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P.I. Bonn

Energy Scale Meeting

DESY, 30 October 1997

Status Report

on a

Second-Generation

Presampler Correction Algorithm

Overview presampler correction algorithms

Performance of the corrections on
CERN test beam data

Systematic uncertainty due to 0.1 X_0 uncertainty
in dead material map

Summary

Overview of Presampler Correction Algorithms

$$E^{corr} = E^{cal} + A_0 + A_1 * E^{pres}$$

Publications

Assume absorber thickness unknown and allow for
linear energy dependence in slopes and offsets

Exploratory Studies (ZEUS Note 93-059)
- $\Rightarrow$ Combine 1,2,3 X_0
- $\Rightarrow$ Correction reasonable $\longrightarrow$ Build Presampler

Construction and Test Beam (Nucl.Inst.Meth. A382, 419 (1996))
- $\Rightarrow$ Treat 1,2 X_0 and 3,4 X_0 separately

First Generation Correction Algorithm

(now in use in ZEUS thanks to A.Bornheim and J.Cole)

One Parameter: Slope = 72 MeV/MIP

Bristol Correction Algorithm

(presented by S.Schlenstedt in April, 1997)

12 Parameters: Polynomial dependence of slopes and offsets

on absorber thickness and calorimeter signal (3-50 GeV, 1-4 X_0)

Energy-Independent Correction

(under study by me)

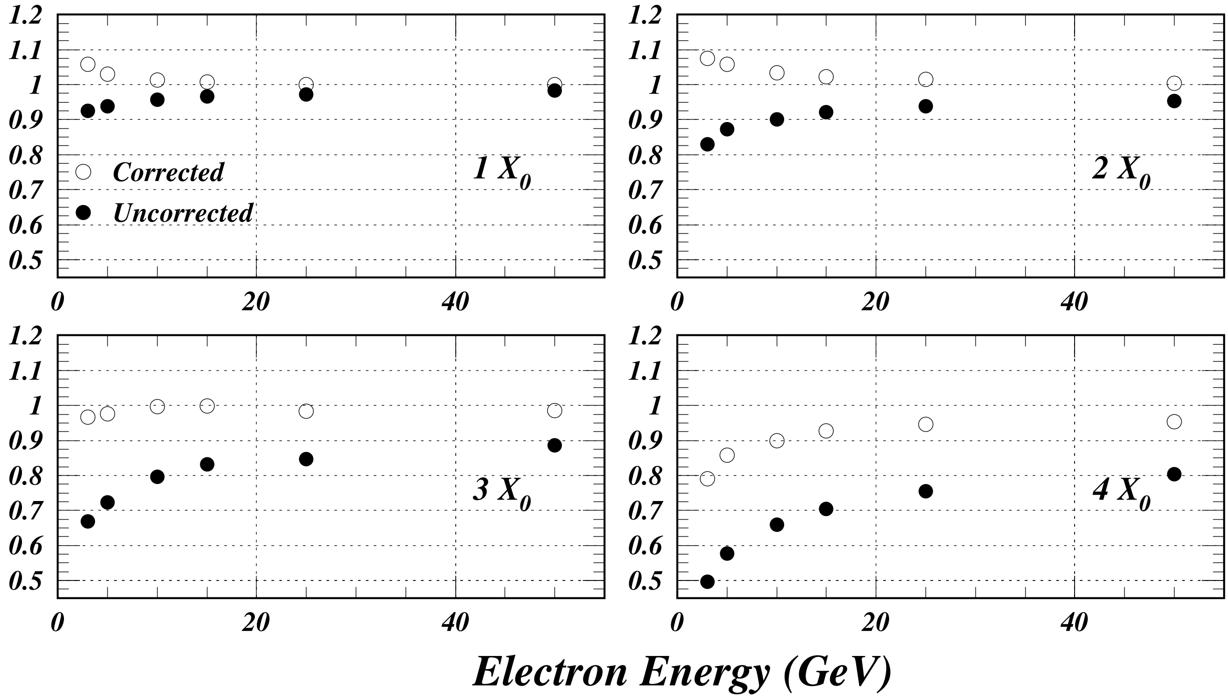
3 Parameters: Polynomial dependence of slope on absorber

thickness. No offsets (No Presampler Signal $\Rightarrow$ No Correction).

First-Generation Correction

(The Bornheim Approximation)

Presently in use as coded by Jo Cole



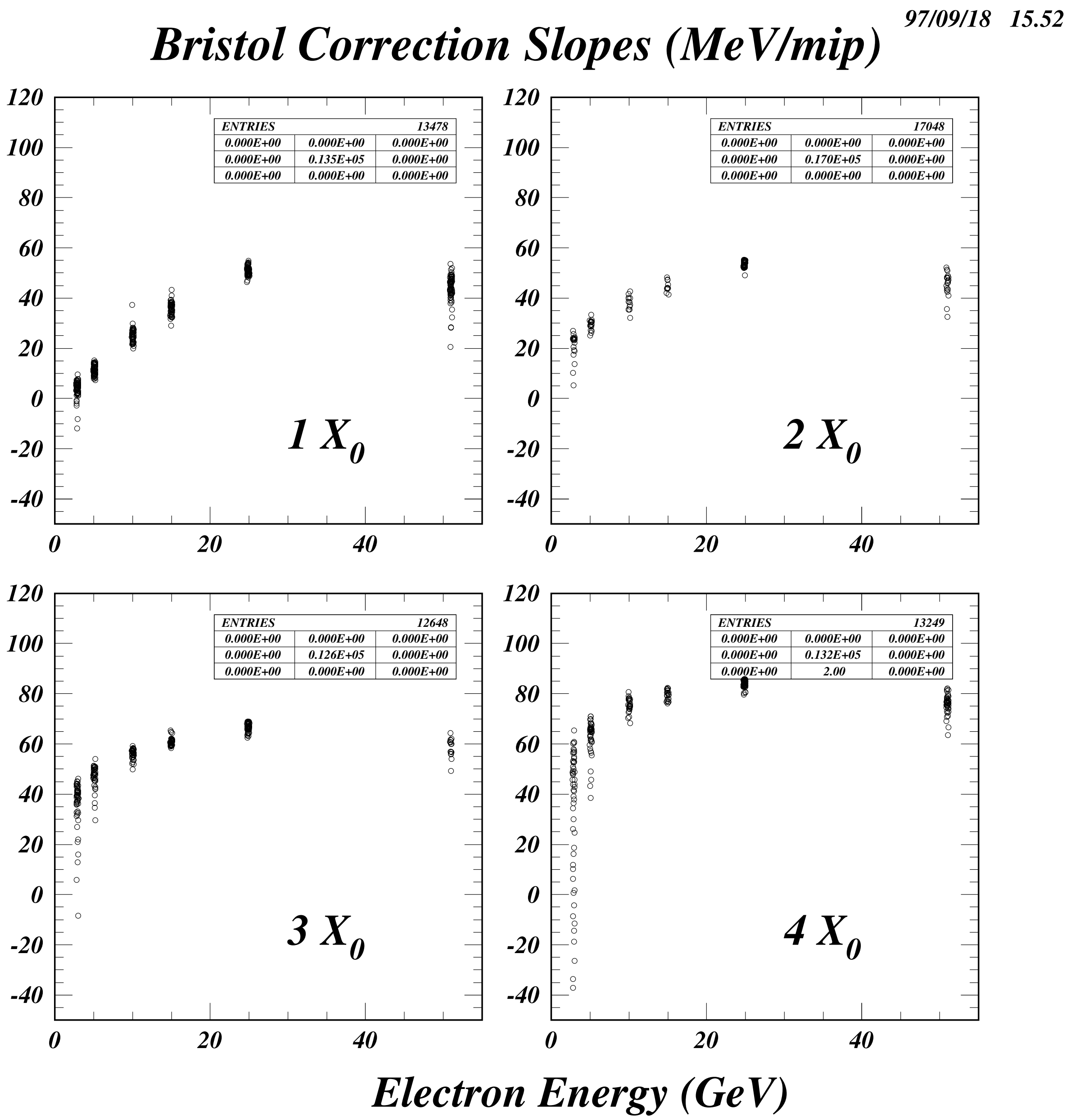
Energy-dependent systematic effects except when presampler is near shower max

Energy Loss and Presampler Signal

Relative Signal Loss

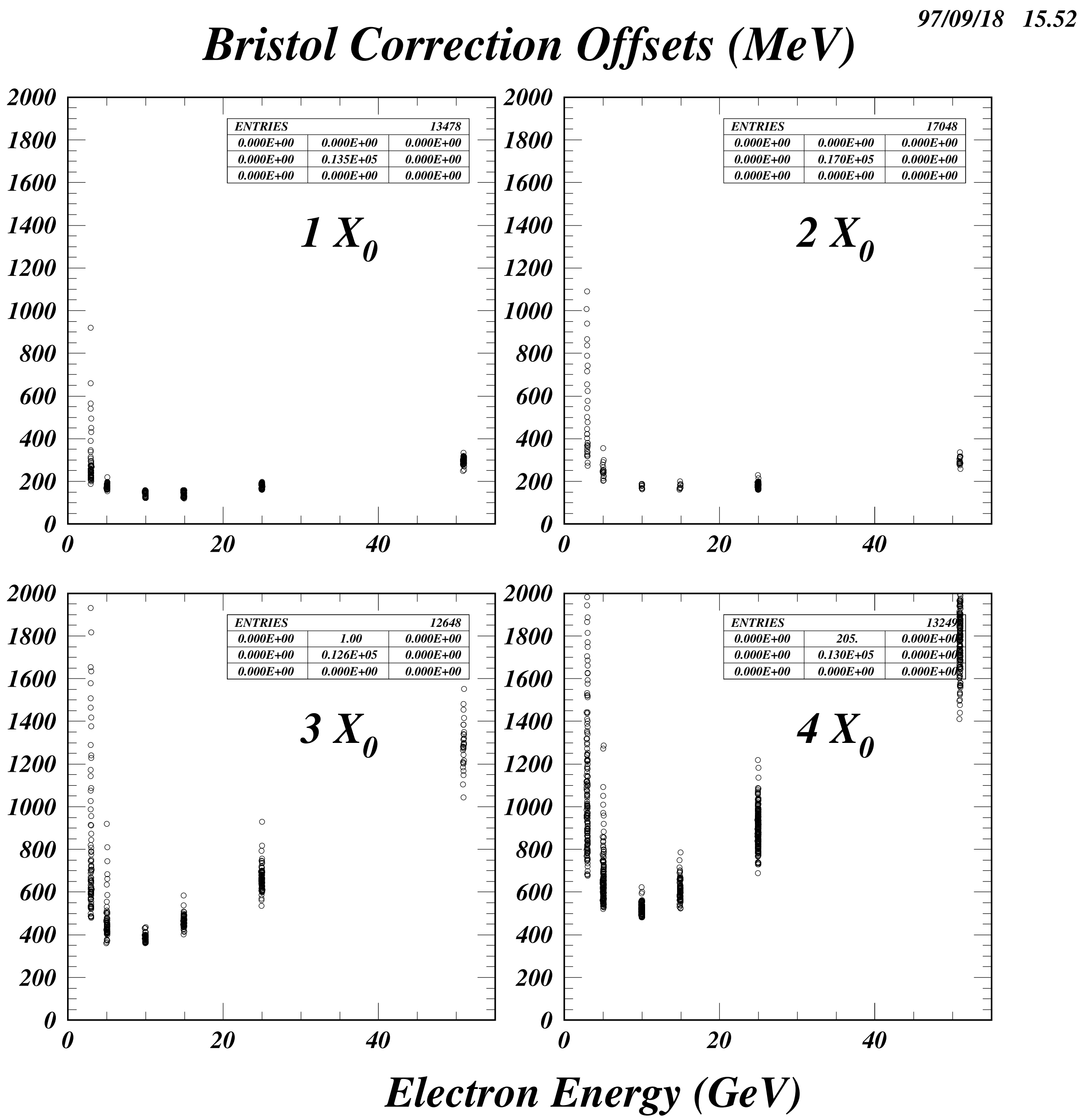
Bristol Correction Algorithm

Slope Values
Dependent on Calorimeter Signal



Bristol Correction Algorithm

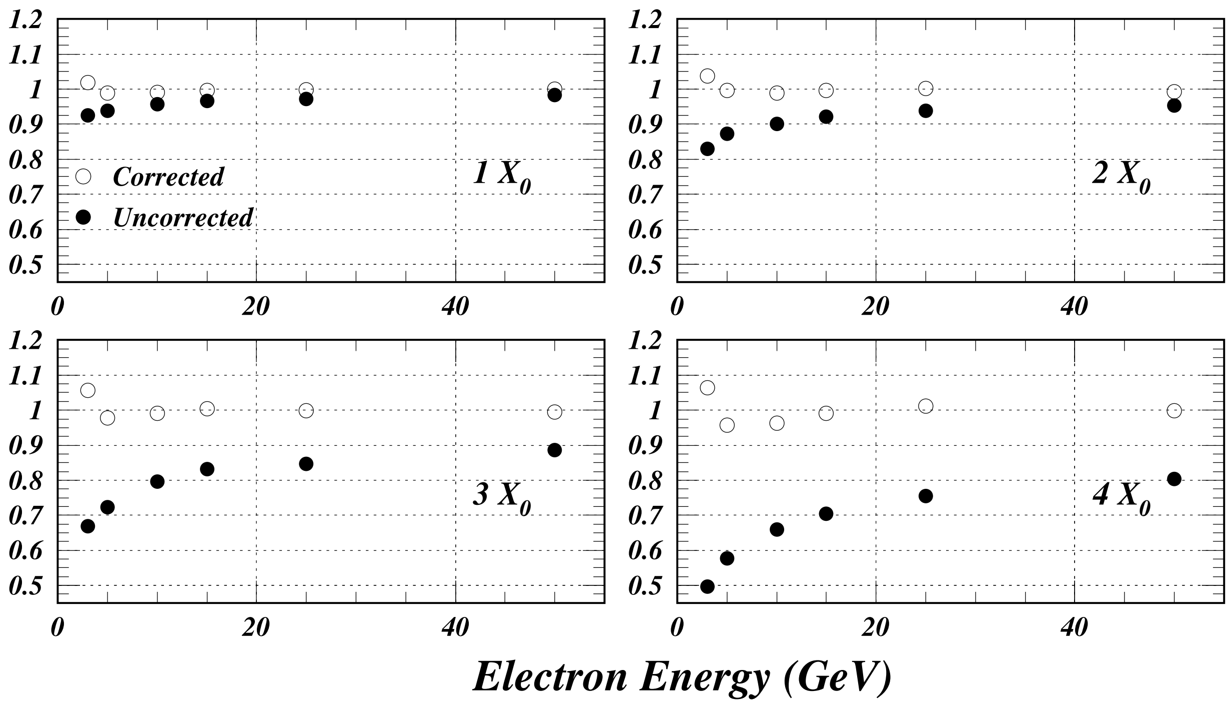
Offset Values
Dependent on Calorimeter Signal



Bristol Correction Algorithm

(12 Parameters)

Dependent on Calorimeter Signal and Absorber

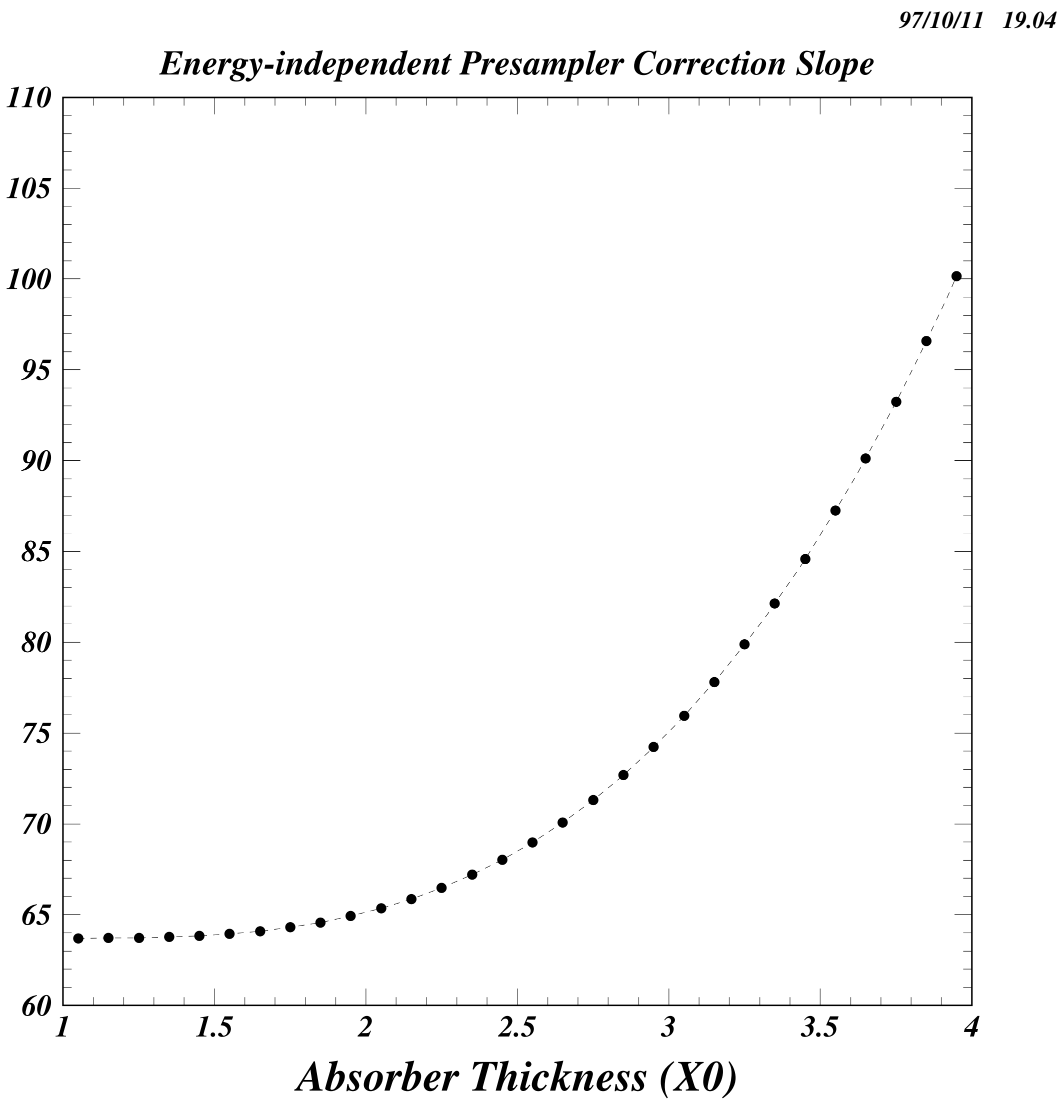


Results energy-independent for E$\geq$ 5 GeV

But some funny effects ...

Energy-Independent Correction

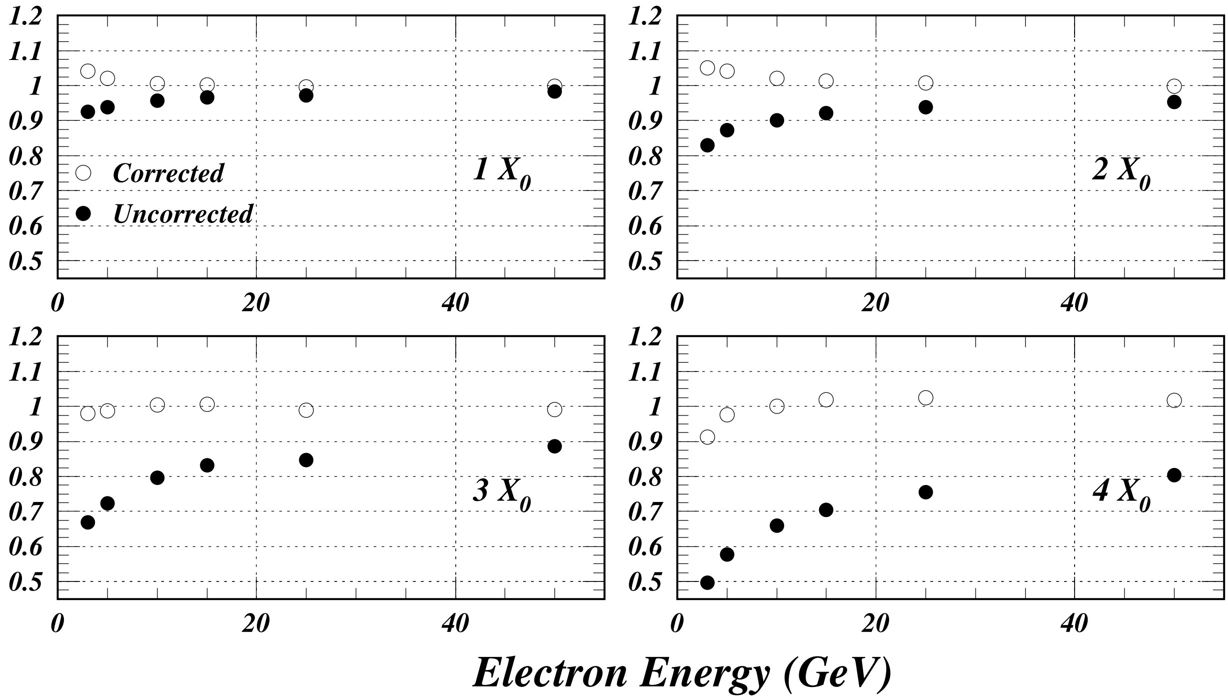
Slope values
dependent only on absorber thickness



Energy-Independent Correction

No Offsets

Slope dependent on absorber thickness only



Residual systematic effects remain at low energy

Comparison of Correction Algorithms

Residual Relative Signal Loss After Correction

(Negative values indicate overcorrection)

Sensitivity to $\pm$ 0.1 X_0

Residual Relative Signal Loss After Correction

(Negative values indicate overcorrection)

Sensitivity to MIP Calibration

Residual Relative Signal Loss After Correction

(Negative values indicate overcorrection)

Summary

First Generation Correction Algorithm

Energy-dependent systematics
(e.g. 6% overcorrection for 5 GeV 2 X_0)

Bristol Correction Algorithm

$\Rightarrow$ $\leq$ 1% systematics for E $\geq$ 5 GeV
$\Rightarrow$ sensitive at 1% level to $\pm$ 0.1 X_0
$\Rightarrow$ Behavior at high energies??

Energy-Independent Correction

$\Rightarrow$ insensitive at 0.1% level to $\pm$ 0.1 X_0

Needs adjustment at low energies
(e.g. 4% overcorrection for 5 GeV 2 X_0)

Presampler correction for dead material
can achieve 1% accuracy
for electron energies $\geq$ 5 GeV