Analysis LST1-LST4

CTLearn vs magic-cta-pipe

Ilaria Viale, 03 Mar 2026

Dataset and software

CTLearn

- `ctlearn 0.10.3.dev91`
- `ctlearn-manager 0.1.1.dev4`
- `dl1-data-handler 0.14.6`
- `ctapipe 0.25.1`

magic-cta-pipe

- `lstchain 0.11.3`
- `ctapipe 0.25.1`

Dataset: `/fefs/aswg/mc/LST_Advanced_Camera_Prod1/{particle}/zenith_20deg/south_pointing/4LSTs_PMT/sim_telarray/` **(same as Elisa's)**

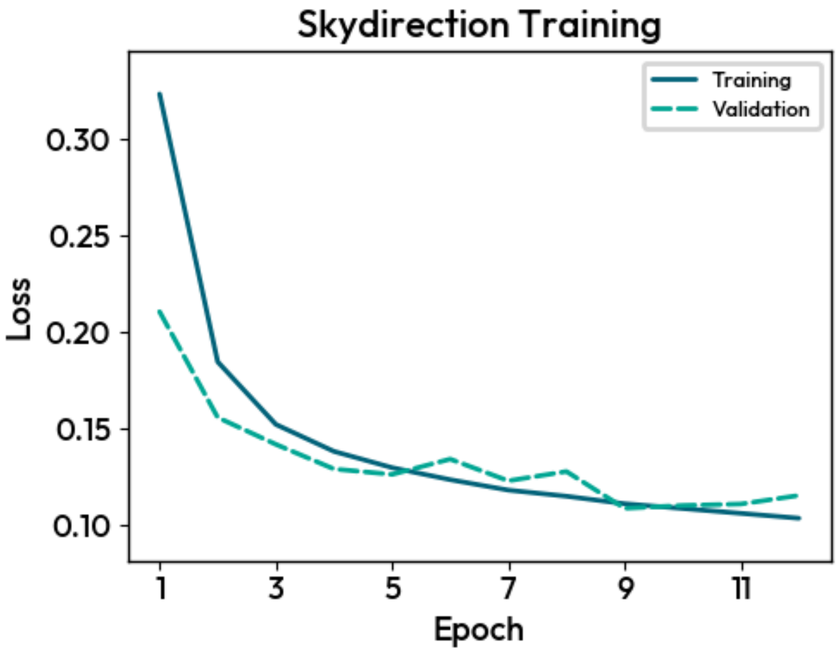
`(ZD, Az): (20.0 * u.deg, 180.0 * u.deg)`

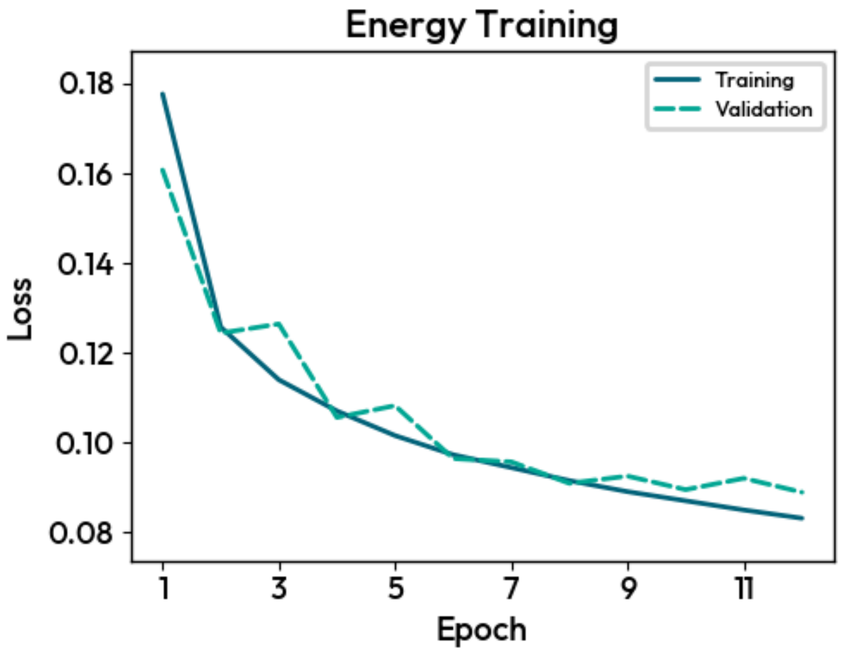
Analysis:

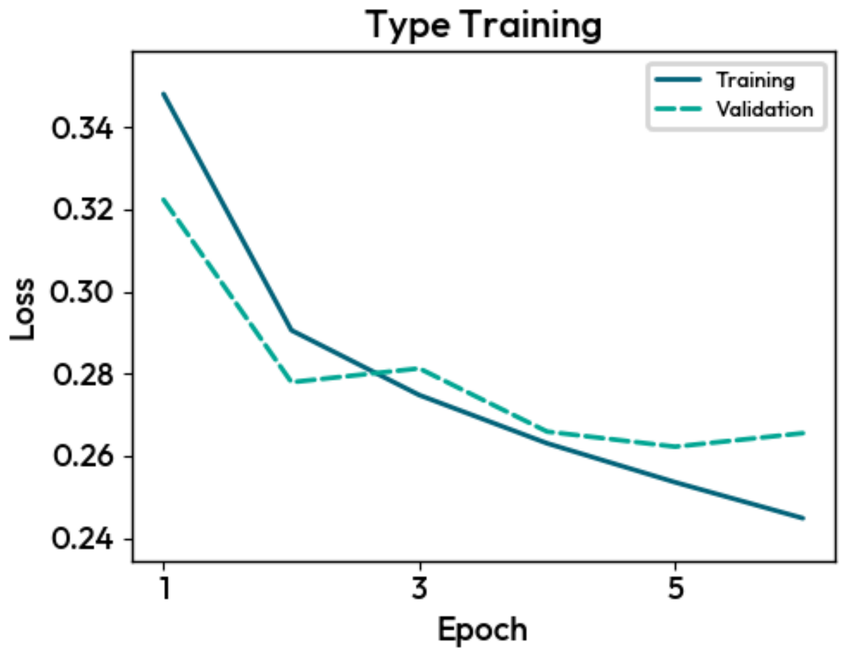
- Main comparison done with notebooks based on pyirf, used for mcp performance paper
- Comparison with CTLearn Manager and crappie functions also done → Some discrepancies found

Loss function

CTLearn





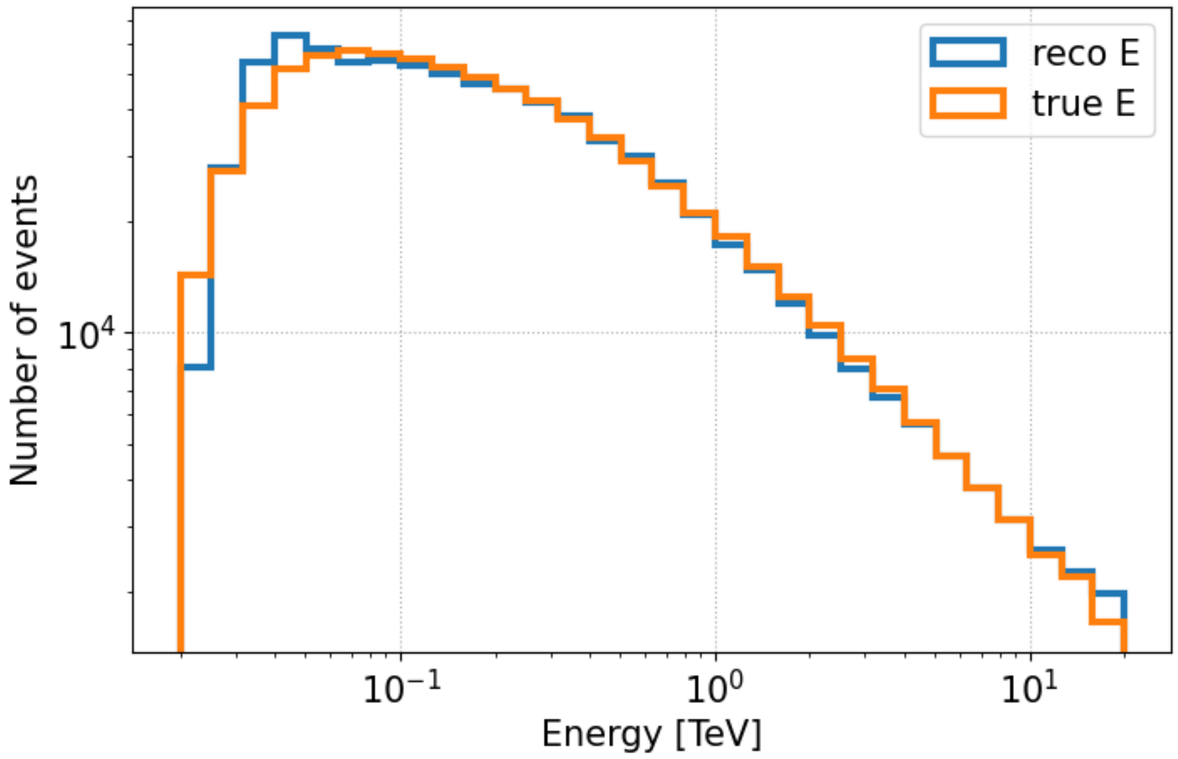



```
n_epochs=6/12, batch_size=64, save_best_validation_only=True
```

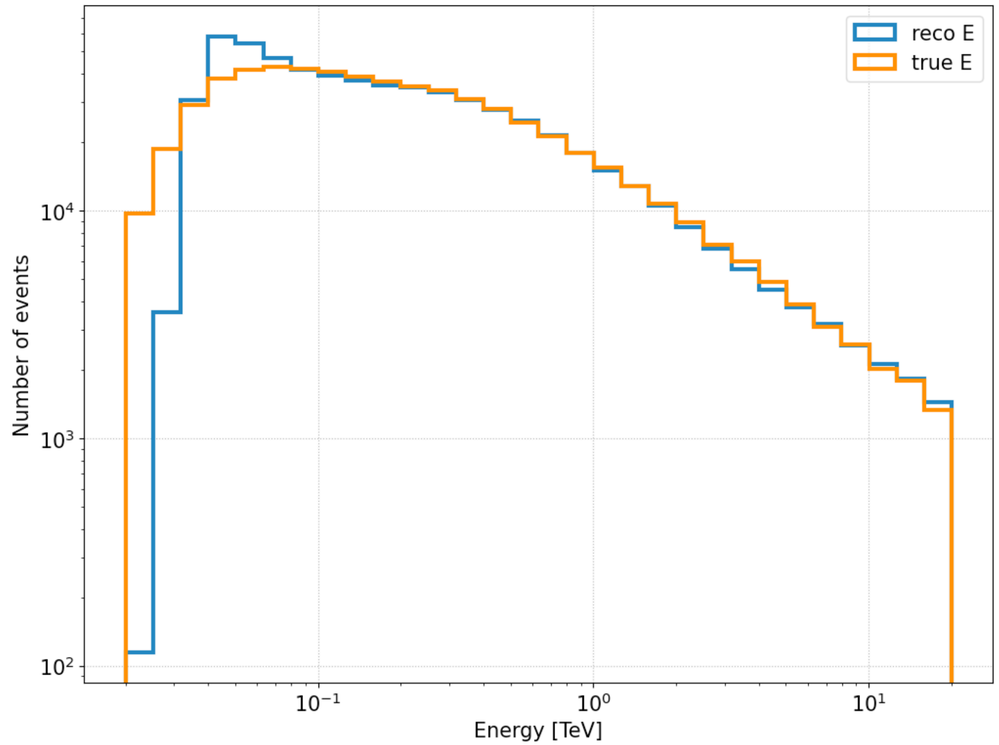
Energy distribution and migration matrix

CTLearn vs mcp

CTLearn



mcp



Energy distribution and migration matrix

CTLearn

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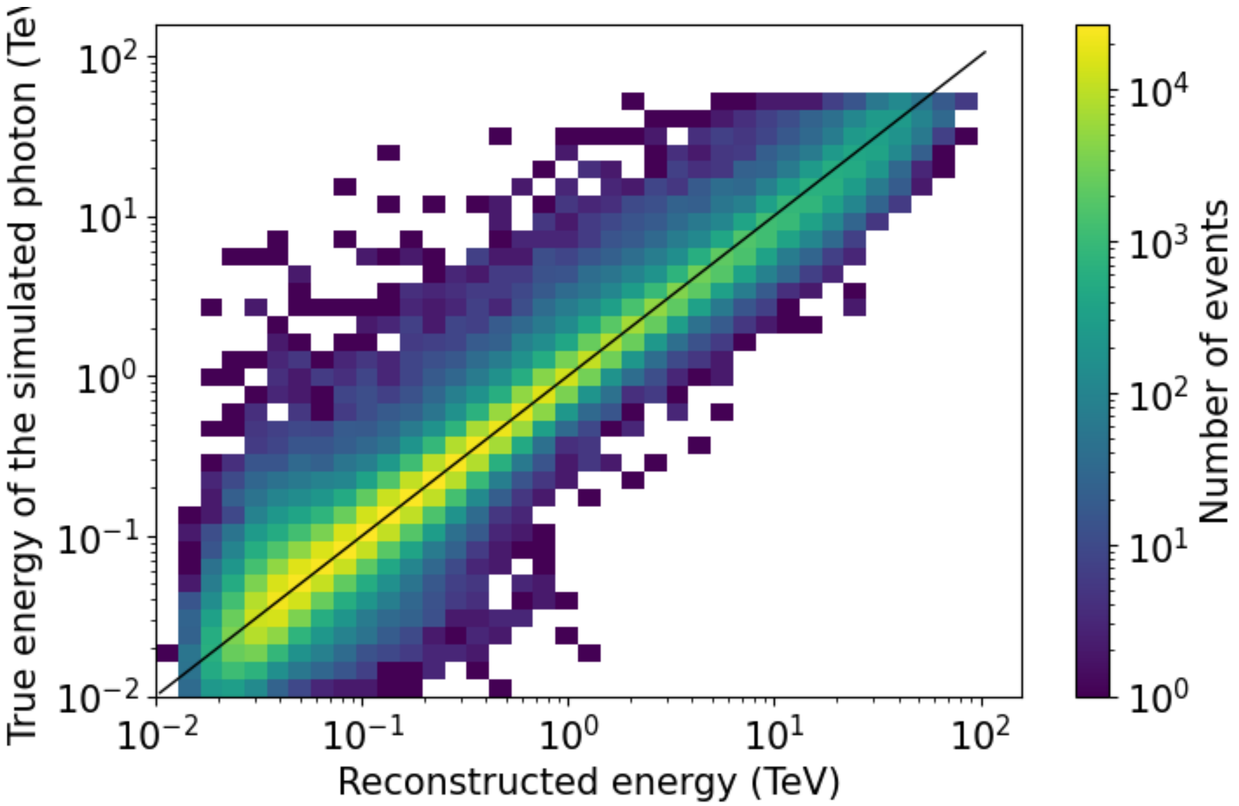
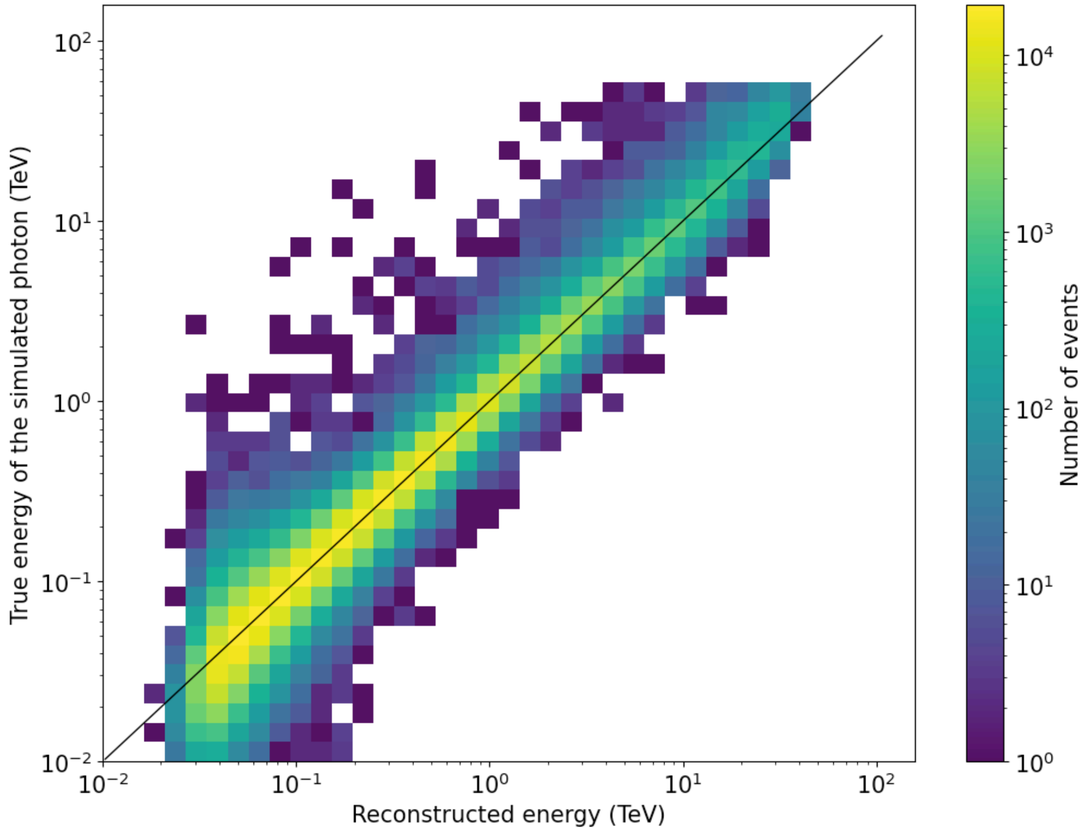
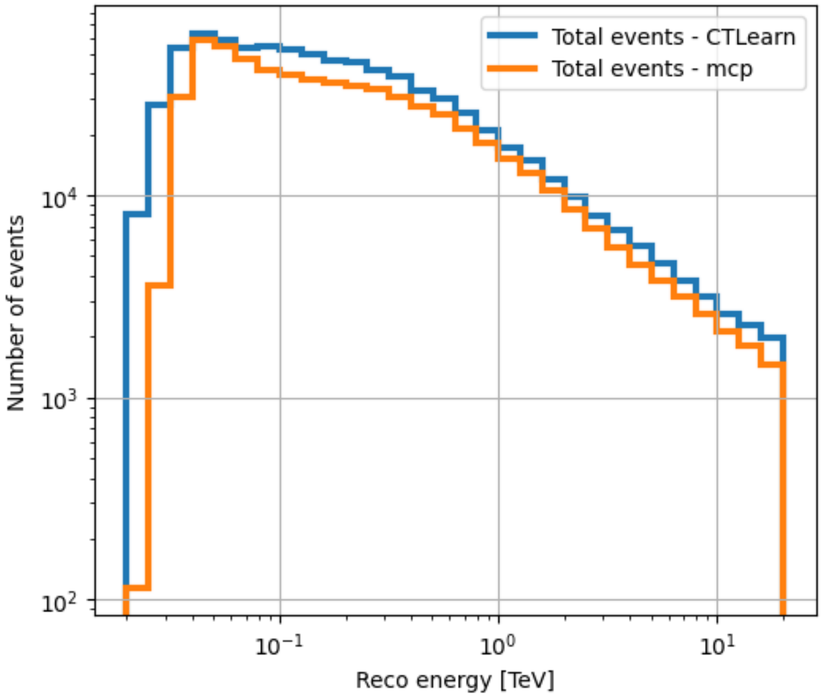


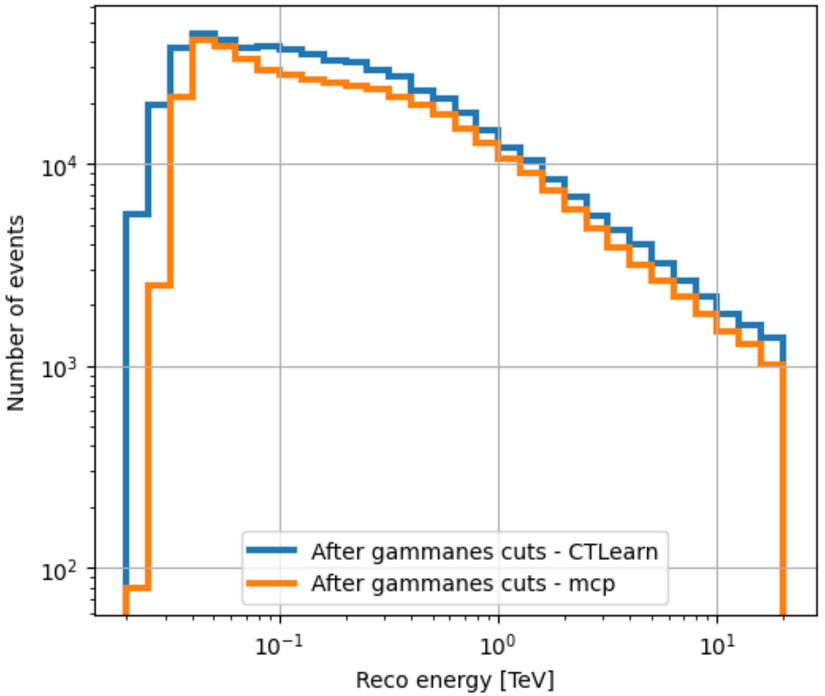
mcp

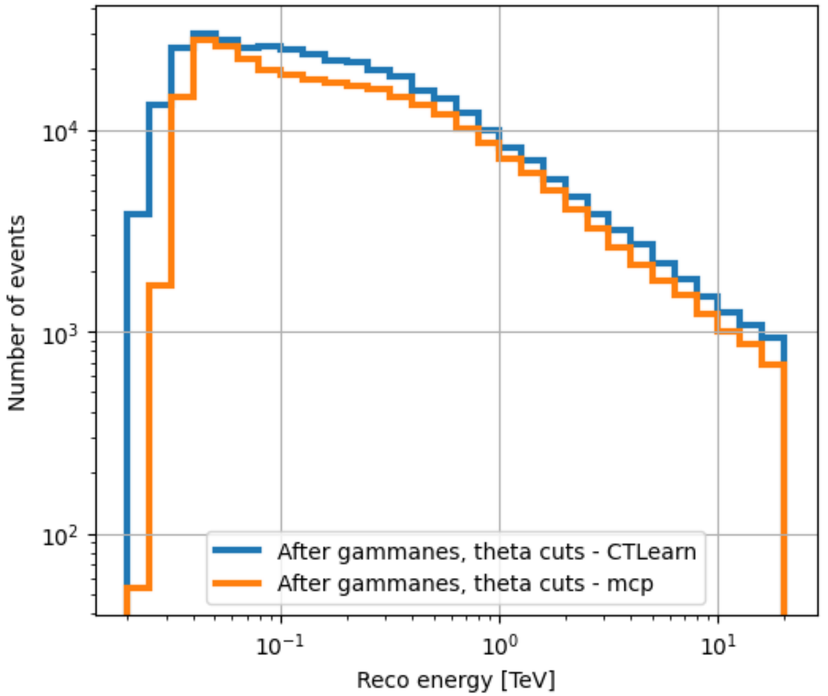


Energy distribution and efficiency cuts

CTLearn vs mcp

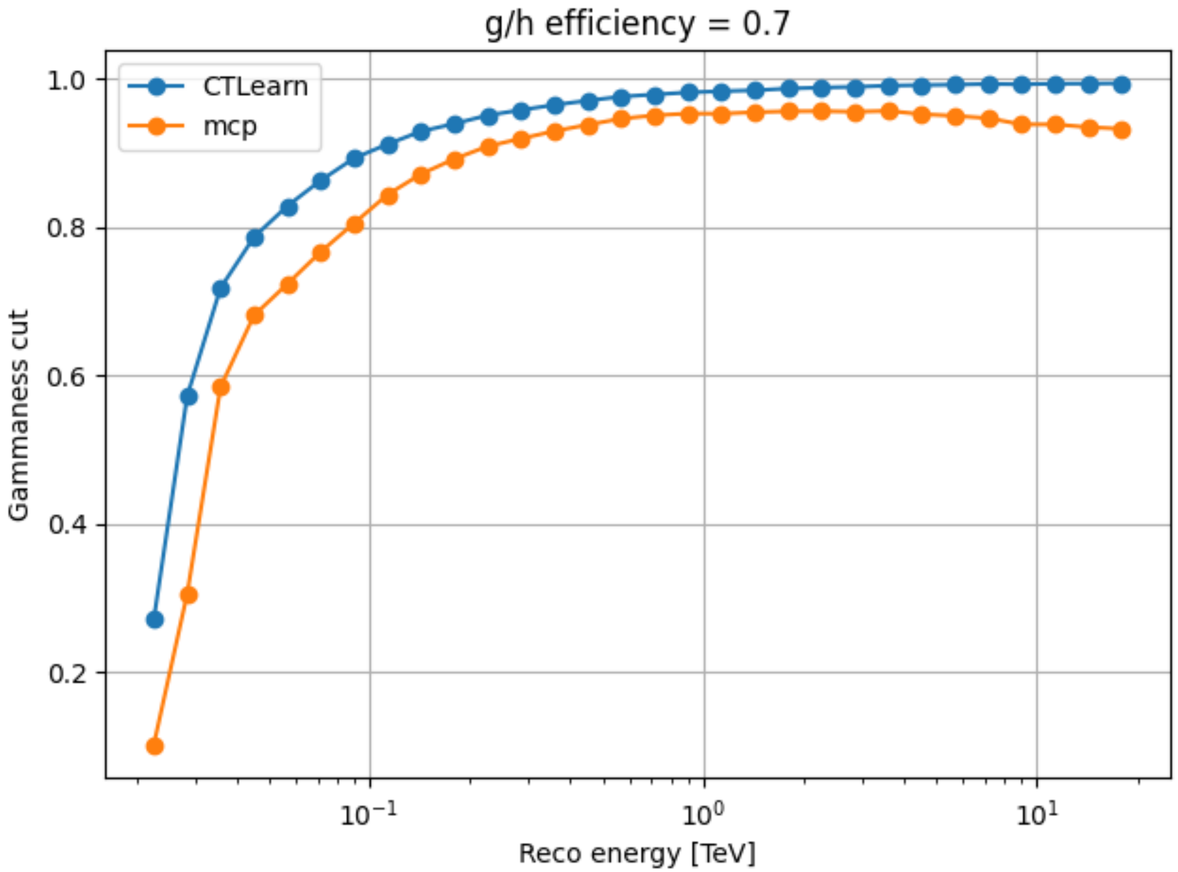


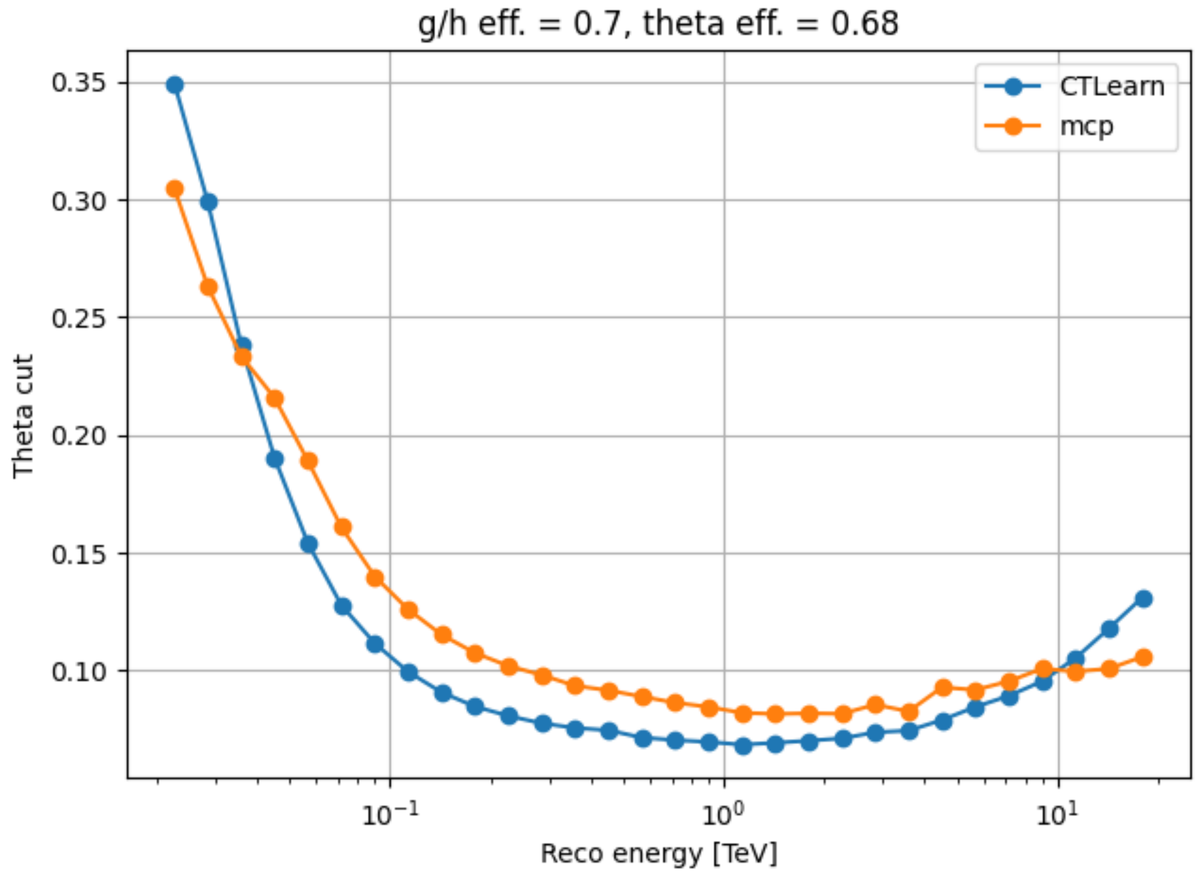




Efficiency cuts

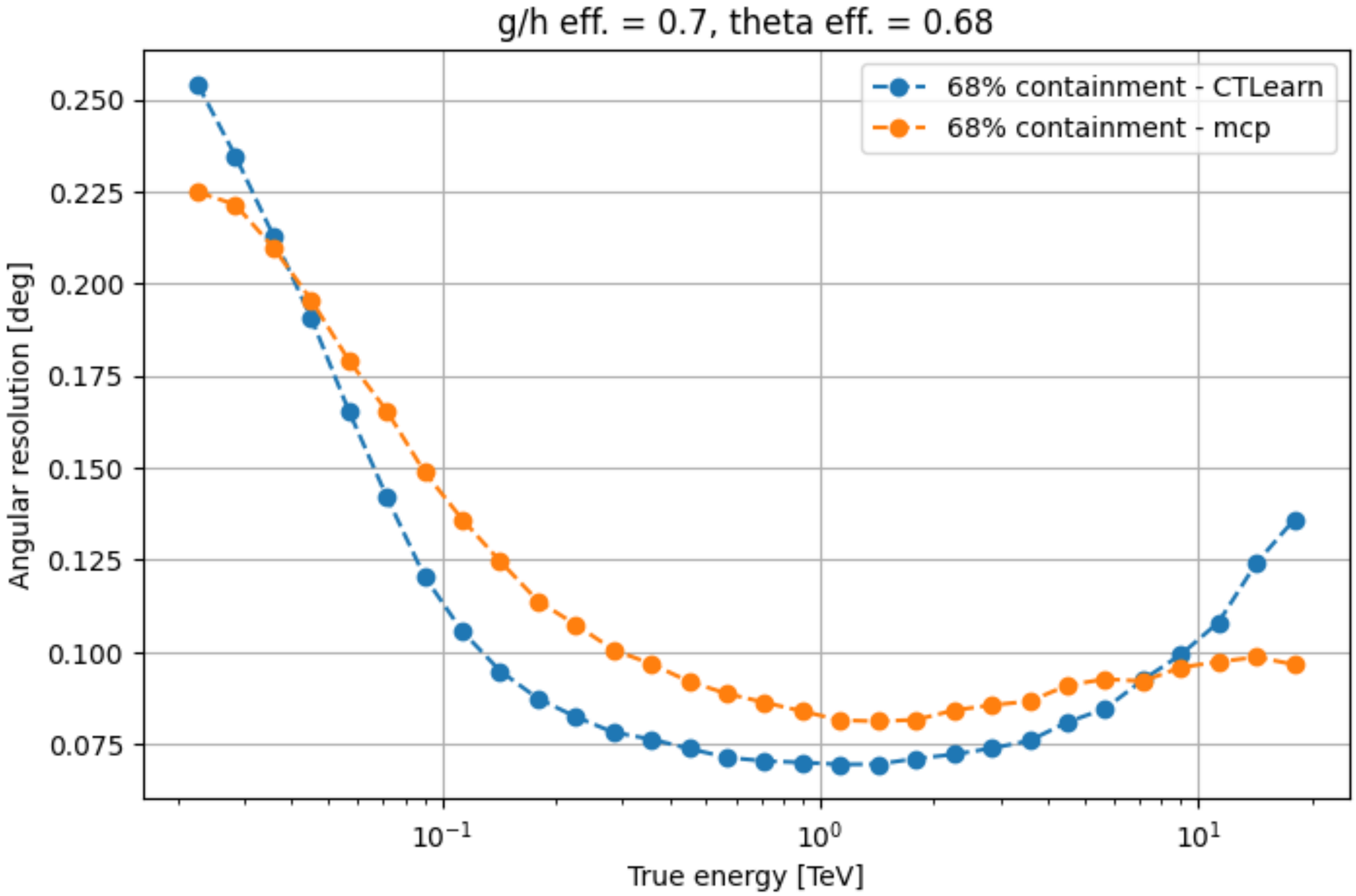
CTLearn vs mcp





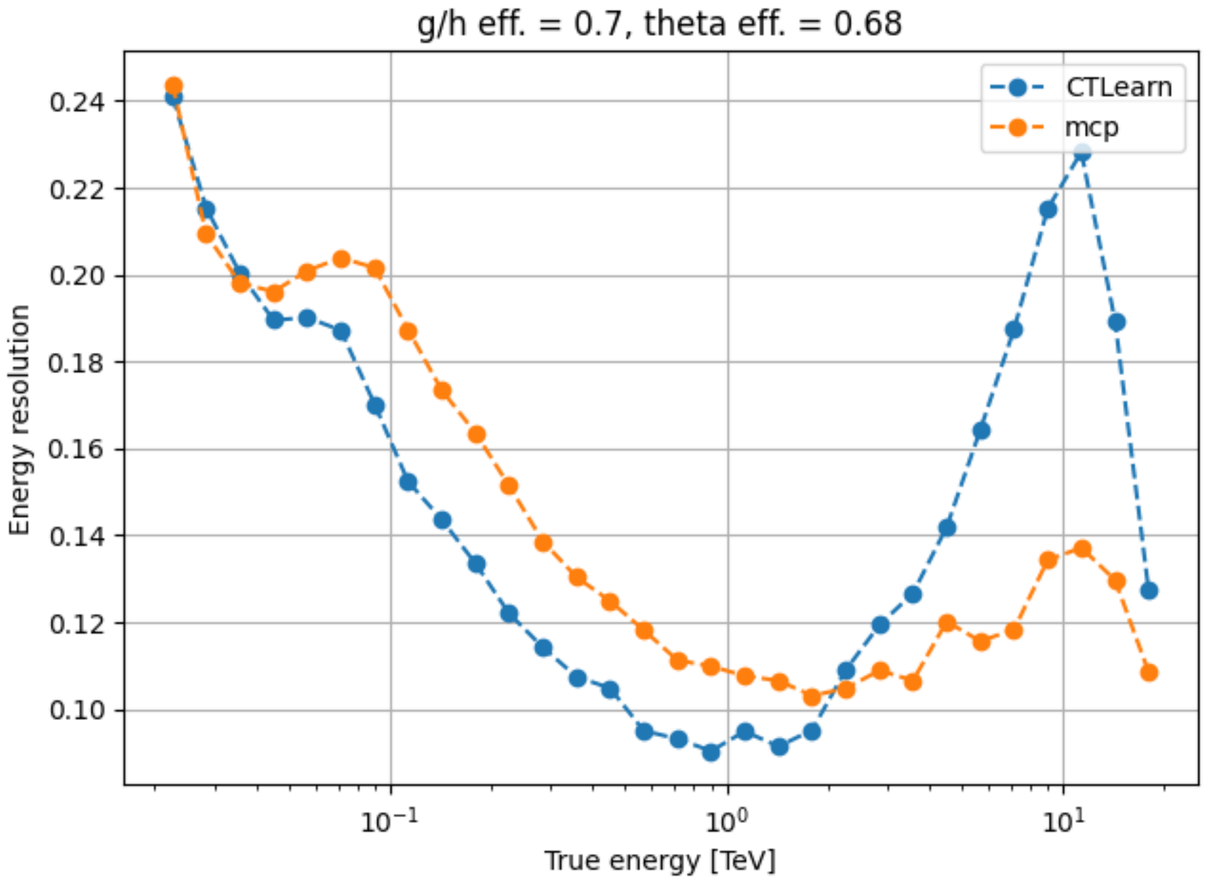
Angular resolution

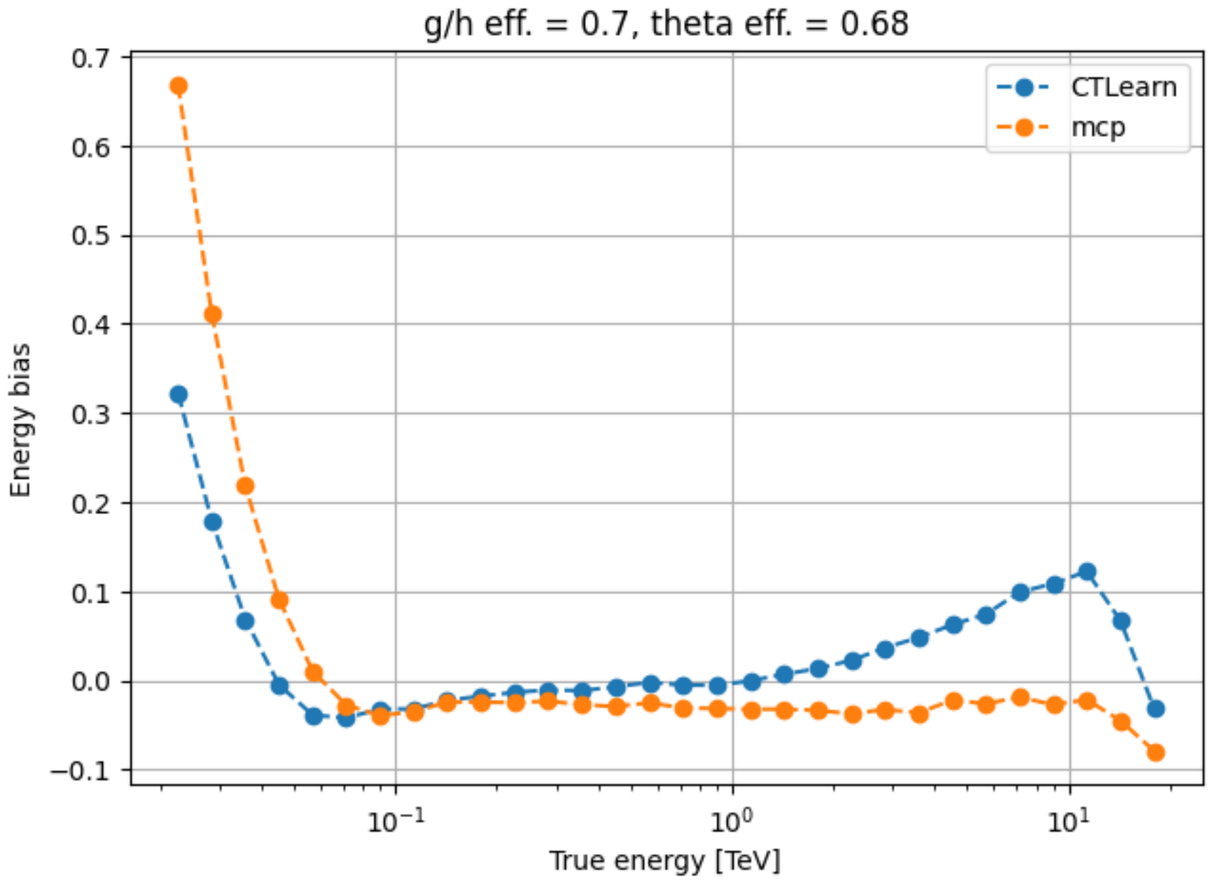
CTLearn vs mcp



Energy resolution and bias

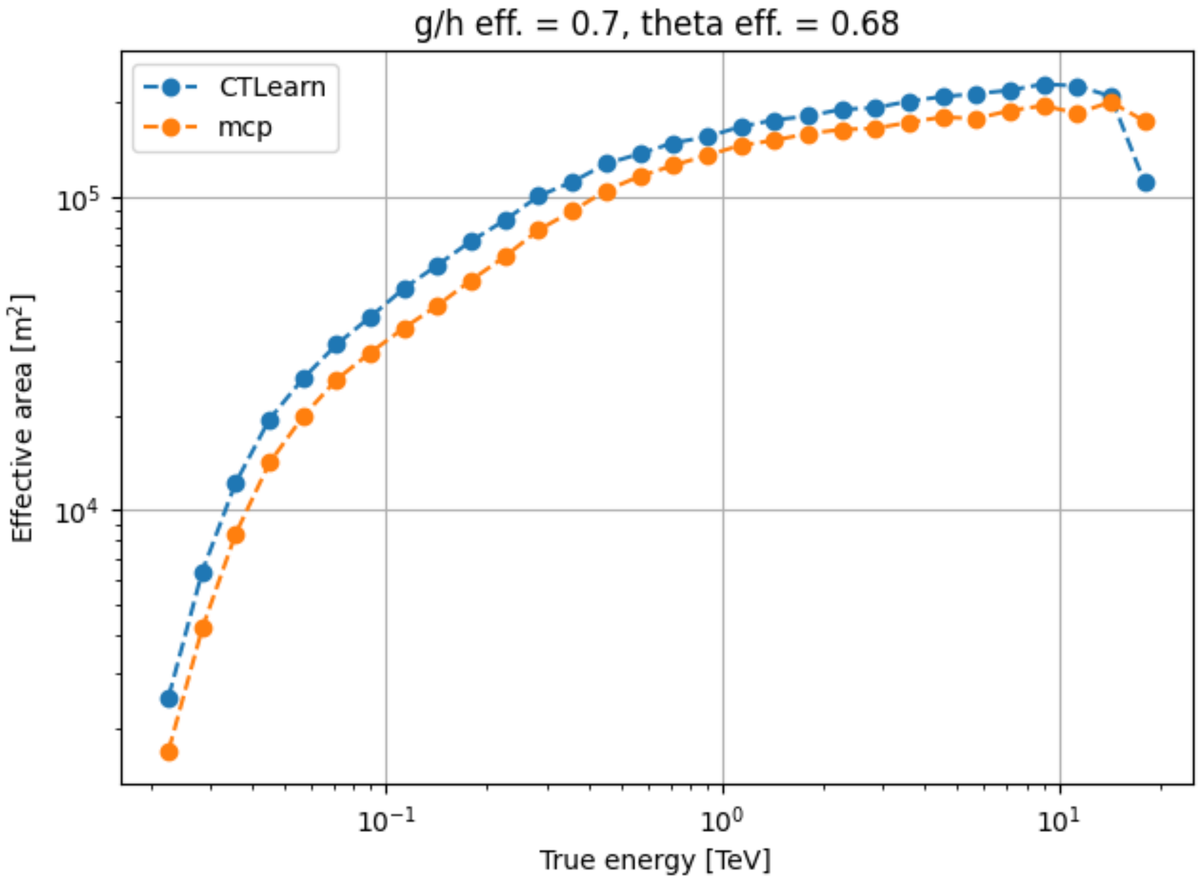
CTLearn vs mcp

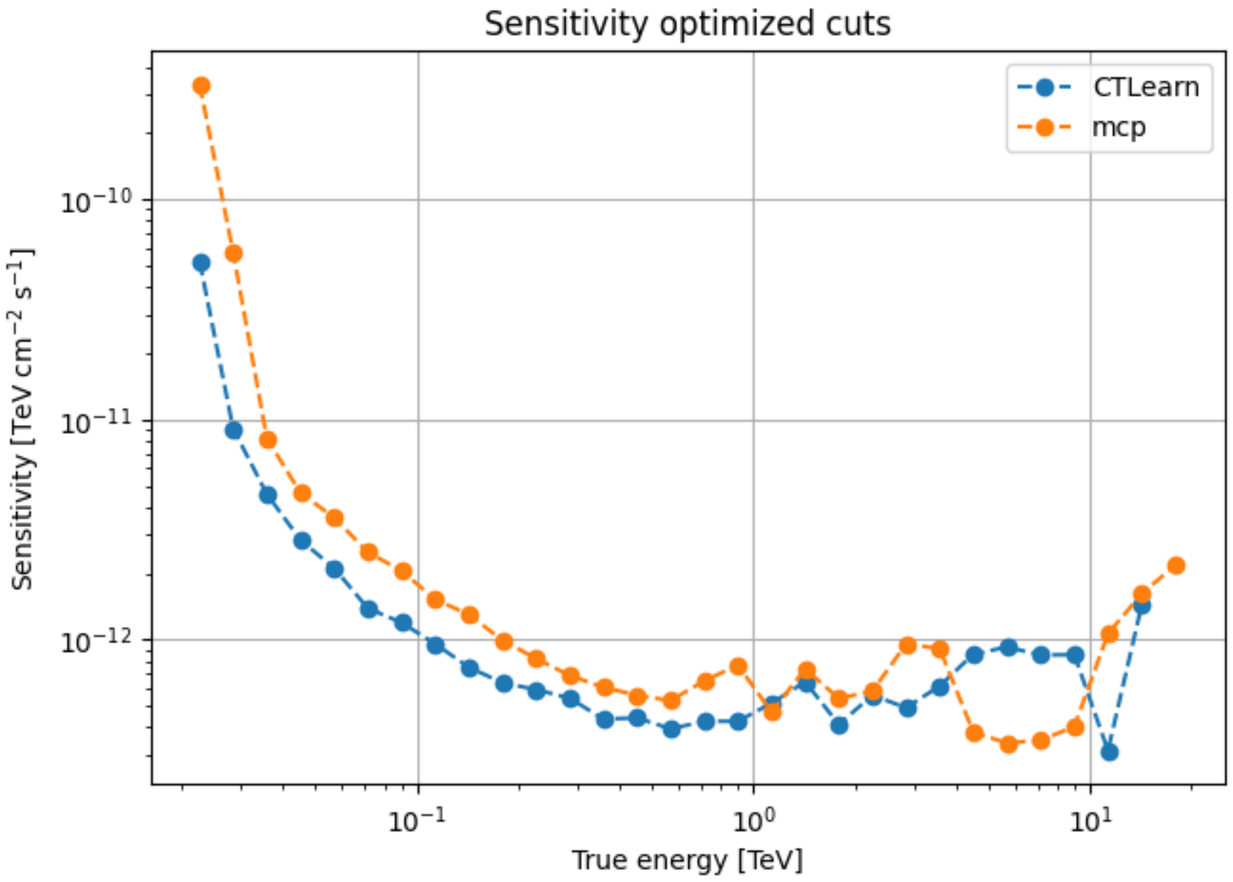




Effective area and sensitivity

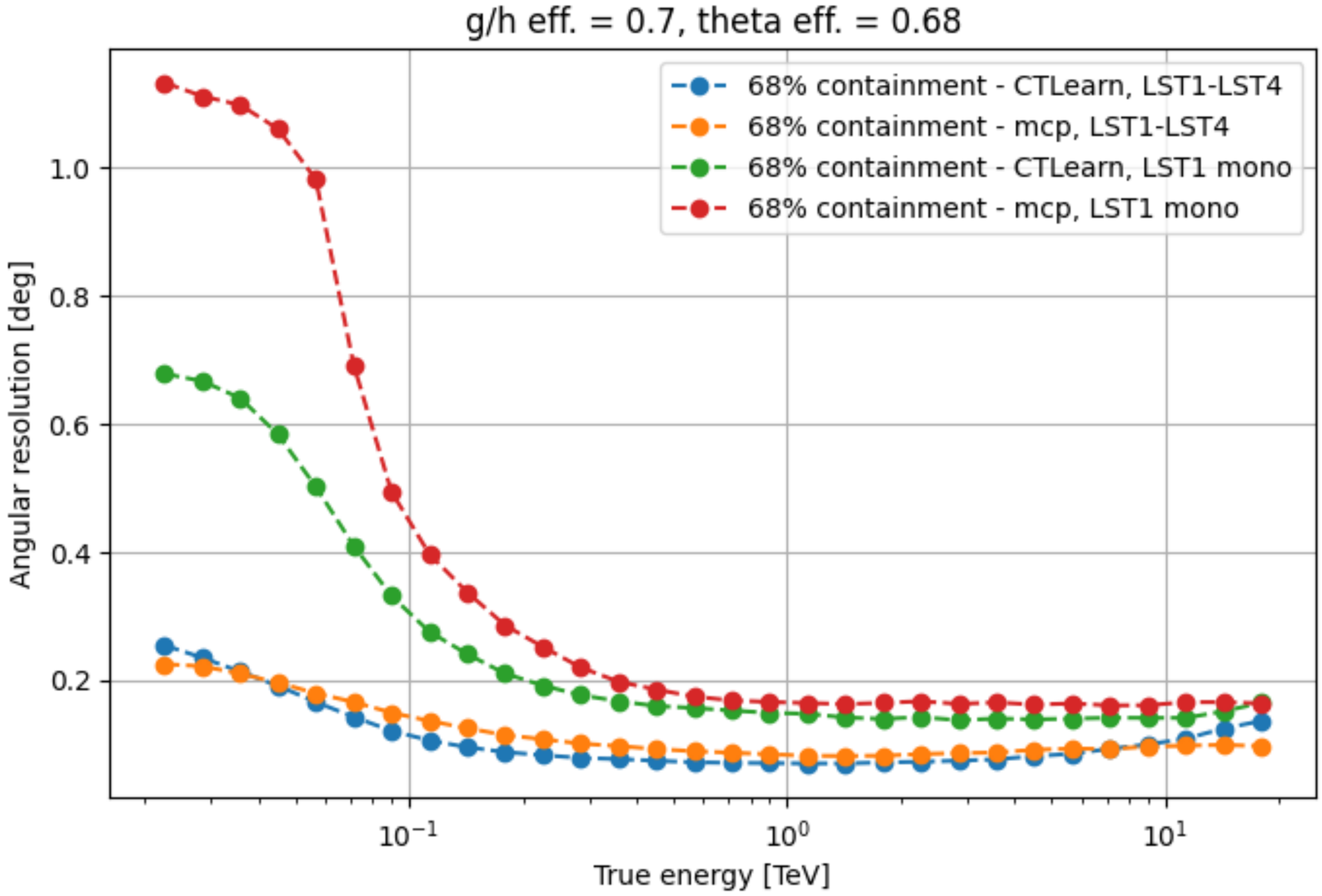
CTLearn vs mcp





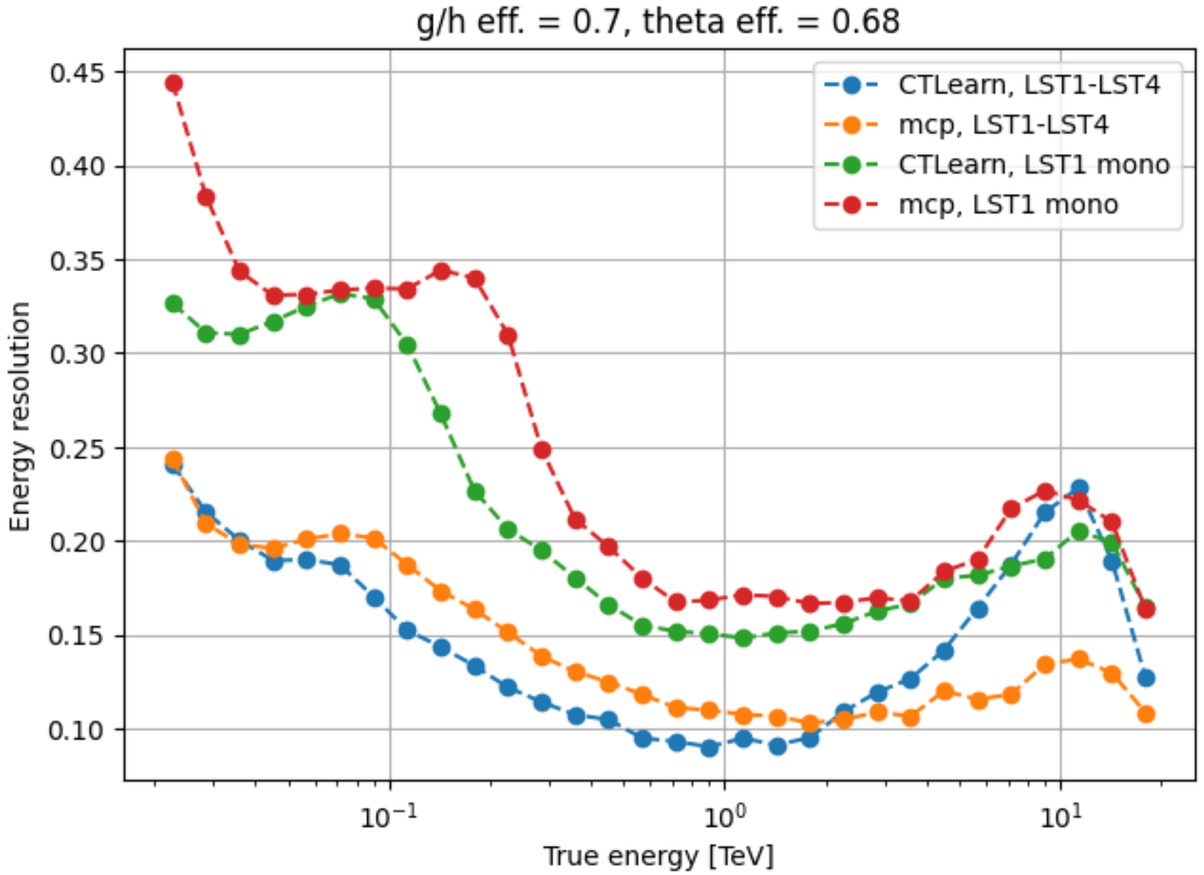
Mono vs stereo performance

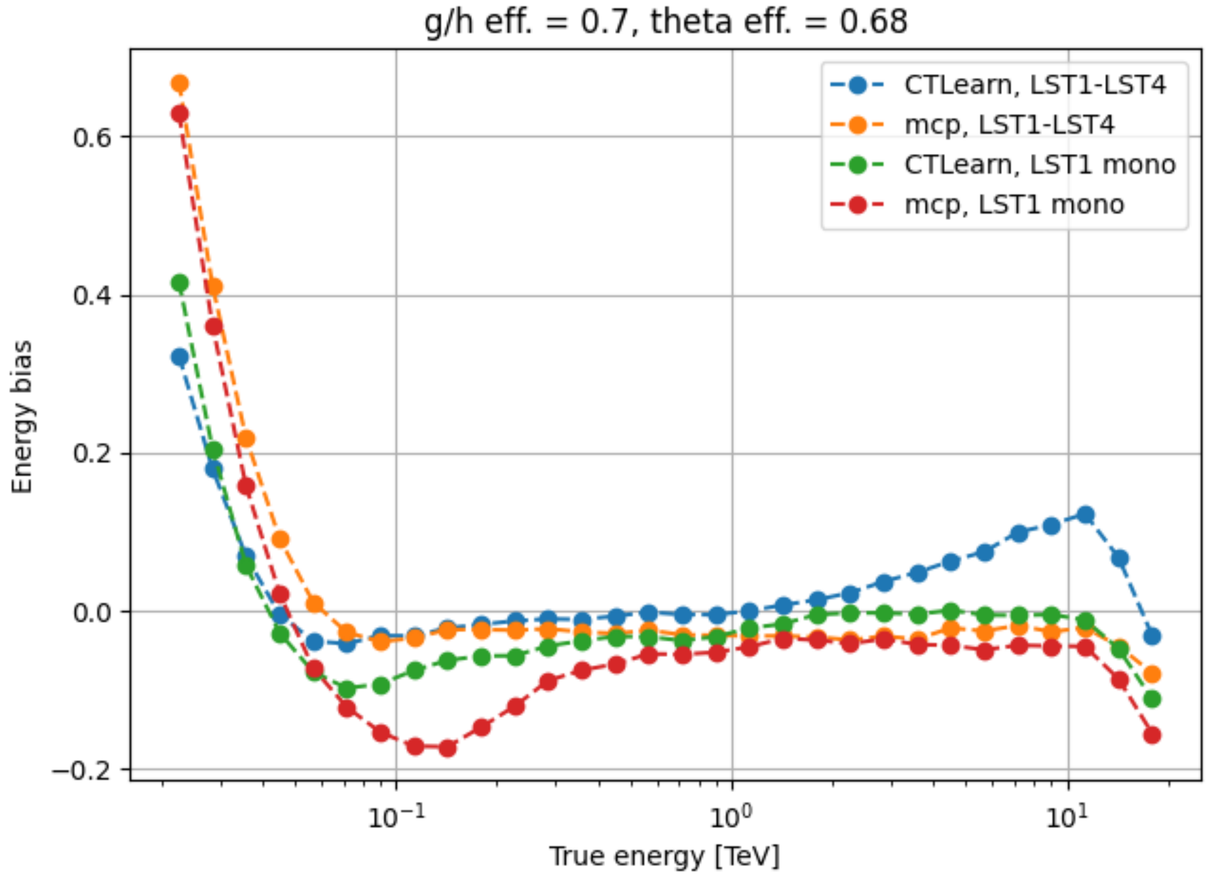
Angular resolution



Mono vs stereo performance

Energy resolution and bias





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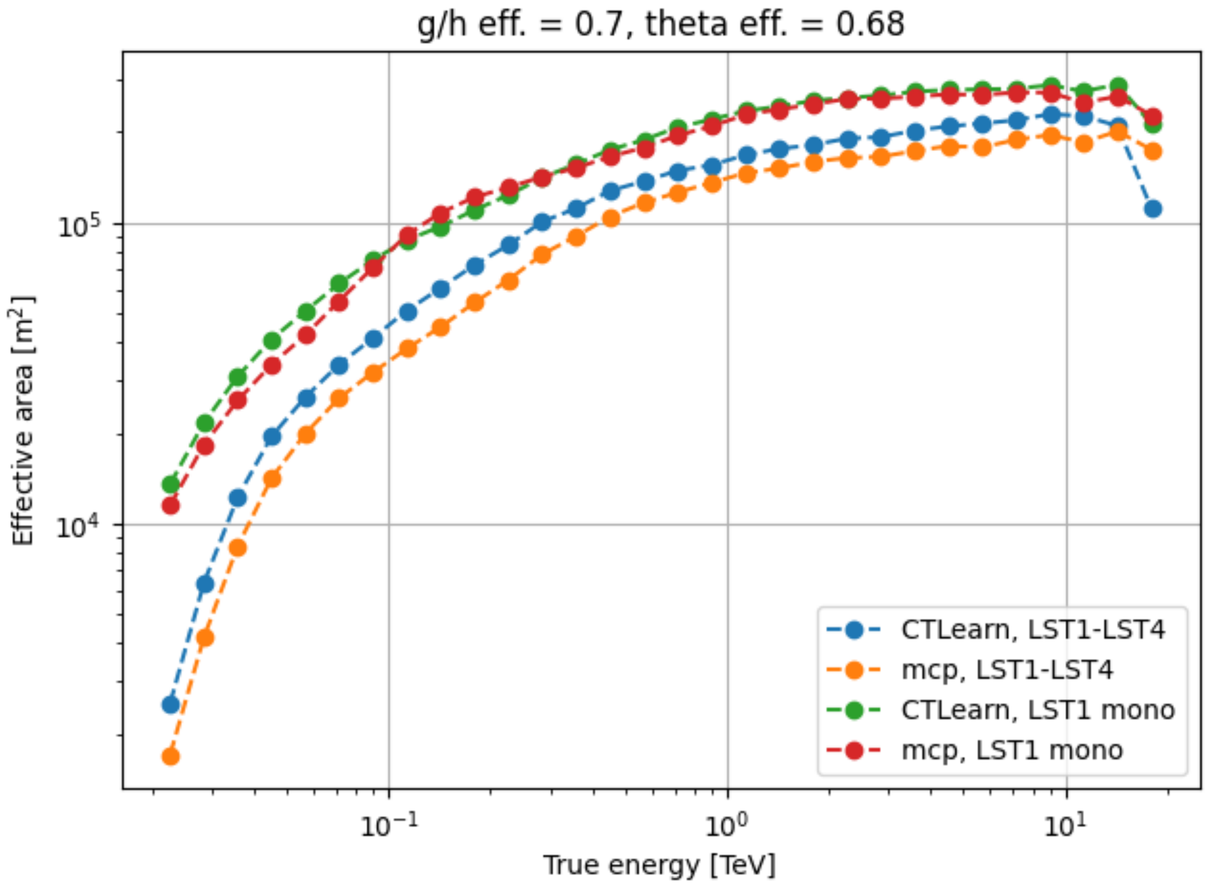
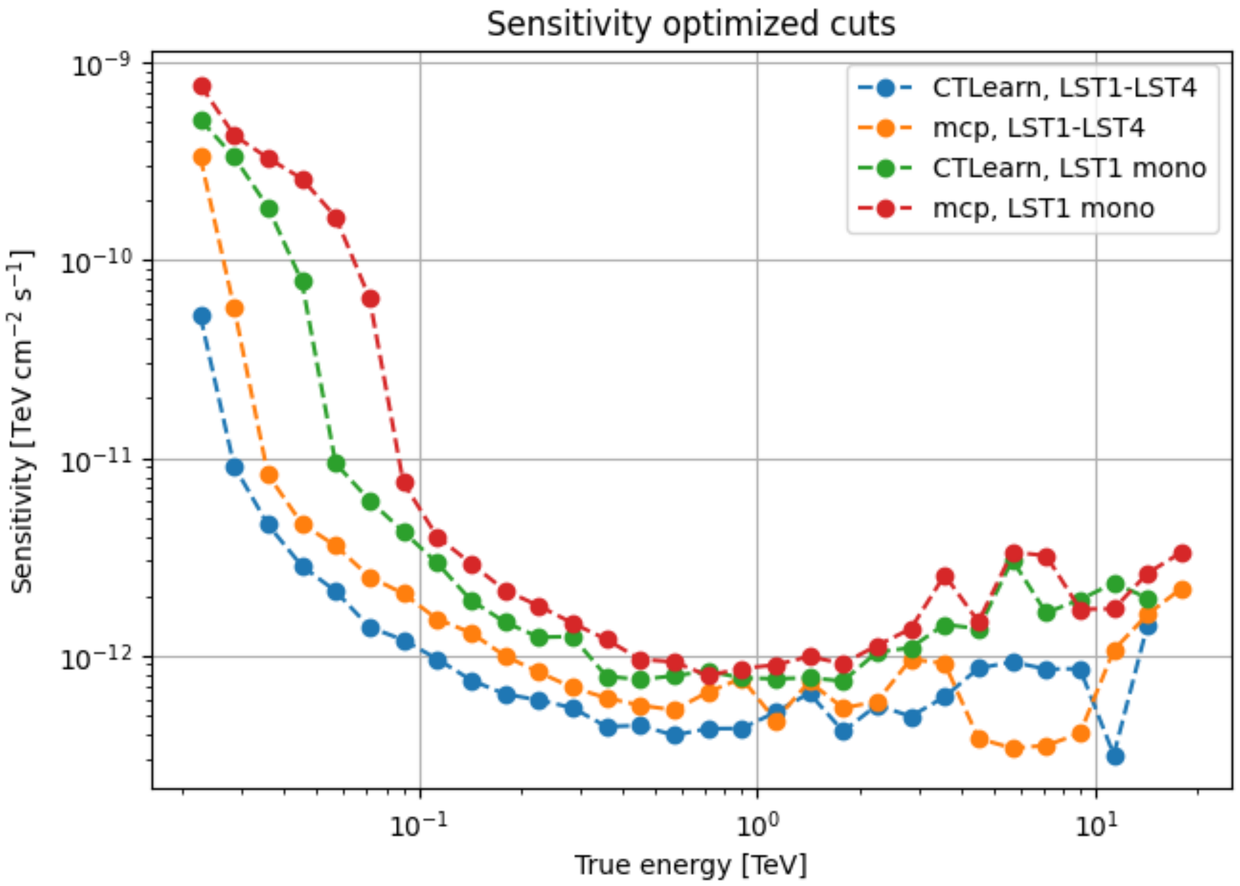
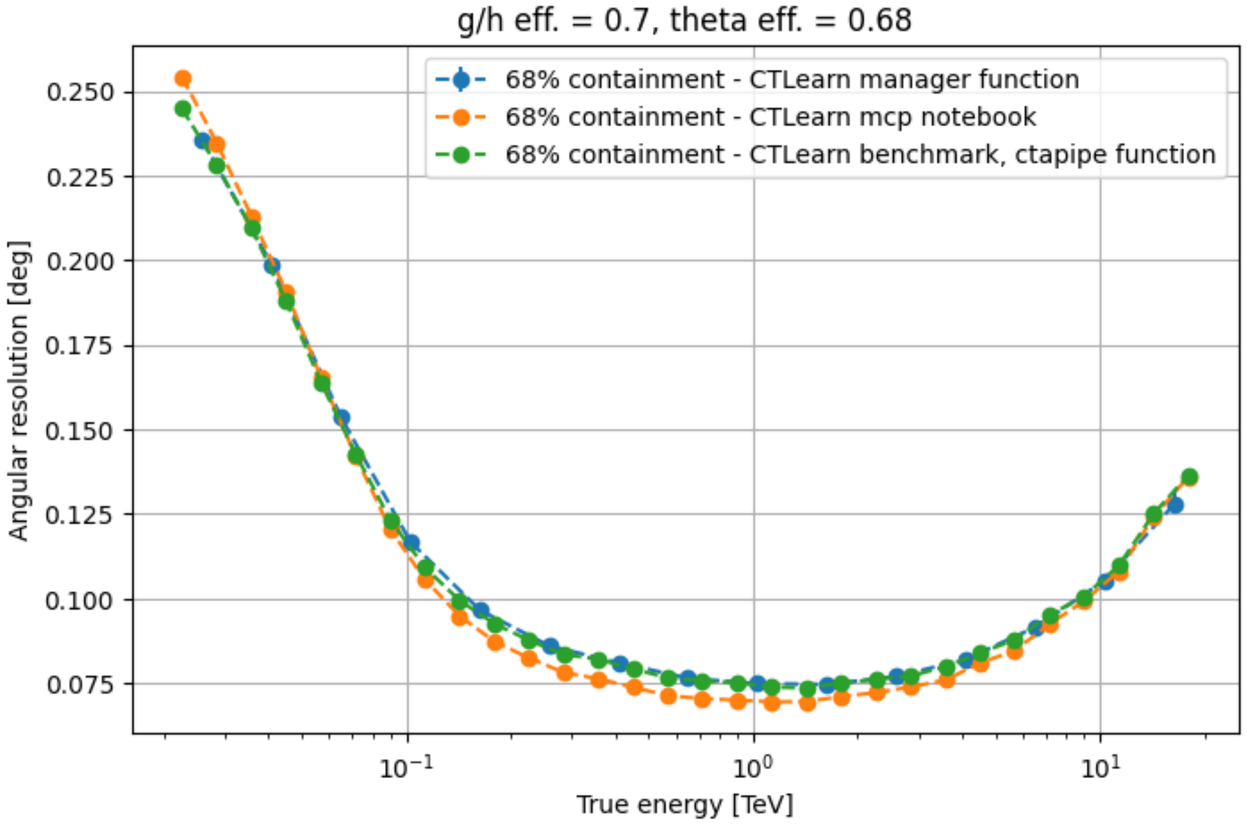




Discrepancies

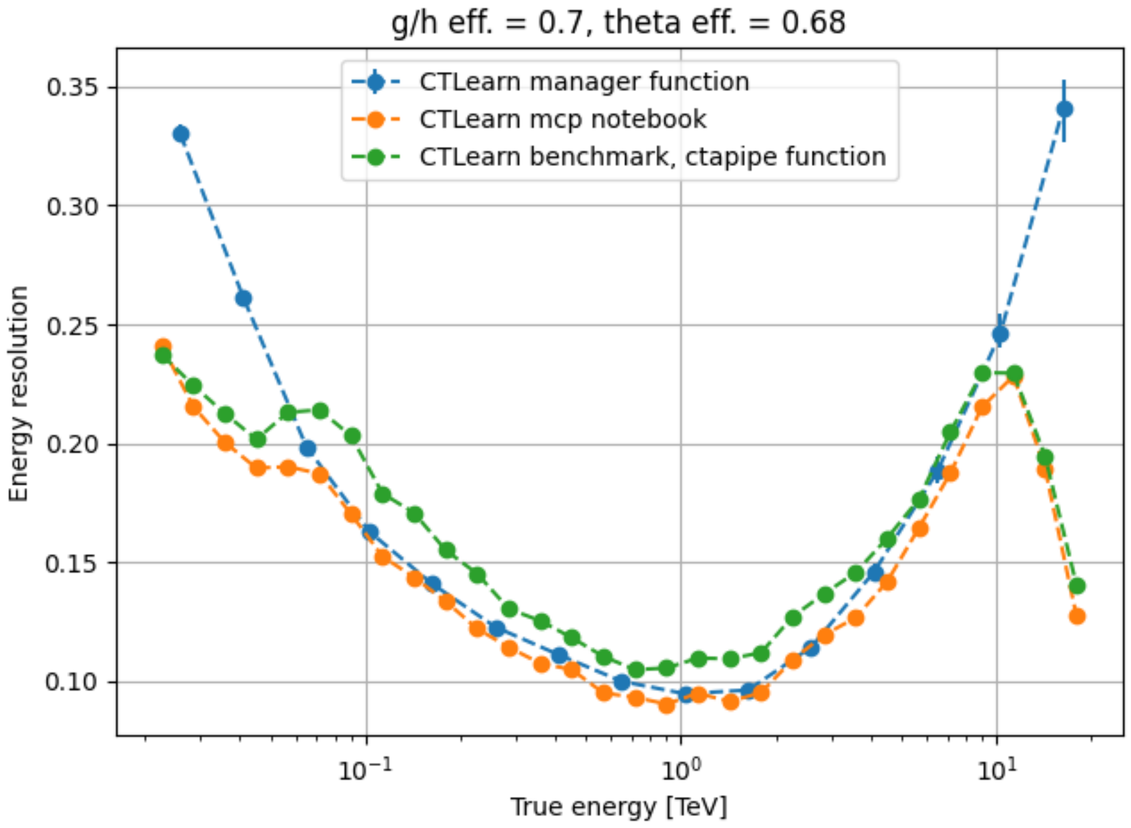
Cross-check of CTLearn results computed with different methods:

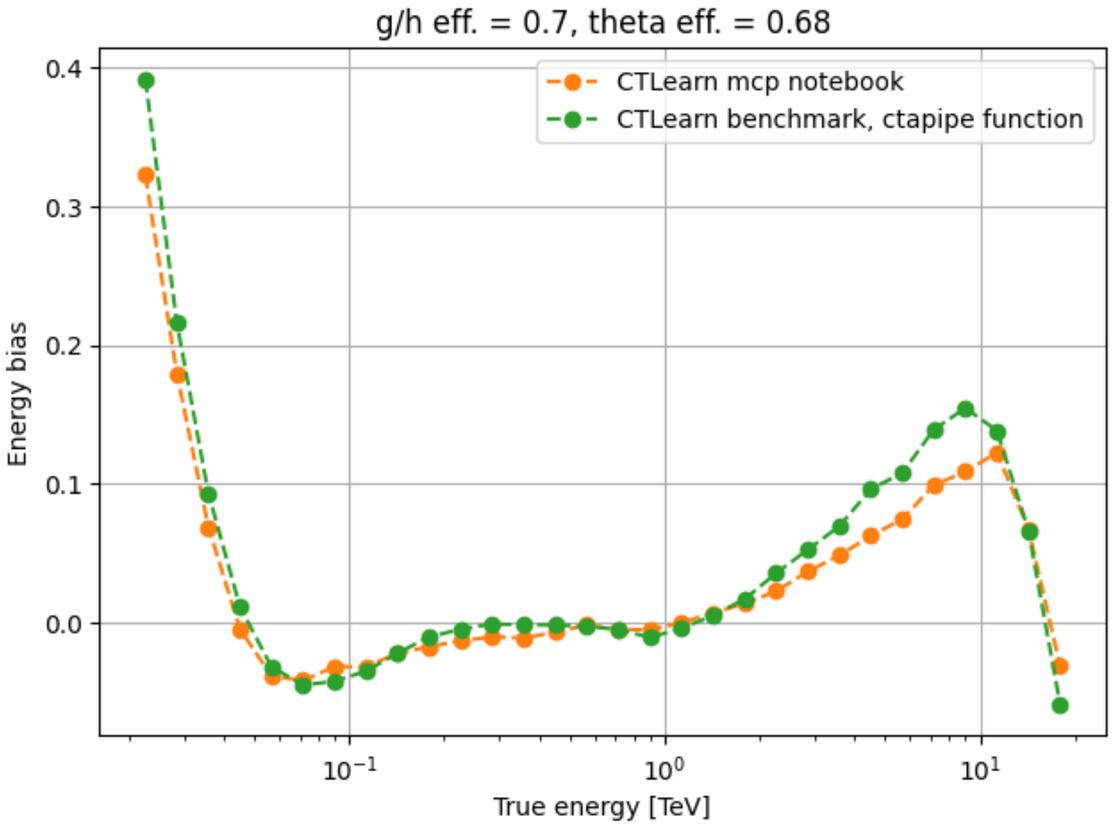
- Functions from CTLearn Manager
- Functions from crappie (“benchmark”)
- Notebook from mcp



Angular resolution

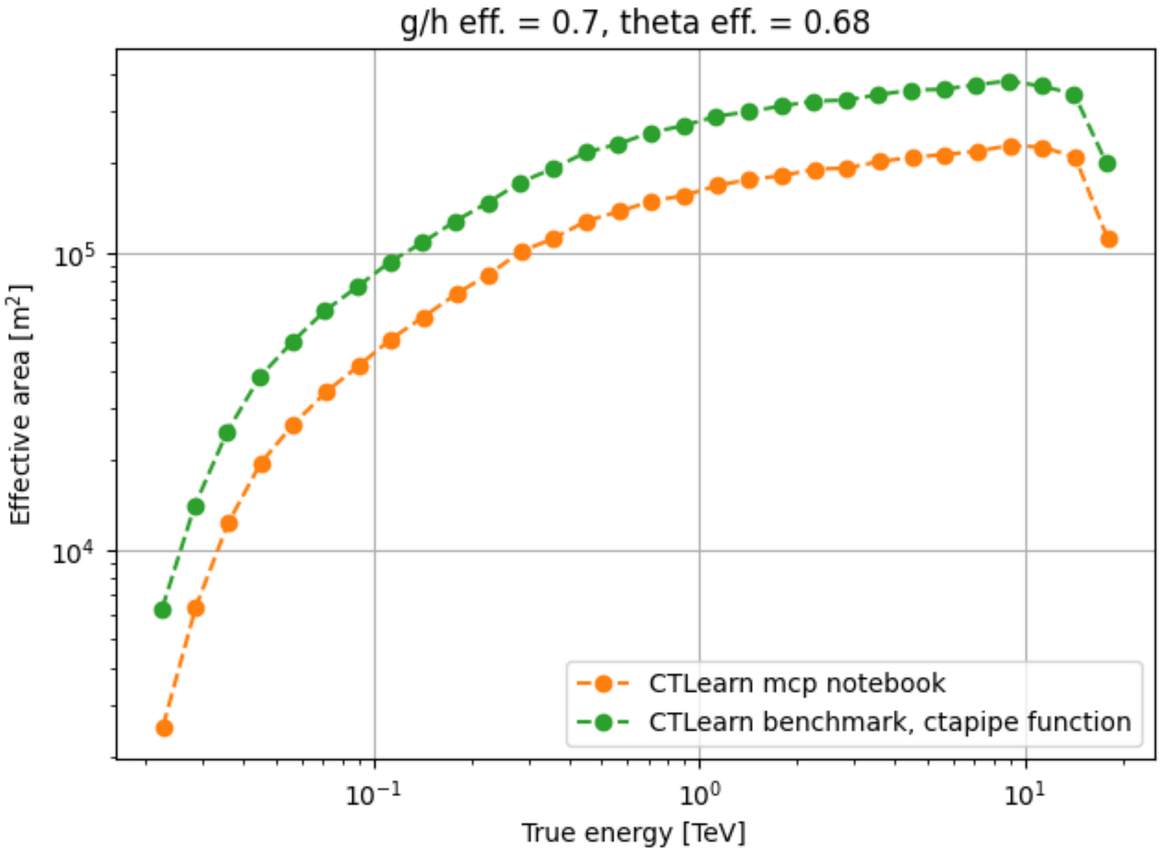
Discrepancies

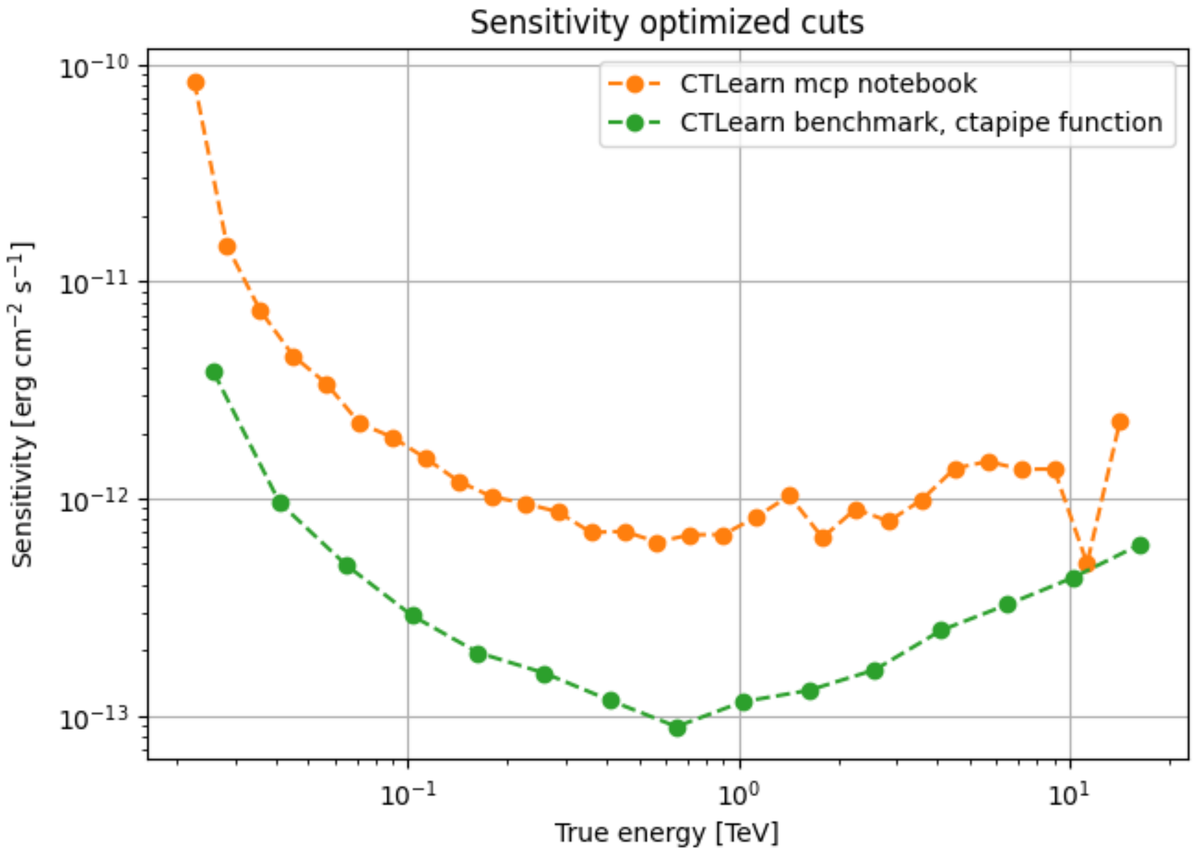




Energy resolution and bias

Discrepancies





Effective area and sensitivity