CALORIMETER WEIGHTS OPTIMIZATION

Using ORCA4:

1. Data from the spring 2000 production
2. QCD 2- jet events at low luminosity
3. Generator particle jets and calorimeter jets are found with the standard ORCA iterative cone algorithm (cone 0.5)
4. Calorimeter jets are matched to particle level jets if $\Delta r < 0.2$

Weighting procedure:

1. Calo jets are found with default ORCA_4_2_0 weights (old)
2. Then additional weights applied to recalculate jet energies:

$$E_{jet} = W_{eb}E_{eb} + W_{hb1}E_{hb1} + W_{hb2}(E_{hb2} + E_{hb3} + E_{hb4}) + W_{ee}E_{ee} + W_{he1}E_{he1} + W_{he2}E_{he2}$$

3. Jet energy corrections are calculated and applied (similar to Silvia and Andrei's corrections)
4. Jet energy resolution is calculated as $\frac{\mathrm{RMS}(E_T^{\mathrm{corr}}/E_T^{\mathrm{gen}})}{\langle E_T^{\mathrm{corr}}/E_T^{\mathrm{gen}}\rangle}$ over 20% of E_T^{gen}
5. Resolutions obtained with different weights are compared

The final weights presented in this report include energy scale corrections and are given with respect to CMSIM120 weights.

Table 1: Optimum weights and energy resolutions for ET=80 GeV jets

eta range	eb	hb1	hb2	ee	he1	he2	RESOLUTION CMSIM120 weights + energy corrections	RESOLUTION optimum weights
0.0 - 0.4	1.48	1.12	1.12				0.143	0.136
0.4 - 0.8	1.49	0.95	1.19				0.141	0.134
0.8 - 1.1	1.49	1.08	1.19				0.144	0.137
1.25-1.45	1.47	0.98	1.40	1.89	1.26	1.54	0.136	0.133
1.7 - 2.0				1.44	1.04	1.15	0.134	0.128
2.0 - 2.4				1.32	1.03	1.15	0.123	0.120

Increasing ECAL weight with respect to HCAL by 30% improves jet resolution by 3-5%.

Having HB1 and HE1 weights increased by a factor ~1.6 in CMSIM120 seems to be optimal (though the effect on the jet energy resolution is below 1%)

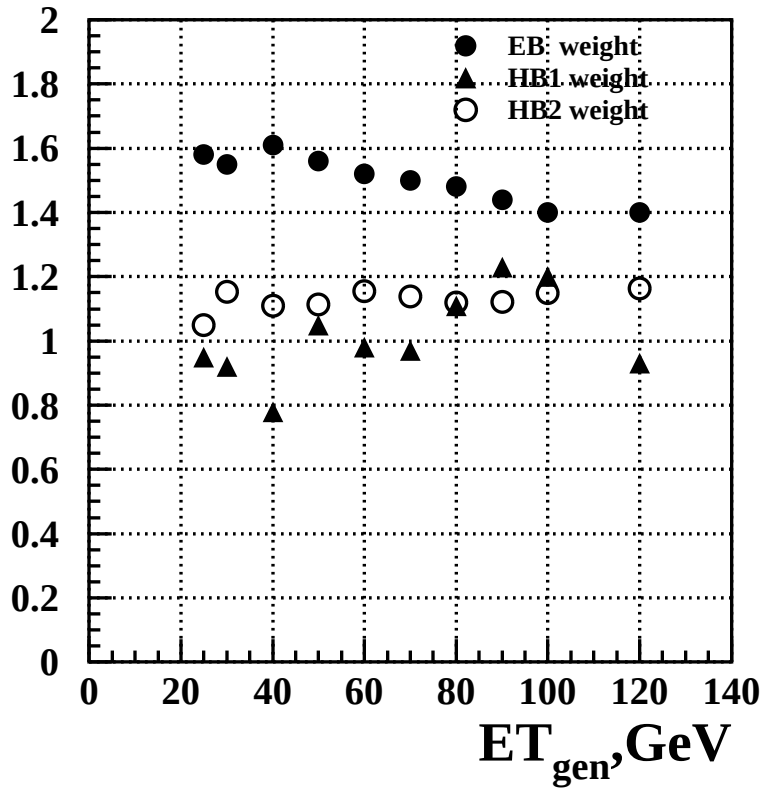
Table 2: Optimum weights and energy resolutions for ET=100 GeV jets

eta range	eb	hb1	hb2	ee	he1	he2	RESOLUTION CMSIM120 weights + energy corrections	RESOLUTION optimum weights
0.0 - 0.4	1.40	1.20	1.15				0.128	0.124
0.4 - 0.8	1.46	1.19	1.08				0.137	0.129
0.8 - 1.1	1.43	1.00	1.25				0.131	0.127
1.25-1.45	1.35	1.42	1.42	2.21	0.85	1.39	0.128	0.125
1.7 - 2.0				1.44	0.81	1.15	0.131	0.124
2.0 - 2.4				1.26	1.03	1.14	0.129	0.128

Table 3: Optimum weights and energy resolutions for ET=120 GeV jets

eta range	eb	hb1	hb2	ee	he1	he2	RESOLUTION CMSIM120 weights + energy corrections	RESOLUTION optimum weights
0.0 - 0.4	1.40	0.93	1.16				0.124	0.119
0.4 - 0.8	1.41	1.13	1.13				0.132	0.126
0.8 - 1.1	1.40	1.16	1.16				0.125	0.121
1.25-1.45	1.44	0.82	1.37	1.85	0.55	1.73	0.125	0.119
1.7 - 2.0				1.37	0.91	1.14	0.122	0.116
2.0 - 2.4				1.29	0.70	1.17	0.117	0.113

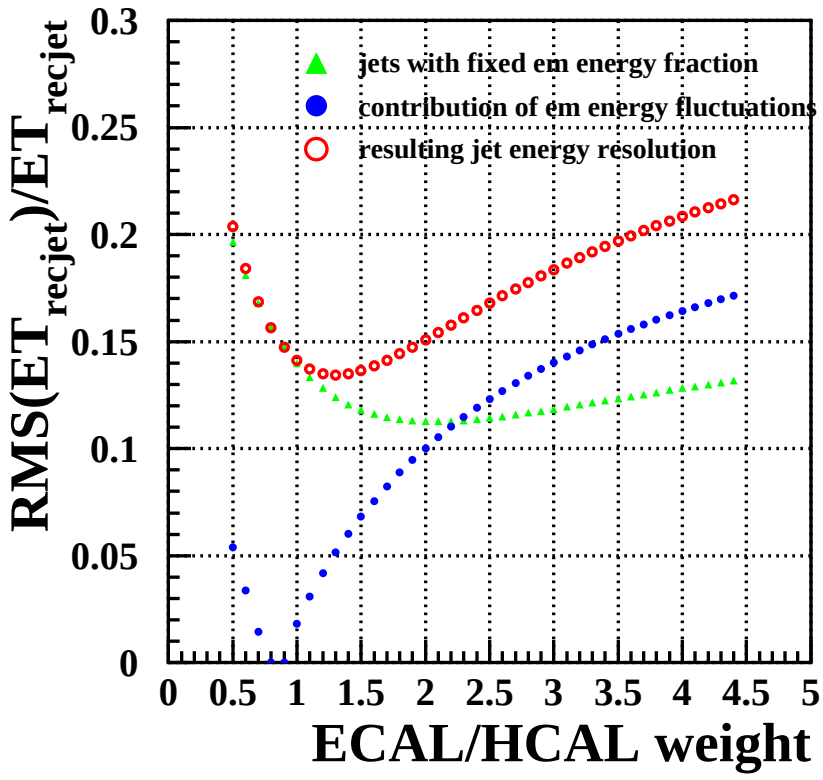
Energy dependence of optimum weights (0<eta<0.4)



Resolutions with cone R=0.5 vs R=0.7

0<eta<0.4
ET = 80 GeV 0.136 with R=0.5 0.133 with R=0.7

0<eta<0.4
ET = 120 GeV 0.119 with R=0.5 0.116 with R=0.7


jets with fixed em energy fraction
contribution of em energy fluctuations
resulting jet energy resolution
RMS(ET_recjet)/ET_recjet
ECAL/HCAL weight
0
0.05
0.1
0.15
0.2
0.25
0.3
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5