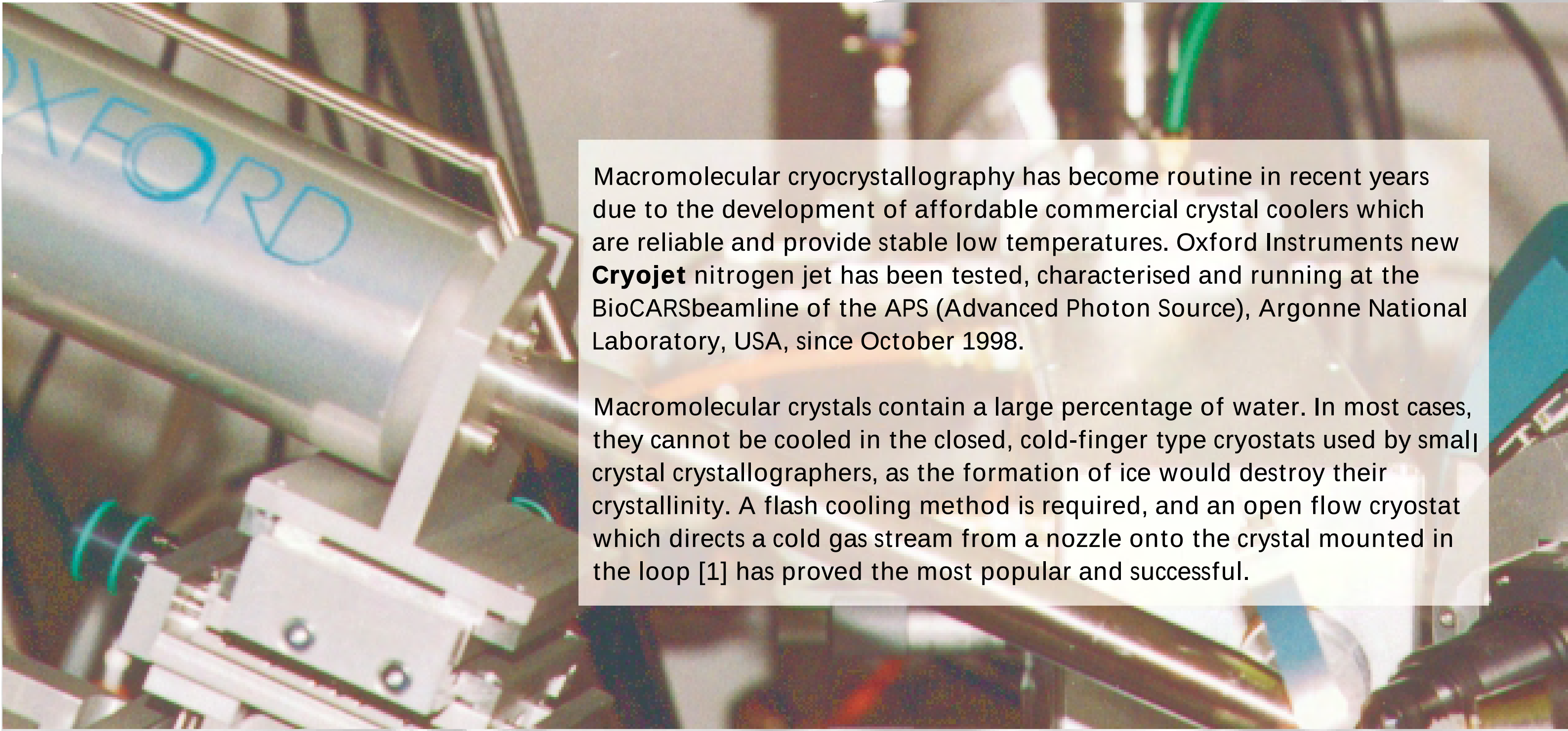

Macromolecular cryocrystallography has become routine in recent years due to the development of affordable commercial crystal coolers which are reliable and provide stable low temperatures. Oxford Instruments new **Cryojet** nitrogen jet has been tested, characterised and running at the BioCARSbeamline of the APS (Advanced Photon Source), Argonne National Laboratory, USA, since October 1998.

Macromolecular crystals contain a large percentage of water. In most cases, they cannot be cooled in the closed, cold-finger type cryostats used by small crystal crystallographers, as the formation of ice would destroy their crystallinity. A flash cooling method is required, and an open flow cryostat which directs a cold gas stream from a nozzle onto the crystal mounted in the loop [1] has proved the most popular and successful.

The Cryojet nitrogen jet installed at the beamline 14-BM-D of the Advanced Photon Source, viewed up-stream of the X-ray from the detector position.

Macromolecular Crystal **the Cryojet nitrogen jet fo** **crystallography** at BioCARS Synchrotron

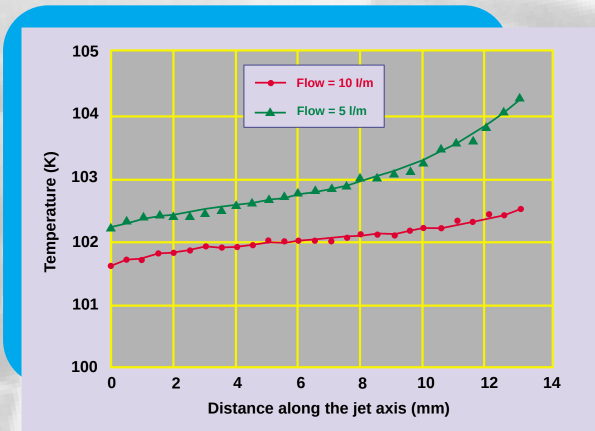

Fig. 1: Temperature profile of the Cryojet nitrogen jet parallel to the jet axis.

The working volume of the cooler is defined as a right circular cone within which the temperature lies within 2 degrees of that on the nozzle axis at its mouth.

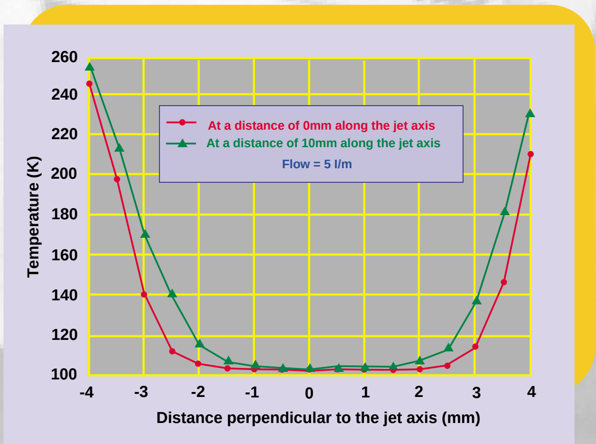

Fig. 2: Temperature profile of the Cryojet nitrogen jet perpendicular to the jet axis.

Early, home-made open flow cryostats [2] re-cooled dry nitrogen, passing the gas through a coil submerged in liquid nitrogen. The commercial products which have dominated the market for the last decade are based on more elaborate, pumped designs [3]. Nitrogen is pumped from a dewar into a heat exchanger, close to the nozzle, and vaporised by a heater. The gas then passes through a long line connecting the pump flow meter and the dryer, and returns to the heat exchanger to be re-cooled by incoming liquid, before finally escaping from the nozzle. These designs overcame early problems due to re-liquefied nitrogen blocking the cooling line at low flow rates, but are complicated. The pump and dryer, in particular, require high maintenance and any water vapour leaking into the system may ice up the nozzle and cause shut down.

Oxford Instruments' new **Cryojet** nitrogen jet generates nitrogen gas by heating liquid nitrogen at the bottom of its transfer line, and delivers cold nitrogen gas through an integrated transfer line to the nozzle. The heater in the heat exchanger only regulates the gas temperature. With no complicated gas lines and joints, the **Cryojet** nitrogen jet eliminates the prime problem of ice blockage. It has no pump, dryer, or other moving parts, and uses a single dewar for both cold and warm (shroud) gases, simplifying maintenance and reducing costs. The **Cryojet** nitrogen jet has been in constant, successful operation for ten months at BioCARS, a synchrotron X-ray facility dedicated to macromolecular crystallography. Though adjustable from 2 - 10 l/m,

Contact
Dr T Y Teng, The University of Chicago, USA
E-mail: t-teng@uchicago.edu