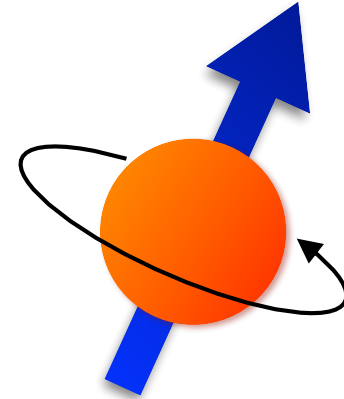


The next steps towards the 2nd WP



Steering Committee

- Gilberto Colangelo (Bern)
- Michel Davier (Orsay) co-chair
- Aida El-Khadra (UIUC & Fermilab) chair
- Martin Hoferichter (Bern)
- Christoph Lehner (Regensburg University & BNL) co-chair
- Laurent Lellouch (Marseille)
- Tsutomu Mibe (KEK)
J-PARC Muon g-2/EDM experiment
- Lee Roberts (Boston)
Fermilab Muon g-2 experiment
- Thomas Teubner (Liverpool)
- Hartmut Wittig (Mainz)

<https://muon-gm2-theory.illinois.edu>

Timeline

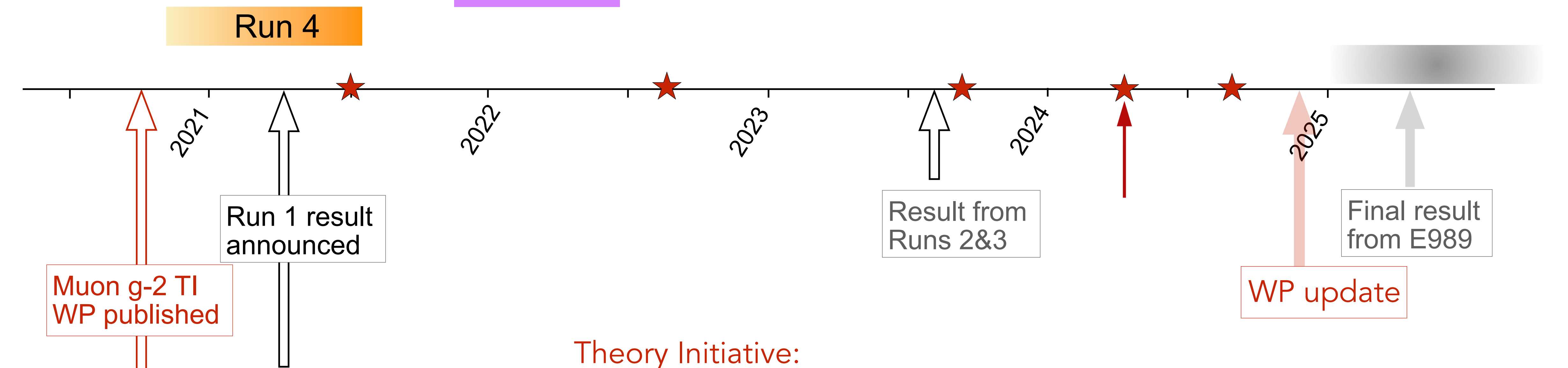
FNAL E989

J-PARC E34

Run 4

Run 5

Run 6



Muon g-2 TI WP published

Run 1 result announced

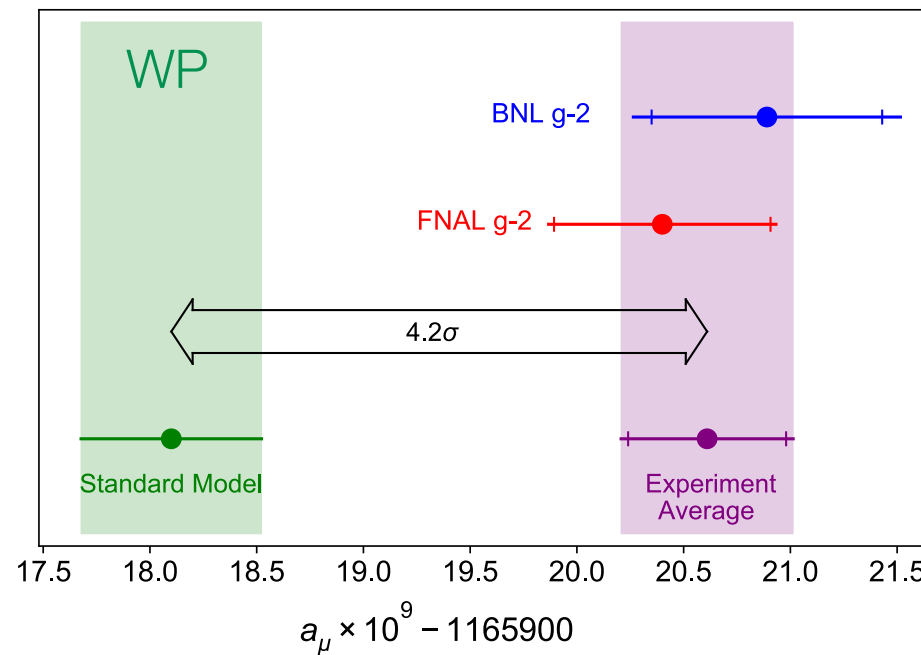
Result from Runs 2&3

WP update

Final result from E989

Theory Initiative:

- ☆ CMD-3 seminar (virtual): 27 March 2023 at 8:00am US CDT
- ☆ 2nd CMD-3 discussion meeting
- ☆ 8/9/2023: Status of Muon g-2 Theory in SM

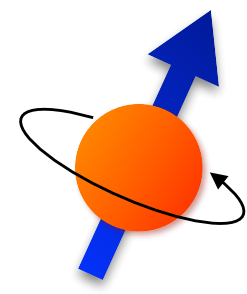


☆ TI workshops:

Jun 2021 @ KEK (virtual)
Sep 2022 @ Higgscentre

Sep 2023 @ Bern
Apr 2024 (virtual)

Sep 2024 @ KEK & KMI



2nd WP: proposed timeline

Summarize the status of SM predictions for a_μ **before** the Fermilab g-2 experiment releases their final measurement (based on runs 4,5,6) in 2025. **aim 2nd WP for end of 2024**

- submit 2nd WP to arXiv by **16 Dec 2024**
- WGs to finish their sections by: **20 Nov 2024**
to allow 3-4 weeks for editing and community feedback
- deadlines for guaranteed inclusion in 2nd WP (discussion or averages):
 - essential inputs, considered for averages: **accepted for publication by 16 Oct 2024**
 - other papers, considered for discussion in prose: **posted on arXiv by 16 Oct 2024**
- 9-13 Sep 2024**: Seventh Plenary workshop of the Theory Initiative
first drafts of majors sections, detailed list of remaining work
- Check-in with working groups and with Fermilab g-2 experiment in summer 2024

Working Groups and coordinators

data-driven HVP

Achim Denig
Fedor Ignatov
Bogdan Malaescu

analytic HLbL

Hans Bijmans
Anton Rebhan

lattice HVP

Steve Gottlieb
Antonin Portelli

lattice HLbL

Luchang Jin
Harvey Meyer

- New results since Berne:
 - Short-distance in the Melnikov-Vainshtein corner, Antonio Rodriguez-Sanchez
 - Dispersive analysis of the eta and eta' form-factors, Simon Holz
 - Axial-vector and tensor contributions in four- and three-point dispersive approaches, Peter Stoffer
 - Prospects for new data relevant for the HLbL contribution, Christoph Redmer
 - Status of holographic results on HLbL, Anton Rebhan
- Status:
 - Short-distance under control; no sign of new large contributions
 - η, η' : improved (CA and dispersive can be compared here as well)
 - Axial vectors and tensors: significant improvement expected compared to whitepaper
 - Thinking about how to combine short distance and the separate channels ongoing
 - Holographic: Pseudoscalars a bit larger than WP, axial-vectors larger (no new dispersive numbers yet to compare with)

Hadronic light-by-light contribution: lattice QCD results

Direct HLbL calculation: RBC/UKQCD; Mainz; BMW to come.

- ▶ RBC/UKQCD and Mainz very consistent, with similar total uncertainty; statistically uncorrelated (except for charm contribution).
- ▶ treat systematic uncertainty as 100% correlated, or something more refined?

TFF	Mainz	ETMC	BMW
π^0	✓	✓	✓
η		✓	✓
η'			✓

NB. Preliminary results with a novel method presented by Xu Feng for RBC/UKQCD.

- ▶ quality criteria to be formulated
- ▶ lattice results less mature for η , η' ; but possible shortcomings probably quite orthogonal to those in the pheno. treatments
- ▶ how should seemingly systematic underestimate of π^0 lifetime be dealt with?

Lattice HVP Summary

- ◆ There have been about 8 archival papers since the original white paper, and a number of Lattice conference proceedings
- ◆ On April 15, we summarized our section and realized there is a need to discuss more windows and that there is overlap of sections with the current outline
- ◆ A new outline is needed for this section
 - We plan to formulate a new outline based in either email discussion or a Zoom meeting in the next two weeks
 - We plan to share the new outline with the Steering Committee for the comments
 - We expect to have to adjust writing assignments
 - We don't anticipate any problem in meeting the deadlines

Summary of the Dispersive HVP Session

Focus of session: Existing tensions among the experimental $e^+e^- \rightarrow \pi^+\pi^-$ measurements

KLOE / BaBar / BESIII / CMD3 ; CMD2 / CMD3 ; ...

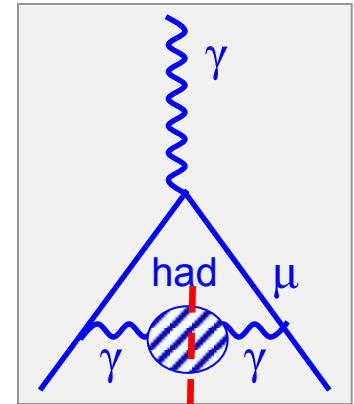
→ Tensions in other hadronic channels (see e.g. new measurement from BELLE-II for 3π)

→ Status / plans for ongoing / future measurements

Reports from: BaBar; BELLE-II; BESIII; CMD2 / CMD3; SND

→ Status of Monte Carlo generators, comparisons with data, relevance for the various measurements

→ Extra ISR/FSR photons in data & simulation: impact in the context of the measurements / observed tensions



Topics for discussion at the end of the session:

→ How many new experimental results to be expected by fall 2024 (deadline for new WP) ?

How to deal with a new HVP-dispersive result in case of no (new published) result ?

→ How to deal with the present discrepancies ?

→ Can the issue of additional radiative corrections be clarified by fall ?

→ Importance to apply blinding mechanisms to make results credible !!!

Remarks / questions concerning the WP:

→ Dispersive HVP section more general than the (“most urgent”) topics covered during the session yesterday

→ How “fixed”/“flexible” is the Fermilab / WP2 schedule ? Possible update during next workshop ?

→ Foreseen section(s) for Lattice / Dispersive comparisons ? (both for HVP and LbL)

→ Need balance between no real page limit / avoid repeating too much from other publications (keep WP readable)

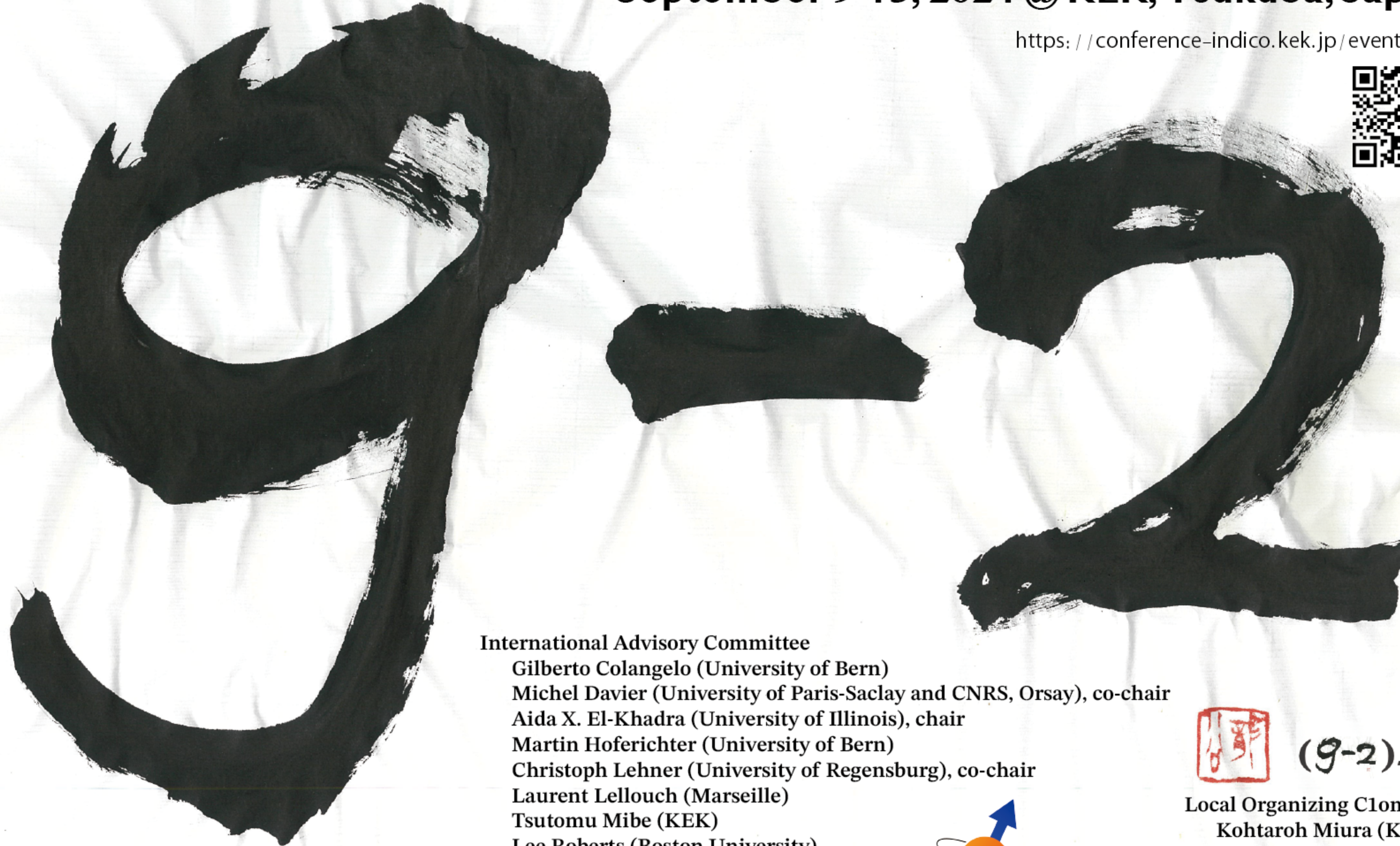
Items for discussion

1. Should we insist that essential inputs be published (or accepted for publication)?
2. What to do if there are no new HVP (lattice or data-driven) results available by fall?
3. How to treat new essential inputs (i.e. 2024 or later) that aren't based on a blind analysis?

7th Plenary Workshop of the Muon $g-2$ Theory Initiative

September 9-13, 2024 @ KEK, Tsukuba, Japan

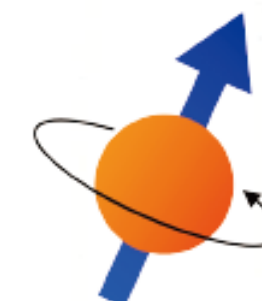
<https://conference-indico.kek.jp/event/257>



Hope to
see you all
in Japan!

International Advisory Committee

Gilberto Colangelo (University of Bern)
Michel Davier (University of Paris-Saclay and CNRS, Orsay), co-chair
Aida X. El-Khadra (University of Illinois), chair
Martin Hoferichter (University of Bern)
Christoph Lehner (University of Regensburg), co-chair
Laurent Lellouch (Marseille)
Tsutomu Mibe (KEK)
Lee Roberts (Boston University)
Thomas Teubner (University of Liverpool)
Hartmut Wittig (University of Mainz)



(9-2)₇

Local Organizing Committee

Kohtaroh Miura (KEK)
Shoji Hashimoto (KEK)
Toru Iijima (Nagoya)
Tsutomu Mibe (KEK)