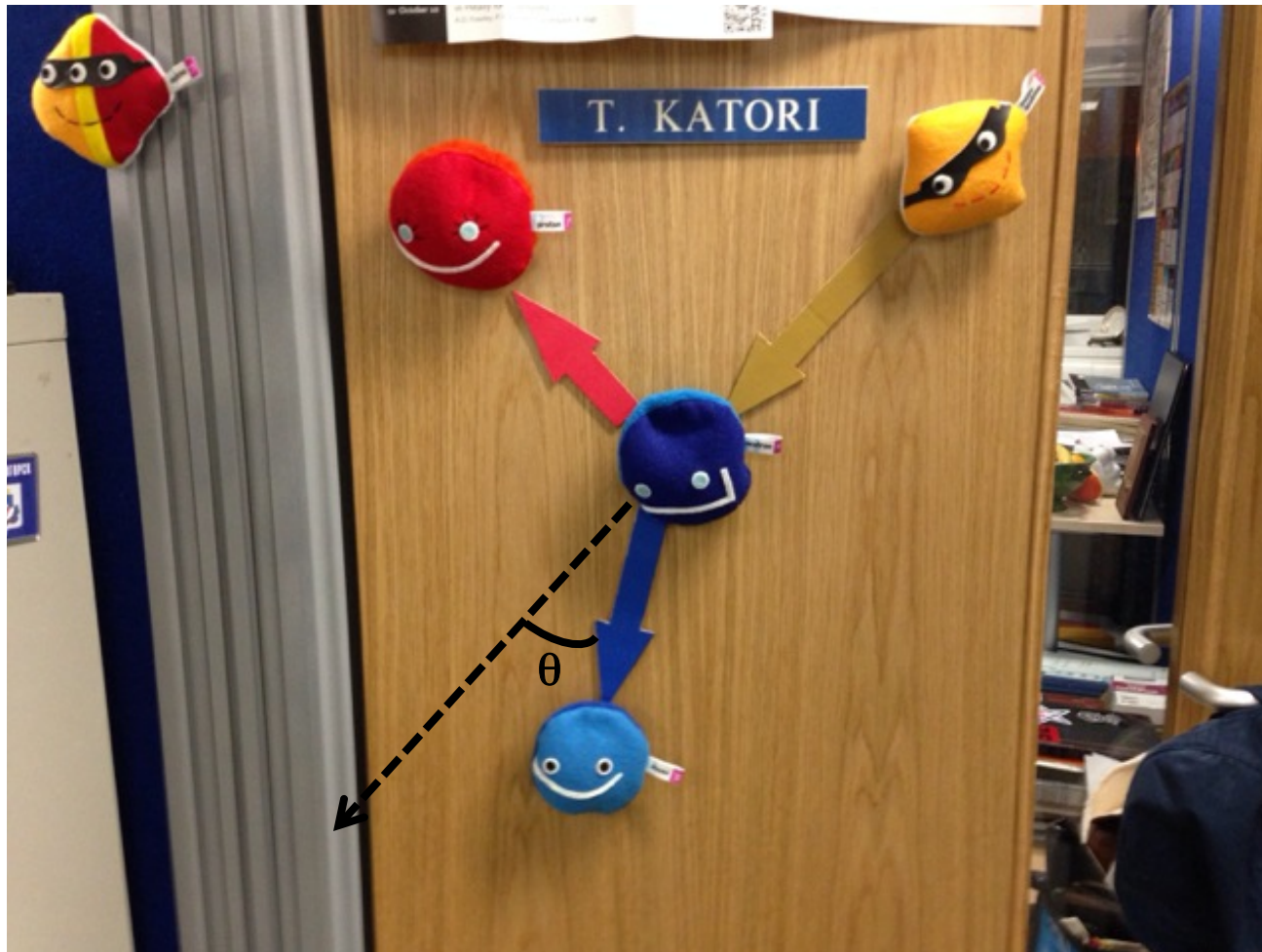


Importance of low momentum transfer (for theorists) and high angle measurements (for experimentalists)

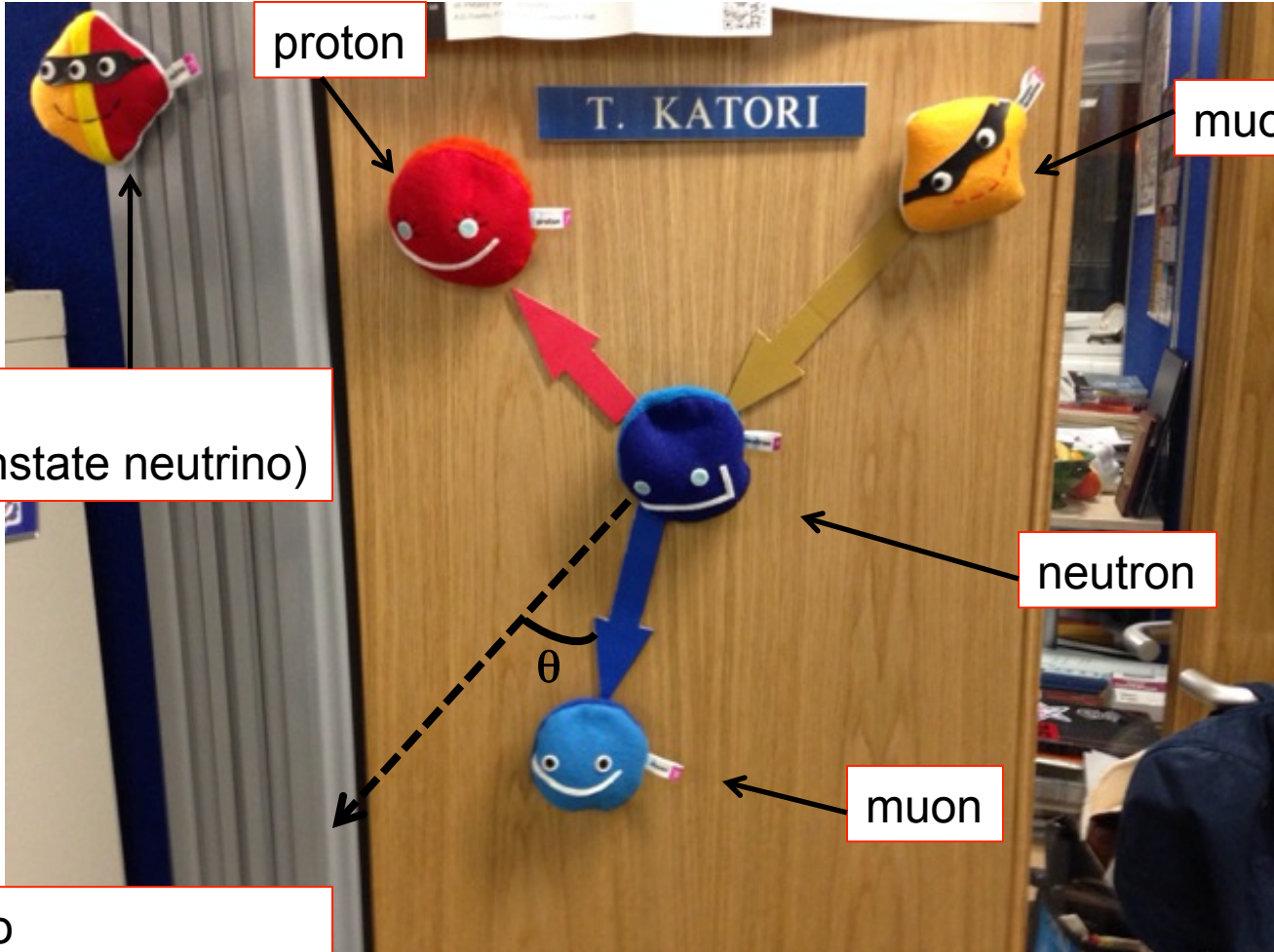


Teppei Katori

Queen Mary University of London

INT workshop, Seattle, USA, Dec. 12, 2013

Importance of low momentum transfer (for theorists) and high angle measurements (for experimentalists)



proton

muon neutrino

ν_3
(mass eigenstate neutrino)

neutron

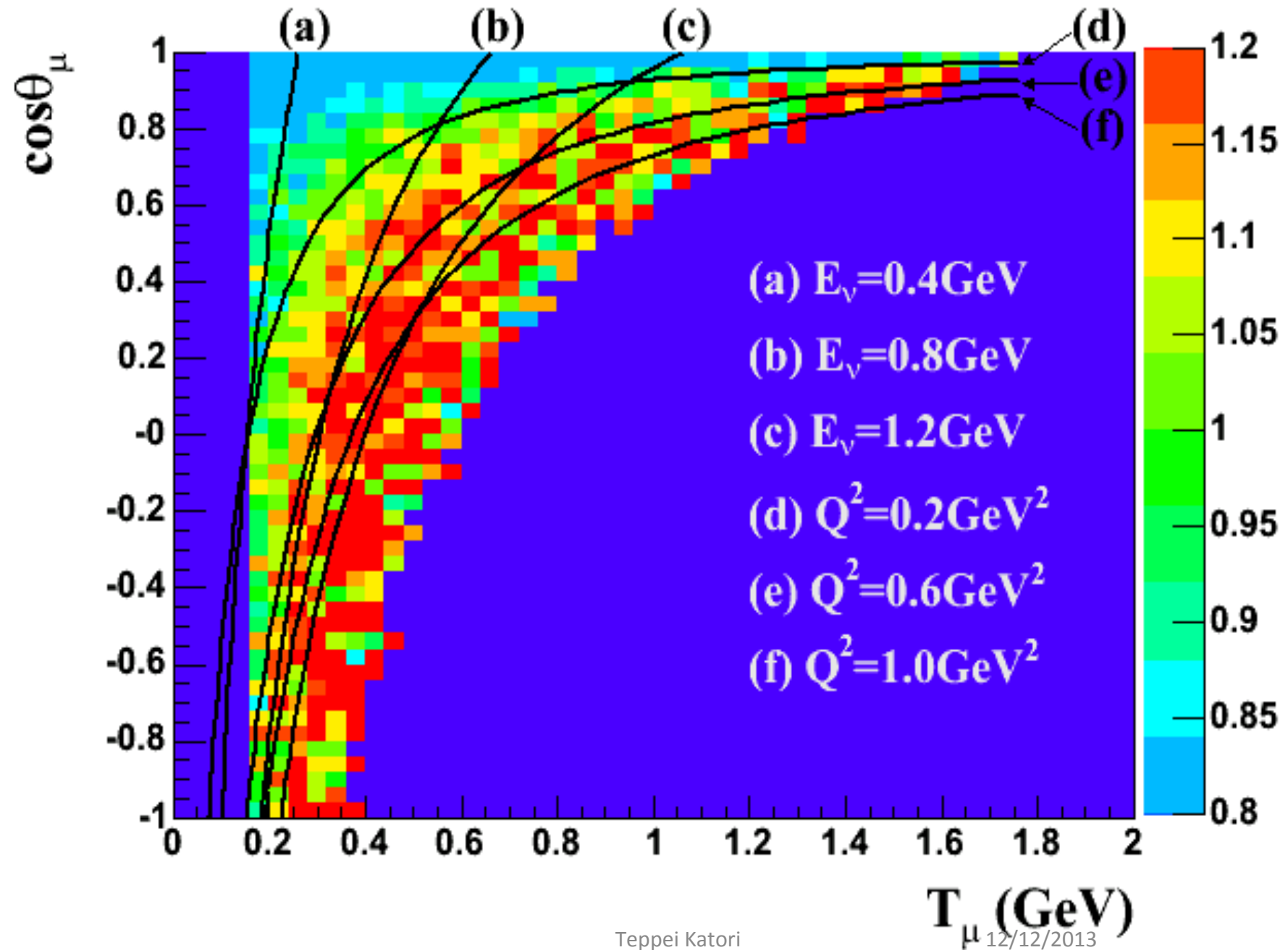
muon

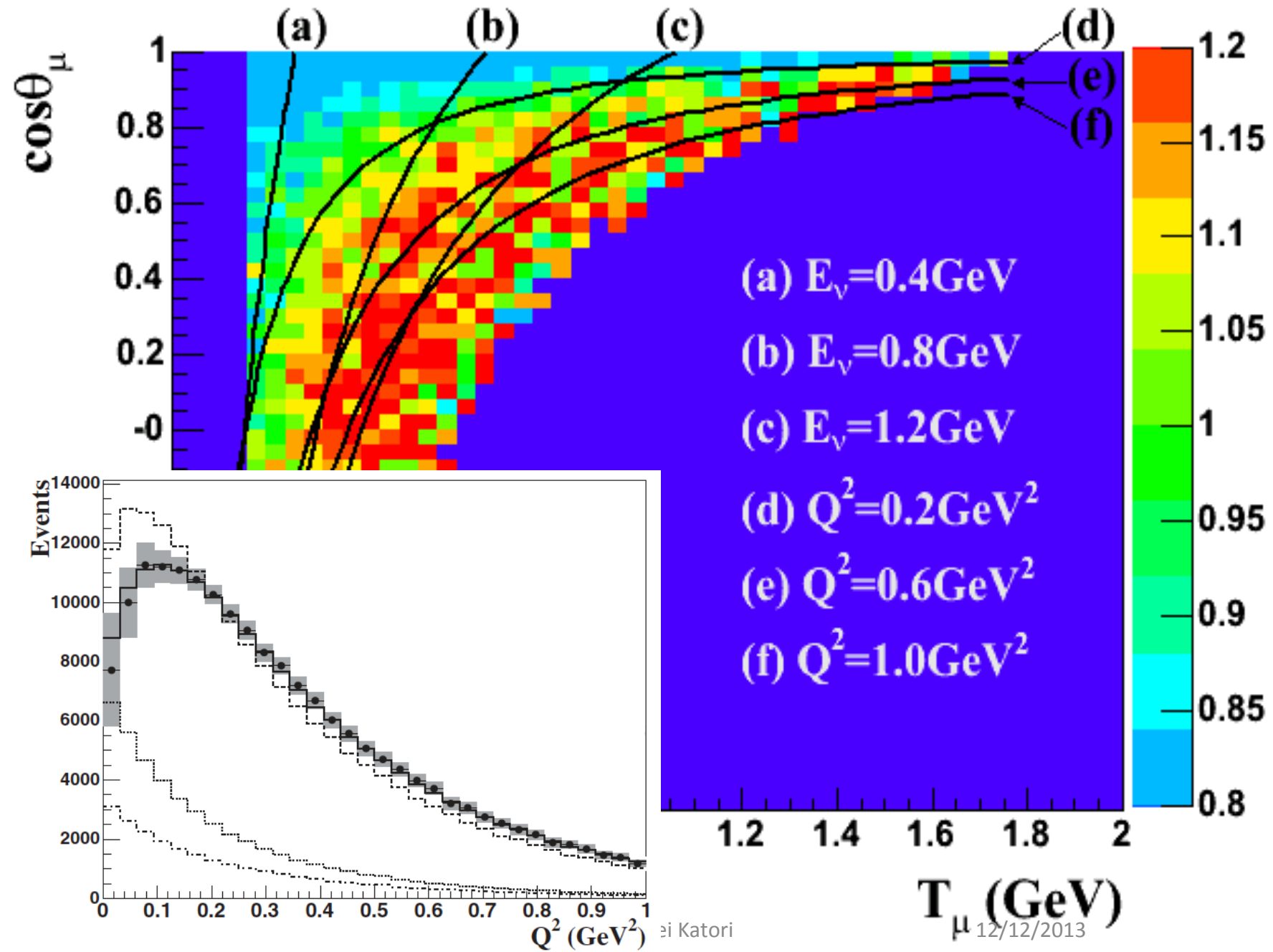
Particle Zoo
<http://www.particlezoo.net/>

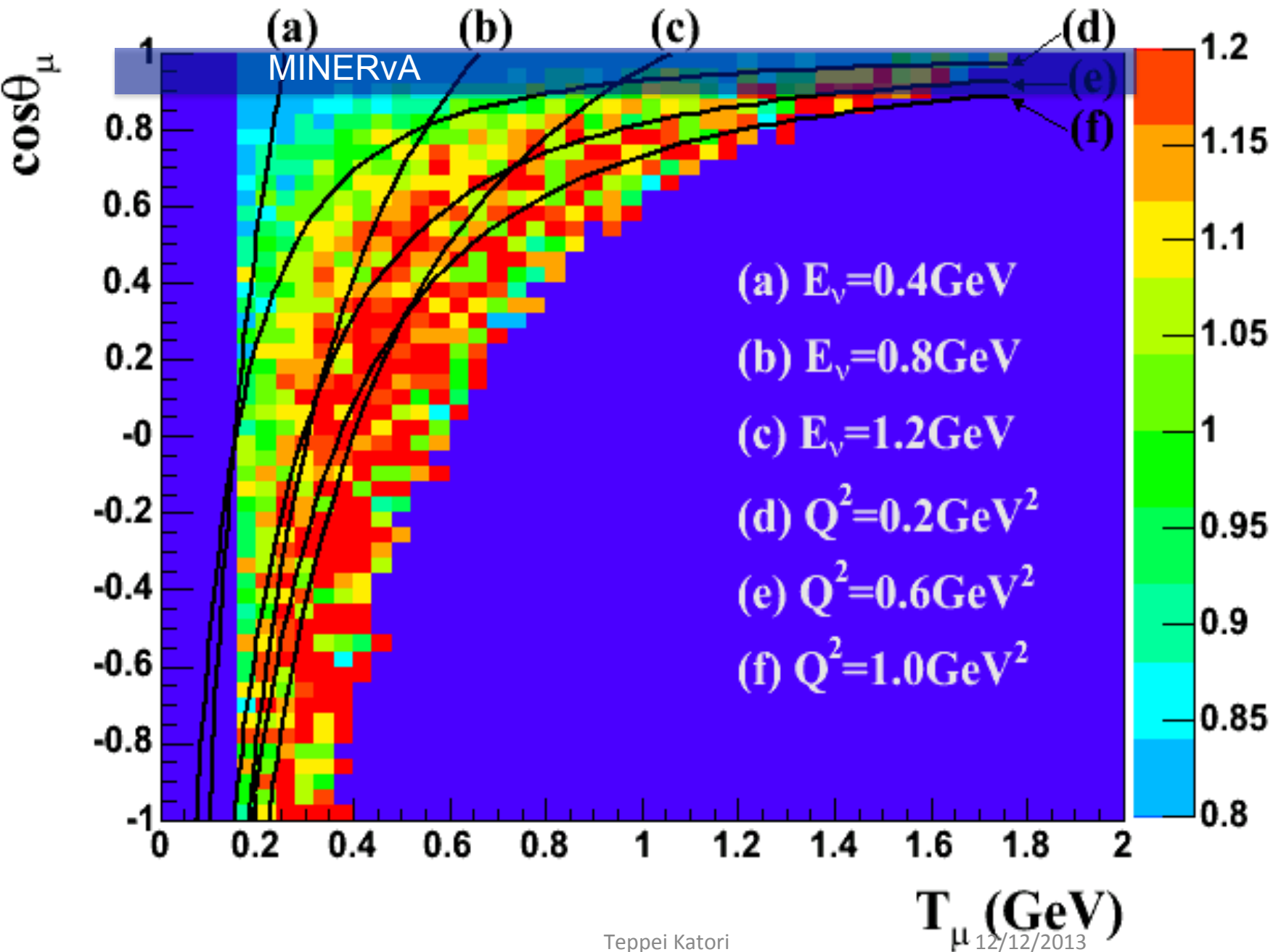
Teppei Katori

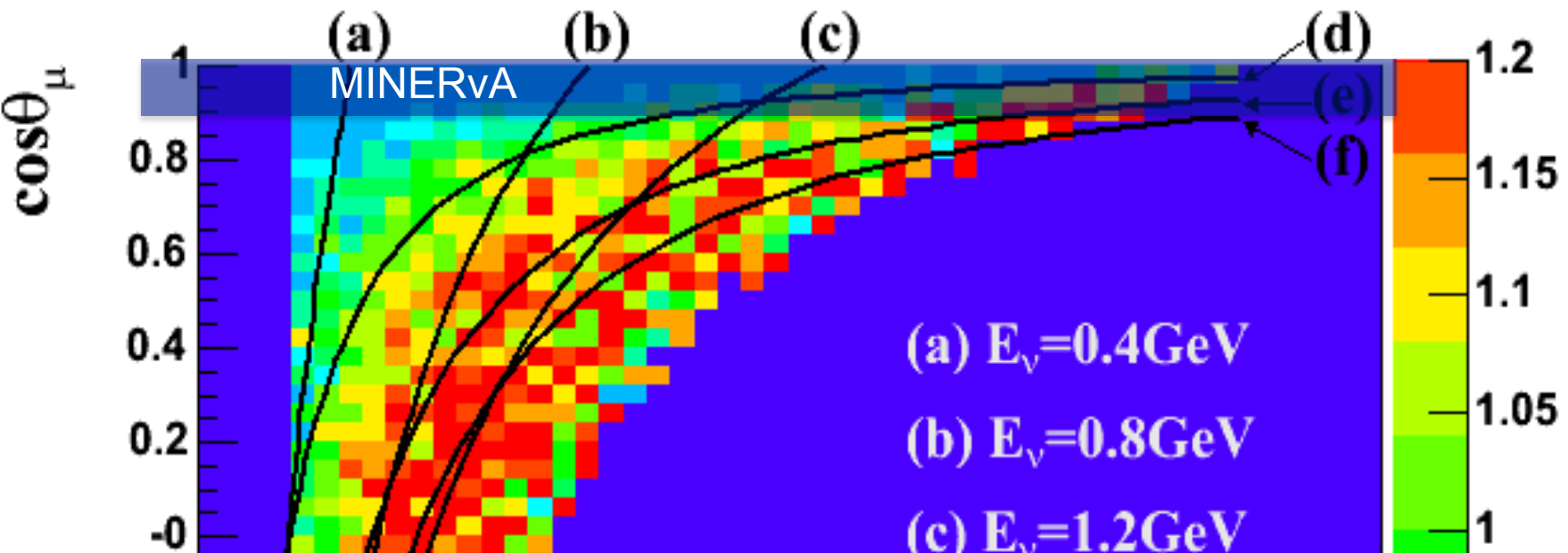
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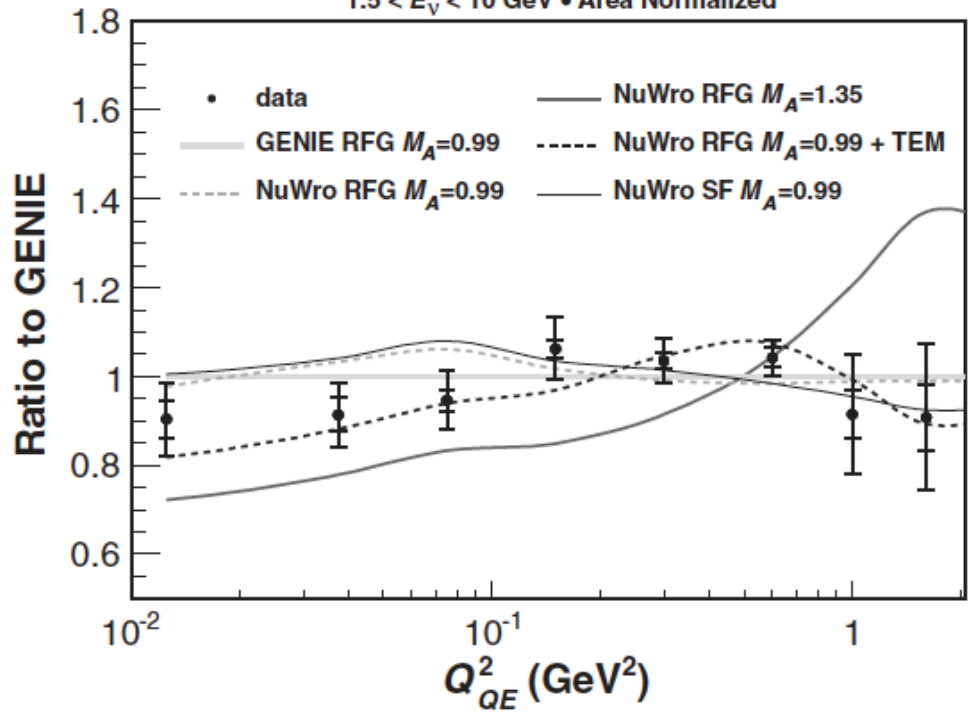






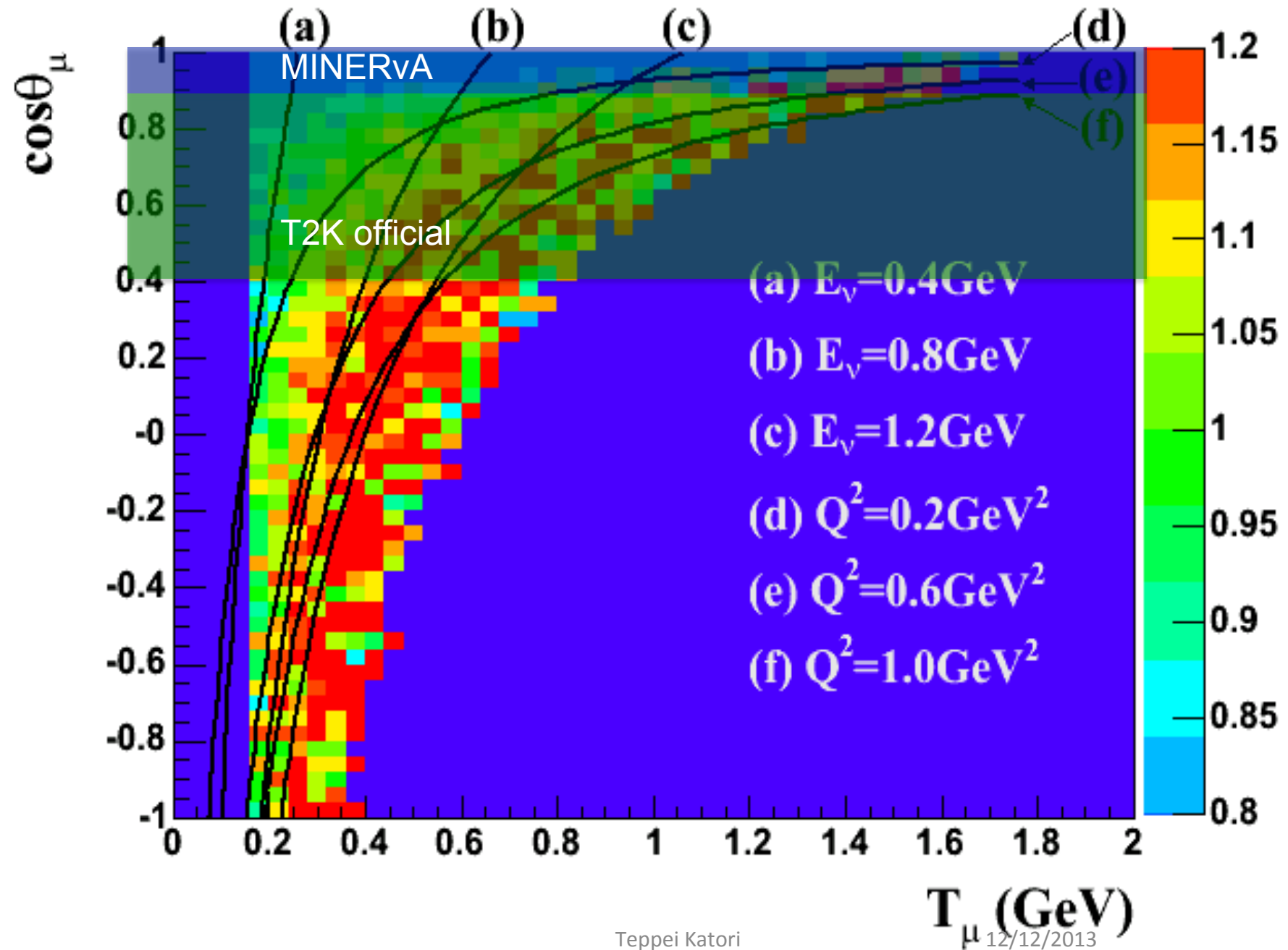


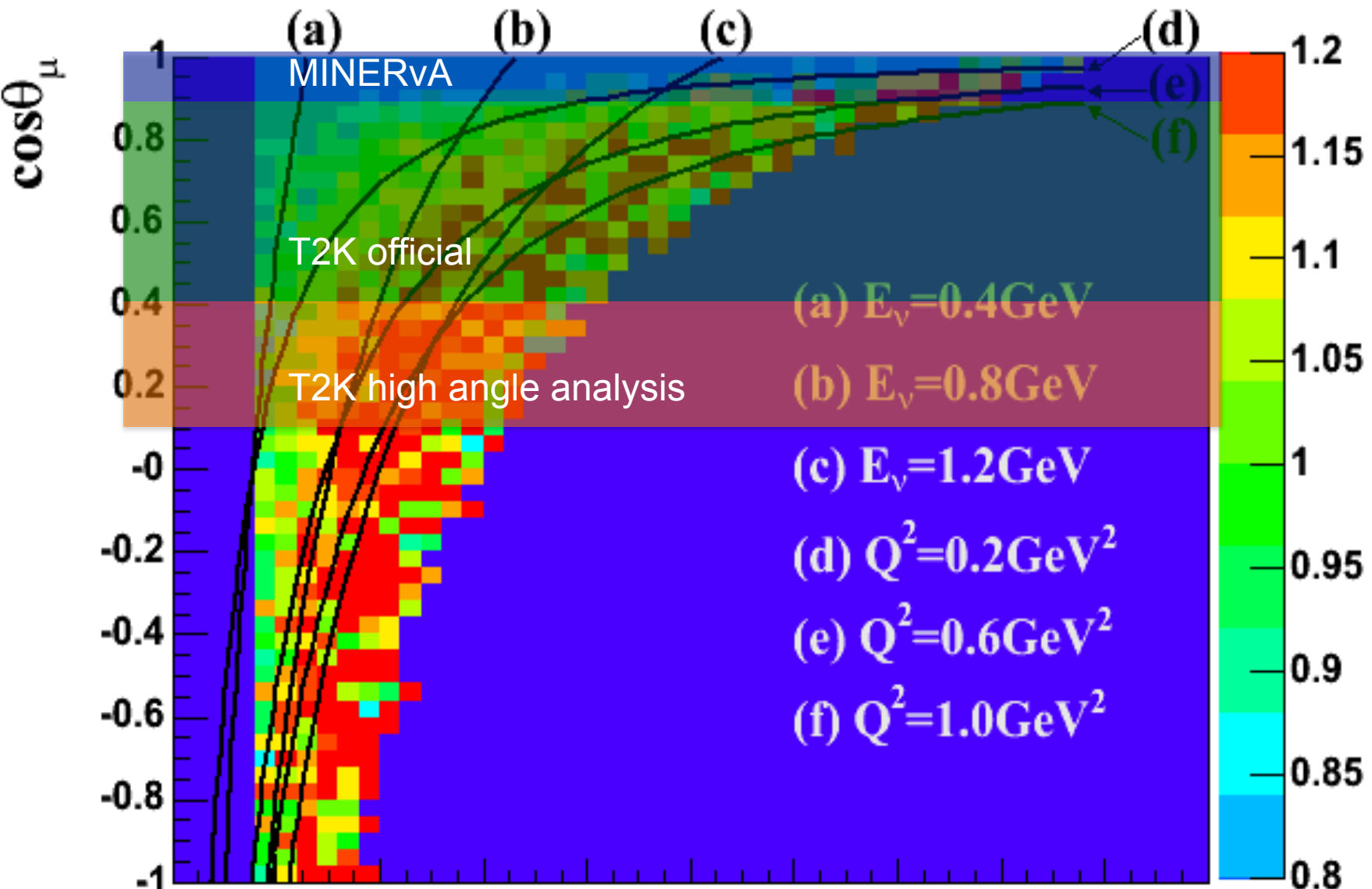
1.5 < E_ν < 10 GeV • Area Normalized



- (a) $E_\nu = 0.4 \text{ GeV}$
- (b) $E_\nu = 0.8 \text{ GeV}$
- (c) $E_\nu = 1.2 \text{ GeV}$
- (d) $Q^2 = 0.2 \text{ GeV}^2$
- (e) $Q^2 = 0.6 \text{ GeV}^2$
- (f) $Q^2 = 1.0 \text{ GeV}^2$

MA=1.35 disagrees with MINERvA, but definition of Q^2_{QE} is quite different with MiniBooNE → Q^2_{QE} is not good variable to compare experiments





For experimentalists
→ larger angular acceptance is crucial to understand the physics

Impulse Approximation is broken at low Q^2 (or low $|\mathbf{q}|$)

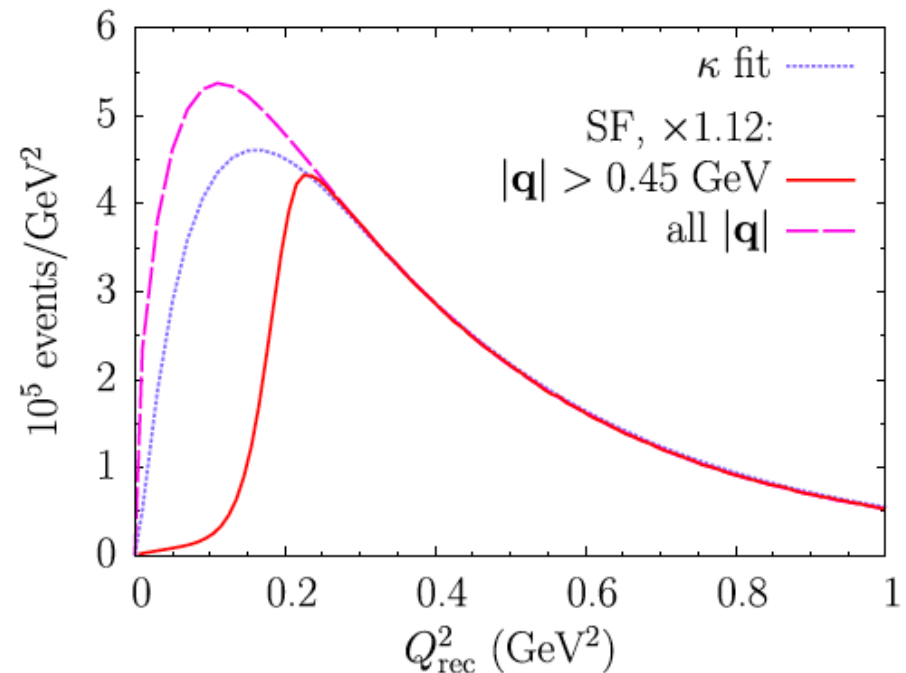
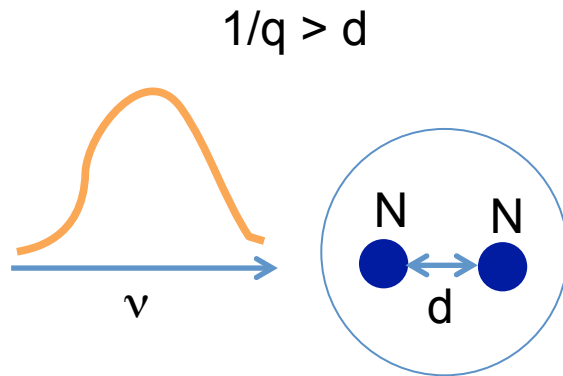


FIG. 6 (color online). Comparison of the MiniBooNE parametrization of the data (dotted line), labeled as the κ fit, to the spectral function calculation (dashed line). The solid line depicts the contribution to the latter from the region where the IA is expected to be valid. The SF results are multiplied by a factor 1.12 to make them match the κ fit.

For MiniBooNE, you can throw away the region $|q| < 400$ MeV, but for small angular acceptance experiments (MINERvA, T2K, NOvA, MicroBooNE, all current and future experiments!), $|q| < 400$ MeV is significant fraction of data and we cannot throw away

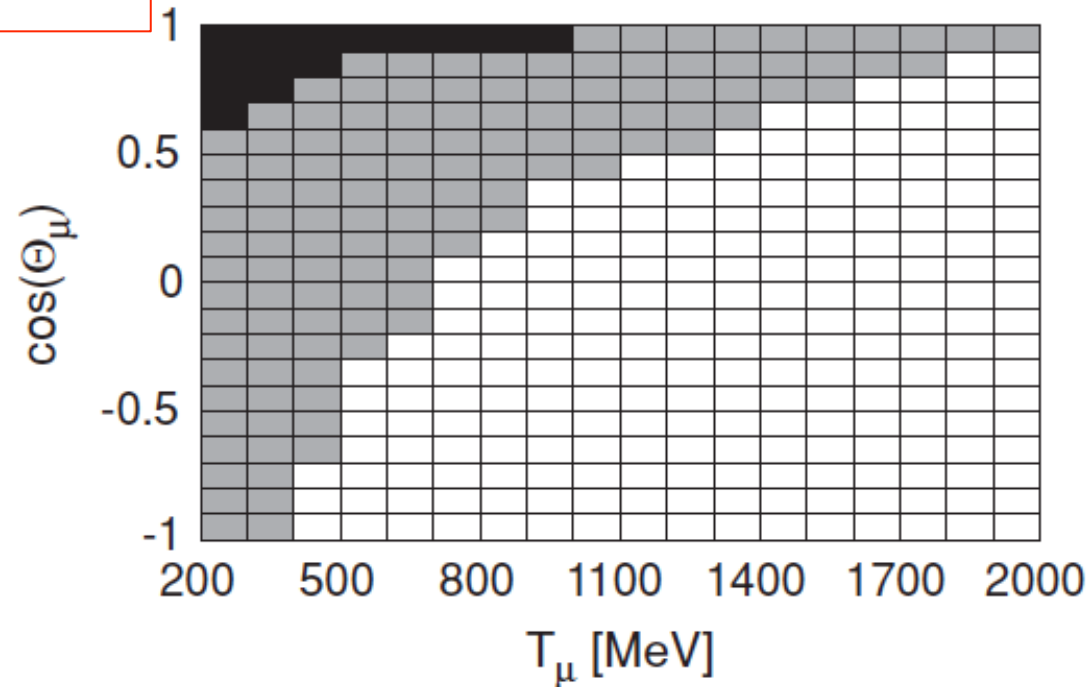
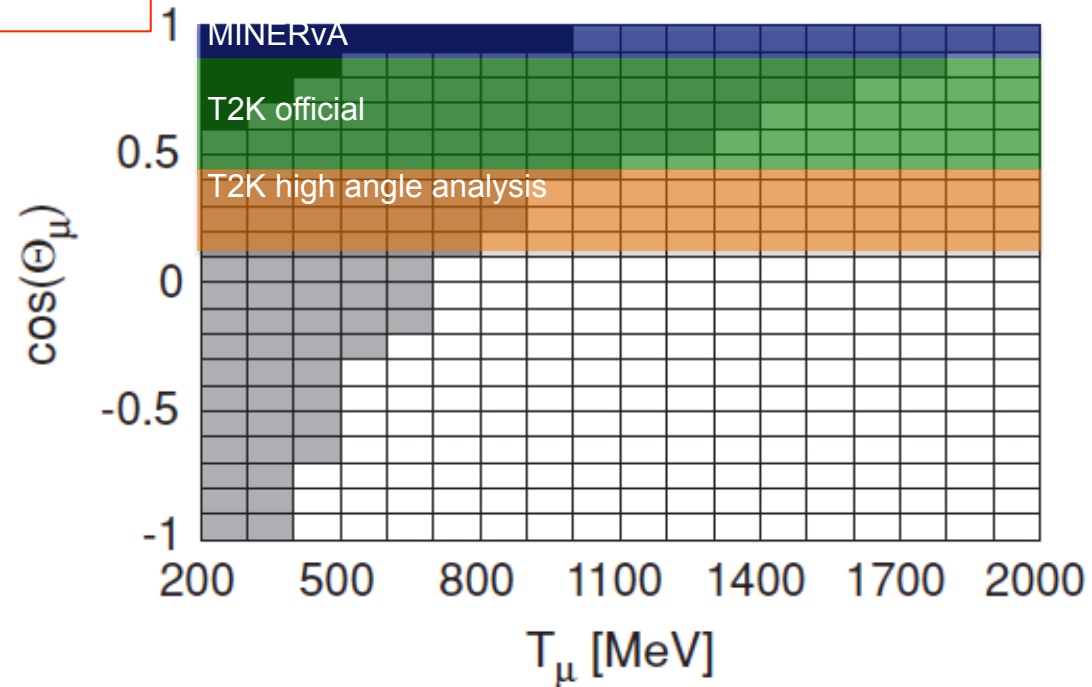


FIG. 3. Bins excluded from the fitting procedure for $q_{\text{cut}} = 400$ MeV/ c are shown in black. Bins with a nonzero cross section measured by MiniBooNE are shown in gray.

For MiniBooNE, you can throw away the region $|q| < 400$ MeV, but for small angular acceptance experiments (MINERvA, T2K, NOvA, MicroBooNE, all current and future experiments!), $|q| < 400$ MeV is significant fraction of data and we cannot throw away



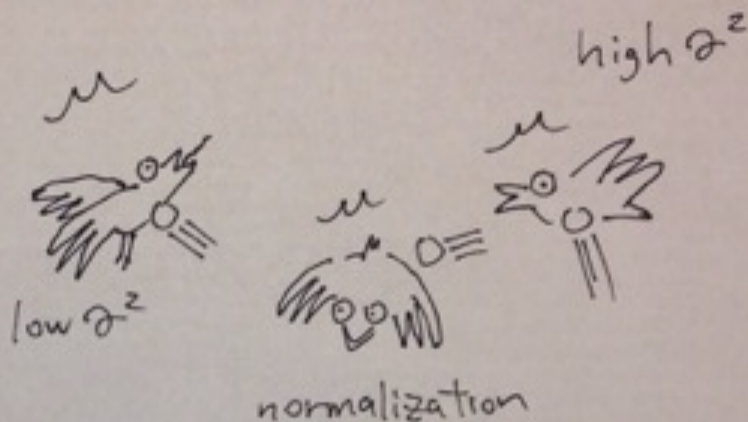
For theorists

→ low $|q|$ is very important to utilize data of next generation experiments (seems to me RPA or similar treatment is essential)

QE+2p-2h+RPA kills three birds with one stone

- 1st bird = high Q^2 problem
- 2nd bird = normalization
- 3rd bird = low Q^2 problem

Juan Nieves



Marco
Martini

$Q^2 E + 2p - 2h + RPA$ kills
three birds with one stone

Teppeř K.
12/12/13