STATE OF THE WIRES OF THE STRAW TUBE TRACKER

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STT

Contents

Why "Straw" Tube?

You will find the answer to this question in the picture:

Straw is long and thin ...

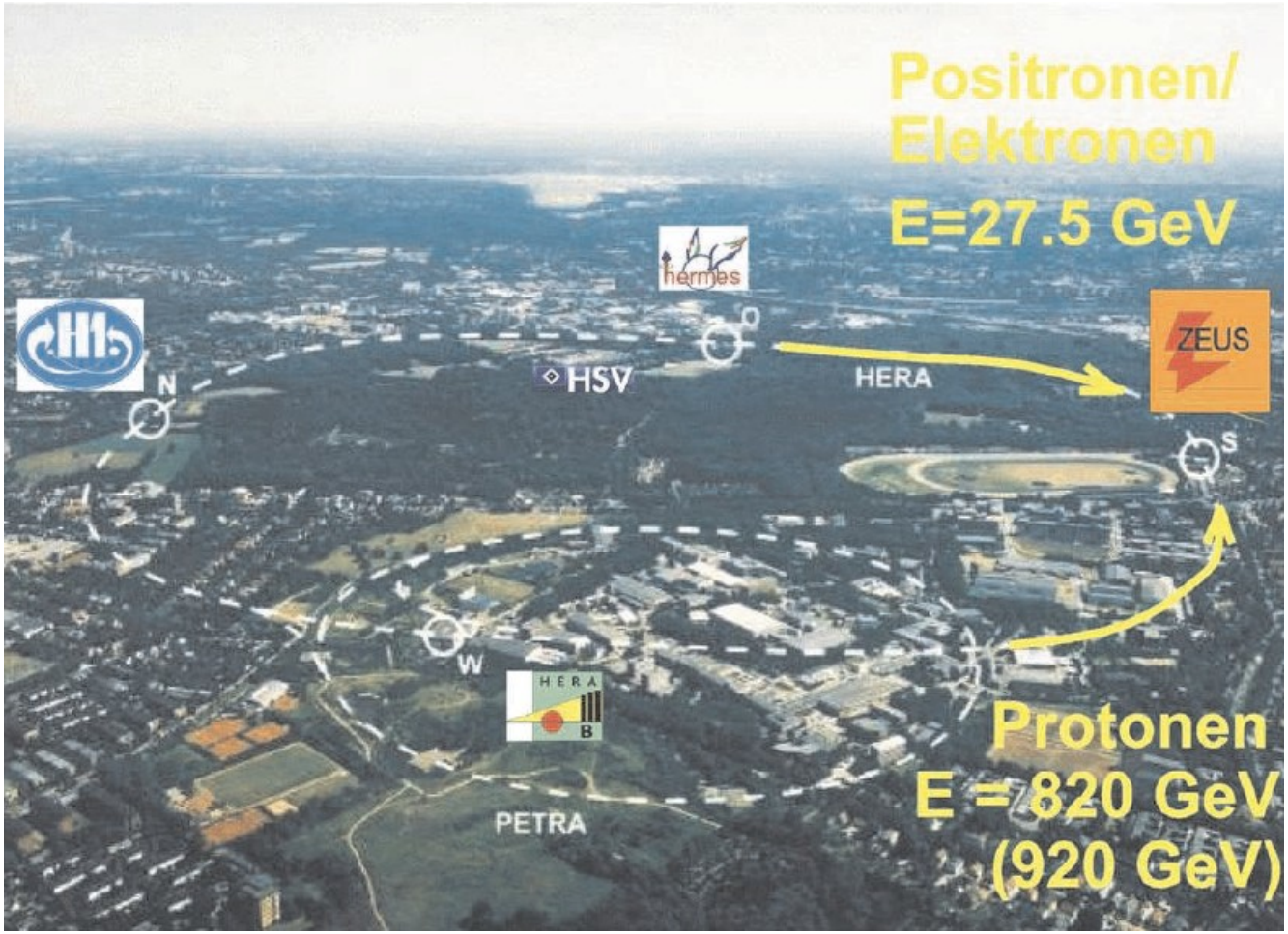
What is the STT?

The STT (Straw Tube Tracker) is a component of the ZEUS detector

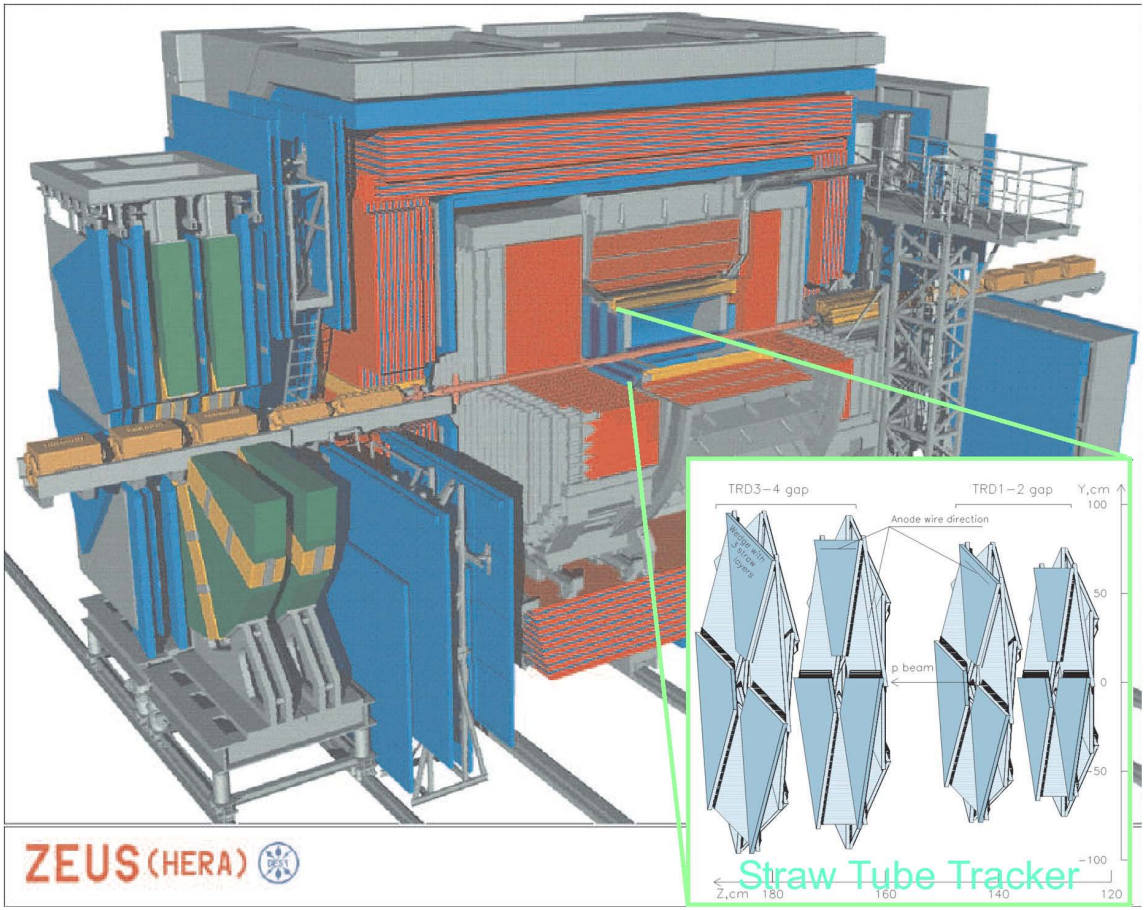
It is designed to improve the track reconstruction in the forward region of the detector

It was installed during the HERA shutdown in 2000

Where is ZEUS?

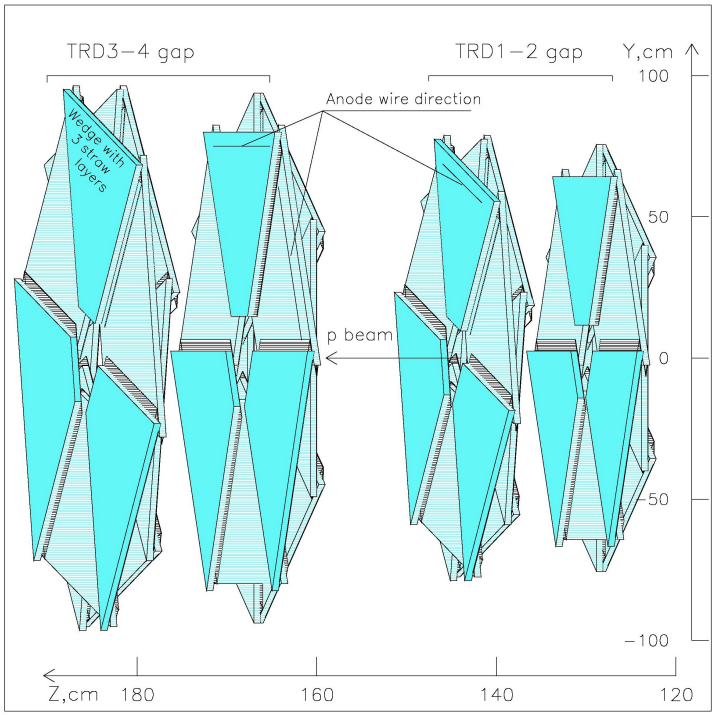


Where is the STT inside the detector?



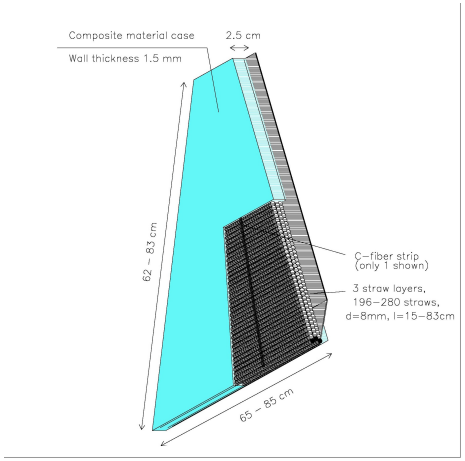
Parts of the STT

- Two STT: STT1 (small sectors) and STT2 (large sectors)
- Eight superlayers (wheels): four for each STT
- Six sectors per superlayer
- Sectors consists of tubes with wires inside:
  - Small sectors: 64
  - Large sectors: 88
- Also three layers of wires per sector
- Position of the superlayers:



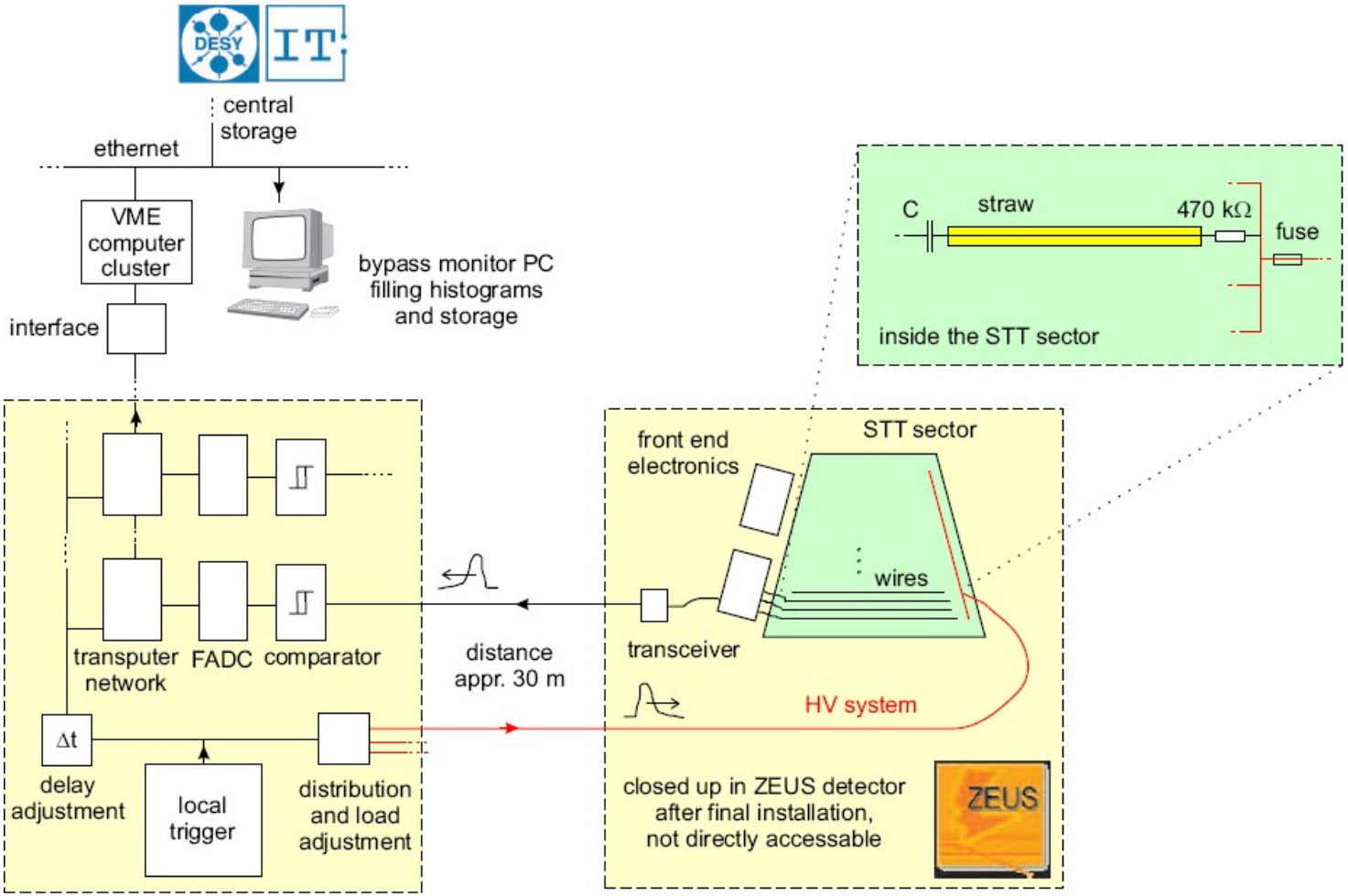
Sectors

- A sector is something like this ⟶
- Each sector has at one side two or three data acquisition electronic boards
- But not all the wires of the sectors are OK! There are:
  - Dead wires
  - Unstable wires



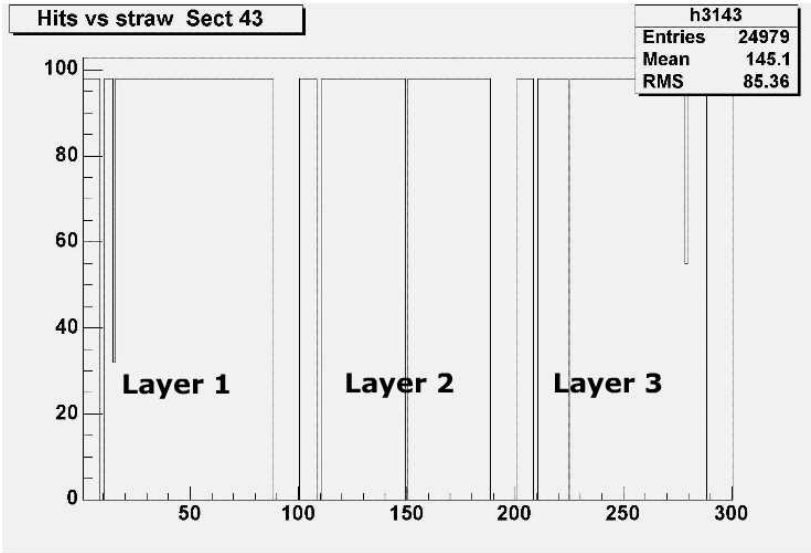
- Analysis of these wires is very important to:
  - Know the state of the STT
  - Analyse if there is any similar evolution in order to detect a source of damage in the system
- To check the wires we use injected pulses (Pulse Test) ⟶ Big amount of **DATA** to analyse

Pulse Test Setup



Data obtained from the tests

- 48 histograms (one per sector), e.g.:
- In the X axis: wires grouped in three layers
- In the Y axis: number of pulses received
- A number of 98 pulses are introduced but not always all the pulses reach the output
- The number of pulses in the output establish the grade of unstability (0 hits means that the wire is dead)



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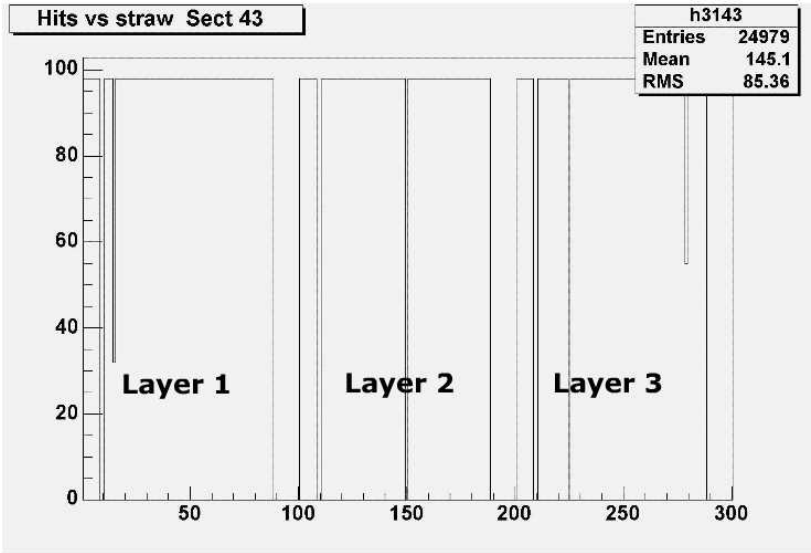

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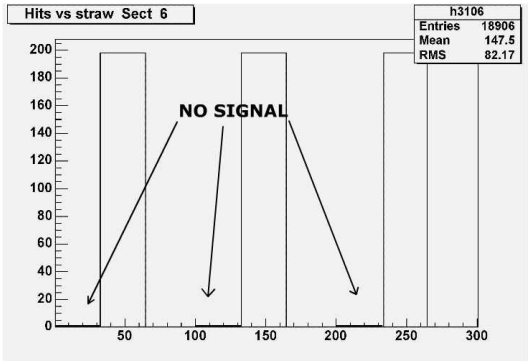
Previous knowledges I

In some cases we know the reason why the wires don't work, so these data musn't be taken into account, e.g.:

- **Broken electronic board**

  This effect appears in the histogram as:



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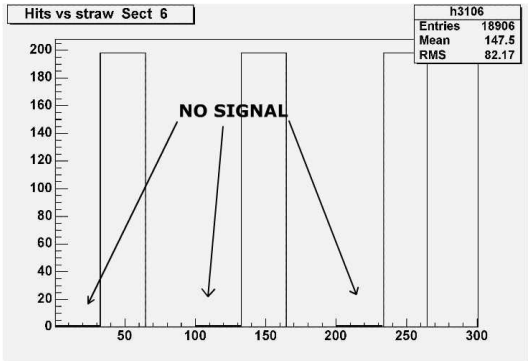
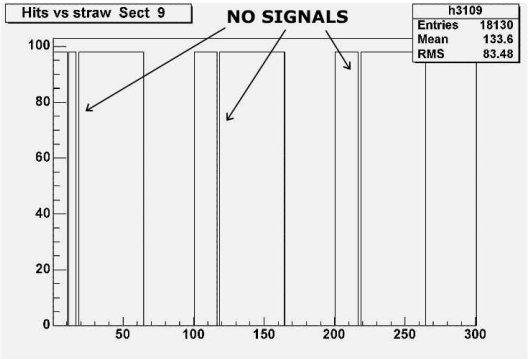


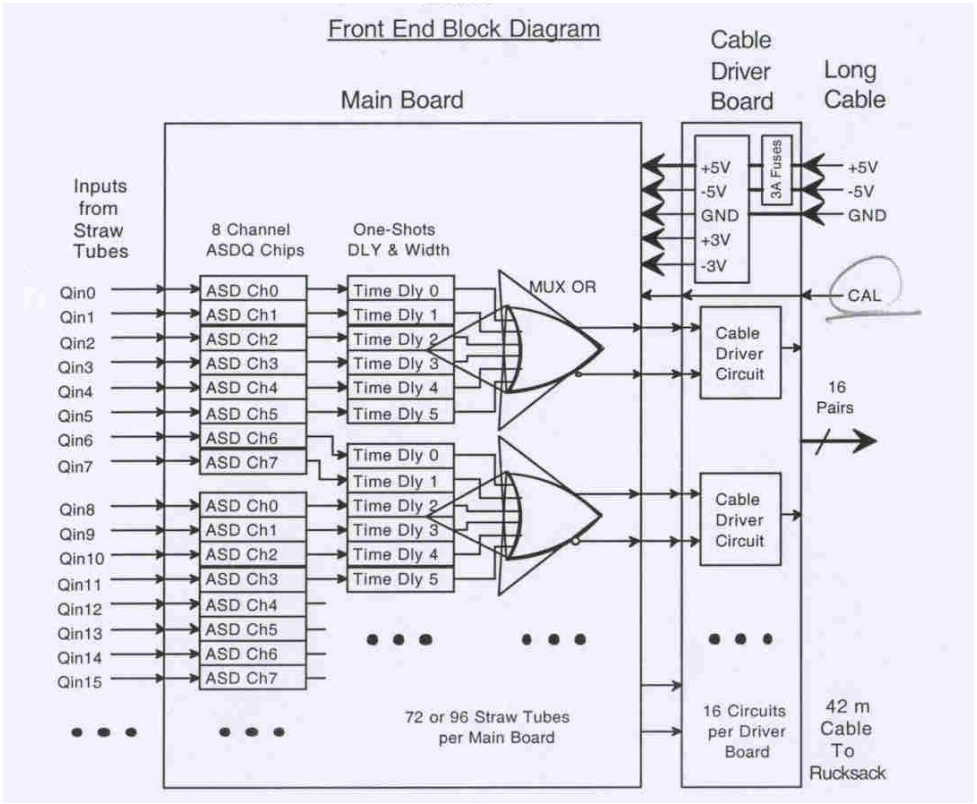
- **Transmission line fail**

  It seems that there are dead wires at the same position in each layer



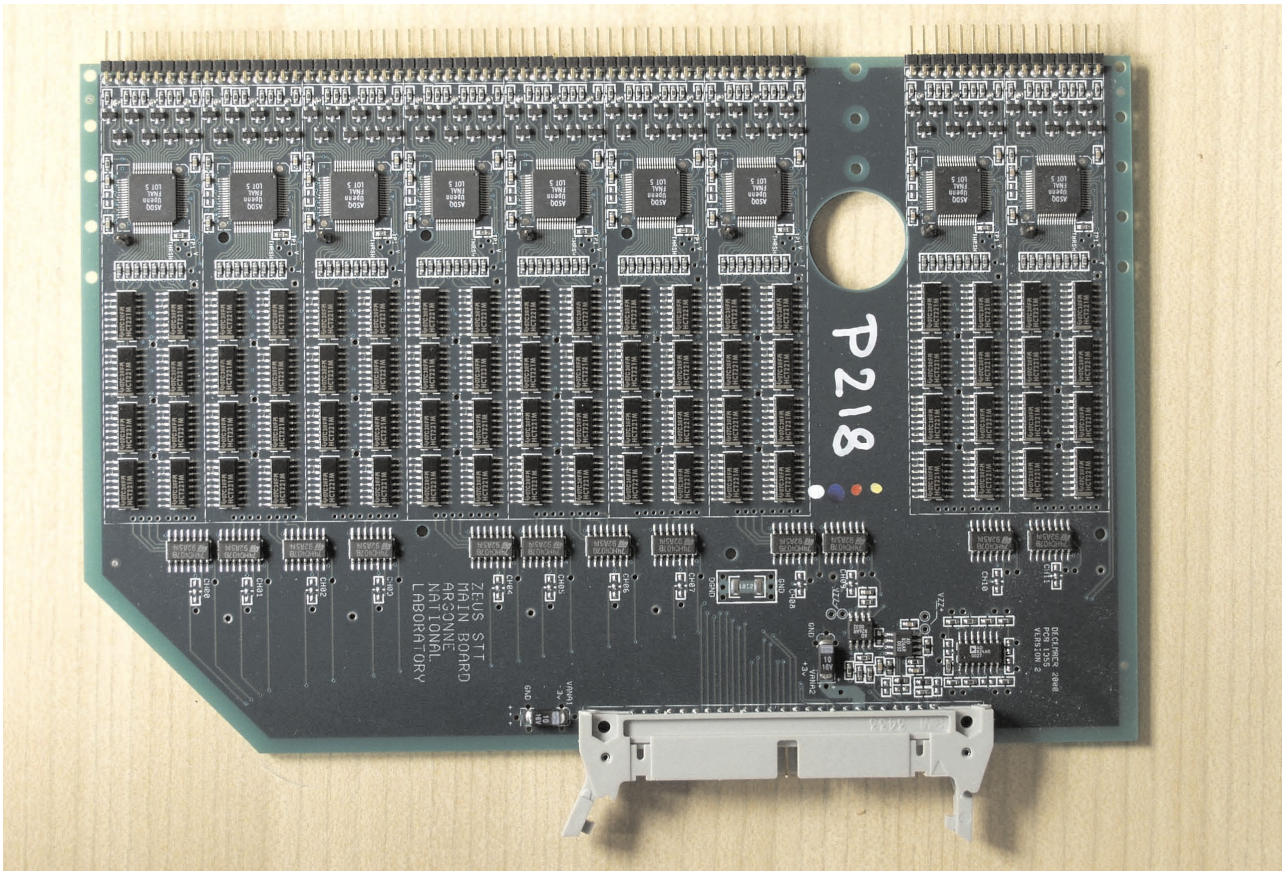
Previous knowledges II

The main board of the acquisition uses MUX-OR gates for each 6 wires so if one of these is broken → **Transmission line fail**



Previous knowledges III

A typical electronic board with mux gates, pre-amplifiers, . . . :



Results I

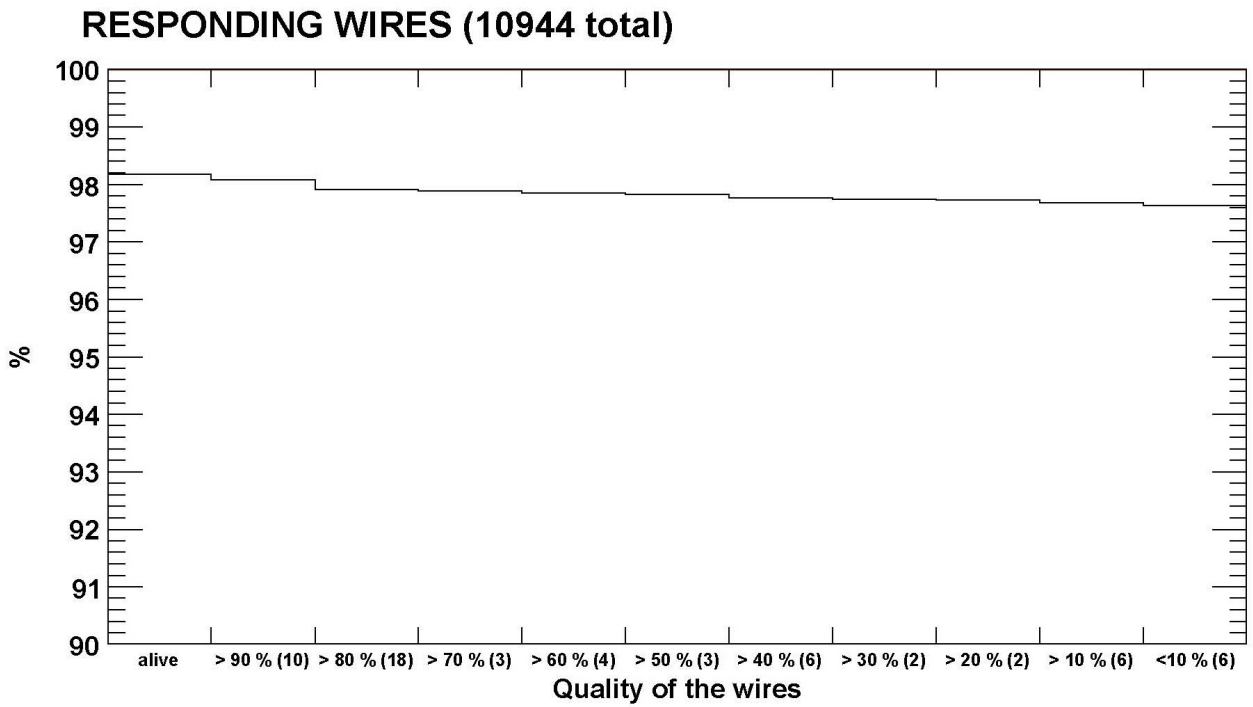
- Number of dead and unstable wires (10944 wires in total):

	Number
Dead wires	199
90-100 % Unstable wires	10
80-90 % Unstable wires	18
70-80 % Unstable wires	3
60-70 % Unstable wires	4
50-60 % Unstable wires	3
40-50 % Unstable wires	6
30-40 % Unstable wires	2
20-30 % Unstable wires	2
10-20 % Unstable wires	6
0-10 % Unstable wires	6

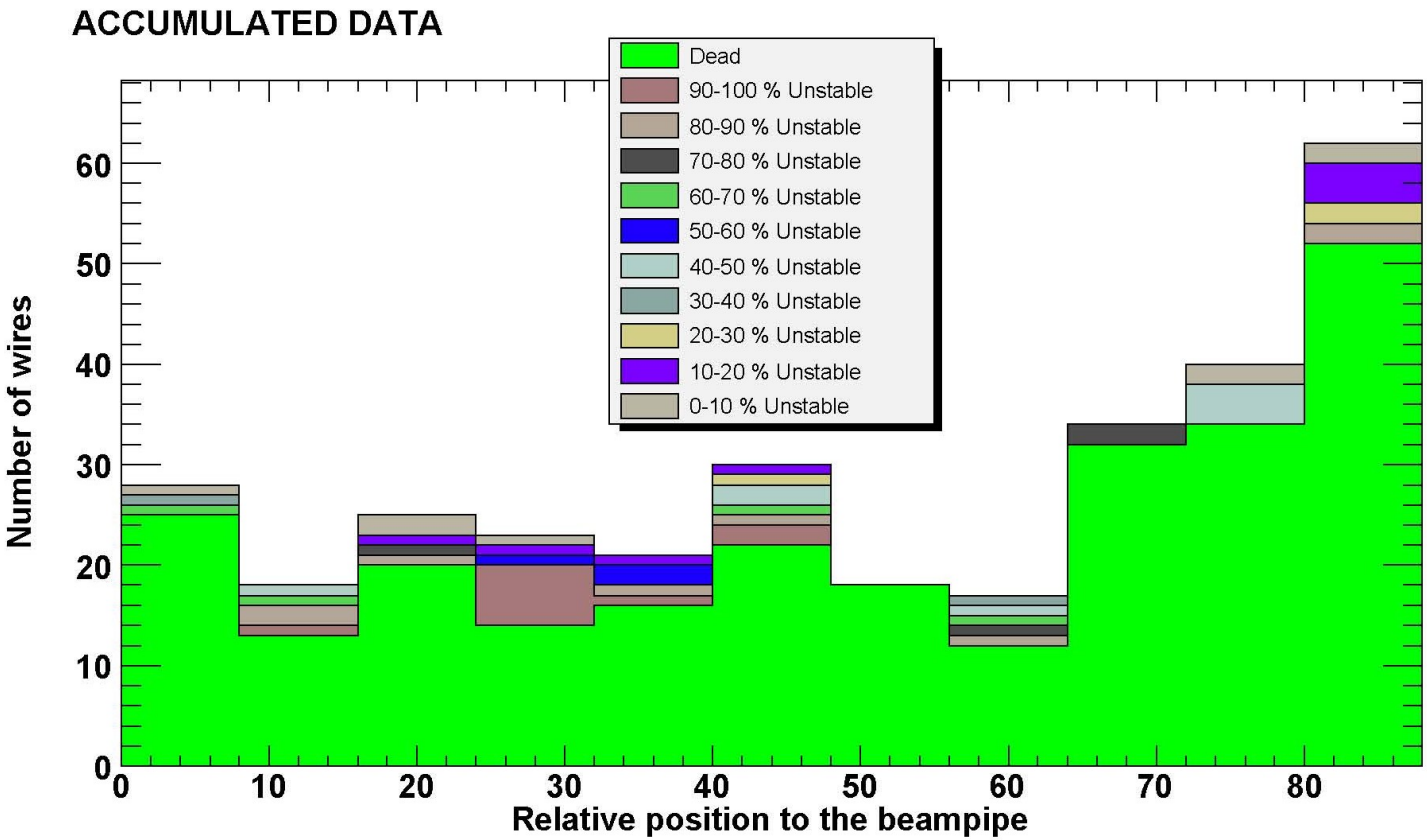
Only 1.82 % of the wires are dead $\longrightarrow$ **Not Bad!**

Results II

- Quality of the wires:



Results III


ACCUMULATED DATA
Dead
90-100 % Unstable
80-90 % Unstable
70-80 % Unstable
60-70 % Unstable
50-60 % Unstable
40-50 % Unstable
30-40 % Unstable
20-30 % Unstable
10-20 % Unstable
0-10 % Unstable
Number of wires
0
10
20
30
40
50
60
0
10
20
30
40
50
60
70
80
Relative position to the beampipe

Results IV

Dead wires with respect to the relative position to the beampipe:

- *Inner wires:* no general behaviour found
- *Outer wires:* dead wires increasing with the relative position

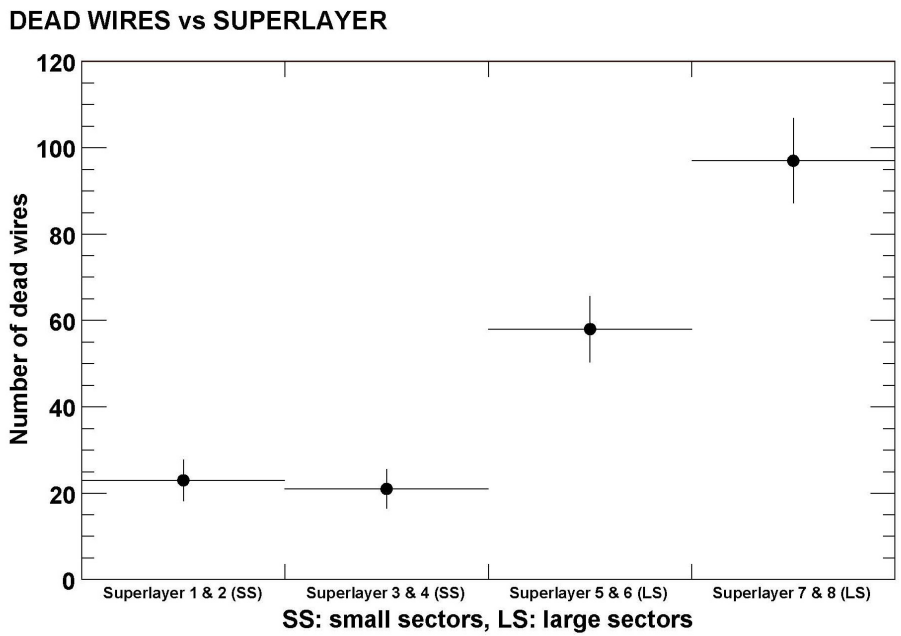
Unstable wires with respect to the relative position to the beampipe:

- No conclusion has been found
- Not enough unstable wires to establish a pattern

Results V

Dead wires with respect to the superlayers:

- *First superlayers:* no tendency
- *Last superlayers:* increasing number of dead wires with the axial coordinate



Supposed reasons of the damage of the wires

- **Length of the wires**

  Long wires $\longrightarrow$ more probability to break

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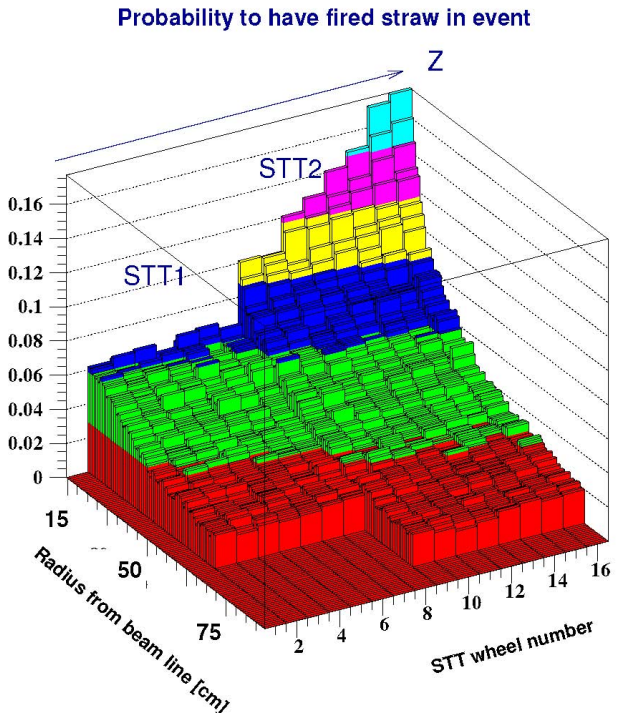
- **Hit probability of the wires:**



Conclusions

- 97.5 % of wires completely OK and 1.82 % dead (rest unstable) $\longrightarrow$ **Quite well**
- **Length** is a decisive parameter
- Linear dependence of the dead wires with respect to the superlayers

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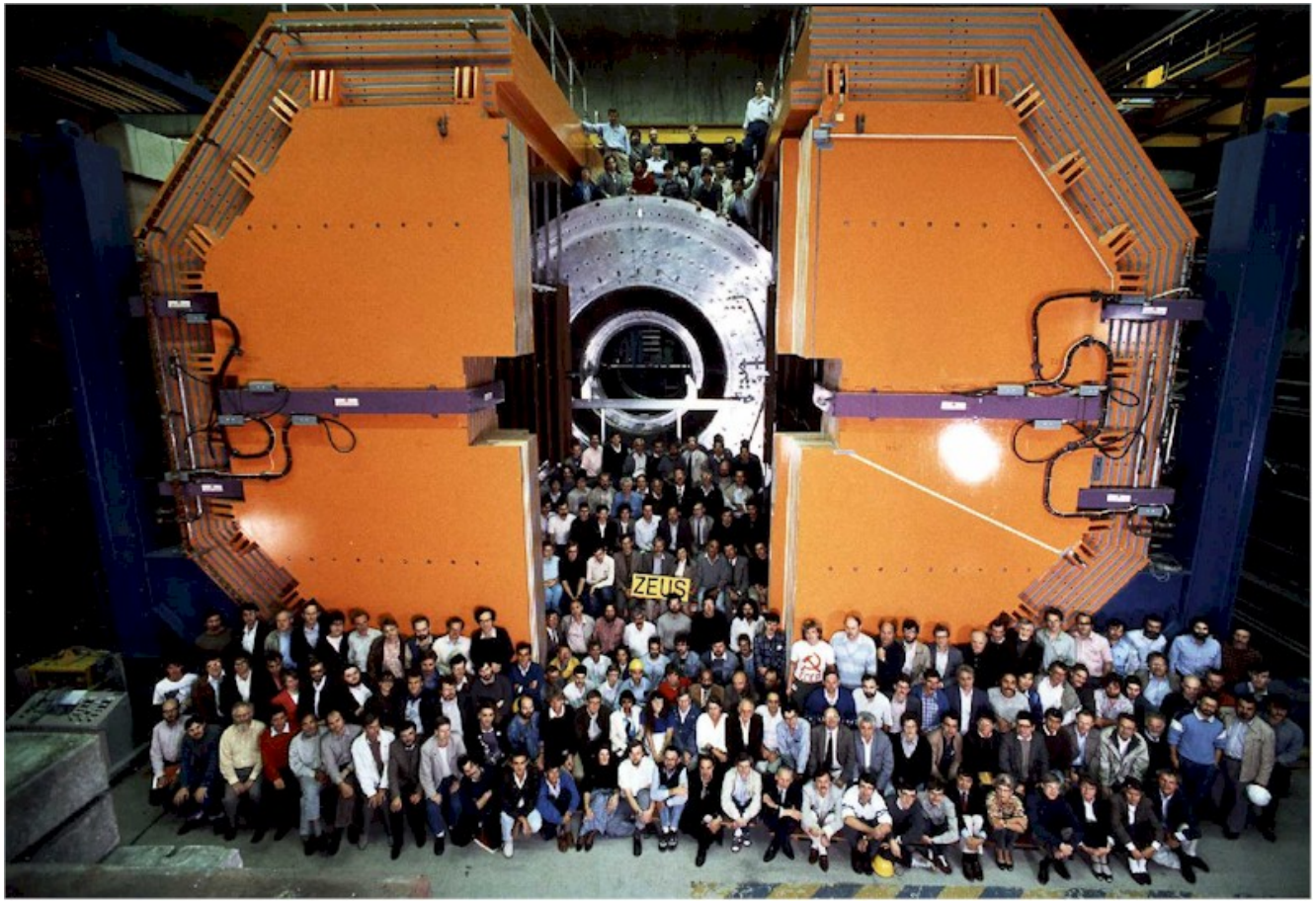
Supervisor: FALK KARSTENS, University of Freiburg



Thank you for your attention