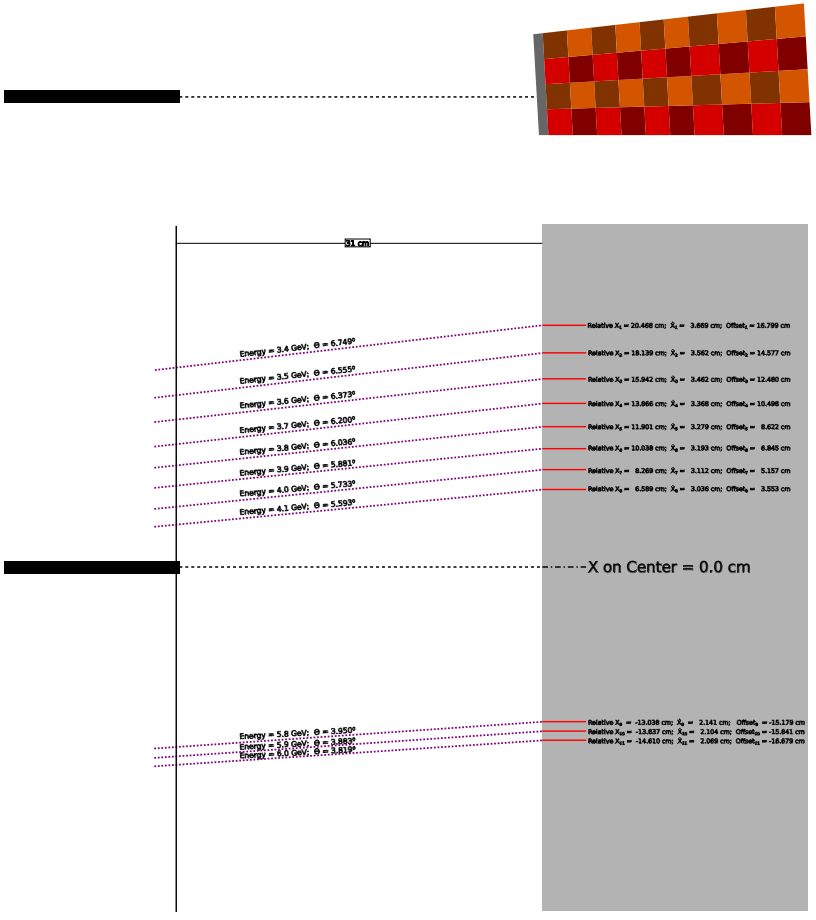
Energy Resolution
BeamTest
JLab HallD, 2023

Setup, with Cladding Material as Composite




```
<material name="SciFiPb_Scintillator">
  <D type="density" value="1.049" unit="g / cm3"/>
  <fraction n="0.077" ref="H"/>
  <fraction n="0.921" ref="C"/>
  <fraction n="0.001" ref="N"/>
  <fraction n="0.001" ref="O"/>
    <constant name="BirksConstant" value="0.132*mm/MeV"/>
```

```
</material>
<material name="SciFiPb_Scintillator_Cladding">
  <D type="density" value="1.190" unit="g / cm3"/>
  <composite n="8" ref="H"/>
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  <composite n="2" ref="O"/>
</material>
```
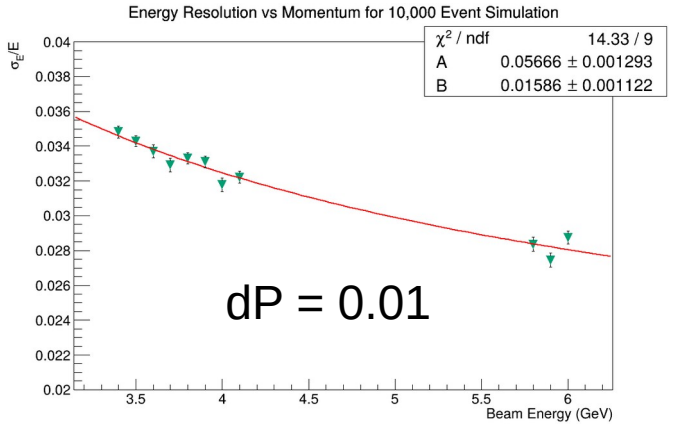
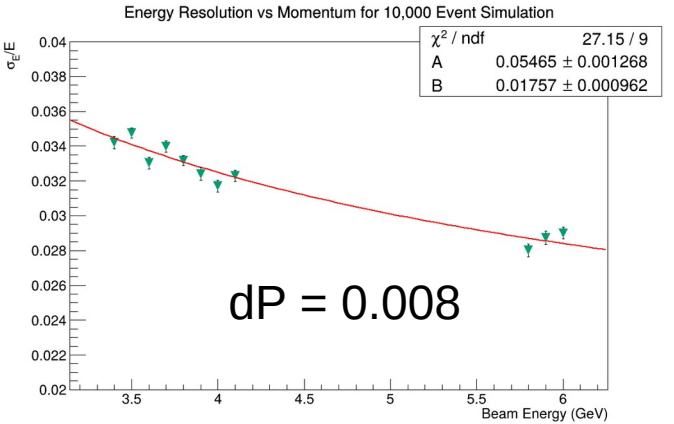
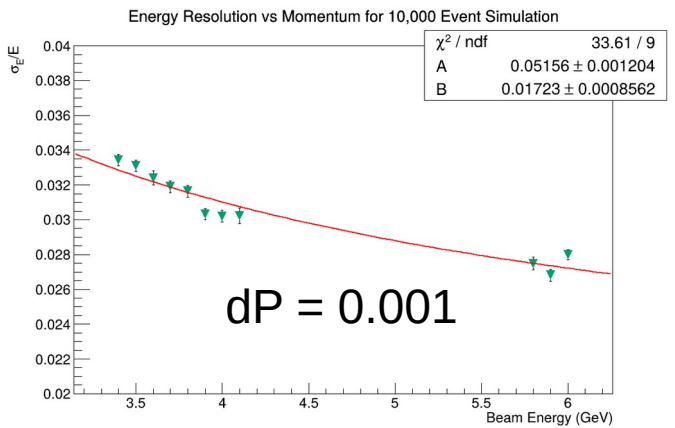
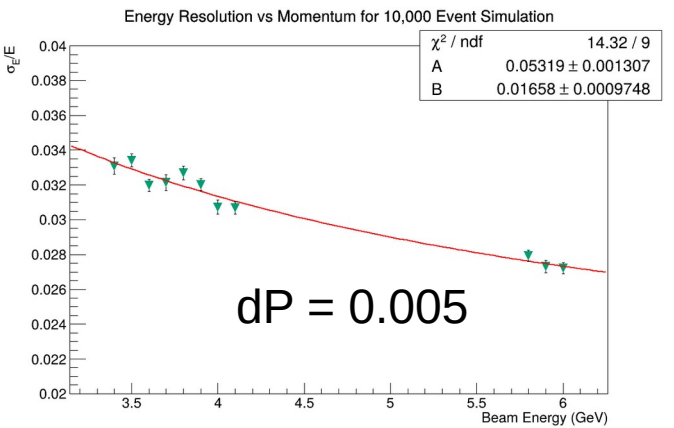

6% Cladding, PMMA (Composite Definition), No Threshold Applied









Combine 0.5% with 0.8%

Performance of the Pair Spectrometer in Hall D at Jefferson Lab

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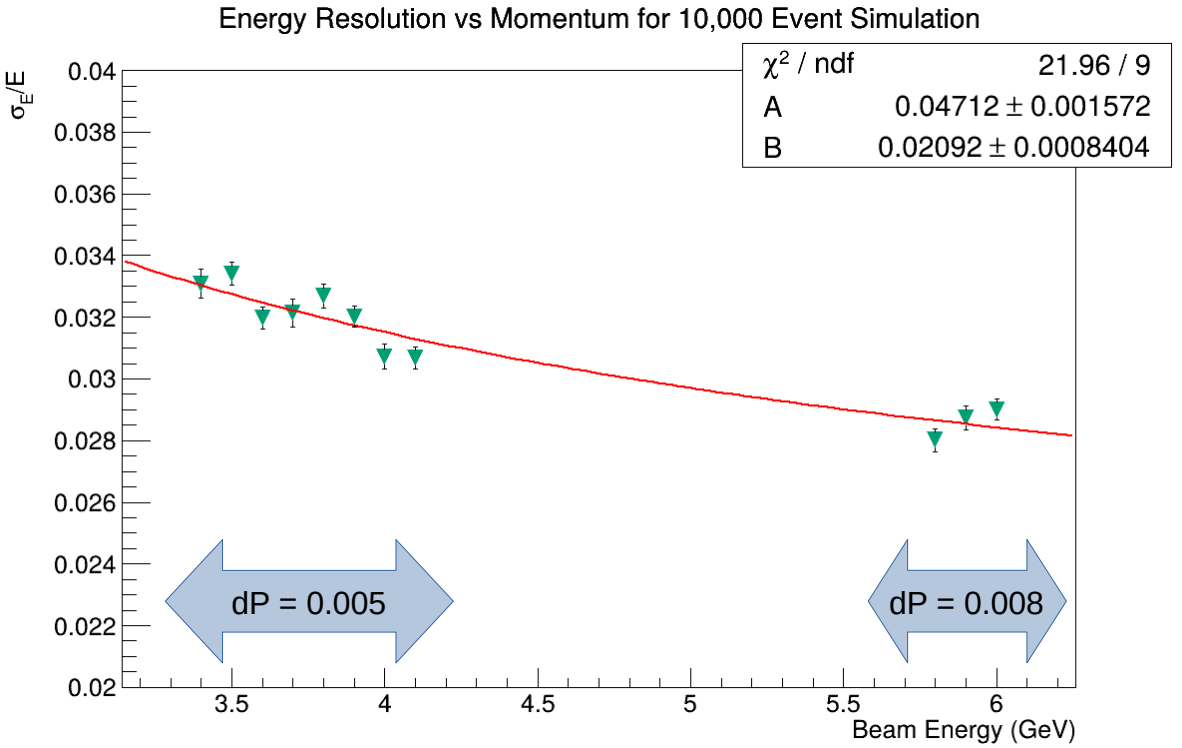
[b] National Research Nuclear University MEPhI, Moscow, Russia

4. Test setup using pair spectrometer

The pair spectrometer provided a unique capability for testing calorimeter prototypes using leptons produced via the e^+e^- pair-production process. The test setup was installed in the positron arm of the PS, approximately 80 cm downstream of the coarse counters, as shown in Fig. 2. This configuration allowed prototype tests to be conducted in parallel with GlueX data taking and enabled rapid reconfiguration during routine accelerator and detector maintenance.

Lepton energies were determined using the PS hodoscope counters, which spanned 3-6 GeV for most Hall D experiments. For typical GlueX production running with a 75 μm Be converter and a 5 mm-diameter beam collimator, the relative energy resolution of leptons in the prototype region exhibited a weak energy dependence, increasing from approximately 0.5% at 3 GeV to about 0.8% at 6 GeV. The resolution depends on the beam-spot size on the PS converter, set by the collimator diameter. Since the e^+e^- production vertex is not reconstructed



Comparison with Experimental Results

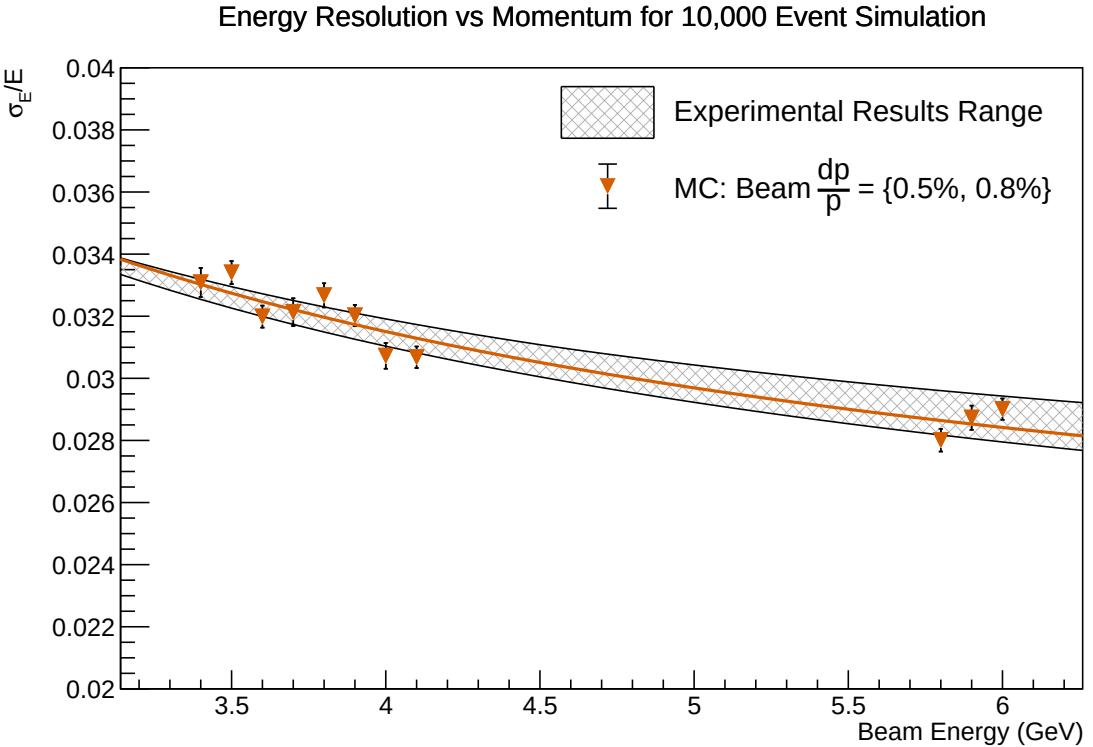
Energy Resolution and Number of Photoelectrons
of a prototype lead-scintillating fiber calorimeter
(work in progress)

U of Regina/JLab: Maggie, Jon, Zisis, Dave, Sasha, Vlad,
Karthik, Stjepan et al.

August 2024

Run #	a (%)	δa (%)	b (%)	δb (%)	χ^2/NDF	# events
121050	4.68	0.02	2.04	0.01	185.3/35	5173816
121051	4.66	0.02	2.05	0.01	208.2/35	5170644
121128	4.42	0.02	2.28	0.01	389.6/35	5150822
121129	4.27	0.03	2.35	0.01	345.9/35	5149274
121185	4.34	0.02	2.34	0.01	302.8/35	2433483
121186	4.24	0.03	2.38	0.01	434.9/35	2405987
121197	4.64	0.03	2.10	0.01	105.6/33	5462274
121199	4.72	0.03	2.05	0.01	199.3/33	5533506
121200	4.72	0.03	2.05	0.01	205.8/33	5642726
121201	4.66	0.03	2.09	0.01	226/33	5658354
121204	4.56	0.03	2.14	0.01	171.1/33	5662725
121206	4.72	0.03	2.06	0.01	144.1/33	5660740
121216–121219	5.71	0.01	0.00	4.65	43.55/33	236953
121221–121223	5.43	0.02	0.8	0.3	39.55/33	162258

Table 2: Summary of a, δa, b, δb, and χ^2 values found across all run numbers after applying cuts due to energy leakage. χ^2 values are divided by the number of degrees of freedom (NDF).



Experimental Results Range:
The maximum and minimum values are calculated from each of the above tabulated resolution fits at various points along x. The last two tabulated rows are excluded.