L3 Trigger Status

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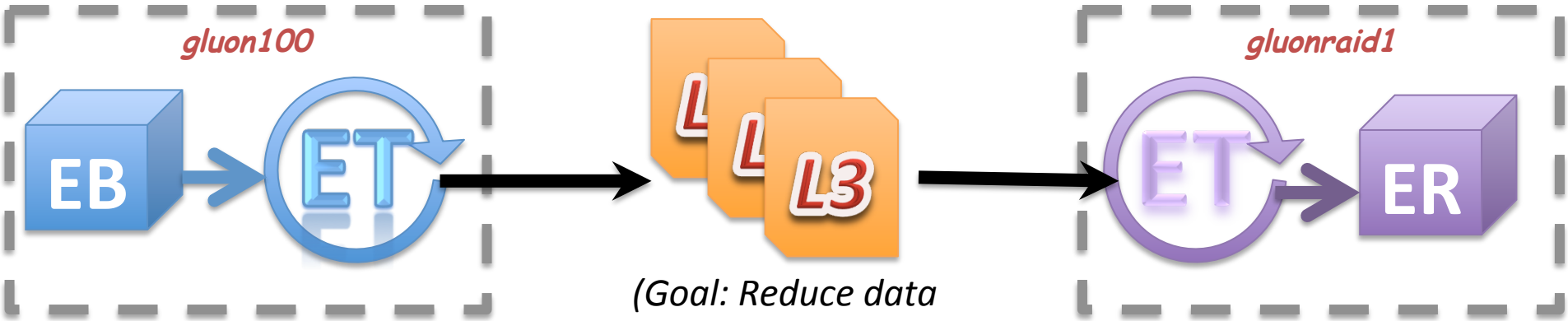
Fe. 17, 2017

From PR12-13-003 (GlueX strangeness proposal)

… we propose a gradual increase in the photon flux towards the GlueX design of 10^8 γ/s in the peak of the coherent bremsstrahlung spectrum (8.4 GeV < Eγ < 9.0 GeV). Yield estimates, assuming an average flux of 5×10^7 γ/s, are presented.



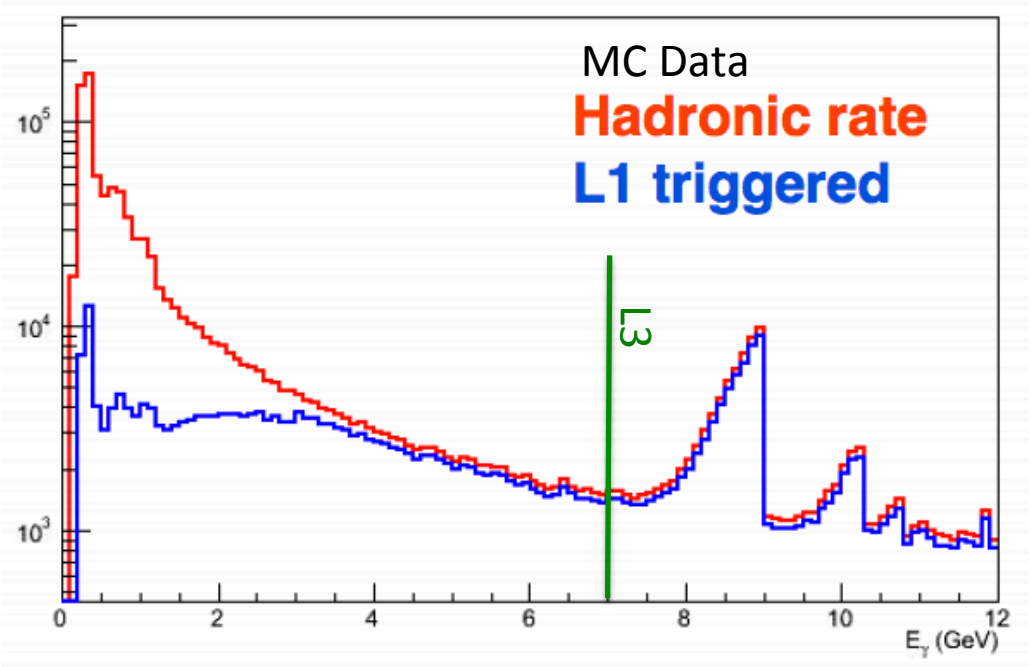
(Goal: Reduce data volume by factor of 10)

- L3 = Level-3 trigger
  - Sometimes called *High Level Trigger*
- What it is:
  - Computer farm used to make *keep/discard* decision for each event as it is acquired before writing to disk

L3 Algorithm Strategy

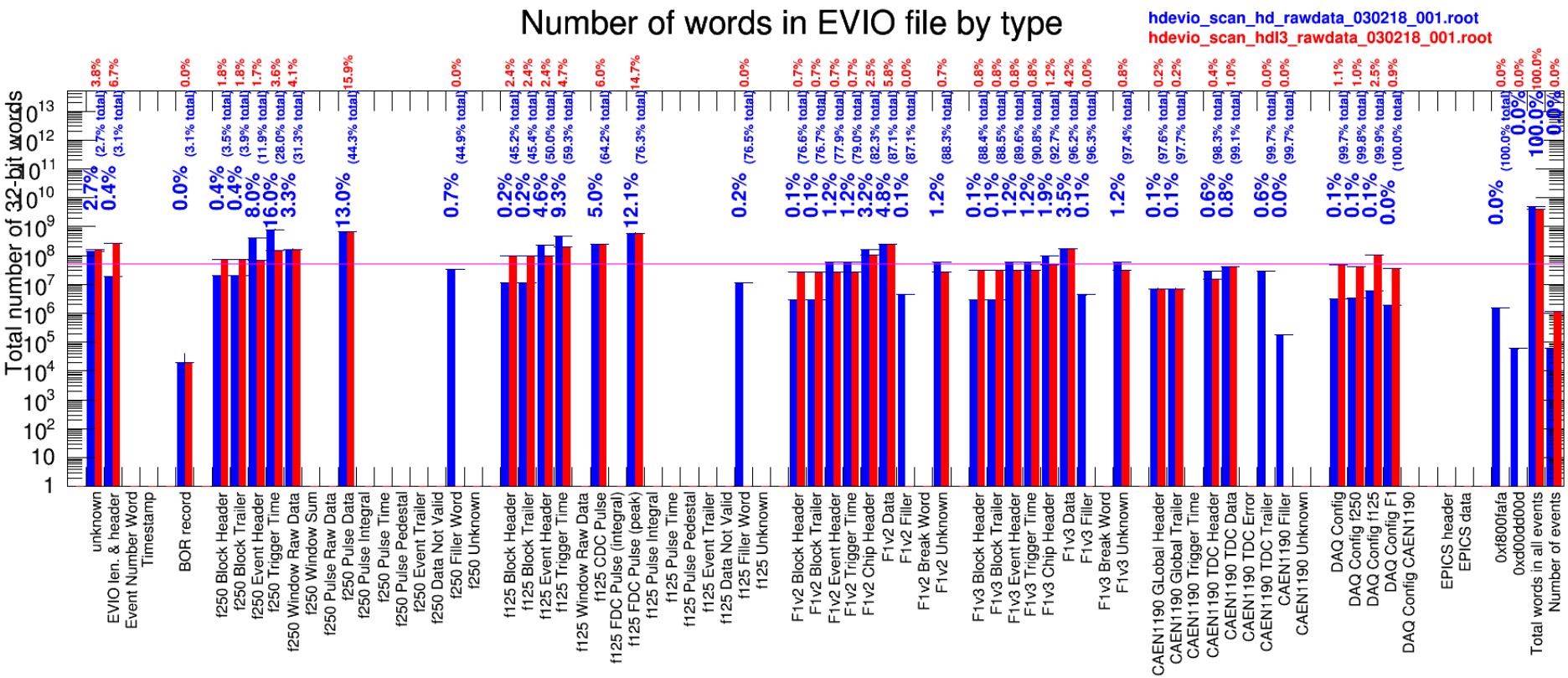
- Use Multivariate Analysis such as BDT or ANN to classify events *(similar to LHCb)*

- Multiple levels may be used with each level requiring more expensive input variables



- Use fully reconstructed, real data to provide training samples (signal and background)

Words by type for raw and reconstituted data



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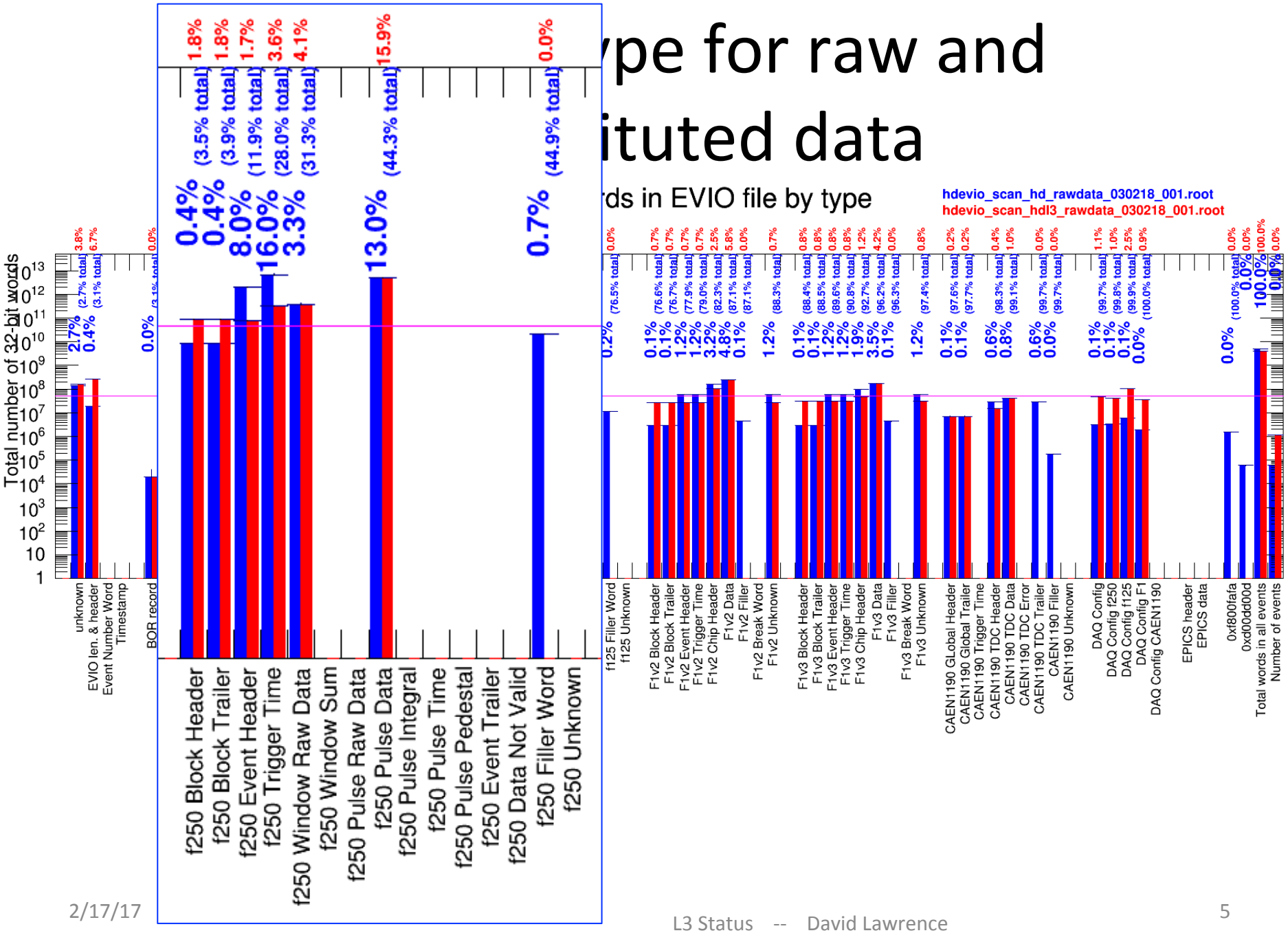

Run 30218

RAW EVIO Data

	trig 1	trig 3	trig 4
Triggers	6.56e+05 (55.0%) of all trigs	4.44e+05 (37.2%) of all trigs	2.59e+05 (21.7%) of all trigs
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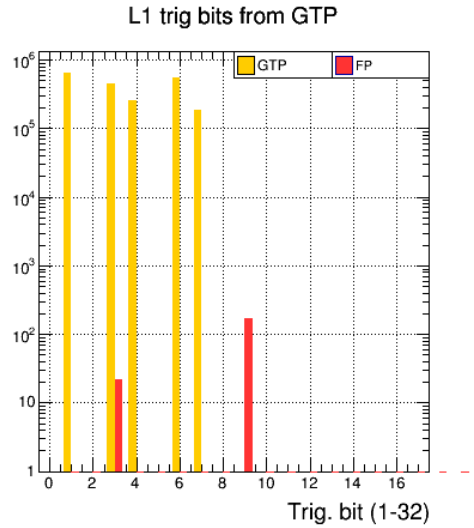

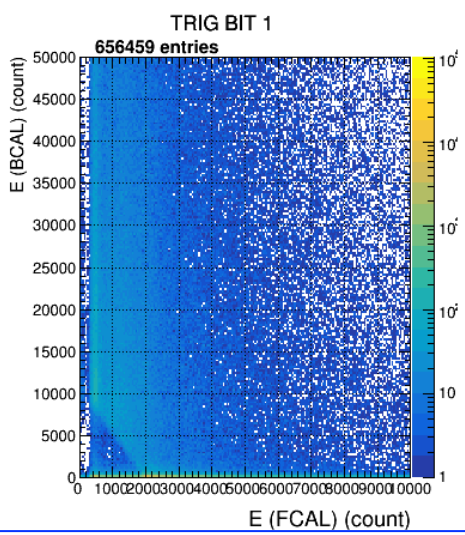

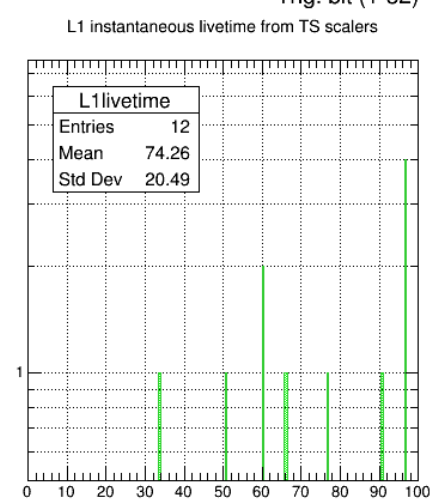

Reconstituted L3 EVIO Data

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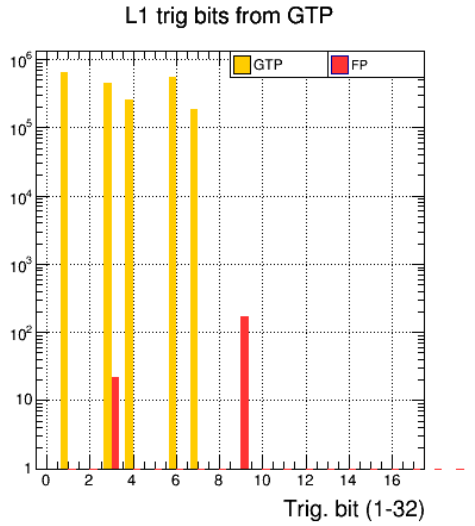

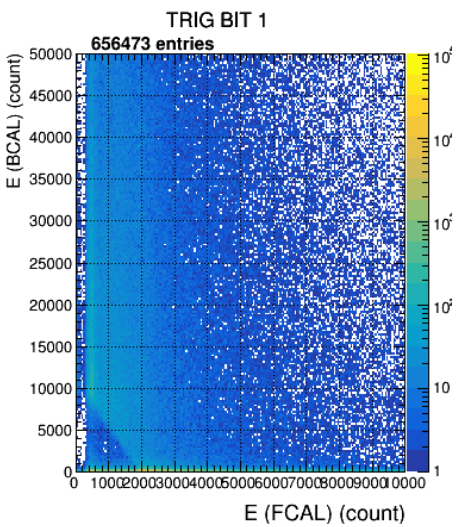

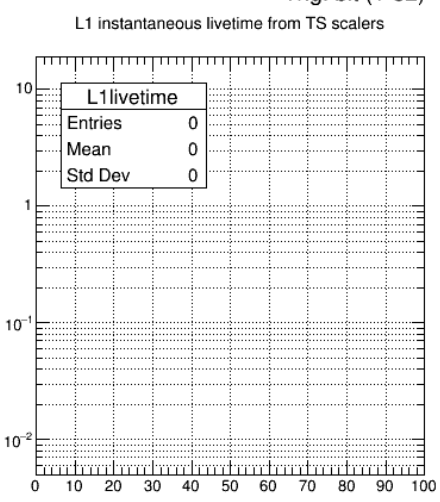

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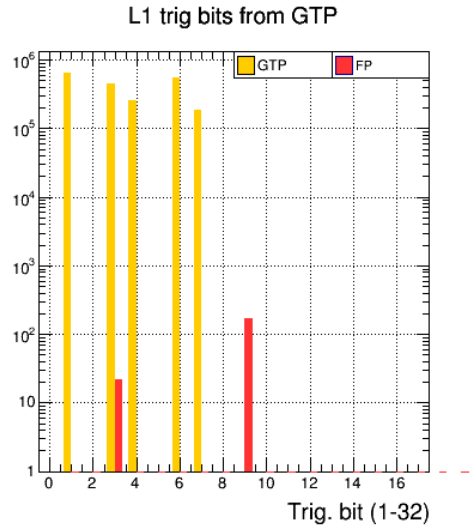

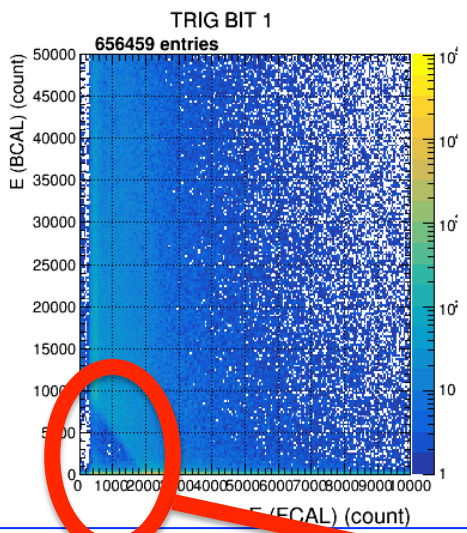

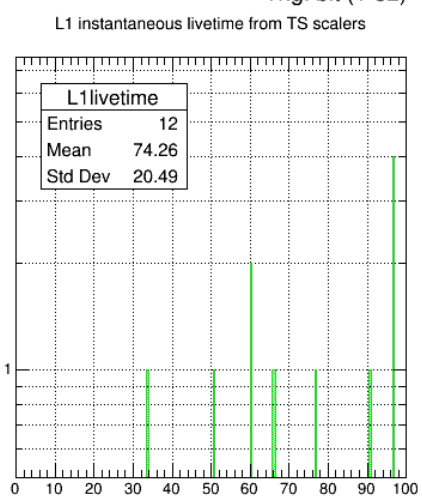

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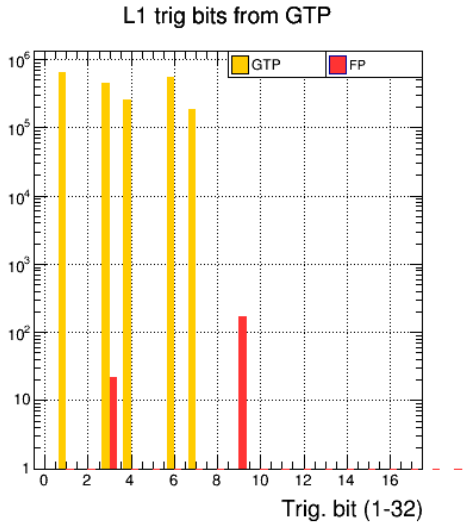

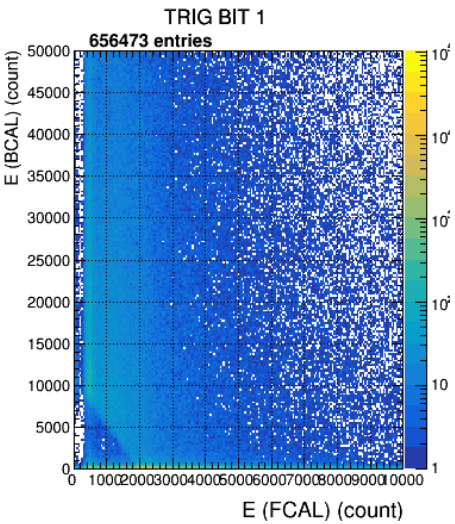

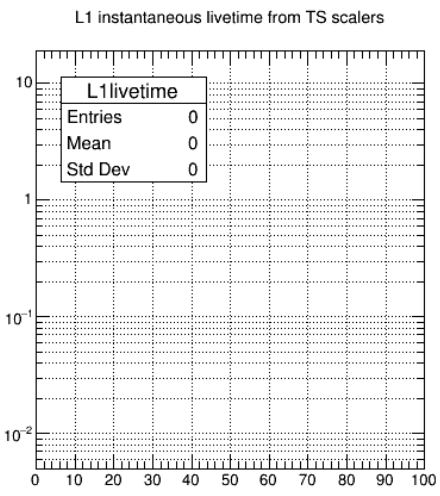

L1 Trigger differs from production

Run 30218

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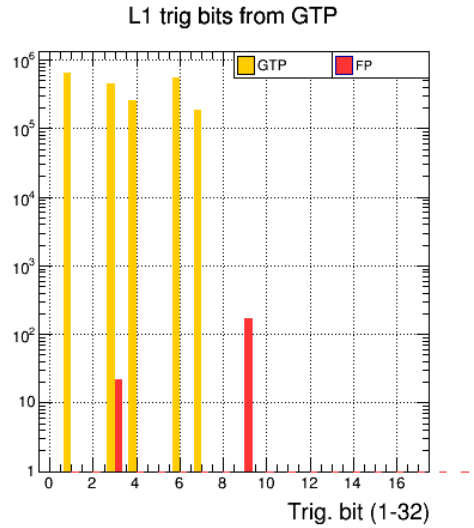

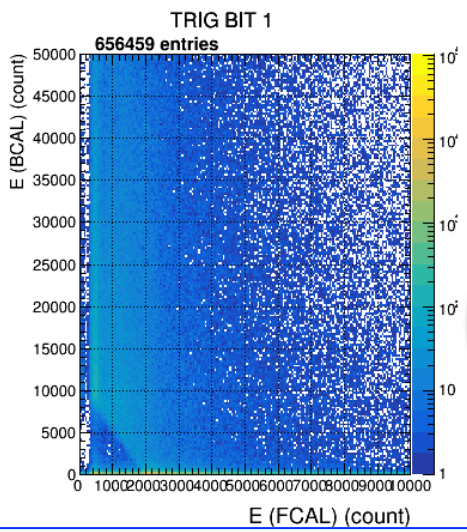

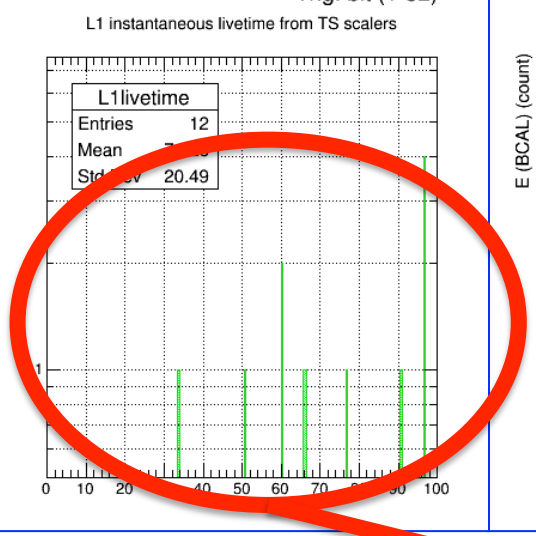

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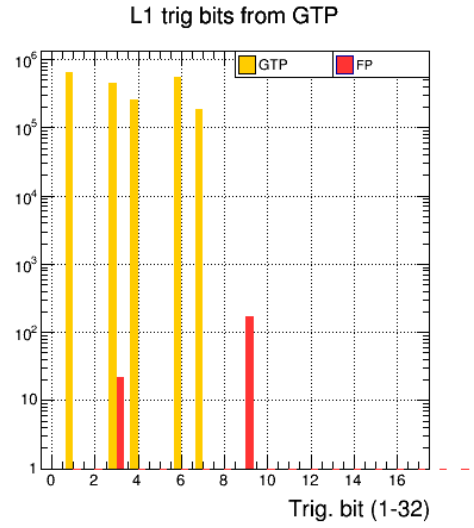
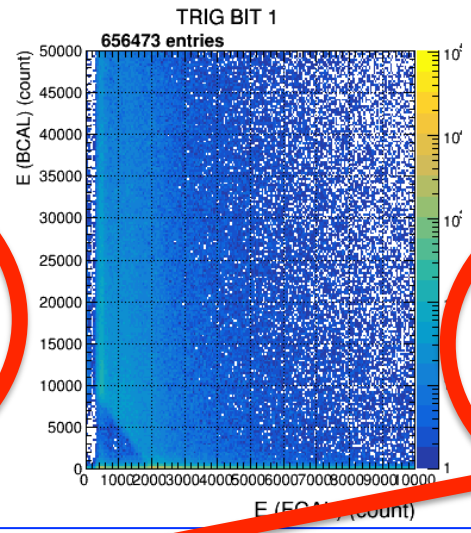
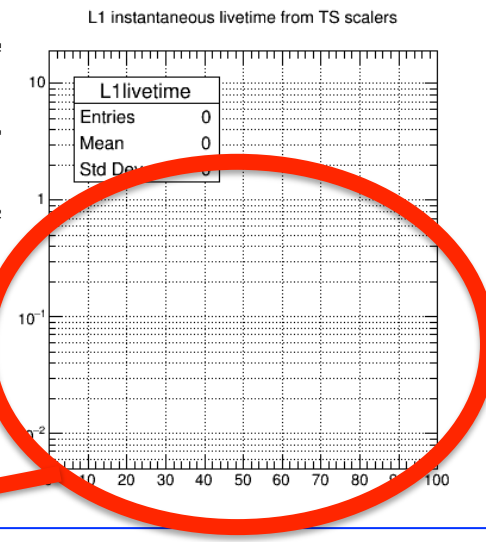
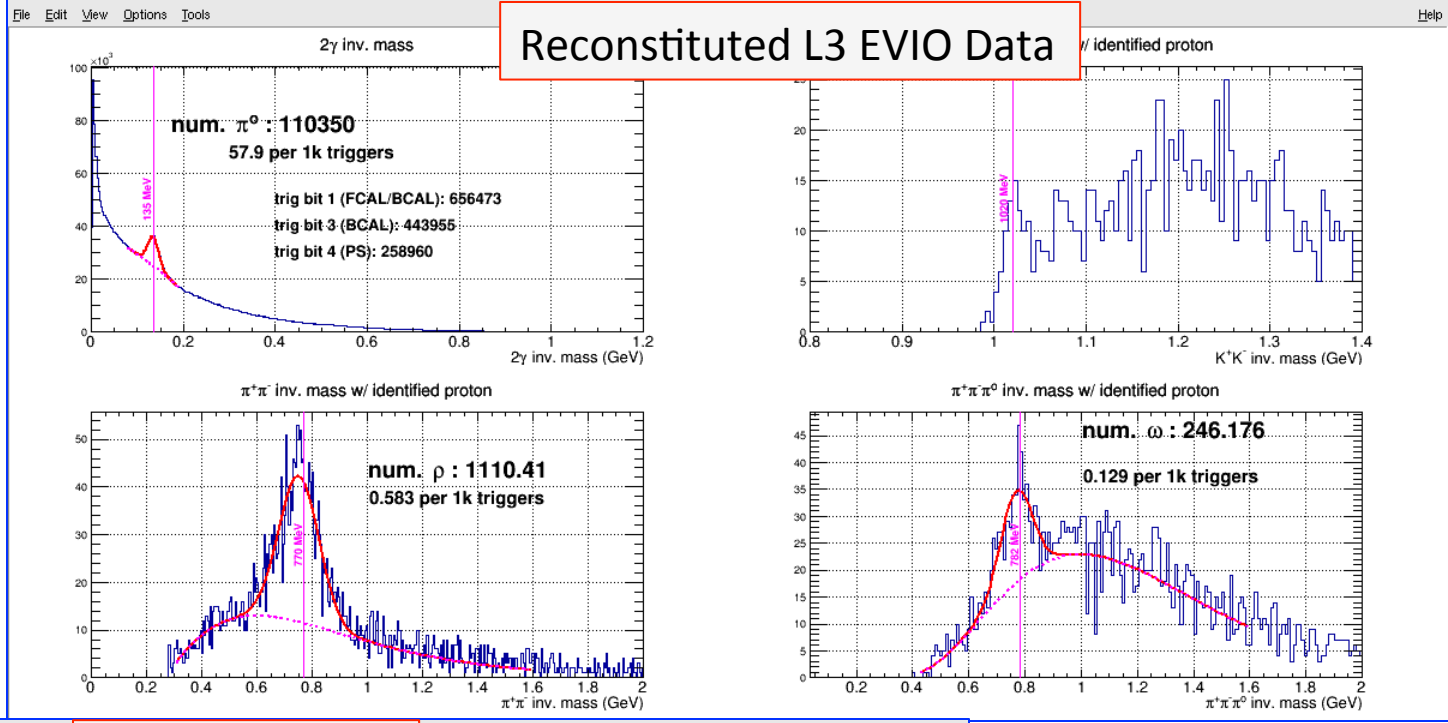




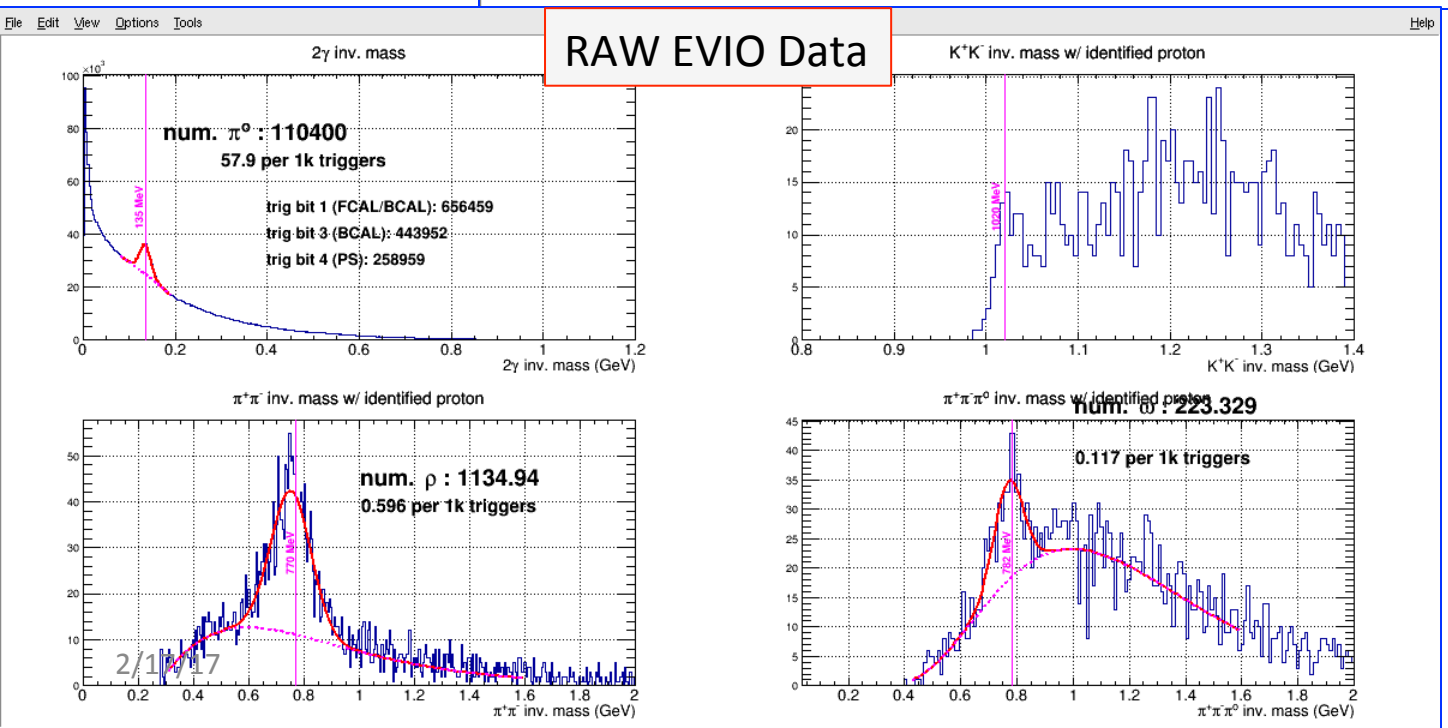


Special sync event data missing

Reconstituted L3 EVIO Data

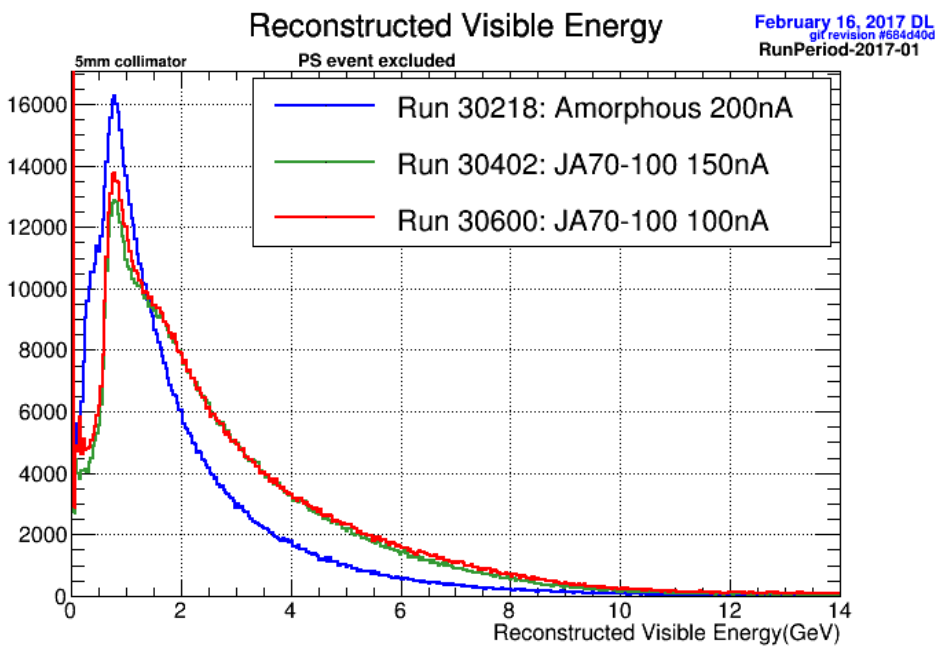


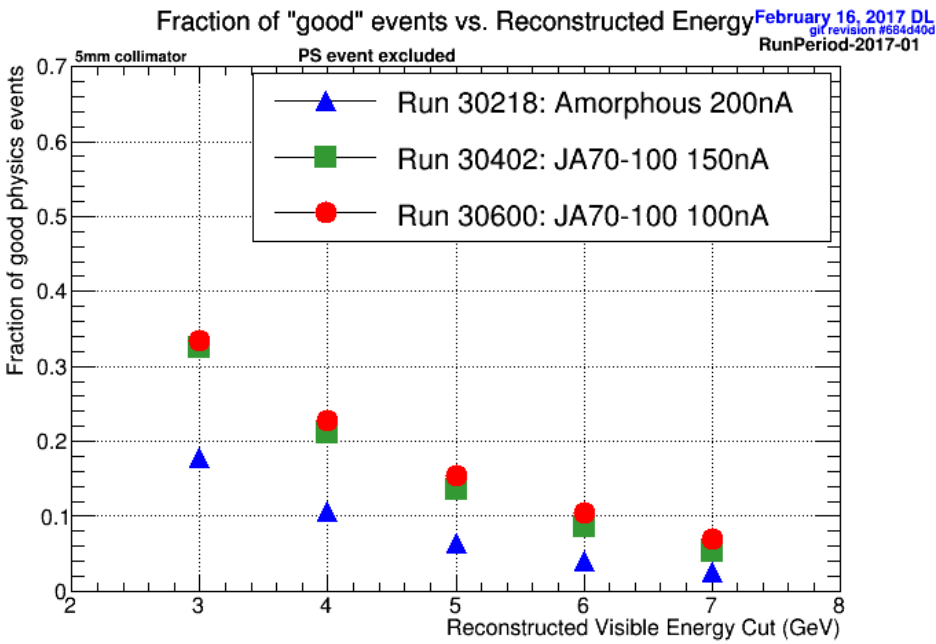
RAW EVIO Data



Reconstructable Events

Using fully reconstructed events, add up all visible energy from all DChargedTrack (best tracking FOM) and DNeutralShower objects



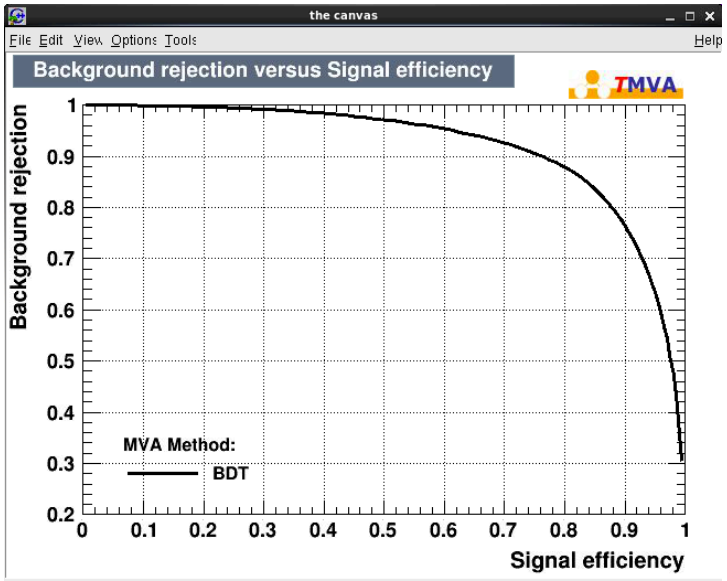


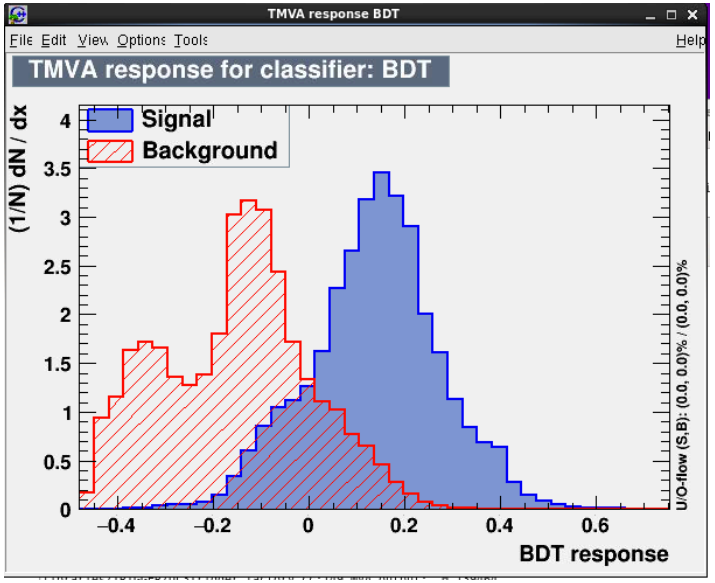
events with >1 PS hit are excluded

Test With BDT

Variable	Correlation to MVA Response
Nstart_counter	-0.121
Ntof	+0.172
Nbcal_points	+0.139
Nbcal_clusters	+0.123
Ebcal_points	+0.053
Ebcal_clusters	+0.052
Nfcal_clusters	+0.357
Efcal_clusters	+0.509
Ntrack_candidates	-0.115
Ptot_candidates	+0.001

values are for training run 30600 with 3GeV of visible energy



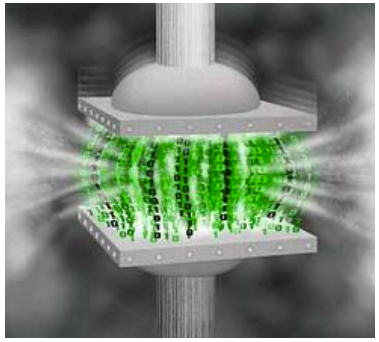


CPU needs from Spring 2017 data

L3 software infrastructure built into sim-recon including TMVA support

One fast (2016) node

- Reading and writing from file
- Writing ~20% of data selected by BDT
- ~**3kHz** when generating
  - DBCALCluster
  - DFCALCluster
  - DTrackCanditate
- Writing random 20% of data selected by BDT
- ~**8kHz** when generating
  - DBCALCluster
  - DFCALCluster
- n.b. ~**0.5kHz** full reconstruction, no writing



Compression of Data Stream

- Suggestion at Software Review to compress data stream to conserve bandwidth from ROC
- EVIO files can be compressed by factor of ~2
- BUT: to compress at ROC level one must compress smaller buffers which is less efficient
- Tested by using LZ4 compression on individual ROC buffers in file from run 11667.
- Overall file size reduced by 20%

Testing Plan

(from wiki)

Conditions [edit]

```
- 100nA-1000nA , 5mm collimator, JD70-100 58 um
- Standard L1 trigger: FCAL_BCAL_PS_m9.cnf
- L3 CODA config.: hd_all.L3.tsg
- Detector settings for high intensity running
 + CDC HV?
 + TOF HV?
 + …
```

Step by step instructions [edit]

```
1. Take short run (5 min.) using non-L3 config to establish baseline. This will be hd_all.tsg
 1a. Record event rate, data rate, and lifetime.
```

```
2. Test non-rejection rate maximum
 2a. Start at low current mode (50nA) and verify system works with high livetime
 2b. Gradually increase beam current until livetime drops to 50% or less
 2c. Identify bottleneck (farm, disk, …)
```

```
3. Test 75% rejection rate limits
 3a. Edit $DAQ_HOME/config/farm/run_hdl3.py to set L3:FRACTION_TO_KEEP=0.25
 3b. Raise and lower beam current to find where livetime is at 90% and 50% points.
       - record beam current, data rate, event rate, and livetime for each.
       - Identify bottleneck (farm, disk, …)
```

```
4. Test 75% rejection rate limits with wire-based tracking and BCAL cluster finding turned on.
   This will mimic an algorithm with CPU usage.
 4a. Edit $DAQ_HOME/config/farm/run_hdl3.py and uncomment appropriate lines
 4b. Repeat 3b.
```

```
5. Test using trivial rejection algorithm
 5a. Edit $DAQ_HOME/config/farm/run_hdl3.py, restoring to state prior to item 3 above
 5b. Edit $DAQ_HOME/config/farm/run_hdl3.py to turn on trivial rejection algorithm
 5c. Repeat 3b.
```

```
6. Do long term test by restoring to the state of "2" and running for at least 1 hour.
```

Summary

- Reconstitution of single events mostly working
  - Sync event data not yet copied
  - May still be some object order dependence in reconstruction
- High Intensity Spring 2017 data suggests 75%-80% of physics triggered events may be uninteresting
- EVIO data stream compression can reduce bandwidth by ~20%
- L3 infrastructure software exists and is ready for testing