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Operating parameters of liquid helium transfer lines used with continuous flow cryostats at low sample temperatures

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Continuous flow cryostats are used to cool samples to a variable temperature level by evaporating a cryogen, e.g. liquid helium (LHe). For this purpose LHe is usually stored outside the cryostat in a mobile dewar and supplied with a transfer line. In general, the complete setup has to be characterised by a low consumption of LHe. Additionally, a minimum sample temperature is favourable from an experimental point of view. The achievement of both requirements is determined by the respective cryostat design, as well as by the transfer line performance. Characteristic operating data, e.g. the LHe consumption during cool-down and steady state, the sample temperature and the outlet quality, are achieved with a test rig similar to a common continuous flow cryostat setup. In addition, an experimental transfer line with built-in pressure sensors has been commissioned to examine the frictional pressure drop of the LHe flow inside the transfer line. The presented operating data provide the basis for the development of an improved transfer line design as part of an ongoing research project. A decreased LHe consumption will reduce the operating costs of a continuous flow cryostat. Furthermore, decreased sample temperatures widen the field of application for continuous flow cryostats operated with LHe.

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