EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office via the User Portal:

https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do

Reports supporting requests for additional beam time

Reports can be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Probing the medium range order dynamics of metallic glasses	**Experiment number**:
Beamline: ID10	**Date of experiment**: from: 21/11/2018 to: 27/11/2018	**Date of report**: 16/03/2020
Shifts: 18	**Local contact(s)**: Federico Zontone	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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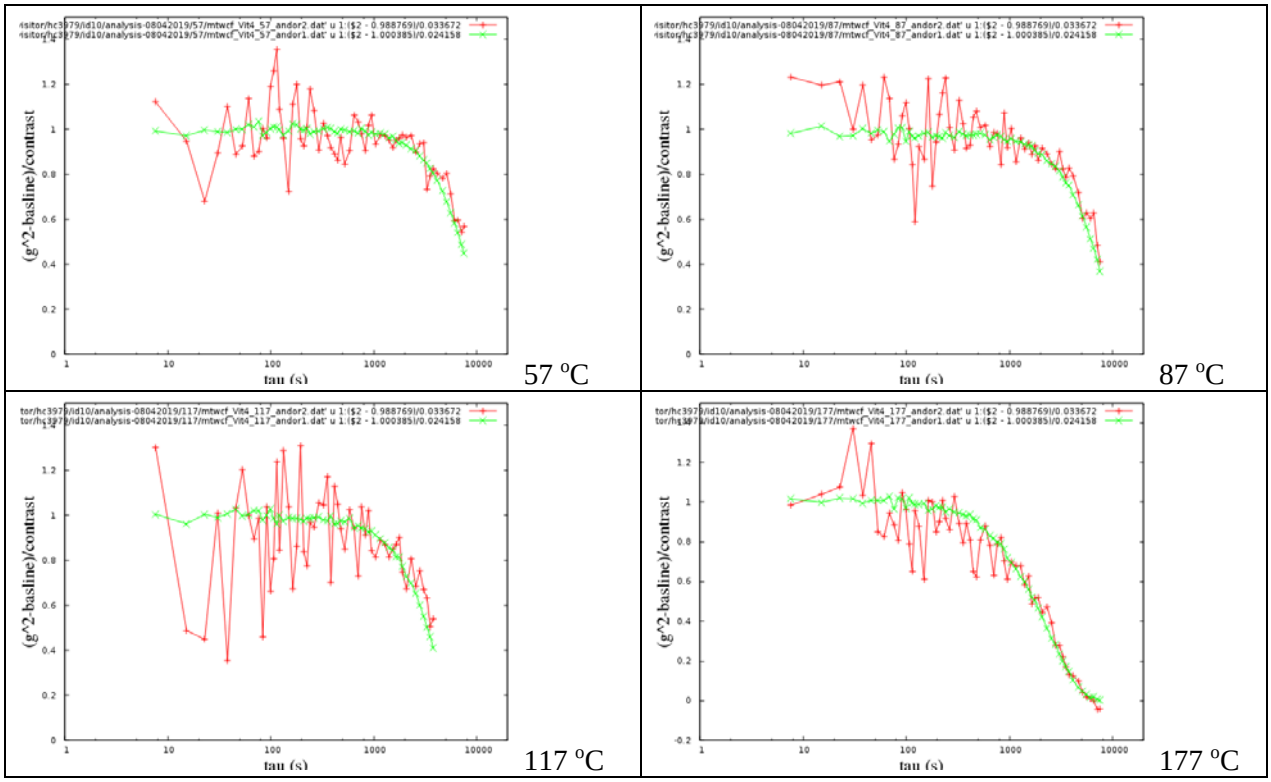
Report:

The aim of the experiment was to measure the microscopic dynamics of metallic glasses at different length scales. Therefore, the dynamics were measured in transmission geometry using 8.1 keV coherent radiation and the signal was collected by two CCD detectors mounted at two different q-values in the horizontal scattering plane. On of the q-values was near the maximum of the structure factor $S(q)$, as usually probed in previous measurements of metallic glasses, while the other detector was placed at a smaller angle. The metallic glass samples were selected to have as maximum intensity as possible at the smaller angle detector.

Some of the samples (Al-Ni-Y compositions) showed a complex aging behavior and small resistance to crystallization during the long isothermals and were discarded. Finally, Vit4 metallic glass, known by its high glass-forming ability and stability against crystallization was used in the experiment. The experimental set-up worked fine and multispeckle series were collected with one detector placed around $2\theta=18^{o}$ and the other near $2\theta=37^{o}$. The figure below shows the dynamics collected at the maximum of $S(q)$ and at the smaller angle. The figures show that the correlation functions obtained from the two detectors overlap perfectly when rescaled taking into account the contrast and baseline. Therefore, it was found that in the glass state far below T_g the dynamics have not q dependence within the studied range.



The study of the dynamics at higher temperatures (in the glass near T_g and in the supercooled liquid) was attempted but the decrease in relaxation time reduced the statistics and it was impossible to get the dynamics from the lower angle detector. Therefore, some of the main questions expected to be solved by this experiment were not answered. Considering the increase in intensity expected after the ESRF upgrade, a similar experimental set-up would permit to resolve the microscopic dynamics near T_g, and even in a larger q-range, in future experiments.