SIGILLUM : UNIVERSITATIS : SCOLARIUM : STUDII : PRAGENSIS +

FCC-ee: Upstream & Downstream Corrections

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MINISTRY OF EDUCATION,
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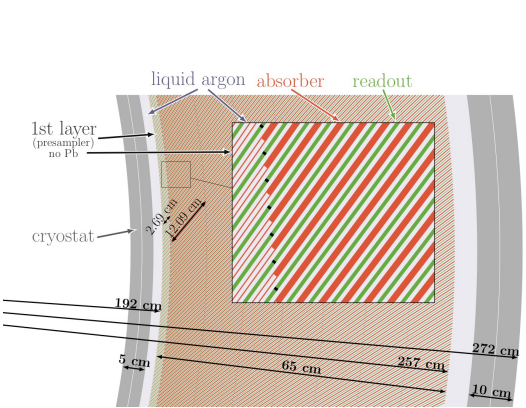
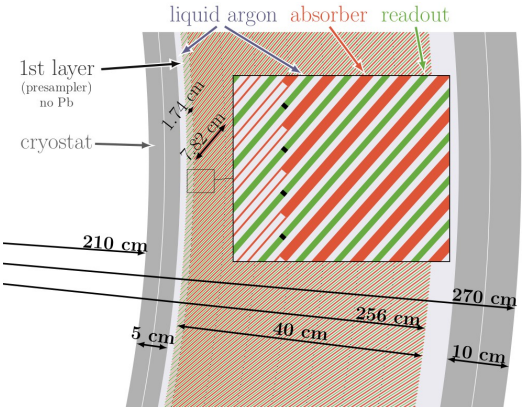
LAr Calorimeter FCC-hh vs. FCC-ee

- Going from FCC-hh calorimeter to FCC-ee:
  - Loss of 15 cm in barrel thickness
  - Current thickness: $\sim 22X_0$ at $\theta = \pi/2$
- Geometry on the right used for FCC-ee calculations



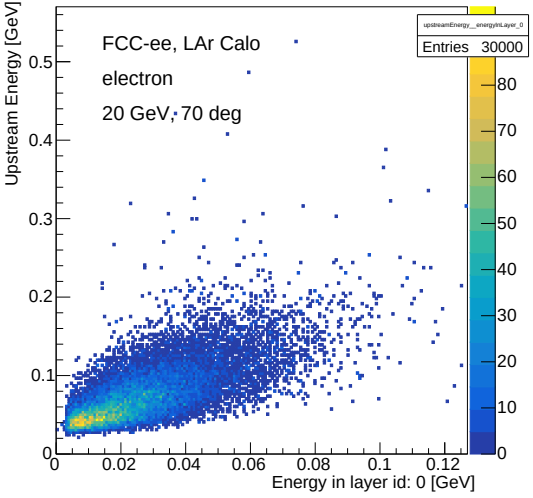


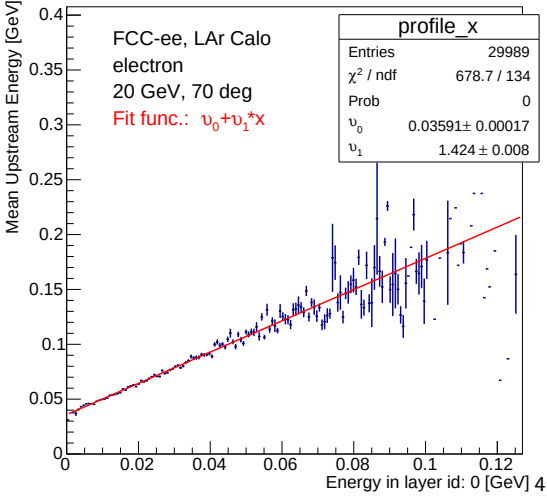
FCC-ee: Energy deposits outside calorimeter I.

- Energy is deposited also outside calorimeter, most notably in front and back cryostat
- There is correlation between first calorimeter layer and energy deposited in front cryostat
- Similarly, there is correlation between last calorimeter layer and energy deposited in back cryostat
- Energy deposited in side cryostats negligible (< 0.003 GeV for e^-, 100 GeV, $\theta = \pi/2$)
- Those correlations are exploited to create upstream and downstream energy corrections
- **This presentation:**
  - **Corrections derived for 12 layer version of FCC-ee LAr Calorimeter (Merged Brieuc's branch)** (Code was not yet transfered to FCCDetectors repository)
  - **Back cryostat extended to 1100 mm**

FCC-ee: Energy deposits outside calorimeter II.

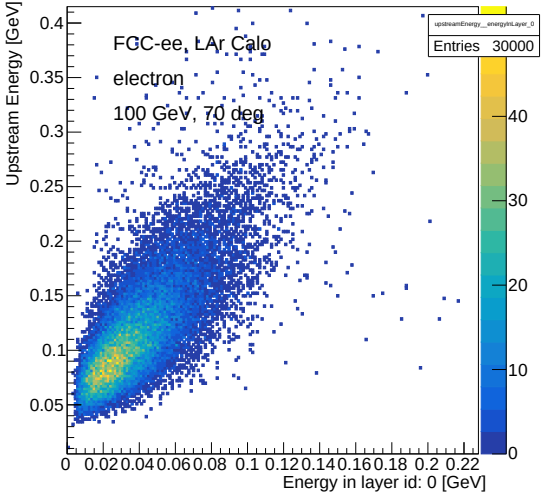
FCC-ee, e^-, 20 GeV , $\theta = 70°$

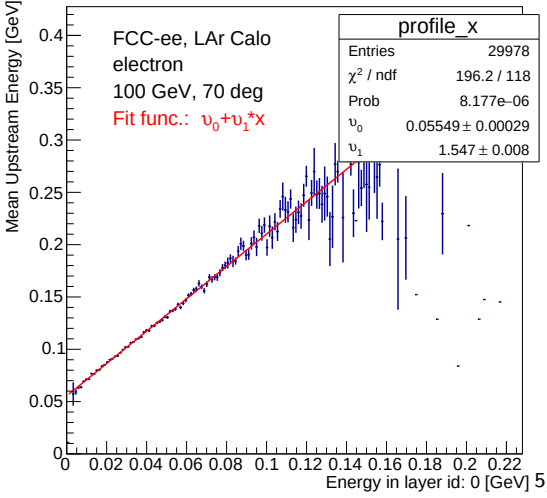




FCC-ee: Energy deposits outside calorimeter III.

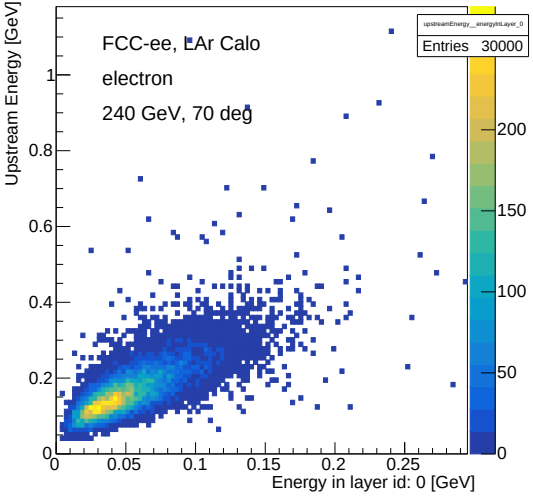
FCC-ee, e^-, 100 GeV , $\theta = 70°$

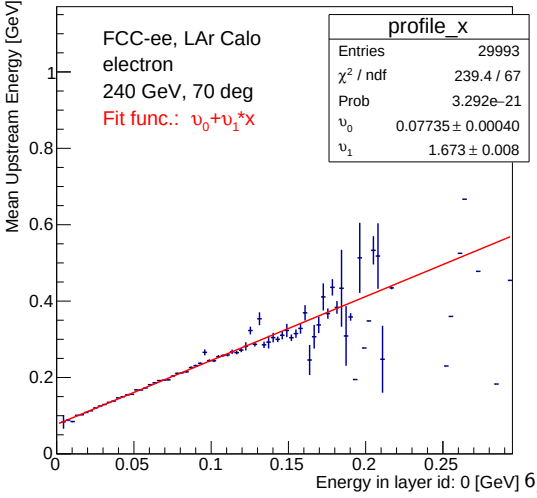




FCC-ee: Energy deposits outside calorimeter IV.

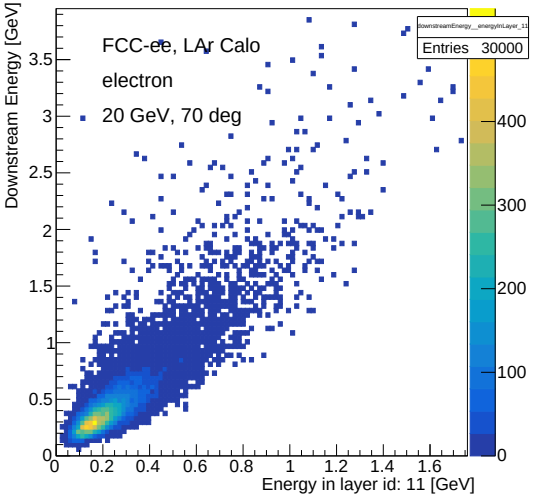
FCC-ee, e^-, 240 GeV , $\theta = 70°$

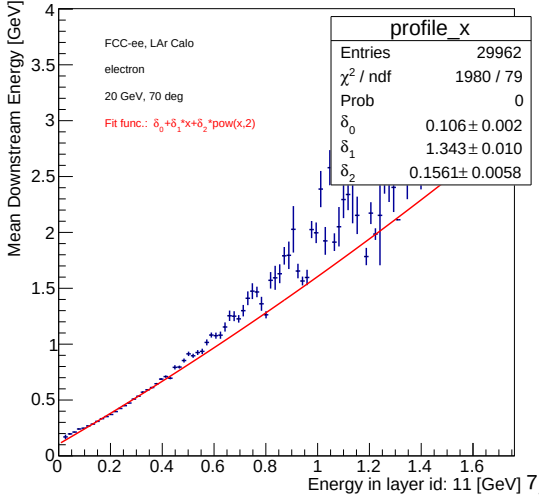




FCC-ee: Energy deposits outside calorimeter V.

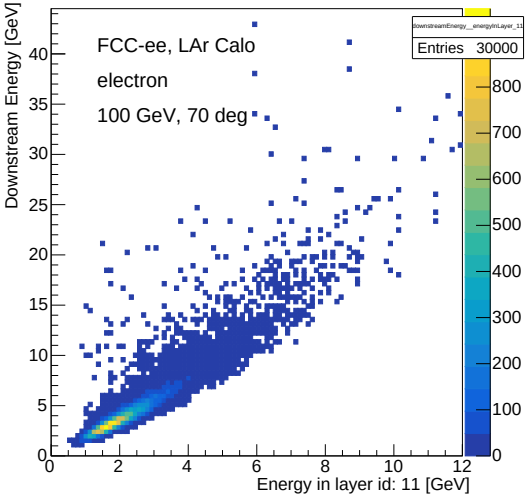
FCC-ee, e^-, 20 GeV , $\theta = 70°$

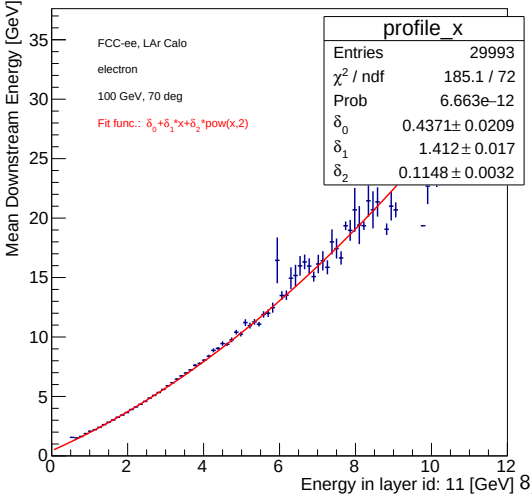




FCC-ee: Energy deposits outside calorimeter VI.

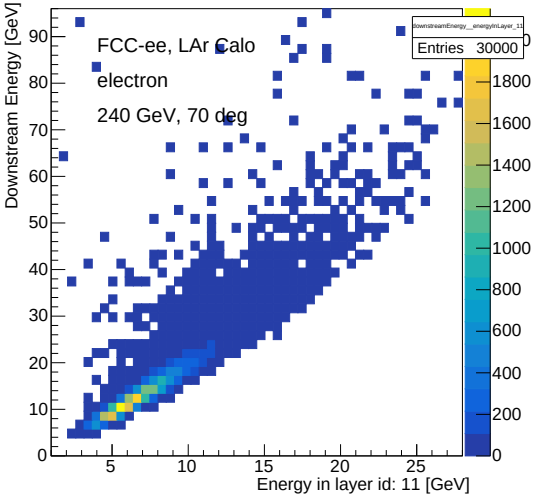
FCC-ee, e^-, 100 GeV , $\theta = 70°$

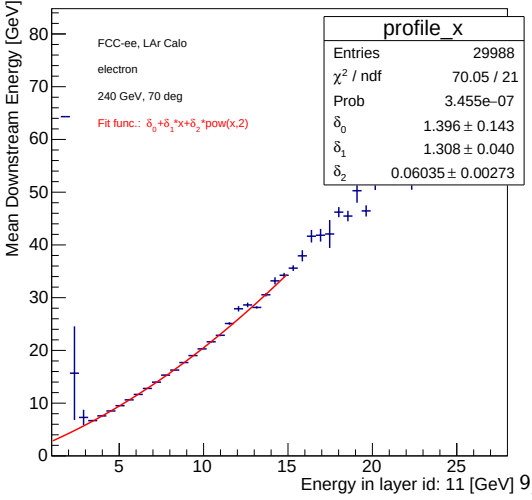




FCC-ee: Energy deposits outside calorimeter VII.

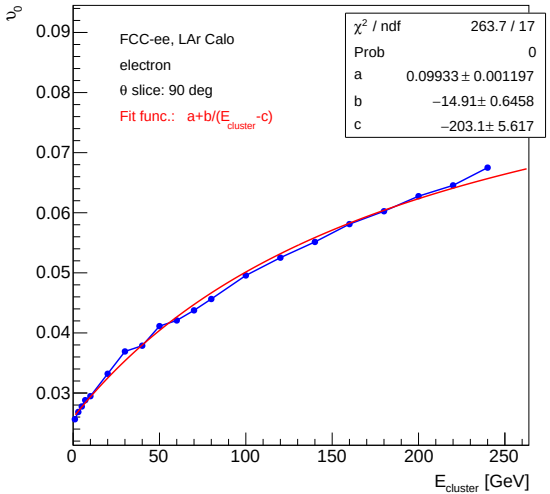
FCC-ee, e^-, 240 GeV , $\theta = 70°$

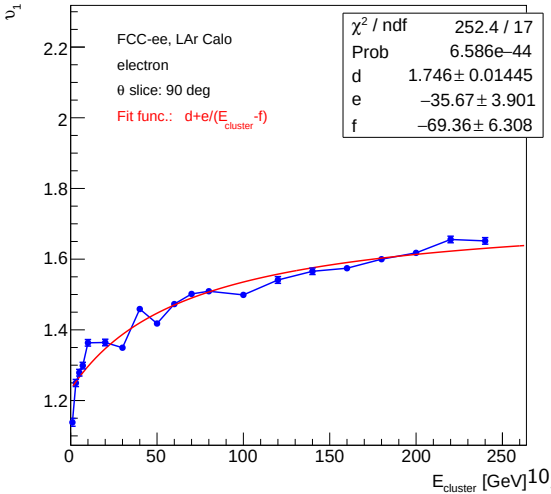




FCC-ee: Upstream Energy vs. First Layer

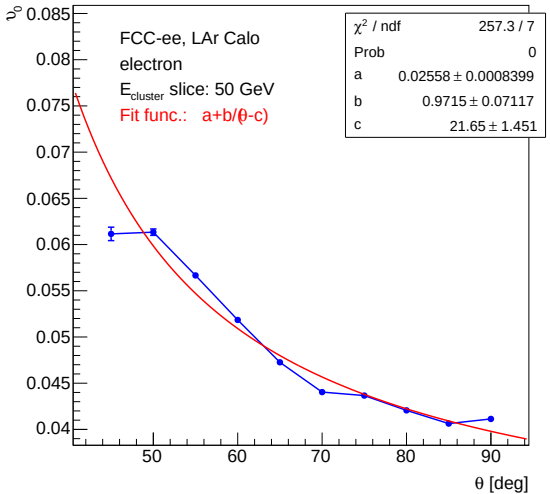
Cluster energy dependence

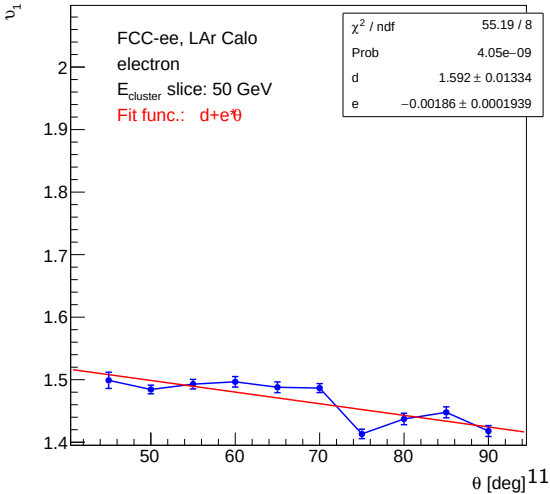




FCC-ee: Upstream Energy vs. First Layer

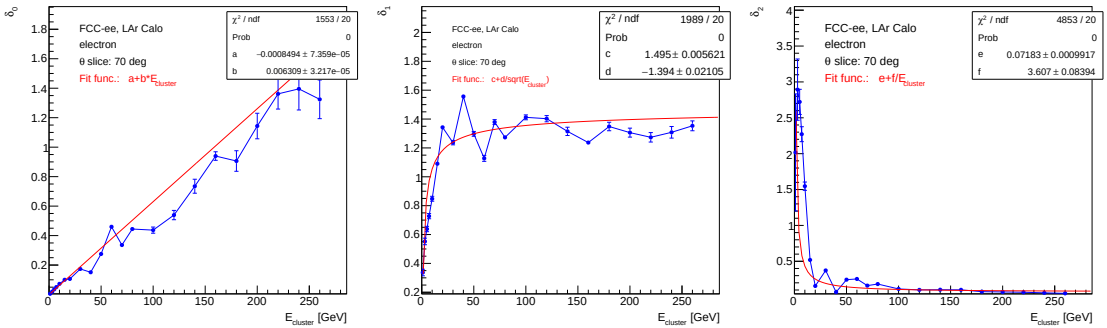
Cluster angle dependence





FCC-ee: Downstream Energy vs. First Layer

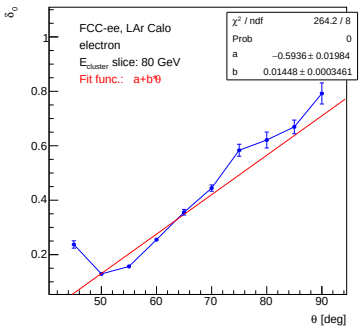
Cluster energy dependence

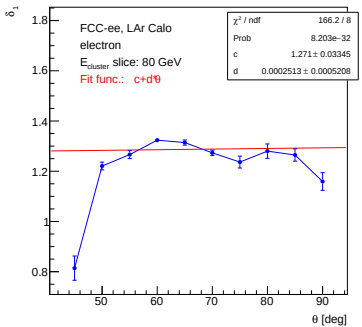


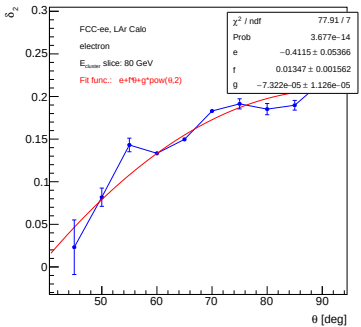
Cluster angle slice: 70 °

FCC-ee: Upstream Energy vs. First Layer

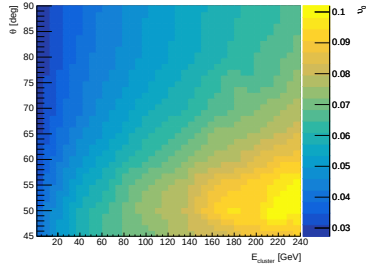
Cluster angle dependence







FCC-ee Upstream Correction Energy Dependence



FCC-ee, LAr Calo

electron

a = 0.19± 0.00046

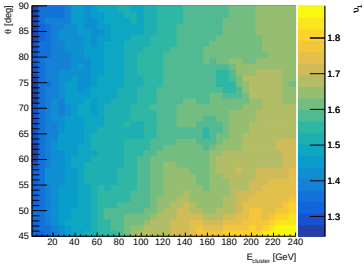
b = -94± 0.4

c = -5e+02± 1

d = 1.6± 0.0057

e = -6.7e-07± 4.3e-09

$a+b/(E_{cluster}-c)+d/\theta+e*E_{cluster}*\theta$



FCC-ee, LAr Calo

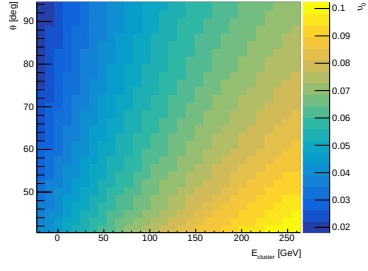
electron

f = 1.6± 0.0032

g = 0.0014± 7.1e-06

h = -0.003± 4.5e-05

$f+g*E_{cluster}+h*\theta$



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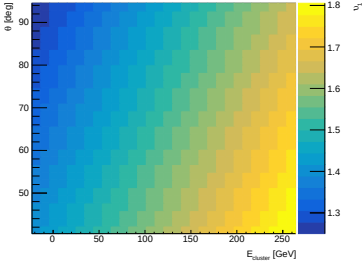

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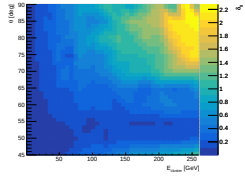
$f+g*E_{cluster}+h*\theta$

FCC-ee Downstream Correction Energy Dependence



FCC-ee, LAr Calo

electron

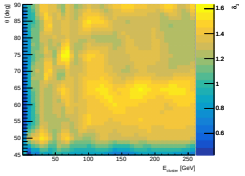
a = 0.012± 6.2e-05

b = -0.011± 1.6e-05

c = -0.00017± 1.1e-06

d = 0.00024± 2.9e-07

$a+b*E_{cluster}+c*\theta+d*E_{cluster}*\theta$



FCC-ee, LAr Calo

electron

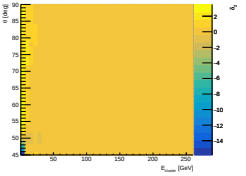
e = 0.84± 0.0043

f = -1.4± 0.0069

g = 0.0035± 6.9e-05

h = 3.3e-05± 1.7e-07

$e+f/E_{cluster}+g*\theta+h*\theta*E_{cluster}$



FCC-ee, LAr Calo

electron

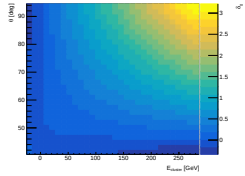
i = -0.01± 0.0009

j = -0.0054± 0.086

k = 0.00041± 1.3e-05

l = 0.11± 0.0014

$i+j/E_{cluster}+k*\theta+l*\theta/E_{cluster}$



FCC-ee, LAr Calo

electron

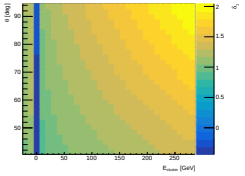
a = 0.012± 6.2e-05

b = -0.011± 1.6e-05

c = -0.00017± 1.1e-06

d = 0.00024± 2.9e-07

$a+b*E_{cluster}+c*\theta+d*E_{cluster}*\theta$



FCC-ee, LAr Calo

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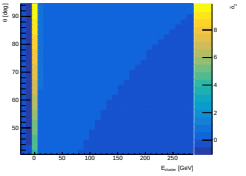
h = 3.3e-05± 1.7e-07

$e+f/E_{cluster}+g*\theta+h*\theta*E_{cluster}$



FCC-ee, LAr Calo

electron

i = -0.01± 0.0009

j = -0.0054± 0.086

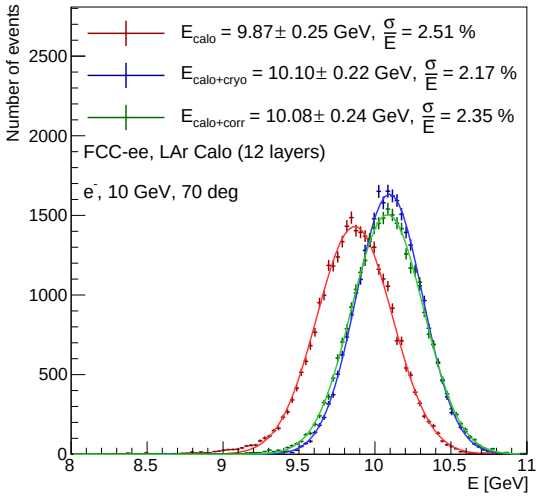
k = 0.00041± 1.3e-05

l = 0.11± 0.0014

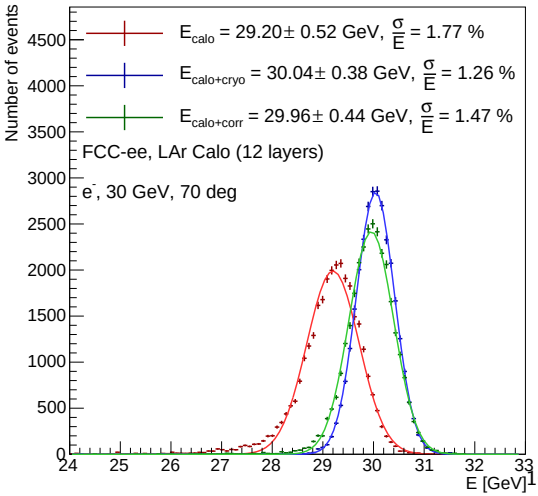
$i+j/E_{cluster}+k*\theta+l*\theta/E_{cluster}$

FCC-ee: Energy correction test I.

FCC-ee, e^-, 10 GeV , $\theta = 70$ deg

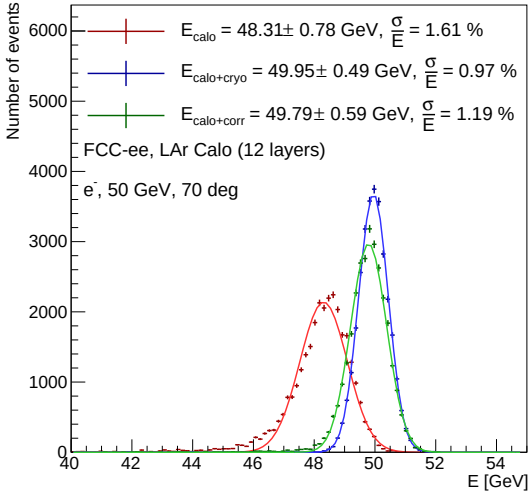


FCC-ee, e^-, 30 GeV , $\theta = 70$ deg

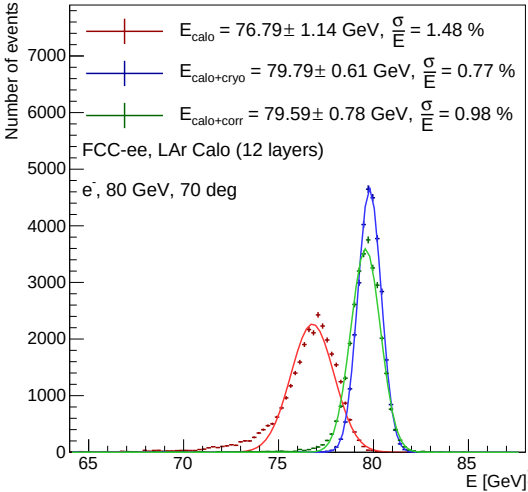


FCC-ee: Energy correction test II.

FCC-ee, e^-, 50 GeV , $\theta = 70$ deg

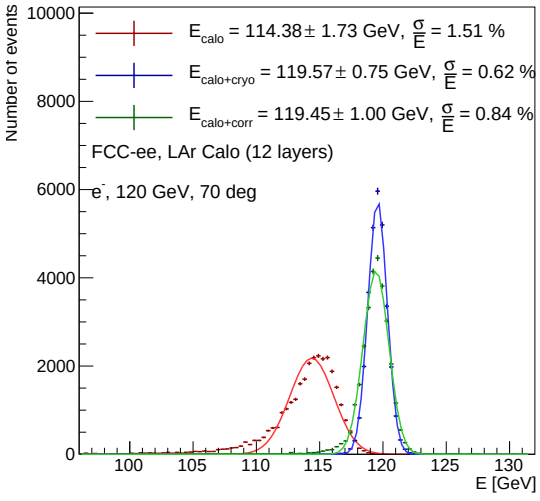


FCC-ee, e^-, 80 GeV , $\theta = 70$ deg

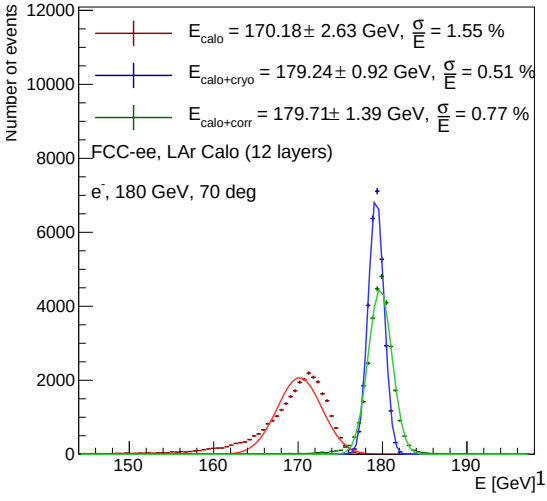


FCC-ee: Energy correction test III.

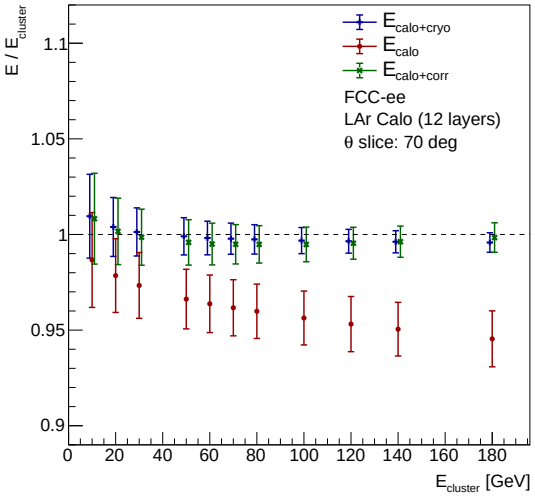
FCC-ee, e^-, 120 GeV , $\theta = 70$ deg

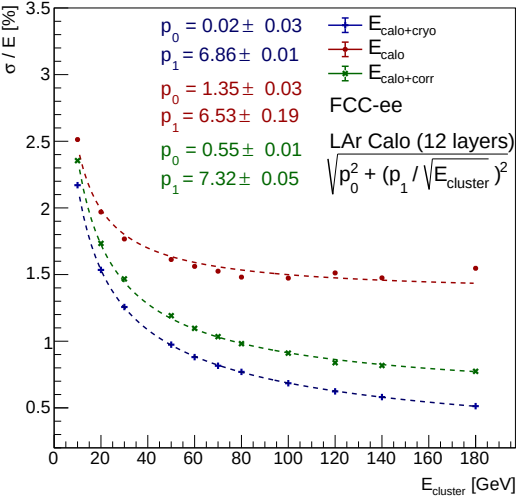


FCC-ee, e^-, 180 GeV , $\theta = 70$ deg



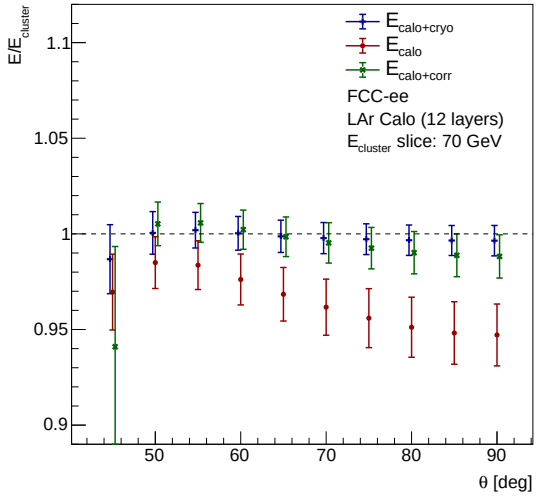
FCC-ee: Energy correction test IV.



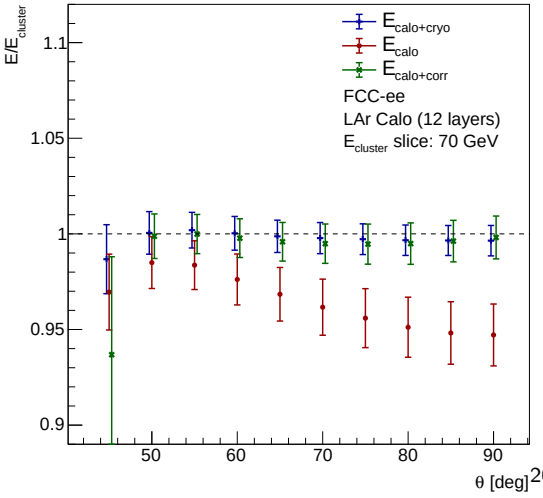


FCC-ee: Energy correction test V.

Only $E_{cluster}$ dependence



θ and $E_{cluster}$ dependence



Conclusion and Plans

- For FCC-ee large energy leakage observed
- Correlation between first/last layer and back cryostat exploited to create up/downstream corrections
- Upstream energy vs. energy in first layer linear
- Downstream energy vs. energy in last layer quadratic
- Parametrization can use any basic 1D/2D ROOT function
- Energy correction reconstructs cluster energy in whole energy and theta range
- Inclusion of cluster theta dependence needed
- **Links:**
  - `calo_corr`: https://github.com/kjvbrt/FCCSW/tree/calo_corr
  - Correction lives in: `Detector/DetStudies/scripts`
  - `calo_corr_12`: https://github.com/kjvbrt/FCCSW/tree/calo_corr_12