Energy resolution of SPD ECAL

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SPD Physics & MC meeting

08.04.2020

Outline and plans

This talk: ECAL resolution (“flat” ECAL geometry, no reconstruction algorithm)

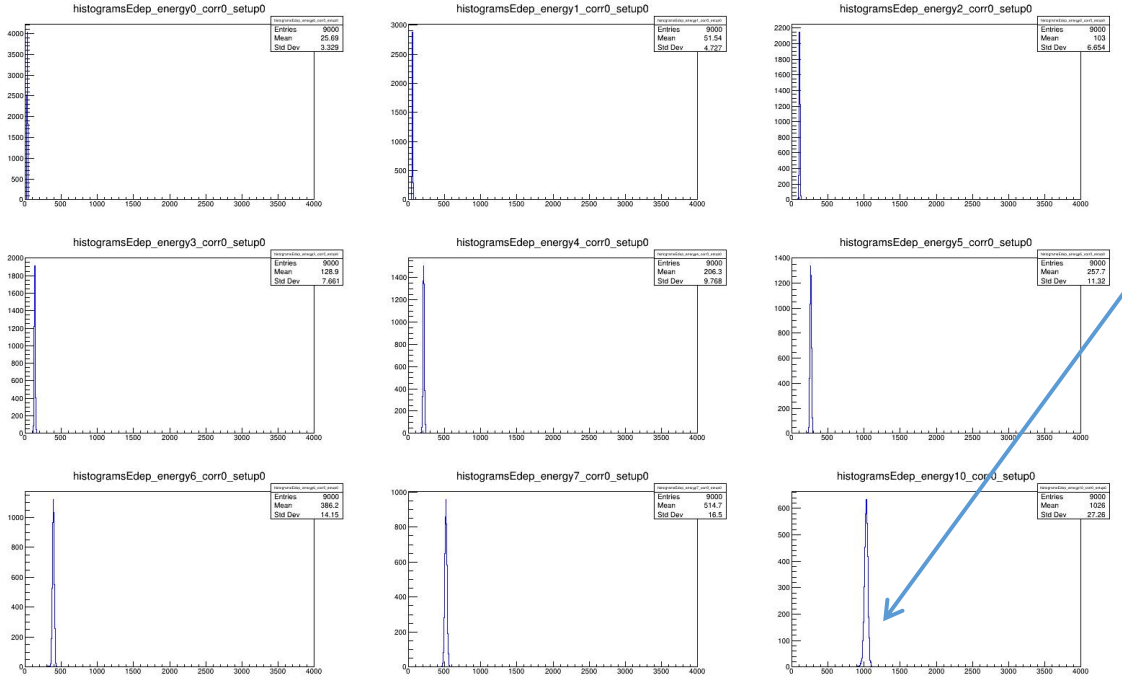
Next steps:

1) Building ECAL geometry

2) Implementation of a simple reconstruction algorithm (weighted mean)

How is ECAL resolution obtained from MC?

Energy deposition in scintillator, for different energies

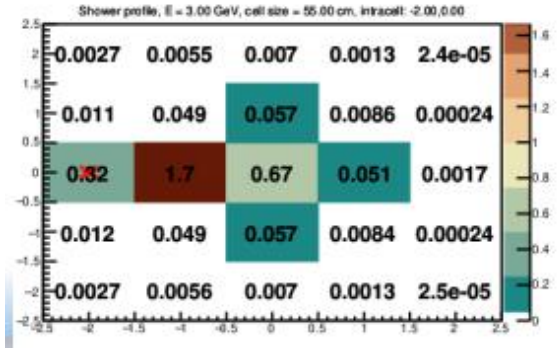


(width of peak)/(position of peak) = =resolution

Added corrections:

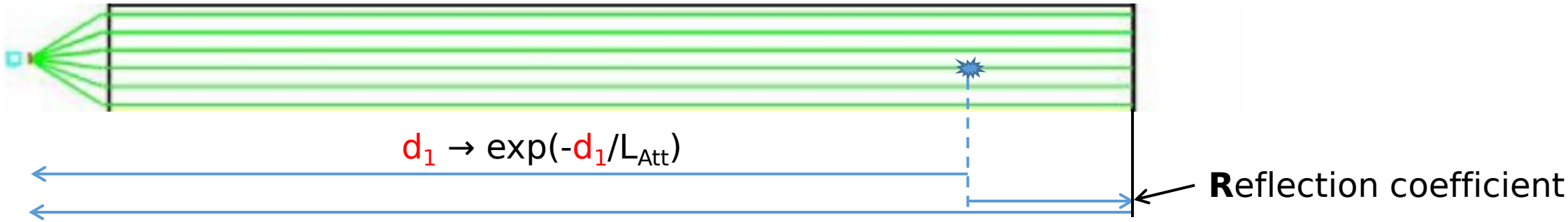
- photoelectron statistics
- light attenuation in light guides
- cell energy threshold effect

Resolution is a function of energy and angle



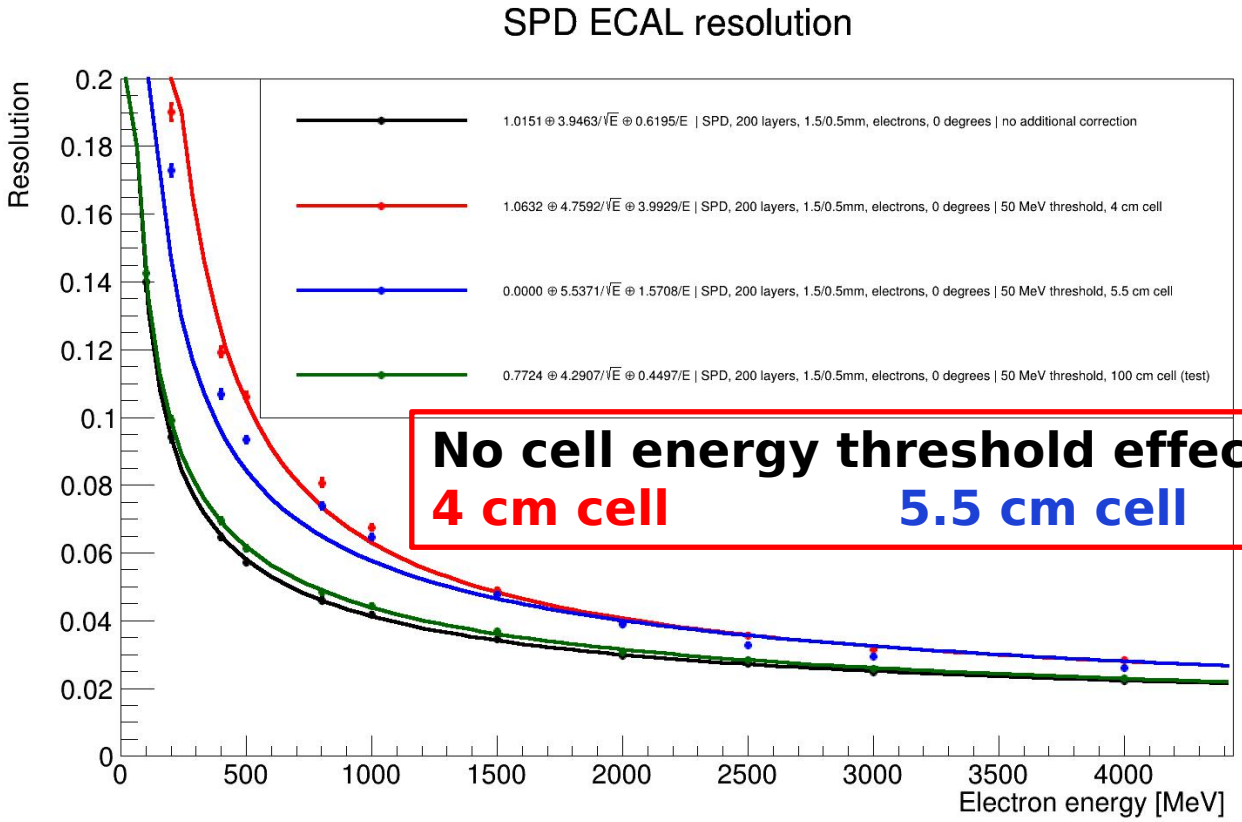
Setup details

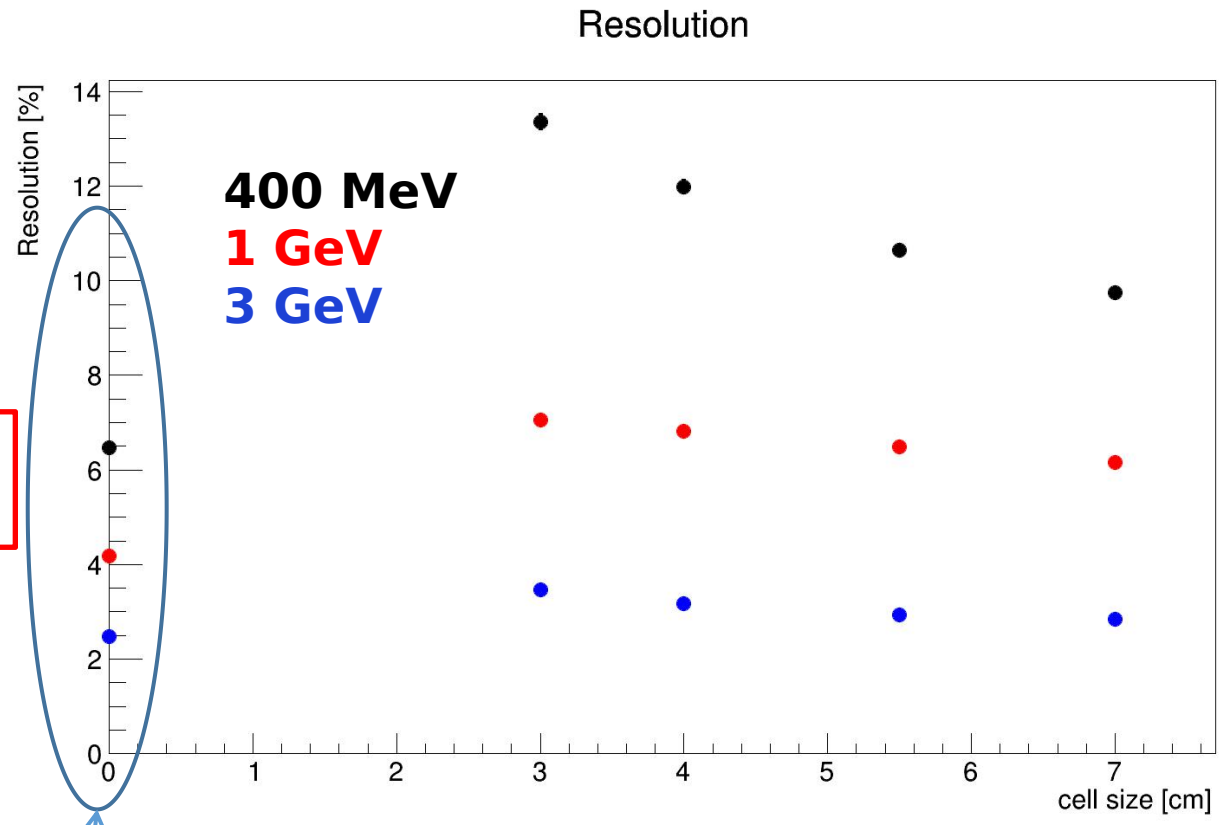
- 200 layers of shashlyk: 1.5 mm Pb/0.5 mm scintillator
- 50 MeV cell energy threshold, 4x4 cm cell
- L_{Att}= 1.0 m, R = 0.9, 5000 photoelectrons per 1 GeV in scintillator



Effect of ECAL cell size on energy resolution

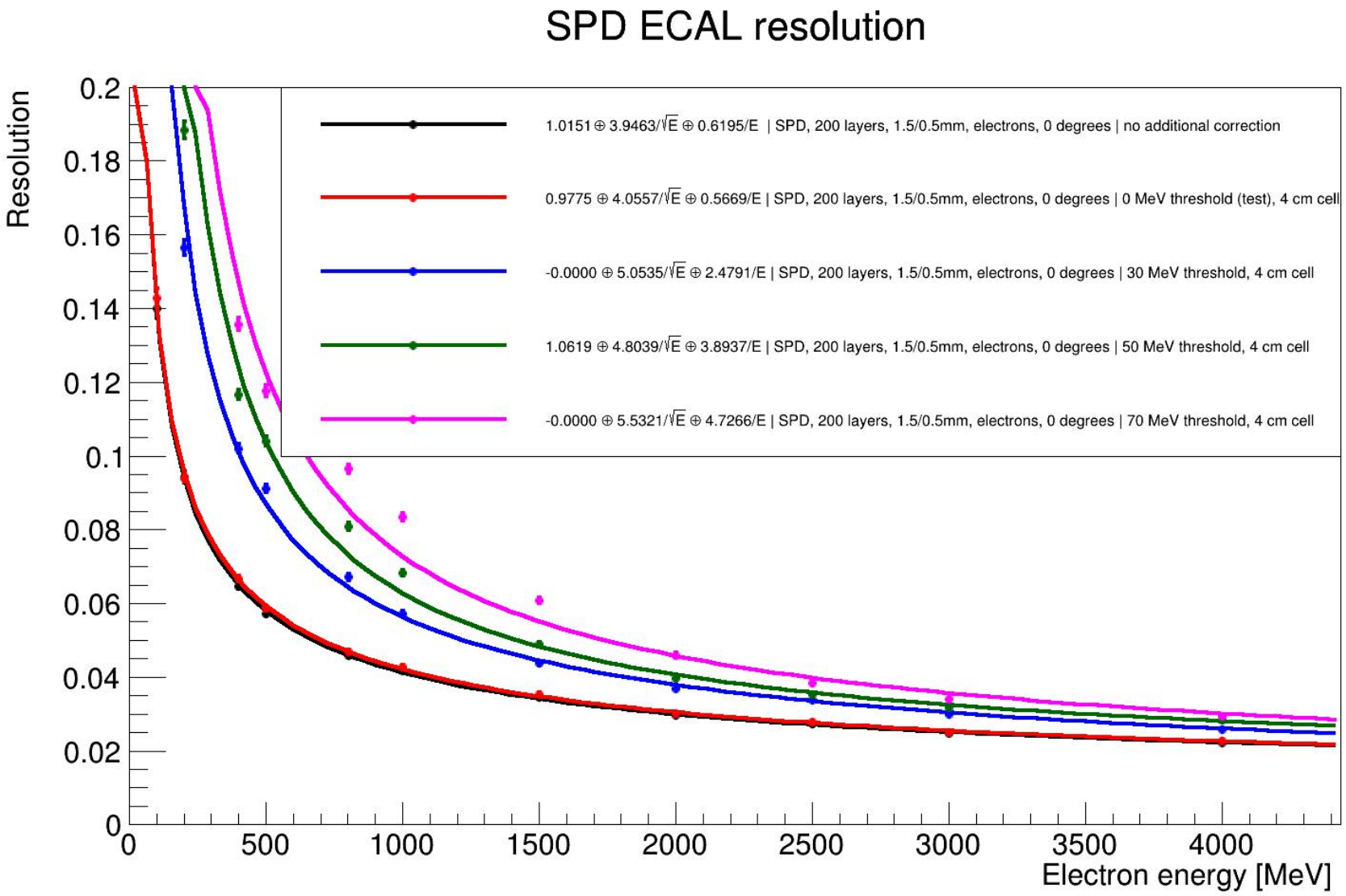
50 MeV cell energy threshold





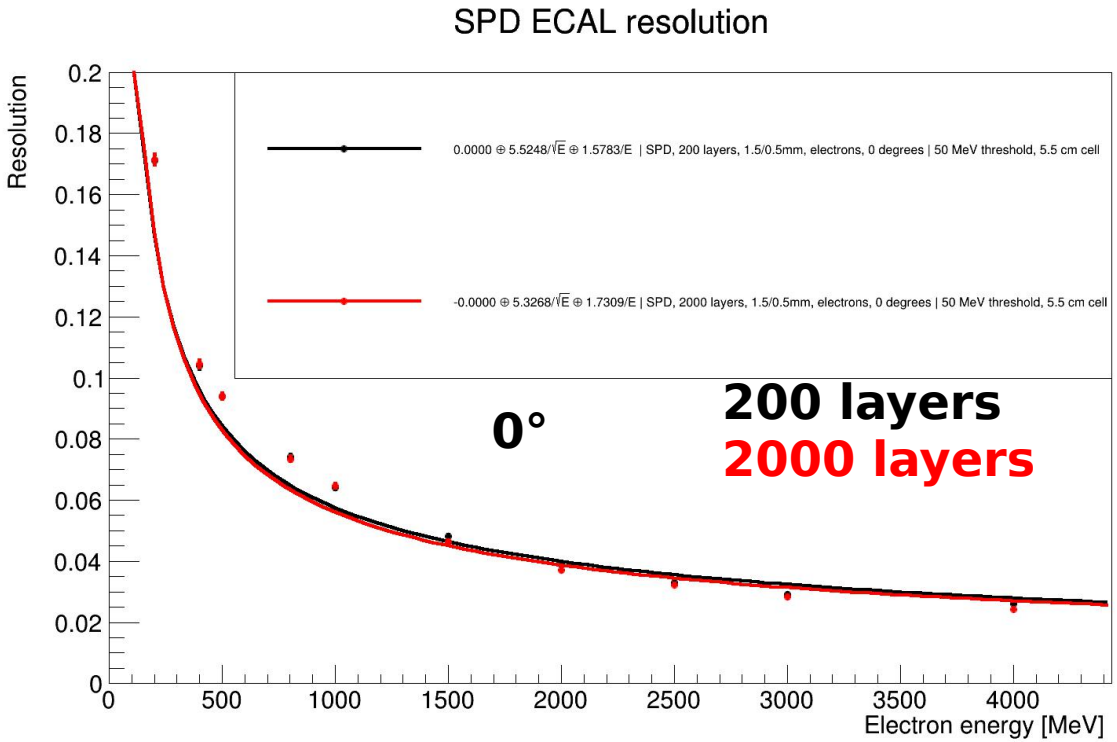
“infinitely large cells”: no cell energy threshold effect

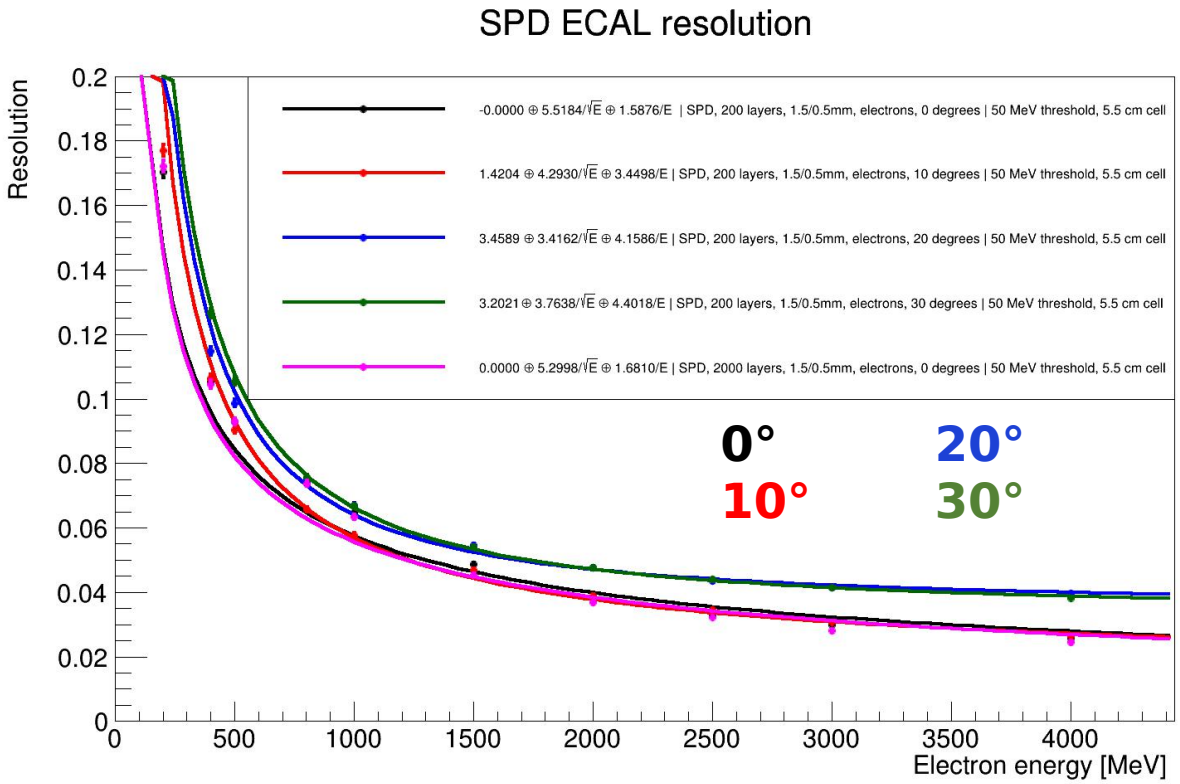
Effect of cell threshold on resolution



NO CORRECTION
30 MeV THRESHOLD
50 MeV THRESHOLD
70 MeV THRESHOLD

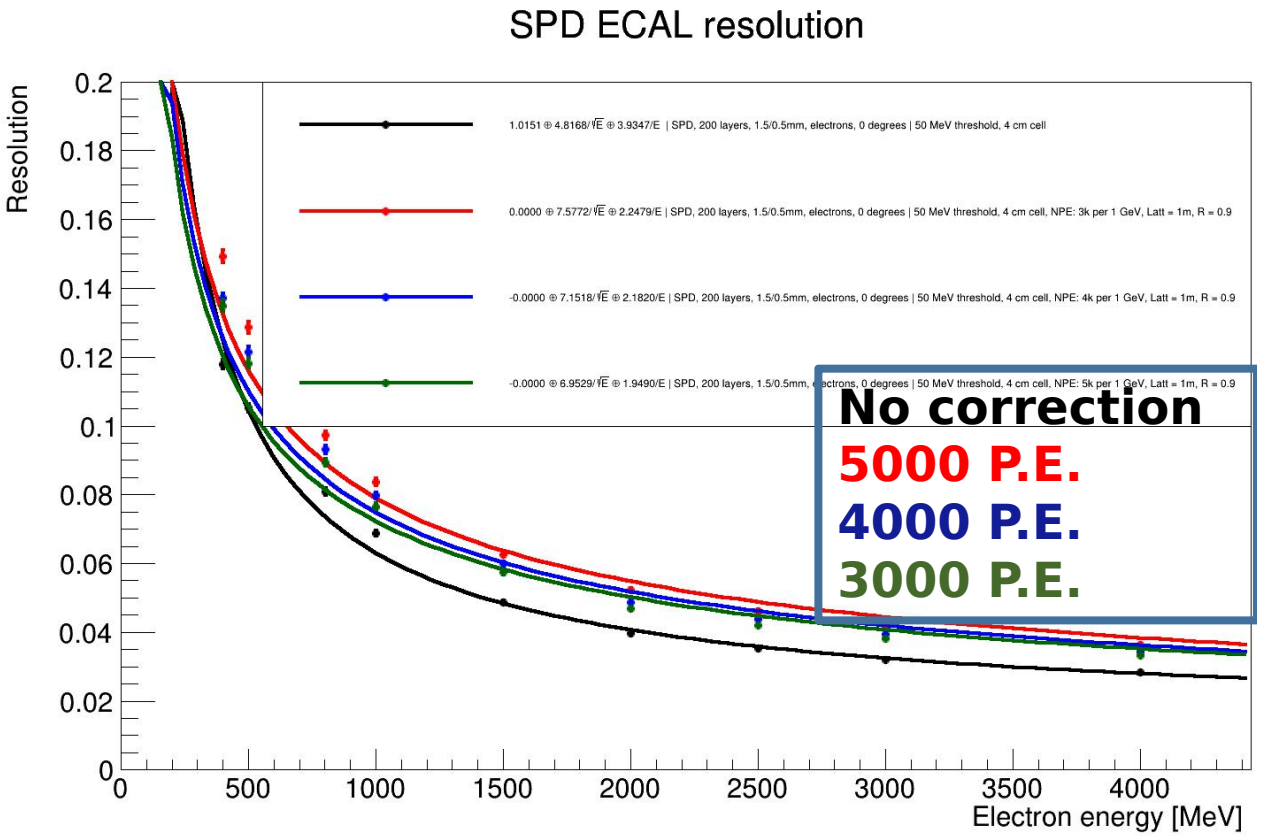
ECAL resolution for different angles

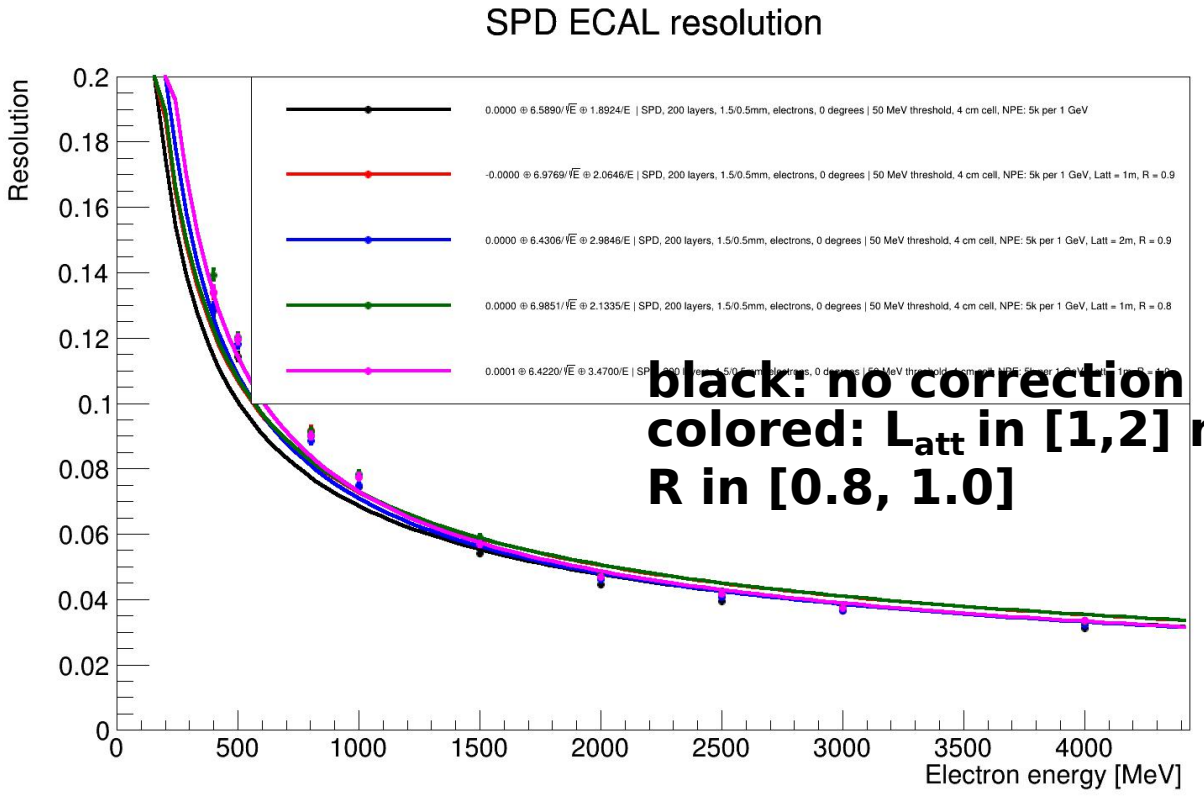




The angle effect is not caused by increasing the effective width of ECAL

Effect of corrections on ECAL resolution

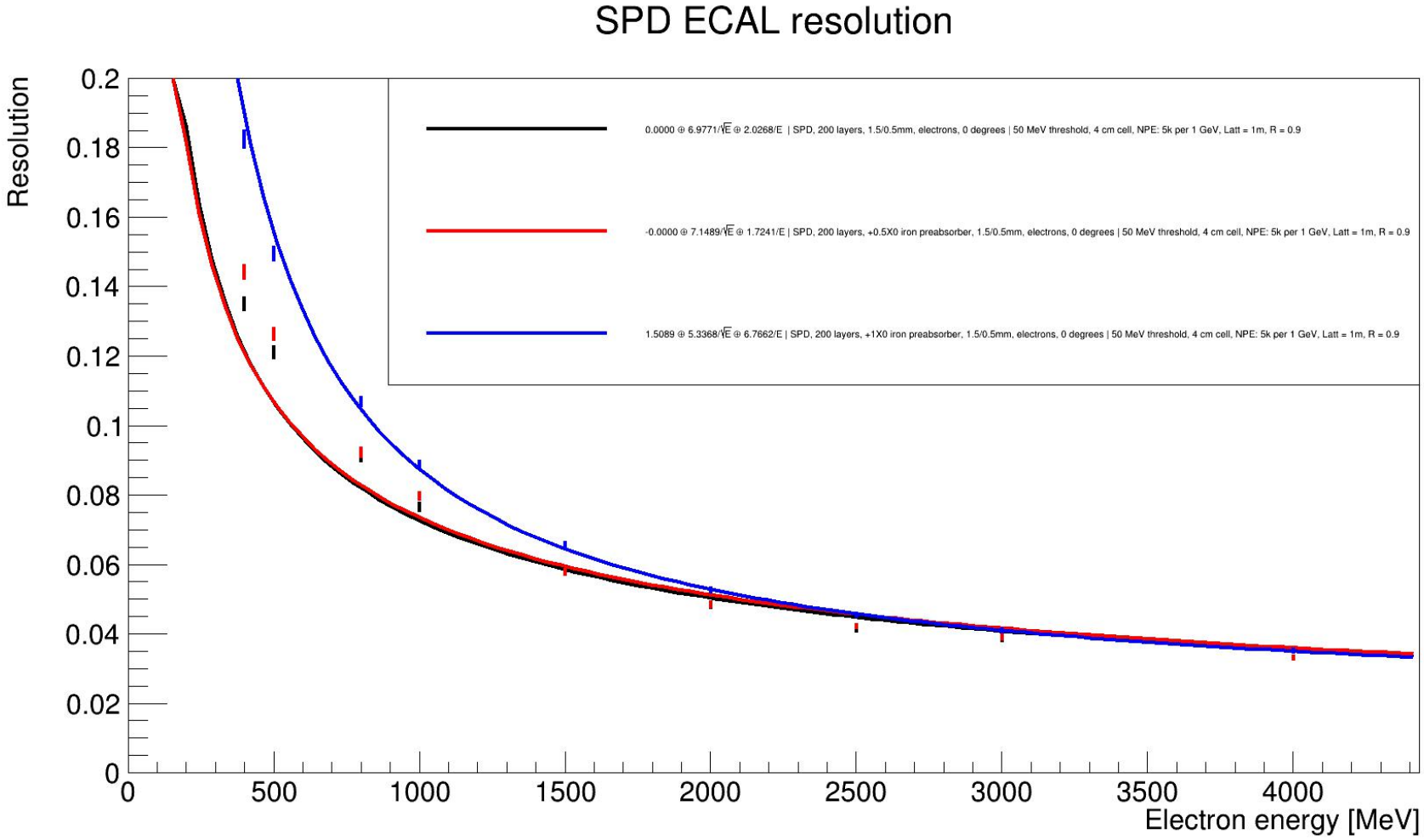




All other corrections are also applied

Bigger contribution is from photoelectron statistics

What is the effect of magnet coils on ECAL resolution?



no “preabsorber”

0.5 X_0 “preabsorber”

1.0 X_0 “preabsorber”

Summary and outlook

- Approximate result for ECAL resolution: $7\%/\sqrt{E} \oplus 2\%$

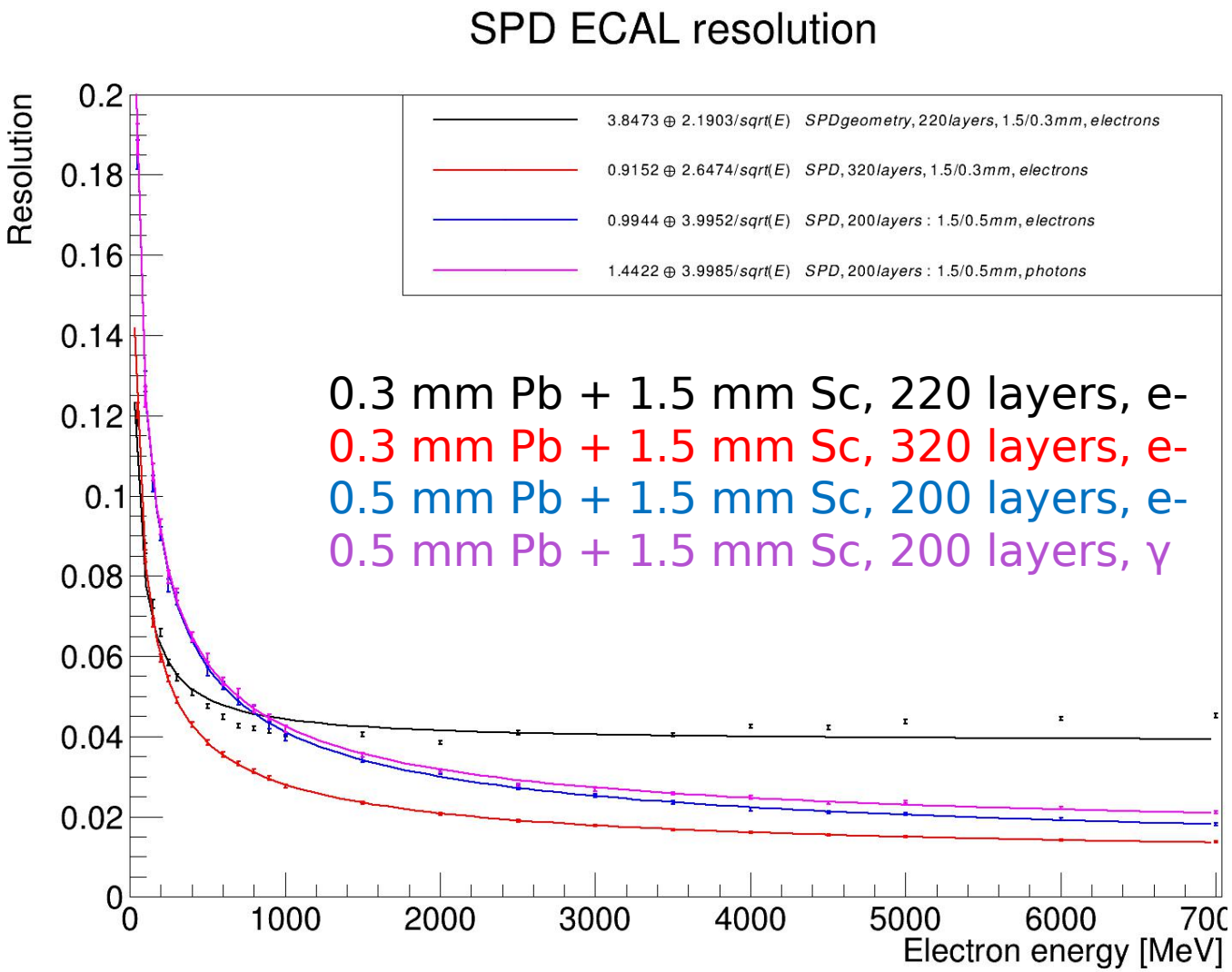
(in the range of 0.1 - 4 GeV, shashlyk modules, with all corrections)

- Setup details are still under discussion

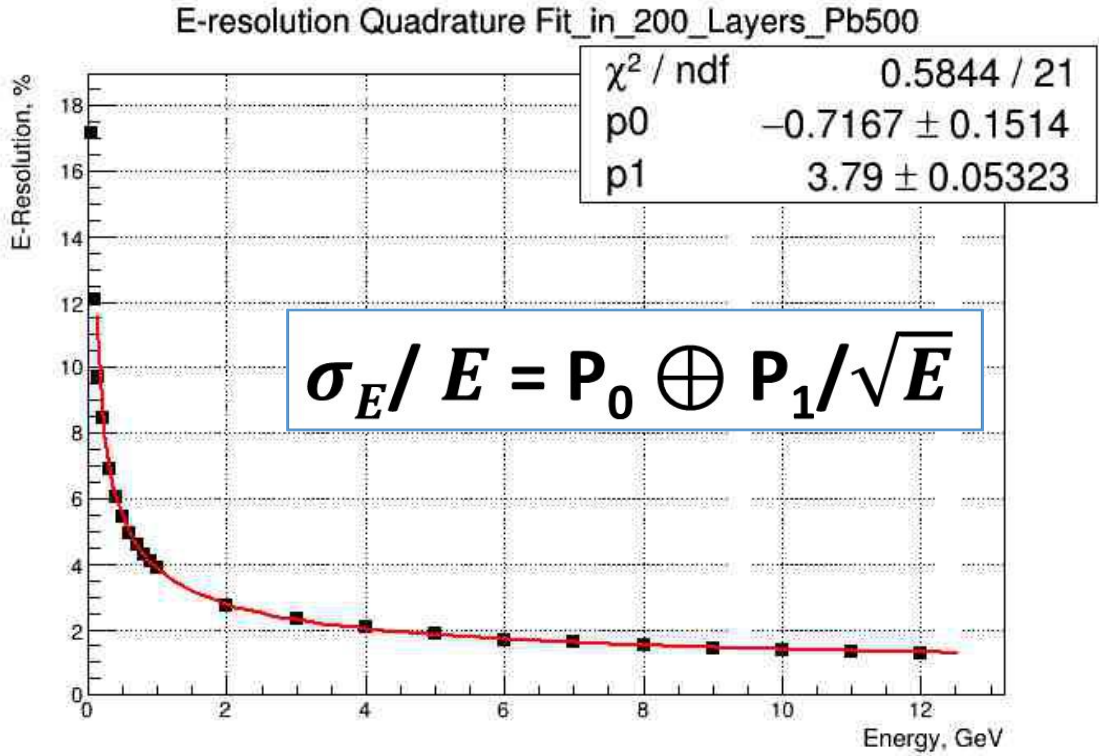
Any other requests? (Scintillator modules?)

Future steps (next month): projective ECAL geometry (fully parametrized), reconstruction algorithm

BACKUP



0.5 mm Pb + 1.5 mm Sc, 200 layers, e-
(Result of O.Gavrishchuk)



The results are consistent with the results of O.Gavrishchuk
200 layers, 0.5 mm Pb + 1.5 mm Sc was taken for further studies