

# Intelligence Compression of HEP Data

Amit Bashyal (ANL)

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# Intelligent lossy Compression Test Framework

- Uses IDEALEM, MGARD and SZ3
- Takes fake waveform raw data or experimental data as input
- Decompresses using above algorithms
- Writes decompressed data into RNTuple with Compression parameters as JSON string



## Tests with Fake Raw Data

- Fake Raw data generated by superposing random sine waves with different amplitudes, frequencies and phase differences.
- Length of 200,000
- Limited exploration of compression parameters for now.
- Applied a common error bound of  $1E-2$  for the data.
- Some of the parameters are not common among algorithms.
- Thorough exploration upcoming



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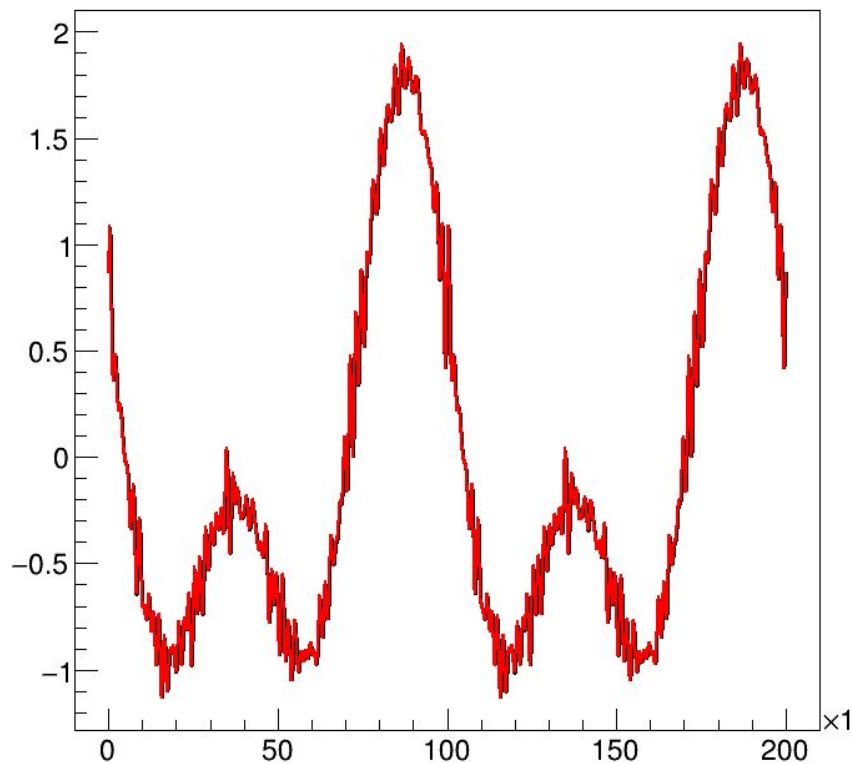
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# Initial Results (Original and Decompressed Data)

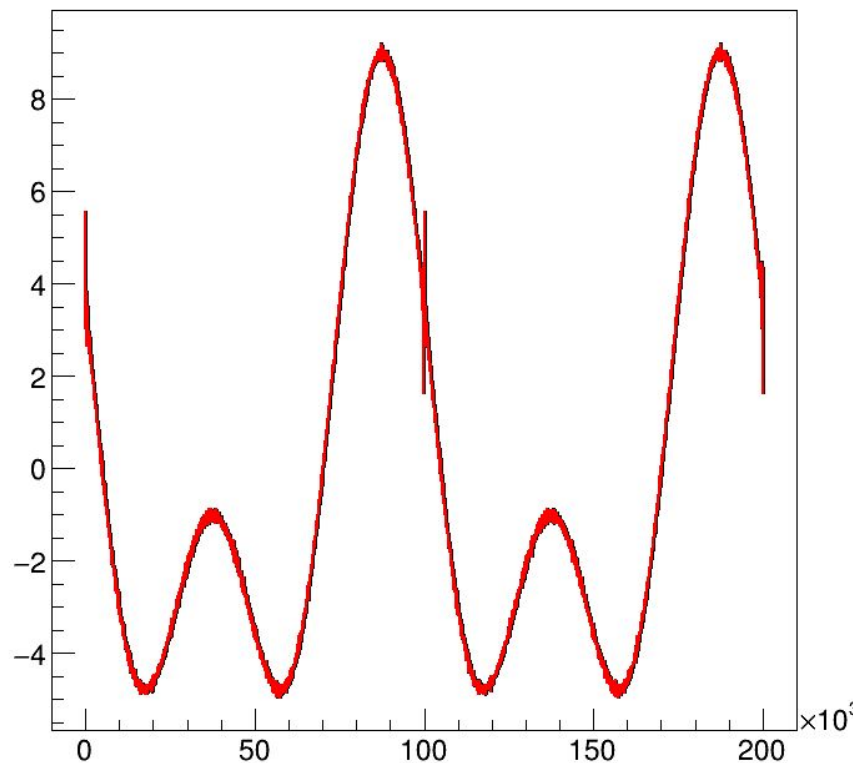
KS-VAL: 0.000000, CR: 14

KS-VAL: 1.000000, CR: 16

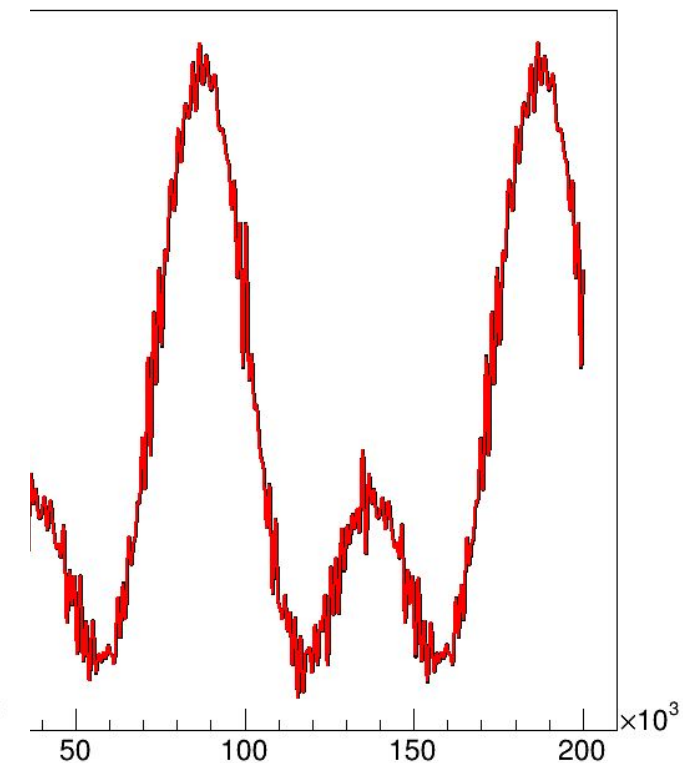
$\beta$ -VAL: 0.000026, CR: 773



IDEAL-EM



MGARD

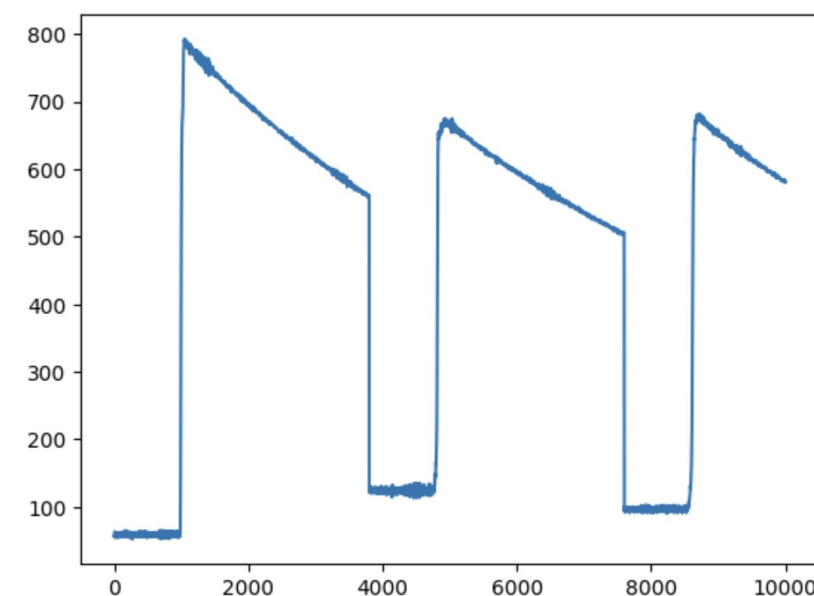


SZ3

RNTuple loss-less compression: 1.13

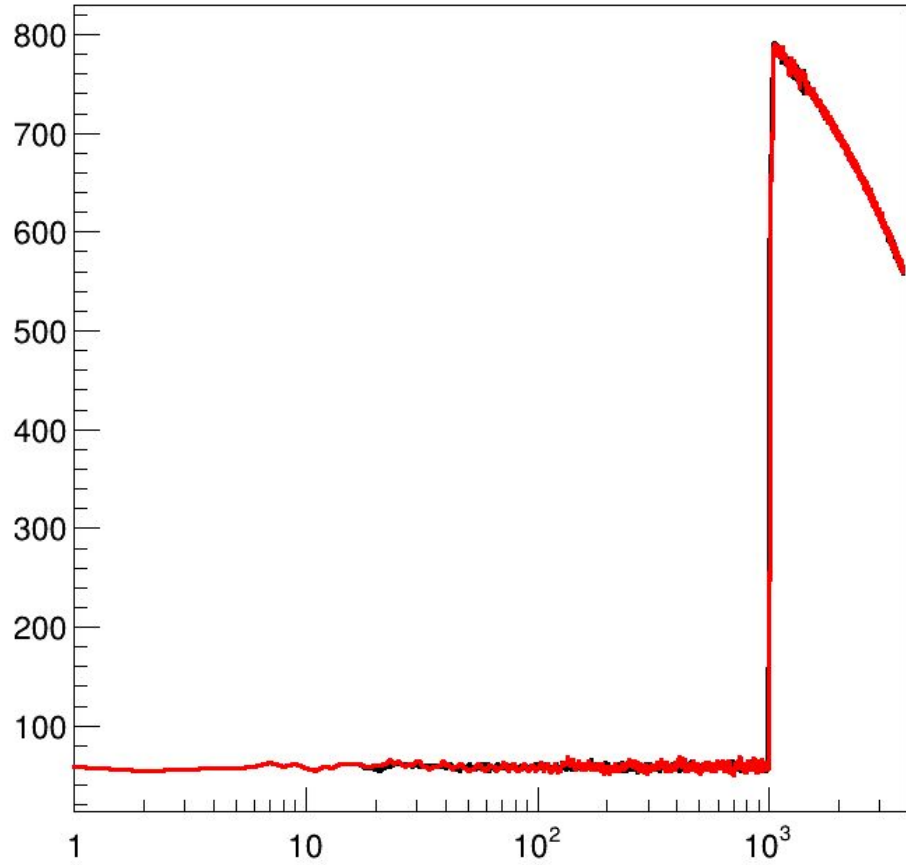
## Exploration with Majarona Demonstrator Data

- Neutrino double beta decay experiment
- Raw waveforms from Germanium detector
- Relatively quiet experiment (i.e. very few event rates)
- <https://zenodo.org/records/8257027>
- Tested because it was publicly available
- Raw data is waveforms repeating every 3800 ticks. Test done with data over 3800 ticks.
- Tested with SZ3 and IDEAL-EM
  - Same compression parameters from previous slides.

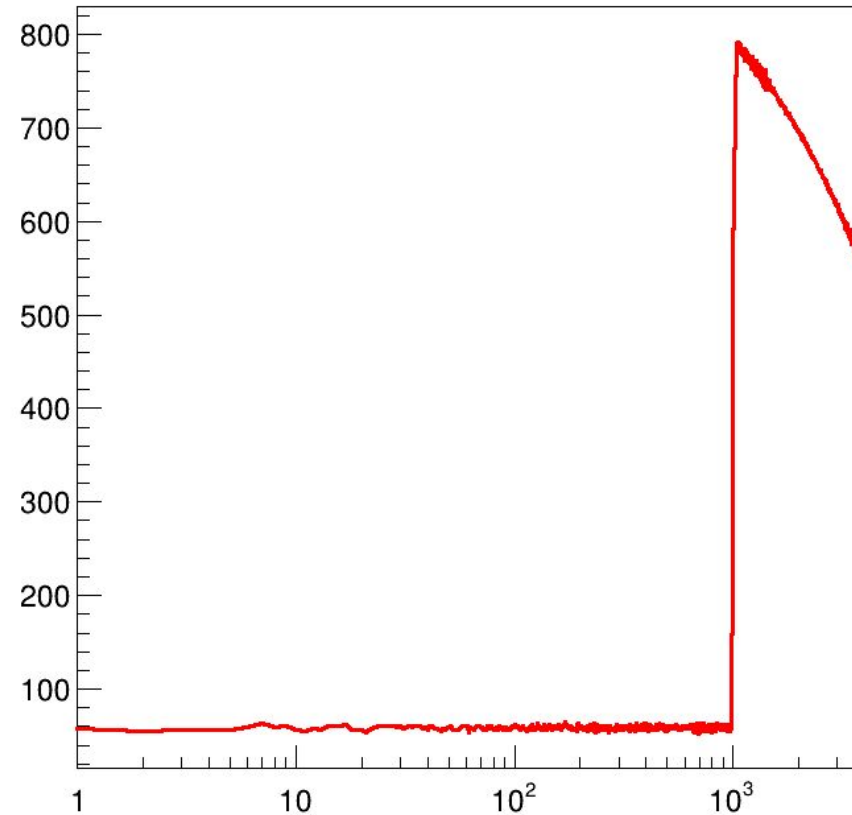


KS-VAL: 0.024227, CR: 13

KS-VAL: 1.000000, CR: 5



IDEAL-EM



SZ3

Original and Decompressed data



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