CUTS ON β RECONSTRUCTION IN TOF FOR ANTIDEUTERONS ANALYSIS

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GOALS

- Optimization of β recostruction in TOF.
- Rejection of events with large scattering.
- Rejection of events with large χ^2 (the numerical method does not work).
- Background rejection:

$$m = p\sqrt{\left(\frac{1}{\beta^2} - 1\right)} > 1.6 \text{ GeV/c}^2.$$

Tuning of cuts and rejection of background with antiprotons.

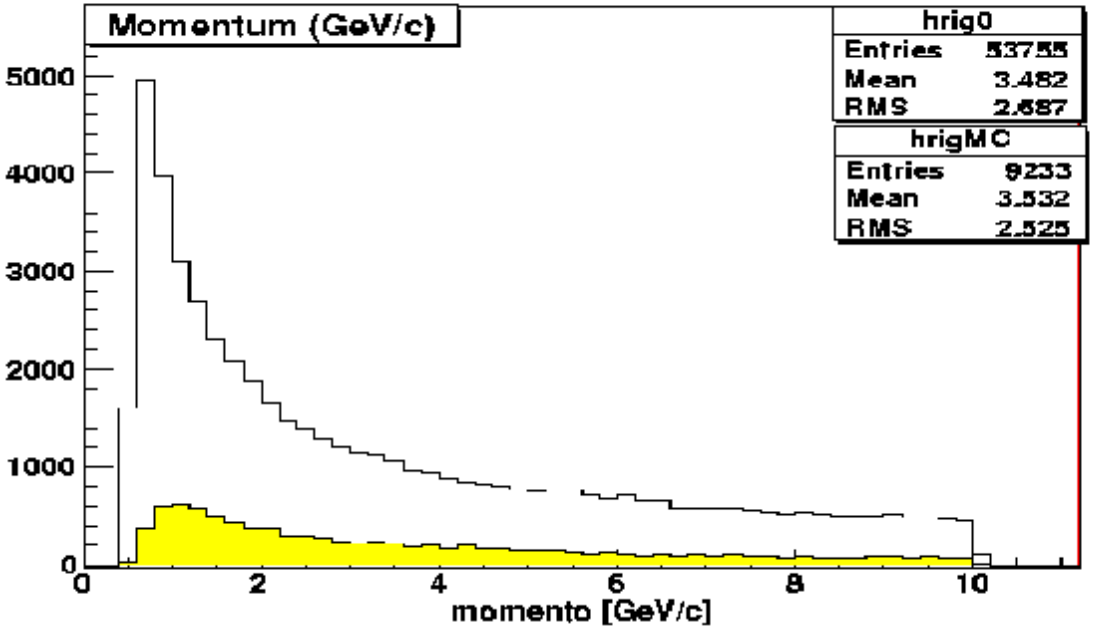
PRESELECTION

Generation:
Logaritmic spectrum for particles generated with momentum between 0.5 and 10 GeV/c, and generated on the plane above AMS-2.

- No signal in Anticoincidence Counters.
- Only 1 Track for 1 AMS particle.
- A track in TRK.
- A track in TRD.
- A measurement of beta (in TOF).
- Absolute value of the charge = 1.

EFFICIENCY OF PRESELECTION

	D	***e*$^-$**	***p***	***anti_p***
Eff. presel.	0.264	0.166	0.272	0.172

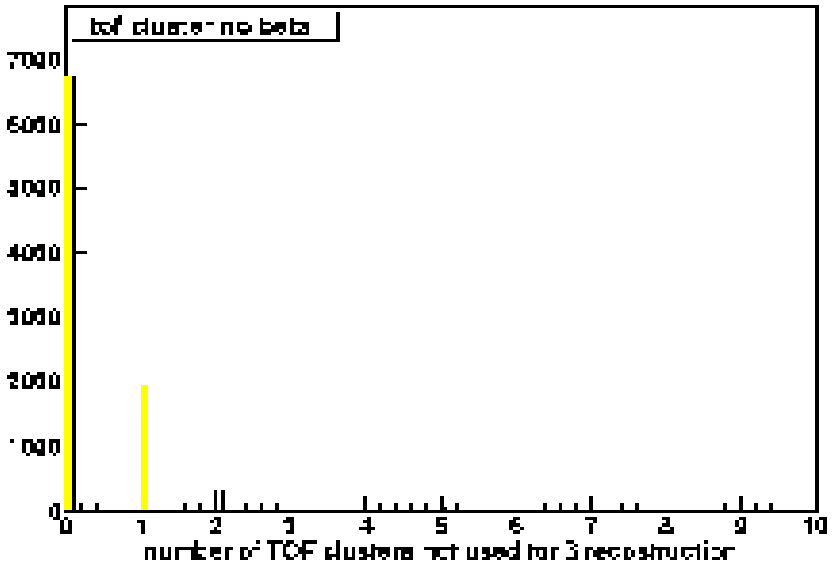


distribution of generated momentum. The yellow graph comes after the preselection cuts, while the other one is without selections.

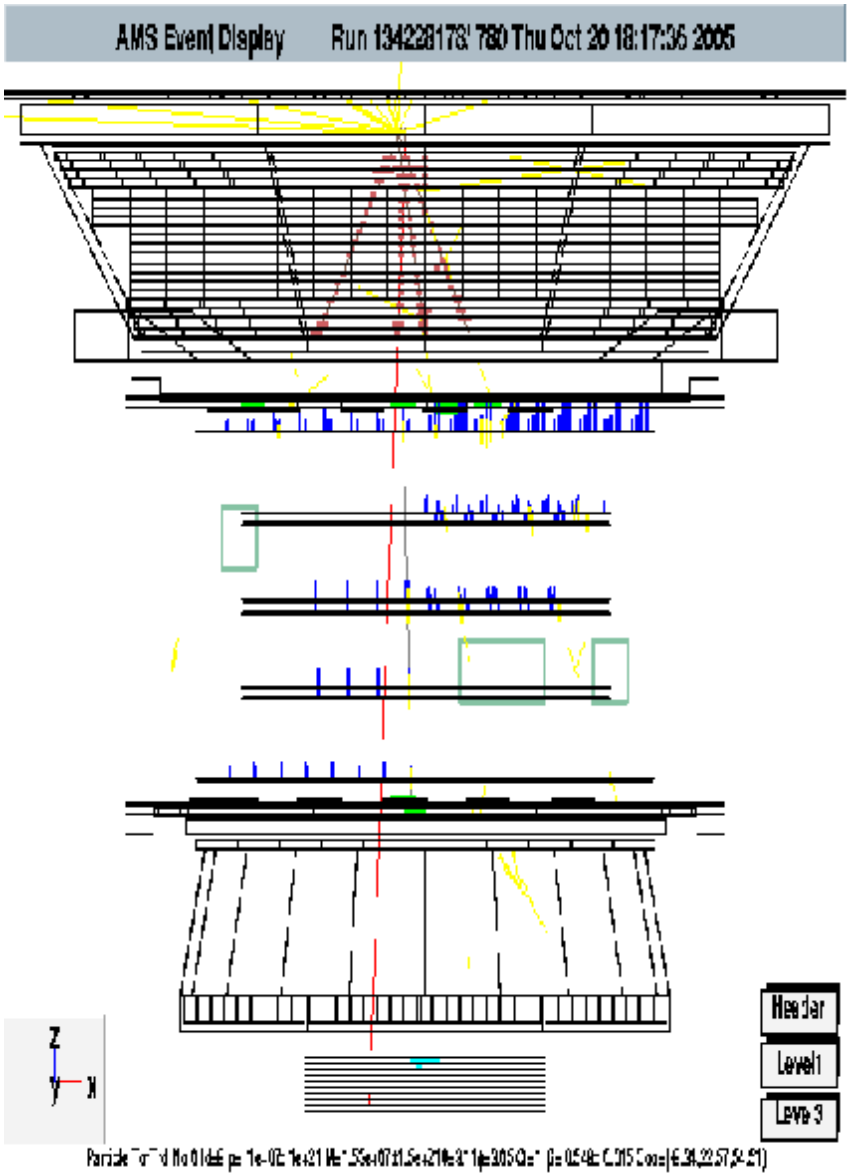
Proposed cuts in TOF

- Num. of TOF cluster not used for β recostruction.
- Num. of TOF layers used for β recostruction.
- χ^2 of time fit.
- Distance between TOF cluster and the extrapolation of the track reconstructed in TRK.
- Cut on the value of recostructed β.

Num. of TOF clusters not used for β recostruction



rejected!



Num. of TOF clusters not used for β recostruction

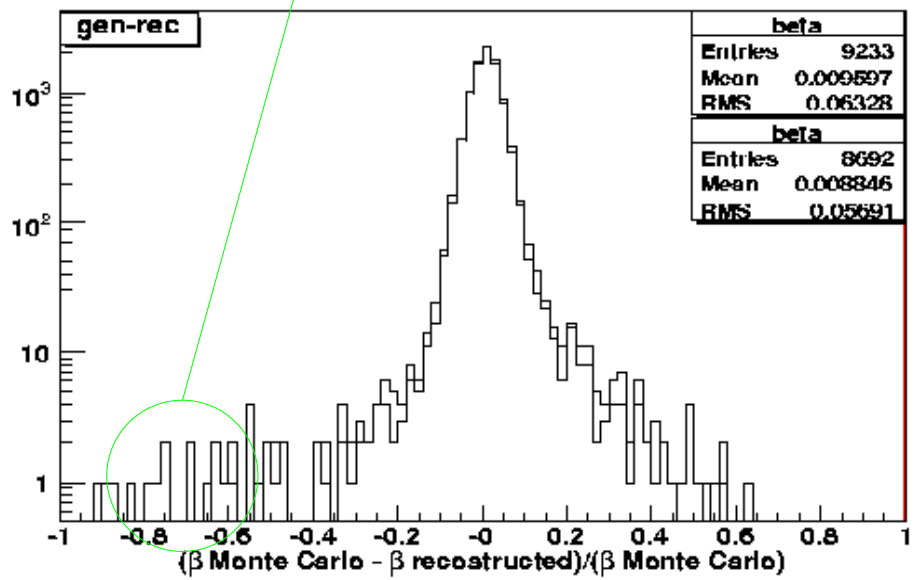
distribution of (β Monte Carlo - β recostructed)/(β Monte Carlo) for the two values of the cut and compared with the preselection cuts distribution.

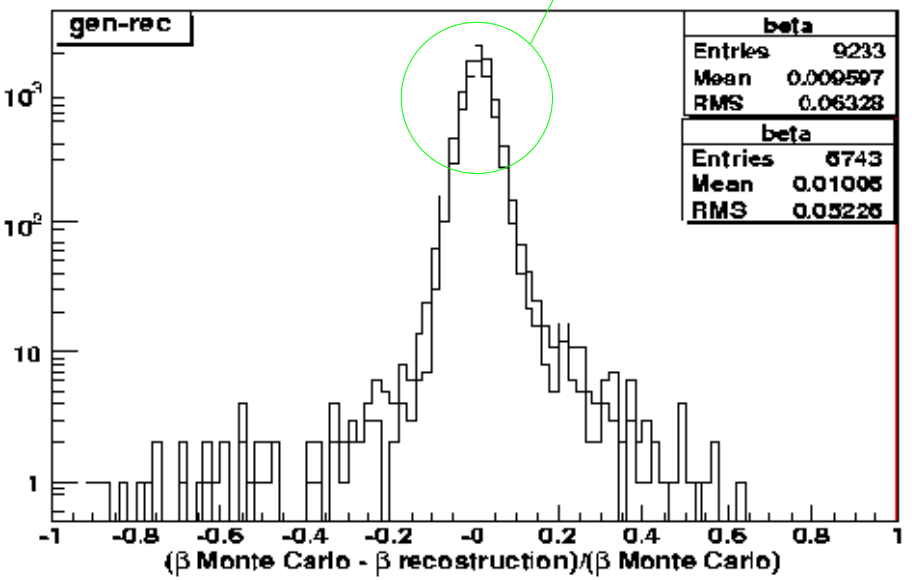
Num. clusters not used <2

Num. clusters not used <1

Overstimated β, it is good to cut this tail

Cuts events in peak!



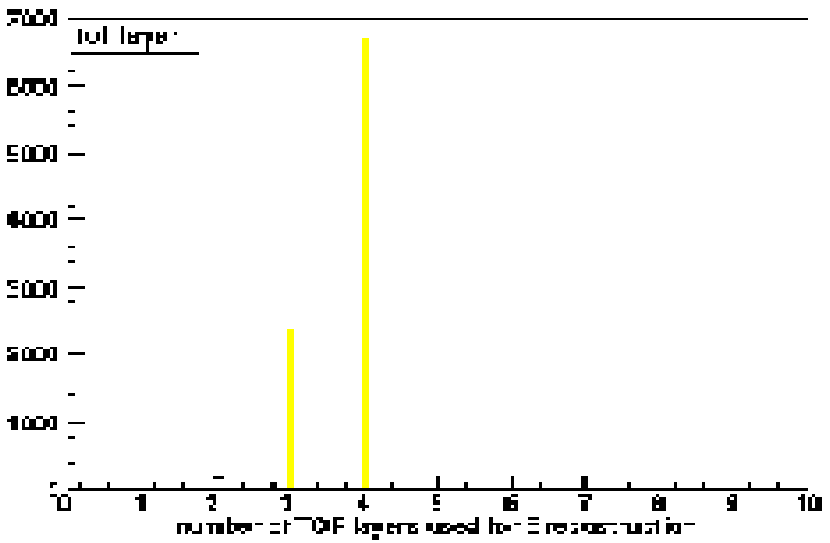


Eff. antiprotons: *0.941*

Eff. deuterons: *0.938*

So choose clusters not used<2

Num. of TOF layers used for β recostruction



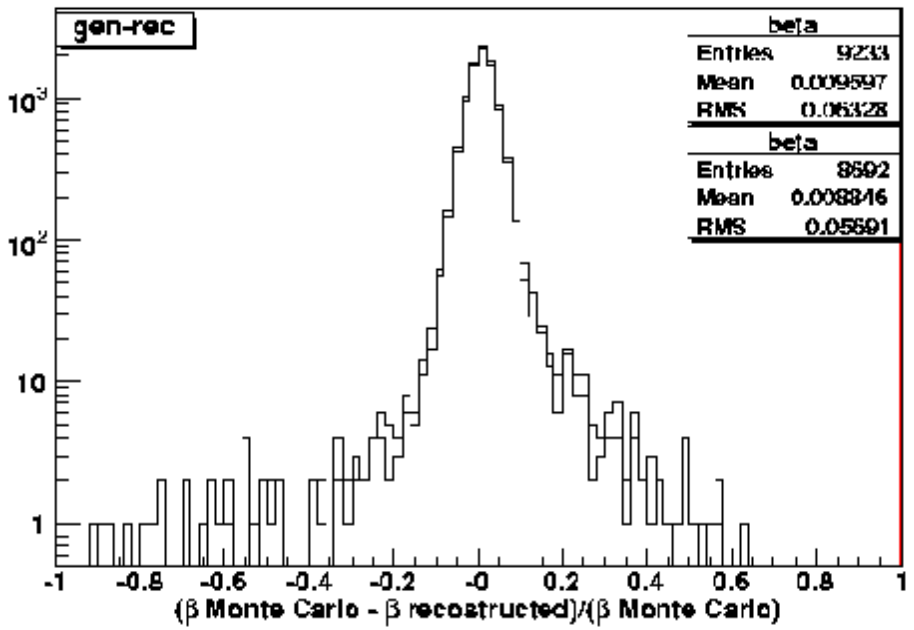
Eff. antiprotons: *0.981*

Eff. deuterons: *0.953*

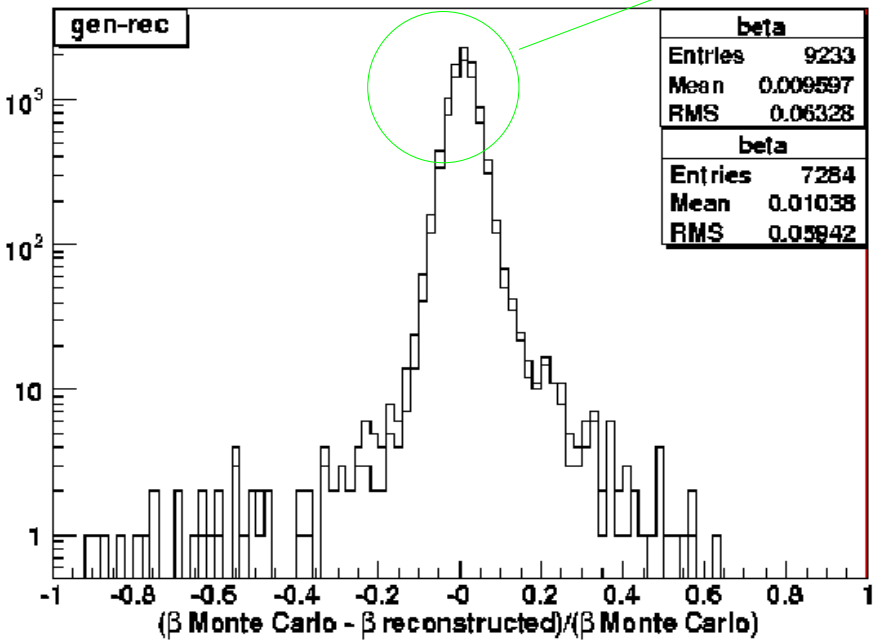
Num. of TOF layers used for β recostruction

distribution of (β Monte Carlo - β recostructed)/(β Monte Carlo) compared with the preselection cuts distribution.

Num. layers used=3 or 4



Num. layers used=4

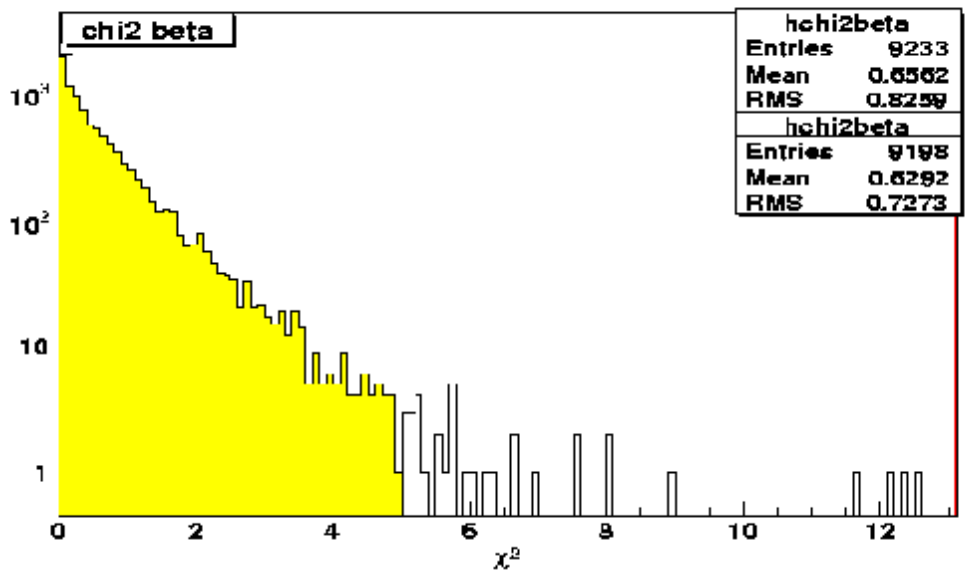


So choose layers used=3 or 4

χ^2 on time fit

Cuts on antiprotons (deuterons):

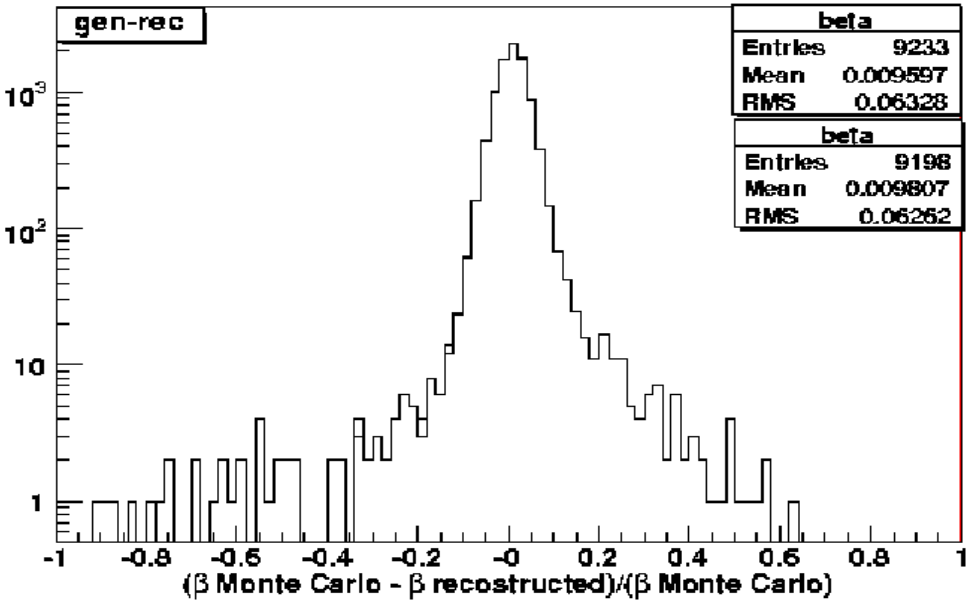
χ^2=3	ε=0.978
χ^2=3.5	ε=0.987
χ^2=4	ε=0.991
χ^2=4.5	ε=0.994
χ^2=5	ε=0.996 used (0.997)
χ^2=5.5	ε=0.997



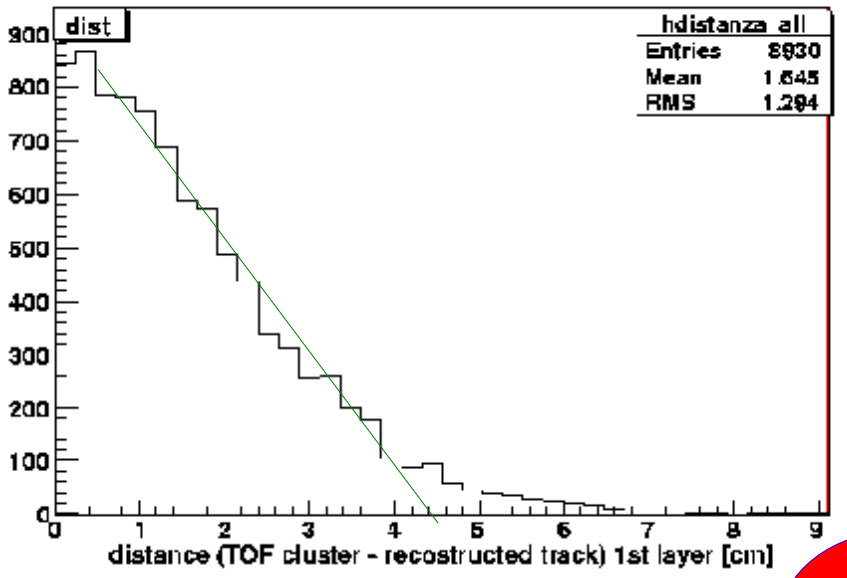
χ^2 on time <5

distribution of (β Monte Carlo - β recostructed)/(β Monte Carlo) compared with the preselection cuts distribution.

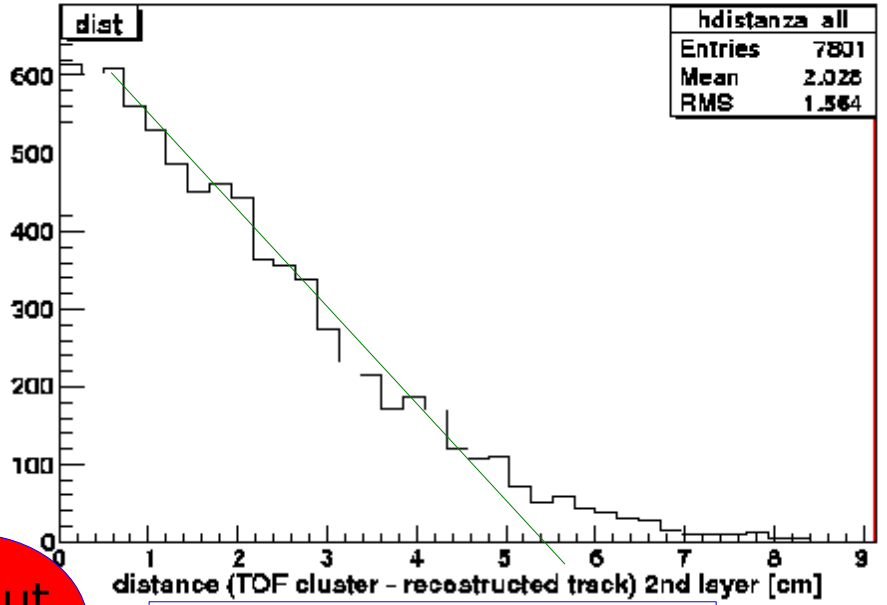
We still think about optimization



Distance TOF cluster - reconstructed track

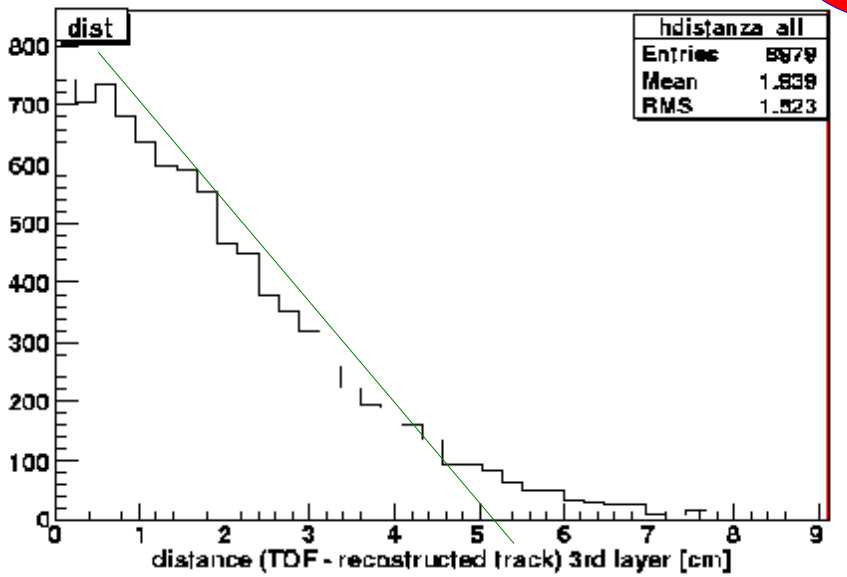


dist=$|x_{TOF}-x_{trk}|$<4.5 cm

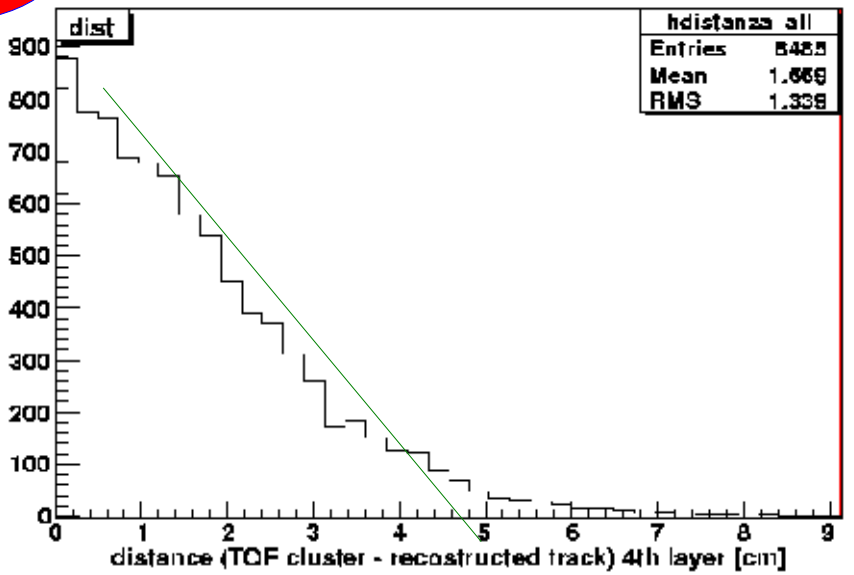


dist=$|y_{TOF}-y_{trk}|$<5.5 cm

We cut tails!



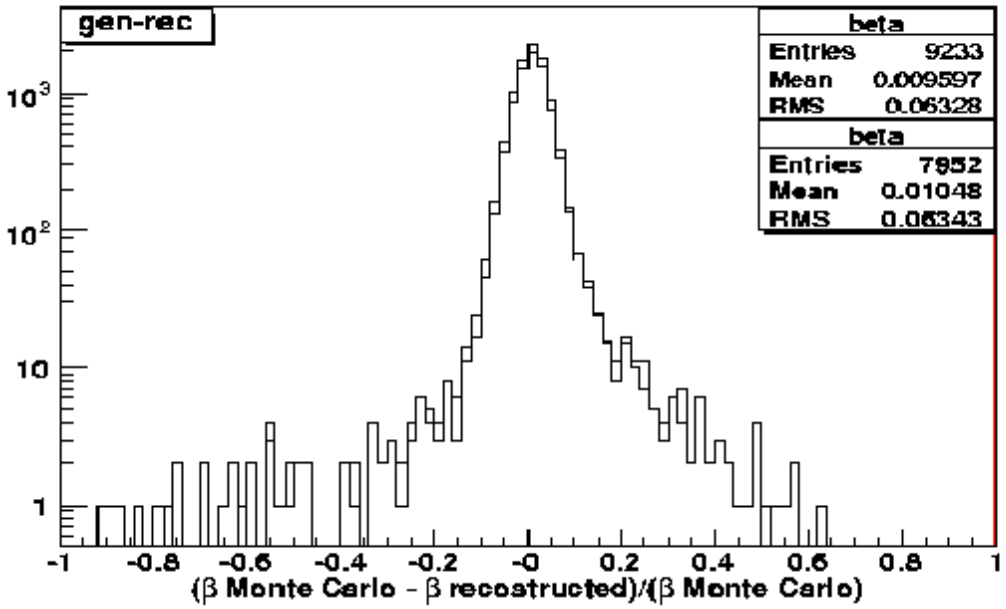
dist=$|y_{TOF}-y_{trk}|$<5 cm



dist=$|x_{TOF}-x_{trk}|$<4.5 cm

Distance TOF cluster - reconstructed track

distribution of (β Monte Carlo - β recostructed)/(β Monte Carlo) compared with the preselection cuts distribution.



We still think about optimization

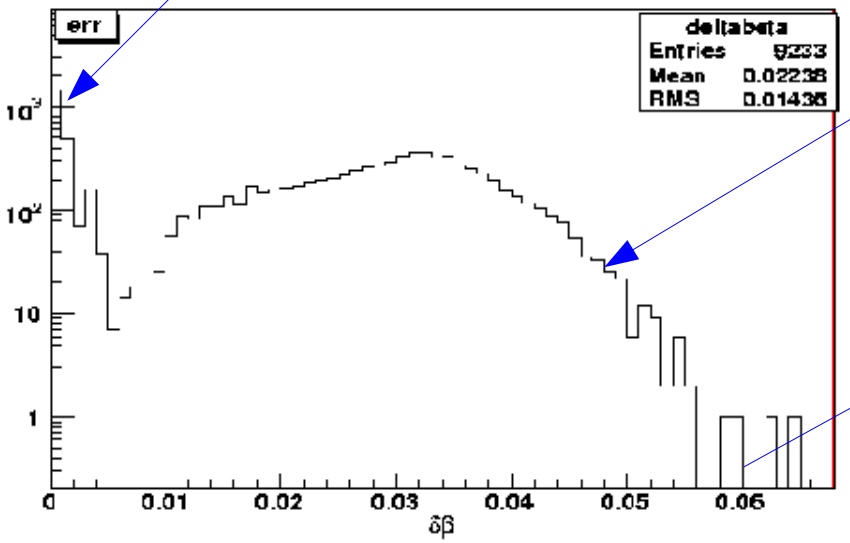
Eff. antiprotons: *0.861*

Eff. deuterons: *0.886*

Cut on β value

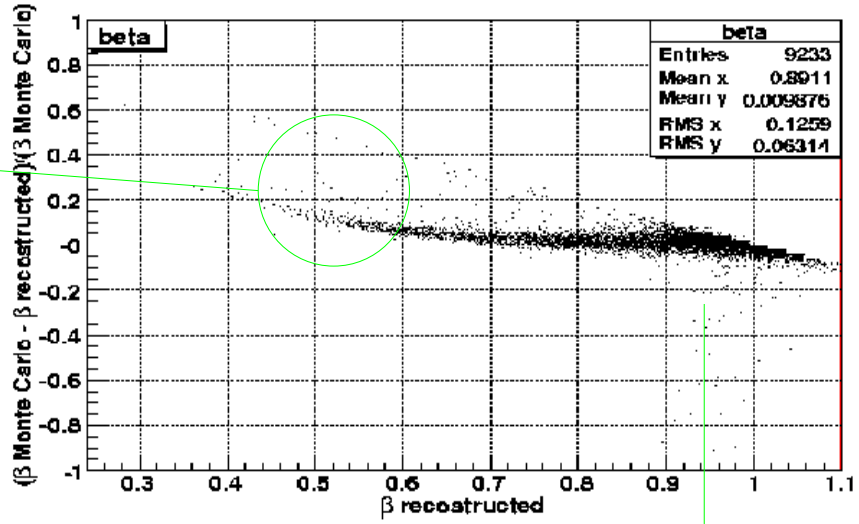
RICH

TOF



Maximal error=0.06
so we can cut β<0.94

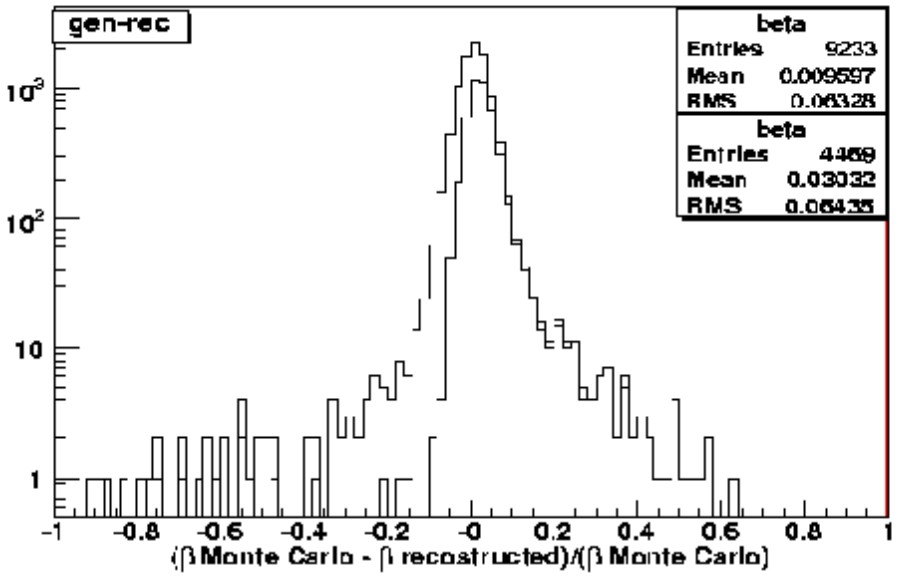
For low β
maybe a systematic
correction can be done



Cutting here
we reject
also good events!

Cut on β value

distribution of (β Monte Carlo - β recostructed)/(β Monte Carlo) compared with the preselection cuts distribution.



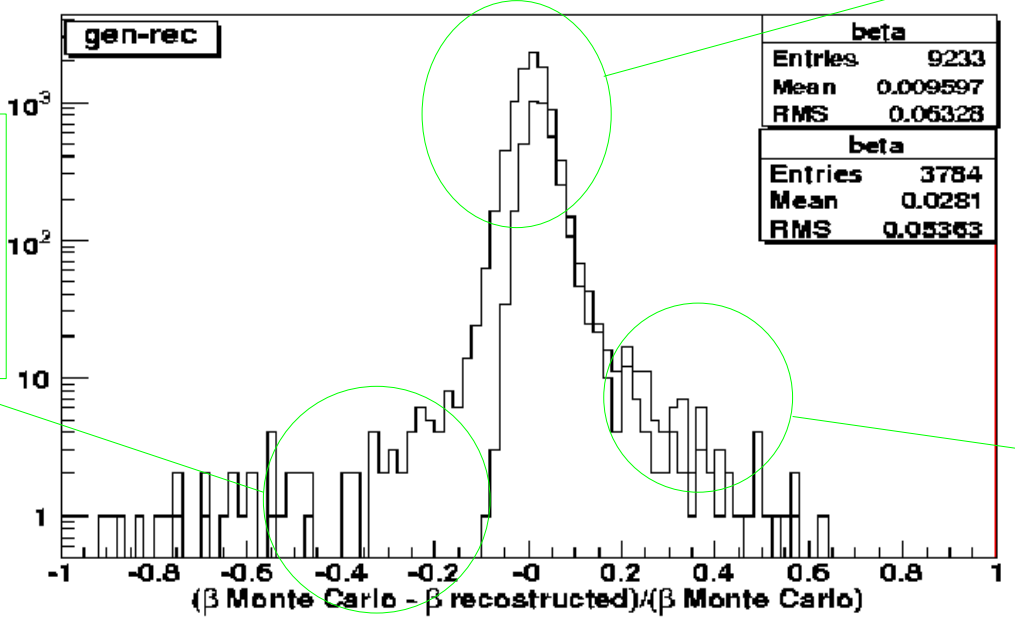
β<0.94

Eff. antiprotons: *0.646*

Eff. deuterons: *0.780*

Total results on TOF

- Num. of TOF clusters not used for β recostruction <2.
- At least 3 TOF layers used for β recostruction.
- χ^2 on time <5.
- Distance between the cluster and the reconstructed track <4.5 cm, 5.5 cm, 5 cm, 4.5 cm for the 4 layers respectively.
- Recostructed β <0.94



Cuts events in peak!

Good rejection of events with overstimated β!

We still look for a cut or a correction for this tail...

distribution of (β Monte Carlo - β recostructed)/(β Monte Carlo) for all the TOF cuts compared with the preselection cuts distribution.

SUMMARY

Total efficiencies for TOF cuts:

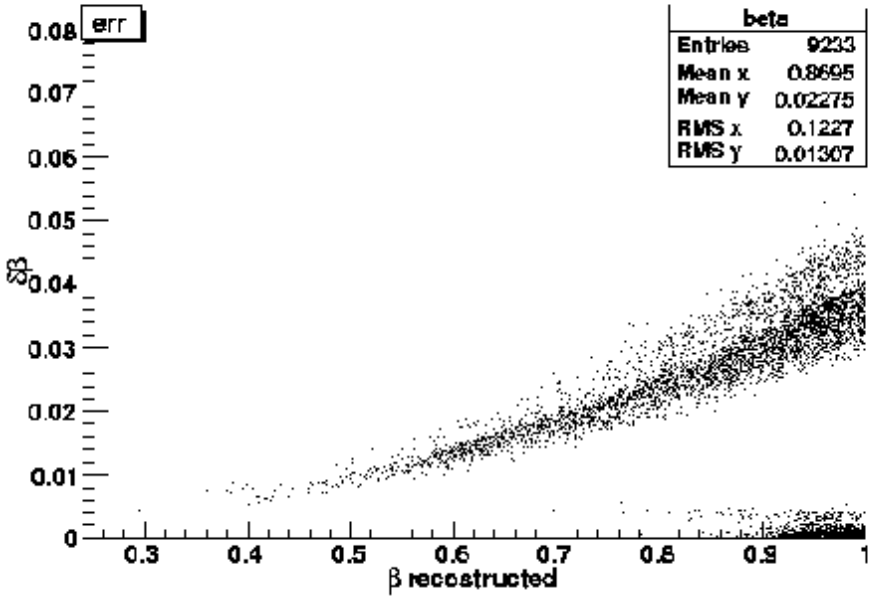
	D	***e*⁻**	***p***	***anti_p***
Eff. TOF cluster	0.938	0.909	0.970	0.941
Eff. TOF layer	0.953	0.962	0.982	0.981
Eff. χ^2 beta	0.997	0.995	0.996	0.996
Eff. dist.	0.886	0.810	0.859	0.861
Eff. β	0.780	0.025	0.686	0.646
Total eff. (TOF)	0.561	0.005	0.458	0.410
Total eff. (TOF) m>1.6 GeV/c^2	0.532	0.001	0.008	0.008

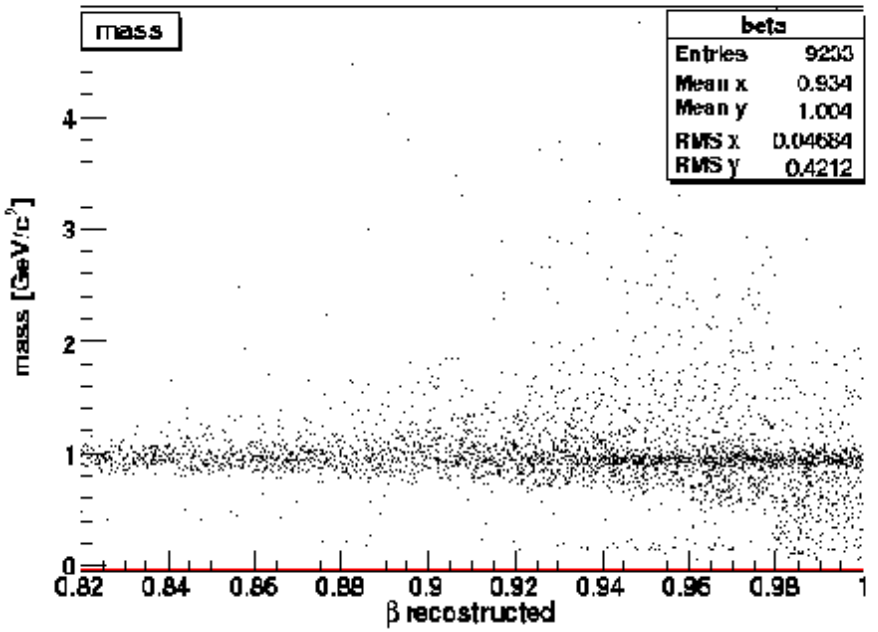
Conclusions

- A set of cuts on β recostruction in TOF are presented.
- Still some details to optimize.
- About 56% efficency for signal and 0.8% efficiency for antiproton background

BACKGROUND REJECTION ...

$$m = p\sqrt{\left(\frac{1}{\beta^2} - 1\right)} \quad > 1.6\ \mathrm{GeV/c^2}$$





BACKGROUND REJECTION ...

$$m = p\sqrt{\left(\frac{1}{\beta^2} - 1\right)} \quad > 1.6 \text{ GeV/c}^2$$

Test on β TOF to see the rejection of antiprotons background:

	β <0.95	β <0.90	β <0.85	β <0.80
Eff. tot test	0.571	0.385	0.282	0.207
Eff. peak test	0.697	0.555	0.453	0.347
Eff. tail test	0.414	0.070	0.002	0.000

Datas taken after preselection for antiprotons with masses 0.88 GeV/c^2<m<1.08 GeV/c^2 and 1.6 GeV/c^2.

… BACKGROUND REJECTION

$$m = p\sqrt{\left(\frac{1}{\beta^2} - 1\right)} \quad > 1.6 \text{ GeV/c}^2$$

Test on β TOF to see the rejection of antiprotons background:

	β <0.95	β <0.90	β <0.85	β <0.80
Eff. antiprotons	0.467	0.074	0.003	0.000
Eff. deuterons	0.912	0.754	0.639	0.539

Datas taken after preselection for antiprotons with masses 1.6 GeV/c^2 and for events without a signal in RICH.