ECAL PID Efficiency with Light Yield

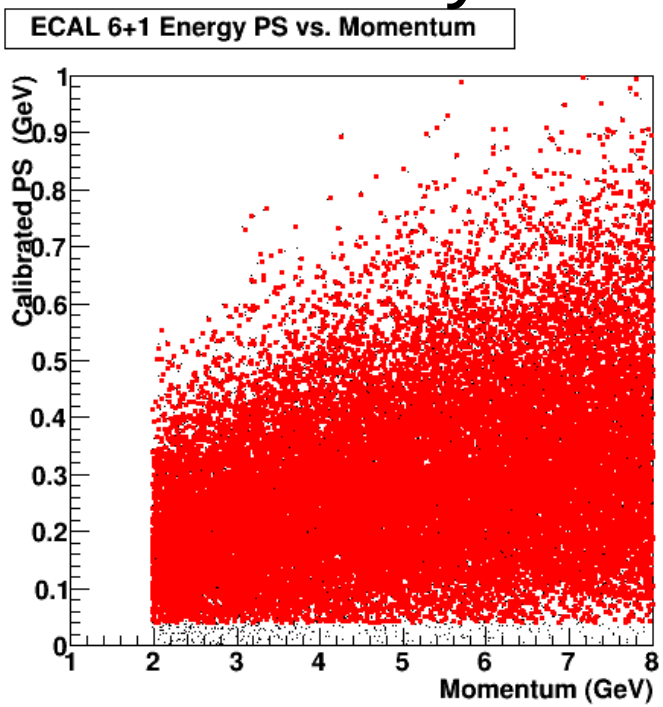
Update 5

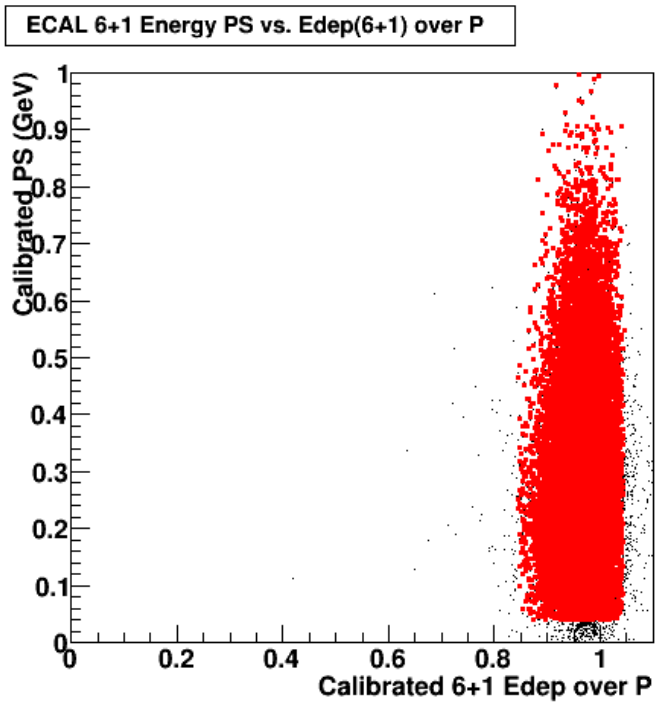
Simulation Overview

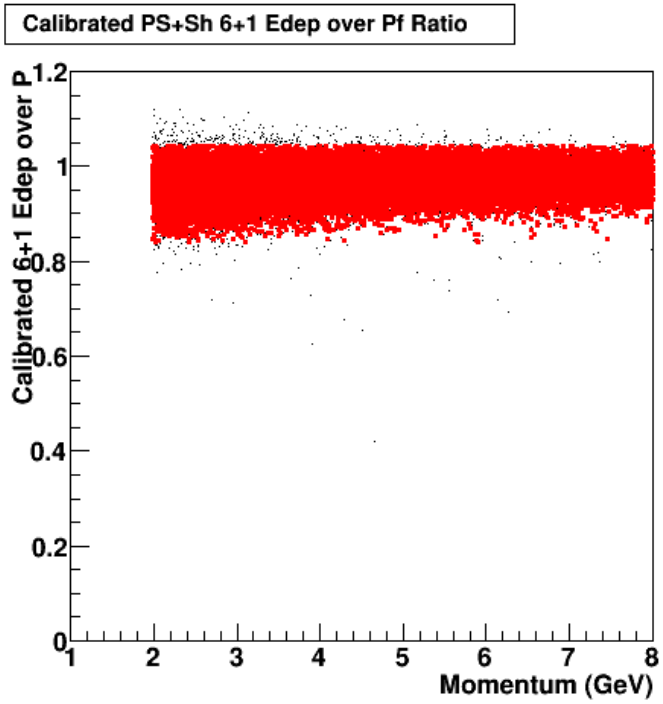
- Uniform electrons and Pions distributions incident on ECAL
- Started implementing light yield for scintillator material
  - Birk's attenuation : The quenching effect in scintillators where light output saturates when the energy loss density is large
  - For the scintillator used for ECAL : Birk's constant is 0.126 mm/MeV

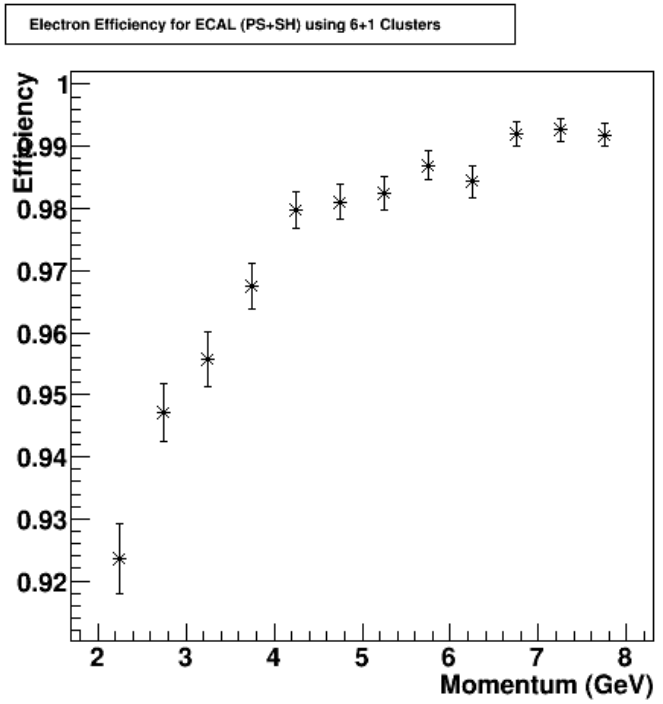
```
G4Material* Sci =
new G4Material("Scintillator", density= 1.032*g/cm3, ncomponents=2);
Sci->AddElement(C, natoms=9);
Sci->AddElement(H, natoms=10);
```

Electron Efficiency: no Birk's Attenuation

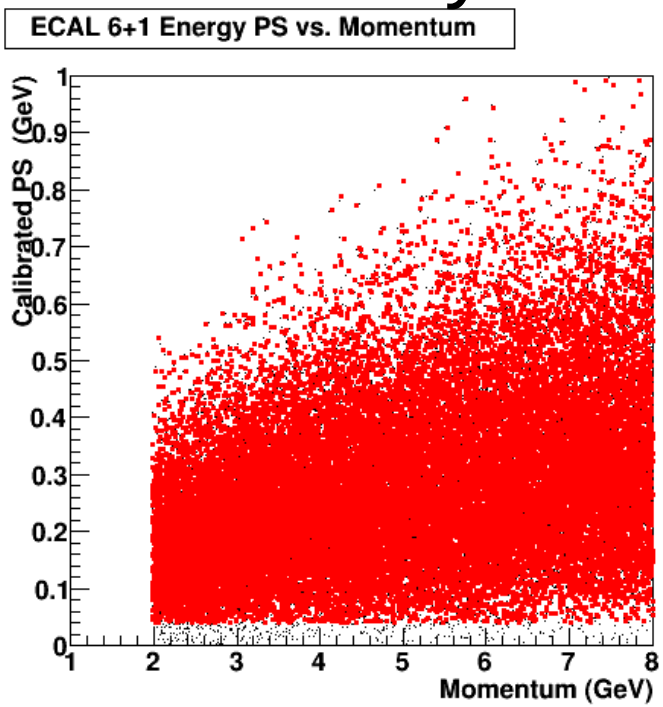


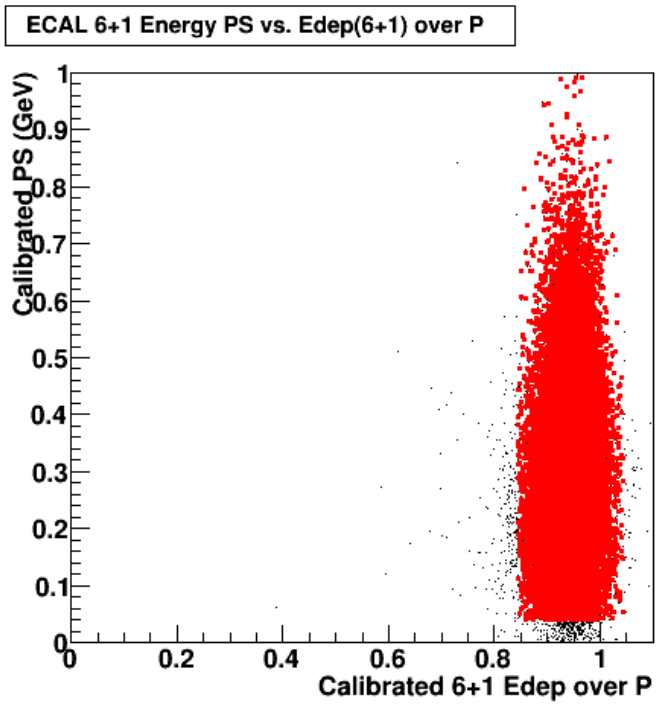


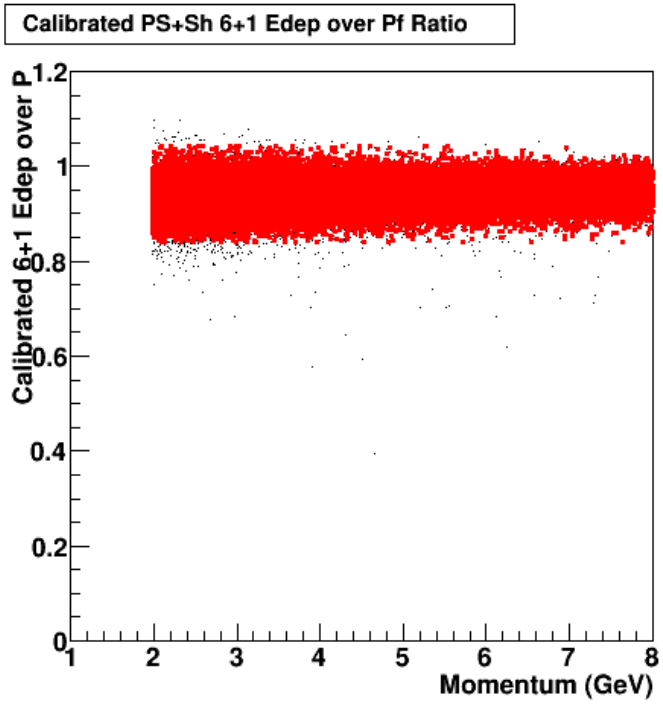


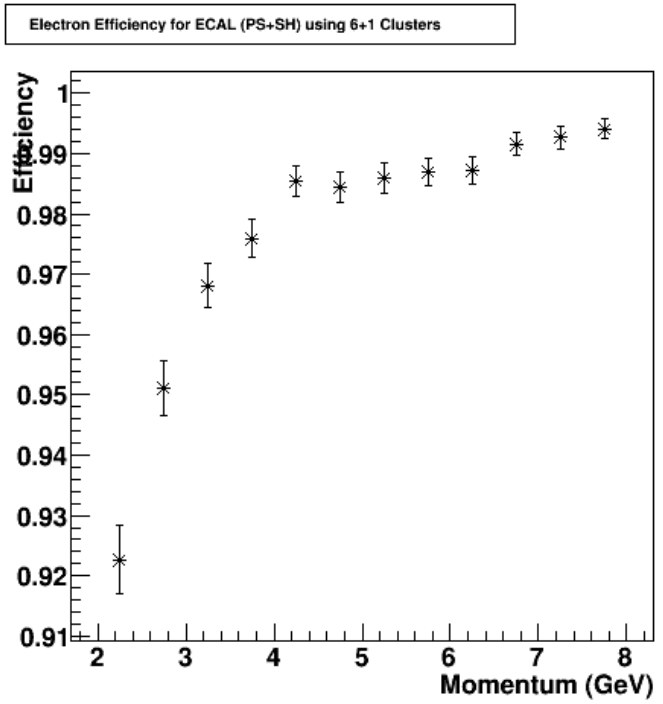


Electron Efficiency: with Birk's Attenuation

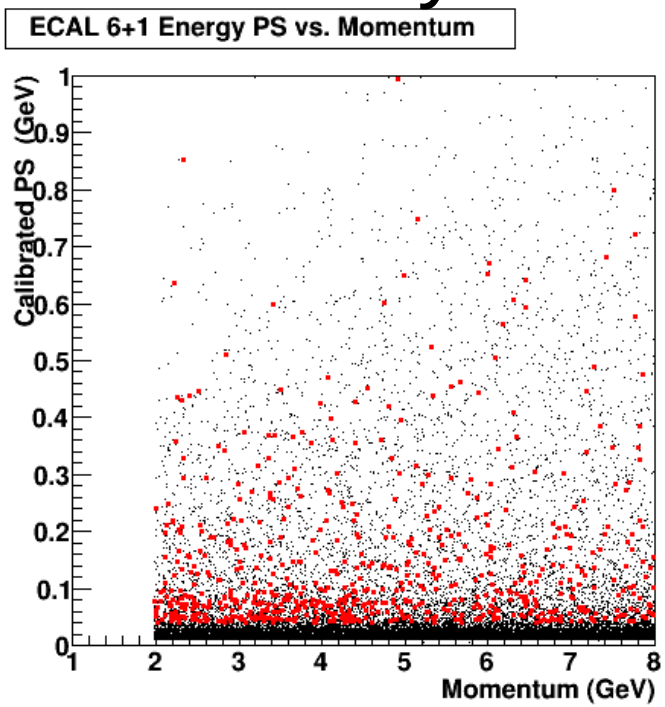


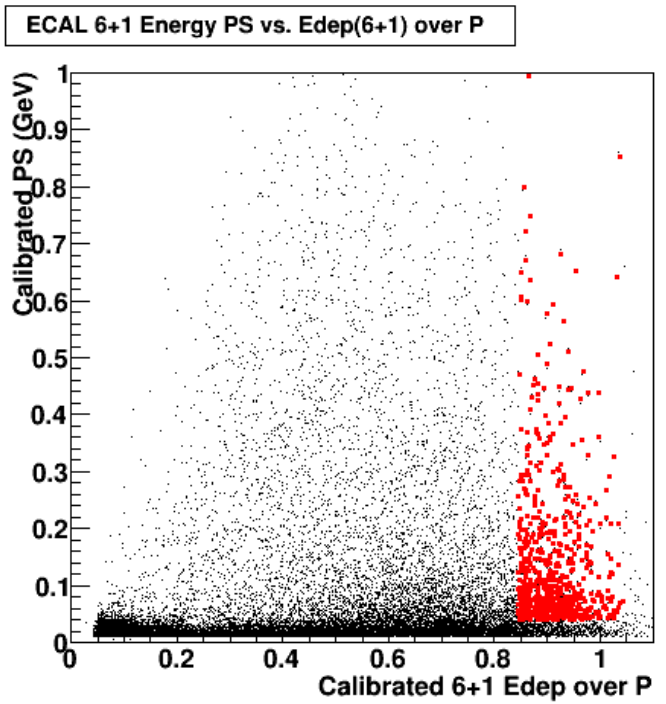


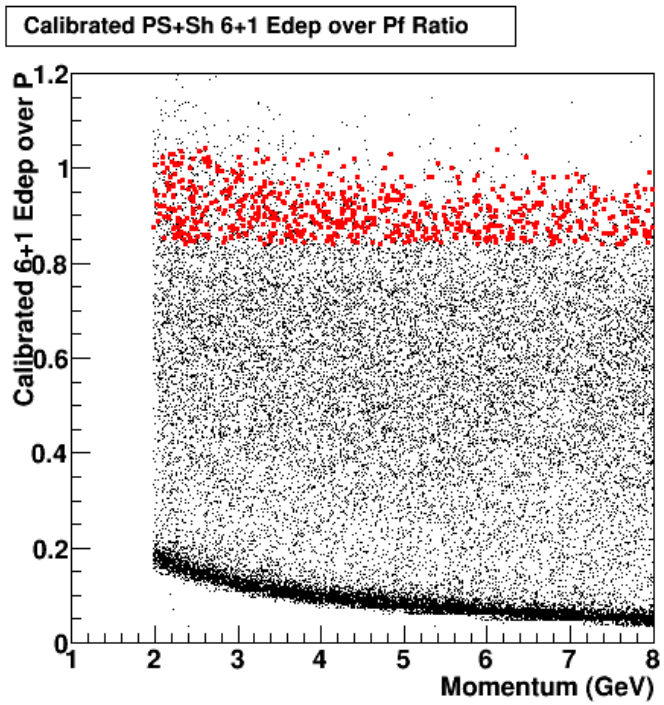


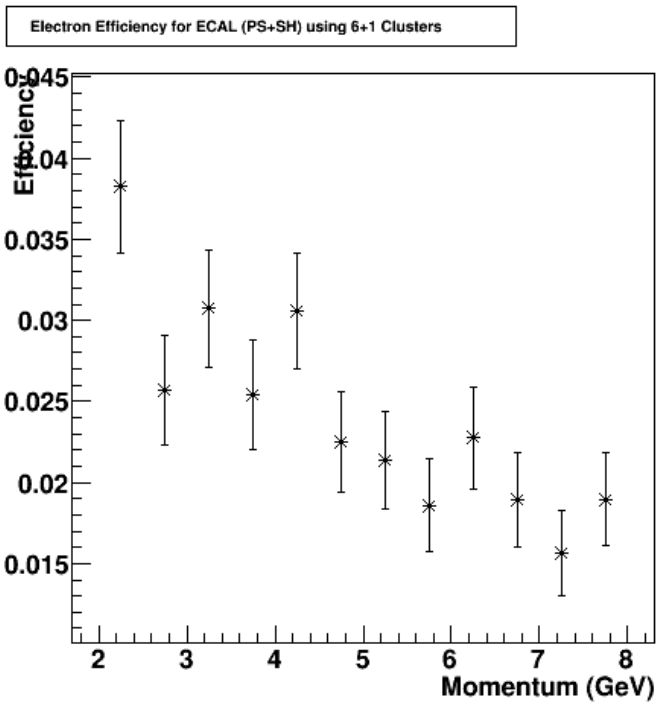


Pion Efficiency: no Birk's Attenuation

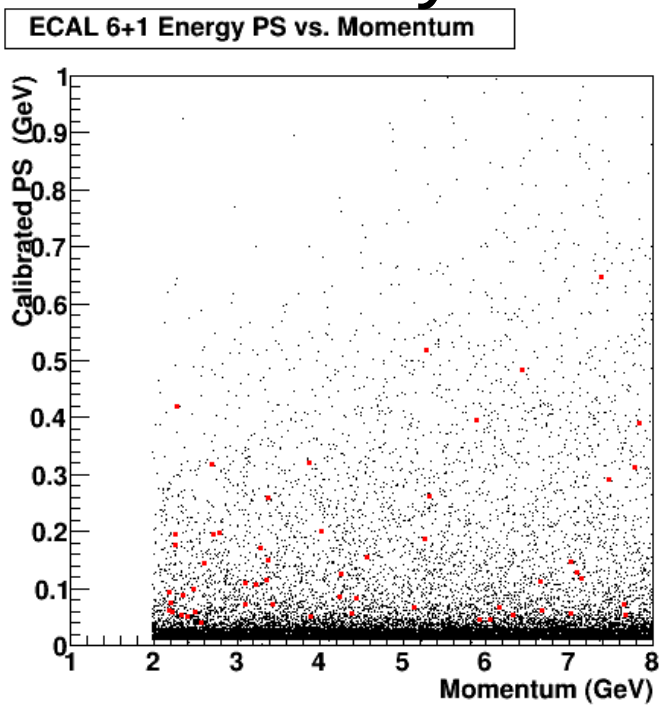


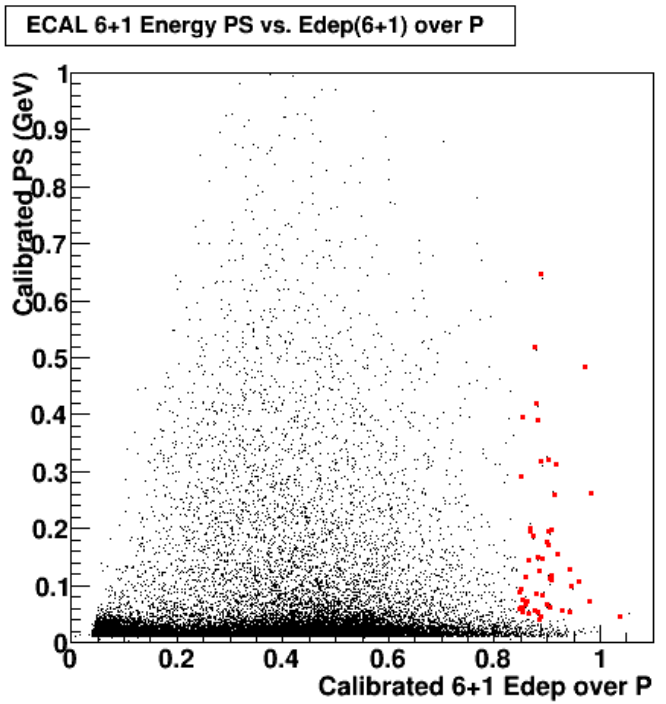


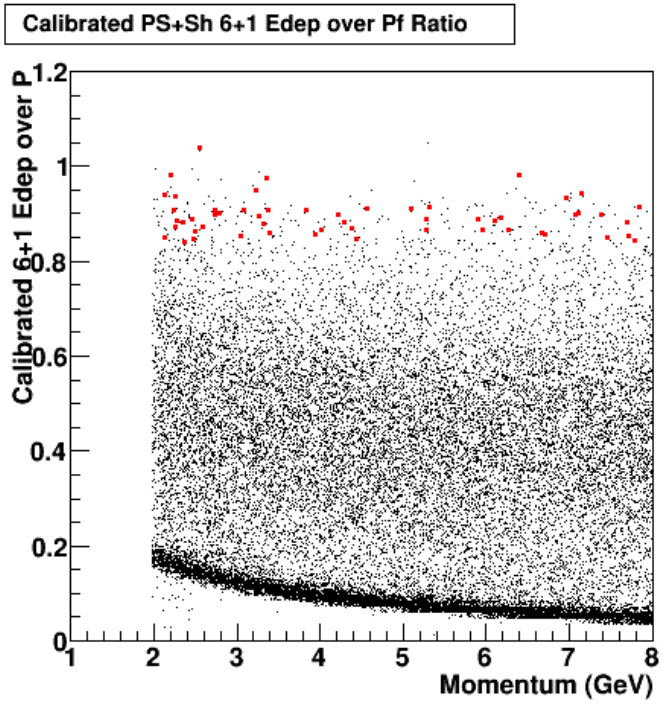


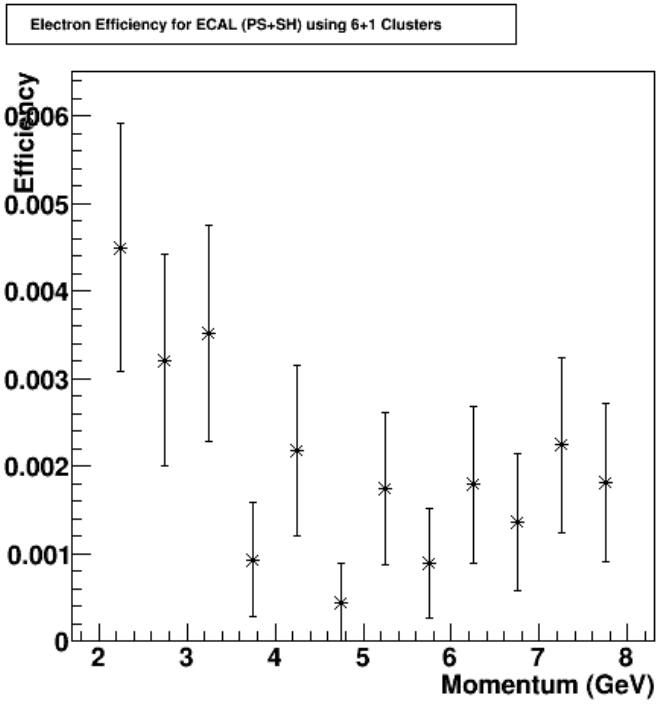


Pion Efficiency: with Birk's Attenuation









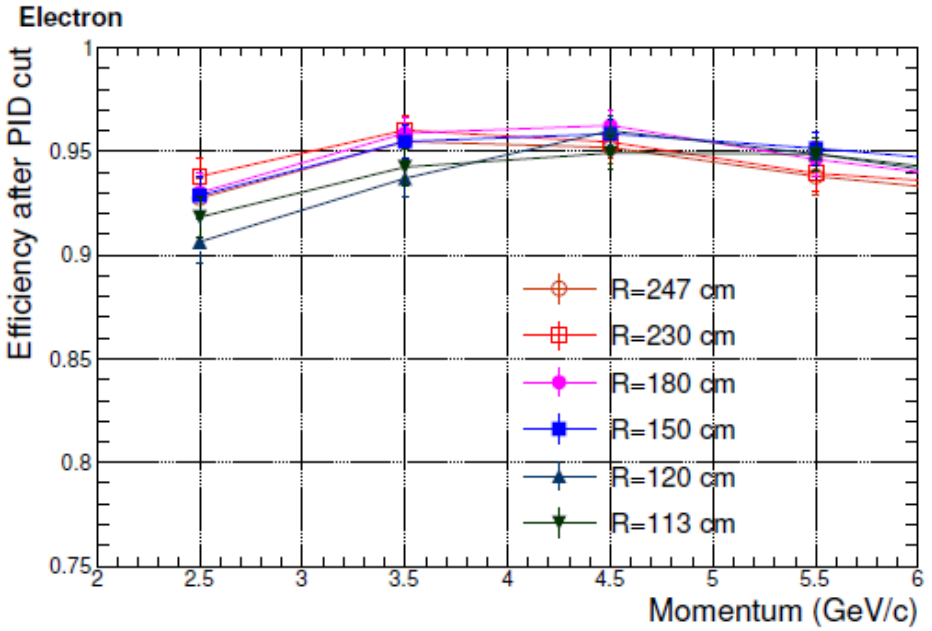
PID Efficiency : no Birk Effect

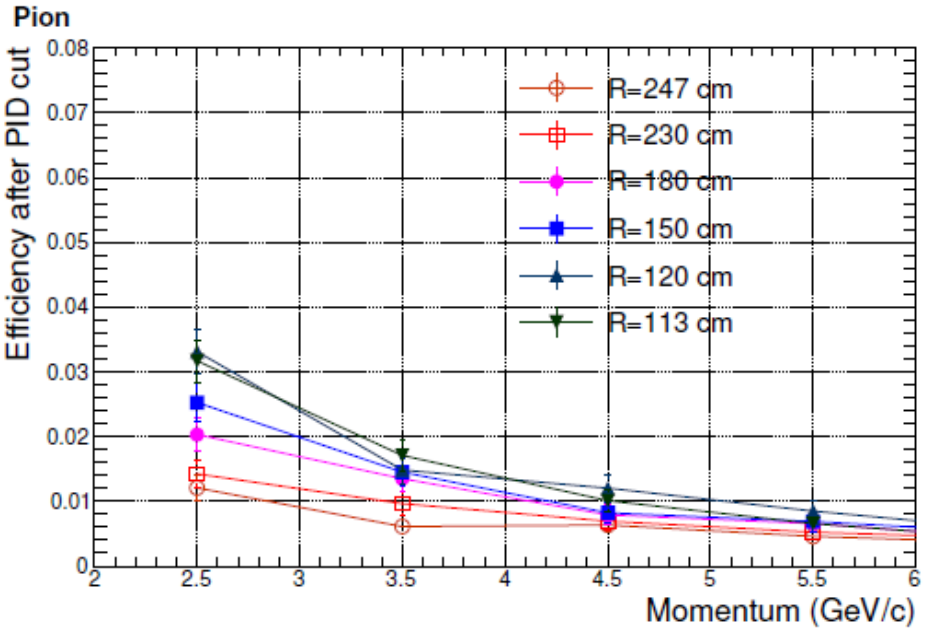
	Electron		Pion	
Momentum	Efficiency	Error	Efficiency	Error
2.25	0.924	0.006	0.038	0.004
2.75	0.947	0.005	0.026	0.003
3.25	0.956	0.004	0.031	0.004
3.75	0.967	0.004	0.025	0.003
4.25	0.98	0.003	0.031	0.004
4.75	0.981	0.003	0.022	0.003
5.25	0.982	0.003	0.021	0.003
5.75	0.987	0.002	0.019	0.003
6.25	0.984	0.003	0.023	0.003
6.75	0.992	0.002	0.019	0.003
7.25	0.993	0.002	0.016	0.003
7.75	0.992	0.002	0.019	0.003

PID Efficiency : with Birk Effect

	Electron		Pion	
Momentum	Efficiency	Error	Efficiency	Error
2.25	0.923	0.006	0.004	0.001
2.75	0.951	0.004	0.003	0.001
3.25	0.968	0.004	0.004	0.001
3.75	0.976	0.003	0.001	0.001
4.25	0.985	0.002	0.002	0.001
4.75	0.984	0.003	0.0001	0.0001
5.25	0.986	0.002	0.002	0.001
5.75	0.987	0.002	0.001	0.001
6.25	0.987	0.002	0.002	0.001
6.75	0.992	0.002	0.001	0.001
7.25	0.993	0.002	0.002	0.001
7.75	0.994	0.002	0.002	0.001

From preCDR





Efficiency with Backgrounds From PreCDR			
Momentum (GeV)	Electron Efficiency	Pion Efficiency	Pi/e ratio
2.5	0.91	0.03	30.3
3.5	0.94	0.017	55.3
4.5	0.96	0.01	96.0
5.5	0.95	0.008	118.8