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Thermal-electrical coupling quench study of HTS cyclotron for medical application

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A 240 MeV proton cyclotron is under-development in Hefei for proton medical application. Two double-split HTS superconducting coils are designed to generate max. 5 T magnetic fields which are used to confine the proton beam revolving around the median plane. In the past experience, low temperature superconducting coils are classic design, but people have to face lower operating temperature and higher operating cost. The HTS material is becoming cheaper and cheaper in industrial market. In order to improve the superconducting magnet, we start to upgrade the magnet design from Low temperature superconducting technology to high temperature superconducting technology. The HTS superconducting magnet contains total magnetic storage energy of ˜ 4 MJ. Magnet will generate possible killo-voltage during the quench. In order to reduce the impact of the high voltage, the coil is spitted into a few parts. This article will study thermal-electrical property of the coil quench based on the different electrical-diagram. The temperature hotspot, quench resistance and voltage are calculated and presented in the paper.

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