

Reliability and Uptime in Proton Therapy Accelerator and Beam Delivery Systems: The Need for a Fresh Medical Device Design Methodology

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Introduction:

The utilization of high-energy accelerators for medical uses, mainly in high-energy proton therapy is increasing rapidly. Traditionally these systems was developed by scientific research institutions and re-purposed for medical uses. Many design philosophies and system characteristics found in today's high-energy medical systems still resembles these earlier systems. Completing patient treatments on time and as scheduled is very important from a clinical perspective but also from a patient satisfaction and experience perspective.

Materials + Methods:

Modern medical devices need to focus on uptime with the ultimate goal of never missing a patient treatment as was scheduled. While Patient and staff safety is not a negotiable aspect, an over focus on safety often results in "fail safe" systems being implemented at the cost of reliability and uptime. We can learn from the airline industry where any potential system failures or irregularities can only be dealt with or repaired after the aircraft has landed and the passengers have disembarked. In analogy to this we need to be able to complete a patient treatment before the device is taken out of service for repair. This warrants a very detailed Failure mode effects analysis (FMEA) with the specific aim of completing a treatment safely rather than failing the system safely. Several real life case studies will be presented during this presentation and the author will attempt to convince the audience that a new approach towards designing medical devices is required.

Conclusions:

A new thinking towards the design and operation of medical accelerators, beam lines and beam delivery systems used for patient treatments is required to allow for more uptime and less treatment interruptions while patient and staff safety is never compromised.