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Verification of passive cooling techniques in the Super-FRS beam collimators

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The Super FRagment Separator (Super-FRS) at the FAIR facility will be the largest in-flight separator of heavy ions in the world. The separation principle is based on the use of beam collimators to stop the unwanted ions. In one of the most common situations, the heavy ions are produced by a fission reaction of a primary Uranium-238 beam (1.5 GeV/u) hitting a Carbon-12 target. In this situation, some of the produced ions are highly charged states of Uranium-238. Those ions can reach the collimators with energies of up to 1.3 GeV/u and a power of up to 500 W. Under these conditions, a cooling system is required to prevent damage to the collimators and to the corresponding electronics. Due to the highly radioactive environment, both the collimators and the cooling system must be suitable for robot handling. Therefore, an active cooling system is undesirable because of the increased possibility of malfunctioning and other complications. By using thermal simulations (performed with NX9 of Siemens PLM), the possibility of passive cooling is explored. The validity of these simulations is tested by independent comparison with other simulation programs and by experimental verification. With this validation, reasonable estimates can be made on the true effectiveness of passive cooling of the beam collimators. This information is used to ensure stable and safe operation of the Super-FRS beam collimators. Some results and conclusions will be presented in this contribution.

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