

**DRAFT 6/6/08**  
**Alignment of Muon g-2 with P5 recommendations with specific emphasis on  
implementation in the near term at FNAL**  
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## Overview

### P5 writes:

Flavor-conserving muon properties are also likely to reveal important information concerning physics beyond the Standard Model. The long muon lifetime and relatively large mass allow measurement of some of these properties with great precision. The muon anomalous magnetic moment  $(g-2)/2 = a$  is particularly significant in this regard.

A next-generation (g-2) experiment could be mounted at Brookhaven or Fermilab or offshore at JPARC. There is an [excellent physics](#) case for this classic precision measurement. Nonetheless, the [estimated cost](#) to the US particle physics program is [substantial and would compromise the timely development of higher-priority precision physics experiments such as muon-to-electron conversion](#). US participation in an experiment at JPARC would cost less and the US in-kind contribution of the existing precision storage ring, which is central to the experiment, would be substantial. [A modest level of R&D support should be made available for the \(g-2\) collaboration to determine the optimal path toward a next generation experiment.](#)

The cost considered by P5 was above \$50 M. This was based on an elaborate installation that would be compatible with a broader muon program and would be located in a place where eventually a muon cooler might reside. Alignment with P5 has two messages for now:

1. Determine a real cost that satisfies the concern about delaying Mu2e. As guidance, it should be less than \$20M. Intra-agency cooperation was not considered in the budget. NSF is expected to pay for detectors / daq / electronics, together with International contributions from our interested collaborators. The Long Range Plan of Nuclear Physics strongly supported muon g-2. This should translate into some cooperation and support, particularly in moving the Storage Ring. It would be helpful to get a tentative statement of intended support from these resources.
2. Modest R&D is required ASAP to make studies of the decay beamline, proton targeting (with 8 GeV protons vs 30 GeV protons), for storage ring kicker improvements, and for general siting considerations. We also need access and effort from the Machine - Experiment Interface Study Group (MEISG) to determine if there is an acceptable footprint at FNAL that would minimize costs.

The JPARC team is also actively pursuing g-2 and acquisition of the storage ring from BNL. Their time scale for a proposal is late 2008. We should be cognitive of this time scale and make decisions on the same time scale.

### Requests to FNAL:

1. Establish a lead local contact to the Collaboration (likely from the Accelerator Division for now).

2. Hold monthly meetings to develop a proposal and work out a credible plan. (This can be with the MEISG.)
3. Assign some modest FNAL effort to work on:
  - a. Target optimization (need 3.1 GeV/c pions from 8.9 GeV/c protons). The key here is to see if the rate agrees with preliminary calculations based on MiniBooNe programs.
  - b. Preliminary design of possible beam transport and delivery system and development of relevant beam physics parameters.
  - c. Cost estimate for a modest building with services (cryo, crane, power, stable floor).
  - d. Visit BNL with Collaboration to examine list of re-useable items. This is important to see what new items must be purchased.
    - i. Storage Ring
    - ii. Power supplies (main, quads, etc.)
    - iii. Beamline elements, shutters, target, monitoring

**Requests to DOE / NSF** (This is in line with P5 recommendation)

1. PDRA position to Brookhaven group to work on g-2 simulations (site independent) and transport to FNAL or JPARC.
2. Two PDRA positions to University groups to work on simulations and detector development. These could come from NSF as a supplemental bump (not a raise of base) until experiment site is determined.

\* This was prepared without consultation of the Muon g-2 Collaboration as input to Young-Kee Kim's planning exercise during the 3<sup>rd</sup> Workshop.