Measurement of the time-like pion form factor above 1 GeV with the initial-state radiation technique at BESIII

CRC 1660 Kick-Off

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Project B03

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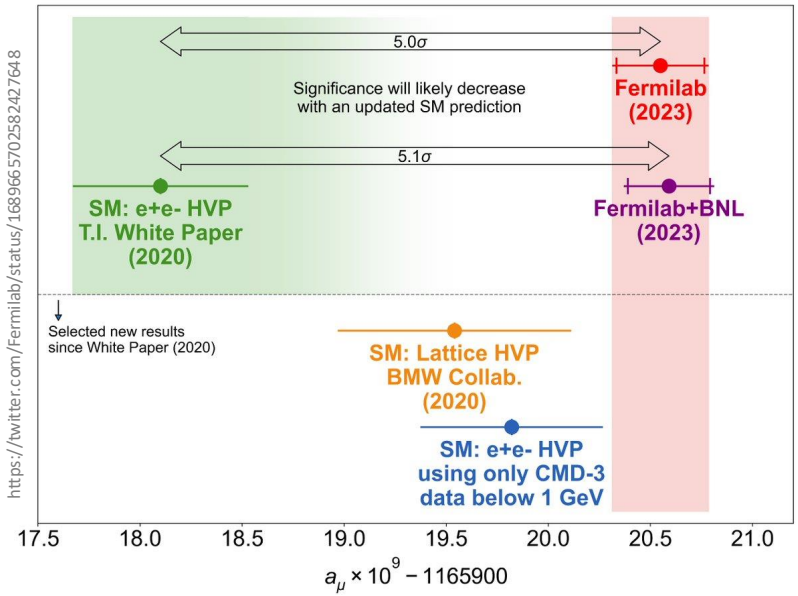
Anomalous Magnetic Moment of the Muon

- Muon g-2 puzzle: $a_\mu = |g_\mu - 2|/2$
- Standard Model (SM) prediction: $a_\mu^{\mathrm{SM}} = a_\mu^{\mathrm{QED}} + \boldsymbol{a_\mu^{\mathrm{QCD}}} + a_\mu^{\mathrm{weak}}$
- Direct measurement: Experimental average of BNAL & FNAL



Discrepancy of 5.1σ!

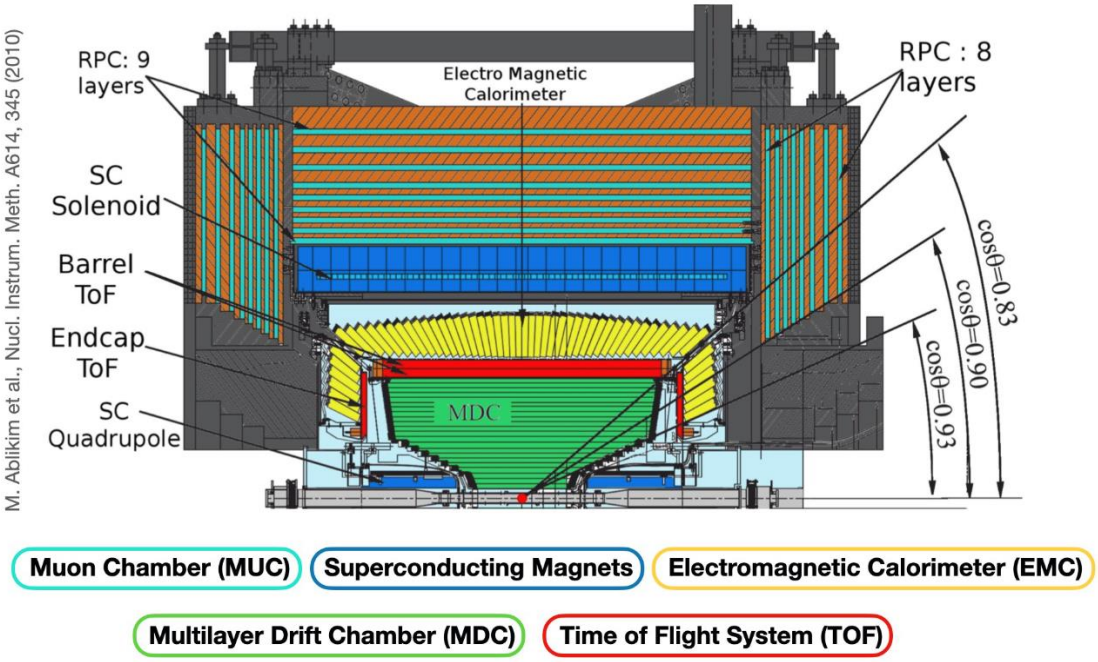
Hadronic contributions dominate uncertainty for a_μ^{SM}

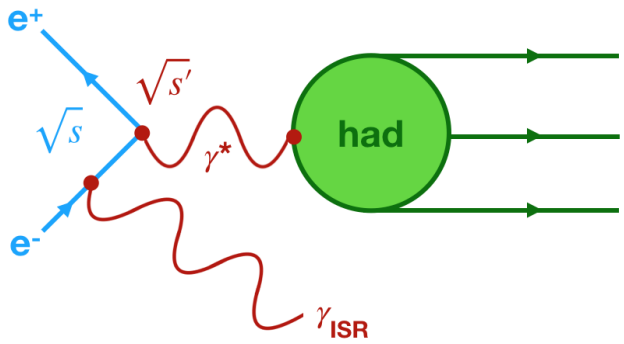
→ **Hadronic Vacuum Polarization (HVP)**

→ Most important channel: $\boldsymbol{\pi^+\pi^-}$

Reaction Channel $e^+e^- \to \pi^+\pi^-$ at BESIII

- BESIII: electron-positron collider with CM energies between 2.0 to 5.0 GeV
- Initial State Radiation technique to measure the pion form factor above 1 GeV

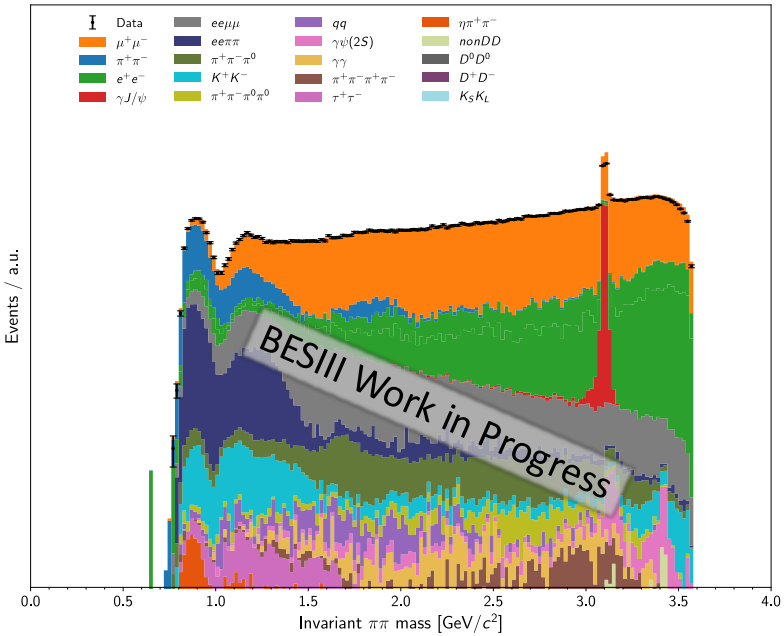


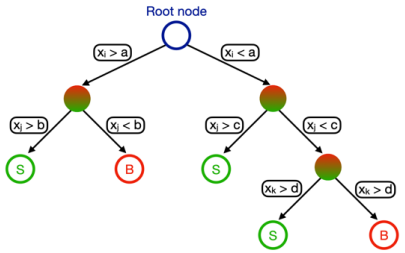


Data set: 2.9 fb^{-1} at 3.773 GeV
(New data set: 20 fb^{-1})

Main Challenge: Pion-Muon Separation

- Signal: $e^+e^- \to \pi^+\pi^-\gamma_{\mathrm{ISR}}$ & main background: $e^+e^- \to \mu^+\mu^-\gamma_{\mathrm{ISR}}$
- Difficult to distinguish pions from muons at BESIII → Multivariate Analysis
- **Boosted Decision Tree with Gradient Boost (BDTG)**





Apply BDTG
+ PID corrections