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Minutes of the meeting of 11 November 1993 on the PS Fast Wire Scanner project

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The aim of the meeting was to review the situation of the project, establish the programme until the LHC type beam tests in December, estimate the precision of the measurement and assess the reliability of the system.

The state of the project

1) Mechanics

The horizontal wire in SS64 broke a week ago during experimental use. The only spare available is the one with which position calibrations were performed. It will have to be installed in the machine before the test for LHC. But it is not clear when it will be possible since LEAR intends to work until December 7th, even during critical periods. On the other hand, another possibility may be considered during the MD period of November 24.

The test tank will be free for measurement target tests from Friday November 19th on, further software tests being carried out with a simple motor-resolver assembly.

For the unit damaged earlier this year, the new arm, ordered from the main workshop, and the repair of the bellows are both not yet complete.

2) Electronics

The 4 counters and the filter for the sampling of the beam intensity Ip have to be installed. Vacuum interlocks must be foreseen for each sector containing a wire scanner. J. Olsfors will take care of the cabling and contact R. Gavaggio (AT) to get the vacuum status information. ADAS is supposed to ship the ordered spare VME modules next week.

3) Software

Measurements have been done routinely since the end of August from a work-station, through direct log into the DSC (VME crate). Later, K. Priestnall's application program has been adapted for the display of data read from files in the DSC. This situation, though temporary and uncomfortable, is accepted for the LHC test.

The position corrections have to be added (look-up tables), using the measurements obtained with the laser last month. The time of flight has to be measured precisely and

introduced in the software to ensure the correct timing of the measurement. Some streamlining and addition of user-friendliness are also foreseen before the December MD session. Unfortunately, some problems with strange behaviours of the ICV101 and MPV908 VME modules will probably not have been solved. Reset of the crate seems to be necessary when the 101 module occasionally refuses to acquire new data. The 908 has a bug (known since the beginning of the year) which causes an exchange of the addresses of the most and least significant bytes after a reset. The only way to get around this problem is to switch the power off and on.

4) Calibrations

Complete position calibrations have been done during the month of October in the test tank using the laser. They cover both in and out movements with the 3 available velocities (10, 15, 20 m/s). The results are discussed in more details in the next chapter.

Extensive measurements have been made with beam. The PM linearity was found to be good within about ± 3 %. This result was obtained by comparison of the maximum output amplitudes for different optical filters, subtracting the direct radiation component. Other measurements were done with different beam intensities and comparison of the PM output integrated over the sweeps. Though more difficult to interpret, they also give satisfactory results within ± 3 %.

5) Comparison with the old system

A series of measurement was made with the vertical wire-scanners. After various difficulties due probably to the non-reproducibility of the beams, one found that the two devices disagree on emittance by about 10 % for wide beams (of the order of 20 mm), and 5 % for narrow ones (3 mm). This discrepancy is not too surprising since the old system has not been calibrated for a long time, and the position precision is known to decrease away from the central orbit.

Precision of the measurement

The resolvers are excited with a fixed frequency of about 8 kHz, near the RF/h (or particle revolution) frequency divided by 64. The output signals are carried by screened twisted pairs to the two sampling ADC modules HYTEC VTD 1612 and PENTLAND MPV 908A. The first one samples the sine and cosine signals at RF/h, from which the motor angle is calculated. A quadratic fit is then executed after elimination of the low precision values taken at unfavourable phases of the excitation. The positions of the wire are then calculated by the formula established by J. Olsfors from the system geometry. This result was compared with the mechanical position of the laser beam on the test bench at the lab. The discrepancy was a function of the wire velocity and of the wire movement direction. The reproducibility error on the absolute position was found to be of the order of ± 1 mm.

However, the error on the measurement of the profile width is about ± 3 % which corresponds to an emittance error of ± 6 %.

System reliability

Several features have been foreseen to avoid major breakdowns or simple misfunctioning. Part of them originate from the experience with the old system. They have been reviewed very briefly. The following table lists them with their implementation in both old and new system, for comparison, together with some comments.

	Ancien système	Nouveau système
Initialisation des modules	modules Camac, à chaque mesure	modules VME, à discuter
interrupteurs sur modules	blocage des gammes DAC	pas nécessaire
Alimentation moteurs	Enclenchement codé	Enclenchement + stand-by codés
Mesure de position	Vérifiée avant mouvement	Vérifiée avant mouvement
Position de départ mécanisme	Vérifiée avant mouvement	Vérifiée avant mouvement
Test de continuité fil	Non	Oui
Test tachymètre	Non	présence testée
Abort possible	jusqu'au début du cycle choisi	prévu jusqu'au début du cycle choisi
Abort sur intensité faisceau	Possible	à discuter
Timing maximum	Seulement pour cycles de 2.4 s	à discuter (vérification par PLS?)
Interdiction d'un secteur	Non	possible mais difficile...
Test du vide secteur	Non	à faire

Ch. Steinbach

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