Digitization and Zero Suppression

Jonathan Insler

LBNE

February 13, 2013

Method

- Testing zero suppression and Huffman compression in MicroBooNE geometry
- Begin with single muon and single electron events
- Standard noise modeling
- Save ADC from all channels
- Apply zero suppression, Huffman compression
- Compare data sizes on disk

Zero Suppression

- Method: sparse array
  - Scan ADC vector
  - First entry is total number of entries in ADC starting vector
  - Save all nonzero entries as index/entry pairs in new vector
  - Truncate vector to contain only nonzero entries
  - Selectable by setting CompressionType: ”ZeroSuppression” in detsimmodules.fcl
  - Threshold selected by setting “ZeroThreshold” in detsimmodules.fcl
- ZeroSuppression and ZeroUnsuppression functions in RawData apply and reverse zero suppression on data
  - Reverse function reconstructs original ADC vector by placing nonzero entries into full length ADC vector (initialized with zero entries)
  - Returns input ADC vector after zero suppression and reversal (for threshold = 0)

Results

Table 1: Data Size on Disk (kB)

Event type	None	Huffman	ZS (0)	ZS (1)	ZS (5)	ZS (10)
Single muon	51734.3	1896.42	1075.11	989.92	820.17	714.363
Single electron	51783.3	2162.03	2006.96	1494.48	1073.03	796.59

Table 2: Data Compression Factors

Event type	None	Huffman	ZS (0)	ZS (1)	ZS (5)	ZS (10)
Single muon	1.0	27.3	48.1	52.3	63.1	72.4
Single electron	1.0	24.0	25.8	34.6	48.2	65.0

None = no data compression
Huffman = Huffman compression
ZS (X) = Zero suppression with threshold X

Next Steps

- More precise noise simulation for LBNE
- SimWire for LBNE geometry
  - SimWireLBNE_module.cc based on SimWireMicroBooNE_module.cc
  - SignalShapingServiceLBNE based on SignalShapingServiceMicroBooNE in Utilities
  - Testing on single events
  - Currently debugging: hangs at G4PhysicsList Helper::AddTransportation() – G4CoupledTransformation is used