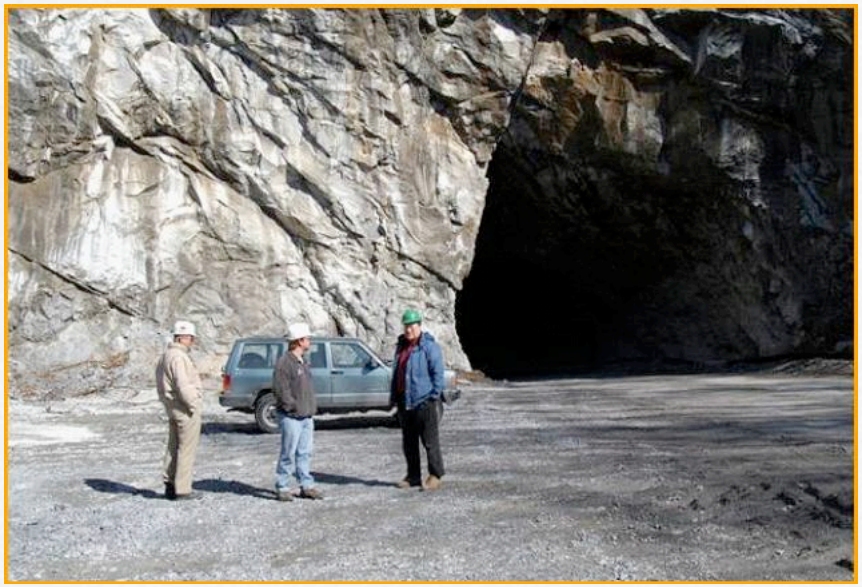
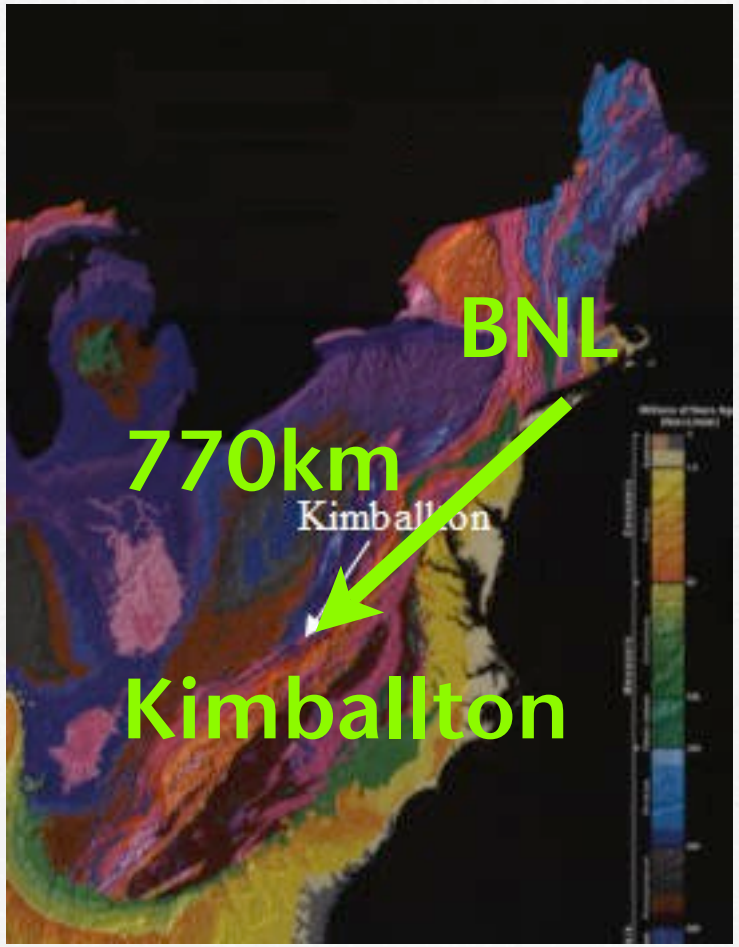
Possibility of BNL-Kimballton Long Baseline Experiment

Masafumi Koike (Virginia Tech)
with
Naotoshi Okamura (KIAS)
Masako Saito
Tatsu Takeuchi (Virginia Tech)

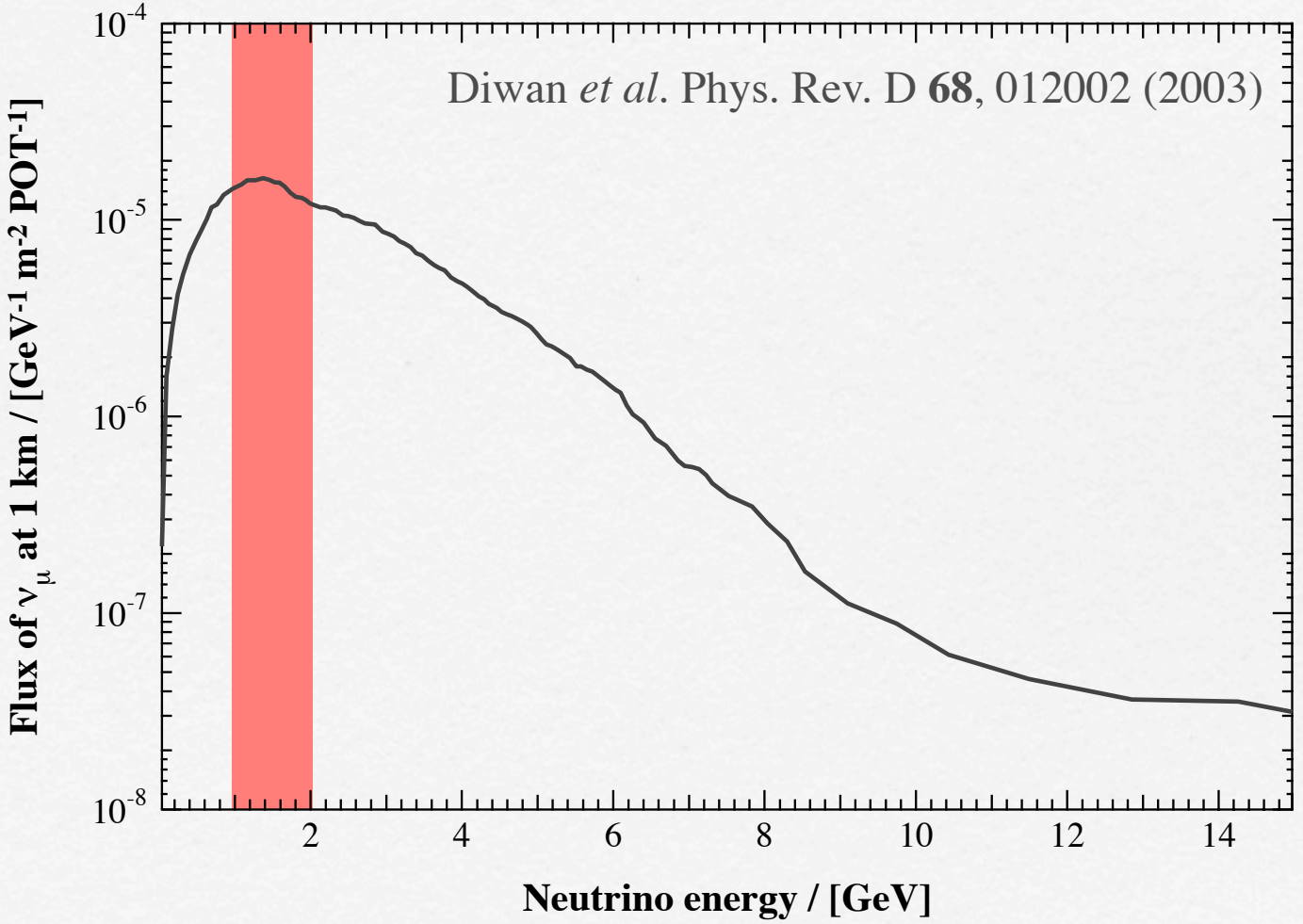
BNL to Kimballton

Kimballton mine, Virginia

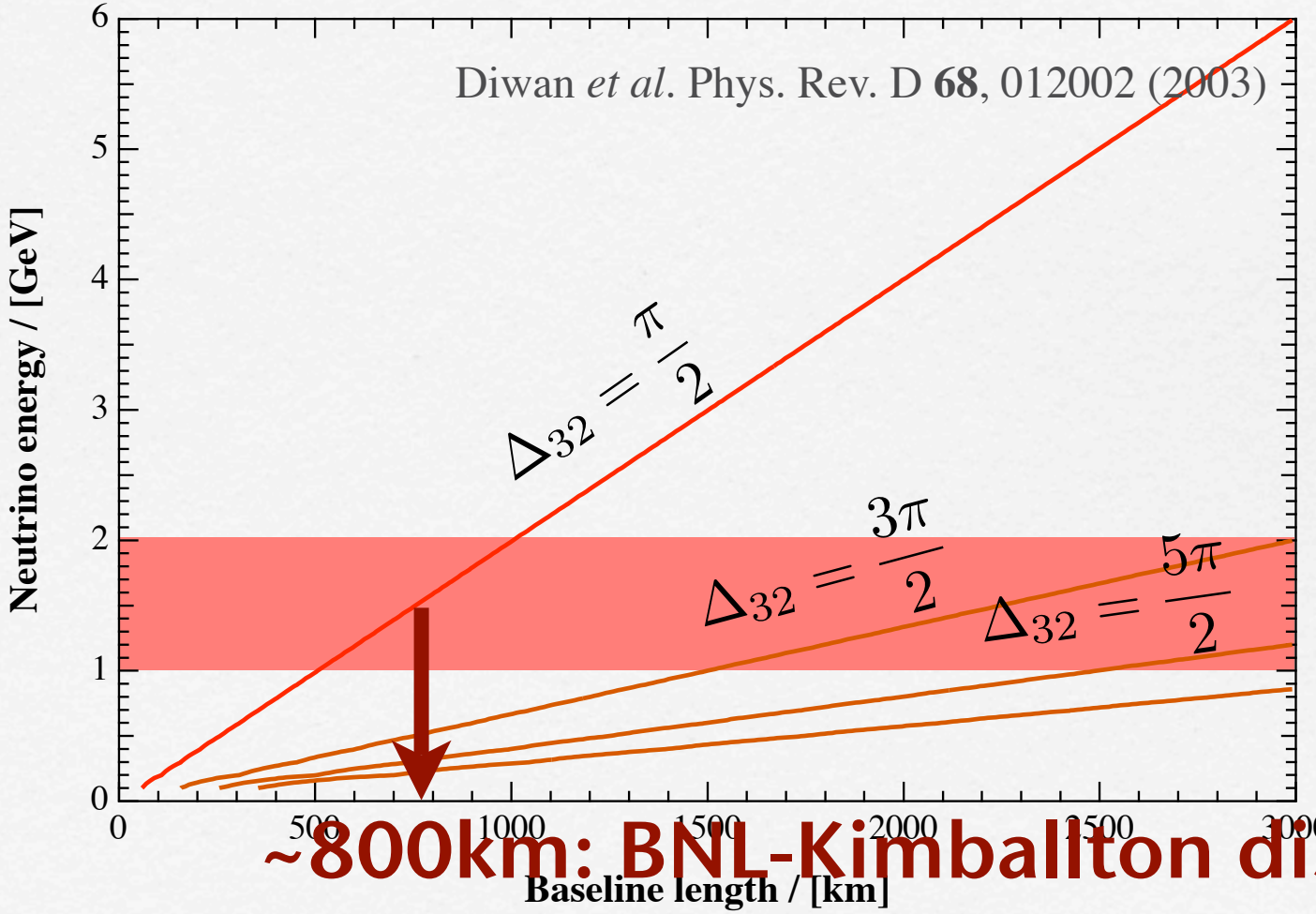




BNL Beam Profile



Oscillation Peaks

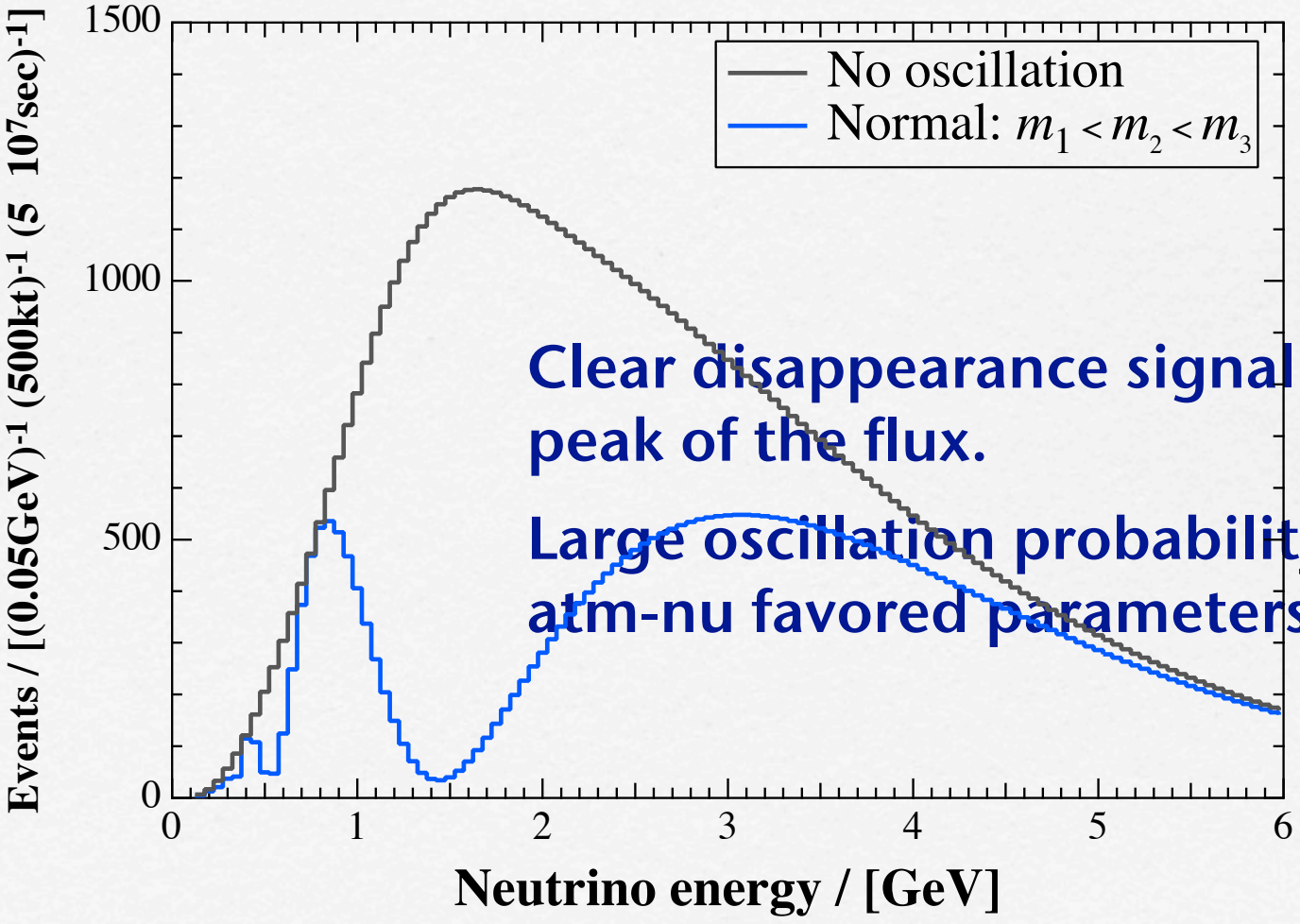


~800km: BNL-Kimballton distance

ν_μ disappearance

770km Baseline

$\delta m^2_{21} = 7.3 \times 10^{-5}\,\mathrm{eV}^2$
$\delta m^2_{32} = 2.5 \times 10^{-3}\,\mathrm{eV}^2$
$\sin^2 2\theta_{12} = 0.86$
$\sin^2 2\theta_{23} = 1.0$
$\sin^2 2\theta_{13} = 0.04$
$\rho = 2.6\,\mathrm{g/cm}^3$



Clear disappearance signal at the peak of the flux.

Large oscillation probability for SK atm-nu favored parameters.

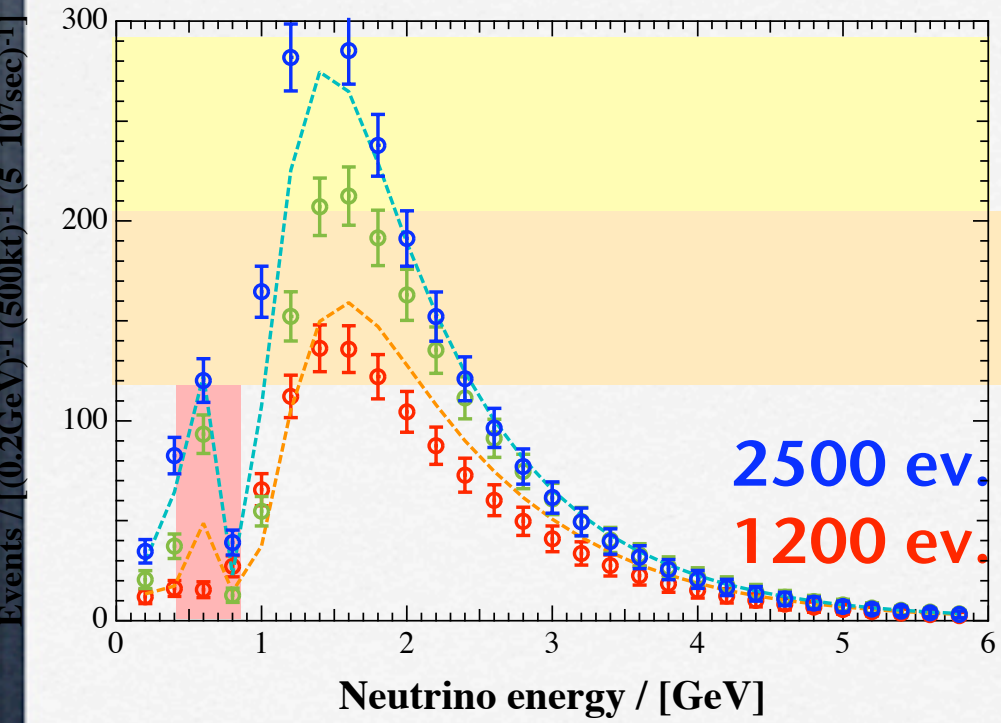
74000 ev

25000 ev

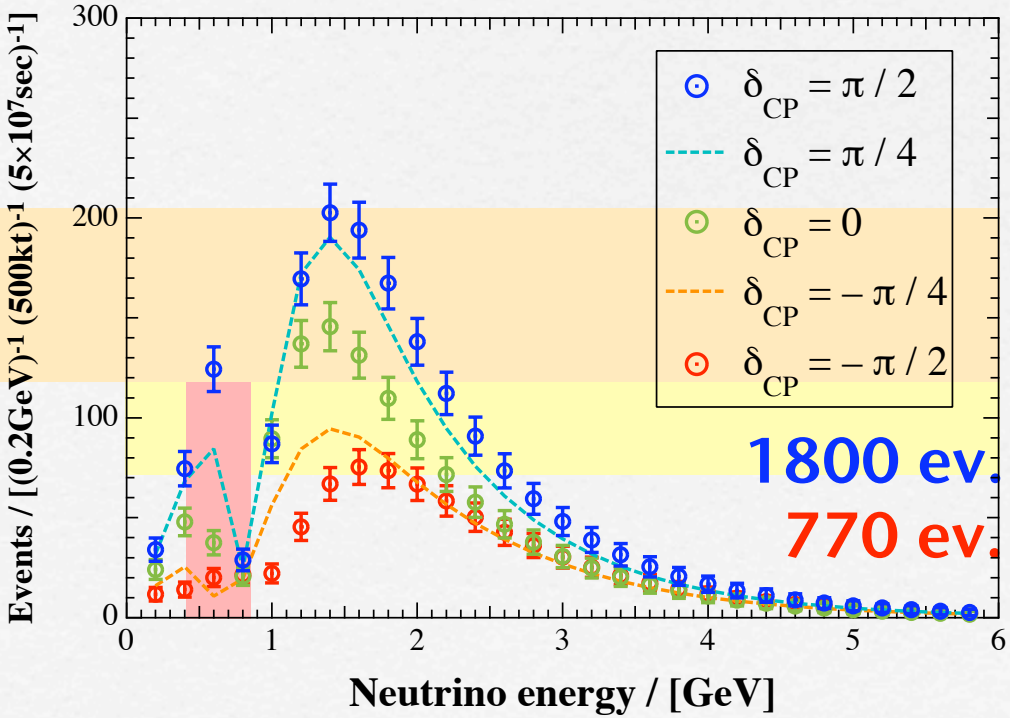
ν_e appearance

770km Baseline

Normal hierarchy



Inverted hierarchy



Advantages of 770km Baseline

- Large flux
  - Fits well to the BNL beam profile
  - Large statistics
  - Possible use of anti-neutrinos
- Clear oscillation signals
  - for the favored/allowed parameter region
  - at the peak of the flux
- Less ambiguous estimation of matter effect (path entirely within the crust)

Summary

- 770km experiment *can* do the good physics.
  - Large statistics for δm^2_{32} and $\sin^2 2\theta_{23}$.
  - Can search for $\mathrm{sgn}(\delta m^2_{32})$ and δ_{CP}.
  - Further study is anticipated to quantify the impact.

Bottom line

- Considered ~50kt scintillation detectors (SD) [LENA, SSD]...
  - Low-energy solar neutrinos
  - Proton decay
  - Geoneutrinos
  - Supernova
  - Dark matter
- Synergy between Long Baseline Experiments and Scintillation Detectors?