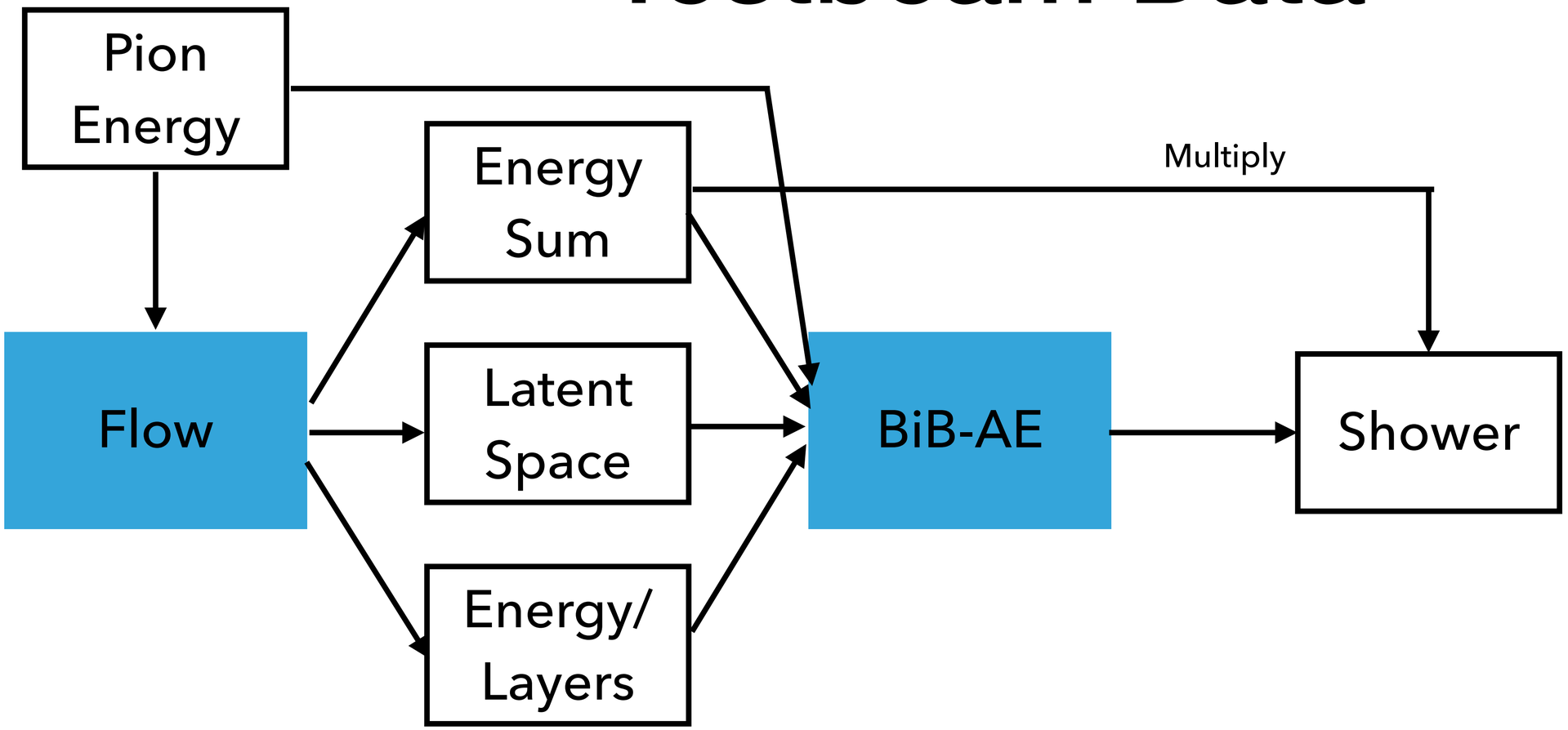
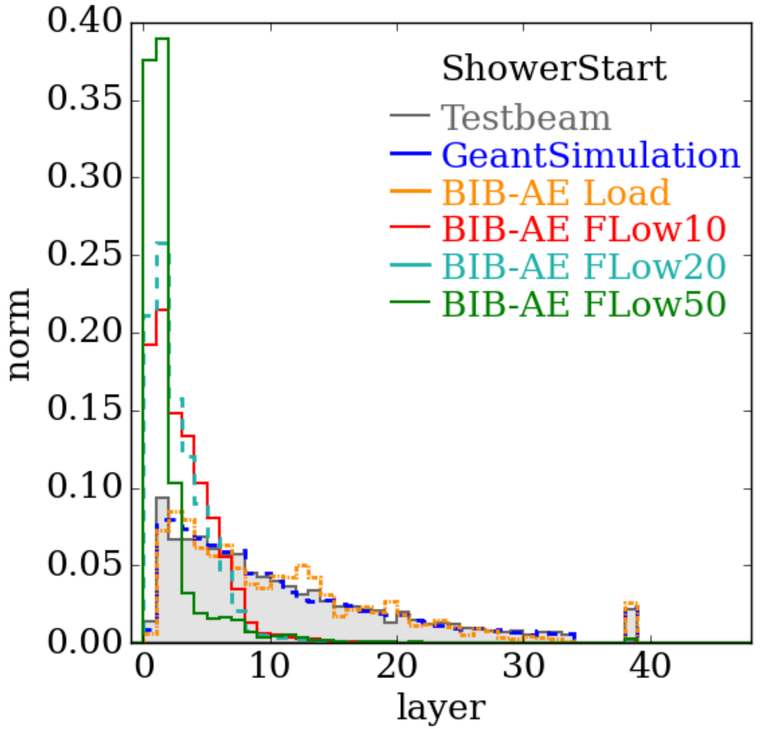
Testbeam Data

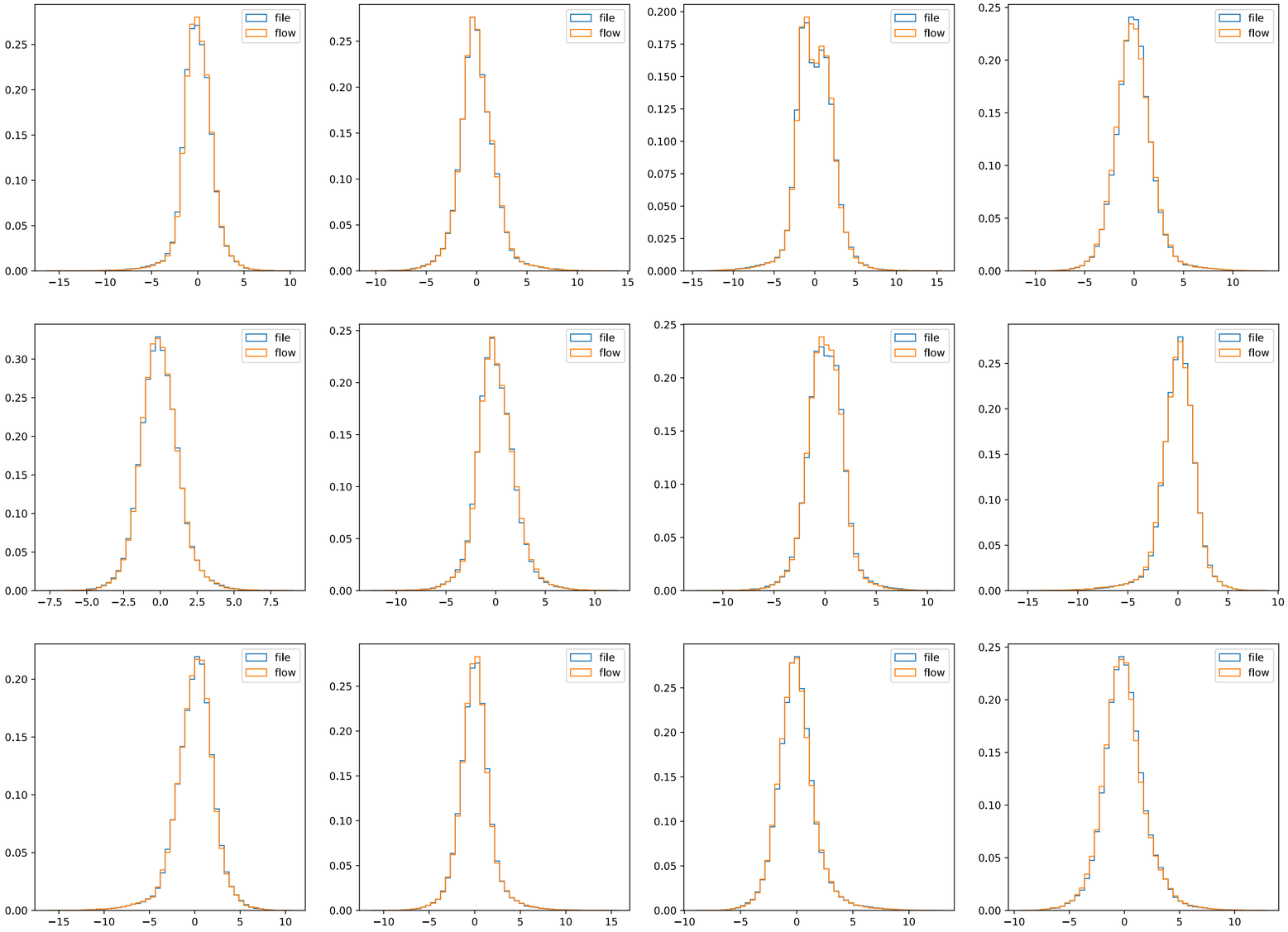


Latent Flow

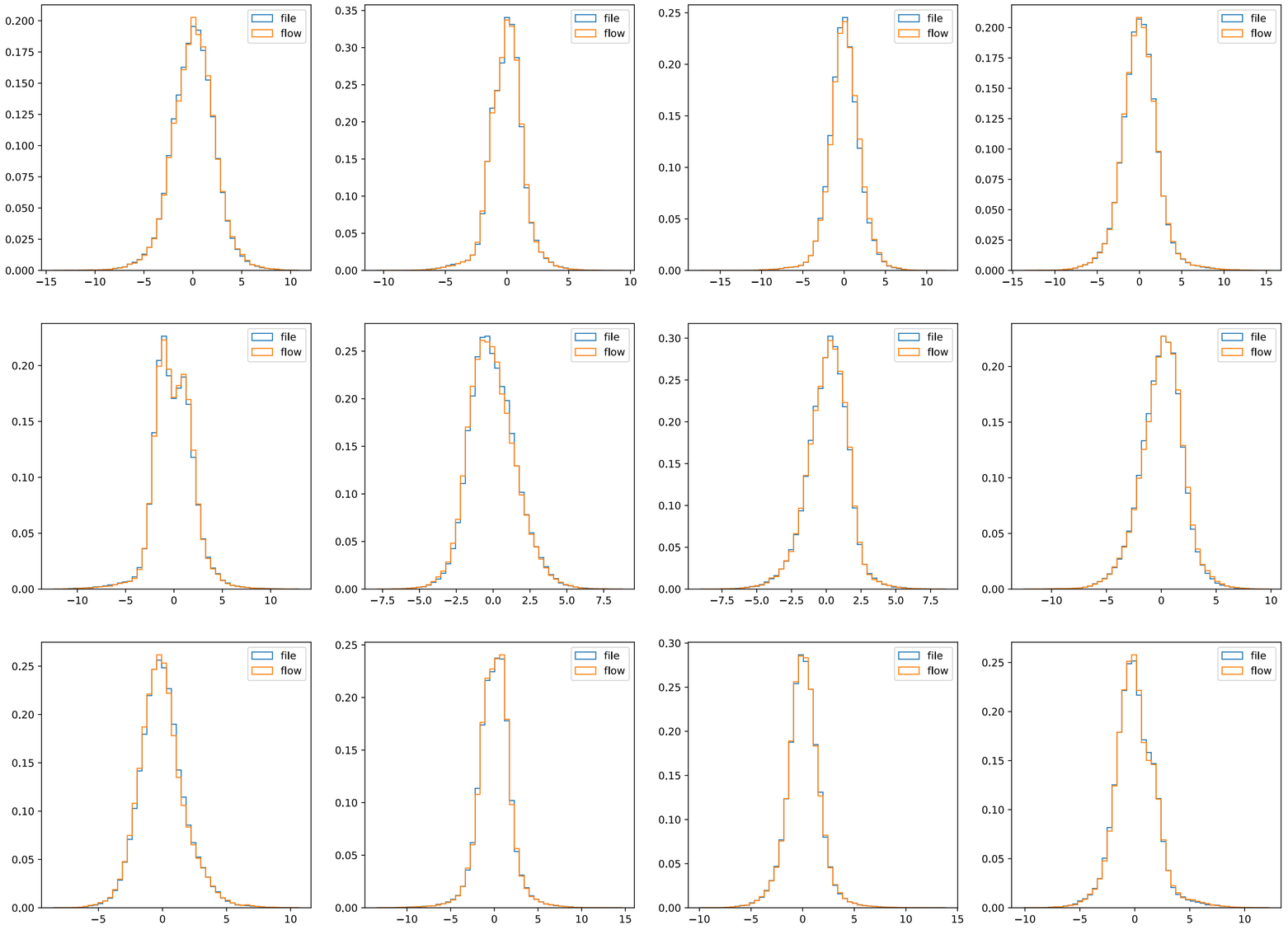
- Approach so far: ConditionalSpline
- Results not great
- Check latent flow performance



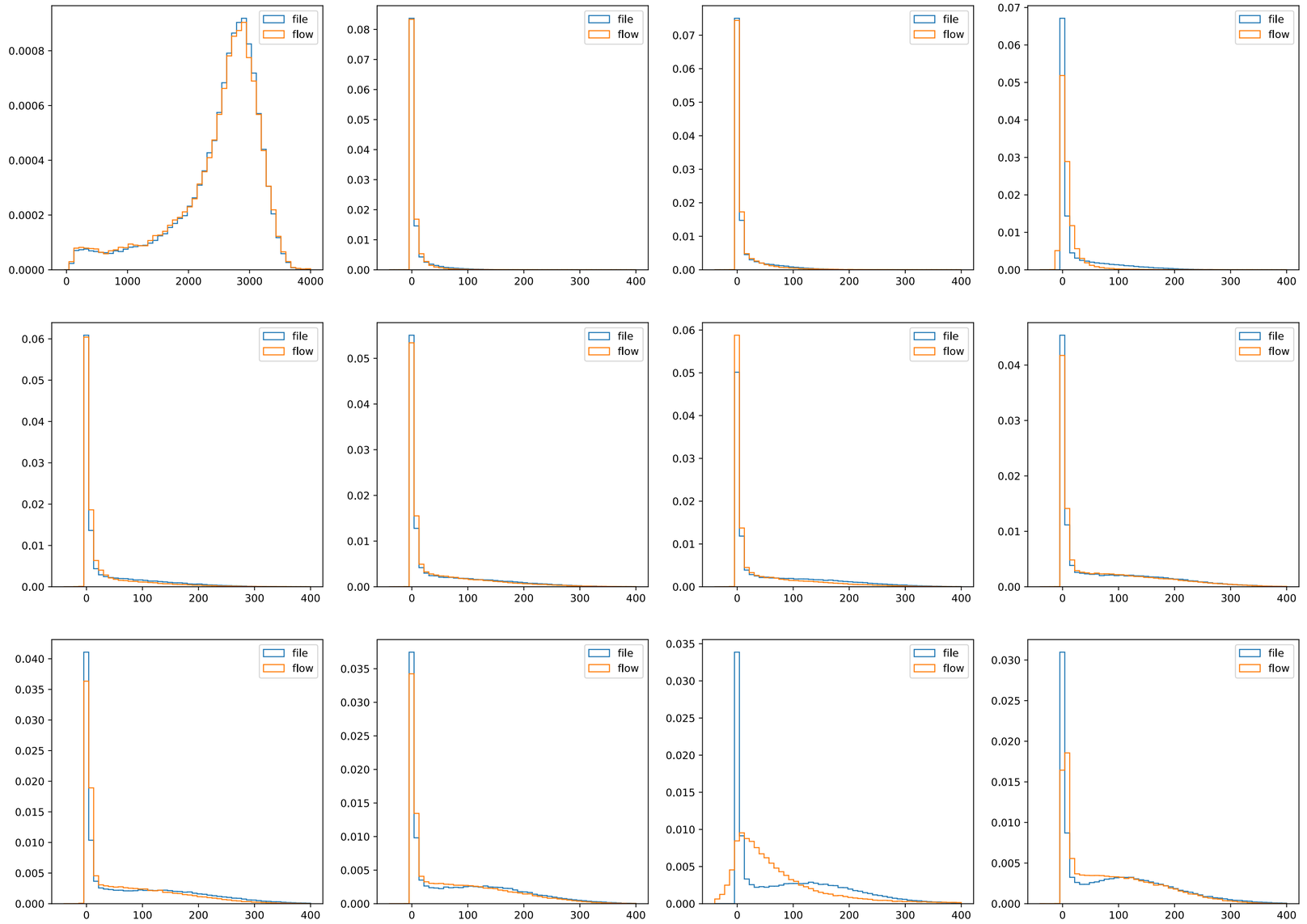
Latent 1-12



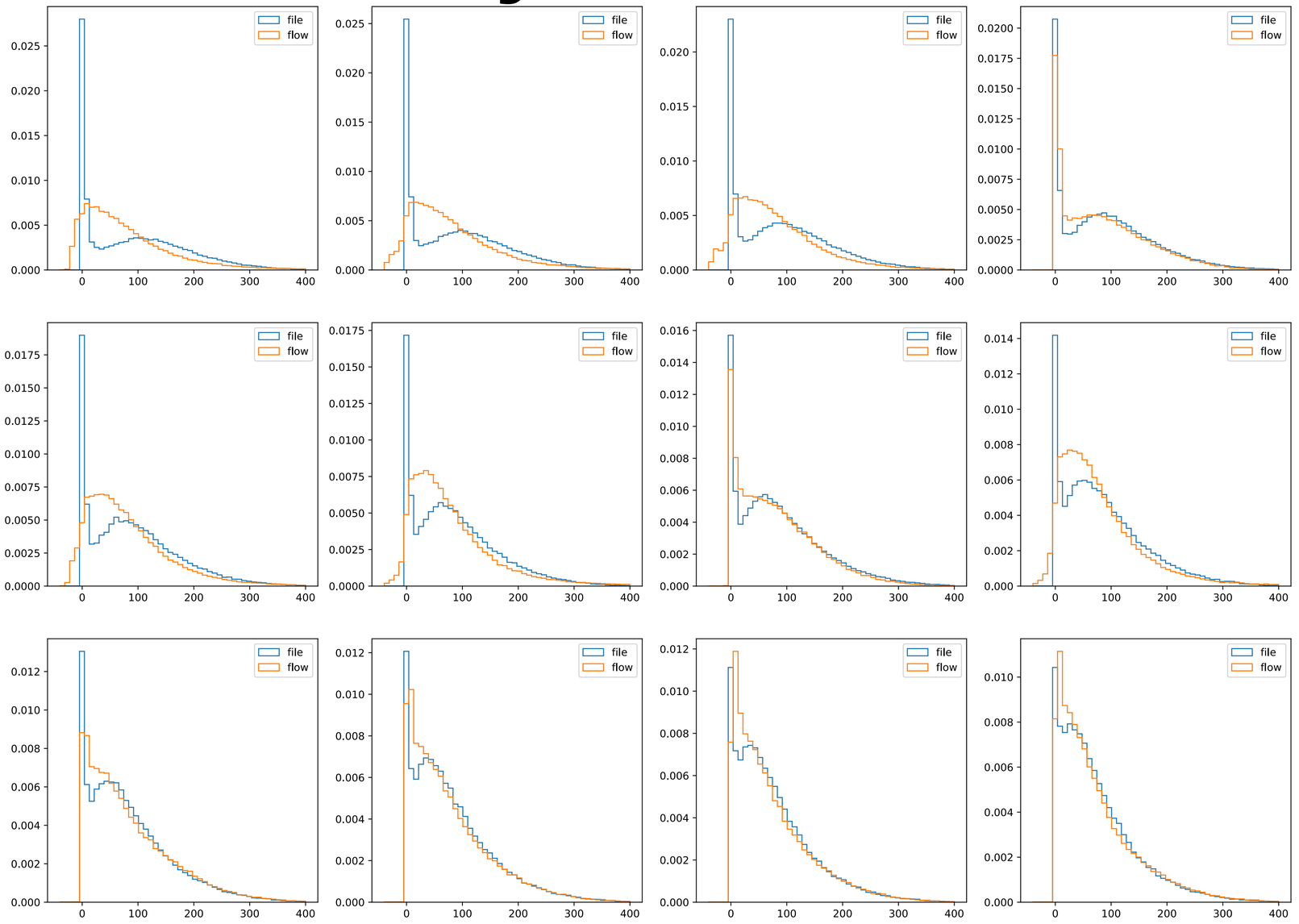
Latent 13-24



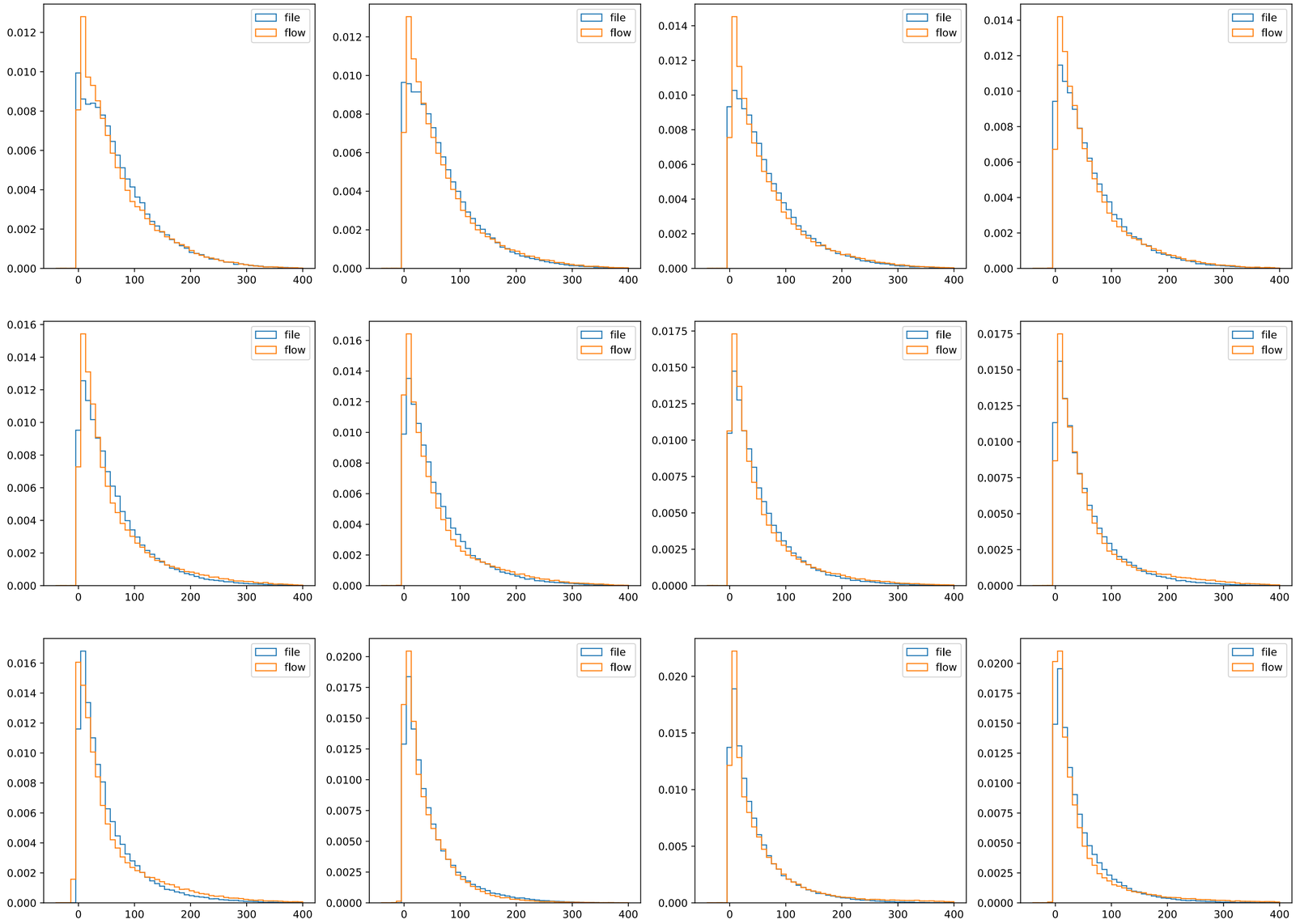
Sum + Layers 1-11



Layers 12-23



Layers 24-35



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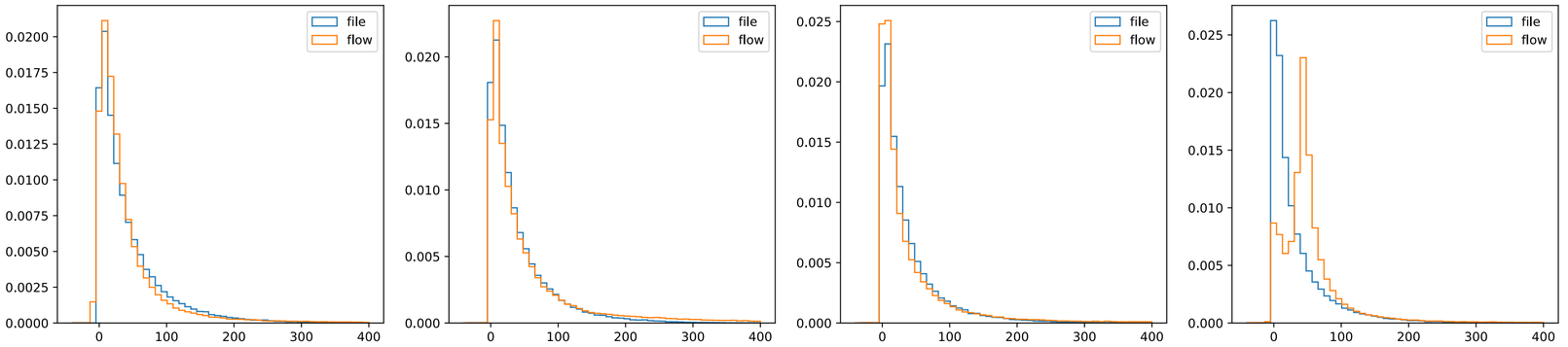
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0.005
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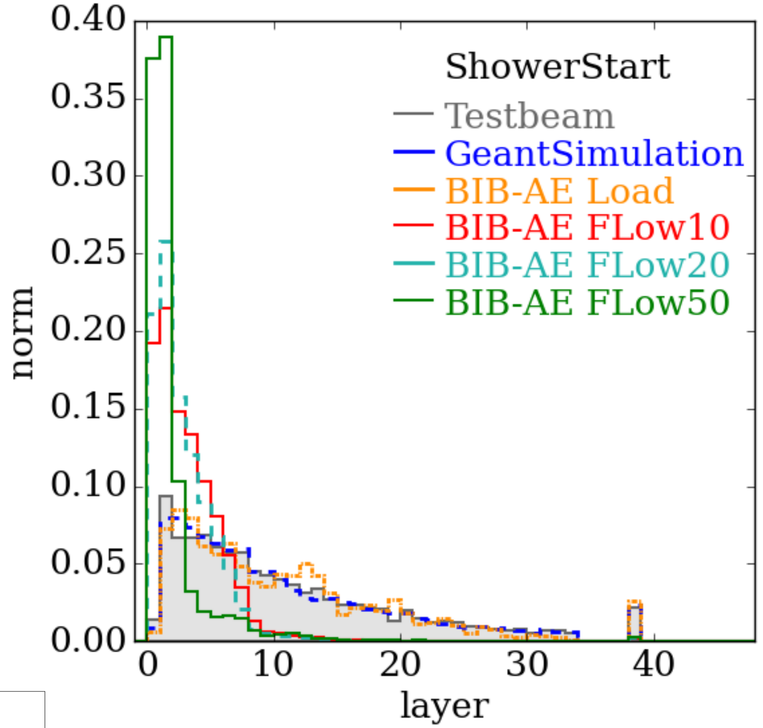
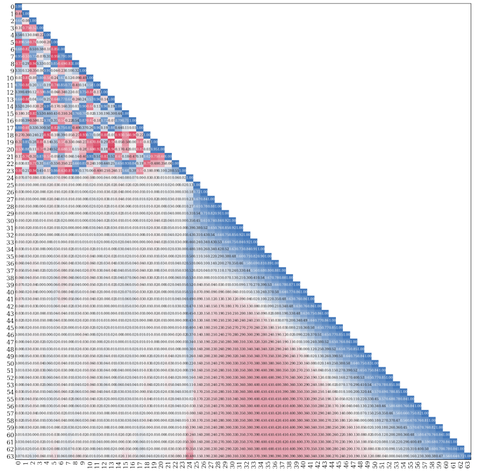
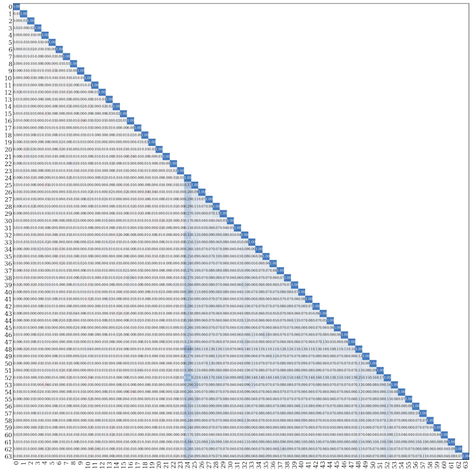
100
200
300
400

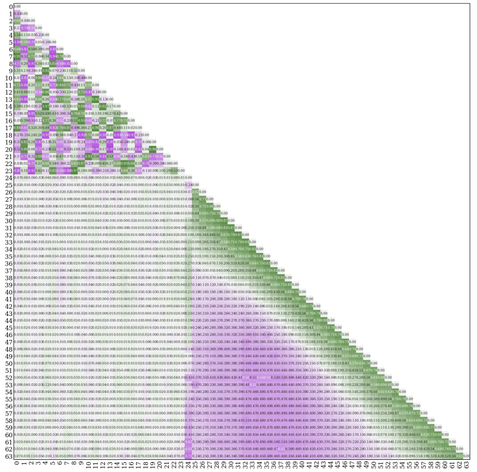
Latent Flow

- Approach so far: ConditionalSpline
- Results not great
- Check latent flow performance
- Individual Distributions look well
- Correlations fail









Latent Flow

- Approach so far: ConditionalSpline
- Results not great
- Check latent flow performance
- Individual Distributions look well
- Correlations fail
- ConditionalSpline is element wise transformation
- Need ConditionalSplineCoupling

```
domain = constraints.real
codomain = constraints.real
bijective = True
```

?

BatchNorm
BlockAutoregressive
ConditionalAffineAutoregressive
ConditionalAffineCoupling
ConditionalGeneralizedChannelPermute
ConditionalHouseholder
ConditionalMatrixExponential
ConditionalNeuralAutoregressive
ConditionalPlanar
ConditionalRadial
ConditionalSpline
ConditionalSplineAutoregressive
ConditionalTransformModule
GeneralizedChannelPermute
Householder
MatrixExponential
NeuralAutoregressive
Planar
Polynomial
Radial
Spline
SplineAutoregressive
SplineCoupling

Latent Flow

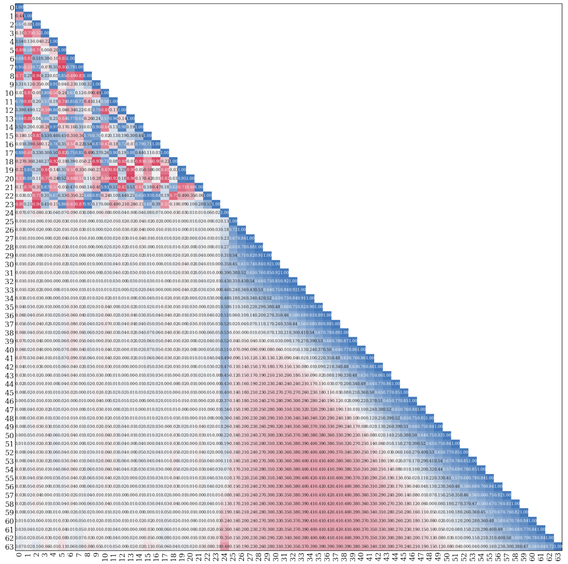
- Need ConditionalSplineCoupling
- Does not exists
- Tried ConditionalSplineAutoregressive
- Extremely slow

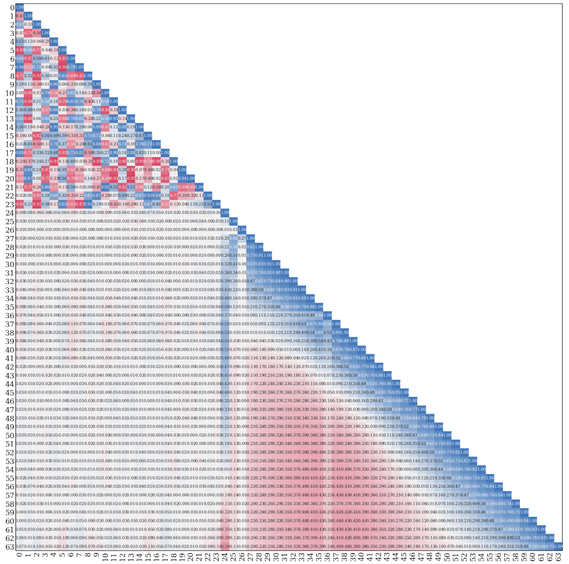
- Problem: Want conditioning and Splines, but not Autoregressive
- Custom ConditionalSplineCoupling?
- Difficult in Pyro format

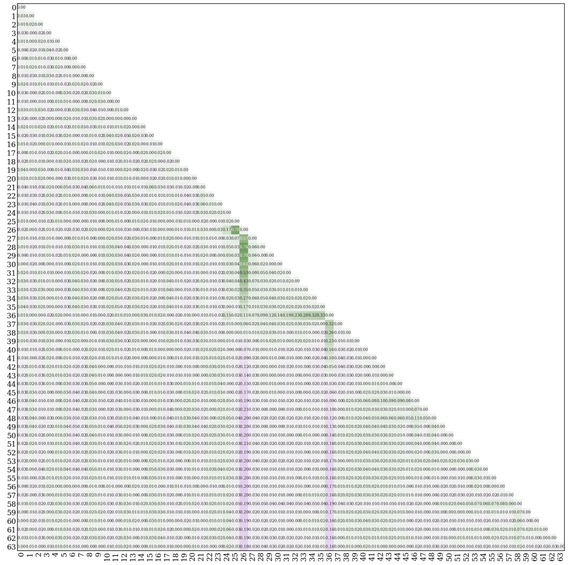
BatchNorm
BlockAutoregressive
ConditionalAffineAutoregressive
ConditionalAffineCoupling
ConditionalGeneralizedChannelPermute
ConditionalHouseholder
ConditionalMatrixExponential
ConditionalNeuralAutoregressive
ConditionalPlanar
ConditionalRadial
ConditionalSpline
ConditionalSplineAutoregressive
ConditionalTransformModule
GeneralizedChannelPermute
Householder
MatrixExponential
NeuralAutoregressive
Planar
Polynomial
Radial
Spline
SplineAutoregressive
SplineCoupling

Latent Flow

- Hybrid Approach:
- Alternating 6x ConditonalAffineCoupling and ConditionalSpline
- Should provide correlations and give expressiveness of spline for individual shapes

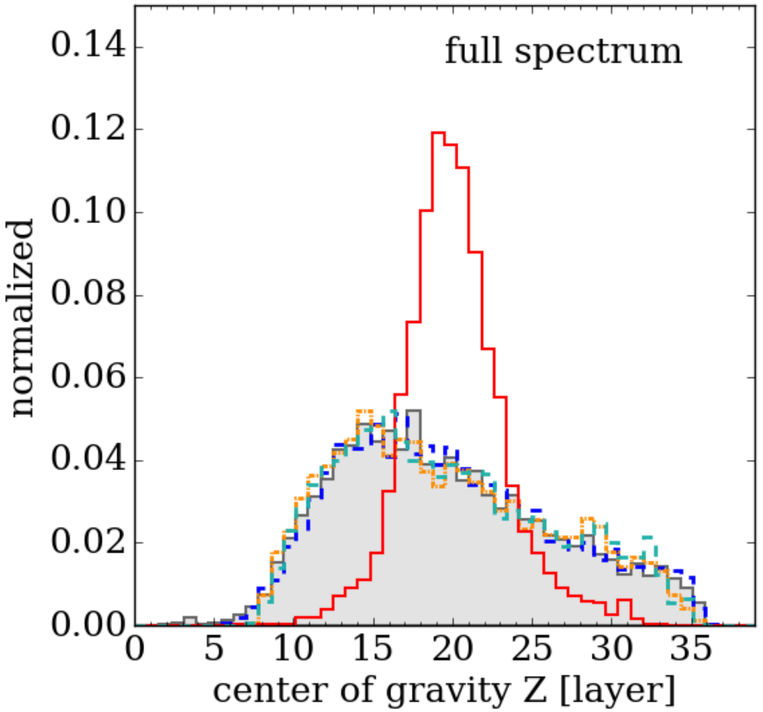


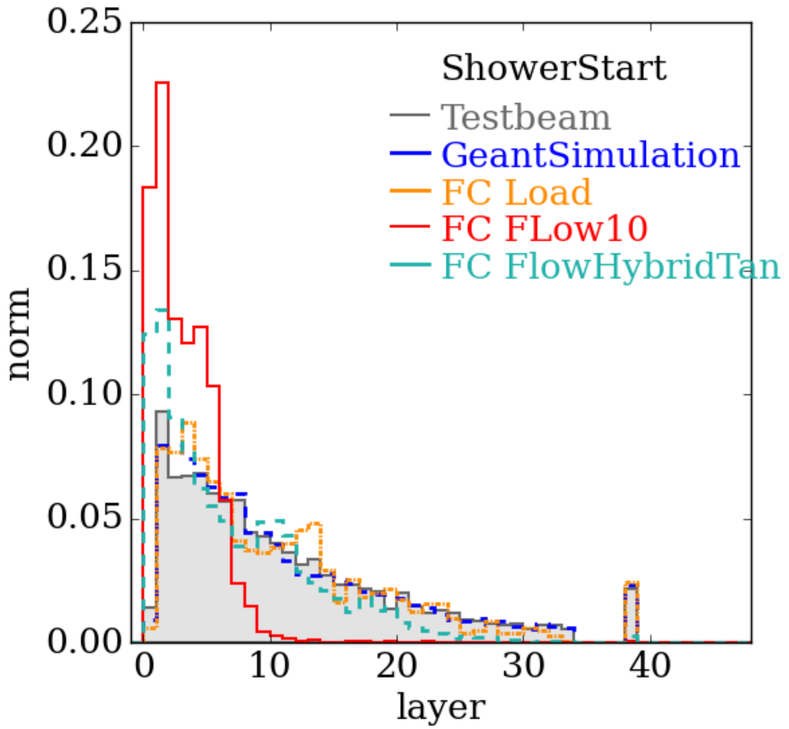


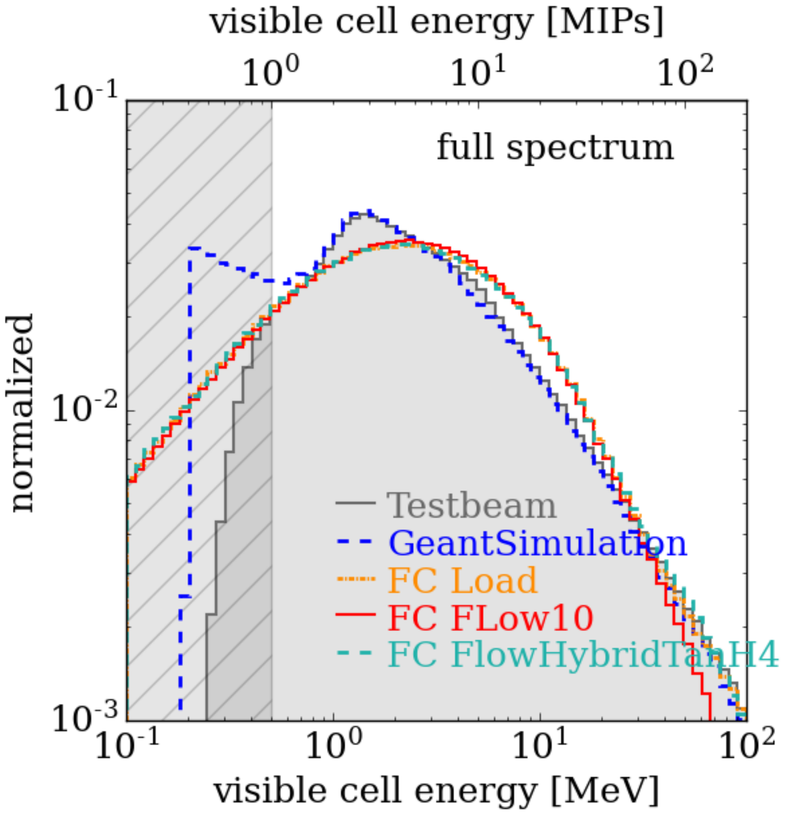


Fully Conditioned

BIBAE: Intermediate result, no fidelity selection, no PostProcessor
Geant4: June2020, v04-14-01_gcc49, QGSP_BERT_HP







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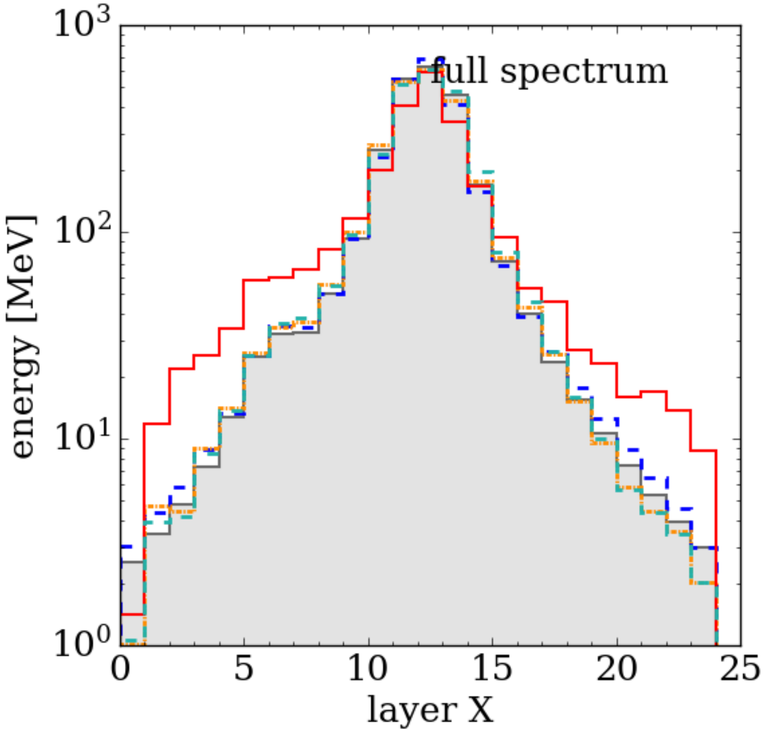
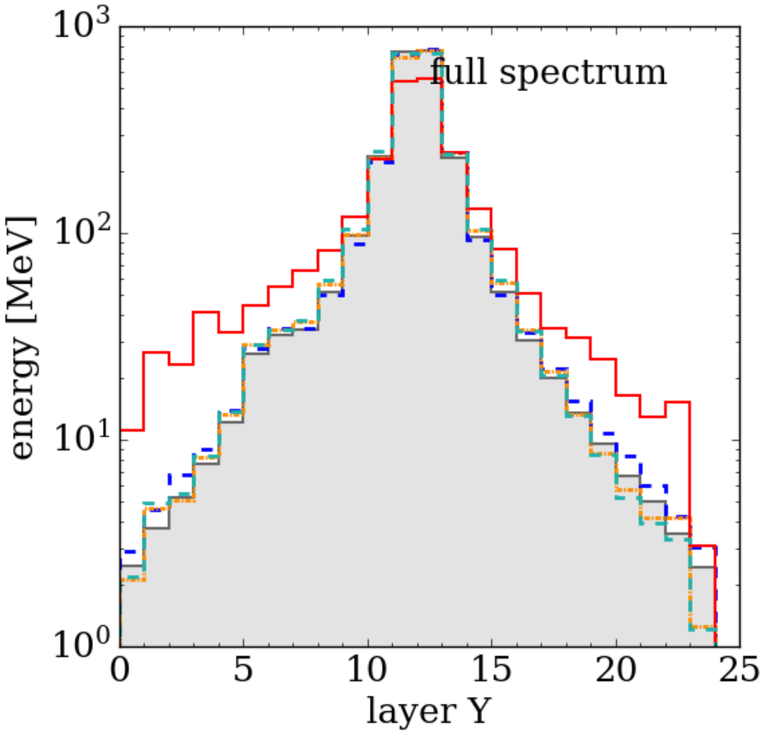
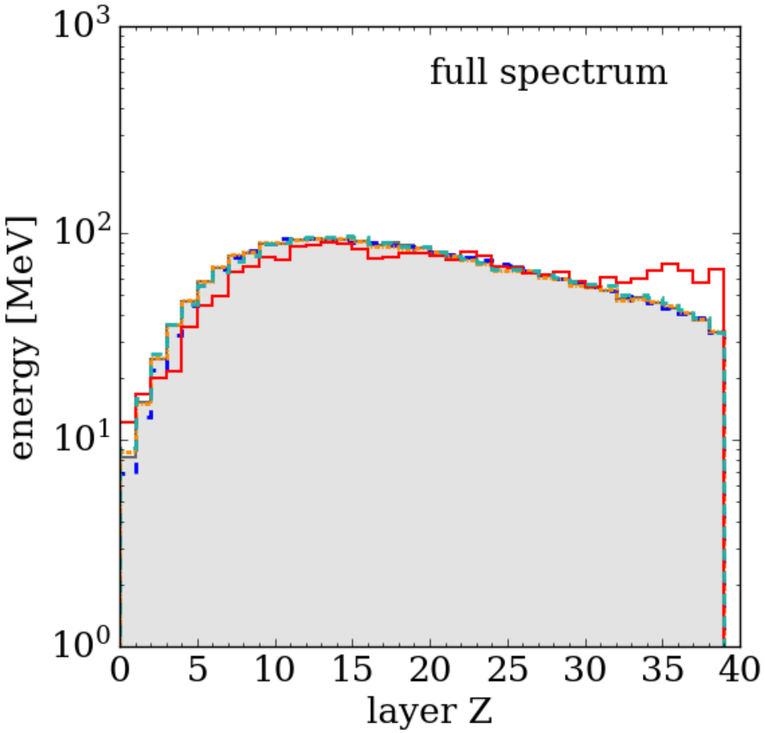
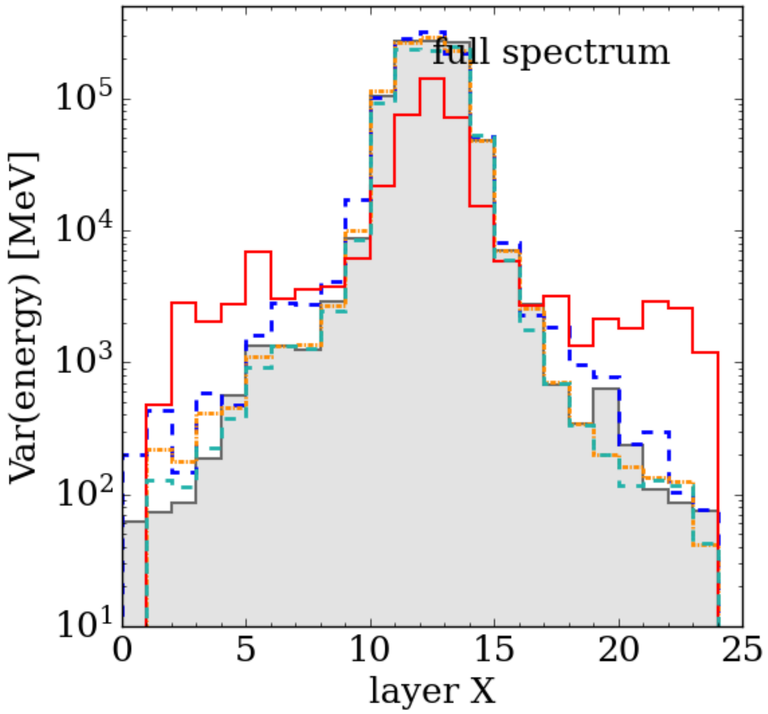
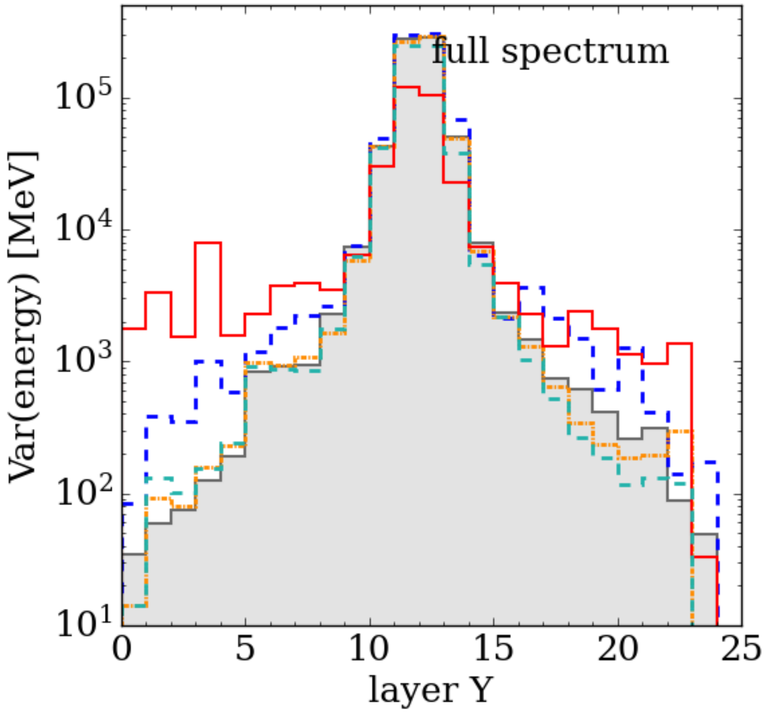


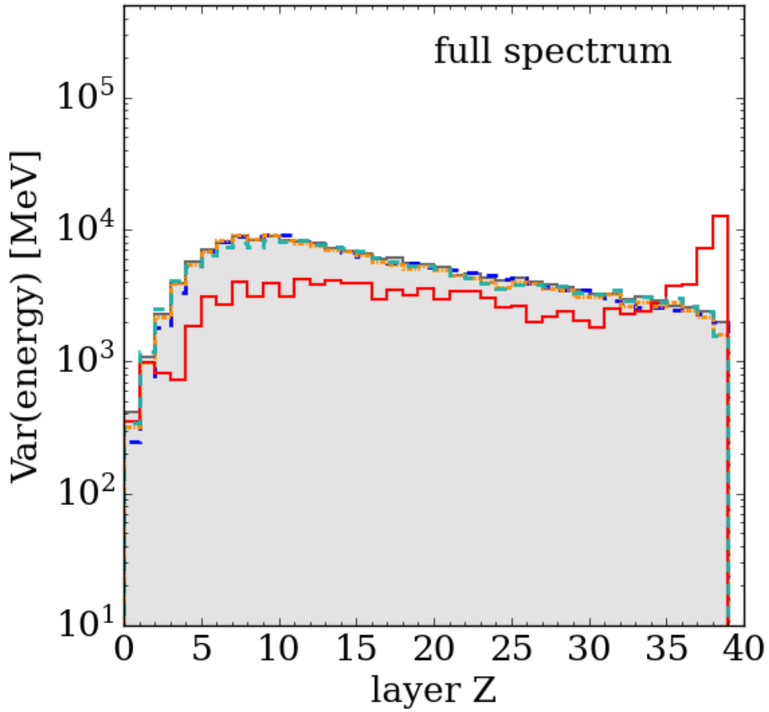




Fully Conditioned







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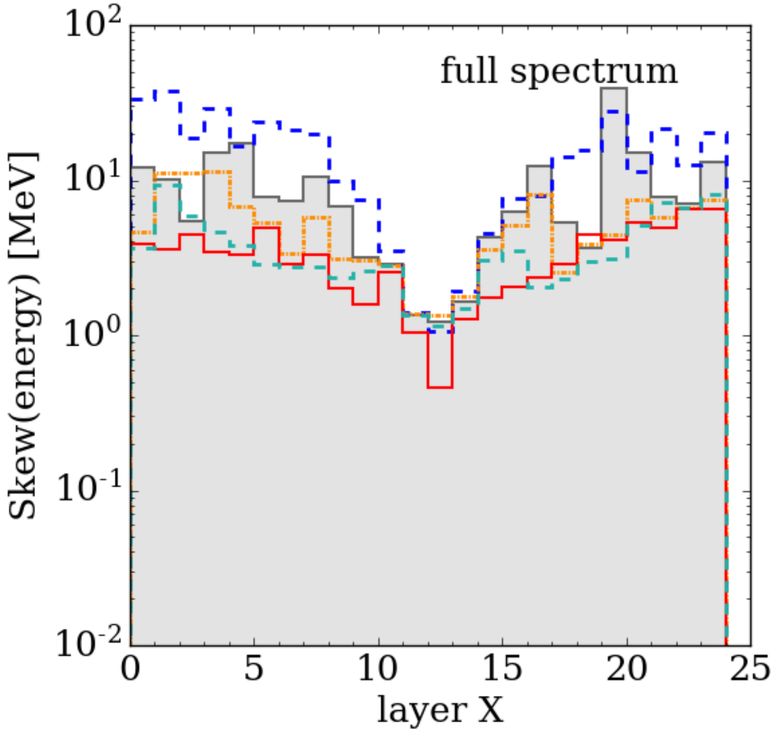

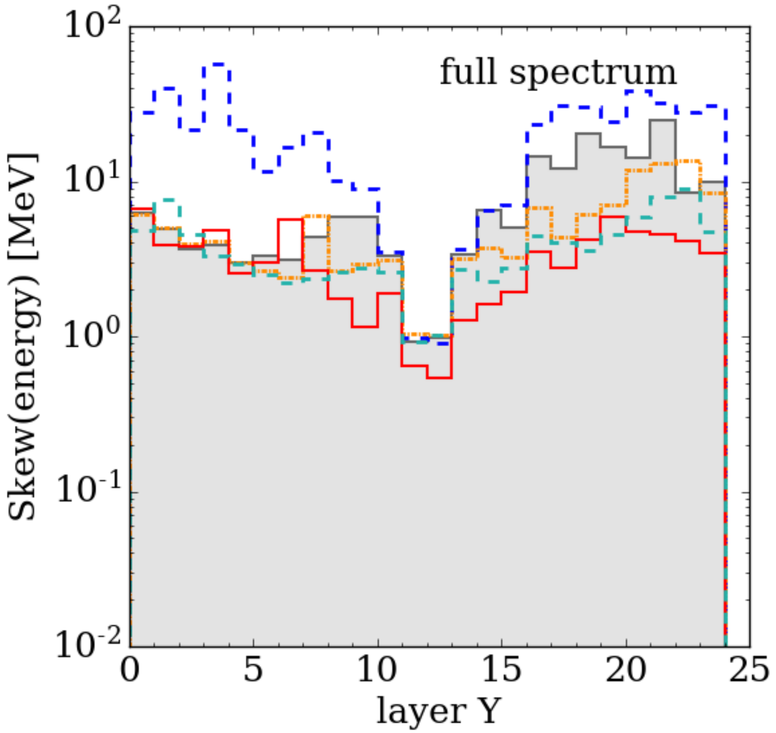

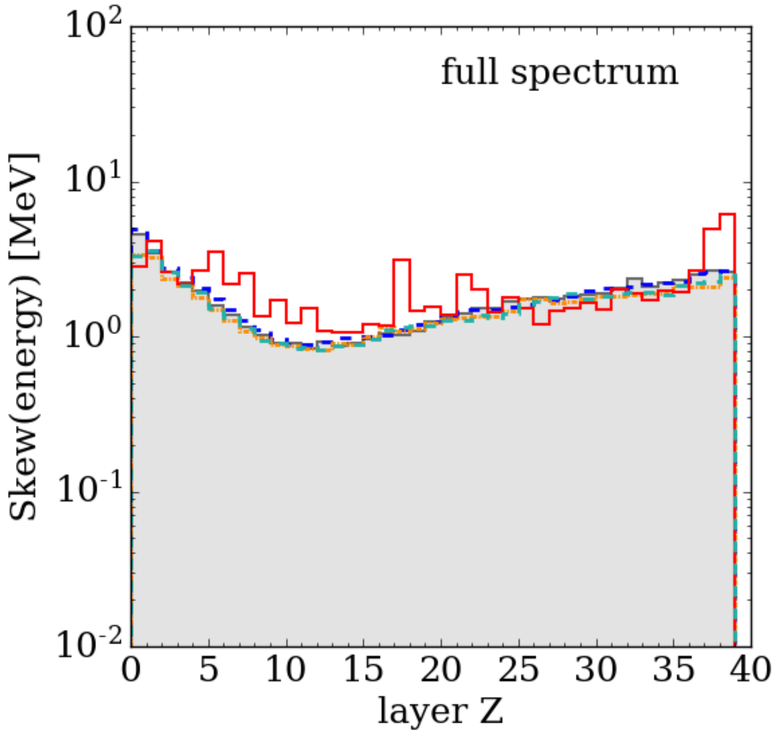

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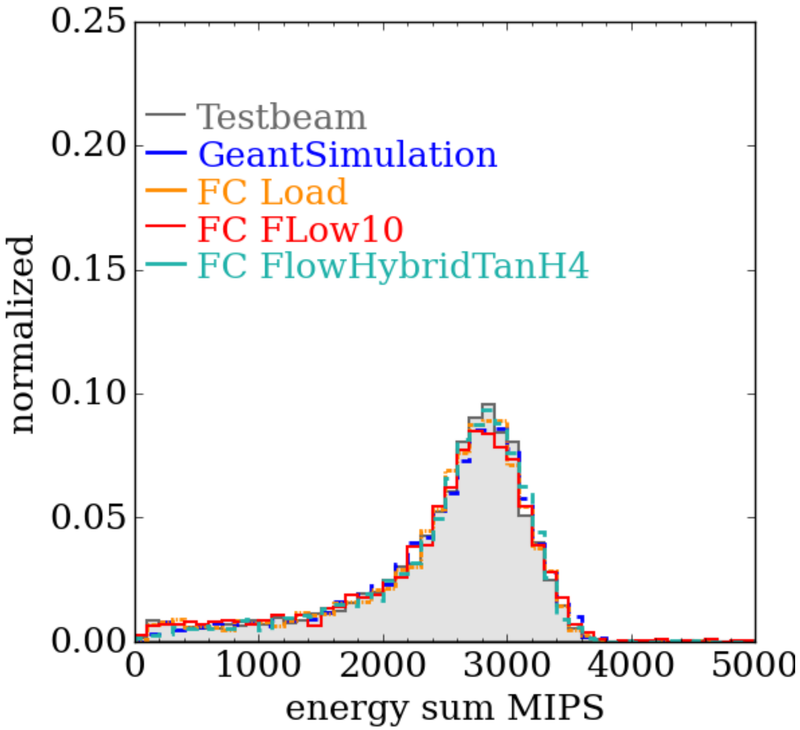
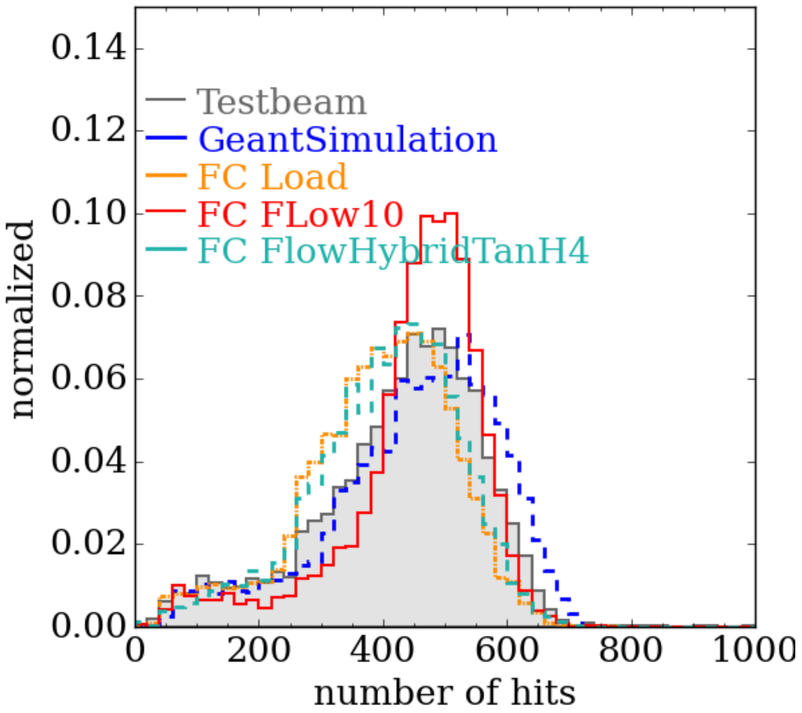
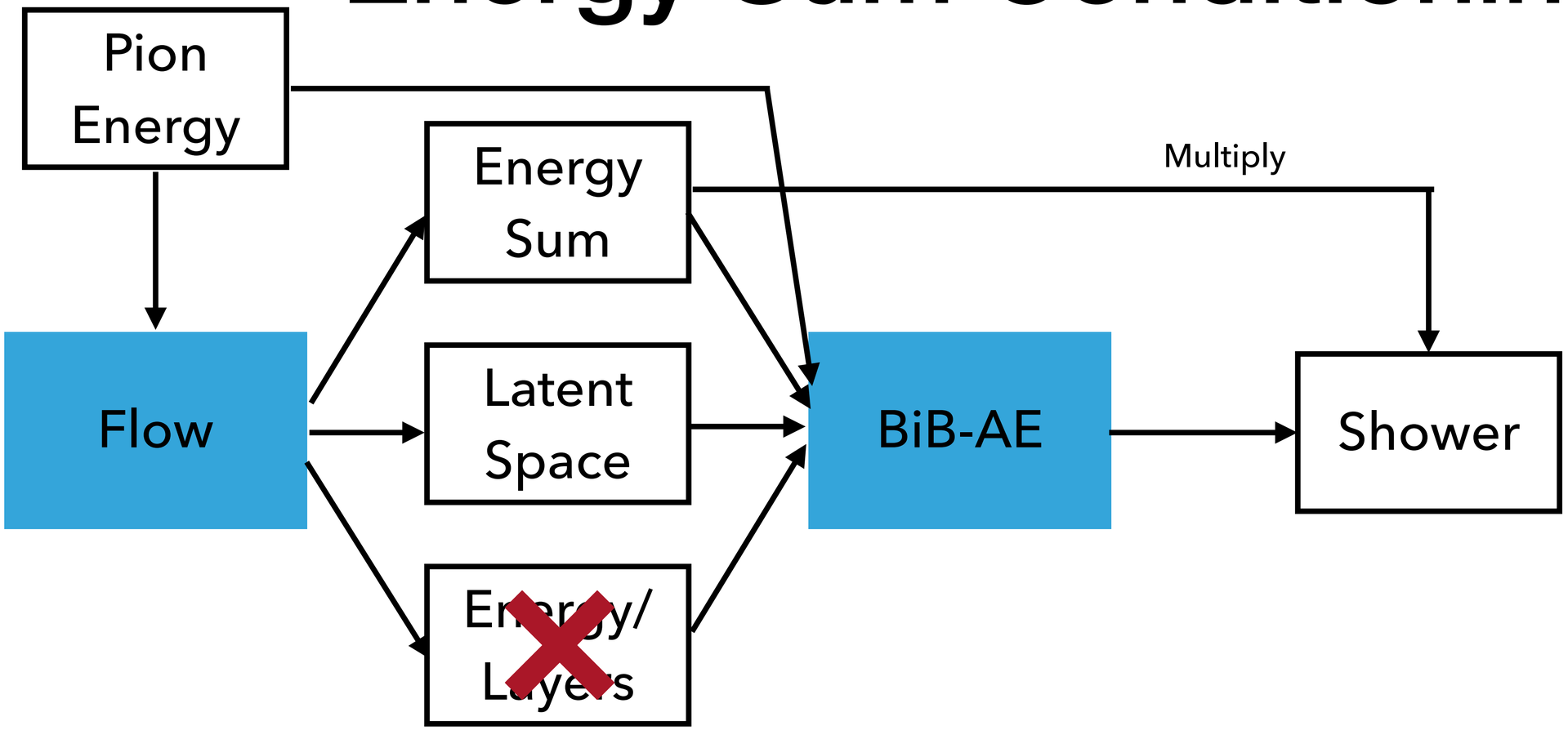
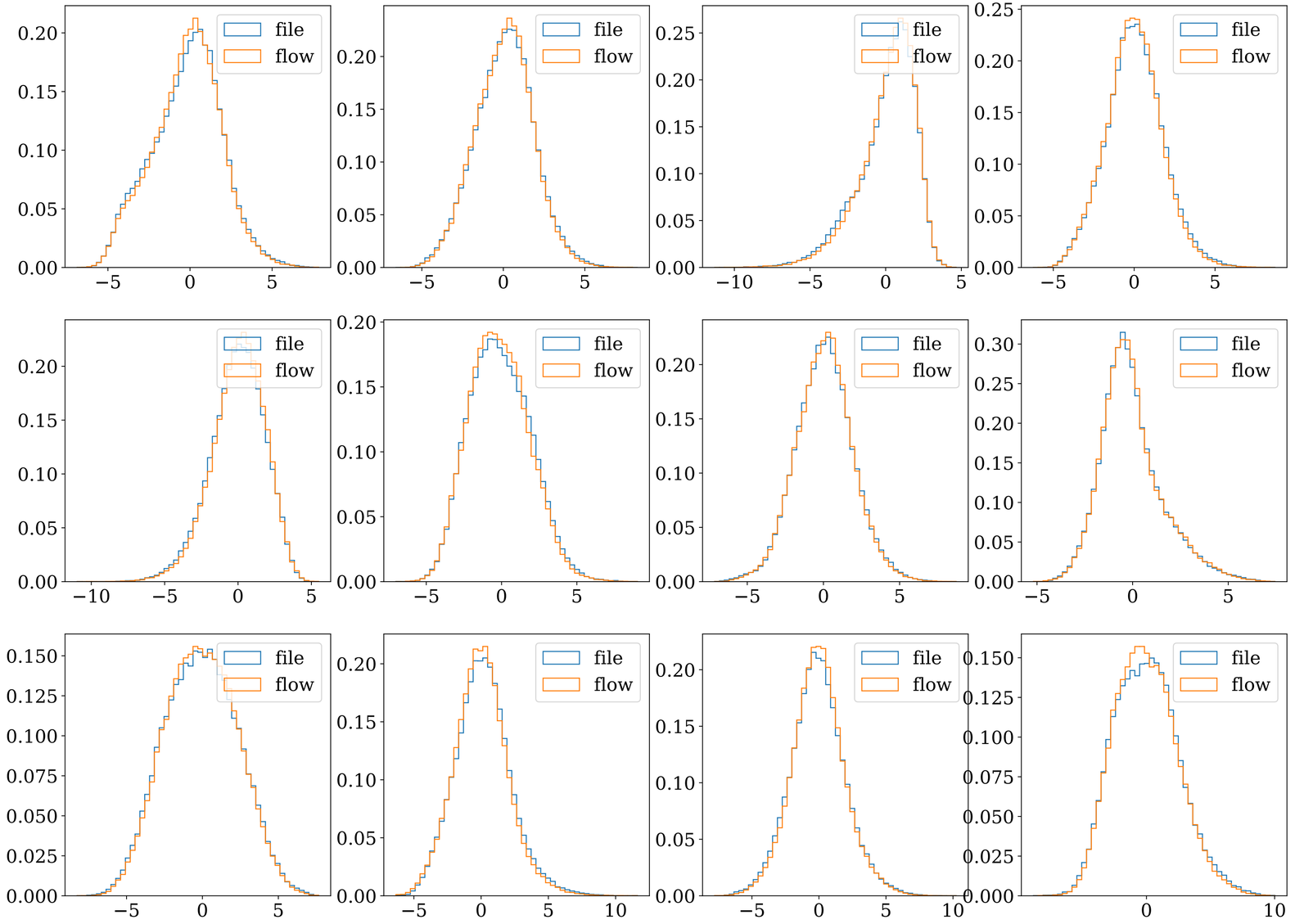




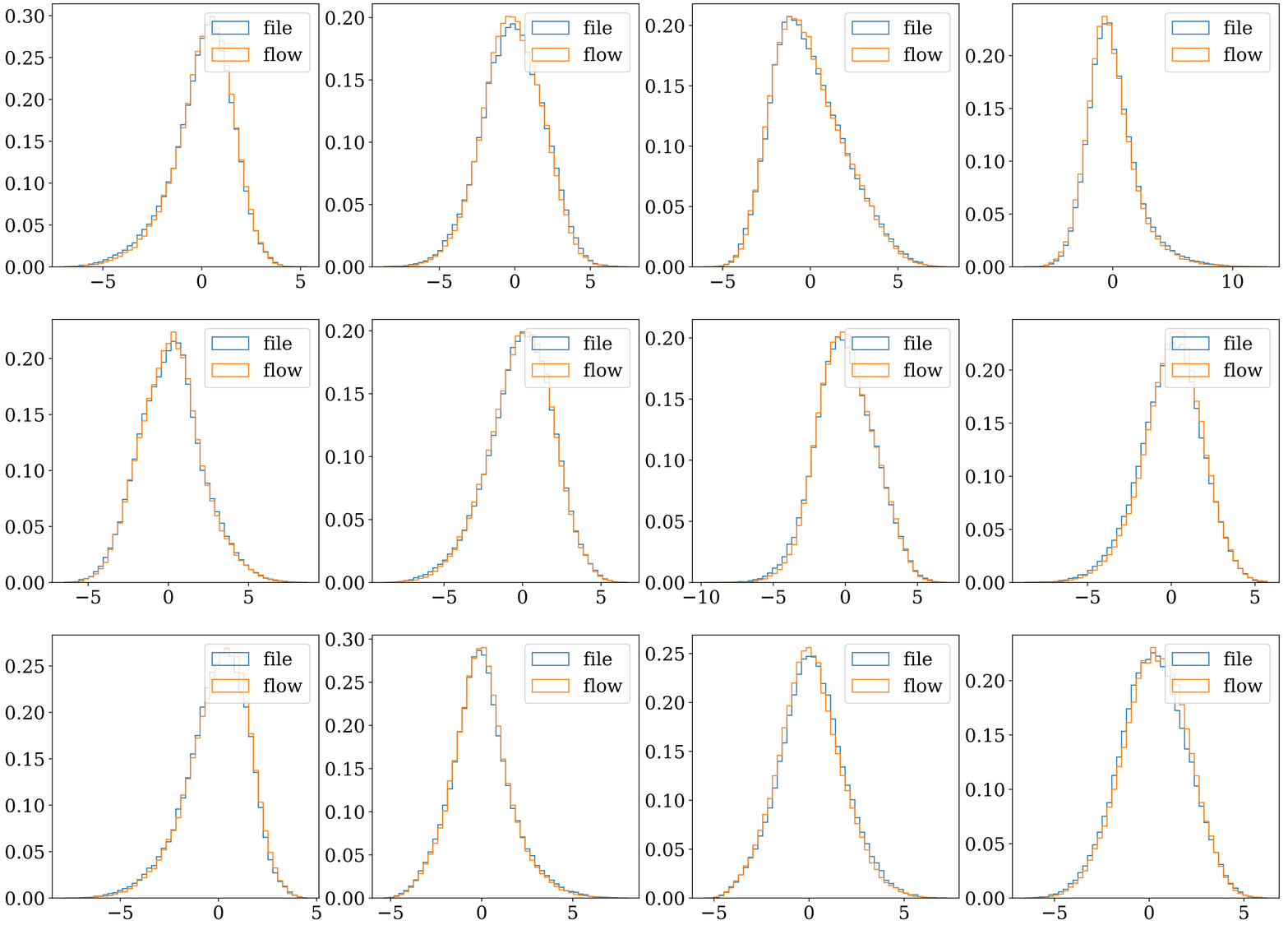
Energy Sum Conditioning



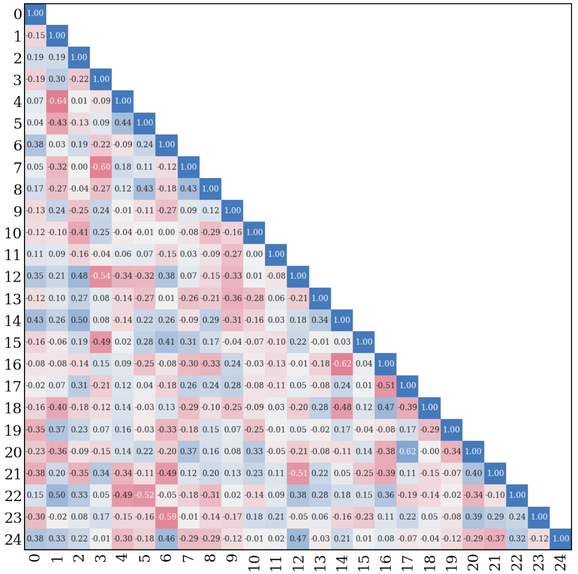
Latent 1-12

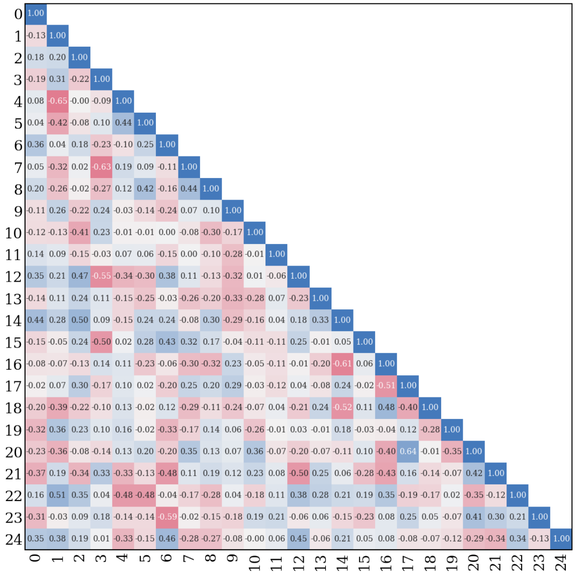


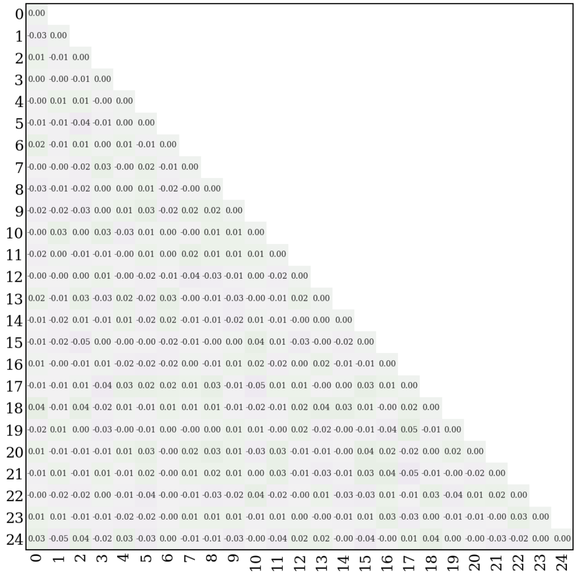
Latent 1-12

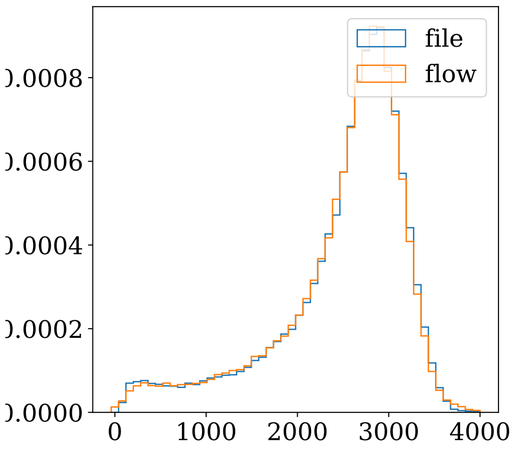


Latent 13-24





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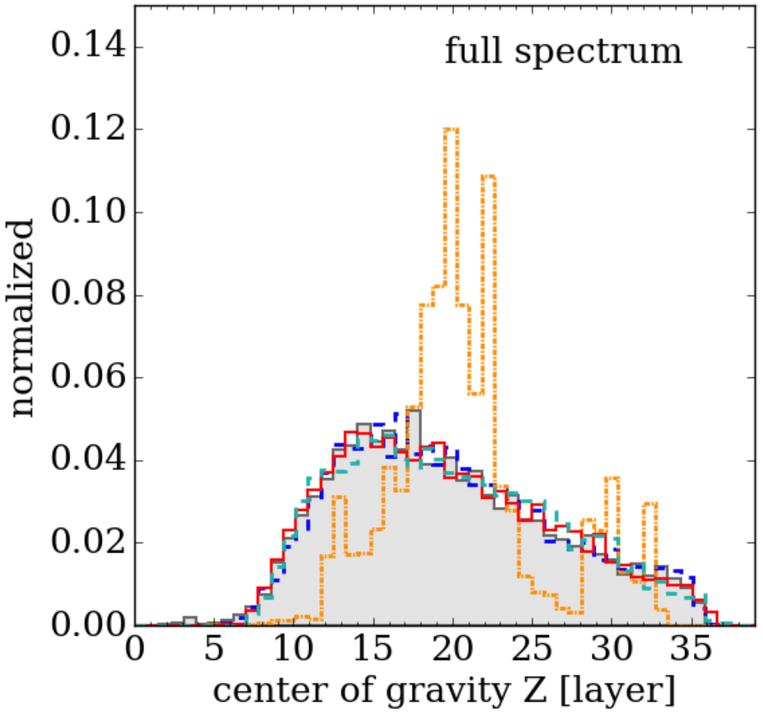
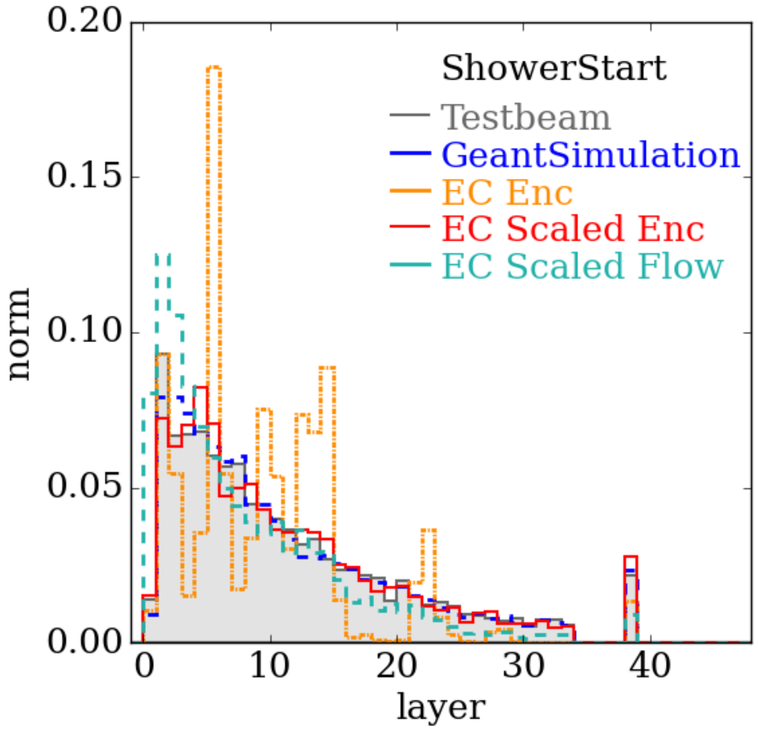
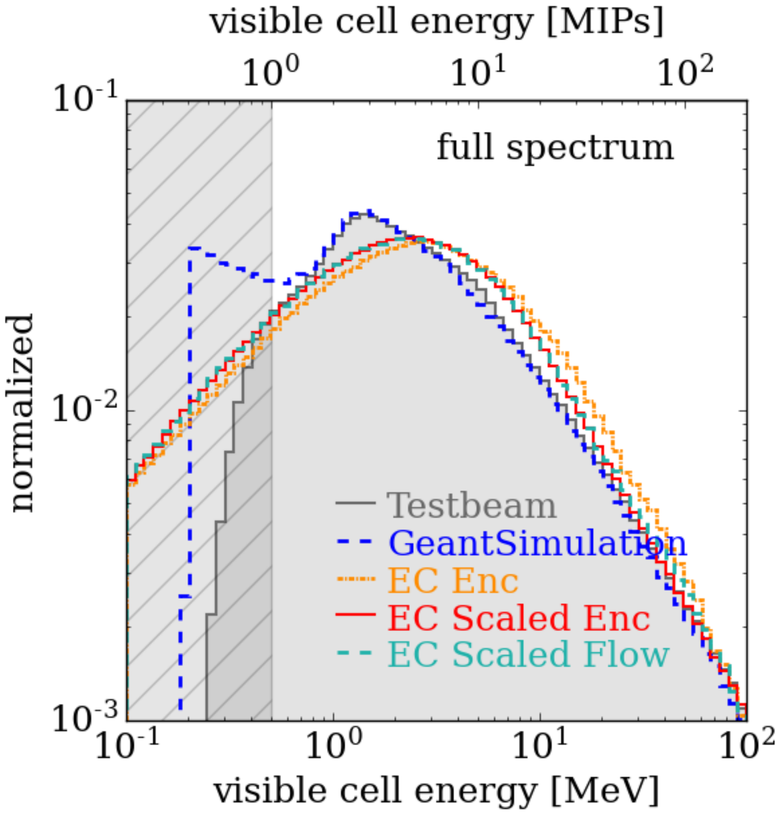
Energy Conditioned

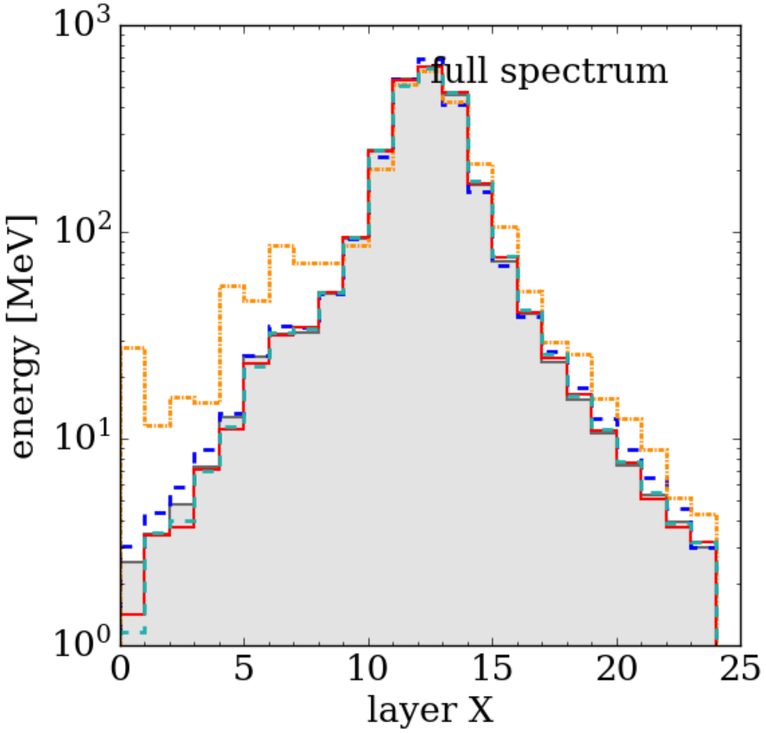
BIBAE: Intermediate result, no fidelity selection, no PostProcessor
Geant4: June2020, v04-14-01_gcc49, QGSP_BERT_HP

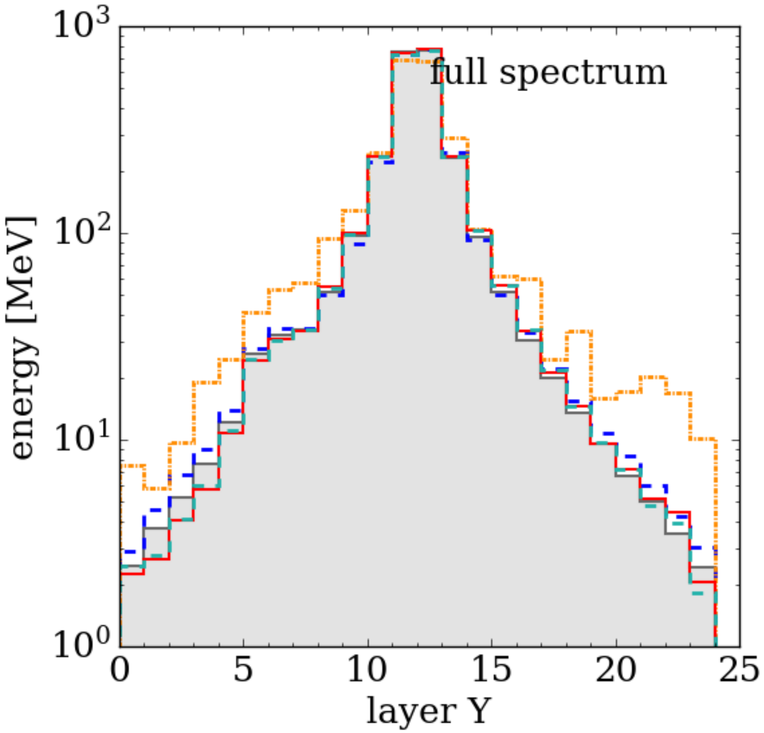


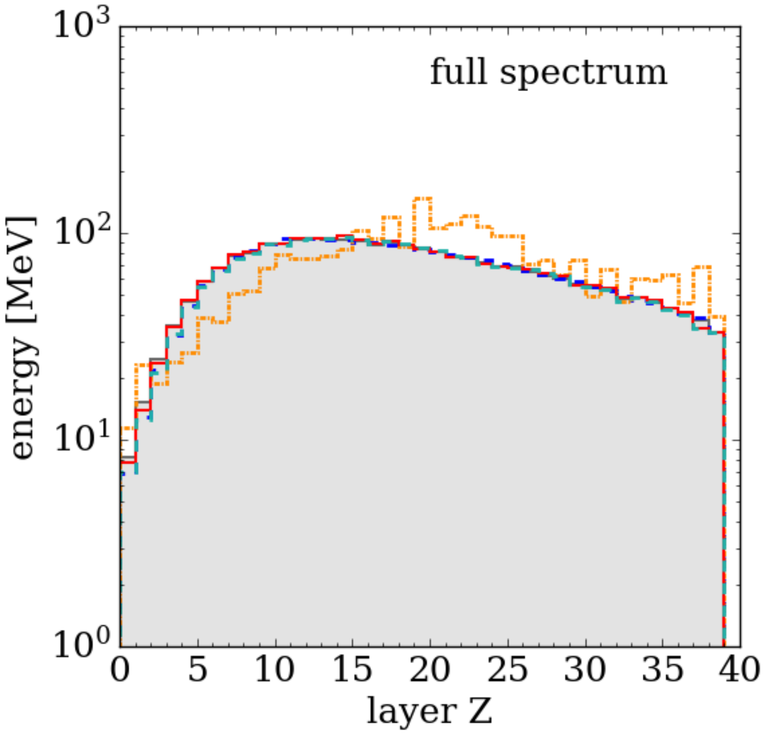




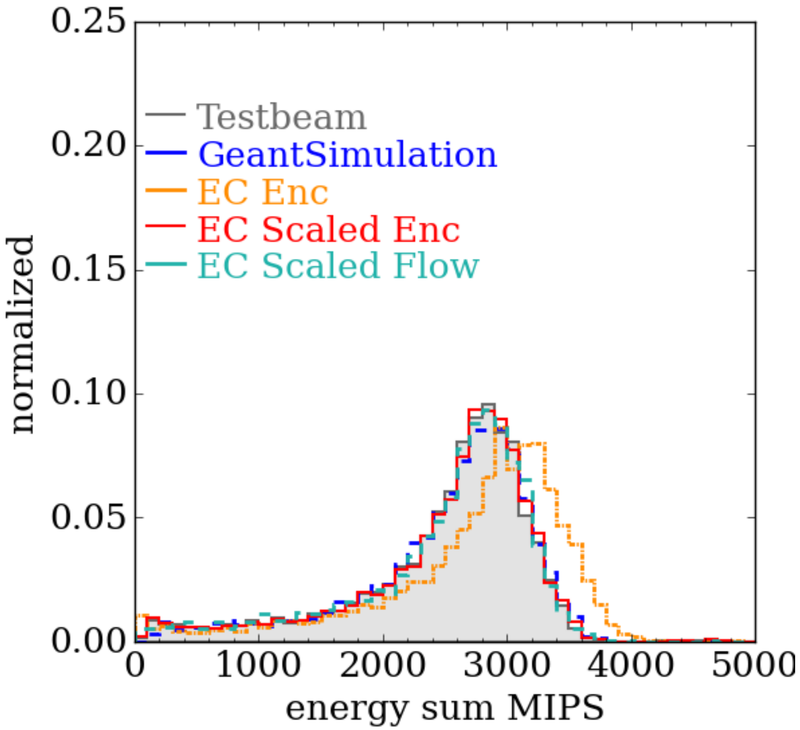
Energy Conditioned

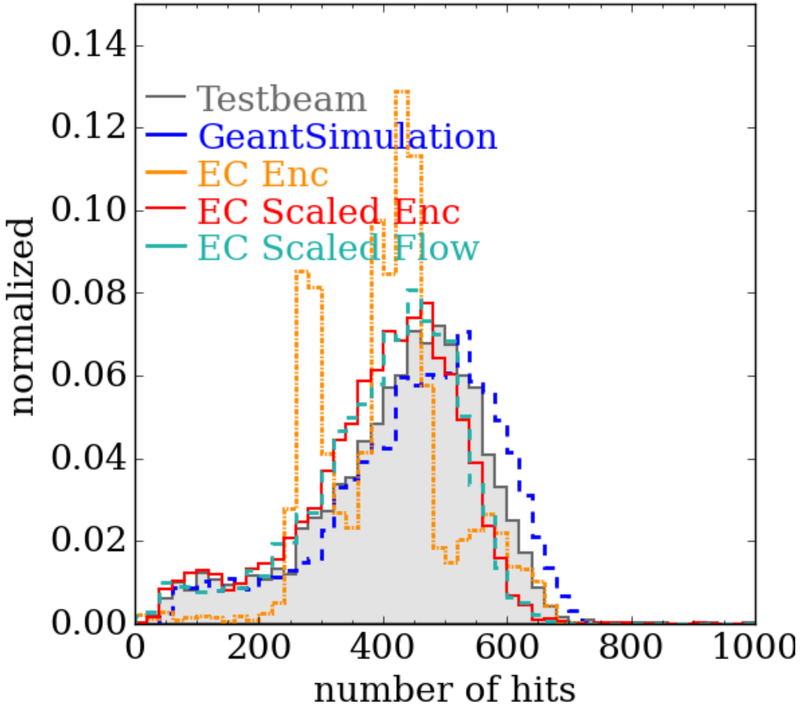




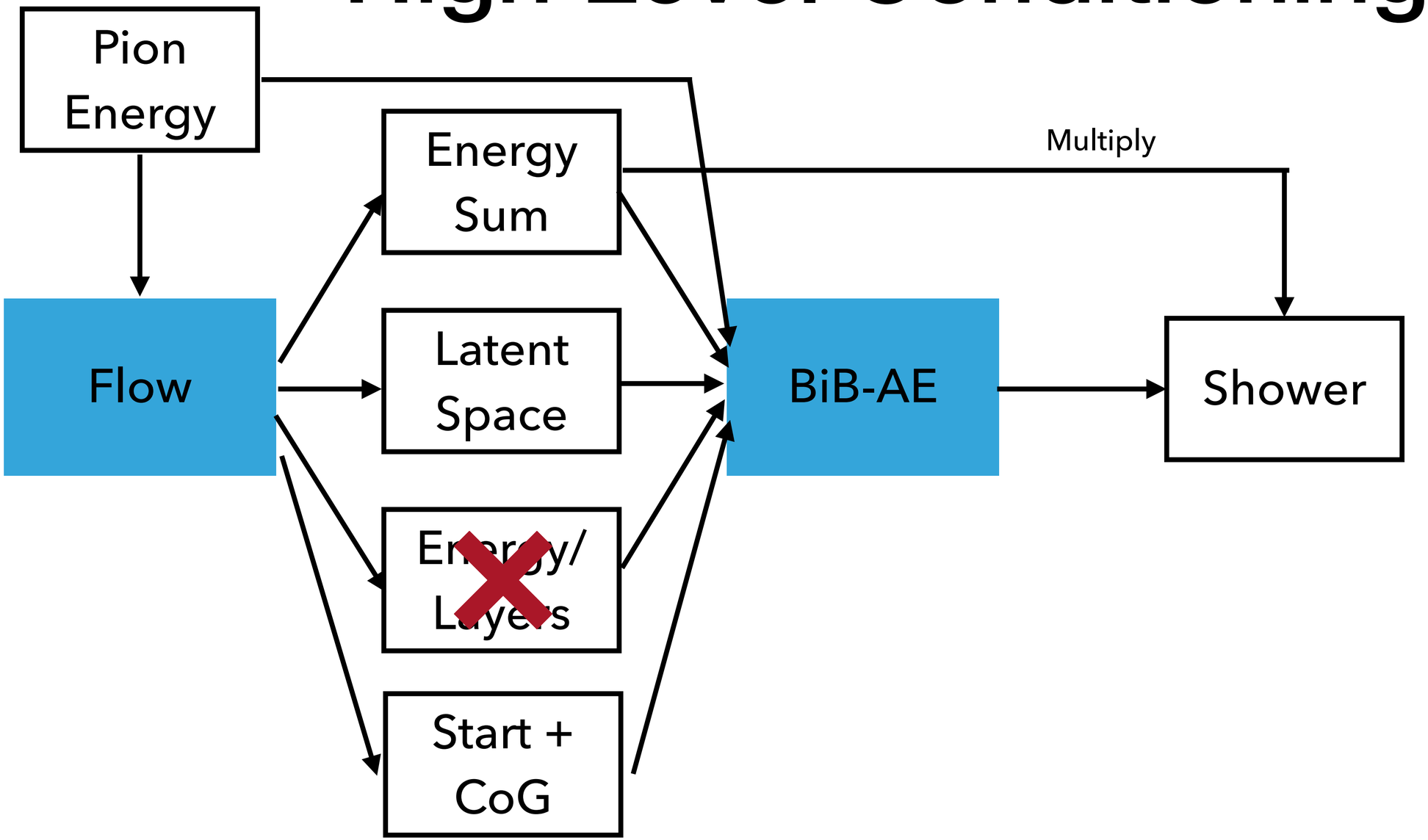


Energy Conditioned



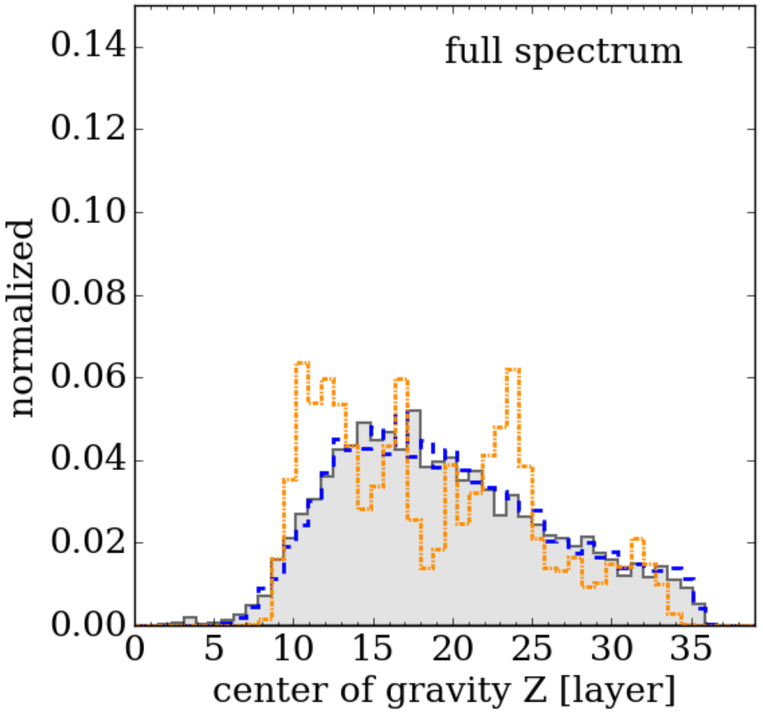


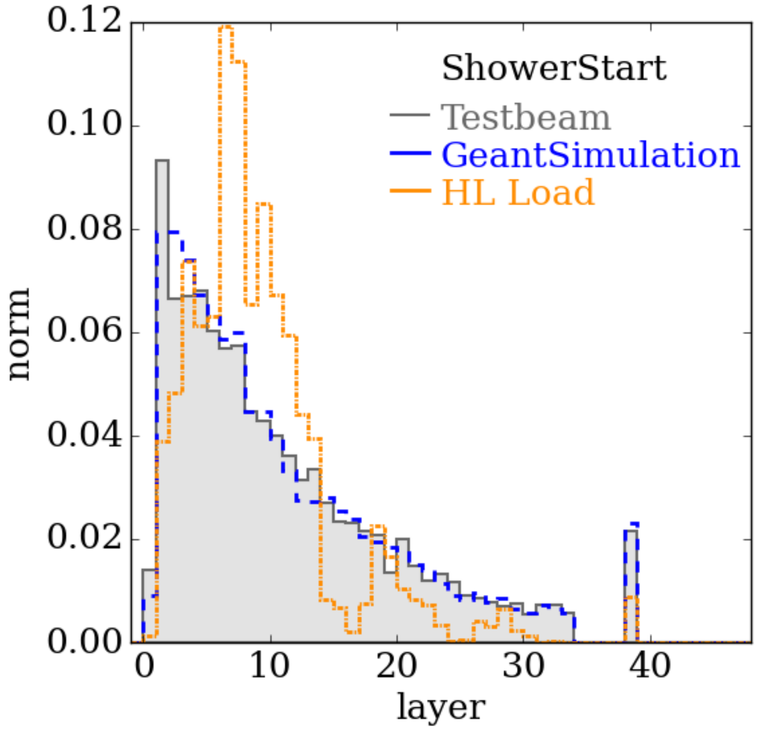
High Level Conditioning

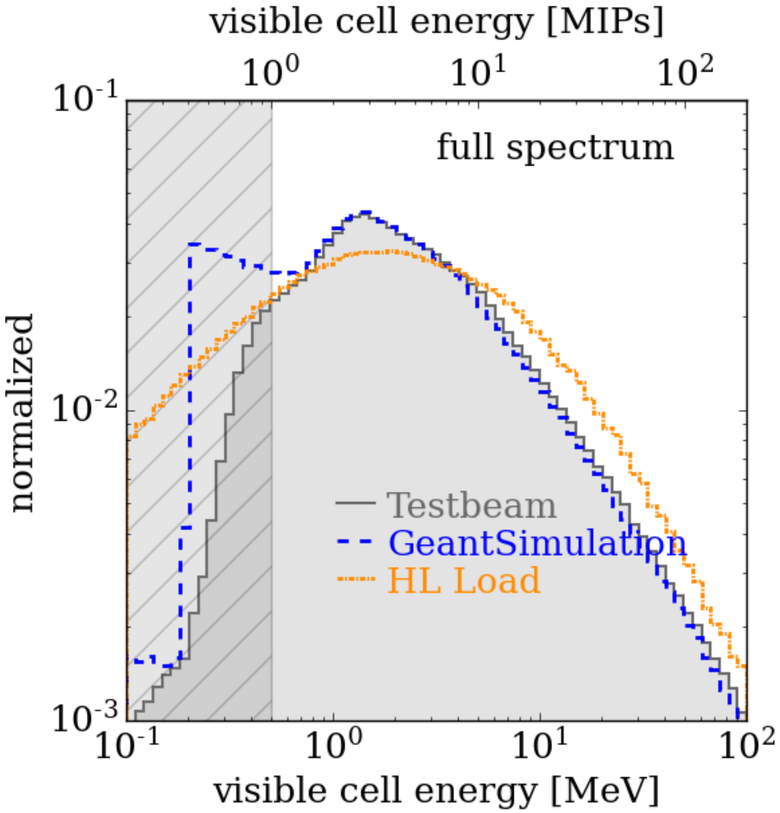


High Level Conditioned

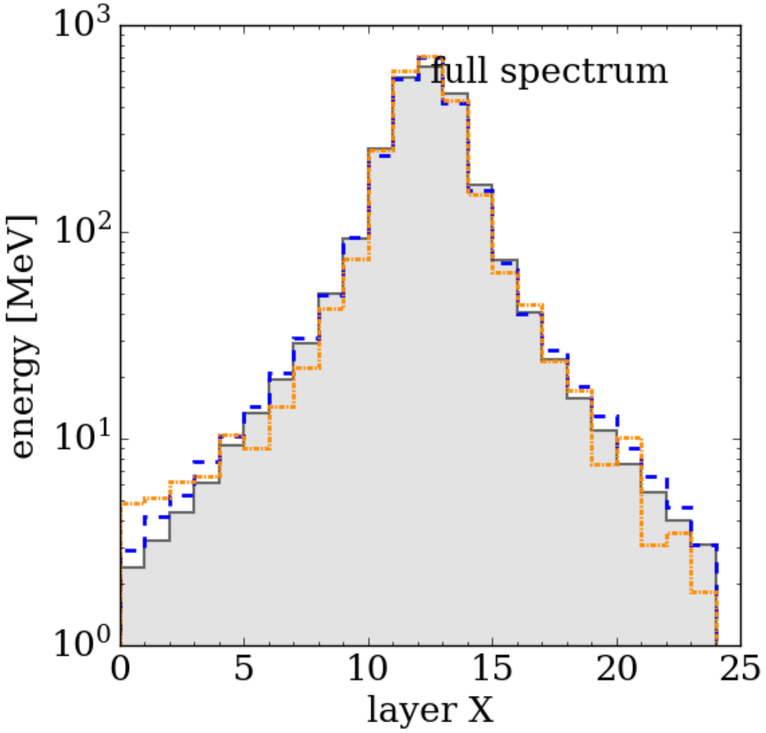
BIBAE: Intermediate result, no fidelity selection, no PostProcessor
Geant4: June2020, v04-14-01_gcc49, QGSP_BERT_HP

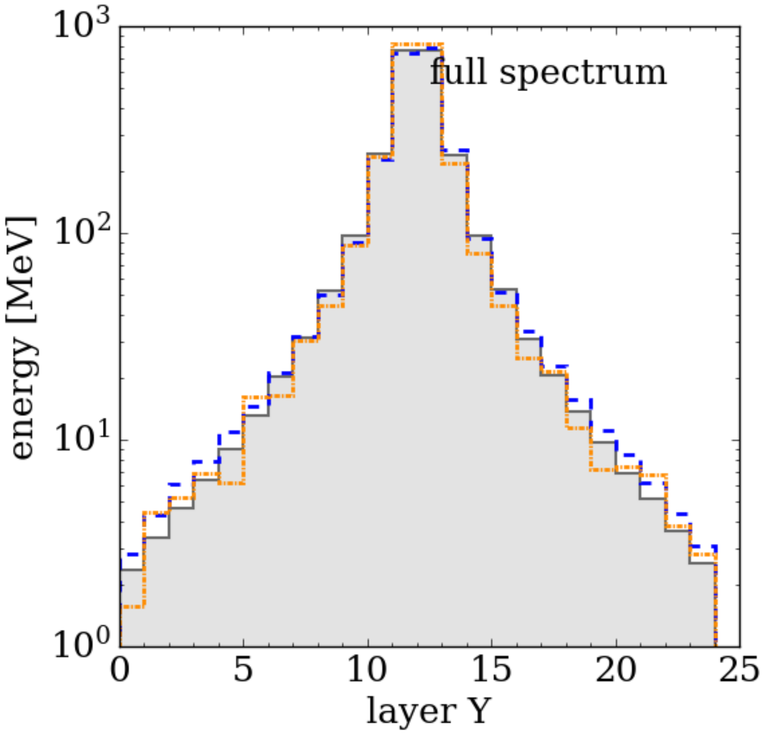


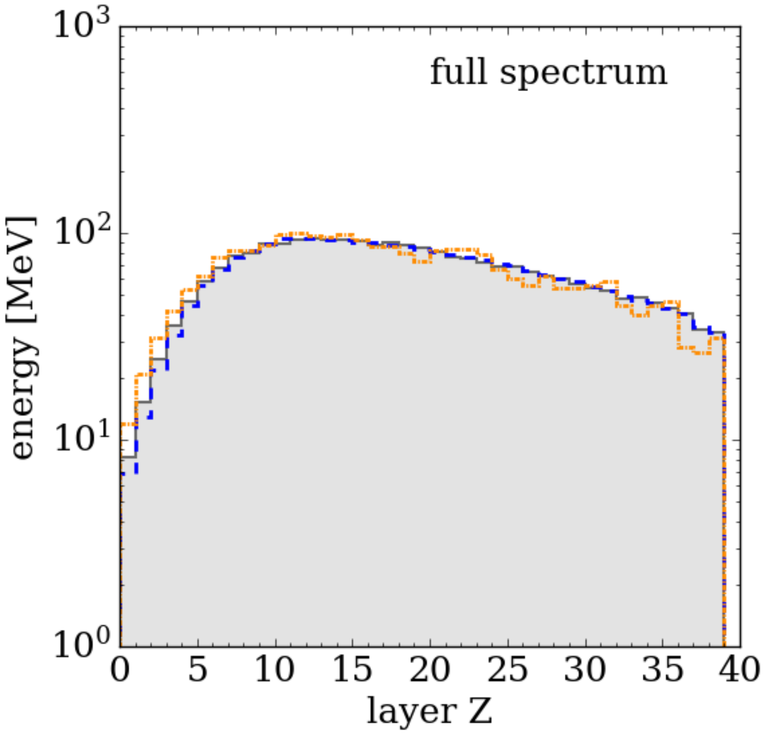




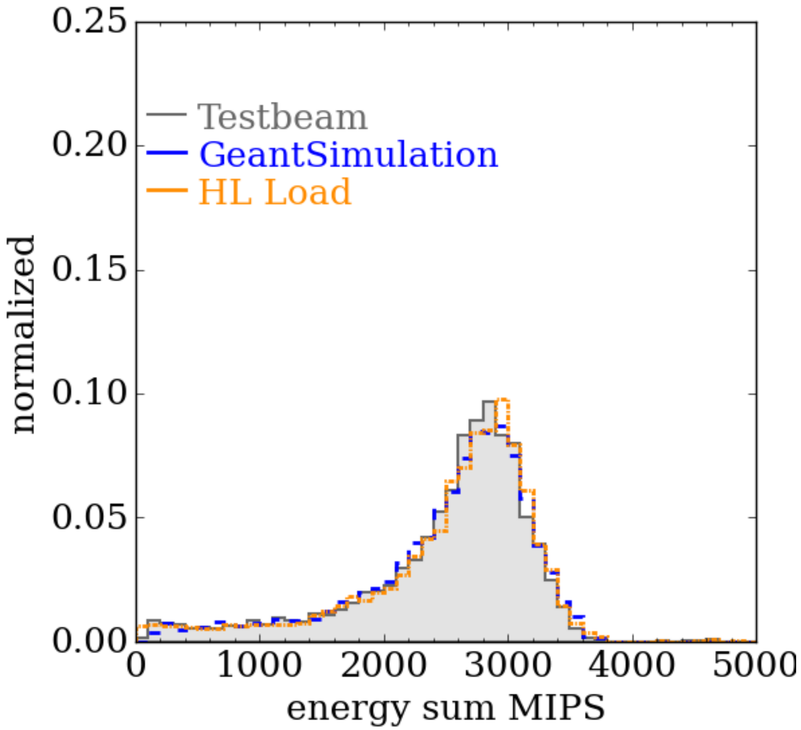
High Level Conditioned

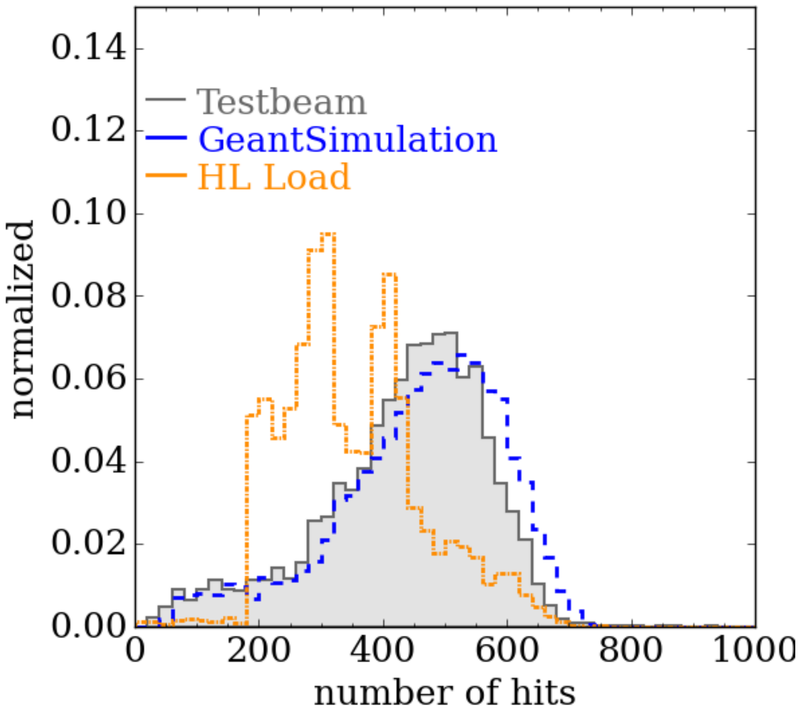




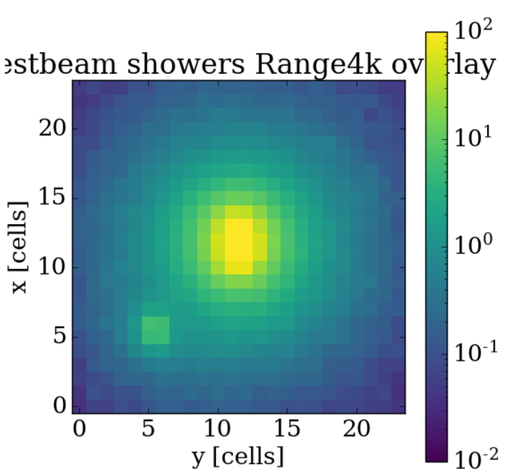


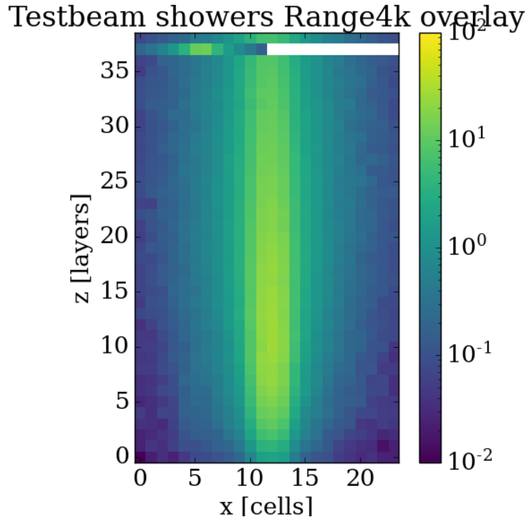
High Level Conditioned

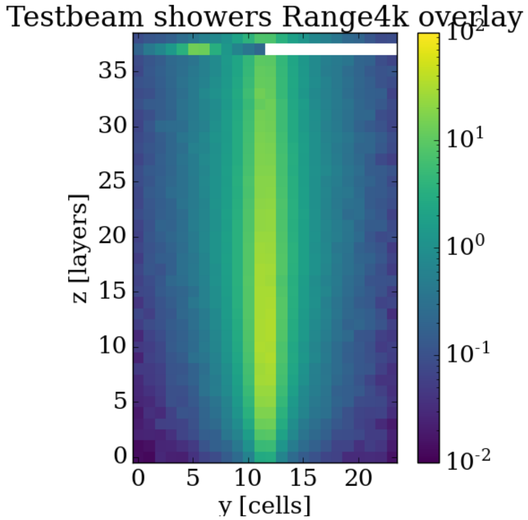


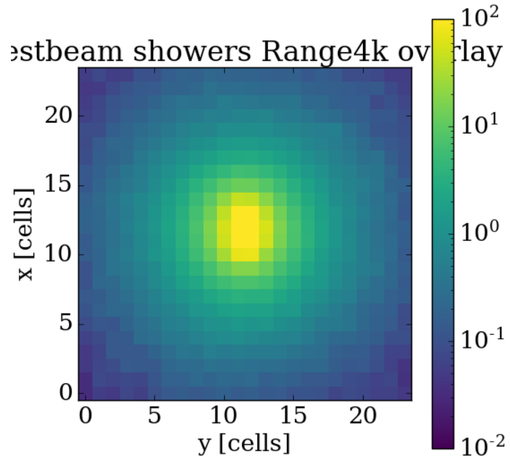


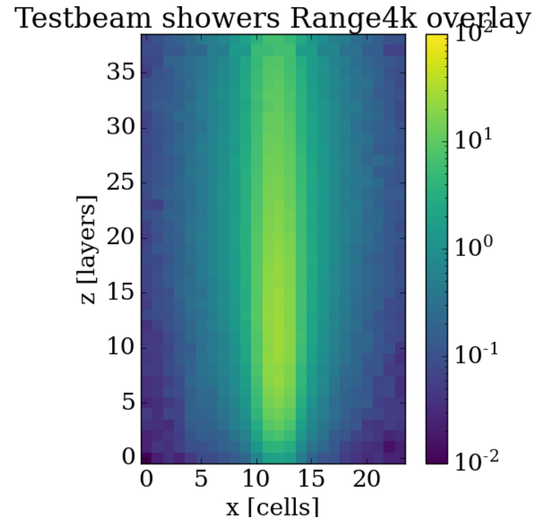
Shower Artefacts

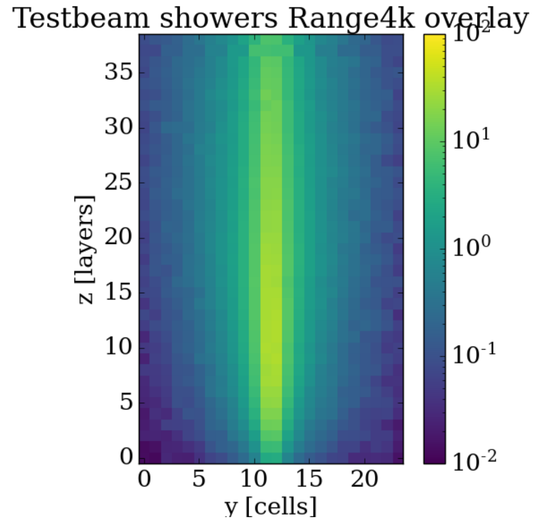












- Second to last layer has 2x cell size
- 1/4 as many channels
- Divide hit number by 4
- Upsample by factor of 2
- Preserves sum
- Lines up shower core
- Fits into grid