CS and brick finding efficiency

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A study of CS use for improving plane and x-y B.F.E

- Introduction and framework
- Tools for good plane finding
- Tools for XY brick finding: muon use, CS mean tracks, CS Vertex 2
- Results for most of channels, perfect postionning and zero background
- Disalignments sensitivity
- Background tracks sensitivity
- First preliminary evaluation of the mean CS surface to scan
- Conclusions

Introduction and frame work

- 2 Super Modules geometry; CS surface = brick surface
- Neutrinos events generated in the i=26,j=32, plane= 3, brick
- 2 CS strategy:
  - 1) remove the tracker-indicated brick1 and CS1, and scan CS1; use emulsion informations to re-define the " good" brick.
  - 2) If no tracks found in CS1 (20%): remove the closest " voisine" of X0,Y0 tracker vertex in the same plane; scan CS2 and use CS2 infos to re-define the " good" brick.
  - 3) If still no tracks, open the tracker-indicated brick1.

REMEMBER:

The tracker PLANE finding efficiency is strongly correlated to the presence or not of backward particles in the event. The weak values for QE mu and e channels are responsible for a good natural plane finding efficiency (first hit plane gives 95% plane finding efficiency).

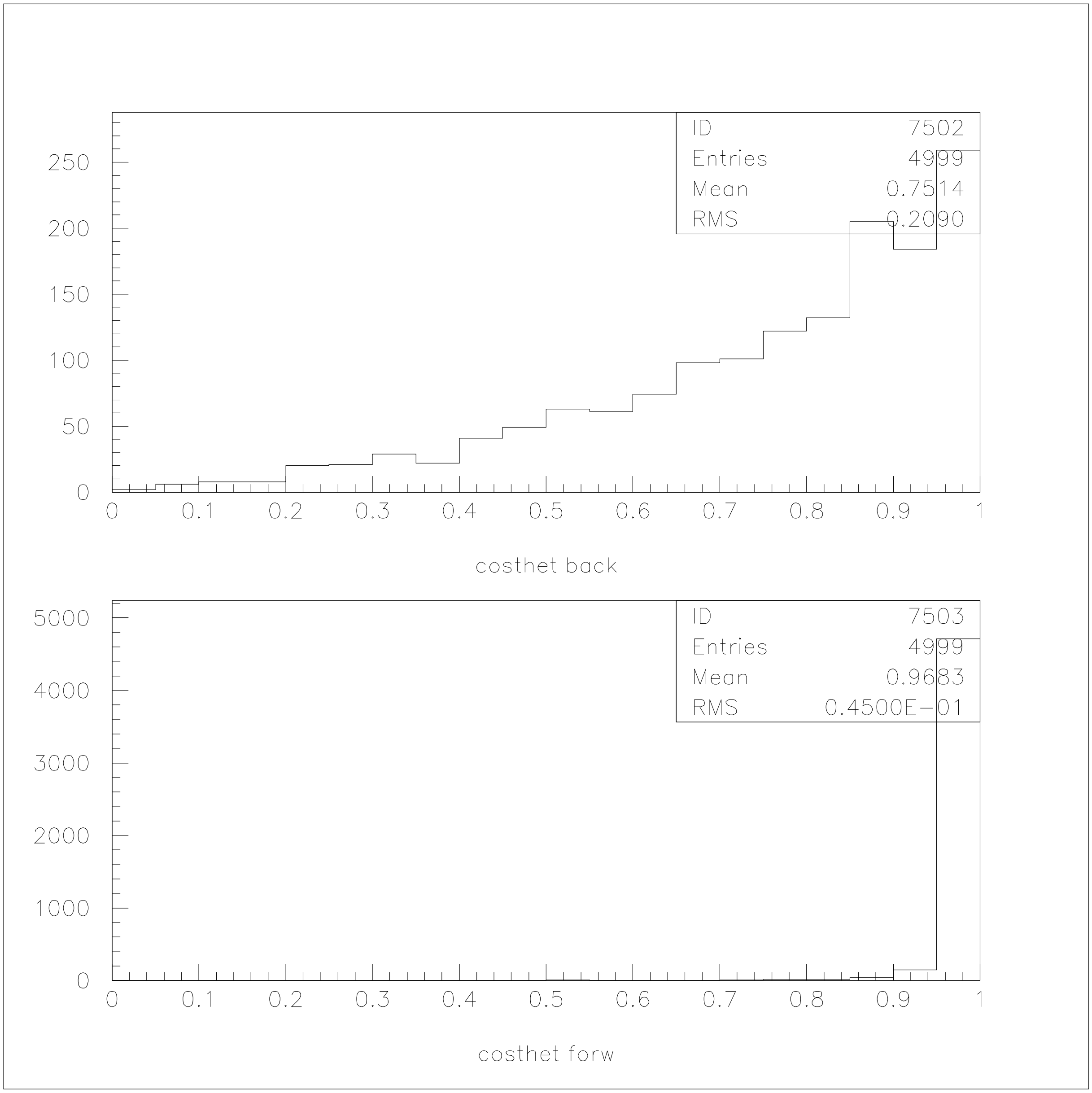
Channel	fraction of events with backward
TAU-mu DI	33.%
TAU-mu QE	4.6%
TAU-e DI	32.8%
TAU-e QE	5.5%
TAU-had DI	37.%
TAU-had QE	25.4%

SOME WAYS OF USING CS FOR PLANE FINDING

- 1) Use CS only for TAGGING based on presence or not of tracks: if neither CS1 nor CS2 has tracks, then recoils by one wall and take in it the brick. This works for DI but not for QE (because efficiency already very high)
- 2) Use pairs of CS tracks to make a vertex, then predict wall
- 3) Use the cut on the cosine of the smallest theta track (see notes); clear separation between backward and forward in the DI case; but nefast effect on QE events again.

If averaging on all channels, plane re-definition by CS is not obviously efficient

ABS(COS(θ_{min})) for deep-inelastic tau-mu events



X-Y REDEFINITIONS BY CS

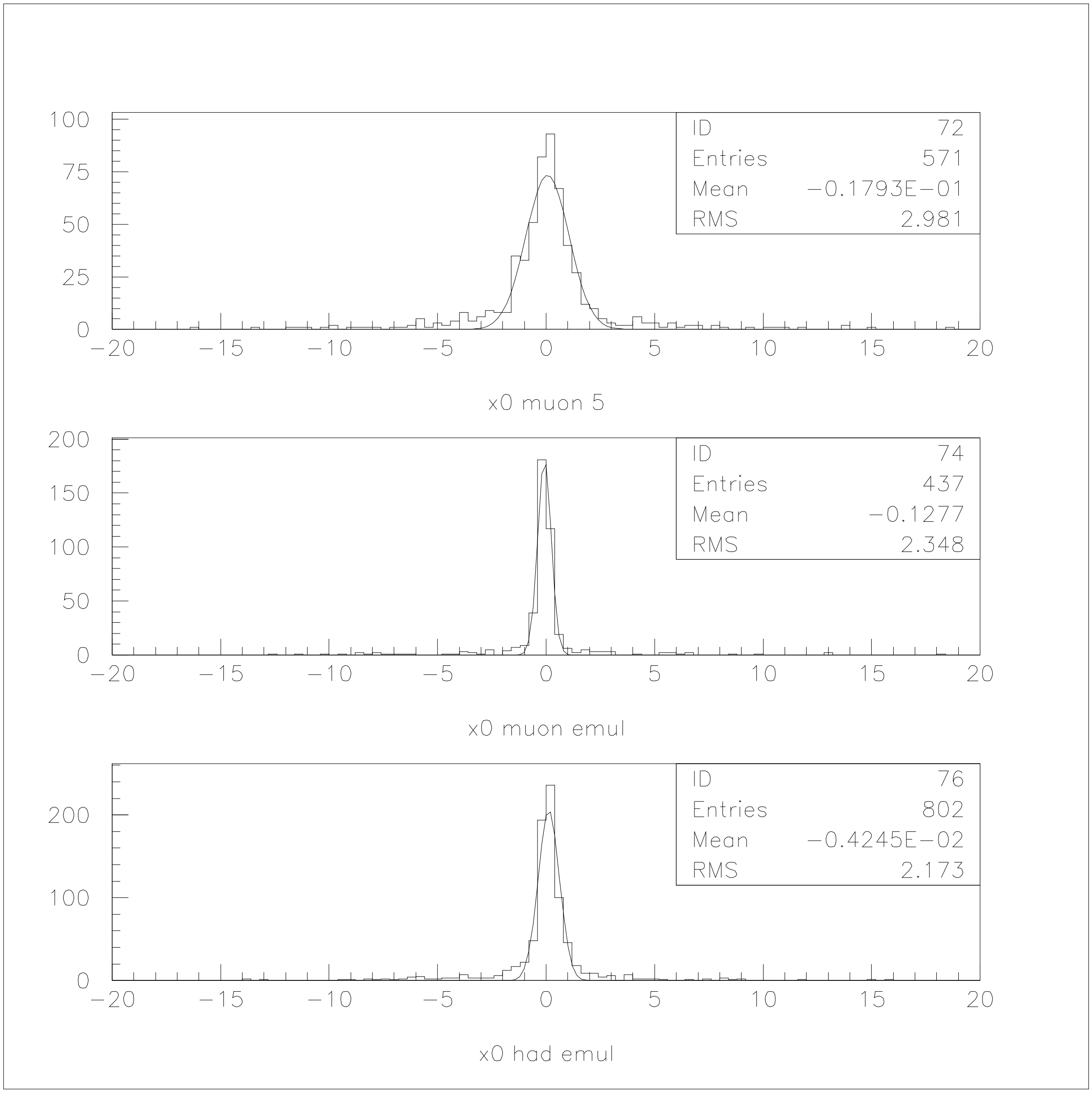
- A) Take tracker fit and associate in CS the corresponding muon track. The association efficiency depends of the muon energy (X-scattering) and of the mean number of hadronic tracks in the CS. The best result is only using track angles comparison.
  - DI tau-mu: 73%
  - QE tau-mu: 98.9%
  - DI CC: 86.%
  - QE CC: 99.6%
- B)Use of the mean predicted X-Y by the CS tracks (average on slopes and positions)
- C) Use of the X,Y vertex obtained by 2*2 CS track association with two projection constraint (Zx-Zy smaller than...)

Sequence:

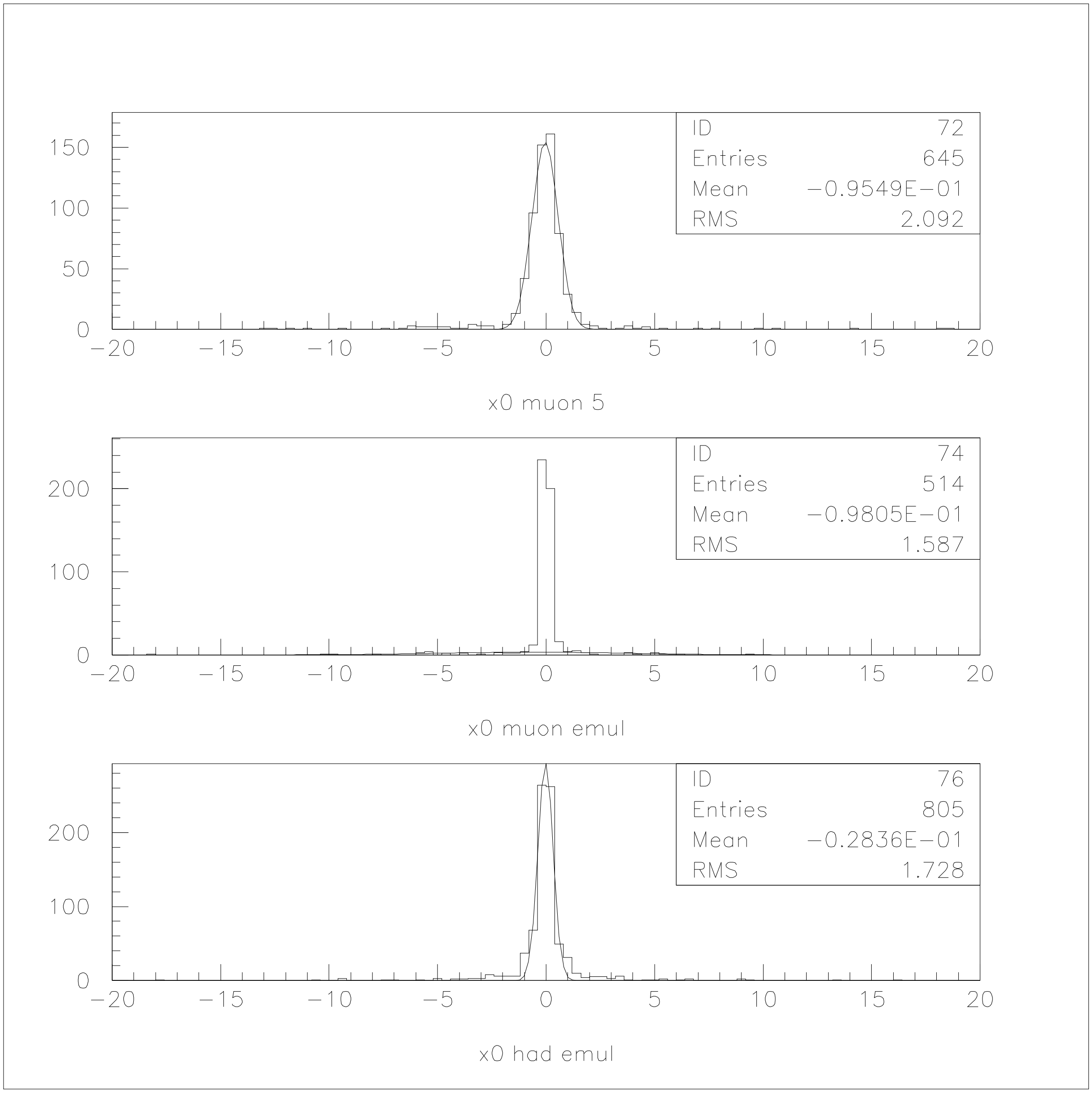
- Start with(B) (defaut)
- If V2, takes V2 (C)
- If associated muon: take muon (A)

If the CS resolution is intrisically better, tails and providing the wrong CS (in Z or in X-Y) attenuates the improvment: averaged on all channels, this is 1.4% in DI mode and 0.5% in QE mode

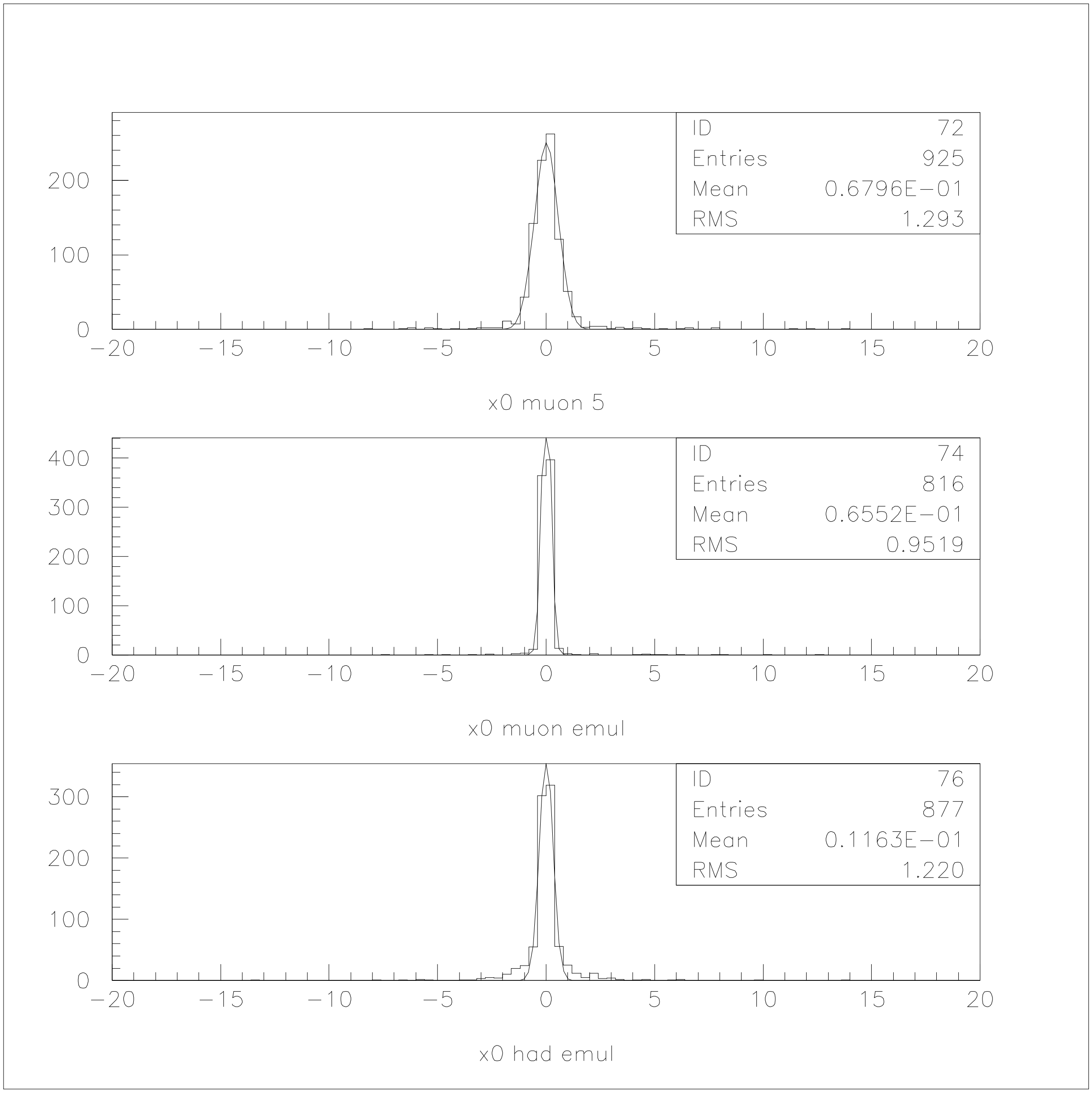
Vertex predictions: tau-mu DI



Vertex predictions: tau-mu QE



Vertex predictions: CC QE



RESULTS

QE EVENTS			DI EVENTS		
CS	no CS	gain	CS	no CS	gain
Tau-mu b.f.e 67.9% plane 77.8%	68.6% 84.5%	0.99	68.7% 81.6%	61.7% 78.9%	1.1
Tau-e b.f.e 77.2% plane 85.6%	73.6% 88.5%	1.05	72.2% 83.9%	69.4% 82.6%	1.04
Tau-had b.f.e 65.4% plane 79.5%	60.3% 76.6%	1.08	74.9% 84.1%	71.4% 83.1%	1.05

- OVERALL GAIN: 1.05 (insensible to 0.2 cm CS X and Y disalignment)
- TAGGING and " voisine" shift: 1.04
- TAGGING without " voisine": 1.015

EFFECT OF ADDING BACKGROUND TRACKS

- Very important effect;
- Tau mu DI: 68.7 – 61.3
- Tau el QE: 77.2 – 69.8

Adding a scan window centered on the tracker vertex; tau-mu DI :

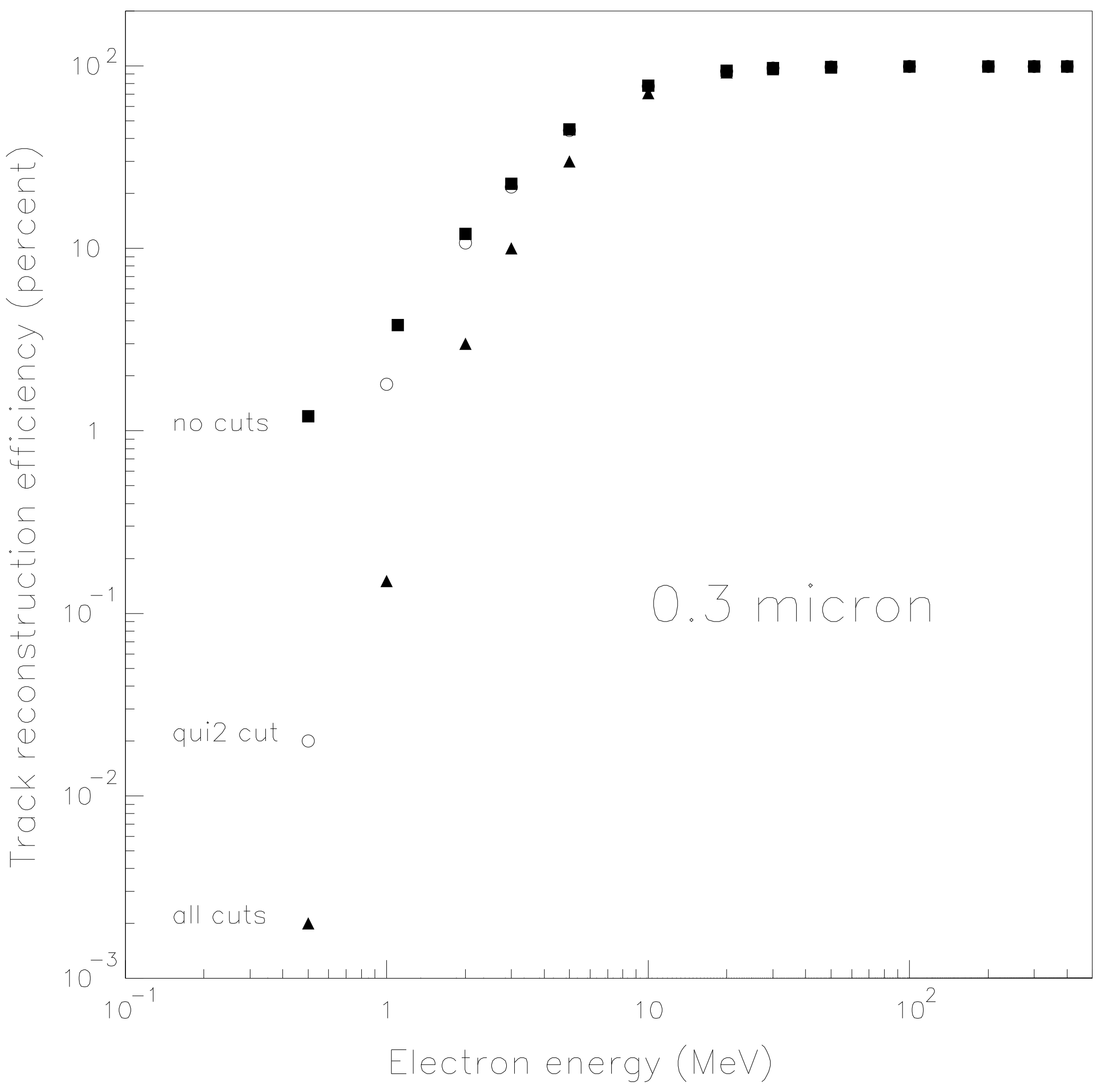
Scan window	0 tr	0.5 tr	1 tr	mean surface
2*2	60.3%		55.3%	13 cm2
4*4	64.9%		59.1%	47 cm2
6*6	66.6%	64.4%	60.8%	86 cm2
8*8	67.7%		61.%	120 cm2
10*10	68.3%		61.6%	141 cm2
the whole	68.5%		61.3%	153 cm2

(J.F Opera note on backgrounds)

The following table give the number of expected found base tracks in one CS for one year exposure, without refreshing effect. In the special case of wall radioactivity, the effects are of course concentrated near the edges of the detector, as shown in fig 1, and also in wall 1 and 24. For the total, we have excluded these parts, where the high number of tracks makes the possible use of CS difficult. UPDATES: only minor effects

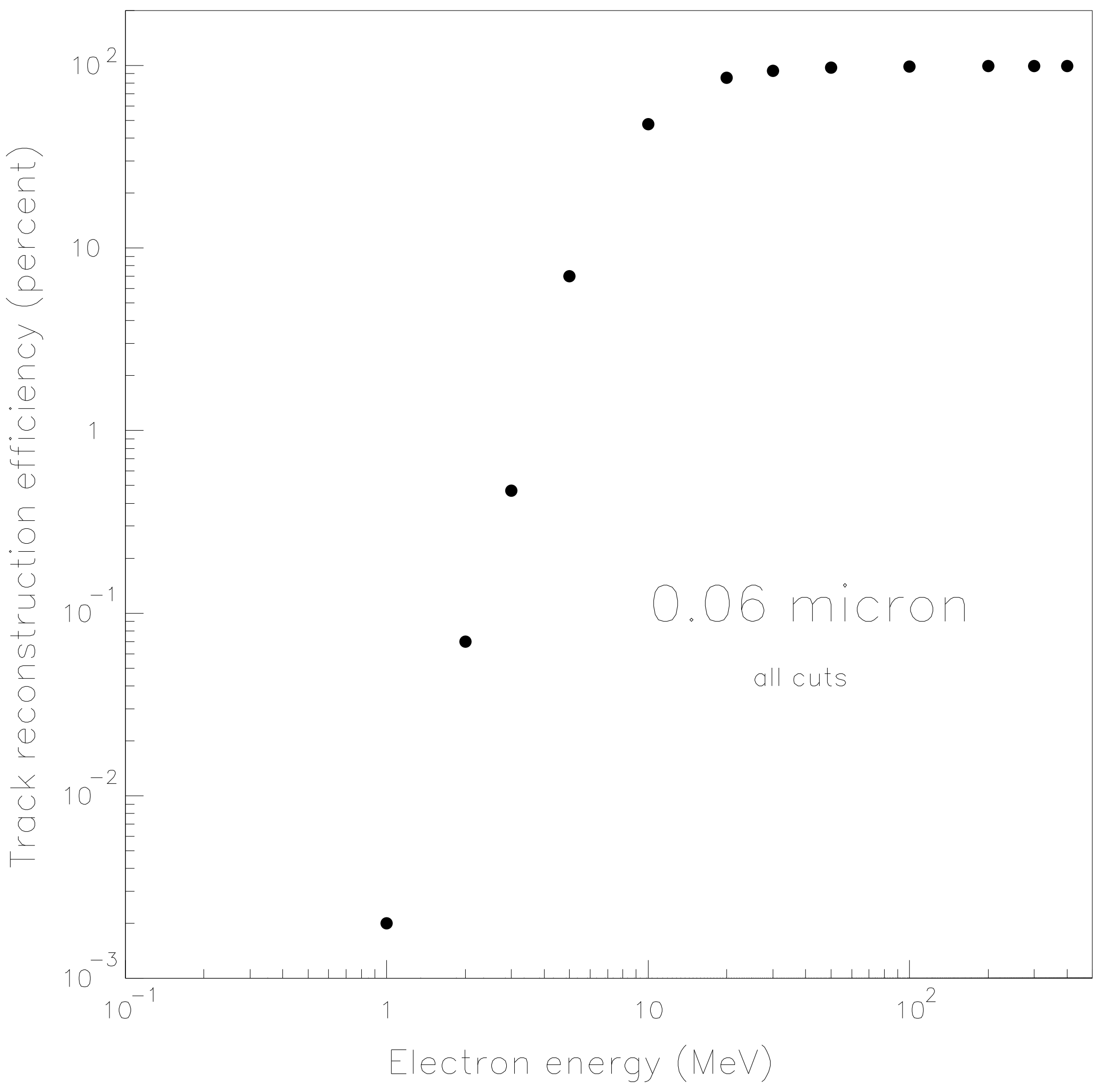
process	$\tan\theta \leq 1$ tracks/CS/year	$\tan\ \theta \leq 0.4$ tracks/CS/year	remarks
ν in front rocks	1.2	1.2	
ν in lateral rocks	0.22	0.18	
ν in detector	1.	0.65	
Cosmic muons	54.	6.	
Wall radioactivity	500.	125.	-for detector edges
Wall radioactivity	1.2	0.3	-inner part
Lead radioactivity	8.5	2.	
Glue radioactivity	0.8	0.2	
Radon	0.5	0.12	
Total	67.5	10.5	-inner part

Electron efficiency with a grain resolution of 0.3μ

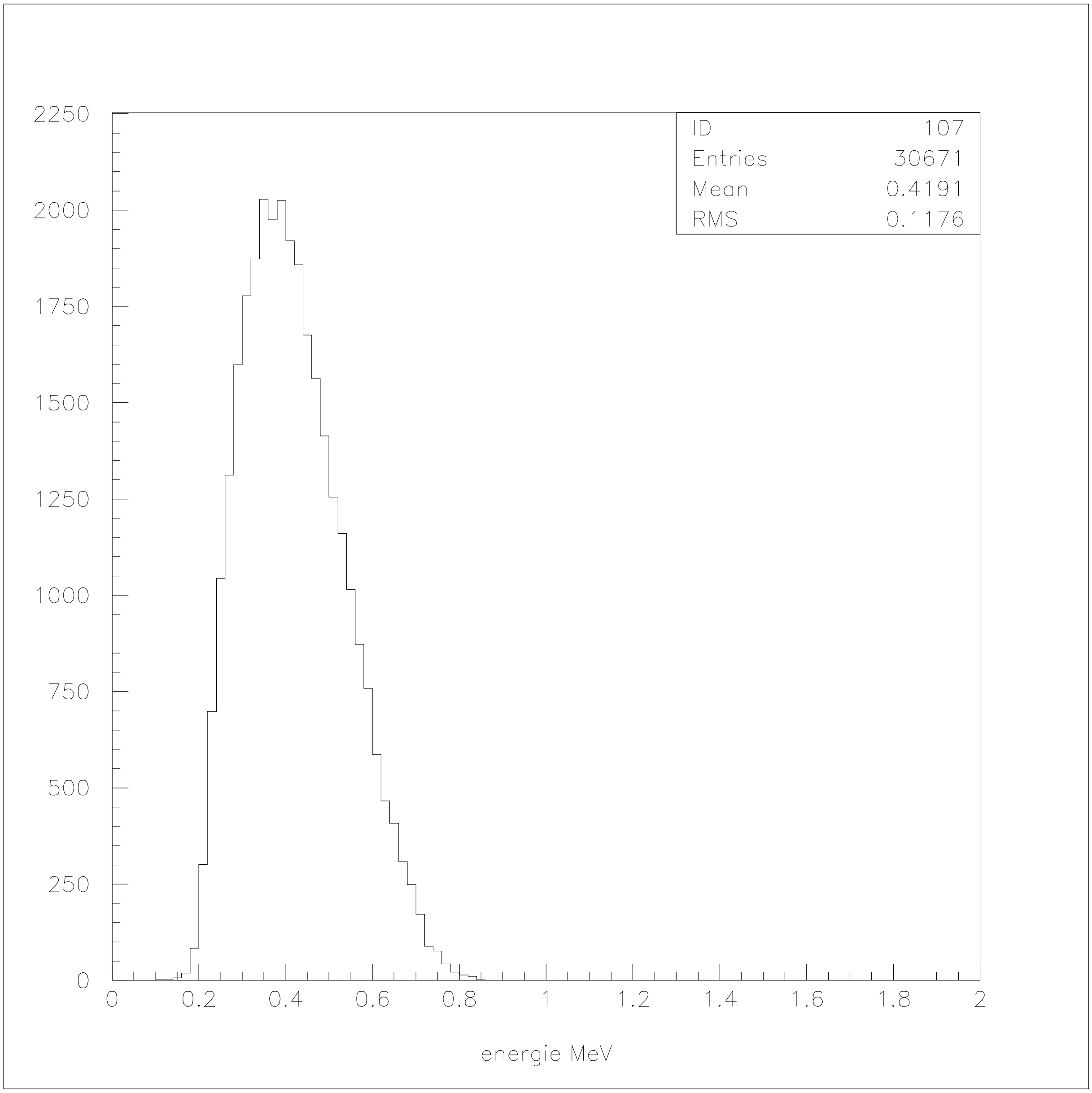


Track reconstruction efficiency (percent)
10^2
10
1
10^-1
10^-2
10^-3
no cuts
qui2 cut
all cuts
0.3 micron
10^-1
1
10
10^2
Electron energy (MeV)

Electron efficiency with a grain resolution of 0.06μ



Beta electron energy at the CS entrance



CONCLUSIONS

- When no background, CS can improve BFE by 1.05; deception from x-y CS determination
- Insensible to 0.2 cm x y CS disalignments
- Gain mainly due to tagging (1.04 without x y z vertex redefinition)
- Dramatically sensitive to background tracks: need the best spatial accuracy to kill beta electrons from lead; algo for selecting tracks not to far from vertex to study.
- First estimation of mean CS surface to scan: about 60 cm2 ?
- Improve NN for plane finding
- NN FOR CLASS DETERMINATION SHOULD BE EXTREMELY USEFUL TO PERSONALIZE CUTS