Highlights of the 13 August 2009 SPIN@COSY Teleconference Meeting

ATTENDEES:
M A Leonova (Moscow); A M Kondratenko (Novosibirsk); D W Sivers (Portland); A D Krisch, V S Morozov, R S Raymond (Michigan).

A.D. KRISCH: Papers, etc.
1. The Narrow Deuteron Resonance paper was submitted to PRL on 23jul09 and sent to two referees on 3aug09. [NOTE by ADK: It was accepted by PRL on 21aug09.]
2. The SPIN 2008 Proceedings should soon be arriving by mail. [NOTE: Prof. Crabb just received his copies.]
3. He said there was some progress on a new paper about the wide-when-bunched proton resonance. We tried making a calculation to explain the data but it seems very difficult to fit the data with a calculable theory. We have some idea about what might be happening but we cannot prove it with our data.
4. He said that, in the late 1960s, Orlov wrote a letter to Picasso about an effect of synchrotron oscillations on spin behavior; it was referenced as a private communication in a 1970 Bailey and Picasso paper and now in our recent Narrow Deuteron Resonance PRL; Orlov agreed to look for a copy of the letter and send it to us.

V.S. MOROZOV / A.M. KONDRAZHENKO: New KTC (Kondratenko Triple Crossing) Shape
1. Morozov e-mailed a 28-page file with update of his earlier KTC presentation.
2. Page 1 defined the KTC shape and listed its conditions; pp 2-14 showed different cases that satisfy these conditions. Cases I-X on pp 2-11 were for were for our maximum rf-solenoid strength $\varepsilon = 10^{-2}$, where he varied the frequency ranges $\Delta f$ and phase advances $\Psi_{ab}$; calculations were done for both bunched and unbunched beams. Cases XI-XIII were for a stronger resonance with $\varepsilon = 5 \times 10^{-3}$, as suggested by Prof. Kondratenko.
3. Page 15 summarized, for all cases (XI-XIII), the KTC shape parameters and the final polarization $P_f$ after each fast crossing (FC) and after KTC crossing; page 16 plotted these polarizations.
4. Case VIII gave the largest depolarization advantage of KTC over FC, thus, most studies were done for this case.
5. Page 18 shows the final polarization $P_f$ plotted vs. against $f_{KTC} - f$; the problem was that the peak was too narrow.
6. We then studied the width of the $P_f$ peak's dependence on $\Psi_{ab} = \pi n$; as we increased n the peak got narrower. Thus, on page 20 we studied $\Psi_{ab} = \pi n$. However, for odd n, KTC flips rather than preserves the polarization.
7. As shown on the last page, he then increased $\varepsilon$, but could not find a practical solution.
8. Krisch noted that we successfully tested KC with deuterons at COSY using the rf-solenoid, but we have not yet found a way to test KTC. He suggested earlier to Derbenev, that the longer KTC time scales may destroy spin-coherence, while the shorter KC time scales may allow spin-coherence.
9. Kondratenko said that the KTC calculations made sense, thus, they be correct. It depended on each specific situation whether KC or KTC is best, one should consider not only the coherence times, but also the allowed momentum spread for the crossing.
10. In response to a question by Krisch, Kondratenko said that using an rf solenoid to both make a resonance and overcome the same resonance should work for a test.

M.A. LEONLOVA: Bukin et al. Paper Draft Translation
1. Leonova used the 1980 Derbenev et al. paper to make the Bukin et al. notation more consistent. The text in red indicates her changes to Bukin et al. based the Derbenev et al. paper. Krisch asked Kondratenko and Derbenev to check the translation.
2. She has now translated everything except the references. The paper discusses an absolute energy calibration method using a spin resonance to measure the $\Phi$-meson’s mass. The paper’s main goal is to determine the beams’ energy and thus the $\Phi$-meson mass by measuring an rf resonance’s frequency. Another point of the paper is that rf bunching makes the resonance width narrower thus improving the energy measurement’s precision.
3. Leonova said it seems that Bukin et al. has about the same amount of theoretical details as Derbenev et al., which has been translated. Krisch then asked why Kondratenko had suggested that we focus on Bukin et al.
4. Kondratenko responded that Bukin et al. was an experimental paper, where narrowing of the resonance by bunching was utilized. He said there is also a 1971 paper with more theoretical details; he promised to send references to both the Russian and English versions of that paper; Krisch asked Leonova to check the quality of translation in the English version, since the official translators are often not experts in accelerator physics.

V.S. MOROZOV / A.D. KRISCH: Wide Proton Resonance Paper
1. Morozov noted that the author list now includes Jeffery Liu. He then read the abstract; the last clause was removed, as suggested by Sivers. He then read the introductory paragraph and next the summary paragraph; one sentence of the introduction containing references 6-11 was re-written by Krisch.
2. Morozov then showed the figures and read their captions. The data was fit with different order Lorentzians to obtain the resonance widths for comparison. The unbunched case in Fig. 1 was calculated using the Chao formalism since there was no synchrotron motion. The tables describing the fit results were shown as part of figures, but these will be removed in the submitted paper and their information will be included in the text.
3. Krisch said that this is an experimental paper; too much complex theory may result in delaying its publication or getting it rejected. Moreover, the calculations for protons are perhaps orders of magnitude longer than for deuterons and thus may be impractical. Morozov said that the conceptual problem with the proton calculations is that he had to include many synchrotron sideband resonances ($\sim 70$ resonances in our $\Delta f$ region); while for the deuteron calculations he could ignore the synchrotron motion.
4. Krisch asked Morozov to send these calculations, with some explanations, to everyone who is present at this meeting. [NOTE by VSM: Morozov sent these results to the collaboration.]
Morozov showed results of recent work on the data reanalysis, mainly by Jeff Liu. As discussed at the previous teleconference, we found better time cuts and channel cuts, and then used them to reanalyze our data.

Page 1 shows the difference between the online and reanalyzed polarization $P_f$ data plotted vs. the run number. The largest differences were in an early $v_y$ curve and the $\Delta t$ curves where we varied $v_y$ very near the spin-flip resonance.

Pages 2-11 showed the November 08 runs plotted vs. run number. The plot in the upper left corner had a typo: the horizontal scale should be $v_y$.

For the runs with the normal $v_y$ there is almost no difference between the online and reanalyzed data. In the $\Delta t$ curves near the resonance on pp 5-6, the reversed $P_f$ sign may be due to $P_f$ changing during the measurement time; the time cuts are very different for the online and reanalyzed data. Thus, we are producing plots of $P_f$ vs. time.

Krisch noted that we had data suggesting the same problem when we studied higher-order resonances in April 04; thus, we published it as preliminary data in the SPIN04 Symposium (Trieste), but never corrected it for PRL or PRST-AB. Our new data may help us find a proper way to correct for this problem.

Morozov said the bunched beam studies start on page 6. There was again a typo (right column top) the horizontal axis should be $v_y$. Krisch said the spin-coherence studies were not successful. The effect we saw, as we varied the time between 2 pulses, turned out to be also present with 1 pulse; it was probably due to some accelerator changes.

Morozov said that, for bunched beam, the $\Delta t$ curves showed only depolarization, and no spin-flip. This was probably due to crossing many synchrotron sideband resonances, which depolarize the beam.

Page 12 the resonance strength $\varepsilon$ obtained from the online and reanalyzed data plotted vs. $\Delta f$ and vs. $v_y$. The reanalyzed $\varepsilon$ data seems to show much more sensible behavior very near the very strong $G\gamma = 8 - v_y$ resonance.

[NOTE by ADK: Perhaps this reanalysis technique should be extended to the April 04 data, so that the higher-order resonance data might finally be published]

ROUNDTABLE:
1. The next SPIN@COSY Teleconference was scheduled for Thursday, 17 September 2009 at 11:00 EDT.