The limits on the hadronic energy resolution

- *Why is hadronic resolution so much worse than em resolution in same detector?*

  Fluctuations in "invisible energy" : ΔB

- *Dual-readout is based on the assumption:* $E_{non\text{-}em} \propto \Delta B$

- *Compensation is based on the assumption:* $\Sigma E_n \propto \Delta B$

  works better in high-Z materials (exception U!)

- *The dual-readout assumption works BETTER and does not depend on Z*

  Already for < 2 tons, DR beats ZEUS/SPACAL

- *The combination of the two methods gives even better results*

a) Electrons

b) Hadrons

a)

Entries	78198
Mean	66.1
RMS	12.4

b)

$0.35 < f_{em} < 0.40$
$0.60 < f_{em} < 0.65$
$0.80 < f_{em} < 0.85$

Čerenkov signal (GeV)

c)

200 GeV "jets"

Neutron fraction in scintillator signal

Čerenkov/Scintillator signal ratio

d)

All data
$.06 < f_n < .065$
$.07 < f_n < .075$
$.08 < f_n < .085$

Number of entries per bin

Total Čerenkov signal (arbitrary units)