

# **FLUKA Simulation of the NuMI Target**

**(Future v.18 Flux)**

**Francisco Yumiceva**

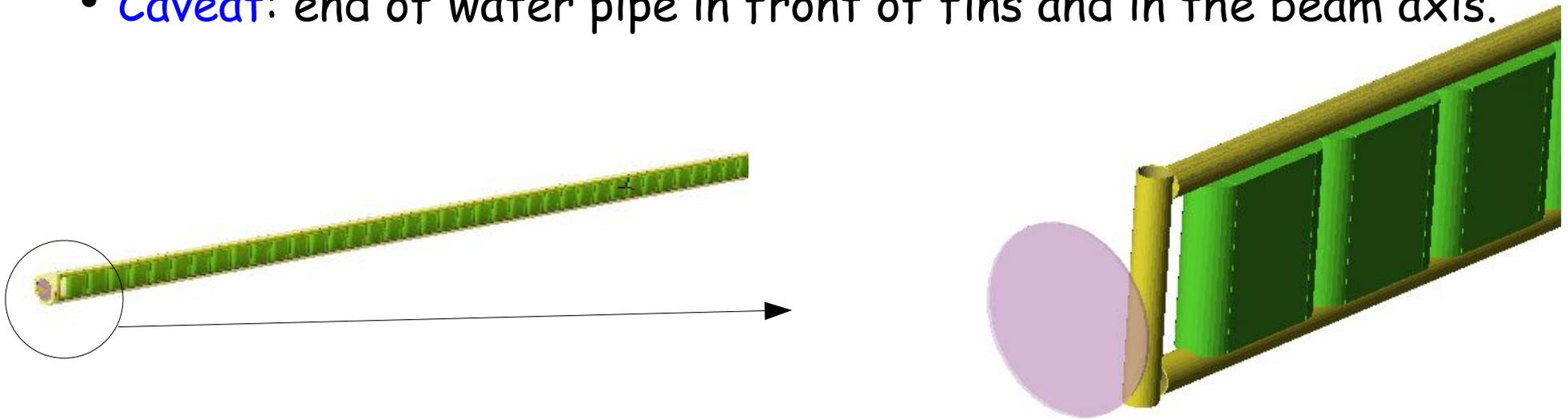
**September 21, 2005**

1. Different FLUKA versions under the same (old) geometry.
2. New Target Geometry.
3. GNUMI Fluxes with different Input Targets.
4. Summary and Current Plan (for v.18)

**1. Different FLUKA version under the same (old) geometry.**

# Target Geometry - Version 2001

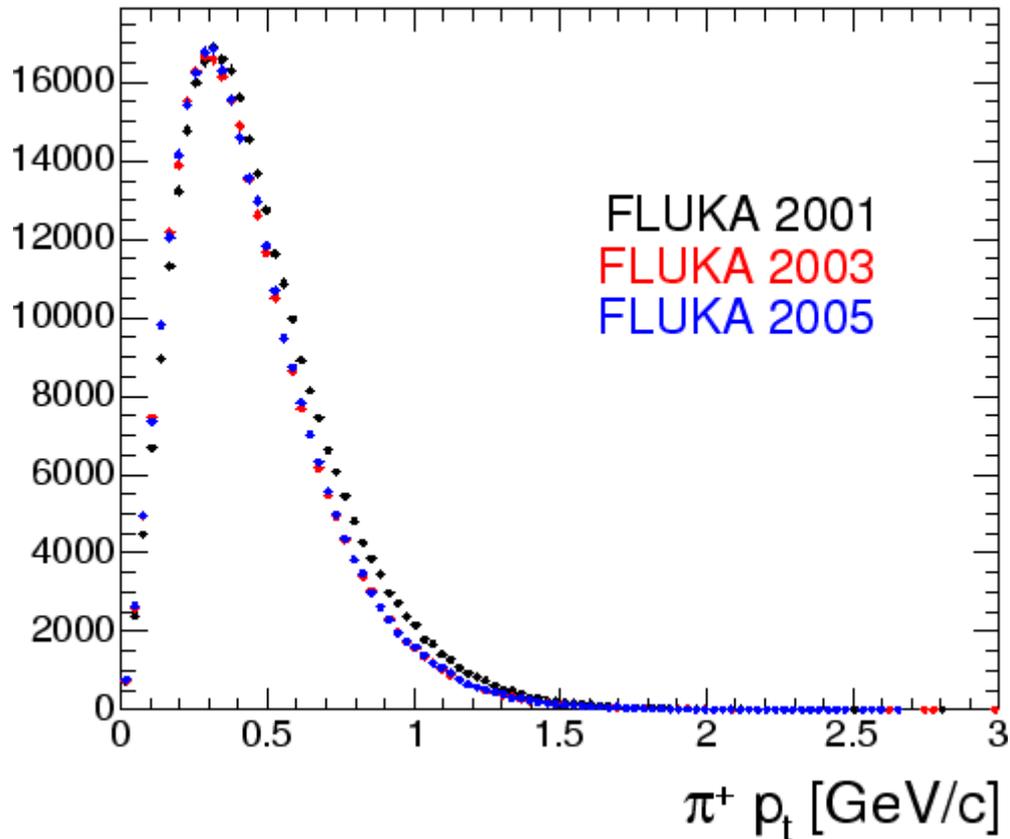
- Bob Zwaska wrote the original geometry in 2001:
  - Reduced version of the water cooling pipes.
  - Simplified aluminium canister filled with vacuum.
  - No Budal monitor (horizontal fin).
  - Upstream and downstream beryllium windows.
  - **Caveat**: end of water pipe in front of fins and in the beam axis.



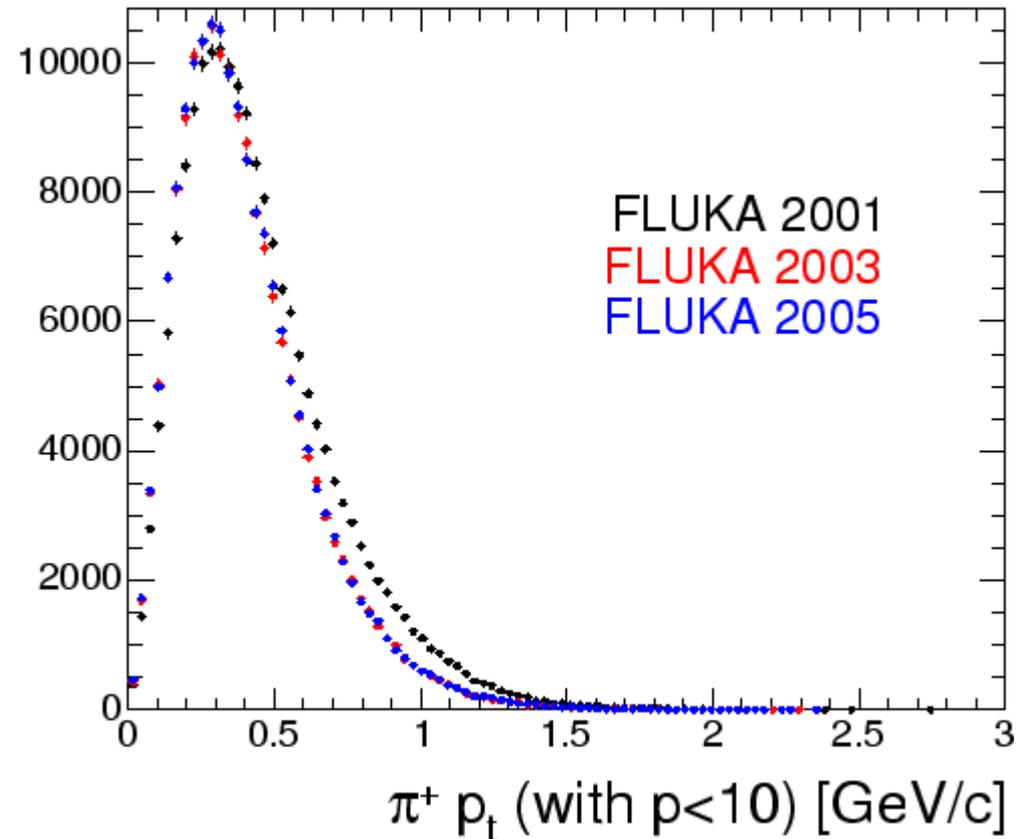
# Target Geometry - Version 2001 (II)

Comparison of the 2001 geometry with FLUKA versions 2001, 2003, 2005.

With Only the 2001 Geometry

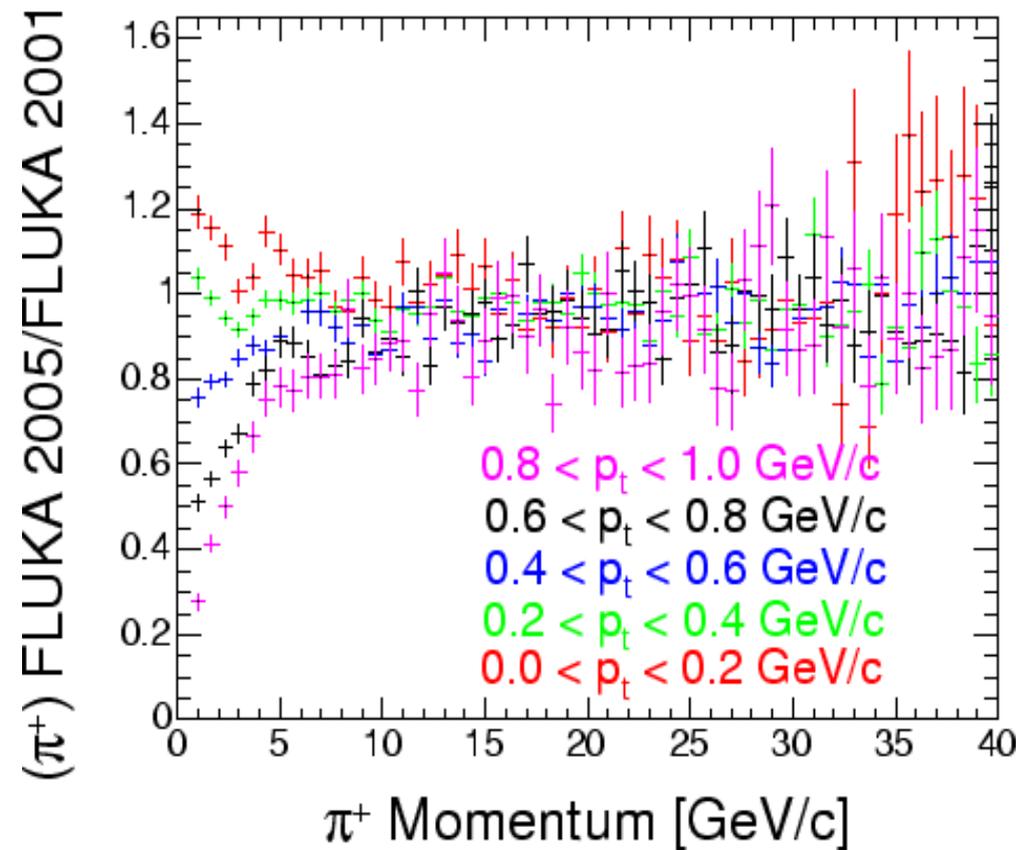


With Only the 2001 Geometry

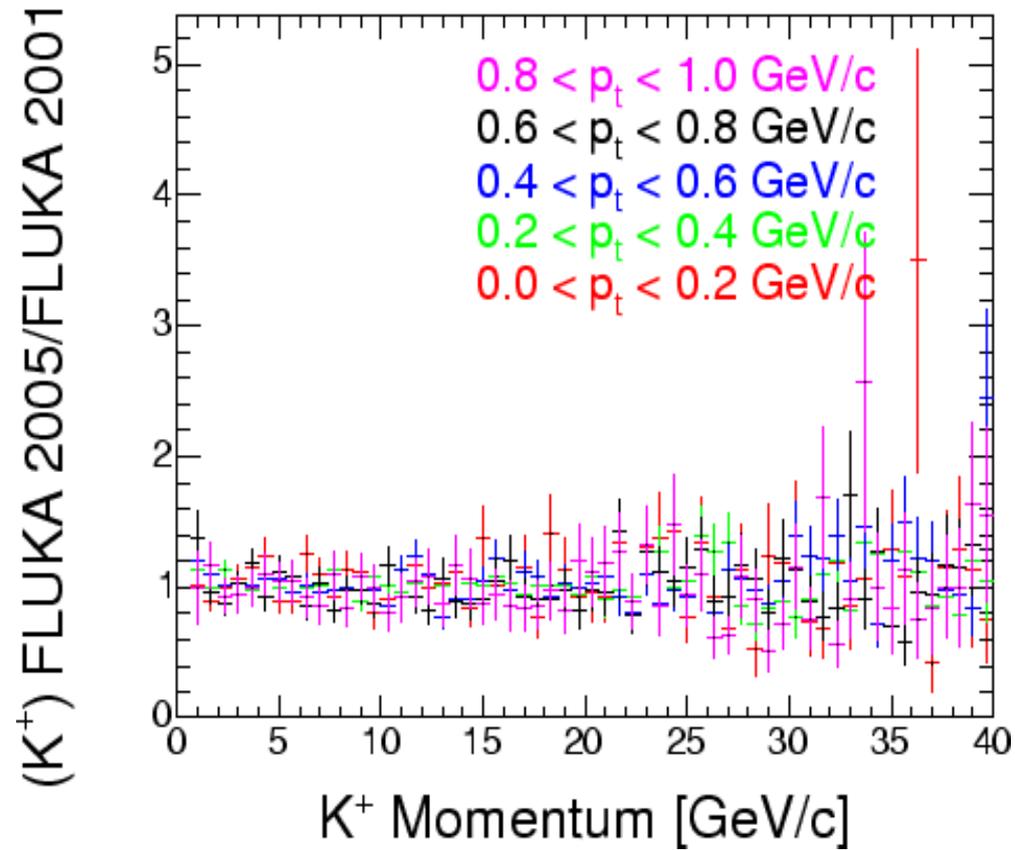


# Target Geometry - Version 2001 (III)

With Only the 2001 Geometry



With Only the 2001 Geometry

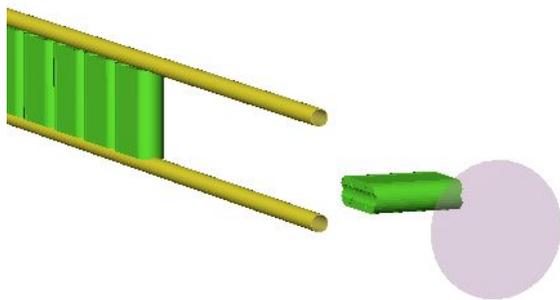


- FLUKA 2005 has a pion production shifted towards lower  $p_t$  compared with FLUKA 2001.
- No differences (within stat. errors) in kaon production.
- No differences observed between FLUKA 2003 and 2005.

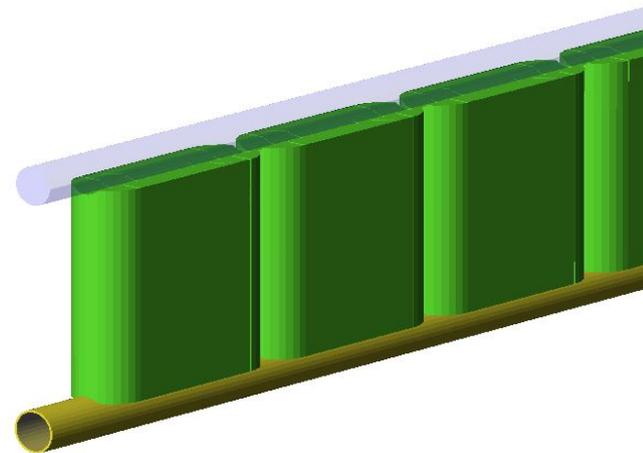
## **2. New Target Geometry**

# Updates to the 2001 Target Geometry

- Budal monitor included.
- Downstream water pipe replaced by a water ring pipe.
- Updated dimensions of target fins and cooling pipes.
- Changed internal vacuum to pressurized He (2.55 atm).
- Beam position shifted at  $y=+1.1$  mm.  $\sigma_x = \sigma_y = 1.0$  mm.

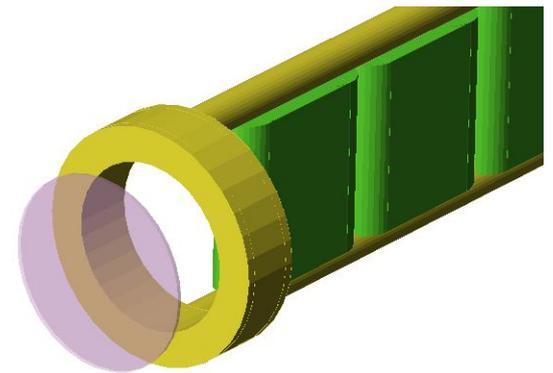
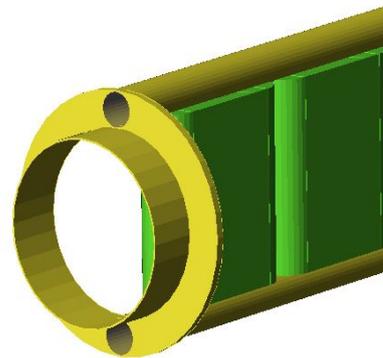
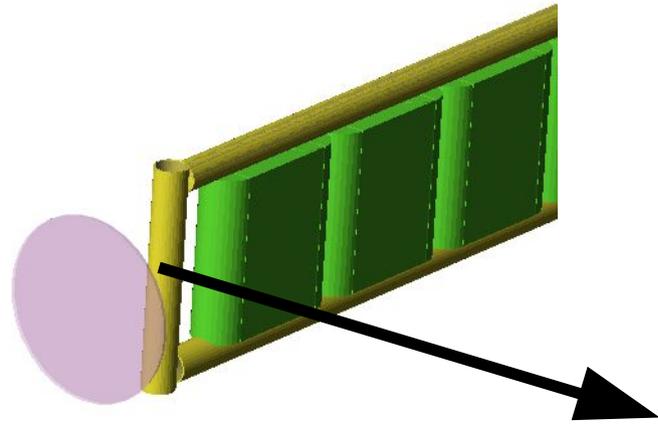


Budal monitor



Water pipes and graphites

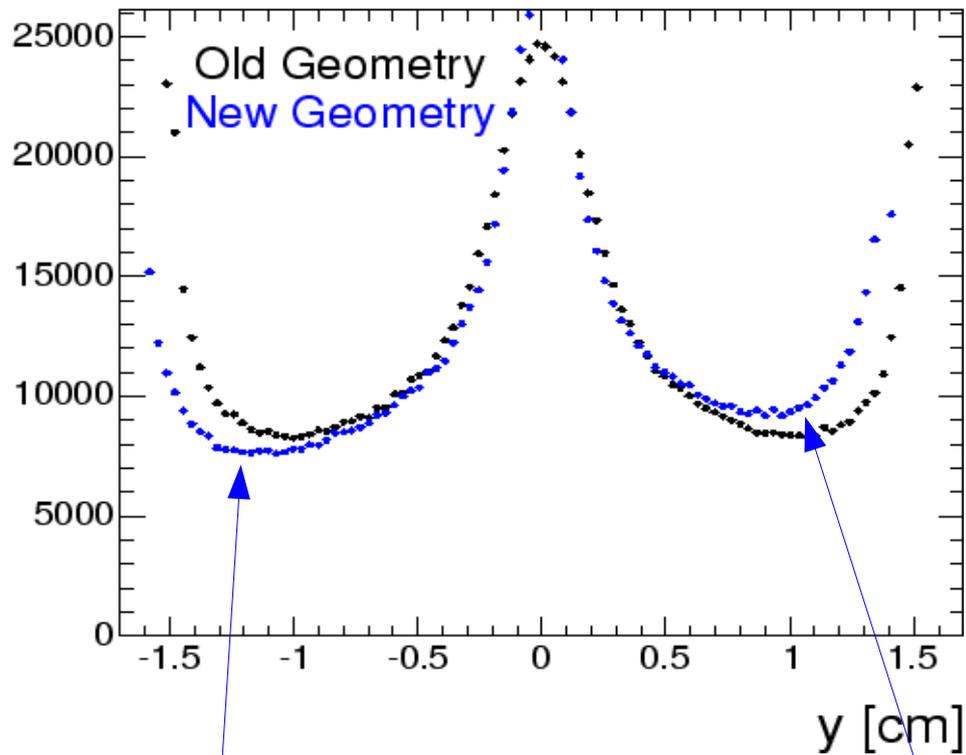
# Updates to the 2001 Target Geometry (II)



Ring pipe

# Differences between Old and New Geometry

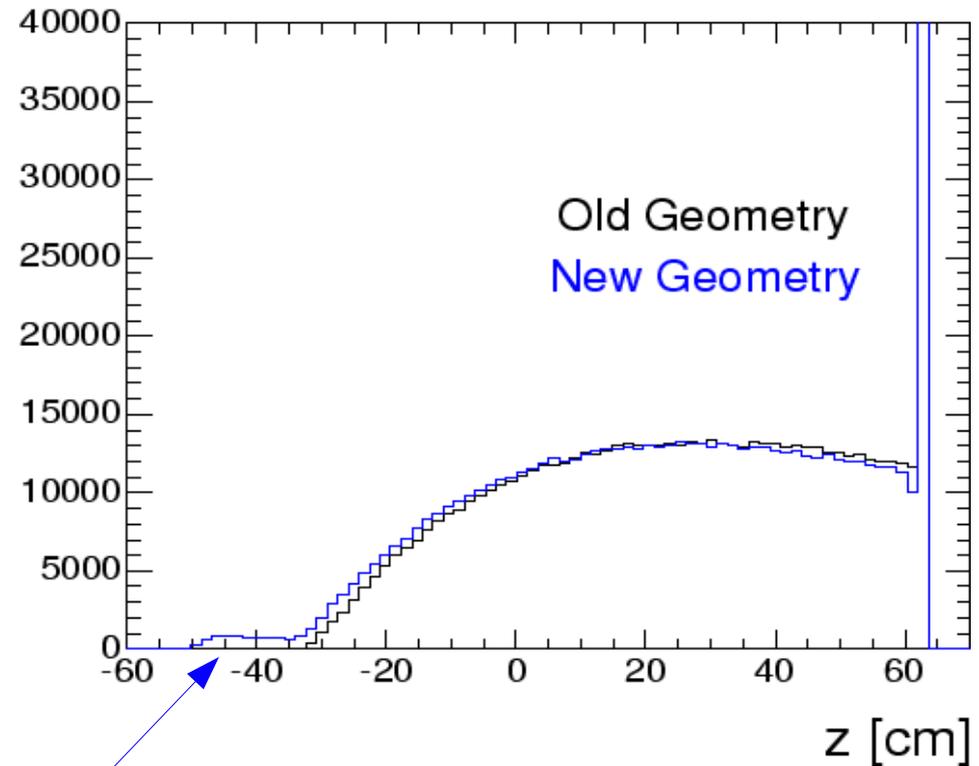
With FLUKA 2005



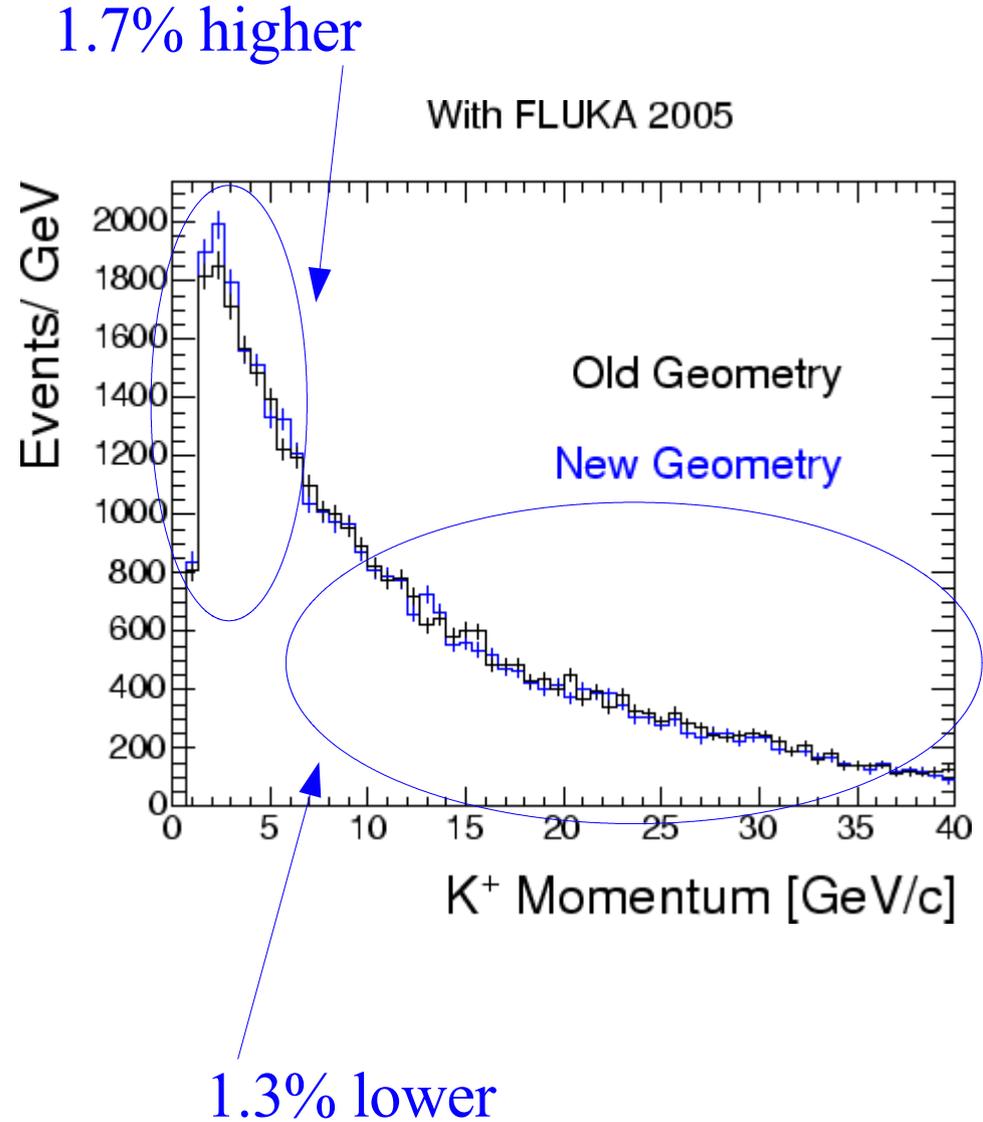
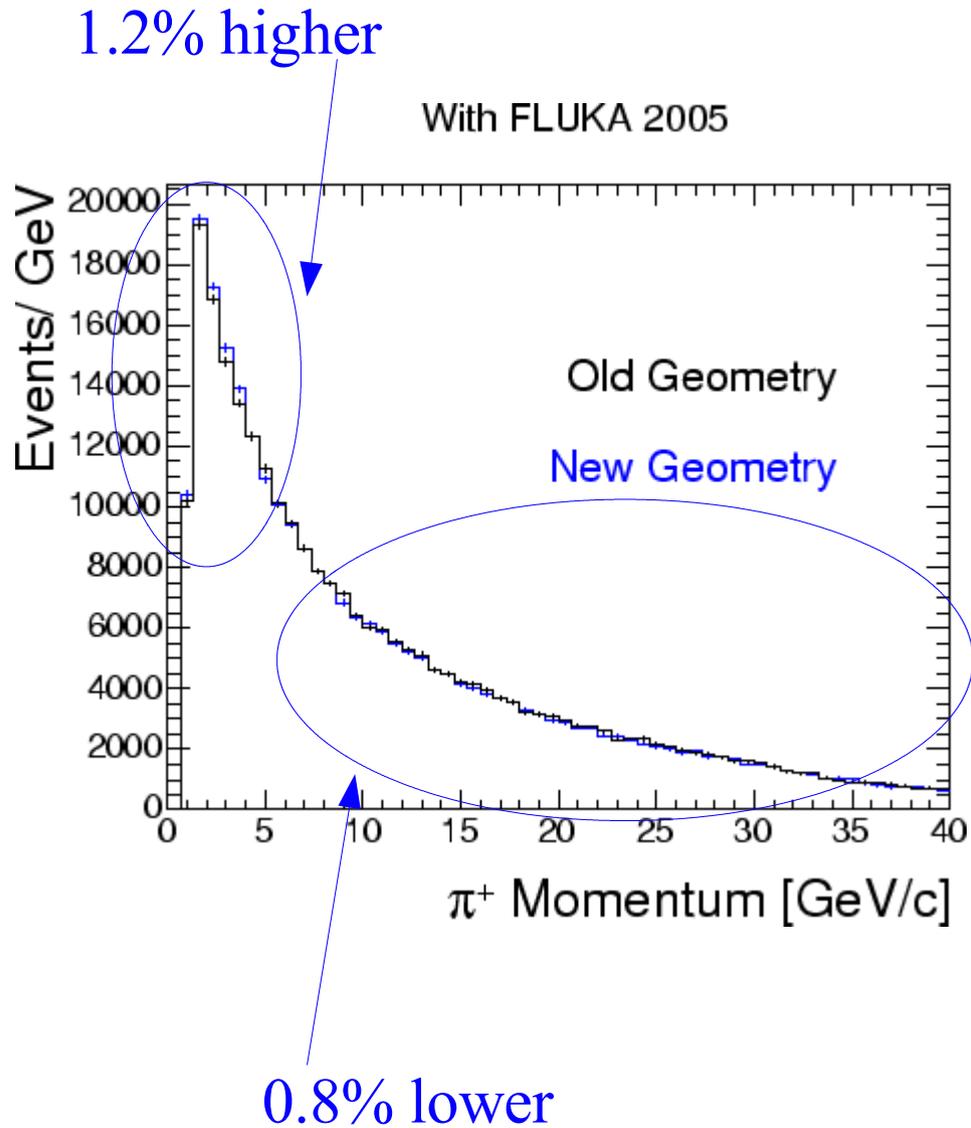
Target displacement

Budal monitor contribution

With FLUKA 2005

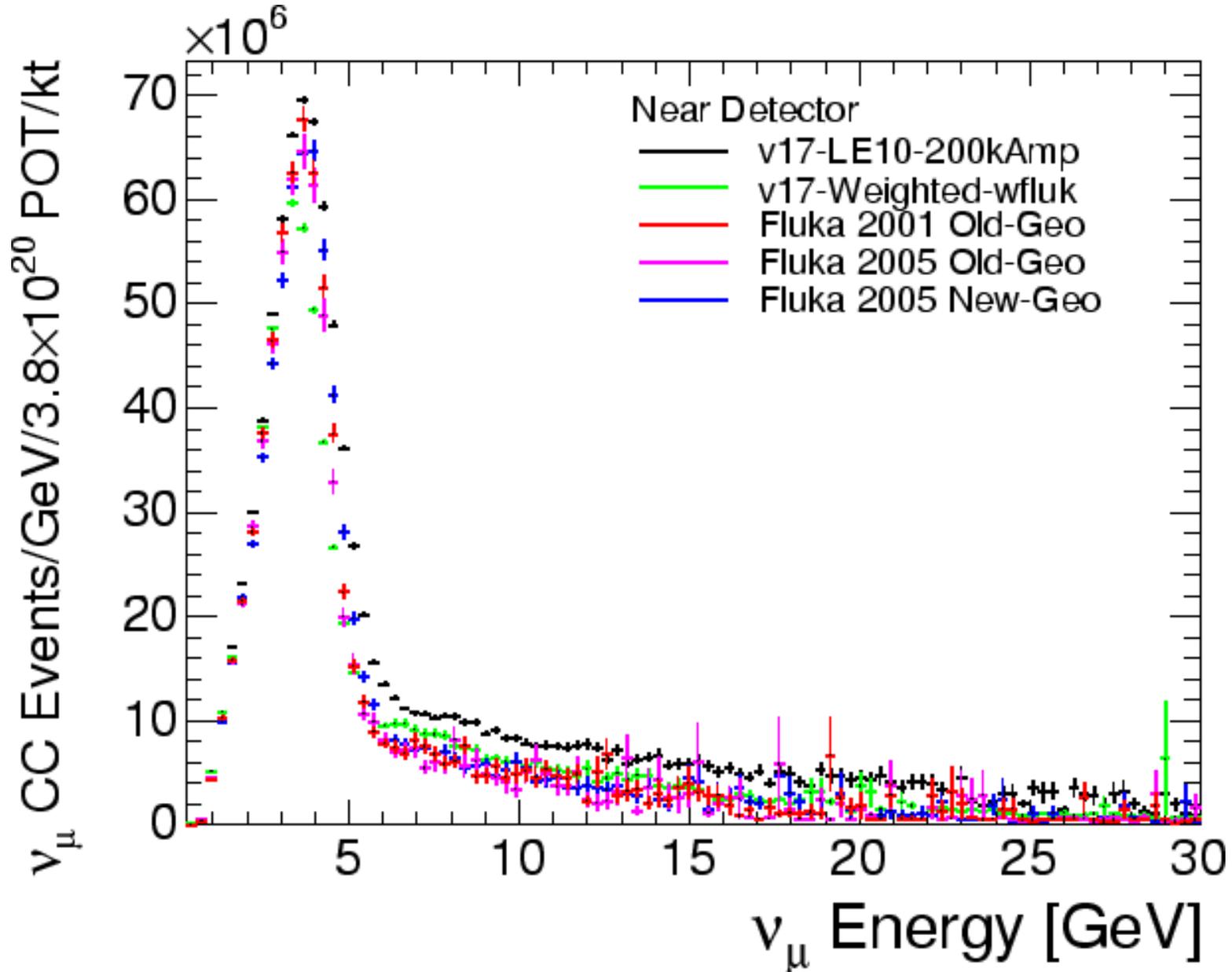


# Differences between Old and New Geometry (II)

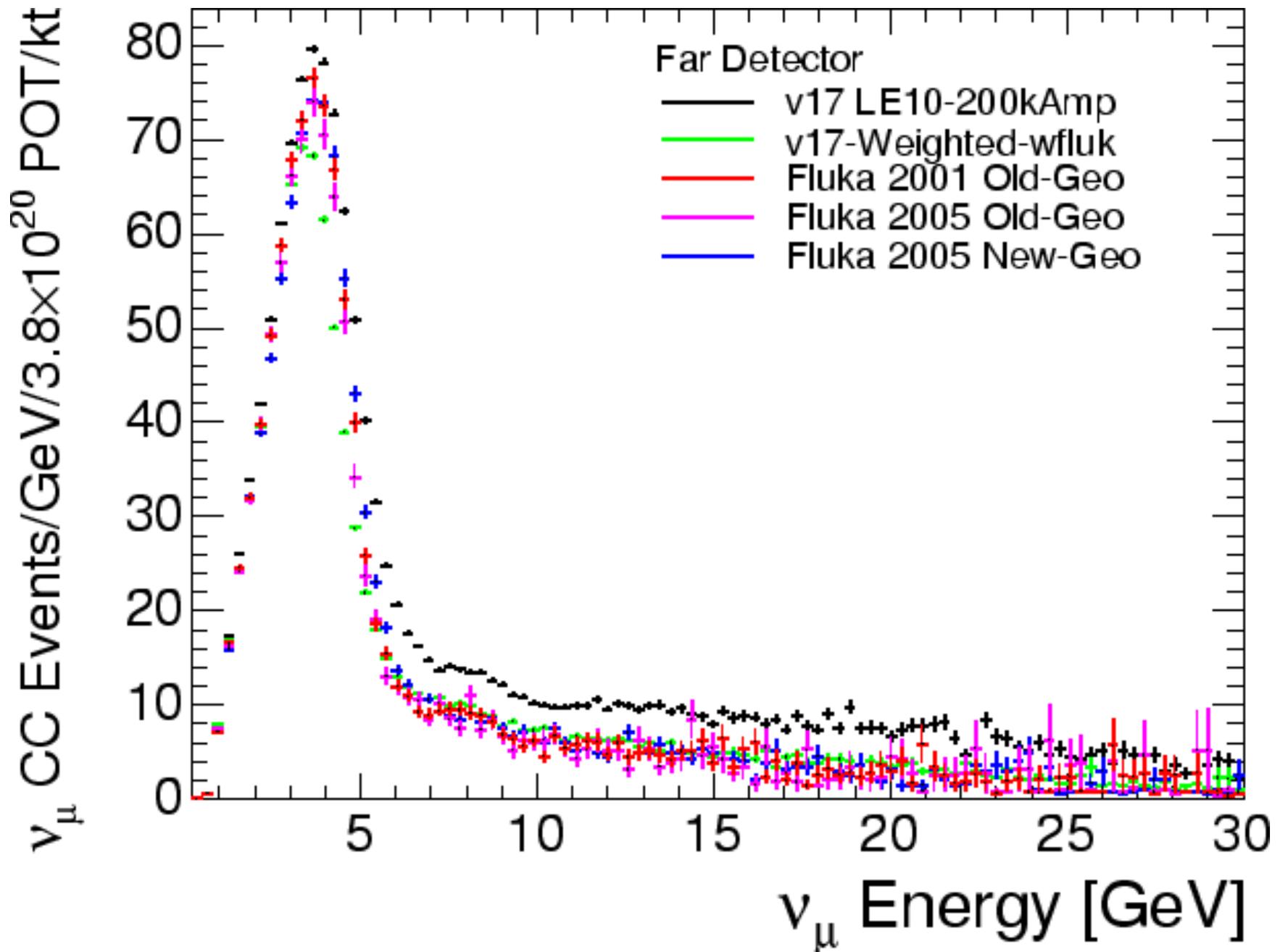


# **3. GNUMI Fluxes with Different Input Targets**

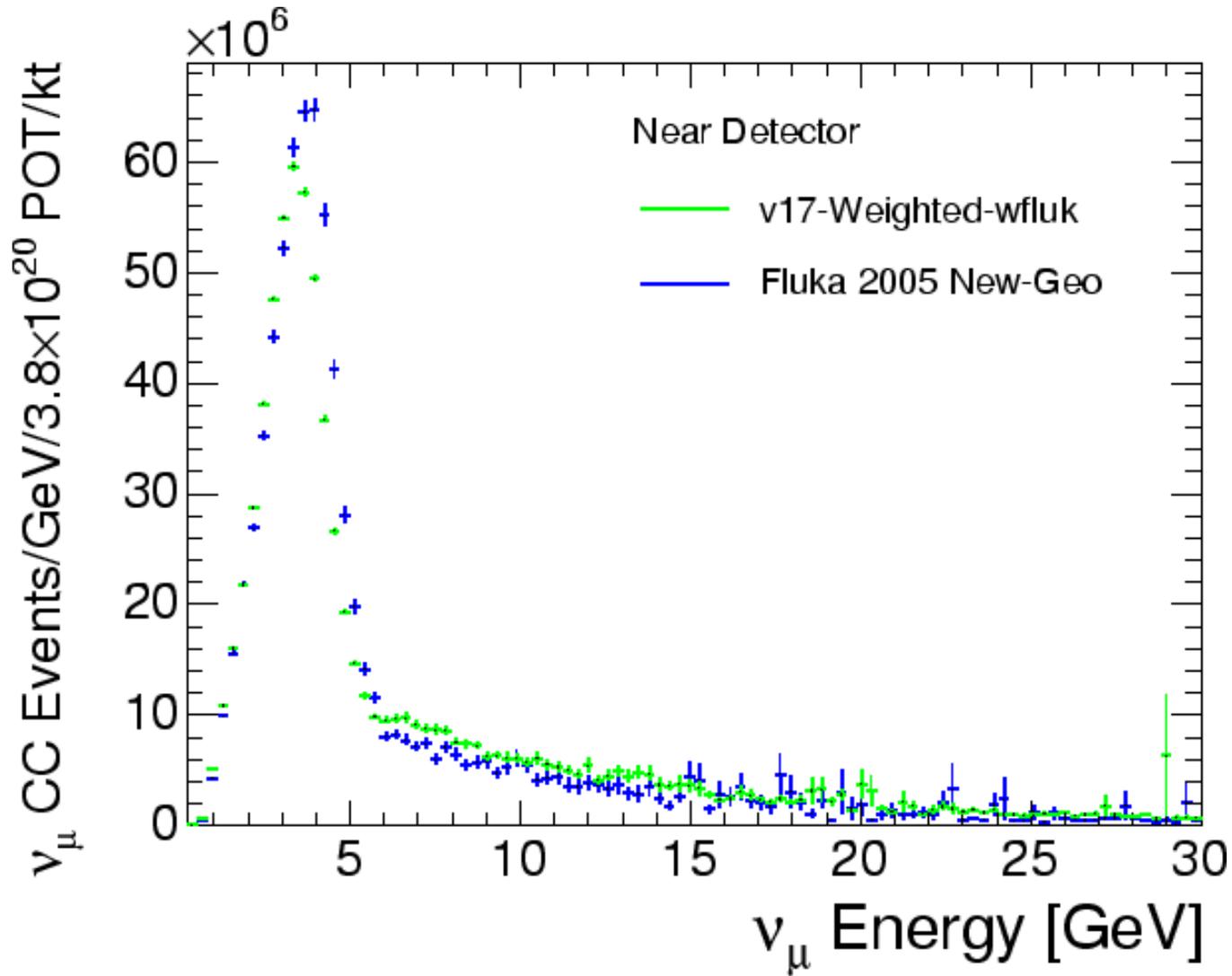
# GNUMI Fluxes



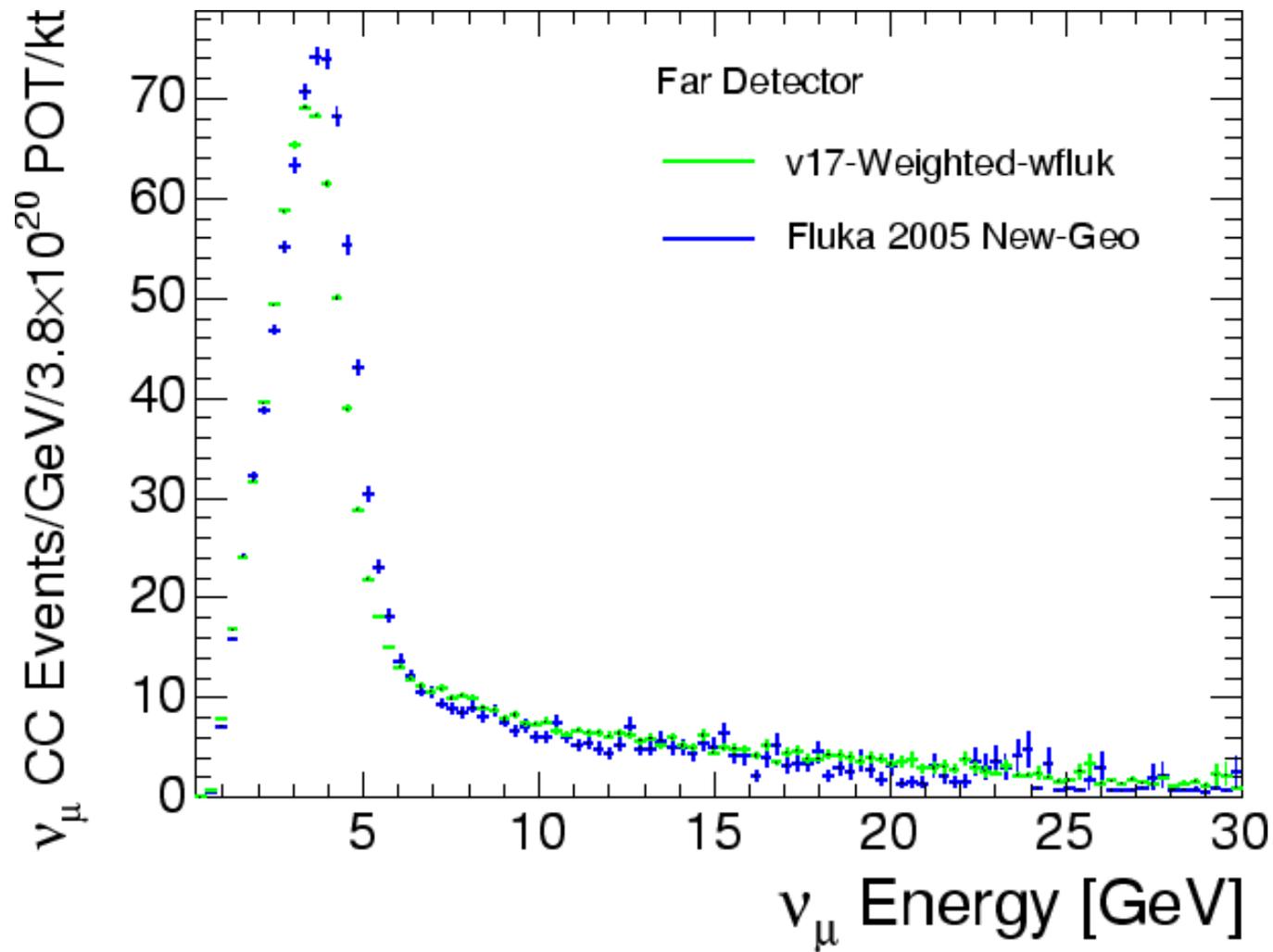
# GNUMI Fluxes



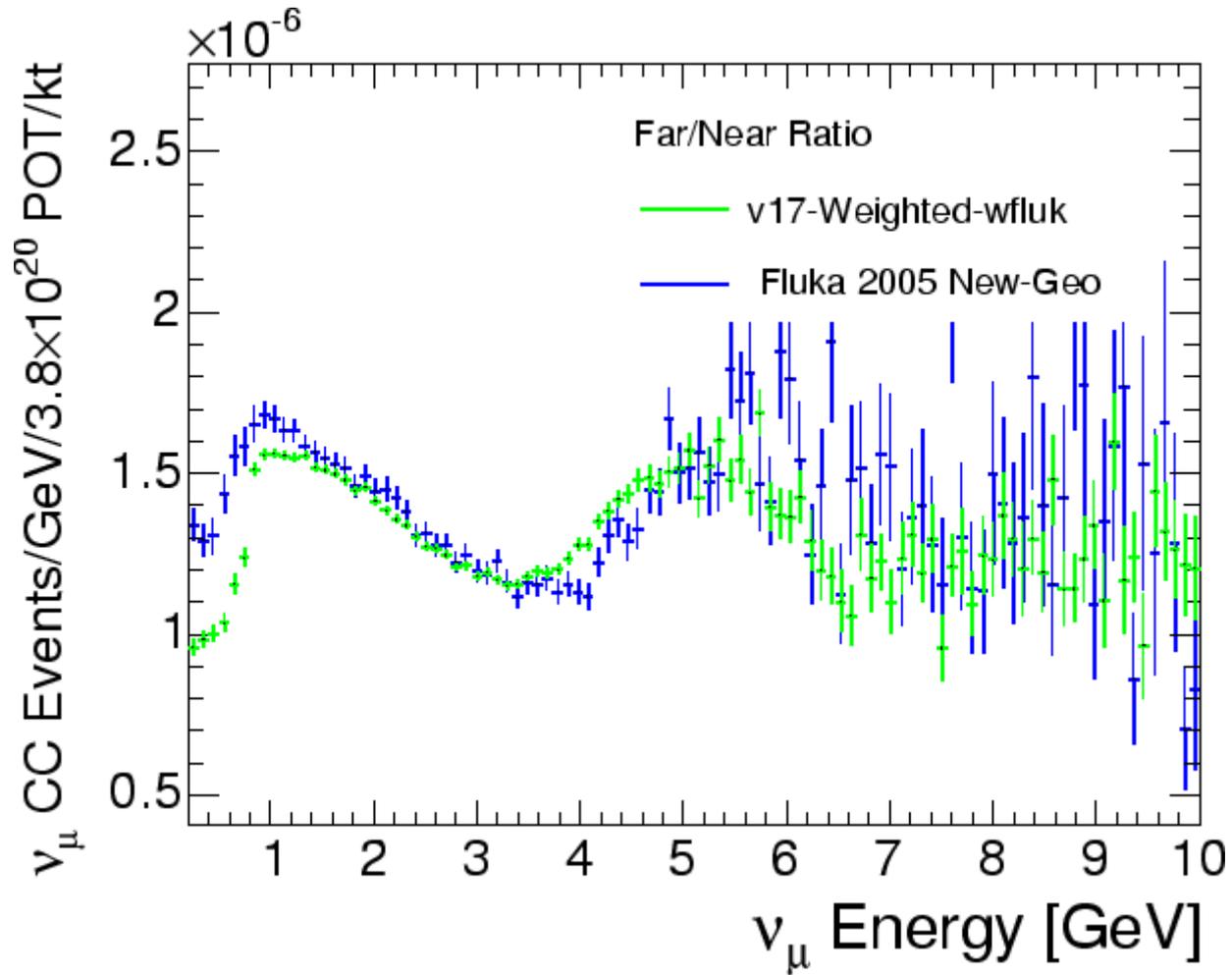
# GNUMI Fluxes - Near Detector



# GNUMI Fluxes - Far Detector



# GNUMI Fluxes - Near/Far Ratio



## **4. Summary and Current Plans**

# Summary and Current Plans

## Summary:

- New FLUKA version and new geometry produced significant changes in the fluxes as seen in the Near/Far ratio.
- Detailed documentation of this work can be found:  
<http://www-hep.physics.wm.edu/~yumiceva/talks/fluka>  
together with a description of the ROOT scripts to plot the fluxes, how to run FLUKA, and more.

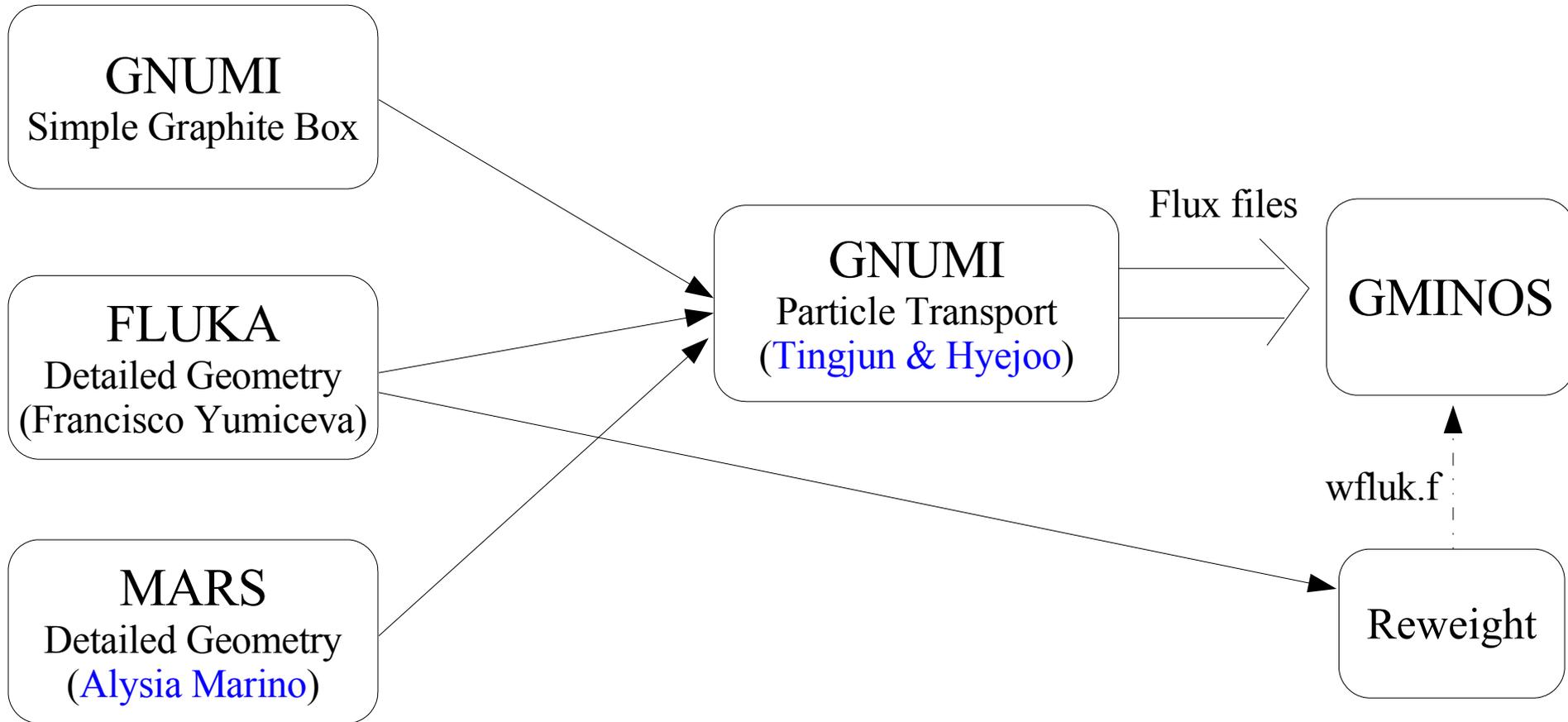
## Plans:

- Use FLUKA and MARS (Alysia) hadron ntuples to produce v.18 fluxes.
- New version will remove the hadron reweighting (wfluk).
- Run LE, LE10, pME, pHE beam configurations (in days).
- Run ME, HE beams (in weeks).

# Acknowledgment to the Beam Systematics Group

Target Geometries

Horns, decay pipe, absorbers, etc.



Sacha Kopp, Mark Messier, Tingjun Yang, Alysia Marino,  
Hyejoo Kang, Zarko Pavlovich, Bob Zwaska, Jim Hylan