

The SISN Training on Neutron Techniques (TNT) Advanced Schools^(*)

R. MAGLI^{(1)(**)}, M. CERETTI⁽²⁾, F. FORMISANO⁽³⁾⁽⁴⁾, F. GRAZZI⁽⁵⁾
and A. PIETROPAOLO⁽⁶⁾

⁽¹⁾ *Department of Biomedical, Surgical and Dental Sciences, University of Milan
via Saldini 20133, Milan, Italy*

⁽²⁾ *ICGM, Univ. Montpellier, CNRS, ENSCM - Montpellier, France*

⁽³⁾ *CNR-IOM INSIDE@ILL c/o Operative Group in Grenoble (OGG) - F-38042, Grenoble,
France*

⁽⁴⁾ *Institut Laue Langevin (ILL) - F-38042, Grenoble, France*

⁽⁵⁾ *CNR-IFAC and INFN-CHNet - Sesto Fiorentino, Italy*

⁽⁶⁾ *ENEA, Dipartimento di Fusione e Tecnologie per la Sicurezza Nucleare - via E. Fermi 45,
00044, Frascati, Italy*

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Summary. — Since 2012, the Italian Society of Neutron Spectroscopy has been organizing Advanced Summer Schools on neutron scattering techniques for the study of condensed and soft matter. They are open to Graduate and PhD and to Post-Docs and researchers working in scientific disciplines as Biology, Chemistry, Earth Sciences, Material Sciences, Physics, Sciences for Cultural Heritage Conservation, and similar. After a first three-year cycle focused on Neutron Diffraction and Reflectometry (2012), Inelastic Scattering (2013) and Small Angle Neutron Scattering and Neutron Imaging (2013), in 2015, the Schools were devoted to Neutron Scattering applied to Polymer Systems, again to Inelastic Scattering in 2016, to Neutron Scattering Data Handling, Numerical Methods, Statistical and Computational Tools in 2018, to Neutrons and Muons for Magnetism in 2019 and, finally, to Applications of X-rays and Neutron Scattering in Biology in 2020. The current project is a three-year program called Training on Neutron Techniques (TNT). Here, a brief summary of the 2022 edition focused on structural properties is reported.

The first edition of the Italian Society of Neutron Spectroscopy (SISN) Summer School ‘Training on Neutron Techniques: Diffraction and Structural Imaging’ has been hosted in S. Giovanni, Bolzano, Italy, from 11th to 18th June 2022. It is part of a three-year

^(*) Contribution to the special joint SISN-SIF session.

^(**) E-mail: renato.magli@unimi.it

program of Advanced Schools organized by SISN. The main objective of the program is to present and discuss the scientific bases and potentialities of the neutron scattering methods for instruments accessible both at reactor-based facilities and at spallation sources, also in view of the European ESS project, the future European Neutron Scattering facility. For the 2022 edition, a maximum of 25 attendees were allowed, therefore we adopted a selection procedure. Among the 50 applications received by students and researchers from Asian and European Laboratories and Research Institutions, 24 participants were accepted. All the teaching materials used during the lessons and the tutorials (handouts with slides, examples, etc.) were distributed to the students, both printed and in electronic format. The teaching staff included 23 lecturers and tutors, all well recognized experts in the field, coming from European Laboratories and Universities. The School program started on Sunday 12th with a lesson focused on Mathematical Tools, followed by an introduction on Neutron Scattering Theory and an introductory presentation devoted to the Physics of Neutron Sources (both reactors and spallation sources) and of the instrumentation needed for structural studies. In the following days, the School was divided into two subsequent sections. In the first one, Neutron Diffraction techniques for crystals, powder and disordered systems were discussed with examples and tutorials ranging from single crystal applications to magnetic scattering, to cultural heritage conservation and to materials science and industrial applications. Specific attention was paid to recent developments and to those in progress and expected for the current decade. This first section consisted of 13 hours of frontal lessons and 8 hours spent in tutorials organized in small groups of maximum 6 students. After a free afternoon devoted to leisure activities, on Thursday 16th the second section started, and the Neutron Structural Imaging techniques became the subject of the program: general lectures introduced the theory of Neutron Imaging and the related instrumentation, while several applicative seminars and small groups tutorials enlightened the energy selective, phase contrast, polarized imaging techniques, as well as grating interferometry and neutron resonance imaging. This section consisted of 7.5 hours of frontal lessons accompanied by 8 hours of tutorials. A couple of after-dinner seminars enriched the program. In the first seminar, Prof. Luca Bindi, from the University of Florence, showed that, starting from the discovery of natural quasi-crystals, his research extended and is currently enlightening how planetary collisions, atomic blasts and lightning strikes can forge ‘impossible’ new materials. In the second one, Dr. Leonardo del Rosso from CNR in Sesto Fiorentino discussed some structural insights recently obtained with his research group investigating the ice phase diagram with neutron diffraction. The attending students, mostly in their PhD path, showed deep interest in the topics of the School and greatly esteemed the way the lecturers and tutors gave the lessons and discussed with them in both frontal and tutorial sessions. Some students declared their interest to be part of next editions. The general appreciation was also proven by the results of the assessment questionnaire the students were asked to compile, in an anonymous way. The overall result can be summarized saying that the School got an average rating of 4.6 out of 5. The 2023 TNT edition will be focused on Inelastic Neutron Scattering, while in 2024 Small Angle Scattering and Reflectometry will be dealt with.