SAMPLING FLUCTUATION STUDY USING ELECTRONS

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Overview

- Same configuration as my talk on October 18th, 2006
 - 400 layers of Cerenkov layers and active layers
 All made of lead glass
 - Cerenkov layer depth (dche): 10, 20, 50, 75 mm and for each kind of Cerenkov layer depth:

vary active layer depth (dact): 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 mm

- Check only the total energy deposited in Cerenkov and active part
- Convert the depth to sampling fraction $SF \equiv \frac{dact}{dact + dche}.$
- This time we use 20 GeV electrons (instead of pions)!
- Check the following variables vs. SF:
 - Response: eact/esum
 - Resolution contribution from sampling fluctuation: $\sqrt{20} \frac{RMS(response)}{Mean(response)}$
 - $rightarrow Total resolution : \sqrt{20} \frac{RMS(eact)}{Mean(eact)}$

 $\ \ \, @ \ \ \, $ Fluctuation: \sqrt{20} \frac{RMS(\frac{eact}{SF}-esum)}{Mean(\frac{eact}{SF}-esum)} }$

Response



Cerenkov layer 20 mm

Average response: Cerenkov layer 20 mm



Sampling fraction (SF) Cerenkov layer 75 mm



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Resolution component from sampling fluctuation

Cerenkov layer 10 mm

Resolution: Cerenkov layer 10 mm



Sampling fraction (SF) Cerenkov layer 50 mm

Resolution: Cerenkov layer 50 mm



Cerenkov layer 20 mm



Resolution: Cerenkov layer 20 mm

Sampling fraction (SF) Cerenkov layer 75 mm



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Total resolution of the energy measurement

Cerenkov layer 10 mm **Resolution: Cerenkov layer 10 mm** RMS(eact) 0.9 $\sqrt{20} \times$ electron 0.8 Mean 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0 0.4 0.5 0.6 0.2 0.3 0.7 0.8 0.9 Ó 0.1Sampling fraction (SF) Cerenkov layer 50 mm **Resolution: Cerenkov layer 50 mm** RMS(eact 0.9 $\sqrt{20} \times 10^{-1}$: electron 0.8 Mean 0.7



Sampling fraction (SF)

Cerenkov layer 20 mm

Resolution: Cerenkov layer 20 mm



Sampling fraction (SF) Cerenkov layer 75 mm

Resolution: Cerenkov layer 75 mm



Sampling fraction (SF)

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Sampling fluctuation

Cerenkov layer 10 mm

Fluctuation active: Cerenkov layer 10 mm



Sampling fraction (SF) Cerenkov layer 50 mm

Fluctuation active: Cerenkov layer 50 mm



Cerenkov layer 20 mm

Fluctuation active: Cerenkov layer 20 mm



Sampling fraction (SF) Cerenkov layer 75 mm

Fluctuation active: Cerenkov layer 75 mm



Sampling fraction (SF)

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Conclusion

- For the same sampling fluctuation, electrons have better energy resolution than pions.
- Electrons' energy resolution are dominated by the sampling fluctuation.