

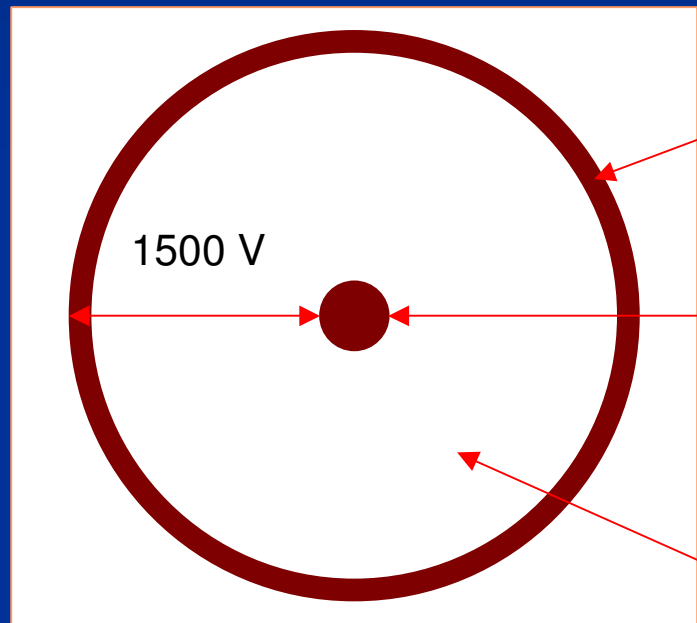
Straw tube measurements

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The Detector

- A model of the straw tube detector used for the Outer Tracker in LHCb
- 16 channels
- 1500 V bias
- Gas mixture: 75% Ar, 15% CH₄, 10% CO₂

The straw tube

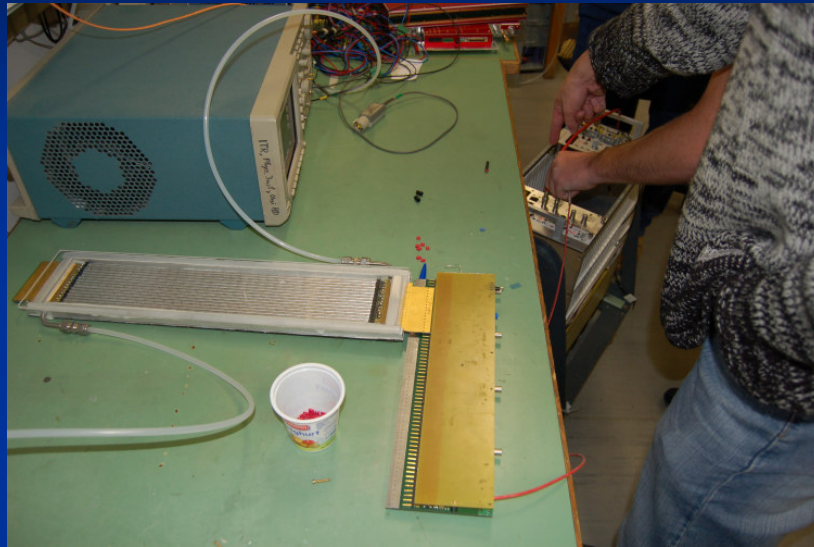


Cathode tube,
(5 mm Ø)

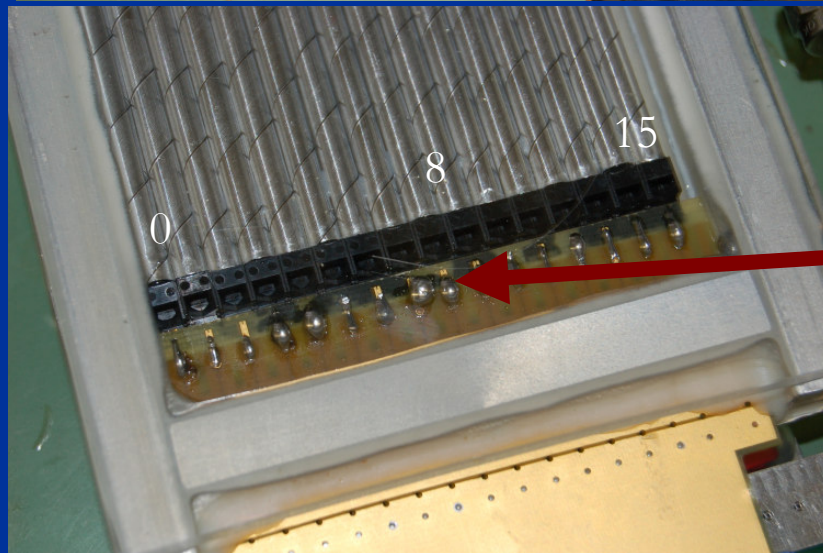
Anode wire, Au-plated
tungsten (0,025mm Ø)

Gas:
75 % Ar
15 % CH₄
10 % CO₂

Testing

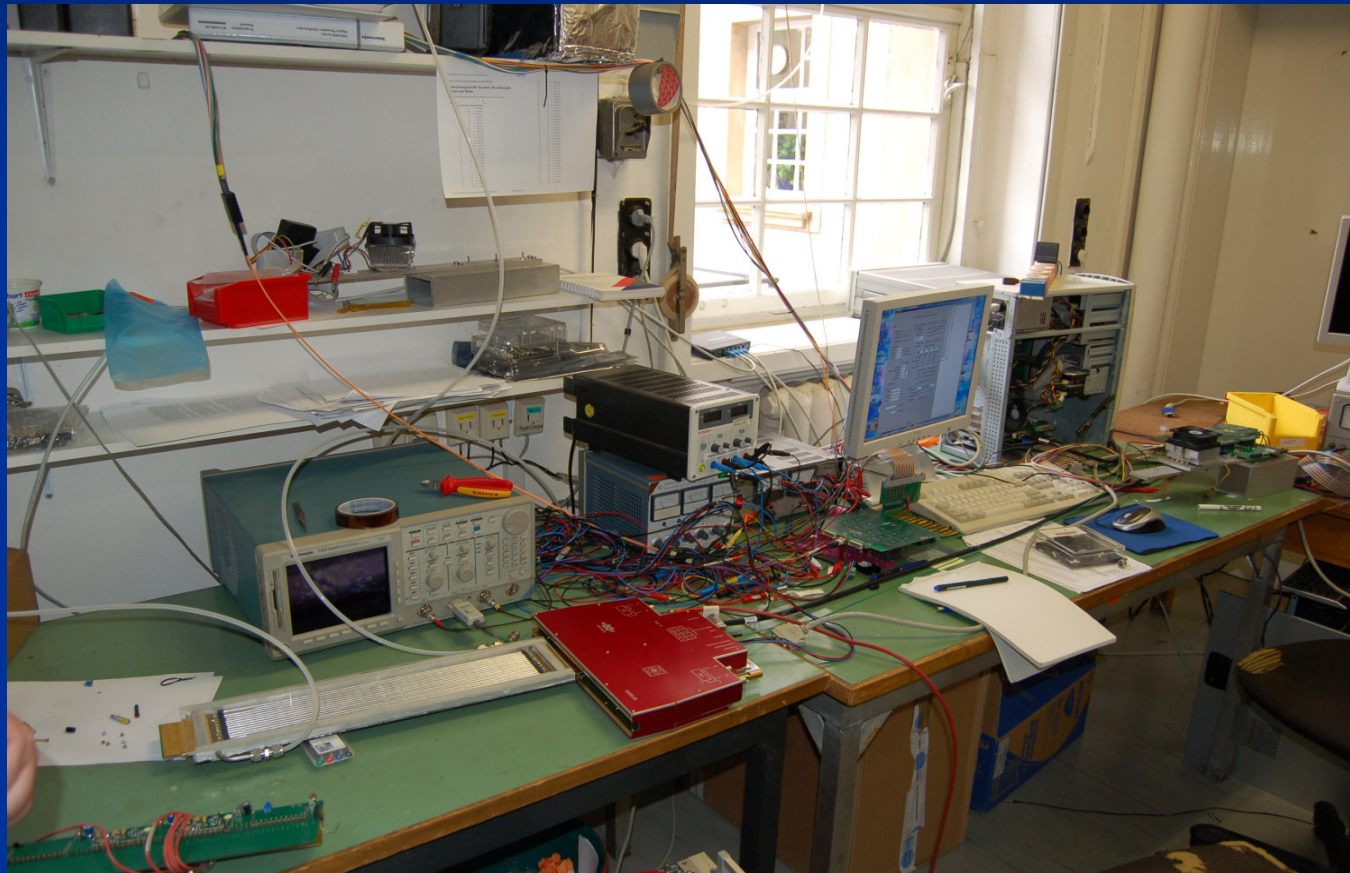


- Test setup for testing the 16 channels one by one
- “Only” 2 dead channels

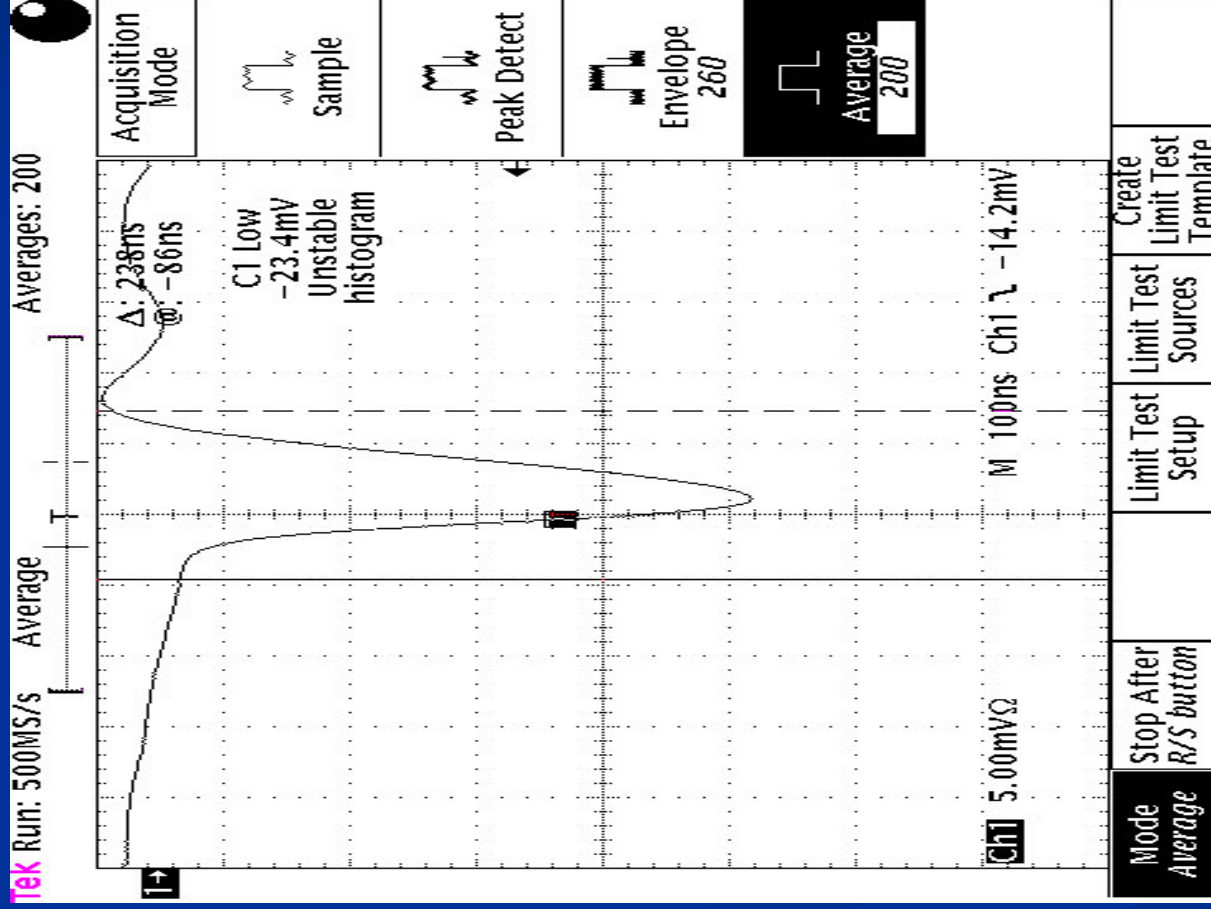


Nice soldering points!

The Final setup



Scope trace (average) of output voltage from straw tube 15.



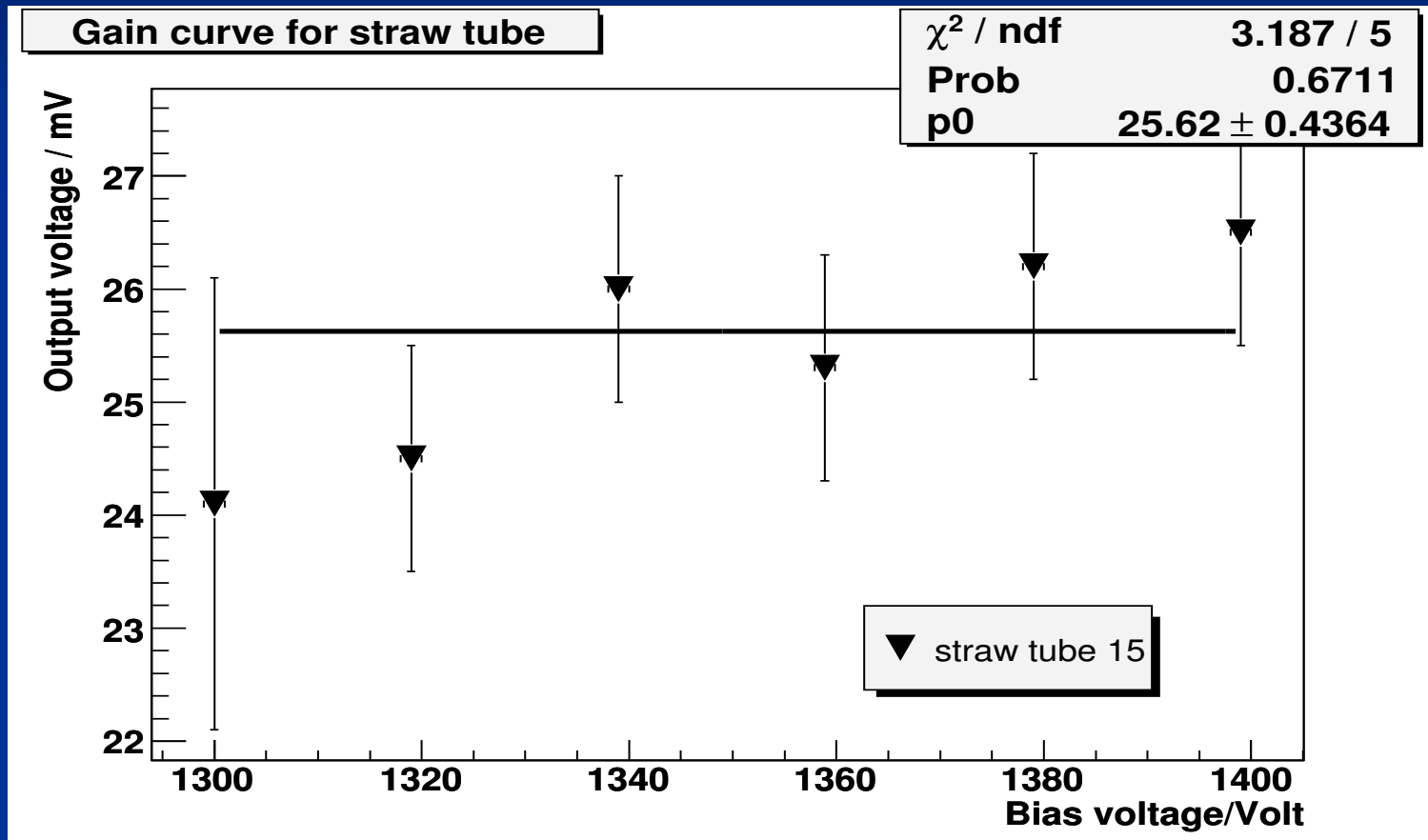
Hypotesis

- The gas amplification gain depends on the bias voltage of the straw tubes.
- The gain increases at higher voltages

Test of hypothesis

- Measure the output signal from the straw tubes for different values of the HV.

Results



Conclusion (preliminary)

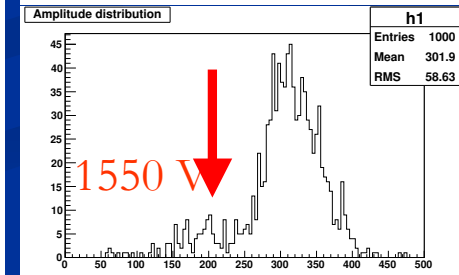
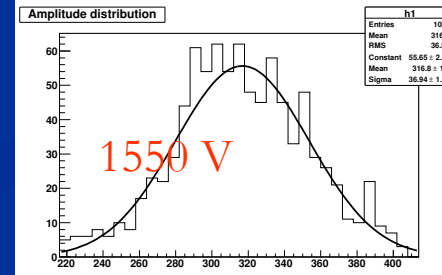
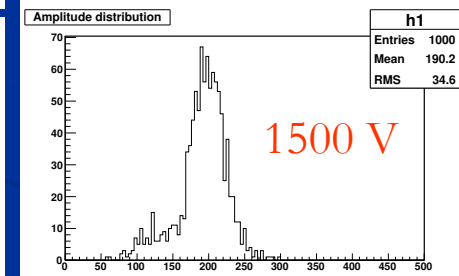
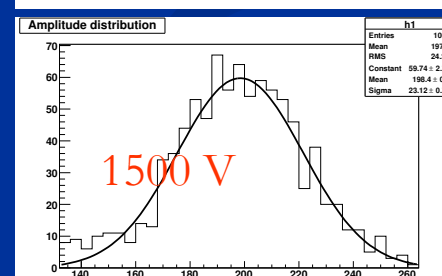
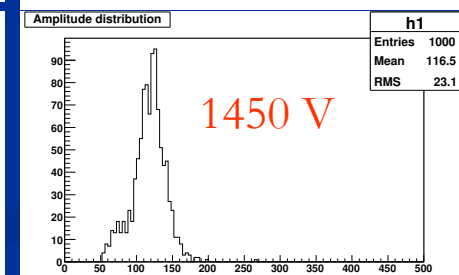
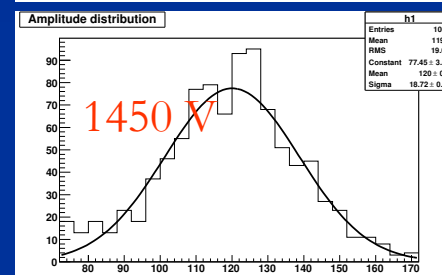
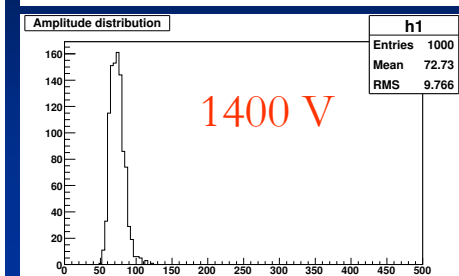
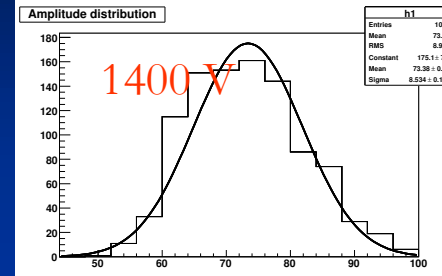
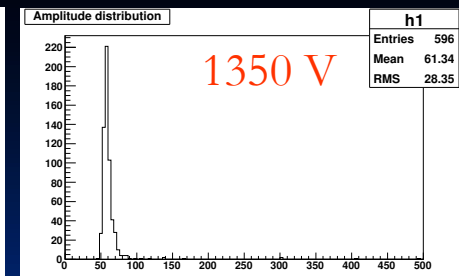
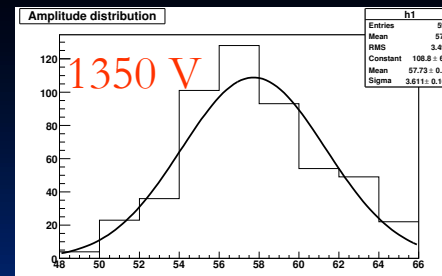
- Our observations contradicts the Hypotesis. The gain is independent of the bias voltage.

Discussion

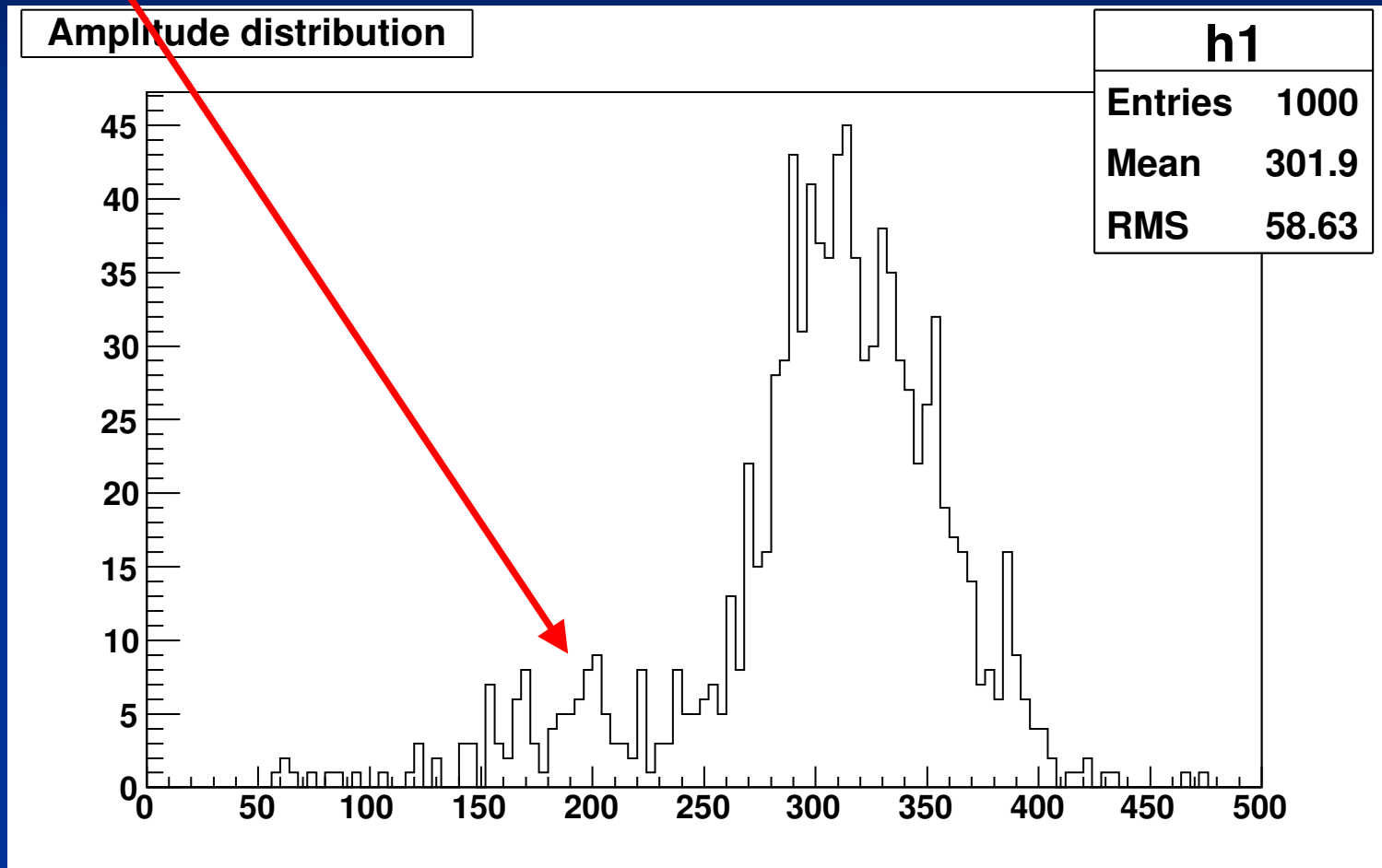
- We don't believe in these results, gain should depend on HV.
 - Implication: We need an ad-hoc hypothesis
- Ad hoc hypothesis: We used wrong type of radioactive source (strontium).
- We should repeat the measurements again with a monochromatic source (Fe55).

New Gain measurements

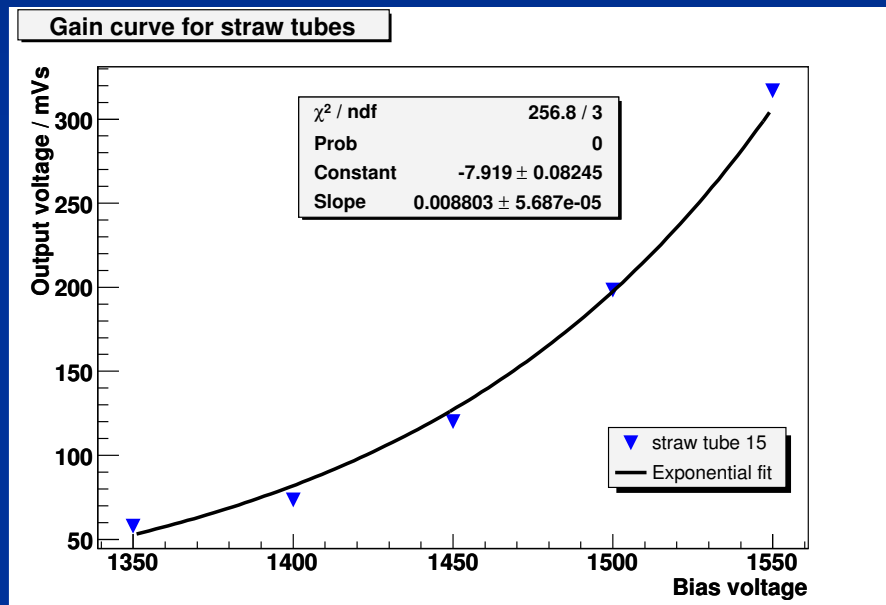
- The output voltage of the straw tubes was measured for 1350, 1400, 1450, 1500, 1550 Volt.
- At 1550 V we could also see the escape peak.



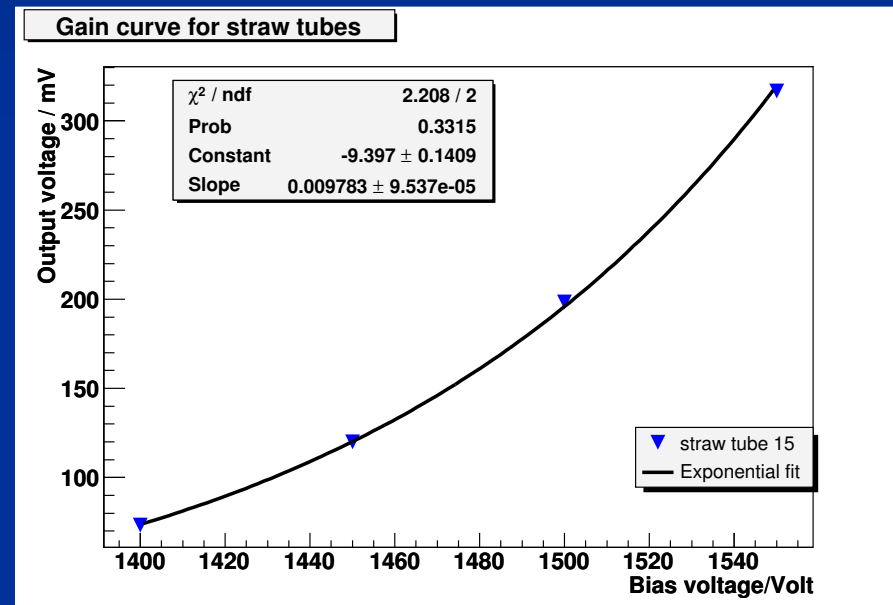
Escape peak, enlarged view



Results



All measurements fitted with an exponential Function.



Only the 4 highest measurements fitted with an exponential Function.

Conclusion

- The output signal from the straw tubes depends on the bias voltage.
- The dependence is exponential between 1400 and 1550 Volt

Noise measurement

- We measured the number of fake trigger as a function of the trigger threshold.
- Without radioactive (upper figure).
- With radioactive source (bottom figure). The source was centered above straw 8

