Analysis of DMS under Cosmics

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(Fermilab)

- Setup
- Analysis of Hit Resolution
- Analysis of Chamber Inefficiency
- Summary

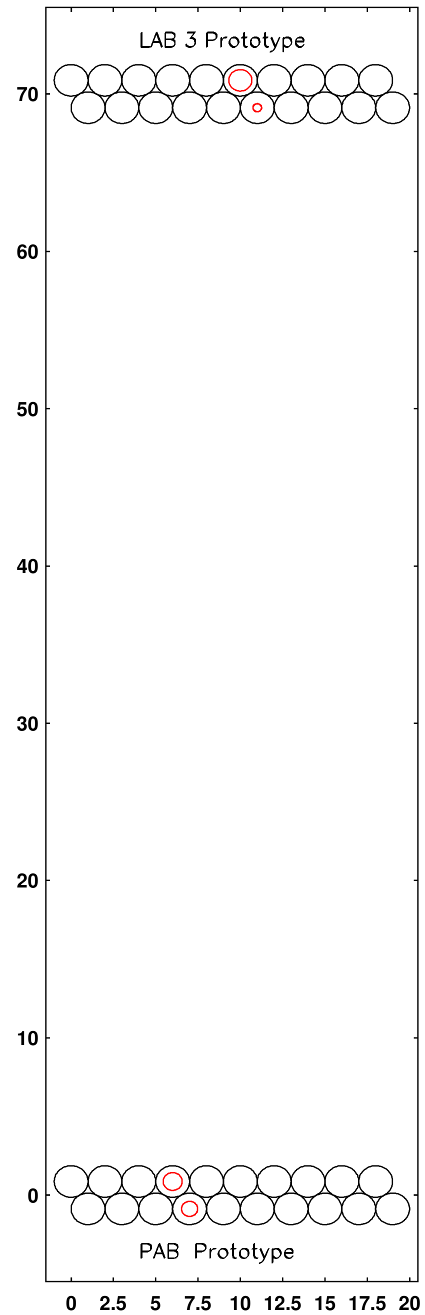
Experiment Setup

• Combine both prototypes, one prototype is in the tank with thin windows in the middle;
• Trigger on top/bottom both counters ;
• 10cm Fe55 was used to cut $<$ 100MeV μ ;

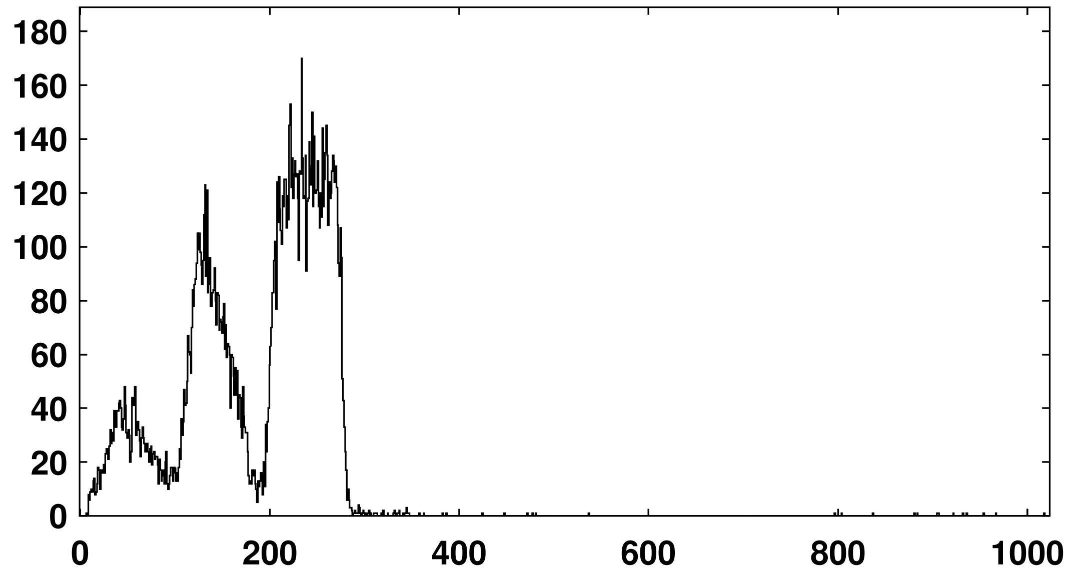
Data was taken 11/26/02 – 12/9/02 :

— Gas : Arco2
— Chamber high voltage: 1550V;
— Electronics cards from BNL ;
— 3377 TDC : $\sim$ 0.5nsec resolution.

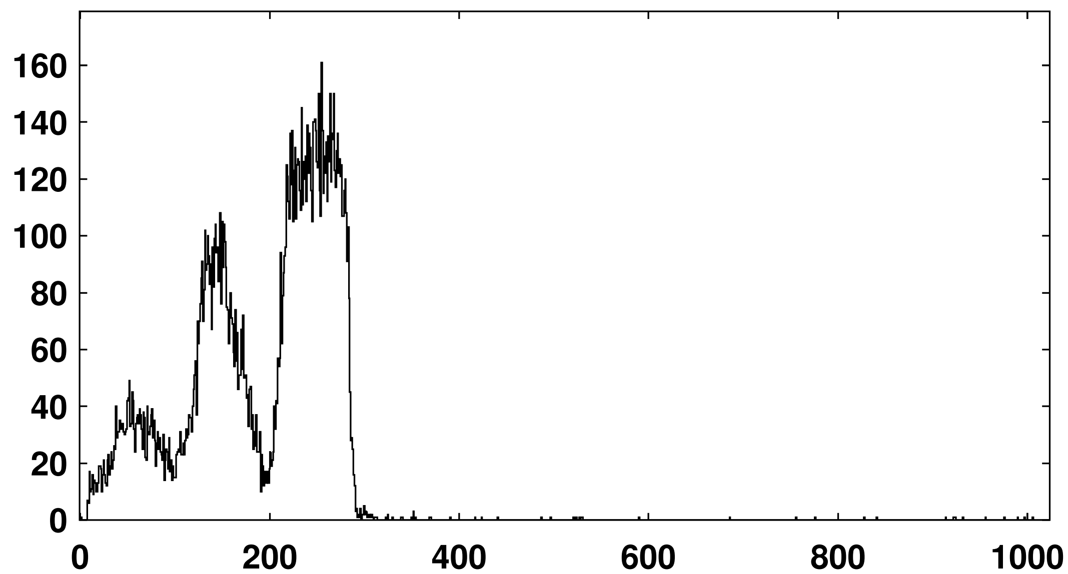
An Example of Good Event



Some TDC Distributions

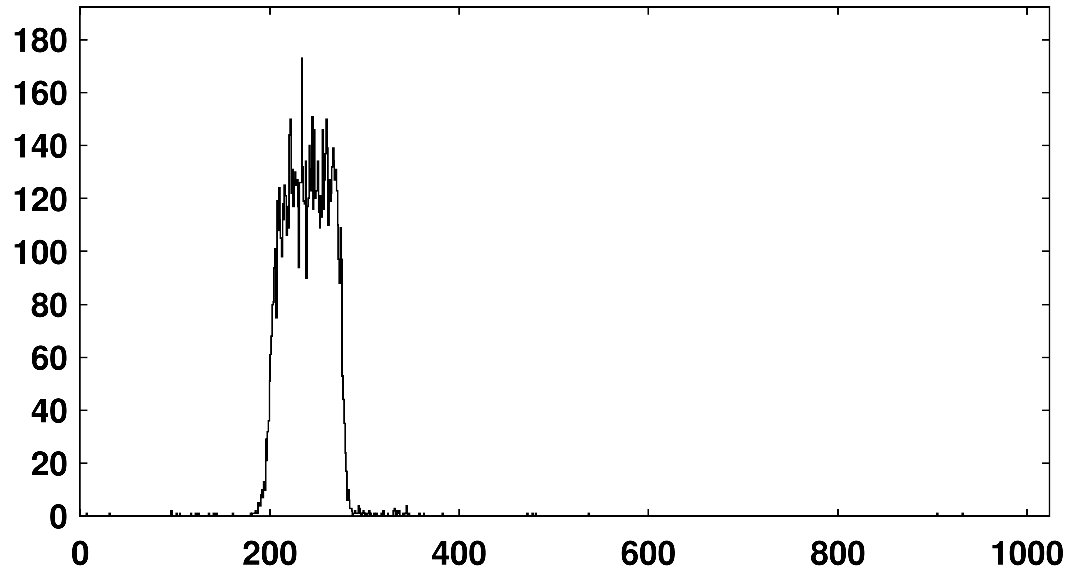


TDC dist. for all hits, LAB 3

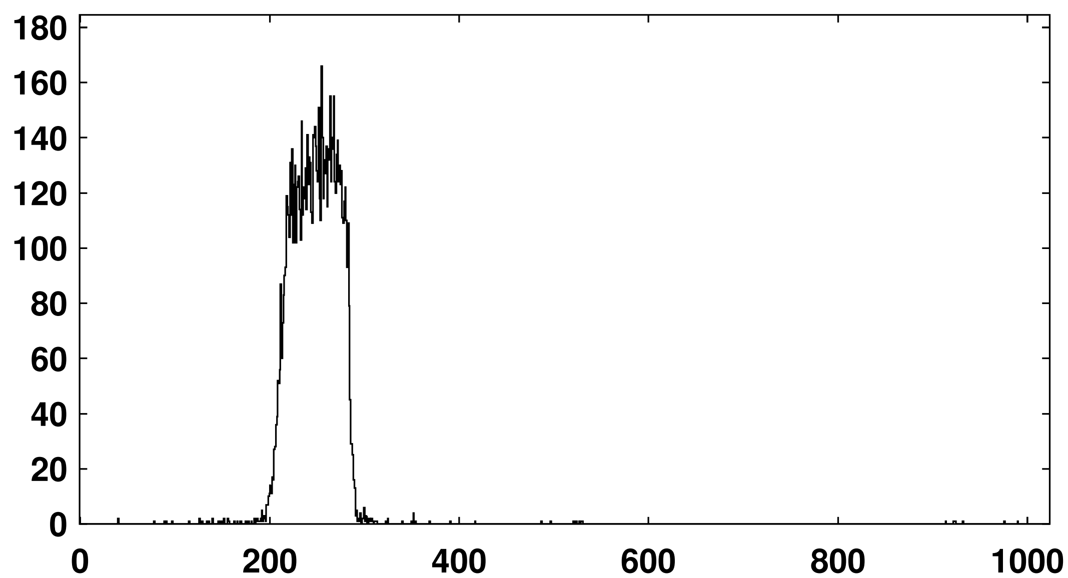


TDC dist. for all hits, PAB

Some TDC Distributions

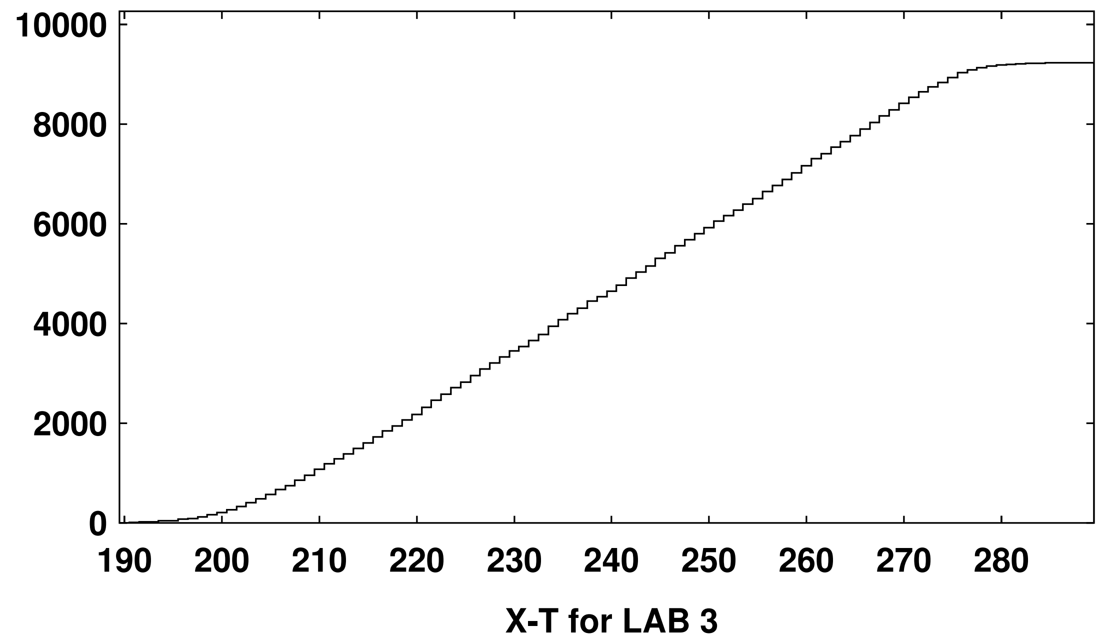


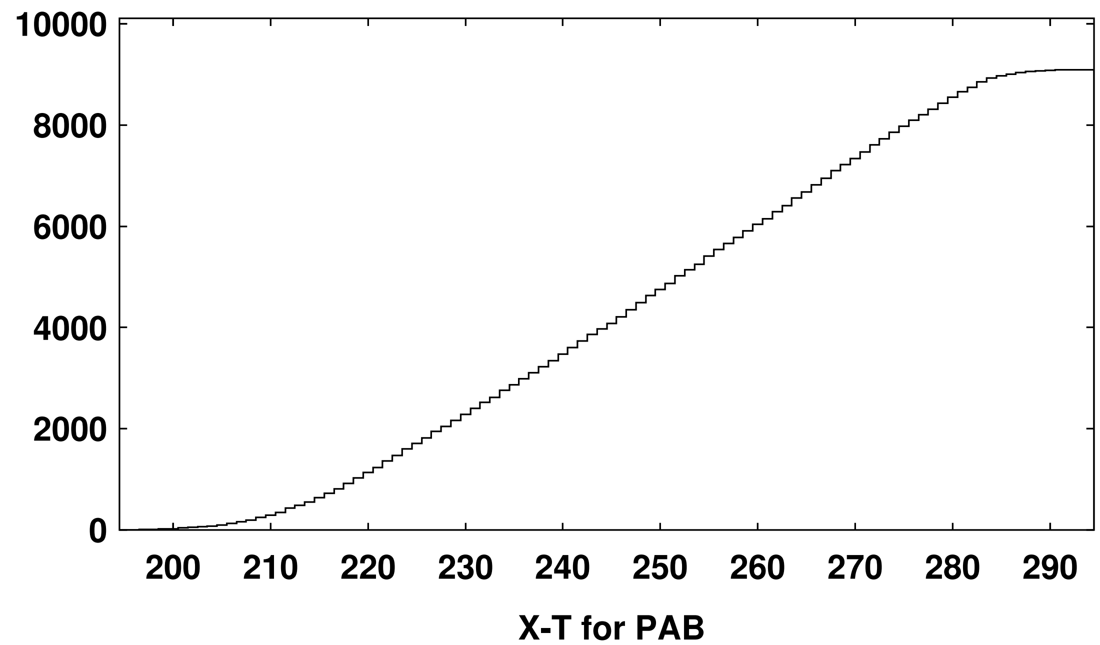
TDC dist. for first hits, LAB 3



TDC dist. for first hits, PAB

Some TDC Distributions





Analysis of Hit Resolution

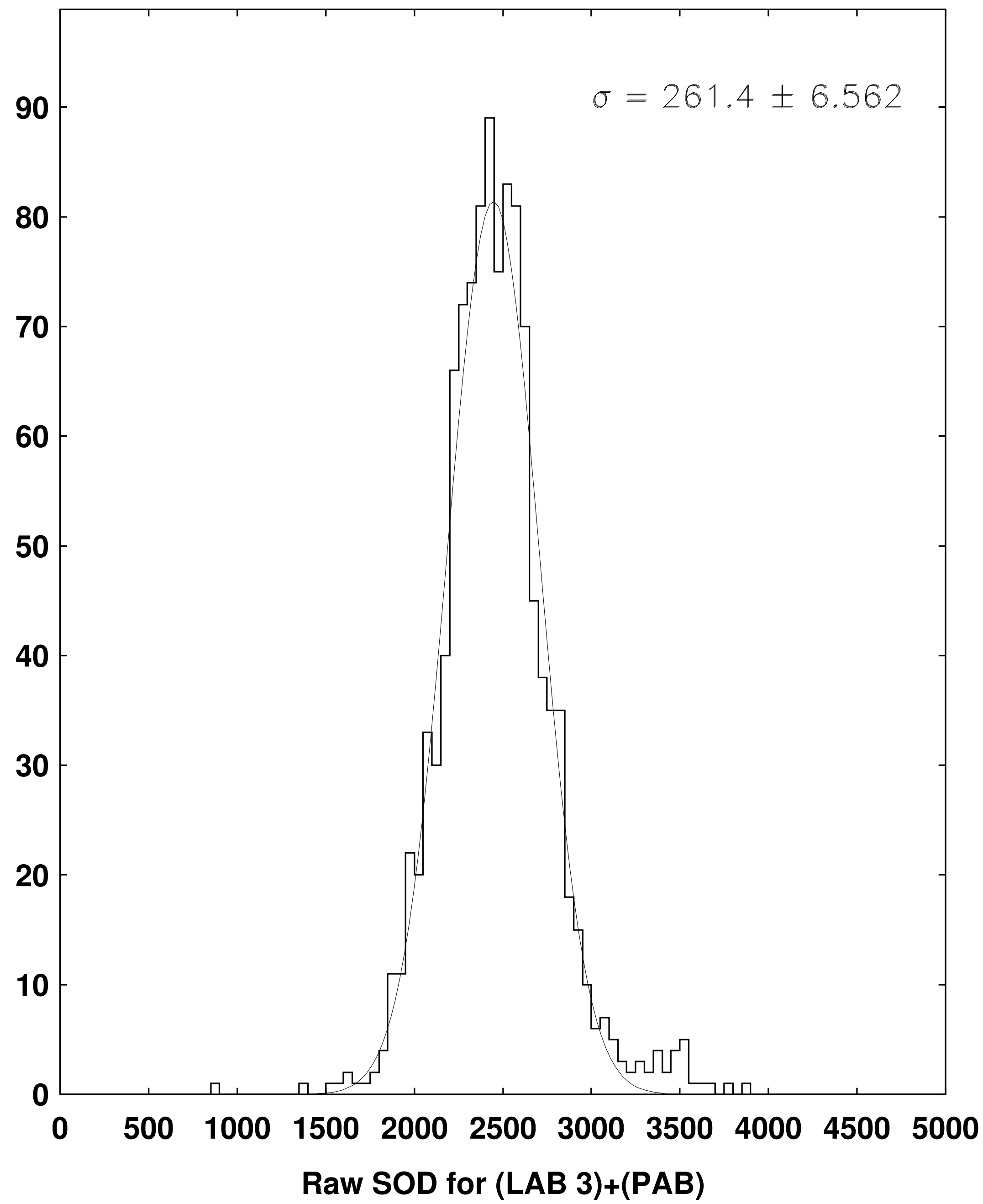
- Event selection :

— 4 hits for 4 layers;

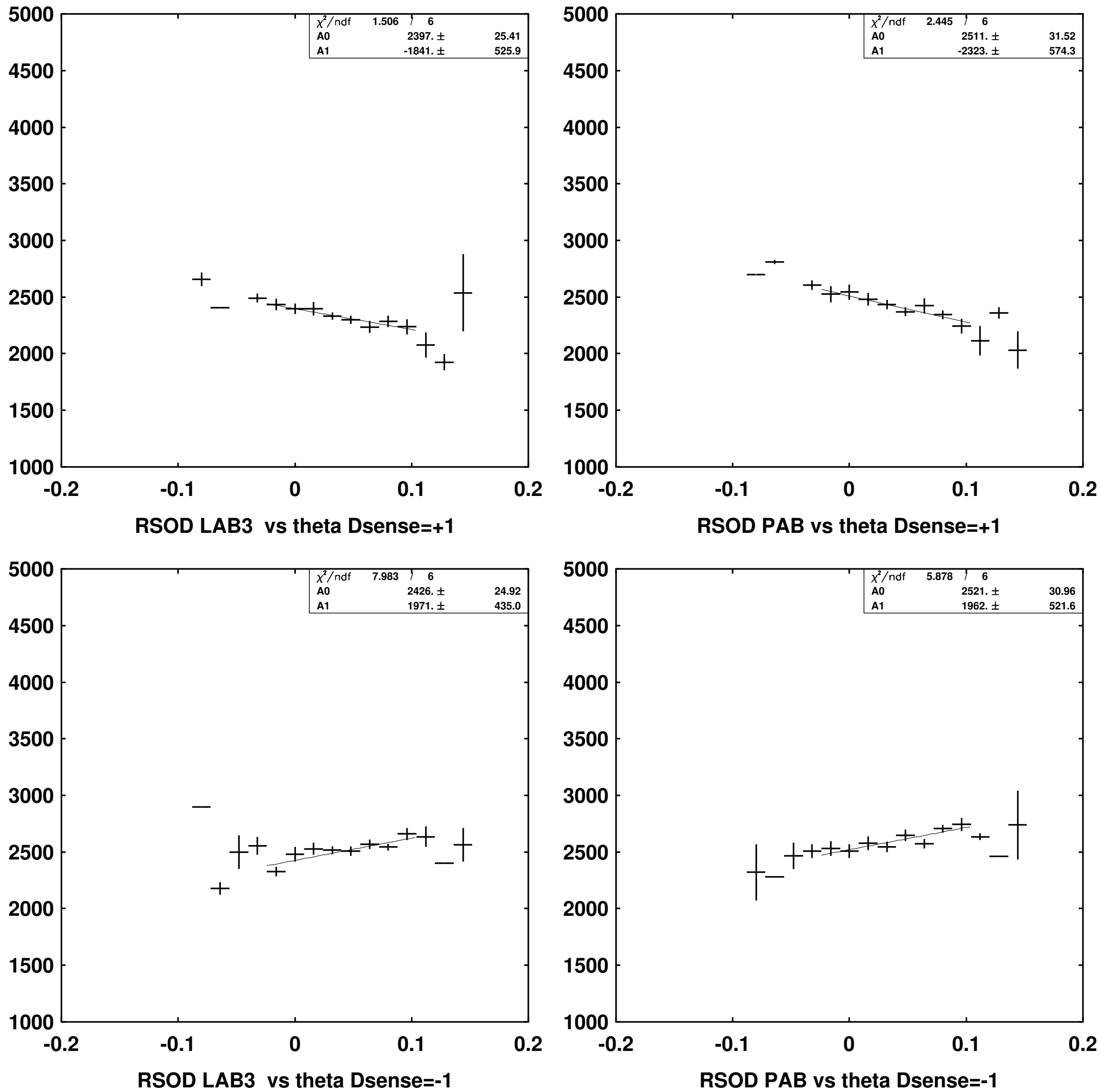
— Exact one hit in each layer ;

— Hits in the complementary straws are required.

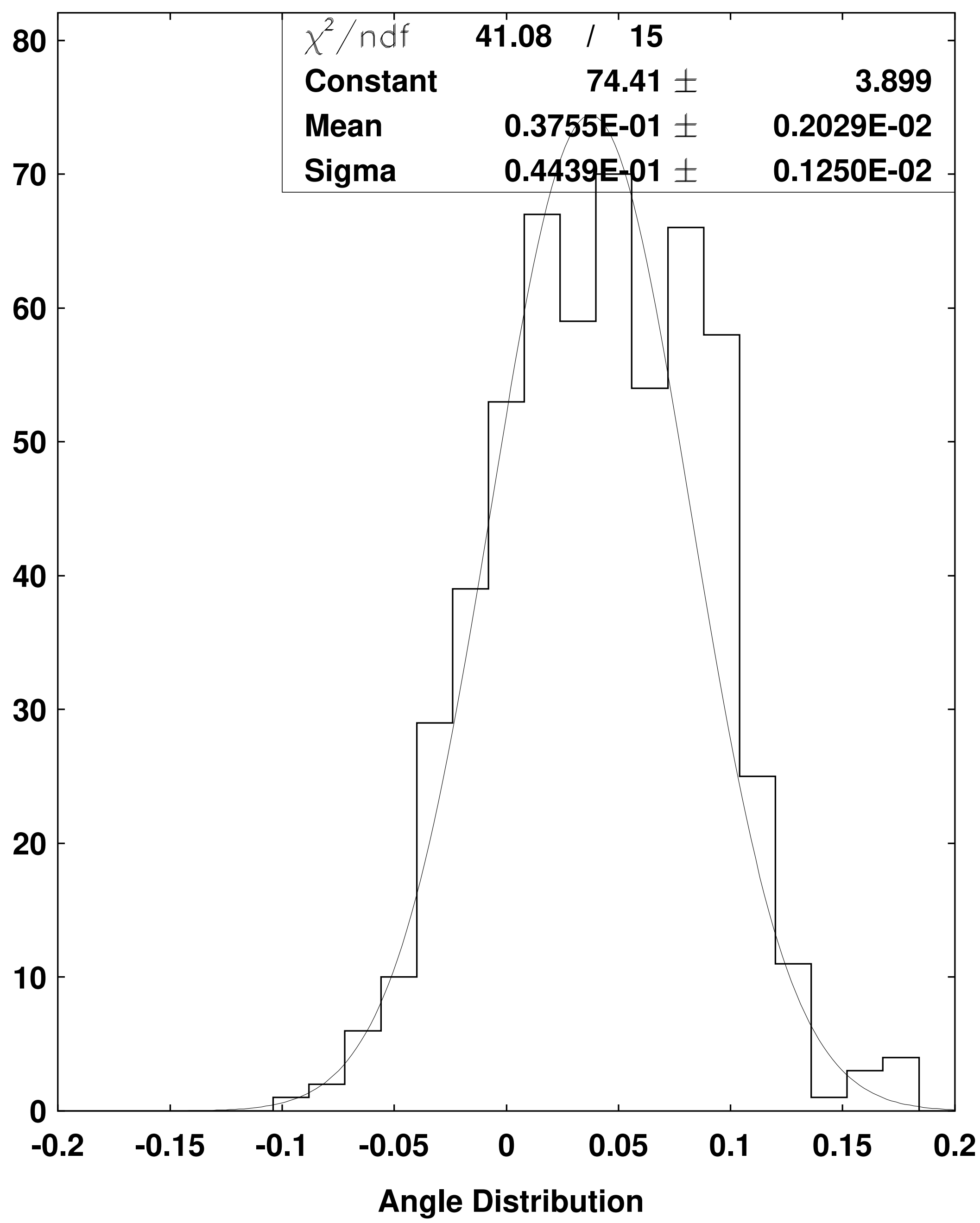
Raw Sum of Distance(SOD)



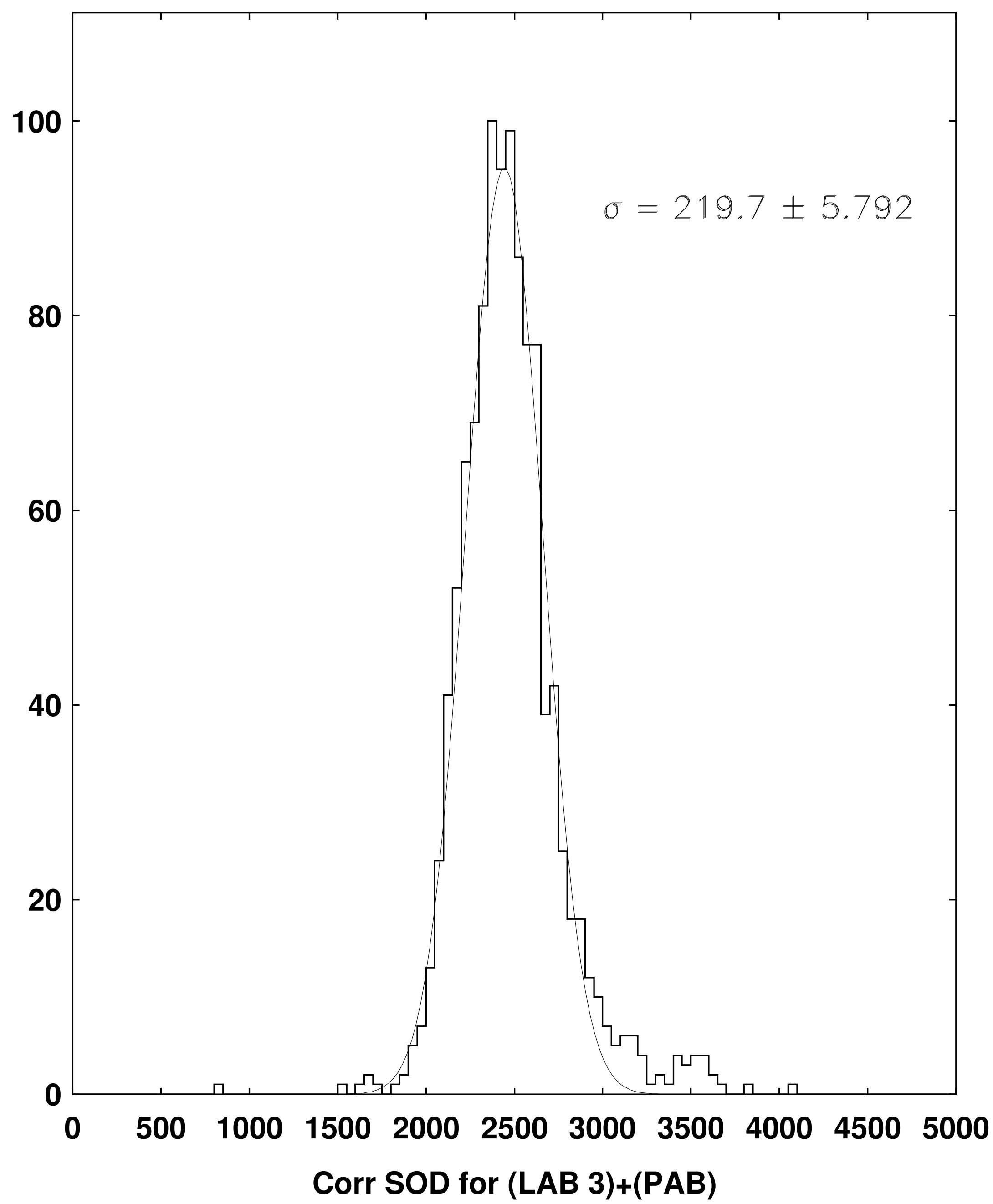
Angle Correction to Raw SOD



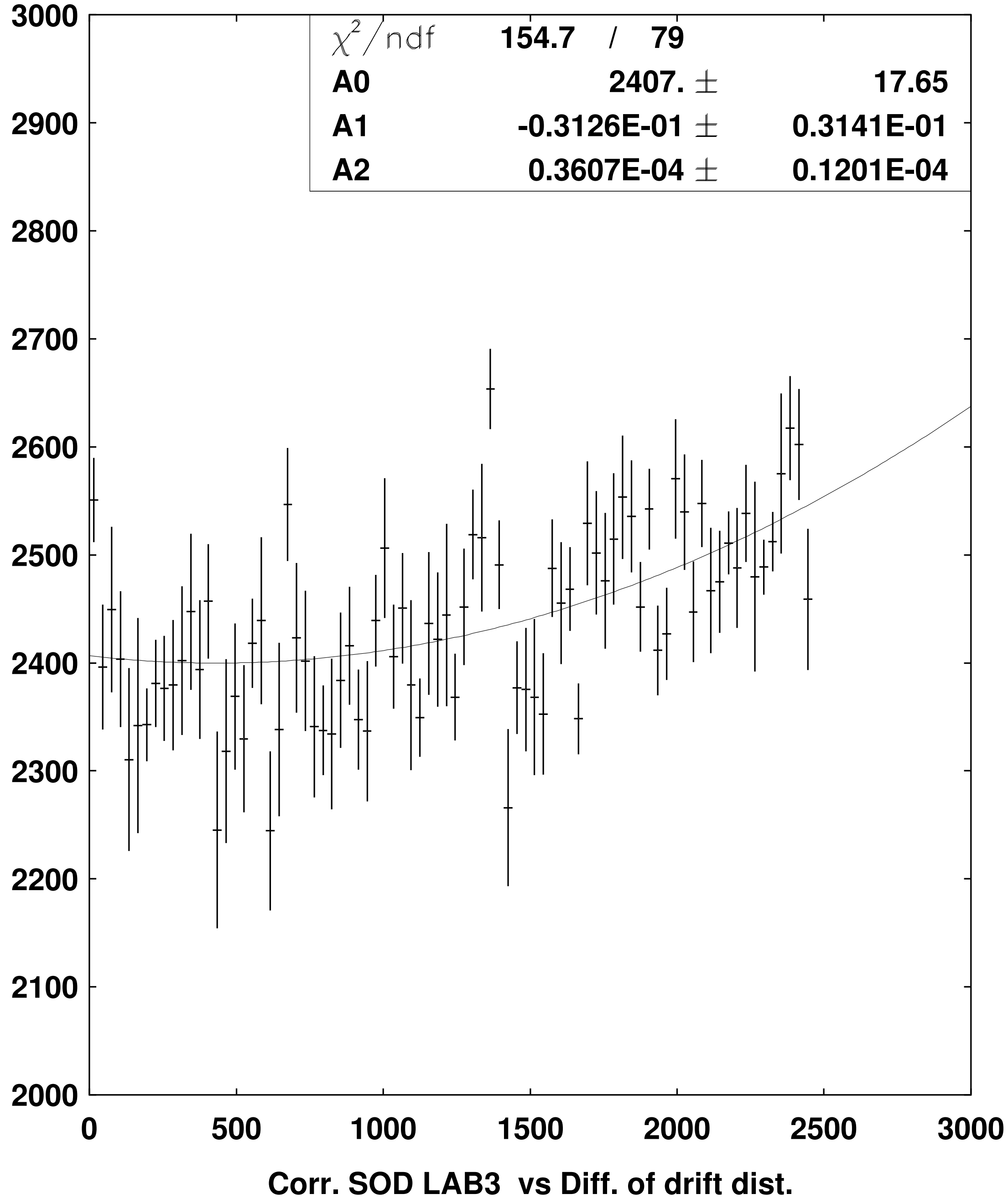
Angle Distribution



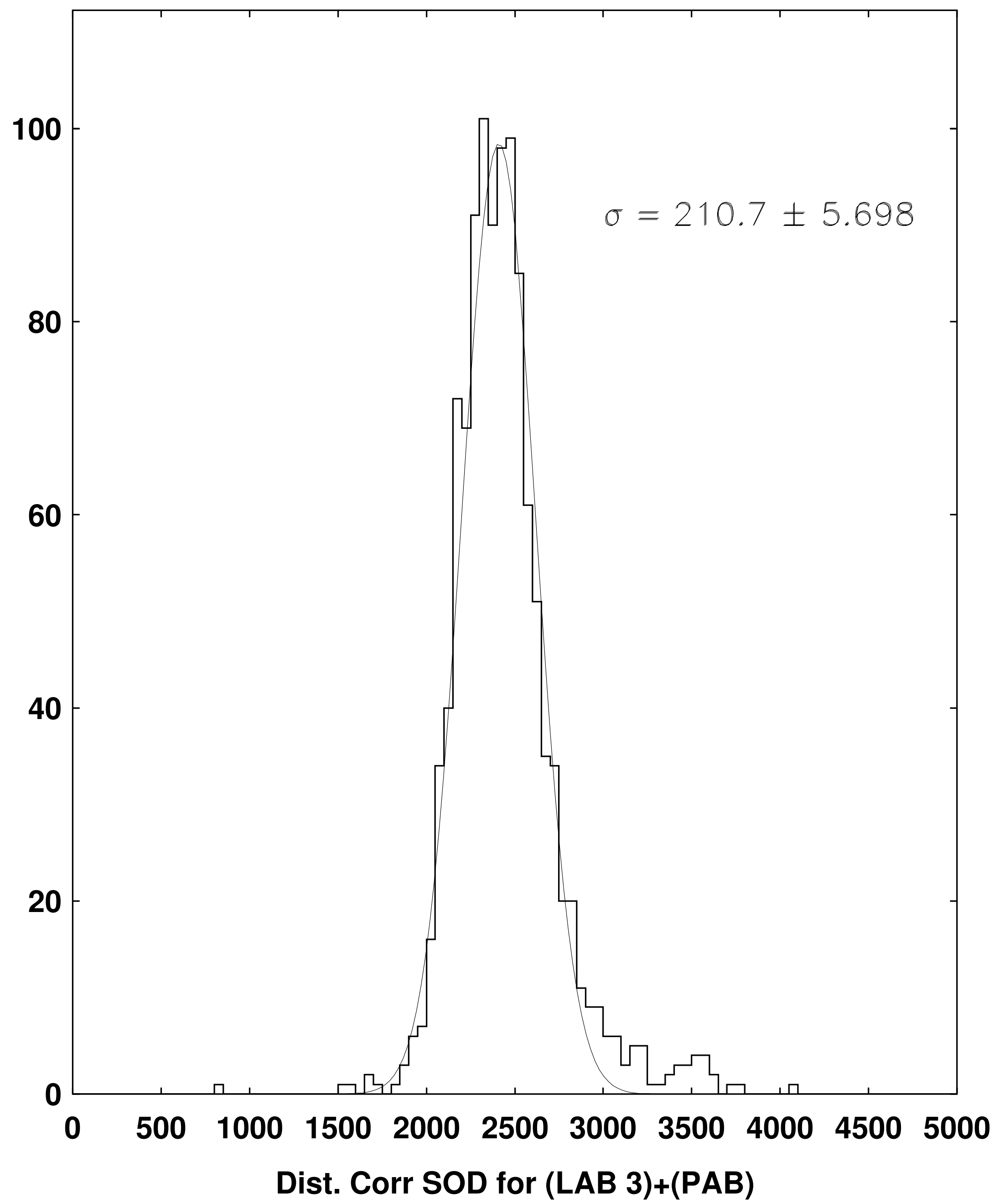
SOD with Angle Correction



Drift Distance Correction



SOD with Drift Distance Correction



Hit Resolution

- Raw SOD : $\sigma_{raw} = 260$ μ m/$\sqrt{2}$ =183 μm
- SOD with Angle correction :

$$\sigma_{ang} = 220 \ \mu \ \mathrm{m}/\sqrt{2} = 155 \ \mu \ \mathrm{m}$$

- SOD with angle & drift distance corrections :

$$\sigma_{ang+dist} = 210 \ \mu \ \mathrm{m}/ \sqrt{2} = 149 \ \mu \ \mathrm{m}$$

Straw Inefficiency

- Inefficiency is defined as :

$$\text{Inefficiency(L4)} = \frac{1 \cdot 2 \cdot 3 \cdot \bar{4}}{1 \cdot 2 \cdot 3}$$

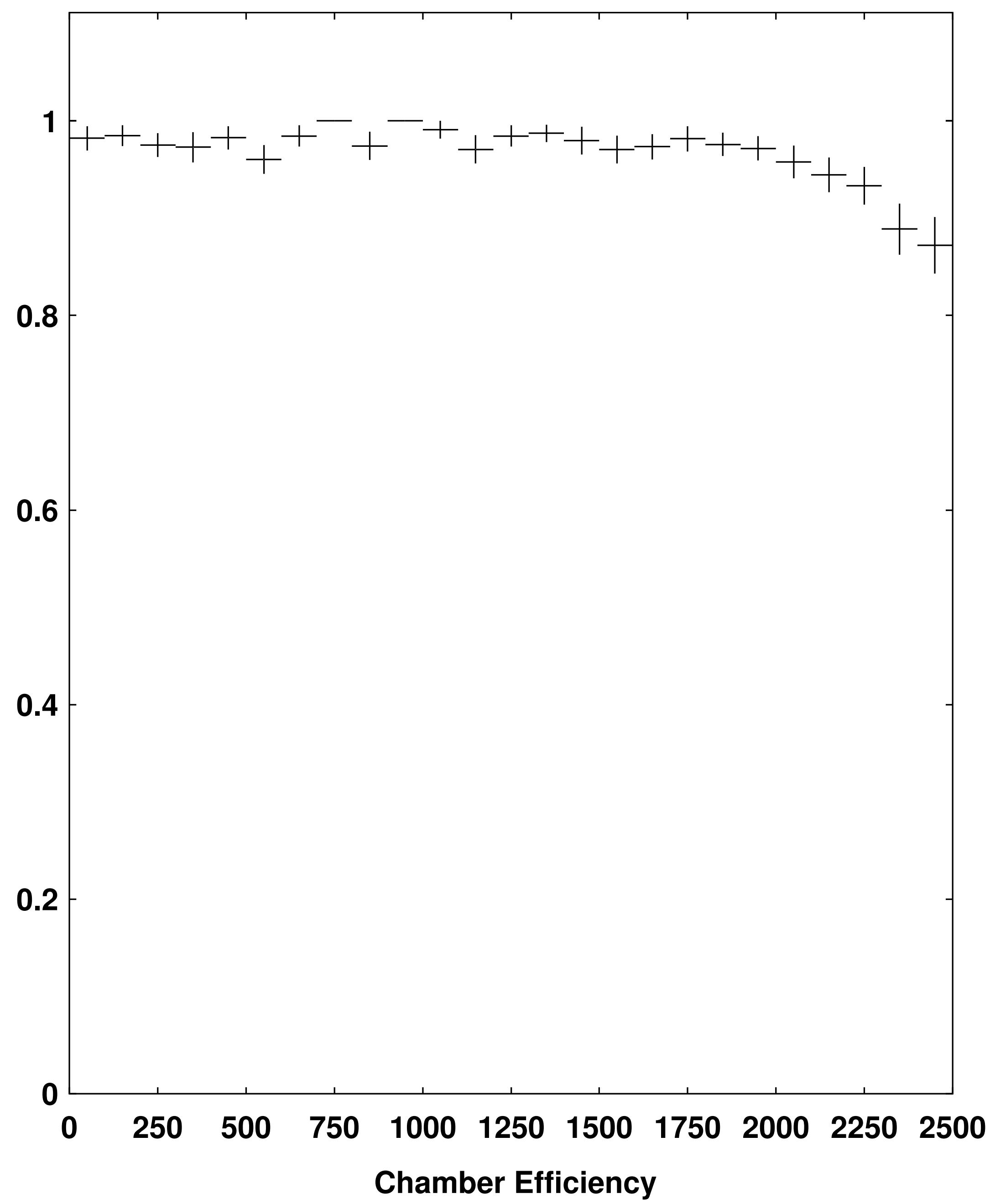
- Event selection:

— $\geq$ 3 hits for 4 layers;

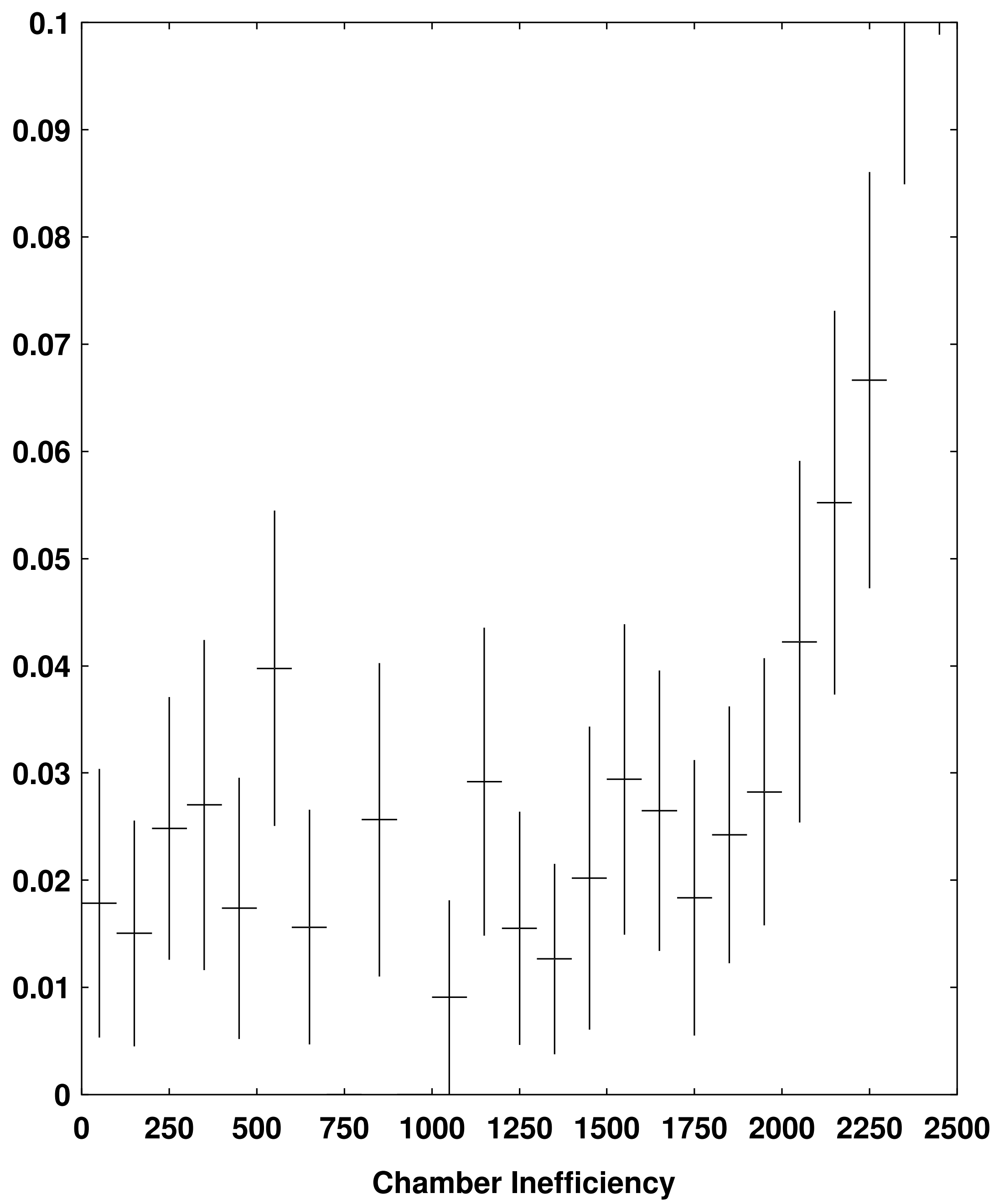
— Exact one hit in each layer for 3 out of 4 layers ;

— The pair should be complementary straws.

Straw Efficiency



Straw Inefficiency



Summary

- Both prototypes work fine under cosmics;

- The raw hit resolution is about 183 μm; after correction < 150 μm;

- The average chamber efficiency is ~ 96 %.

- Run with ArEthane gas is ongoing $\cdots$