

## When it all began

CERN – ICEC Workshop – October 29, 2024

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*TERA and CNAO Foundation*

I thank the organisers for the invitation, but I never wanted to be here to speak to you after Mike and Steinar because it was Norm who had to describe the beginnings, explain his vision and inspire, as he always did, the proceedings of this Workshop.

For personal reasons, on April 8 I was unable to be present at the Recognition Ceremony in Washington, D.C. but I followed it by remotely and was as moved as those who were present. He was a great human being and a pioneer and visionary in the field of radiation oncology, and more, who dedicated his life to advancing the science of radiation therapy and improving patient care. I cannot add much to what was said on that occasion, but I want to underline an apparently minor, however important and very rare, characteristic of his personality: his human qualities and intellectual brilliance were clear even after a very short encounter. This struck me very much when I talked to him for the first time, as I still remember very distinctly.

As I will shortly describe, it was ten years ago here in Geneva and in the following week we had many occasions to talk about the topics he was passionate about, ICEC and its potential future incidence on cancer care in LMICs. Since then, we have exchanged e-mails and met for four years at a few ICEC workshops for very hectic days of work. After a long interruption, last August I wrote him that I would have liked to start discussing again with him and Manjit my possible contributions to the Stella project but, very sadly, we could not advance very far in this direction.

Going back ten years, in January 2014 Steve Myers, who had finished his responsibility as CERN Director for Accelerators and Technology, was nominated - by Director General Rolf Heuer - Head of the newly established '*Office of Medical Applications*'. Fortunately, Freddy Bordry, another staunch supporter at CERN of medical applications, took his role in the Directorate.

In February 2014 at the International Conference Centre in Geneva Manjit Dosanjh and Jacques Bernier organized the first of a new series of Conferences by joining two well-known series of Geneva international meetings called '*Translational Research in Oncology*' and '*Physics for Health in Europe*'.

On February 10, 2014, at 13:30 Fabiola Gianotti, spokesperson of the ATLAS Collaboration, opened the Conference with a fascinating talk titled '*The Higgs boson and our life*'. At 14:30 Norm took the floor and said that he had a different topic than radiation biology, which was initially listed on the agenda, that might be of interest - cancer health disparities and the recent creation of ICEC. I was fascinated but his talk and this initiative and, straight after his presentation, I waited him in the lobby and told him: "*We can build the linac you need to enable cancer treatments in LMICs*".

As I explained to him and Manjit during the coffee break, by 'we' I meant CERN, where I had been working till my retirement in 1999, and TERA, a Foundation I chair since 1992 that has developed, with CERN and INFN, the techniques of hadron therapy and has designed and promoted the construction of the Italian National Centre of Hadron Therapy (CNAO) in Pavia, where we have treated 5000 patients with beams of carbon ions and protons. In the world there are six centres of this type.

At this point, before continuing, I have to apologize because, in the following, I'll speak about myself and describe my personal, possibly biased, point of view on what happened in those years.

Going back to my sharp statement to Norm on that day, I was sure of what I was saying because CERN has invaluable expertise in designing and constructing more difficult linacs (for high-energy electrons, protons and nuclei) and to build sophisticated and robust instruments. From my side, in the 70's I had proposed a superconducting 300 GeV electron-positron *linear* collider<sup>1</sup> and in the 90's we had designed - in the framework of a TERA-CERN-INFN collaboration - and built for medical purposes a room-temperature *proton linac* called LIBO, which runs at the same 3 GHz frequency used in X-ray radiotherapy systems<sup>2</sup>.

At the Conference, three days after Norm, I gave in the Conference Auditorium an evening talk for the general public titled "*Physics is beautiful and useful*" on both particle physics and hadron therapy. I was very pleased because Norm appreciated it very much. In introducing me, Director General Rolf Heuer said that this event was taking place in the year of my 80th birthday.

After the Conference Steve Myers had organized in a Divonne Hotel a two-day Brainstorming Meeting on '*CERN Plan for Medical Applications*'. During a discussion Session on hadron therapy Vikram Bhadrasain (who, 10 years before, had founded at the International Atomic Energy Agency the 'Program of Action for Cancer Therapy - PACT' and then had moved to NCI) said "*we spend a lot of intelligence and work to improve (slightly) radiation therapy for wealthy people with hadron therapy, working in developed countries, and do not take care of the millions of persons, especially women with breast cancer, who live in Low and Medium Income Countries*". This reinforced my decision to involve CERN in this initiative together with ICEC and, in the following coffee breaks and dinners, I managed to get the full support of Norm, Manjit and Vikram - of course - but also of Steve Myers and Michel Baumann, a world known German radiation oncologist who, in the next months, was chosen as Chair of the '*International Strategy Committee for Medical Applications*', a consulting body of the CERN Directorate.

In November 2014, at the first meeting of this newly created Committee, I brought up the issue and, at the end of the discussion, Michel Baumann said that he would support this action.

In 2015 the only relevant fact, as I am concerned, was that Steve and I met in a Geneva restaurant Nelly Enwerem-Bromson, Director of the PACT Division of the *International Atomic Energy Agency*. She was very positive towards the proposal, which was in her agenda, and

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<sup>1</sup> U.A., *A possible scheme to obtain e-e- and e-e+ collisions at energies of hundreds of GeV*, Phys Letters 61B, 313-315:

[www.sciencedirect.com/science/article/abs/pii/037026937690157X](http://www.sciencedirect.com/science/article/abs/pii/037026937690157X)

<sup>2</sup> U.A. et al, *LIBO - A linac-booster for proton therapy: construction and test of a prototype*, NIM A 521(2004) 512: [www.sciencedirect.com/science/article/abs/pii/S0168900203023994](http://www.sciencedirect.com/science/article/abs/pii/S0168900203023994)

said two things: (1) she considered very real the possibility of finding donors for such a project who, as we suggested, could be given to the CERN and Society Foundation, established a year before; (2) she understood that the collaboration with a Company was essential but said very strongly that IAEA could not make such a choice and that in this CERN help would have been essential.

In January 2016 Fabiola Gianotti became CERN DG and this gave me the possibility, as I'll say in a moment, of a direct action. In fact, I knew Fabiola since her University studies because in the 80's I had been teaching Particle Physics at Milano University, as invited professor, and she followed my course.

In February 2016, the second Conference, organized by Manjit and Jacques Bernier, took place in the same Geneva Conference Centre. Norm spoke of *"Implementing a global force to address the catastrophic rise in cancer in the developing world"*. The Conference was followed by the second Divonne meeting organized by Steve. With Norm, Manjit, Steve and the other interested people, we had ample coffee and dinner time to discuss the few steps forward we had made in two years and to decide that a new approach was needed.

The Divonne Meeting ended on February 21 and on March 12 I wrote a long e-mail to Fabiola describing her who Norm and Vikram were on the international scene of Radiation Oncology. The central sentence was *"All these people considered positively the idea of trying to involve CERN - together with a European Company producing X-ray apparatus - in the development of good, robust and relatively simple X-ray systems for radiation therapy in LMIC."*

Two weeks later I was invited to give a talk on *"Historical summary of Medical Applications at CERN"* at the very first meeting at the still existing 'CERN Medical Applications Steering Committee' (CMASC). Freddy Bordry chaired it and Manjit was Scientific Secretary; this was another occasion to discuss the initiative. In parallel, discussion started between CERN, IAEA and other potential partners.

At the beginning of April 2016 Manjit had to go to a radiobiology meeting at NCI, Washington, organized by Norm. She remembers that, following my suggestion, they discussed having a first Workshop at CERN. On April 7 Norm wrote to Manjit an email that said: *"I am on a conference call with IAEA based on the topic "Treatment, not Terror" that changed the paradigm"*. In few days, after Manjit return from the States, Freddy agreed to organizing/hosting such a Workshop and for CERN to collaborate with this initiative but not to take the lead. Manjit was asked to put this item on the agenda of the next meeting of the *CERN Medical Application Steering Committee*. Eventually, the Meeting, organized by ICEC and hosted by CERN took place here on November 7 and 8, 2016.

I was chosen to chair Session VII, which was on *"Options for Achieving a Novel Linear Accelerator for Challenging Environments; Exploiting advanced in technology"*. I asked the help of my collaborator and friend Alberto Degiovanni, who is here with us today. He had been Technical Director of TERA Foundation and responsible for the design of the proton 3 GHz linac, the follow up of LIBO. Recently he had left TERA to join the start-up A.D.A.M., which I created in Geneva in 2008 with a friend of mine to build on CERN premises the first medical prototype. At the Workshop I gave the introductory talk of Session VII and Alberto gave a wonderful final Summary.

Three months later CERN Courier published a very complete article written by David Pistenmaa, Norman Coleman and Manjit Dosanjh<sup>3</sup>.

A second Workshop followed at CERN in less than a year on '*Innovative, Robust and Affordable Medical Linear Accelerators for Challenging Environment*'. David Jaffrey - in his presentation titled '*Shortfall of current Radio Therapy technology in developing countries*'<sup>4</sup> – summarized the conclusion of the first Workshop by describing what he called Ugo's '*Branching Point*' which brought to

Branch type 1: Define specifications for novel, 'Starter Machine' and engage industry (to realize it);

Branch Point 2: Identify a 'Program Team' to bury the complexity' of radiotherapy;

OR a hybrid approach for LICs.

At the end of the discussion the hybrid approach was indicated.

I stop here in the hope that my presentation has made clear why this is for me a very sad and, at the same time, a joyful day: we have lost a friend and a guide, but we have the unique opportunity to carry forward, all together, his ideas and to realize the program of a Master who was both visionary and realistic.

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<sup>3</sup> D. Pistenmaa, N. Coleman and M. Dosanjh, *Developing medical linacs for challenging regions*, CERN Courier, 17 February 2017: <https://cerncourier.com/a/developing-medical-linacs-for-challenging-regions/>

<sup>4</sup> David A. Jaffray: *Shortfall of current Radio Therapy technology in developing countries*: [https://indico.cern.ch/event/661597/contributions/2731145/attachments/1548717/2432174/WeaknessesCurrentSystems\\_Jaffray\\_Summary.pdf](https://indico.cern.ch/event/661597/contributions/2731145/attachments/1548717/2432174/WeaknessesCurrentSystems_Jaffray_Summary.pdf)