Long Term Investigation of Beam Parameters Based on Beam Diagnostics

Data Exports

**Abstract**

A high degree of beam stability is essential for the smooth operation of an active scanning system as applied by the Heidelberg Ion Beam Therapy Centre (HIT). Amongst other parameters such as particle intensity and beam width, the feedback controlled beam position at the isocentre is particularly crucial as it has to meet a very tight tolerance band of ±1.0 mm. Due to this fact we pay special attention to beam position fluctuations along the beamline by running daily procedures. The results are stored in CSV-files and visualised by python scripts using the matplotlib plotting library. Our investigation comprises the beam positions as a function of time in the accelerator sections MEBT (middle energy beam transport), synchrotron and HEBT (high energy beam transport). These sections are successively equipped with profile grids, beam position monitors (BPM) or multi wire proportional chambers (MWPC). The aim is to find correlations between the beam position and external factors like e.g. temperature conditions of the surroundings or the cooling water. We also look for seasonal dependencies and interactions with the power load of the facility.

**Conclusion**

The long term logging of beam properties along the beam line is very useful in daily operation of a medical accelerator. Measured values outside the usual band are quickly detected and corrective measures can be triggered in time. On the basis of the diagnostic data the influence of parameter modifications or other beam affecting actions can be studied. This allows predictions on the beam response for certain activities at the machine. We have observed correlations between the cooling water temperatures and beam properties for abrupt variations of the cooling power consumption, e.g. by switching off and on the LINAC-RF, but under typical operations conditions the infrastructure runs very stable and does not contribute to the beam fluctuations. Correlations between the outside temperature / humidity have been investigated but no clear proof could be found.

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