# Technology transfer between ESRF and Industry

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*Abstract*

Technology transfer between the ESRF and European Industry essentially operates through four channels:

- ESRF needs a special product. ESRF invites Industry to develop a new product to meet its specific needs
- Severe operating conditions require stringent specifications which are produced by ESRF and implemented by industry under ESRF supervision;
- licences between ESRF and industry;
- invitation to industry to send technical staff to ESRF for training.

## 1. CREATION OF A PRODUCT BY INDUSTRY TO FULFILL ESRF REQUIREMENTS

A typical example of is illustrated by the elaboration of GLIDCOP by the American company SCM.

The ESRF was interested in using GLIDCOP due to its excellent combination of mechanical and thermal qualities. However, the basic GLIDCOP, currently produced by SCM was unable to meet ESRF UHV brasing requirements. SCM made a substantial modification to its production process in order to achieve a homogeneous small grain size structure and to suppress outgassing from Argon treatment.

The brasing of SCM modified GLIDCOP on OFHC copper offered another challenge to industry. The French company Vide et Traitement succeeded in elaborating a fully satisfactory technique which has since been applied to all ESRF storage ring crotch absorbers.

Another example is the development of the Hydrostatic Levelling System (HLS), originating from the need to monitor in the micron scale the quadrupole girders of the ESRF storage ring. The system developped in collaboration with the FOGALE NANOTECH company is now producing outstanding results in the field of accelerator survey and alignment techniques: the 850m long ESRF storage ring may be realigned in four hours with stored beam on.

## 2. APPLICATION OF ESRF SPECIFICATIONS BY INDUSTRY

The ESRF Quality Assurance manual consists of a compilation of technical specifications used in Call for Tender Exercises for the attribution of manufacturing contracts to Industry. These specifications are written with the aim of satisfying particularly constraining conditions of ultra high vacuum or mechanical precision.

The correct application of these specifications to the manufacturing process is supervised by ESRF experts. This collaboration between ESRF and Industry is particularly favourable for technology transfer. Many examples of this type of collaboration exist in the production of vacuum vessels, beam diagnostics, high precision jacks. For example, heat conduction between photon absorbers located inside the vacuum vessel and the cooled copper block outside the vessel requires a perfectly uniform thin brazing layer between the two metre flat absorber and the stainless steeel wall. Such homogeneous brazing on a large flat surface requires a careful optimisation of parameters backed up with ultra sound measurement of the braze layer thickness distribution.

Another significant example is the construction of Front End modules. The layout of design of the modules including beam diagnostics, personnel and safety systems is produced by the ESRF. This design is then used to place turnkey contracts to industry for the production of the Front Ends including fabrication, assembly, cabling, interlocks, complete tests. Thirty six Front Ends have already been delivered to ESRF by Industry. The rate of production is four modules per month.

However, one serious problem, for which no complete solution has yet been found, has just come to light: insertion device vessels are usually long (several metres) vessels, small in height (7 to 20mm) to fit into the ID permanent magnet gaps. This geometry makes it extremely difficult to obtain perfectly clean vessels: pollution from metallic dust, produced either during the manufacturing process or released from the NEG material used to pump the vessel, seems unavoidable. Some of this metallic dust is magnetic and ESRF suffered serious beam loss due to these magnetic particles short-circuiting the ID gap.

SAES, the NEG 707 product manufacturer, responded positively to this problem: they discovered that the NEG magnetic dust comes from the carbon steel tooling used to crush the ZiVFe NEG alloy into powder.

Under the influence of the ID permanent magnets, these magnetic grains are extracted from the powder and travel through the vessel gap and interact with the electron beam. SAES has recently worked out a sintering technique to produce NEG blades. This solution seems to work, no further beam loss has been observed on ID

vessels equipped with sintered NEG. Nonetheless, pollution of ID vessels also includes metallic dust or debris produced during machining welding. The trend for synchrotron radiation sources is to use smaller and smaller ID gaps, therefore the problem of vessel pollution will become increasingly severe; manufacturing techniques must drastically improve to adopt systematic use of ultra clean environments, similar to techniques used to produce electronic chips.

## 3. LICENCES BETWEEN ESRF AND INDUSTRY

Requests have been made by manufacturing companies for licences to produce and market equipment designed by the ESRF. These companies wish to exploit commercial possibilities to manufacture equipment for other Institutes and are willing to pay for licences for the right to do so.

ESRF considers this a valuable method of transferring advanced technologies into contracting party state industries. Such requests have been made in the fields of Hydrostatic Levelling System; front ends components and assemblies; insertion device carriages; beam position monitors and X beam position monitors.

It is important for firms to provide rapid ways to approve licences. Licence agreements generally include granting of exclusive rights for a period which normally does not exceed two years.

ESRF has set up an administrative procedure for licence approval.

## 4. INDUSTRY STAFF TRAINING

Some member countries experience difficulties in obtaining contracts with ESRF for the manufacture of accelerator components. These difficulties are generally due to a lack of experience of their Industries in the techniques required by ESRF. ESRF therefore has proposed to train staff members of these Industries at ESRF. This proposal has received positive response.