Thematic industry days, 19-20 September 2022

Cabling, assembly and industrialization of electrical cabinets/switchboards, power converters and switchgears

Business opportunities related to CERN Electrical Group

Julien Emonds-Alt, Electrical Group
Julien.emonds-alt@cern.ch

ENGINEERING DEPARTMENT

Outline

- Mandate of the Electrical Group
- CERN electrical network
- Supply and service contracts
- Upcoming industrial opportunities

Mandate of the Electrical Group

1. Electrical transmission and distribution network
   - Electrical equipment from 400 kV to 230/400 V
   - Operation & Maintenance
   - Projects – Consolidation, upgrade and extension
   - Electricity supply

2. Optical fibre network
   - Single-mode fibres, multi-mode fibres and special fibres for specific applications
   - Projects, Operation & Maintenance

3. Cabling installation services
   - Power cables
   - Signal cables

Electrical Network

- Voltage levels
  - 400 kV – 130 kV – 66 kV
  - 20 kV – 18 kV – 3.3 kV
  - 400 V – 230 V
  - 48 V DC
- Main types of networks
  - General services
  - Machine
  - Secured
  - UPS distribution
  - DC distribution
- Equipment quantities
  - HV power transformers – 14
  - Distribution transformers – 400
  - MV switchgear – 1380
  - LV switchboards – 760
  - UPS systems – 330
  - Monobloc batteries – 27 000
  - 48 V DC systems – 100
  - Diesel generators – 16
  - Optical Fibre – 45 000 km

700 MVA installed at 400 kV level

>350 MCHF of installed assets

Supply and Service Contracts

- Blanket contracts for the supply of equipment
  - 12 currently in place (Transformers, LV Switchboards, MV Switchgear, UPS, 48 V systems, Optical fibres, etc.)
  - 5 years typical duration

- Service contracts
  - 8 contracts currently in place
    - 2 for installation (cabling & electrical equipment, fibre optics)
    - 6 for maintenance (General maintenance, LV Switchboards, MV Switchgear, Diesel Generators, UPS, etc.)
  - 3 years typical duration

- One-time supply purchase orders

Upcoming Industrial Opportunities - Supply

Ref	Contract description	Contract type	Market Survey	Invitation to Tender	Estimated volume
	Supply & installation of primary equipment for **66 kV substation**	Purchase order	Q3 2022	Q4 2022	-
	Supply & installation of a 66/18 kV 38 MVA **power transformer**	Purchase order	Q4 2022	Q1 2023	1 unit
	Supply of **24 kV** compact **switchgear**	Blanket contract	2023		TBD
	Supply of 2 emergency **gensets** rated 1.5 and 2.5 MVA	Purchase order	Q2 2023	Q4 2023	2 units
	Supply of **UPS units** from 20 to 200 kVA	Blanket contract	Q1 2023	Q2 2023	100 units
	Supply of **UPS installations** from 300 to 2000 kVA	Purchase order	Q3 2024	Q4 2024	4 installations
	Supply of lead acid **batteries** for UPS	Purchase order	2023		2300 monoblocs
IT-4749	Supply of **LV switchboards**	Blanket contract	Q1 2022 Ongoing	Q4 2022	125 units
IT-4727	Supply of **optical fibre ducts** and **microducts**	Blanket contract	Q3 2022 Ongoing	Q4 2022	200 km
	Supply of radiation resistant single mode optical fibres	Blanket contract	2023-24		1500 km
IT-4643	Supply of **water-cooled cables**	Blanket contract	Ongoing	Q4 2022	120 cables – 2.5 km

Upcoming Industrial Opportunities - Service

Ref.	Contract description	Comments	MS	IT
IT-4717	Maintenance of Borri UPS systems	Existing contract with Borri	Q2 2022 Ongoing	Q4 2022
	Maintenance of 400 kV and 66 kV transformers	New contract	2022	
IT-4740	Maintenance of diesel generator sets	Existing contract with 2H Energy	Q2 2022 Ongoing	Q4 2022
IT-4766	General maintenance services	Existing contract with COMSA	Q3 2022 Ongoing	Q4 2022

Opportunities – 66 kV Substation

- New 66 kVA substation for LHC point 5
- Purchase order for the **Primary equipment**
  - Beginning of procurement process in September 2022 (Market Survey)
  - Scope: Detailed Design, Supply, Installation and Commissioning
  - Equipment: Breaker, Current Transformers, Potential Transformers, etc.
  - Installation during 2025
- Purchase order for the 66/18 kV **38 MVA Power Transformer**
  - Beginning of procurement process in Q4 2022 (Market Survey)
  - Scope: Supply, Installation and Commissioning
- Separate tender for Engineering and Civil works

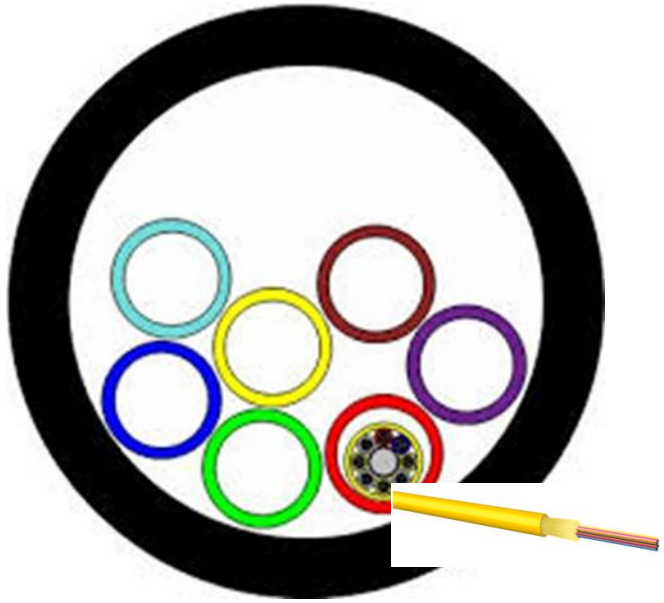
Opportunities – Optical Fibres

- Supply of optical fibre **ducts and microducts** for cable blowing
  - ➢ Tender ongoing
- Supply of **radiation resistant single mode optical fibres**
  - ➢ Specialty fibres for telecom and sensing
  - ➢ Tender foreseen in 2023

Ducts with microducts

Concerning Specialty Fibres, we are also keen to explore opportunities/partnerships with experienced manufacturers for:

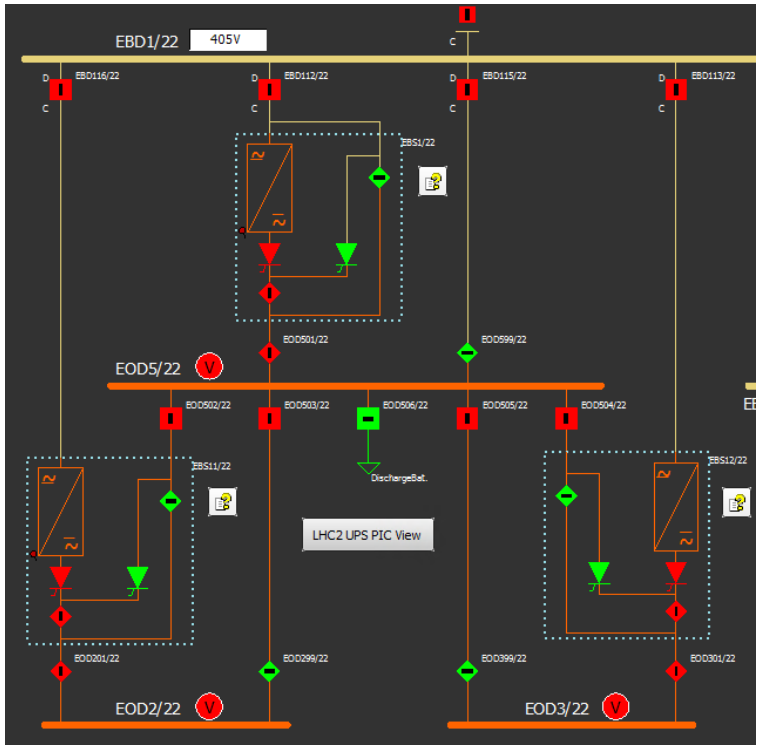
- **radiation-sensors** (e.g. with Phosphorous-doped fibres or radio-luminescent fibres)
- **polarization maintaining fibres**



Microduct fibre cable

Opportunities – UPS

- More than 330 UPS installed, operated and maintained by CERN Electrical Group (36 MVA)
  - Accelerator protection
  - Experiments
  - IT Data center
- UPS
  - Unitary power rating ranging from 10 to 600 kVA
  - Monolithic UPS
  - Double conversion
  - Single / Cascade / Parallel configurations
- Battery
  - Valve Regulated Lead Acid batteries (VRLA)
  - 10 min typical autonomy
  - Installed in cabinet or on rack



Opportunities – UPS 20 to 200 kVA

- Contract: Blanket purchase contract, 5 years
- Scope: Supply of UPS and associated batteries (…maybe UPS only)
- Schedule: Market survey Q1 2023, Invitation to Tender Q3 2023
- Estimated volume
  - Up to 60 kVA – 50 units
  - 60 to 120 kVA – 30 units
  - 120 to 200 kVA – 20 units
- UPS
  - 3x400V+N, TN-S, 50 Hz
  - Modular UPS, N+1 redundancy
  - Static bypass / Manual Bypass included
  - Compliant with IEC 62040 (+ NF C 58 311)
  - max. 400 V DC battery
  - Front and rear access
- Battery
  - AGM VRLA
  - Front terminals
  - Eurobat “Very long life, >12 years”
  - 10 min typical autonomy
  - Battery Monitoring System included

Opportunities – UPS installations above 200 kVA

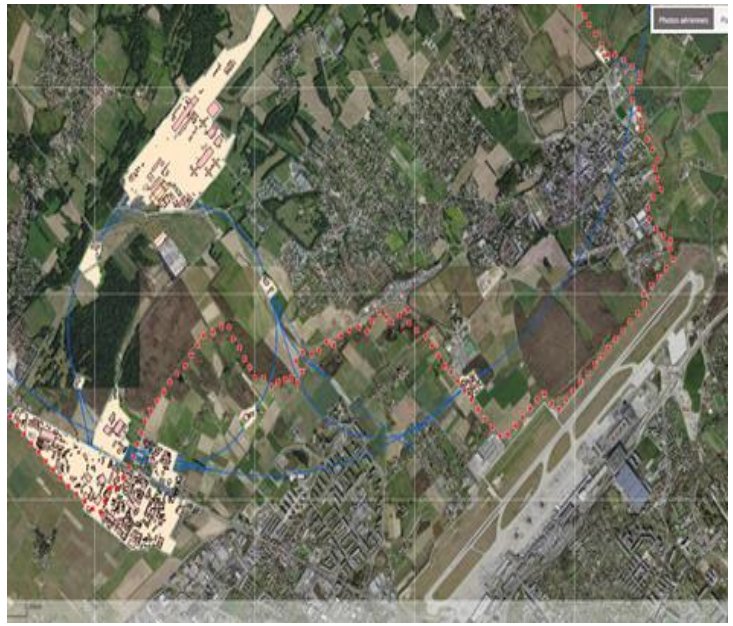
- Contract: One-time supply purchase order(s)
- Scope: Supply of UPS and associated batteries, Commissioning and Maintenance
- UPS installation needs
  - 300 kVA (N+1)
  - 800 kVA (N+1)
  - 1200 kVA (N+1)
  - 2000 kVA (N+1)

  } Procurement process Q3-Q4 2024
- UPS requirements
  - Monolithic UPS (unitary power rating above 200 kVA)
  - Parallel operation with N+1 redundancy
  - Industrial application (high THDi, inrush current, etc.)
  - Particular loads (physic experiments)
  - Alternative solution envisaged: Static switch(es) + Inverter(s)
- Battery requirements – Same as 20 to 200 kVA UPS supply contract

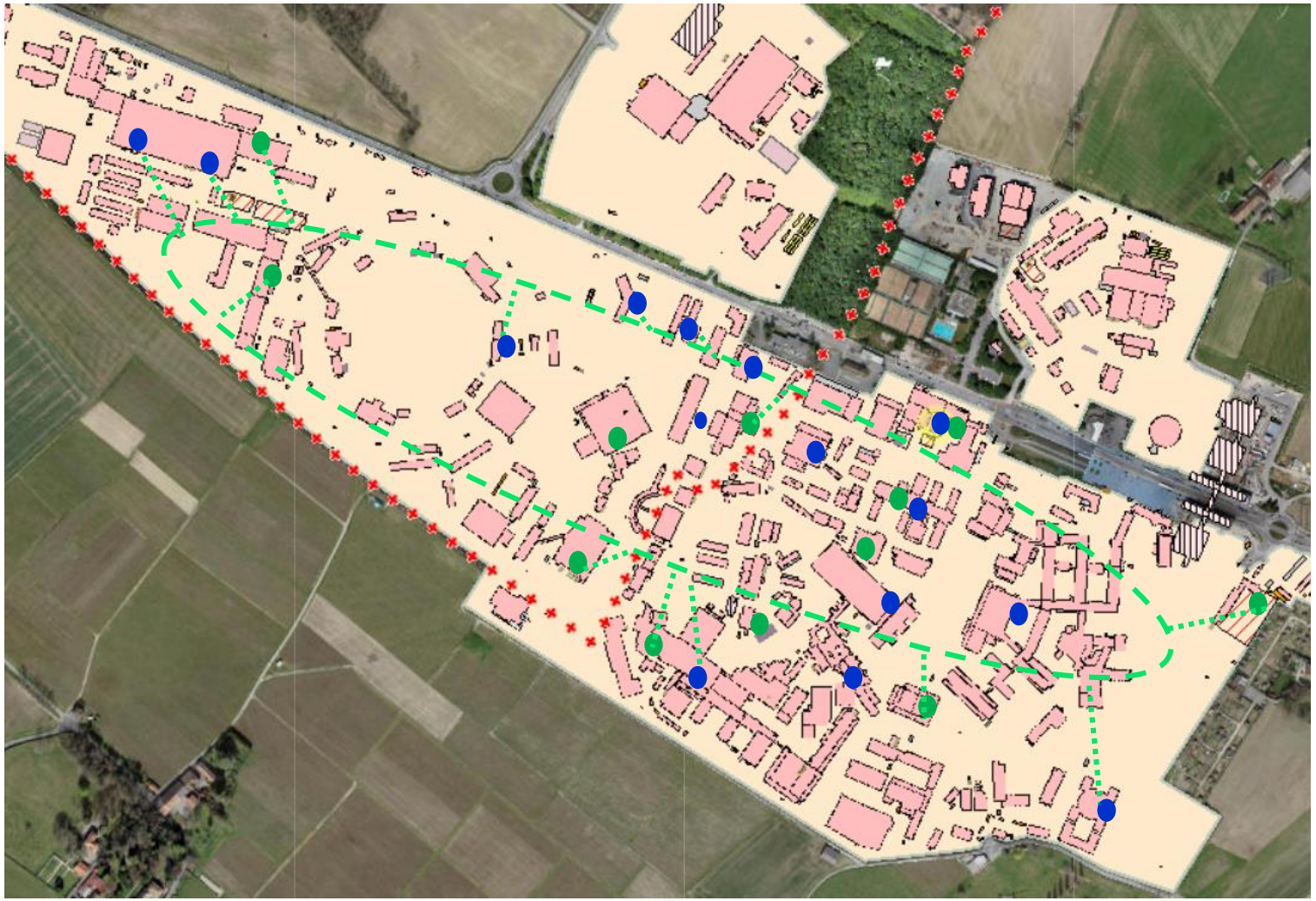
Opportunities – DC Community Concept

- Objectif: Reduction of the number of batteries in operation (UPS application) → DC Community is one of the envisaged solutions
- Situation
  - CERN is composed of wide sites
  - On each site, many UPS (low rated power) and 48 V systems are implemented
    → Include batteries
  - Our UPS and 48 V systems are often redundant and not fully charged
    → Batteries contain huge reserve of energy, not used
- Concept
  - **Sharing the energy reserve present on every location on a DC bus routed around the site**
  - Any UPS without dedicated batteries can be connected on the DC bus and profit from the energy reserve

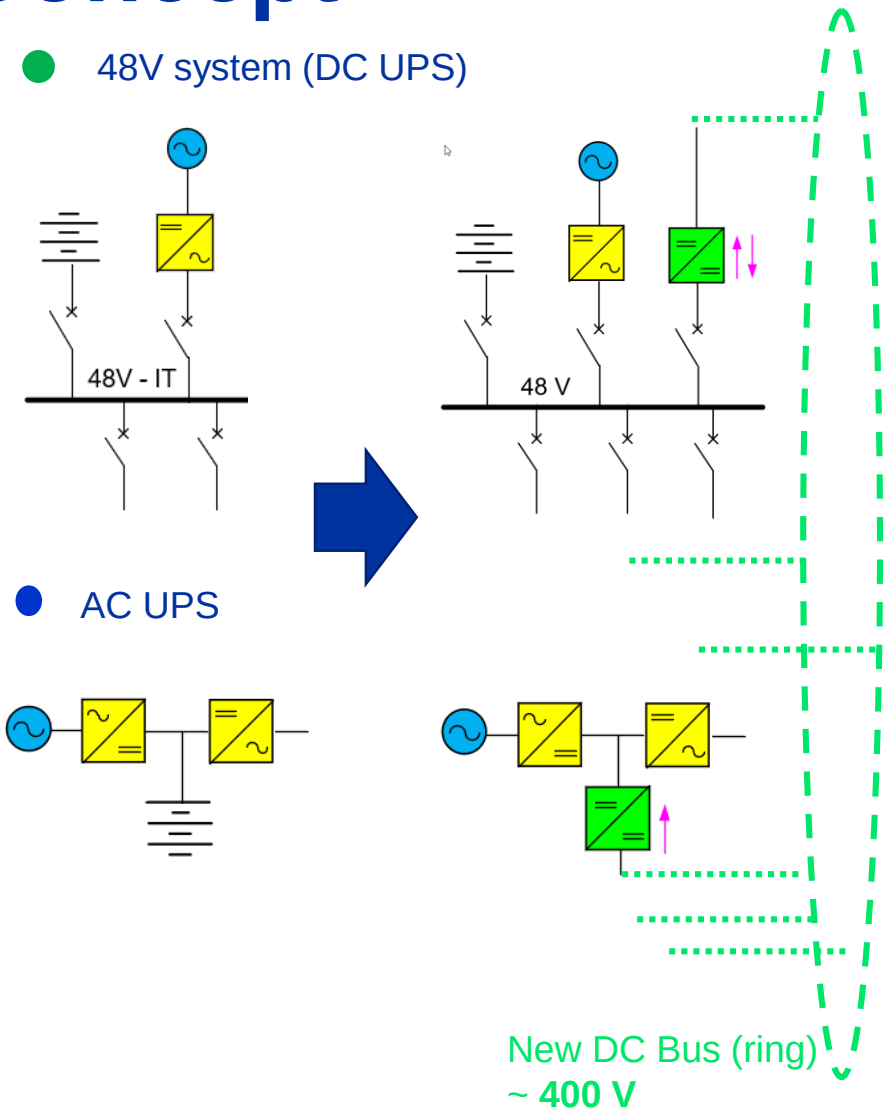
  → Similar concept proposed by some manufacturers



Opportunities – DC Community Concept



CERN Meyrin

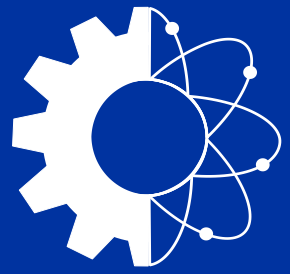


Opportunities – DC Community Concept

- Technical feasibility ongoing
  - DC bus ~ 50 to 100 kW
  - Availability of 48 V DC/ 400 V DC converters (isolated, ~5 kW/system, bidirectional)
  - Availability of the UPS with dual input 230 V AC and ~400 V DC
  - Load sharing (statism/droop regulation, no bus)
  - Reliability of the DC grid (fault tolerant)
- Economical evaluation ongoing
  - DC ring cost
  - Converters cost
  - Comparison with centralized UPS
  - Reduction of the number of batteries
- Please contact us if you have experience or product to push the concept forward

Thank you for your attention

Q&A



Engineering Department