

IMPROVEMENT OF A TUNABLE SURFACE-COIL RESONATOR FOR L-BAND EPR TOOTH DOSIMETRY

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This presentation reports the development of an improved 1.2-GHz tunable surface-coil resonator for EPR tooth dosimetry with the capability of remote control. In particular, we sought to reduce the baseline offset of the EPR spectra, which occurred with previous designs for remote control. The basic design-concept of the surface-coil resonator has been reported elsewhere [1]. The resonator uses varactor diodes to provide remote control of its resonance frequency and coupling [2]. In conjunction with the varactor diodes, a non-magnetic trimmer capacitor is used to extend the range of coupling between the resonator and the 50-ohm RF feeding line. Due to magnetic field modulation in CW-EPR spectroscopy, the potentials applied to the varactor diodes are subjected to a detrimental modulation. This leads to a shift in the baseline of the observed EPR spectra, which degrades the accuracy of the EPR measurements. To suppress the offset of the baseline, we sought to decrease the influence of the magnetic field modulation on the low-frequency potentials in the microwave transmission lines in the resonator. We found that this interaction could be greatly reduced by connecting the transmission lines to the ground with RF choke coils. This modification makes the DC and low frequency potentials of the transmission lines zero. As a result, we have reduced the offset of the baseline by one order of magnitude. This improvement is especially useful for EPR tooth dosimetry using a tunable resonator. The implementation of remote control of the resonator should improve the ease of operation in intra-oral measurements, which may be a critical factor for the practical implementation of EPR tooth dosimetry for after-the-fact dosimetry for large events involving ionizing radiation.

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References:

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