



Quench Detection at the LHC

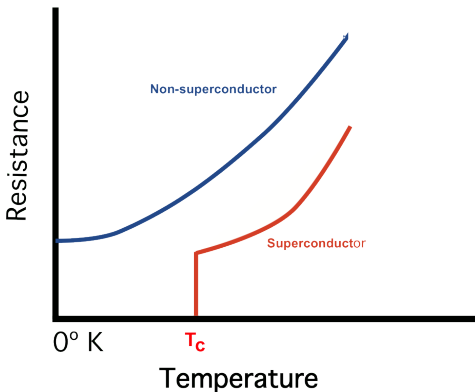
And how we contributed

Sarah, Miro, Ferdinand

What is a quench?

As you probably already know, a quench is the loss of superconductive properties and can be very dangerous in the case of the LHC.

$$U = I \cdot R \quad (1)$$



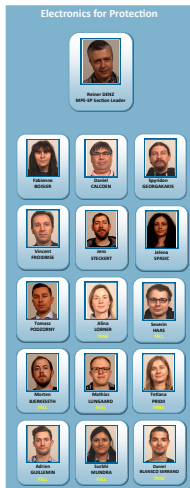
Damage



Figure: The incident 2008

We need a very precise and fast protective system to detect quenches and shut the magnets down as soon as possible.

CERNs dedicated Workgroup



Our Device



Figure: Keysight 34972a (Source: Keysight Product Picture)

Our Device



Figure: First Words

The new device that we had to set up, program with Python to test electronics cards for use in the LHC.

Our Task

- New Quench Detection System has to be tested heavily
- New system has 16 channels
- Test signals will be produced with e.g. signal generators
- Switch Matrix used to route the signals to specific channels
- Using Python to program the device

Our Device



Figure: Universal Quench Detection System

Coding

```
import pyvisa
import time
import matplotlib.pyplot as plt
import numpy as np
```

Figure: Import necessary libraries

Coding

```
rm = pyvisa.ResourceManager()  
rm.list_resources()  
my_instrument = rm.open_resource('USB0::0x0957::0x2007::MY59001715::INSTR')
```

Figure: Establishing a Connection

Coding

```
def switch_close(space):
    tmp='ROUTe:CLOS (@' +space+''
    print(tmp)
    my_instrument.write(tmp)

def switch_open(space):
    tmp='ROUTe:OPEN (@' +space+''
    print(tmp)
    my_instrument.write(tmp)

def switch_reset():
    tmp= 'ROUTe:OPEN (@111:148)'
    print(tmp)
    my_instrument.write(tmp)

def switch_read():
    space= input()
    tmp='ROUTe:READ? (@' + (str(space))+''
    print(tmp)
    my_instrument.write(tmp)
    info = my_instrument.read(tmp)
    print(info)

def error_check():
    info= my_instrument.query ('SYSTem:ERRor?')
    print (info)
```

Electronics

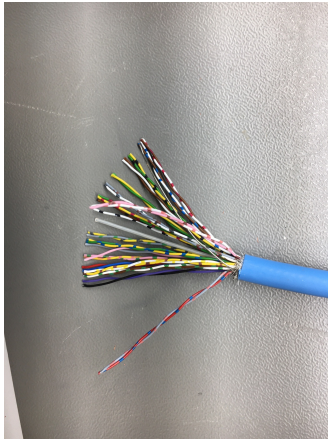


Figure: Multi wire cable

Electronics



Figure: Wire-end sleeves

Electronics

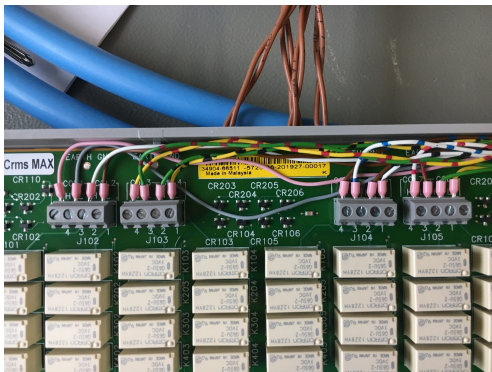


Figure: Switch Matrix output

Electronics

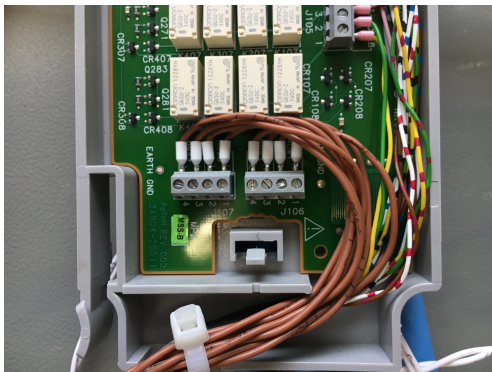


Figure: Switch Matrix input

Electronics

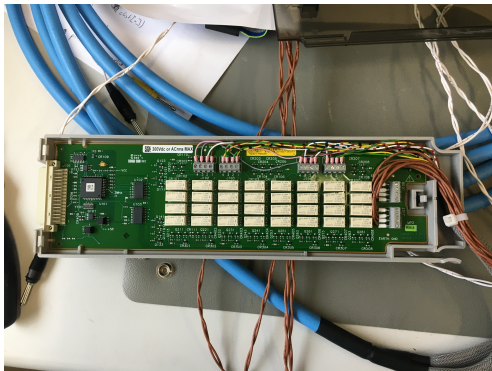


Figure: Finished Switch Matrix wiring

Electronics

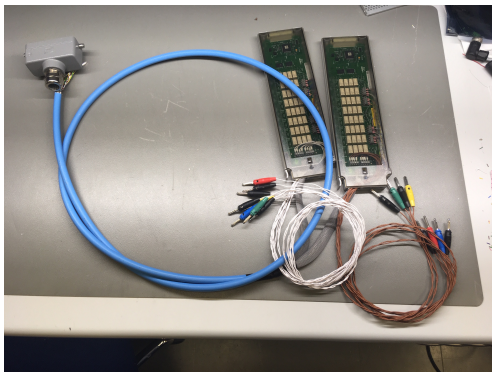


Figure: Finished Switch Matrix wiring

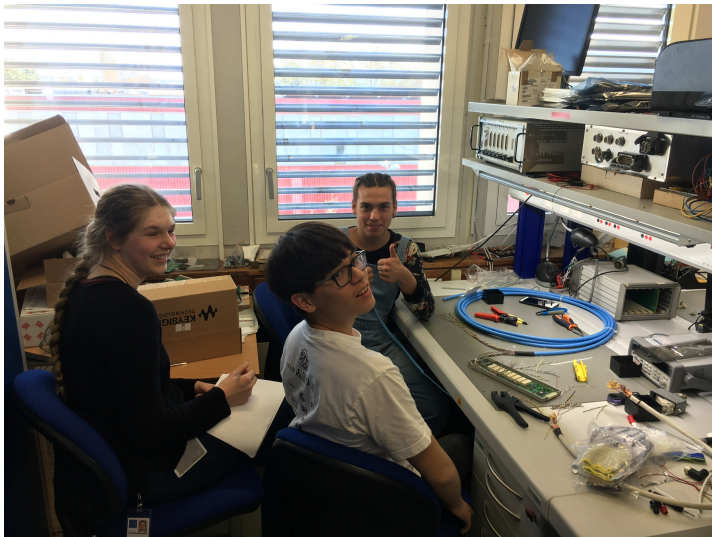


Figure: Wiring the cards in the lab



Figure: Done :)

Conclusion

1. We got a profound insight into the work of one of CERNs engineering departments
2. We learned a lot about coding in python and manage our code with git
3. Learned to work in the lab and build cables
4. We used \LaTeX for the first time to make this presentation!
5. We had lots of fun!



home.cern