Geant4 simulations of sampling and homogeneous hadronic calorimeters with dual readout for future colliders

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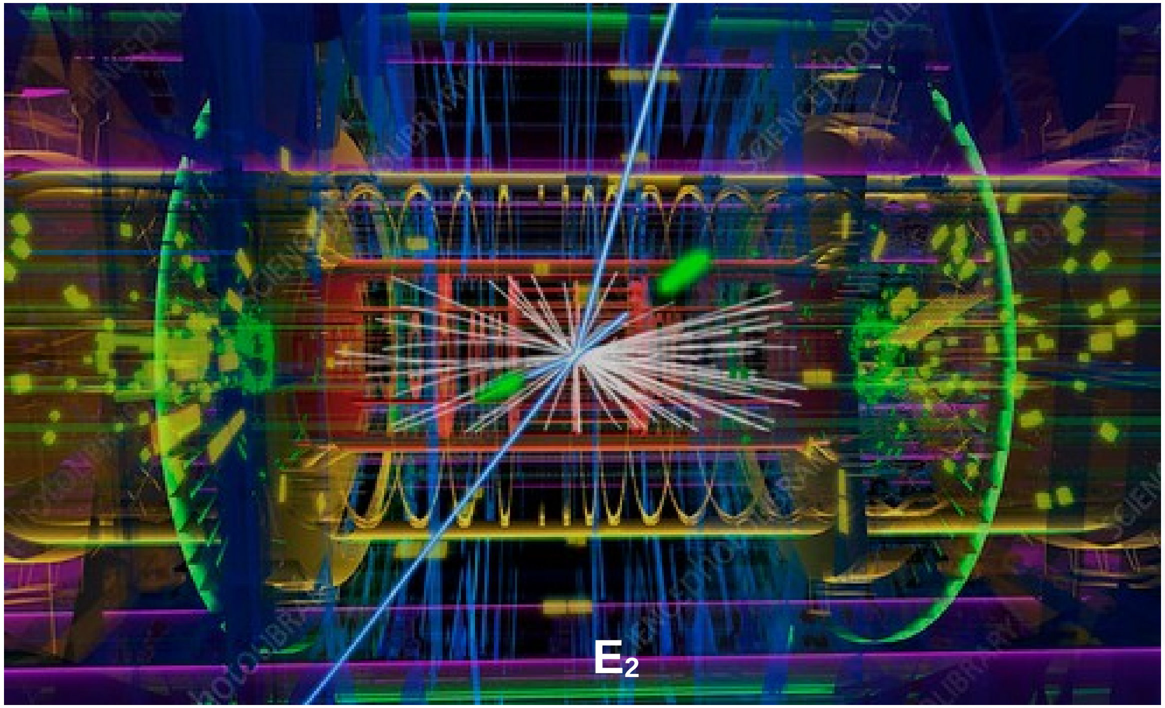
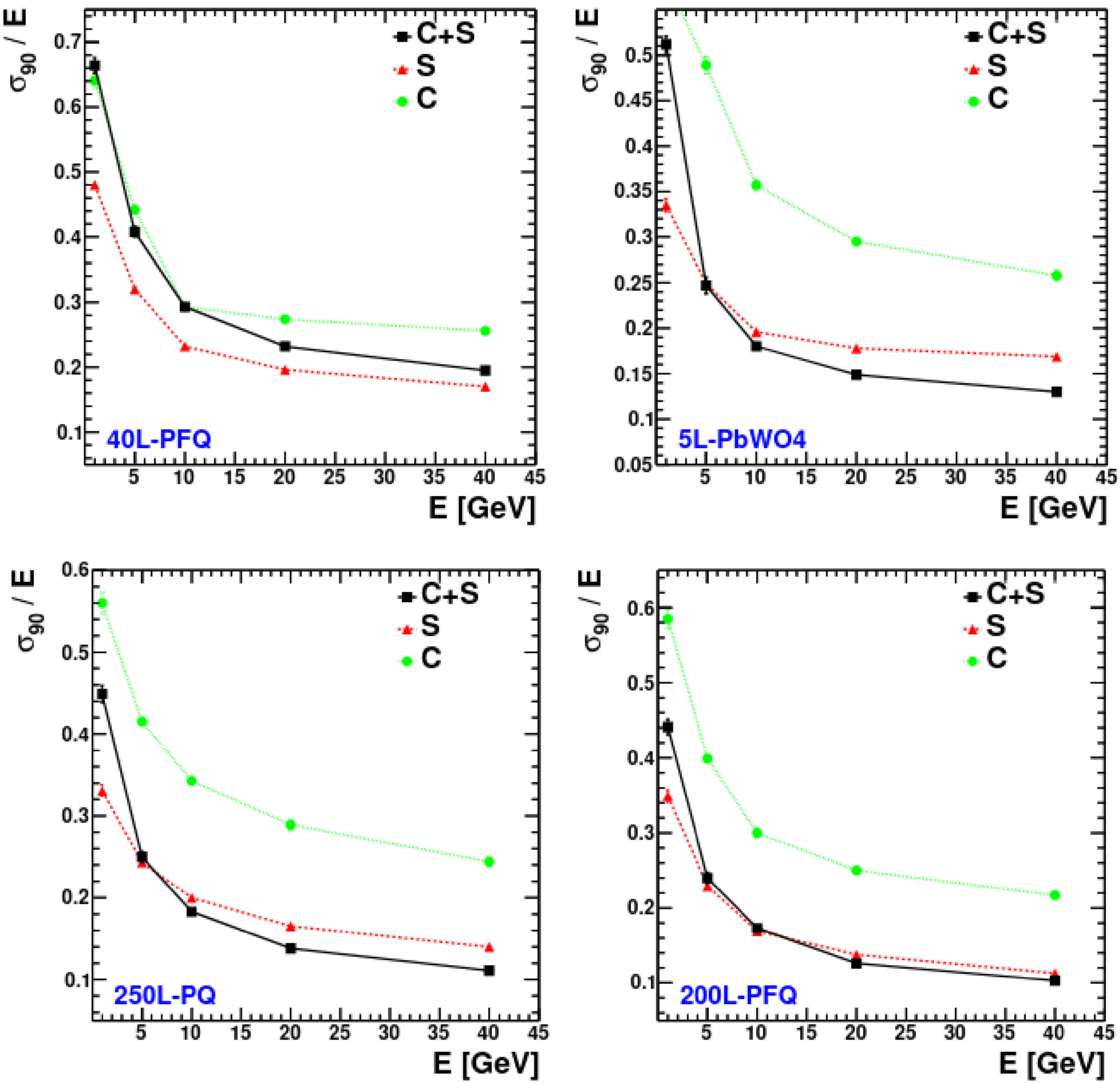
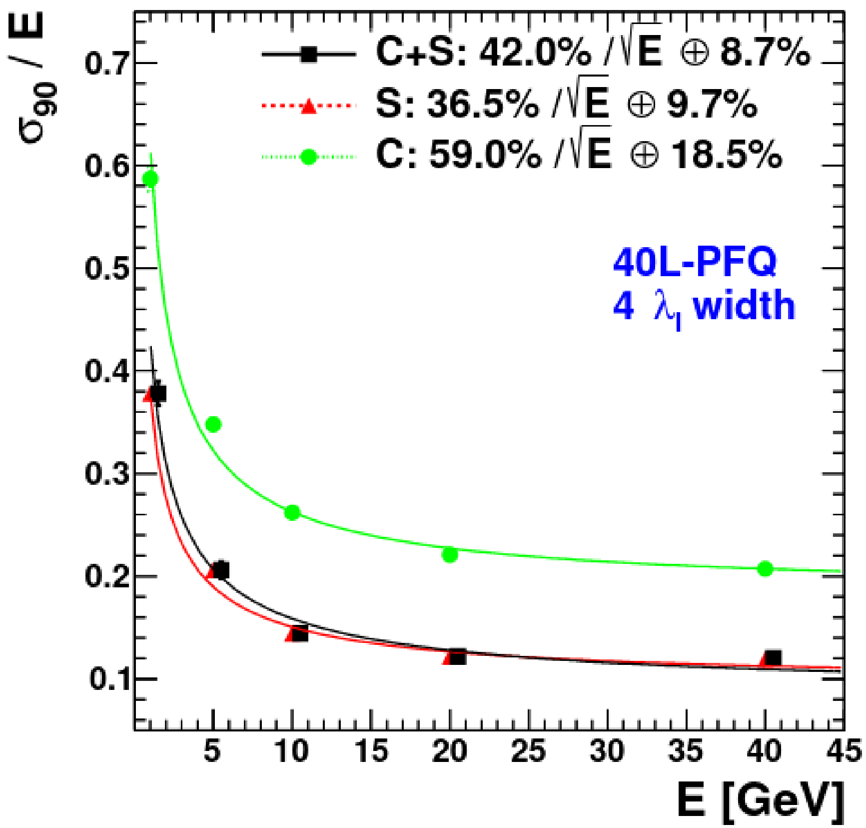


Summary of resolution studies

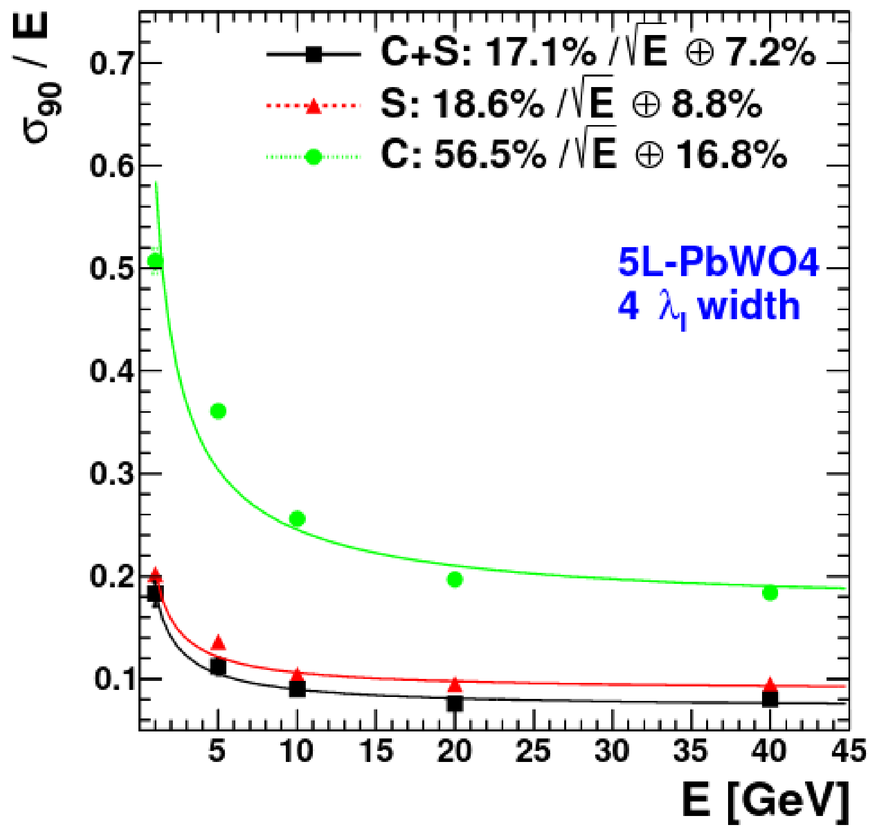


- 40 layer tower design do not show improvement in resolution for S+C (vs S)
- 200 and 250 layer towers show some improvements > 10 GeV
- 5-blocks of PbWO4 shows also significant improvement after inclusion of C signal

Using "towers" with ~95% lateral containment



(a) 40L-PFQ ($4\lambda_I$ tower width)



(b) 5L-PbWO4 ($4\lambda_I$ tower width)

- Simulations repeated to 4 λ_I to reduce shower leakage
- 40L-PFQ becomes almost fully compensating, while PbWO4 is not
- Homogeneous calorimeter shows best sampling term (17%) for C+S, as well as improvements in both sampling and constant terms

Comparison with the RD52 lead-fiber dual-readout calorimeter

S.Lee, M.Livan, R. Wigmans
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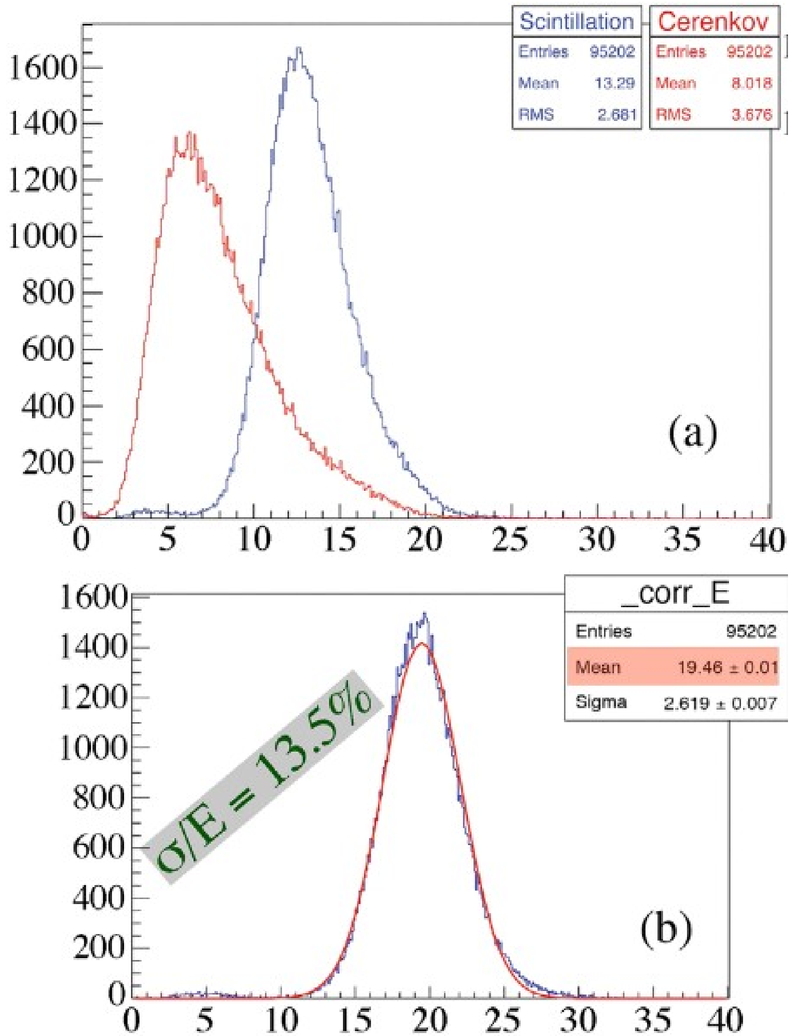

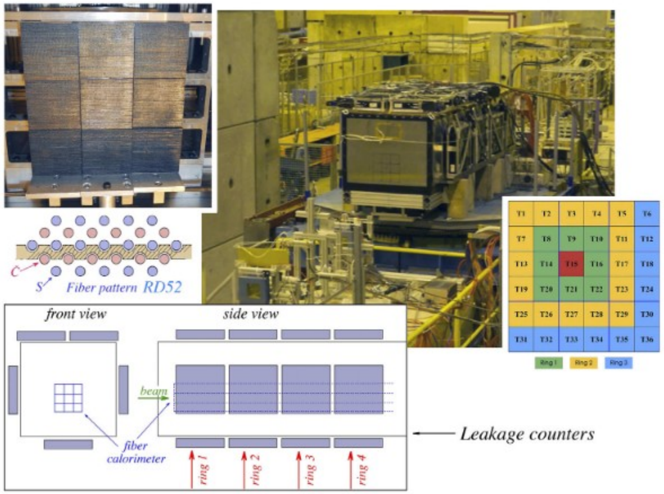

RD52 reports **σ/E=13.5%** for 20 GeV

Our simulations after taking into account lateral shower leakage:

- 40L-PSQ: **σ/E = 15.2%** (same for S and S+C)
- 5L-PbWO4 homogeneous:
  - σ/E = **12%** for S
  - σ/E = **9.5%** for S+C
- 200L and 250L are expected to be similar to RD52 but the exact values are too difficult to simulate for current computations.