Initial Performance and First Results from the ZEUS Barrel Presampler (BPRE)

S.V.Chekanov, S.Lee, S.Magill
Feb 2000

http://gate.hep.anl.gov/srm/bpre.html Proposal

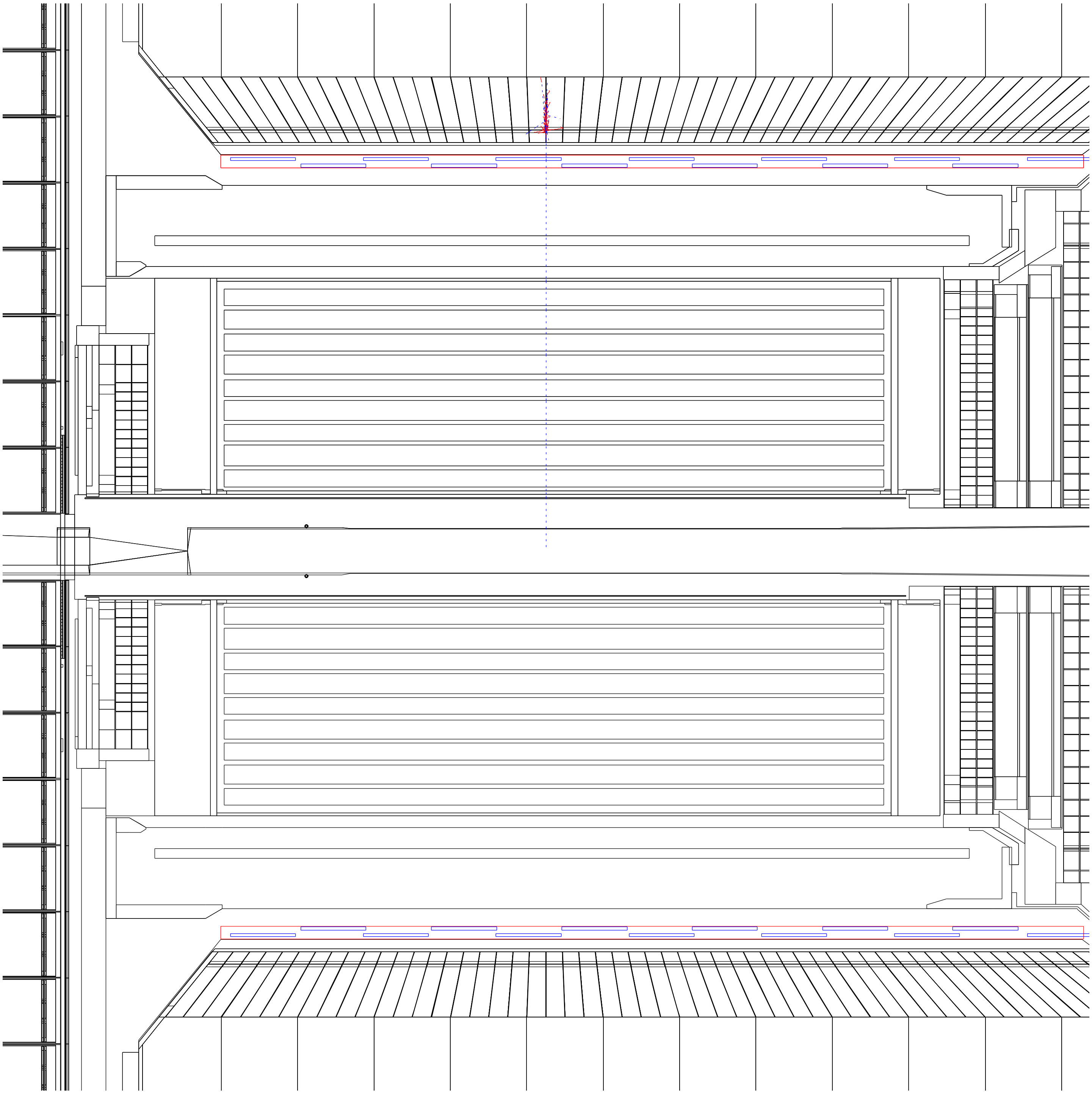
http://gate.hep.anl.gov/srm/bpre99.html Recent results

http://www.desy.de/~chekanov/bpres.html DQM, Status, etc.

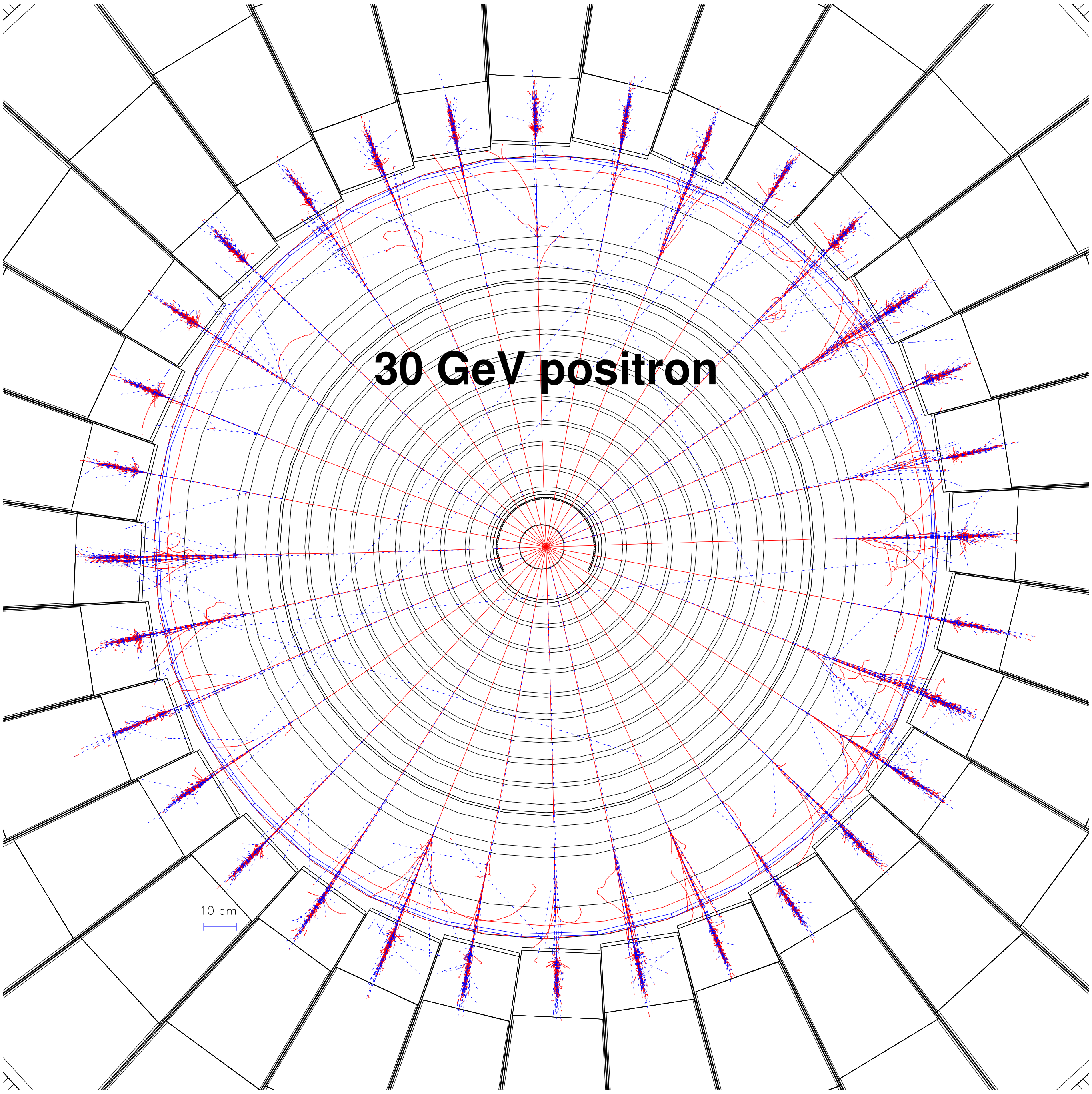
Recent Updates/Results

- Number of bad channels: 3.2%
- BPRE calibration is completed
  - HV was finally adjusted
  - Off-line calibration is completed: pC $\to$ Mips
- New realistic BPRE geometry was developed
  - Implementation of BPRE in Mozart (C. Catterall).
- More user-friendly subroutines for the analysis
- All 1999 data can be used for analysis
- Preliminary Results:
  - Barrel region dead material mapping;
  - DIS scattered electron energy corrections;
  - Jet energy corrections in the Barrel region;
  - e/π separations in the Barrel region;
  - First look at BPRE for $\mu^+\mu^-$, e^-e^+ from J/Ψ (T.Tsurugai, diffractive meeting, Dec 99)
  - Prompt photon studies.
- ZEUS note (in progress)

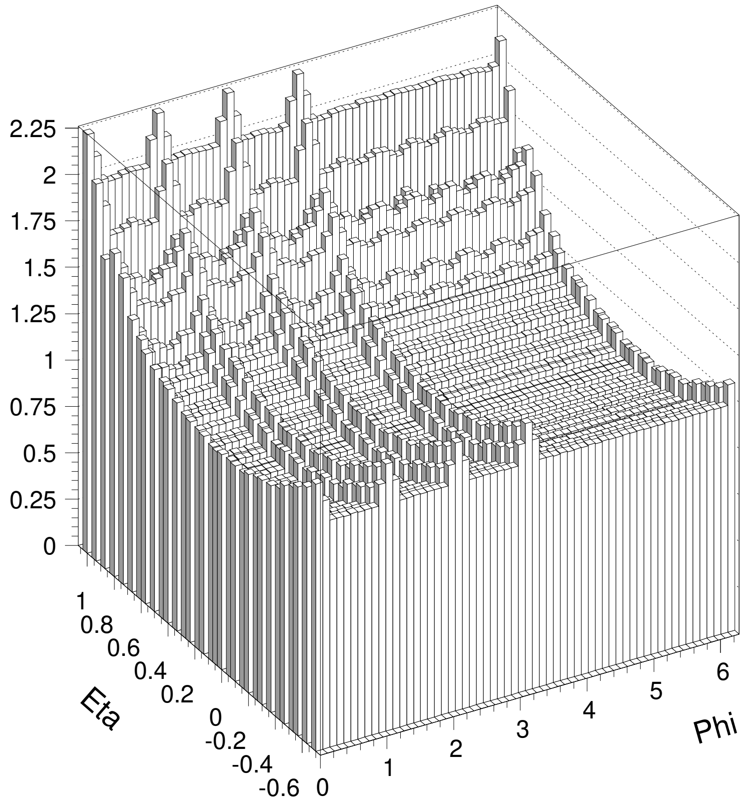
BPRE Geometry



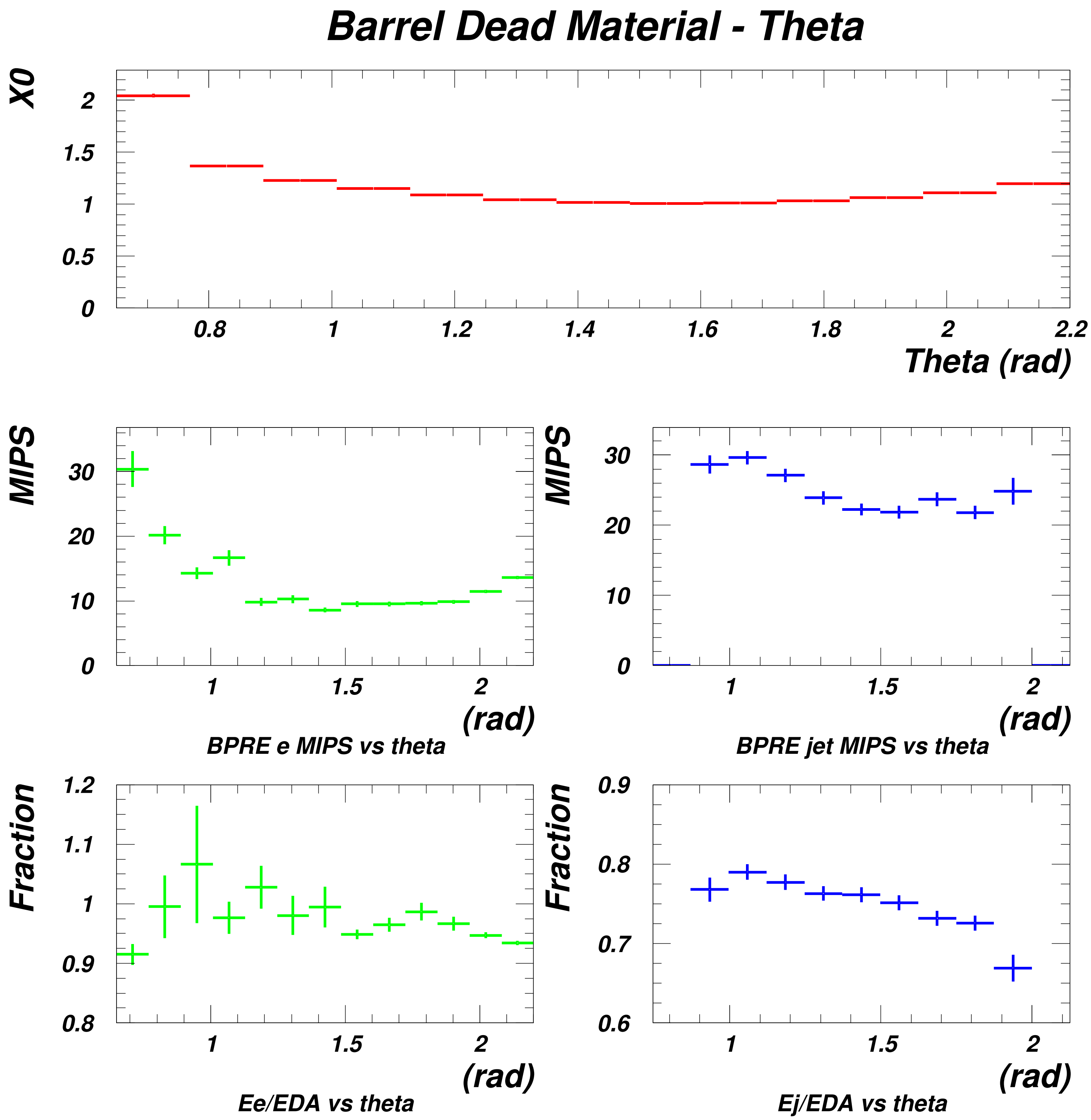
BPRE Geometry

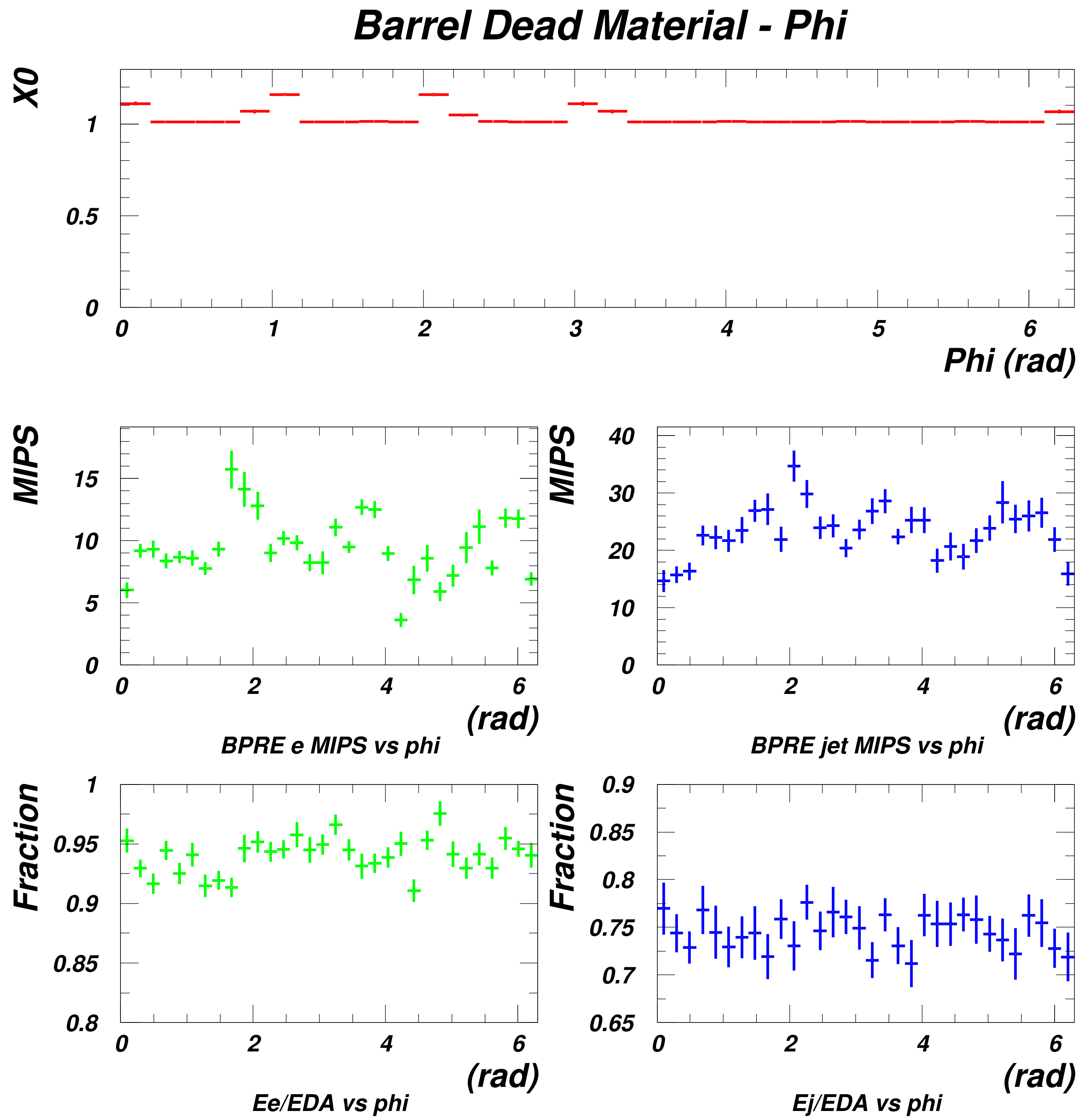


$X0$ Dead-Material Map for 1996 MC



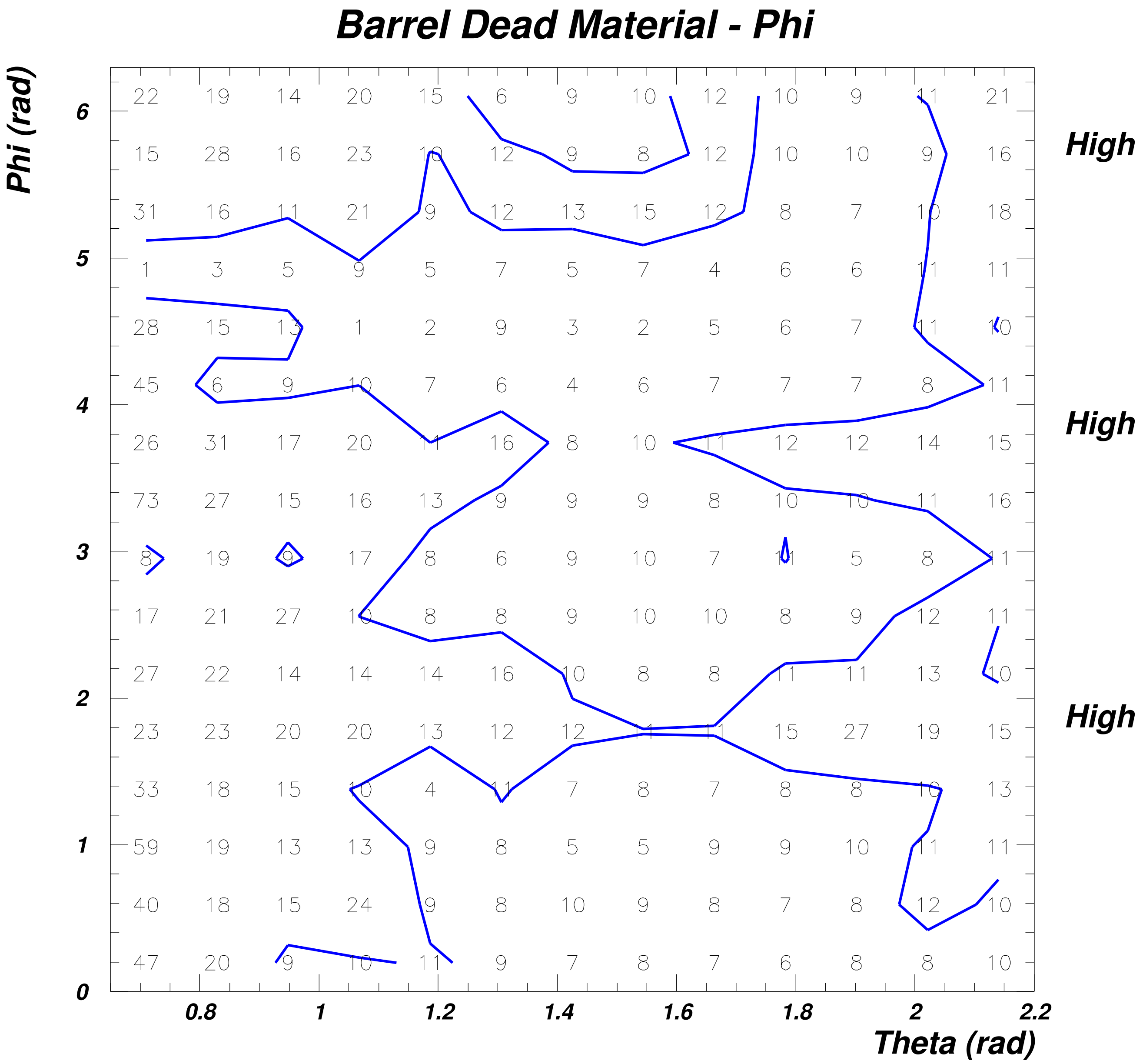
Barrel region dead material mapping with BPRE





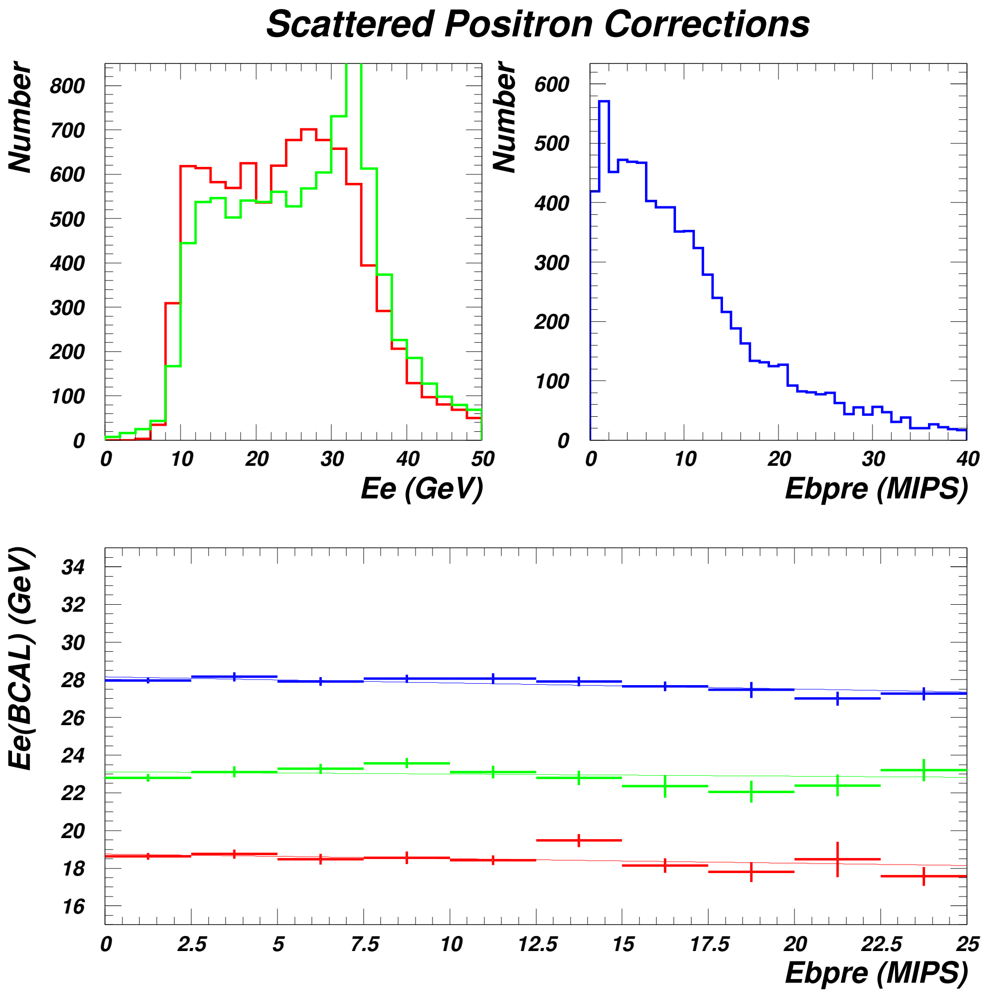
- Data is internally consistent;
- The largest increase in the Mips signals are at 2 rad;
- Dead material MC map for phi is not consistent with the observed signals.

2D dead material mapping with BPRE



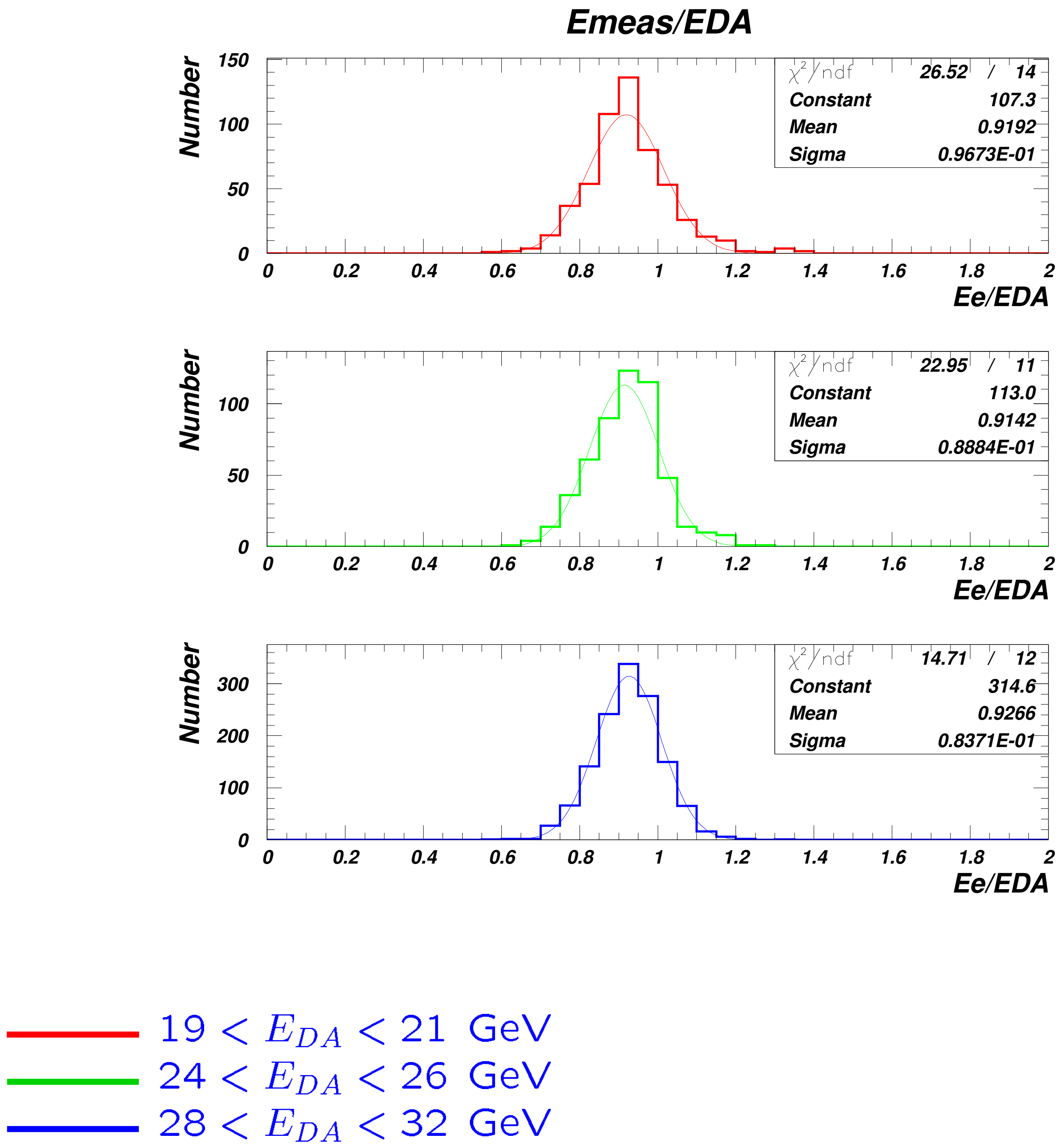
Sergei Chekanov (ANL): *"BPRE performance .."*

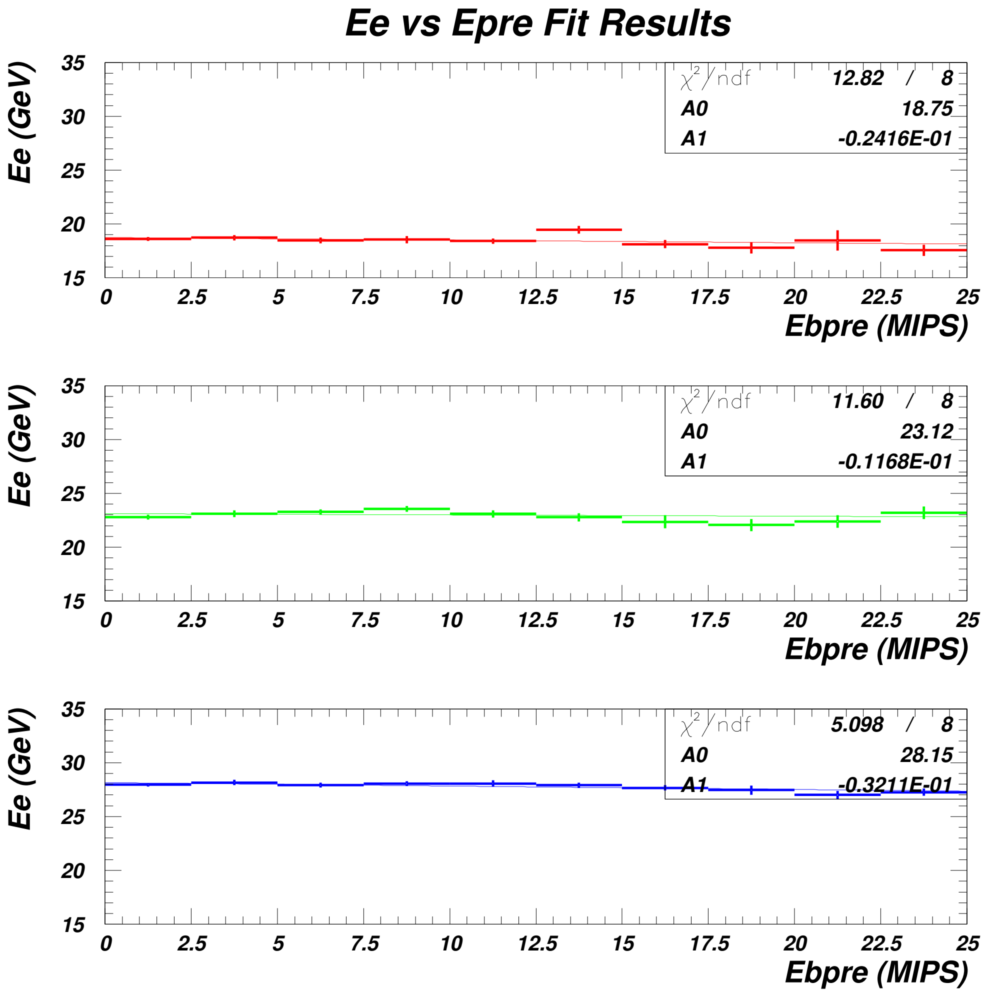
DIS scattered electron energy corrections



$19 < E_{DA} < 21$ GeV
$24 < E_{DA} < 26$ GeV
$28 < E_{DA} < 32$ GeV

$E_e^t \geq 10$ GeV, $40 \leq \delta \leq 60$ GeV, $y_e \leq 0.95$, $y_{\text{JB}} \geq 0.04$
$|Z_v| < 50$, $0.65 < \theta_e < 2.25$ rad


Emeas/EDA
Number
Ee/EDA
χ²/ndf 26.52 / 14
Constant 107.3
Mean 0.9192
Sigma 0.9673E-01
χ²/ndf 22.95 / 11
Constant 113.0
Mean 0.9142
Sigma 0.8884E-01
χ²/ndf 14.71 / 12
Constant 314.6
Mean 0.9266
Sigma 0.8371E-01
$19 < E_{DA} < 21$ GeV
$24 < E_{DA} < 26$ GeV
$28 < E_{DA} < 32$ GeV



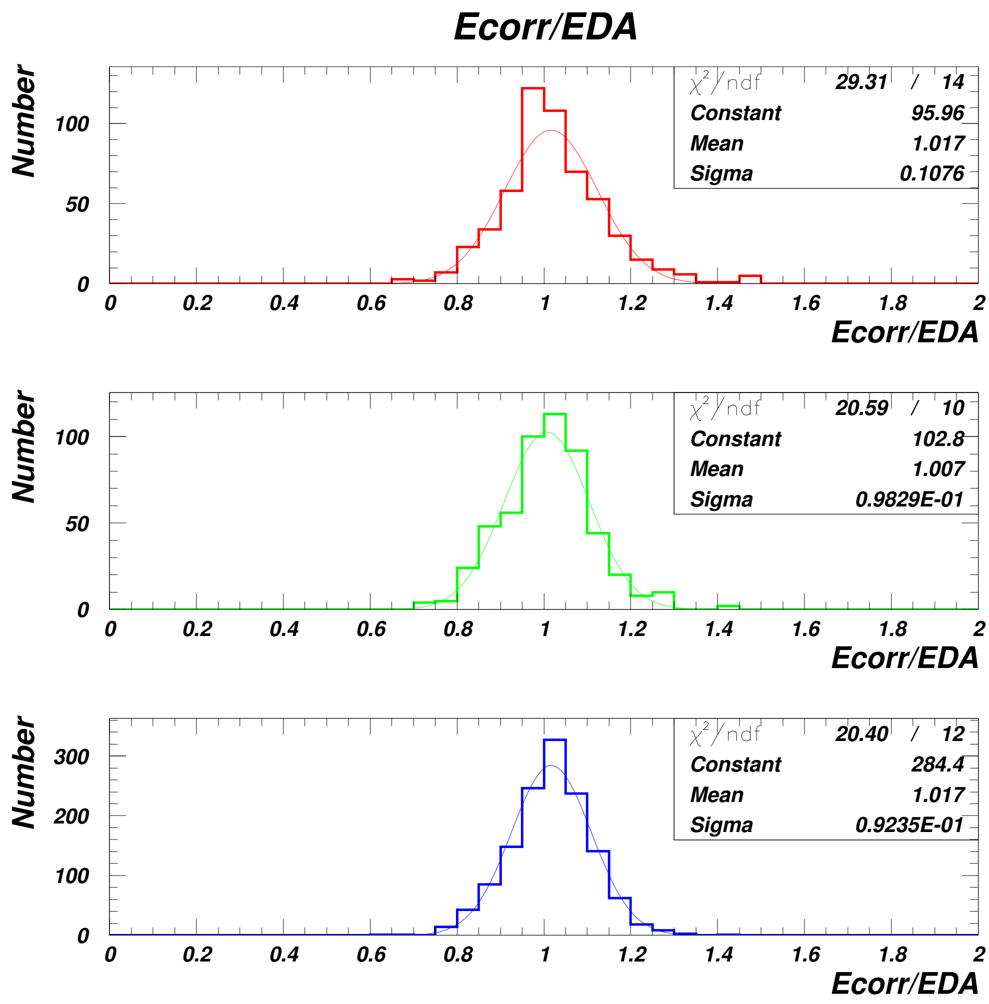
$$E_{meas} = A_0 + A_1 \times E_{bpre}$$

$$A_i = a_i + b_i \times E_{true}, \qquad i = 0, 1$$

$$E_{corr} = \frac{E_{meas} - a_0 - a_1 \times E_{bpre}}{b_0 + b_1 \times E_{bpre}}$$

Fit parameters:

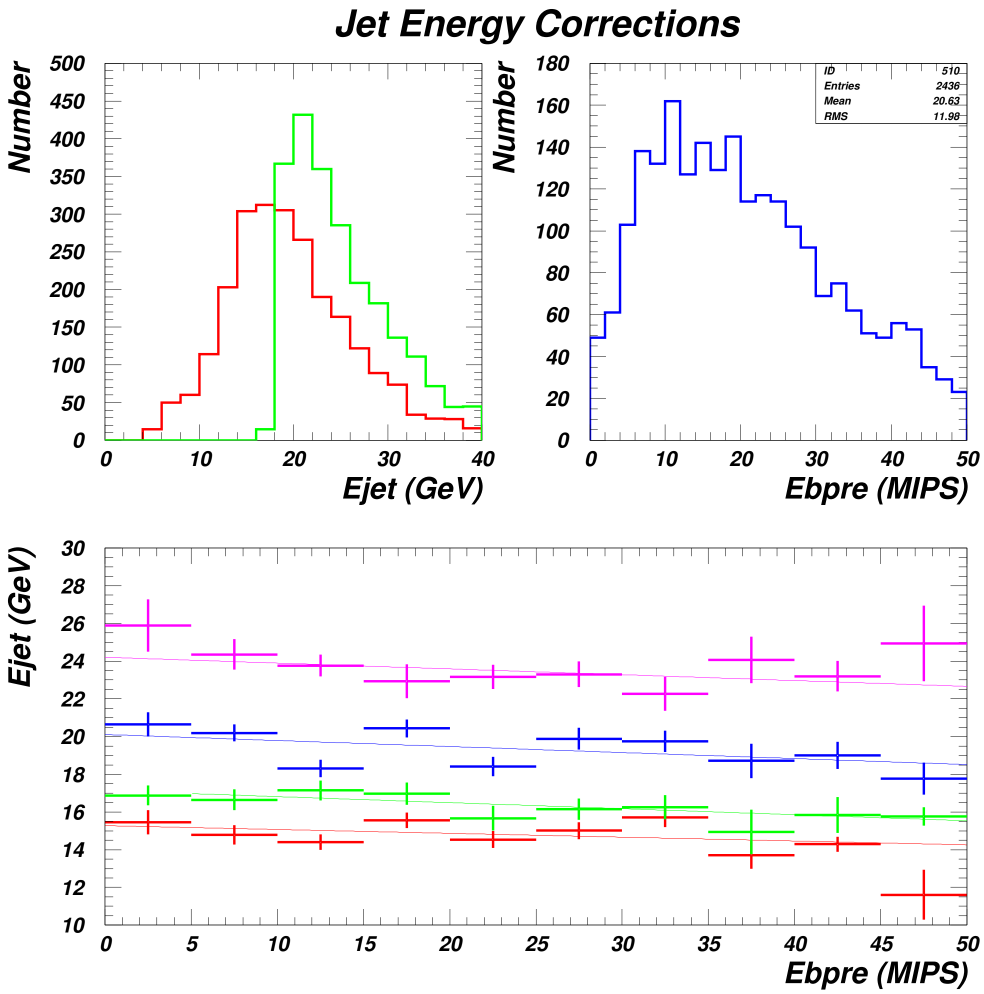
$a_0 = -0.080$ GeV
$a_1 = -0.033$ GeV/MIP
$b_0 = 0.930$
$b_1 = -0.0004$ /MIP (consistent with 0)



Summary:

- BPRE correction contains a shift of about 7% and a dead material correction (2%) (Second analysis: 5% and 2.5%);
- Energy independence of the correction;
- A larger slope in data than in MC (c.f. ZEUS Note 95-133);
- No improvement in the energy resolution (DA method spreads it out ?);
- Electron correction is still not final.

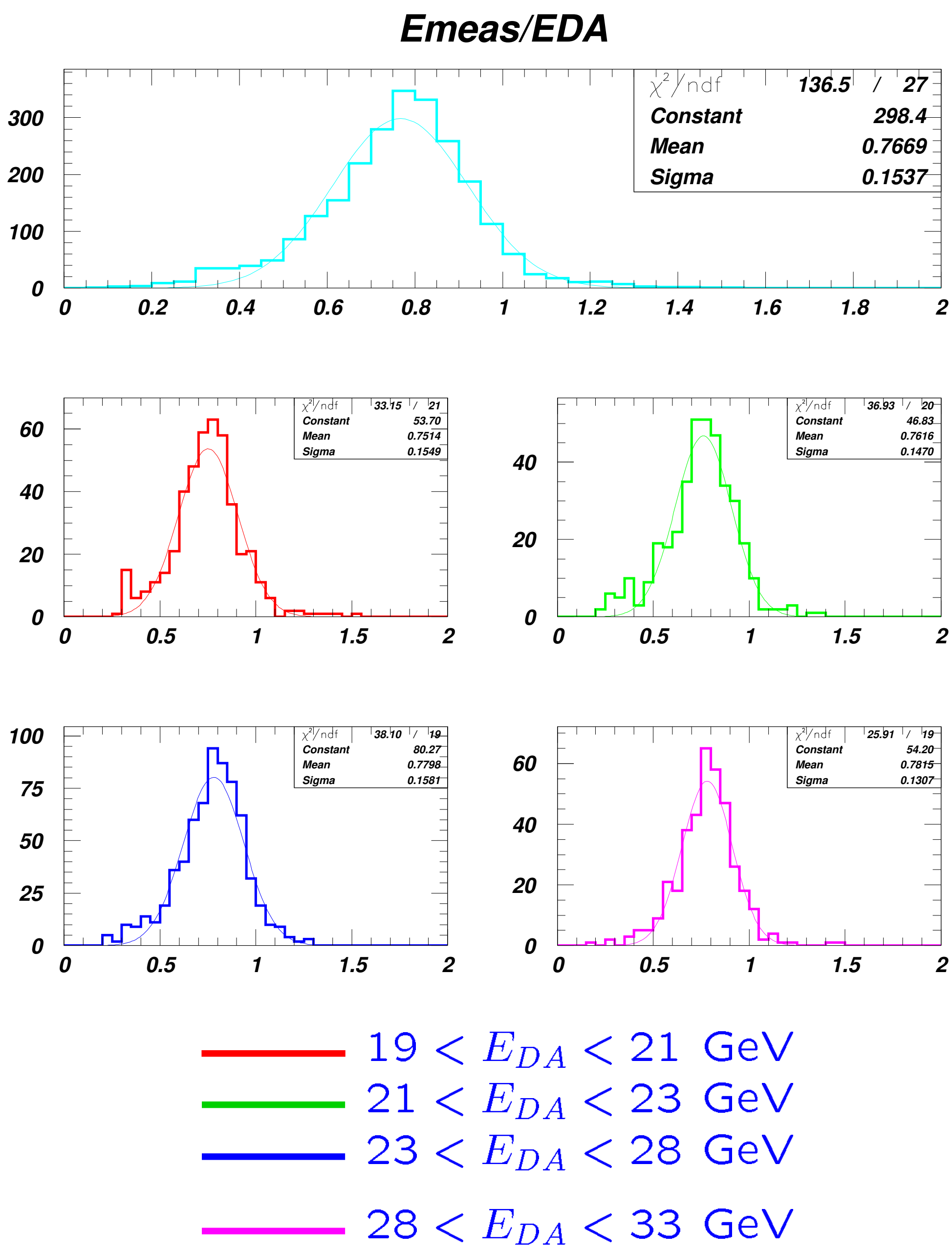
Jet Energy Corrections in the Barrel region

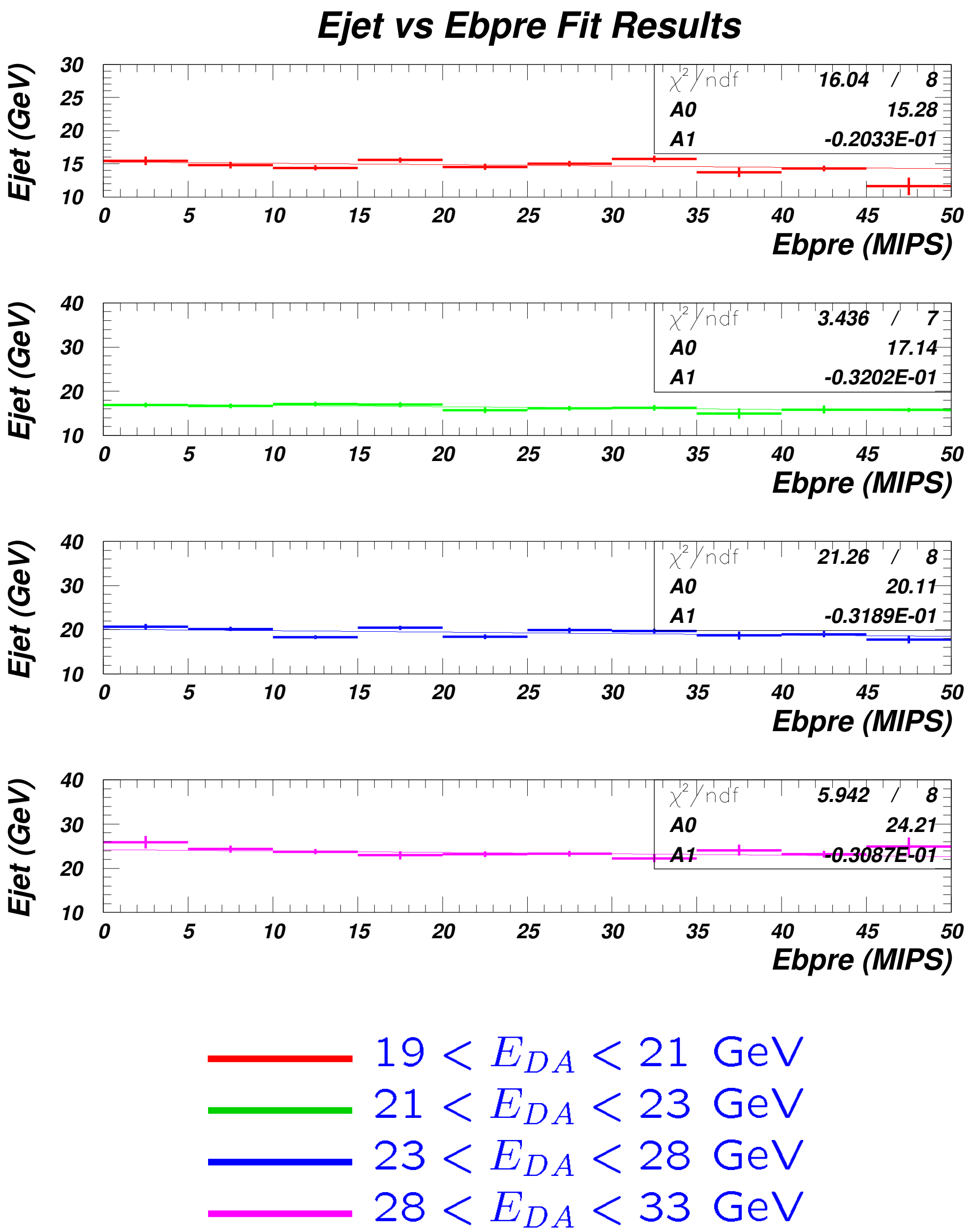


$19 < E_{DA} < 21$ GeV
$21 < E_{DA} < 23$ GeV
$23 < E_{DA} < 28$ GeV
$28 < E_{DA} < 33$ GeV

Selection:

Single cone jet "opposite" to the scattered positron in phi

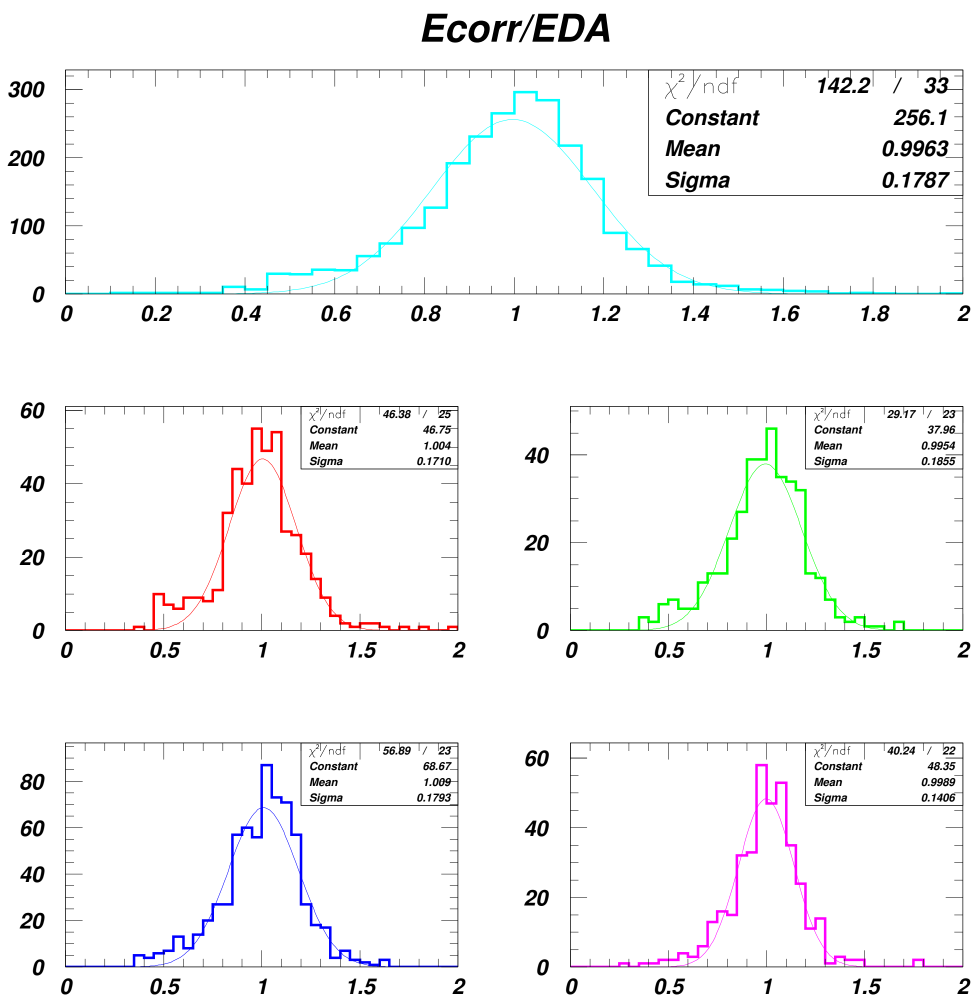

Emeas/EDA
χ²/ndf 136.5 / 27
Constant 298.4
Mean 0.7669
Sigma 0.1537
χ²/ndf 33.15 / 21
Constant 53.70
Mean 0.7514
Sigma 0.1549
χ²/ndf 36.93 / 20
Constant 46.83
Mean 0.7616
Sigma 0.1470
χ²/ndf 38.10 / 19
Constant 80.27
Mean 0.7798
Sigma 0.1581
χ²/ndf 25.91 / 19
Constant 54.20
Mean 0.7815
Sigma 0.1307
$19 < E_{DA} < 21$ GeV
$21 < E_{DA} < 23$ GeV
$23 < E_{DA} < 28$ GeV
$28 < E_{DA} < 33$ GeV



Fit parameters:

$a_0 = -1.380$ GeV
$a_1 = -0.034$ GeV/MIP
$b_0 = 0.852$

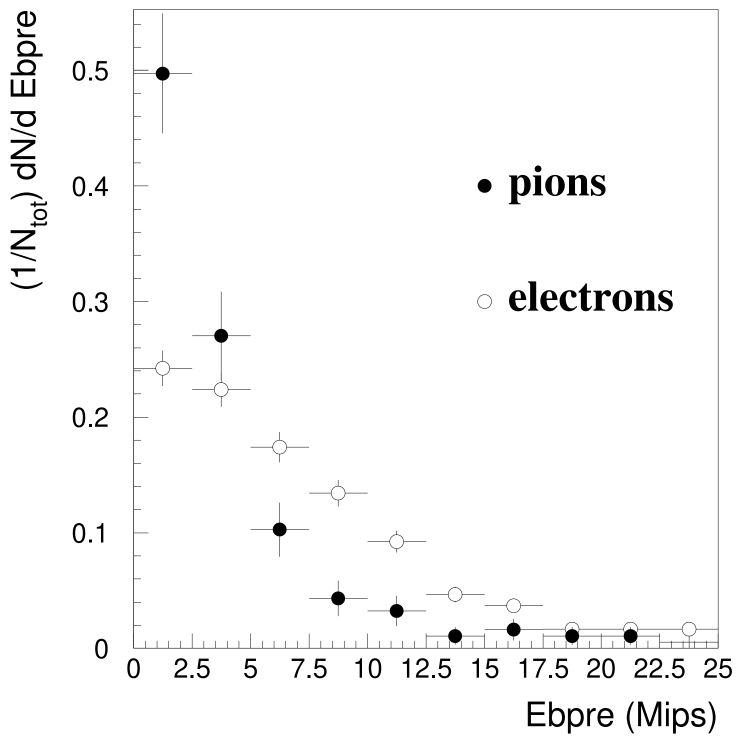
$b_1 = 0.0001$ /MIP (consistent with 0)



Summary:

- An improvement of about 12% is observed in the energy resolution;
- Energy independence of the correction;
- The slope parameter is consistent with that obtained for electrons;
- The correction contains a shift of about 15% and a dead material correction ($\sim 8\%$).

e/π Separation



Kinematic range: 4 - 7 GeV and $\eta < 0$

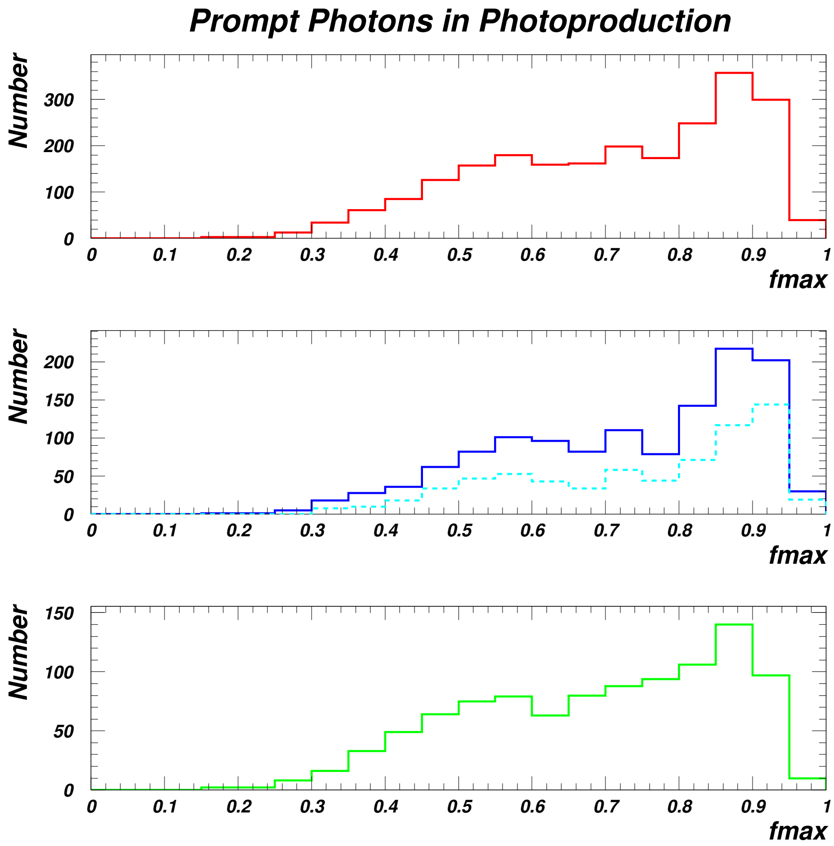
Electrons: SIRA95

Pions: cone islands in BCAL matched to tracks
$E_{EMC}/E < 0.85$ + scattered electron in RCAL

Mip signals for electrons are by factor 2-3 larger

Prompt Photon Studies

Selection criteria: $\langle \delta Z \rangle < 0.65$



No BPRE
$<$ 2.5 Mips from BPRE
$>$ 2.5 Mips from BPRE

No BPRE signals

Peak for f_{max} is enhanced by the low BPRE Mip requirement

Summary

- First preliminary results have verified the BPRE proposal

- To finalize the results with 1999-2000 data:
  - dead material map with electrons
  - electron corrections in several BCAL regions
  - jet corrections for specific algorithms

- Work to be done with 1999-2000 data:
  - CC event kinematics
  - jet corrections throughout the detector (use FPRE)
  - e/pi separation (backg. rejection, J/Psi, etc.)