

# **ECAL reconstruction in SPDROOT and macros for testing and calibration**

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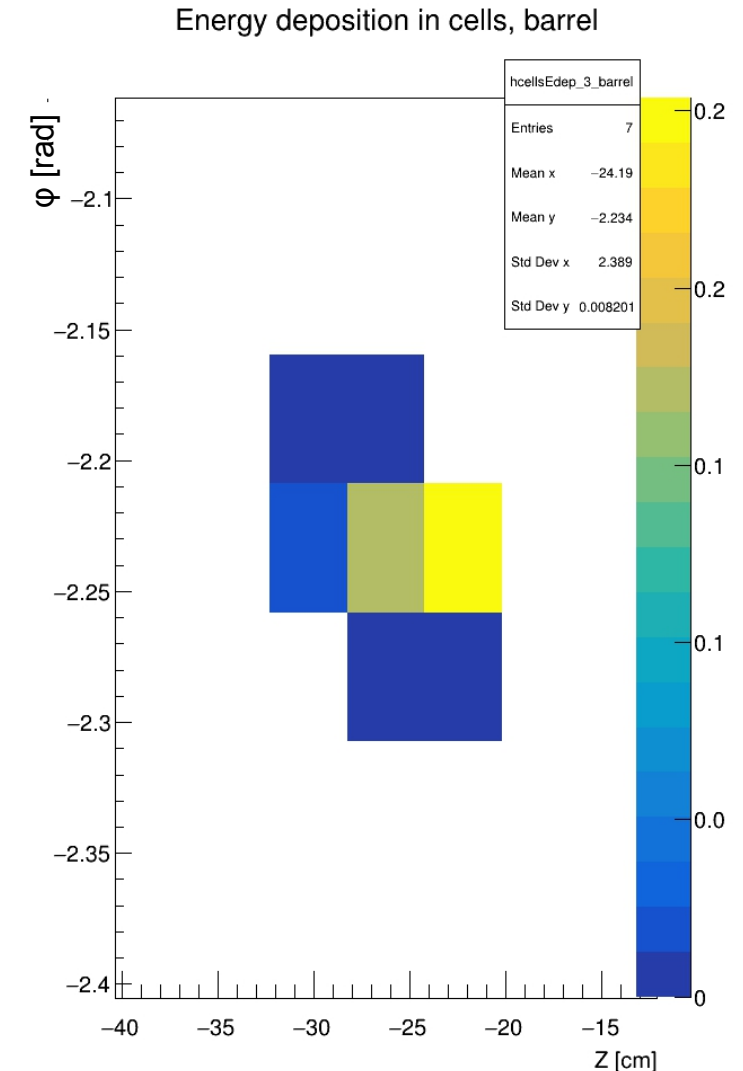
**SPD Physics Bi-Weekly Meeting**

# Status of ECAL reconstruction in SPDR00T

- Cell energy calibration:  $\Sigma E(\text{scint}) \rightarrow \Sigma E(\text{scint}+\text{lead})$ : linear correction, depends on number of layers
- “Simple” reconstruction: 1 cluster (set of neighboring cells)  $\rightarrow$  1 reconstructed particle
- Logarithmic weighting of cells:  $x_c = \frac{\sum_i W_i(E_i) x_i}{\sum_i W_i(E_i)}$

$$W_i^{(\log)}(E_i) = \text{Max}\{0, a_0 + \ln(E_i) - \ln(E_{\text{total}})\}.$$

- $a_0$  depends on energy, angle  $\rightarrow$  calibration sensitive to cell size, number of layers etc.



# Compilation of test pictures

- <https://git.jinr.ru/AndreiMaltsev/spdroot-testing-scripts>
- A macro for testing  $\gamma$  detection efficiency, resolution etc. is present
- Macro for  $\pi^0$  efficiency, resolution in progress
- How to use: main macro: scripts/ECAL/ReconstructionAlgorithms.py (symlink)
- change the outputDir to where you want to store your files (large storage)
- several options that describe geometry, generator, reconstruction parameters

```
options = ["fakeGamma0Deg_energyLow_TDR", "fakeGamma0Deg_energyMid_TDR", "fakeGamma0Deg_energyHigh_TDR"]
mainOpt = "20220728_newUpdateMerged"
neventsPerJob = 100
njobs = 180

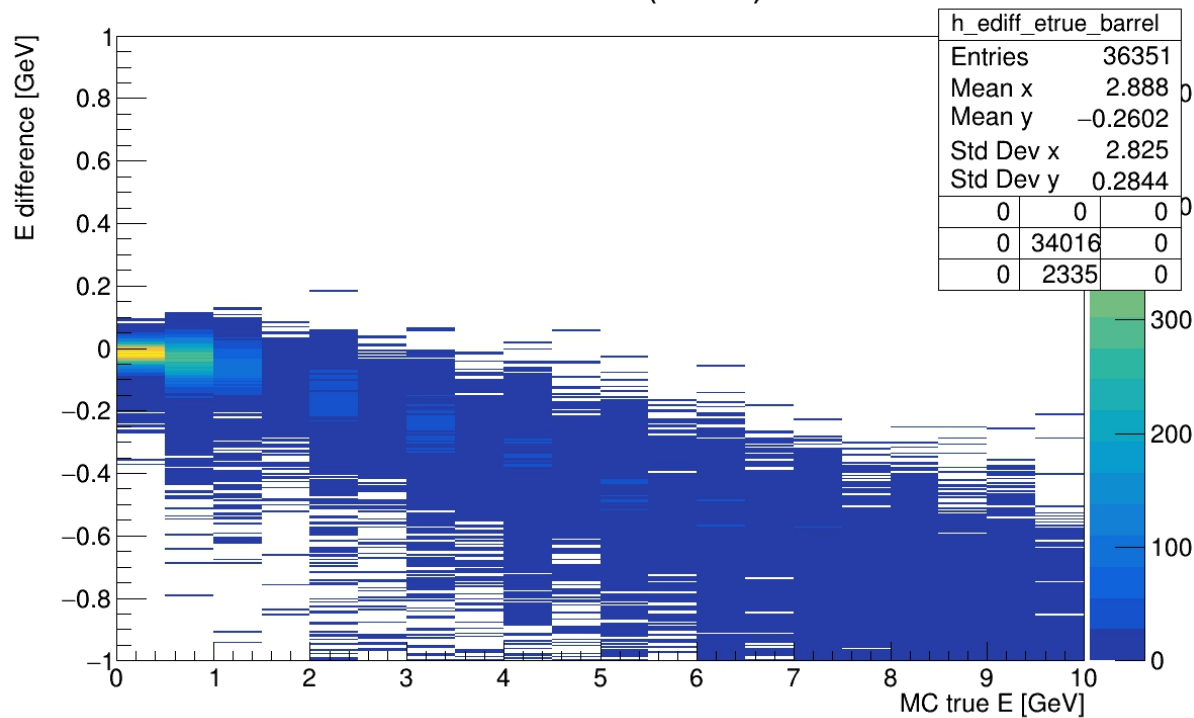
outputDir = "/media/andre/SPD_DATA/SPD/" + mainOpt + "/"
```

```
"fakeGamma0Deg_energyLow_TDR":
{
  "geomParams": "GeometryParams().SetNLayers(190).SetCellPhiInnerSize(3.4)",
  "genParams": "IsotropicGeneratorParams().SetZSmear(30.0).SetPdg(22).SetEStep(0.1).SetNESteps(10).SetThetaRange(89.7, 89.8)",
  "recoParams": "RecoParams().SetRecoVertices(false).SetRecoTracksMC(false).SetRecoRS(false).SetRecoTS(false).SetRecoITS(false).SetRecoTracksRC(false)"
}
```

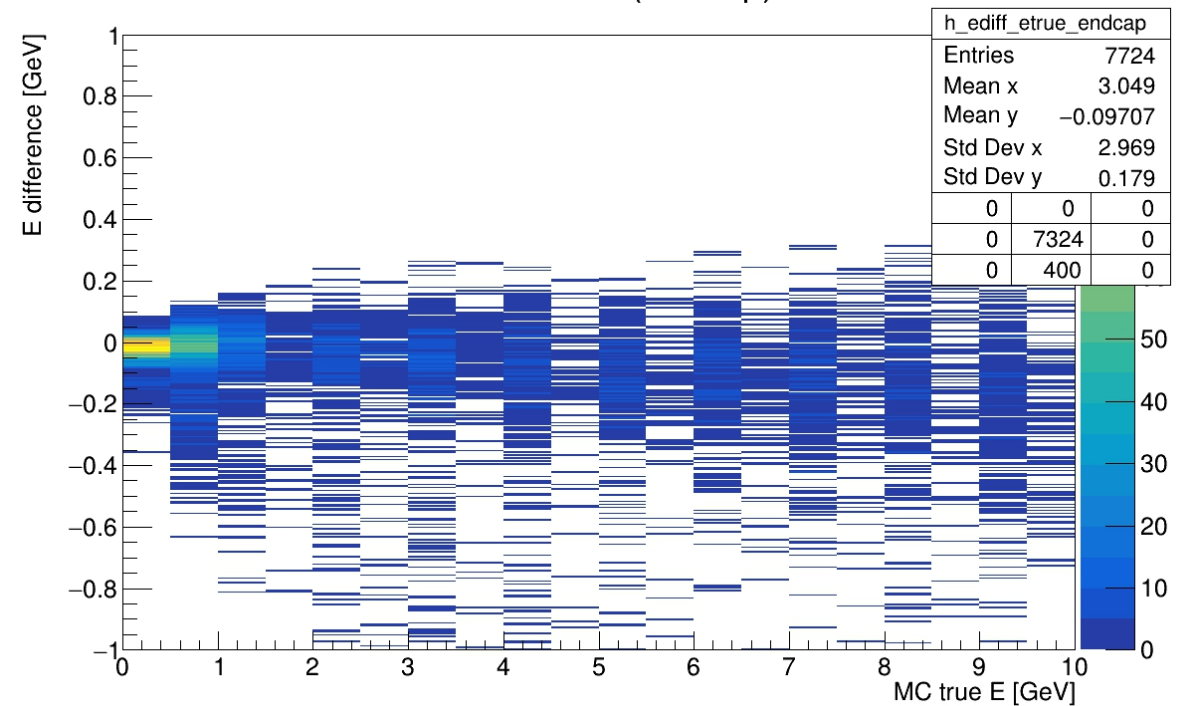
# Pictures

- final/h\_ediff\_etrue\_barrel and final/h\_ediff\_etrue\_endcap

E resolution (barrel)

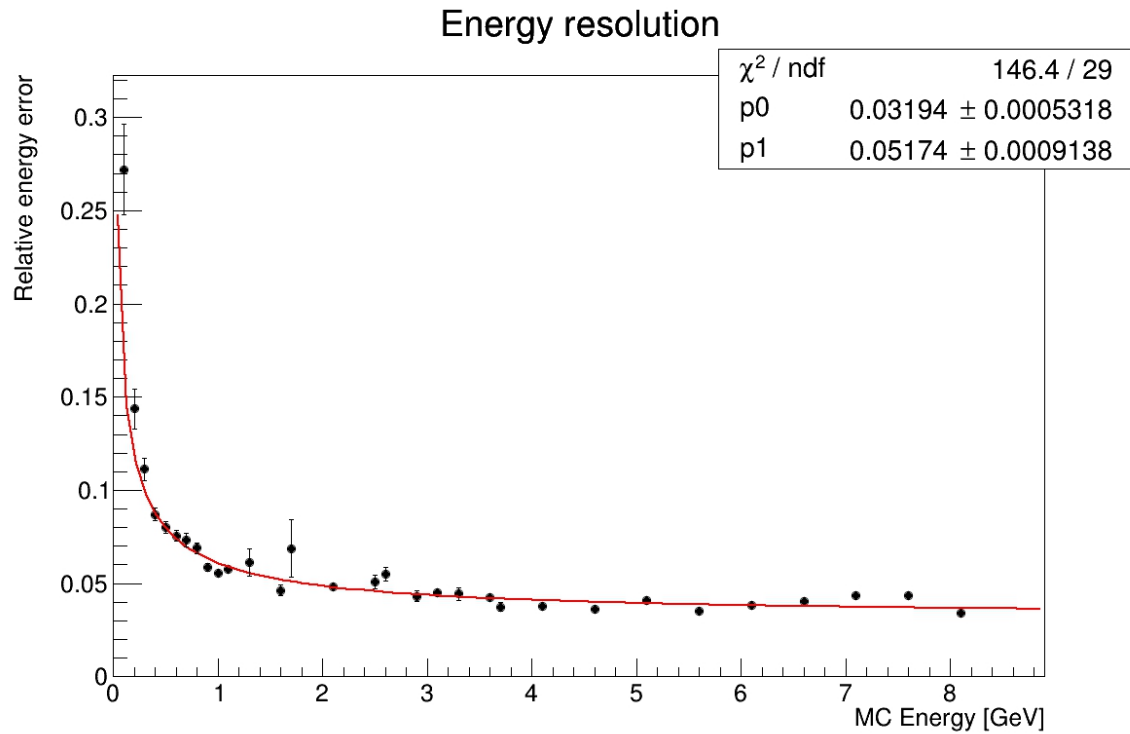


E resolution (endcap)

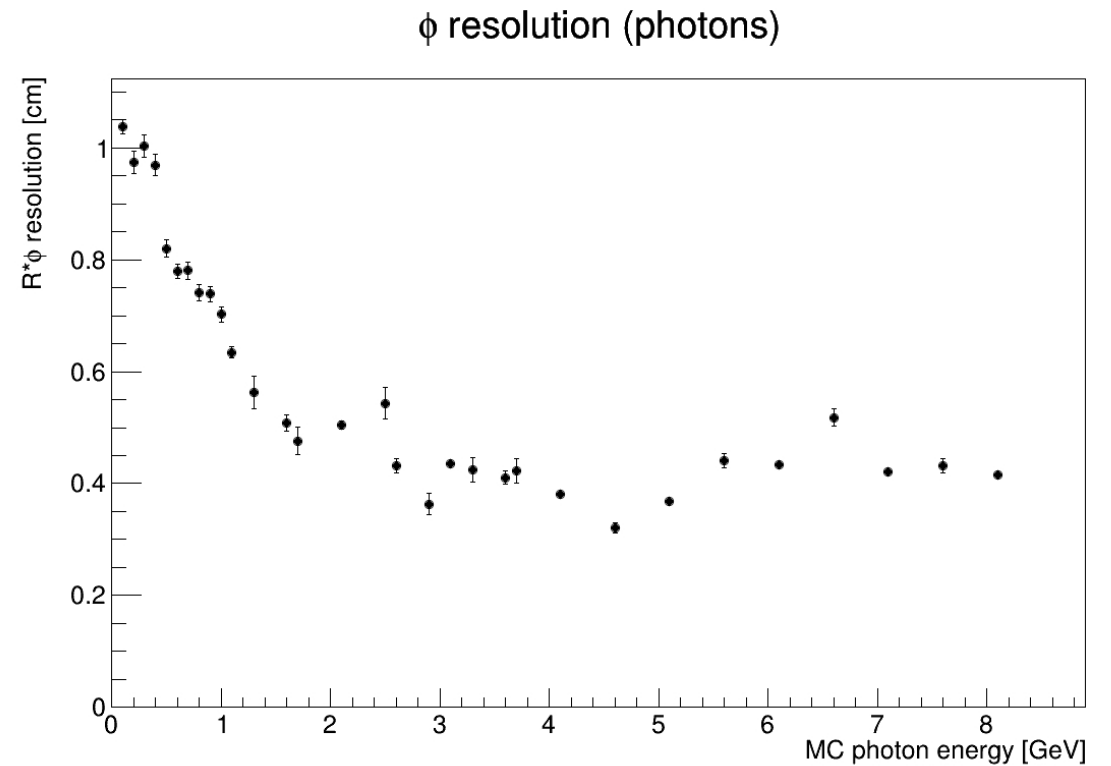


# Pictures

final/h\_ereco\_MCenergy\_energyDisc\_graph



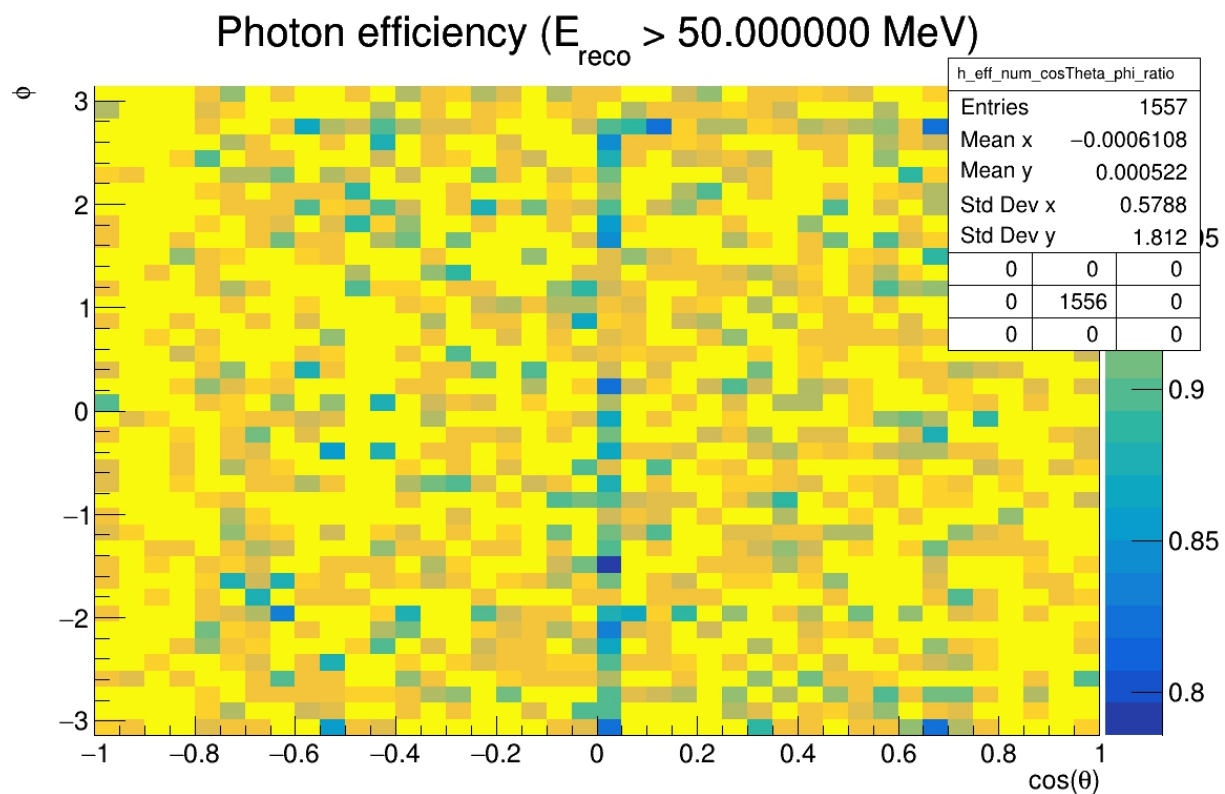
final/h\_phidiff\_MCenergy\_energyDisc\_graph



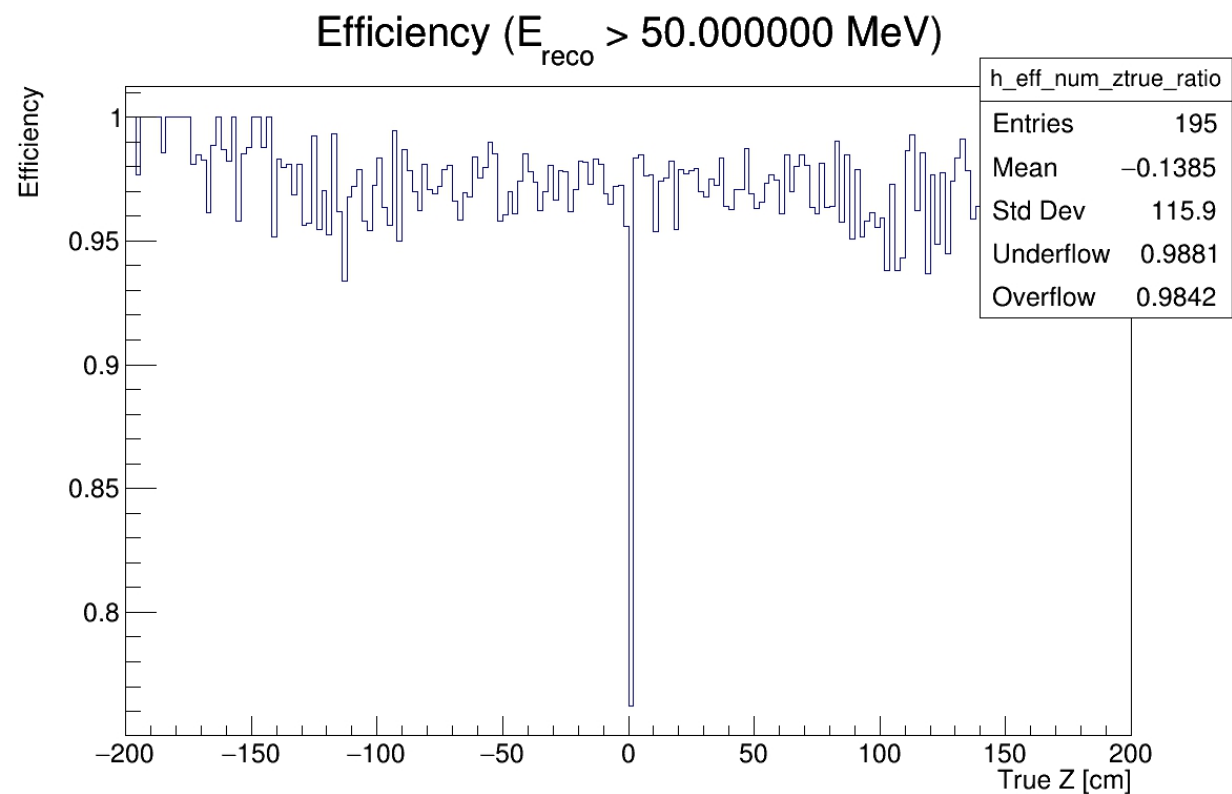
Resolution at low energies should be (cell size)/sqrt(12)

# Pictures

$h\_eff\_num\_cosTheta\_phi/h\_eff\_num\_cosTheta\_phi\_ratio$



$h\_eff\_num\_ztrue/h\_eff\_num\_ztrue\_ratio$



# Conclusions

- The issue with energy miscalibration, which causes  $\pi^0$  mass shift, is known and is being worked on;
- it is planned to implement fast simulation in ECAL, to avoid extra problems with miscalibrations and improve simulation speed;
- one can use the test macros to monitor the quality of ECAL reconstruction with little effort, these macros are being continuously developed (e.g the Z smear of the vertex position and  $\theta$  range don't work yet);
- send your requests/proposals!