The case of Ion Beam Applications s.a. : A technology spin-off from a University Accelerator Laboratory

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Abstract

The Belgian company Ion Beam Applications, with 90 employees, 27 cyclotrons sold today, and an annual turnover of 19 M$, is probably the largest private company manufacturing cyclotrons. IBA has supplied cyclotrons for isotope production to all the largest radio-pharmaceutical companies, and is recognized as a leader in this field.

IBA is a spin-off of the research center for cyclotrons of the Catholic University of Louvain, in Louvain-la-Neuve (Belgium). This research center was operating and developing a large K=120 isochronous cyclotron used as a national facility in the field of Nuclear Physics, isotope production, radiotherapy, engineering, etc...

In 1985, the author and his colleagues developed the design of a 30 MeV, high extracted beam intensity (500 μA), low power consumption (less than 100 kW) H- cyclotron for the production of medical radio-isotopes. This design was extremely innovative in many respects, and a patent was filed by the university.

The laboratory then searched local industries interested in developing this new cyclotron concept but none were found. So, in 1986, the decision was made to start a small private company to develop the new technology. The company started with five employees, a capital of 25 MBEF (730 k$), supplied in part by the university and a loan from the regional authorities. The initial goals of the company were modest : to grow to a size of 15 ... 20 employees, with a turnover of 4 ... 5 M$/year (corresponding, on the average, to one cyclotron sale/year. The company grew actually much faster.

1 HISTORY OF THE COMPANY

Ion Beam Applications s.a. is a spin-off of the "Centre de Recherches du Cyclotron" (CRC) of the Catholic University of Louvain. The development of cyclotrons for nuclear physics and other applications has been a subject of intense study at the university for the last 50 years. The first classical cyclotron accelerating 24 MeV alphas, 12 MeV deuterons and 6 MeV protons was built in 1947 and had a very successful scientific life until 1972. The second cyclotron, a large K=140 multiparticle isochronous cyclotron was ordered in 1969, completed in 1972, and frequently upgraded thereafter. This large accelerator is operated as a national facility at the Belgian level, for nuclear physics, radioactive ion beam production, isotope production, neutron and proton therapy and technology applications. The author, founder of IBA, was head of the cyclotron research center from 1970 until 1986.

In 1984, after a sabbatical year spent on the 88" cyclotron of the Lawrence Berkeley Laboratory, the accelerator research team at the CRC started working on a new design of cyclotron for medical radioisotope production. It was quite obvious for the authors of the project that the best days of cyclotrons in physics research were past, and that the future of cyclotron was in industrial/medical applications. A short market study showed that most cyclotron produced medical radioisotopes could be produced with 20 ... 30 MeV protons, and that the potential world market was 2 ... 3 machines/year. The cyclotrons sold on the market for those applications were designs derived from variable energy, isochronous cyclotrons for physics research. Typical extracted beam powers were 3 kW, for typically 300 kW electrical power, i.e. an energy conversion efficiency of 1%. In contrast, the proposed design intended to produce 15 kW of extracted beam using less than 100 kW of electricity, or 15% energy conversion efficiency.

The basic principles of the new design called CYCLONE 30 were patented by the university. The authors started then looking for an industry that would be interested in taking a licence on the technology, but none was found. It was therefore decided to start a small company whose object would be to industrialize and sell the new cyclotron design. The original goals were

modest : to sell, on the average one cyclotron a year, i.e. a turnover of 4 ... 5 MUS$/year, with a total of 15 ... 20 employees.

Ion Beam Applications was incorporated in March 86. The initial capital of 25 MBEF (760 k$) was invested by the University and the National Institute for Radio Elements (IRE). In addition, the company received an interest-free loan from the regional authorities to finance the development of a prototype cyclotron.

The prototype started to accelerate beam in December 86 and a first machine was sold to Medi+Physics Inc. (USA) one year later. Many more sales followed .

As a result, employment in the company grew almost explosively, from 30 and the end of 1988 to 90 end of 1989. At this date 16 CYCLONE 30 have been sold. IBA perceived then the risk of being a "single product company", and decided to diversify its product line. The first decision was to develop a line of cyclotrons for hospital use in Positron Emission Tomography (PET). Our analysis was that there was a large spread in customer requirements, and that it was difficult to satisfy all customers with single model. Three different cyclotrons were developed : the CYCLONE 18/9 (18 MeV proton, 9 MeV deuterons), the CYCLONE 10/5 and the CYCLONE 3, a very small cyclotron with a vertical acceleration plane, accelerating deuterons up to 3.7 MeV for the production of ^{15}O by the (d,n) reaction on ^{14}N.

In 1990, IBA started to develop the concept of a less expensive proton therapy facility, based on the use of a fixed energy, compact isochronous cyclotron and reduced diameter isocentric gantries. For the development of the proton therapy system, an agreement was made with Sumitomo Heavy Industries (SHI) of Japan. Under the terms of this agreement the parties share the development of the system. Generally speaking SHI manufactures for Asia, IBA for the rest of the world. Around the same time, IBA obtained also a licence from professor Henry Blosser, from Michigan State University, for the manufacturing of a compact, gantry mounted isochronous cyclotron for fast neutron therapy. In May of this year, IBA obtained, against a very strong competition, the contract for the construction of the equipment of the Northeast Proton Therapy Center (NPTC), to be located at the Massachusetts General Hospital in Boston.

Finally, during the last two years, with the Rhodotron, IBA entered also the field of high energy, high average beam current electron accelerators for sterilization and other industrial applications . This new accelerator concept, developed by the team of Professor Pottier at the CEA in Saclay (France), was licensed to IBA. IBA started the development of a 10 MeV, 100 kW Rhodotron. The prototype just completed successfully the beam tests and is presented in other papers of this conference.

2 CONCLUSIONS

IBA represents probably an example of a successful technology transfer from an university laboratory to industry. In a relatively short time, the company has been recognized as a leader in the field of cyclotrons for radioisotopes production. However, the history of industrial companies producing particles or accelerators shows that life in the industrial world is difficult and dangerous, and that early successes are never a guaranty of long term profitability or even of survival. Among the reasons for this (temporary ?) success, we see the following facts :

- The technology transfer took the shape of a physical transfer of the people knowing the technology

- The University of Louvain is a free university, and has a very active group promoting University-Industry relations. The leader of this group, Madame Claire Demain shares much of the credit for the creation of IBA.

- The regional authorities (Region Wallonne de Belgique) provided interest-free loans to the young company. These loans did allow to fund prototype developments.

3 ACKNOWLEDGMENTS

Building a company is obviously a collective effort : IBA is mainly, a group of very talented and dedicated accelerator physicists and engineers.

It is the continuous and tireless efforts of all the personnel that built the company.

The Catholic University of Louvain, and specially Claire Demain, head of the "Cellule de liaison Université-Industrie" was instrumental in building IBA.

Finally, the "New Technologies Administration" from the Walloon Region of Belgium, its director Mrs. A.M. Strauss, and the Ministers in charge of the "New Technologies", Mr. M. Wathelet and Mr. A. Lienard gave an essential help to our young company.