

ESTIMATE FOR  $e^+ e^-$  BEAM INSTRUMENTATION IN THE PS

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An estimate for  $e^+ e^-$  instrumentation in the PS is difficult, and the figures given are very approximate, because the effects of synchrotron radiation on the existing equipment are not yet known and it is uncertain whether our beam loss monitors are sufficiently sensitive to detect the 'bremsstrahlung' from  $e^+ e^-$  beam losses. Next year tests must be carried out at Desy and at CERN in order to answer these questions.

The PS operation is increasing in complexity. Switching-over between operations has to be fast and is carried out by highly skilled technicians but not engineers. For example, it is possible to measure during the running-in, the closed orbit with the existing CODD and protons, which implies deceleration or even injection at 50 MeV. For day-to-day operation this procedure should be avoided.

CLOSED ORBIT MEASUREMENT (CODD)

All pick-up stations, which are in the region of enlarged vacuum chambers (13) are on the outside, exposed to synchrotron radiation. The other pick-ups (27) do not directly see the radiation, if the beam is not on an orbit smaller than the nominal equilibrium orbit. However, we do not know to what extent is the influence of photo-electrons from the surrounding metal surfaces and of reflected synchrotron light. It has to be evaluated by experiment if and how much screens, polarisation of electrodes and/or auxiliary electrodes and the treatment of metal surfaces will help. The situation is more favourable for  $e^-$  due to geometrical reasons.

The bunch signals are much shorter than the present electronics can handle. The signals have to be lengthened with passive filters.

### DEDICATED POSITION PICK-UPS

In view of the difficulties of the present CODD with  $e^+ e^-$  we propose four dedicated pick-ups of the directional coupler type. Directional couplers are less sensitive than button pick-ups to electrical wave modes of the vacuum chamber excited by the electron bunches. Their disadvantage is the largersize which makes it more difficult to find good places in the PS straight sections. One of these pick-ups will also serve for Q-measurements.

### TRANSFORMERS

The transformers can be used in their present form.

### SCREENS

Some development has to be done to find screens and/or cameras, which allow at the the ejection septa, to view a low intensity  $e^+$  or  $e^-$  beam and high intensity proton beams. Here again, the synchrotron light will pose some additional problems. It may be necessary to design a new screen mechanism and modify the septum tanks. On the external beam lines it is probably sufficient to invert the observation stations and to place another screen into each station.

### BEAM LOSS MONITORS

The sensitivity of our present beam loss monitors, at their working point for proton acceleration, is certainly not sufficient. Hopefully, one can increase sufficiently their sensitivity by an increase on the high voltage for the  $e^+ e^-$  cycle. To prove the possibility of this, trials will have to be carried out at Desy. If not, approximately 10 additional beam loss monitors of a different type (photo-multiplier plus liquid scintillator) should be installed in appropriate places in the machine (e.g. injection and ejection septa). In addition it should be pointed out that for the same losses the monitored radiation is different for  $e^+$  and  $e^-$  due to geometrical reasons.

SYNCHROTRON LIGHT MONITOR

One can measure, with a synchrotron light monitor, the beam profile of each bunch (slow) or integrated over all four bunches (fast) and the bunch length. One can provide a TV picture of the beam profile. However, because of our high radiation background, the light has to be brought out of the ring.

Distribution : MAC

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ESTIMATES (excluding CAMAC and computer soft + hardware)

50 CODD pick-ups

Prototype for passive filter hybrid circuit	10 KF
4 x 50 passive filters	100 KF
Polarisation, cables and mechanical modifications	50 KF
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	160 KF

4 Directional couplers

Mechanical development	7 KF
Fabrication of couplers	30 KF
Cables, installation, coaxial switches	14 KF
Electronics (excluding CAMAC)	24 KF
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	75 KF

Screens

1) On septum magnets

Modification of tanks 2 x 4000	8 KF
New screen mechanism 4 x 4000	16 KF
TV-cameras 2 x 2000	4 KF
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	28 KF

2) On beam lines

Mechanical modifications	15 KF
New screens	3 KF
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	18 KF

Beam loss monitors

4 HV power supplies computer controlled 32 outputs each	40 KF
100 cables, connectors, installation	100 KF
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	140 KF

OR if technically not possible

10 detectors	20 KF
10 integrators	10 KF
installation, connectors, cables	10 KF
1 HV power supply computer controlled	10 KF
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	50 KF

Synchrotron light monitor

Optics	100 KF
Electronics	150 KF
Mechanics	15 KF
Light pipe	15 KF
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	280 KF

Total ~ 

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 700 KF