

Advantages of the c-line system compared to conventional liquid nitrogen storage tanks and -80°C devices

The substantial difference of the C-line system is to unconditionally maintain an uninterrupted cooling chain whose upper temperature limit of -100°C isn't exceeded at any time. The samples in the HS200 are stored in the gas phase of liquid nitrogen in the range of <math>< -150^{\circ}\text{C}</math> to -190°C. Thus, the samples are located significantly below that temperature range (approximately -135°C to -120°C), in which sample quality-damaging processes occur such as migratory crystal growth or devitrification¹⁻³.

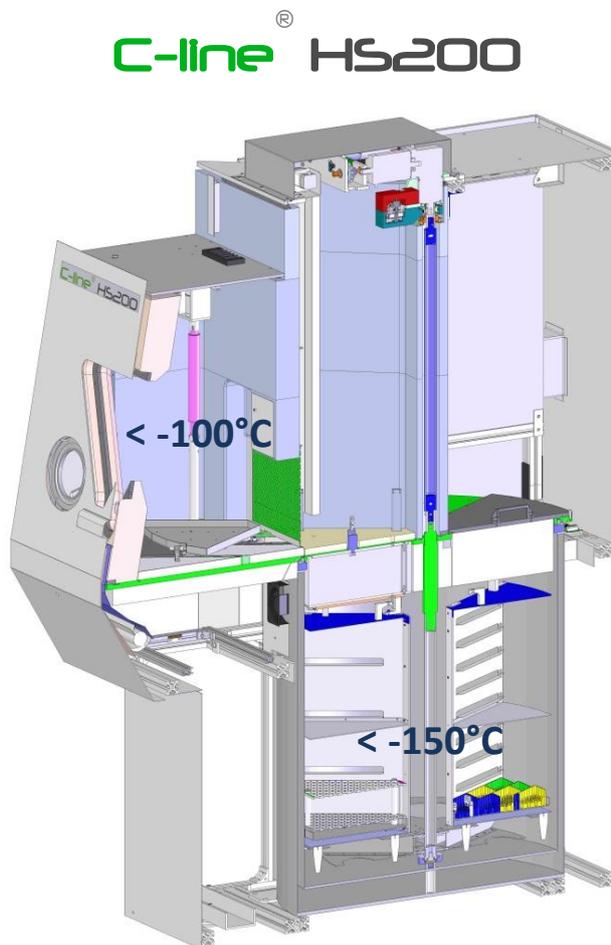
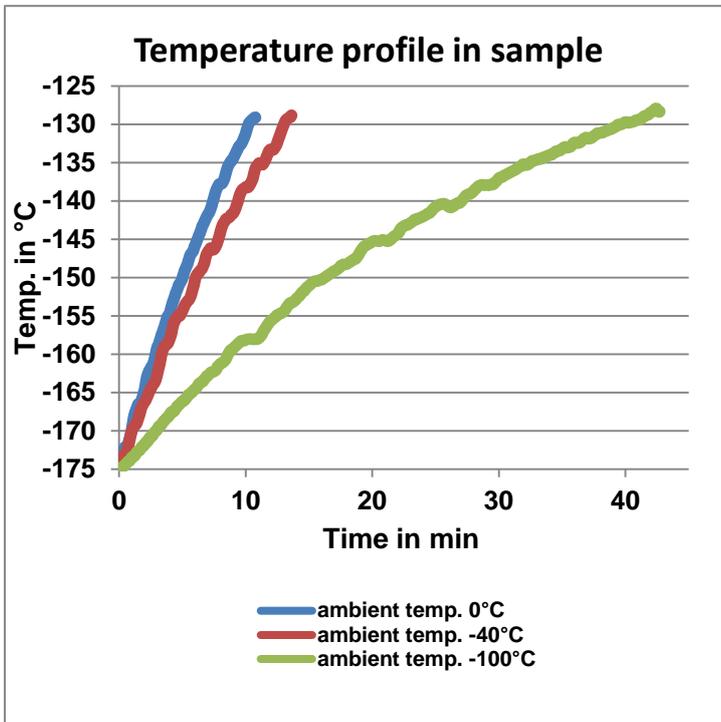


Figure 1: Temperature stratification inside the HS200

Due to the hermetically closed system, implemented by the rack and handling space mounted on the cryo vessel, all storage and retrieval processes can be carried out below -100°C (Figure 1). For this reason, there is only a small temperature gradient between the storage and handling site of the samples, resulting in a very slow sample heating. All necessary handling steps can be carried out in a comfortable time slot without reaching the aforementioned critical temperature range (Figure 2). The sample transport to and from the system takes place in closed transport containers below -100°C and guarantees an ice free system. The possibility of extending the system by a workbench allows also sorting and rearrangement processes in a cryogenic environment and the controlled rate freezing of samples. Thus, an uninterrupted cooling chain is feasible without compromise (Figure 3).

All relevant tracking and temperature data as well as other user-defined data fields of samples are recorded and saved by the system and can be exchanged with present labor information and management systems via appropriate interfaces.



In order to save staff, to gain time and to further increase the sample security HS200 is retrofittable for a variety of sample formats with an internal automation (pick & place robot). This robot takes over fully automated storage and retrieval at the same cryogenic ambient temperatures mentioned above

Figure 2: Measured temperature profile in a 2.0 ml sample as a function of the ambient temperature



Figure 3: The workbench is a cryogenic working space (<-100°C) and comes optionally equipped with up to three independently operating controlled rate freezers

References:

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2. Rouy, D., Ernens, I., Jeanty, C. & Wagner, D. R. Plasma storage at –80 °C does not protect matrix metalloproteinase-9 from degradation. *Anal. Biochem.* **338**, 294–298 (2005).
3. Schrohl, A.-S. *et al.* Banking of biological fluids for studies of disease-associated protein biomarkers. *Mol. Cell. Proteomics* **7**, 2061–2066 (2008).