

CARLO GUARALDO – IN MEMORIAM

CATALINA CURCEANU, INFN-LNF, FRASCATI (ITALY)

**XVIth Quark Confinement and the Hadron
Spectrum Conference**
Cairns Convention Centre, Cairns, Queensland, Australia
19-24 August 2024 (inclusive)



Professor Carlo Guaraldo (INFN-LNF)
Was born in Tornino (Italy) on 17th December 1938,
passed away on 19th May 2024 in Roma.

EMPLOYMENTS HISTORY

- Teaching Assistant, Rome University “La Sapienza” (1966-1975)
- Associate Professor, Rome University “La Sapienza” (1975-1967)
- Research Fellow, Laboratori Nazionali di Frascati (1965-1967)
- Staff, Laboratori Nazionali di Frascati (1967)
- **Director of Research** of INFN (1989-2005)
- Emeritus Scientist Istituto Nazionale di Fisica Nucleare (2006 -)



17 December 1938, Torino



Le Langhe - La Morra

SCIENTIFIC AND MANAGERIAL - Extract

- **Director, Laboratory of Nuclear Physics** of Laboratori Nazionali di Frascati, 1974
- Member, Council INFN, 1978 - 1984
- **Director, Project ALFA3** (proposal high duty-factor stretcher ring), 1981 - 1984
- **Spokesperson, OBELIX** International Collaboration at LEAR, CERN, 1988 - 1994
- **Spokesperson, DEAR** International Collaboration at DAΦNE, LNF Frascati, 1995
- **Chairperson Executive Board, DIRAC** International Collaboration, PS, CERN, 1998
- **Spokesperson, SIDDHARTA** International Collaboration at DAΦNE, LNF Frascati, 2004
- Member, Working Group AFI-FAIR, for FAIR at Darmstadt, 2005
- Member, Working Group AFI-XFEL for X-FEL at DESY, 2005
- **Project Coordinator of the European Integrating Initiative HadronPhysics** within the VI Framework Programme of European Union, 2004 - 2008
- **Project Coordinator of the European Integrating Activity HadronPhysics2** within the VII Framework Programme of European Union, 2009 - 2011
- **Project Coordinator of the European Integrating Activity HadronPhysics3** within the VII Framework Programme of European Union, 2012 - 2014
- **Deputy Scientific Coordinator of the STRONG-2020** , 2019-2024

RESEARCH INTERESTS

- **Nuclear physics with hadronic and electromagnetic probes:** pions, photons, antiprotons, antikaons.
 - Pions: Elastic and inelastic scattering on nuclei; Knock out reactions
 - Photons: Deuteron photodisintegration; Photofission of nuclei
 - Antiprotons: Meson spectroscopy looking for exotic states of QCD; Dynamics of \bar{p} annihilation on nuclei; Atomic physics: \bar{p} stopping power, Barkas effect, \bar{p} He metastables states
 - Protons: Test of CHPT: lifetime and scattering lengths of $\pi\pi$ and πK systems
 - Antikaons: K^-N scattering lengths by measuring kaonic hydrogen and kaonic deuterium; Atomic physics: transition yields in kaonic atoms, cascade models
- **Testing physics foundations:** Test of the validity of the Pauli Exclusion Principle for electrons; Experimental test of quantum mechanics: spontaneous collapse of the wave function

Carlo Guaraldo was author of 600 scientific publications and 2 books

MAJOR ACHIEVEMENTS

➤ Director of the Nuclear Physics Laboratory of LNF-INFN

This was the first Laboratory at LNF-INFN to allow experimentation in nuclear physics with two secondary beams of the electron/positron linac of Frascati: a pion beam produced by the 500 MeV electron beam of the linac; and a monochromatic photon beam from the annihilation of the positrons of the linac on a liquid hydrogen target.



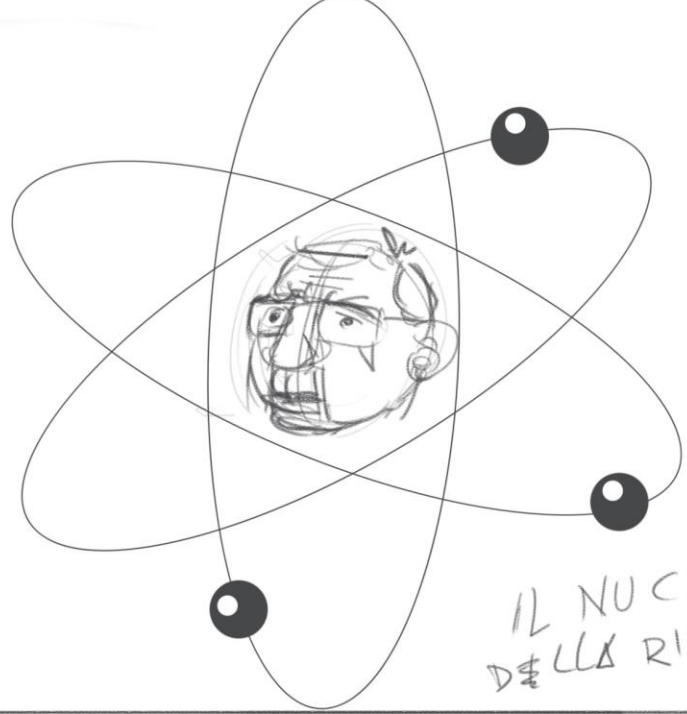
➤ Spokesperson of the International Collaboration OBELIX at LEAR, CERN

OBELIX, a large solid angle axial spectrometer for charged particles and photons, studied \bar{p} -nucleon annihilation, looking for exotics (glueball, hybrids, multiquark states) and the dynamics of \bar{p} annihilation on nuclei (Pontecorvo reactions: search for multinucleon annihilations). The results obtained by OBELIX in the region 1400-1500 MeV, have been the best achievements of LEAR.





LA "STAR"
DELLA
RICERCA



IL NUCLEO
DELLA RICERCA



RICERCA
"ESOTICA"



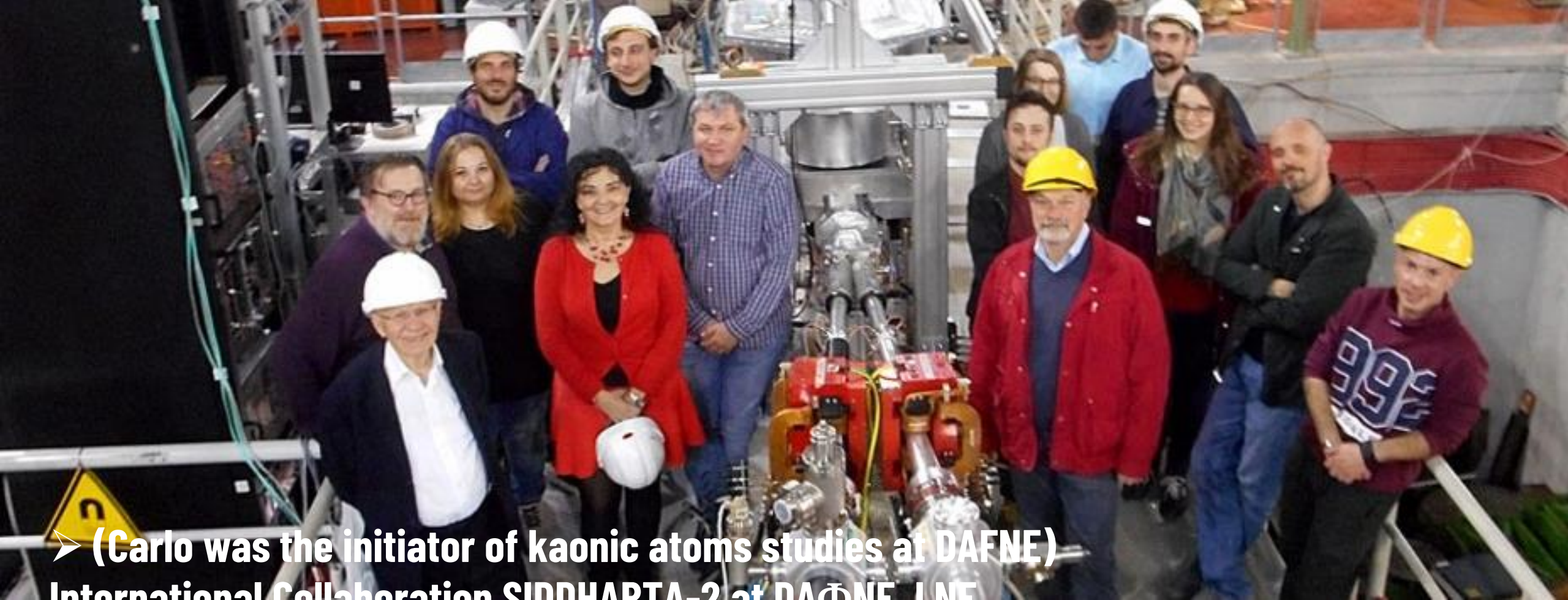
UNA
GRANDE
FAMIGLIA

➤ **Spokesperson of the International Collaboration DEAR at DAΦNE, LNF**

Carlo Guaraldo has introduced in Europe, at Frascati Laboratory, on the DAΦNE collider, the physics of exotic kaonic atoms, which allows to study the K^- -nucleon interaction at threshold, without the extrapolation necessary in scattering experiments. The DEAR experiment, using K^- beam from the decays of φ 's produced in DAΦNE, an array of Charge-Coupled Devices (CCD) as detector and a cryogenic gaseous hydrogen target, has confirmed the solution of the "kaonic hydrogen puzzle", clearly identifying, for the first time, the full pattern of kaonic hydrogen K-lines.

➤ **Spokesperson of the International Collaboration SIDDHARTA at DAΦNE, LNF**

The SIDDHARTA experiment, following the DEAR experiment, has performed the best measurement in literature of the K-p scattering length. This performance could be obtained by using, instead of the CCDs of DEAR, the microsecond timing capability and the excellent energy resolution of a new detector system, the large area Silicon Drift Detector (SDD). SIDDHARTA has as well performed the first K^- - ^3He measurement and the first K^- - ^4He measurement with a gas target.



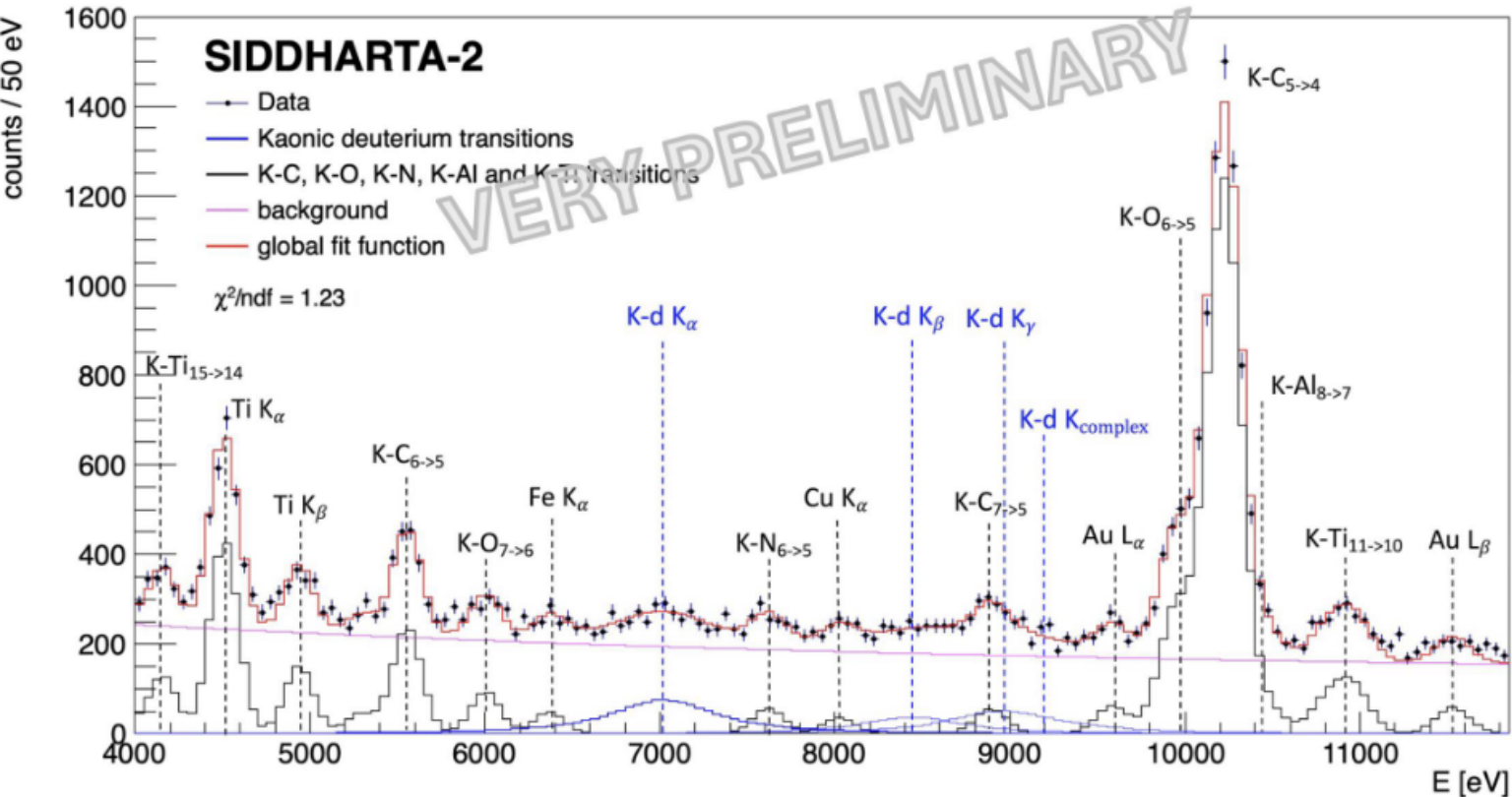
➤ **(Carlo was the initiator of kaonic atoms studies at DAFNE)**

International Collaboration SIDDHARTA-2 at DAΦNE, LNF

The main goal of the SIDDHARTA-2 experiment is to perform the first measurement of the strong interaction induced shift and width of the fundamental level in kaonic deuterium. This measurement, combined with the kaonic hydrogen one already performed by SIDDHARTA, will allow extracting, for the first time, the experimental isospin dependent antikaon-nucleon scattering lengths. The SIDDHARTA-2 experiment is presently undergoing the challenging measurement of kaonic deuterium transitions to the fundamental level.

Kaonic Deuterium: preliminary result

First measurement ever of kaonic deuterium X-ray transitions



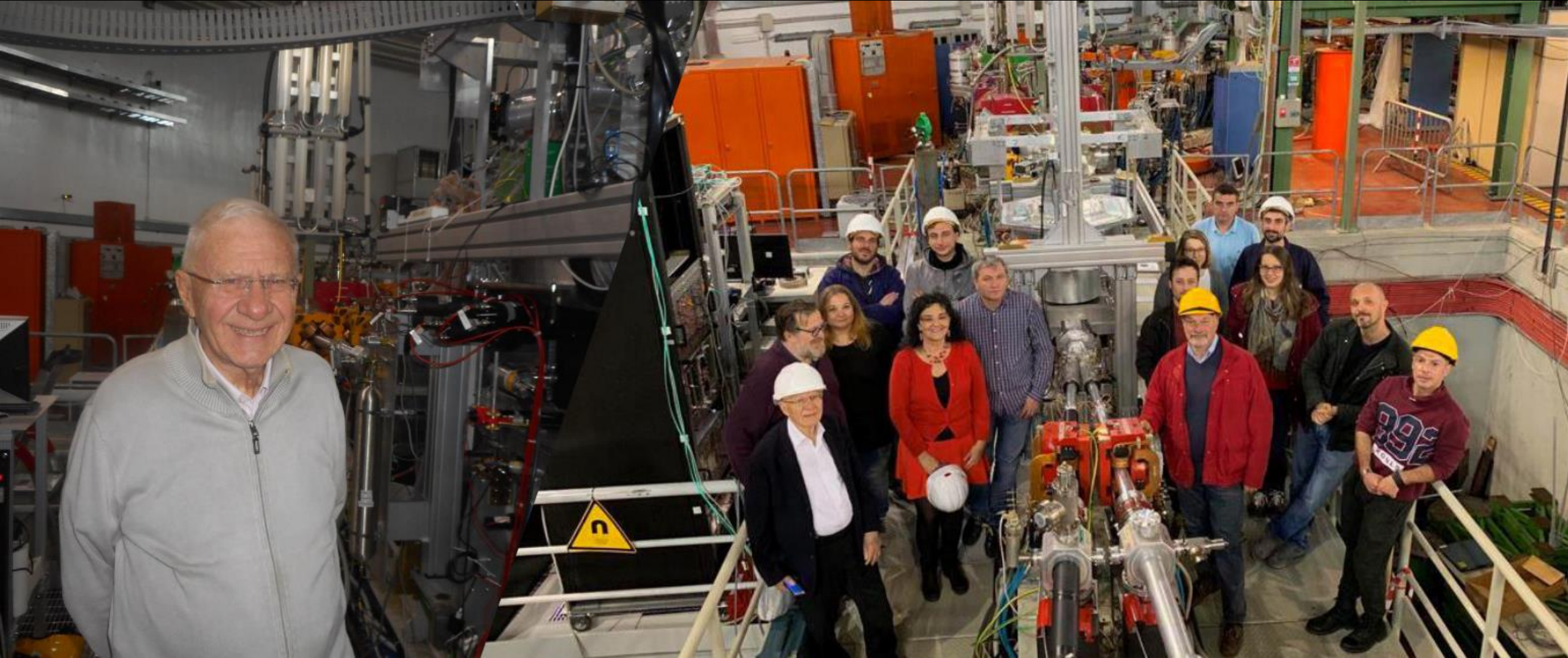
“The most important experiment to be carried out in low energy K-meson physics today is the **definitive determination of the energy level shifts in the K-p and K-d atoms**, because of their direct connection with the physics of $\bar{K}N$ interaction and their complete independence from all other kinds of measurements which bear on this interaction”.

R.H. Dalitz (1982)

$$\varepsilon_{1s} = -816 \pm 53 \text{ (stat)} \pm 2 \text{ (syst)} \text{ eV}$$

$$\Gamma_{1s} = 756 \pm 271 \text{ (stat)} \text{ eV}$$

We did it, Carlo!



and upcoming
unities of FP7

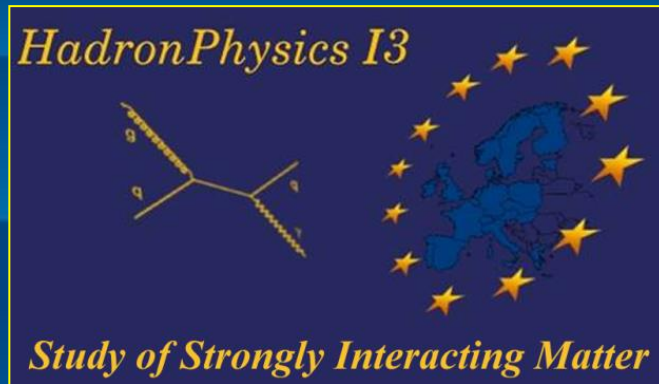
Carlo Guaraldo



HadronPhysics in Europe: Carlo's role

PI of three major EU projects (>30 Meuro!)

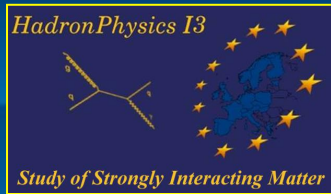
- **HadronPhysics** **2004-2008**
- **HadronPhysics2** **2009-2011**
- **HadronPhysics3** **2012-2014**



HadronPhysics

Study of Strongly Interacting Matter

Call identifier: FP6 – 2002 – Infrastructures – 1
Project number: 506078



The HadronPhysics project

- Coordinator: INFN, Italy
- Project Coordinator: Carlo Guaraldo (INFN-LNF)
- Consortium: 49 European Organizations
- Other involved Institutions: 138
- Involved researchers: 2.000
- Involved Countries: 27
- **EC budget: 17.4 M€**
- Start of the contract: 01/01/2004
- **Contract duration: 60 months
(1 year extension)**

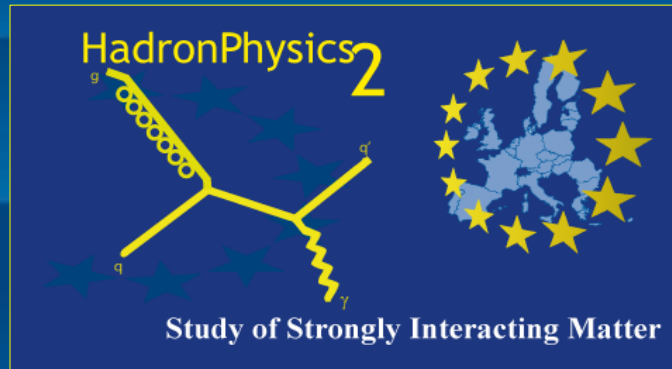
HadronPhysics: Blocks of Activities

NETWORKING
ACTIVITIES (7)

TRANSNATIONAL
ACCESS
ACTIVITIES (9)

JOINT RESEARCH
ACTIVITIES (12)





HadronPhysics2

Study of Strongly Interacting Matter

Call identifier: FP7-INFRASTRUCTURES-2008-1

Funding scheme: Combination of CP & CSA

Project number: 227431

The HadronPhysic2 Project

- Coordinator: INFN, Italy
- Project Coordinator: Carlo Guaraldo (INFN-LNF)
- Consortium: 46 European Organizations
- Other involved Institutions: 103
- Involved researchers: more than 2.000
- Involved Countries: 36
- **EC requested contribution: 10 M€**
- Contract duration: 36 months (amendment request approved) (2009-2011)

NETWORKING
ACTIVITIES (8)
and
MANAGEMENT

TRANSNATIONAL
ACCESS
ACTIVITIES (5)

JOINT RESEARCH
ACTIVITIES (14)



Study of Strongly Interacting Matter



HadronPhysics3

Study of Strongly Interacting Matter

Call identifier: FP7-INFRASTRUCTURES-2011-1

Funding scheme: Combination of CP & CSA

Project number: 283286

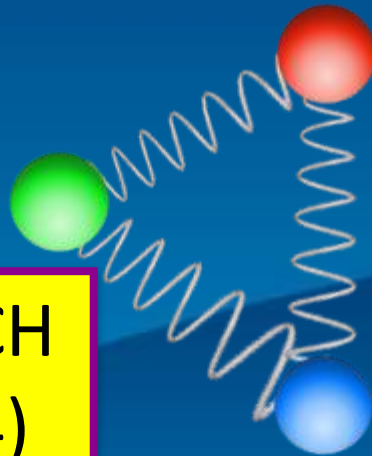
The HadronPhysics3 project

- Coordinator: INFN, Italy
- Project Coordinator: Carlo Guaraldo (INFN – LNF)
- Consortium: 48 European Organizations
- Other involved Institutions: 119 Institutions
- Involved researchers: more than 2500
- Involved Countries: 35
- **EC requested contribution: 9 M€**
- Duration of the project: 2012-2014

HadronPhysics3 blocks of activities

TRANSNATIONAL
ACCESS ACTIVITIES
(5)

JOINT RESEARCH
ACTIVITIES (14)



NETWORKING
ACTIVITIES (9)
and
MANAGEMENT

Final considerations

- The grand total of human effort engaged in the HadronPhysics3 project amounts to about **26.000 person*months**, thus over the three-year duration of the project, more than **700 FTE** contribute. This figure corresponds to about **2.500 scientists** involved in the project.
- This large participation reflects the attractiveness of the blooming, still expanding, research activity in the field.

CARLO
FRIEND and TUTOR













A scientific way
to prepare

PASTA ALLA CARBONARA

by
Carlo Guaraldo

CARLO COOKING



CARLO AND HIS DOG CADEL





CARLO AND CYCLISM

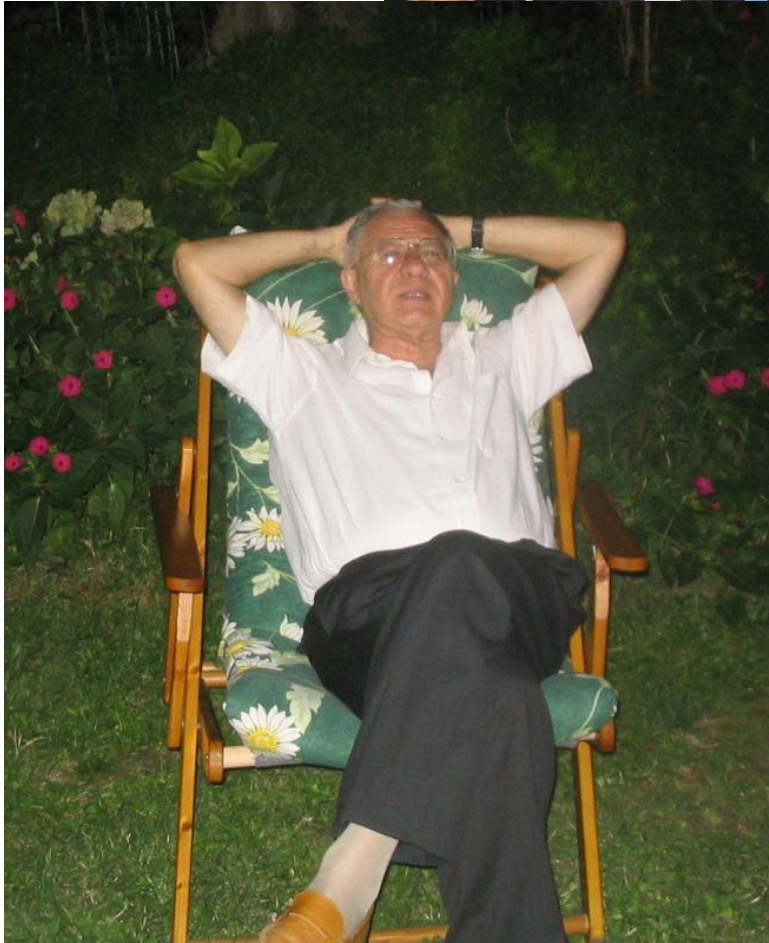


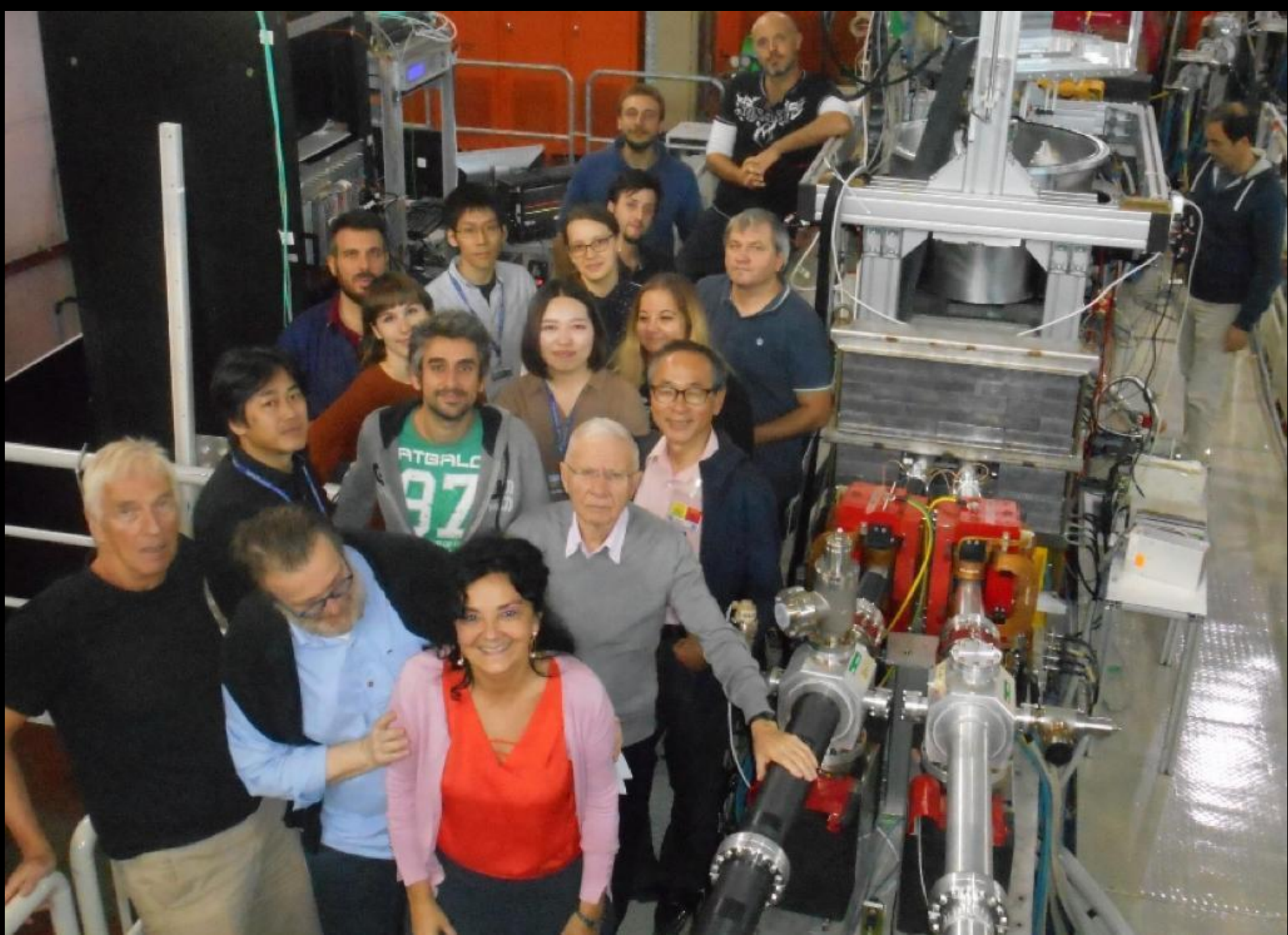
CARLO AND FRIENDS













Grazie Carlo!

No one dies as long as he lives in the hearts and minds of those who remain