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Can you rely upon reliability in a medical proton accelerator system

The probability of a system performing as expected, when it is needed, depends on proper design, appropriate implementation and rigorous maintenance. Measuring this system performance requires that performance goals have to be defined. These are based on clinical, operational and technical desires. Data characterising the system functioning, or metrics, have to be defined and analysed. The analysis may be subject to interpretation, but the trick is to predict the system performance based upon the current knowledge of the system. With this prediction, a plan of action can be developed to improve the system. What is the appropriate information to gather? How is this knowledge obtained? How can this be done in the context of an operating system? Does anyone have time for this, or conversely how many people are necessary to perform the task adequately?

The current experience at the Burr Proton Therapy Center will be reviewed with respect to what we have affectionately termed, the "ilities". Availability results from a combination of maintainability, reliability, and other ilities. A concrete understanding of what these ilities actually mean in a practical sense is necessary. Initial design decisions can have a big impact on the work needed to achieve the desired performance. However, it may not be until operation has started, that the full realization of which aspects of the ilities are relevant for the desired availability.

While one may never reach the goal of 100% availability, one can at least optimize reliability and maintainability. Part of this has to be an approach to system design that allows simple validation and verification of system performance. Examples will be given highlighting the importance of diagnostics capability in reducing the downtime. The information needed spans the domains of clinical physics to accelerator physics and we will show how data in both areas are needed to monitor and diagnose system performance. Quality assurance and preventive maintenance are inseparable. Time is a key issue as well. In a normal clinical operational environment, the time available for daily maintenance is small and the time available for extended maintenance is non-existent. How does one work within these constraints and what are the expected results? Is there a difference, if in addition to all the above, one is continuing to develop the system?

Summary

Aspects of reliability and availability, measurement and design, will be discussed for a medical proton accelerator system, from the perspective of the technical operations staff of an operating medical proton therapy system.

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