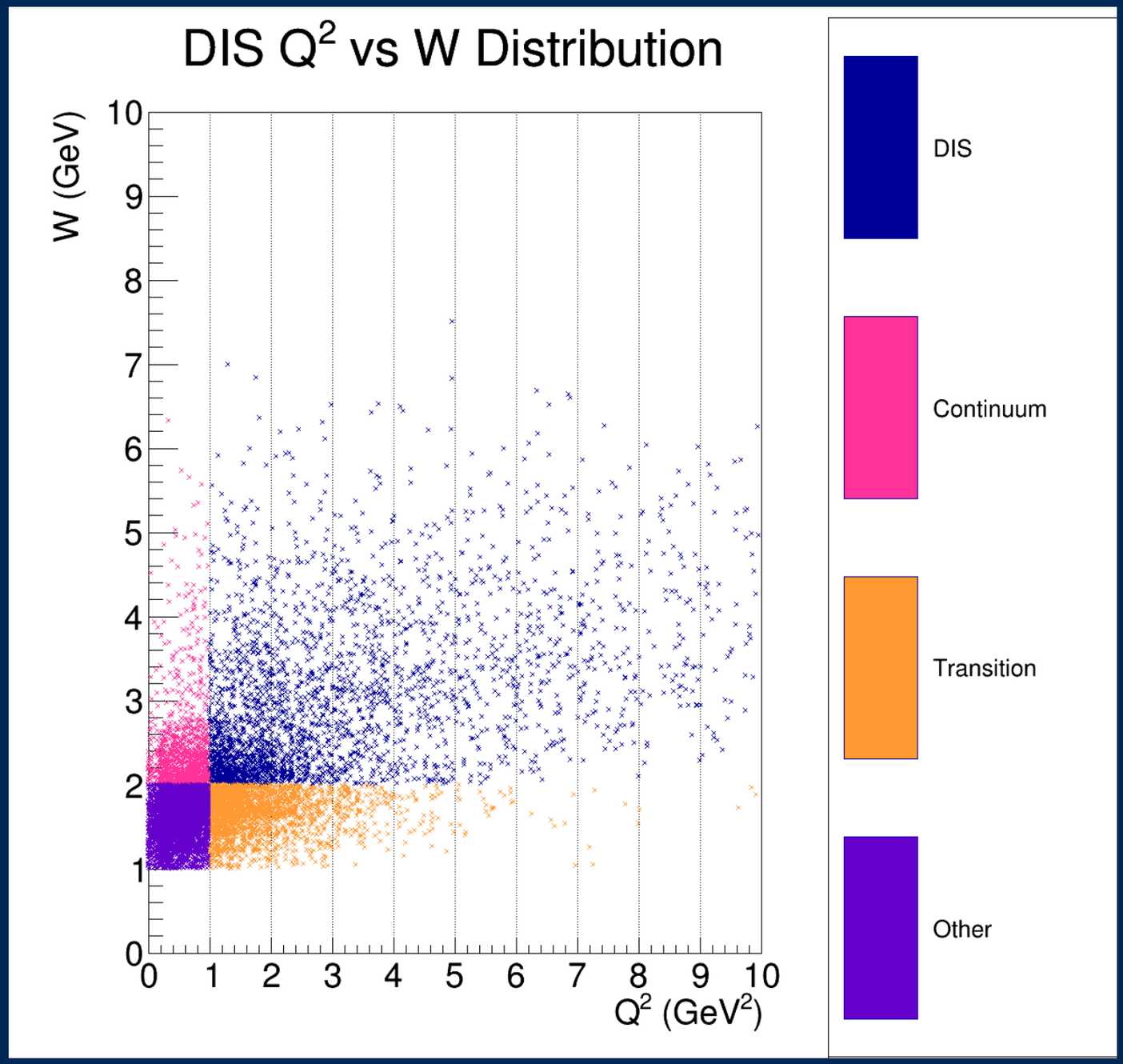
DIS Uncertainties

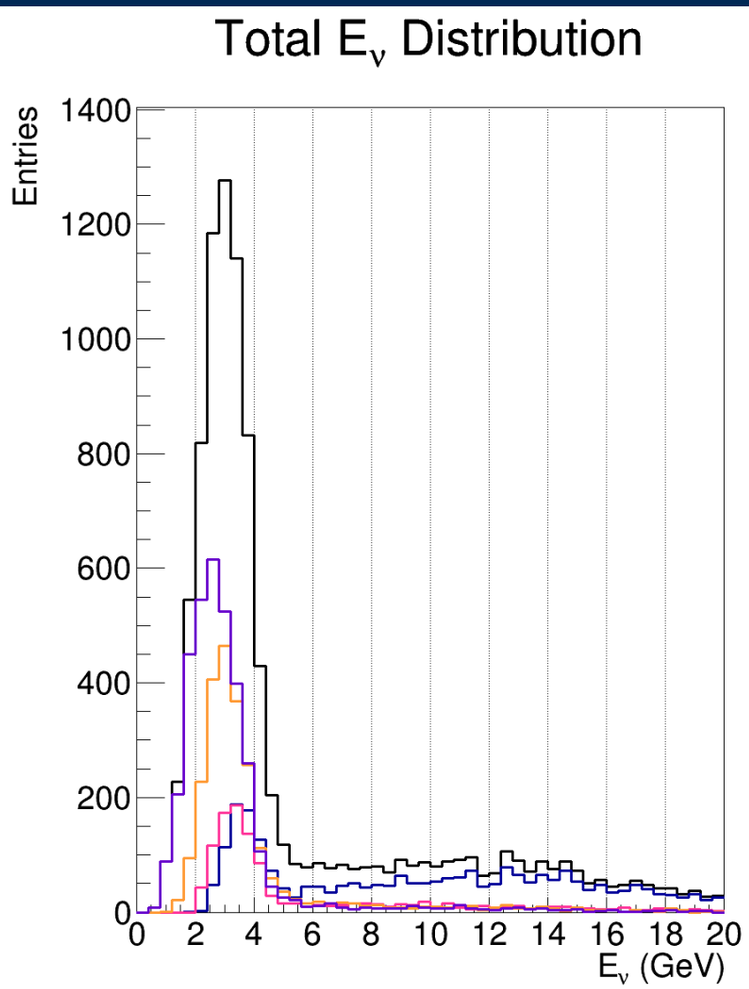
Anne Norrick, DUNE Meeting, Sept 28 2023

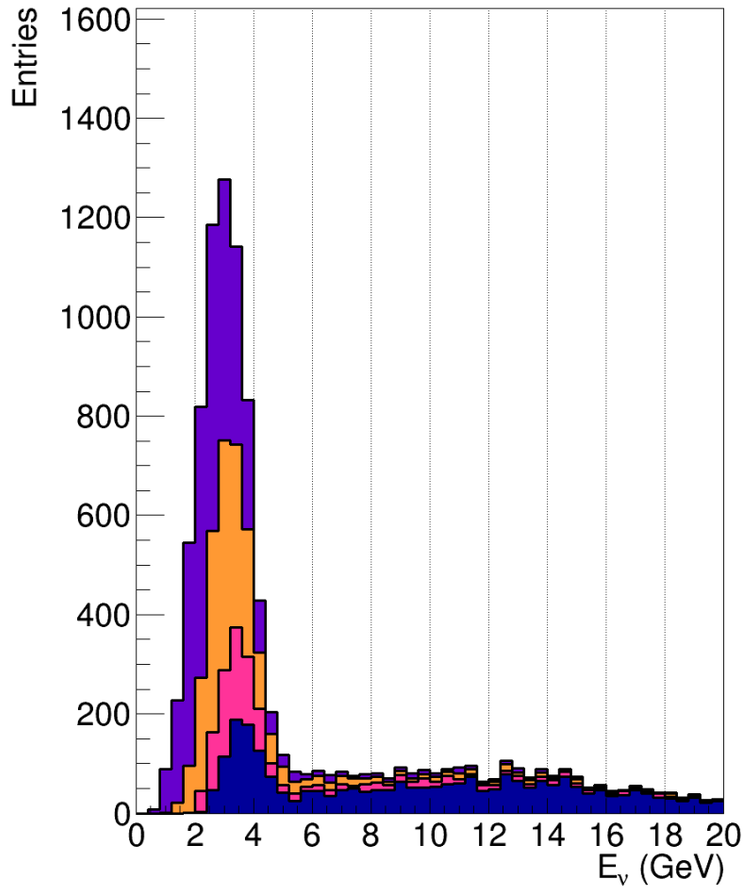
Intro

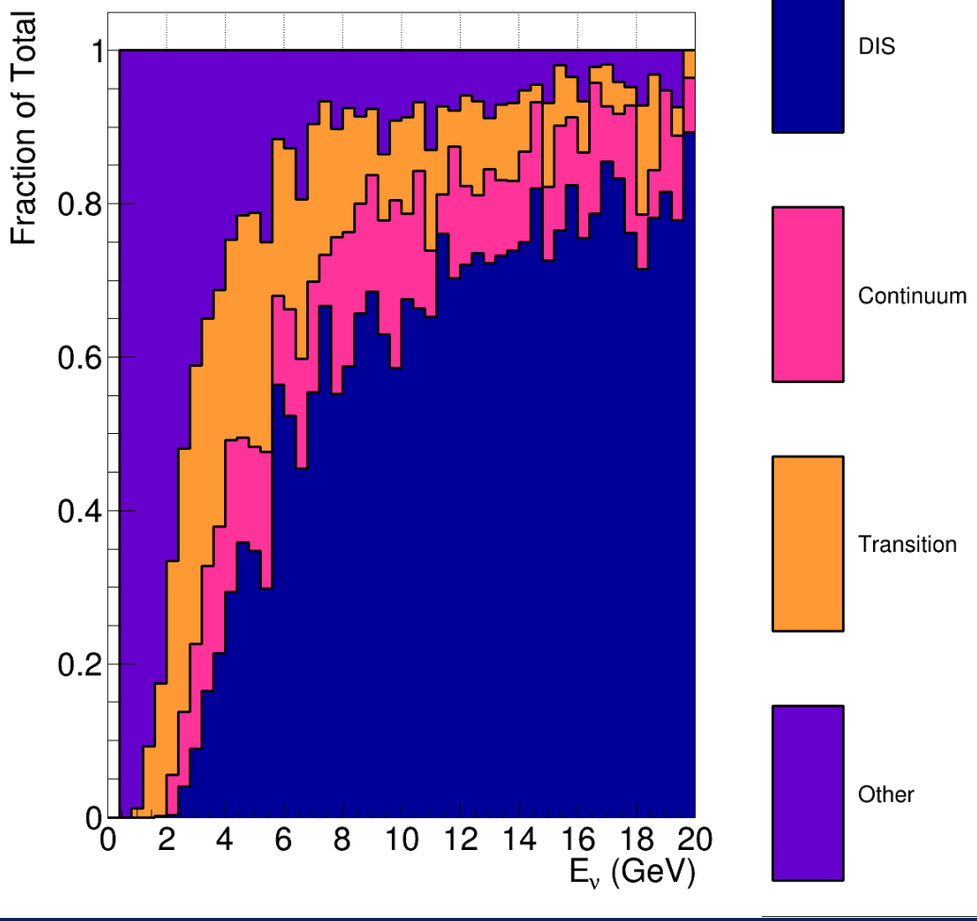
- Looking into uncertainties on DIS events.
- Generated 10k DIS events in GENIE.
- GENIE DIS isn't what the rest of the world calls DIS, it includes all forms of inelastic collisions.
- Divide the sample into different physics categories, based on the W and the Q^2 of the event.



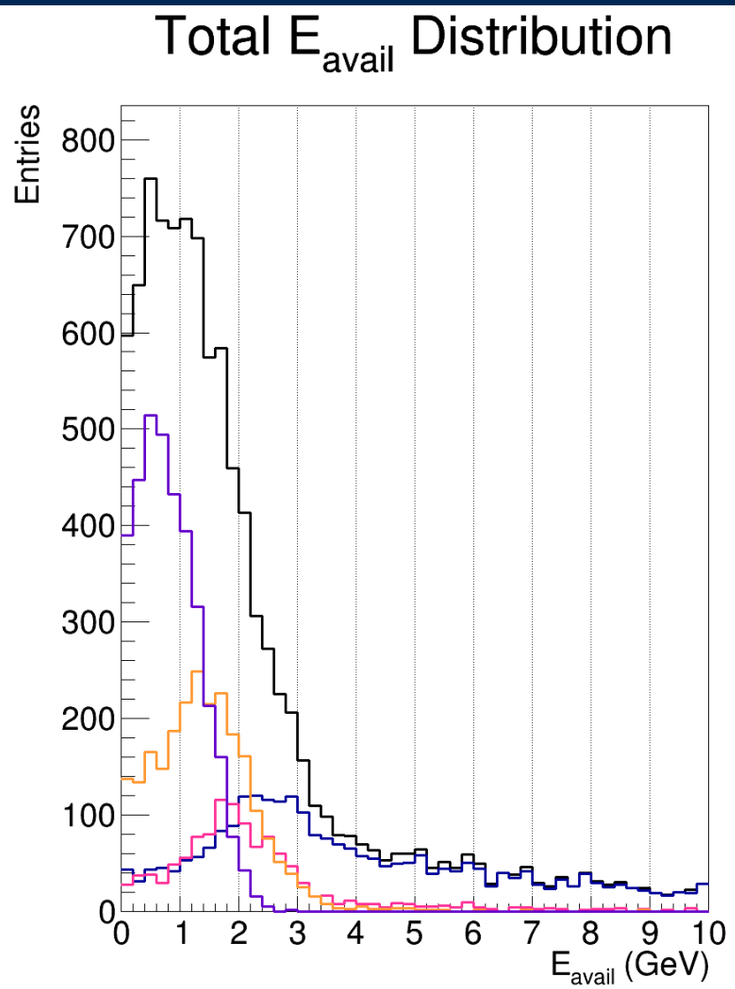
Neutrino Energy

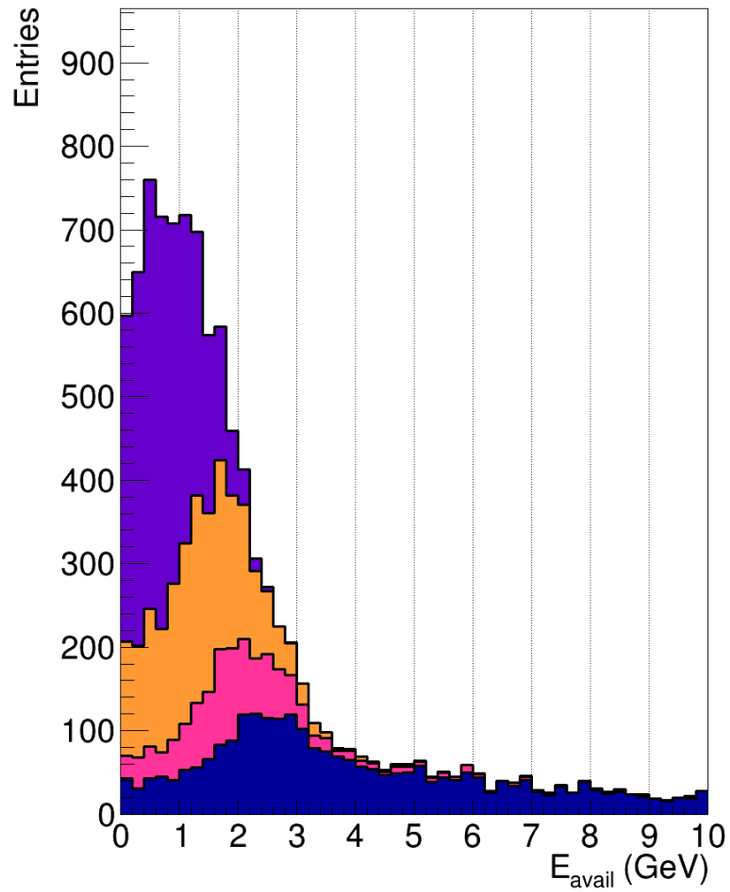


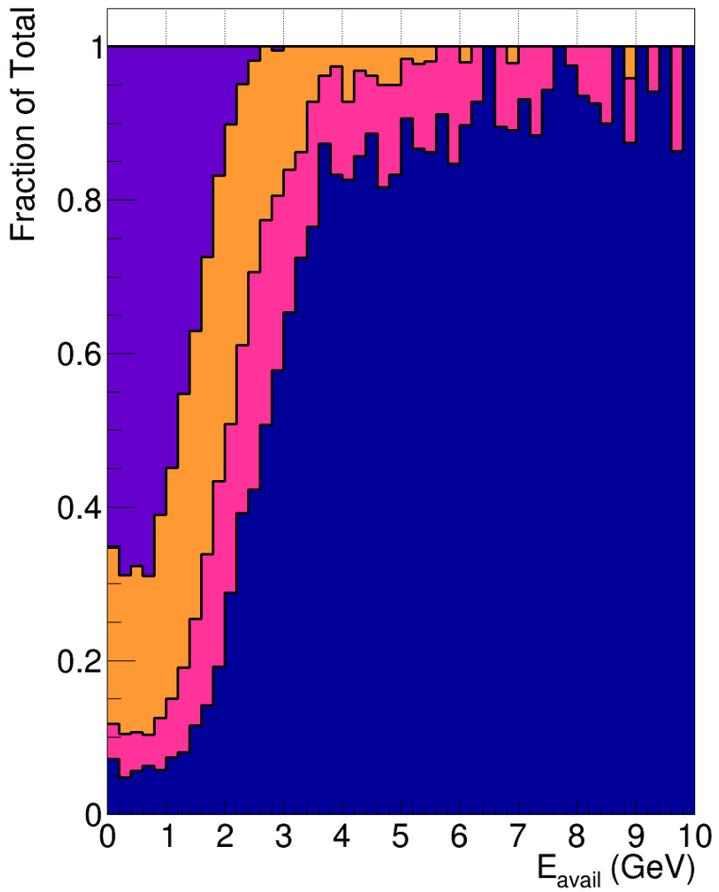


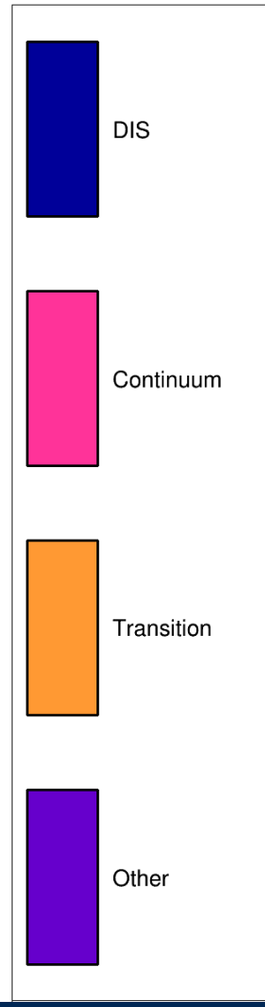


Available Energy









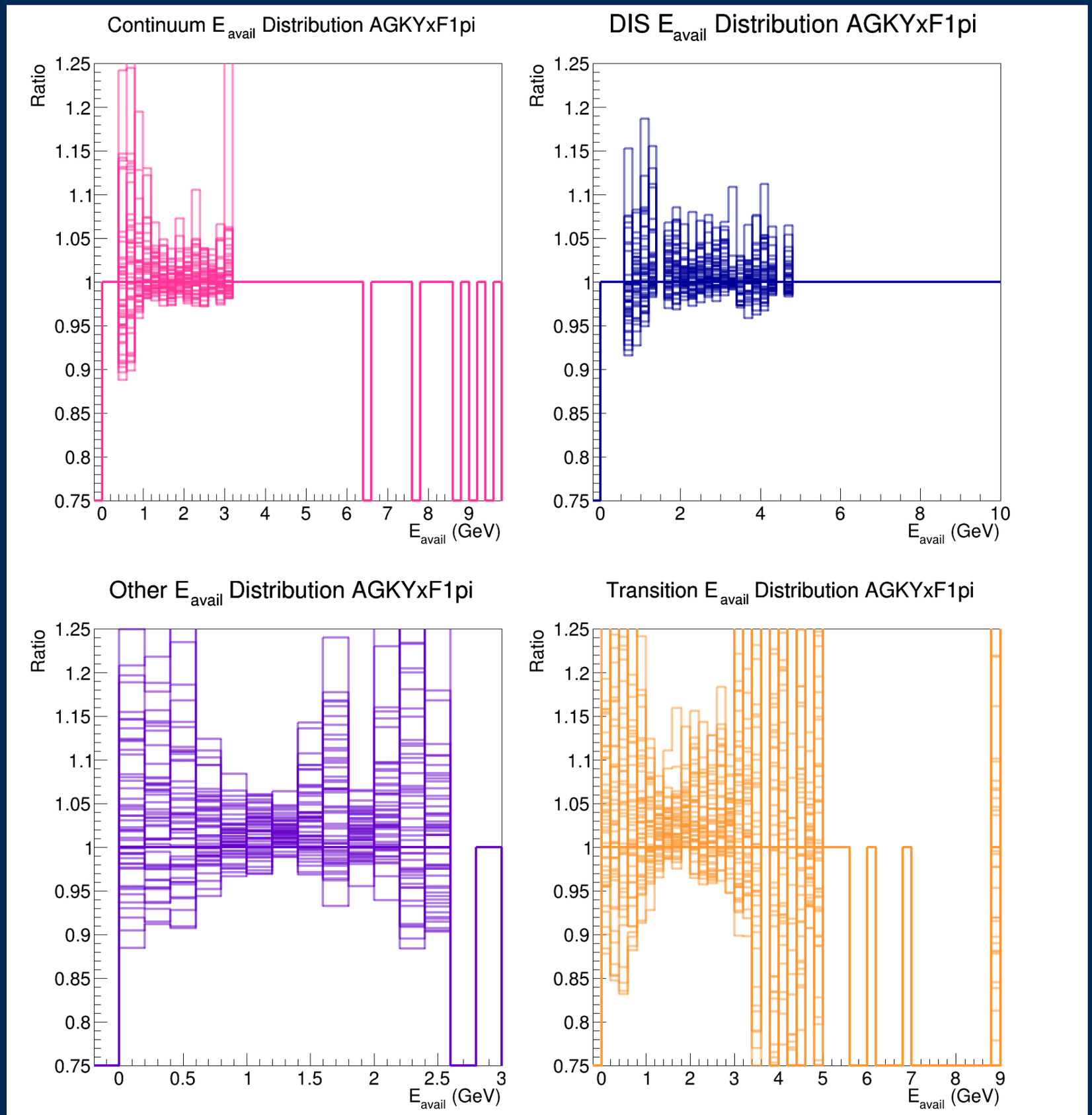
Uncertainties that I've looked at so far..

- I am looking at the GENIE systematics through nusystematics (thanks very much Jaesung for all the help!!)
- I haven't gone through all the applicable uncertainties yet.
- Need to make both a bigger GENIE sample, and to run the last uncertainties.
- Threw 50 universes on a gaussian, not sure this is actually appropriate for each of the uncertainties…
- Subset presented here today…

NonRESBGvpCC1pi	AGKYxF1pi
NonRESBGvpCC2pi	FormZone
NonRESBGvnCC1pi	MFP_pi
NonRESBGvnCC2pi	MFP_N

AGKYxF1pi

- Parameter for the model that covers pion production in the region between resonances to DIS
- 2.3 < W < 3



AGKYpT1pi

- Parameter for the model that covers pion production in the region between resonances to DIS
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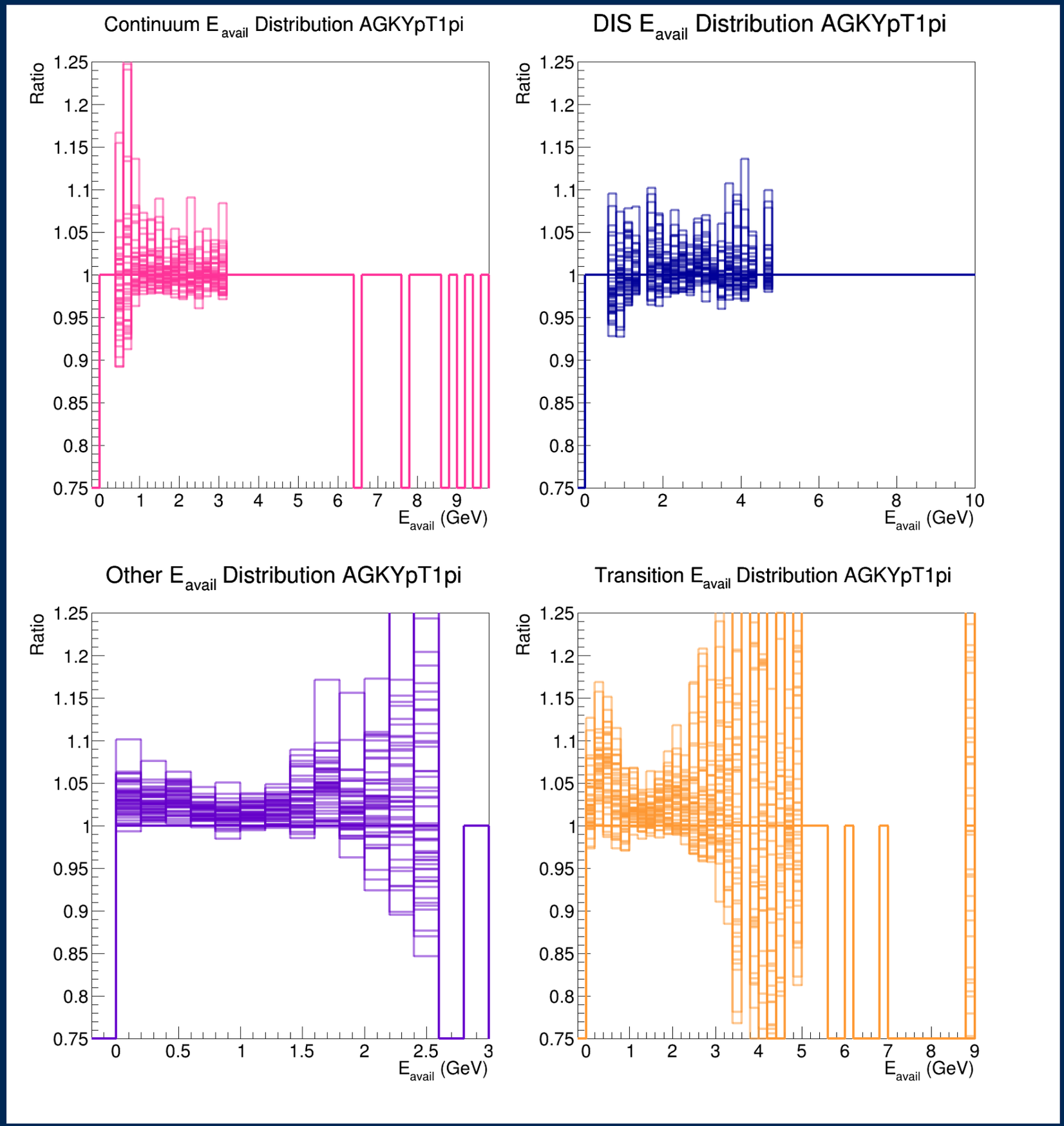
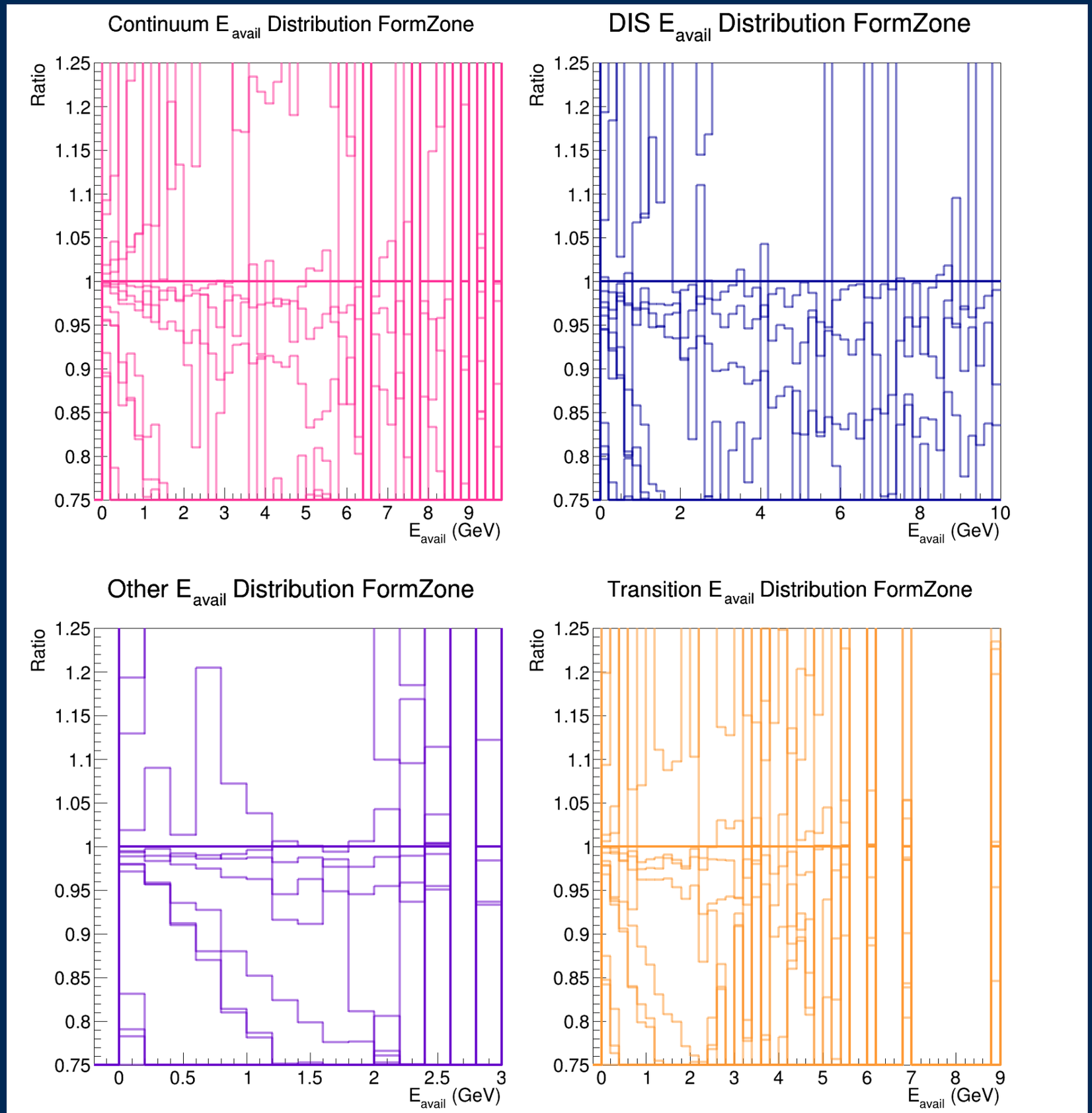


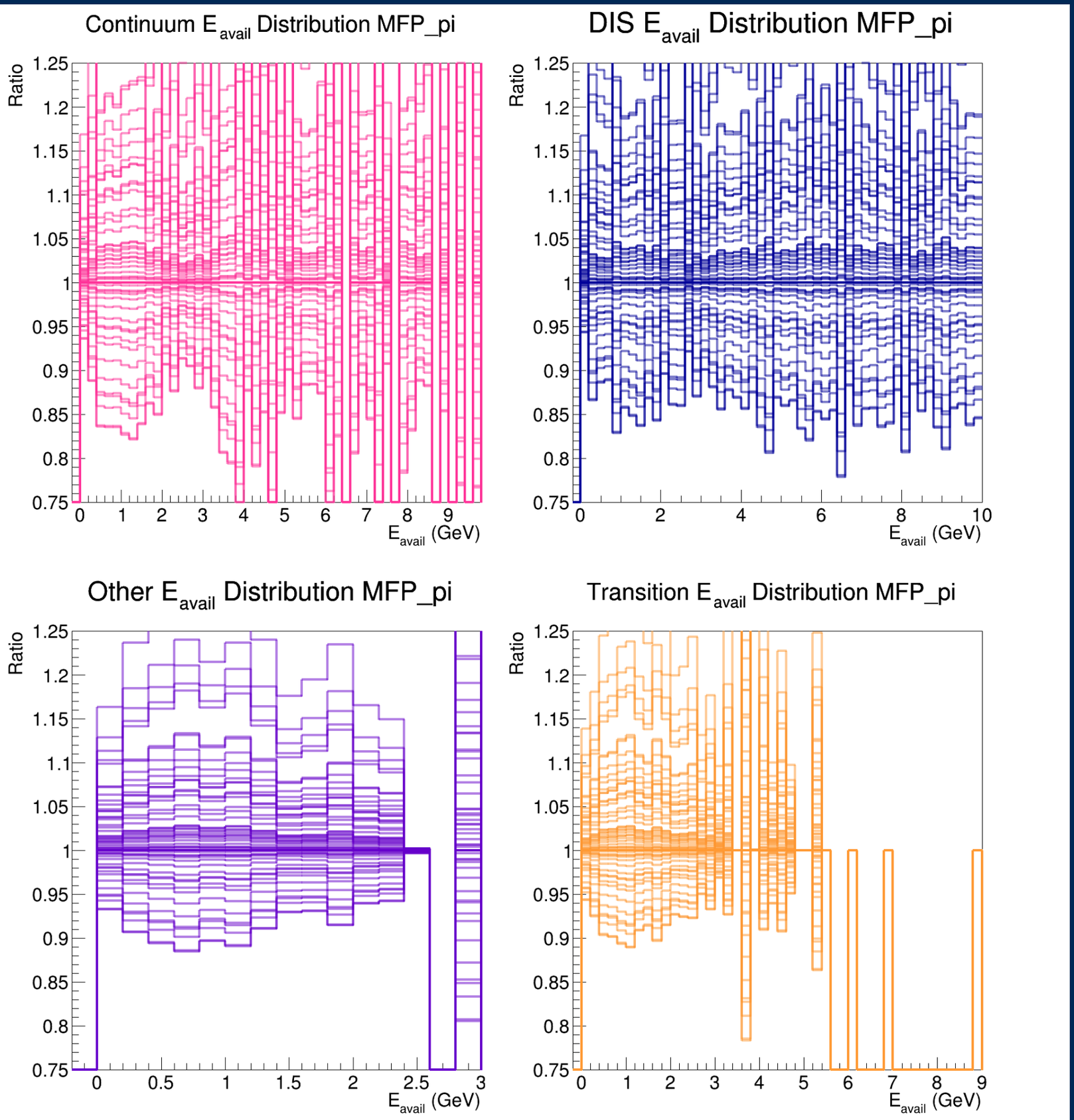
FormZone

- Modifies the range within the nucleus in which a hadron can be formed.



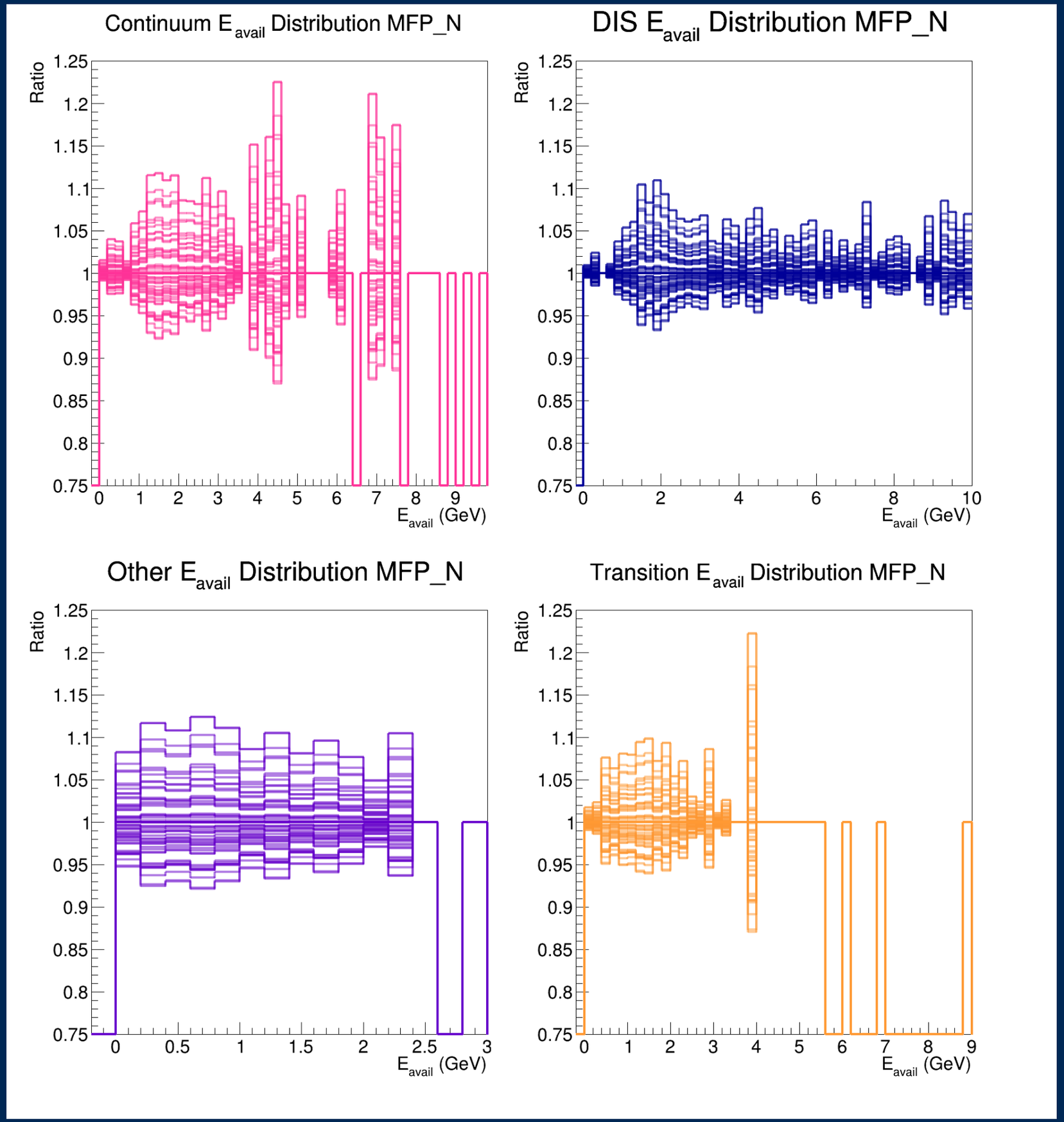
MFP_pi

- Mean free path of pions within the nucleus



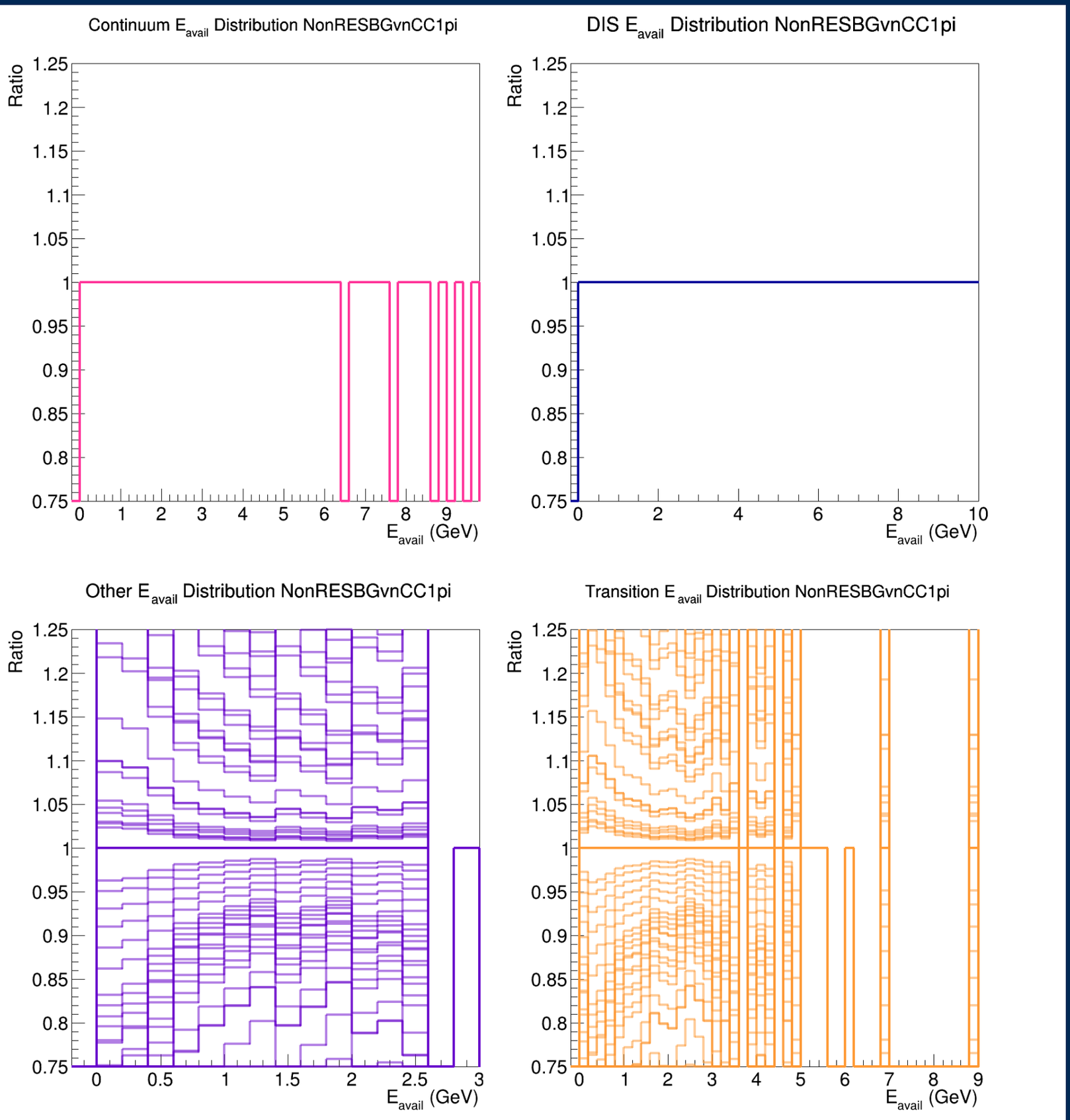
MFP_N

- Mean free path of neutrons within the nucleus



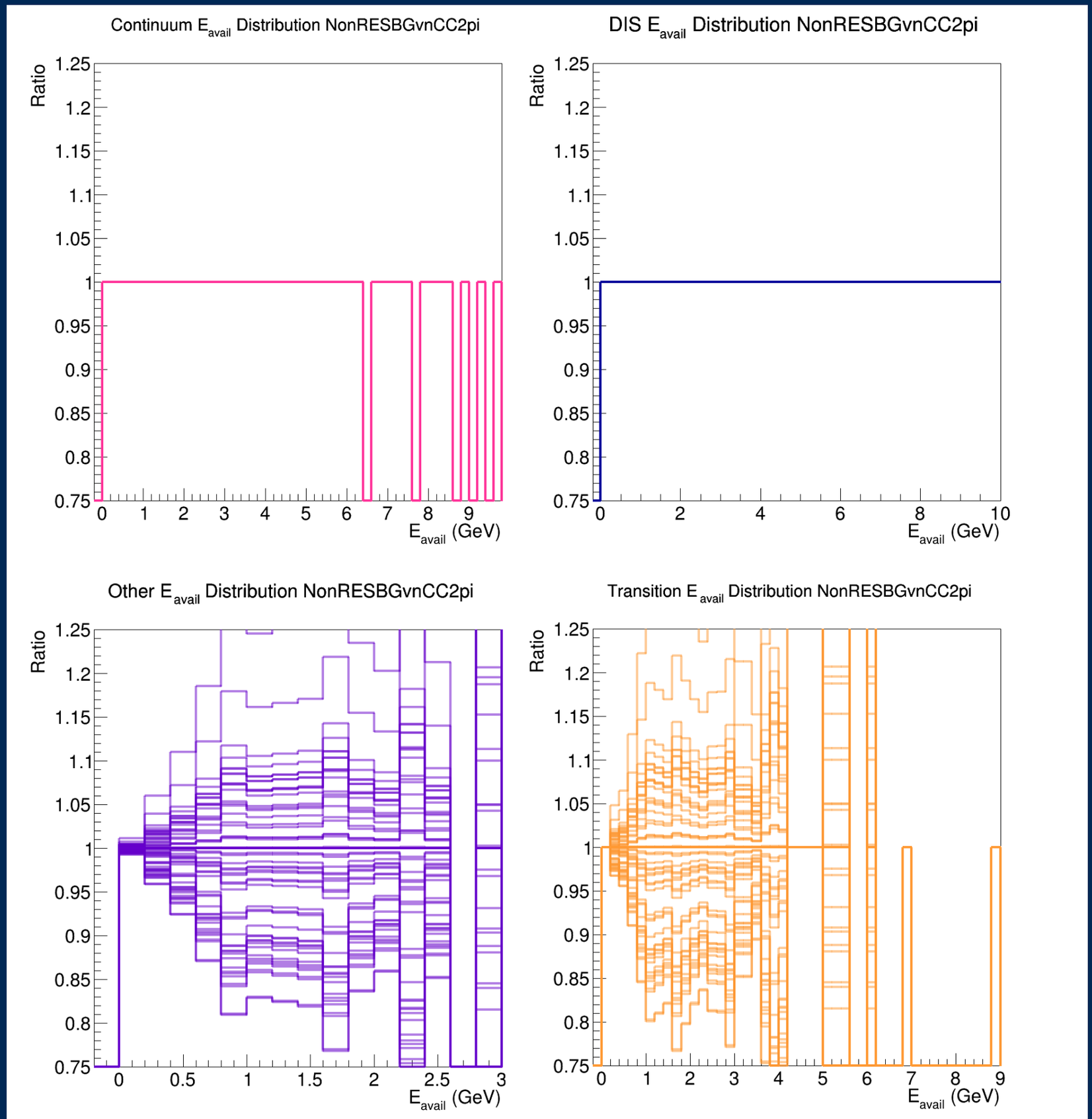
NonRESBGvnCC1pi

- Non-Resonant pion production



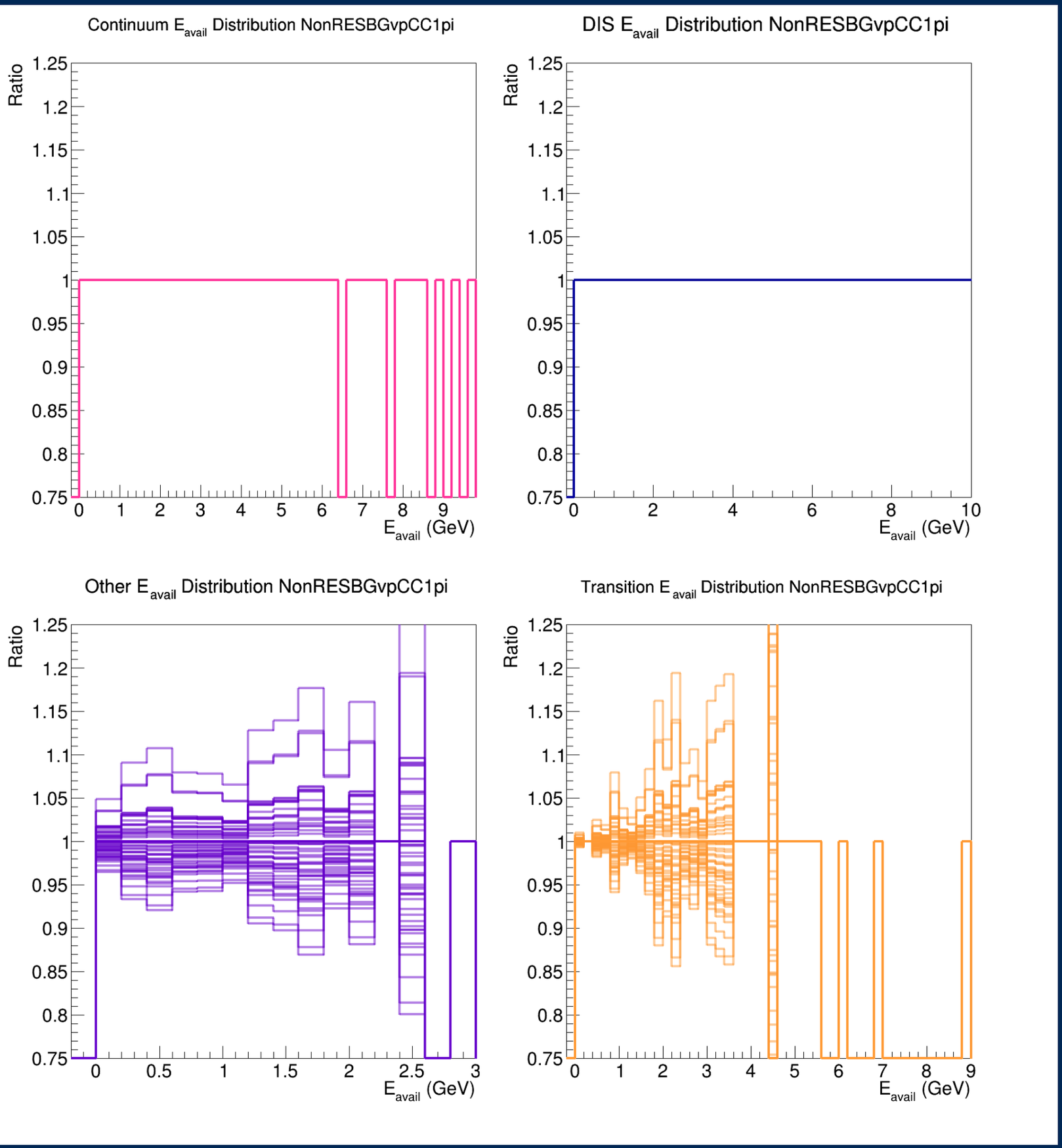
NonRESBGvnCC2pi

- Non-Resonant 2 pion production



NonRESBGvpCC1pi

- Non-Resonant pion production



NonRESBGvpCC2pi

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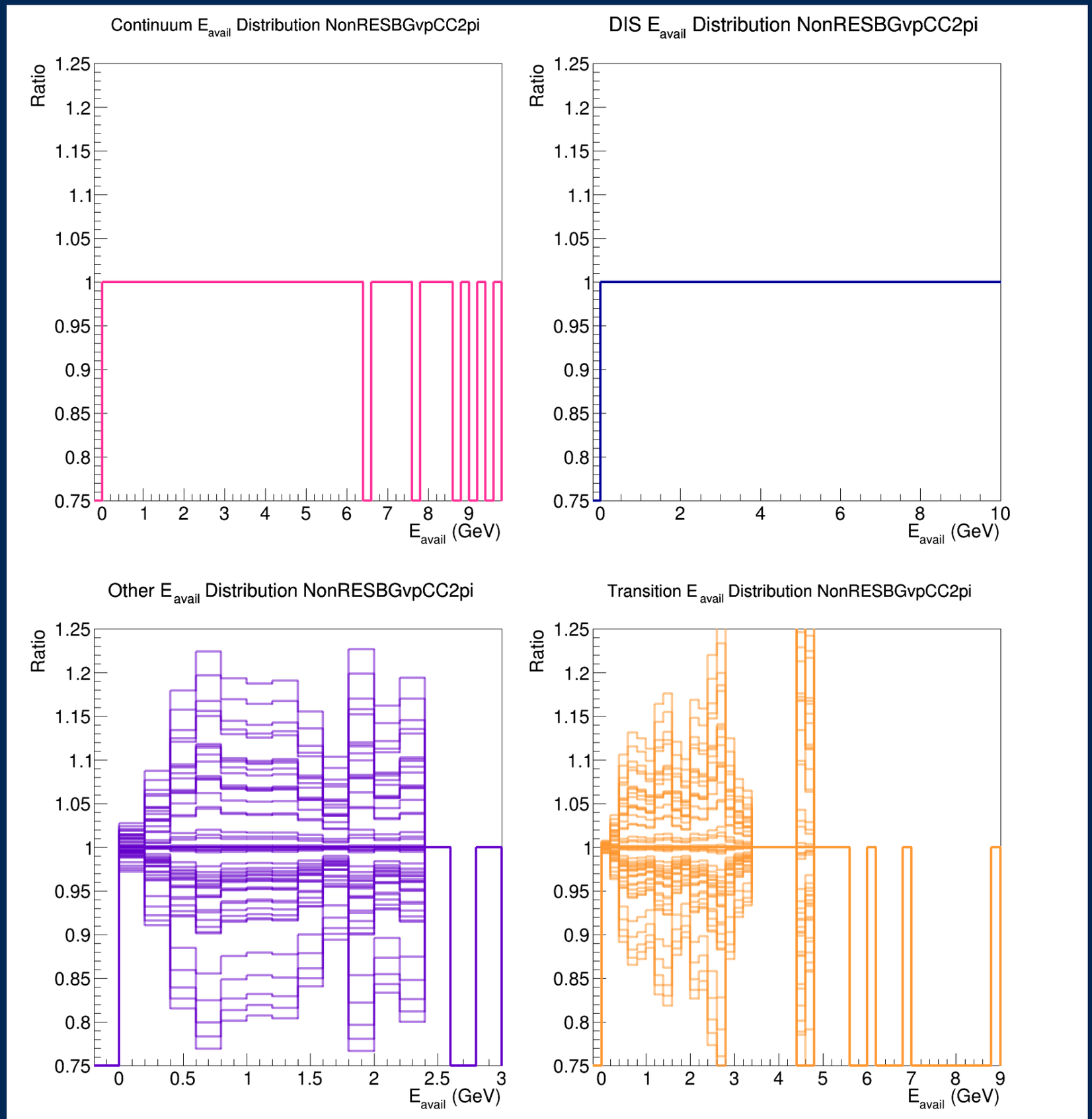
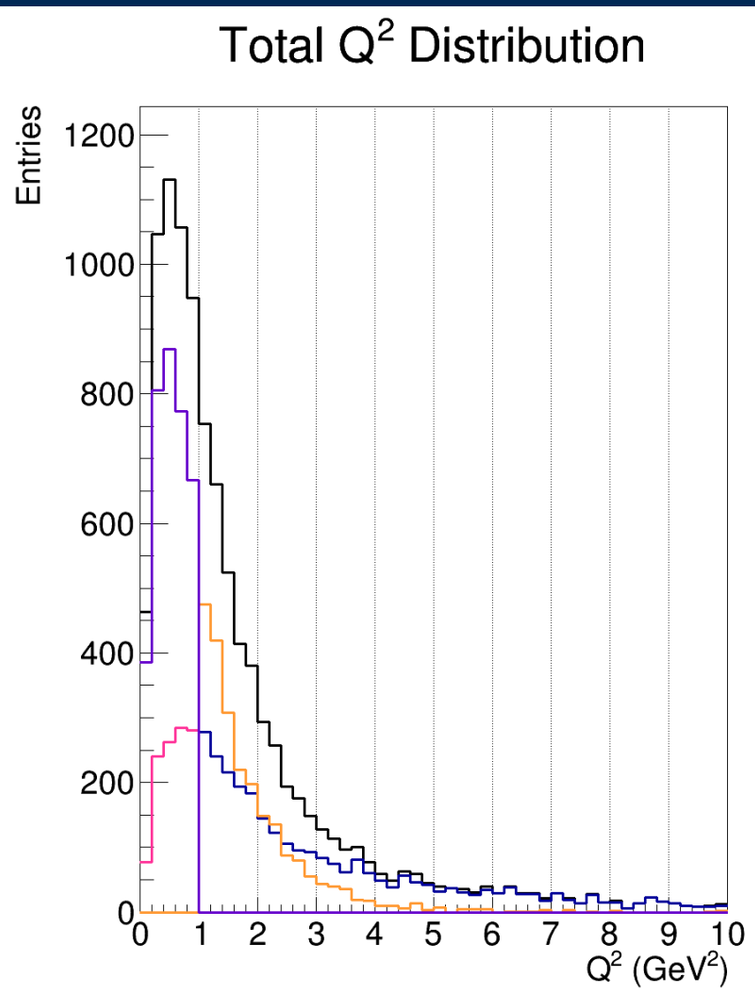


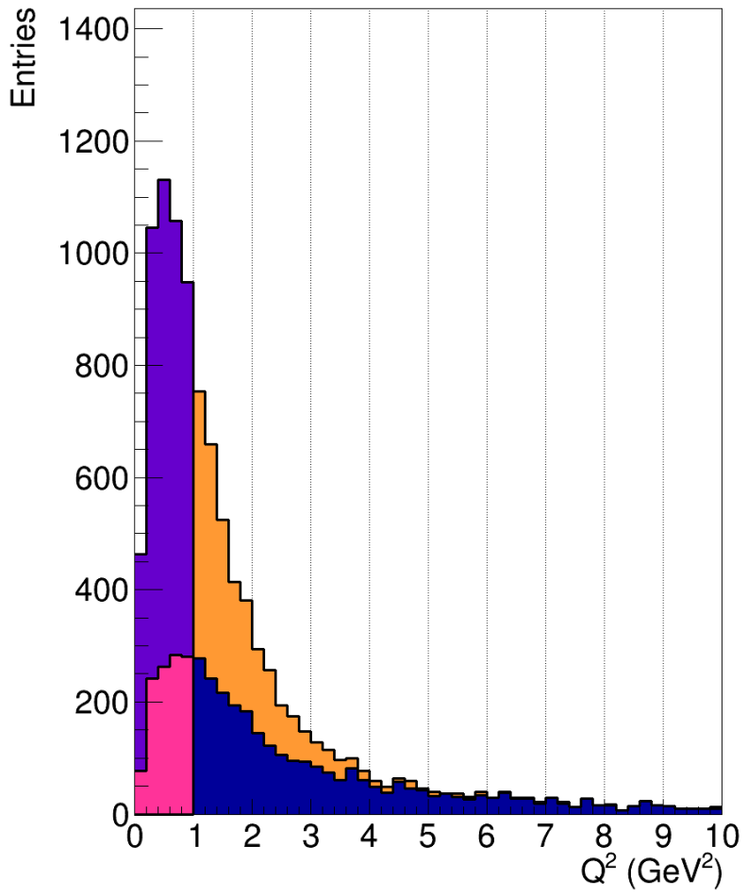
Next Steps

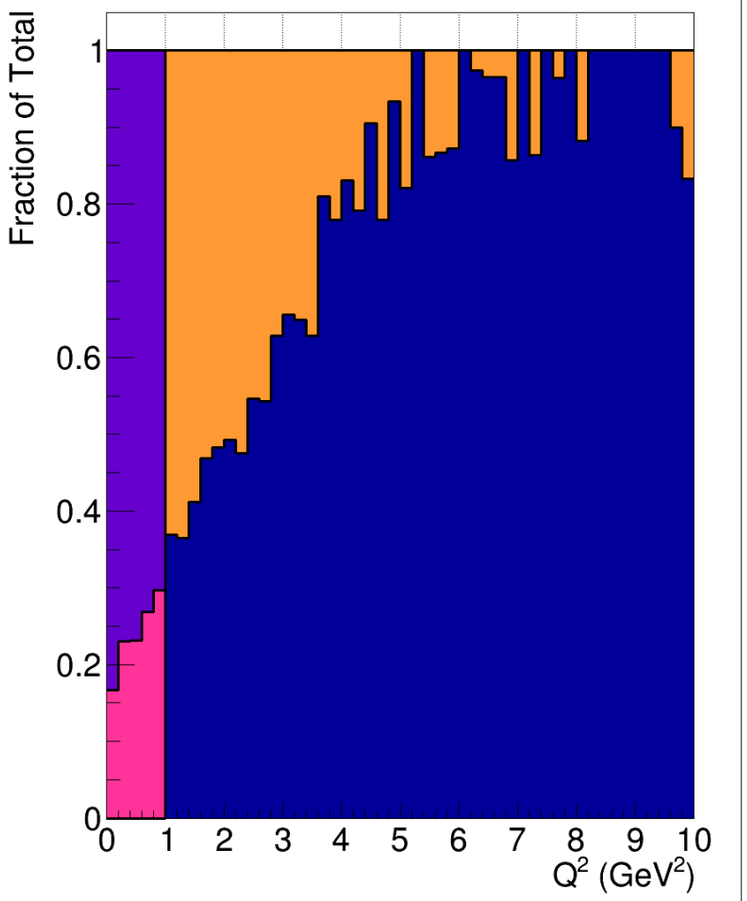
- Now that I understand the mechanics of processing with nusystematics…
  - Consider whether 50 universes is a reasonable quantity for these different parameters. (Probably not!)
- Finish out the remaining GENIE knobs that impact DIS events.
- Program in the AMU model reweighting

Backup

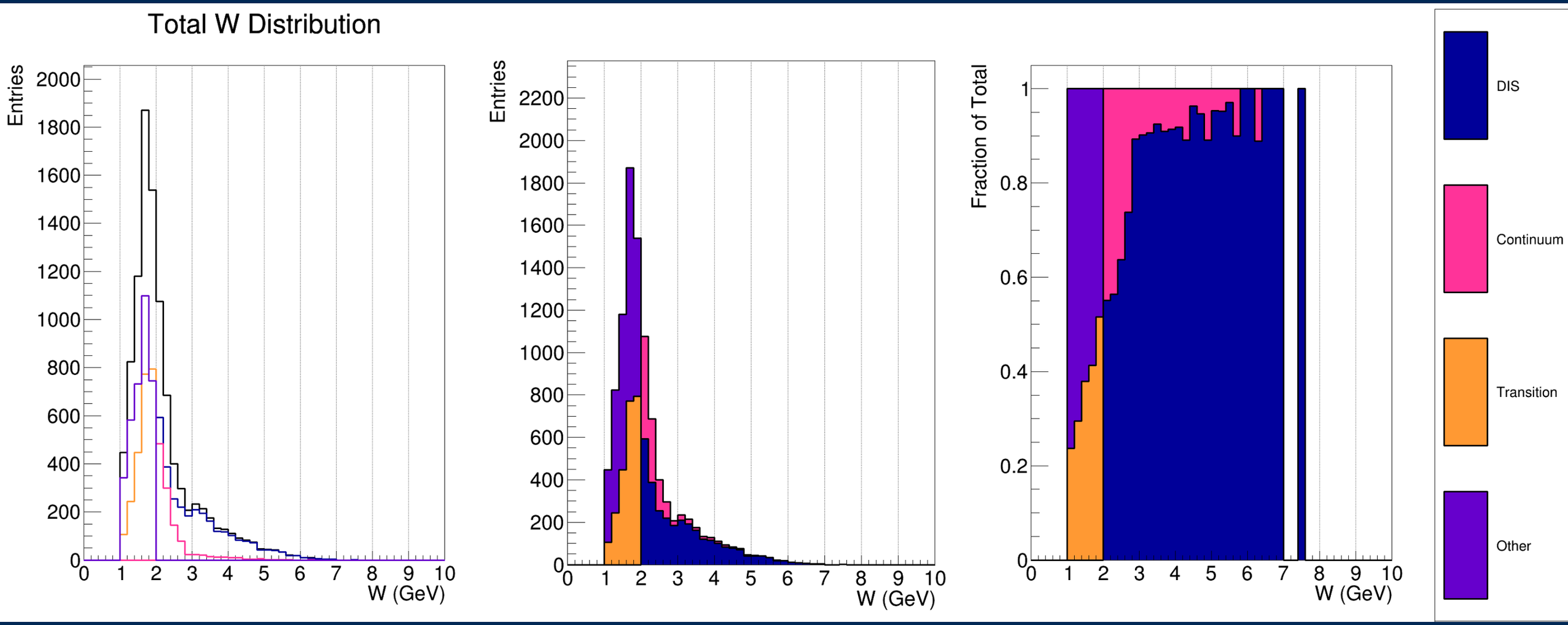
Q^2


Total Q^2 Distribution
Entries
1200
1000
800
600
400
200
0
0 1 2 3 4 5 6 7 8 9 10
Q^2 (GeV^2)


Entries
1400
1200
1000
800
600
400
200
0
0 1 2 3 4 5 6 7 8 9 10
Q^2 (GeV^2)


Fraction of Total
1
0.8
0.6
0.4
0.2
0
0 1 2 3 4 5 6 7 8 9 10
Q^2 (GeV^2)
DIS
Continuum
Transition
Other

W


Total W Distribution
Entries
W (GeV)
Fraction of Total
DIS
Continuum
Transition
Other