IN MEMORIAM: HENRY G. BLOSSER

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Abstract

Henry G. Blosser, physicist and cyclotron designer, died on March 20, 2013 after an extended illness. Henry was a world-renowned accelerator physicist who founded the Cyclotron Laboratory at Michigan State University. Henry's influence extended to many cyclotron construction projects during his 60 years of active participation in the field.

INTRODUCTION

Henry (also known as Hank to his early collaborators) was a passionate accelerator physicist who devoted most of his professional life to the design and construction of cyclotrons. He always pushed the envelope to obtain more precise beams, higher energy and lower cost. From 1958 when he joined Michigan State University until 1993 he was the laboratory accelerator group leader and developer of new machines for nuclear science. After 1993 his efforts concentrated on the medical applications of cyclotrons.

Henry was a very active participant in the Cyclotron Conferences and we will miss his insightful comments.

Figure 1: Henry Blosser, sailor.

EARLY YEARS

Henry was born on March 16, 1928 and grew up in Harrisonburg, Virginia, USA. Influenced by a High School buddy, he joined the Navy after studying business for a year at the University of Virginia (UVA). His Navy experience could be detected in his PA announcements which often started with "Now hear this…" He returned to UVA, where he received his B.Sc. in math in 1951 and his M.Sc. in 1952 and Ph.D. in 1954, both in physics. His Ph.D. thesis adviser was Frank Hereford. Henry joined Oak Ridge National Laboratory and soon became group leader of the cyclotron project. This group pioneered the use of digital computers to design a new generation of sector focused cyclotrons that overcame the limitations in energy of classical cyclotrons (T. Welton and M.M. Gordon). The development of the Thomas-type electron cyclotrons at the University of California [1] gave new impulse to implementing Thomas' proposal of sector focused cyclotrons [2] for nuclear physics. Another electron model was built at ORNL [3] to study the effect of imperfection resonances on orbit stability, and successfully demonstrated that they would not prevent acceleration up to $\beta = 0.69$.

THE K50 YEARS

The completion of the electron analogue at ORNL coincided with an interest at Michigan State University (MSU) in strengthening the Physics Department Nuclear Physics group. The construction of a cyclotron as part of an effort to attract promising faculty was supported by MSU President Hannah. Henry was approached to lead the effort. At age 30 he moved to MSU in 1958 as an Associate Professor and Director of the future Cyclotron Laboratory. He hired Morton M. Gordon from the University of Florida to help with the theoretical work, and Thelma Arnette to do computer programming. By 1961 they had completed a design and received funding from the National Science Foundation to build the K50, a precision cyclotron. The cyclotron began operation three and a half years later. Its precise proton beams set a new standard for cyclotrons and made possible experiments with resolutions comparable to Van de Graaff accelerators. Its high-resolution capability was used by Henry and his collaborators, in his only purely nuclear physics experiment, to delineate in unique detail the nature of bismuth-208 excitations. That established the feasibility of the many experiments that followed and established the unique strength of the Cyclotron Laboratory. Over the next 14 years, the K50 supported a research program that put MSU nuclear physics on the map. The successful cyclotron was copied (with some modifications) at Princeton [5].

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After the completion of the K50, Henry spent 1966-67 on Sabbatical at CERN.

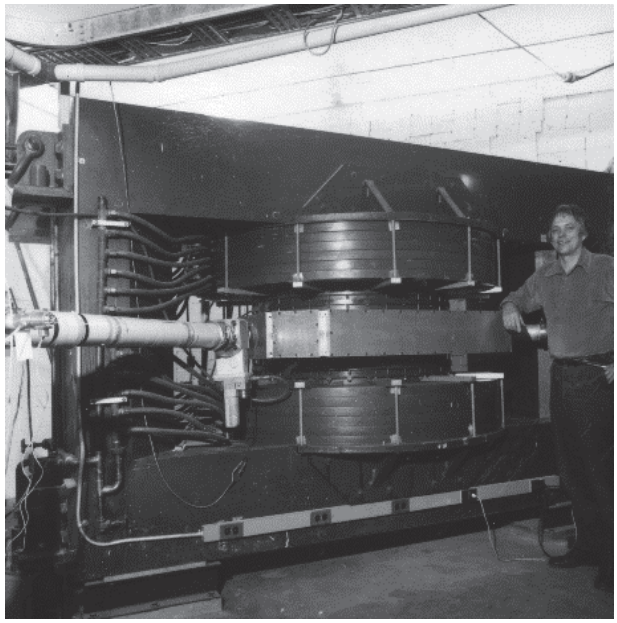

Figure 2: Henry and the K50 cyclotron at MSU.

THE SUPERCONDUCTING CYCLOTRON YEARS

Henry started to work on superconducting cyclotrons in 1973 after visitors from Chalk River, Canada reported on their studies with a low-cost, high quality conductor [4]. The two groups moved in parallel for several years solving the problems associated with these high field cyclotrons. Henry forged a very close friendship with John H. Ormrod that lasted to John's death.

To avoid a distracting competition, the K500 cyclotron was proposed as a demonstration prototype magnet that could in principle be converted to a cyclotron and moved to another laboratory. An NSF grant for its construction was received in 1975. The magnet operated at full field in 1977; a proposal to build a complete cyclotron was submitted to NSF and approved in August 1977. In 1980 a new contract is signed, this time with DOE, to build a second, larger cyclotron that would later become the K1200. The K500 saw first beam in 1981 and the K1200 in 1988.

During these years Henry had the support of another remarkable cyclotron designer, Francesco Resmini, and his team. Henry had great admiration for Francesco and appreciated his collaboration in the design of the K500 and K1200. His early death was very sad for Henry and the MSU team.

Until 1985 Henry had the double duty of Laboratory Director and Project Manager for the construction of the cyclotrons. But it became clear that the construction of the new machine required a more focused attention and Henry became co-Director sharing the administrative duties with Sam Austin. One of the most difficult problems in the design of the K1200 was the extraction system. It took a long time to find a reliable solution: it required the introduction of multiple passive focusing channels and their compensating "images". This was a difficult time for the project team and especially for Henry. Multiple review teams and the funding agency were anxious about the pace of the progress on the project. Henry's steadfast self-confidence and trust in his team helped the Laboratory survive a difficult period. The K1200 cyclotron became an unusually successful nuclear physics instrument validating Henry's expectations – particularly after additional funding made it possible to realize the original concept of coupling the two cyclotrons together.

Figure 3: Working inside the K1200.

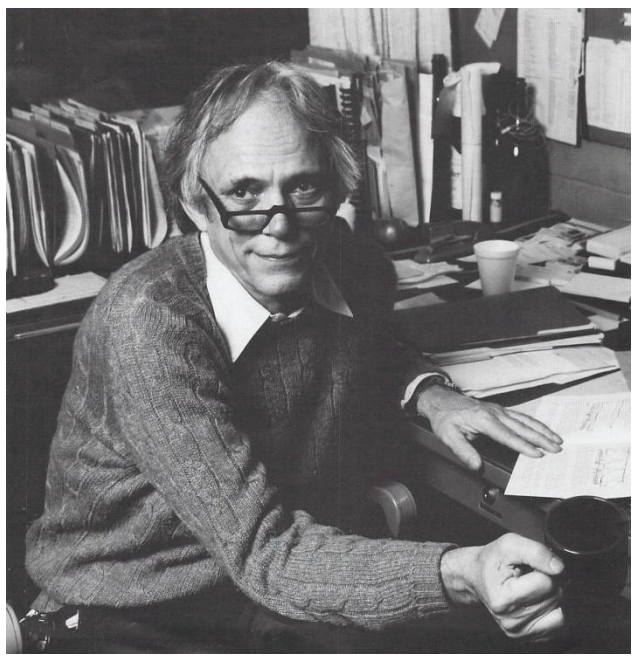

Figure 4: At work.

THE MEDICAL CYCLOTRON YEARS

In September of 1984 a contract with Harper Hospital in Detroit was signed to build a superconducting medical cyclotron for neutron therapy. This project was the

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brainchild of Henry Blosser and William Powell, an oncologist at Detroit's Harper Hospital, who had approached Henry to explore this possibility. The cyclotron was a small superconducting device accelerating deuterons to 50 MeV and mounted on a gantry so it could be rotated about the patient. It was built at the same time as the K1200 was being designed and constructed, which greatly stressed the Laboratory's capabilities. The project was finished in 1990 and ran and treated more than 2000 patients over two decades.

Figure 5 shows the two people responsible for its development standing atop the world's first superconducting cyclotron for cancer therapy: Henry Blosser (left) and William Powell (right). This view is at the National Superconducting Cyclotron Laboratory on the MSU Campus before the cyclotron was moved to Detroit.

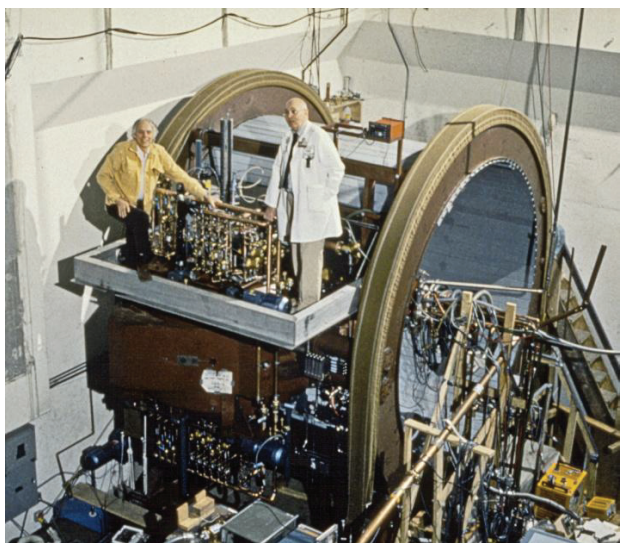

Figure 5: The neutron therapy cyclotron.

In 1993 under Henry's leadership the Laboratory submitted a proposal to a medical funding agency for the construction of a superconducting cyclotron for cancer therapy with protons. The proposal was not funded and lay dormant for many years until ACCEL approached Henry with the idea of building a commercial cyclotron based on the MSU design. This started a close collaboration between ACCEL and MSU and especially with Henry, who spent many weeks in Bergish Gladbach. Eventually this early proposal evolved into the ACCEL-VARIAN 250 MeV cyclotron.

Another innovation was Henry's pioneering investigation in 1993 into the use of very-high-field magnets to make even more compact cyclotrons, involving the construction of an 8-T test stand [6]. This initiative has recently been brought to fruition in the Mevion 1.8 m diameter 250 MeV synchrocyclotron, now installed in several hospitals.

After analysing Henry's contributions to the field of applying superconductivity to cyclotrons we can probably affirm that his statement in the 1972 Cyclotron Conference [7] "...Superconductivity then seems unlikely to make a contribution to cyclotrons in the foreseeable future…" was wrong!

Henry Blosser retired in 2003 but kept coming to the laboratory and being interested in new developments at MSU and all over the world until his illness prevented him from doing so.

The community of cyclotron builders has lost a major contributor and we will miss him.

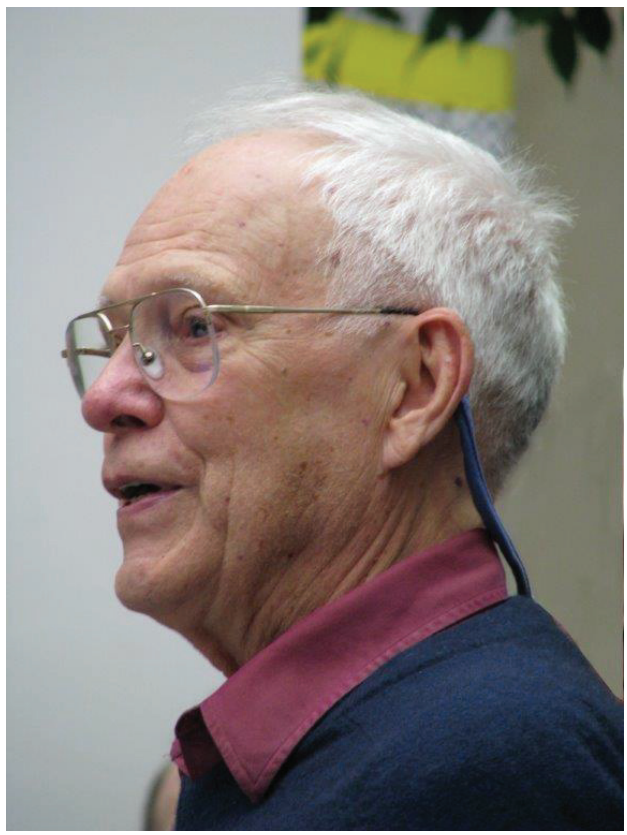

Figure 6: At his 79th birthday.

AWARDS AND RECOGNITIONS

Henry was named Fellow of the American Physical Society in 1968, received a Distinguished Faculty Award from MSU in 1972, a Guggenheim Fellowship in 1973-1974 and was named MSU University Distinguished Professor in 1990. He received the 1992 Tom W. Bonner Prize in Nuclear Physics from the American Physical Society (shared with R.E. Pollock).

ACKNOWLEDGMENT

We would like to thank Lois Lynch, Henry's widow, for providing photographs of Henry at different times in his life.

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