Study of Near and Far Fluxes

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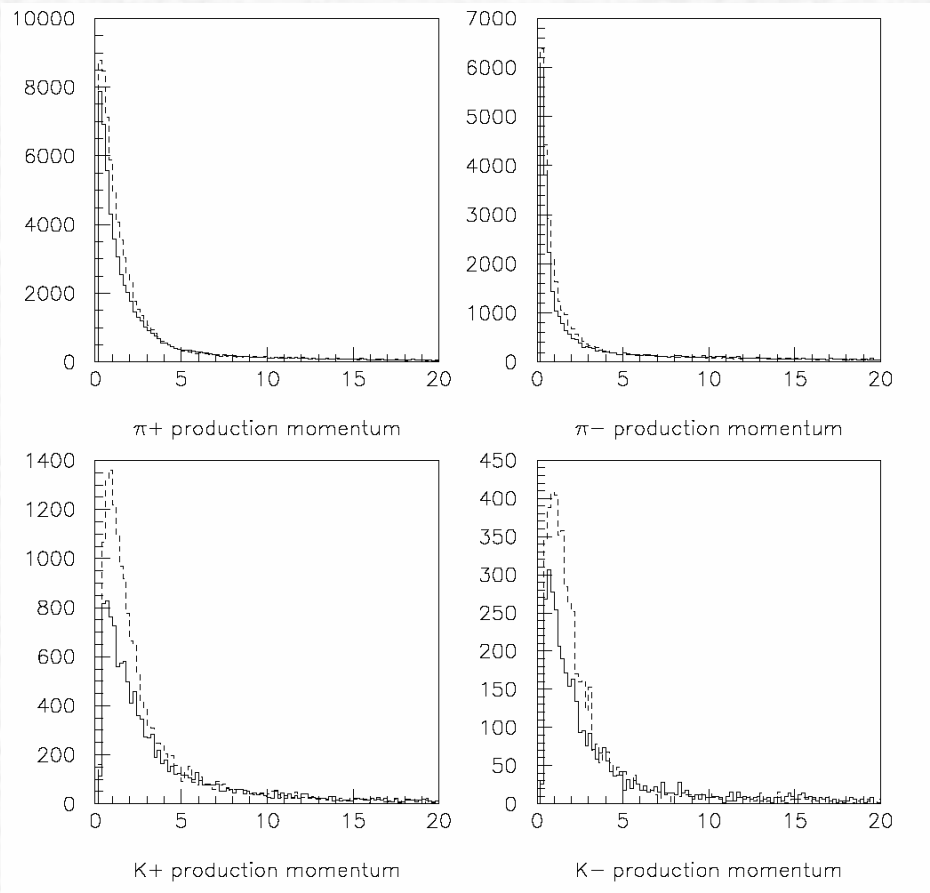
JNUBEAM

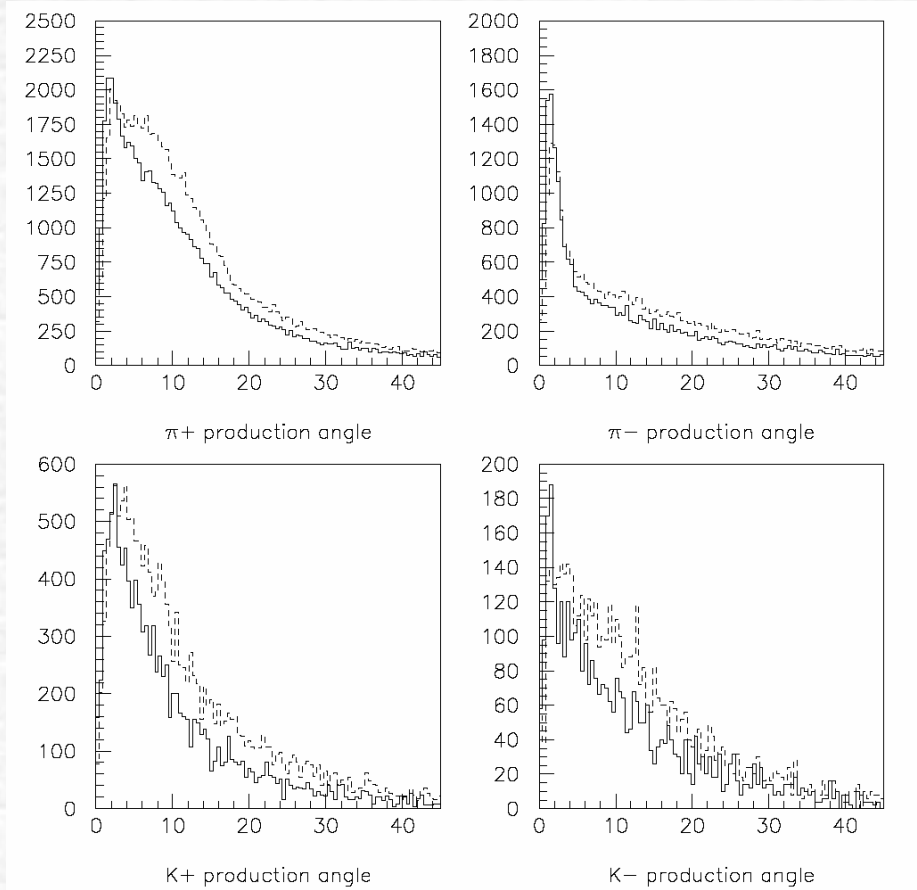
- Use newest geometry
  - Including “04b” position of 2km
- Revise code to calculate far/near correlation matrices
- Official version quite inefficient for 2km fluxes
  - Modify to treat 2km detector analytically instead of by Monte Carlo
- Official version is rather slow
  - It was tracking electromagnetic showers and slow neutrons
- Program currently speeded up by factor ~20 from first runs; anticipate some additional gains, particularly in electron neutrino efficiency

Hadronic Models

- Wanted to use latest FLUKA as well as MARS
- FLUKA interface working
  - Both primary and secondary interactions in target are handled by FLUKA
- MARS code not yet obtained
  - Probably no time before meeting (registration by fax is required...)

FLUKA/GCALOR Comparison





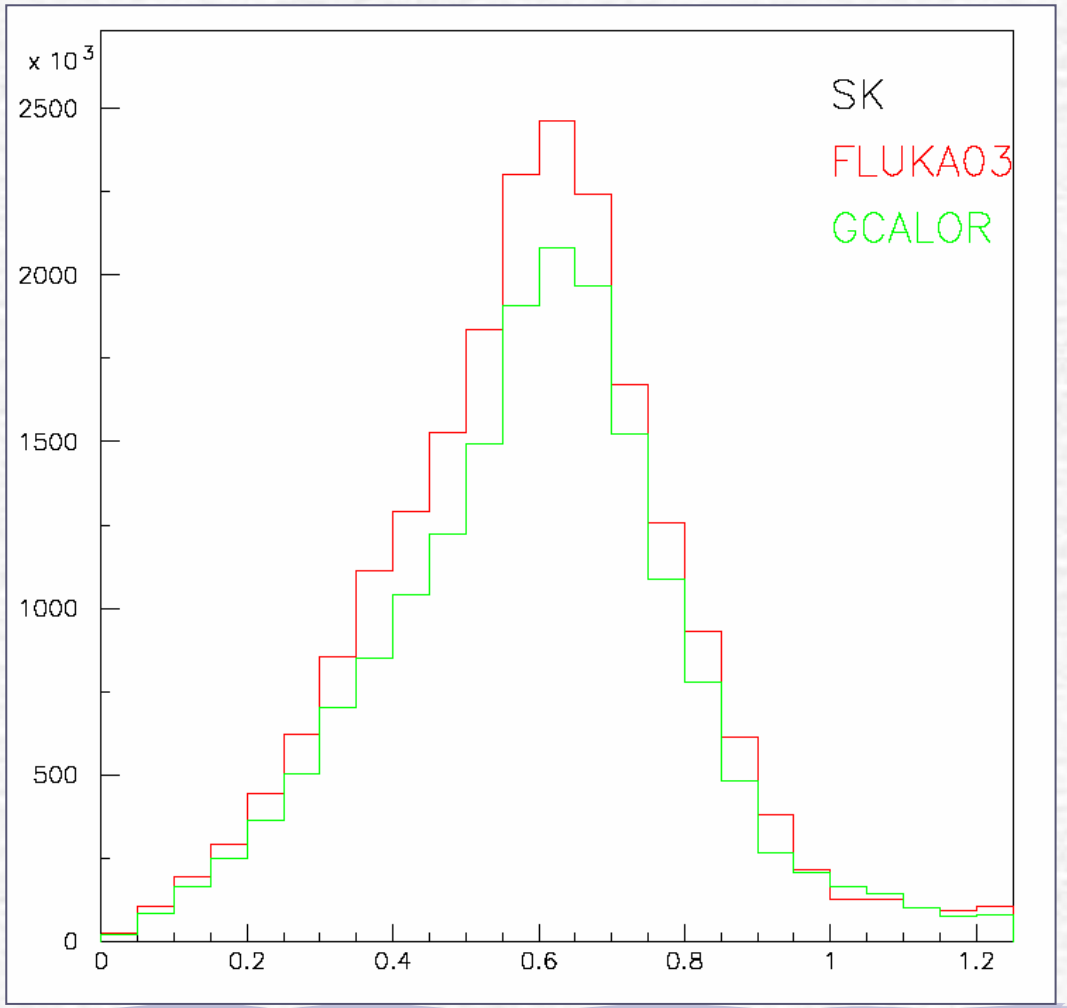
Unweighted (raw) distributions

Correlation Matrix

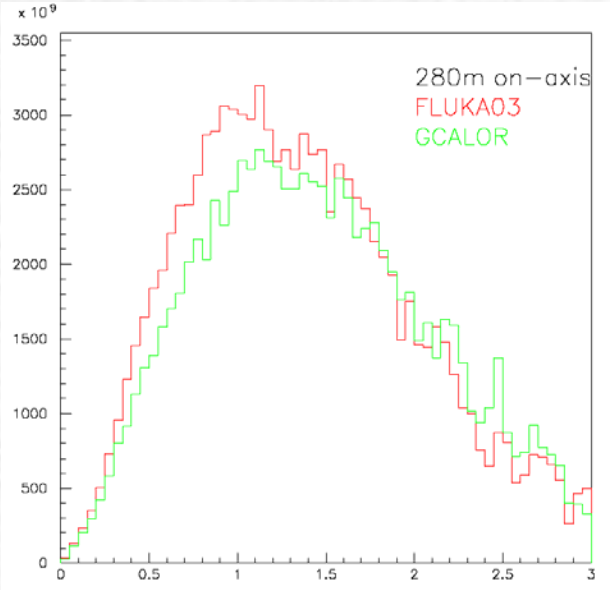
- The flux at the far detector is related to the flux at the near detector according to the correlation matrix

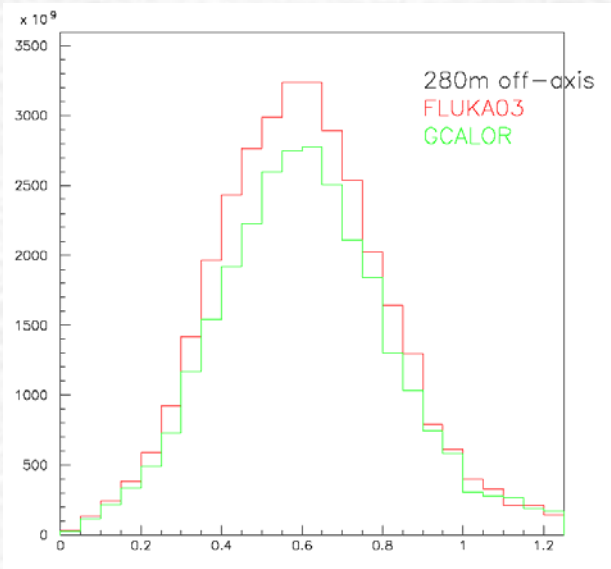
$$\varphi_f = \sum_n M_{fn} \phi_n$$

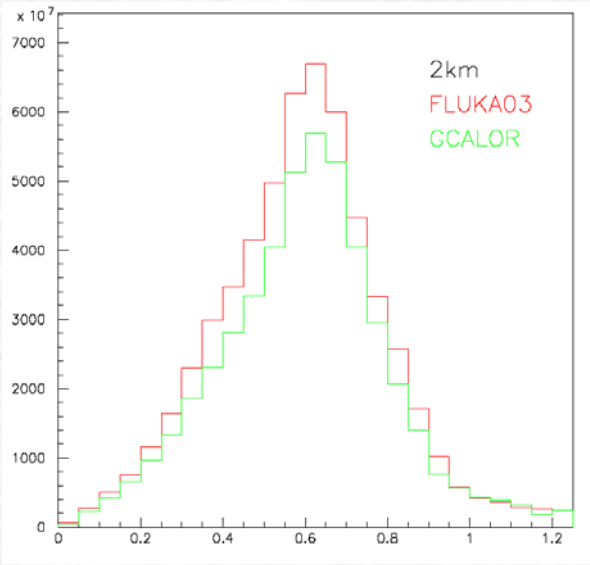
SK Fluxes with FLUKA and GCALOR



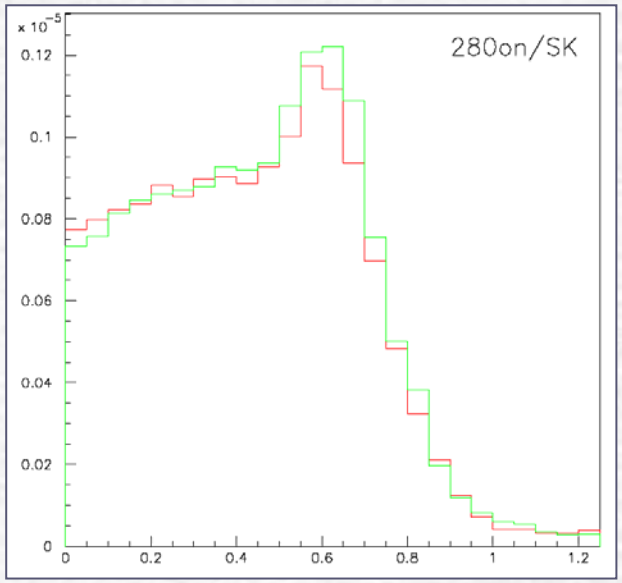
Near Detectors

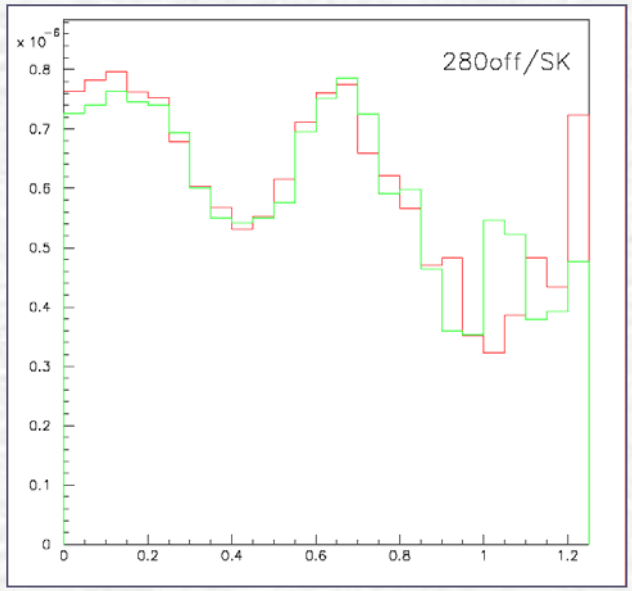


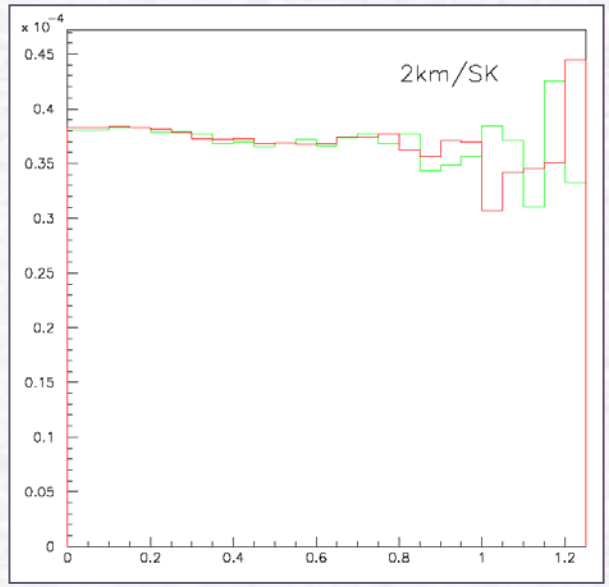




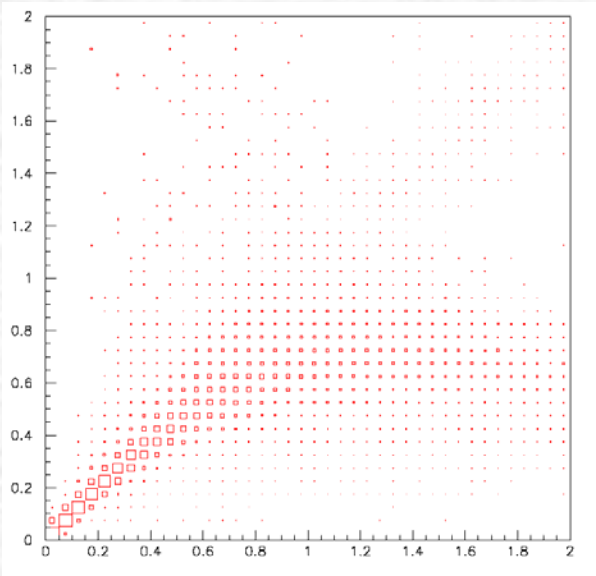
Near/Far Ratios



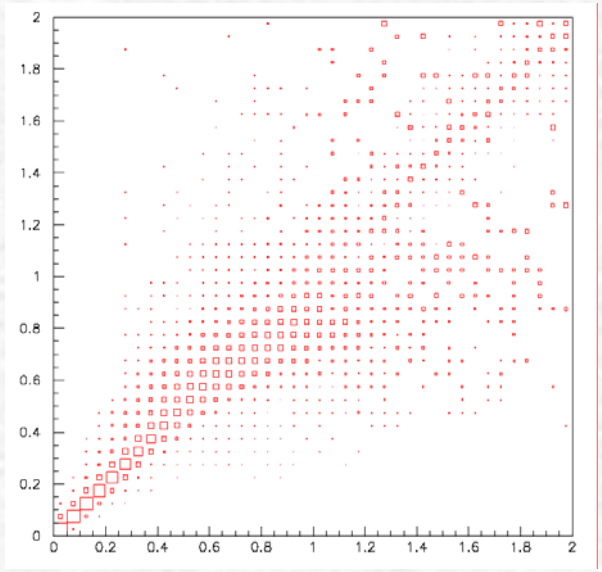




Correlation Matrices



280m on-axis



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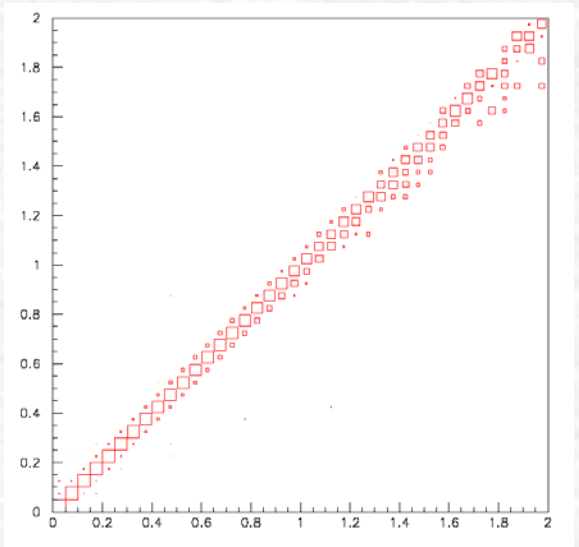
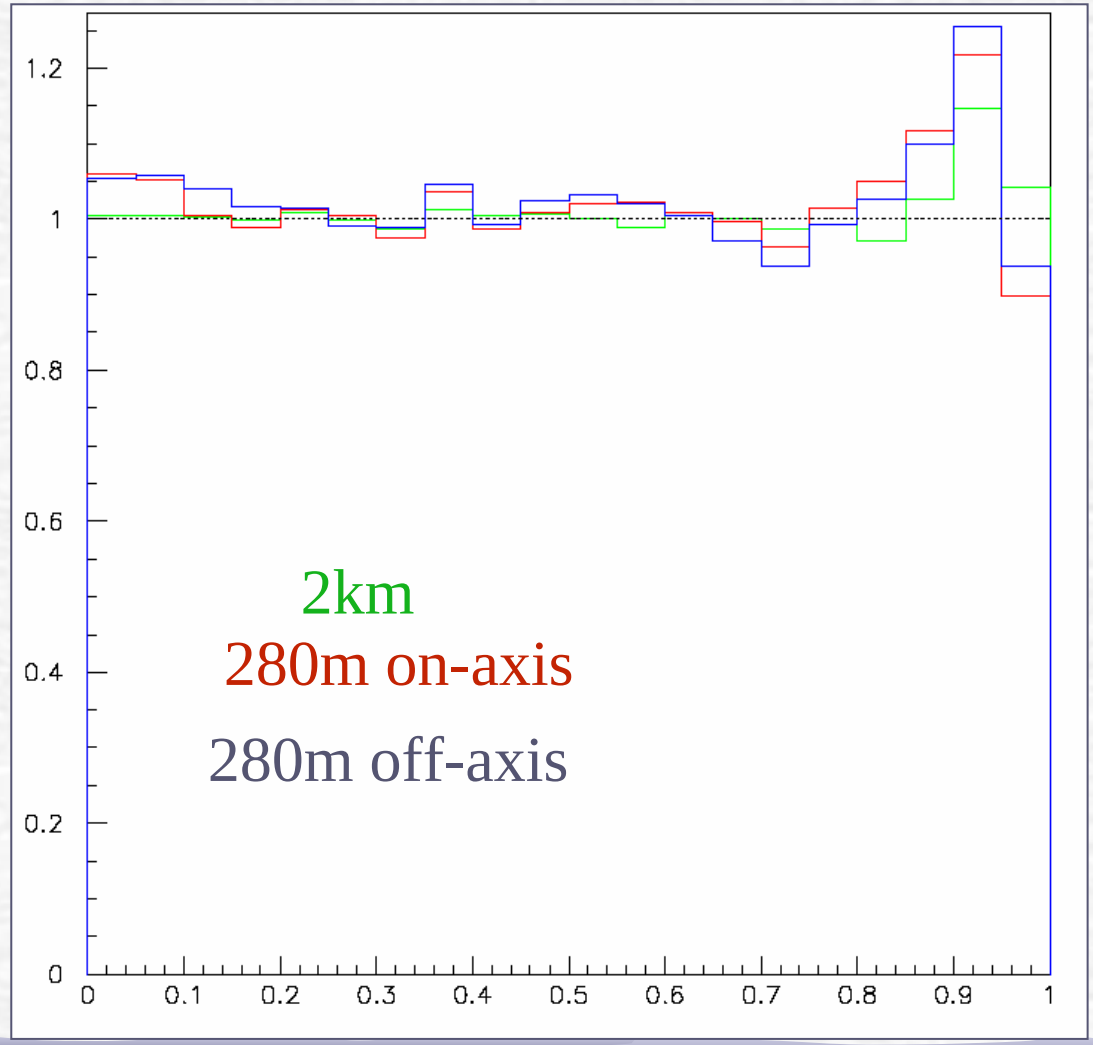


2 km

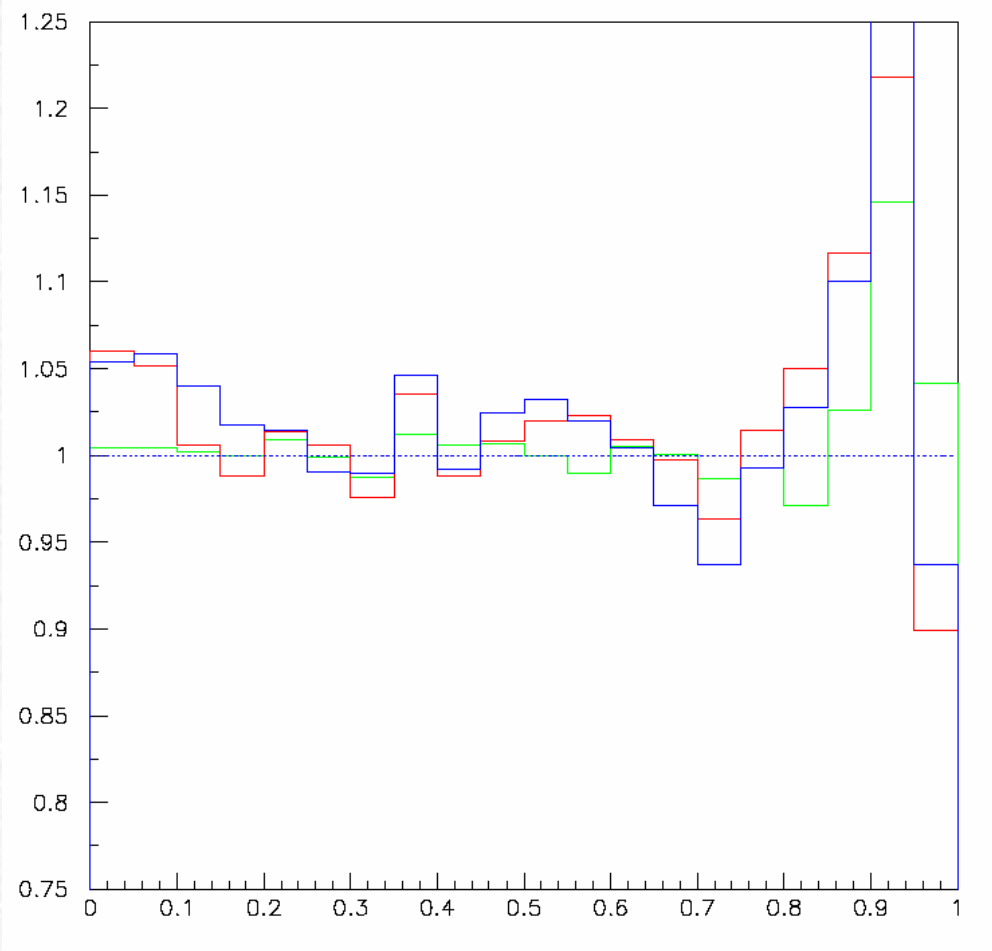
Predicted Fluxes

- Calculate correlation matrix with “wrong” model
- Generate near and far fluxes with “right” model
  - What we would measure
- Attempt to predict far flux with “wrong” matrix and “right” (measured) near flux

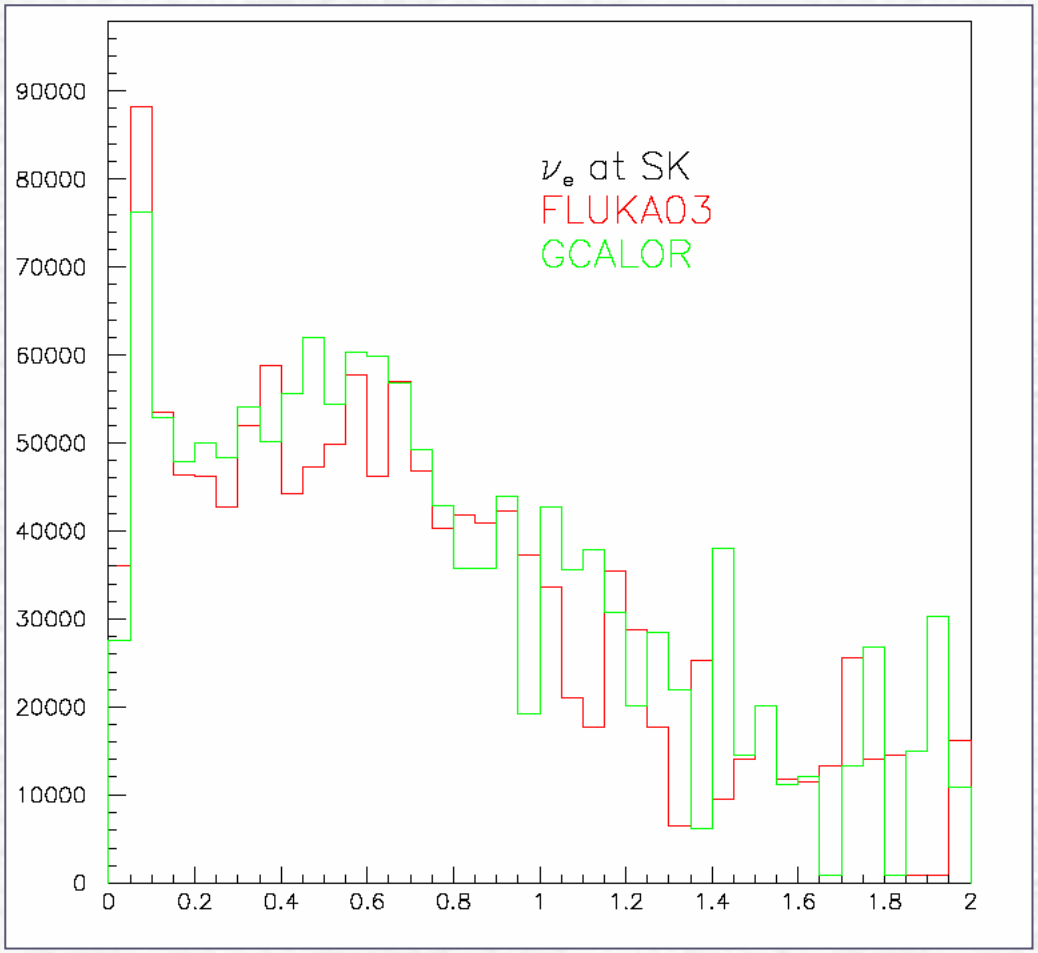


Predicted Fluxes

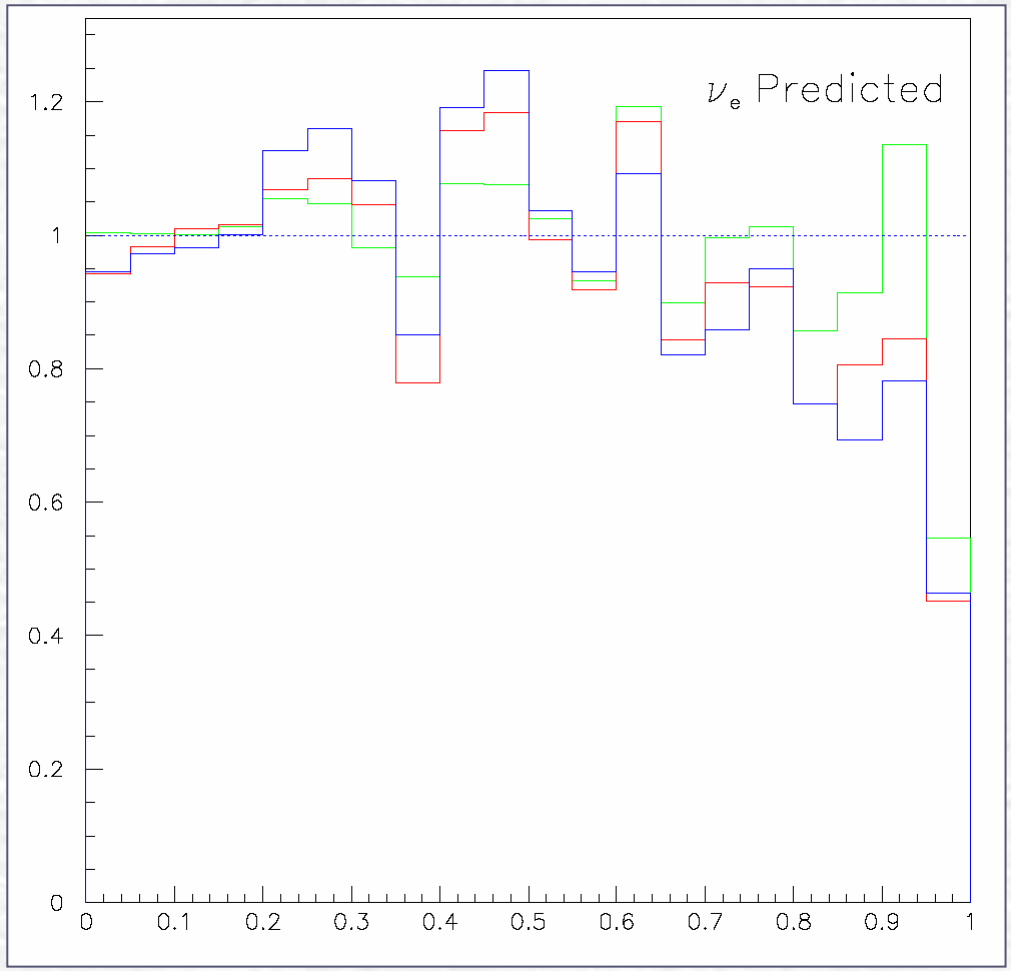
- 2km is clearly best, but the correlation matrix technique works extremely well...
- Need more statistics to tell if bumps are real



Electron Neutrino Spectra



Electron Neutrino Prediction



Conclusions

- Differences in hadronic models clearly evident
- 2 km detector clearly requires smallest corrections
  - Correlation matrix technique works quite well for 280m detectors, however
  - Try with interactions, rather than flux
- Need more statistics, especially for electron neutrinos
  - Expect additional improvements in JNUBEAM to allow ample statistics in a couple days