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LEP SPECTROMETER PROJECT

Summary Notes of the 21st meeting held on November 13, 1998

Present: C. Bovet, R. Chritin, W. Coosemans, D. Cornuet, R. Genand, M. Hildreth, N. Hilleret, J. Montes, G. Mugnai, A. Müller, S. Myers (chairman), J. Palacios, J. Poole, M. Sassowsky, J. Wenninger, W. Weterings, G. Wilkinson

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Comments to Summary Notes of previous meeting - None.

(Note: the minutes are in logical rather than chronological order)

MBI/Mapping Status - W. Weterings and D. Cornuet gave an overview of the progress on the MBI installation in the ISR tunnel. Wim reported that all of the major pieces of hardware (magnet/girder, cooling station) are now in the ISR, and that the cooling water would be connected shortly. G. Mugnai mentioned that the magnet could be cooled from the primary demineralised water circuit in the ISR tunnel while we are waiting for the small techincal details of the cooling station to be sorted out. So, full power tests with the new MBI can begin as soon as the plumbing is completed. Wim also showed the stress-test of the girder, where it was loaded with 13 tonnes (the MBI weighs 9 tonnes). The maximum deflection is about 100 μm with the MBI-equivalent weight on it.

D. Cornuet showed the current state of the mapping programme. The data-acquisition software that drives the measurement arm, controls the dipole power supply, reads back the data, *etc.* is now functioning; a test map was made using the ISR dipole before it was removed last Thursday (5 November) for the MBI installation. Mapping studies can begin in earnest the week of November 16 (week 47).

Didier also gave a discourse on the magnetic properties of lead, which was motivated by his studies of a section of beam pipe. Eventually, the small differences in magnetic field measured ($\Delta B/B \sim 2 \times 10^{-5}$) with and without the lead-shielded beampipe are consistent with the level expected from the lead itself, which has a natural magnetic susceptibility of -15.8×10^{-6} (Aluminum, the other component of the beam pipe, has a susceptibility of 20.8×10^{-6}; in principle, some cancellation in the magnetic effects of the two materials should occur.) So, no special lead will be needed for the spectrometer. Didier also mentioned that the effects of the getter pumps should be a few 10^{-6} at the location of the beam.

News from the Tunnel - E. Torrence reported on results from the BPM electronics studies, comparing the resolution obtained with the electronics running in an "ungated" mode where the average position of the two beams is measured with the gated mode where the signal from one of the beams is excluded. The ungated mode showed an effective resolution of 2.8 μm on successive (every 10 seconds) beam position measurements. This is consistent with an intrinsic resolution of order 1 micron, with some underlying beam motion. This interpretation is borne out by plots from data acquired at a higher rate (2.5 Hz), where beam motion of 15 μm can be seen over a minute, but the intrinsic precision of the measurements over a shorter time is better than 1 micron. When the gating circuit is turned on, there is a large amount of noise introduced into the system, and the resolution becomes five times worse. There are

a number of theories as to why this may happen. First, the "gate" doesn't precisely close; instead, it has a fairly long tail of 1% leakage, which would allow some of the signal from the opposing beam in. Since the beams are separated by $\sim$ 1mm at cell 332, this could have an effect similar to the size observed. Tests made during MD with only one beam, however, still show noise when the gating is turned on. Second, the leading edge of the gate in the current circuit has a timing jitter of up to 50 ns, which could shift the amount of the pulse tails that are included in the position measurement. A gate with less jitter will probably be examined. It should be remembered that the actual measurement of the energy scale with the spectrometer will be done during a polarisation MD with a single beam, which means that the problems with the gating circuit do not affect our ability to do the measurement. The fact that resolutions less than 1 micron are seen with the current electronics is very encouraging. Eric also showed the precision of the signal representing the sum of the charge seen on the pickups, which is approximately 2×10^{-5}. If this can be calibrated against a toroid with sufficient precision, it may allow a measurement of any excess charge being deposited on the pickups from the "QD-20" effect. This may allow us to control this potentially unknown source of systematic error. Investigations continue in this direction.

M. Hildreth showed a summary of the tests made on the WPS system to try and understand the origins of the "jumps" which occur when the system is subject to large amounts of synchrotron radiation. The plots shown were from the last fill of 1998, which was an attempt to observe polarisation at 90 GeV. The beam currents for this fill were about a factor of 10 smaller than what is usually put into physics. These tests confirm rather convincingly that the effect is not wire motion, but due to the interaction of radiation with the sensor assembly (or the air in the gap). A sensor removed from the BPM block and encased in approximately 10 cm of lead (but still containing the wire) shows no jumps at all; the horizontal position is stable to of order 0.5 μm over the fill. A sensor where the wire has been physically attatched to one side of the sensor head so that it cannot move shows jumps of more than 10 microns on the apparent wire position. A sensor head fitted with special electronics to measure the apparent distance between the sensing pads (no wire) shows jumps in the gap size of up to 20 microns. Since this sensor didn't explode from the stress, we conclude fairly definitively that the effect is instrumental. FOGALE is thinking about what can be done in the electronics design to remove this effect. We are in the process of designing easily-removable lead shielding for each of the wire sensors, as well as a means of adjusting the sensor position so that the wire can be centered in the sensor head. A combination of shielding and centering should give a workable system next year.

In addition, Mike showed data that had been successfully stored and retrieved in the Objectivity Database which will be the permanent repository of spectrometer data. This parallel logging was turned on during the last few days of the run to provide a small amount of actual data for development of C++ analysis code during the shutdown. This database will continue to run, logging the temperatures and other data from the ISR tunnel as a test of its long-term stability.

Work in IP3 - Work in the tunnel is proceeding as per the planning of J. Montes . The 1998 spectrometer installation has already been removed from the tunnel.

AOB - The next meeting will be on Thursday, 10th December.

M. Hildreth