Highlights of the 29 July 2008 SPIN@COSY Teleconference Meeting

ATTENDEES:
A Lehrach, A U Luccio, R Maier (COSY); F Hinterberger (Bonn); M A Leonova (Moscow); A M Kondratenko (Novosibirsk); E J Stephenson (Indiana); Yu F Orlov (Cornell); E D Courant (NYC); Yu S Derbenev (J-LAB); A D Krisch, V S Morozov, R S Raymond (Michigan).

A.D. KRISCH: Papers, PAC.
1. The PAC scheduled SPIN@COSY for a one week run with protons during 21-30 November 2008.
2. After much activity, the CANU Users’ Perspective paper was redrafted by Schadmand and sent to the chairman of the PAC; everyone may now be happy with it.
3. An almost final draft of the KC Test PRL was recently sent to all authors; Morozov will discuss it later.
4. We recently received two referee reports on the Solenoid Strength PRL. Referee A said it was important and should be published in PRST-AB; his only request was to reference the PRST-AB Comment by Mane.
5. Referee B made more substantive comments; noting that our theoretical statement [that the 1 in (1+Gr) might be exactly canceled] might lead to confusion and was not supported by our data. Courant recalled that Orlov was earlier concerned about this statement; Krisch suggested removing it; everyone agreed.
6. Referee B also objected to using the term “BNL” to identify the correct factor of 2; we changed the wording to “disputed factor of 2”. Following another Referee B suggestion, “Good progress is being made…” was changed to “Some progress has been made…”
7. We added references to Bai et al. PRL 1998 and Mane PRST-AB 2008. Courant noted that Mane’s paper seems correct; Krisch asked about its originality and suggested referencing it with qualifying statements; Courant agreed.
8. Referee B said ref. [9] had no mistake because it stated that the dipole strength formula was derived under some assumptions limiting its validity; Courant said the assumptions were not realistic. Krisch suggested mentioning the ref. [9] limitations in its reference; and also mentioning that ref. [10] gave only the solenoid strength formula that was correct, except for its factor of 2.
9. The conclusion’s sentence about the factor of 2 was modified for clarity. Krisch said Michigan would prepare a new draft of the paper and e-mail it for final approval. The response letter will remind the PRL editors of the referee report on our earlier rf dipole strength paper, which said that it would be very important if we could demonstrate that (1+Gr) was not correct. [NOTE: The paper was resubmitted to PRL late on 31 July 2008.]

R. MAIER: COSY 2008-II Schedule.
1. Maier said there were no changes in the up-to-date schedule that is available online. The SPIN@COSY run is scheduled to start on Friday, November 21 and finish just before the PAC meeting.

R. MAIER for D. PRASUHN: p-Polarization, Ring Quads & RF.
1. He said there was no solution yet to the low proton polarization problem. The new movable polarimeter was calibrated; it will first be installed at the COSY injection point to measure the injected beam’s polarization. This will test whether polarization loss occurs in the transfer line, which should narrow down the problem’s location.
2. Krisch introduced using the ring quads to form the KC shape in νy to cross an intrinsic resonance. We could also try to test KC with an imperfection resonance; they are often overcome using harmonic corrections. He recalled a 1962 proposal by David Cohen at Argonne to overcome imperfection resonances by quickly accelerating through them; however, it was impractical to quickly ramp the large ZGS magnets. Lehrach said Huang tried an energy jump at the AGS but it was not very successful. Krisch said that jumping a ring’s rf gets the beam out of synchronization with its magnetic field ramp; however, due to the KC shape’s symmetry, one might ramp the energy with only the rf cavity, with the magnet ramp unchanged. Maier agreed to think about it; he said that COSY’s longitudinal acceptance would allow a maximum Δp/p of ~10^{-3}. Krisch said this might be good enough; moreover, KC would be even more valuable if one could show that it works for both intrinsic and imperfection resonances.
3. Krisch said Prasuhn provided fairly detailed information about the ring quads’ properties; we could try some tests with the ring quads; their relatively slow speed might result in a larger difference between KC and FC; this would better demonstrate KC’s advantage over FC. At Maier’s request, Krisch promised to send, before the next teleconference, a realistic picture of the proposed betatron tune vs time ramp. Maier promised to send information about how well COSY’s rf cavity can be controlled and about its properties.

A. LEHRACH: Fast Quads.
1. He sent a two-page presentation. Only one fast quad is currently installed; page 1 listed its parameters. Two power supplies are now connected to the single quad to allow closely time-spaced pulses. The rise time is always 10 μs; the fall-off time is adjustable. With 2.1 GeV/c protons, the maximum Δνy at 3100 A is between 0.06 and 0.08 depending on the β-function.
2. Page 2 showed a typical current pulse and an example of overcoming a strong intrinsic resonance with ε = 1.6 10^{-3}, which is the fast quad’s limit; its power supplies can only generate triangular pulses. Krisch said we would probably use the ring quads and possibly the rf cavity; we might then see a larger difference between FC and KC.

E.J. STEPHENSON: EDM Status.
1. He said they now plan to have a polarimeter development run in September because BNL requested a polarimeter feasibility report by the 2nd half of 2009; moreover the simulations needed for the originally planned horizontal polarization studies, may not be finished. Thus, they plan to study EDDA polarimetery using thick targets.
2. In their June 08 run, the beam energy was probably too high; the many protons from deuteron break-up caused a low analyzing power. They plan to lower the momentum to have the signal dominated by elastic events; they also plan to modify the data acquisition system to better discriminate against the deuteron break-up protons.
3. They plan to optimize EDDA’s operation by studying its systematic errors due to beam movement and how to compensate them. They would induce a small horizontal polarization component by using a weak Siberian snake.

4. They plan to move EDDA downstream to its maintenance position; Krisch said the cables are fragile. Maier said it is a routine procedure, but moving EDDA would reduce the space available for a Siberian snake solenoid.

V.S. MOROZOV: Draft-3 Kondratenko Test PRL.
1. The Draft-3 Kondratenko Crossing (KC) test paper (dated 23 July 08) tried to incorporate all earlier suggestions.
2. He discussed the title and abstract, which were slightly modified for clarity; most changes on page 1 were stylistic.
3. There were changes in most figures. Figure 2 now plots the $P_{V}/P_{V'}$ ratio for each non-zero spin state instead of $P_{V}$, because we don’t know the absolute polarization very well; indeed, one state had $P_{V'} > 1$.
4. The predictions in Fig. 3 used the measured $\epsilon$, and the fairly precise fits to $f_{i}$ and $\delta f$ from the Chao test PRL. Chao had questioned our resonance map procedure for obtaining $\delta f$ (it is probably good for obtaining $f_{i}$). However, minimizing the $\chi^{2}$ in Fig. 3 gave much more precise values of both $f_{i}$ and $\delta f$ that were used to predict Figs. 4-6.
5. The paragraph at page 3’s bottom was rewritten: We earlier had separate discussions for Figs 3-6; now we inserted a table, as suggested by Maier, and the paragraph discusses the data’s significance.

6. Figure 6 now shows the $P_{V}/P_{V'}$ averaged over all non-zero states instead of separate ratios for each spin state; this gives Figs. 3-7 the same notation. The agreement of $P_{V}/P_{V'}$ for different spin states was earlier shown in Fig. 2.

7. Maier asked what one could learn from Fig. 7; Krisch said that it illustrates the difference between KC and FC more visually than the table alone. Maier said that the $x$-axis of Fig. 7 is not physical and referees may complain about it; Krisch suggested that we keep both Fig. 7 and the table for now.

8. Morozov discussed the summary on page 4. Maier suggested eliminating the last sentence about our plans to cross an intrinsic resonance with protons at COSY because the run may go no as planned. Krisch said that it was the next planned step; he asked everyone to e-mail their comments on this point to the Teleconference list.

9. Morozov discussed his 3-page file with some data analysis for the paper. Page 1 had plots of $\chi^{2}$ vs $f_{i}$ and $\chi^{2}$ vs $\delta f$ from Fig. 3; it showed the best $f_{i}$ and $\delta f$ and their errors. These values were used for the predictions in Figs 4-6.

10. His page 2 was a table of $\chi^{2}$’s for all Figs; all were reasonable except for Fig. 4 (varying $\Delta f_{\text{fast}}$). He said the shape was not well defined for small $\Delta f_{\text{fast}}$ values; Krisch suggested deleting the prediction for the 2 smallest $\Delta f_{\text{fast}}$ points.

11. Page 3 showed a plot, requested by Kondratenko, of the final $P_{V}/P_{V'}$ vs $\epsilon$; it shows the $\epsilon$ range where KC is useful. Krisch said there was no room for it in the paper; but we should show it at conferences.

1. Leonova’s Draft 0 Run Plan was dated July 16; its “summary” uses two pages to summarize unbunched and bunched beam studies. She first discussed the initial apparatus setup, which includes both now-standard procedures, and setting up the ring quads to produce the KC shape.

2. We would first locate some 1st and higher-order intrinsic resonances and measure their $\epsilon$ by sweeping $\nu_{x}$ and perhaps $\nu_{x}$. We would then choose two resonances suitable for KC tests. We could test KC by crossing the 1st-order 8-$\nu_{x}$ resonance and a weaker 2nd or 3rd order resonance. [NOTE by ADK: either on flat-top or during acceleration].

3. We would next find and map the rf-solenoid resonance and study its $\epsilon$.

4. Krisch noted that the Run Plan’s page 2 repeats most of page 1 but with bunched beam; we should prioritize the planned studies by importance. We should do some KC tests with unbunched beam; but it may be more important to test KC with bunched beam, with both an intrinsic and imperfection resonance.

5. Leonova said the number of shifts might be underestimated. Krisch was concerned that Parts with less than a shift might not allow enough time for careful setup. He said the planned number of shifts exceeds the beam time available, but it is good to have a choice of options.

A.U. LUCCIO: Resonance Strength Simulation.
1. He said he continued doing simulations. He finished simulations of the rf-dipole resonance strength studies and is now working on simulations of the rf-solenoid studies. He and Lehrach presented a paper at EPAC on this work.

2. Luccio said he does not use any $\epsilon$ equations for the resonance strength; he uses the Thomas-BMT equation to track particles’ spins through the ring’s elements and finds good agreement with the data.

3. He said the Thomas-BMT equation contains a term proportional to $(1+G\gamma)$ but, for rf dipoles, the momentum deflection takes the 1 out of it; this does not happen for quadrupoles because they kick the spins in opposite directions. The overall $\epsilon$ term is neither $G\gamma$ nor $(1+G\gamma)$ but the simulation automatically accounts for this.

V.S. MOROZOV: SPIN@COSY Contribution to CANU Perspective.
1. He said SPIN@COSY’s contribution to “The Users’ Perspective” was based on 2 recent SPIN@COSY proposals.

2. The earlier final CANU draft had many SPIN@COSY figures, but they were all deleted, just after Brinkmann left for vacation, to make the contributions more uniform. Thus, the SPIN@COSY text had to be rewritten [mostly by Susan Schadmand and Morozov] to describe what was done with no Figures; Maier asked if the contribution was still understandable; Morozov said we hoped it was.

3. Maier said that Susan Schadmand sent the website address for “The Users’ Perspective” to the PAC Chairman, van Oers, and the COSY Directors and Spokespersons; they now expect to receive feedback from PAC members. Maier added that “The Users’ Perspective” will be used in the discussions of COSY’s future. The 1st draft should be ready in mid-August. The final draft should be submitted to the Helmholtz Society (Science Ministry) by 3 November.

ROUNDTABLE:
1. The next SPIN@COSY Teleconference was tentatively scheduled for Thursday, 11 September 2008 at 16:30 German time (10:30 Michigan time, etc.).