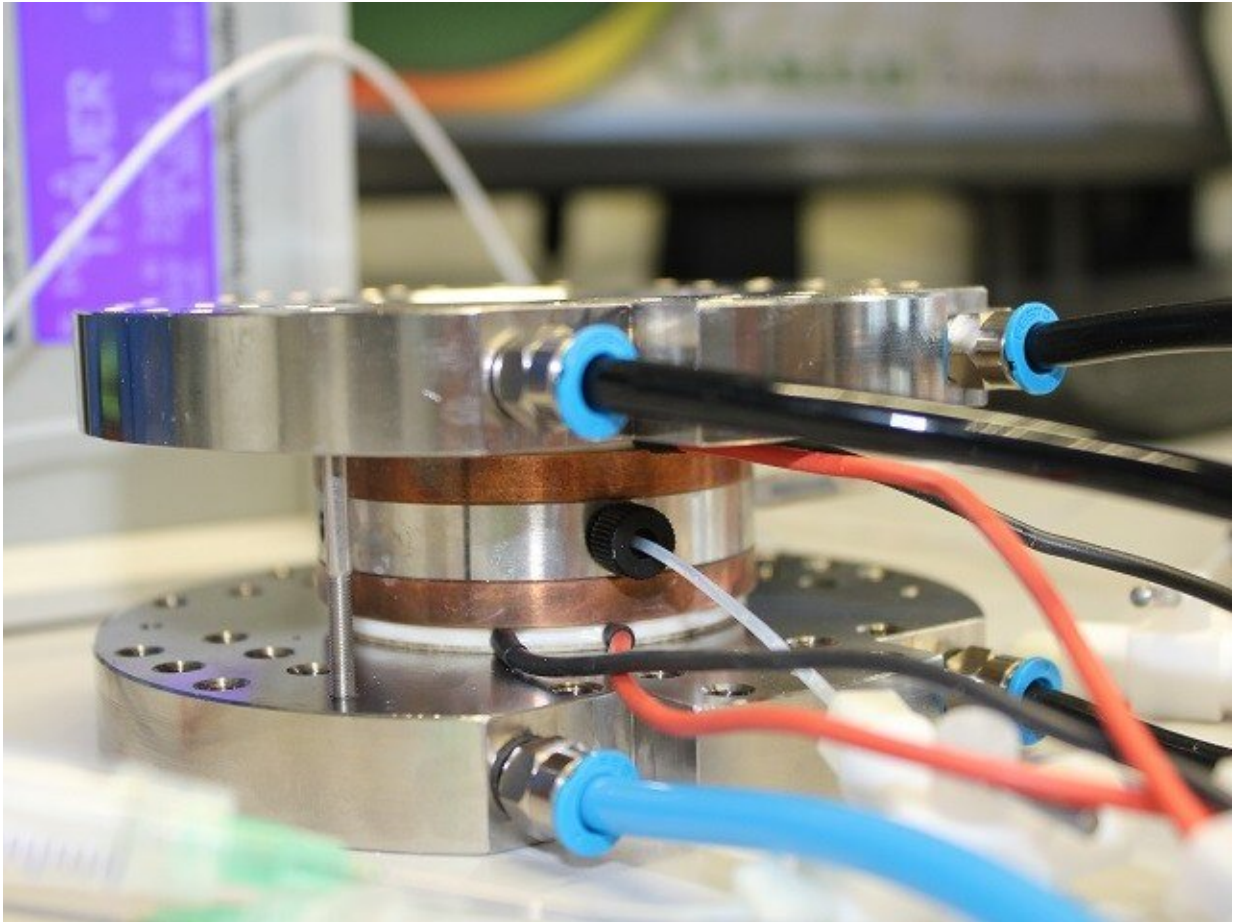


Designing a crystallization chamber

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Credit: SINE2020

Marialucia Longo and Tobias Schrader at the Jülich Centre for Neutron Science (JCNS) based at FRM II in Garching, Germany have been designing and testing a crystallization chamber to grow large protein

crystals.

The chamber consists of two round stainless steel holders that incorporate Peltier heating elements, to control the [temperature conditions](#), and a glass window to allow [crystal growth](#) to be monitored. The circular design facilitates an even [temperature](#) distribution to hopefully provide uniform temperature control in all directions.

Between the holders, a Teflon "spacer" is placed that forms the crystallization chamber itself, where all the action takes place. The spacer module is interchangeable to allow different configurations and provide a choice of crystallization methods (currently, vapour diffusion and batch crystallization spacers are available). As well as having a compartment for the crystal to grow in, these spacers also have pipe inlets and outlets for transporting protein solutions in and out. The spacers were designed and 3-D printed with the help of engineers at the Forschungszentrum Jülich in western Germany.

Post-doctoral researcher Marialucia Longo worked on the design and production of the apparatus for over a year, with expert help from Neils Lumma at Jülich. It is now in the testing phase. Longo started with hen egg white lysozyme, as it is a well-known protein and forms big crystals quickly and easily. Other [potential candidates](#) are thermolysin and streptavidin, as so far, large crystals of these have been elusive. Streptavidin would be a particularly interesting molecule to study with neutrons, as not a lot is known about the hydrogen bonds to the biotin ligand within the structure. Making a crystal big enough to study with neutron techniques could shed light on this.

However, Longo confronts many obstacles and still has plenty of problems to solve. Not least because, with a background in DNA and [inelastic scattering](#), she has first had to learn about proteins and elastic scattering.

Then there have been issues in the apparatus itself:, including unwanted bubbles in the chamber, inadequate performance of the sealing and unreliable temperature control. Particularly frustrating are the user-unfriendly heating elements. Tweaking the temperature using knobs and waiting two minutes for the temperature controller to resume normal operation has proved time-consuming and difficult. It is anticipated that a computer link to the temperature controller may enable the temperature to be stepped down gradually, e.g. by one degree a day. This requires development, but could aid the quest for growing bigger crystals.

Ultimately, the team's ambition is to use this apparatus to produce crystals for use on the instrument BIODIFF, a sophisticated instrument that ideally requires a crystal volume of at least 0.1 mm³. BIODIFF is a monochromatic single crystal diffractometer—a joint project of the FRM II (TUM) and JCNS (Forschungszentrum Jülich) run by Tobias Schrader and Andreas Ostermann, who has also been a big help on this project.

So far, the biggest crystals they have grown are 0.2 mm³ using the model protein lysozyme. As SINE2020 reaches its end, this project will continue with extra funding provided by Forschungszentrum Jülich.

Provided by CORDIS

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