Integrating in Europe

During the last 20 years the process of integrating the European Countries within the structure of the European Union was much harder for Eastern Countries where the starting point was behind the Iron Curtain. However, nuclear physicists from these countries integrated much faster than their respective societies; they were already, more or less, integrated mostly due to the previous personal scientific collaborations. During the transition period these collaborations were fruitful and beneficial for scientific and financial survival.

Today the situation is changed. The Eastern European Countries are politically integrated in EU and we have to find the right way to fully integrate in the European nuclear physics community. In order to keep our strengths we have to concentrate in two directions: developing strong in-house programs and participation into European collaborations centered on the Large Scale Facilities (LSF): GSI, GANIL, ISOLDE, and so on.

These facilities are concentrated in Western Europe, whereas in Central and Eastern Europe the facilities are, by comparison, Small Scale Facilities (SSF). The European Research Infrastructure inventory should continue to keep both types of facilities, thought to be mutually complementary and seminal. *A correct attitude and consequent practical approach should be developed in order to properly balance the two kinds of research.*

The LSF activities are and will be centered on the frontline research in the hottest topics of nuclear physics. Such experiments will generally target and investigate new nuclei, very far from the line of stability, therefore addressing the most exotic and perhaps ambitious aspects of nuclear structure physics. Such research would inherently draw on an extensive collaboration between groups from different institutes and universities, as well as on complex experimental setups, a large infrastructure and high running costs. For such an enterprise to thrive on a sustainable basis there will be a permanent need of well-educated and custom-trained physicists. From this point of view, SSFs could play a time-verified, substantial, and important part. Small scale facilities represent, even in a long run, *a useful and profitable complement to the large scale facilities*, and in more than one way.

Although there is no doubt that the activities conducted at LSFs are the most likely to generate breakthroughs in knowledge, commensurate with the money invested, it is also a fact that there are many other, more "classical" directions worth pursuing—because of their potential to add important contributions to the general development of the domain. Physicists with a deep knowledge of the domain—as there are many in the SSF groups—are constantly proving that there are experimental areas where low-energy accelerators and tools, much more modest than those at LSFs, may contribute with new, exciting results. In the context, the observation is perhaps worth making that, while the LSF may well make the cutting edge of modern Physics, it will continue to fall *on the SSFs* the natural burden of *securing the "genetic diversity" of the research, and researchers*—coming from a vitally important variety of geo-cultural environments, the absence of which would certainly jeopardize the future of the LSFs in the long run. The SSFs are essential in enhancing the contribution of the nuclear physics community in the big European Projects such as FAIR and SPIRAL2. And we are doing it with full enthusiasm and responsibility! Another aspect that was enduringly verified as profitable in the practice of the inter-laboratory cooperation in Europe is that an SSF may make *an appropriate place for developing instruments, or measuring methods, or parts of these, that are intended for an LSF*, saving in this way expensive beam time at LSFs.

SSFs are, traditionally, highly productive, performing excellent research. In all honesty, the simple fact is that the SSFs are, for decades now, the very cradle wherefrom top scientists have emerged to contribute to the personnel environment of the large installations—a process still ongoing. That would make the SSFs ideal places for educating and training young scientists in the field of nuclear physics. SSF-sized experiments addressing well defined and significant queries in Physics have *a great potential in education and training of young researchers*. At SSFs there is usually comparatively ampler "beam time," and also one can iterate an experiment until the best results are achieved.

Moreover, the young people will go through all the steps: designing the experiment; building the experimental set-up; the preparation of the beam; performing the experiment; proper data acquisition and analysis; performing theoretical calculations and comparisons with various theoretical predictions; writing a paper for a peer-reviewed journal. All these stages, which of course parallel, at a smaller scale, a "large scale" experiment, are well under the control of the learning young person, making the research activity very attractive; even young students can be involved in real experiments early in their classes, at acceptable costs, to enjoy such activities and really acquire experimental and theoretical skills *that would make them eligible, some time in their careers, for work in LSF groups*.

Last, but not least, by the communities developed around them, by their diversity, by their experimental programs including various applications of nuclear physics, spin-offs of basic nuclear physics research, the SSFs contribute significantly to the public acceptance of nuclear research, a delicate issue with which the modern society is confronted.

The existing SSFs are usually financed by national authorities. This type of support may, in many cases, become stronger, if it can be demonstrated that such domestic activity enjoys international relevance; is able to improve the ability of the R&D realm to absorb EU funding, a deficit area, especially with some EU newcomers. The recognition of the positive role of the SSF and the effective support of the NuPECC and of all European Nuclear Physics scientists played and plays an important role in preserving and developing the East European Nuclear Physics Community.

In conclusion, the ambitious plans of developing Nuclear Physics in Europe can be accomplished only by common scientific programs sharing both resources and experience of the entire European Nuclear Physics Community from North to South and from West to East.

N. V. Zamfir
National Institute of Physics and Nuclear Engineering
Bucharest-Magurele, Romania