TRD GAS SYSTEM STATUS

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Summing up

- Box S:
  - Heaters tested for both Xe and CO_2;
  - Mixing cycles successfully executed under computer control;
  - Emergency procedure tried:
    - Ar through CO_2 line opening V1a, V20a&V20b, V2b, V3b: too few gas transferred to D vessel → buffers too small;
    - CO_2 through Xe line opening V1b, V20a&V20b, V2a, V3a: controllable;
  - Pressure sensors jitters eliminated after rewiring.

- Box C:
  - All components tested and operated successfully under computer control but V8b (always close?) and P4;
  - Kang Li device connected: proper communication with MCA;
  - MCA calibrated;
  - Preamplifier connected and tested;
  - Monitor tubes connected and tested.

- Electronics:
  - USCM 4E-NB: port 0 not working;
  - 2 USCMs plugged in;
  - UHVG connected and tested.

Present status

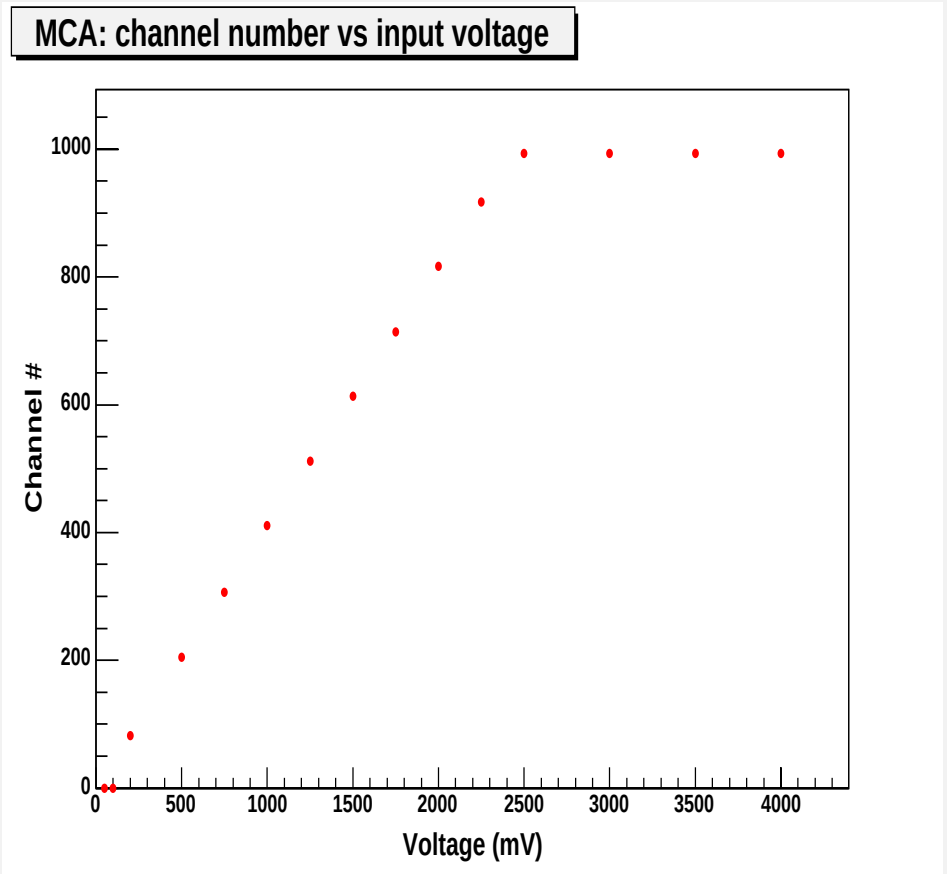
- Box S:
  - All components working but GP:50 P2a:
  - Ω sensor used on D vessel;
  - Ω read out using UGBS;
  - Calibration needed:
    - Ready to do it for pressures below ~2 atm;
    - No means to calibrate it in the range [0,300] psi;
  - Dallas calibration almost completed (Mariusz);
  - Premixed Ar/CO_2 (80:20) mixture injected using pressure reducer from source bottle to D vessel through CO_2 line.

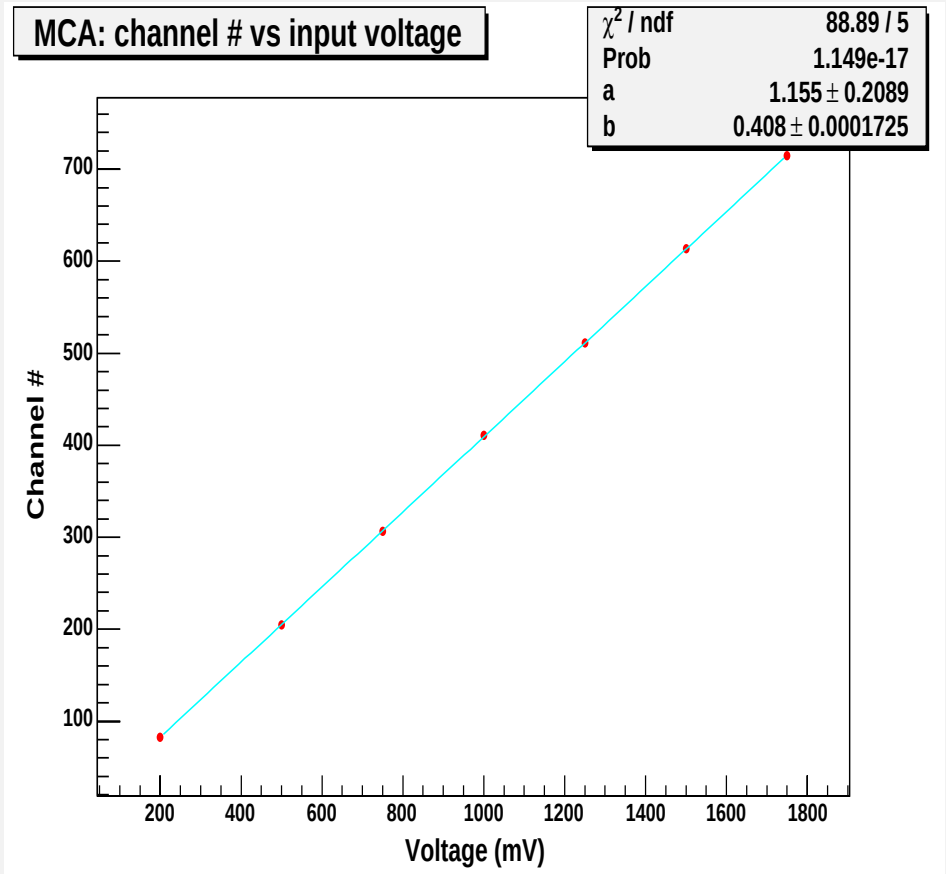
- Box C:
  - Need to change GP:50 P4: waiting for new Ω sensors;
  - Monitor tubes input connected directly to D vessel using plastic tube while output is open;
  - Waiting for tubes connection to the circuit (between V6a & P4);
  - Need to connect 100 l vessel: waiting for VCR fittings, needle valve and flowmeter;
  - MCA saturation due to memory settings: no possibility to change them using present Kang Li device → waiting for a new one;

- Found a strange behaviour (count is just pedestal) in measurements of ^{55}Fe spectra using channels 3 & 4 of preamplifier:
  - Proper work of tubes tested using channels 1 & 2;
  - Checked HV supply and preamplifier capacitors status measuring HV before and after capacitors → good results;
  - Conclusion: channels 3 & 4 are not working properly;
- Measurements with no HV applied performed to check noise introduced by the amplifier;
- Channels 1 & 2 used to record spectra for each tube using premixed mixture;
- Spectra recorded for tubes 1, 3, 4 using a mixture enriched in Ar:
  - Found a saturation probably due to amplifier (working on it)

Test results

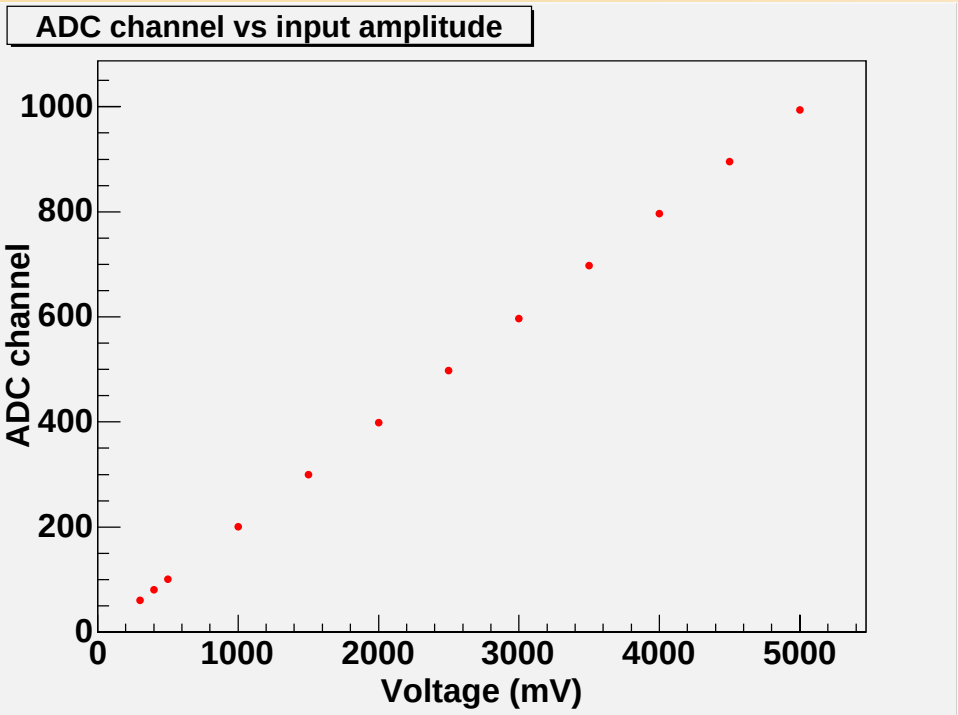
- MCA calibration with input range [0,5] V

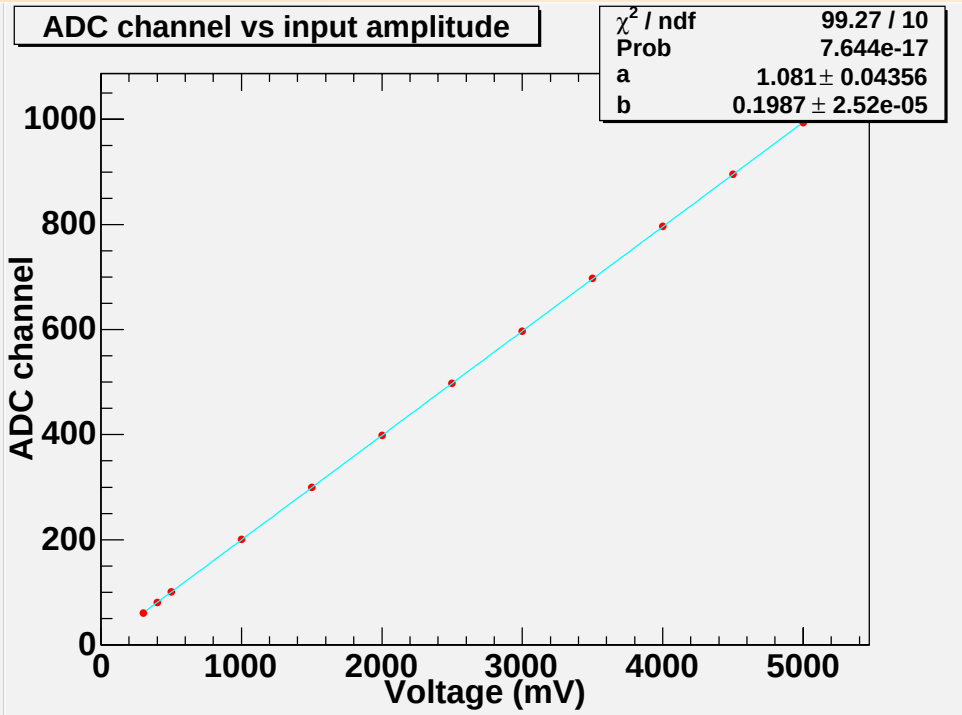




Saturation on ADC channel 993 for input amplitudes > 2.5 V

- MCA calibration with input range [0,10] V

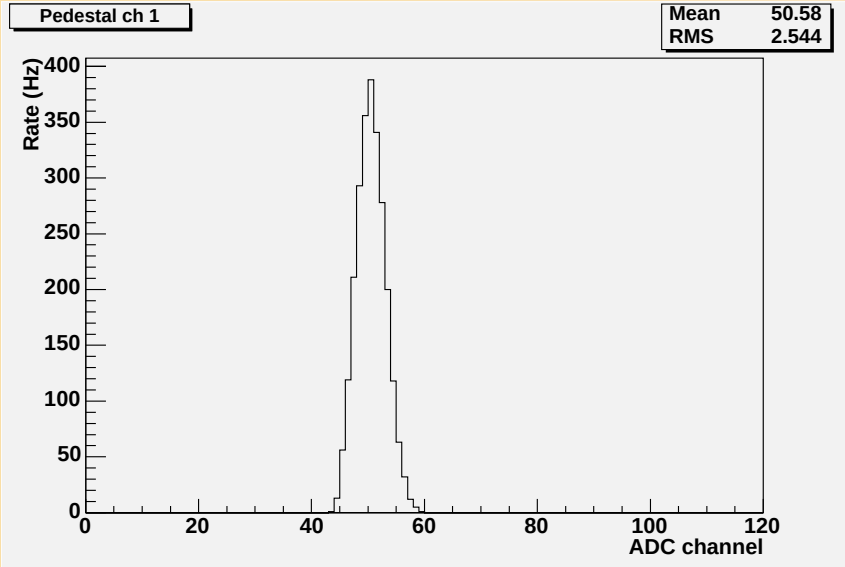




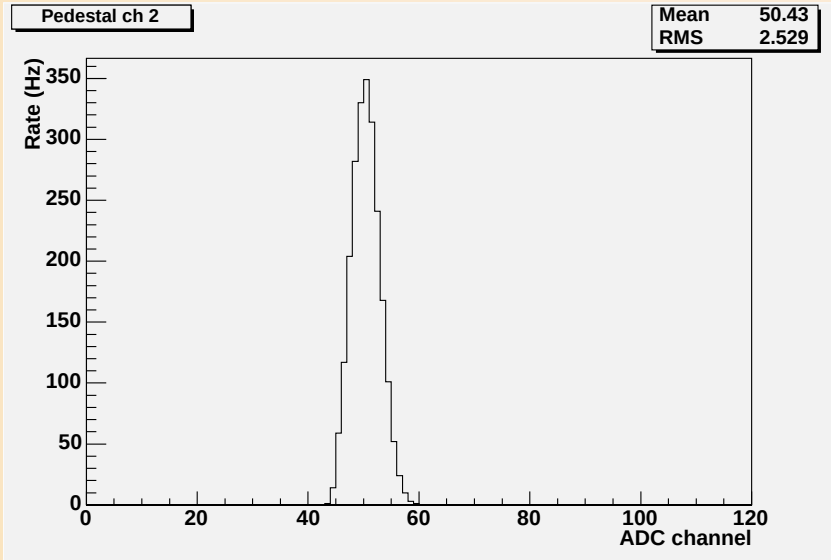
No possibility to send input with amplitude > 5 V anyway all counts on ADC channel 993 at 5 V → presumed saturation on this channel also in this range.

- Amplifier noise

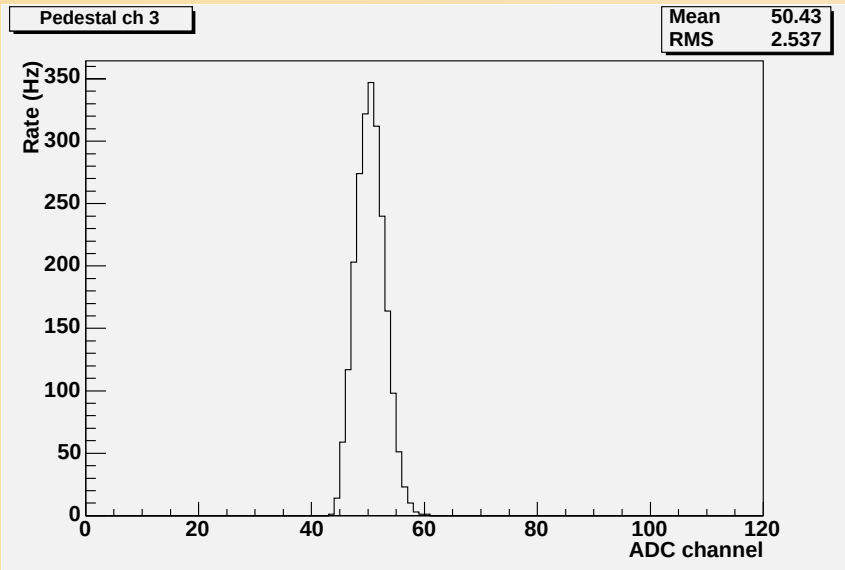
Channel 1



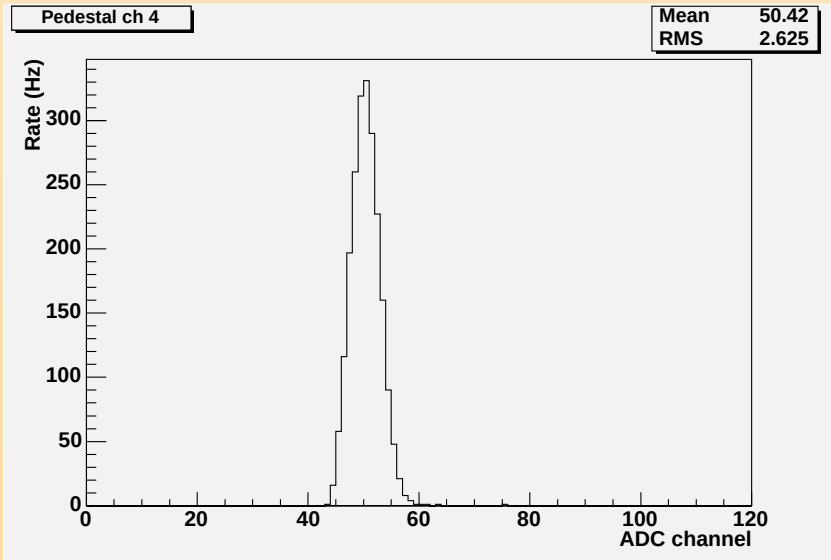
Channel 2



Channel 3

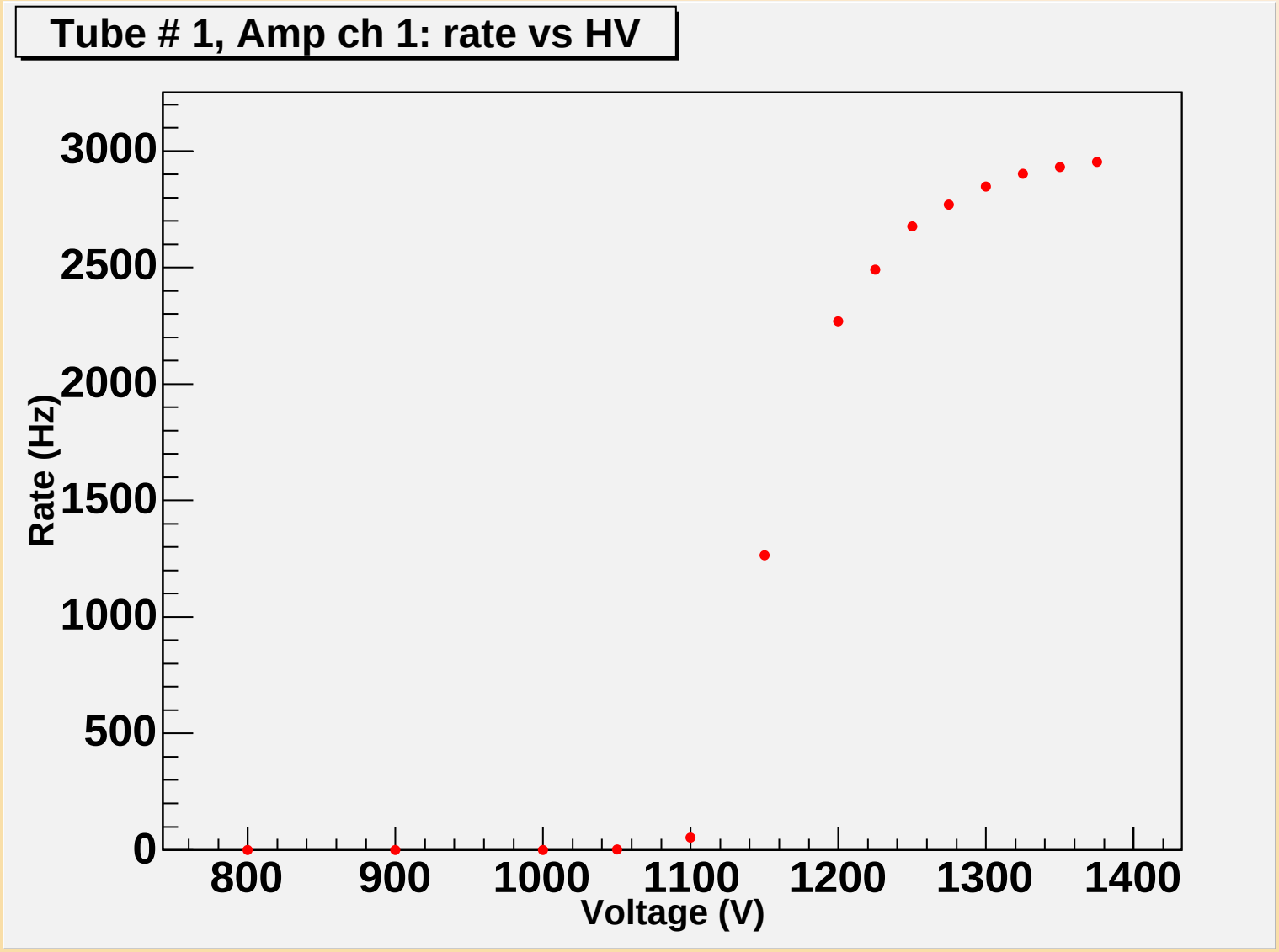


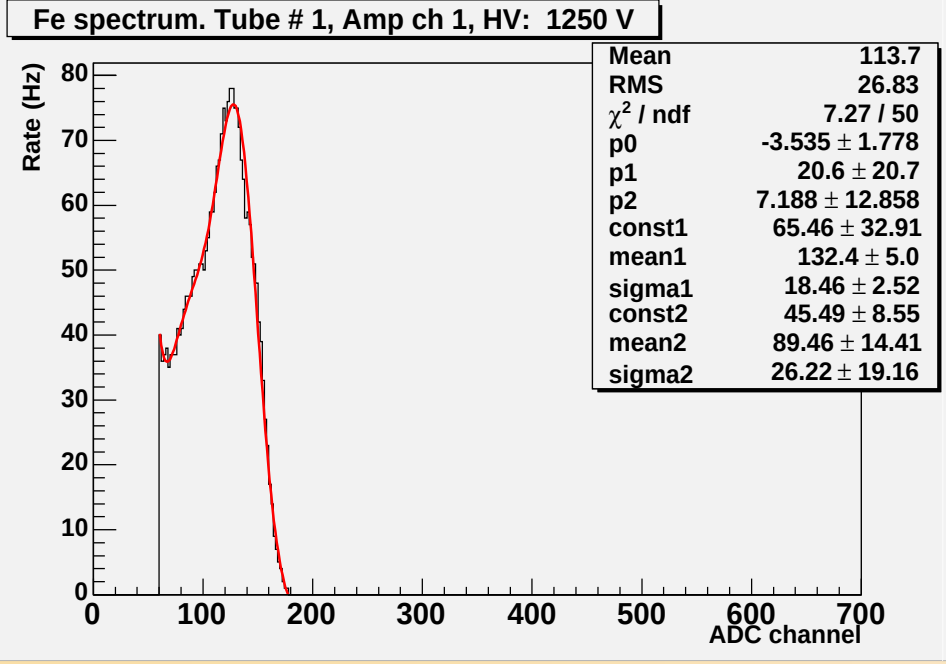
Channel 4

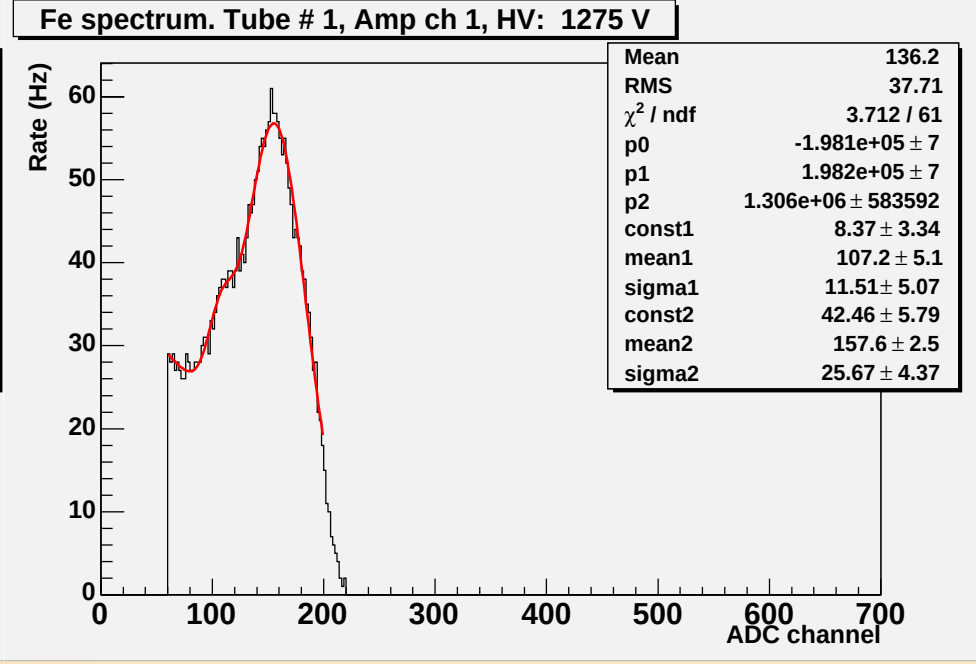


- ^{55}Fe spectra:

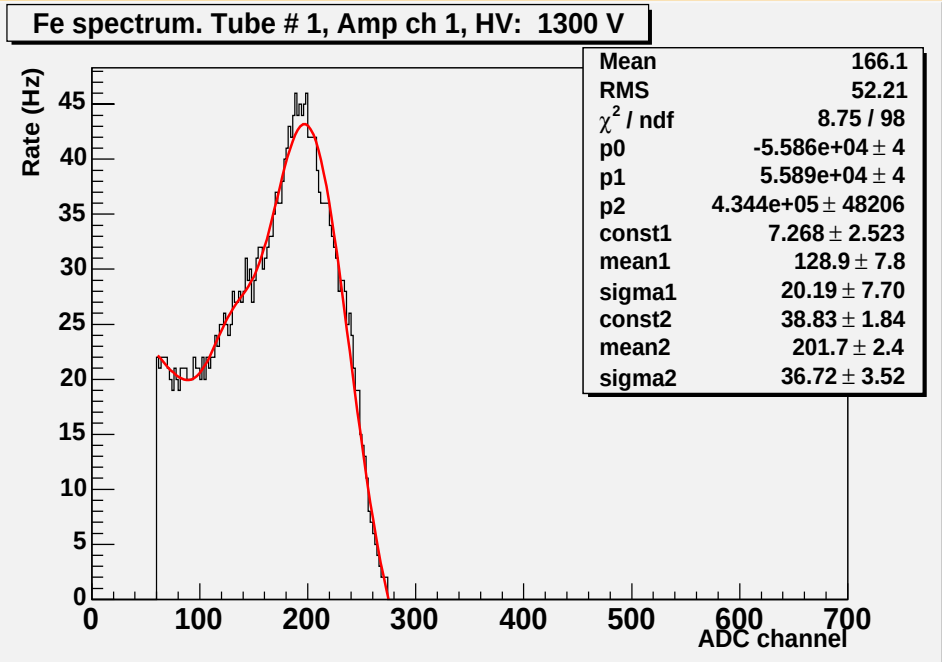
  - Tube 1, amp ch 1: cut on ADC channels ≤ 60

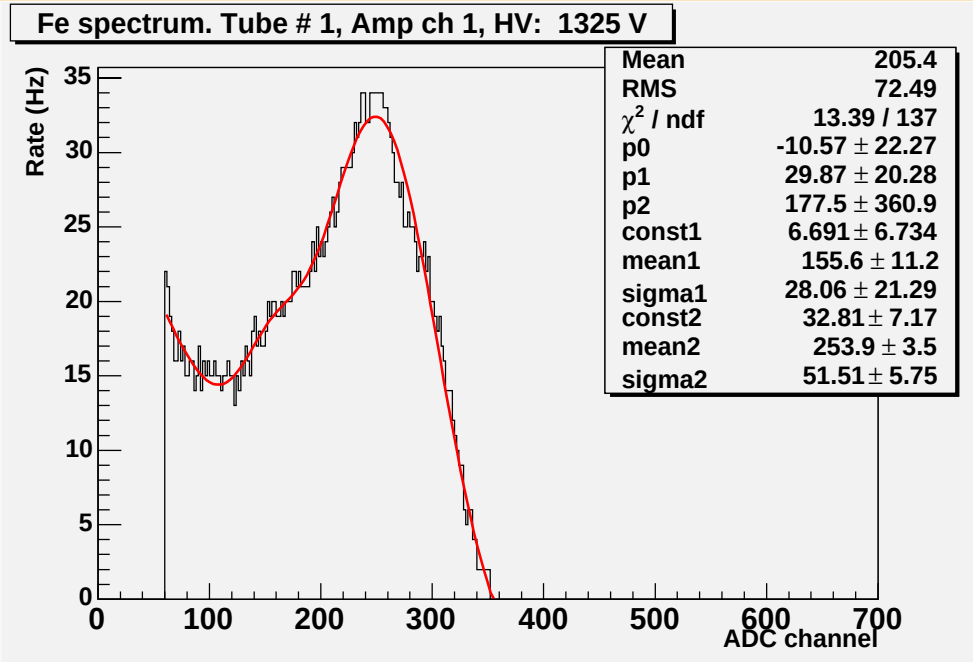


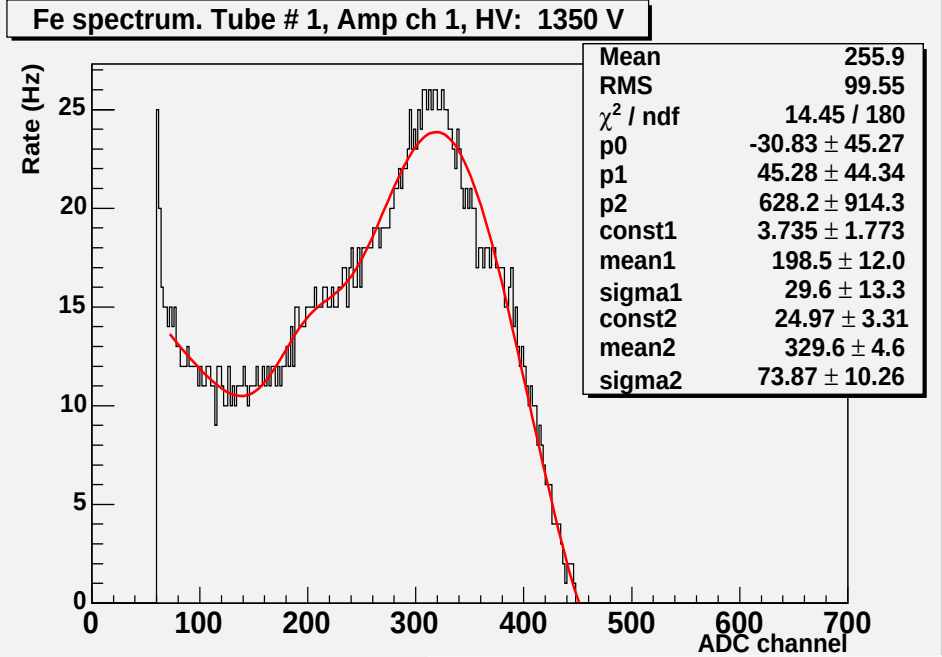


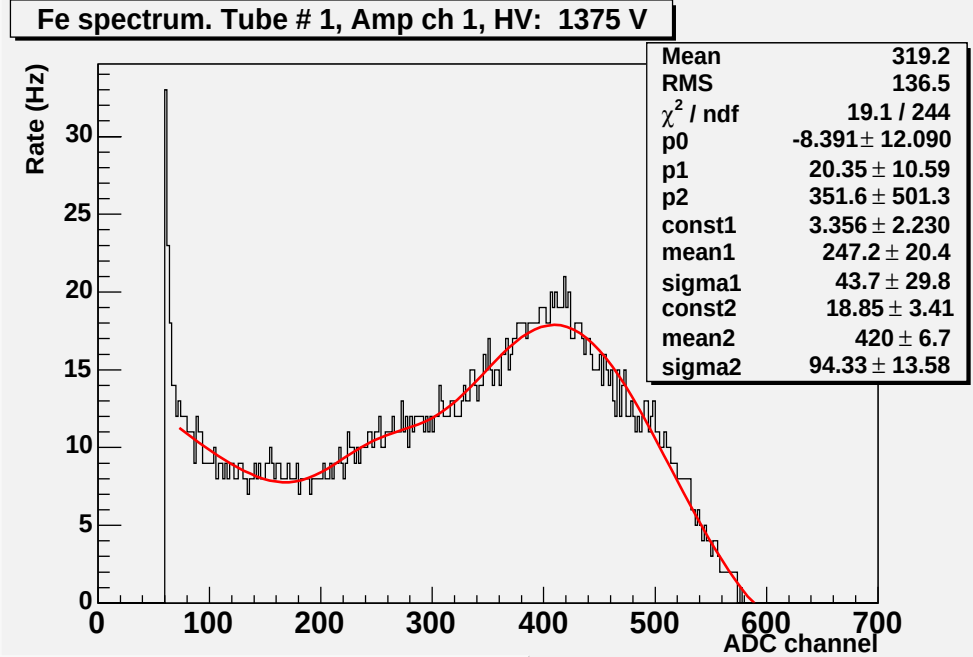


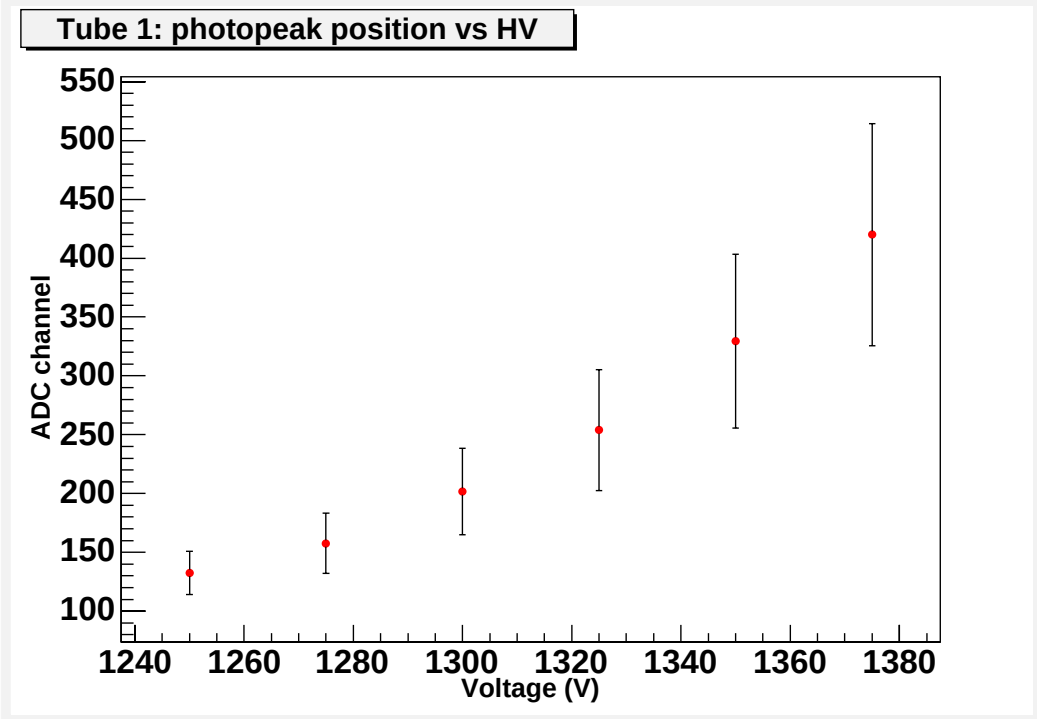
All spectra fitted using an exp function for background + two gaussian functions





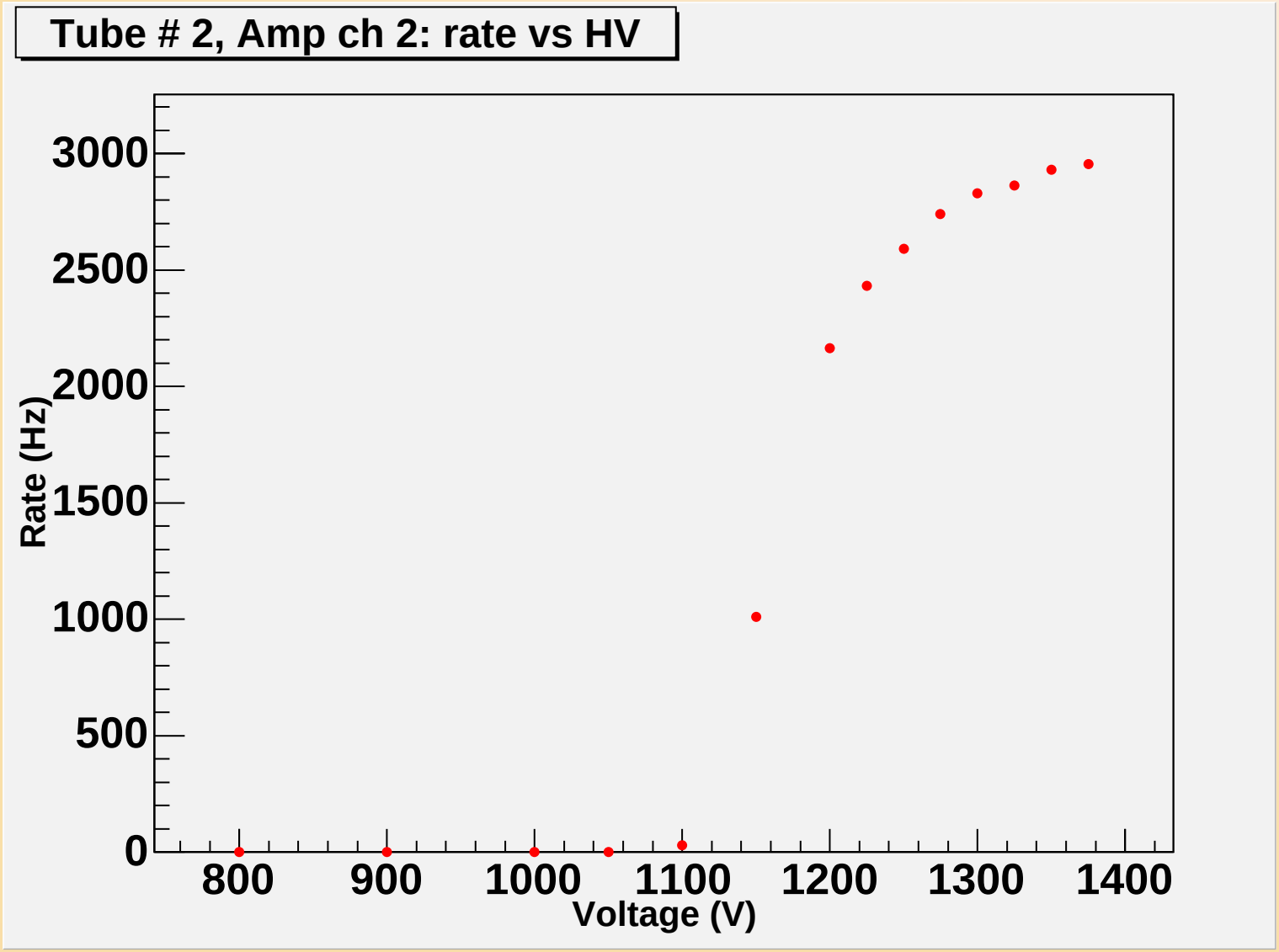


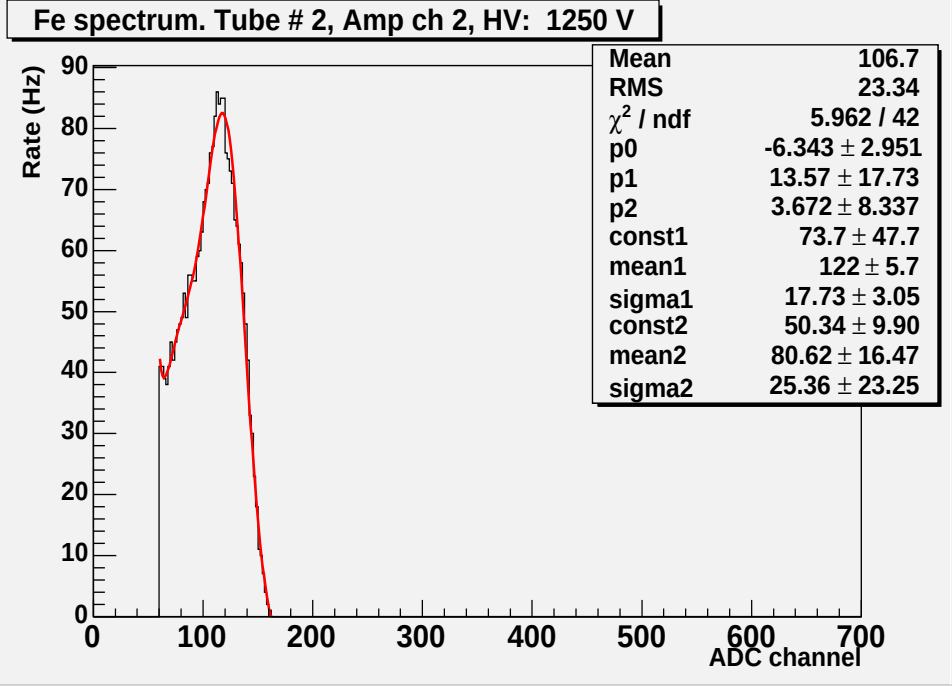


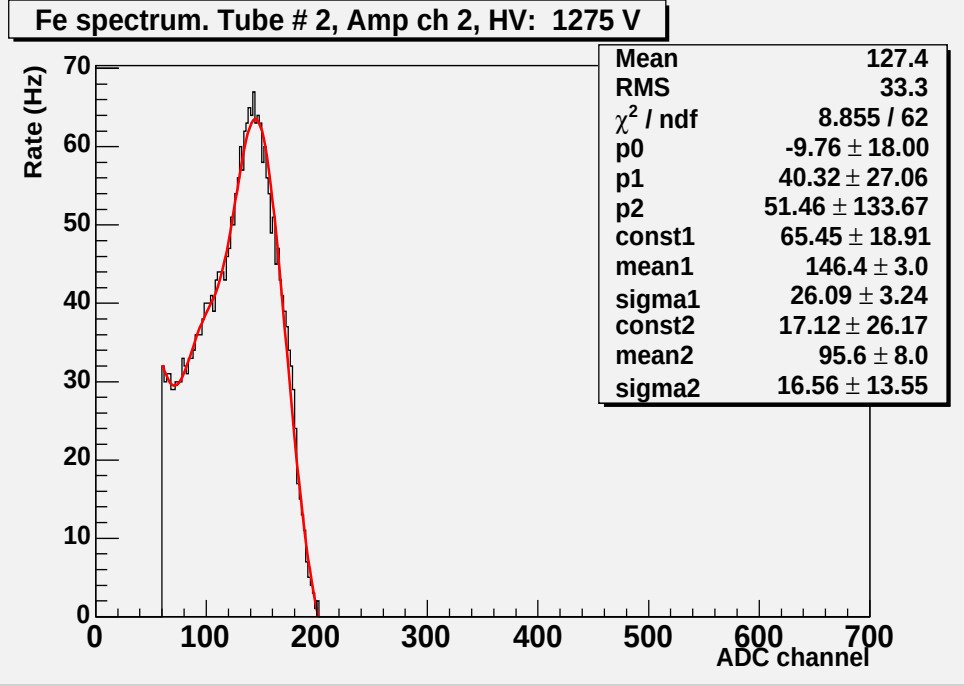


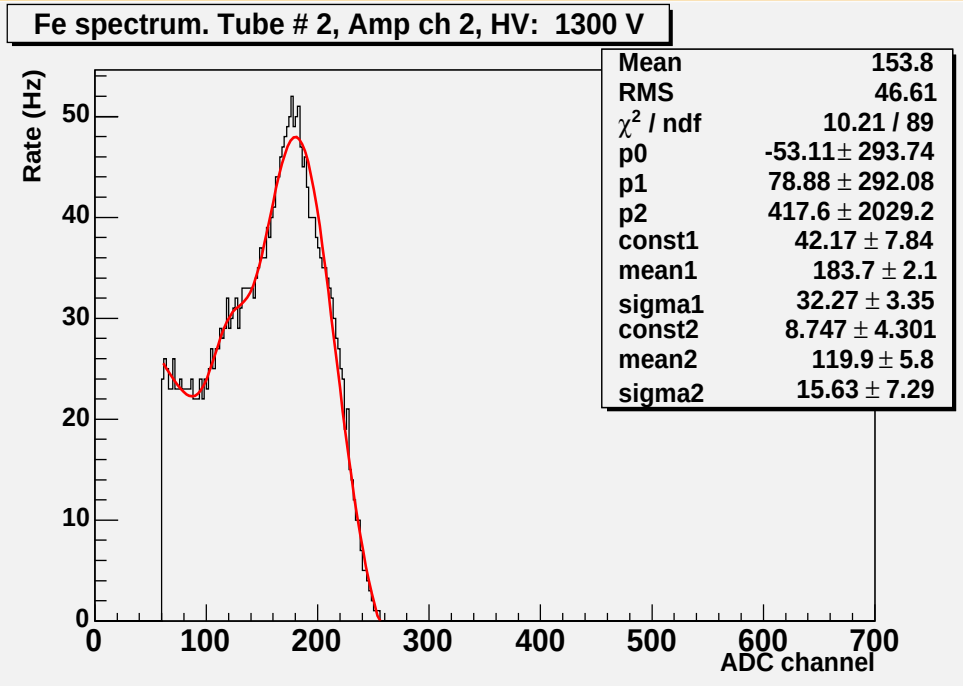
Photopeak position as a function of HV applied

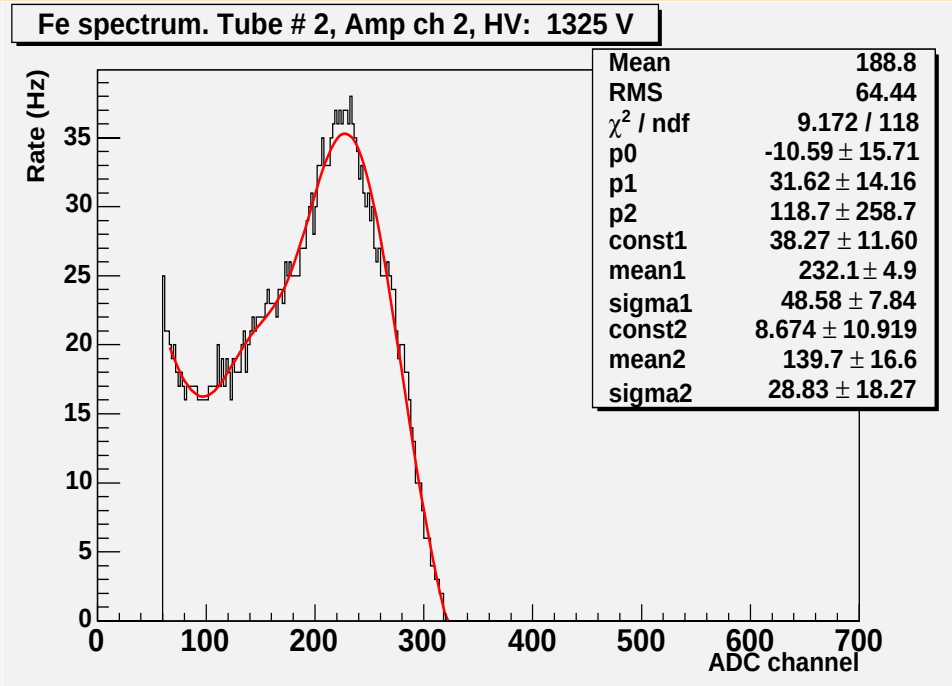
•Tube 2, amp ch 2: cut on ADC channels ≤ 60

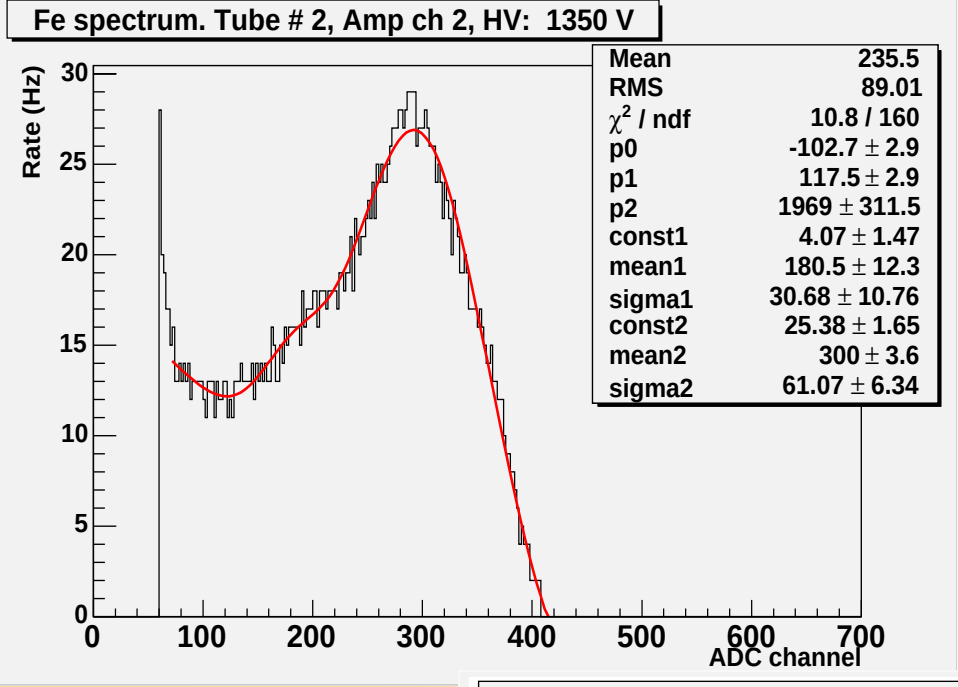


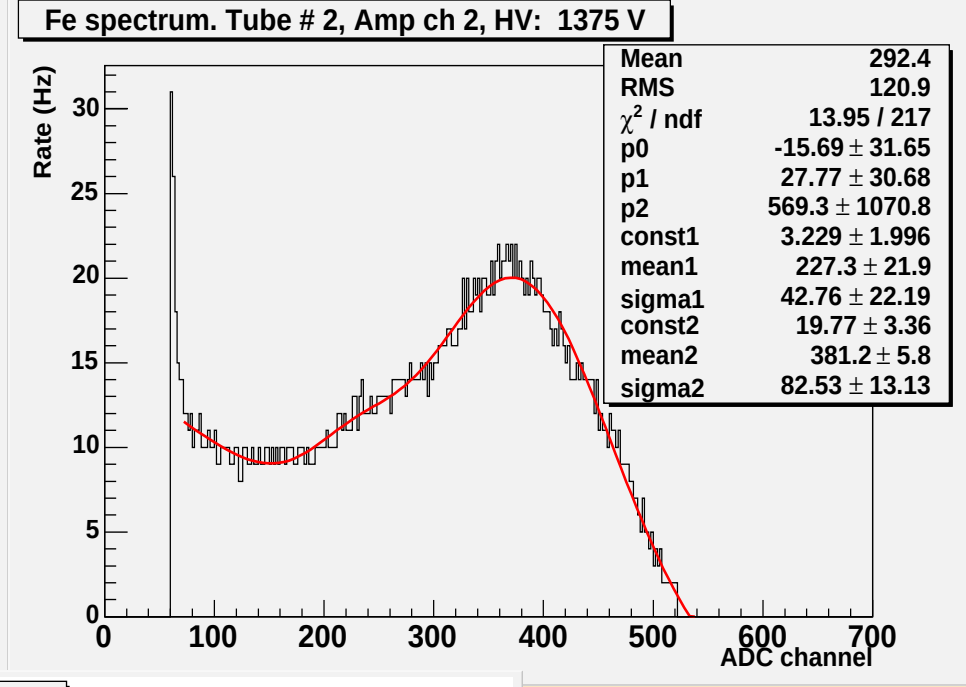

Fe spectrum. Tube # 2, Amp ch 2, HV: 1250 V
Mean 106.7
RMS 23.34
χ² / ndf 5.962 / 42
p0 -6.343 ± 2.951
p1 13.57 ± 17.73
p2 3.672 ± 8.337
const1 73.7 ± 47.7
mean1 122 ± 5.7
sigma1 17.73 ± 3.05
const2 50.34 ± 9.90
mean2 80.62 ± 16.47
sigma2 25.36 ± 23.25
Rate (Hz)
ADC channel

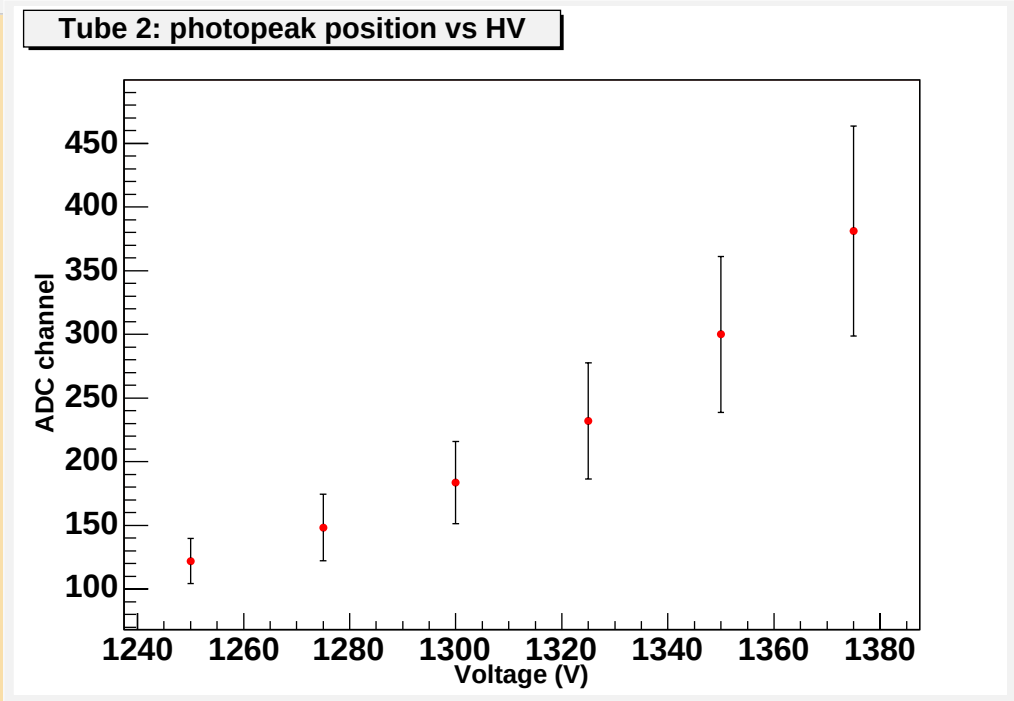

Fe spectrum. Tube # 2, Amp ch 2, HV: 1275 V
Mean 127.4
RMS 33.3
χ² / ndf 8.855 / 62
p0 -9.76 ± 18.00
p1 40.32 ± 27.06
p2 51.46 ± 133.67
const1 65.45 ± 18.91
mean1 146.4 ± 3.0
sigma1 26.09 ± 3.24
const2 17.12 ± 26.17
mean2 95.6 ± 8.0
sigma2 16.56 ± 13.55
Rate (Hz)
ADC channel


Fe spectrum. Tube # 2, Amp ch 2, HV: 1300 V
Mean 153.8
RMS 46.61
χ² / ndf 10.21 / 89
p0 -53.11 ± 293.74
p1 78.88 ± 292.08
p2 417.6 ± 2029.2
const1 42.17 ± 7.84
mean1 183.7 ± 2.1
sigma1 32.27 ± 3.35
const2 8.747 ± 4.301
mean2 119.9 ± 5.8
sigma2 15.63 ± 7.29
Rate (Hz)
ADC channel


Fe spectrum. Tube # 2, Amp ch 2, HV: 1325 V
Mean 188.8
RMS 64.44
χ² / ndf 9.172 / 118
p0 -10.59 ± 15.71
p1 31.62 ± 14.16
p2 118.7 ± 258.7
const1 38.27 ± 11.60
mean1 232.1 ± 4.9
sigma1 48.58 ± 7.84
const2 8.674 ± 10.919
mean2 139.7 ± 16.6
sigma2 28.83 ± 18.27
Rate (Hz)
ADC channel

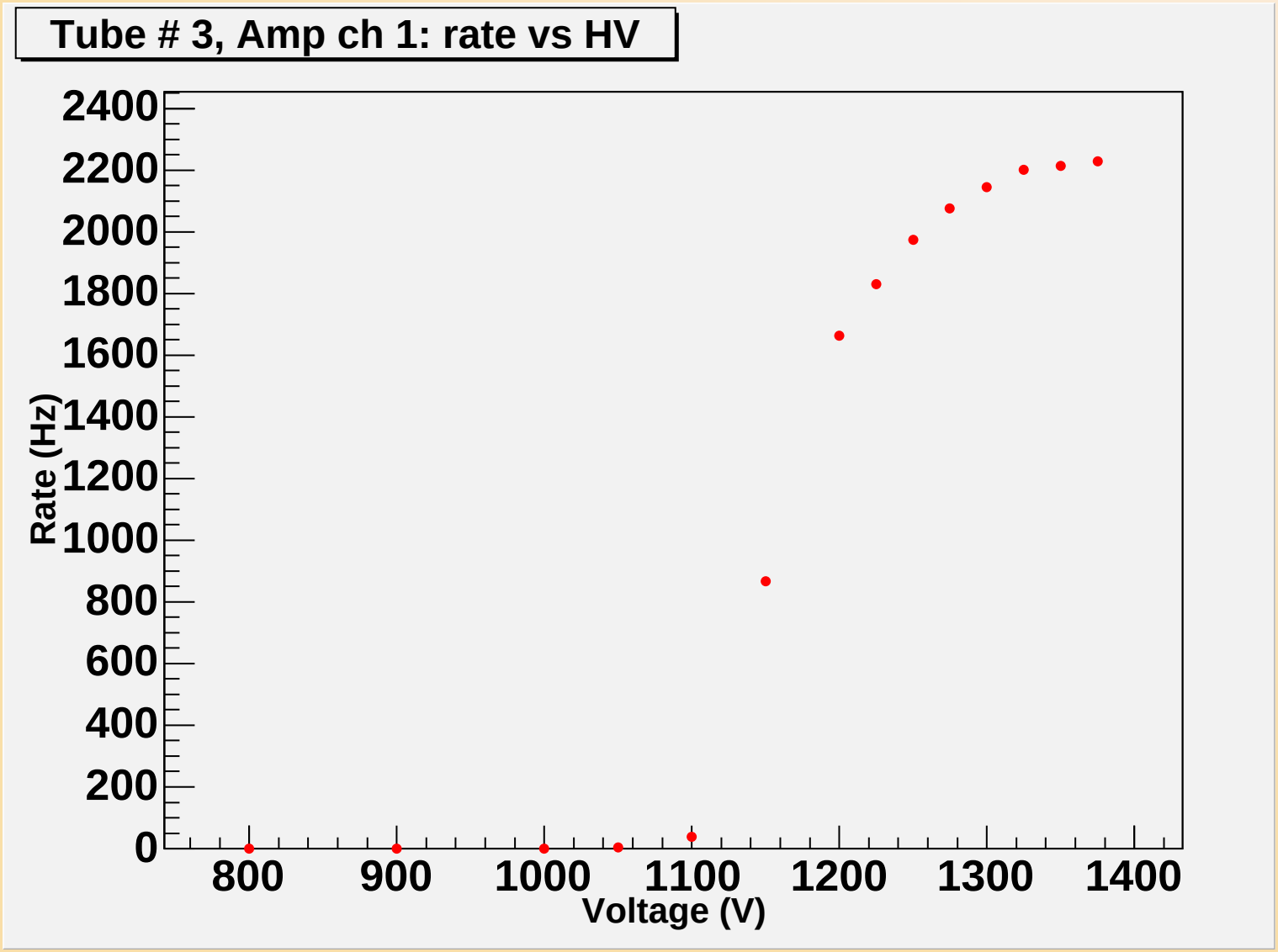


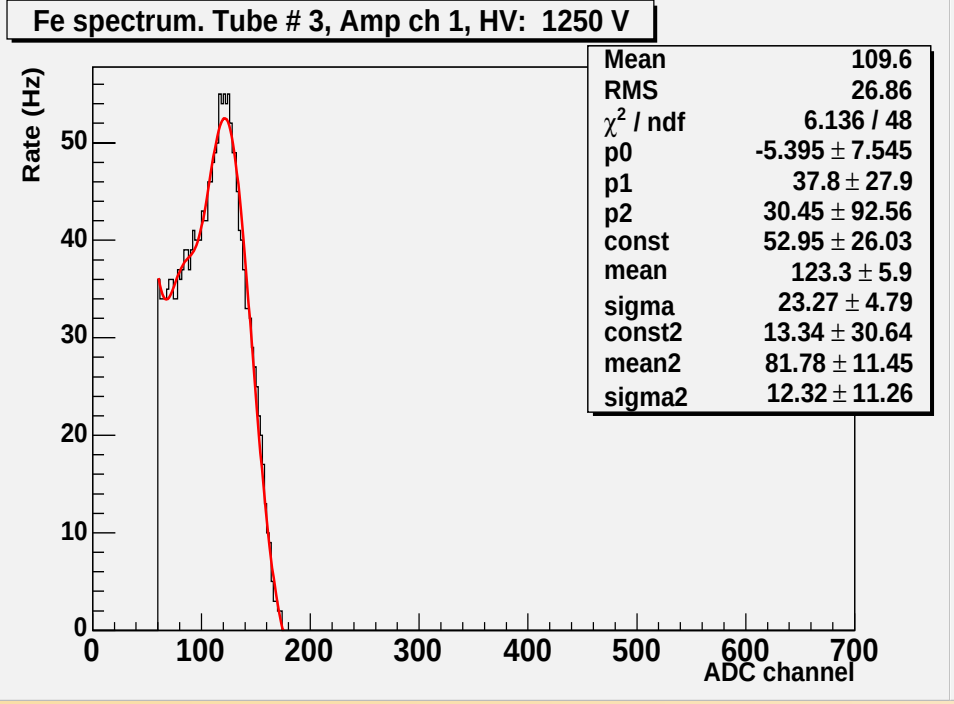


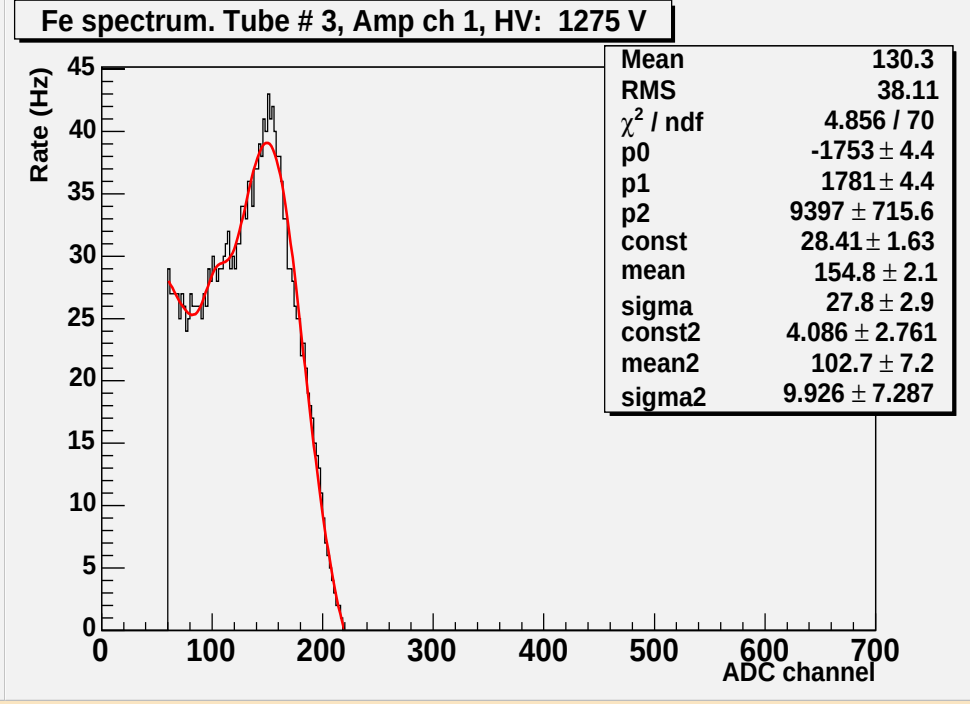


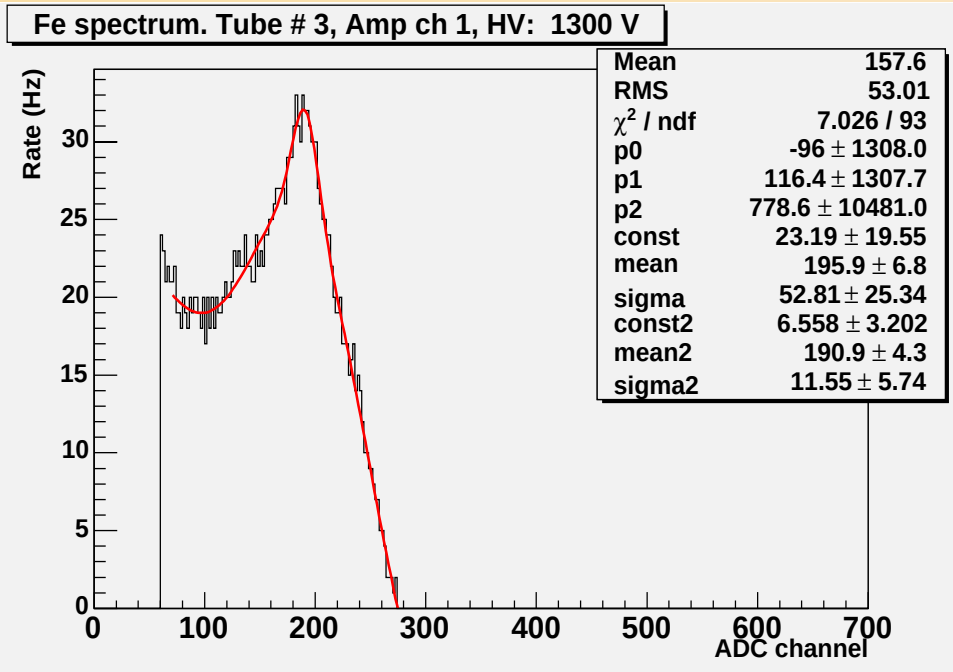
Photopeak position as a function of HV applied

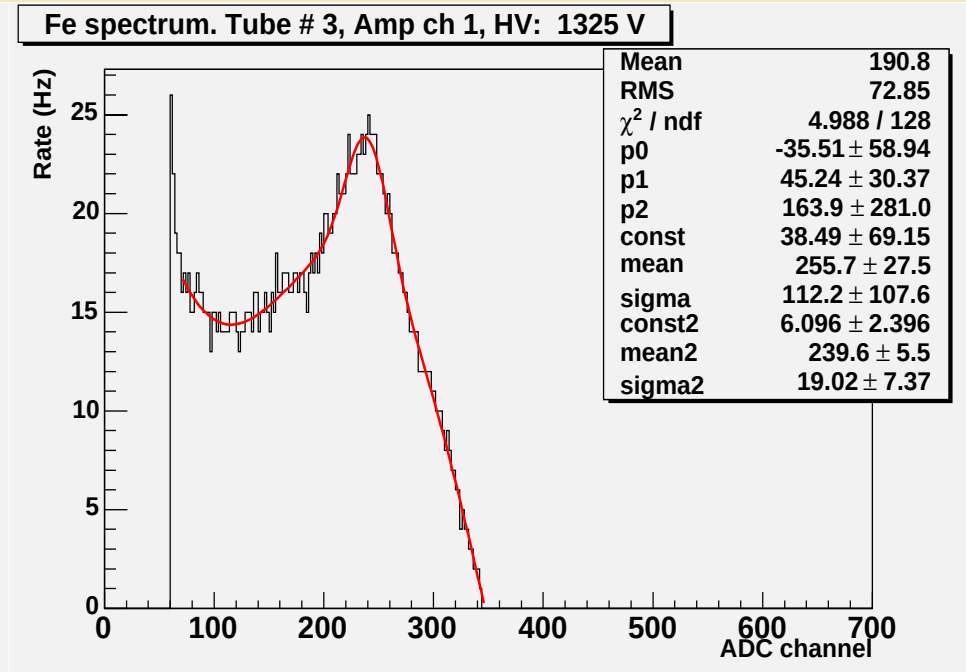
•Tube 3, amp ch 1: cut on ADC channels ≤ 60

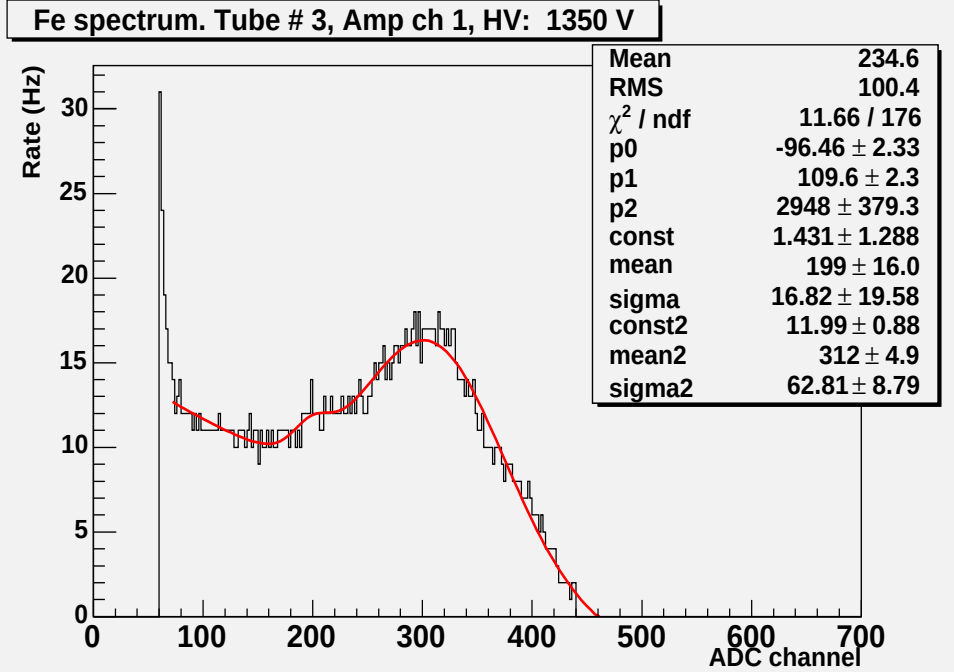


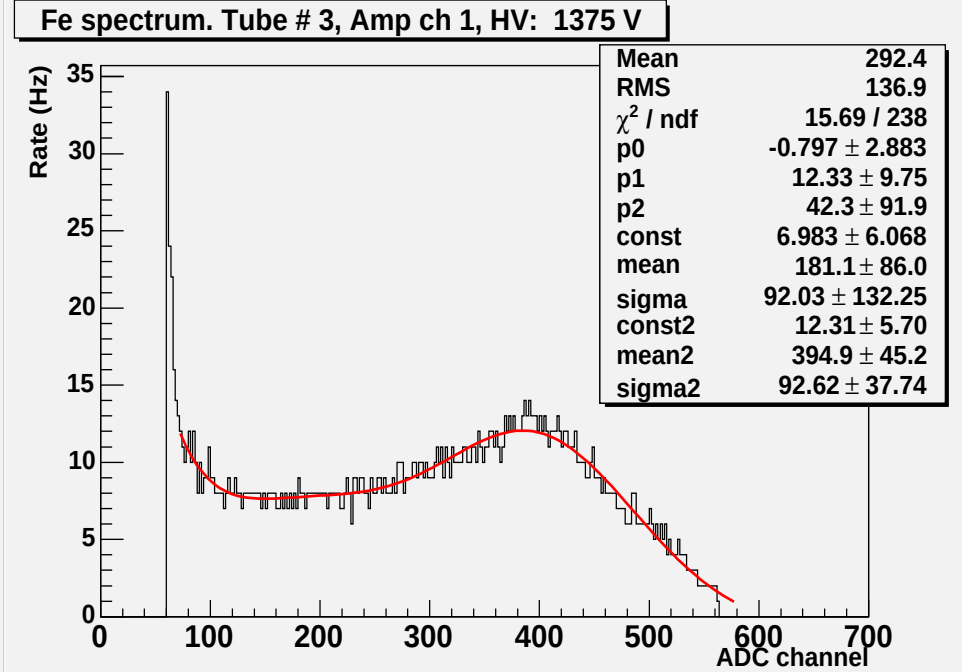

Fe spectrum. Tube # 3, Amp ch 1, HV: 1250 V
Mean 109.6
RMS 26.86
χ² / ndf 6.136 / 48
p0 -5.395 ± 7.545
p1 37.8 ± 27.9
p2 30.45 ± 92.56
const 52.95 ± 26.03
mean 123.3 ± 5.9
sigma 23.27 ± 4.79
const2 13.34 ± 30.64
mean2 81.78 ± 11.45
sigma2 12.32 ± 11.26
Rate (Hz)
ADC channel

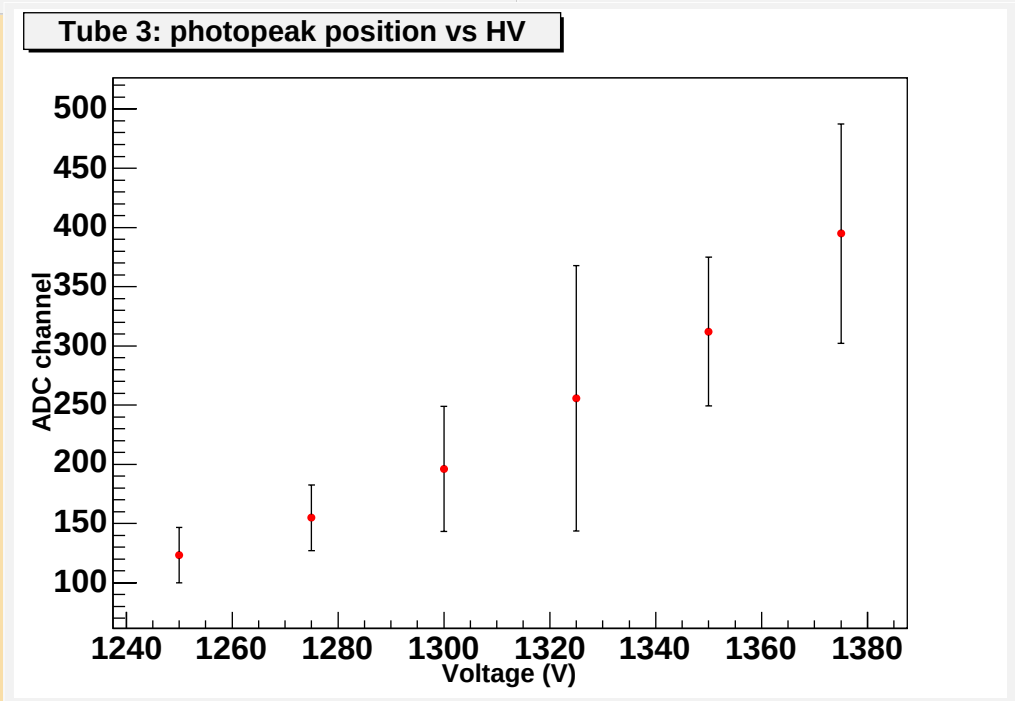

Fe spectrum. Tube # 3, Amp ch 1, HV: 1275 V
Mean 130.3
RMS 38.11
χ² / ndf 4.856 / 70
p0 -1753 ± 4.4
p1 1781 ± 4.4
p2 9397 ± 715.6
const 28.41 ± 1.63
mean 154.8 ± 2.1
sigma 27.8 ± 2.9
const2 4.086 ± 2.761
mean2 102.7 ± 7.2
sigma2 9.926 ± 7.287
Rate (Hz)
ADC channel


Fe spectrum. Tube # 3, Amp ch 1, HV: 1300 V
Mean 157.6
RMS 53.01
χ² / ndf 7.026 / 93
p0 -96 ± 1308.0
p1 116.4 ± 1307.7
p2 778.6 ± 10481.0
const 23.19 ± 19.55
mean 195.9 ± 6.8
sigma 52.81 ± 25.34
const2 6.558 ± 3.202
mean2 190.9 ± 4.3
sigma2 11.55 ± 5.74
Rate (Hz)
ADC channel


Fe spectrum. Tube # 3, Amp ch 1, HV: 1325 V
Mean 190.8
RMS 72.85
χ² / ndf 4.988 / 128
p0 -35.51 ± 58.94
p1 45.24 ± 30.37
p2 163.9 ± 281.0
const 38.49 ± 69.15
mean 255.7 ± 27.5
sigma 112.2 ± 107.6
const2 6.096 ± 2.396
mean2 239.6 ± 5.5
sigma2 19.02 ± 7.37
Rate (Hz)
ADC channel

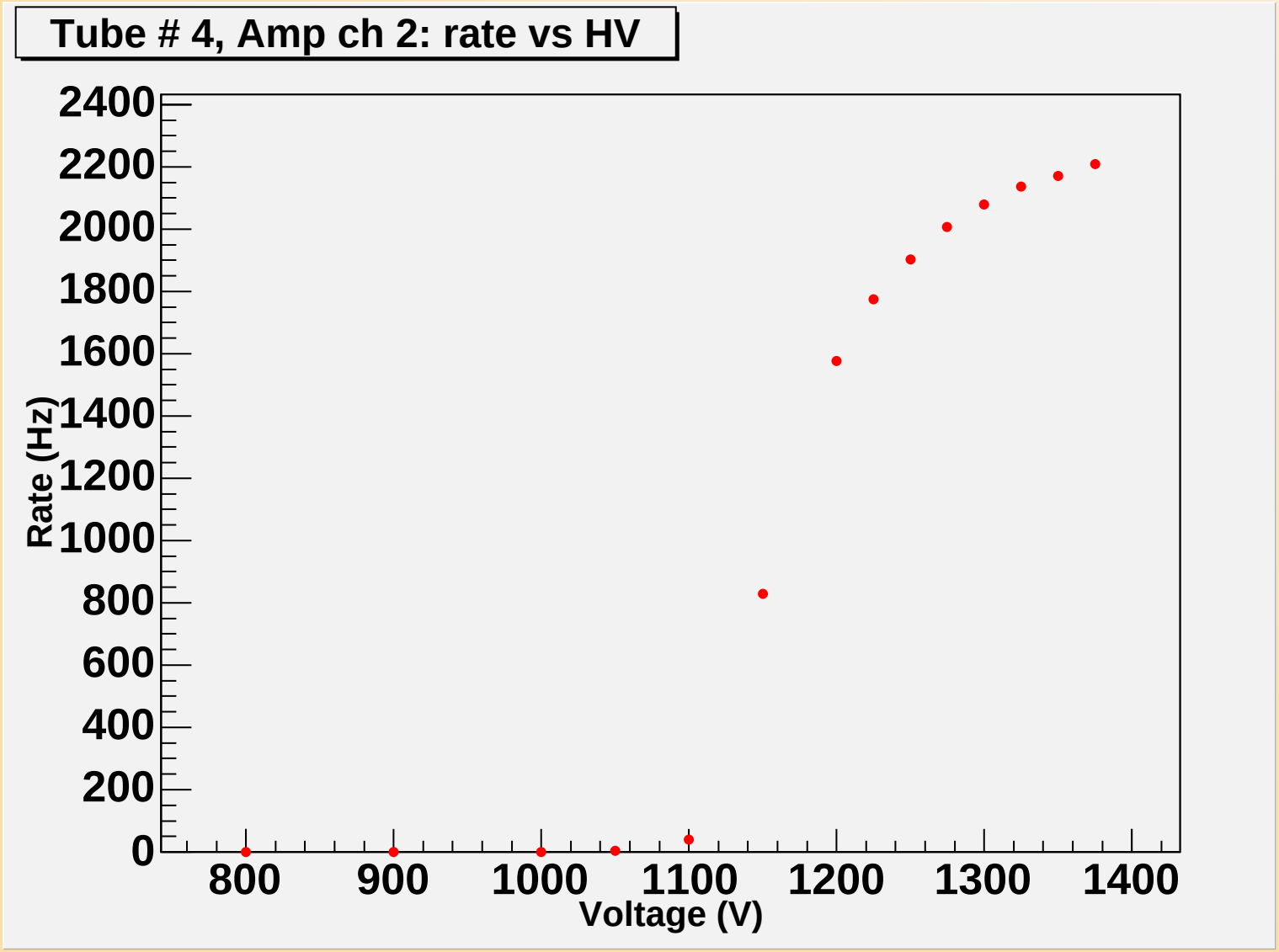


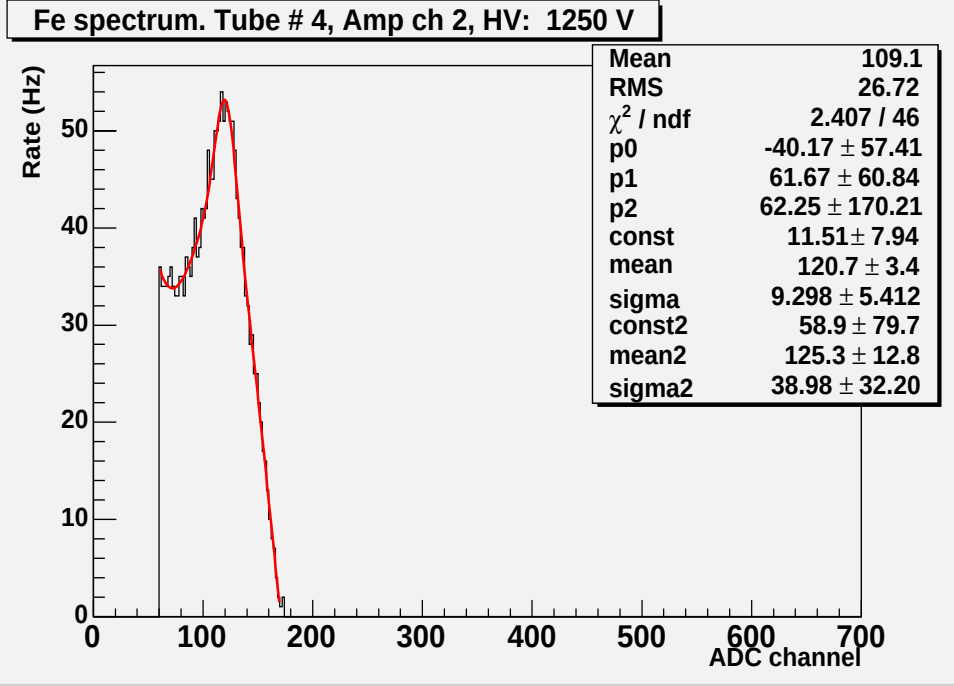


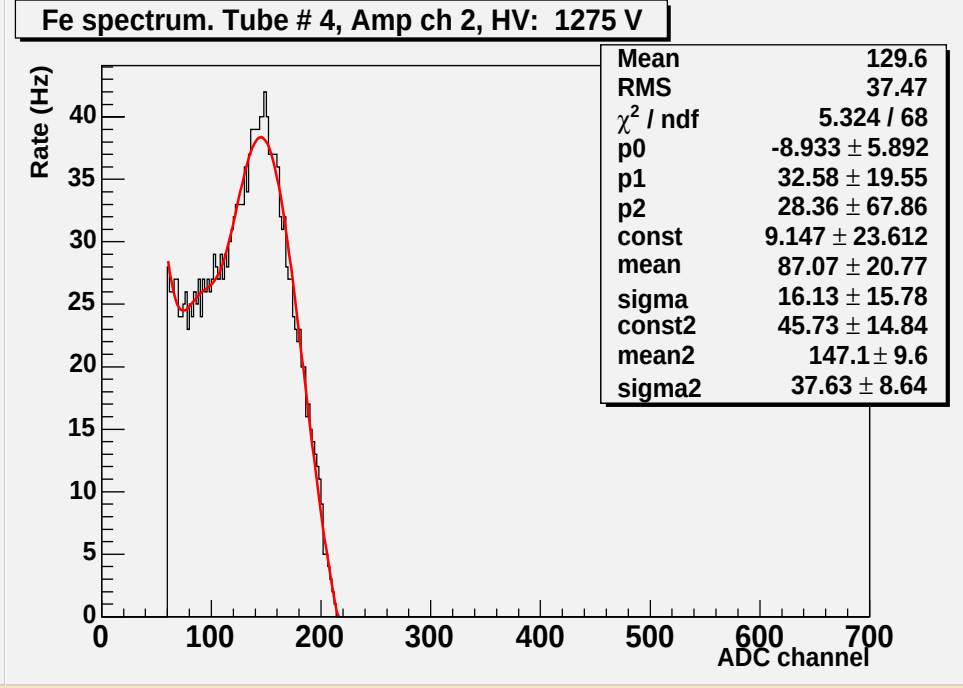


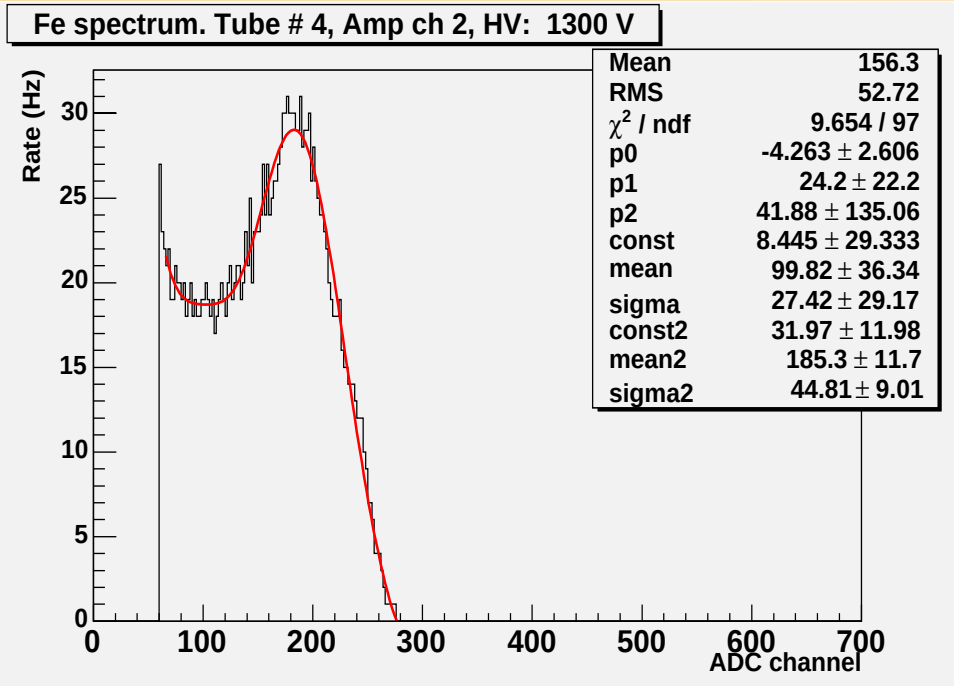
Photopeak position as a function of HV applied

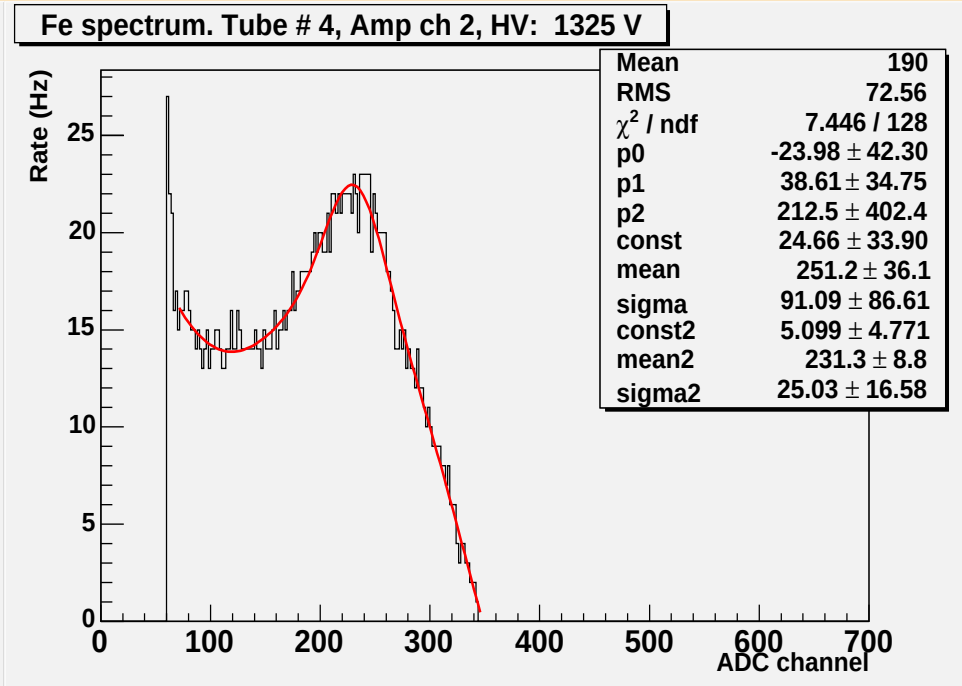
•Tube 4, amp ch 2: cut on ADC channels ≤ 60

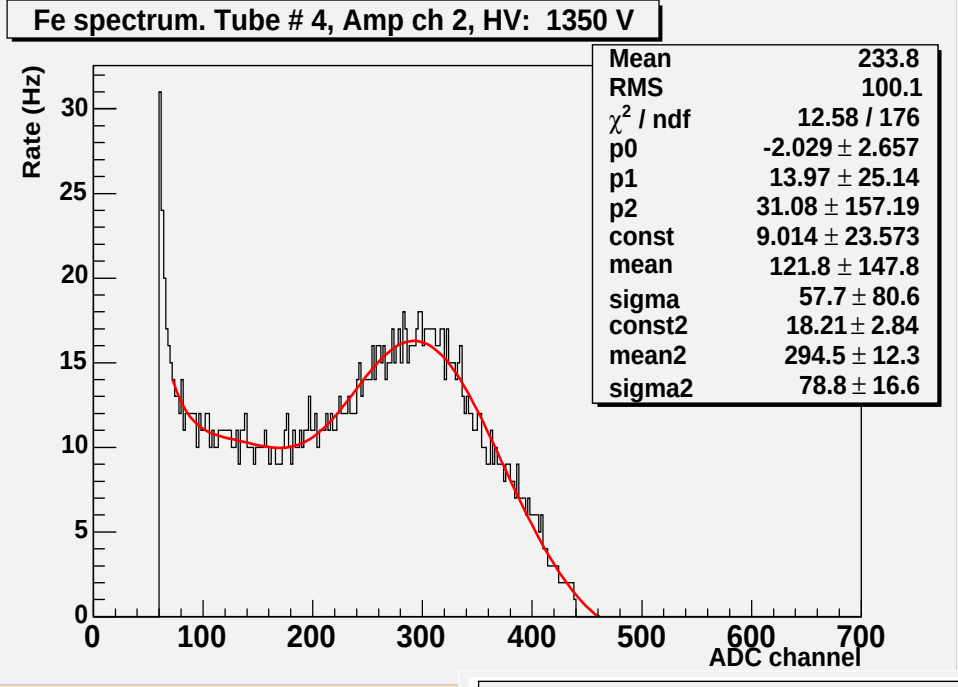


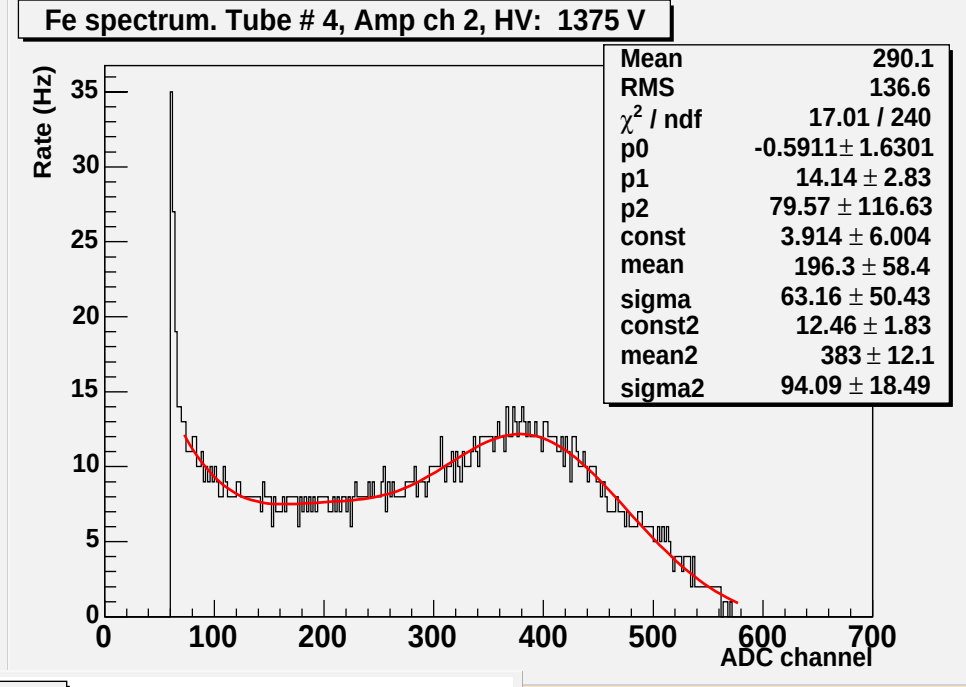

Fe spectrum. Tube # 4, Amp ch 2, HV: 1250 V
Mean 109.1
RMS 26.72
χ² / ndf 2.407 / 46
p0 -40.17 ± 57.41
p1 61.67 ± 60.84
p2 62.25 ± 170.21
const 11.51 ± 7.94
mean 120.7 ± 3.4
sigma 9.298 ± 5.412
const2 58.9 ± 79.7
mean2 125.3 ± 12.8
sigma2 38.98 ± 32.20
Rate (Hz)
ADC channel

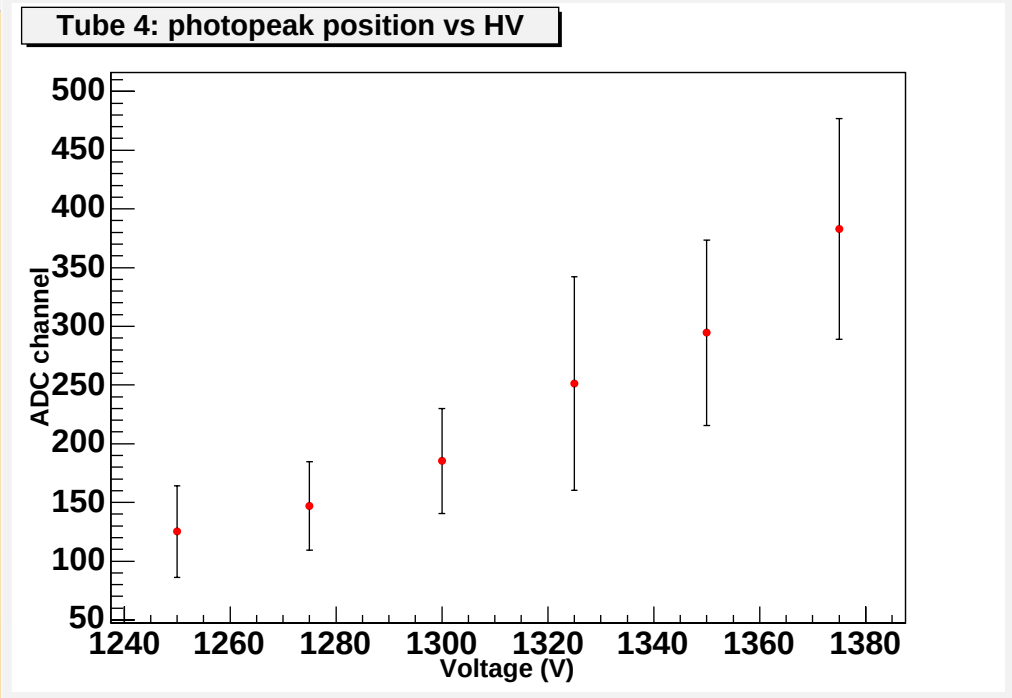

Fe spectrum. Tube # 4, Amp ch 2, HV: 1275 V
Mean 129.6
RMS 37.47
χ² / ndf 5.324 / 68
p0 -8.933 ± 5.892
p1 32.58 ± 19.55
p2 28.36 ± 67.86
const 9.147 ± 23.612
mean 87.07 ± 20.77
sigma 16.13 ± 15.78
const2 45.73 ± 14.84
mean2 147.1 ± 9.6
sigma2 37.63 ± 8.64
Rate (Hz)
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1300 V
Mean 156.3
RMS 52.72
χ² / ndf 9.654 / 97
p0 -4.263 ± 2.606
p1 24.2 ± 22.2
p2 41.88 ± 135.06
const 8.445 ± 29.333
mean 99.82 ± 36.34
sigma 27.42 ± 29.17
const2 31.97 ± 11.98
mean2 185.3 ± 11.7
sigma2 44.81 ± 9.01
Rate (Hz)
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1325 V
Mean 190
RMS 72.56
χ² / ndf 7.446 / 128
p0 -23.98 ± 42.30
p1 38.61 ± 34.75
p2 212.5 ± 402.4
const 24.66 ± 33.90
mean 251.2 ± 36.1
sigma 91.09 ± 86.61
const2 5.099 ± 4.771
mean2 231.3 ± 8.8
sigma2 25.03 ± 16.58
Rate (Hz)
ADC channel

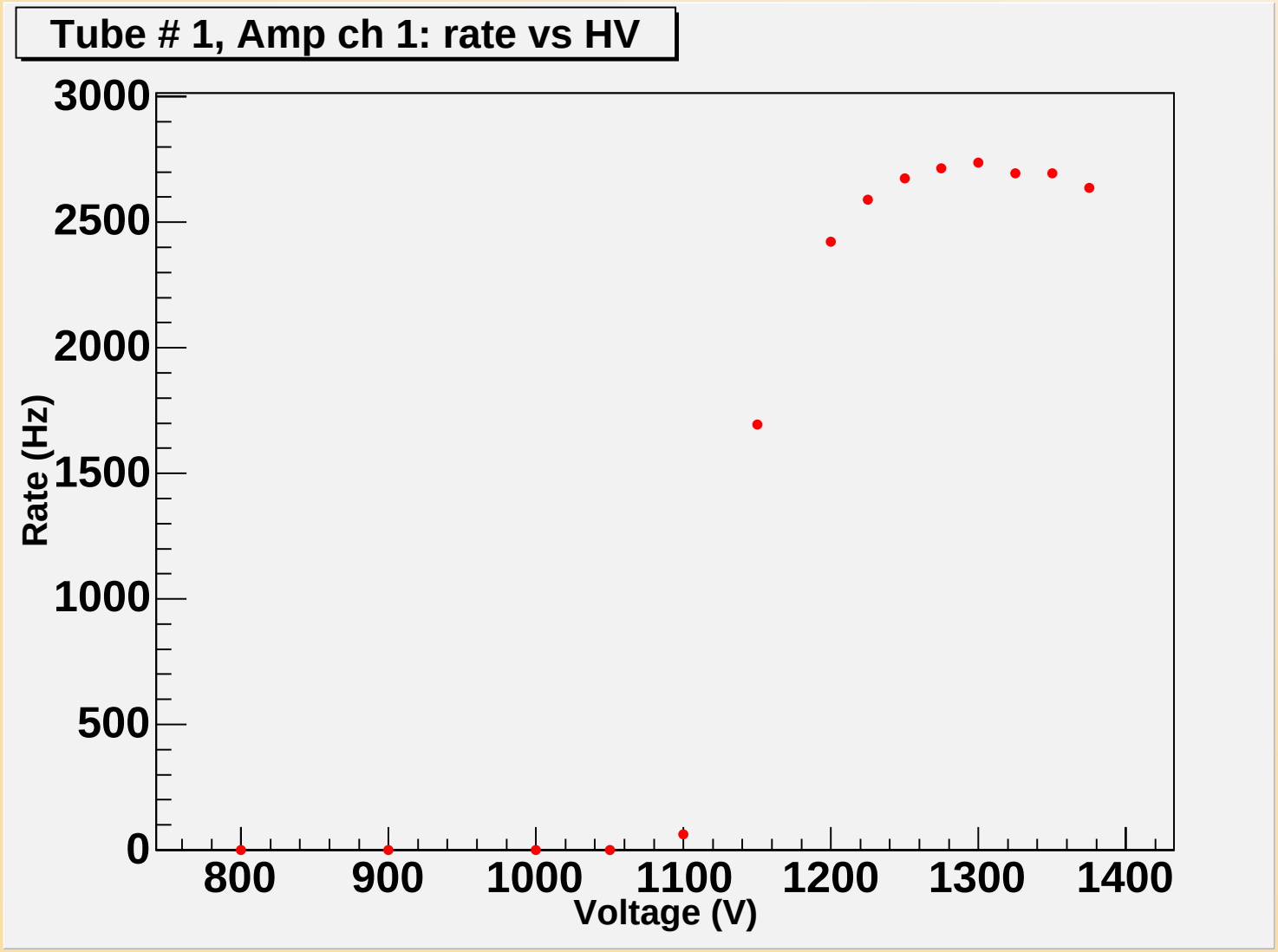


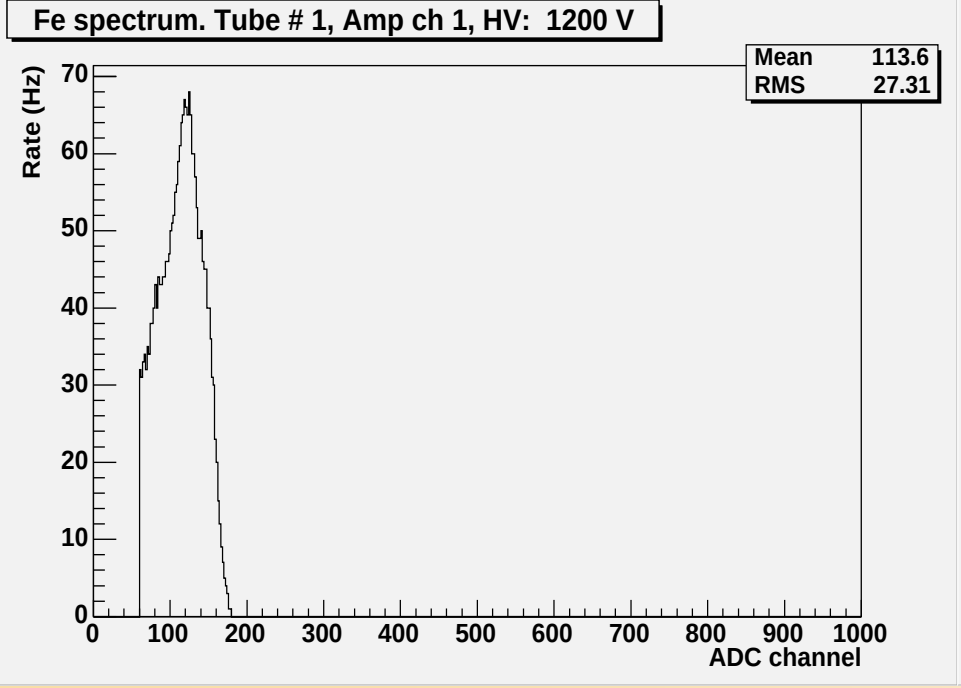


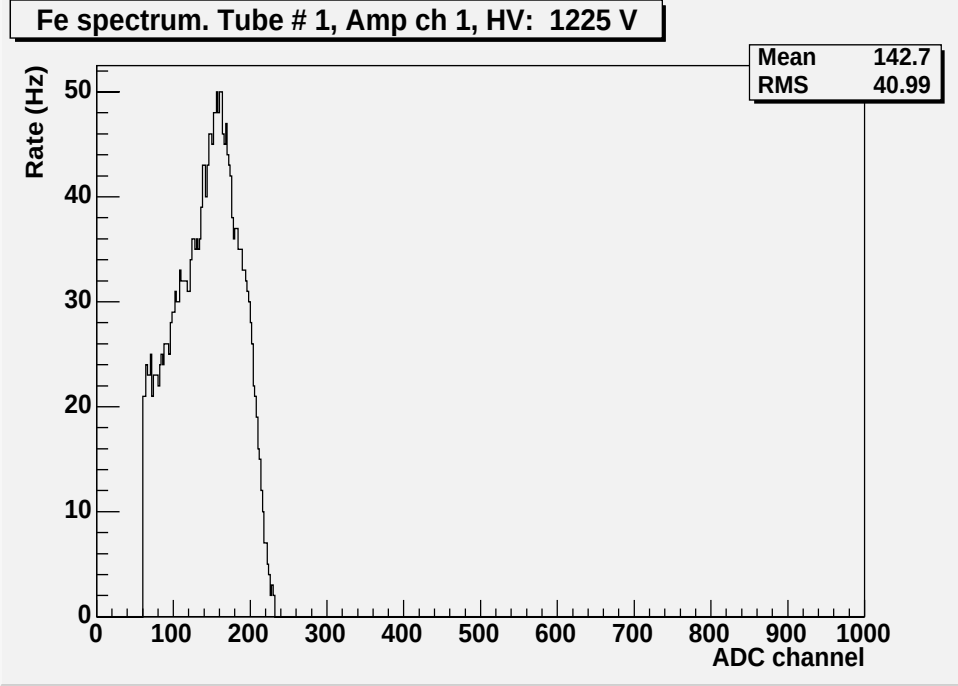


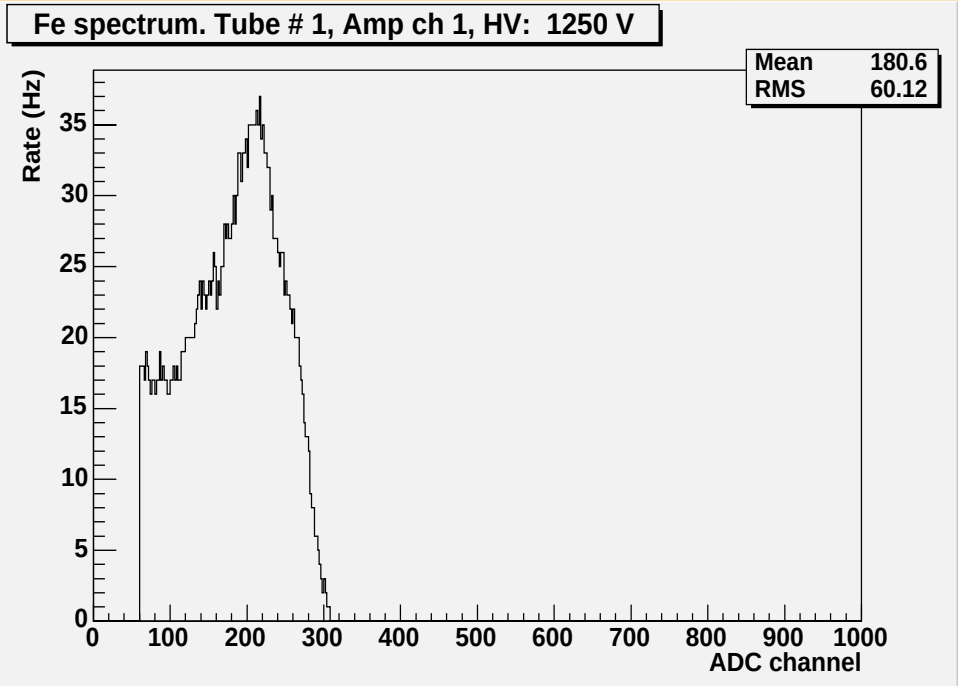
Photopeak position as a function of HV applied

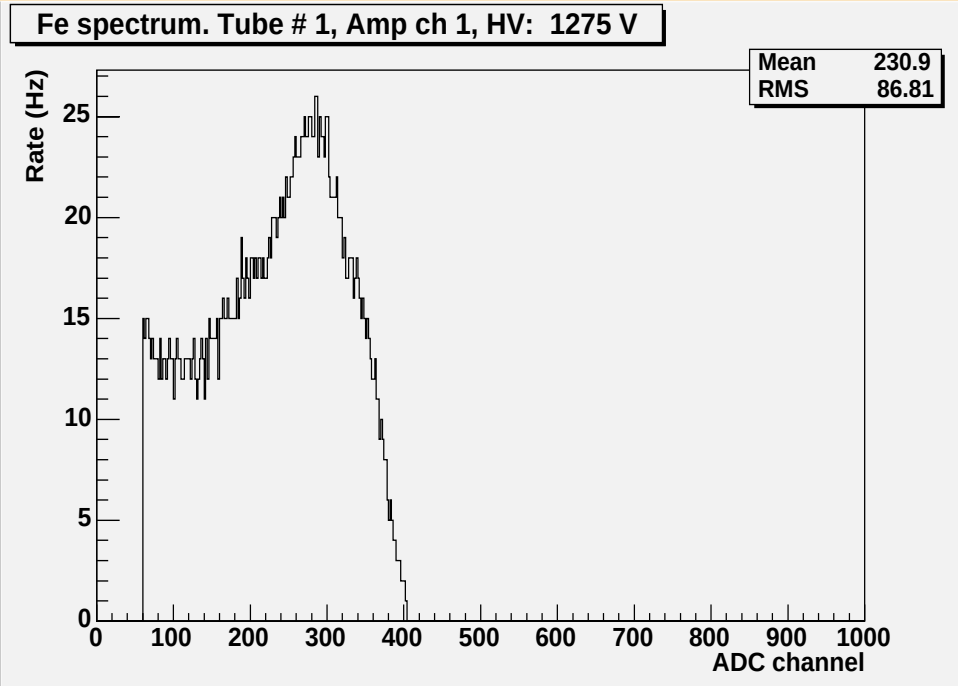
- ^{55}Fe spectra using mixture enriched in Ar:
  - Tube 1, amp ch 1: MCA input range [0,10] V

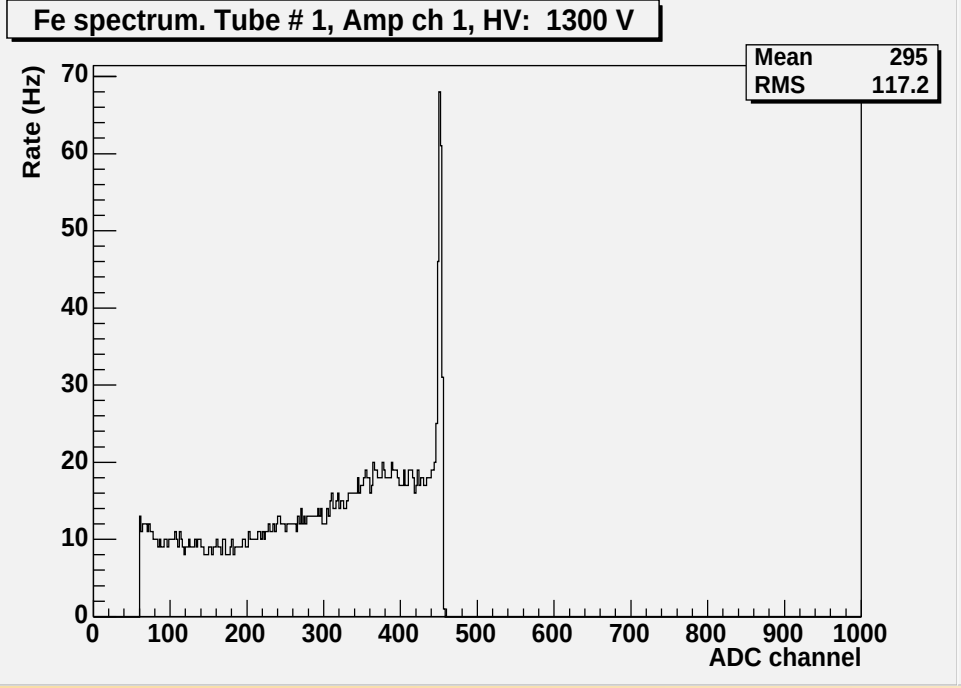


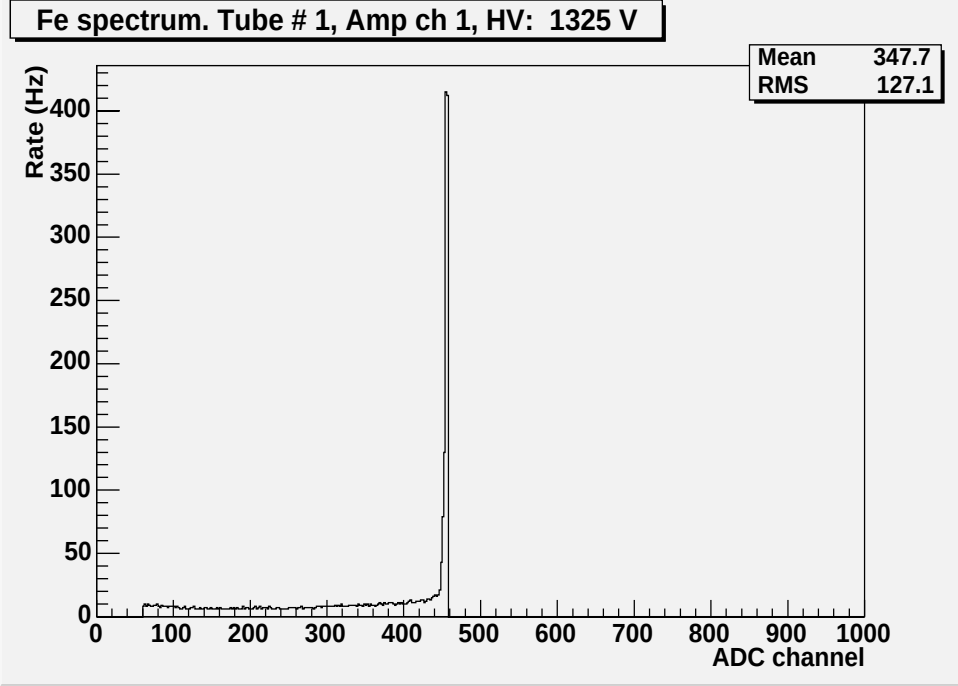

Fe spectrum. Tube # 1, Amp ch 1, HV: 1200 V
Mean 113.6
RMS 27.31
Rate (Hz)
ADC channel


Fe spectrum. Tube # 1, Amp ch 1, HV: 1225 V
Mean 142.7
RMS 40.99
Rate (Hz)
ADC channel

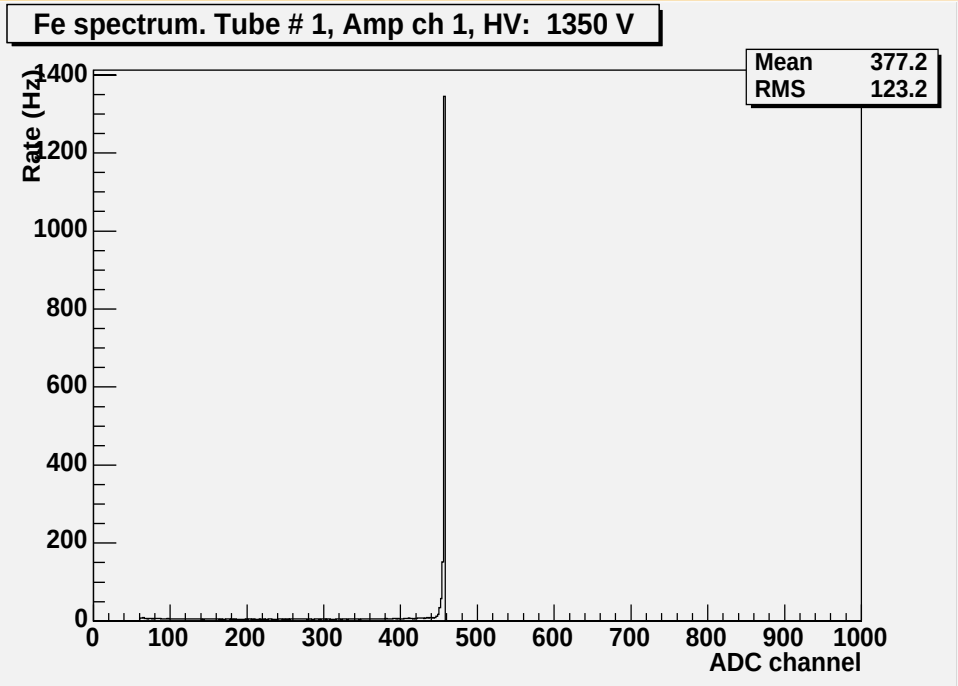

Fe spectrum. Tube # 1, Amp ch 1, HV: 1250 V
Mean 180.6
RMS 60.12
Rate (Hz)
ADC channel

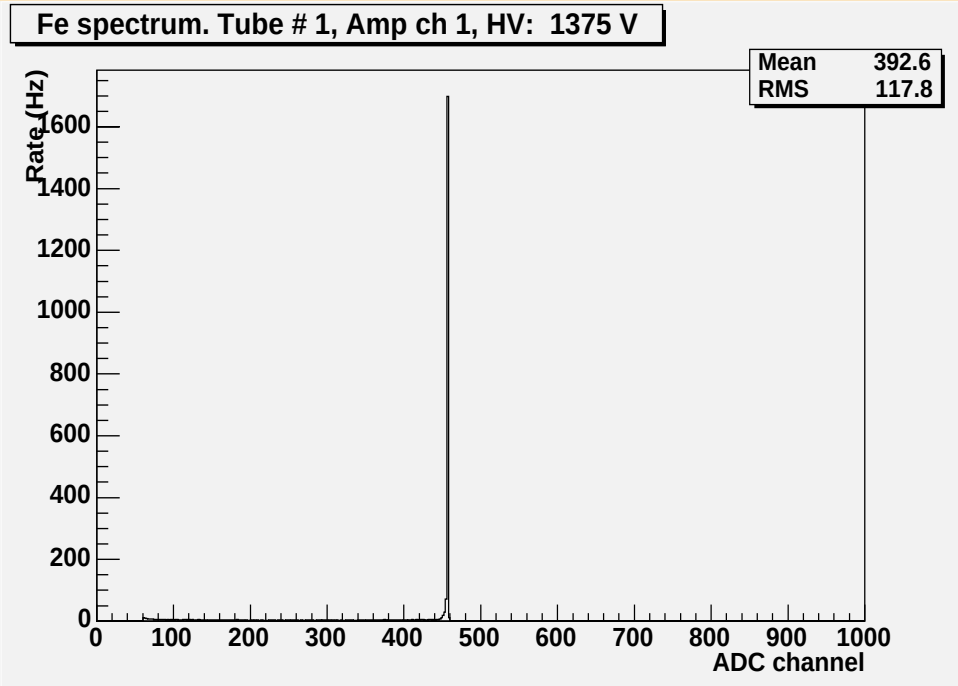

Fe spectrum. Tube # 1, Amp ch 1, HV: 1275 V
Mean 230.9
RMS 86.81
Rate (Hz)
ADC channel



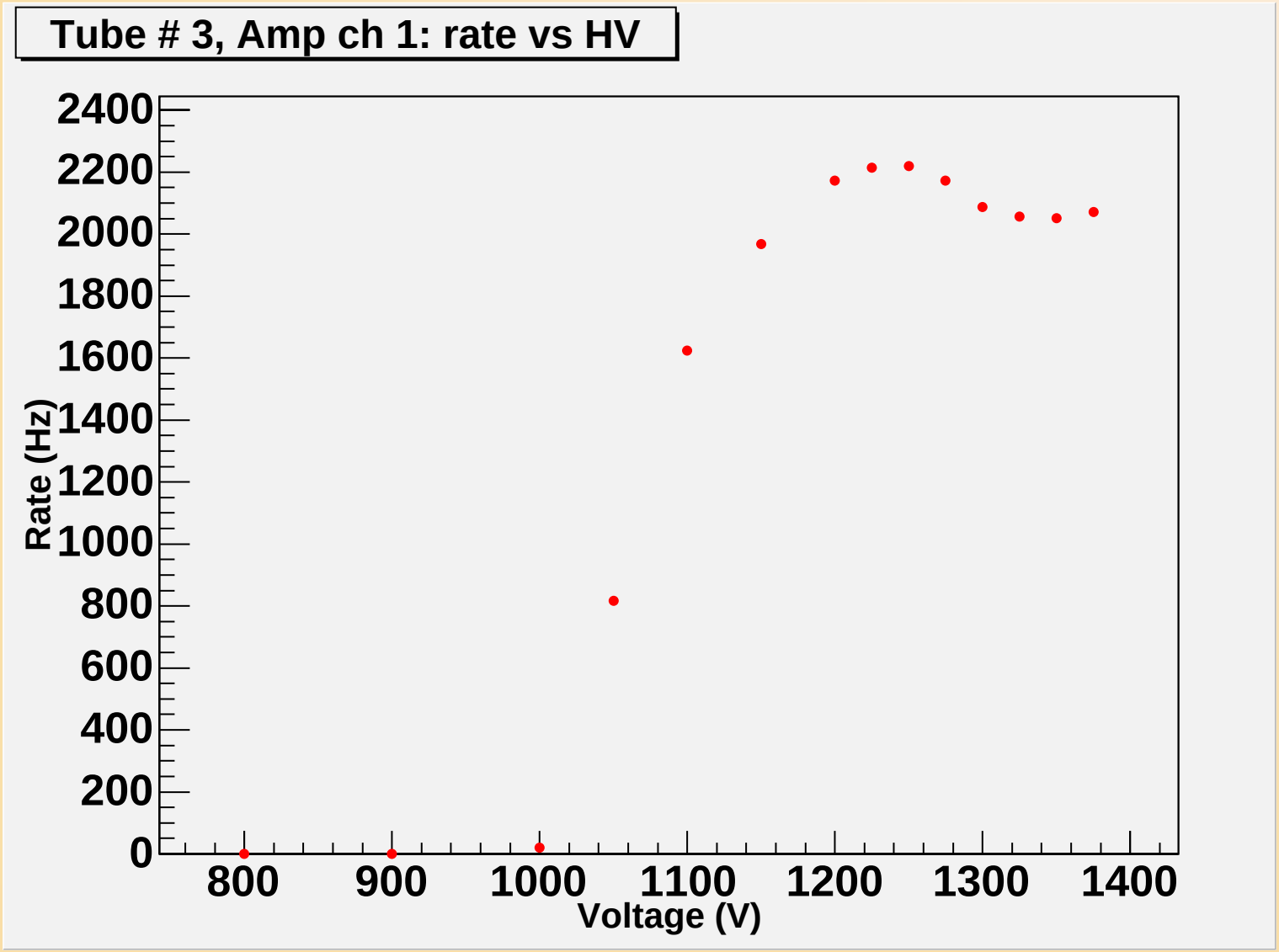


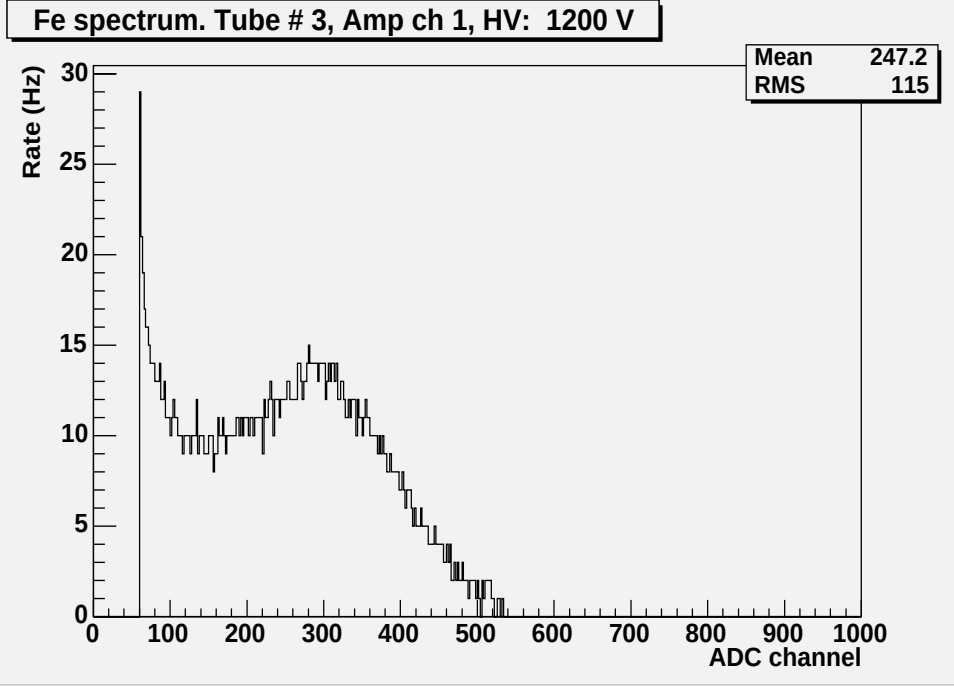
Saturation on ADC channel 450

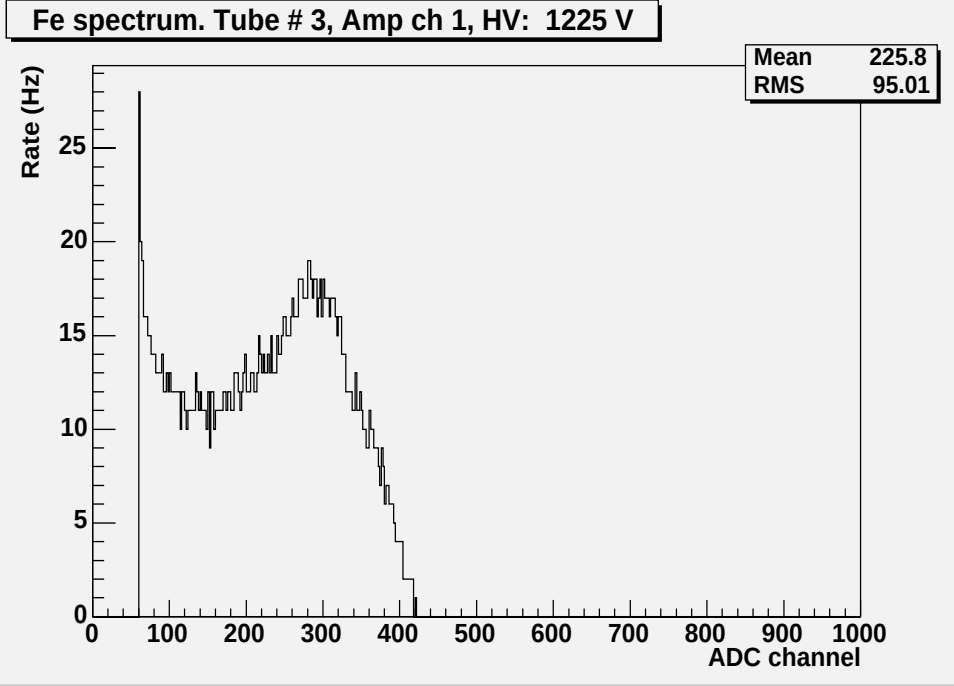


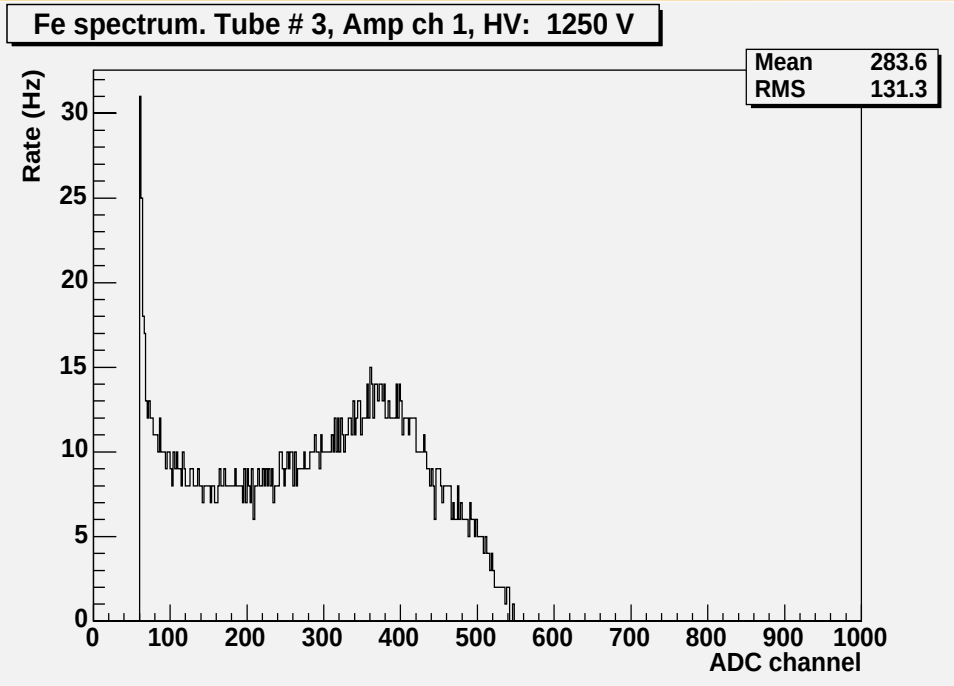


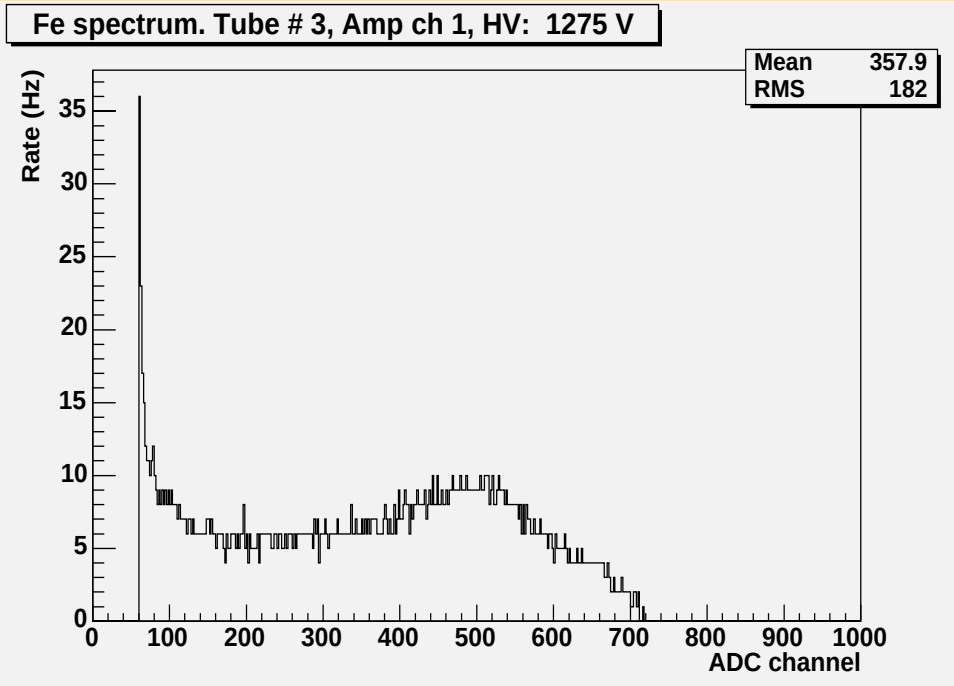
•Tube 3, amp ch 1: MCA input range [0,5] V + cut on ADC channels ≤ 60

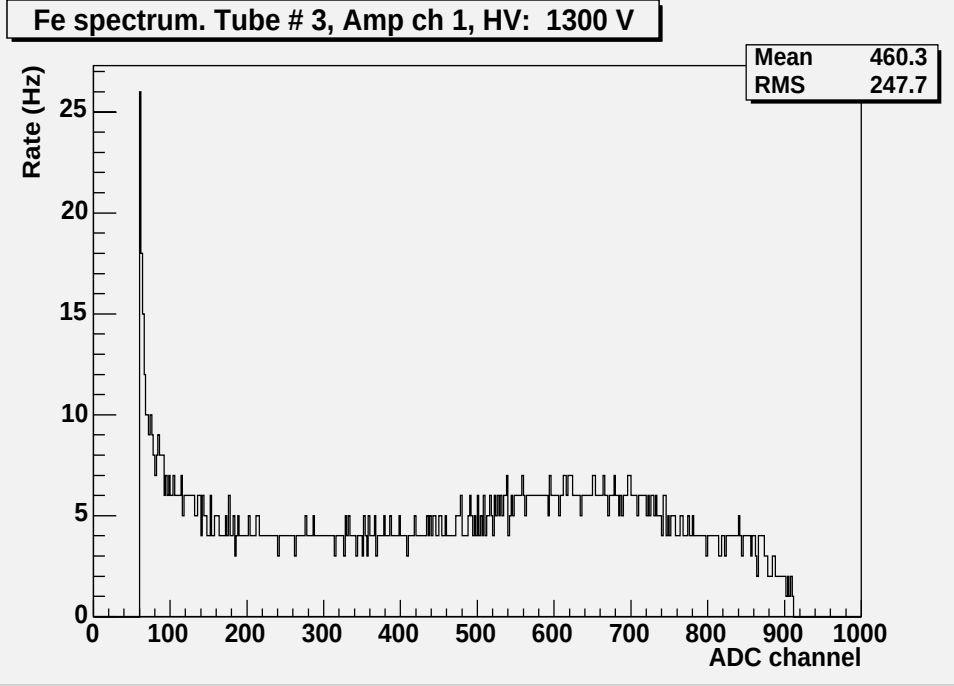


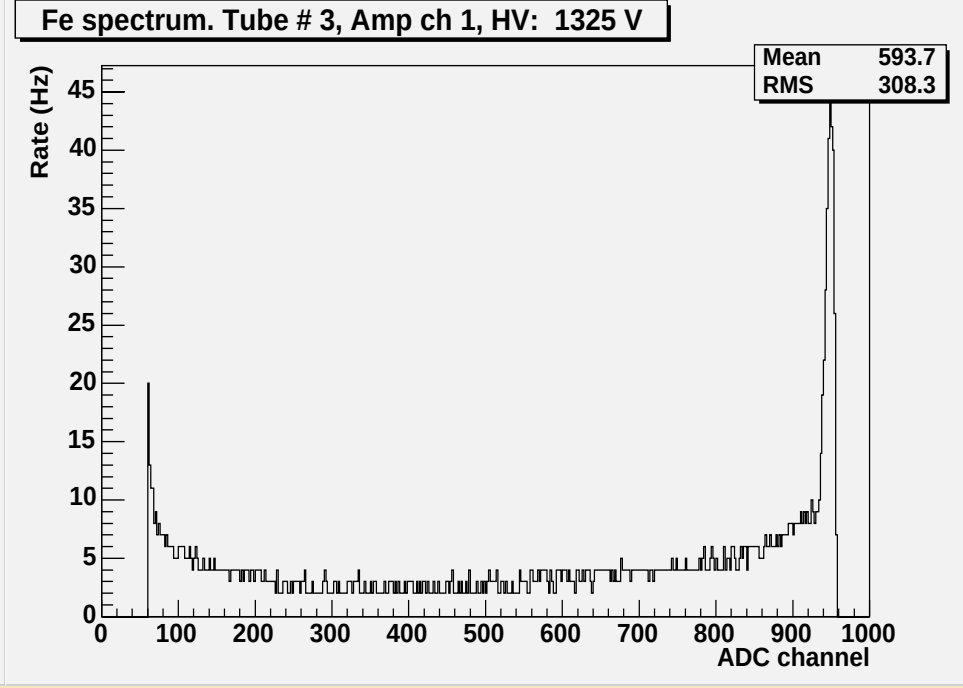

Fe spectrum. Tube # 3, Amp ch 1, HV: 1200 V
Mean 247.2
RMS 115
Rate (Hz)
ADC channel


Fe spectrum. Tube # 3, Amp ch 1, HV: 1225 V
Mean 225.8
RMS 95.01
Rate (Hz)
ADC channel

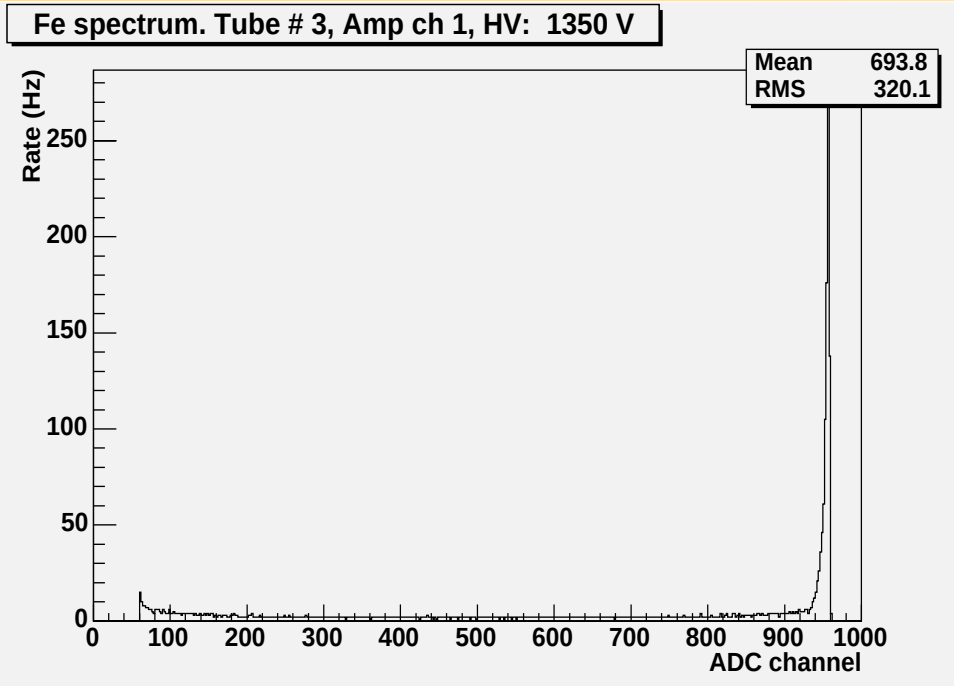

Fe spectrum. Tube # 3, Amp ch 1, HV: 1250 V
Mean 283.6
RMS 131.3
Rate (Hz)
ADC channel

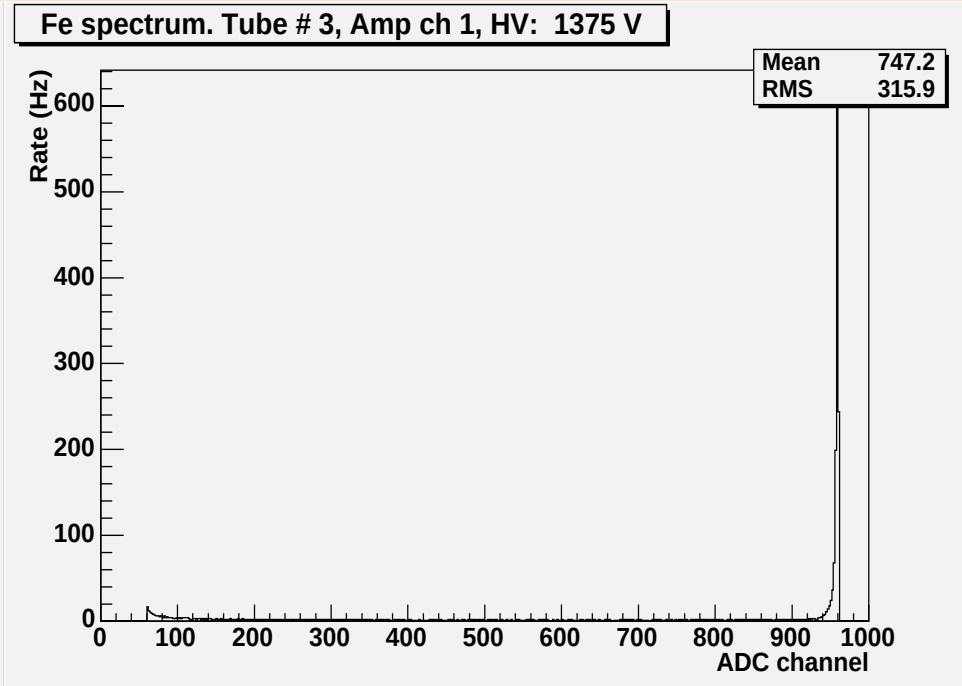

Fe spectrum. Tube # 3, Amp ch 1, HV: 1275 V
Mean 357.9
RMS 182
Rate (Hz)
ADC channel



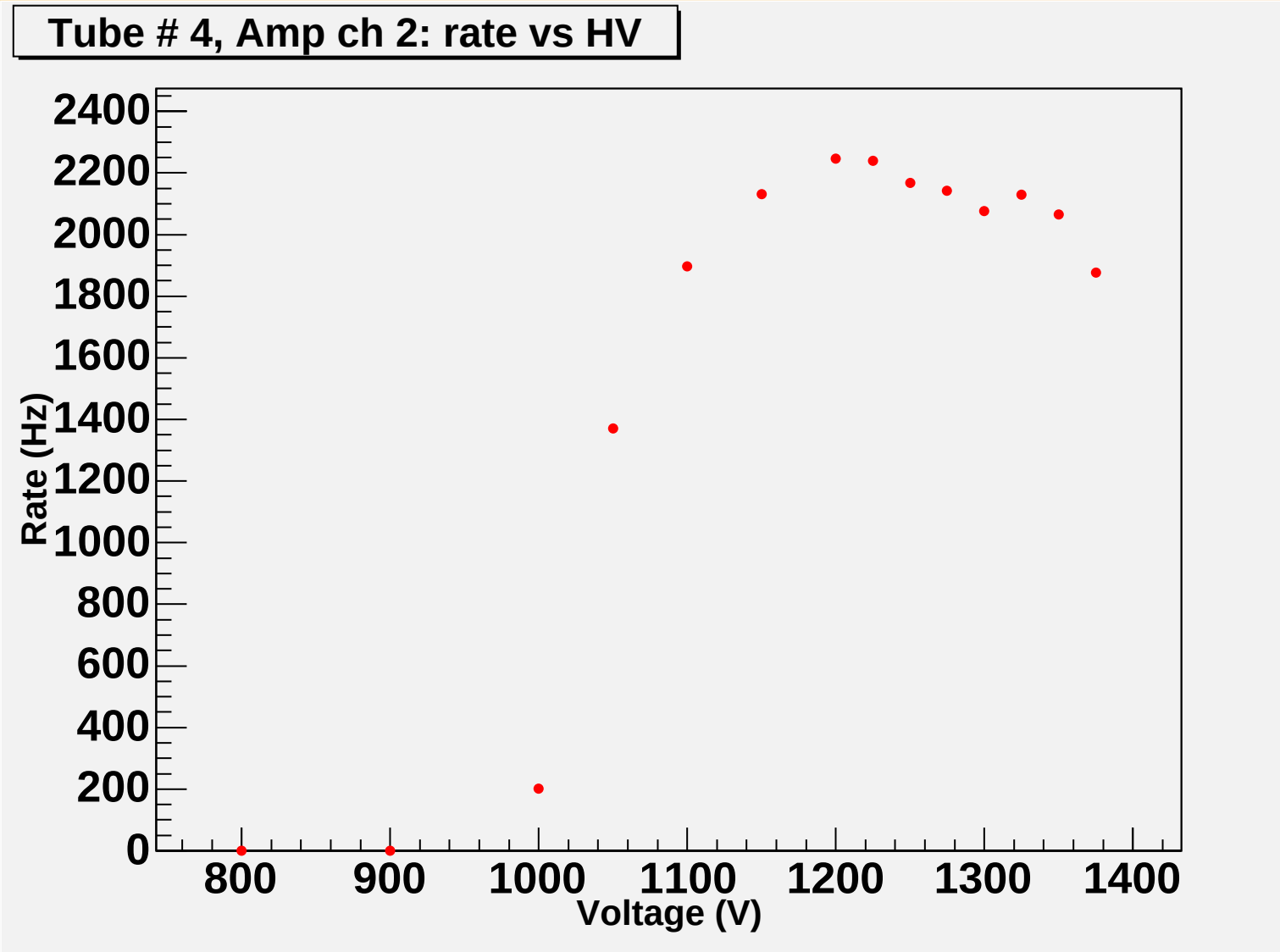


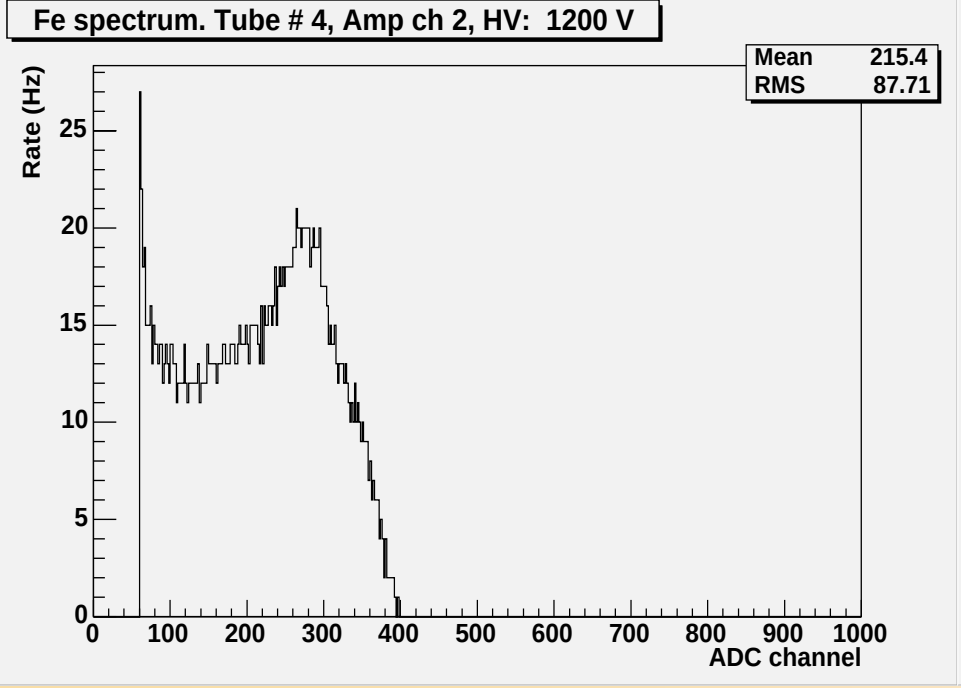
Saturation on ADC channel 950

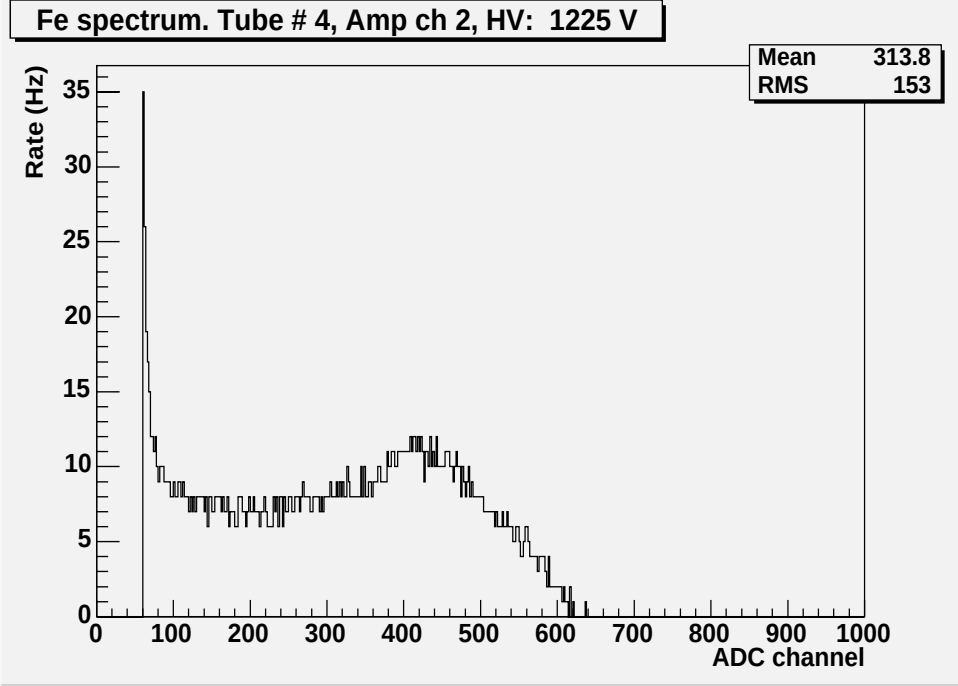


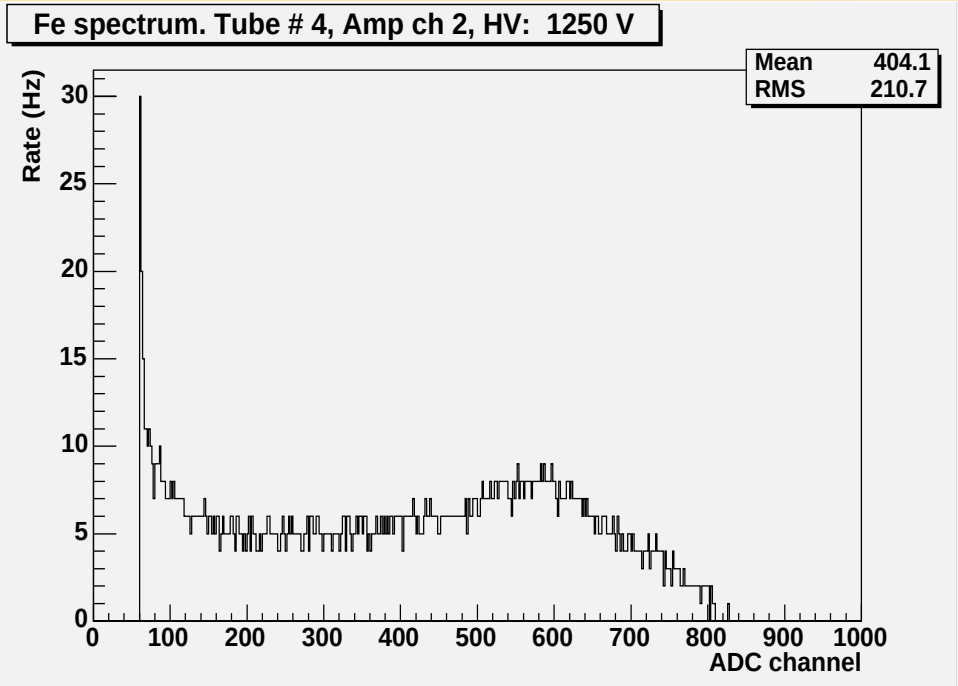


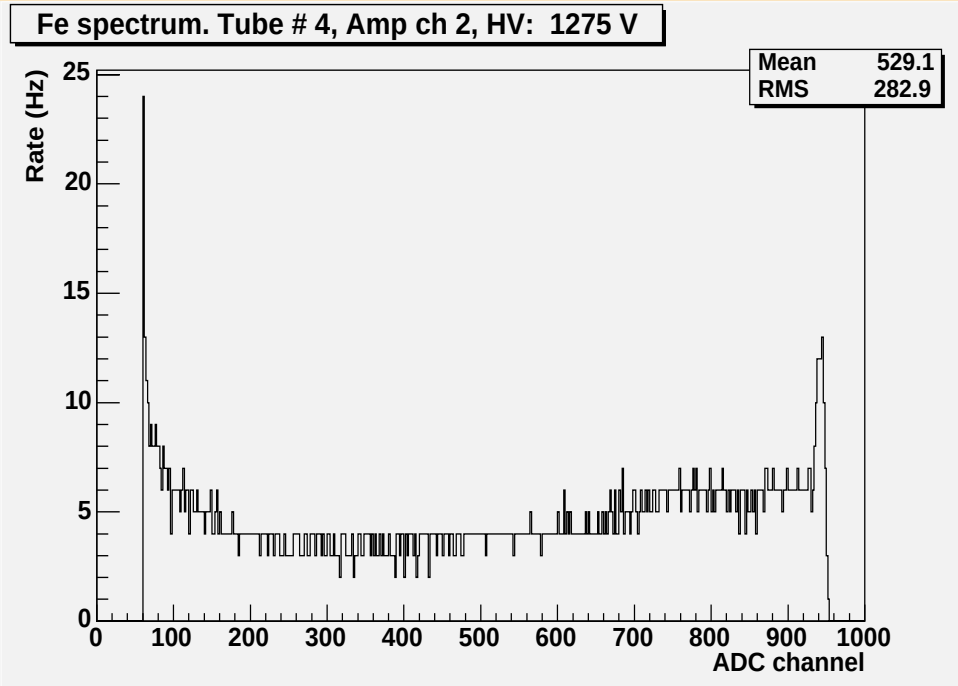
•Tube 4, amp ch 2: MCA input range [0,5] V + cut on ADC channels ≤ 60

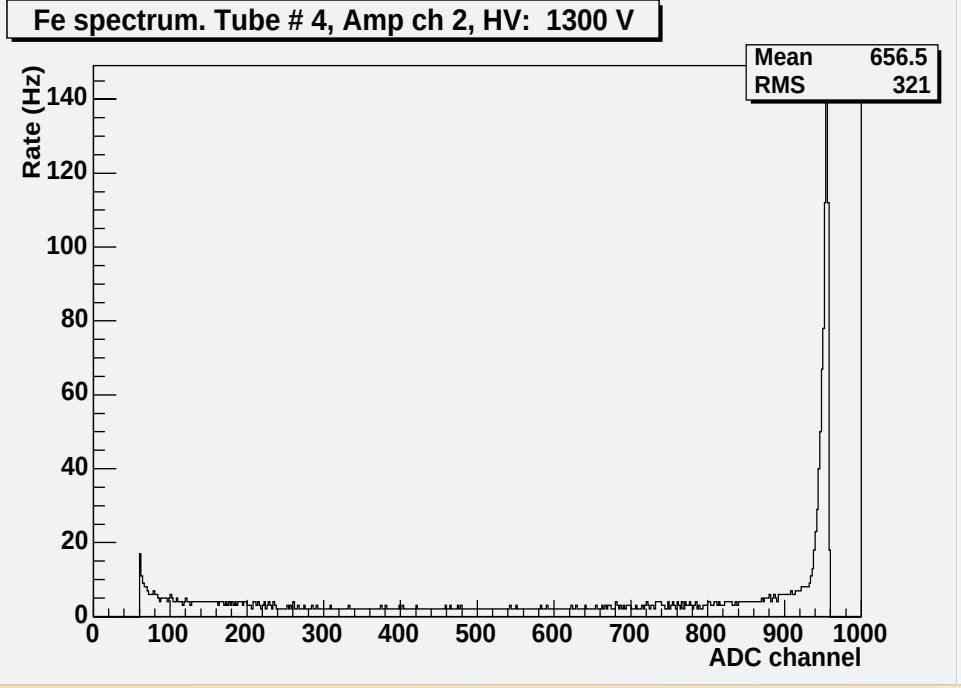


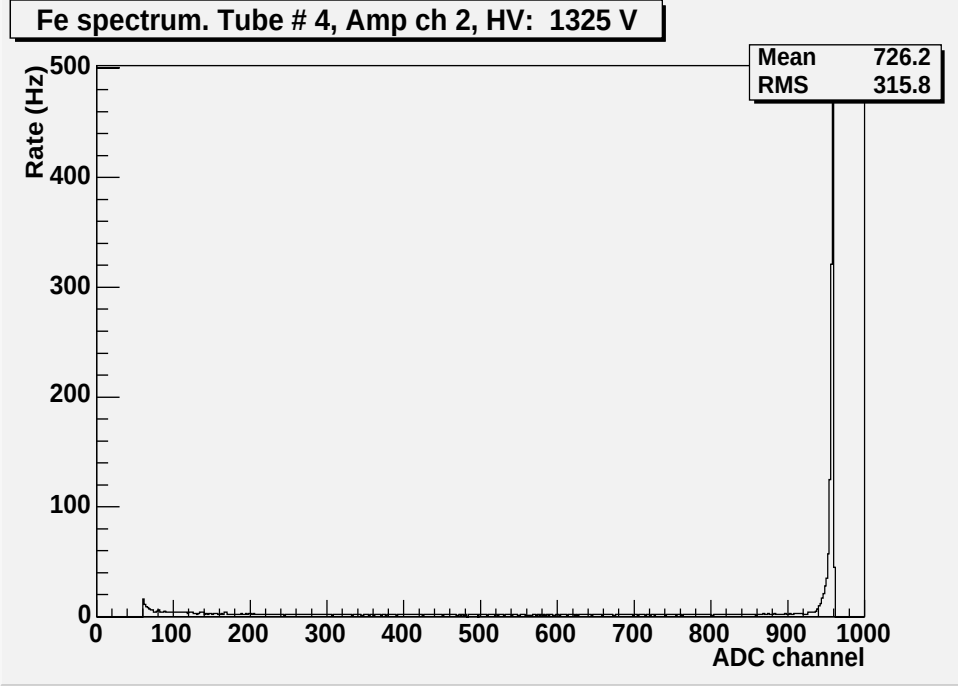

Fe spectrum. Tube # 4, Amp ch 2, HV: 1200 V
Mean 215.4
RMS 87.71
Rate (Hz)
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1225 V
Mean 313.8
RMS 153
Rate (Hz)
ADC channel

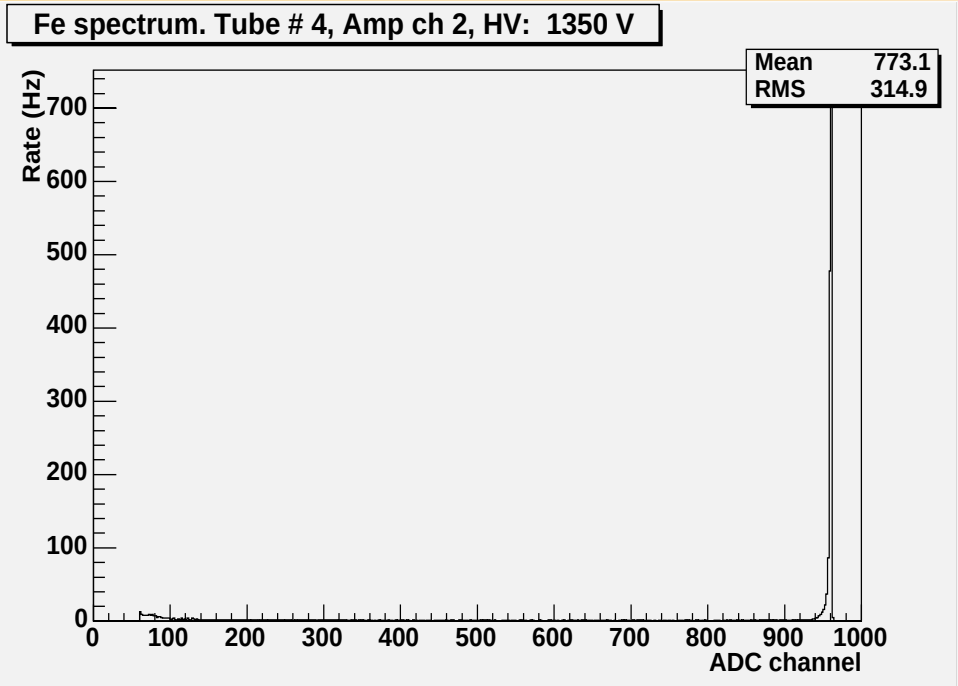

Fe spectrum. Tube # 4, Amp ch 2, HV: 1250 V
Mean 404.1
RMS 210.7
Rate (Hz)
ADC channel

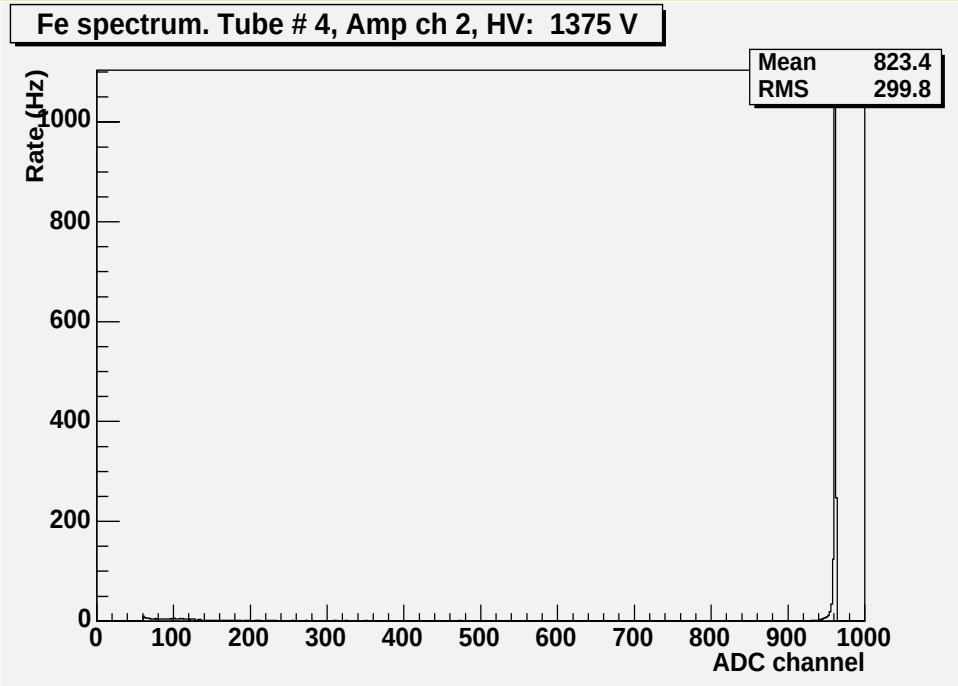

Fe spectrum. Tube # 4, Amp ch 2, HV: 1275 V
Mean 529.1
RMS 282.9
Rate (Hz)
ADC channel





Saturation on ADC channel 950





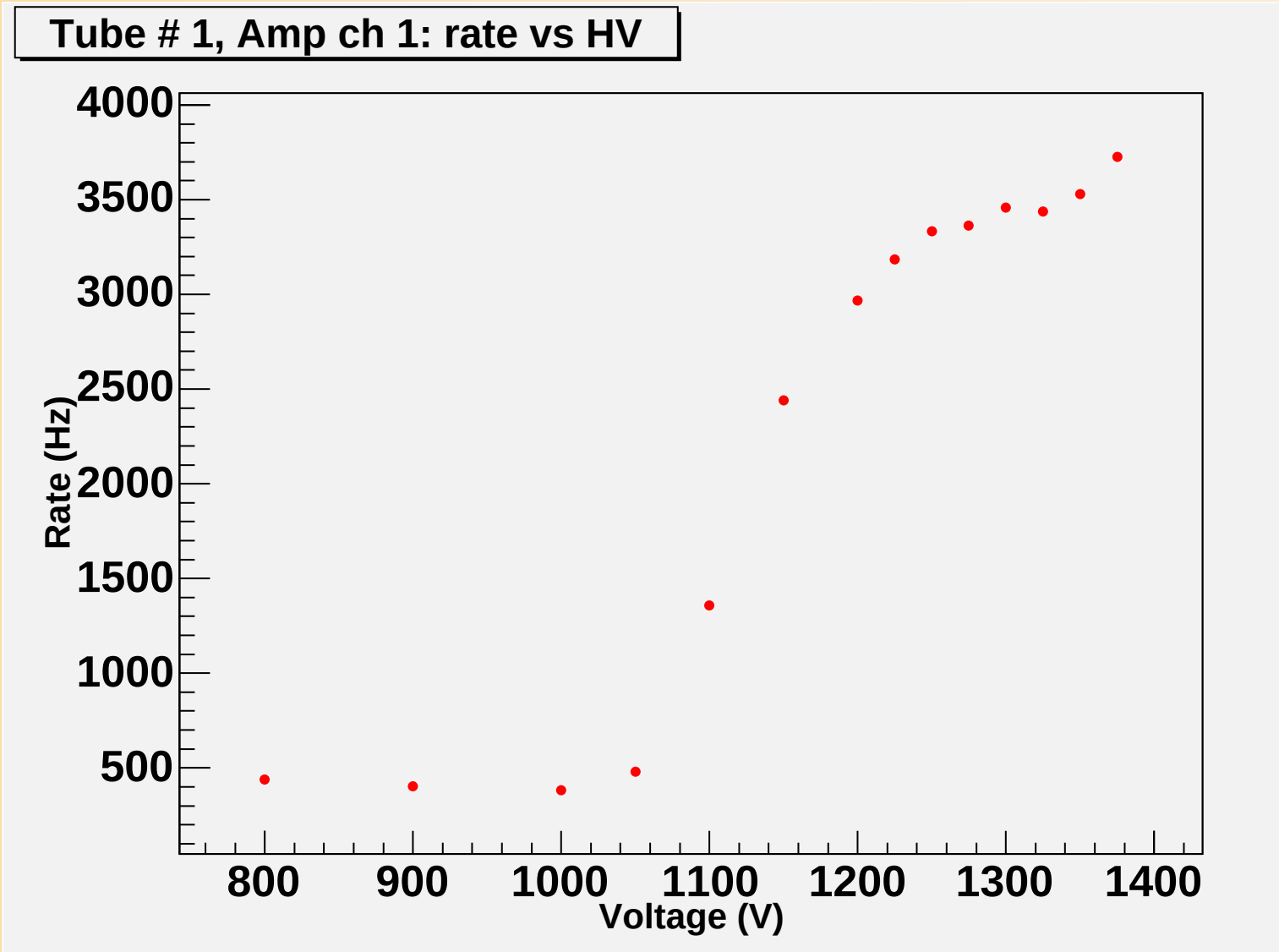
- Electronics:
  - UHVG working properly:
    - HV supplied up to 1800 V;
  - USCMs hot & cold, UGBS hot, UGBC hot tested:
    - All components responded correctly;
    - Proper communication with serial ports;
  - USCMs, UGBSs, UGBCs hot & cold tested:
    - Each module working properly in hot or cold mode;
    - No conflicts between board while using any combination of USCM hot or cold with UGBS, UGBC hot or cold;
    - **A note on the test results is ready to be spread.**

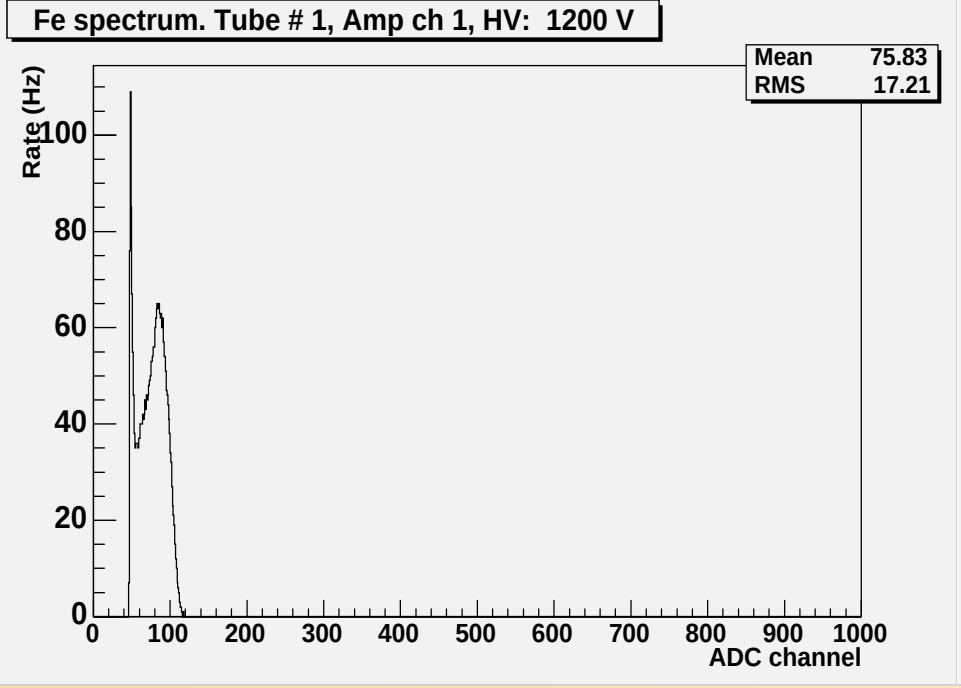
What could be done

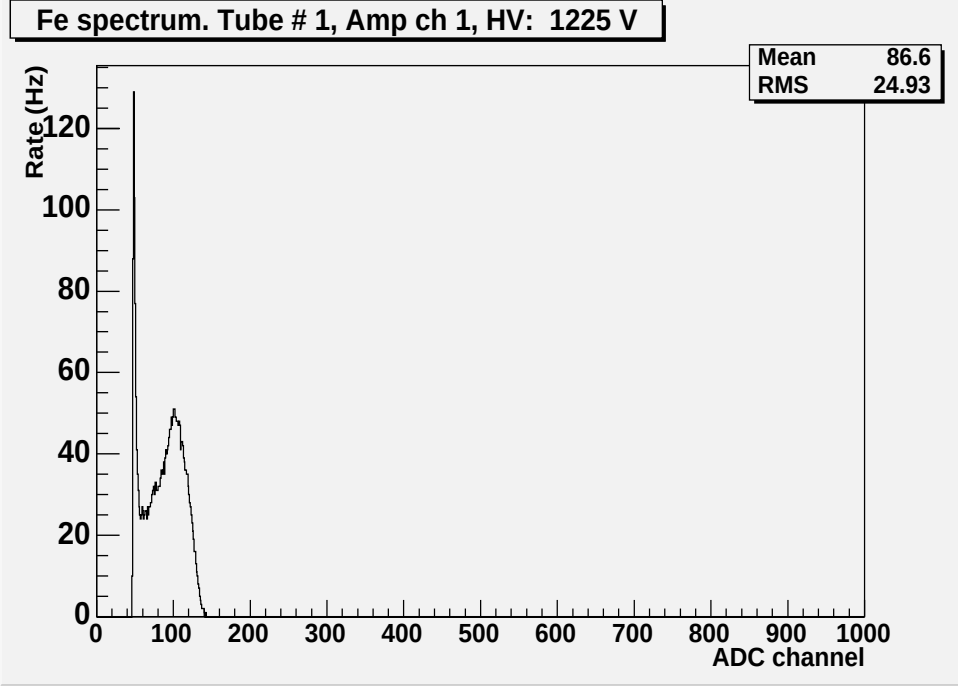
- Circulate gas in box C;
- Spirometer readings compared to partial pressures;
- Heat canister: transit time dependence on temperature studies.

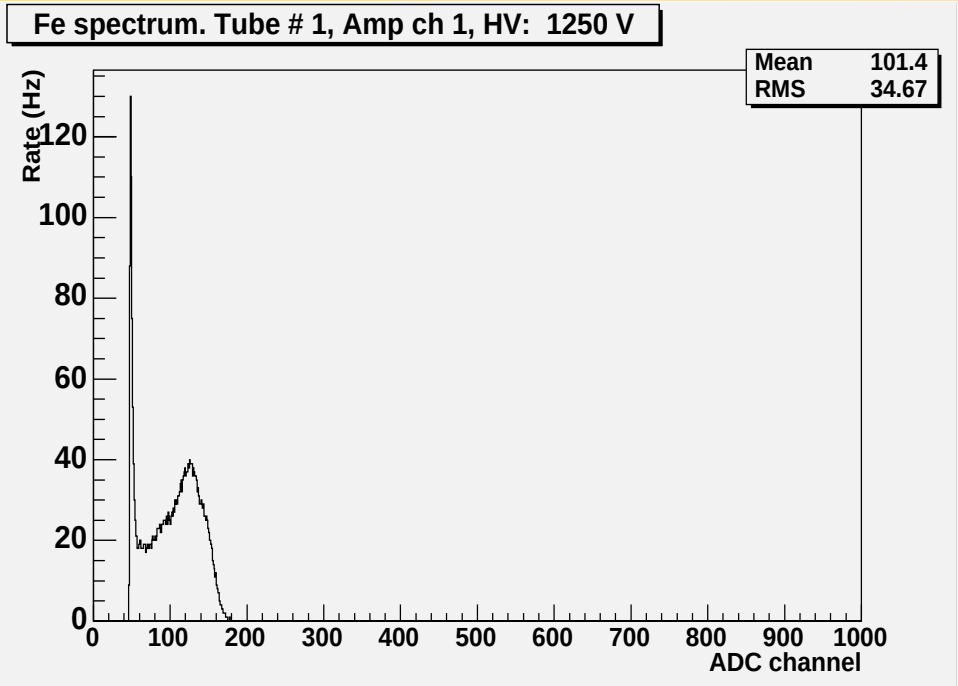
Spectra without cut

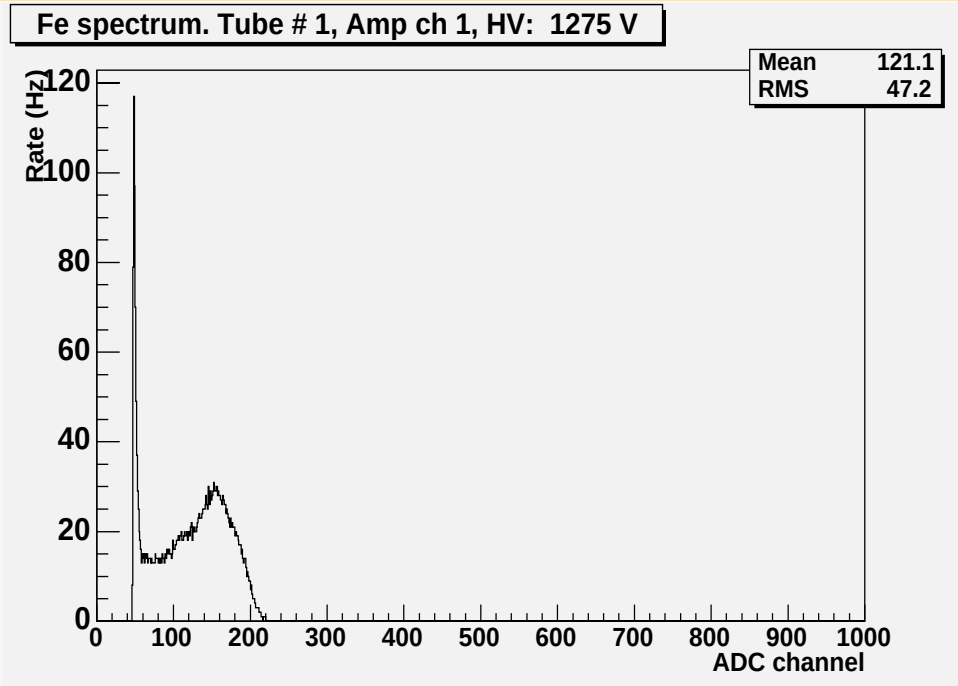
Tube 1:

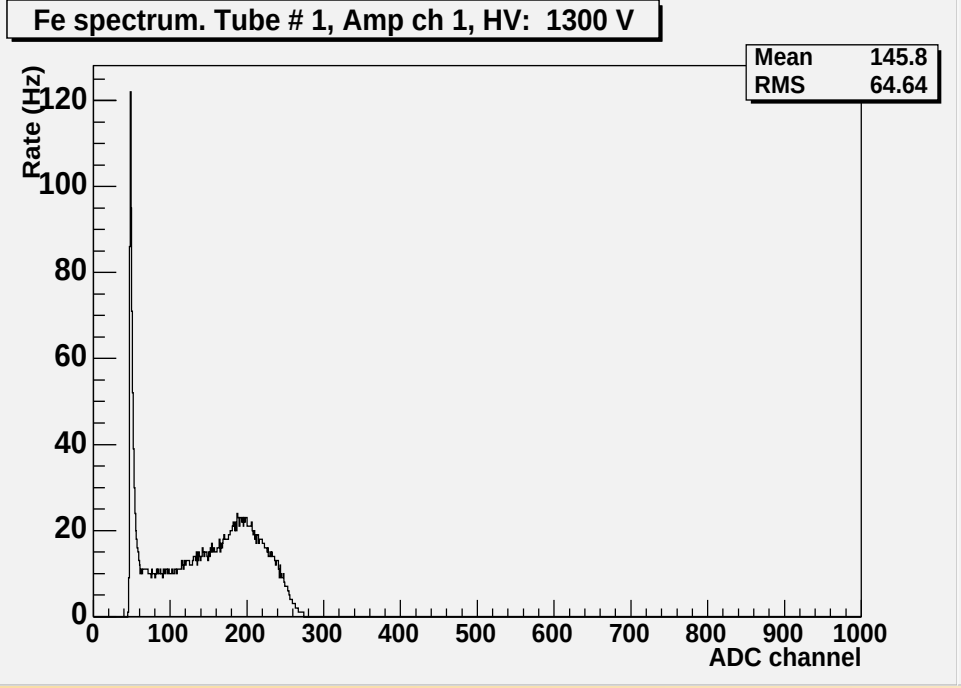


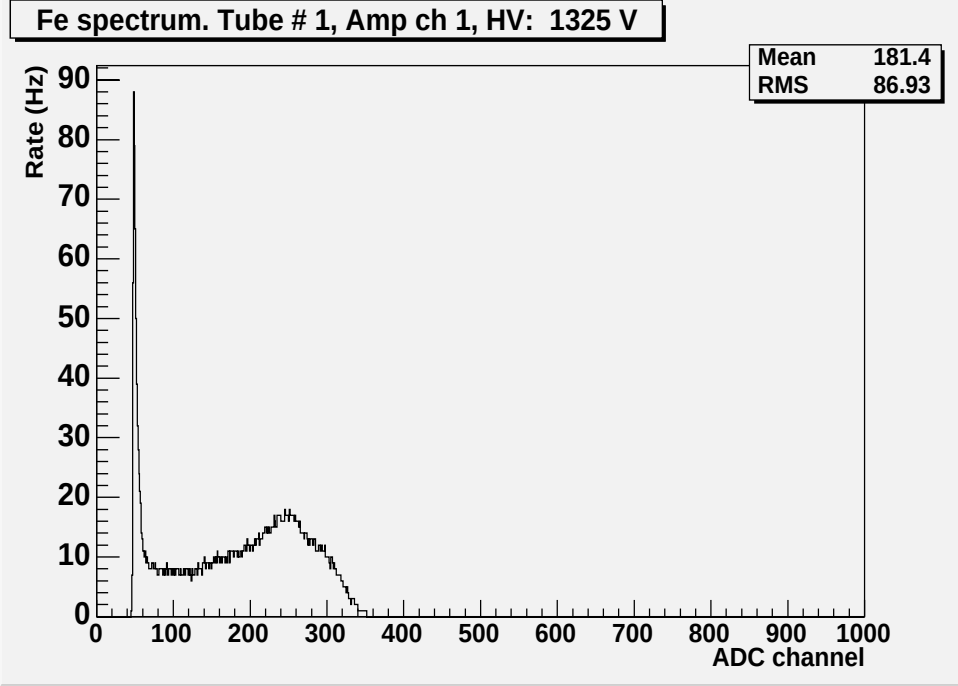

Fe spectrum. Tube # 1, Amp ch 1, HV: 1200 V
Mean 75.83
RMS 17.21
Rate (Hz)
ADC channel

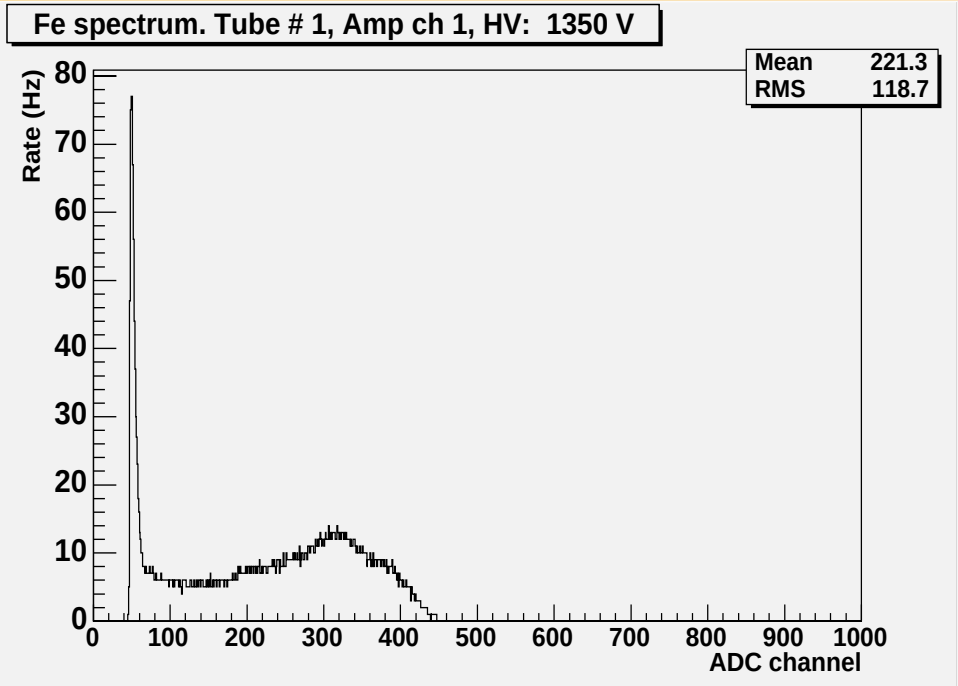

Fe spectrum. Tube # 1, Amp ch 1, HV: 1225 V
Mean 86.6
RMS 24.93
Rate (Hz)
ADC channel

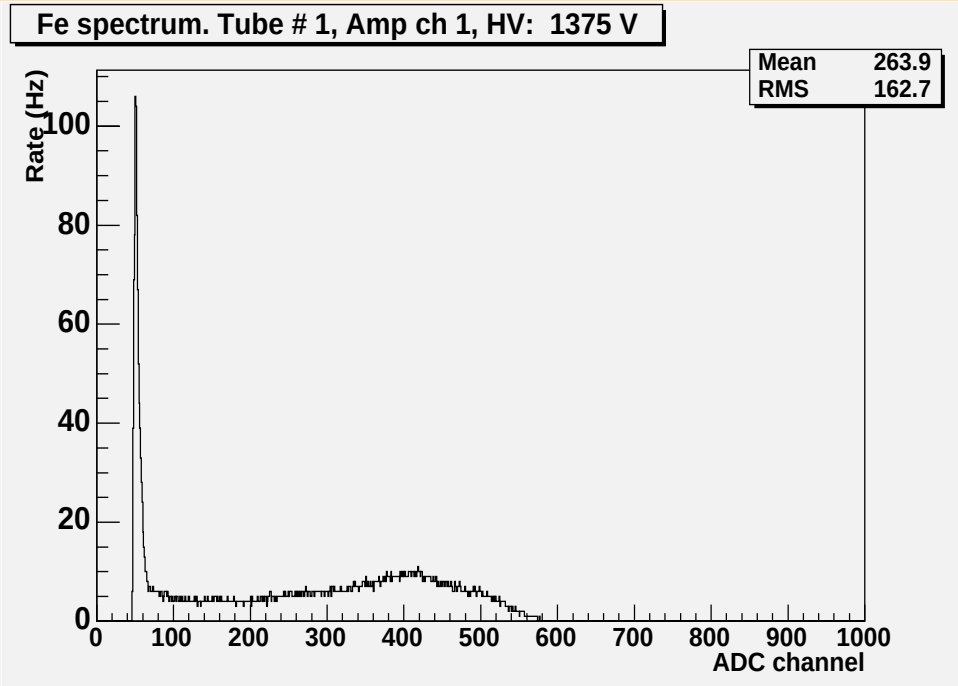

Fe spectrum. Tube # 1, Amp ch 1, HV: 1250 V
Mean 101.4
RMS 34.67
Rate (Hz)
ADC channel


Fe spectrum. Tube # 1, Amp ch 1, HV: 1275 V
Mean 121.1
RMS 47.2
Rate (Hz)
ADC channel

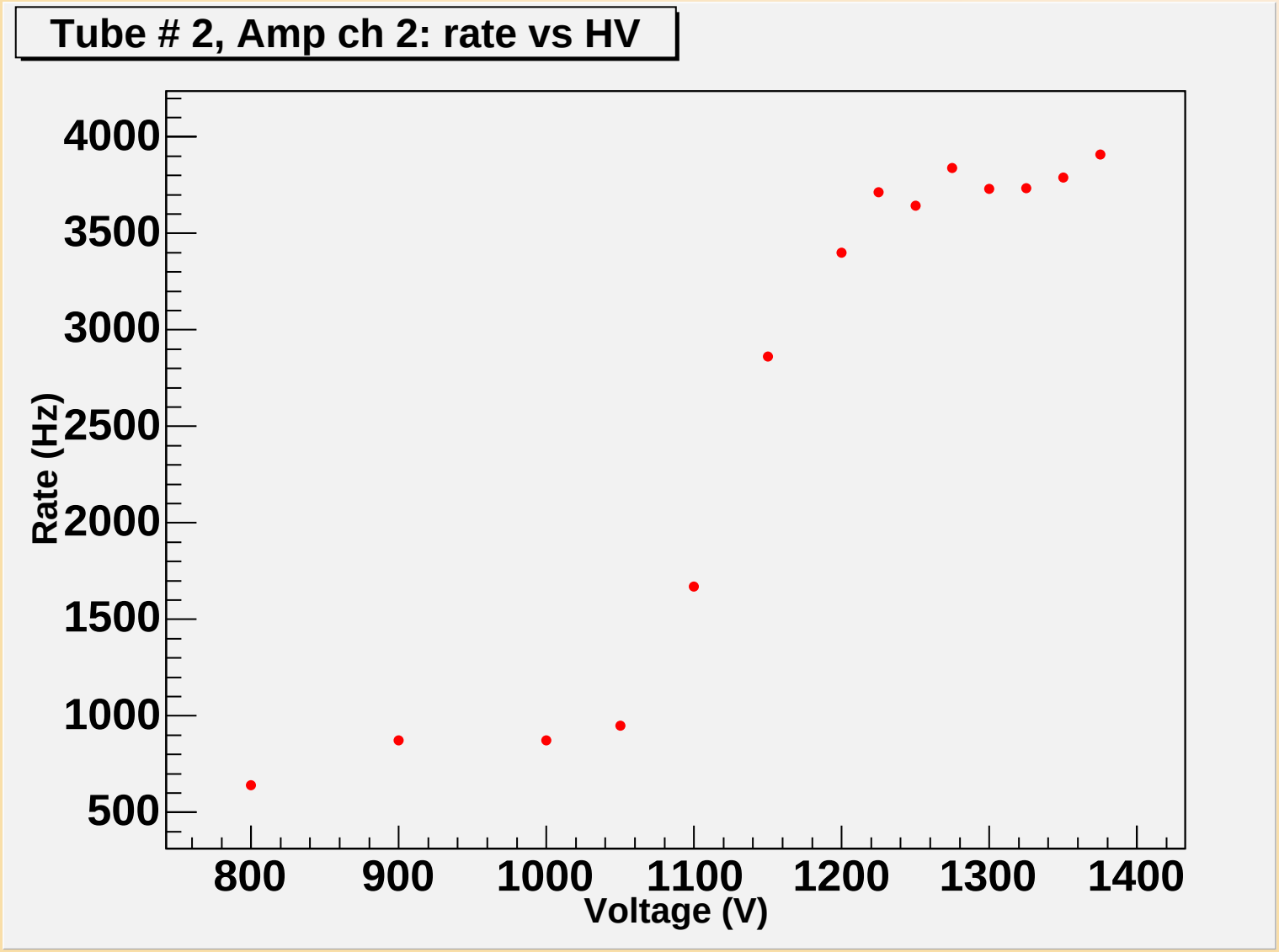

Fe spectrum. Tube # 1, Amp ch 1, HV: 1300 V
Mean 145.8
RMS 64.64
Rate (Hz)
ADC channel

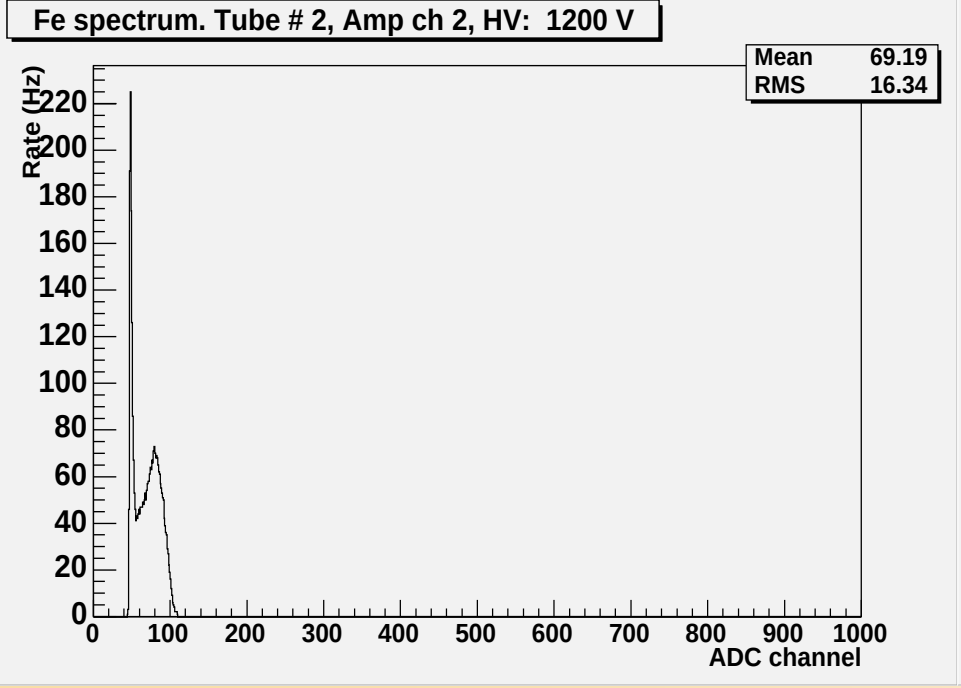

Fe spectrum. Tube # 1, Amp ch 1, HV: 1325 V
Mean 181.4
RMS 86.93
Rate (Hz)
ADC channel

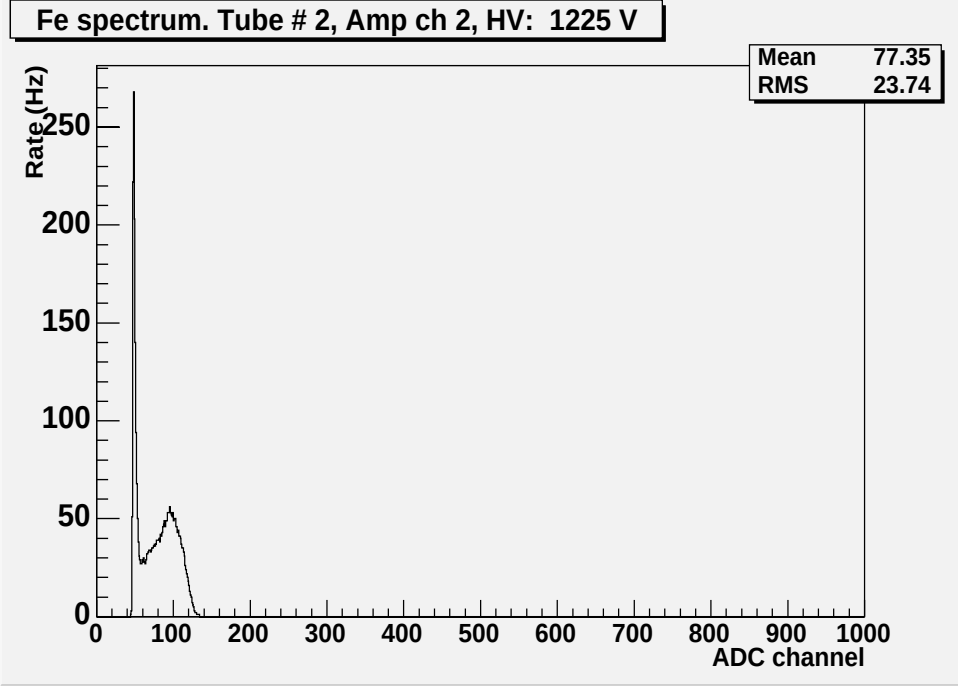

Fe spectrum. Tube # 1, Amp ch 1, HV: 1350 V
Mean 221.3
RMS 118.7
Rate (Hz)
ADC channel

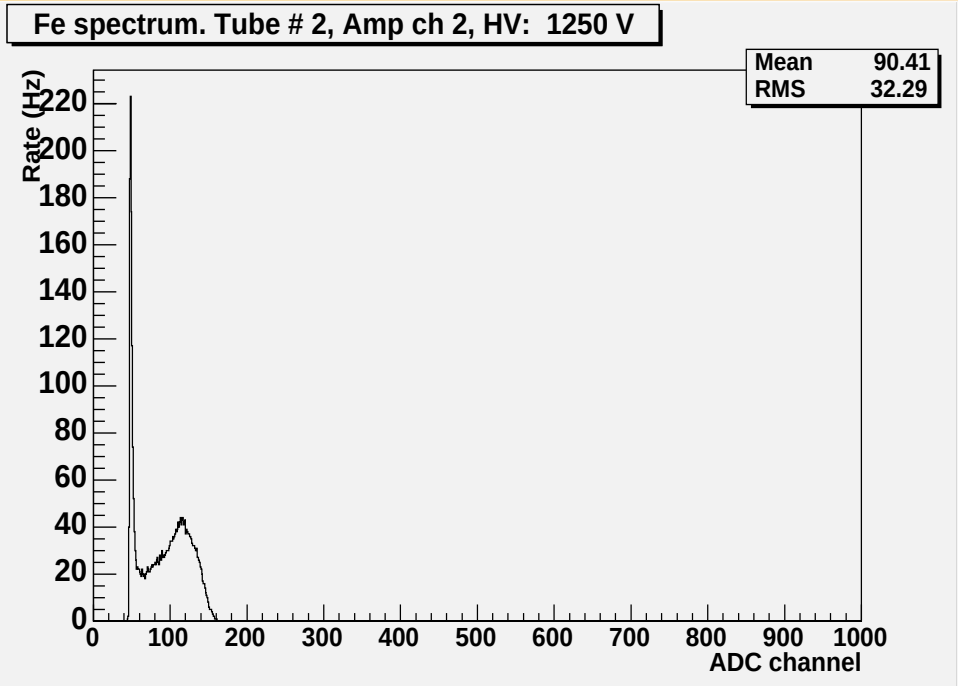

Fe spectrum. Tube # 1, Amp ch 1, HV: 1375 V
Mean 263.9
RMS 162.7
Rate (Hz)
ADC channel

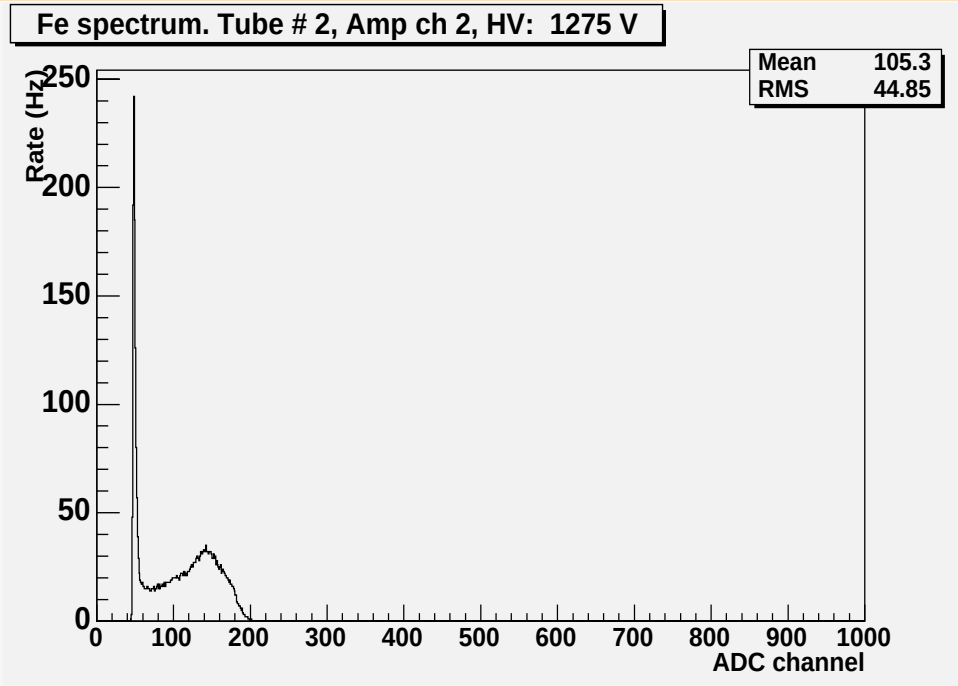
Tube 2:

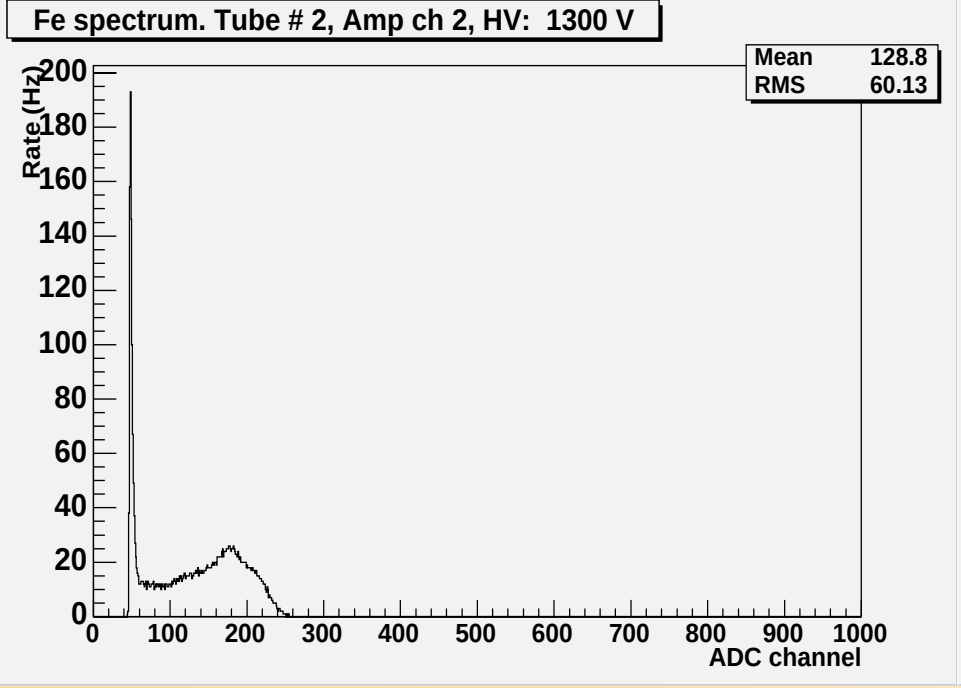

Tube # 2, Amp ch 2: rate vs HV
Rate (Hz)
4000
3500
3000
2500
2000
1500
1000
500
800
900
1000
1100
1200
1300
1400
Voltage (V)

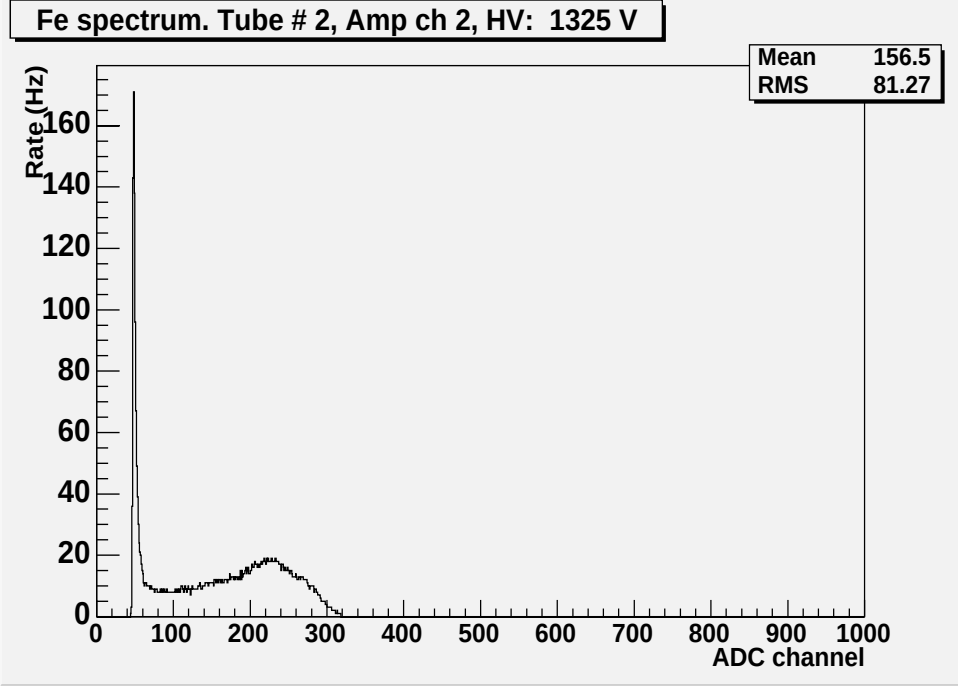

Fe spectrum. Tube # 2, Amp ch 2, HV: 1200 V
Mean 69.19
RMS 16.34
Rate (Hz)
ADC channel

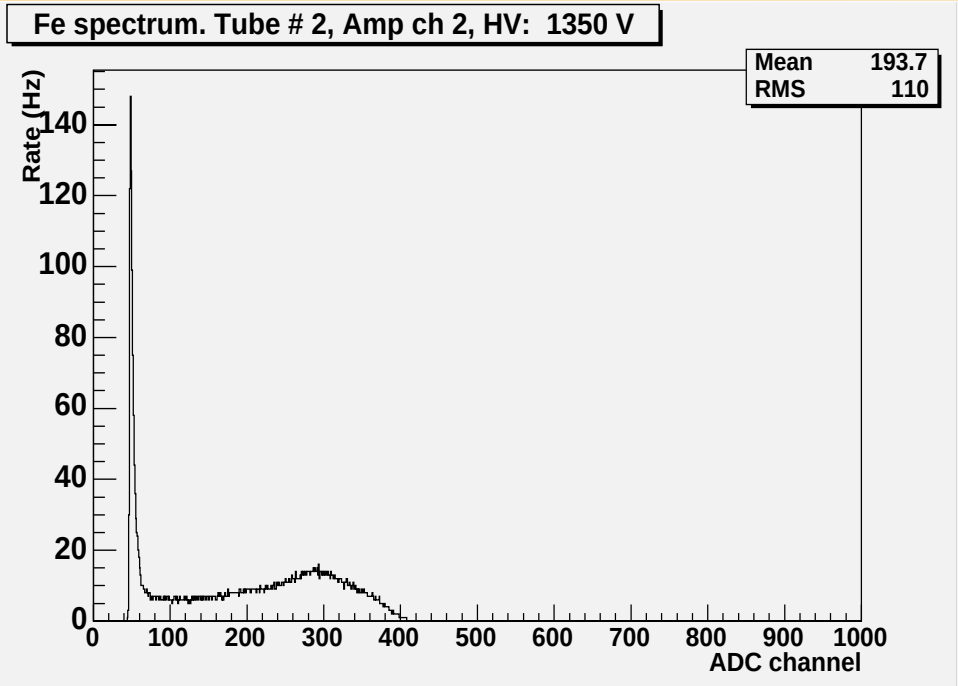

Fe spectrum. Tube # 2, Amp ch 2, HV: 1225 V
Mean 77.35
RMS 23.74
Rate (Hz)
ADC channel

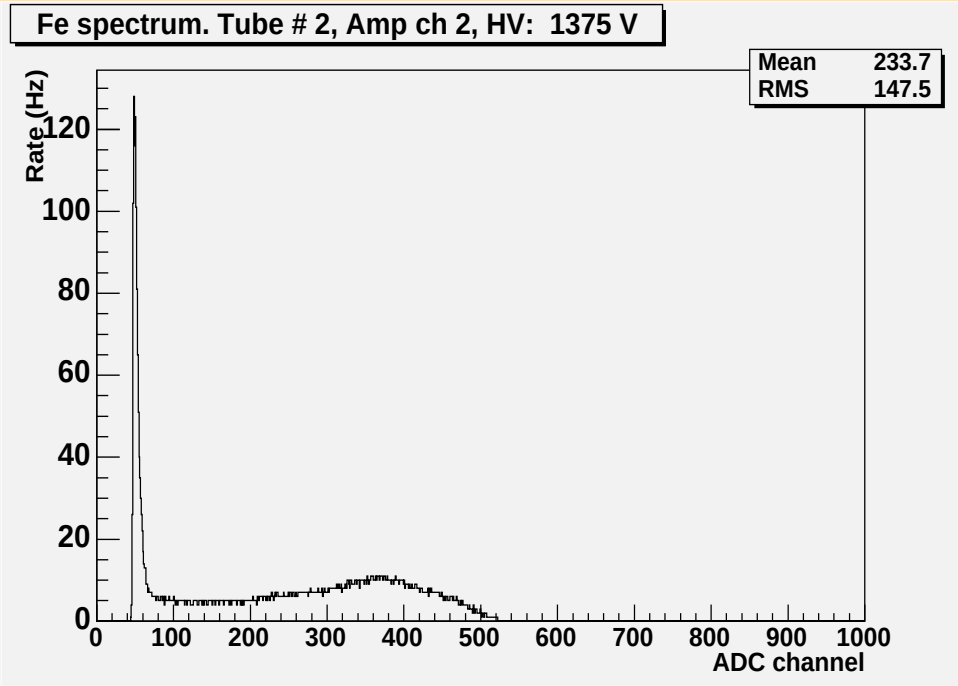

Fe spectrum. Tube # 2, Amp ch 2, HV: 1250 V
Mean 90.41
RMS 32.29
Rate (Hz)
ADC channel


Fe spectrum. Tube # 2, Amp ch 2, HV: 1275 V
Mean 105.3
RMS 44.85
Rate (Hz)
ADC channel

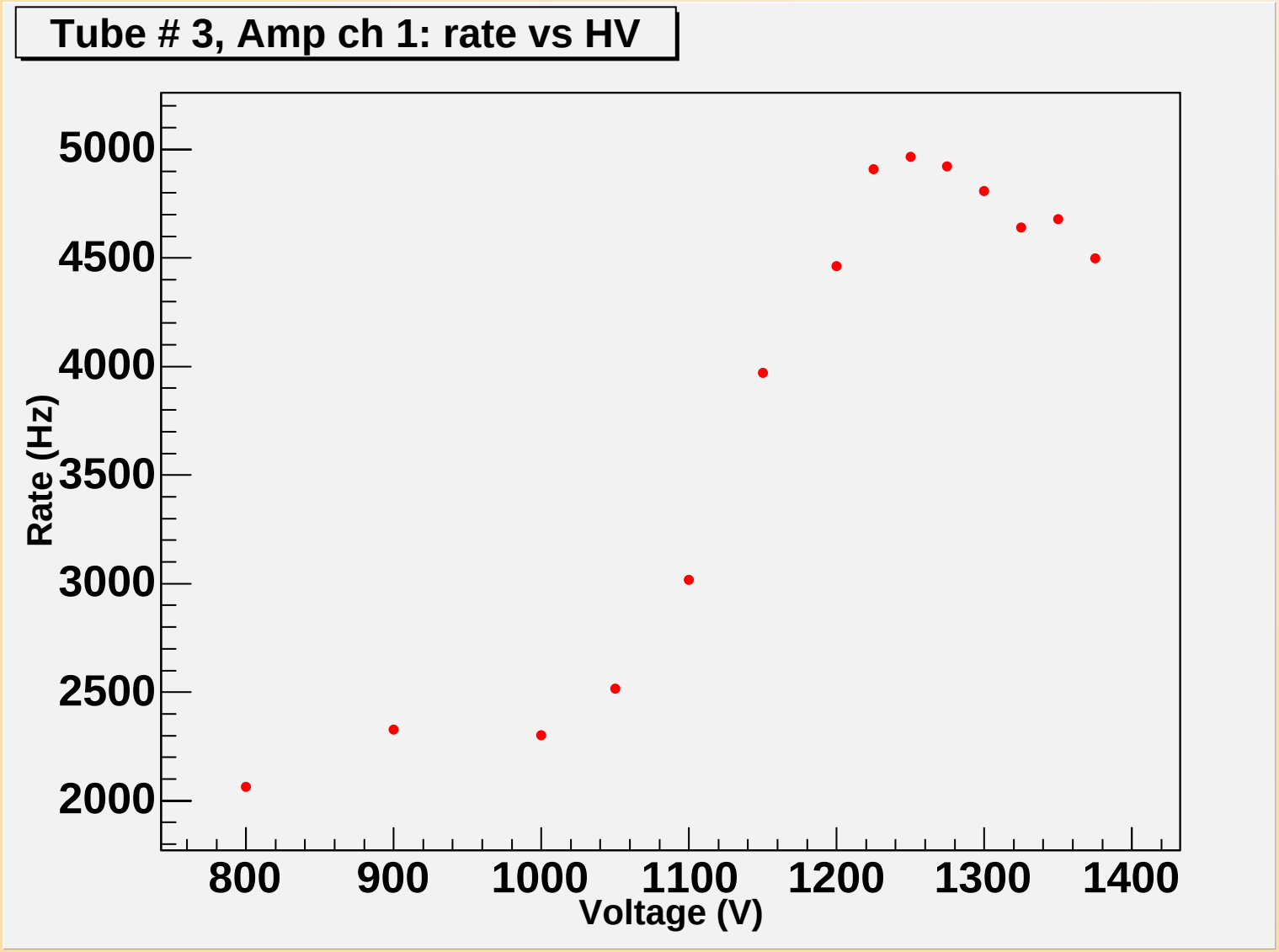

Fe spectrum. Tube # 2, Amp ch 2, HV: 1300 V
Mean 128.8
RMS 60.13
Rate (Hz)
ADC channel

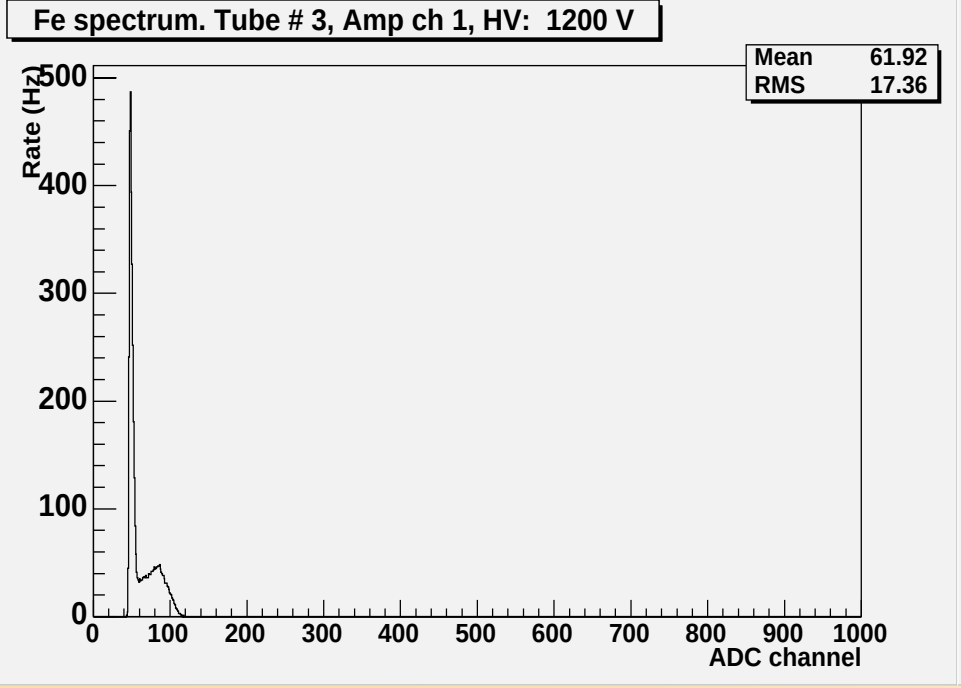

Fe spectrum. Tube # 2, Amp ch 2, HV: 1325 V
Mean 156.5
RMS 81.27
Rate (Hz)
ADC channel

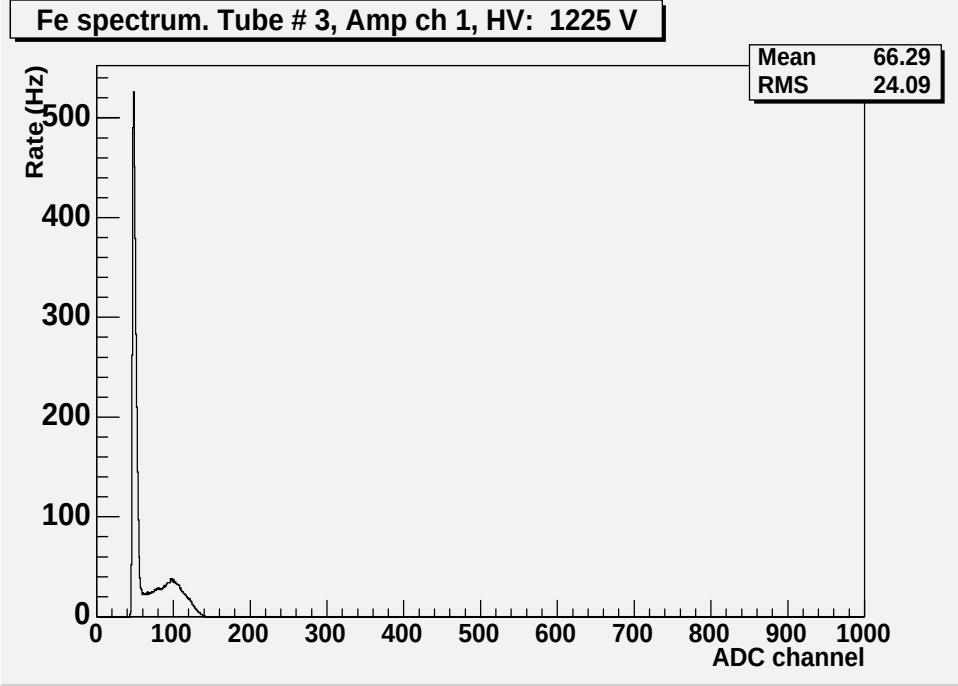

Fe spectrum. Tube # 2, Amp ch 2, HV: 1350 V
Mean 193.7
RMS 110
Rate (Hz)
ADC channel

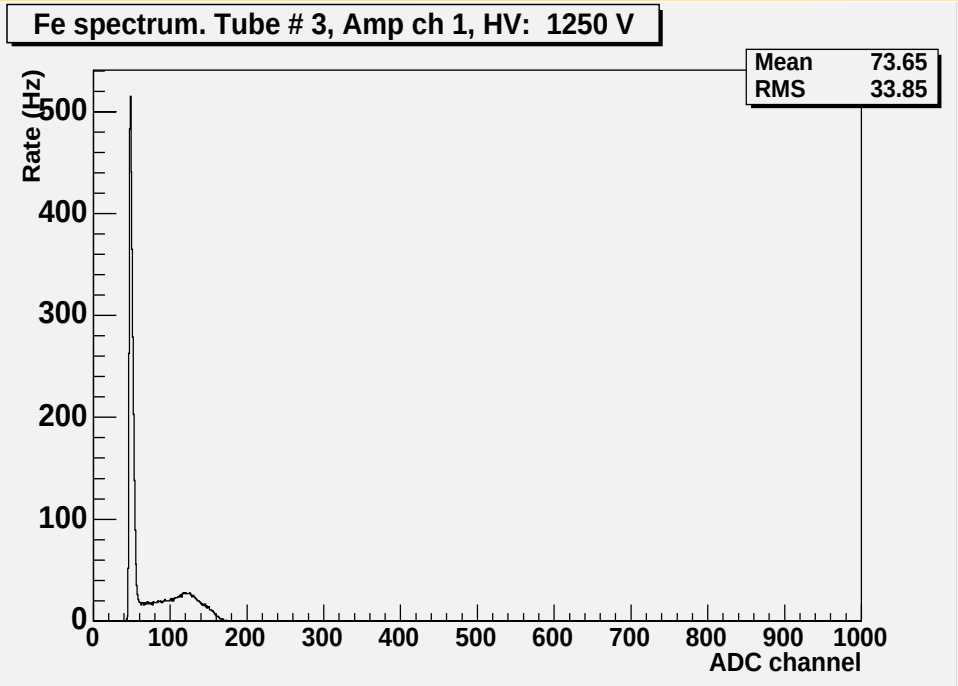

Fe spectrum. Tube # 2, Amp ch 2, HV: 1375 V
Mean 233.7
RMS 147.5
Rate (Hz)
ADC channel

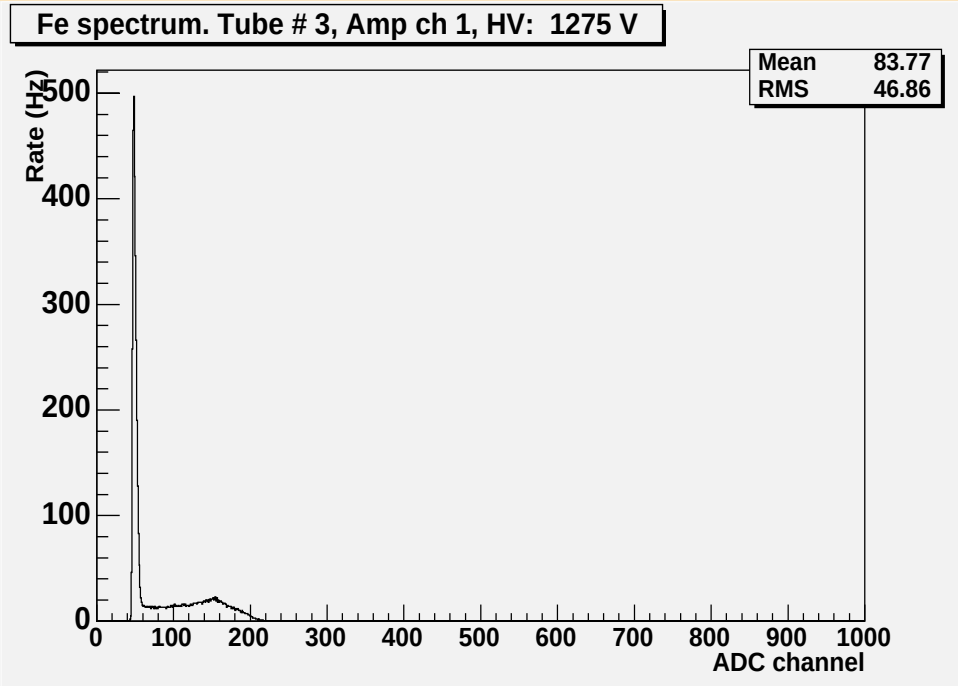
Tube 3:

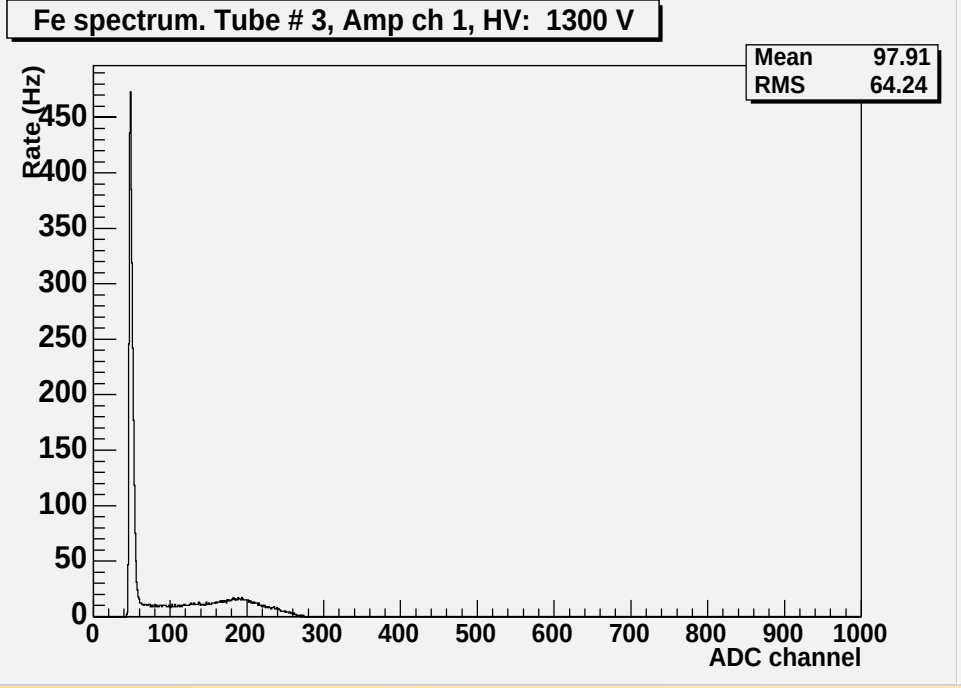

Tube # 3, Amp ch 1: rate vs HV
Rate (Hz)
5000
4500
4000
3500
3000
2500
2000
800
900
1000
1100
1200
1300
1400
Voltage (V)

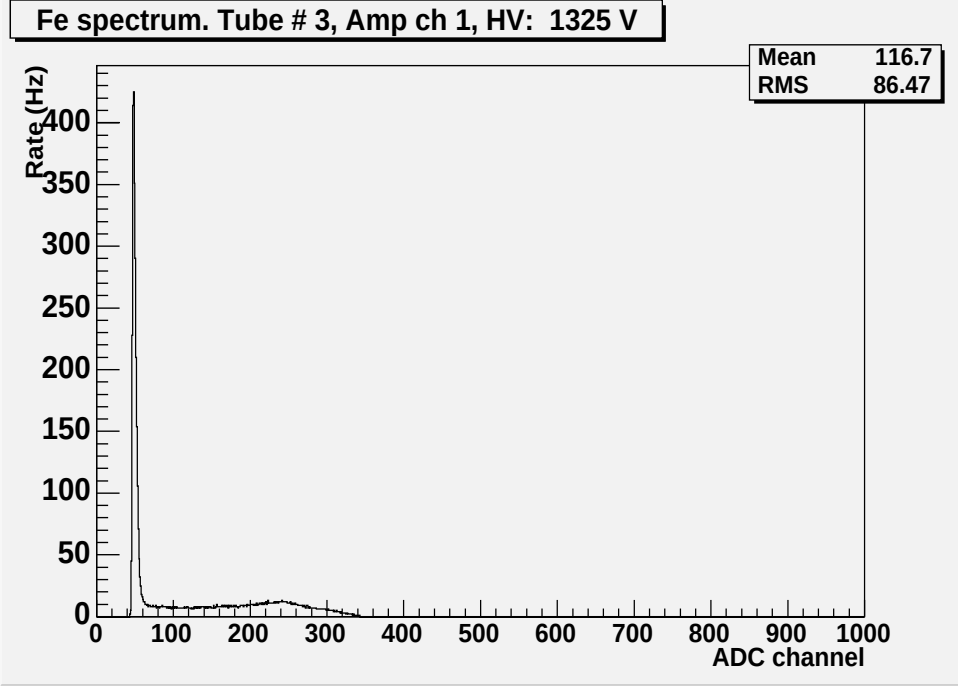

Fe spectrum. Tube # 3, Amp ch 1, HV: 1200 V
Mean 61.92
RMS 17.36
Rate (Hz)
ADC channel

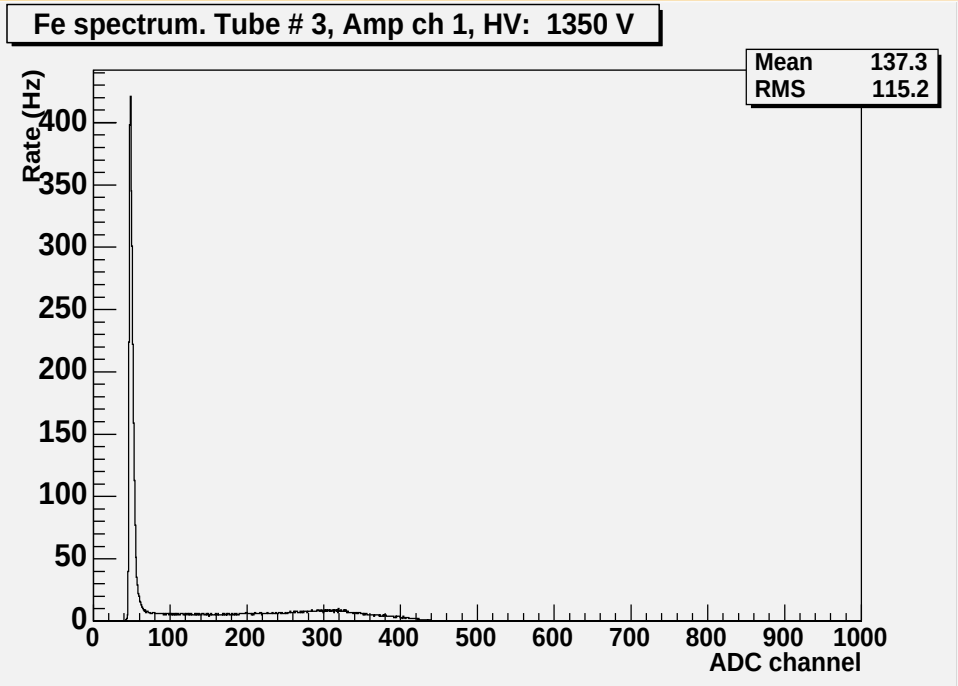

Fe spectrum. Tube # 3, Amp ch 1, HV: 1225 V
Mean 66.29
RMS 24.09
Rate (Hz)
ADC channel

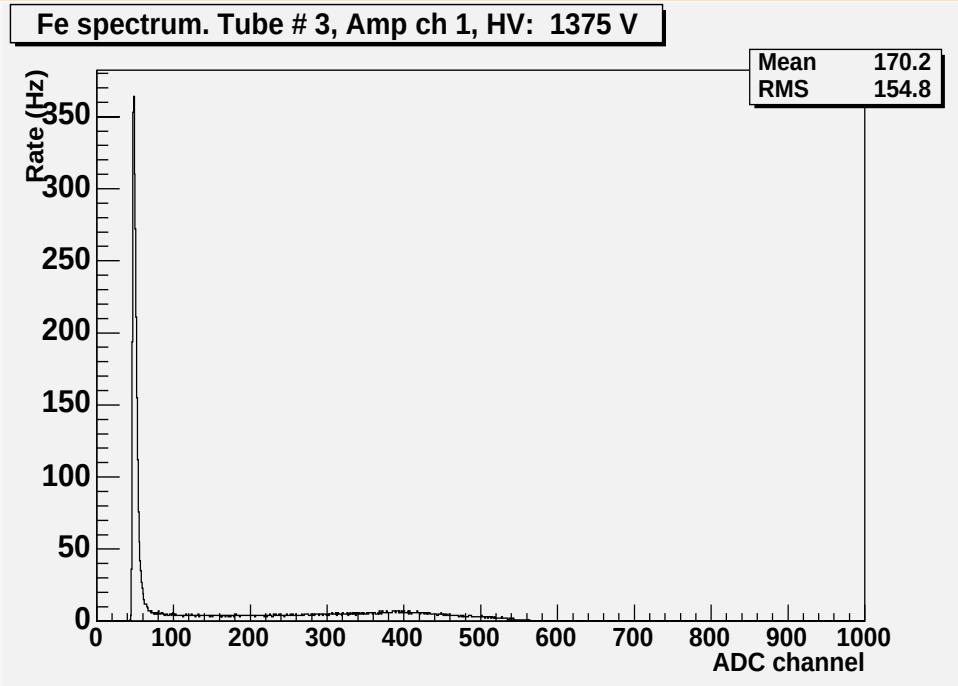

Fe spectrum. Tube # 3, Amp ch 1, HV: 1250 V
Mean 73.65
RMS 33.85
Rate (Hz)
ADC channel


Fe spectrum. Tube # 3, Amp ch 1, HV: 1275 V
Mean 83.77
RMS 46.86
Rate (Hz)
ADC channel

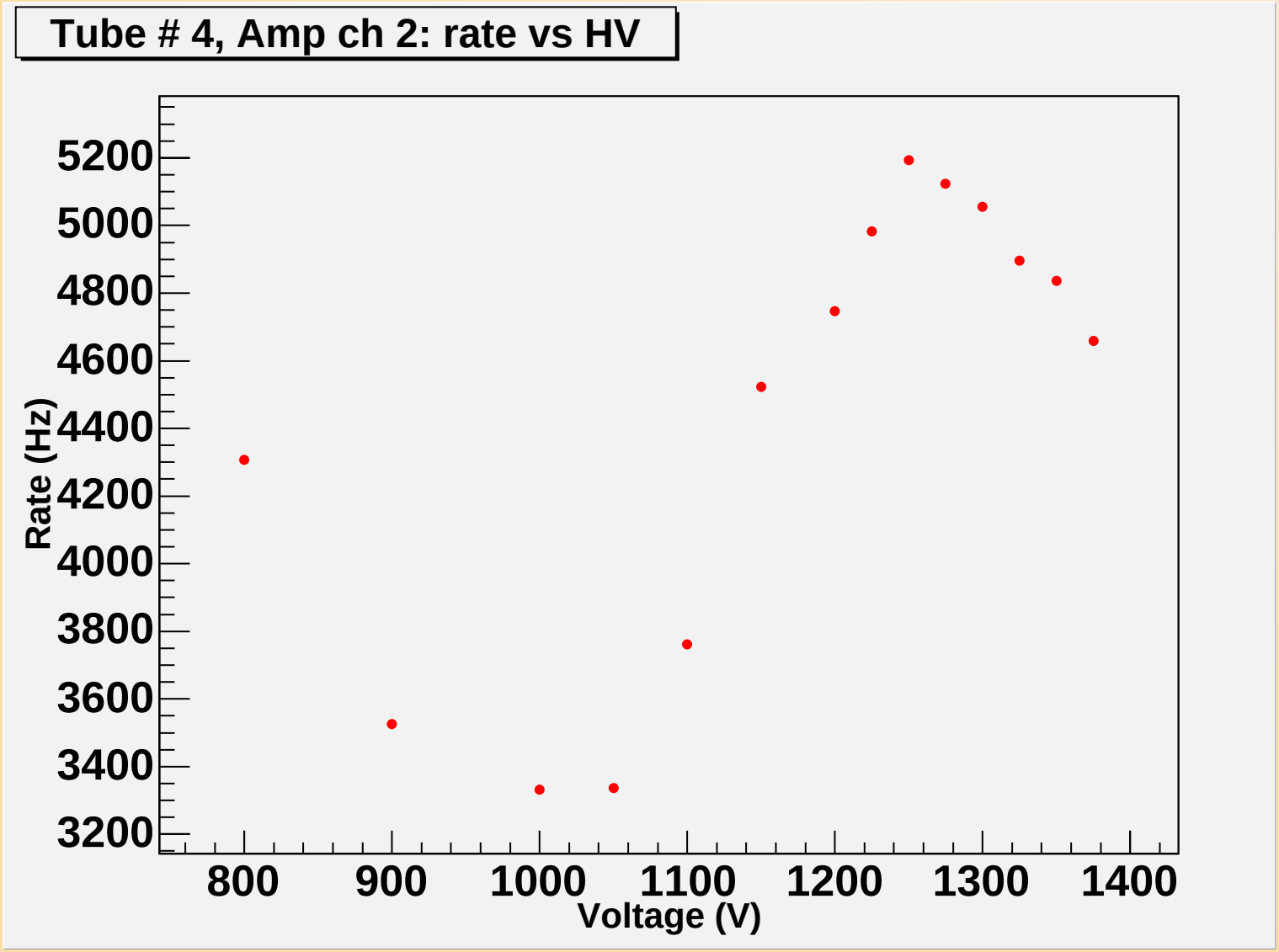

Fe spectrum. Tube # 3, Amp ch 1, HV: 1300 V
Mean 97.91
RMS 64.24
Rate (Hz)
ADC channel

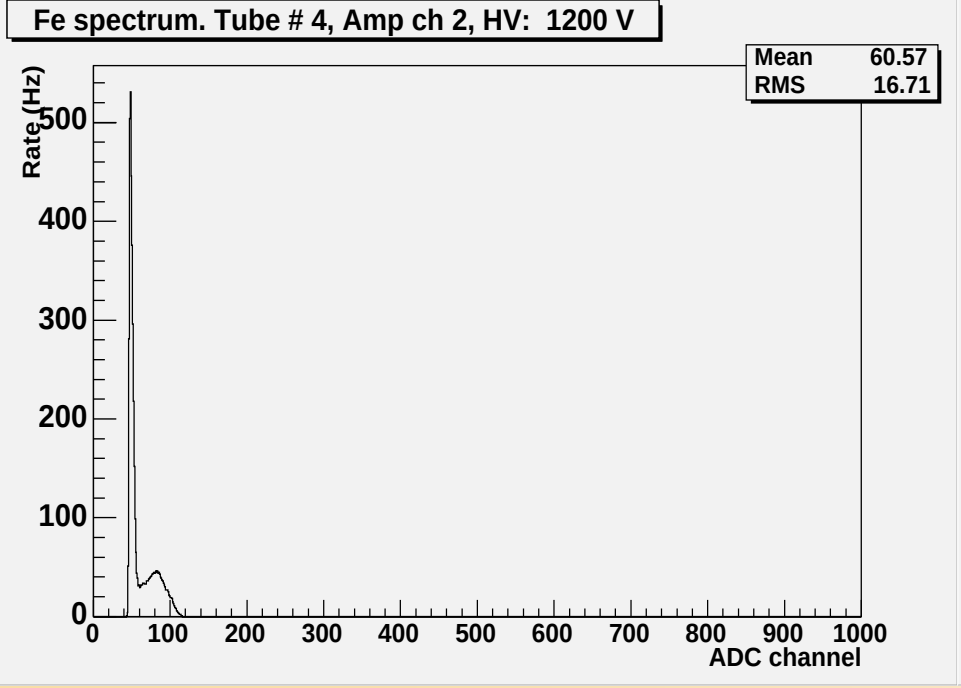

Fe spectrum. Tube # 3, Amp ch 1, HV: 1325 V
Mean 116.7
RMS 86.47
Rate (Hz)
ADC channel

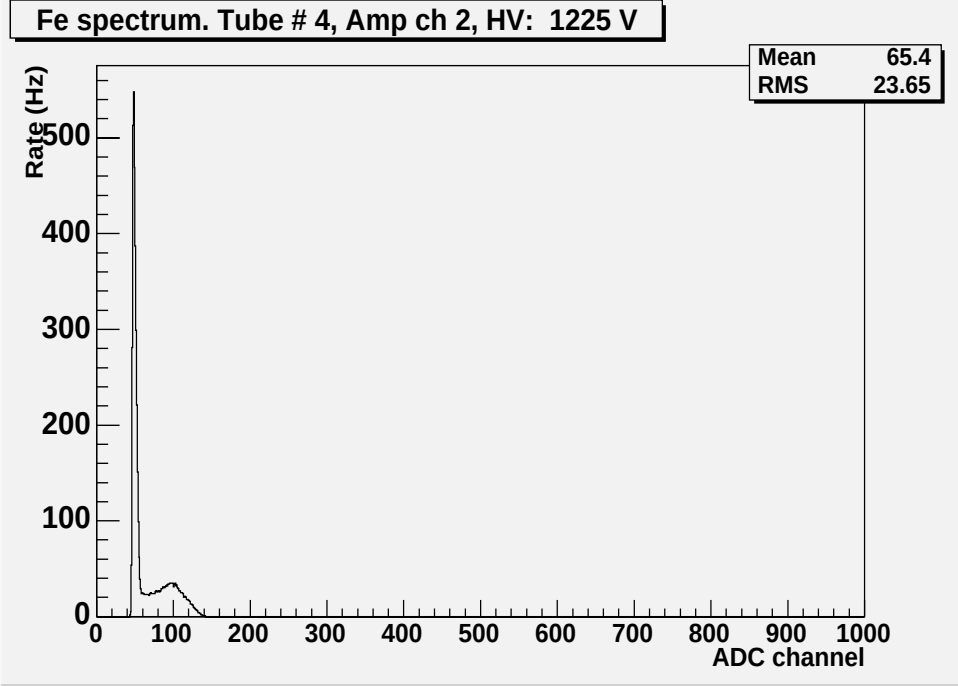

Fe spectrum. Tube # 3, Amp ch 1, HV: 1350 V
Mean 137.3
RMS 115.2
Rate (Hz)
ADC channel

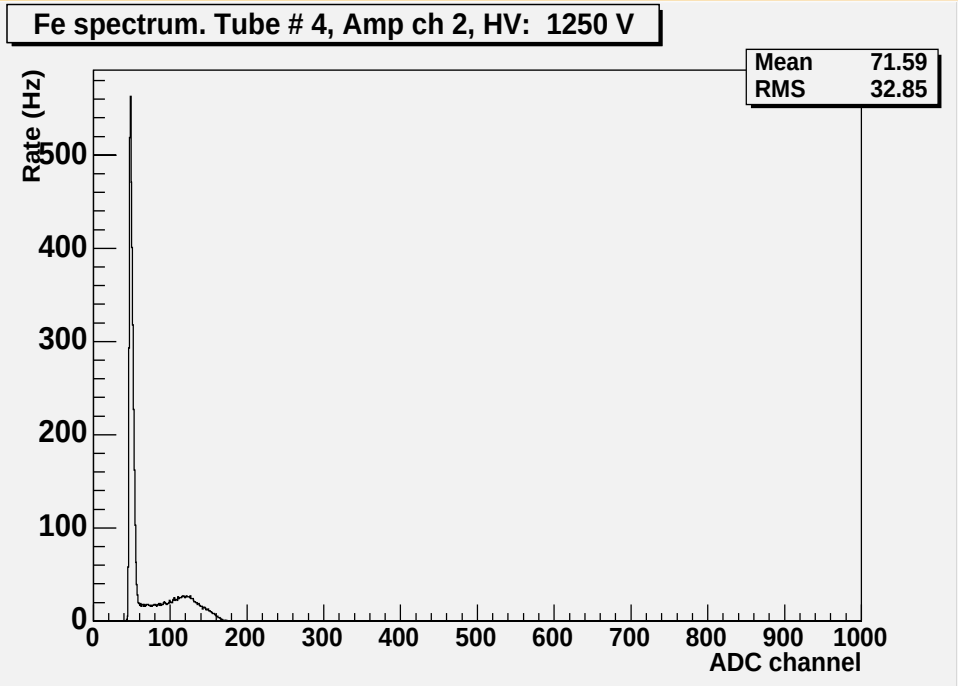

Fe spectrum. Tube # 3, Amp ch 1, HV: 1375 V
Mean 170.2
RMS 154.8
Rate (Hz)
ADC channel

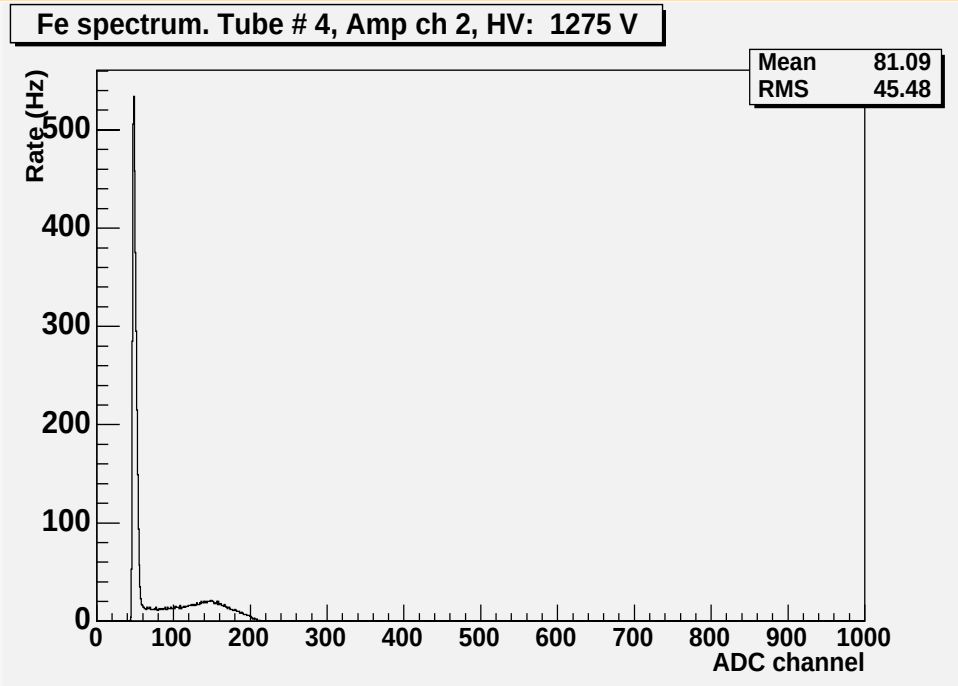
Tube 4:

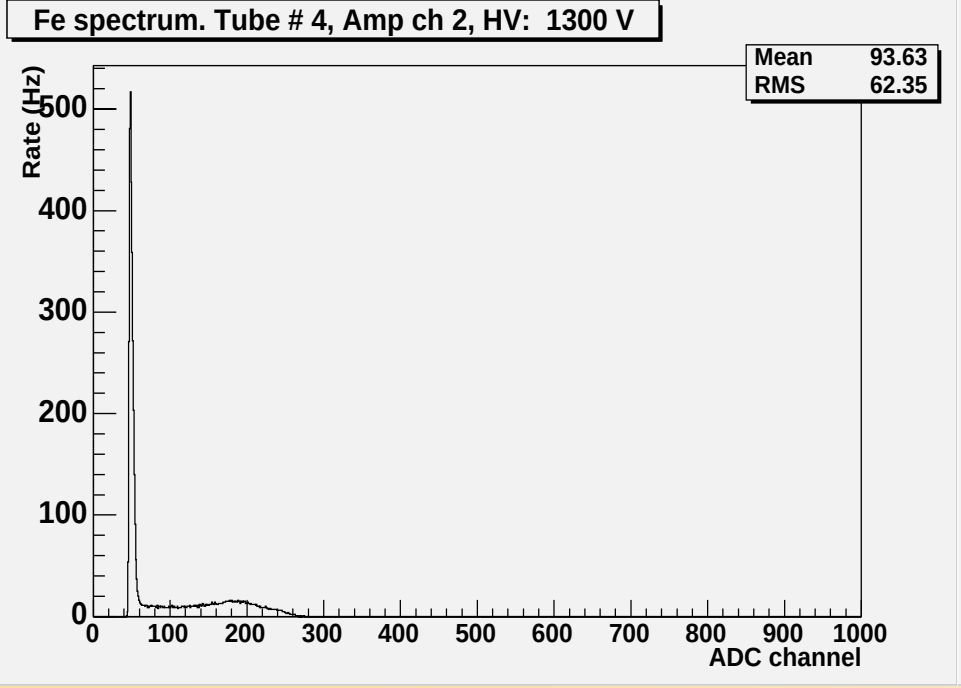

Tube # 4, Amp ch 2: rate vs HV
Rate (Hz)
5200
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
800
900
1000
1100
1200
1300
1400
Voltage (V)

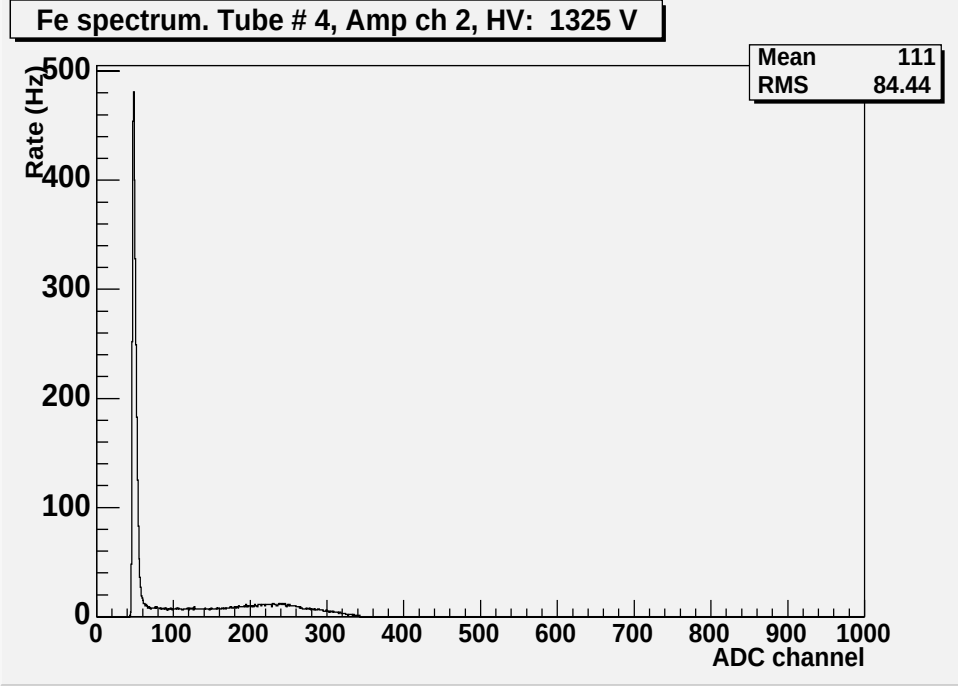

Fe spectrum. Tube # 4, Amp ch 2, HV: 1200 V
Mean 60.57
RMS 16.71
Rate (Hz)
0
100
200
300
400
500
0 100 200 300 400 500 600 700 800 900 1000
ADC channel

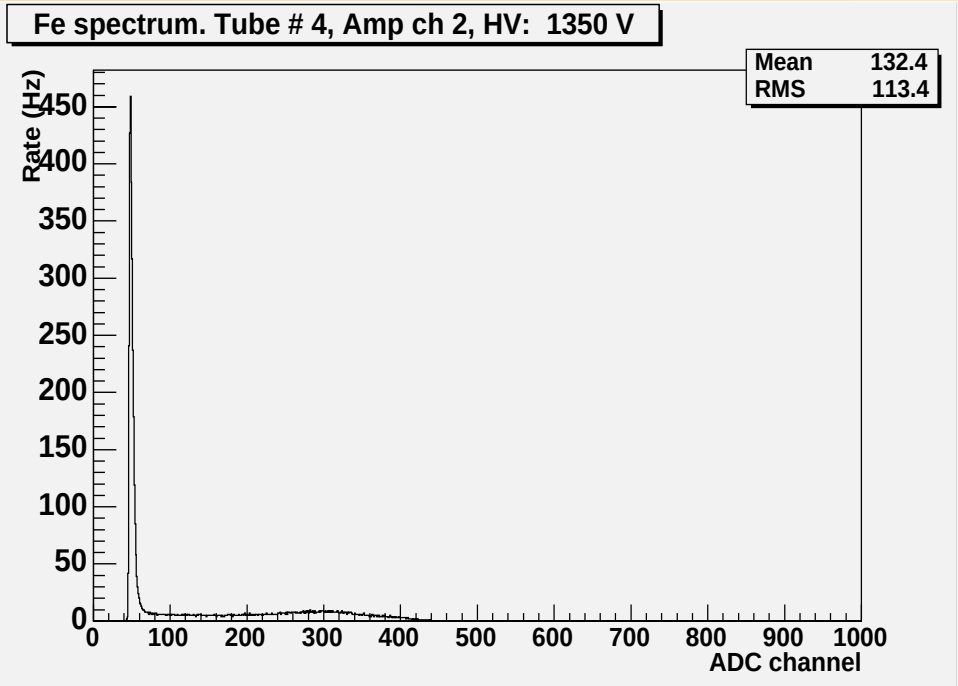

Fe spectrum. Tube # 4, Amp ch 2, HV: 1225 V
Mean 65.4
RMS 23.65
Rate (Hz)
0
100
200
300
400
500
0 100 200 300 400 500 600 700 800 900 1000
ADC channel

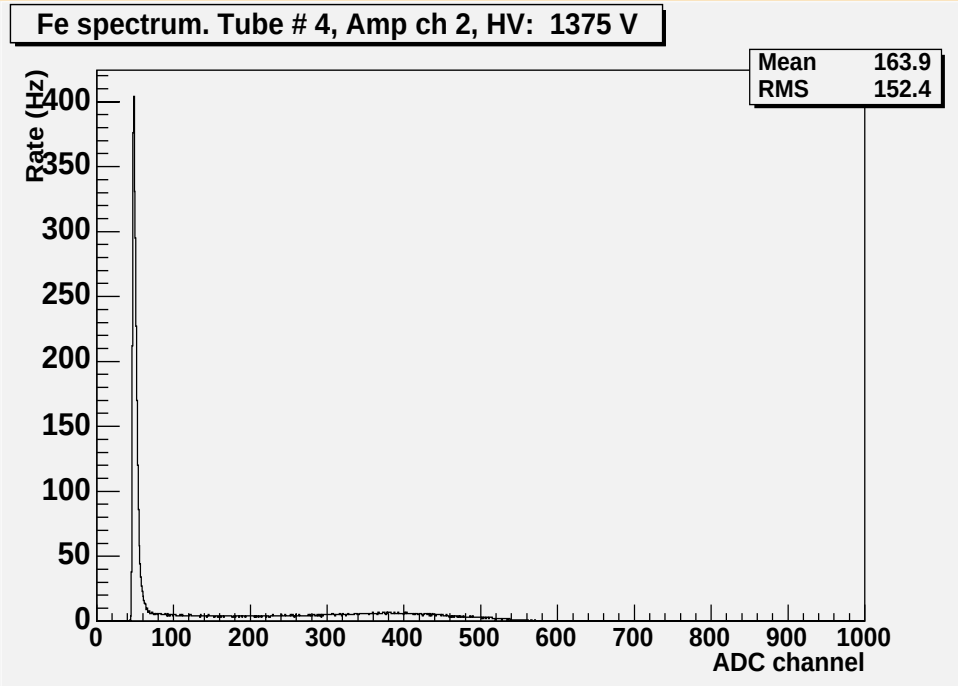

Fe spectrum. Tube # 4, Amp ch 2, HV: 1250 V
Mean 71.59
RMS 32.85
Rate (Hz)
0
100
200
300
400
500
0 100 200 300 400 500 600 700 800 900 1000
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1275 V
Mean 81.09
RMS 45.48
Rate (Hz)
0
100
200
300
400
500
0 100 200 300 400 500 600 700 800 900 1000
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1300 V
Mean 93.63
RMS 62.35
Rate (Hz)
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1325 V
Mean 111
RMS 84.44
Rate (Hz)
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1350 V
Mean 132.4
RMS 113.4
Rate (Hz)
ADC channel


Fe spectrum. Tube # 4, Amp ch 2, HV: 1375 V
Mean 163.9
RMS 152.4
Rate (Hz)
ADC channel