LBNE Beam: Decay Pipe Prodcution

2/2/10

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The LBNE Decay Pipe

- **The current design of the DP for LBNE has a radius=2m, length=250m.**
- **The DP is air cooled - this is more reliable than water cooling**
- **With air cooling, you may not need a DP window - simpler design**
- **The NuMI DP is r=1m and l=675m. The DP was evacuated for the 2005-2008 running. Radiation damage to the Al DP window was observed $\Rightarrow$ in Fall 2008, NuMI DP was filled with He at 1atm.**

The LBNE DP will not be evacuated to mitigate risk .

What is the effect of the DP fill material on the ν flux?

MINOS data on He production in DP

The MC is a FLUKA08 simulation

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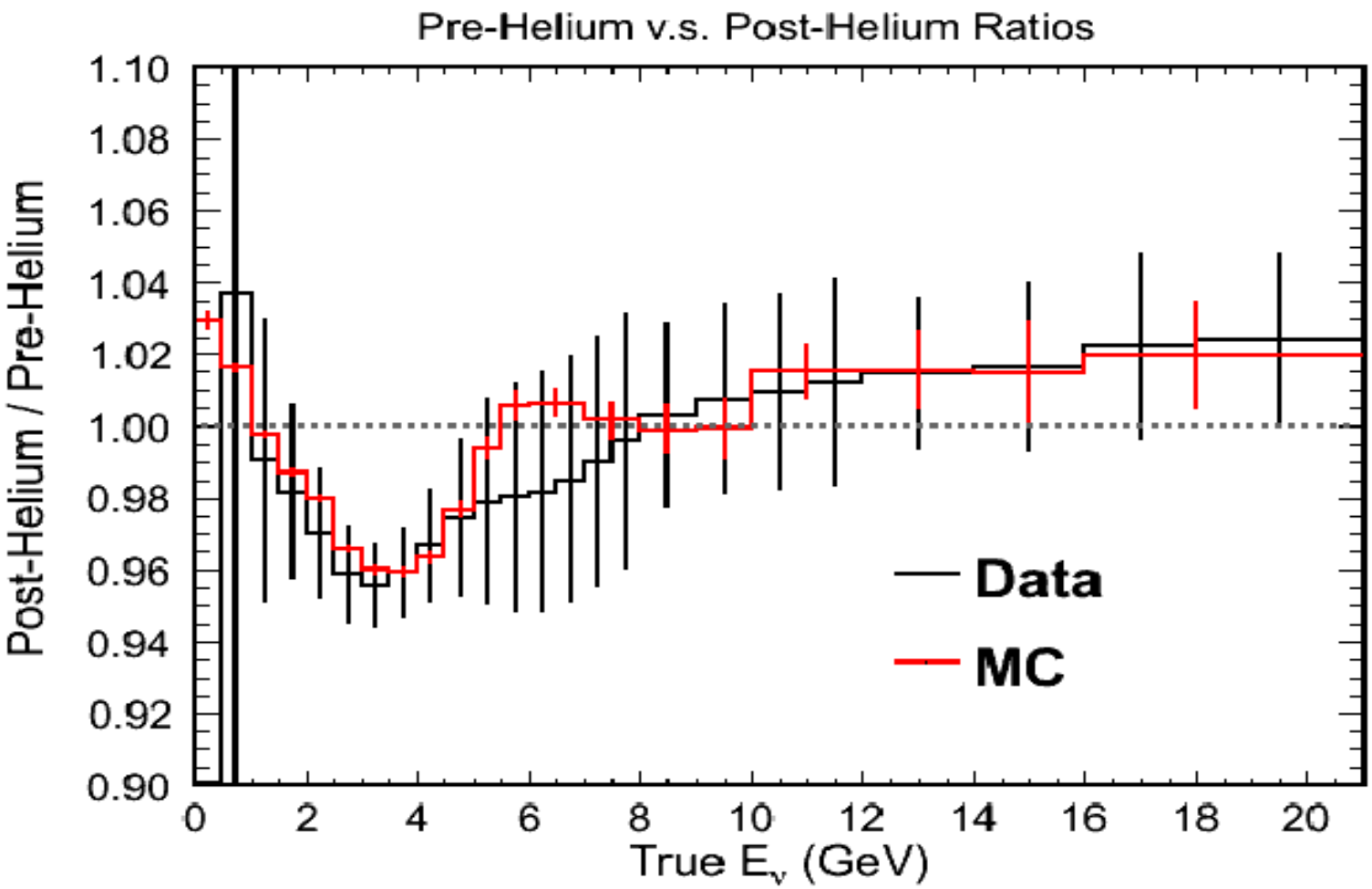

The NuMI DP is 675m long. Only 4% loss in flux at focusing peak with

Naively expect $\sim$ 1.5% loss in 250m DP (π interaction length in He = 6

Using He instead of Air in the LBNE DP

Using GNUMI simulation

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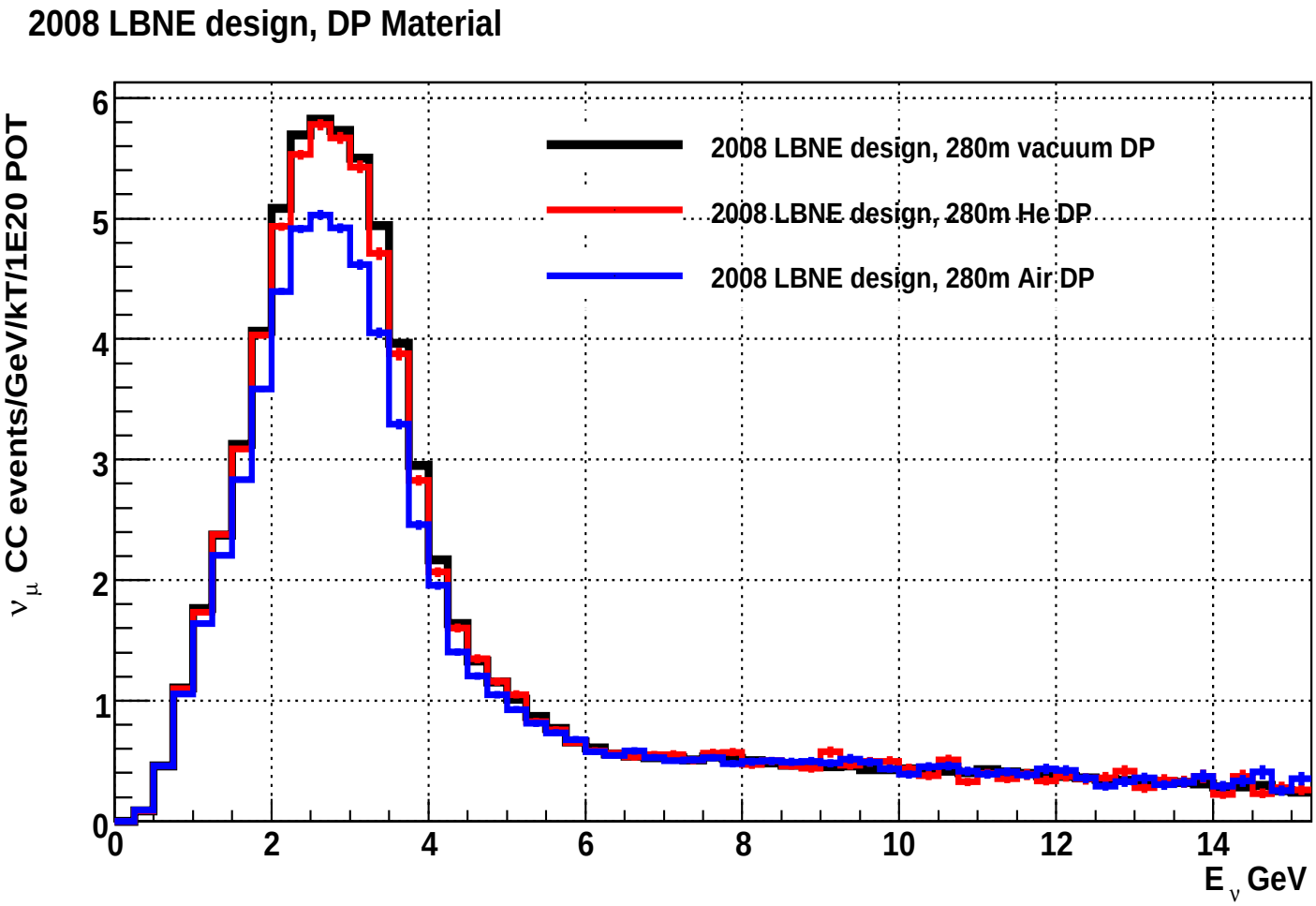

No significant loss in flux if we use He !

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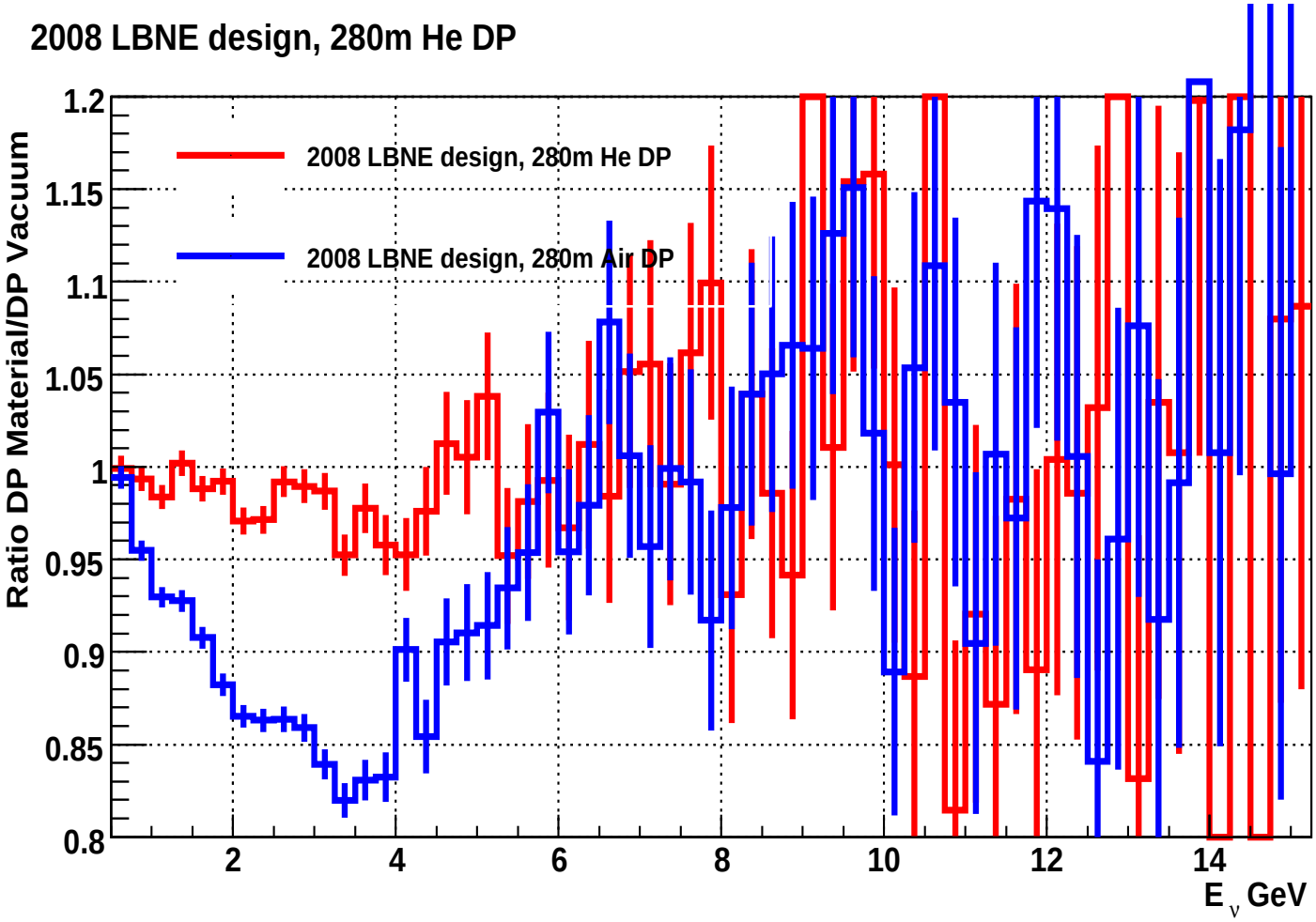
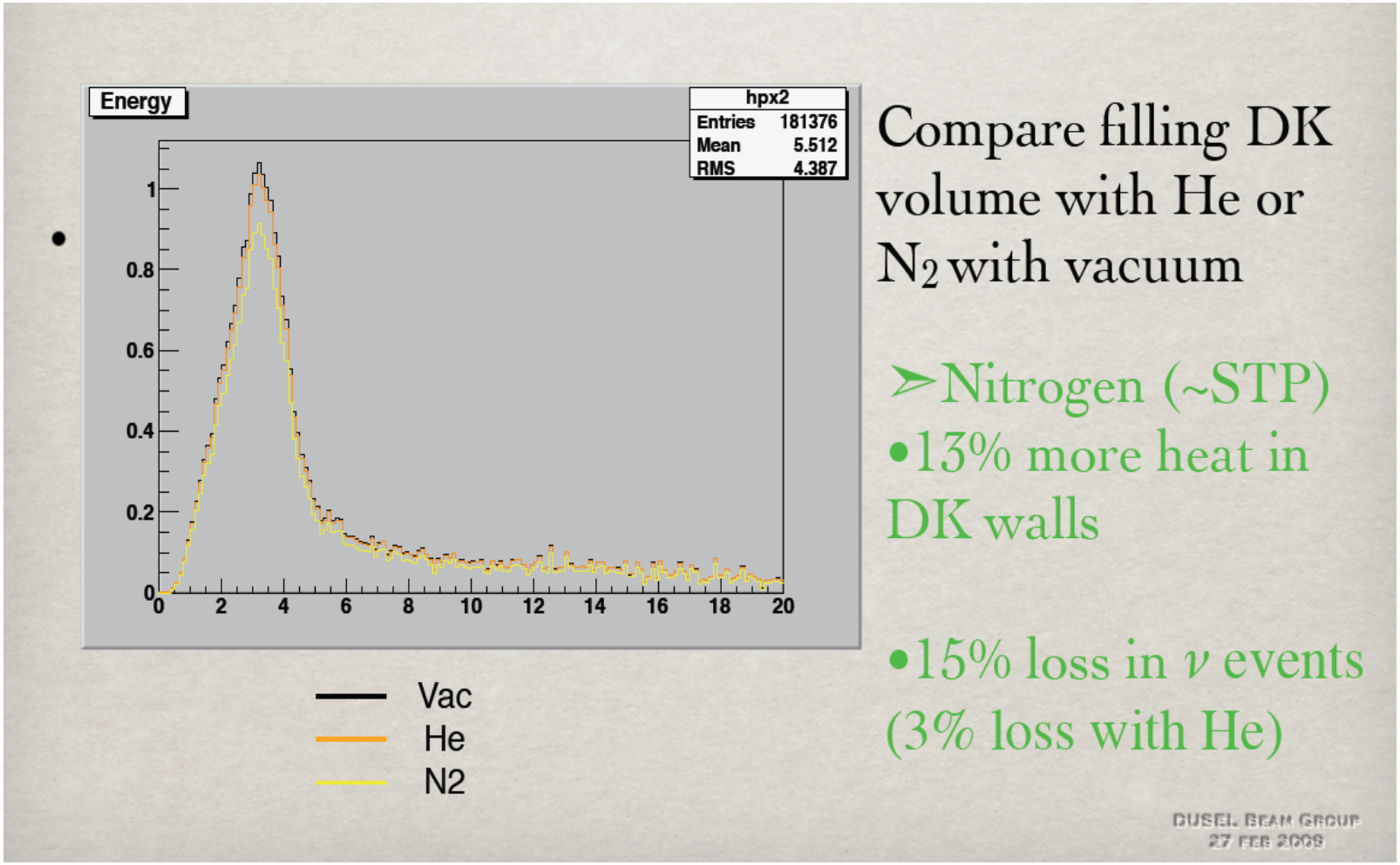
Using GNUMI simulation



No significant loss in flux if we use He !

Original study of DP material from Byron - 2009

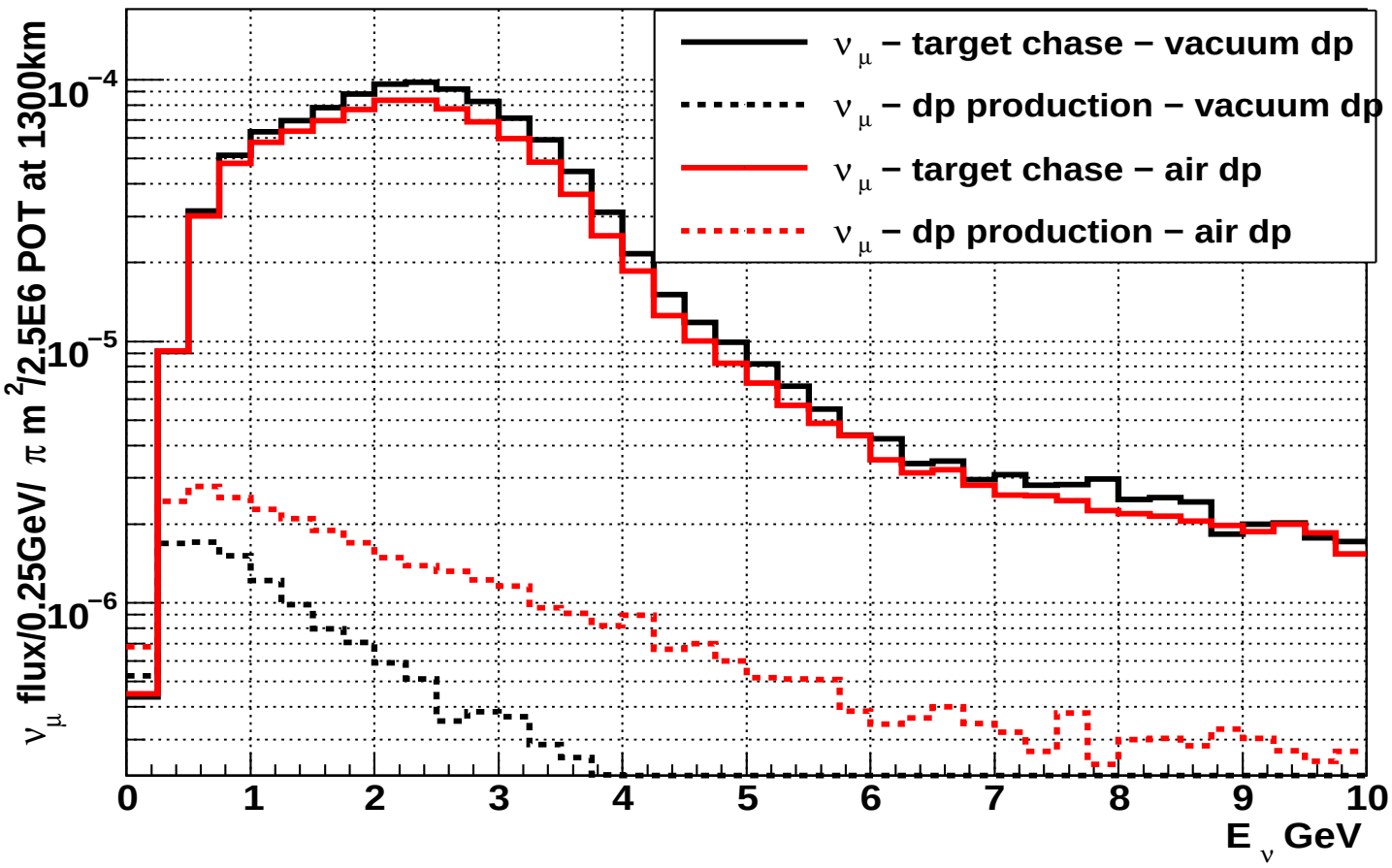


MARS studies show the same effects of Air/He

Production in the LBNE decay pipe air

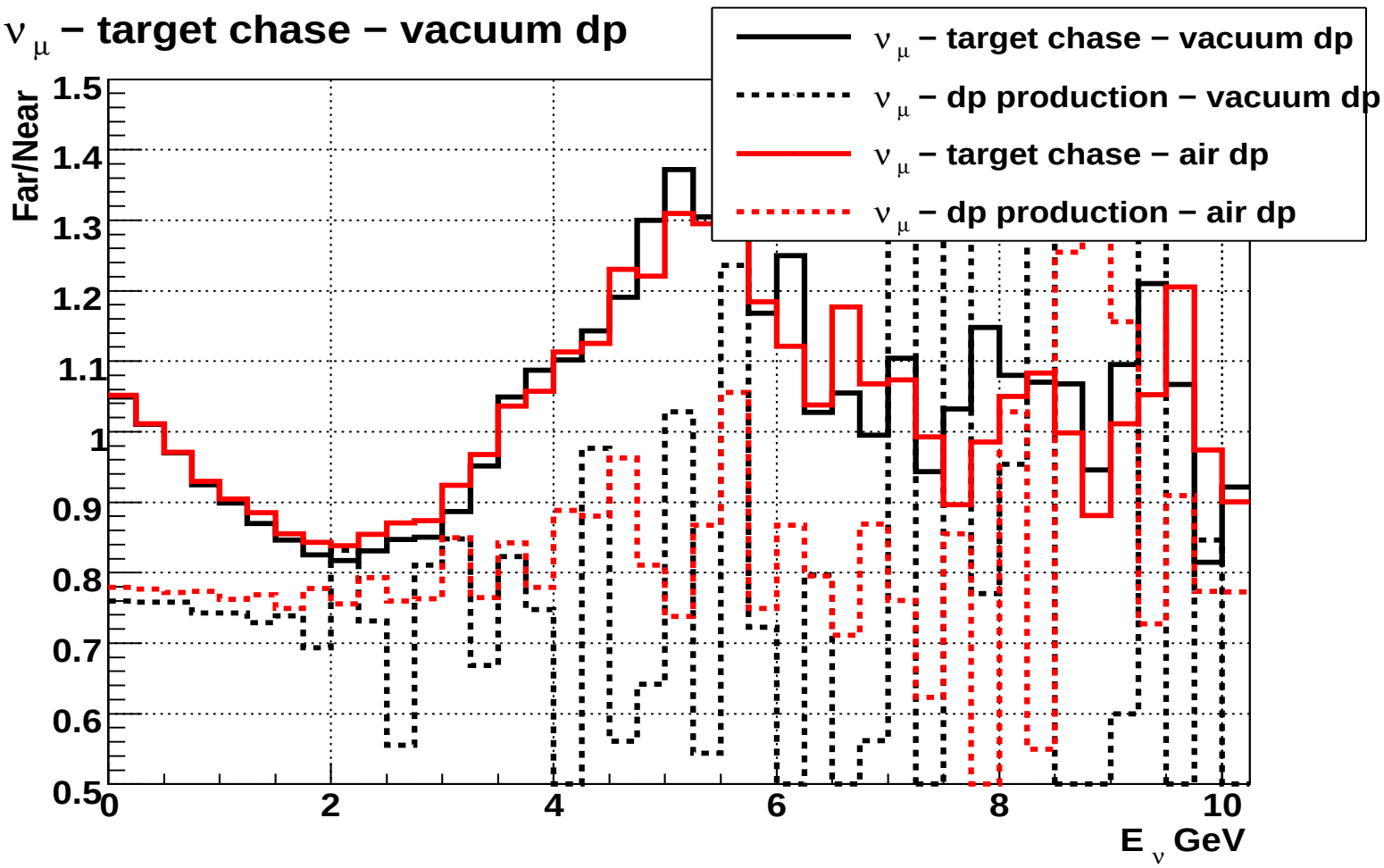
—- **Neutrinos that originate from the decays of hadrons produced in the target chase region (target, horns, shielding, decay pipe window).**
- - - Neutrinos from hadrons produced in the decay pipe walls, dump and material in the decay pipe.

ν_μ – target chase – vacuum dp



Extrapolation of decay pipe νs

Far/near ratio for target chase and decay pipe neutrinos



Extrapolation of decay pipe neutrinos is very different than target chase

Conclusions

We expect no loss of ν flux from He in the DP. With air, we lose 20% of the focusing peak. Smaller uncertainty on F/N if we reduce secondary production in DP.

What are the design limitations of using He in the DP?