Background study using CAL

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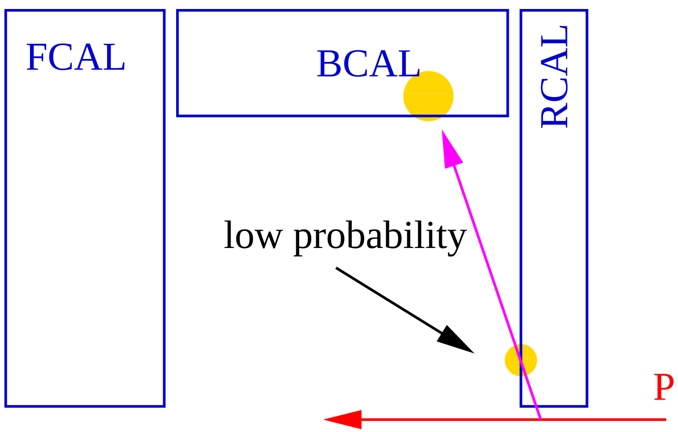
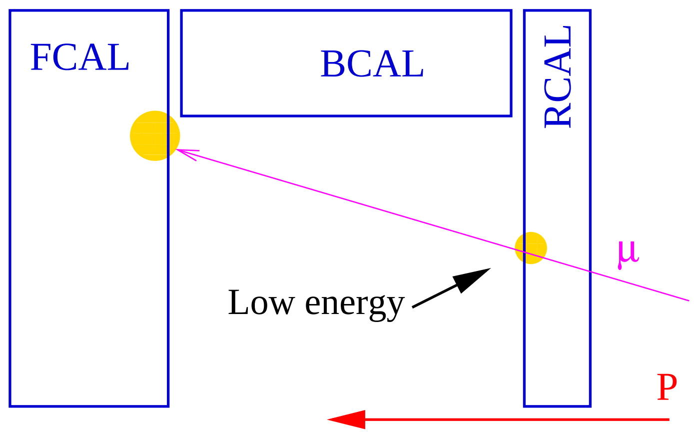
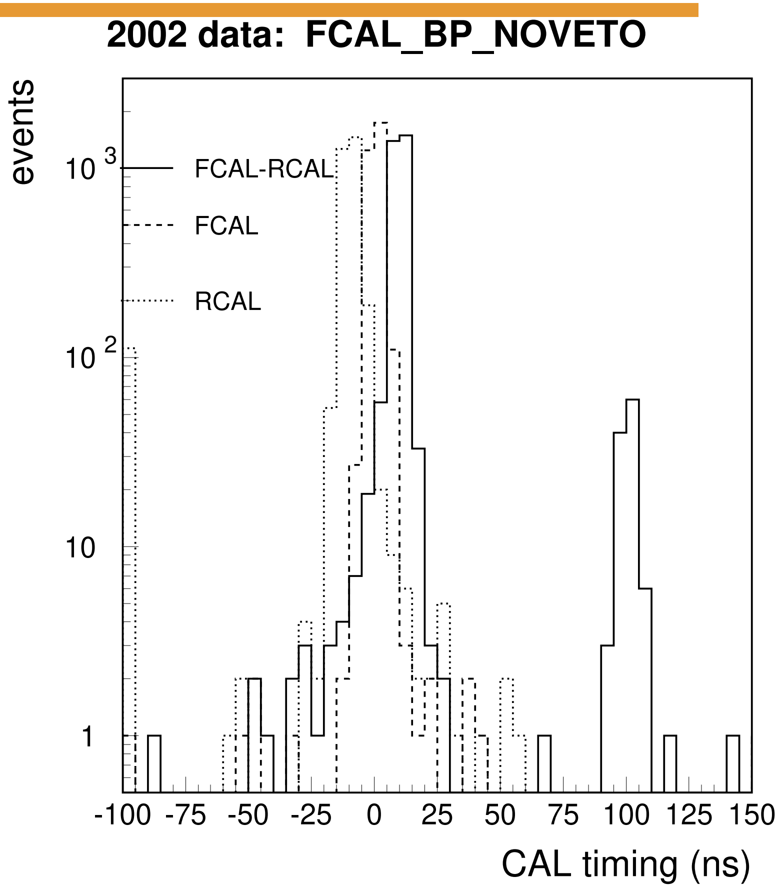
To study the origin of background using energy flows is difficult: CAL is well protected from outside ($\boldsymbol{\sim 100 X_0}$ for RCAL), therefore, only timing can be used:





CAL timing

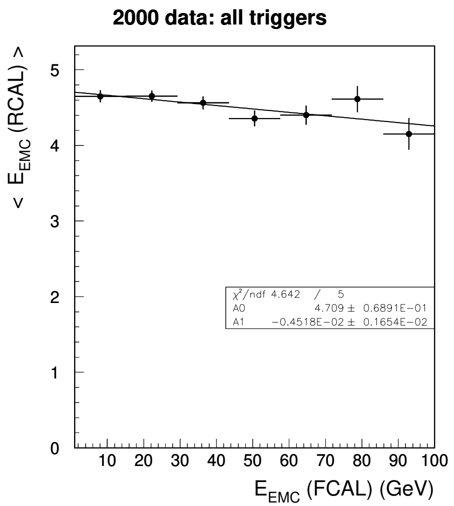


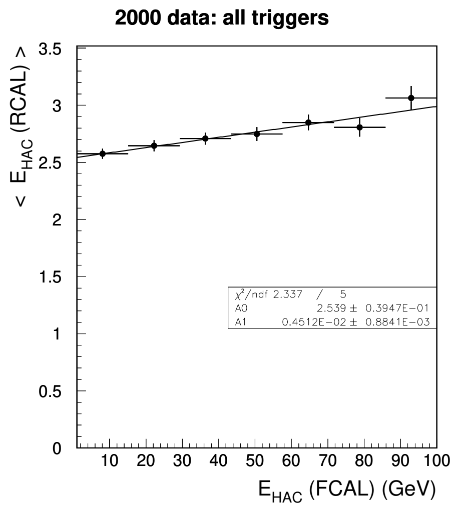
1. p-data: FCAL_BP_NOVETO
2. runs: 41719-41726
3. $E_{RCAL} > 1$ GeV and E_{FCAL}>1 GeV
4. peak at 100 ns means no timing from RCAL
5. main peak at ~ 9 ns

Looking at energies in FCAL and RCAL

One possibility - to look at dependence of energies in RCAL as a function of energies in FCAL

$$< E_{RCAL} >= aE_{FCAL} + b, \qquad a = 0 \text{ for no correlation}$$



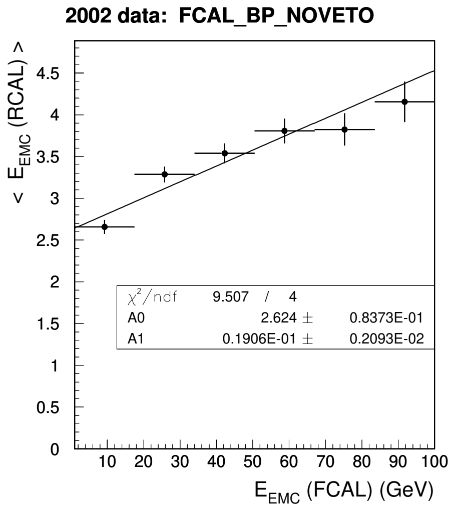


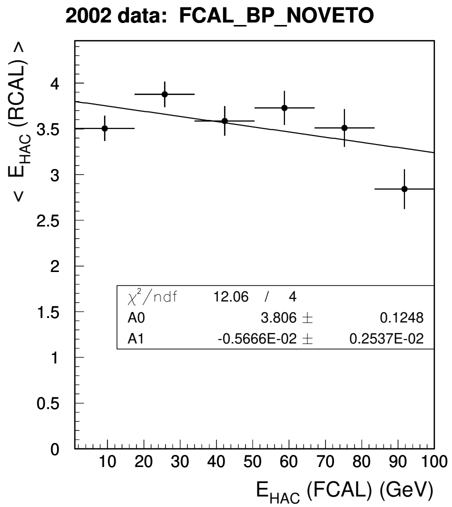
- very small correlations for EMCs - dominated by independent production of low energetic particles
- large positive correlations for HACs : probably hadronic jets (dominated by PHP)

Looking at CAL energies for 2002 data

When correlations are possible ($\boldsymbol{a \neq 0}$):

1. particles from outside crossing RCAL and FCAL (muons)
2. admixture of events with a large multiplicity producing particles in all directions

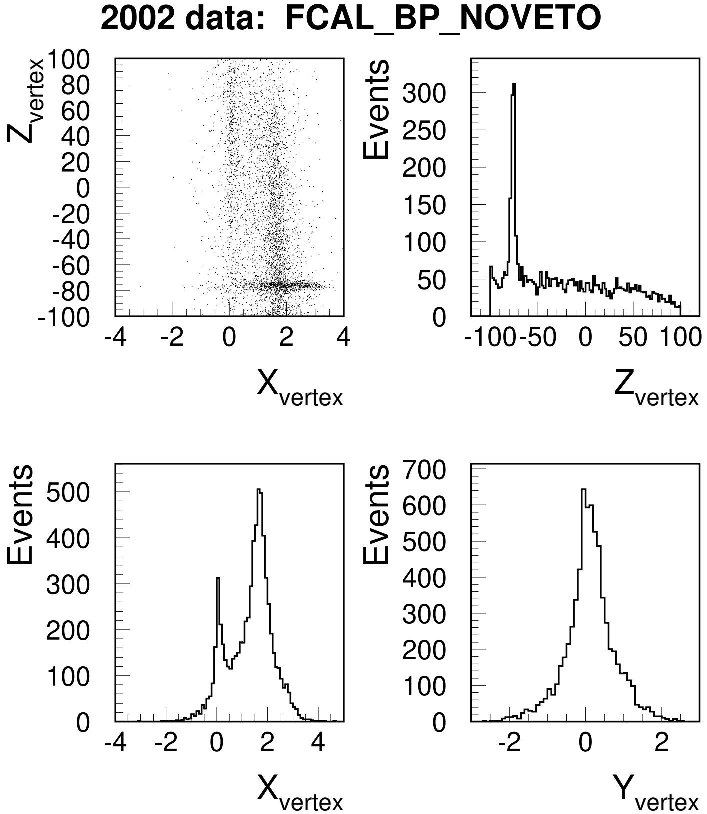




Significant correlations for EMC (?) and almost no correlations from HAC (!)

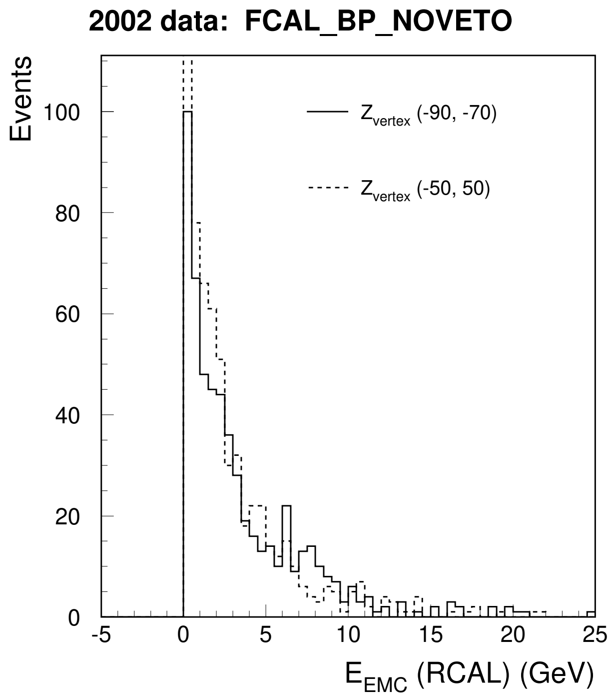
Opposite to physics events !

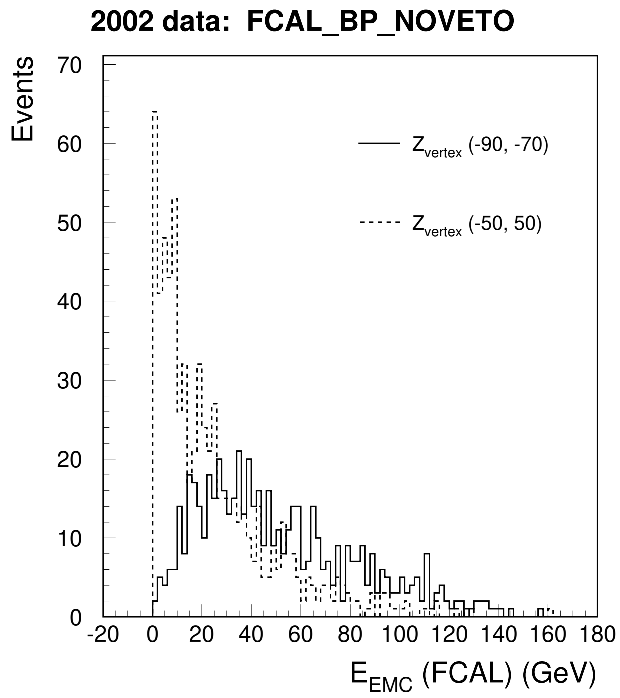
Looking at CTD vertex distributions



- Z_{vertex} has a peak at -80 cm
- X_{vertex} has 2 peaks: at 0 and 1.6 cm
- note that events with zero's are removed from plots

Distributions for different vertex cuts (proposed by Y.Yamazaki)





Events at $Z_{vertex} \sim -80$ are characterized by large FCAL EMC's energies

No significant effect is seen for RCAL

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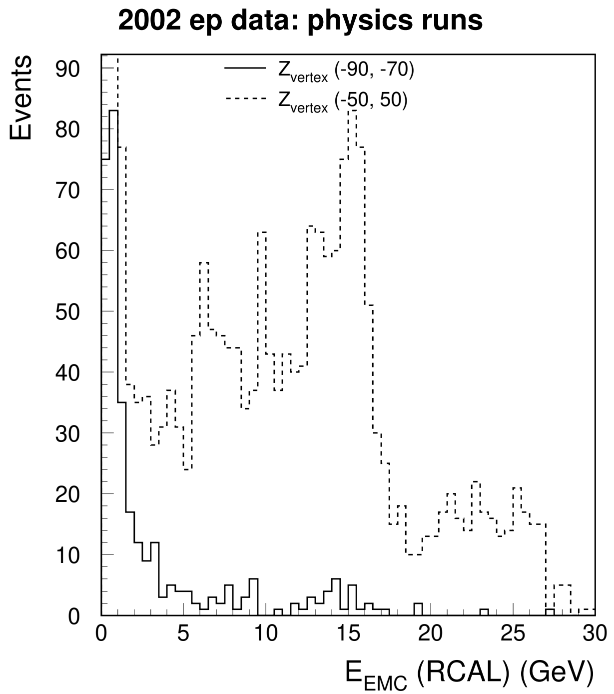
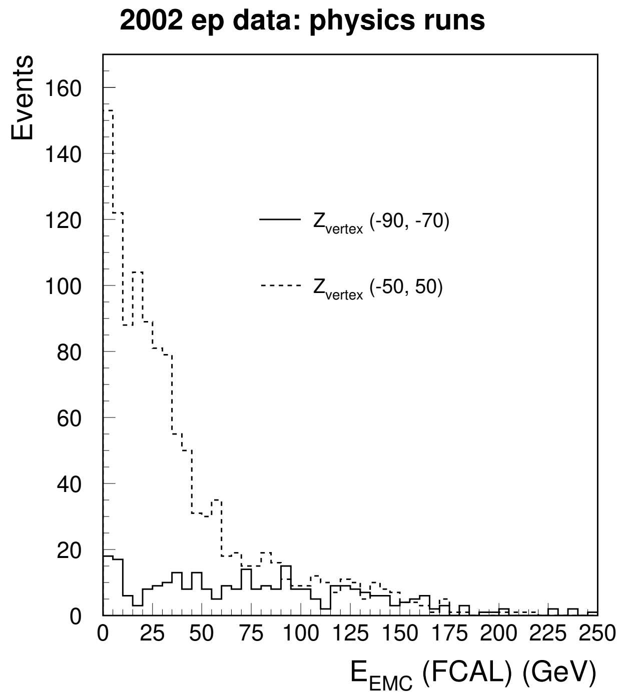
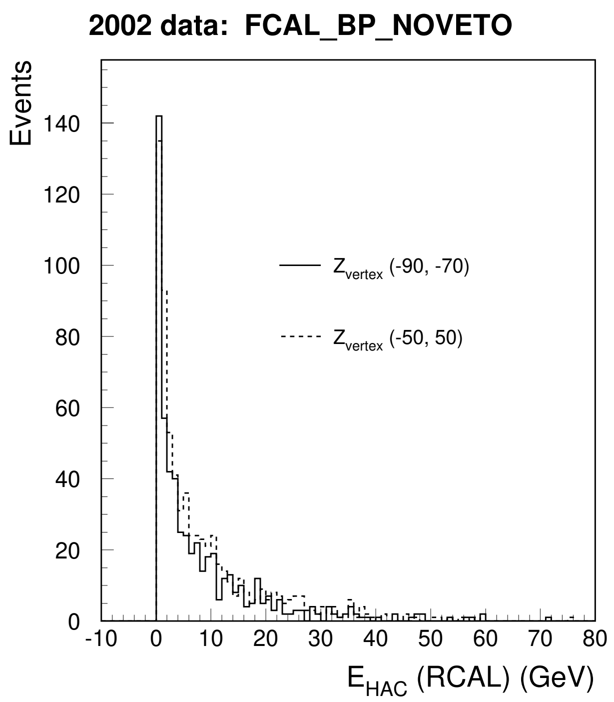
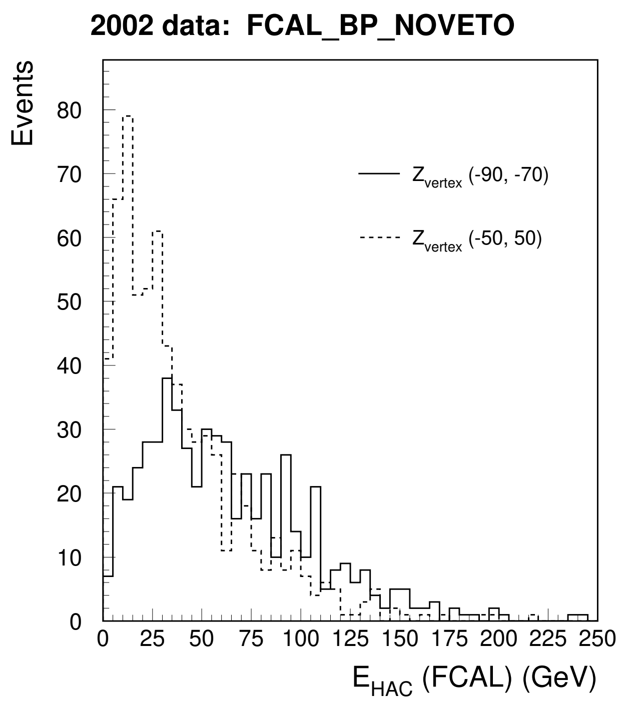




Events at $Z_{vertex} \sim -80$ are characterized by smaller FCAL EMC's energies

HAC's energy distributions for different vertex cuts (cont'd)

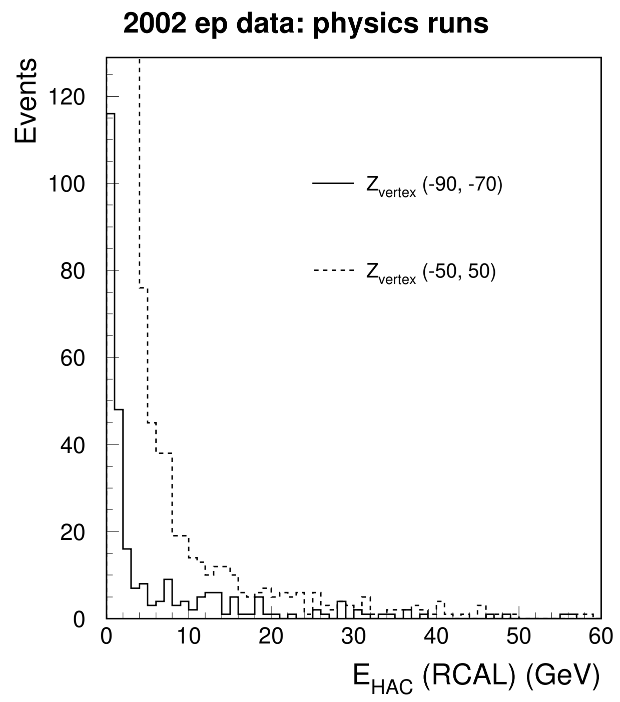


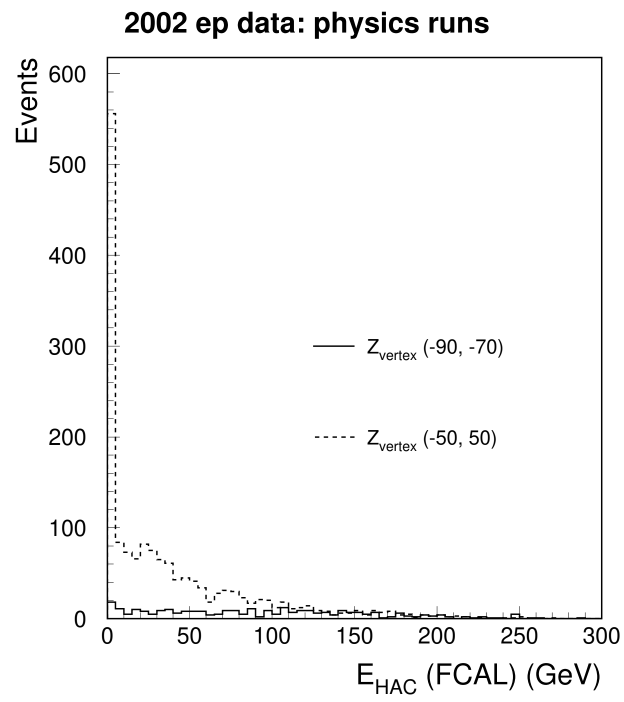


Events at $Z_{vertex} \sim -80$ are characterized by large FCAL HAC's energies

Again no significant effect is seen for RCAL

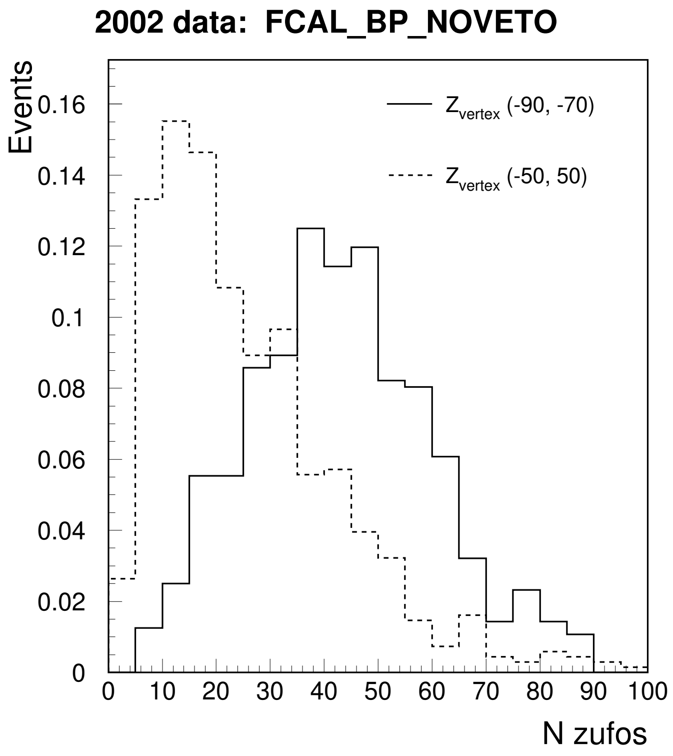
HAC's energy distributions for different vertex cuts (cont'd)





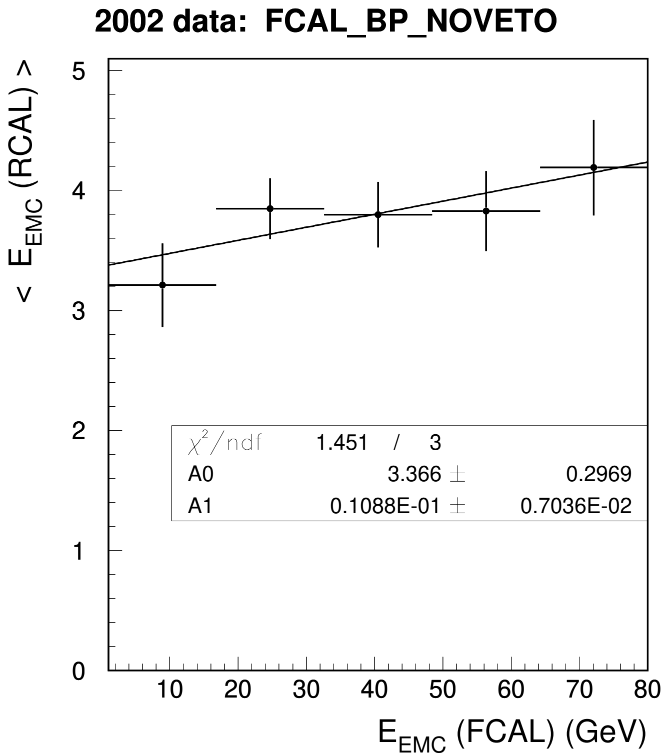
Events at $Z_{vertex} \sim -80$ are characterized by smaller FCAL HAC's energies

Distribution for number of Zufos' (cont'd)

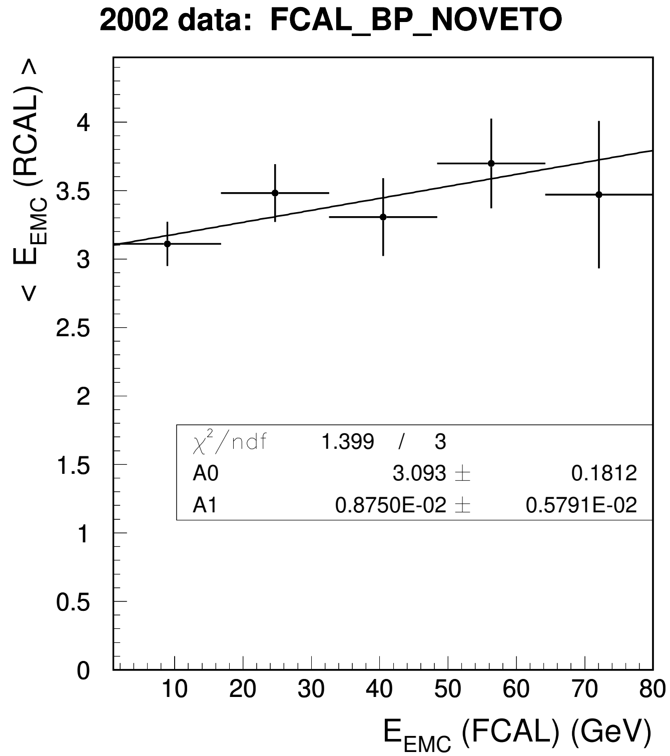


Large difference for multiplicities of Zufo's !

For $-90 < Z < -70$ cm



For $|Z| < 50$ cm



No difference for correlations

Summary

- This study shows that there is a unique signature for 2002 (only p) data: a correlation between EMCs of FCAL and RCAL.
- This can be understood if one assumes a contribution from events with a very large multiplicity (which populate entire CAL), and which have a larger electromagnetic component than the usual physics events.
- Looking at the vertex distribution, there are a few features: a peak at -80 cm (scatterings on C5) and double peak for $\boldsymbol{X_{vertex}}$.
- Decomposing events according to the CTD vertex indicates that there are significant differences between events coming from $\boldsymbol{Z_{vertex} \sim -80}$ and events with the correct vertex $\longrightarrow$ Events with $\boldsymbol{Z_{vertex} \sim -80}$ have very specific CAL energy distributions (and multiplicities of zufo's), and can be easily distinguished from events with only p-data as well as from usuall physics e+p data.