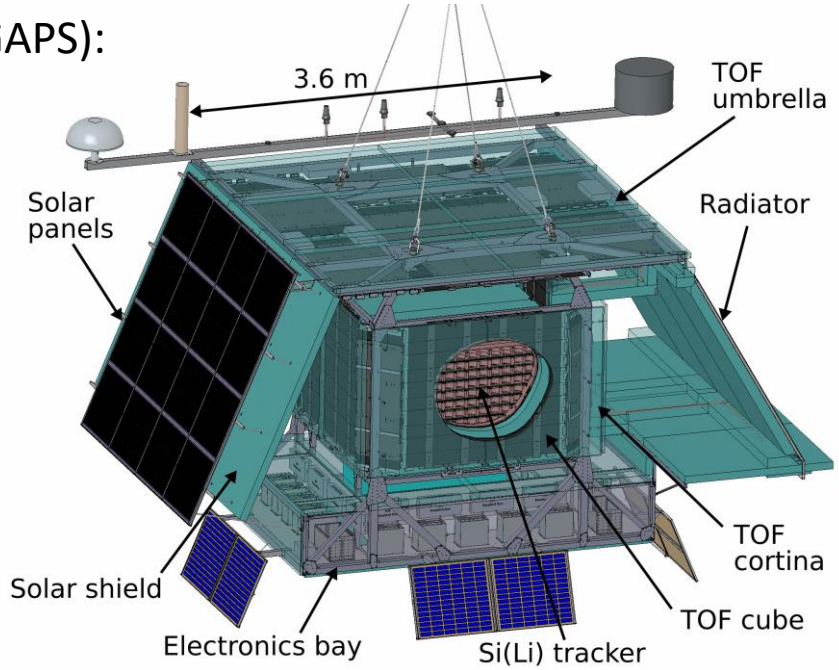
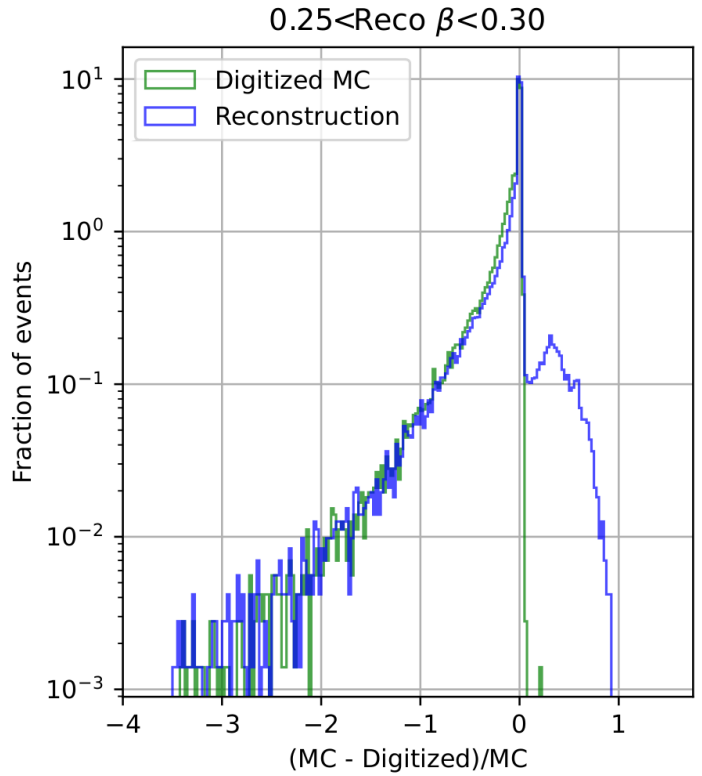
Neural Networks approach for GAPS

General AntiParticle Spectrometer (GAPS):

- Designed to measure low energy (<0.25 GeV/n) cosmic antinuclei as dark matter signature
- More about the mission and the instrument in this conference contributions
- A custom reconstruction algorithm identifies the primary and secondary particles tracks





- Digitization process applied to simulation to mimic realistic instrument response
- Digitization affects energy reconstruction
- In some cases, reconstructed primary energy present an excess with respect to Monte Carlo truth

The excess is caused by:

- Primary particles annihilates in a detector and produced secondaries release energy in the same volume
- Secondary particles cross a volume already crossed by the primary

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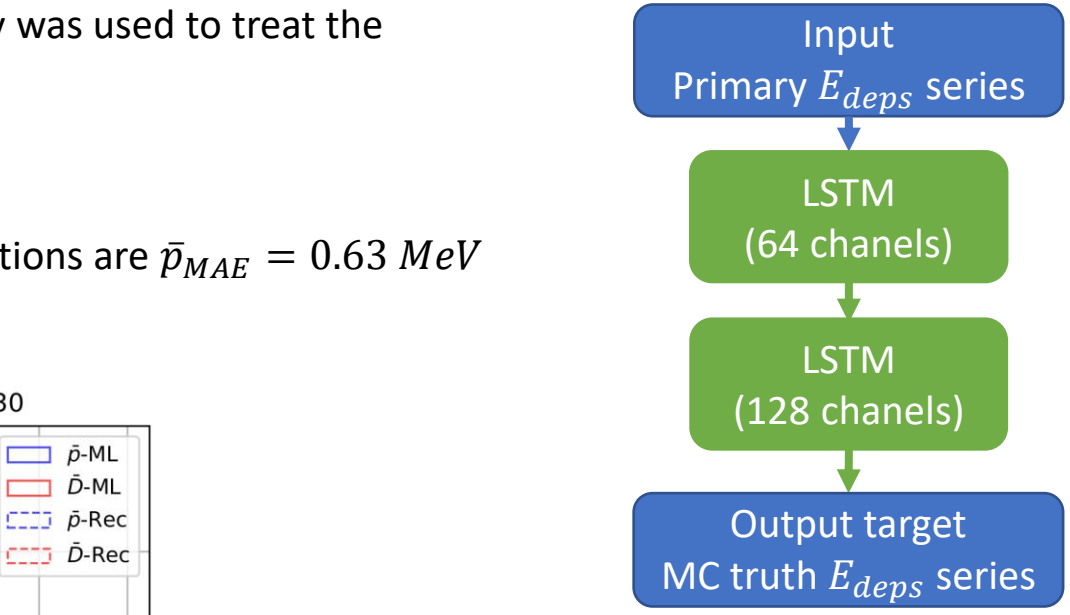
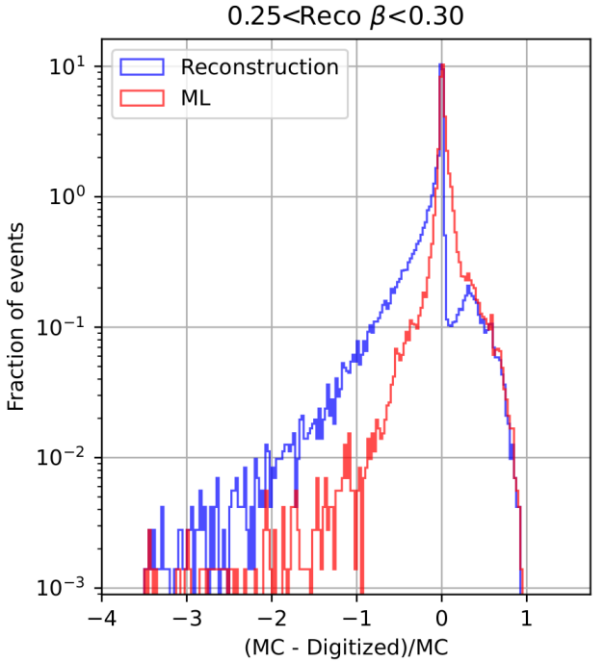
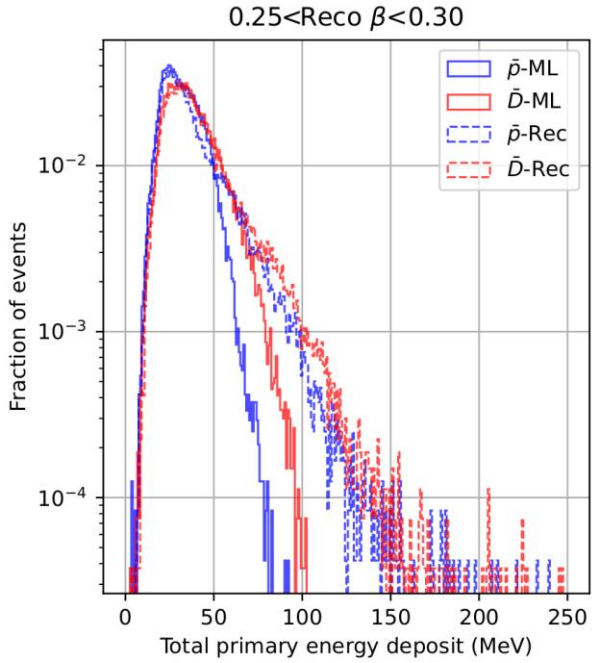
A Recurrent Neural Network known as Long-Short Term Memory was used to treat the observed energy excess :

- It can easily manage variable length input/output sequences
- It can extract information by the order of the input
- The mean absolute error (MAE) of the neural network predictions are $\bar{p}_{MAE} = 0.63\ MeV$ and $\bar{D}_{MAE} = 0.69\ MeV$







- A clear reduction of the energy excess can be observed with the ML output
- Differences between the two species in the total energy distributions increase after applying the ML correction
- This ML tool has the potential to significantly benefit $\bar{p}$ and $\bar{D}$ identification analysis