3.2 Injection and Extraction

Summary: The injection system of the SSC, consisting of two bending magnets (BM1 and BM2) and a magnetic inflection channel (MIC) in the pole tip of one sector magnet, has been operating without failure since installation. Beam injection efficiency of 100% is achieved with ease.

The extraction system performs well. The first extraction element, the electrostatic extraction channel (EEC), located in the second half of the injection valley vacuum chamber, lost a few of its foils of the septum, presumably from interception of a beam of high intensity. This does not interfere with the proper functioning of the channel and we have thus decided to replace these foils during the next scheduled shut-down of the cyclotron. The 5 MΩ damping resistor located between the high-voltage power supply and the EEC had to be repaired twice during the past year. A slight modification to the design should prevent recurrence of this problem.

Although the second extraction element, i.e. the first septum magnet SPM1, has been functioning satisfactorily, its driving mechanism had to be repaired during a scheduled shut-down.

The final extraction element, i.e. the second septum magnet SPM2 is functioning well, but a water leak on the inner liner (collimator) made it necessary to remove SPM2 for repairs. A slightly modified driving system has been fitted to this magnet as the previous system occasionally failed to function properly due to unexpectedly high forces.

3.2.1 The first septum magnet SPM1

Owing to the malfunctioning of the drive system of the first septum magnet (SPM1), it was necessary to remove the magnet from the resonator during a scheduled shut-down. The removal was necessary to gain access to the driving mechanism of the magnet, situated behind and below the magnet in the east resonator. This operation proved the feasibility of removing the magnet as well as the driving mechanism through the pumping station port at the back of the resonator, i.e. it is not necessary to split the resonator. (However, after repairs were carried out on the driving mechanism, a water leak detected at a connection on one of the water-supply tubes forced us to split the resonator for repair work.) The cause of the drive failure was a faulty brake which would not release. We thus decided to remove all the brakes on this system as the spindle of the drive is self-holding and, when the resonator is closed, the drives cannot be actuated by hand which could cause accidental damage.

During these repairs we discovered that the insulation material used for various parts on and around the magnet and driving mechanism had deteriorated to such an extent that they had to be replaced. A different material was chosen for the replacements which will hopefully prove to be more radiation and heat resistant.

Because the magnet is often intercepting at least part of the extracted beam, it becomes very radioactive and we thus try to reduce the

radiation exposure time to personnel as much as possible. Mainly owing to this, we decided not to repair the scanner which is mounted on top of the magnet. It is suspected that the electrical pick-off at the rotating scanner blade is faulty. The spare SPM1, together with its scanner, is now ready, and when a working scanner is required we will replace the magnet together with its scanner with this spare. This will allow enough time for the active magnet to "cool off" sufficiently so that repairs can be carried out without radiation danger to personnel.