On the multiplicity of high-energy clusters

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The workflow

- After the clusterizer identified all clusters in an event, it looks for the beam-particle cluster (a.k.a. the “primary” cluster). It is defined as a highest-energy cluster in this event:

```
128    Double_t maxEnergy = 0.0;
129    for(Cluster * cluster: m_clusters){
130      if(cluster->Energy()>maxEnergy){
131        maxEnergy = cluster->Energy();
132        m_primCluster = cluster;
133      }
134    }
```

- The clusterizer does not throw away any clusters; it does not even know about our energy cut we require our beam-particle clusters to pass (>200 keV) as it happens later, at the analysis stage;

- If there are two or more clusters satisfying the E>200 keV requirement in an event, one of these will be a beam-particle cluster, and the other one(s) will be TR-photon cluster(s).

How often does a TR-photon cluster with E>200 keV show up in runs 45-55 of the 2018 data taking?

Trigger	Number of TR-photon clusters with $E > 200$ keV	Overall number of TR-photon clusters	Number of events	Fraction of TR-photon clusters with $E > 200$ keV per event
electron	2649	361k	229k	1.2%
pion	104	460	24k	0.4%
any of the above	2753	361k	253k	1.1%

1. Electrons, 4 m of He
   - Runs 40, 41, and 42: Mylar, 90 foils, 50 µm / 3 mm
   - Run 43: Mylar, 30 foils, 50 µm / 3 mm
   - Run 44: polyethylene, 90 foils, 67 µm / 3 mm
   - Run 45: polyethylene, 30 foils, 67 µm / 3 mm
   - Runs 46 and 47: polyethylene, 90 foils, 67 µm / 2 mm
   - Run 48: polyethylene, 30 foils, 91 µm / 2.3 mm
   - Run 49: dummy radiator
2. Pions, 4 m of He
   - Runs 40, 41, and 42: Mylar, 90 foils, 50 µm / 3 mm
   - Run 43: Mylar, 30 foils, 50 µm / 3 mm
   - Run 44: polyethylene, 90 foils, 67 µm / 3 mm
   - Run 45: polyethylene, 30 foils, 67 µm / 3 mm
   - Runs 46 and 47: polyethylene, 90 foils, 67 µm / 2 mm
   - Run 48: polyethylene, 30 foils, 91 µm / 2.3 mm
   - Run 49: dummy radiator

1. Electrons, 2 m of He
   - Runs 31 and 50: Mylar, 90 foils, 50 µm / 3 mm
   - Runs 32 and 51: Mylar, 30 foils, 50 µm / 3 mm
   - Runs 33, 34, and 52: polyethylene, 90 foils, 67 µm / 3 mm
   - Runs 35 and 53: polyethylene, 30 foils, 67 µm / 3 mm
   - Runs 36 and 54: polyethylene, 90 foils, 67 µm / 2 mm
   - Runs 37 and 55: polyethylene, 30 foils, 91 µm / 2.3 mm
   - Run 38: no radiator
   - Run 39: dummy radiator
2. Pions, 2 m of He
   - Runs 31 and 50: Mylar, 90 foils, 50 µm / 3 mm
   - Runs 32 and 51: Mylar, 30 foils, 50 µm / 3 mm
   - Runs 33, 34, and 52: polyethylene, 90 foils, 67 µm / 3 mm
   - Runs 35 and 53: polyethylene, 30 foils, 67 µm / 3 mm
   - Runs 36 and 54: polyethylene, 90 foils, 67 µm / 2 mm
   - Runs 37 and 55: polyethylene, 30 foils, 91 µm / 2.3 mm
   - Run 38: no radiator
   - Run 39: dummy radiator

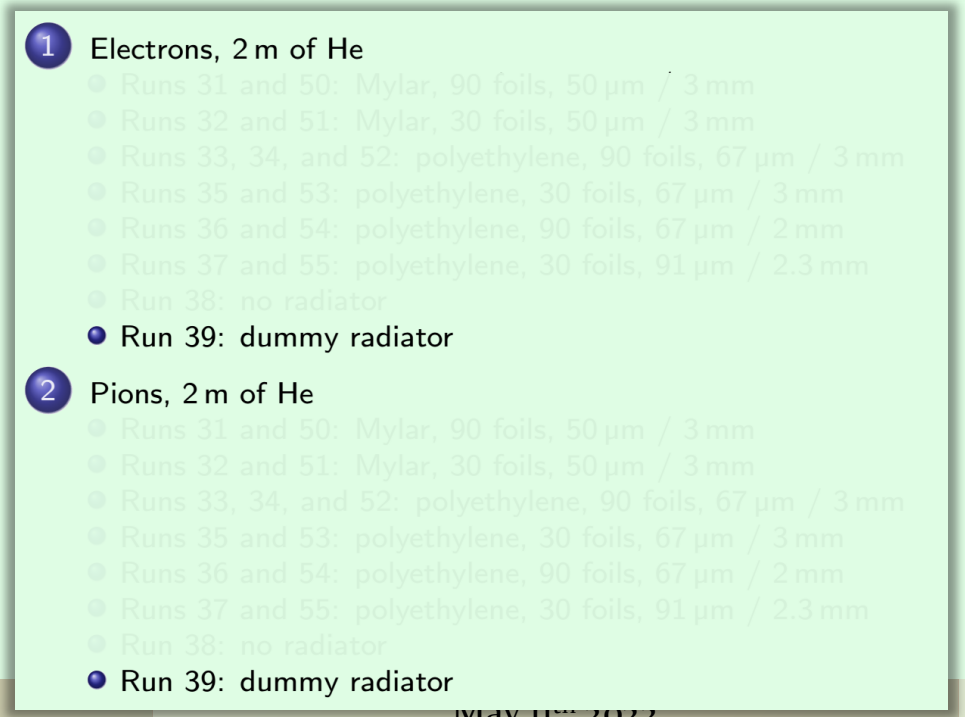
How often does a TR-photon cluster with E>200 keV show up in run 49 (dummy radiator @ 4 meters) of the 2018 data taking?

Trigger	Number of TR-photon clusters with $E > 200$ keV	Overall number of TR-photon clusters	Number of events	Fraction of TR-photon clusters with $E > 200$ keV per event
electron	202	5028	16.4k	1.2%
pion	10	39	1953	0.5%
any of the above	212	5067	18.4k	1.2%

1. Electrons, 4 m of He
   - Runs 40, 41, and 42: Mylar, 90 foils, 50 µm / 3 mm
   - Run 43: Mylar, 30 foils, 50 µm / 3 mm
   - Run 44: polyethylene, 90 foils, 67 µm / 3 mm
   - Run 45: polyethylene, 30 foils, 67 µm / 3 mm
   - Runs 46 and 47: polyethylene, 90 foils, 67 µm / 2 mm
   - Run 48: polyethylene, 30 foils, 91 µm / 2.3 mm
   - Run 49: dummy radiator
2. Pions, 4 m of He
   - Runs 40, 41, and 42: Mylar, 90 foils, 50 µm / 3 mm
   - Run 43: Mylar, 30 foils, 50 µm / 3 mm
   - Run 44: polyethylene, 90 foils, 67 µm / 3 mm
   - Run 45: polyethylene, 30 foils, 67 µm / 3 mm
   - Runs 46 and 47: polyethylene, 90 foils, 67 µm / 2 mm
   - Run 48: polyethylene, 30 foils, 91 µm / 2.3 mm
   - Run 49: dummy radiator

How often does a TR-photon cluster with E>200 keV show up in run 39 (dummy radiator @ 2 meters) of the 2018 data taking?

Trigger	Number of TR-photon clusters with $E > 200$ keV	Overall number of TR-photon clusters	Number of events	Fraction of TR-photon clusters with $E > 200$ keV per event
electron	116	2835	9.0k	1.3%
pion	65	237	12.6k	0.5%
any of the above	181	3072	21.6k	0.8%



How often does a TR-photon cluster with E>200 keV show up in run 174 (dummy radiator @ 2 meters) of the 2021 data taking?

Trigger	Number of TR-photon clusters with $E > 200$ keV	Overall number of TR-photon clusters	Number of events	Fraction of TR-photon clusters with $E > 200$ keV per event
electron	949	16.7k	170.3k	0.6%
pion	959	3364	65.8k	1.5%
any of the above	1908	20.1k	236.2k	0.8%

1. Electrons, "sides-only"
   - Mylar, 90 foils, 50 µm / 3 mm at 2175.75 mm
   - Mylar, 30 foils, 50 µm / 3 mm at 2084.25 mm
   - No radiator at 2040.00 mm
   - Dummy radiator, 6.5 mm at 2043.13 mm
   - Mylar, 90 foils, 50 µm / 3 mm at 1175.75 mm
   - Polypropylene, 180 foils, 15.5 µm / 0.21 mm at 1060.19 mm

THANKS!