Good morning everyone!

I will try to stick to timetable ! ☺

I apologize in advance if I will be some time rude or "direct" in my slides…and not politically correct ☺

Let's move on ☺

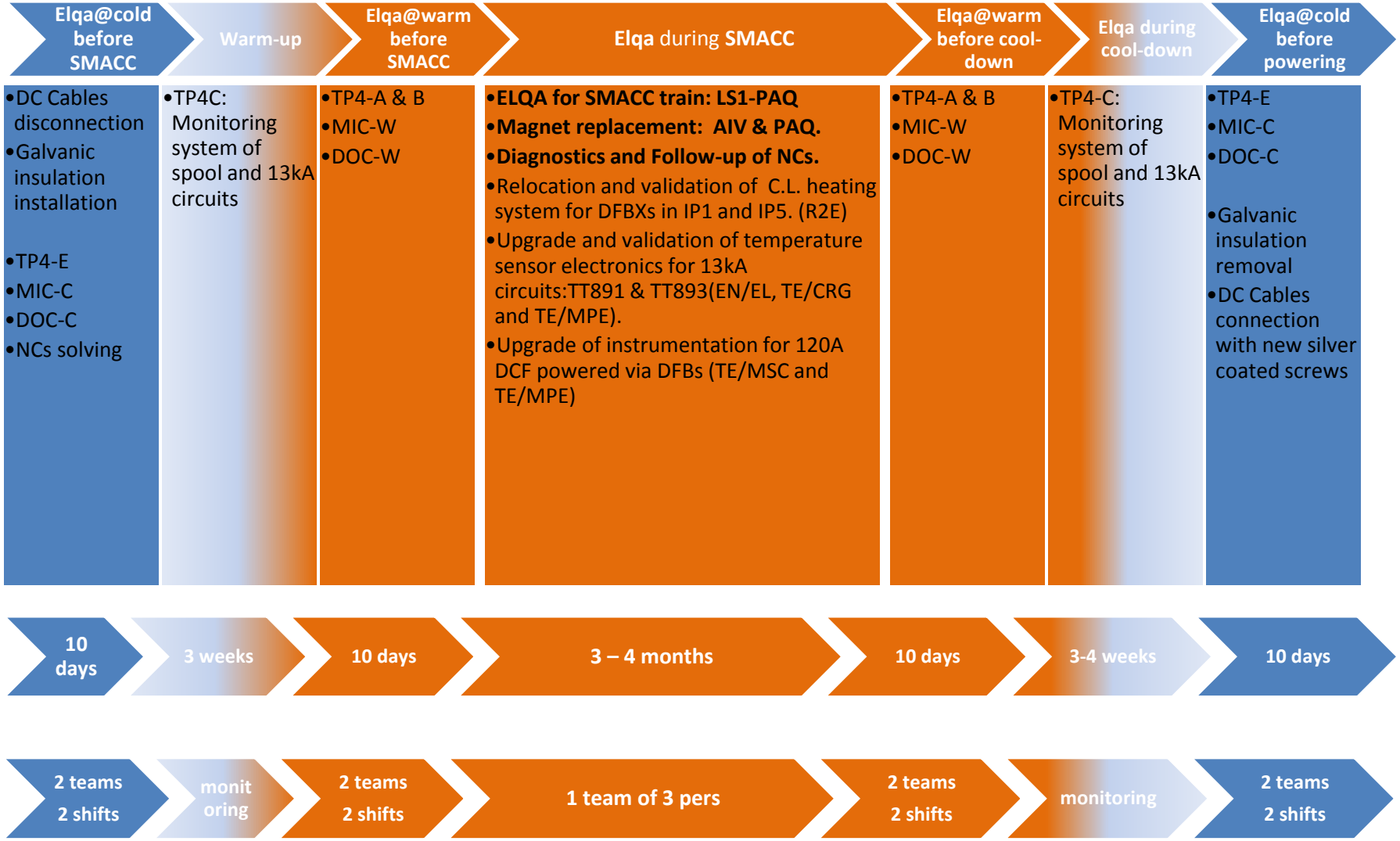
Giorgio

ELQA during LS1 - the “expected” activities

- Preparation for ELQA campaigns
- Elqa @ cold (1.9K) before warm-up
- Elqa during warm-up
- Elqa @ warm (300K) before SMACC
- Elqa during SMACC
- Elqa @ warm (300K) after SMACC, before cool-down
- Elqa during cool-down
- Elqa @ cold (1.9K) after SMACC, before powering
- Preparation for powering
- **Conclusions** (problems/improvement)

Giorgio on behalf of ELQA team

Summary of planned activities during LS1



Preparation for ELQA campaigns (1/2)

- In order to perform ELQA campaigns, the circuit and the associated Power Converter must be “consigné” (TE/EPC & EN/MEF) and the DQHDS turned OFF (TE/MPE).
- A galvanic insulation must be installed decoupling from the PowerConverter and allowing fast, easy and reliable connection to the circuit via the current leads:
- Mainly 4 types of current leads (13kA, 8kA, 6kA and 600A) are spread around the LHC for a total of **1174** DC cable connections:





Preparation for ELQA campaigns (2/2)

- In order to complete one entire sector, it required 2 days with 2 shifts/day of for 1 team of 2 persons➔ **4 pers/day, 2 days**
- Part of this job could be done in // with the start of ELQA campaign

Worked well:

- The **material** (galvanic insulation, cables, banana plugs, screws, etc…) was **prepared in advance** (6 months before LS1). *Stephen and Grzegorz*
- The material was **organized into container** (plastic boxes), with their proper **label for each DFBs**. *Stephen and Grzegorz.*
- A **dedicated procedure** was prepared with photos and used on place by all teams involved into it. *Stephen*

Improvements:

- Plan for additional plastic box to recover the old metallic screw and bolts
- Knowing in advance if a DC cable is going to be replaced (no need to fix it!)
- Thickness of the galvanic insulation increased on the spot for HV test on RBs (2.1kV).

Next time: same way including improvements

Elqa @ cold (1.9K) before warm-up (1/2)

- The ELQA campaign at cold, consist of verifying the **integrity** of a **circuit, including its instrumentation and protective equipment** (quench heaters).
- Especially for this campaign, at cold, before SMACC, the **new parameters** were **applied** (increase of voltage, EDMS 788197.v2). It was **important** to eventually **discover bottle neck** that would imply changes in the design of circuit or their insulation withstanding (revealing NCs).
- The electrical tests can be grouped in:
  - local test (performed along the magnet itself): **MIC-C** and **DOC-C**. These test required the transport of the measuring equipment, TP4 system among the ARC.
  - global test (**TP4-E**) performed from the DFBs, even if the circuit goes across the ARC.




Elqa @ cold (1.9K) before warm-up (2/2)

Worked well:

- The ELQA campaign is known from the past. The **work was planned one year in advance** (need of signing agreement with HNINP), and we tried to have **trained people**, especially at the beginning. Hardware and Software development were prepared one year before the start, with the goal of delivery **8 upgraded TP4 measuring systems** (initially 4, and was limiting).
- Time window required and allocated for this campaign: 10 days/ sectors, 2 shifts/day with 2 teams of 2 persons ➔ **8 pers/day, 10 days with a maximum of 2 sectors in parallel, exceptionally 3.**

Improvements:

- Personnel from the collaboration should have come earlier in order to be better trained, have time to follow the safety courses, get their **P**ersonal **P**rotective **E**quipment, **4 weeks in advance !**
- Make the **sector doors** in the middle of the ARC "**openable**".
- **Reduce or forbid parallel activities** (electrical risk), avoiding exceptions.
- **Ensure** the presence of **WiFi** by the DFBs and in the ARC.
- Allocate one **experienced engineer** per **2 sectors** to assure "online data validation" and NCs follow-up

Next time: same way including improvements

Elqa during warm-up (1/1)

- At the end of the standard ELQA cold campaign, the monitoring system of some circuits was installed.
- During the warm-up phase of a sector, this system allowed the monitoring of insulation to ground for 13kA and Spools circuits.

Worked well:

- The measuring system was installed in about 2 hours by 2 persons. It is remote controlled. It was **done in the shadow of ELQA** at cold **campaign**.

Improvements:

- **Ensure** the presence of **WiFi** by the DFBs and in the ARC
- Provide **reliable PCs** (the one used initially were "recycled" and sometimes they hanged
- Have a dedicated hardware and software from the beginning (it was developed during SMACC by HNINP), done ☺.

Next time: same way including improvements

Elqa @ warm(300K) before SMACC (1/2)

- The **ELQA campaign at warm** is very similar to the previous one at cold, with **different parameters**. It consist of verifying the integrity of a circuit, including its instrumentation and protective equipment (quench heaters).
- Also for this campaign, at warm, before SMACC, the **new parameters** were **applied** (increase of voltage, EDMS 788197.v2). It was important to eventually **discover bottle neck** that would imply changes in the design of circuit or their insulation withstanding (revealing NCs).
- The electrical tests can be grouped in:
  - local test (performed along the magnet itself): **MIC-W** and **DOC-W**. These test required the transport of the measuring equipment, TP4 system among the ARC.
  - global test (**TP4-A&B**) performed from the DFBs, even if the circuit goes across the ARC.




Elqa @ warm(300K) before SMACC (2/2)

Worked well:

- Time window required and allocated for this campaign: 10 days/ sectors, 2 shifts/day with 2 teams of 2 persons ➔ **8 pers/day, 10 days with a maximum of 2 sectors in parallel, exceptionally 3.**

Improvements:

- **Ensure** the presence of **WiFi** by the DFBs and in the ARC
- Make the sector doors in the middle of the ARC “openable”.
- Reduce or forbid parallel activities (warm bus bar measurement, etc…), avoiding exceptions.
- Ensure the presence of WiFi by the DFBs and in the ARC
- Allocate one experienced engineer per 2 sectors to assure “online data validation” and NCs follow-up.

Next time: same way including improvements

Elqa during SMACC (1/12)

- List of planed activities during SMACC:
  - **LS1-PAQ** on **all** 8 **Sectors** during SMACC! Up to 5 in parallel.
  - 19 Magnet replacements: **AIV & PAQ** 15 MBs, 2 SSSs, 1 IPQ.
  - **Relocation of current lead heating system for DFBXs** in IP1 (Left and Right) and IP5 (Right).
  - **Upgrade of the measuring chain of temperature sensor for 13kA circuits.**
  - **Upgrade of the cabling regarding 120A circuit powered via DFBs**: exchange of cabling and connector in order to fulfill High Voltage specifications. Validation of the measuring chain.
  - **Follow-up of Non Conformities.**

Elqa during SMACC (2/12): **LS1-PAQ**

- **LS1-PAQ:**
  - this test was applied to the circuits that were sensitive to SMACC activities: 13 kA and Spools (EDMS 1269114)
  - The goal is to ensure the continuity and the insulation to ground of the circuit.
  - The **baseline** was to have up to **4 Sectors in //**, and the test performed on a **daily basis** (evening hours).
  - **Daily basis test**, changed to **twice a week per sector**, from 17:00
    - Field team performing the test
    - Message on Safety Panel to be changed
    - WISH tool to be signed when test is "**PASSED**" or **block** SMACC!
      - http://wish.web.cern.ch/
  - The test procedure was prepared in advance, but the hardware and software were finalized on site, once HNINP collaborator were trained.
  - Because of the safety aspects and the length of the circuits under test, a field team of minimum 3 persons was needed (use of electrical bike).

Elqa during SMACC (3/12): **LS1-PAQ**

- **LS1-PAQ:**
  - The transmission of the safety aspect information was an issue.
  - The fact of having a “live circuit” with changing conditions from one day to another was very critical

Worked well:

- The collaboration with SMACC field team, even if started with difficulties (agreement forgotten, metallic parts in contact to GND) was essential!
- We ended with 6 sectors in parallel**.**

Improvements:

- Better control of **ambient conditions** in the tunnel environment: **too humid** !!
- Improve the way of transmitting the **safety message to next team**: work was finishing at 22.00 or 23.00 in the night and MSC restarted at 6.00 the morning after! **Ensure** the **grounding** of the circuits!
- Allocate one **experienced engineer per 2 sectors** to assure “**online data validation**” and NCs follow-up

Next time: same way including improvements and update procedure.

Elqa during SMACC (4/12): **A.I.V.**

- **AIV Magnet replacement:**
  - This test procedure was applied when a magnet was replaced
  - The goal is to ensure the correct connectivity of the magnet including all the circuits passing through it (Line N, etc…)
  - 19 Magnets were planed to be replaced: up to 5 Sectors in parallel
    - 3 SSSs (Q7R3, Q23R3 and Q27R3 all in Sector 34)
    - 1 IPQ (Q5L8)
    - 15 MBs:
      - S12 (6): A29L2:2372, C30R1:2373, B33L2:2377, C15R1:2395, C33R1:2387, A22R1:2413
      - S23 (3): B25R2:2336, C15L3:2353, A23R2:2357
      - S34 (2): A26R3:2438, B32R3:2252
      - S45 (2): B31R4:2138, C17R4:2214
      - S78 (2): B30R7:1007, B21L8:2007
  - A.I.V. test was strictly linked with **S**pecial **I**ntervention **T**eam (N. Bourcey) and the collaboration was efficient and fruitful

Elqa during SMACC (5/12): **A.I.V.**

- **AIV Magnet replacement :**
  - AIV field team of **minimum 3 persons** performing the test, Reporting, Updating AIV DB
  - The test procedure is split in 2 repetitive tests: before US welding and after US welding

Worked well:

- **Time and Resources well planed** : after installation on site, 2 hours per test for a Team of 3 persons

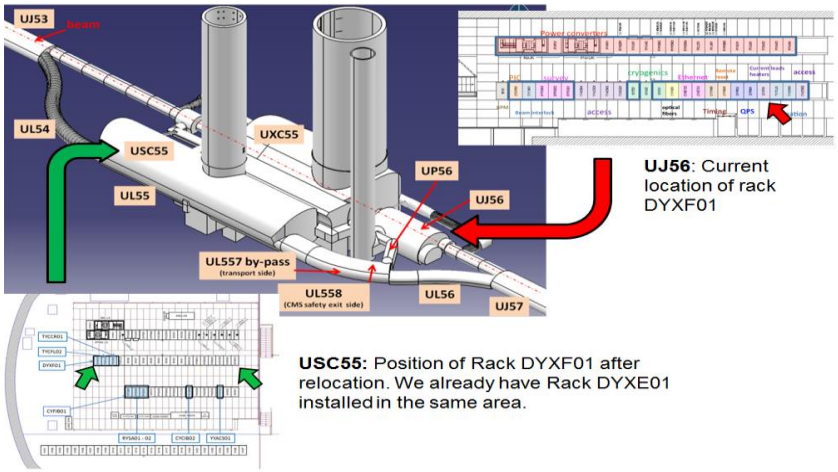
Improvements:

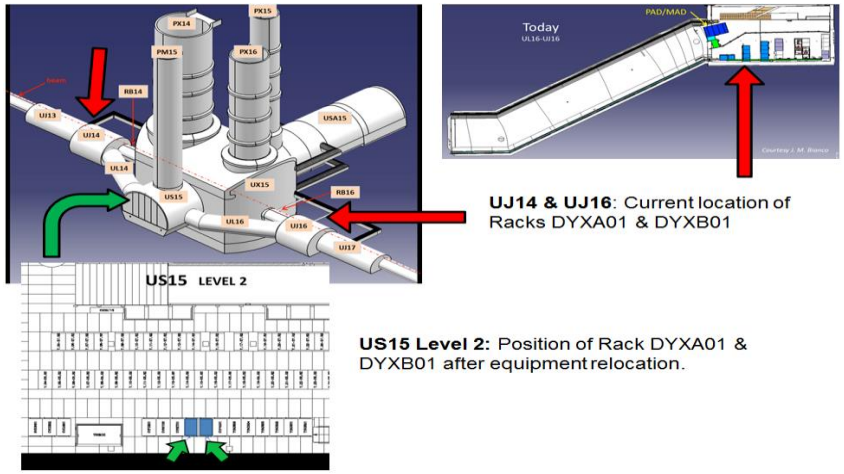
- The **hardware and software are obsolete**. We need next generation of test equipment ➔ **new agreement with HNINP signed for it!**
- Training of specialized team was mandatory, and this team was dedicated to magnet replacement

Next time: same way including improvements (hardware and software) and update procedure.

Elqa during SMACC (6/12) :**R2E**

- **Within R2E project, the relocation of electronics racks controlling the current lead heating system of I.Ts was planed** (R. Mompo and G. Seweryn):
  - **from UJ14 and UJ16 to US15 (IP 1)**
  - **and from UJ56 to USC55 (IP5)**





  - The relocation was planed **one year in advance**. It included purchasing of specific parts, meeting follow-up, integration and cabling specification to EN/EL.

Elqa during SMACC (6/12) :**R2E**

- **Relocation of electronics racks controlling the current lead heating :**

Worked well:

- Each IP required **2 persons** (Grzegorz and Richard) , **5 days** for cabling verification, debugging and commissioning of the current lead heating system
- This task was **well planed in advance** and therefore the project went though smoothly, except cabling execution (Mateusz's presentation)

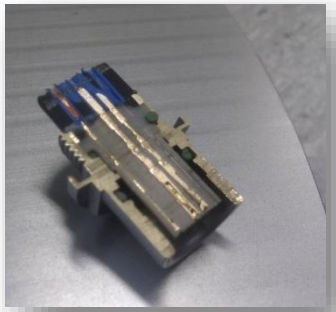
Improvements:

- Ask EN/EL to **improve the identification of cables**
- **Verification** of new cabling delivered **by the contractor**

Next time: same way, well planed in advance!

Elqa during SMACC (7/12) :**120A Vtap routing**

- **Upgrade of the cabling regarding 120A circuit powered via DFBs:**
  - exchange of cabling and connector in order to fulfil High Voltage specifications. Validation of the measuring chain.
  - Initially planned for 36 Fischer connector, finally replaced **only 1!** (NC 1195151)



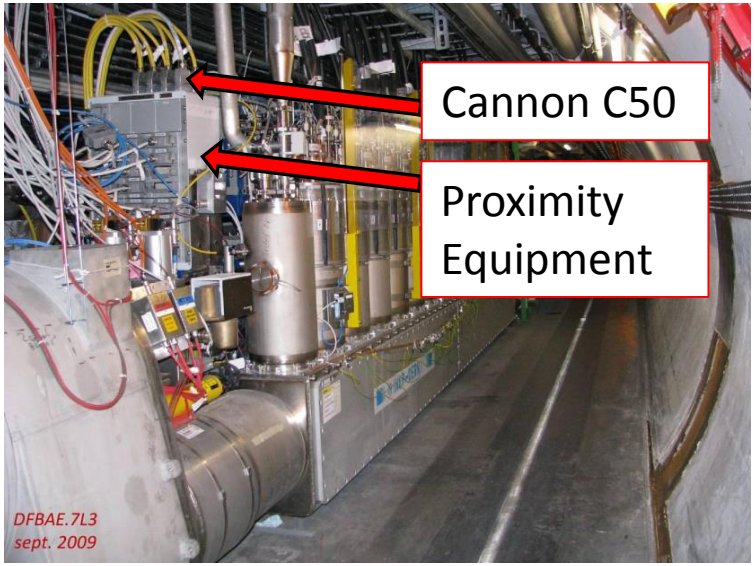
Improvements:

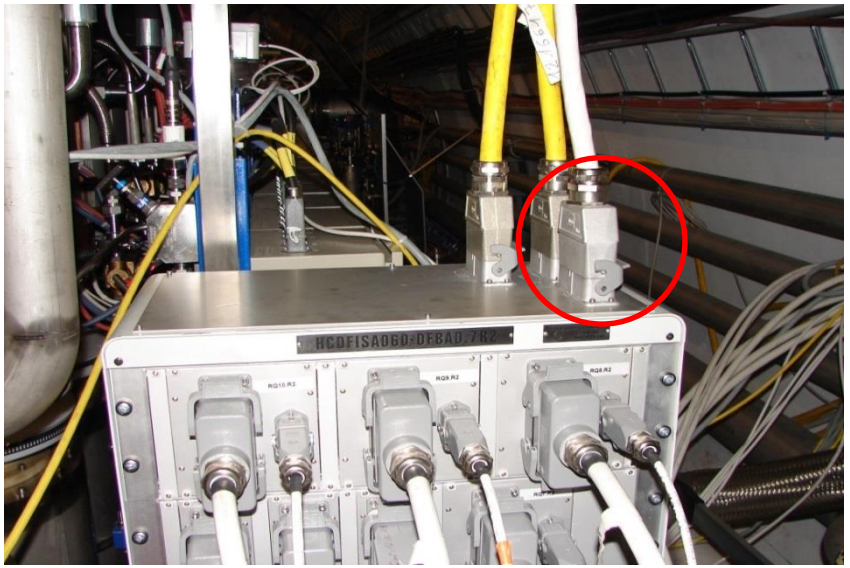
- **Lot of time lost in discussions (with TE/MSC-SD)! The subject was mentioned in on TE/TM meeting, but still argued!**
- The work itself was relatively simple and could have been done, in the tunnel, without time constrain➔ **convince the person before!**

Next time: convince the responsible person of the equipment well in advance and have this work planned from her side!

Elqa during SMACC (8/12) :**13kA TT sensors**

- **Upgrade of the measuring chain of temperature sensor for 13kA circuits:**
  - Consolidation of the cabling (connector replacement) in order to improve **High Voltage requirement** (Giorgio, Grzegorz, Pawel and TE/CRG-IN)
  - **16 P**roximity **E**quipments removed from the tunnel, modified, tested in the lab, re-installed and commissioned





Elqa during SMACC (9/12) :**13kA TT sensors**

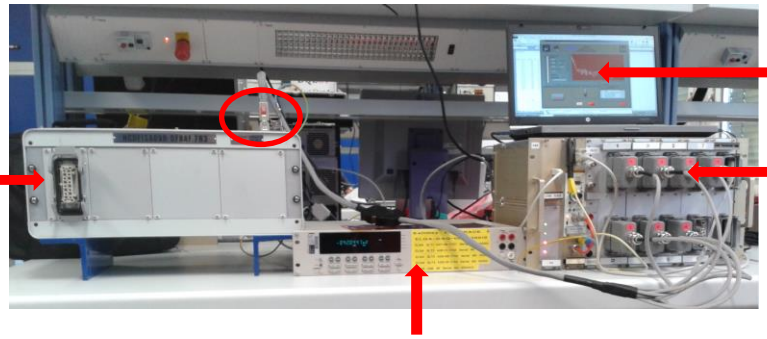
- **Upgrade of the measuring chain of temperature sensor for 13kA circuits:**

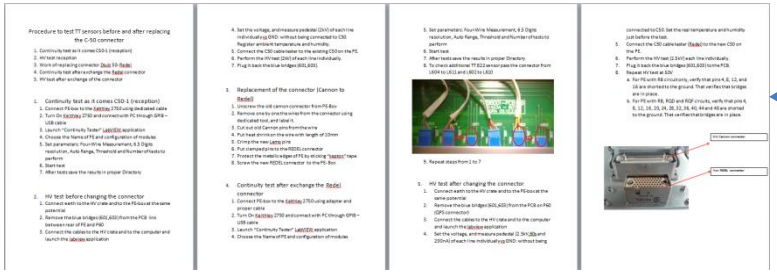
Cannon connector (300V)

Redel connector (3,2kV)

Elqa during SMACC (10/12) :**13kA TT sensors**

- **Upgrade of the measuring chain of temperature sensor for 13kA circuits:**





Test procedure

Test report

1.1 CONTINUITY TEST,

1.1.1 ROUTING TO NORMAL SENSORS,

Entry	Date & Time	Pin Name	Mean Resistance [ohm]	Std Deviation	Status
1	16/10/2013 09:27	C50-1_Pin 1	2.63E-01	2.60E-05	OK
2	16/10/2013 09:27	C50-1_Pin 2	2.60E-01	1.40E-05	OK
3	16/10/2013 09:27	C50-1_Pin 3	2.62E-01	1.10E-05	OK
4	16/10/2013 09:27	C50-1_Pin 4	2.66E-01	2.20E-05	OK
5	16/10/2013 09:27	C50-1_Pin 5	2.86E-01	1.40E-05	OK
6	16/10/2013 09:27	C50-1_Pin 6	2.87E-01	2.10E-05	OK
7	16/10/2013 09:27	C50-1_Pin 7	2.81E-01	2.10E-05	OK
8	16/10/2013 09:27	C50-1_Pin 8	2.72E-01	1.50E-05	OK
9	16/10/2013 09:27	C50-1_Pin 9	2.41E-01	1.60E-05	OK
10	16/10/2013 09:27	C50-1_Pin 10	2.37E-01	1.70E-05	OK
11	16/10/2013 09:27	C50-1_Pin 11	2.33E-01	2.30E-05	OK
12	16/10/2013 09:27	C50-1_Pin 12	2.32E-01	1.60E-05	OK
13	16/10/2013 09:27	C50-1_Pin 13	2.42E-01	2.70E-05	OK
14	16/10/2013 09:28	C50-1_Pin 14	2.55E-01	1.20E-05	OK
15	16/10/2013 09:28	C50-1_Pin 15	2.49E-01	1.30E-05	OK
16	16/10/2013 09:28	C50-1_Pin 16	2.45E-01	2.20E-05	OK

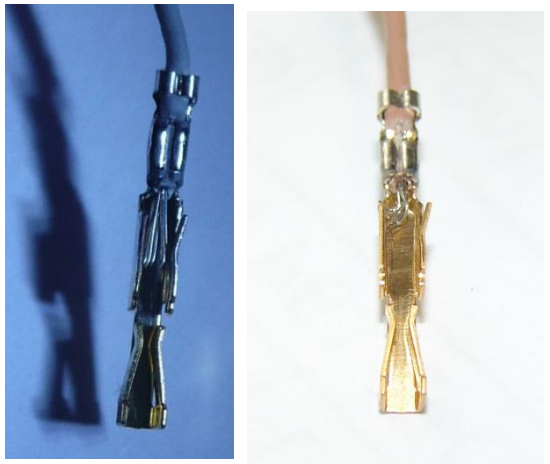
1.6 HV TEST SINGLE CURRENT LEADS (C61-L,P61-L) + (C61-U,P61-U) - TWO CHANNELS

1.6.1 NORMAL SENSORS

Meas.	Name	Voltage [V]	Time [s]	Limit [A]	Max current [A]	Leakage current [A]	Status
1	RB C61-L+RB P61-L	2500	60	1.00E-06	1.55E-07	1.35E-07	OK
2	RB C61-U+RB P61-U	2500	60	1.00E-06	1.56E-07	1.35E-07	OK

1.6.2 SPARE SENSORS

Meas.	Name	Voltage [V]	Time [s]	Limit [A]	Max current [A]	Leakage current [A]	Status
1	RB C61-L+RB P61-L	2500	60	1.00E-06	1.57E-07	1.34E-07	OK
2	RB C61-U+RB P61-U	2500	60	1.00E-06	1.6E-07	1.36E-07	OK



Faulty pin: crimped on insulator

Elqa during SMACC (11/12) :**13kA TT sensors**

Worked well:

- The discussions about this **project** started **4-5 years ago** (Giorgio & TE/CRG).
- The **project** was finalized **1 year in advance** (ordering parts, etc…)
- Duration and manpower for 1 Proximity Equipment:
- Removal/Installation in the tunnel: ½ day for a team of 2 persons.
- Upgrade and validation in the lab: 3 days for 1 person

  ➔ **Total of 5 days for 1 person / P.E.**
- This **project was properly planed** and could be done in time, in the shadow of SMACC activities

Improvements:

- **None**.

Next time: the same…

Elqa during SMACC (12/12) : **NC follow-up**

- **NC follow-up :**
  - Part of **DNA** of **ELQA** activities, including reporting !
  - I will not go into details, see Mateusz talk…

<u>Improvements</u>:

- **Software tools to track them and link them to MTF, EDMS, etc…**

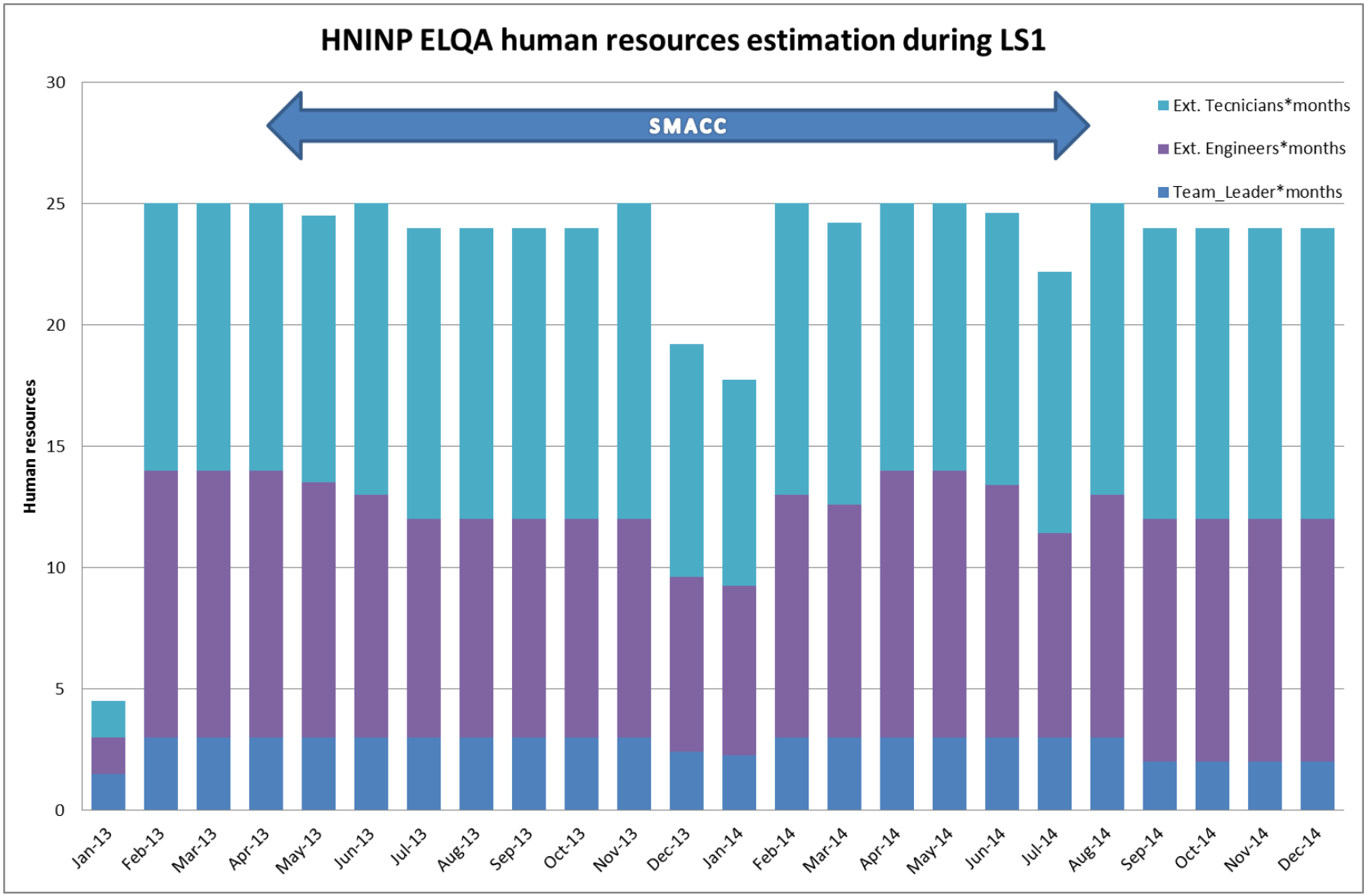
More in Mateusz talk…

Elqa after SMACC: **Standard ELQA campaigns**

- **ELQA @ warm, after SMACC (TP4 A&B):**
  - **similar to ELQA @ warm, before SMACC**
- **ELQA during cool down, after SMACC (TP4-C):**
  - **similar to ELQA during warm-up, before SMACC**
- **ELQA @ cold (1.9K) after SMACC, before powering (TP4-E):**
  - **similar to Elqa @ cold (1.9K) before warm-up**
- **Preparation for powering (DC cable connection)**
  - **similar to Elqa @ cold (1.9K) before warm-up**

ELQA manpower during LS1

- 5 CERN Staff + 1 Fellow + 1 FSUs + 25 HNINP



ELQA manpower during LS1

- **Well done**:
  - Quantity and quality of people was appropriate
  - Duration of test campaigns was correct
  - Tasks were well estimated. The reduction of LS1-PAQ activity allowed the accomplishment of unforeseen projects (Mateusz talk)

- **Improvements**:
  - Outside collaborators should be present at CERN, at least **4 weeks before starting working** (safety courses, equipment, training, etc…).
  - As initially proposed by myself, the part of the **collaborators** should **stay beyond the end of the project**: to cope some delays, to contribute into documentation and reporting, to continue equipment maintenance, to go on with data mining, etc…

Conclusions (well done/improvements)

- **Well done**:
  - Logistic (cars, 622, bike, etc…) was handled with the help of Bruno and Brigitte and went smoothly.
  - Quantity and quality of HNINP collaborators was appropriate!
  - ELQA Tasks were well estimated and announced in advance to general planning responsible person.
  - Regular coordination meetings were attended by an ELQA representative.
  - Real Team spirit was shared among all participants!
- **Improvements**:
  - Outside collaborators should be present at CERN, at least **4 weeks before starting working** (safety courses, equipment, training, etc…).
  - As initially proposed by myself, part of the **collaborators** should **stay beyond the end of the project**: to enable us to cope with some delays, to contribute into documentation and reporting, to continue equipment maintenance, to go on with data mining, etc…

Conclusions (well done/improvements)

- **Improvements**:
  - **Each team or Section** should **plan better his work**, his tasks and ***announce it to general planning***! Trying to squeeze hidden tasks leads to delays, stress and incident (if not accident)! Practical example: warm bus bar measurement cannot be done fully in parallel to ELQA campaign!
  - **Sectors doors**: should be **open** to ease the work and save time!
  - **Network** connection (WiFi) should be **available** from A ➔ Z
  - **IMPACT system**: is it really worth when accessing the whole machine, all the time?
  - **Yellow paper**: Authorisation de Travail should be **more transparent**, and **no exception** should be applied!

Conclusions (well done/improvements)

- **Improvements**:
  - Sequence of **MPE activities** should be **coordinated** otherwise it will **spoil** the **ELQA** performed:
    - QPS crate installation/removal
    - Heater cabling check
    - QPS card replacement
    - Heater firing verification (cabling modification)
    - Cryo thermometer conditioner repair (TE/CRG)
  - ELQA requested that the cryo conditioner withstand the HVQ parameter (2.1kV for RBs). TE/CRG-IN modified their electronics and the cost is of some Millions of CHF! It is **embarrassing** to be still obliged to **perform the HVQ of RB in 2 steps** because the **electronic cards developed in our group does not withstand the voltage** ! ➔ **To be upgraded!**

Many thanks to all collaborators that make it possible!!!

Left over from LS1

- Q7R3 magnet replacement (internal splice too high)
- RSS.A34.B1: HV failure, known problem, circuit not used during Run 2
- 120A Inner Triplet correctors not repaired: not mandatory for the machine
- Upgrade of the cabling regarding 120A circuit powered via DFBs: to be revised if mandatory and planned.