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Using P-Spice model for spark detection in TRIUMF's main cyclotron system

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Sparks in TRIUMF's main cyclotron have to dissipate a lot of energy due to the large volume of the RF cavity, causing a trip of the system, resulting in down time of the machine and provide a risk of damaging the system if not reacted to immediately. A spark detection system evaluating the rate of change of the reversed power signal within the cyclotron when a spark occurs is employed but can currently not provide any information about its location.

Simulations with a detailed P-spice model including the entire RF infrastructure from the amplifier, the combiner station, the waveguide system, and the rather big cyclotron with a diameter of 18 meters will provide the necessary information whether the location of a spark in the system can be located. The evaluated signals are the rate of change of the falling DEE voltage and the RF signals in different locations of the RF system. These results and actual measurements of sparks in the system can then in the future be used to train a Machine Learning model to implement a real time spark detection and reaction system. Such a system provides fast diagnostics and enables preventative maintenance during scheduled maintenance times and hence can reduce the machine downtime significantly.

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Footnotes

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Yes

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