Improving the Muon g - 2 Track Finding and Fitting Algorithms to Minimise the Uncertainties on the ω_a Measurement

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Run 1 Results

-The BNL Muon g-2 experiment measured $a_{\mu} \equiv (g-2)/2$ to a precision of 540ppb.

-The FNAL Muon g-2 experiment seeks to improve upon this with a target precision of 140ppb.

-Data from the first physics run in 2018 has been analysed, representing approximately 6% of the total data. The discrepancy has been improved to 4.2σ - closing in on the target of 5σ .



https://doi.org/10.1103/PhysRevLett.126.141801

Operations

-In order to achieve the required level of precision, data collection needs to continue at optimum rate.

-Speed up in processing of already taken data is required.

-Doing two types of shifts; operational and offline data processing.



On course for ~20x BNL data to reach target goal of 140ppb

Fermilab LTA

-Continuation of data collection and processing on-site during a year long LTA in late September or early October

-Working with the straw tracking team on the new Kalman filter to improve tracking algorithms.

-Straw trackers help us better understand and control systematics on ω_a



-Not currently optimised for multiple crossing tracks, representing a loss of data.

-Leads on to my own research...

Track Identification Improvements

-Building a machine learning algorithm to differentiate between multiple crossing tracks to build a more effective beam profile.

-Can now separate ideal single tracks in isolation as a basis.

-Creation of unique 2D histograms for every isolated track which can be used as a comparison between different events.

-Track modification code can be used to create simple events with known solutions.

-After testing on simple, user defined pileup events, we will move on to actual data.



Conclusions

-Exciting results from the g-2 collaboration!

-Undertaking offline and remote shifts for data collection and analysis

-Working towards optimising tracking algorithms to determine between multiple crossing tracks with machine learning.

-Continuation of project and shift work on site in late 2021.

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Thank you for listening!

Any questions?





