

Reconstruction of Strip HCAL

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CALICE meeting at Kyushu University

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Strategy of Strip AHCAL

Optimization of parameters for $10 \times 10 \text{mm}^2$ AHCAL

- at least better JER than $30 \times 30 \text{mm}^2$ AHCAL's,
- using the hadronic energy cell truncation method,
- timing window is 100 ns to prevent effect from neutrons.

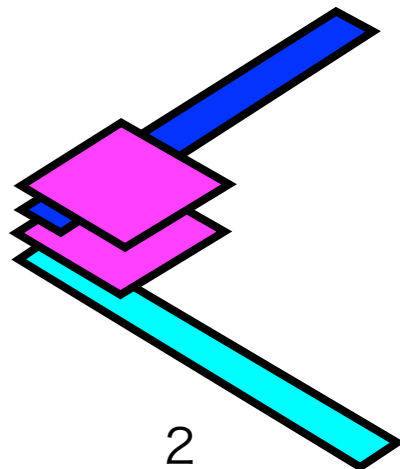
Make strip AHCAL in ILD by the ganging method:

- creating strip by gathering $10 \times 10 \text{mm}^2$ tiles
(for ECAL, we used strip ECAL at the generator step)

```
<processor name="MyCellMerger" type="CellMerger">  
  <parameter name="HCALMergeNumbersInPhi" type="IntVec"> 1 3 9 3 </parameter>  
  <parameter name="HCALMergeNumbersInBeamDir" type="IntVec"> 9 3 1 3 </parameter>
```

SSA for HACAL,

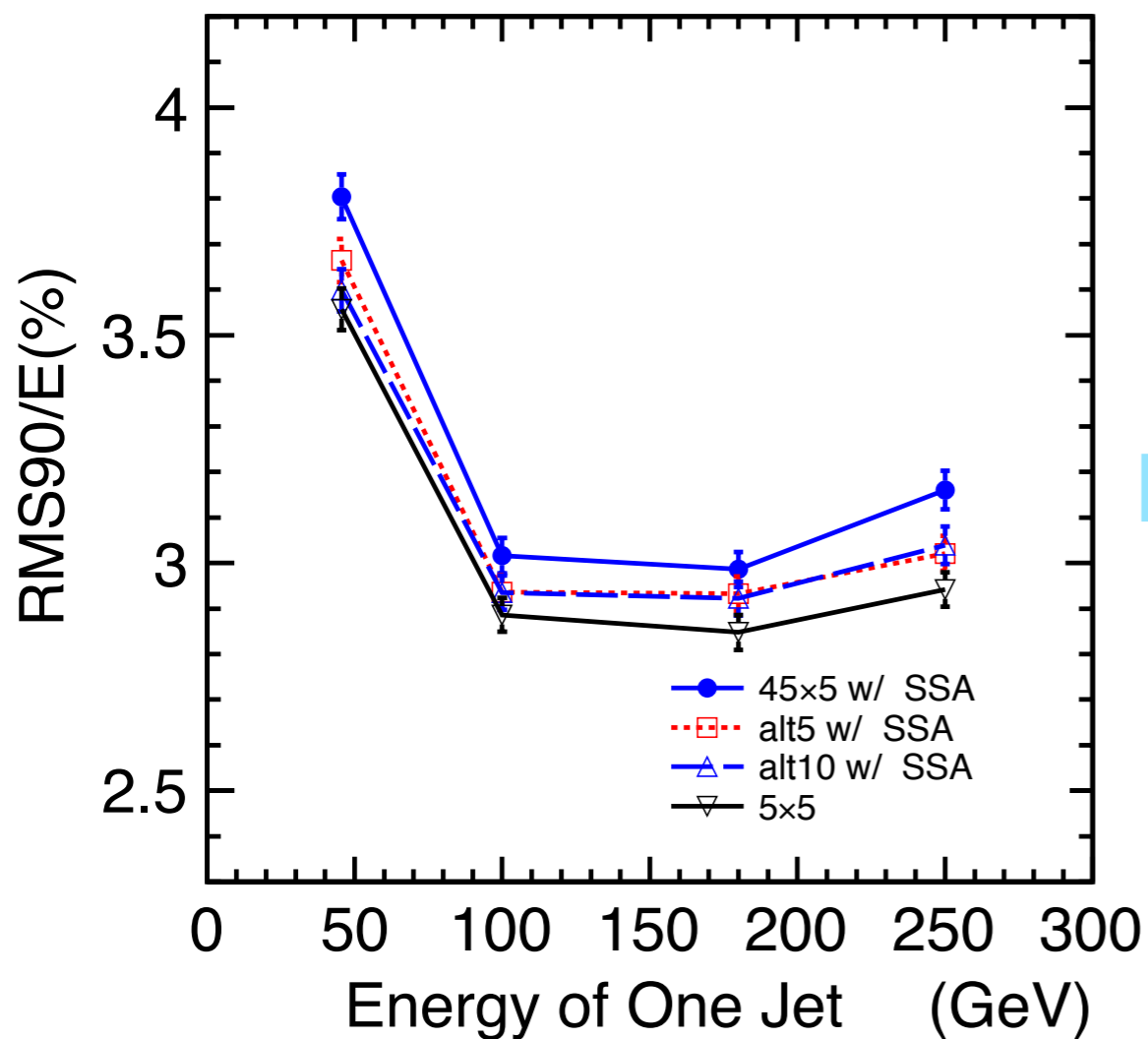
- implemented in hybridRecoProcessor (for ECAL)
- preTileSplitter for large tile layers



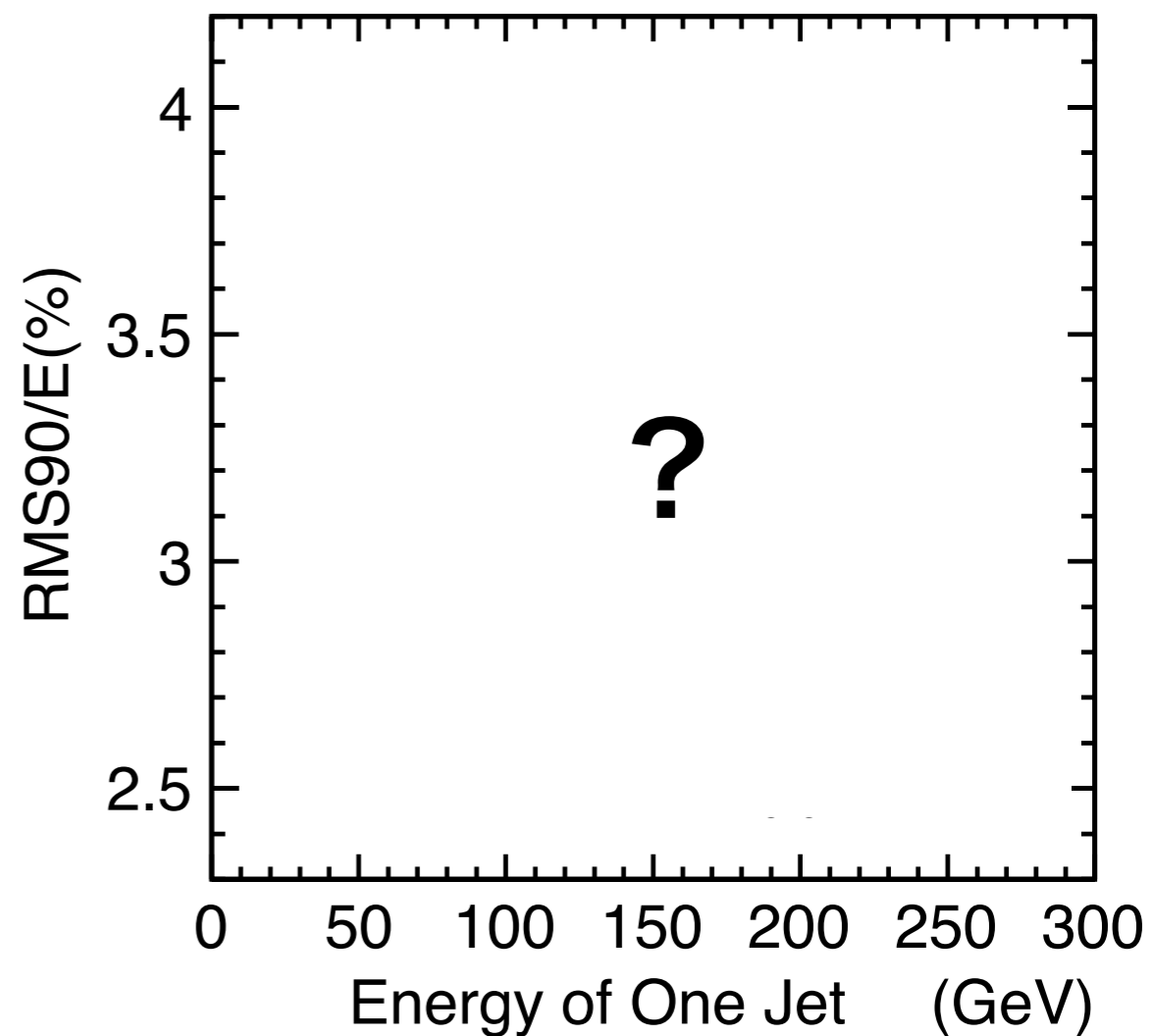
Our goal

ScECAL: stip + tile configuration has closer performance to pure small tile configuration

ScEcal ?



AHcal ?



Start from the default parameters for ILD_o1_v05(06)

In this study,

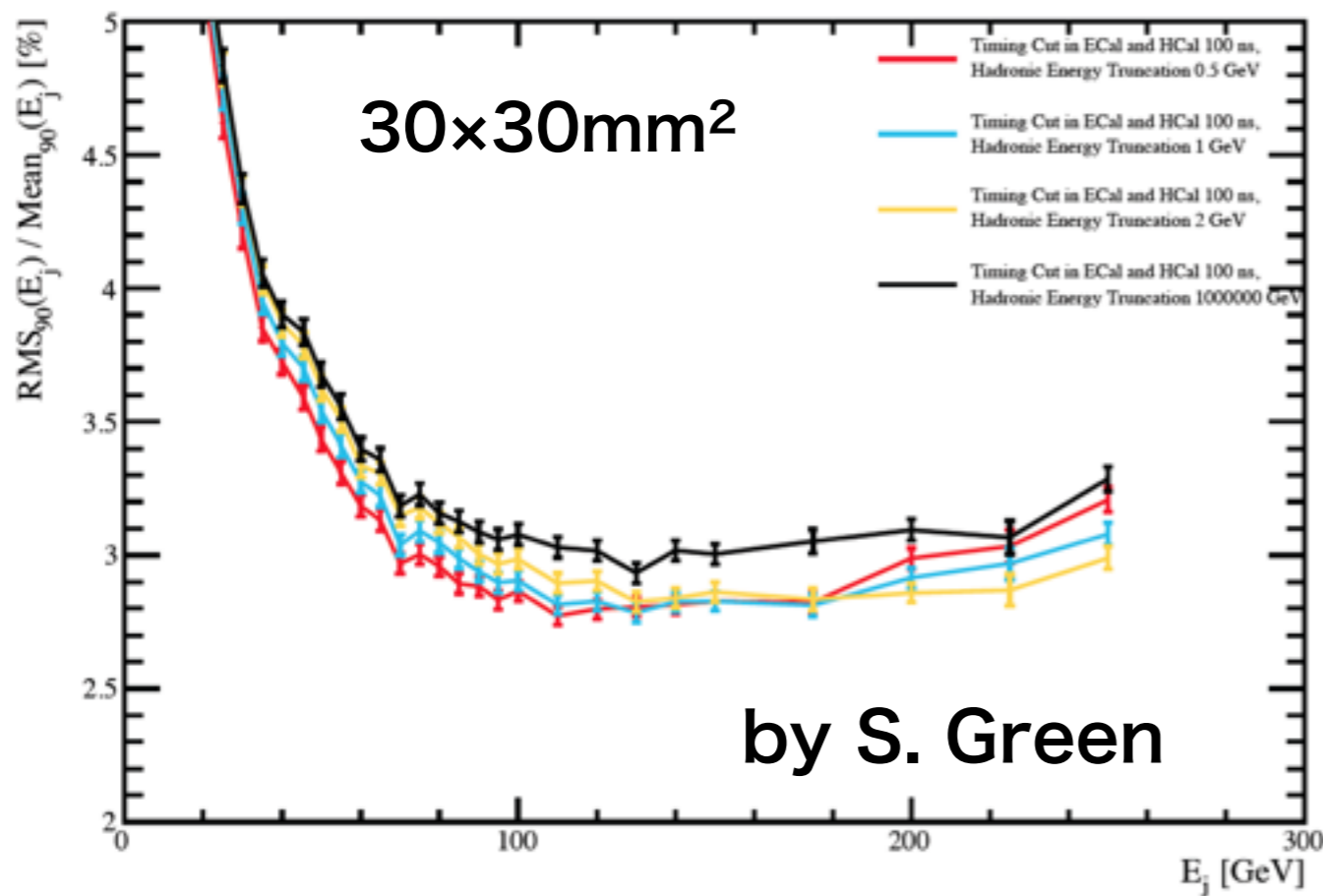
**Only Calibration factor (CalibrHCAL) and the truncation
value were changed for testing.**

Energy cell truncation.

Large energy in single cell is cut to the upper limit
: a kind of naive software compensation.

Done in PandoraPFA (started by Mark Thomson not so recently).

Steve has shown his results with 0.5, 1.0, 2.0, and 10^6 GeV.

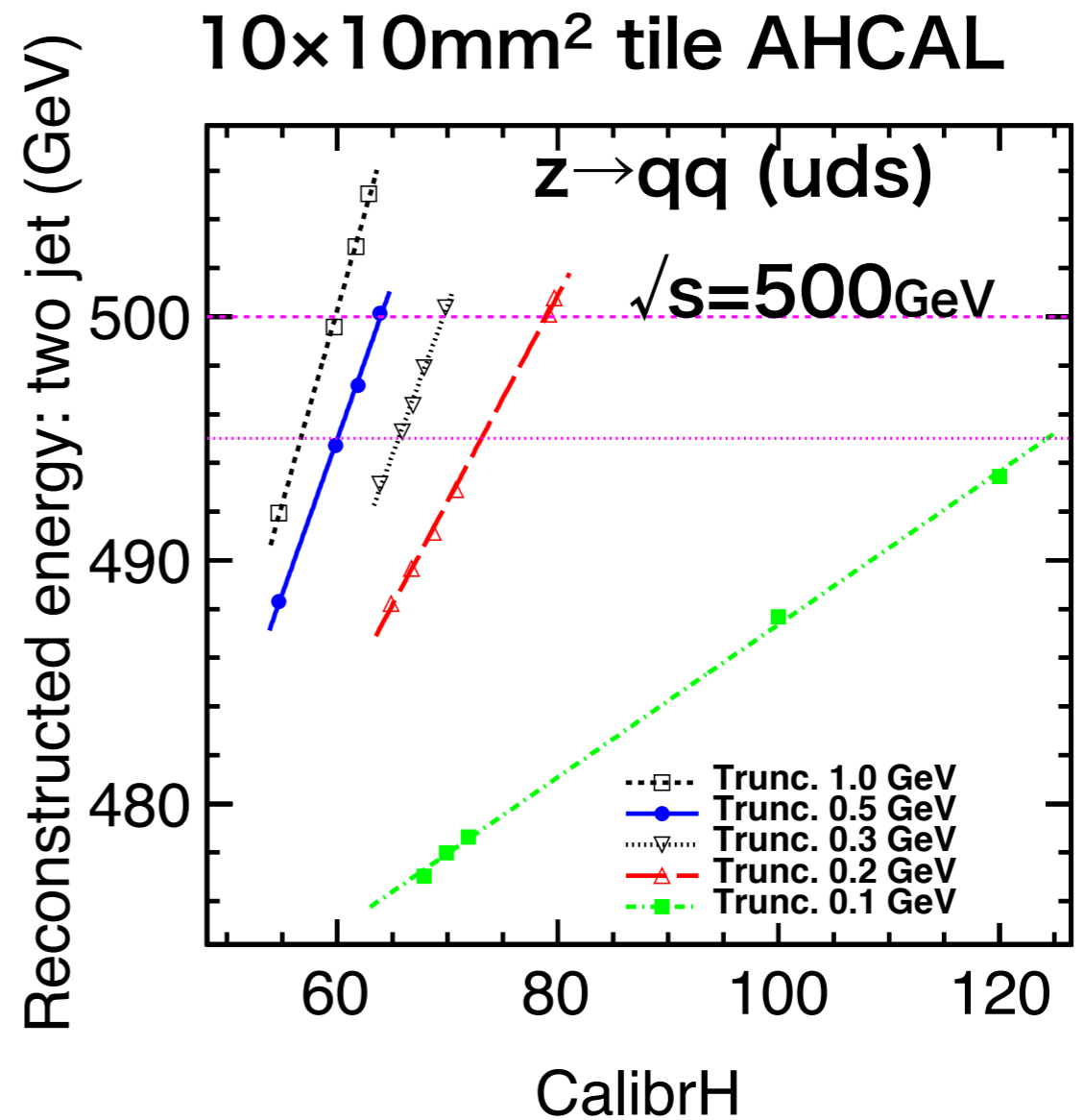
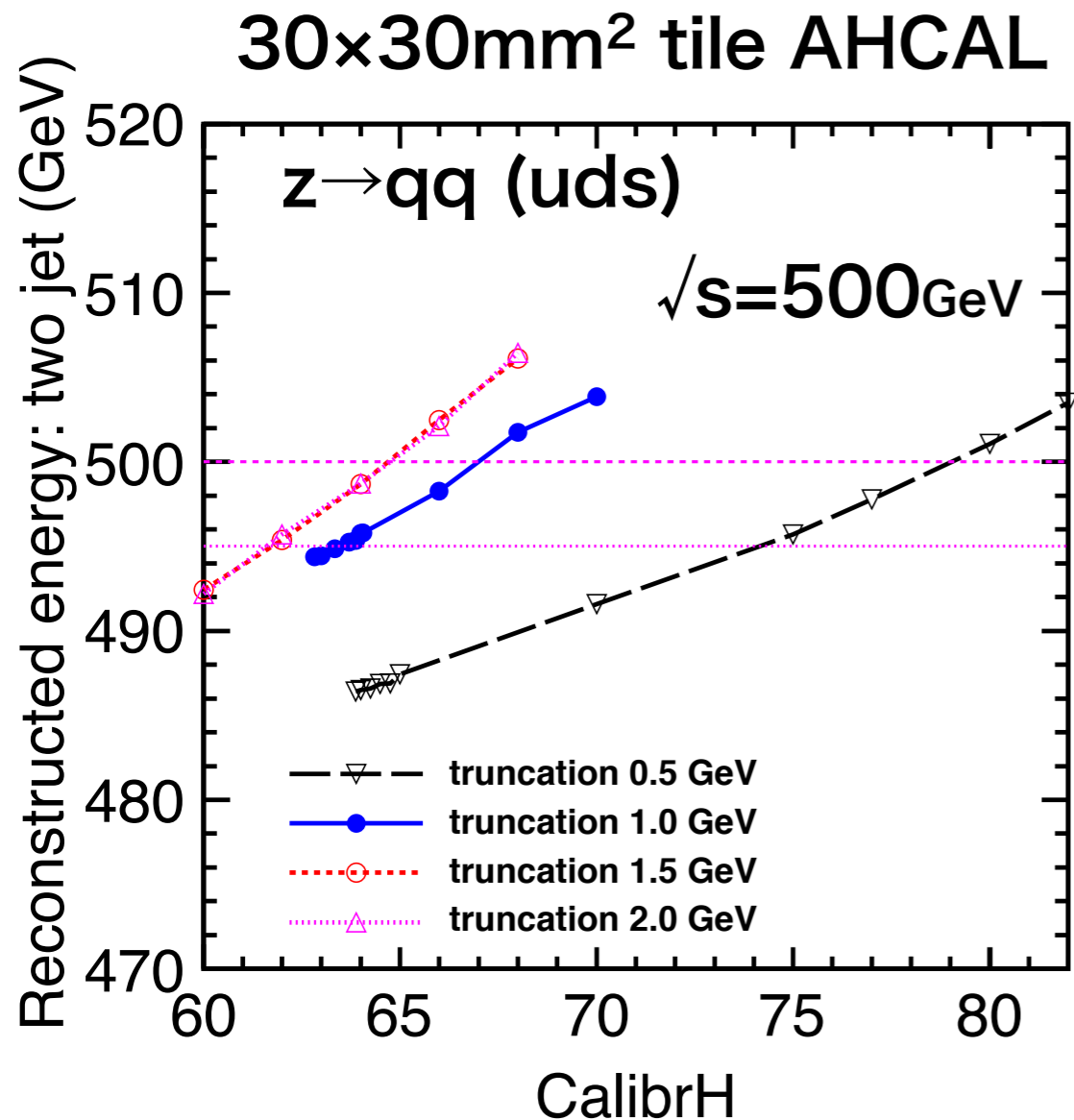


the best energy truncation varies
as a function of energy

and depends on tile size

Small tile → small energy limit

Reconstructed energy vs. CalibrHCAL



CalibrH: calibration factor for HCAL

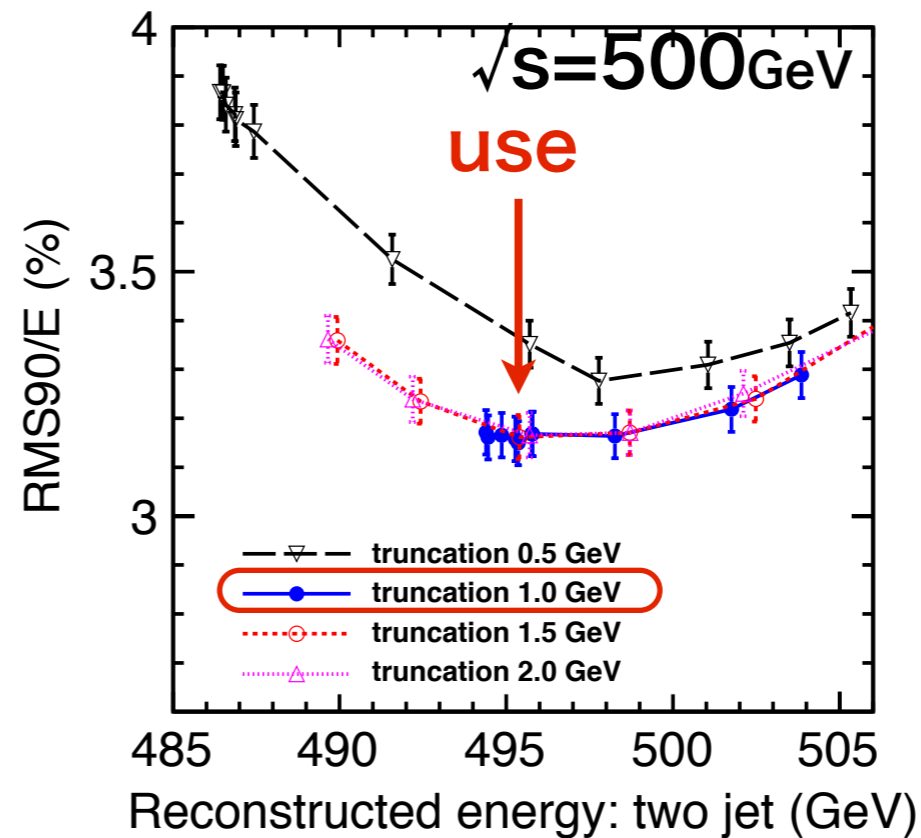
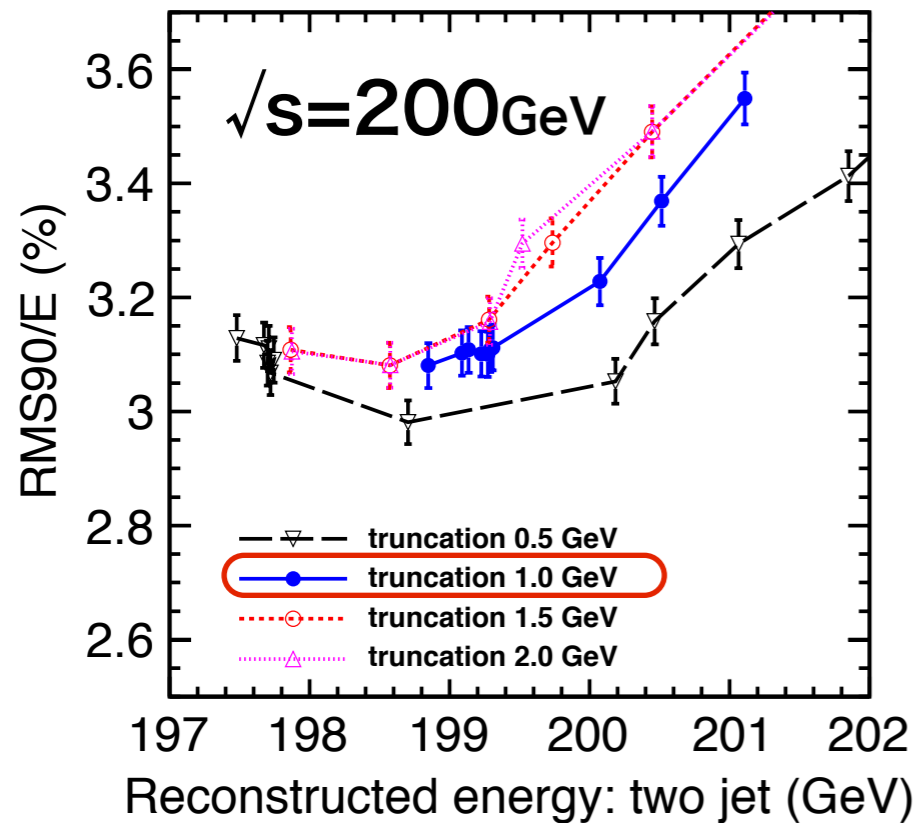
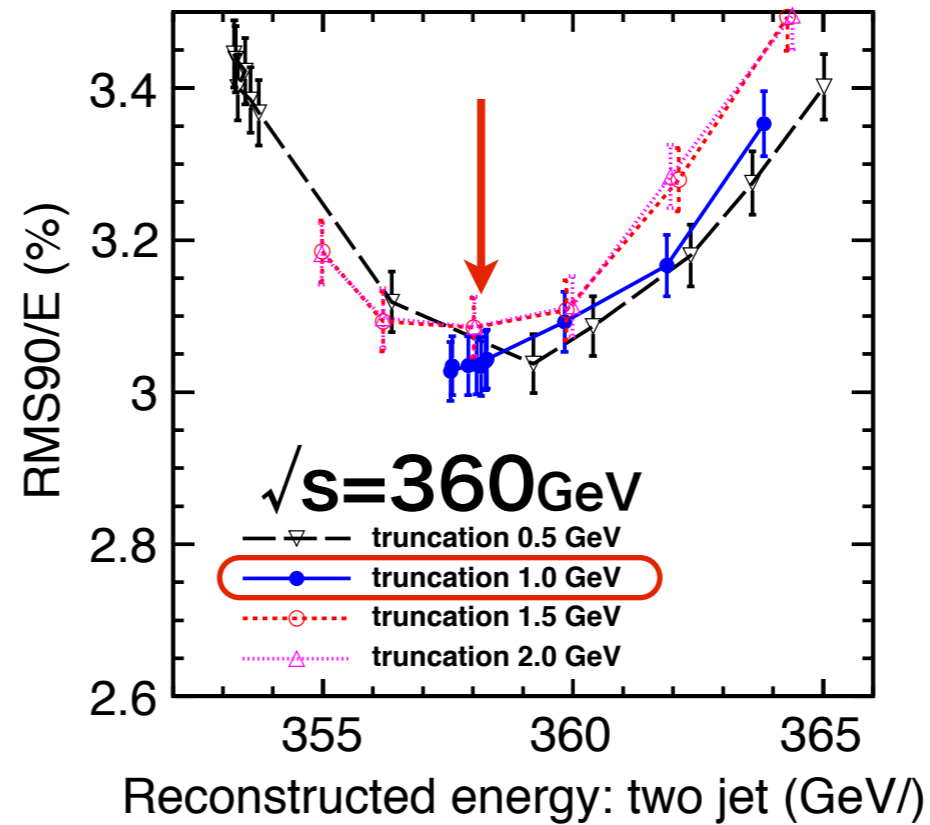
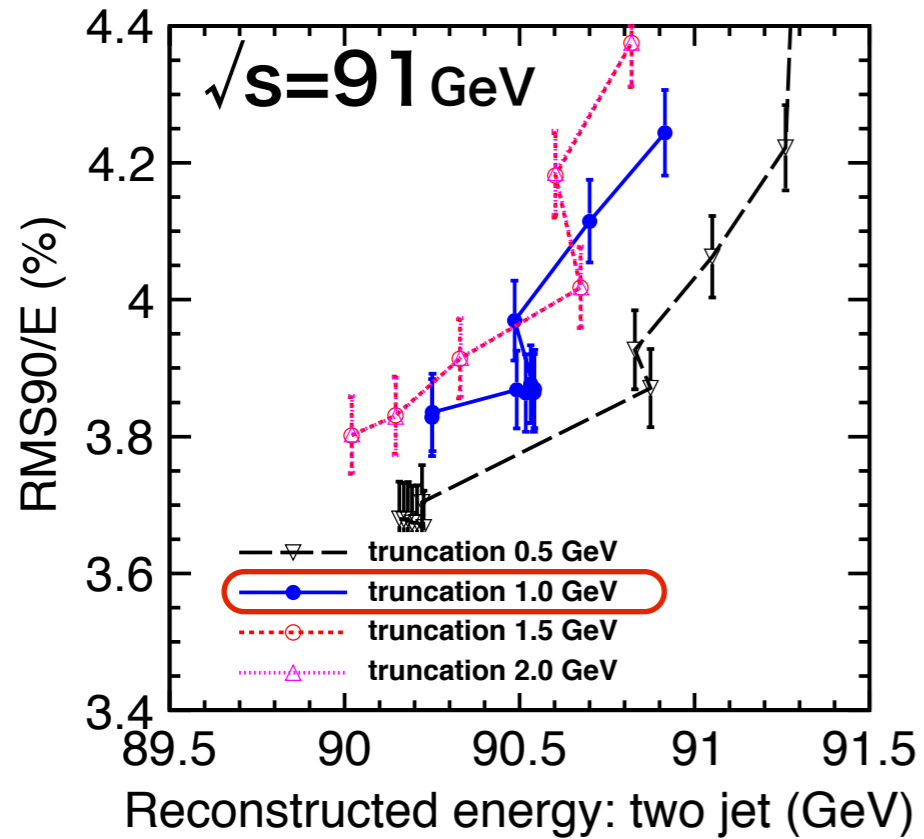
30x30mm² tile AHCAL

Truncation 1.0 \rightarrow 0.5 GeV drastically changes the effect of CalibrH.

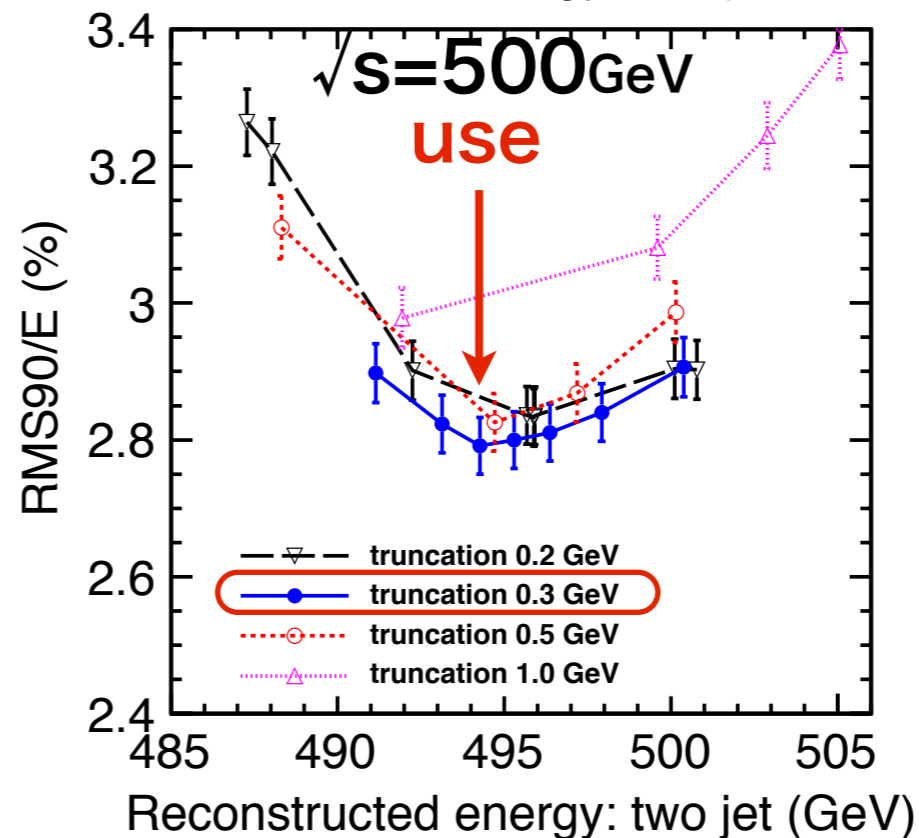
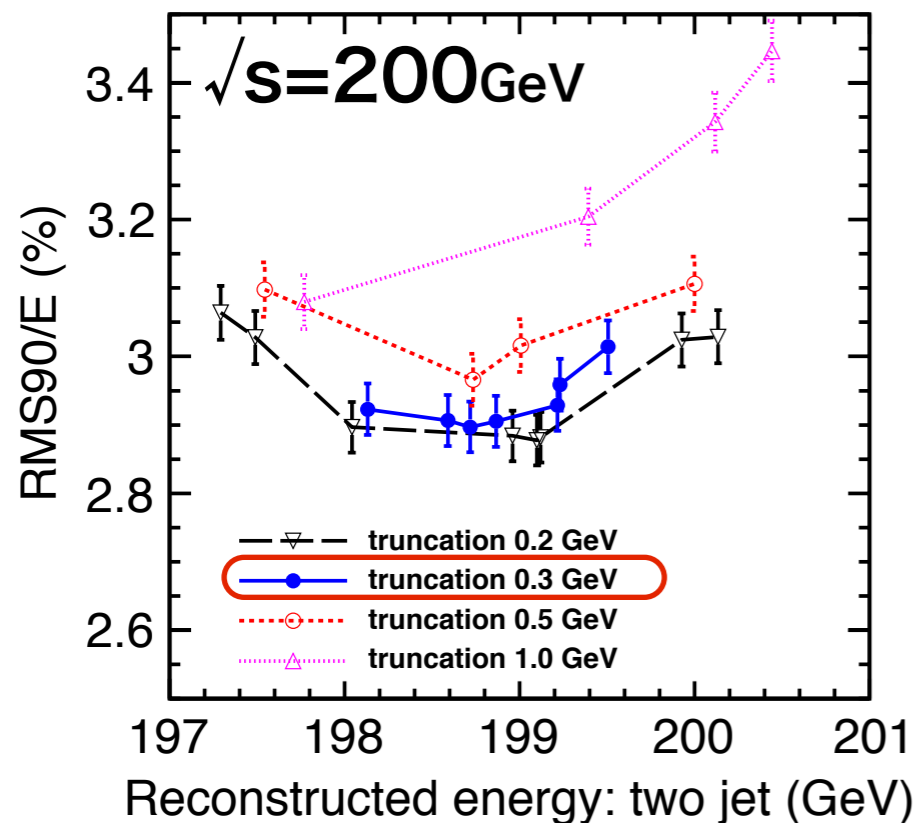
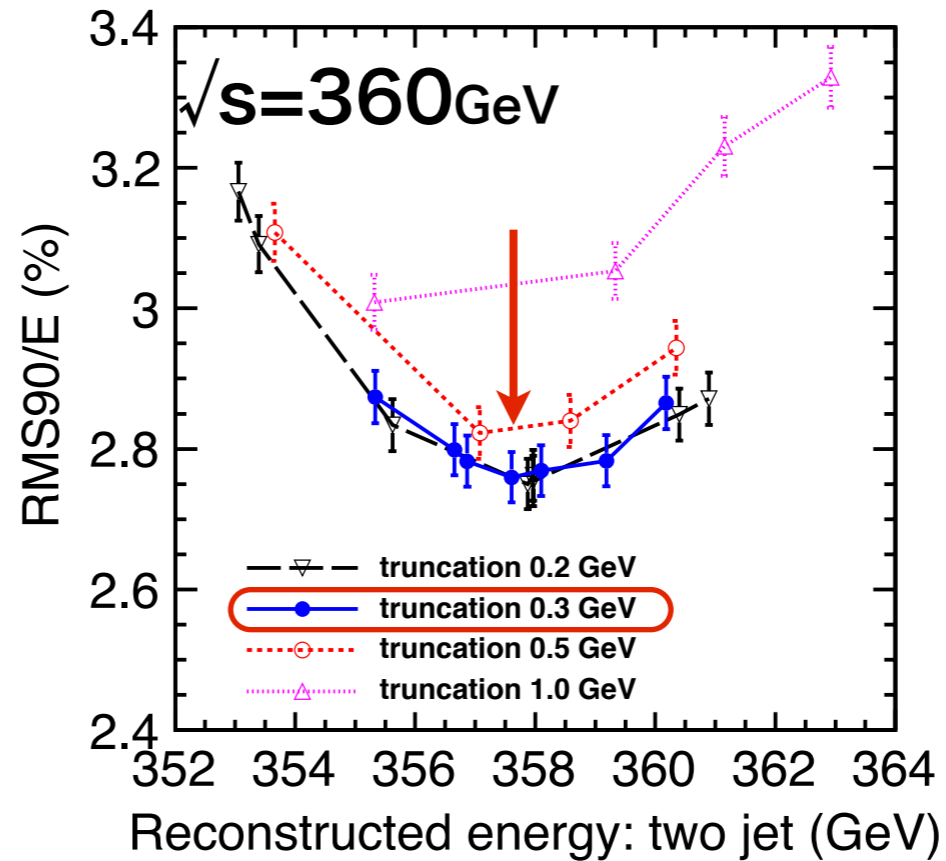
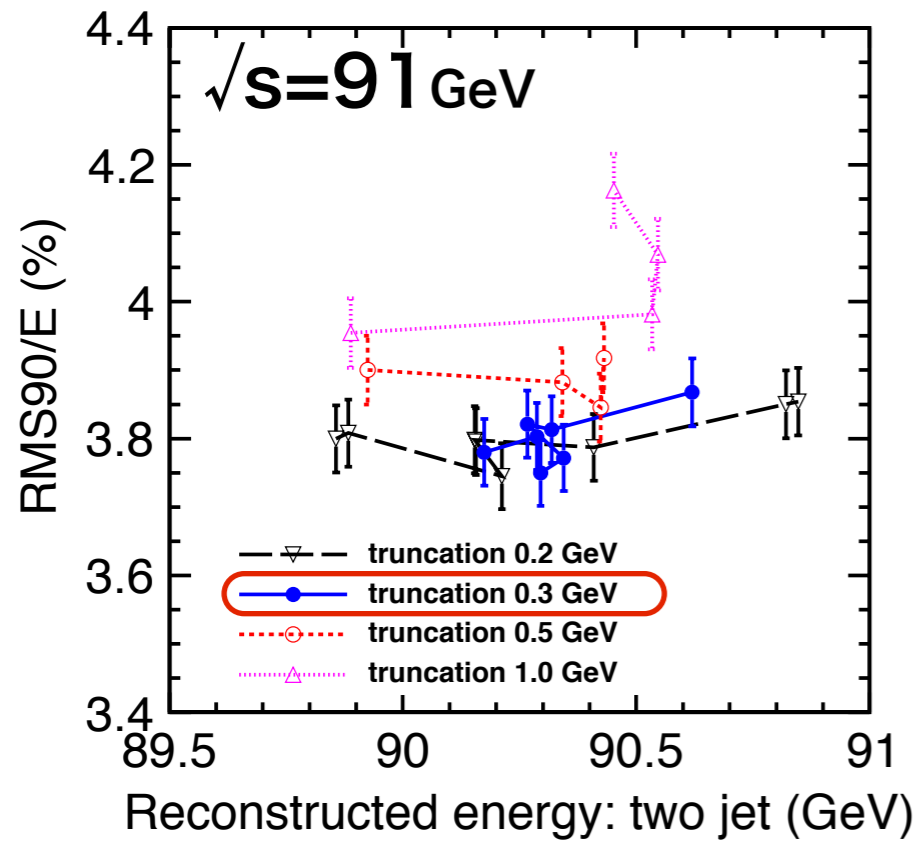
10x10mm² tile AHCAL

Truncation 0.2 \rightarrow 0.1 GeV drastically changes the effect of CalibrH.

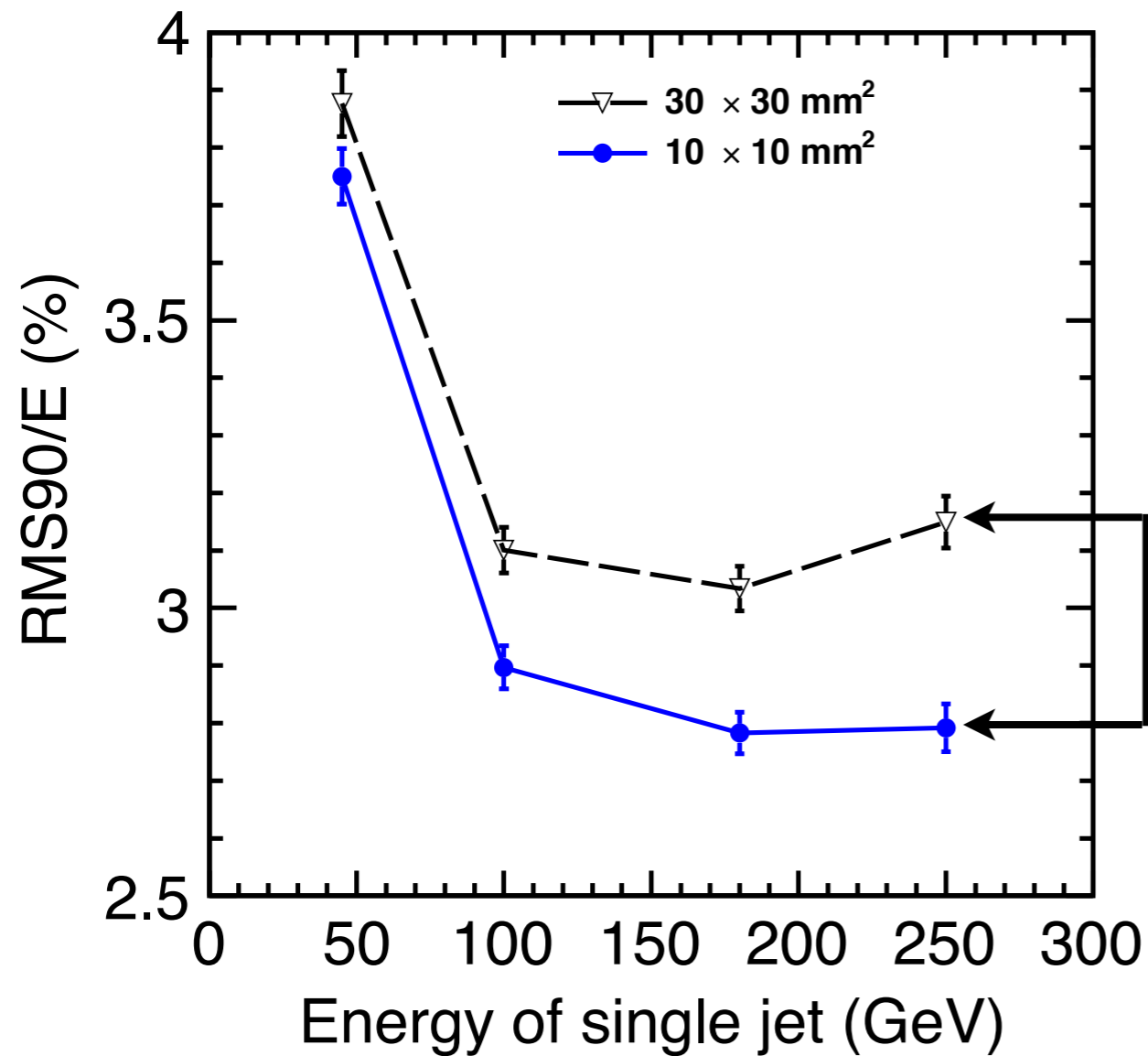
JER vs. Reconstructed energy 30x30_{mm}²



JER vs. Reconstructed energy $10 \times 10 \text{ mm}^2$



JER vs. Jet energy 10x10 : 30x30



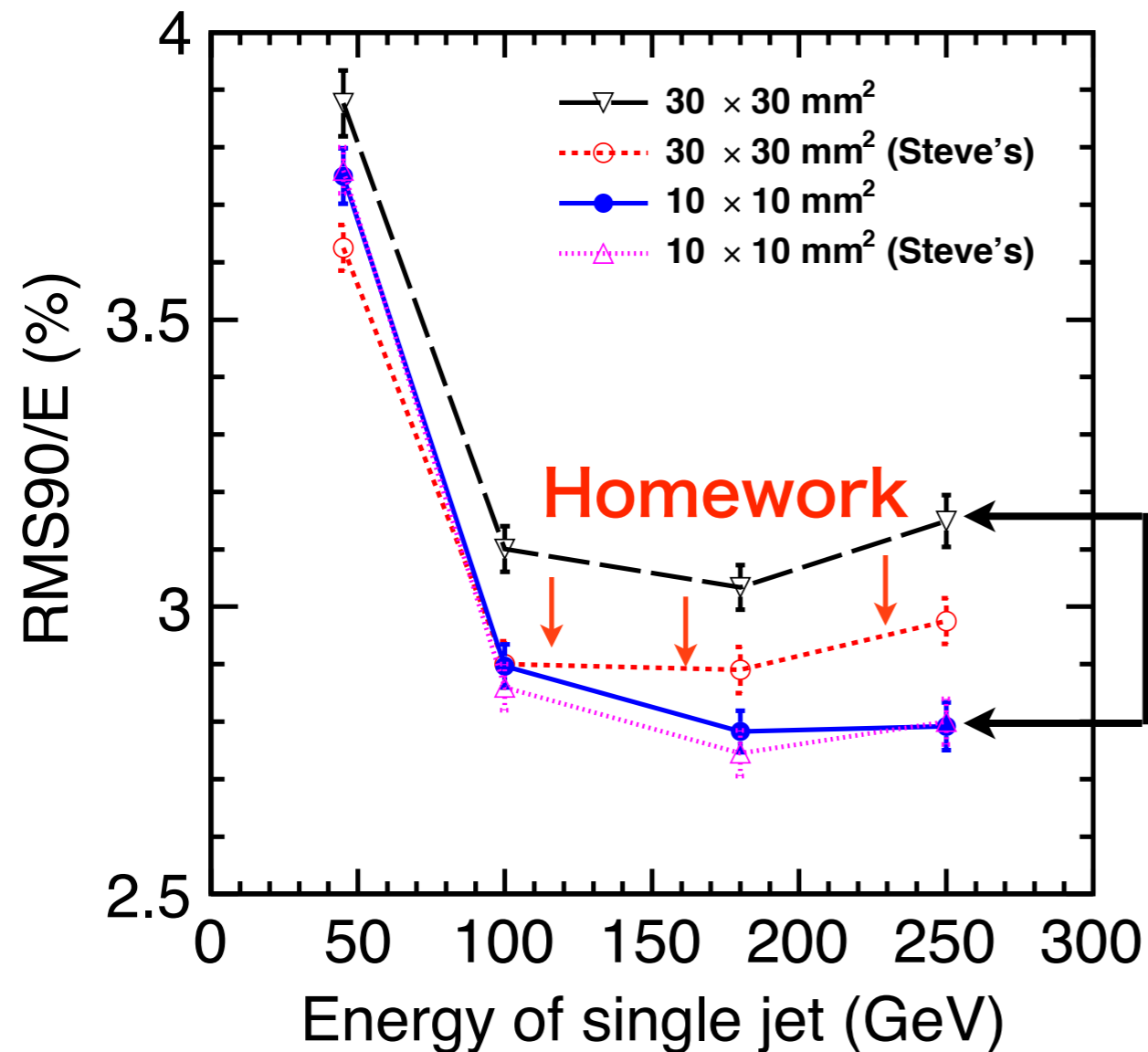
differences

cell size: 30x30, 10x10 (mm²),
truncation: 1.0, 0.3 (GeV)
CalibrHCAL: 63.87, 64.87

30x30 optimization is not
enough

Our 10x10mm² is OK.

JER vs. Jet energy 10x10 : 30x30



differences

cell size: 30x30, 10x10 (mm²),
truncation: 1.0, 0.3 (GeV)
CalibrHCAL: 63.87, 64.87

Steve's best results with
30x30mm² better than mine

Our 10x10mm² is OK.

Study on Strip HCAL reconstruction

10×10mm² tile HCAL

ilcsoft v01-17-07, ILD_vo1_v05(06)

merge to favorite sizes

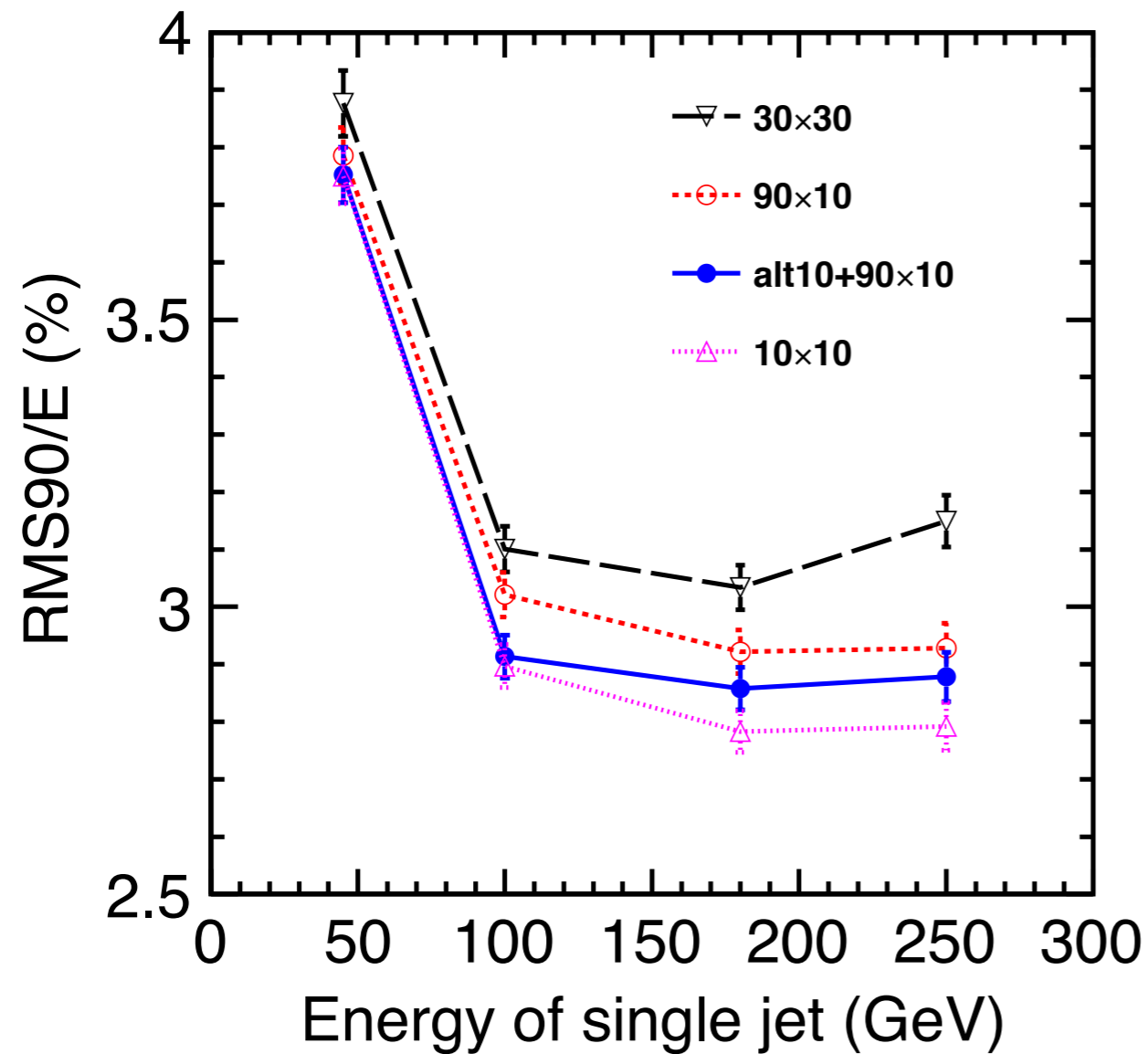
CellMergerProcessor

SSA or SSA' for large tile

preTileSplitter (for SSA')

hybridEcalSplitter (modified for also HCAL)

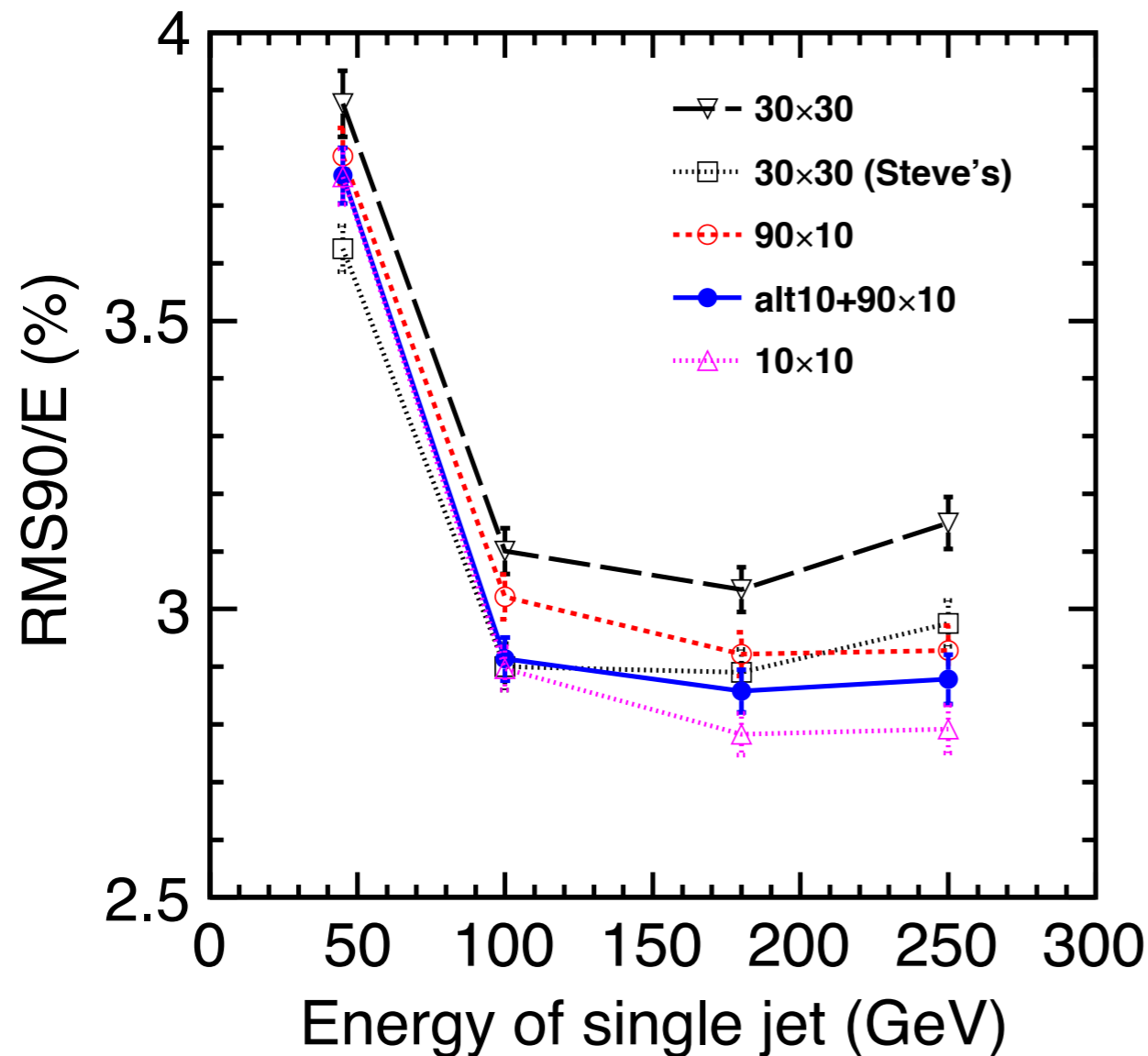
JER vs. Jet energy 9x1, 9x1+1x1



90x10mm² better than 30x30

**alternate 10x10mm² +
90x10mm² configuration is
close to pure 10x10mm²**

JER vs. Jet energy 9x1, 9x1+1x1



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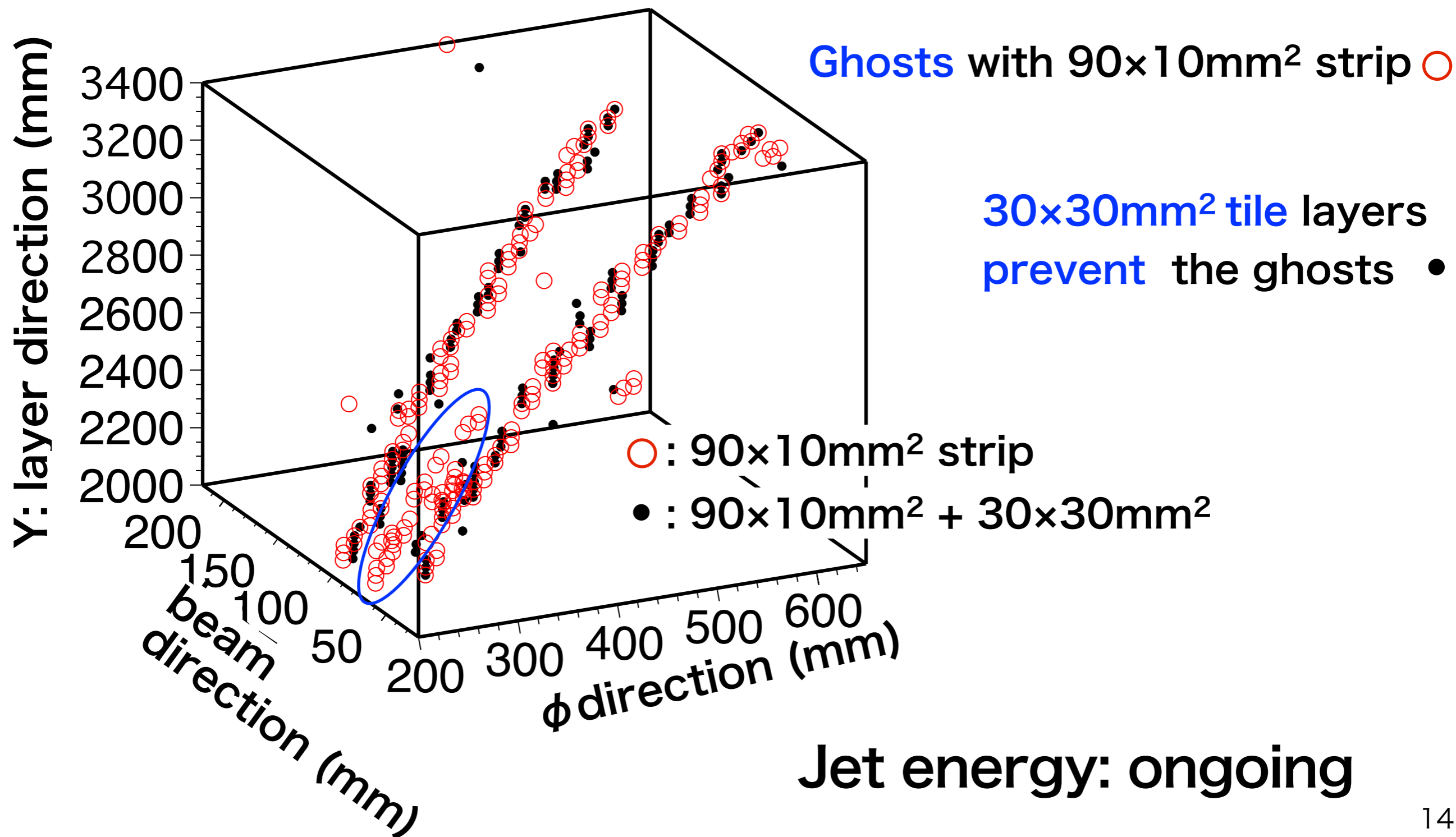
Comparison with Steve's 30x30mm²

alt. 10x10mm² + 90x10mm² : still better

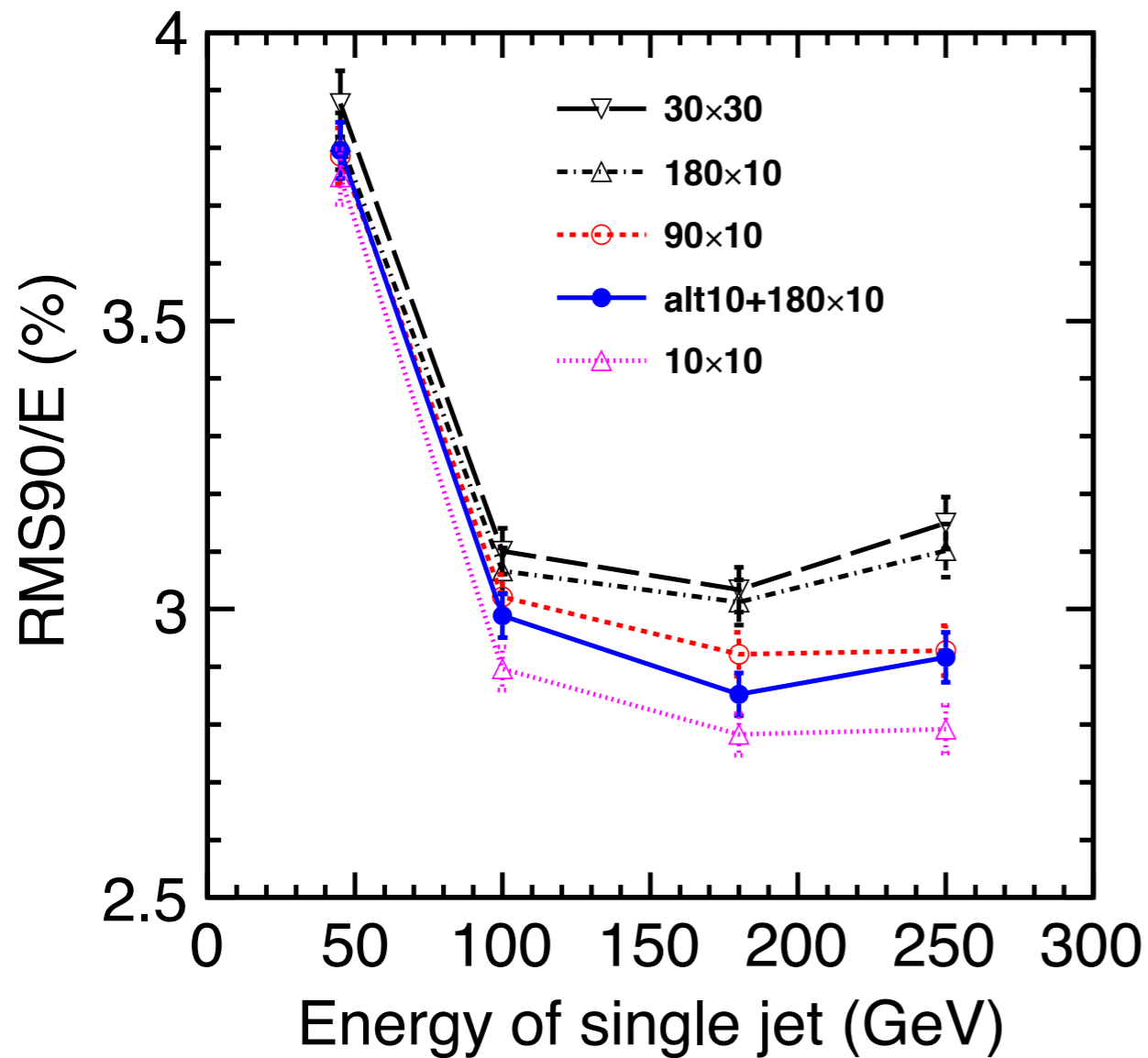
90x10mm² : better for high energy

Large tiles between strips

MIP separation with tile layers



Long strips (180×10mm²)



**180×10mm² strip
better than “My” 30×30mm² tile.**

**180×10mm² alternate 10×10mm²
better than 90×10mm² strip HCAL.**

Summary and plan

- Strip HCAL reconstruction methods were tested.
- Tune for $10\times 10\text{mm}^2$ has almost been done.
- Need some more lesson with $30\times 30\text{mm}^2$.
- $90\times 10\text{mm}^2$ is encouraging.
- alternate $10\times 10\text{mm}^2 + 90\times 10\text{mm}^2$ is Promising.
- Large tiles can resolve the ghosts.
- Jet energy study with the large tile layers is ongoing.
- long strips has good JER than my result of $30\times 30\text{mm}^2$, but not yet than Steve's result.
- Parameter optimizations are ongoing.

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Homework