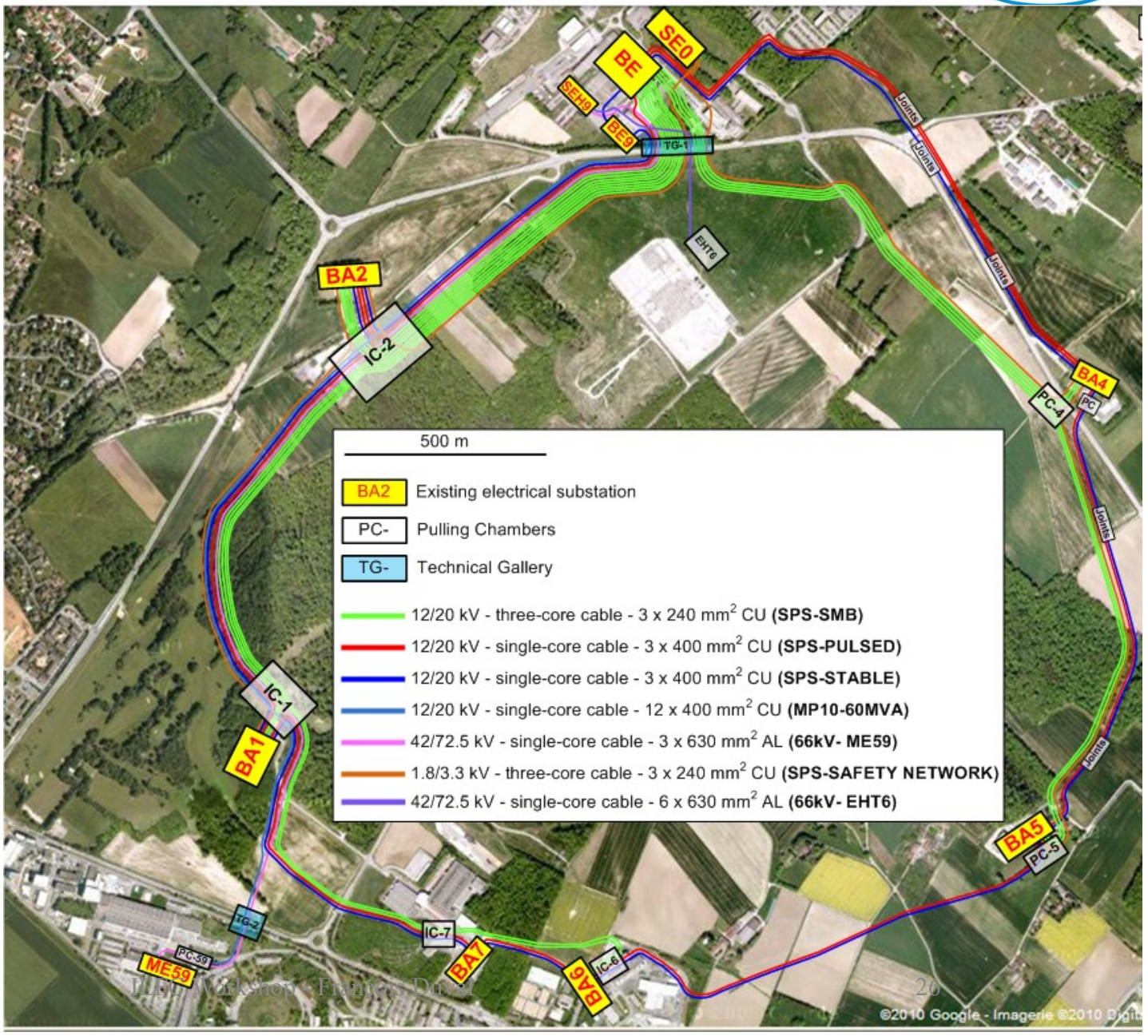
In addition

Taking advantage of the trench opened for SPS cable, we will lay necessary tubes for the 2025 network

Implementation:

Forcast

- 3.3 kV SAFETY
  - SE0-BA4-BA5
  - SE0-BA2-BA1
- MP10 - 18 kV - 60 MVA
- 66 kV - ME58 - 70 MVA
- 66kV - EHT6 - 220 MVA



Priority / Schedule until next shutdown

- The replacement of ME9 JURA substation, unique Meyrin site feeder is our first priority

  To do so, we need to develop our transport network in the following sequence:

  1. BE91* ; New SE0 *; ME591**, BA5*** (2011/2012)
  2. then new ME59 (66kV)**, BA1*** (2012)
  3. Meyrin fed from ME59 (2013)
  4. New ME9 (2013/2014)
  5. New transformer from RTE (2014/…..)
  6. Then the rest…

*Linked to CCC repowering project

**Can be done during accelerators runs

*** Ongoing SPS consolidation

Further considerations

To make the right decisions in our consolidation we need accurate power demand and location forecast from users and particularly from new projects (LIU, Consolidation, High luminosity LHC, RF, etc.)

Further considerations

As far as we can estimate, the cost of this program is about 80 MCHF which is 5 to 6 MCHF a year. Our feeling is that represents a normal average trend to be extended to 2025….

A complete document describing the whole consolidation program until 2025 will be published soon.