electron analysis within OpEmuRec framework

LAPP – Annecy
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Réunion OPERA 03/11/2011

Outline

Electron energy estimation within 2 bricks : nue sample
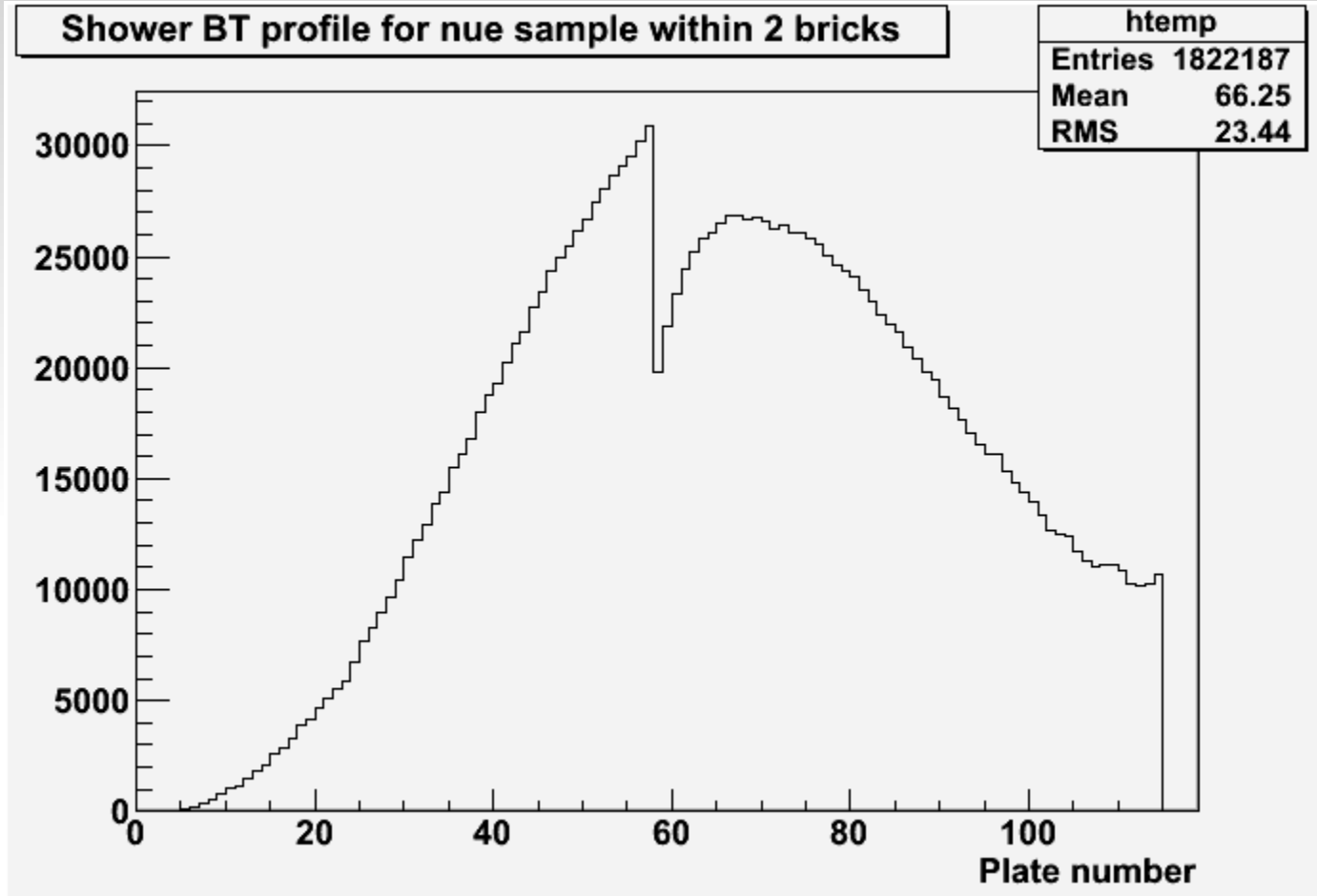Calibration with electron testbeam bricks data

Outlook

MC Sample - OpRelease 4.0

Samples of 1000 $\tau \rightarrow$ e DIS & QE produced by Elisabetta
/sps/opera/operap/production/OpEmuIO/march2011/TAUE/DATA/tauef
oremu_tgt1000_OpR4.0_rec_11.root

◦ Processed through OpEmuIO
◦ Processed through OpEmuRec packages : CS, Scanback, Link,
Alignment, Track & Shower by using all plates available in the brick

◦ All packages up to OpEmuRec Track are taken from the release
$GROUP_DIR/soft/OpRelease4.0_emulsion_march2011/
◦OpEmuRec Shower is released here :
/sps/opera/scratch/flbrunet/analysis/OpRelease_2011-04-
04_OKwithShower/4.0/OpEmuRec/

**FEDRA RELEASE (1210)
OPEMUREC(v3)/OPRELEASE(4.0)**

Nue BT shower profile

Shower BT profile for nue sample within 2 bricks

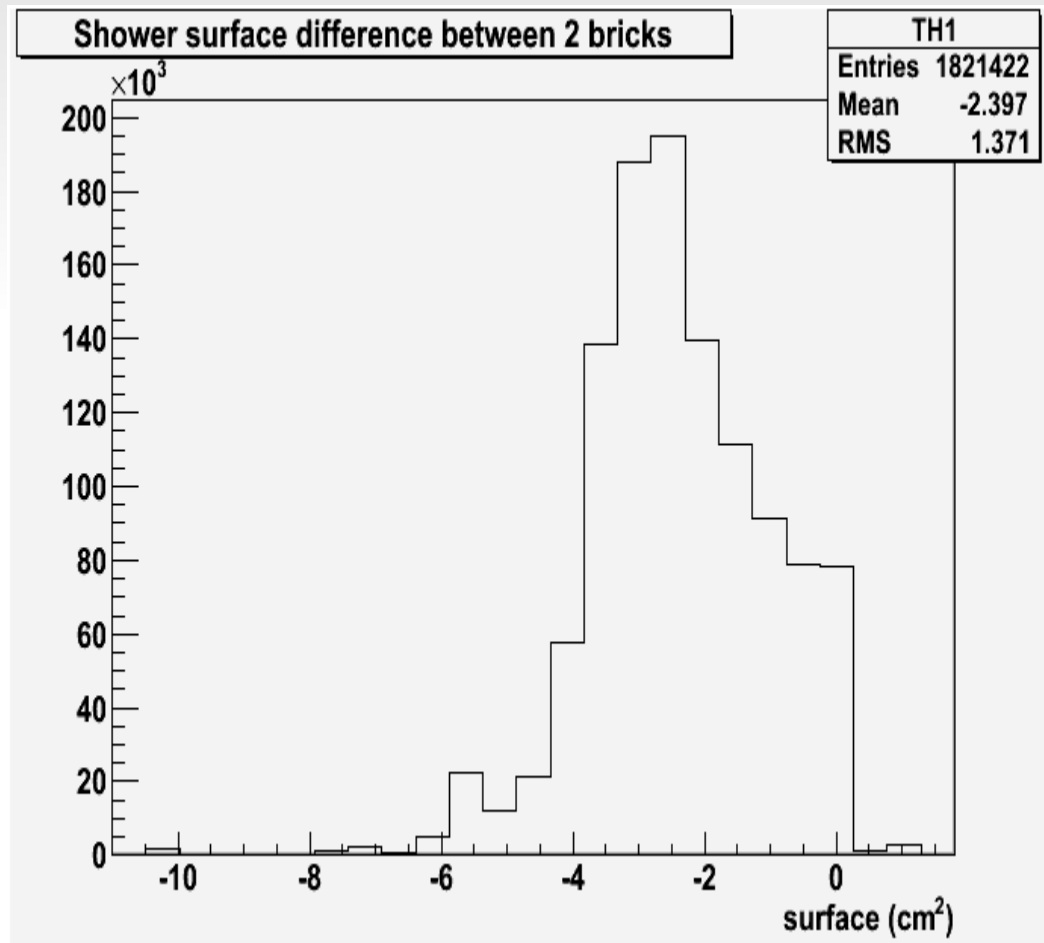| htemp	
Entries	1822187
Mean	66.25
RMS	23.44

Small drop between the two bricks
Energy error estimation using the frist brick profile
→ check distribution of maximum shower development

Nue BT shower profile

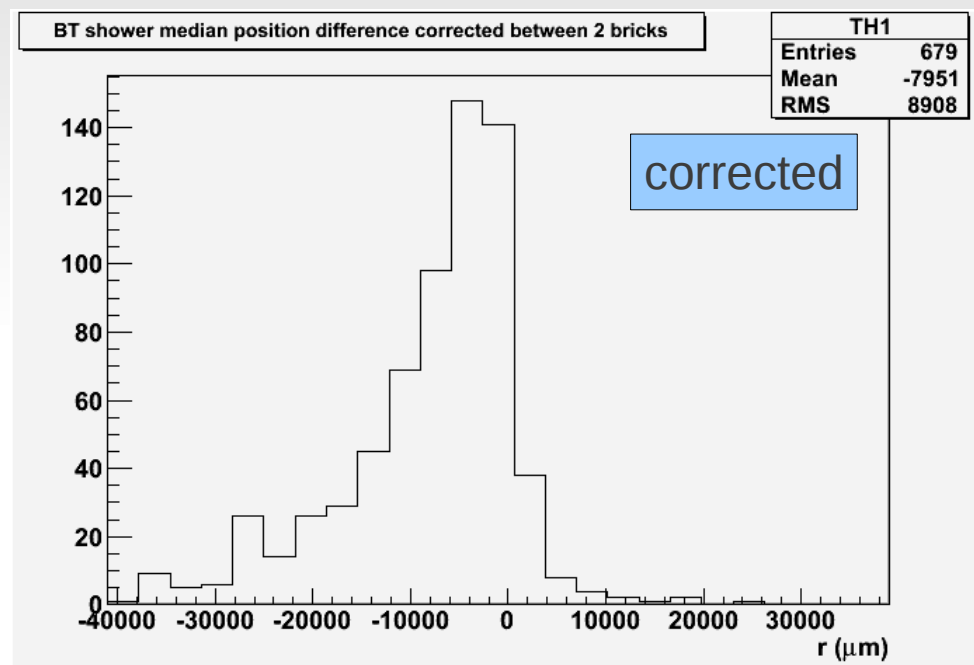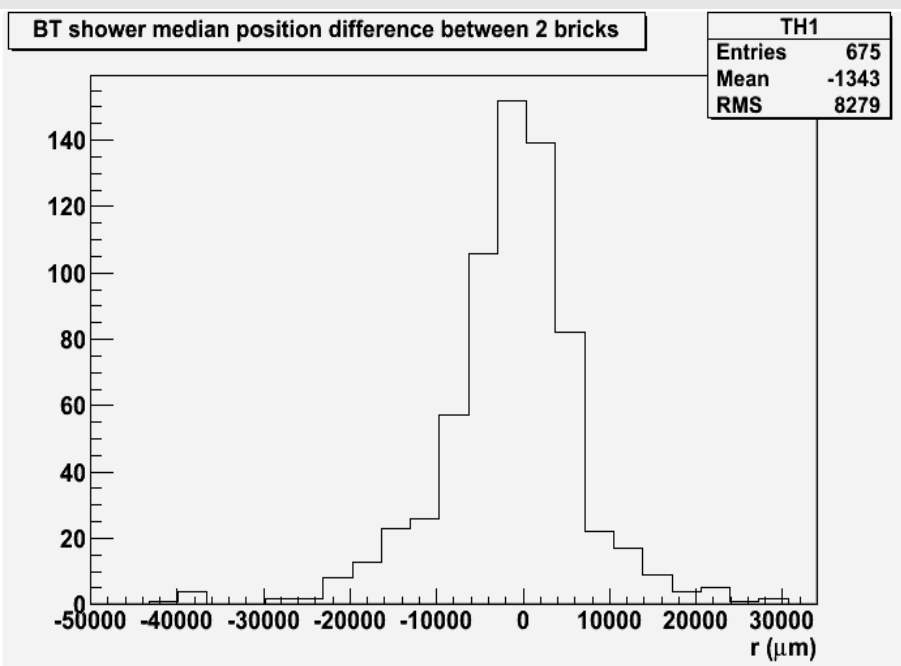Goal : determine surface and number of plates to scan in the second brick downstream

Ratio #BT in pl 58/pl 57 = 0.64

Surface increases between plate 57 & 58 by a mean value of 2.4 cm^2
→ BT density decreases
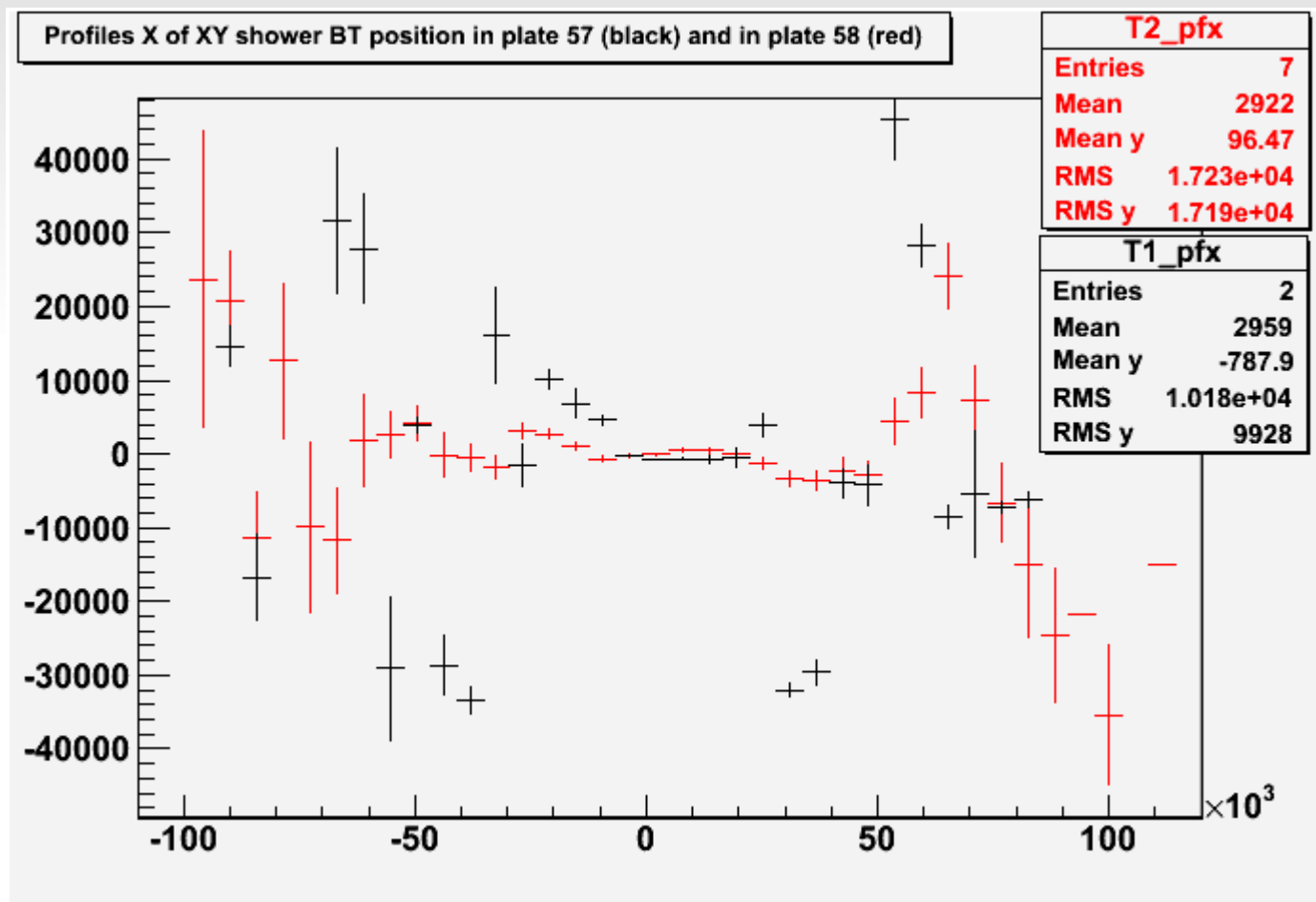
Nue BT shower profile

Goal : determine surface and number of plates to scan in the second brick downstream

Corrected : difference median position – XY projection of the electron track

Nue BT shower profile

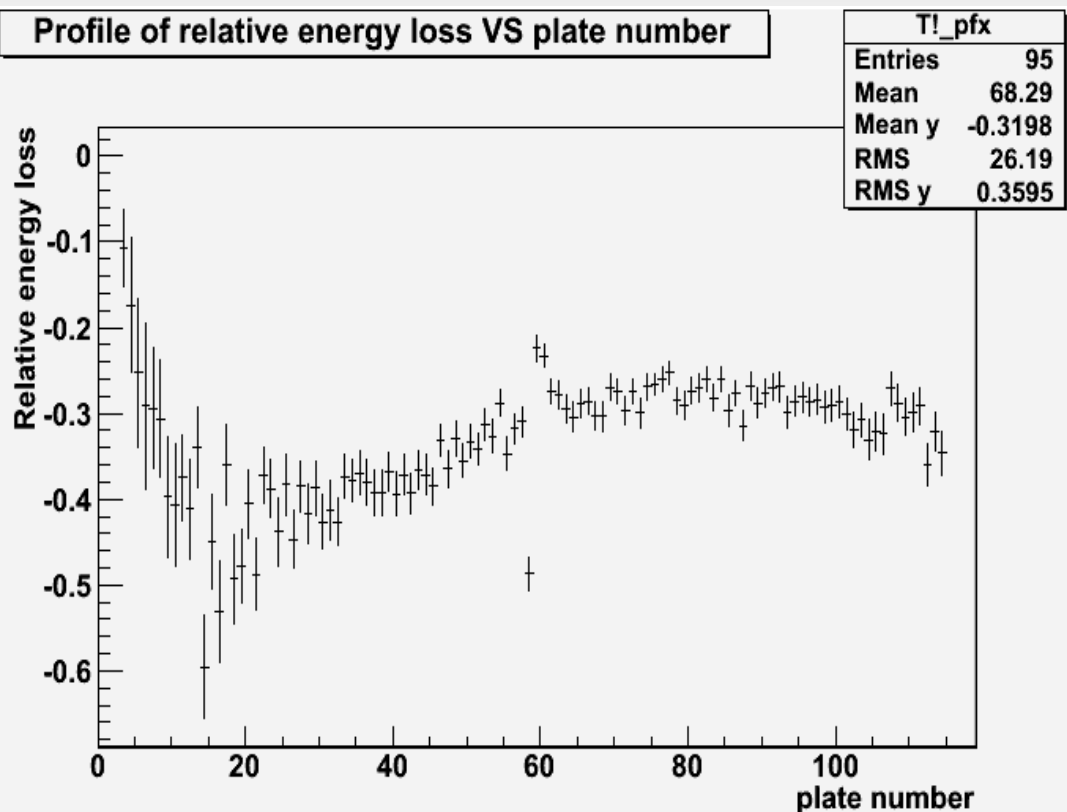Goal : determine surface and number of plates to scan in the second brick downstream

Profiles X of XY shower BT position in plate 57 (black) and in plate 58 (red)

Nue BT shower profile

Goal : make sure MC simulation within 2 bricks is OK

Energy loss : sum of BT energy in one plate – sum of BT energy in the former plate

BT energy : MC energy of the most dowstream hit in the film
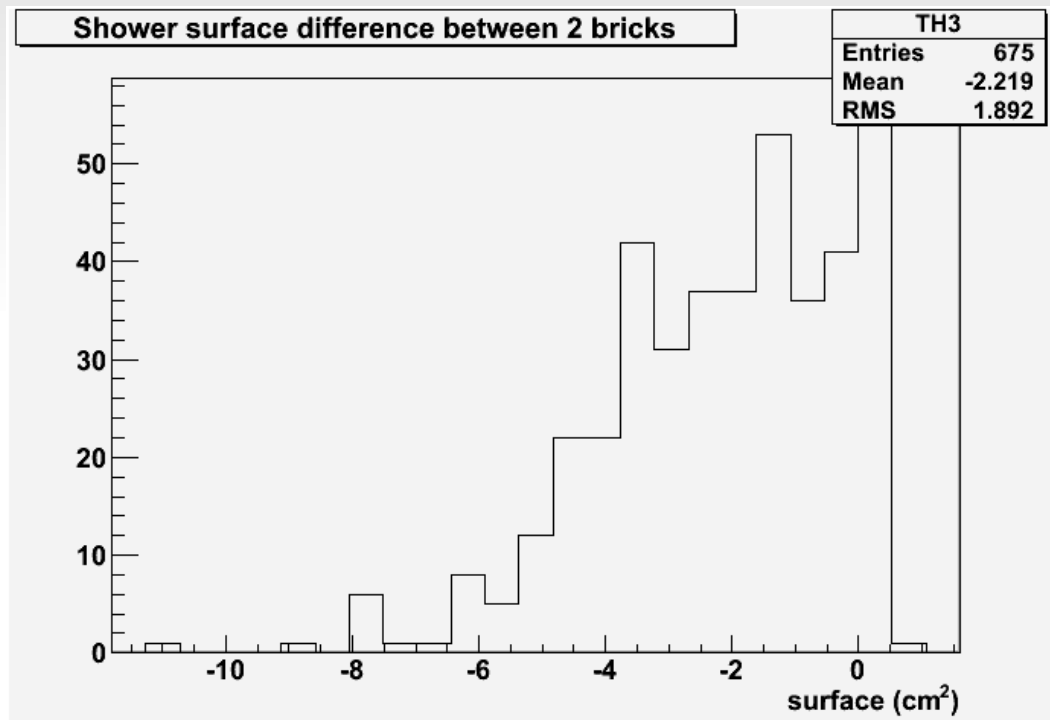

Profile of relative energy loss VS plate number

T!_pfx	
Entries	95
Mean	68.29
Mean y	-0.3198
RMS	26.19
RMS y	0.3595

30% energy loss in the first 5 plates = 1 X_0

Energy loss enhancement in plate 58 ?

taue BT shower profile

Goal : determine surface and number of plates to scan in the second brick downstream
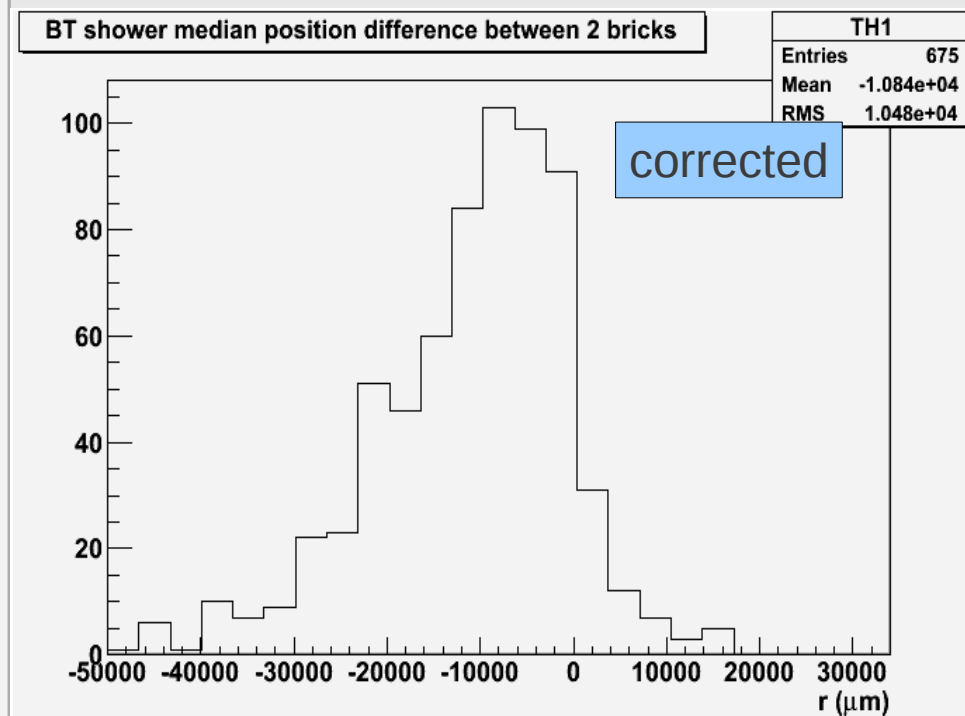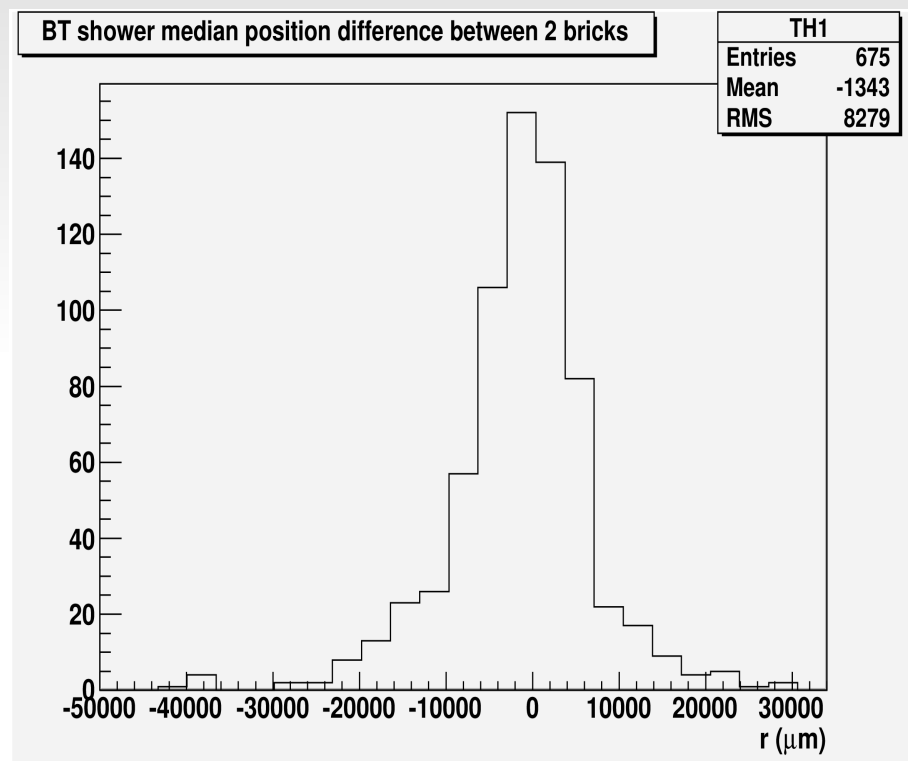

Ratio #BT in pl 58/pl 57 = 0.64

Surface increases between plate 57 & 58 by a mean value of 2.2 cm^2

→ BT density decreases
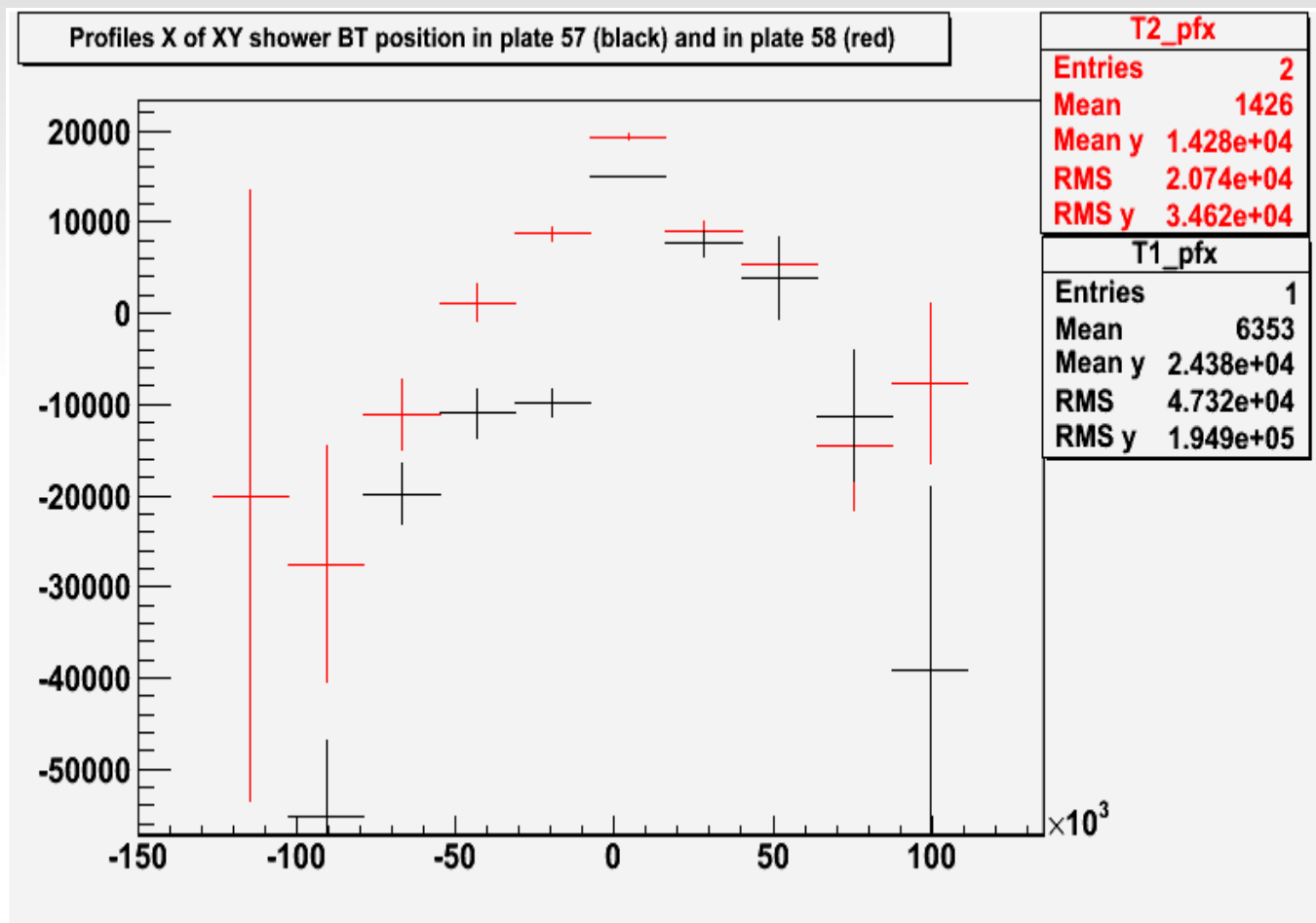
taue BT shower profile

Goal : determine surface and number of plates to scan in the second brick downstream

Corrected : difference median position – XY projection of the electron track
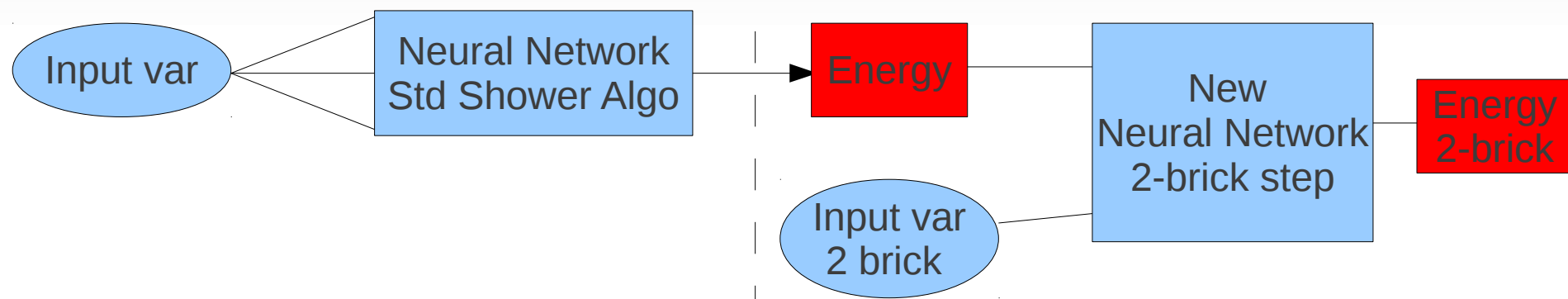
taue BT shower profile

Goal : make sure MC simulation within 2 bricks is OK

Shower reconstruction within 2 bricks

Brick 1

Brick 2

Idea 1 :

Input var → Neural Network Std Shower Algo → **Energy**

Input var 2 brick → New Neural Network 2-brick step → **Energy 2-brick**
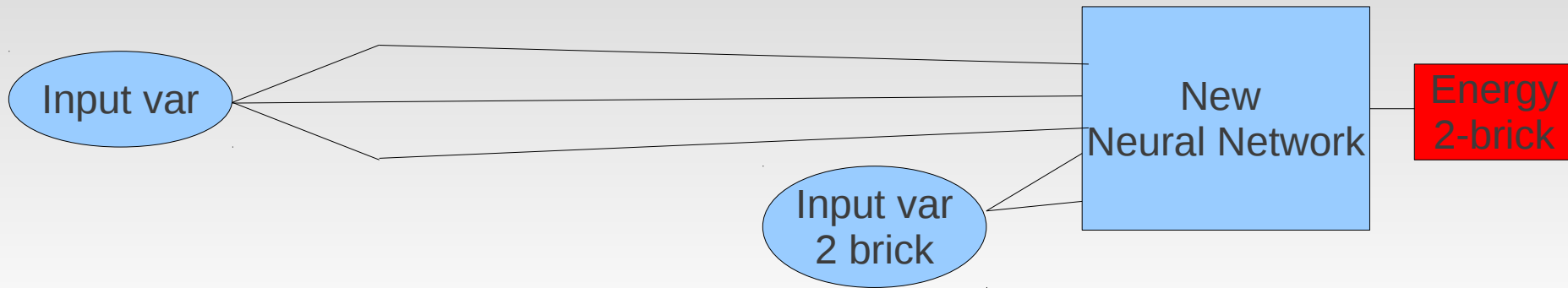
<u>Interest</u> : relatively quick → adding a next step after normal shower reconstruction

<u>Problem</u> : First Energy estimation has possibly unkwown systematics

Shower reconstruction within 2 bricks

Idea 2 :

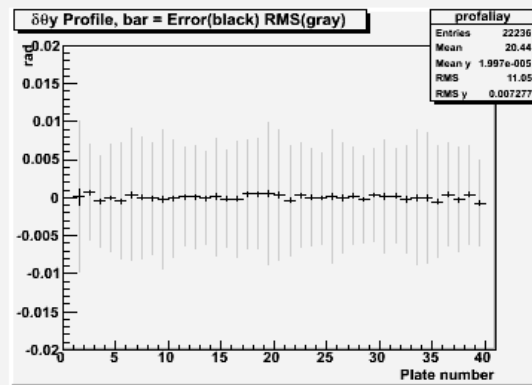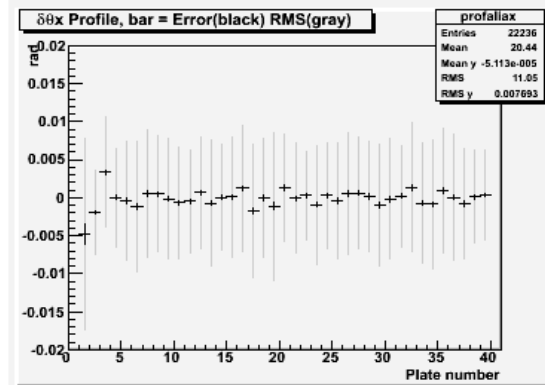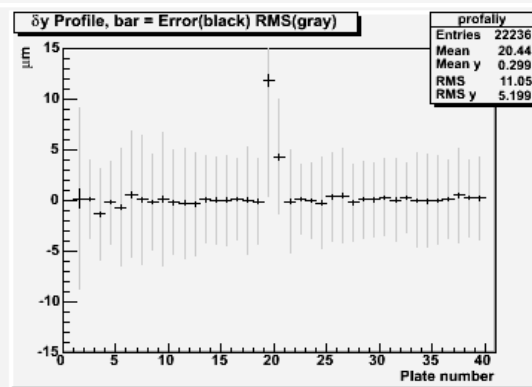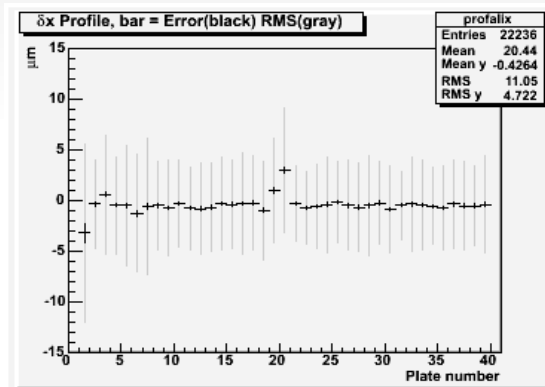

Interest : a more understood energy estimation
Problem : a tool different from the official one

Calibration of shower tool : beamtest brick analysis in Bern

Scanning in Bern is currently on going thanks to Tomoko, Ariga, Serhan :

4 GeV electron brick → 40 plates available on ½ area

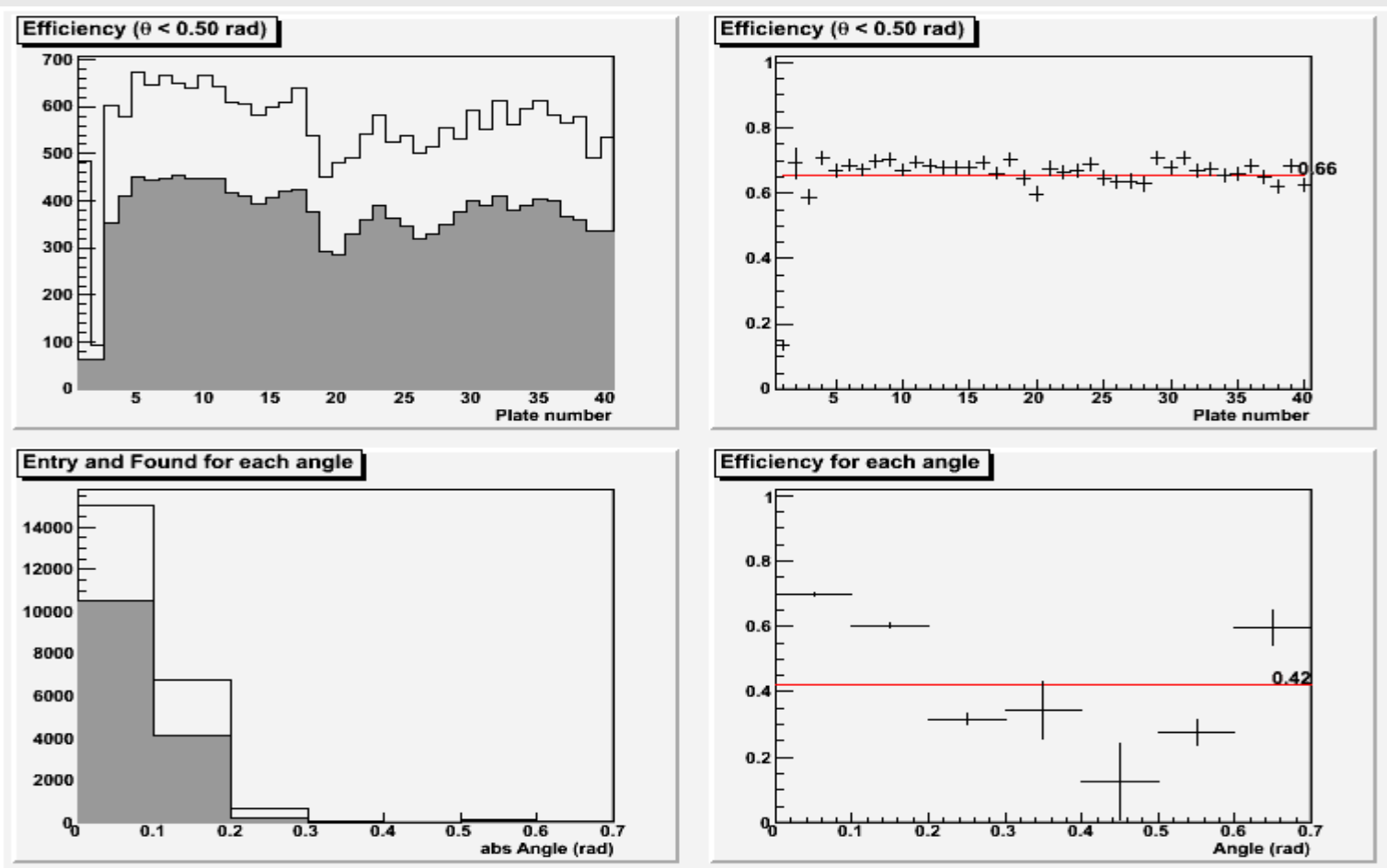2 GeV electron brick → 37 plates available on ½ area

Analysis in Annecy : on going

Alignment 4 GeV:
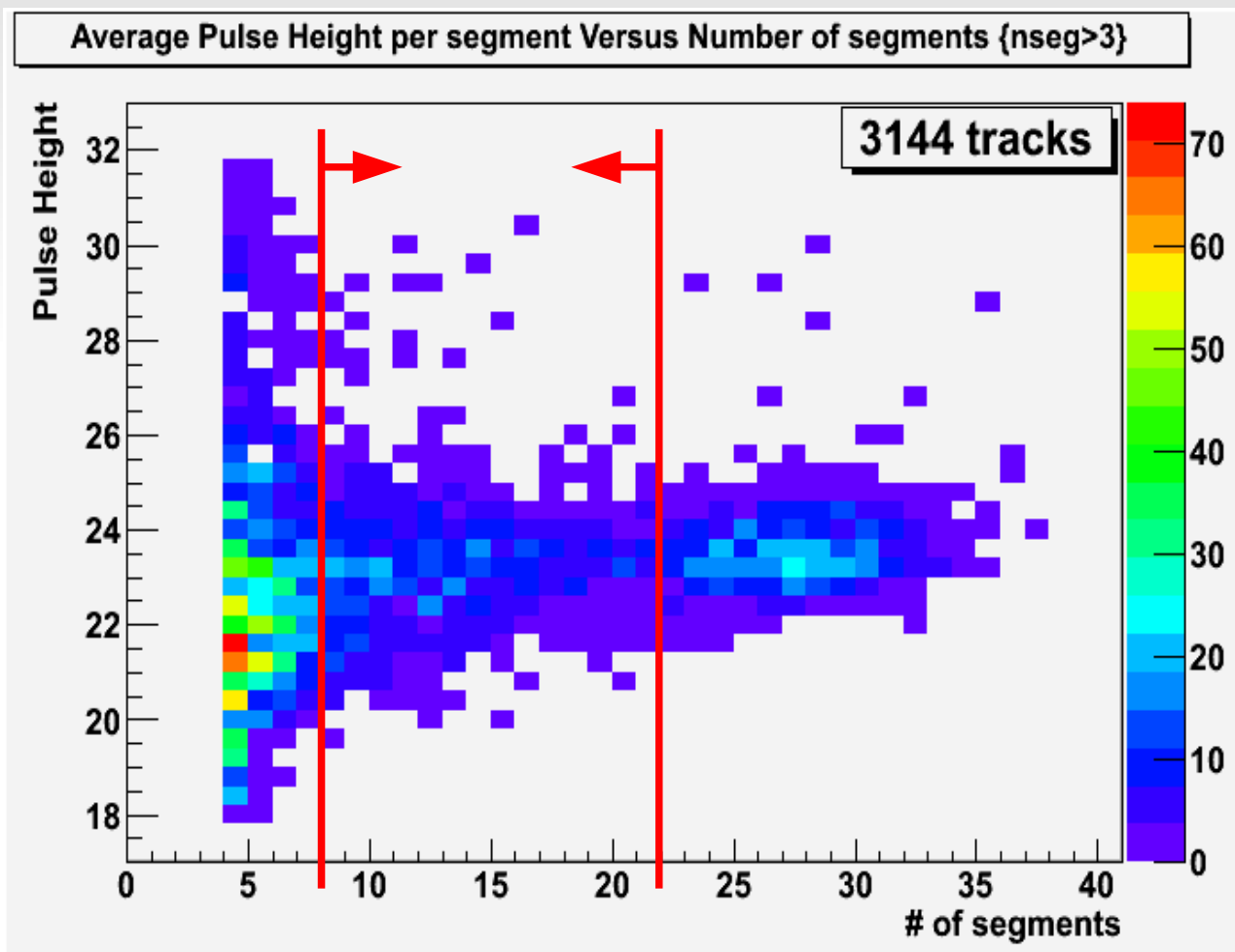→ rescan of pl 20 ?

Alignment 2 GeV :
→ process failure : ask Aki

Calibration of shower tool : beamtest brick analysis in Bern

Efficiency : seems OK

Ariga
Florian

Calibration of shower tool : beamtest brick analysis in Bern

→ selection of electron tracks : 8 < nseg < 22 ≈ 500 tracks

Average Pulse Height per segment Versus Number of segments {nseg>3}

3144 tracks

Goal :
- Select only « beam tracks »
- Reconstruct showers on selected tracks to separate e/pion and estimate electron energy

Outlook

1/ 2-Bricks analysis
    a/ shower algo development within 2 bricks : idea 1 or 2
    b/ nue & taue BT shower profile analysis : investigate energy +
   reconstruct showers & estimate error on the energy

2/ Electron Energy estimation
    a/ understand over & under estimation in MC nue sample
    b/ systematics study on pure electron MC samples
    c/ Calibration of shower tool : shower reconstruction on selected
        tracks
    d/ Data analysis : comparison of my result with the one already
produced by scanning labs

3/ $\tau \rightarrow e$ analysis : background study

Backup slides

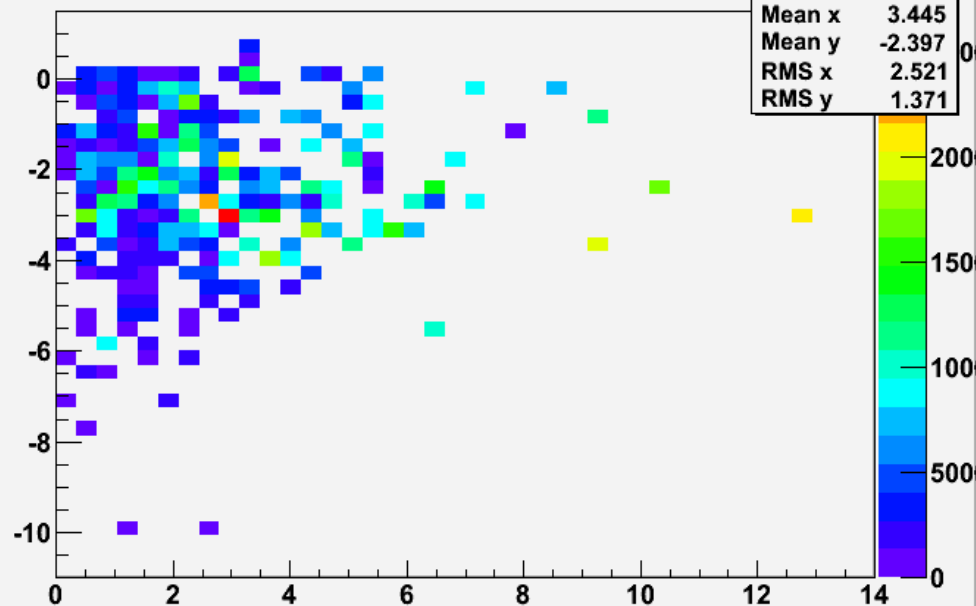TMath::Pi()*(rmsPosition57**2-rmsPosition58**2)*10^-8:eE {PDGprimary==11}
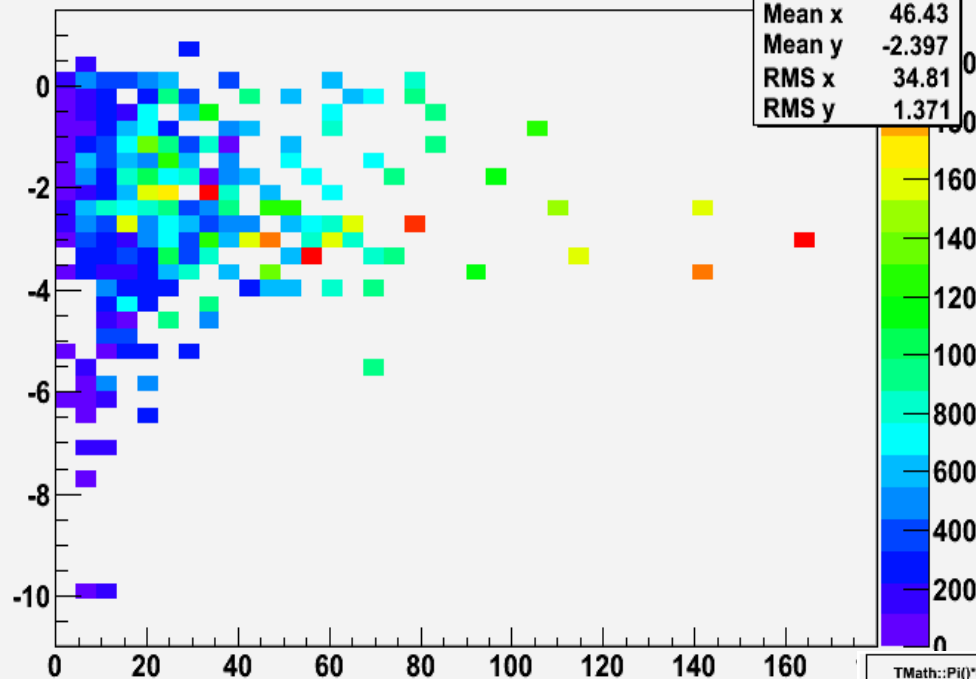
TH6	
Entries	1821422
Mean x	46.43
Mean y	-2.397
RMS x	34.81
RMS y	1.371

nue

Surface difference VS MC electron pT

Surface difference VS MC electron energy

TMath::Pi()*(rmsPosition57**2-rmsPosition58**2)*10^-8:sqrt(ePx**2+ePy**2) {PDGprimary==11}

TH5	
Entries	1821422
Mean x	3.445
Mean y	-2.397
RMS x	2.521
RMS y	1.371

TMath::Pi()*(rmsPosition57**2-rmsPosition58**2)*10^-8:eE {PDGprimary==11}

TH6	
Entries	1821422
Mean x	46.43
Mean y	-2.397
RMS x	34.81
RMS y	1.371

taue

Surface difference VS MC electron pT
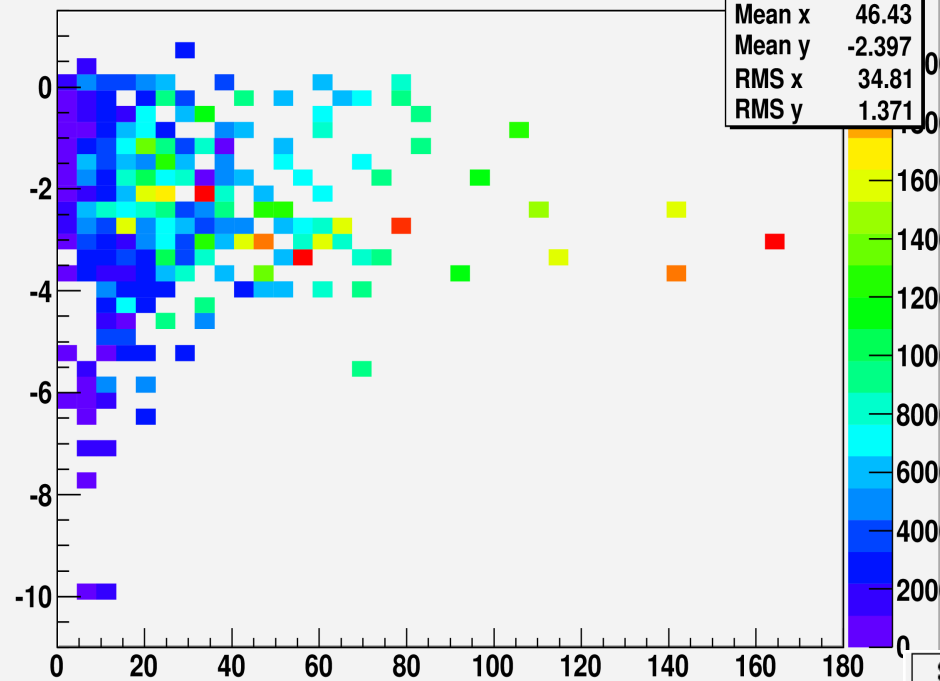
Surface difference VS MC electron energy

Shower surface difference VS MC electron pT true

TH5	
Entries	675
Mean x	0.968
Mean y	-2.219
RMS x	1.113
RMS y	1.892

Surface (cm²)

pT (GeV/c)