

Short Minutes of the BVR 45

Meetings of January 27 – 29, 2014

1 Meetings of the Committee

closed meetings:	Tuesday, January 28, from 9:00 – 12:00 Wednesday, January 29, from 9:00 – 12:00
present:	D. Bryman A. Ceccucci (Tue) G. Colangelo B. Filippone G. Greene C. Hoffman (chair) P. Kammel St. Passaggio M. Pendlebury M. Pohl M. Ramsey-Musolf A. Signer (secretary) U. Straumann
beam time coordinators:	C. Petitjean (Tue) St. Ritt
ex officio:	K. Clausen K. Kirch
apologies:	A. Ceccucci (Wed) C. Petitjean (Wed)

2 New Proposals

The committee received three new proposals. These experiments requested more beam time than is available, especially in $\pi E1$. The committee reiterates that the reduction of beam time from 8 to 6 months has a serious negative impact on the physics program and urges the PSI management to minimize the loss of beam time for the proton machine. Furthermore, we strongly endorse a feasibility study for a high intensity muon beam (HiMB), as such a beam line would ensure the continued world leadership of PSI in muon physics.

R-13-02.1: Search for muonium decay $\mu^+e^- \rightarrow \bar{\nu}_\mu\nu_e$ (MUTON) (S. Gninenko *et al.*)

The aim of this experiment is to measure the invisible decay of muonium, i.e. the branching ratio $\text{BR}(\mu^+e^- \rightarrow \bar{\nu}_\mu\nu_e)$. The current indirect limit of this branching ratio $\text{BR} < 5.7 \times 10^{-6}$ is about 6 orders of magnitude above the Standard Model value $\text{BR}_{SM} = 6.6 \times 10^{-12}$. The collaboration claims that the proposed experiment can achieve a sensitivity of 10^{-12} provided

that enough beam time at π E1 is provided, and that an enhanced BR would be clear evidence for physics beyond the Standard Model.

The committee feels that the proposed reach in the sensitivity of the experiment is very optimistic. More importantly, we feel that the science case is not compelling. While there might be special scenarios where new physics could be revealed in this branching ratio measurement, it seems unlikely due to constraints from the muon lifetime. In view of the tight constraints on beam time in π E1, the experiment is not approved. If the science case can be bolstered, the committee is willing to reconsider.

R-14-01.1: Pion induced change of material parameters in silicon (T. Rohe *et al.*)

In this experiment, the change of properties of silicon under pion irradiation is to be studied. Pions are the main source of radiation damage in the tracking layers close to the interaction points of the CMS and Atlas experiments. Thus the experiment will provide essential information and input for the design of detector upgrades that are required in connection with the planned high luminosity phase at LHC.

The committee recognizes that this is a very important measurement. π E1 is the only beam line in the world where this experiment can be done and the requirements of the collaboration are minimal. We enthusiastically approve this experiment and the requested beam time of 4 weeks at π E1 in 2014.

R-14-02.1: High-brightness ultra-cold muon beam: test of transverse compression (A. Antognini *et al.*)

The long term goal of this study is to develop a tertiary muon beam line with exceptional phase space quality to be used as an enhancement to existing or future muon beam lines. The reduction in phase space can reach a factor 10^{10} with an efficiency of 10^{-3} . The longitudinal compression has already been partially tested in 2011 and the collaboration requests 4 weeks of beam time at π E1 in 2014 to test the transverse compression of the beam. To allow for the construction of the apparatus, the beam time has to be in December.

This is a very exciting development. The prospect of a well defined muon beam is potentially very important for both the particle physics and μ SR communities. It could have a significant impact on the future of muon physics at PSI. The combination of such a tertiary beam line with a possible future high-intensity muon beam at PSI would open unprecedented opportunities. In view of this the committee approves the experiment and the request for beam time in December 2014.

3 Progress Reports and Beam Requests

R-99.05.2: Search for $\mu^+ \rightarrow e^+ \gamma$ (MEG II) (T. Mori, A. Baldini *et al.*)

There was a detailed half-day review of this experiment on January 27. The committee is very pleased with the progress of the collaboration and is confident that the ambitious goals can be reached and the experiment can be completed in timely fashion. In the past year, the collaboration has made improvements to the detector and the remaining problems are being

addressed. There will be further tests in 2014 and possibly the collaboration will have an engineering run in 2015. The committee expects to give MEG the highest priority in $\pi E5$ in the coming years.

We look forward to the result of the analysis of the 2013 data that will hopefully be available during summer 2014.

R-05-03.1: Measurement of the neutron EDM (K. Kirch, G. Ban *et al.*)

Despite the problems related to the performance of the UCN source the experiment is in good shape and is on track to achieve the world's best value for the neutron EDM. In view of the history of previous neutron sources, it is not surprising that the UCN flux is presently below expectations. However, even with the current flux, there is the potential for an order of magnitude improvement compared to the current best upper limit.

The collaboration is encouraged to continue their efforts to try to increase the UCN flux, such that the full power of the detector can be exploited.

A special report of the technical subcommittee will be provided.

R-08-01.1: Muon capture on the deuteron (MuSun) (P. Kammel, C. Petitjean, A. Vasilyev *et al.*)

The committee acknowledges the receipt of a very detailed progress report. Unfortunately the experiment suffered from the extended downtime of the accelerator in 2013 and collected fewer events than planned. The collaboration requests three months of beam time at $\pi E1$ in 2014 for a major production run. The experiment is in a very solid position and the committee is happy to approve the request.

R-10-01.1: Lamb shift in muonic helium (CREMA) (R. Pohl, F. Kottmann *et al.*)

This important experiment had a successful run in 2013 and there are no major outstanding issues. The committee hopes for more results and if all goes well the run in 2014 should conclude the experiment.

R-12-01.2: Studying the “Proton Radius Puzzle” with μp elastic scattering (MUSE) (R. Gilman *et al.*)

The committee thinks there is a compelling physics case for a high precision μp elastic scattering measurement and reiterates the scientific approval given at BV44. However, as noted in the report from July 2012, the available documentation is still not suitable to serve as a basis for a conclusive technical decision on the proposal. There are reservations about a number of technical aspects of the proposed measurement and whether the collaboration effort is sufficient to carry out this experiment. In particular, we are not convinced that the level of effort committed by senior people is adequate.

If the collaboration wants to be considered for beam time at the BV46, a full Technical Design Report (TDR) has to be delivered to the technical subcommittee by 1. November 2014 at the latest. The collaboration is urged to consult with the technical subcommittee to ensure the completeness of the TDR.

R-12-03.1: Search for the decay $\mu^+ \rightarrow e^+ e^- e^+$ (Mu3e) (A. Schoening, St. Ritt *et al.*)

The committee strongly supports the physics case of this experiment. Achieving the proposed sensitivity in connection with HiMB would ensure the continued world leadership of PSI in this field. The staged approach of this experiment is a very attractive feature.

While the collaboration has made a lot of progress they are still in the R&D phase. The collaboration is expected to come back with a full TDR, once the R&D phase is completed. We expect to have a more detailed review of this experiment next year, but it still might be too early for a full technical review, as the schedule presented is extremely optimistic. The technical subcommittee will provide a more detailed report to help the collaboration.

R-13-01.1: Laser spectroscopy of pionic helium atoms (PiHe) (M. Hori *et al.*)

The committee is very impressed by the progress of the collaboration and approves the request of 8 weeks beam time at $\pi E5$ in 2014. A major problem of the experiment is to reduce the electron contamination in the beam. The collaboration will investigate whether the spin rotator can be used to eliminate electrons from the beam.

Since the long term situation at $\pi E5$ is not clear, the collaboration has been urged to consider the possibility of using $\pi E1$. However, the e^+ contamination seems to be a major problem there and the option to run at $\pi E1$ appears to be possible only with a substantial new investment.

R-13-03.1: Study of muon capture for $\mu \rightarrow e$ conversion experiments (AlCap) (P. Kammel, Y. Kuno *et al.*)

The committee acknowledges the progress report obtained from the collaboration and notes that they plan to submit their next beam request in 2015.

4 Miscellaneous

This was the last meeting chaired by Cy Hoffman and as of 2015 Brad Filippone will take over as chair of the committee. However, Cy Hoffman will remain on the committee to ensure a smooth transition.

This year, Stefan Ritt and Claude Petitjean jointly did beam time coordination: Stefan Ritt will take over this task next year.

During the open session Maxim Posepelov presented a talk “Precision tests of the Standard Model after the Higgs Discovery”.

5 Next Meeting

The next meeting (BV 46) is again planned as a 3-day meeting and will take place from Monday to Wednesday, February 9 – 11 2015 with Monday reserved for detailed technical reviews. Following the users meeting there will be a workshop on a possible high intensity muon beam HiMB at PSI.

February 26, 2014

C. Hoffman, A. Signer