

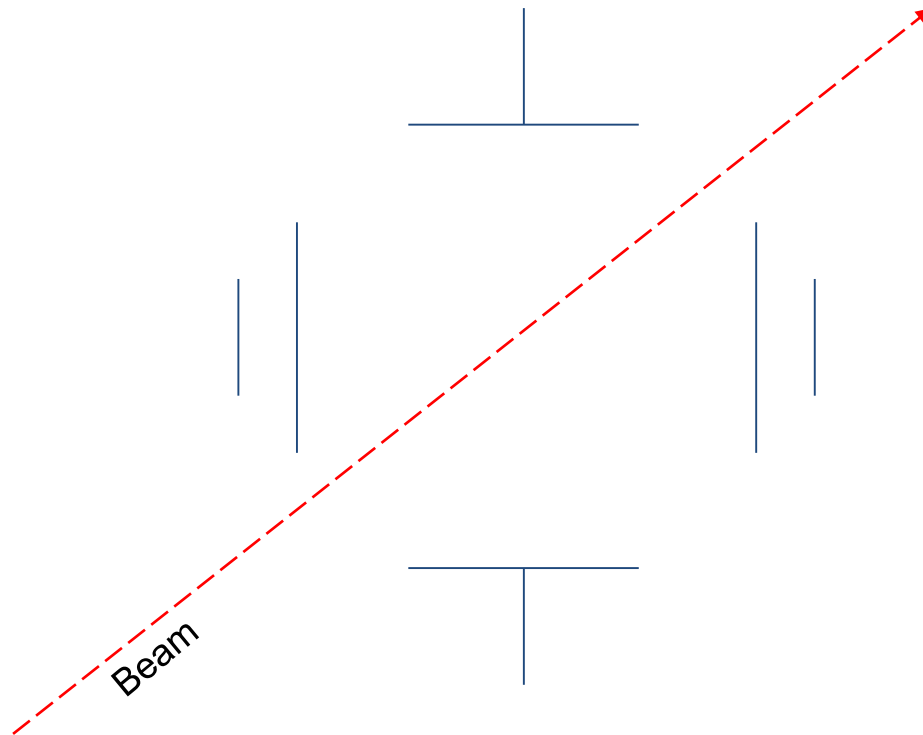


CERN Internship

High frequency and vacuum technology

Beam Positioning

- Being able to reliably say where the beam is
- different methods



Structure

- 1. High frequency board**
- 2. Beam Gas Curtain**
- 3. Beam Monitor**
- 4. Experiences**

Positioning of the beam with electromagnetic waves

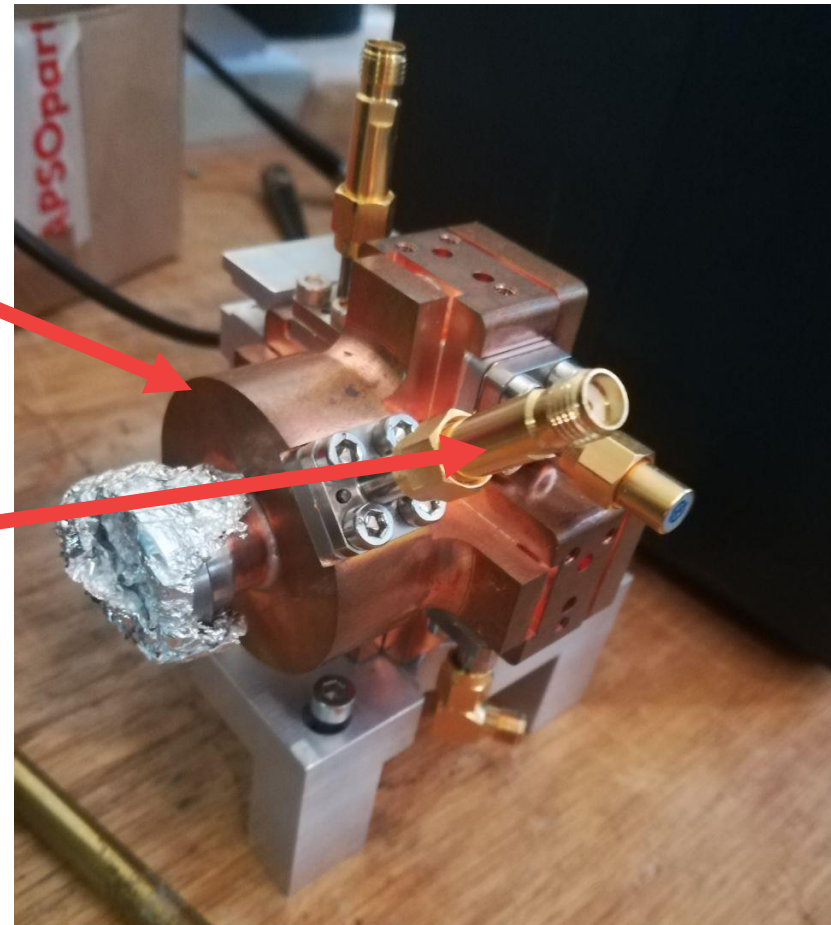
**Element measures position of
the beam**

Resonance generated in the cylinder

Resulting in an high frequency signal

Signal output

Amplitude = degree of deviation



High frequency technology

Signal of 15GHz

→ too high to process it

Board converts signal to lower frequency

Attenuator

2 Amplifiers



High frequency technology

Task: find out how the amplifiers work

Take measurement with different amplification

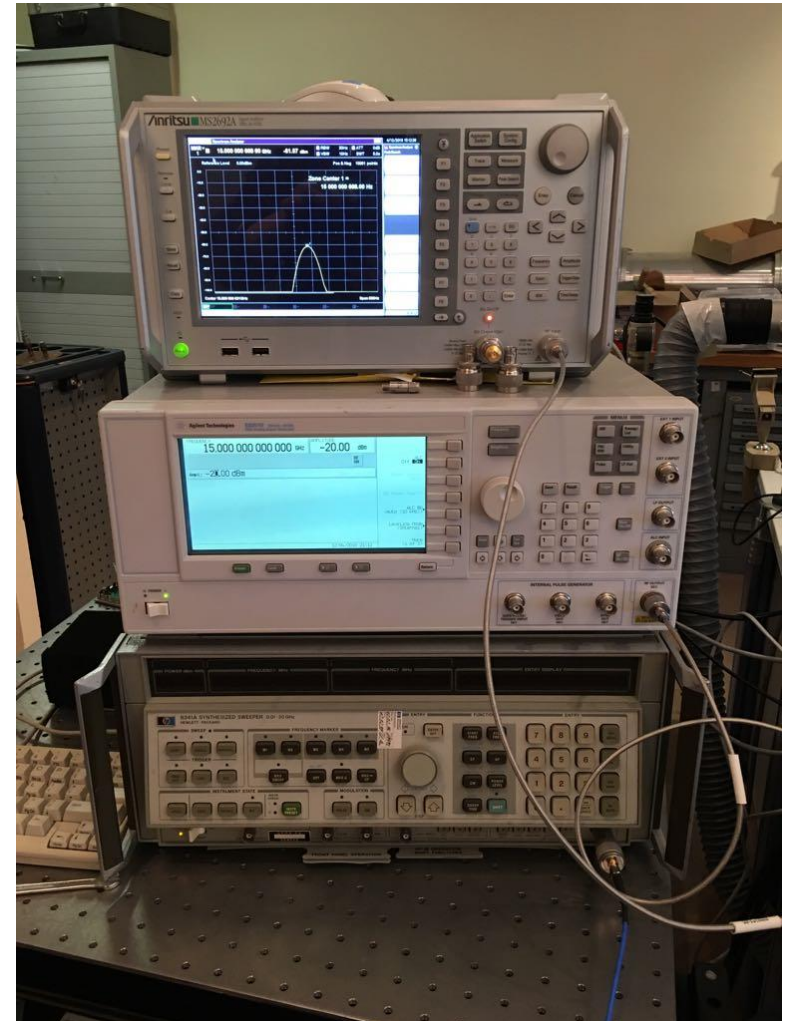
2 Amplifiers



High frequency technology

Measurement tool

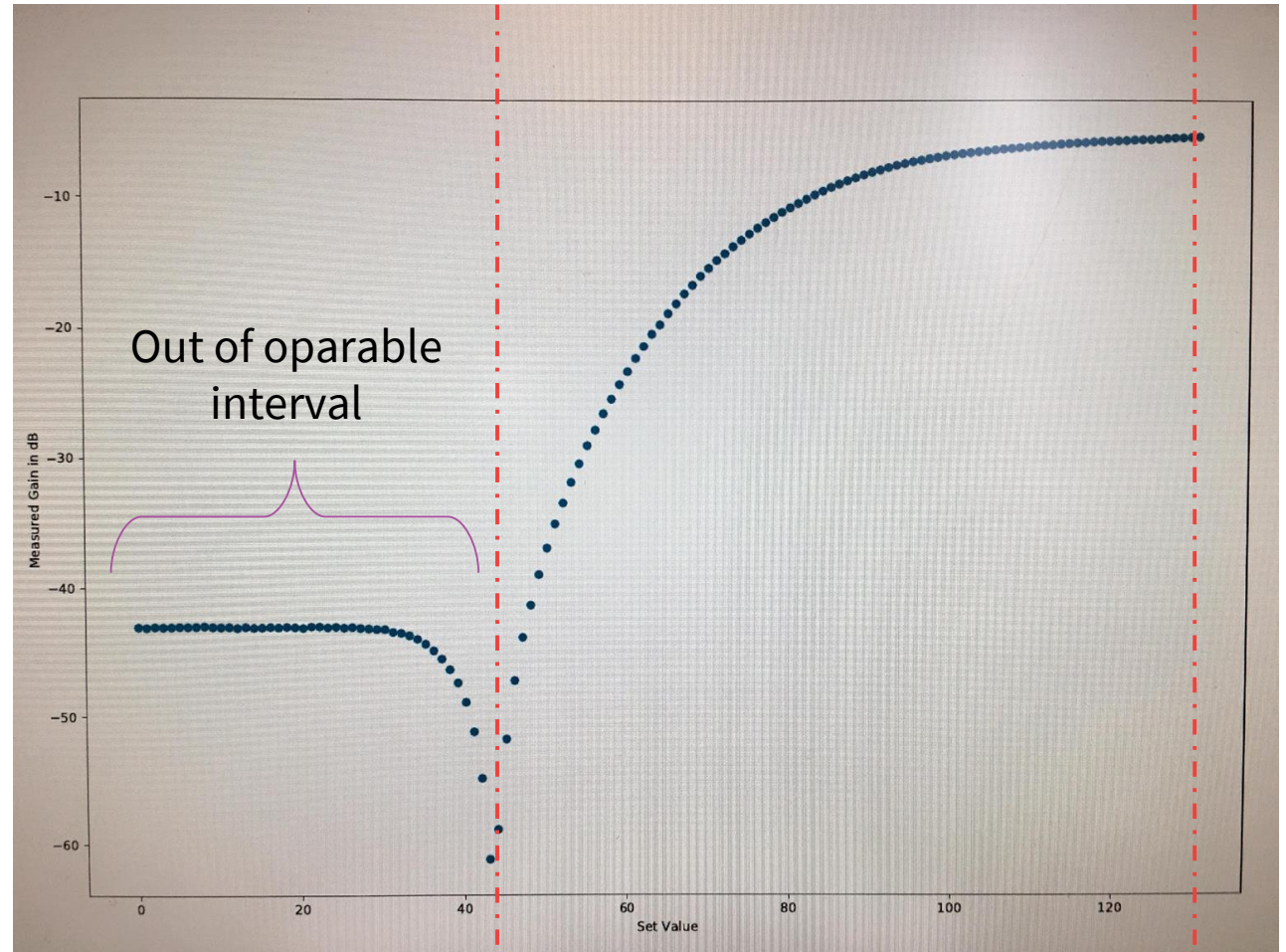
Frequency generator



Characteristics of specific elements

Measurement

Need of linearisation



Amplification with max attenuation and varying activation of amplifiers

Linearisation of the curve with a look up table

```
array1
File Edit Search Options Help
import numpy
gfaktor= []
nfaktor= []

#Dateneubernahme
import csv
reader = csv.reader(open("Werte.csv"))
for row in reader:
    gfaktor.append(row[0])
for i in range(0,131):
    nfaktor.append(i)
#Eingabe
input= input("gewuenschter Wert:")

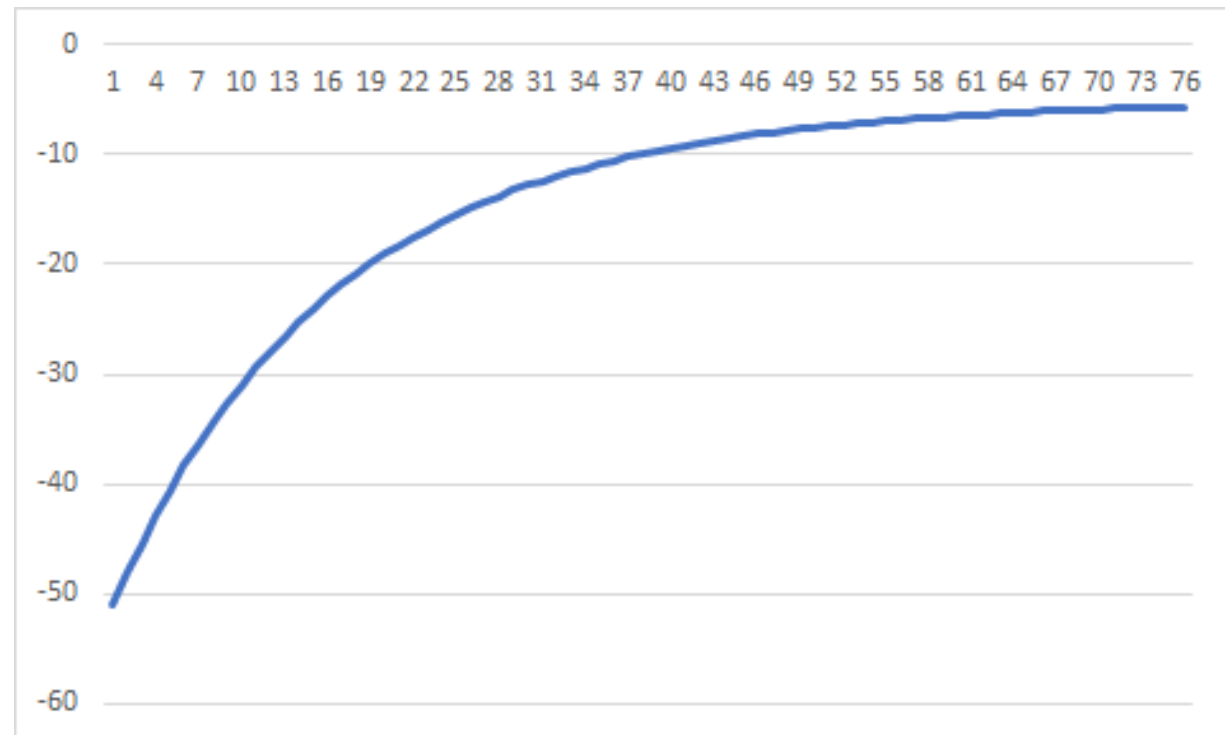
#Erster Wert manuell errechnet
erg= (input-float(gfaktor[45]))**2
ergat=0

#Wert mit geringster Abweichung ermitteln
for k in range(46,131):
    if ((input-float(gfaktor[k]))**2)<erg:
        erg= (input-float(gfaktor[k]))**2
        ergat= k

#Ausgabe
print str(nfaktor[ergat])+" "+str(gfaktor[ergat])
```

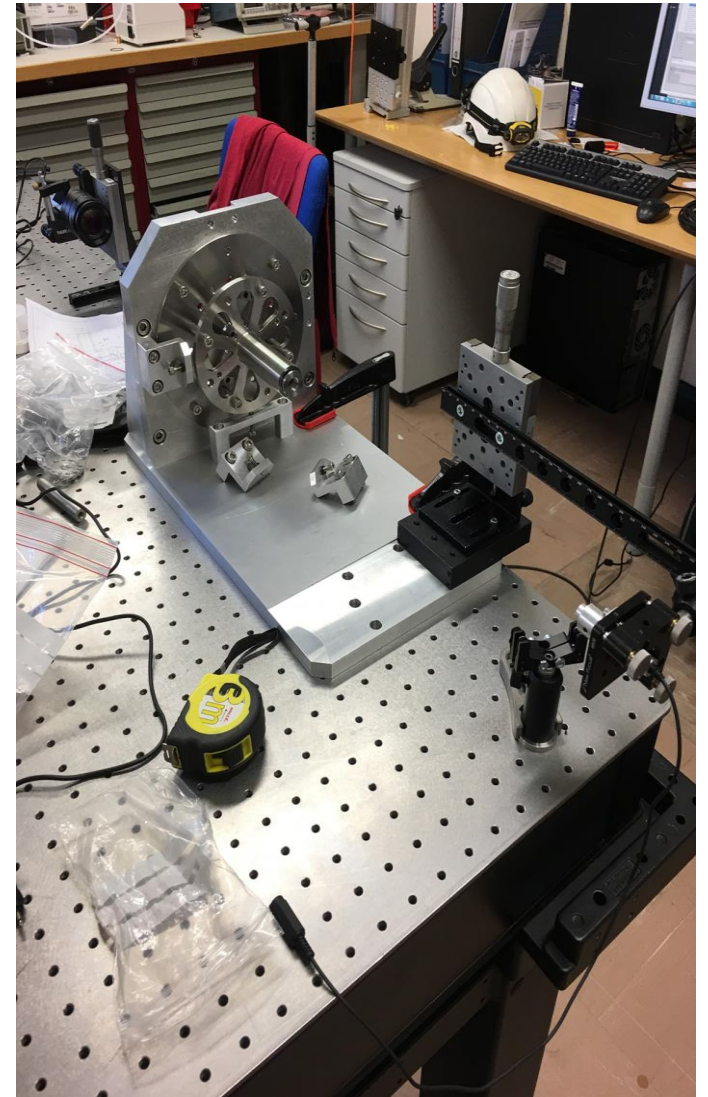
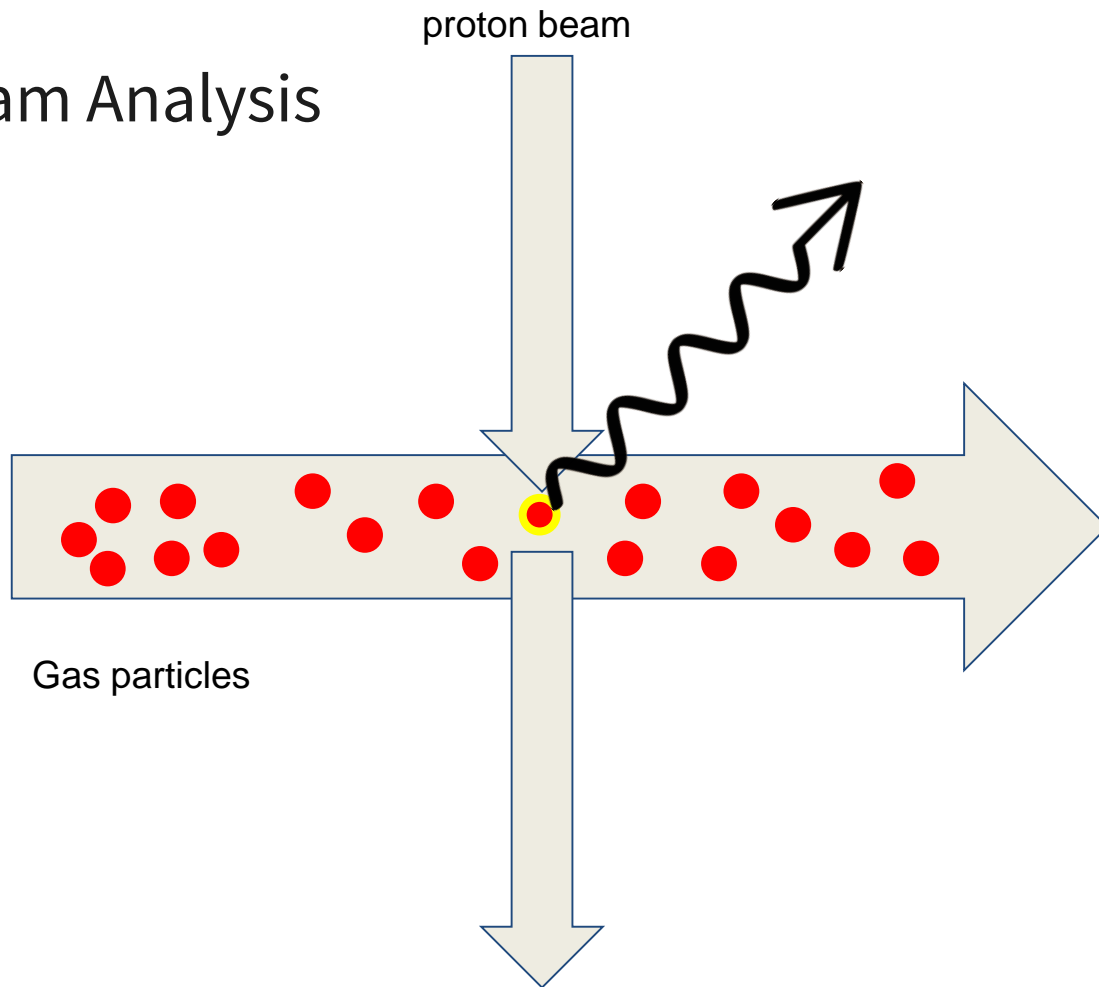
Linearisation of the curve with a function

$$f(x) = -\left(\frac{315}{x+203}\right)^{16} + 5$$



2. Beam Gas Curtain

Beam Analysis



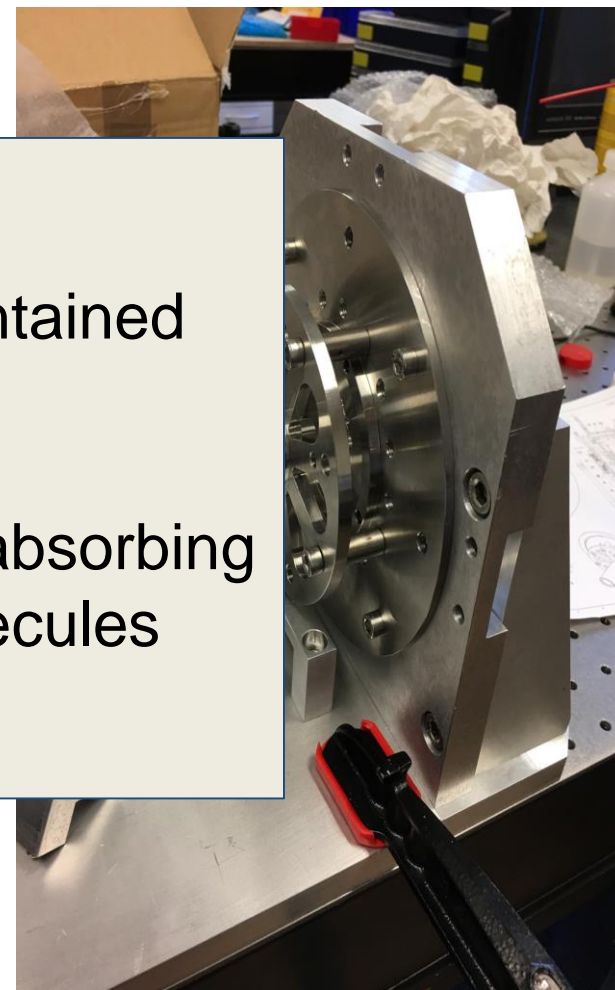
2. Beam Gas Curtain

Curtain Gas

Problem:
Ultrahigh vacuum needs to be maintained within the LHC beam pipes

=> Parts need to be covered with absorbing coating to bind remaining gas molecules not reaching the foreseen dump

Beam

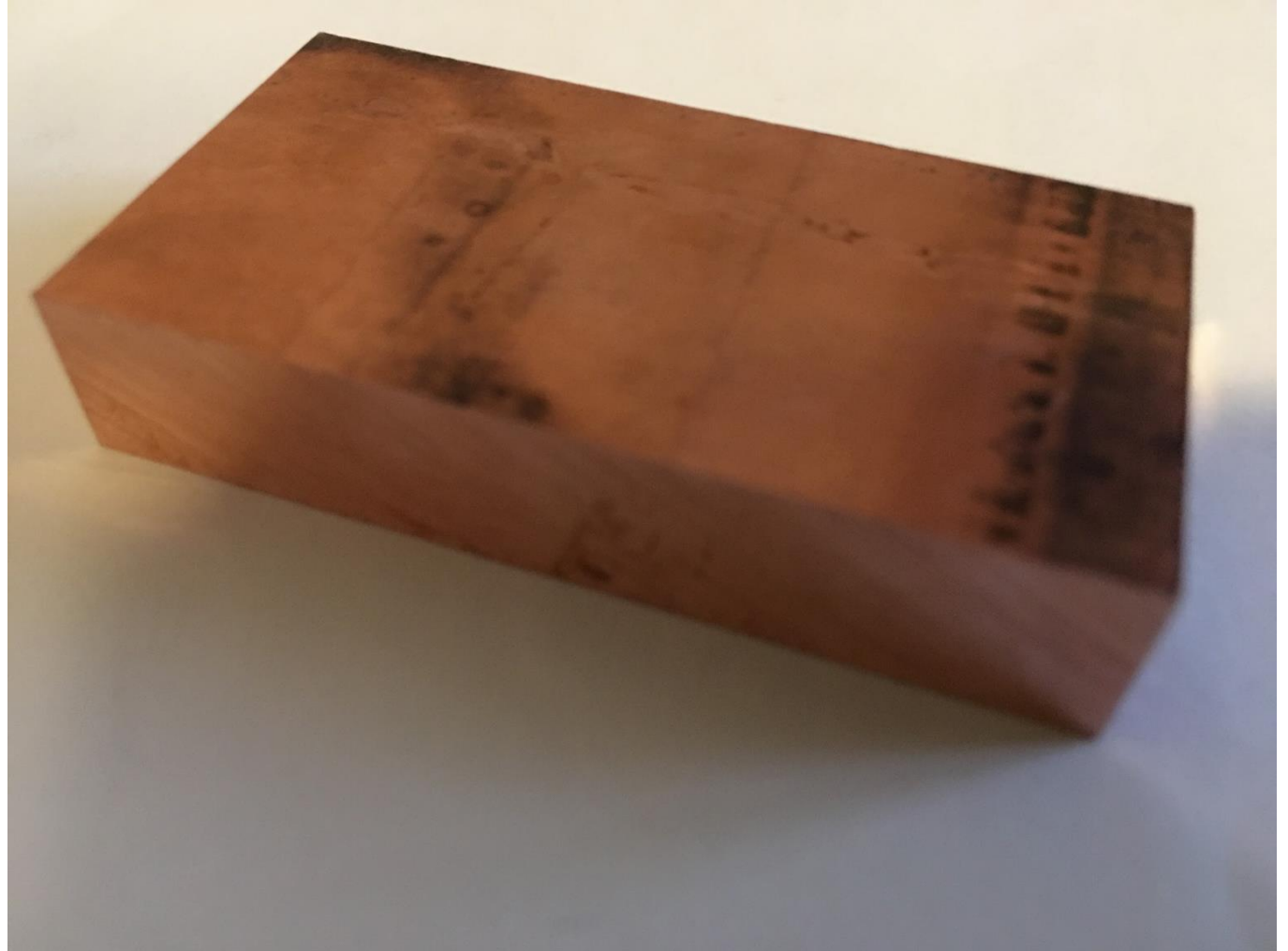


2. Beam Gas Curtain

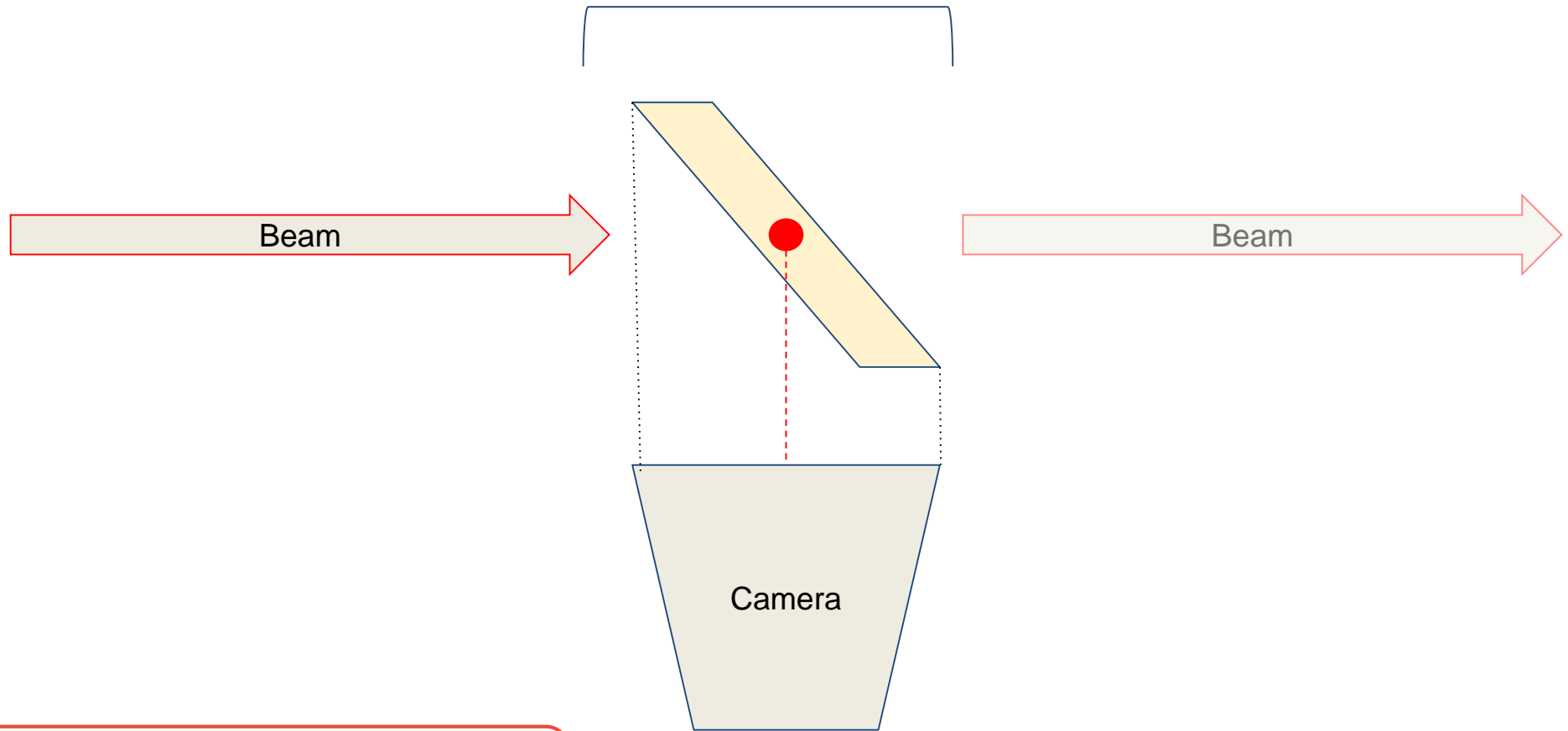
5x5x1 cm cuboid
8x steel
8x copper

drilled the holes
for fixation in
test
smoothened the edges

later:
coated and tested

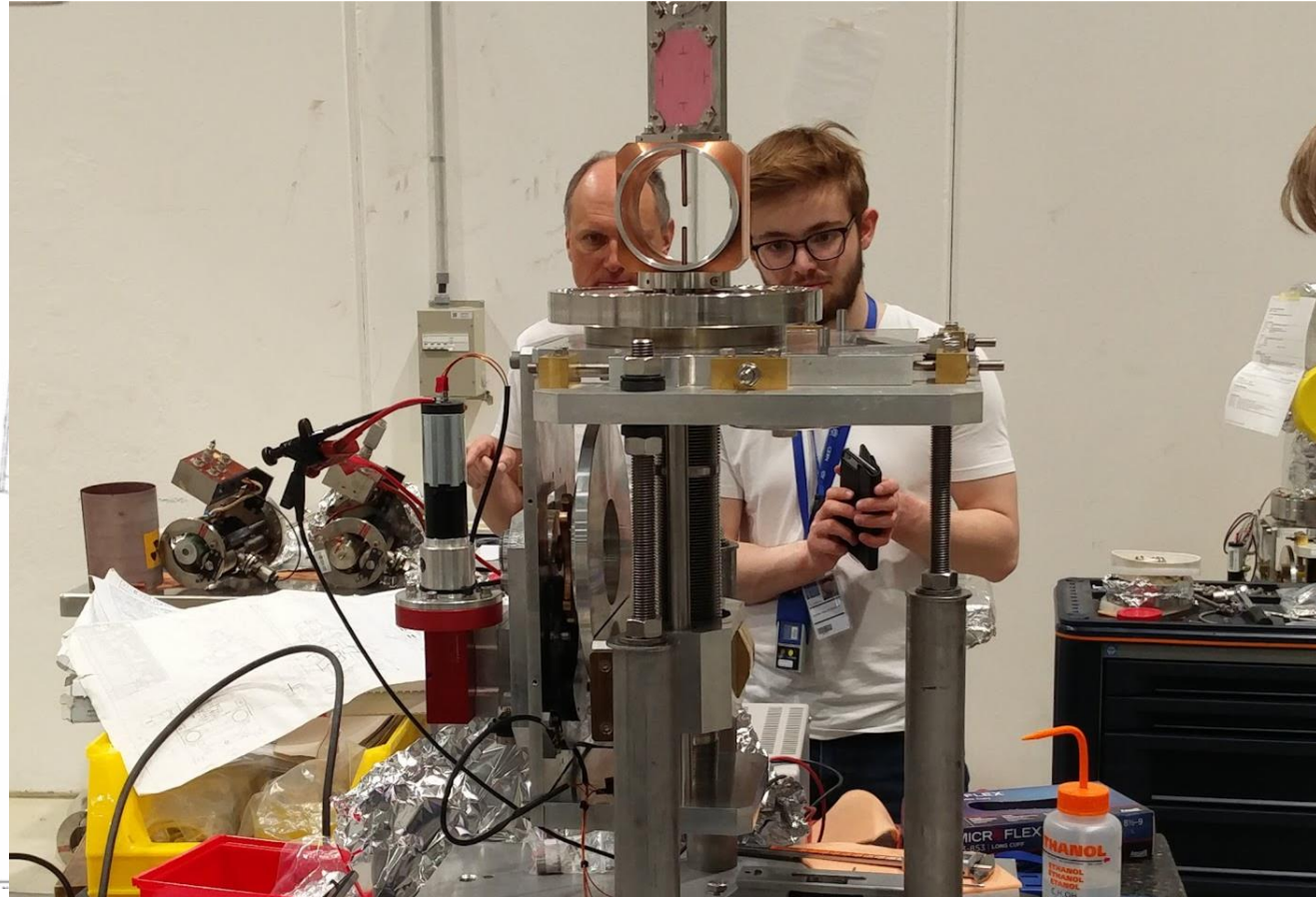
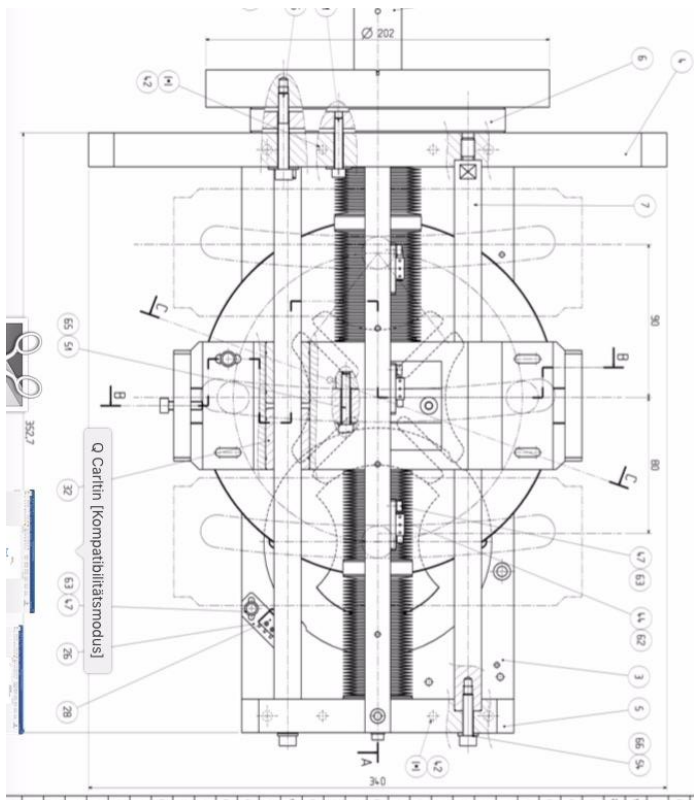


3. Beam monitor

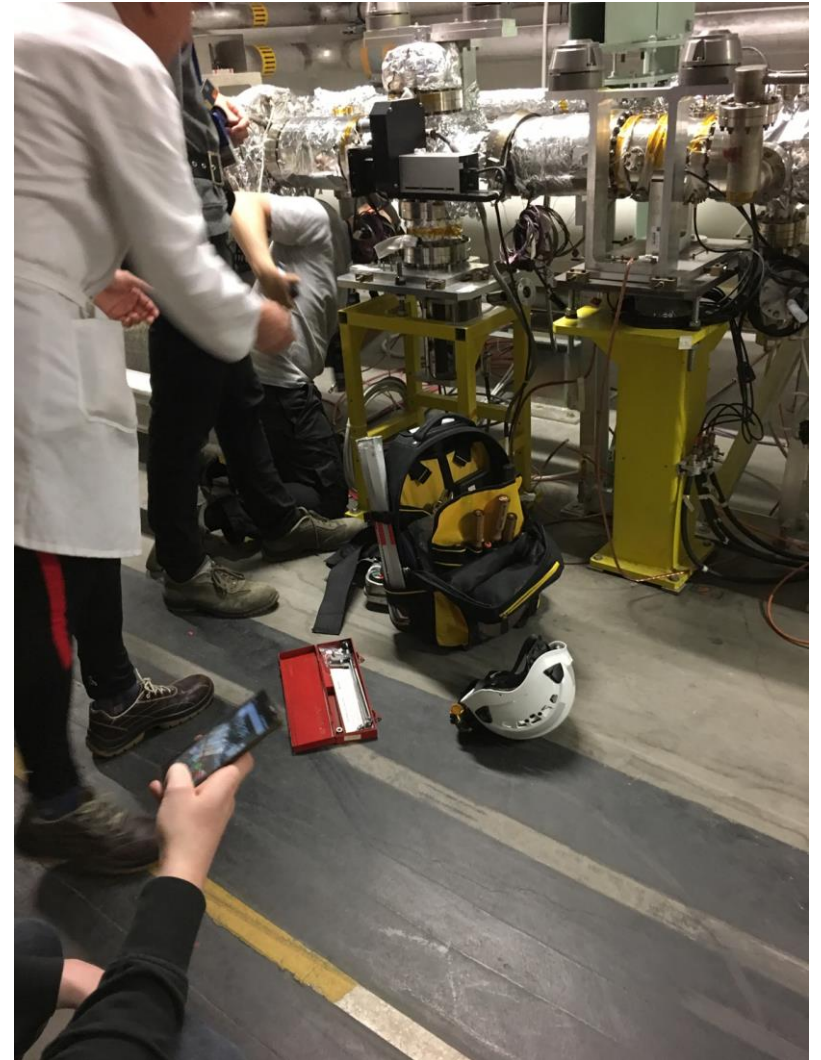
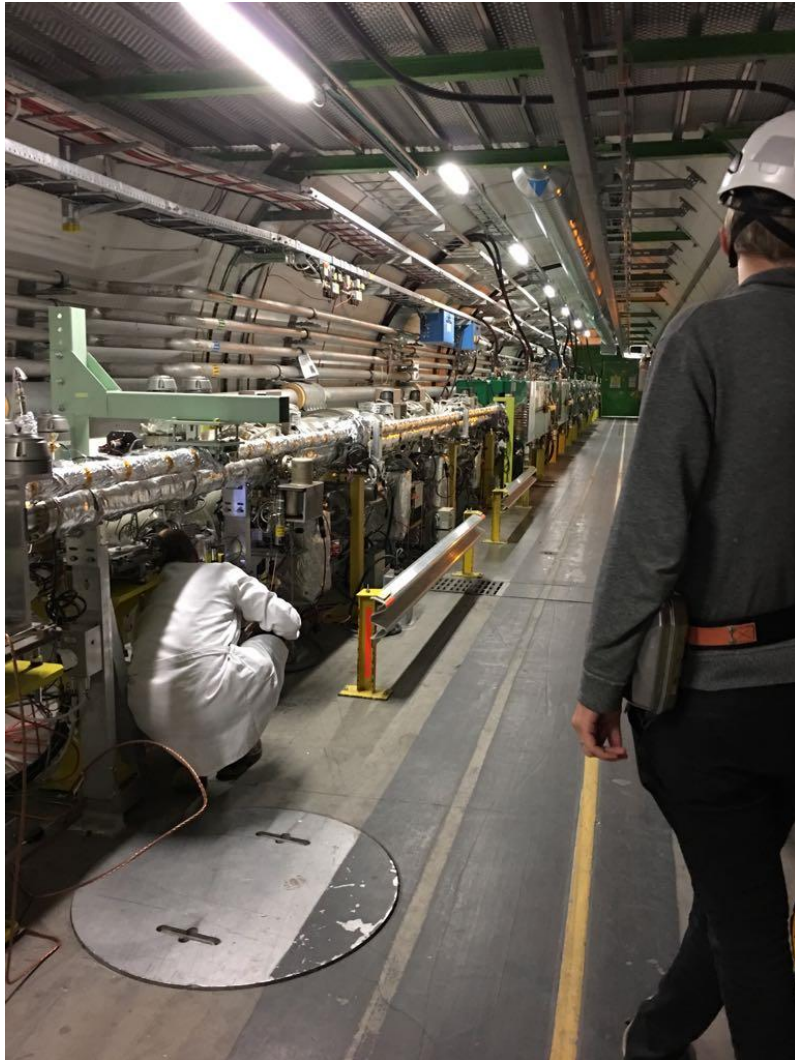


Monitor can not withstand the actual beam!

3. Beam monitor



3. Beam monitor

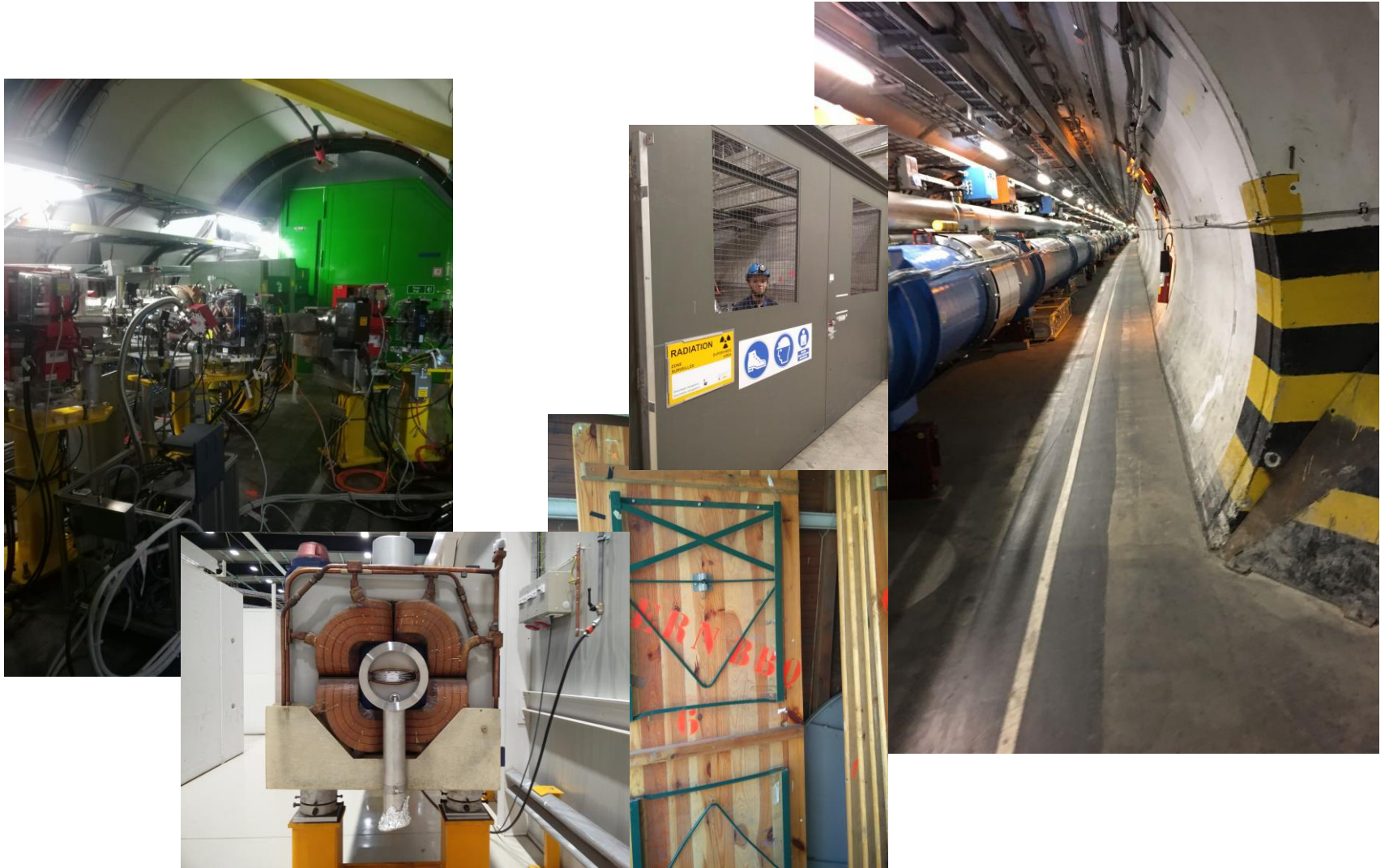


3. Beam monitor

- Finding out the spring rate
- Calculating the forces and the momentum
- Why did the element fail?



4. Experiences



THANK YOU

... for your attention!