

Minutes of the Missing Energy Meeting CERN, 3 December 1992

Recorded by D. Nicod

In this first meeting, different ways to improve neutrino energy reconstruction have been presented and applied to various analysis. For each analysis, common features are used : P. Janot energy flow package, the basic neutrino energy definition in the neutrino hemisphere : $E_\nu = E_{beam} - E_{visible}$. The visible energy is defined as : $E_{visible} = E_{charged} + E_\gamma + E_{remaining}$, where $E_{remaining}$ is also named neutral hadron energy.

1 Proposal - I.Tomalin

I.Tomalin couldn't be at CERN during the Aleph Week, but he send us an e-mail contribution. The aim of this proposal is to improve the use of neutral hadron energy. The main point is to associate to each neutral hadron the probability it has to be really present.

2 Measurement of B Fragmentation using $l + D$ events - I. de Bonis / J.P Lees

I. de Bonis presented a measurement of B fragmentation using two jet events, in the exclusive mode : $B \rightarrow D^0 l \bar{\nu}$, $D^0 \rightarrow K \pi$. The event selection includes a cut on the thrust ($|thrust| > 0.9$) and also cuts on B decay length, L_B ($L_B > 0$) and on D decay length, L_D ($L_D > L_B$). Assuming the absence of neutral hadrons in their events, they consider that all neutral hadrons in the energy flow are fake and remove them. With this assumption they obtain a neutrino energy resolution of 1.9 GeV.

The fit of B fragmentation gives : $\langle X_B \rangle = 0.706^{+0.017}_{-0.021}$

3 Neutrino Reconstruction in $D^* - l$ correlations - H. Duarte / P. Colas

H.Duarte pointed out various motivations to neutrino energy reconstruction, among which exclusive semi-leptonic decay mode reconstruction like $B^0 \rightarrow D^* l \bar{\nu}$. The event selection requires D and lepton with opposite sign in the same hemisphere and only one lepton with $P_l > 3$ GeV in the whole event. With a cut $E_\nu > 3$ GeV, the neutrino energy resolution is 3.17 GeV. As total energy could be not the same in both hemispheres, a correction taking into account the masses of both hemispheres is applied to beam energy. This improves the neutrino energy resolution to 2.46 GeV. An attempt is made to measure neutrino direction, the resolution is $\simeq 15^\circ$.

4 Missing energy in semileptonic b hadrons decays - D.Nicod / M. Talby

M. Talby presented a way to improve missing energy reconstruction. Note that for this first study, missing energy is assumed to measure the neutrino energy in the hemisphere studied. Improvement needs two steps :

- Make missing energy spectrum identical in Monte Carlo and data : apply Tomalin's correction on visible energy.
- remove the linear correlation between $(E_{missing} - E_{\nu}^{true})$ and $E_{visible}$ components : apply correction on visible energy ,

$$E_{vis}^{corrected} = E_{vis} - a_1(E_{ch} - b_1) - a_2(E_{\gamma} - b_2) - a_3(E_{remaining} - b_3)$$

For inclusive semileptonic B decays, neutrino energy resolution is improved from 4.5 GeV after Tomalin's corrections to 3.5 GeV after all corrections. The gain is also clearly visible in momentum and kappa factor resolution used in B_s and Λ_b lifetime analysis.

5 Comments

- **D. Rousseau / A. Bonissent**

D. Rousseau presented a general property which explains a part of the improvement seen with corrections applied by M. Talby. Given a physical quantity x_{true} with an approximately gaussian distribution measured with a gaussian resolution, a linear correlation between $(x_{measured} - x_{true})$ and $x_{measured}$ exists. Then the best estimate of x is a linear combination: $x = kx_{measured} + (1-k) \langle x_{true} \rangle$. In our particular case, the neutrino energy resolution is improved partly by using implicitly the neutrino spectrum from Monte Carlo.

- **P. Janot**

P. Janot stated that neutral hadron energy resolution may be improved inside the Energy Flow using the digital patterns and using an improved GAMPEC.

In conclusion : There is still lots of work to do in this topic. The aim is to have if possible a common way to measure neutrino energy from missing energy in the different Heavy Flavour analysis and also in Higgs search and τ physics.