3.4.3 Transfer Lines Diagnostics (LBTL and BSTL)

3.4.3.1 LBTL Diagnostics Overview

Measurement	Comments	Instrument
Macropulse envelope	Rise time ≤1 ns	Wall Current Monitor (WCM)
Position (partly destructive)	OTR-screens of sub-μm thickness could remain in the transfer line	OTR and FS
Position - nondestructive	Simple cost effective stripline pickups	Digital Beam Position Monitor System in first turn mode
Transverse Profile and Position (non-destructive)	Each bending magnet in the TLs will be equipped with an SR-monitor	SR-Monitor
Transverse profile (partly destructive)		OTR and FS
Energy and Energy Spread	OTR-screen in a dispersive section of the TL as an add. measurement	OTR and FS
Emittance	Changing quad(s) strength and measuring beam profile. Single shot measurement possible.	OTR and FS
Bunch Purity	Photomultiplier or micro channel plate could be used.	OTR or SR-monitor
Limit energy aperture	Located in a high dispersive region (can be in transfer line)	Scraper

3.4.3.2 Optical Transition Radiation (OTR) and Flourescent (FS) Screens

As (partly) destructive devices for measuring the electron beam position and profile in the Linac to Booster TL (LBTL) as well as in the Booster to Storage Ring TL (BSTL) the same concept as in the pre-injector LINAC will be pursued. Energy, energy spread and emittance of the beam can be determined in the same way as in the pre-injector LINAC with the help of OTR-screens, bending magnets and quads.

For linearity and resolution reasons, OTR is preferred over the use of flourescent screens. Still every profile monitor port will be equipped with two selectable stations for an OTR screen and an optically transparent, but highly sensitive quartz screen. The latter will be used in the low current top up mode of the SLS.

We are presently investigating the use of very thin (500 nm) Si_3N_4 wafers as OTR-foils. These screens will be practically non-destructive to the electron beam in the single pass TLs and therefore allow on-line measurement of emittance and energy spread. In combination with gateable CCD cameras (< 1 μs gating time), single shot measurements over one macropulse period will be possible.

3.4.3.3 Horizontal Scraper (HS)

Due to transient beamloading effects (typically 0.2 % per nC) in the pre-injector LINAC the macropulse can have a slope in it's energy distribution. If the according energy distribution exceeds the energy acceptance of the booster synchrotron a horizontal scraper will be placed in a dispersive section of the LBTL and will cut the high energy part of the macropulse. The finger, which stops the high energy electrons, should be electrically isolated in order to read out the scraped current. For on-line adjusting it to the desired position, which strongly depends on the operation mode of the injector LINAC, it would be preferred to remotely control the finger position.

3.4.3.4 Synchrotron Radiation (SR) Monitors

Each bending magnet in the transfer lines will be equipped with a synchrotron radiation outlet. The position and profile of the electron beam can be non-destructively monitored during injection operation. A simple and cost effective set-up similar to the booster SR-monitors will be used, consisting of a quarz vacuum window, a 45° mirror and a synchronized CCD camera.

3.4.3.5 Wall Current Monitors

If the horizontal scraper will be used behind the LINAC, it will be essential to adjust the macropulse length of the LINAC to the desired bunch pattern in the booster synchrotron. For measuring the macropulse envelope of the electron beam in the LBTL the same concept as in the pre-injector LINAC will be pursued.

3.4.3.6 Beam Position Monitors

See Injector Beam Position Monitors.