SUMMARY

- EN-EL-CF SECTION
- FIBER UNIT MAIN ACTIVITIES
- ORGANISATION FOR LS1
- COLLABORATION WITH CERN EXPERIMENTS
- OVERVIEW ON THE COLLABORATION FOR CMQ DAQ UPGRADE
THE SECTION

EN-EL-CF : Cabling and Optical Fibre Section

MANDATE

- Provide and standardise copper (DC & control) and fibre cabling systems for all CERN users
- Organise cabling installation and removal campaigns
- Assure preventive and corrective maintenance
- Provide and manage an optical fibre installation database

ORGANISATION

- 3 Units
FIBRE UNIT MAIN ACTIVITIES:

- In collaboration with CERN users, design and manage the optical fibre infrastructure

- Establish and manage industrial contracts for the supply and installation of passive optical fibres components
  - A large contract for supply and installation of all standard components (fibres, cables, terminal equipment, patchcords)
  - Large contracts for supply of RAD-RESISTANT fibres (~ 2500 km) plus cabling (~100 km) within existent frame contract

- Qualification, quality assurance and quality control of specialty optical fibres and new passive optical components through frame contract.
  - Laboratory equipped with microscopes, interferometers, OTDR, insertion loss/return loss meters for single and multi-fibre connectors.
  - CERN Safety Instructions Compliant
  - Standard Passive Solutions for all CERN users

Fig. 1 - Overview on the complex and capillary fibre infrastructure at CERN with approximately 30'000 km
**ORGANISATION OF FIBRE UNIT FOR LS1**

- **ANTICIPATION OF LS1: PREPARATION STARTED ABOUT 1.5 YEARS BEFORE**
  - Studies, qualification and procurement components
  - Establish deadline for new projects requests
  - 18 Large projects and 350 works for LS1

- **SMOOTH SECTION MANPOWER INCREASE BEFORE LS1**

- **DELIVER PLANNING OF ACTIVITIES TO CONTRACTOR**
  - Organisation of contractors resources and expertise
COLLABORATION WITH CERN EXPERIMENTS DURING LS1

EXAMPLES OF OPTICAL FIBRE REQUESTS

- Qualification and supply of components (ex: Trunk Cables)
  - CMS DT Barrel Muon Detector
  - CMS Trigger Upgrade
  - TOTEM

- Project design, supply and installation of components
  - CMS Data Acquisition System Upgrade
  - CMS Fibre Sensor System
  - ALICE T0/V0 Upgrade
  - ALICE TPC Upgrade for LS2
  - LHCb DAQ Upgrade (17000 FO)
COLLABORATION FOR CMS DAQ UPGRADE

1ST Phase: Project design, supply and installation of components
- From SCX5-1 to USC55-S2
- 1700 Multimode OM3 Fibres
- LC connectors for active equipment

2nd Phase: Qualification and supply of optical components
- USC55-S1/S2
- Passive Terminal Equipment
- Patchcords and Patchcables
COLLABORATION FOR CMS DAQ UPGRADE (1st Phase)

PRELIMINARY STUDY OF TECHNICAL FEASIBILITY
COLLABORATION FOR CMS DAQ UPGRADE (1st Phase)

PROJECT DESIGN AND COST ESTIMATION

**CMS DAQ:** Liaison SCX5 (3562) – USC55 (3524)
COLLABORATION FOR CMS DAQ UPGRADE (1st Phase)

PROCUREMENT OF COMPONENTS
- Ducts, microduct, cables
- Optical terminal equipment
- Patchcords

PREPARATION OF TECHNICAL DOSSIERS, SAFETY PROCEDURES AND PLANNING
COLLABORATION FOR CMS DAQ UPGRADE (1st Phase)

WORK EXECUTION & CONTROL BILL OF QUANTITIES
COLLABORATION FOR CMS DAQ UPGRADE (2nd Phase)

PROJECT DESIGN OF HIGH DENSITY MANAGEMENT SYSTEM IN USC55-S2
COLLABORATION FOR CMS DAQ UPGRADE (2nd Phase)

- PROCUREMENT OF COMPONENTS
  - Optical terminal equipment
  - Patchcables and Patchcords

- QUALITY CONTROL
  - Visual inspection of components (cables and terminal equipment)
  - Measurements of ferrules end-face geometry (interferometer)
  - Insertion and return loss measurements
COLLABORATION FOR CMS DAQ UPGRADE (2nd Phase)

PROCEDURES FOR INSTALLATION & CLEANING

ATTENTION! se rappeler de nettoyer les connecteurs et les adaptateurs avant de connecter!

1. Make sure that the leads are turned off before you begin the inspection.
2. Remove the protective dust cap using the reverse adapter to avoid any contact with your fingers in the process.
3. Insert the hexagonal nut of the connector head into the connector. Keep the hex nut aligned with the connector.
4. Follow the picture to hold the connector. Place the connector into the socket. Lower the screwdriver into the socket of the connector.
5. Insert the patch-ribbon into the connector. Keep the hex nut aligned with the connector. Keep the hex nut aligned with the connector. Keep the hex nut aligned with the connector.
6. Put back the cap on the lead.

Cleaning F2000 Connectors

- Cleaning Cassette
  - Can be purchased at the CERN store:
    - 24 13 01 000 8 : Pile cleaner with cleaning cassette
    - 24 13 01 000 9 : Cleaning spare reel

- Bulkhead Module
  - 1. Make sure that the leads are turned off before you begin the inspection.
  - 2. Remove the protective dust cap and store it in a small container.
  - 3. Insert the patch-ribbon into the connector. Keep the hex nut aligned with the connector. Keep the hex nut aligned with the connector. Keep the hex nut aligned with the connector.
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COLLABORATION FOR CMS DAQ UPGRADE (2nd Phase)

IMPLEMENTATION RESULTS
COLLABORATION FOR CMS DAQ UPGRADE (2\textsuperscript{nd} Phase)

PROJECT DOCUMENTATION

(1\textsuperscript{st} Phase)

Cabling and Optical Fibre Section (EN-EL-CF)

(2\textsuperscript{nd} Phase)
Thanks
Backup slides
INDUSTRIAL SUPPLY CONTRACT SPECIFICATIONS:

- Detailed requirements on
  - Compliance with ITU-T international standards
  - Radiation resistance and optical properties
  - Spool minimum lengths, tracking, etc.
- 2500 km procured in 2006 plus 2400 km procured in 2012 (~150 km/month)

A QUALITY ASSURANCE PLAN, WITH EXTENSIVE QUALITY CONTROL WAS PUT IN PLACE:

- Extensive fibre qualification tests performed during 2 years before contract placement
- Each preform was tested (radiation).
- Implemented cabling and fibre tracking system at both manufacturer's and CERN
10GbE, 40GbE and 100 GbE upgrade

QUALIFICATION OF COMPONENTS FOR HIGH DENSITY SYSTEM
- Sub-Racks 4U for 288 fibres
- Terminal Modules (2*12F MTP to 24 LC)
- Trunk Cable with 12F MPO for 72 OM4 FO
- High performance MPO connectors with Elite Ferrule

SUPPLY AND INSTALLATION OF MODULAR CABLING SYSTEM
- Polarity Method B
- Max. Channel Insertion Loss 1.5 dB
- Average MPO/MTP loss 0.1 dB (max. 0.35 dB)
- Minimum Return Loss 25dB