Short Minutes of the BVR 43

Meetings of February 21 – 23, 2012

1 Meetings of the Committee

closed meetings: Wednesday February 22, from 9:00 – 12:30
Thursday, February 23, from 9:00 – 11:00

present: D. Bryman
G. Colangelo
B. Filippone
C. Hoffman (chair)
St. Passagio
J. M. Pendlebury
M. Pohl
M. Ramsey-Musolf
M. Spira (secretary)
U. Straumann

excused: A. Blondel
A. Ceccucci

local consultant: C. Petitjean

ex officio: K. Clausen
K. Kirch

2 New Proposals

R-12-01.1: Studying the Proton "Radius" Puzzle with μp elastic scattering (R. Gilman *et al.*)

The motivation behind this experiment is to explore the discrepancy between the proton radius derived from the recent mu-Lamb shift measurement at PSI with radii obtained with measurements of ep elastic scattering and the Lamb shift in electronic hydrogen. It may be that this discrepancy points to a breakdown in $\mu - e$ universality or to some problem interpreting the atomic and the scattering results. An accurate measurement of μp elastic scattering provides the fourth leg of this study and may give some new clues into the solution of the problem. Thus the committee feels that this experiment addresses important physics and that the proposed experiment is a useful and important way to attack the proton radius puzzle. However, this is a difficult experiment and we therefore defer acting on the proposal and ask the collaboration to study and understand the beam better and to perform a full Monte Carlo simulation of the detector. We hope that the collaboration will be ready for a detailed technical review of this experiment by July 2012. After that technical review, this committee will be ready to respond.

3 Letters of Intent

R-12-02.0: Experimental Verification of the exotic Six-Quark Hadron d_1^*(1956) production in the process $pp \to pp\gamma\gamma$ below the pion production threshold (A.S. Khrykin *et al.*)

The Committee thinks that a conclusive observation of hexaquark bound states would be very important. Although there is some evidence for these states, it has been published for some time and is not convincing. The experiment discussed in this letter of intent is just a repeat of a previous one with an additional incident energy. We feel that a new experiment addressing this issue should be significantly different from previous experiments.

R-12-03.0: Letter of Intent for an Experiment to search for the Decay $\mu \to eee$ (A. Schöning, S. Ritt *et al.*)

The origin of the flavor structure of elementary particles and their interactions remains one of the outstanding puzzles in particle physics. The wide range in quark and lepton masses, the sizable gap between the masses of charged fermions and neutrino masses, and the notable differences in the patterns of quark and lepton mixing have motivated a number theoretical scenarios. Many of these also predict the non-conservation of the flavor of charged leptons.

Experiments searching for the flavor violating decays $\mu^+ \to e^+\gamma$, $\mu \to eee$ and conversion process $\mu A \to eA$ probe different combinations of possible mechanisms for charged lepton-flavor violation. The observation of a non-zero result in any one of these channels would constitute a major discovery. More broadly, the combination of results – either positive signals or limits – would provide a critical window on the origin of flavor.

A search for the $\mu \to eee$ decay with a branching ratio sensitivity of 10^{-15} or better would constitute a powerful part of a comprehensive search for charged lepton flavor violation, which includes the MEG experiment.

The Committee is enthusiastic about this experiment. The anticipated goal to improve the sensitivity of previous experiments by 3–4 order of magnitude is very exciting. With good resolutions, this measurement should be free of background. However, there are a many things to be done before a proposal for this experiment can be considered. Certainly there is more work to do on the Monte Carlo and on the tracker. The collaboration should consider all possibilities before deciding on the best technology to use. The Committee is looking forward to these next steps and a complete proposal of the experiment.

4 Progress Reports and Beam Requests

The Committee received six Progress Reports, three of which were presented orally in the afternoon session on Wednesday (February 22). In addition, one request for time to measure rates and backgrounds in the UCN area was received: the group making this request may submit a proposal to PSI in the future.

The Committee thanks all speakers for their presentations which were very helpful and informative.

R-99-05: Search for $\mu^+ \to e^+\gamma$ (T. Mori, A. Baldini *et al.*)

There was a separate day of presentations on this experiment on Tuesday (February 21). A more detailed report will be prepared by the MEG subcommittee. The Committee congratulates the collaboration on the successful 2011 run and hopes for a successful run in 2012. If the 2012 run achieves the expected sensitivity, it will probably be the last run with the present equipment: it makes little sense to continue running with only a marginal increase in sensitivity. The Committee looks forward to hearing about the possible major upgrades of the detector (e.g. of the LXe calorimeter, the tracker or the implementation of an active target) and a proposal for an upgraded experiment.

R-05-03.1: Measurement of the Neutron Electric Dipole Moment (K. Kirch, W. Heil *et al.*)

There was a separate day of presentations on this experiment on Tuesday (February 21). This is a major project on which a separate report by the EDM subcommittee will be prepared. The Committee would like to congratulate the collaboration for collecting data at the end of the 2011 run and hopes for a successful run in 2012. The experiment needs a significant increase of the ultracold neutron flux. The Committee is looking forward to the continued progress of this important experiment.

R-07-01.1: A Precision Measurement of the Neutron Lifetime in a Trap with Superconducting Magnets (J. Hartmann *et al.*)

The Committee acknowledges the written report from the PENeLOPE collaboration which does not request beam time this year. It recognizes that the construction of this experiment should start next year and the plan to have the experiment ready in 2014. At that point the collaboration will decide where to run the experiment, with the main criterion being the largest number of ultracold neutrons stored in their detector volume.

R-08-01.1: Muon Capture on the Deuteron - The MuSun Experiment (P. Kammel, C. Petijean, A. Vasilyev *et al.*)

This experiment is going quite well. The Committee congratulates the collaboration on the successful performance of the experiment and acknowledges the glimpse of the results given in the oral presentation. The major activity in this year is the move of the experiment to the πE1 area with a new beam channel and the demonstration that the experiment will succeed in the new environment. This requires 5 weeks beam time in the expanded πE1 area. A major data run is planned for next year.

R-98-03: Lamb-Shift in Muonic Atoms (F. Kottmann, R. Pohl *et al.*)

The Committee received an update on the status of this experiment via email and looks forward to a more formal written report next year with a request for beam time in 2013.

R-12-04.0: Towards a new slow μ^+ Beam Line with small Phase Space (A. Antognini *et al.*)

and

R-12-05.0: Muonium Emission into Vacuum from Mesoporous Thin Films at Cryogenic Temperatures (A. Antognini *et al.*)

The Committee acknowledges the written reports about these exciting technical developments.

5 Request for beam time to prepare a Letter of Intent

Measurement of the A asymmetry parameter in Neutron Decay (UCNA) (B. Filippone *et al.*)

The Committee recognizes that this experiment, currently running at Los Alamos, is very important. This experiment aims to measure the A asymmetry parameter in neutron decay with a precision that allows an extraction of the first-generation mixing parameter V_{ud} of the Cabibbo-Kobayashi-Maskawa (CKM) matrix with similar accuracy as the present world average. This will allow a measurement of V_{ud} independent of the determination of the neutron lifetime which yielded conflicting results in previous experiments. Operation of the UCN source at Los Alamos may end soon. There could be interest to continue this experiment at PSI where it should benefit from the higher UCN flux. While there is no formal letter of intent from this group, the Committee would welcome a proposal to run this experiment at PSI, should circumstances warrant.

6 Miscellaneous

G. Isidori (Laboratori Nazionali di Frascati) gave an interesting Invited Talk on "Flavour Mixing beyond the Standard Model" in the Open Users Meeting on Wednesday afternoon before the presentations of the experiments. These overviews have become a standard and very useful part of the Open Users Meetings.

7 Next Meeting

The next meeting (BV 44) is again planned as a 3-day meeting, tentatively for Monday – Wednesday, January 14 – 16, 2013. The earlier date of this meeting will require a deadline for new proposals and progress reports to be before Christmas. The first day of the meeting will be devoted to reviews of the MEG and neutron EDM experiments.

March 9, 2012 C. Hoffman, M. Spira