

# SpinQuest evaporation refrigerator

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## Abstract

The SpinQuest polarized target system at Fermilab uses a continuous flow helium-4 evaporation refrigerator to provide the required cooling power during the dynamic nuclear polarization (DNP) process and the intense proton beam from the 120 GeV main injector. The refrigerator was designed in compliance with the American Society of Mechanical Engineers (ASME) to pass the cryogenic safety review required to operate at Fermilab. The large Oerlikon roots pump stack coupled to the refrigerator has a pump rate of  $17000\text{ m}^3/h$  (two  $8400\text{ m}^3/h$  in parallel) backed with another  $8400\text{ m}^3/h$  roots pump backed with an  $840\text{ m}^3/h$  rotary vane pump. With such a high-powered backing pump a radiation-resistant flow control system is required near the target cryostat to regulate flow during target calibrations. A restricted flow around the roots path gate valve is fitted to the system to enable refrigerator flow control while the main roots path is closed. This flow control provides a warmer temperature range for thermal equilibrium calibration measurements necessary for the polarized target system. The ASME design and the refrigerator control system are presented in this talk.