AMS02 TRD-Meeting

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Testbeam Results

- Fe^{55}-Calibration of Straw Tubes
- Comparison of Radiators

RWTH Physics AC-I

Comparison of Radiators

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Comparison of Radiators

1) LRP 375 BK vlies (used by ATLAS)

- fibermaterial: Polypropylene
- fiber thickness 10 μm
- density: 0.06 $\frac{\mathrm{g}}{\mathrm{cm}^3}$
- prize: 15.00 $\frac{\mathrm{DM}}{\mathrm{m}^2}$

2) LRP 375 BK vlies (used by ATLAS)

- cleaned with CH_2Cl_2
  Extraction 2 hours at normal conditions
- prize: 15.00 $\frac{\mathrm{DM}}{\mathrm{m}^2}$ + cleaning ??? $\frac{\mathrm{DM}}{\mathrm{m}^2}$

3) Separet 405

- fibermaterial: Polyacryl
- fiber thickness 14 μm
- density: 0.08 $\frac{\mathrm{g}}{\mathrm{cm}^3}$
- prize: 5.00 $\frac{\mathrm{DM}}{\mathrm{m}^2}$

1) - 3) manufacturer: Freudenberg Vliesstoffe KG
69465 Weinheim, Germany

Comparison of Radiators, Outgassing

NASA-Tests:

- ASTM E 595 (thermal vacuum test I)
  - outgassing, evaporation under vacuum (screening test, 24 h at 125 ^{o}C)
    LIMITS: TML$\leq 1.0\%$, **CVCM** $\leq 0.1\%$

    TML: **T**otal **M**ass **L**oss

    CVCM: **C**ollected **V**olatile **C**ondensable **M**aterial

- ASTM E 1559 (thermal vacuum test II)
  - outgassing, evaporation, sublimation and redeposition test,
    mass-loss as a function of time,
    mass-loss after 144 h

Comparison of Radiators, Outgassing

Deposition rate on nearby attached payloads:

LIMIT: $10^{-14}\ \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$

$\rightarrow$ maximum allowable outgassed mass flow rate:
(2 vents diameter: 2.54 cm each)

$$1.4 \cdot 10^{-6} \frac{\mathrm{g}}{\mathrm{s}}$$

$\rightarrow$ max. allowable outgassed mass flow rate of radiator: (total area of radiator $\approx 110\ m^2$)

$$1.2 \cdot 10^{-12} \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$$

Comparison of Radiators, Outgassing

Austrian Research Center

Thermal Vacuum Test I, 24 h Screening Test

ESA-PSS01-702, ASTM E 595

LIMITS: TML $\leq$ 1.0%, CVCM $\leq$ 0.1 %

Sample	TML (%)	WVR (%)	RML (%)	CVCM (%)
LRP 375BK				
not cleaned	0.22	0.02	0.20	-0.01
CH_2Cl_2	0.04	0.02	0.02	-0.01
Separet				
405	0.20	0.15	0.05	0.00

WVR: **W**ater **V**apour **R**egained

RML: **R**ecoverd **M**ass **L**oss

Thermal Vacuum Test II, 144 h Test

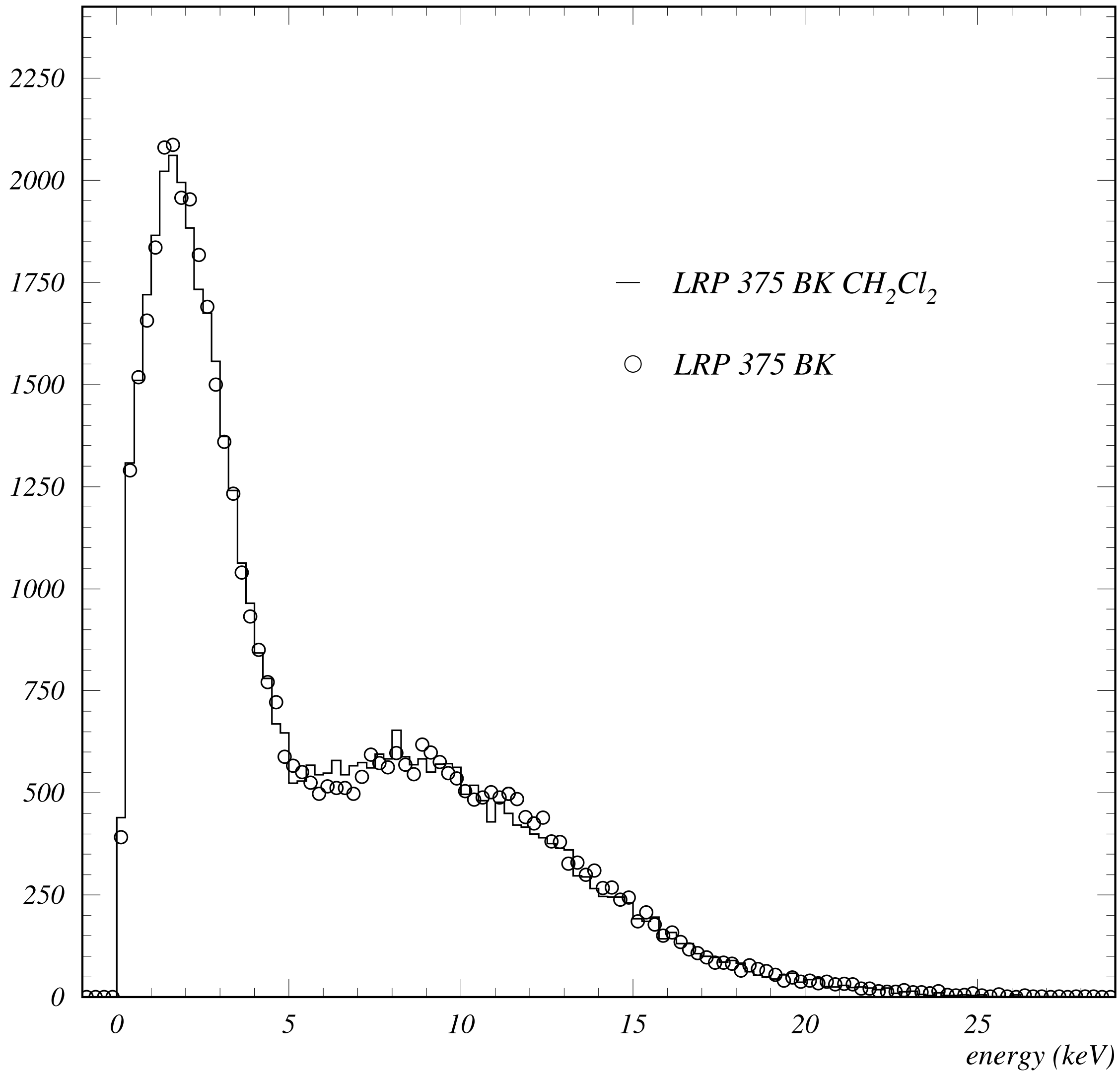
ESA-PSS01-702, ASTM E 1595

LIMIT	:	$1.2 \cdot 10^{-12} \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$
LRP 375BK (CH_2Cl_2)	:	$1 \cdot 10^{-12} \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$
Separet 405	:	$2 \cdot 10^{-12} \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$

Comparison of Radiators, Testbeam

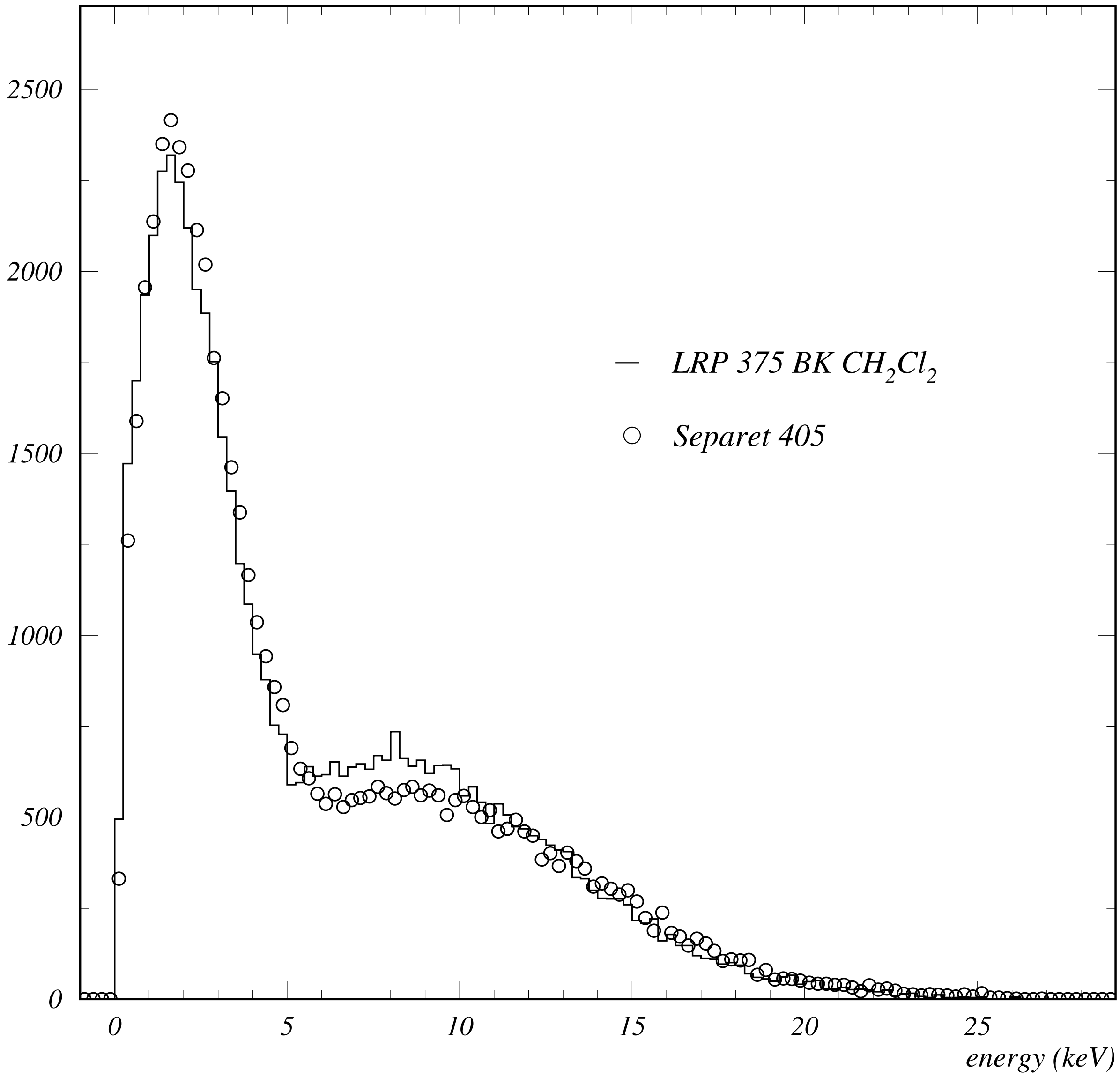
P-Tower: 4 Layers LRP 375 BK
4 Layers LRP 375 BK cleaned with CH_2Cl_2
4 Layers Separet 405

Run 435, 20 GeV electron



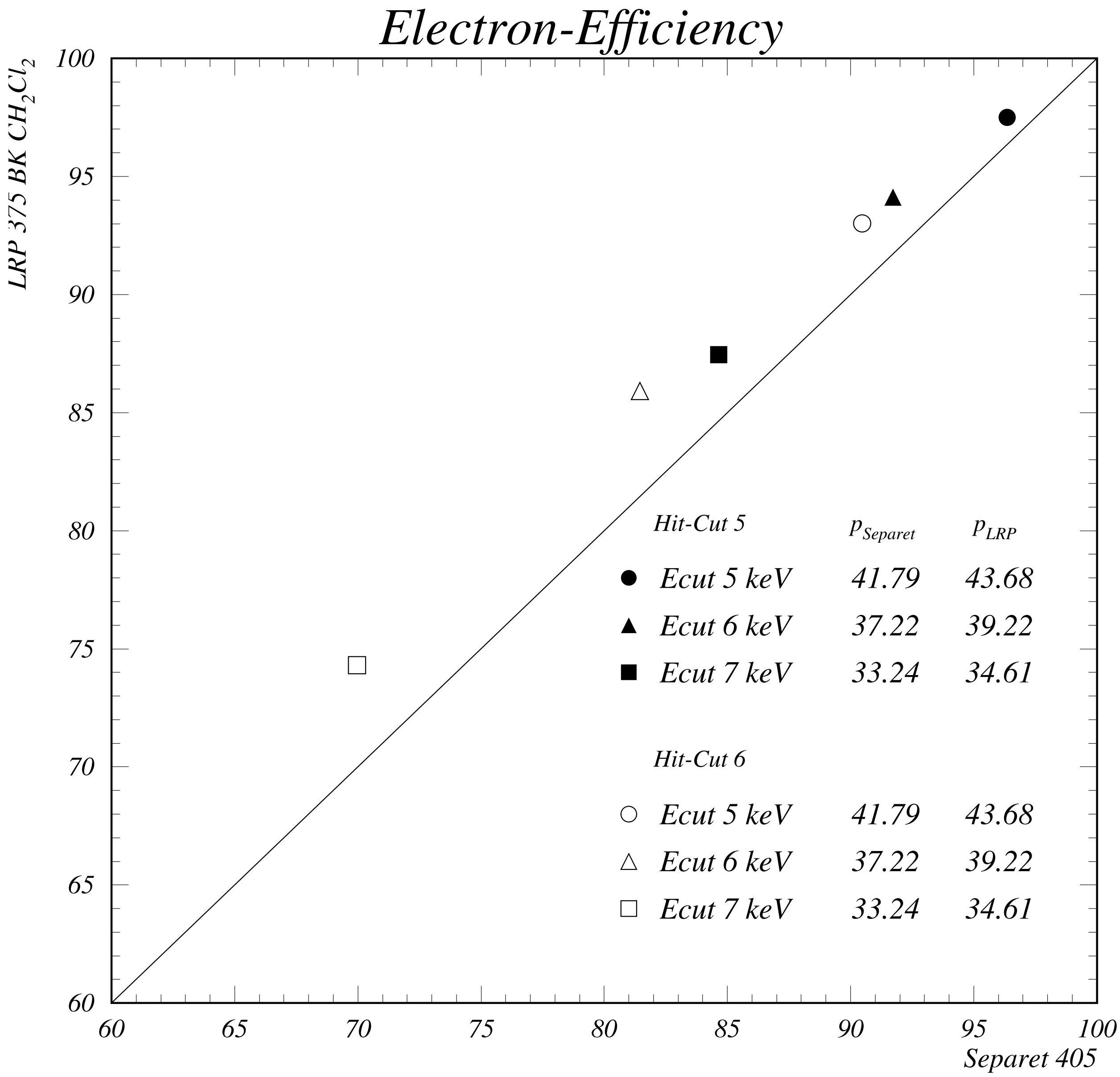
Comparison of Radiators, Testbeam

Run 435, 20 GeV electron



Comparison of Radiators, Testbeam

Run 435, 20 GeV electron



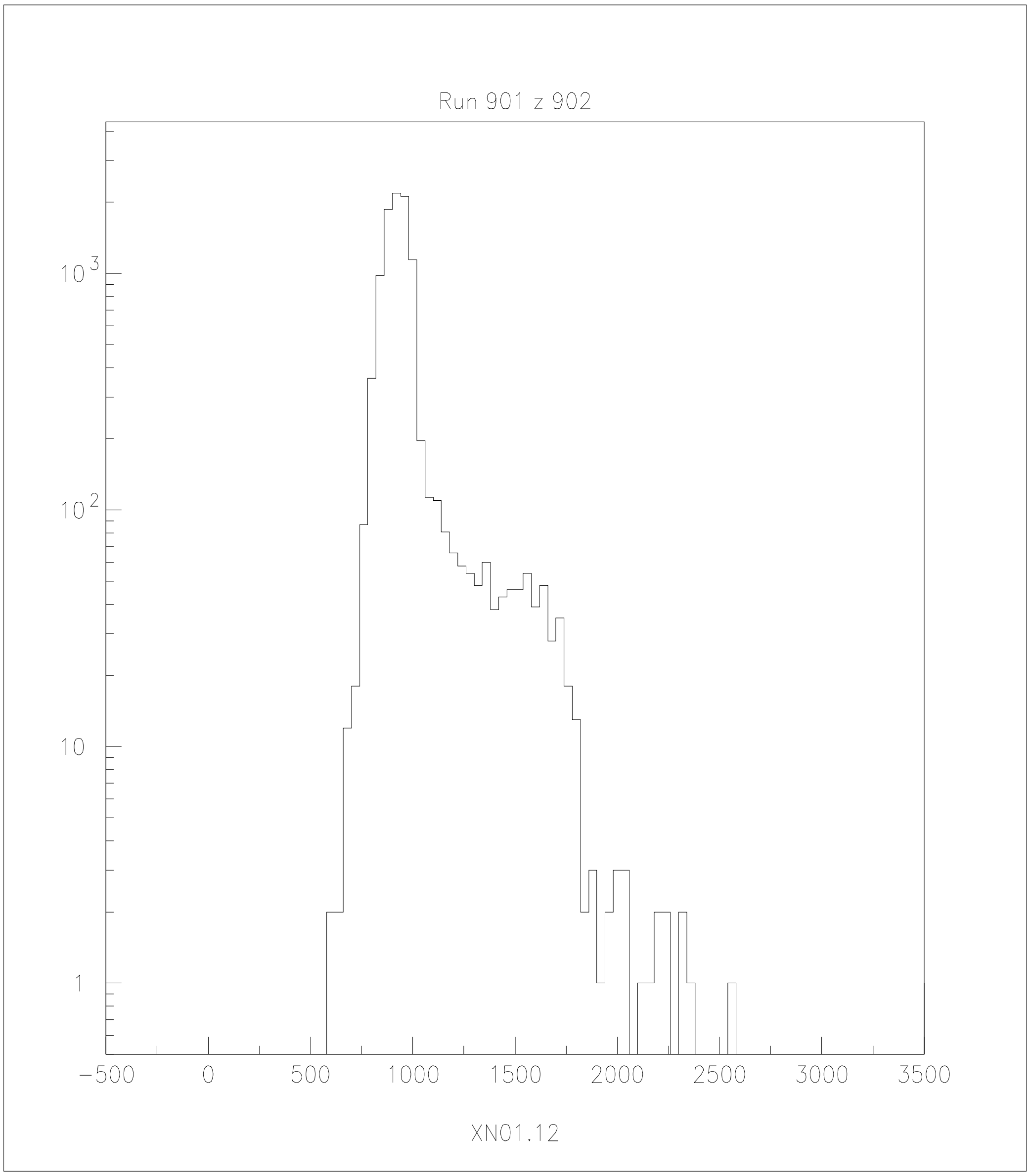
Comparison of Radiators, Conclusion

- Outgassing measurements
  - LRP 375 BK after cleaning with CH_2Cl_2 (soxhlett extraction) and Separet 405 passed ASTM E 595
  - Both radiators close to limit of $1.2 \cdot 10^{-12} \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$ after 144 hours
    $\rightarrow$ both radiators under investigation at Lockheed Martin
- Testbeam Measurements
  - Cleaning of LRP 375 BK with CH_2Cl_2 has no influence on transition radiation effect
  - Amount of produced transition radiation photons in Separet 405 is $\approx 2\%$ less than in LRP 375 BK
- Development of soxhlett extraction setup for larger amount of LRP 375 BK has to be done

Fe^{55}-Calibration

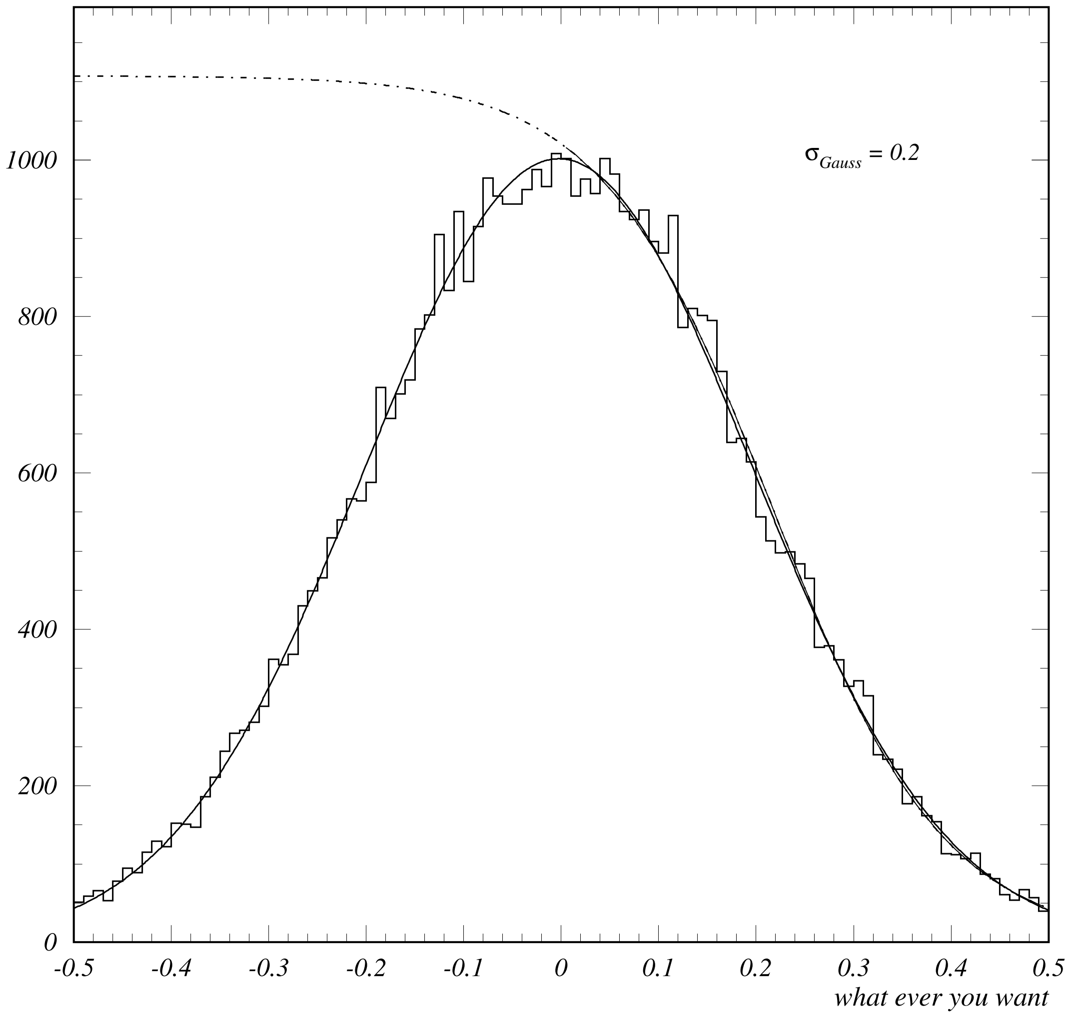
Th. Kirn

Fe^{55}-Calibration



How to determine Photo-Peak?

Fe^{55}-Calibration

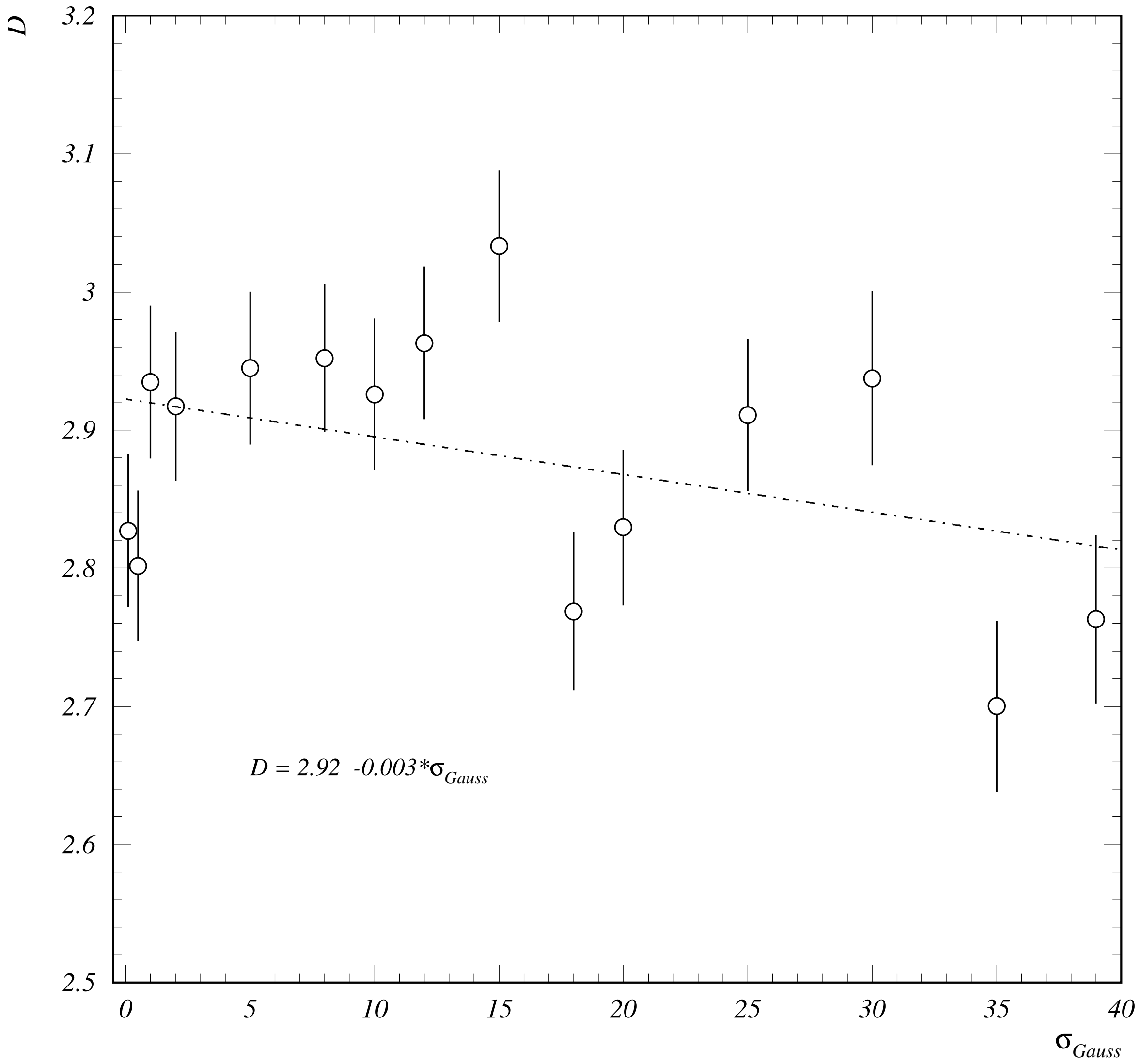


Correlation Fermi-Funktion and Gaussian Funktion

$$f(x) = \frac{A}{e^{\frac{x-B}{C}} + 1} \rightarrow ADC = B - D \cdot C$$

Correlation between D and σ_{Gauss} ?

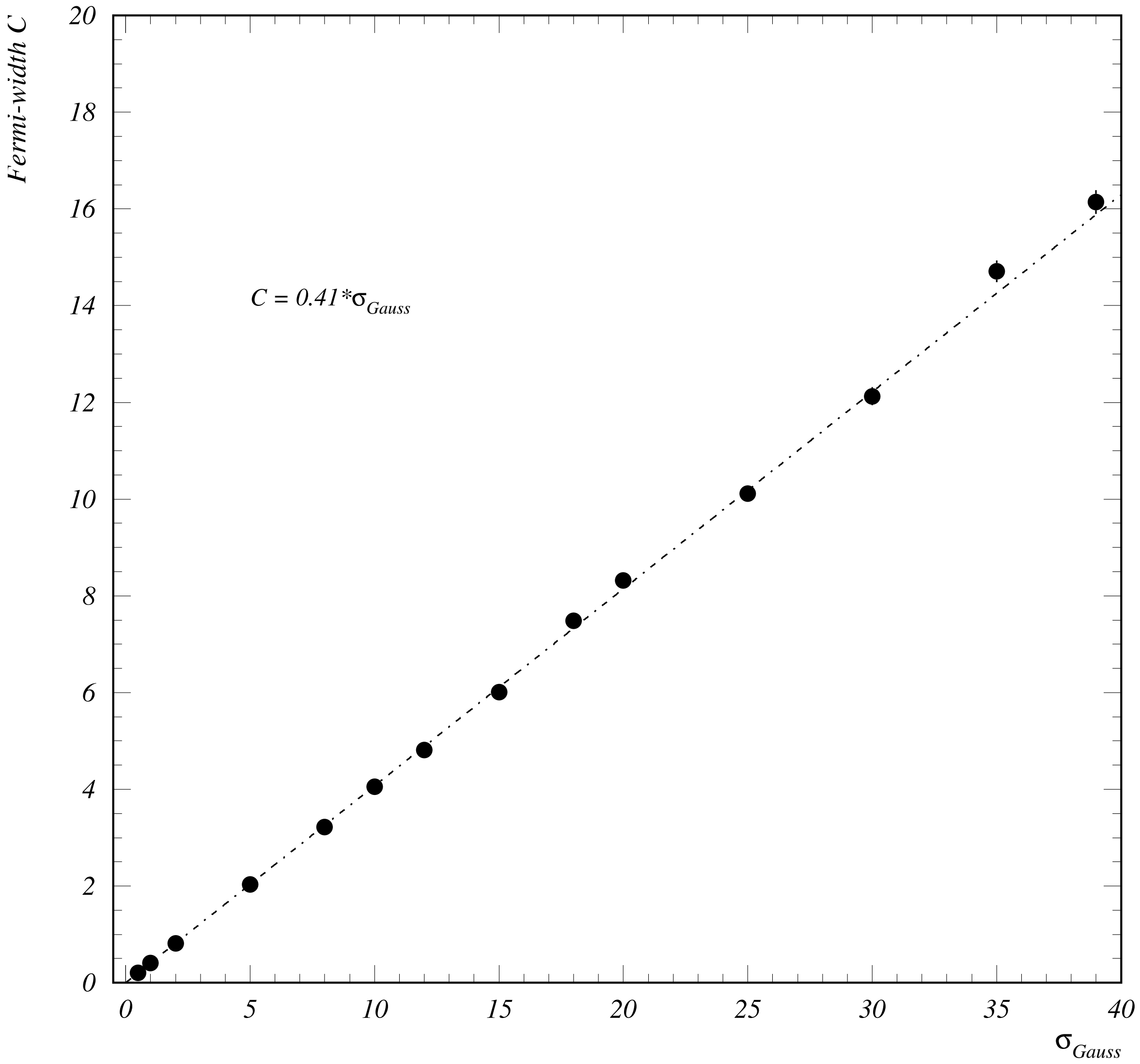
Fe^{55}-Calibration



$$ADC = B - (2.92 - 0.003 \cdot \sigma_{Gauss}) \cdot C$$

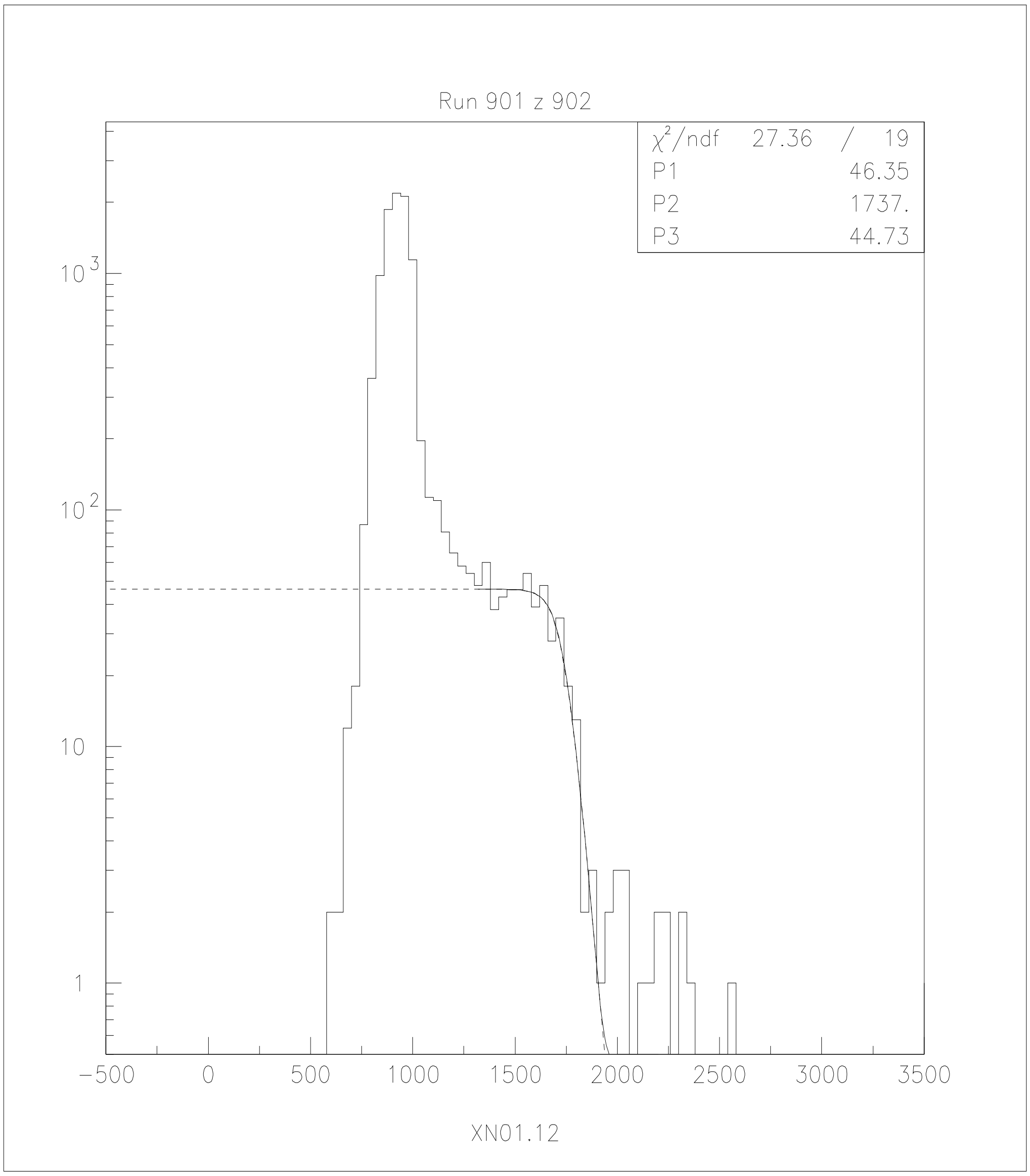
Correlation between C and σ_{Gauss} ?

Fe^{55}-Calibration



$$ADC = B - 2.92 \cdot C + 0.007 \cdot C^2$$

Fe^{55}-Calibration



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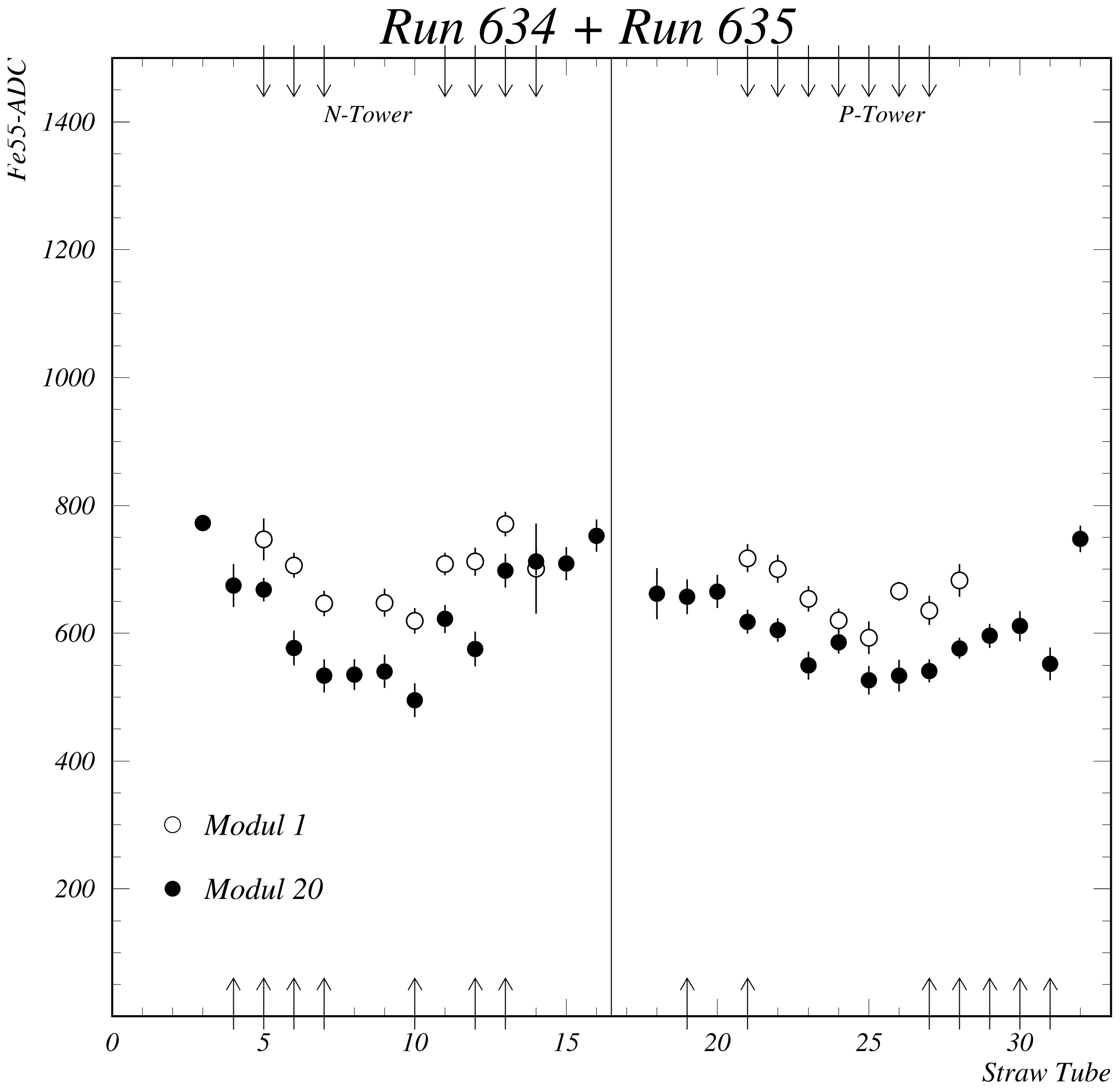
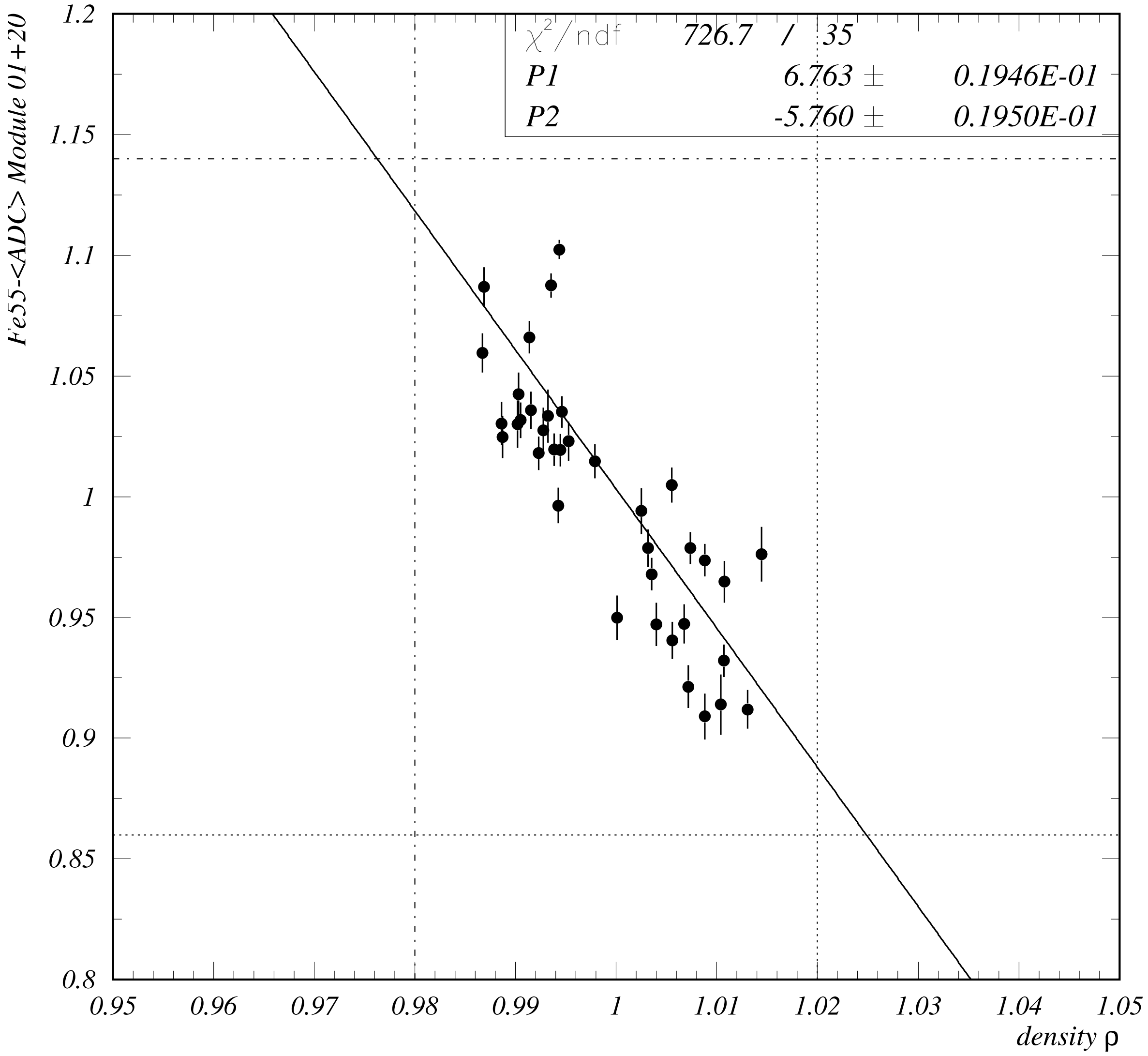


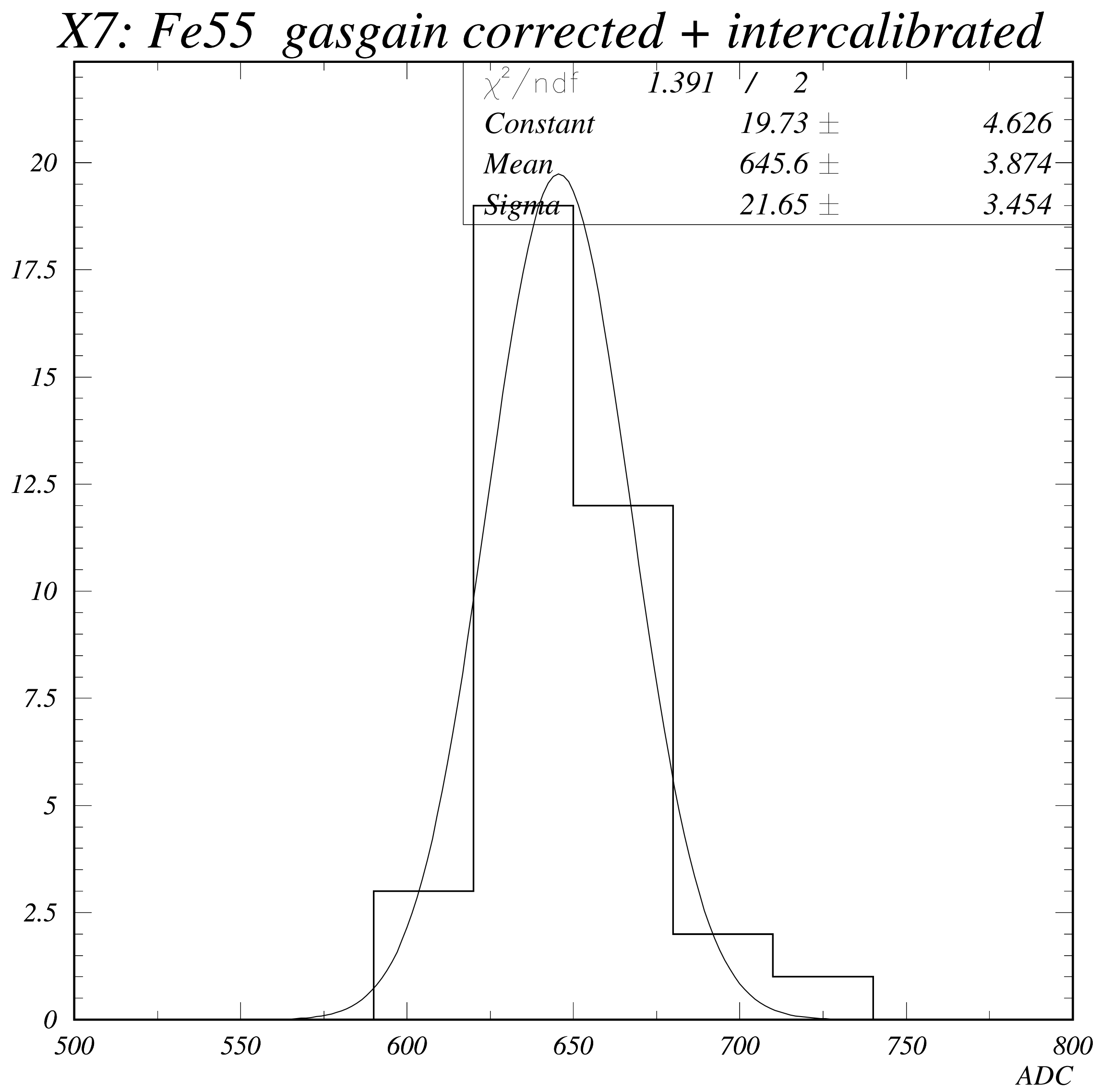
Fe^{55}-Calibration



gasgain-correction:

$$ADC' = ADC \cdot \left(1 + \left(\frac{\rho}{\overline{\rho}} - 1\right) \cdot 5.7\right)$$

Fe^{55}-Calibration



Energy Calibration:

$$(645.6 \pm 3.9)ADC = 5.9keV$$