

# Triumpf – Milano collaboration



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# The AVF Cyclotron in Milan

The previous lecture reported in an essential way the first years of scientific activity of Gerardo Dutto in Milan and the reasons why my generation of experimental physicists who grew up in the same laboratory has brought with it the narration of this colleague who lived overseas and which in any case gave notoriety to the laboratory.

The AVF cyclotron in Milan was a heroic adventure for the years in which it was built (in the middle of '60 of the past century), for the efforts required of a small group of people, for the very limited funding and for the state of technologies.

# The arrival at TRIUMF

In 1970 Gerardo and his wife (Marie-Paule Crettiez) arrived at the TRIUMF Laboratories. Gerardo had been invited for one year with the prospect of a possible extension. The cyclotron group in Milan helped young researchers to find opportunities to acquire experience abroad, in the knowledge that this, in one way or another, would benefit research in Italy.

From 1975 Gerardo decided to stay at TRIUMF where he carried out his entire scientific career. His contacts with Milan and with the cyclotron laboratory always remained alive and practically every year during his travels in Italy he spent part of his time with us.



# TRIUMF – An Opportunity for Italian Researchers

Gerardo has been a `people' person with an amazing ability to bring people together and for a long time before we experience Internet based collaboration tools he has been able to develop and maintain a global network across a number of Laboratories.

It has been in the framework of this vision that Gerardo promotes the participation of some people from Milan, Padova, Catania to different activities at Triumph.

I will just mention Lucio Rossi (formerly project leader of the HL-LHC project at CERN up to 2020 and now back at INFN-LASA in Milan). He met Gerardo at a Cyclotron Conference and was invited to work for 3 months at TRIUMF on the very first TR30, the new generation of medical isotope cyclotron that Triumph was just launching at the time (1989).

The interest toward accelerator science in every branch that at any time sounds interesting to Gerardo pushed him to invite a young Luca Serafini from Milan in 2002 for seminars and discussions on advanced injectors and FEL applications (and to have the opportunity to climb in the beautiful mountains around Vancouver).



# TRIUMF – More than Cyclotrons

In the early 1990's Gerardo put together a small team of accelerator physicists to advance the design of a linear accelerator for radioactive ion beams, which later evolved into the ISAC post-accelerator. The development of linacs marked a paradigm shift where TRIUMF became known as more than just a cyclotron lab and paved the way for developments such as superconducting radiofrequency linac technology.

I had the honour to be contacted by Gerardo in late 2002 to give a contribution in this framework.

The theme of the proposed collaboration was a system that people of Milan developed in the framework of the Desy-based Tesla Test Facility (TTF) collaboration.

The TTF facility will consist of four 12 m long cryounits each with eight 9-cell superconducting cavities operating at 1.3 Ghz and one focusing quadrupole.

The test program for TTF includes measures of the cryomodule alignment stability and reproducibility during cool-down/warm up operations.

The required alignment tolerances for the elements inside a cryomodule are 0.5 mm for the RF cavities and 50 micron for the quadrupole. After final assembly inside the cryomodule, the stability of the axis position will be on line monitored during thermal cycles with a resolution of 10 micron.

# Wire Position Monitors at TRIUMF

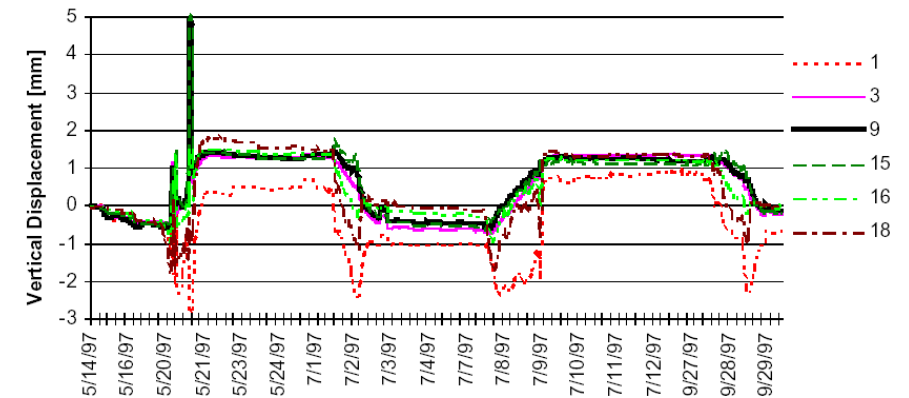
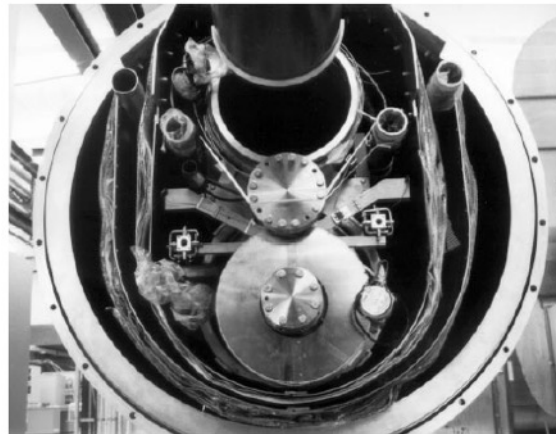
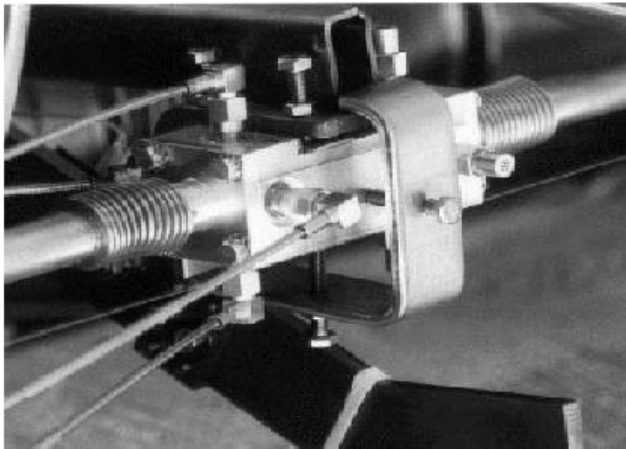
To accomplish this duty we proposed to use devices very similar to the Beam Profile Monitors (BPM) adopted in beam diagnostics. These devices were called Wire Position Monitors (WPM) in analogy.

The WPMs receive their signal from a stretched wire excited by a RF signal and centered inside a tube. The tube is the outer conductor in a coaxial structure which presents a constant impedance to the signal and which shields the signal from external interferences.

The body of each WPM is fixed to a cold mass element.

The wire is stretched by means of an external system which will also provide the reference to the wire.

This means that the WPMs move together with the cold mass while the excitation wire is fixed.



# Wire Position Monitors at TRIUMF

The idea of Gerardo was to try to adopt these instruments for the ISAC-II cavities diagnostics during the cool down process and during operations.

The main peculiarities we drafted to be used as a reference for this application, were summarized as follows:

- Removable system
- The radioactive environment has not been considered in the design
- The detectors must be based on a simplified mechanical design
- Completely new design for the electronics and the data acquisition system

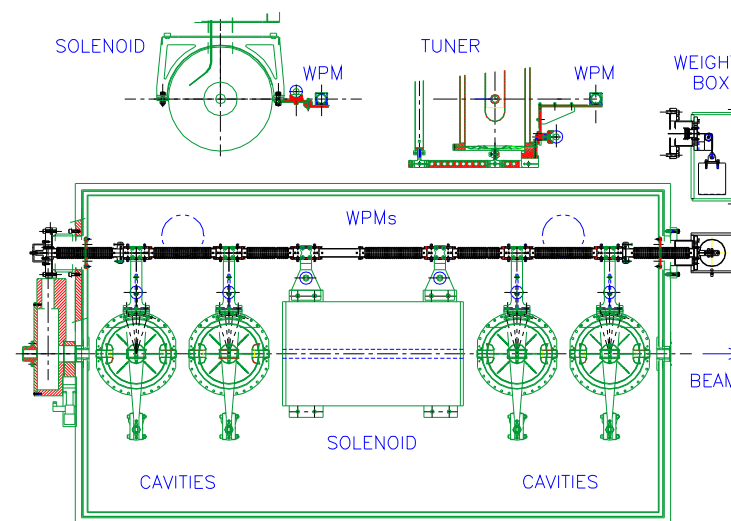


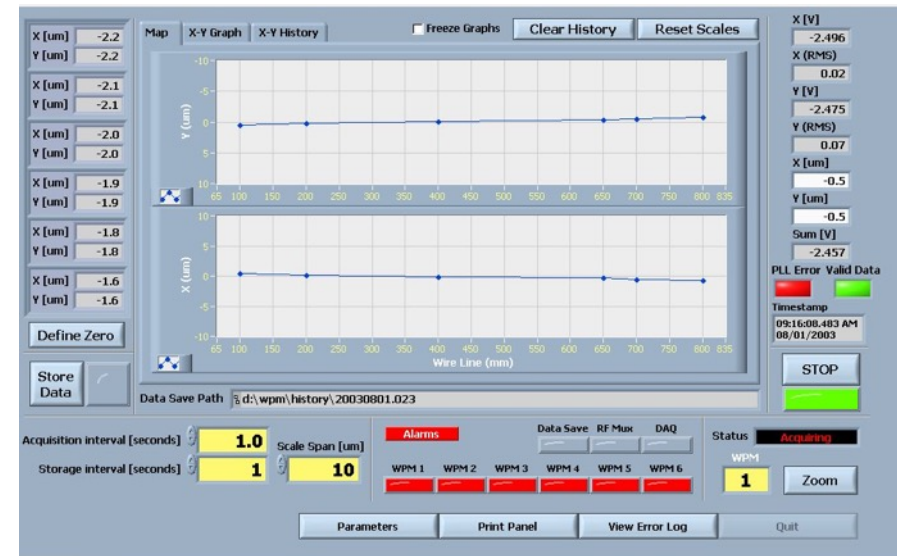
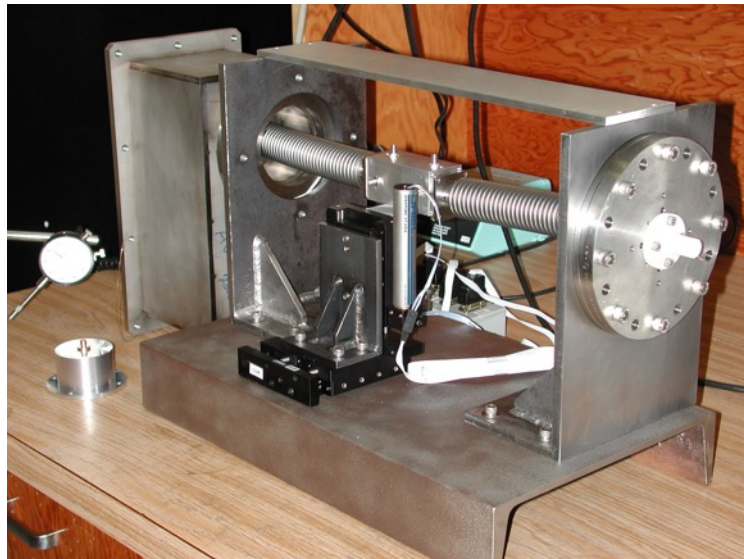
Figure 1 A plan view of a medium beta cryomodule and cross-sections of the wire weight box and WPM mounting brackets.

# Wire Position Monitors at TRIUMF

In an interview on a Canadian magazine the answer of Gerado about the differences between the scientific environment in Canada and Italy, he answered **"In Canada less words and more facts, with adequate funding for requirements, even if limited"**

This approach was reflected in the time scheduled he fixed for the project

- January 2003      First visit of Bill Rawnsley in Milan
- May 2003        Kick off meeting during PAC 2003. The collaboration was established and a detailed work program was agreed.
- August 2003     A full month of permanence and work at Triumf and the first prototype was ready



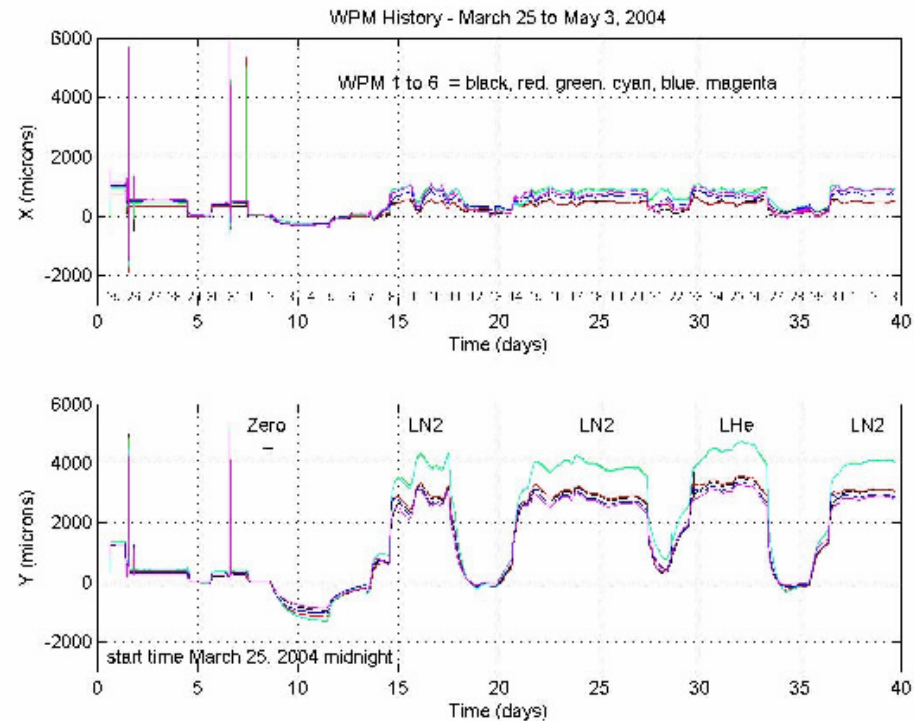


# Wire Position Monitors at TRIUMF

A lot of work was done by the people involved (I just mention Yuri Bylinski, Bill Rawnsley and Ken Fong ) in a friendly and positive environment.

The monitors were installed in the cryomodule during March and April of 2004 and tests were carried out immediatly.

The WPM data were monitored continuously providing detailed data that were extremely valuable to help characterize the structure.



# Cyclotron at INFN-Legnaro

When Gerardo retired from TRIUMPH, as a consultant to Best Cyclotrons, he worked for the development of a 70 MeV, 700 microA proton cyclotron for the production of radioactive beams and radioisotopes for which INFN had made an international competition for the National laboratory of Legnaro.

The race was won by Best and Gerardo actively participated in its realization even with several trips to Italy.

The commissioning of the cyclotron was successful a few years ago, but unfortunately the disease had already limited Gerardo's abilities.



# GERARDO

The experience I had during 2003 and 2004 working for nearly 3 months at TRIUMF to the WPM project has been fantastic and I feel proud and nostalgic even after all this time.

After talking about science, however, let me say that the opportunity to have met and appreciate the man Gerardo was truly priceless. I had the good fortune to learn from people of more than considerable scientific substance, one above all Francesco Resmini in Milan.

Gerardo had a profound intellect and knew how to combine the humanity and simplicity of a great man with it. I talked about his contribution to the world of accelerators and I pay tribute to it.

In my family, who spent part of that time in Vancouver and saw him again at our home in Milan, we like to remember him as a person we really loved and who loved us all.



*Thanks Ludka*

*Ciao, Gerardo*



