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C2Or2C-02: Protection of the SFRS Local cryogenic system against catastrophic pressure increase and sizing of safety valves

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Super Fragment Separator (SFRS), currently under construction at FAIR GmbH, is a superconducting powerful in-flight facility which will provide spatially separated isotopic beams up to elements of the heaviest projectiles. The facility is divided into 8 functional sections, called branches, and ultimately will comprise 63 cryostats containing dipole and multiplet magnets. The magnets in the cryostats will be cryostated at 4.5 K by liquid helium. The cryostat cold masses will be thermally protected by a shield cooled by 50 K – 80 K gaseous helium. Helium is to be distributed along the SFRS separator by Local Cryogenics System (LCS), which is also sectorized into 8 branches. Each LCS branch consists of Feed Boxes supplying the cryostats with helium and interconnected by a 4-channel cryogenic line. The hydraulically coupled LCS branches connected via so called Common Cryogenic System with a dedicated helium plant and several distribution boxes, create a very complex hydraulic system. All process lines of the LCS system must be protected by safety valves against excessive pressure that may arise in the event of the system failure. The paper presents the details of the SFRS Local Cryogenics System construction and explains the concept of the process lines overpressure protection. Further it discusses the most critical scenario of the LCS failure and introduces the methodology of safety valves dimensioning, used by Wroclaw University of Science and Technology during the System design phase.

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