

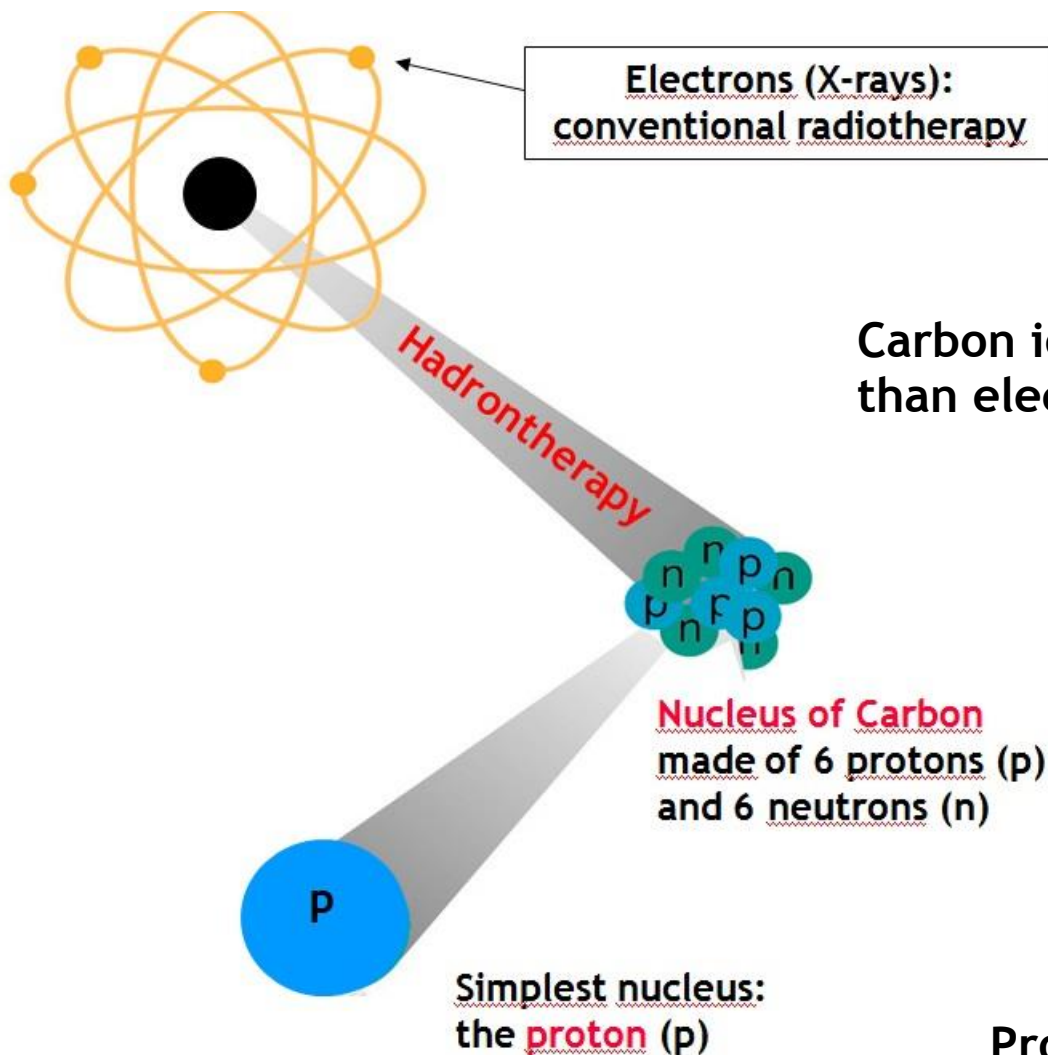


# OMA School on Medical Accelerators: WELCOME

Sandro Rossi – CNAO Foundation

*June 5<sup>th</sup>, 2017*

# Hadrontherapy ?



Carbon ion is 12x2000 times heavier than electron

Proton is 2000 times heavier than electron

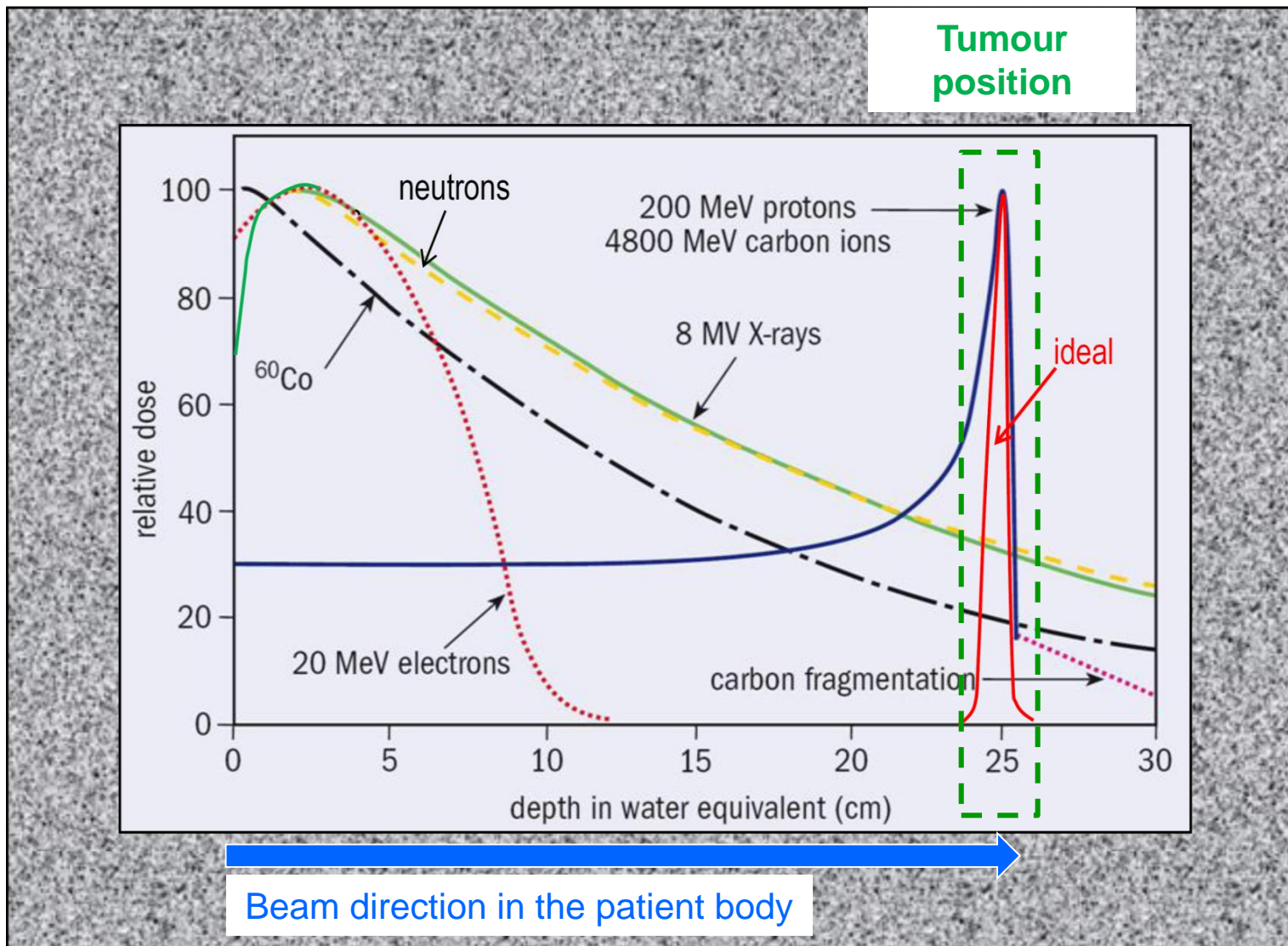
# Which advantages with hadrons ?

**+ PRECISION**



Conformal irradiation of tumour volume  
(= reduced damages to healthy tissues)

# Precision in hadrontherapy



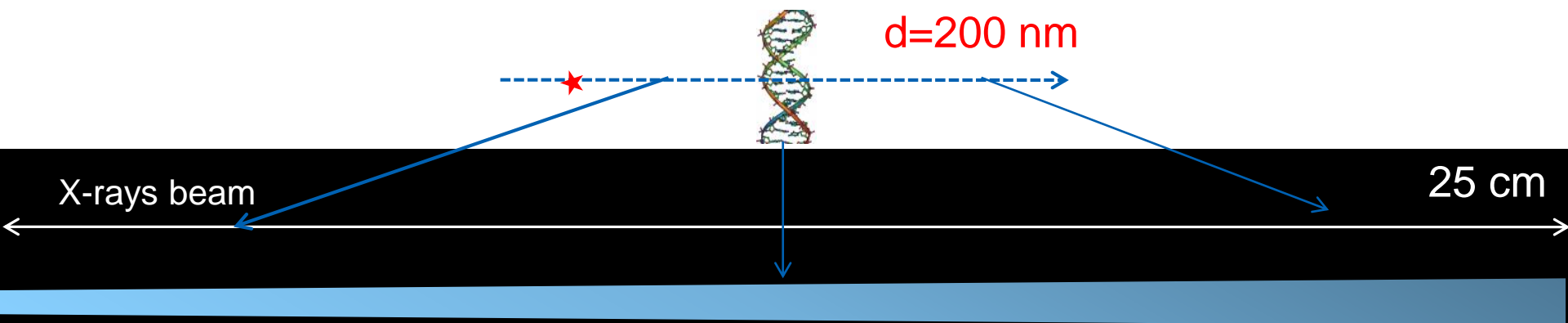
# Which advantages with hadrons ?

**+ EFFICACY**

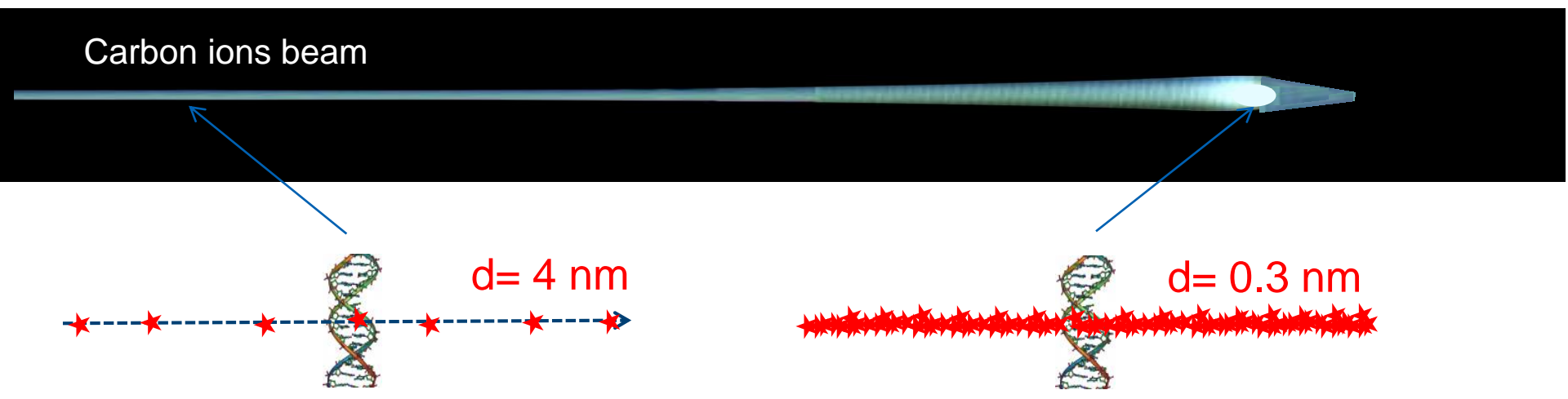


Increased radiobiological efficacy of carbon ions  
(= DNA of tumour cells destroyed in multiple hits)

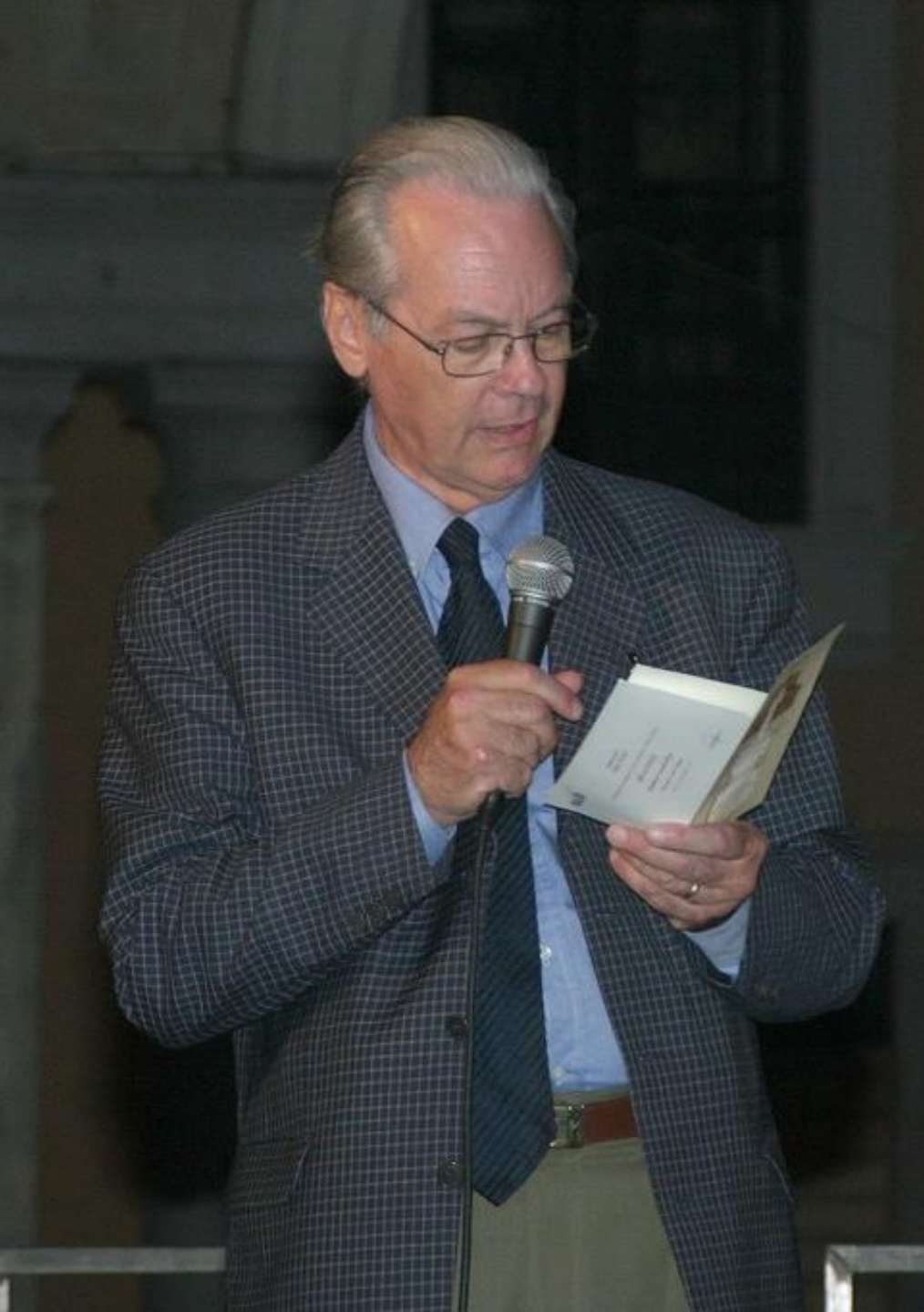
# X-rays: **sparse damage and indirect effects**



# Carbon ions: **clustered damage on tumour and direct effect**







**Year 1991...**

CERN/PPE/UA/eo

25 Maggio 1991

Per un Centro di  
Teleterapia con Adroni

**Ugo Amaldi**

CERN e Università di Milano

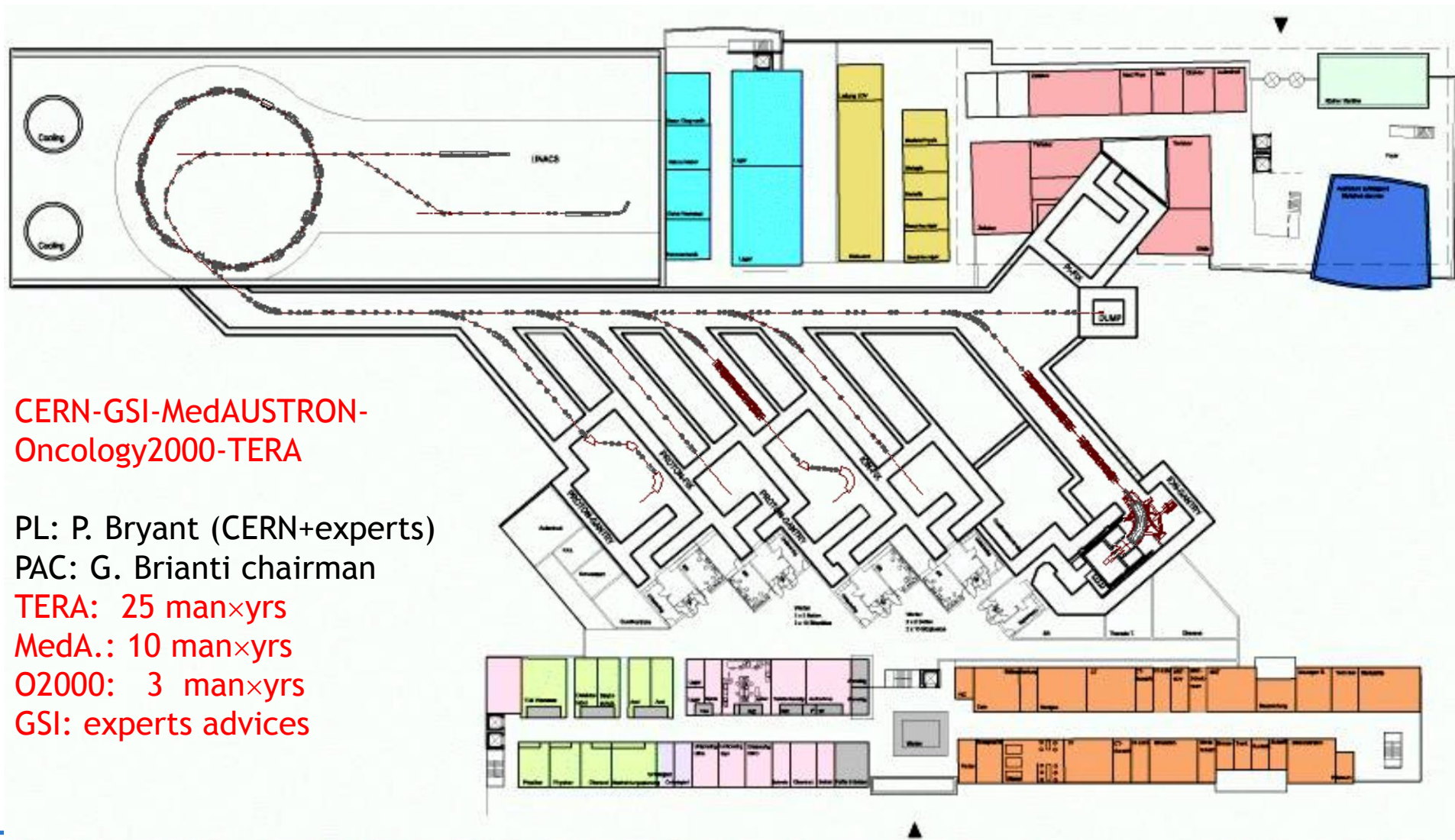
**Giampiero Tosi**

Ospedale di Niguarda, Servizio di Fisica Sanitaria,  
e Università di Milano

***ATER-INFN***

*From 1996 to 1999 at CERN*

## PIMMS (Proton-Ions Medical Machine Study)



**CERN-GSI-MedAUSTRON-  
Oncology2000-TERA**

PL: P. Bryant (CERN+experts)

PAC: G. Brianti chairman

**TERA: 25 man×yrs**

**MedA.: 10 man×yrs**

**O2000: 3 man×yrs**

**GSI: experts advices**

**Objective: define the optimal hadrontherapy centre without constraints**



fondazione **CNAO**

**Not-for-profit private Foundation**

**Created by the Italian Ministry of Health at the beginning of 2001**

**with the purpose to build and run a hadrontherapy Centre**

**The Board is formed by 13 Institutions:**

- 5 hospitals
- 3 universities
- 2 research institutes
- 2 public entity (Ministry of Health and Town of Pavia)
- 1 bank foundation

# Phases of CNAO

**Phase 0: organization**



Years: 2002 - 2004

**Phase 1: construction**



Years : 2005 - 2010

**Phase 2: experimental**

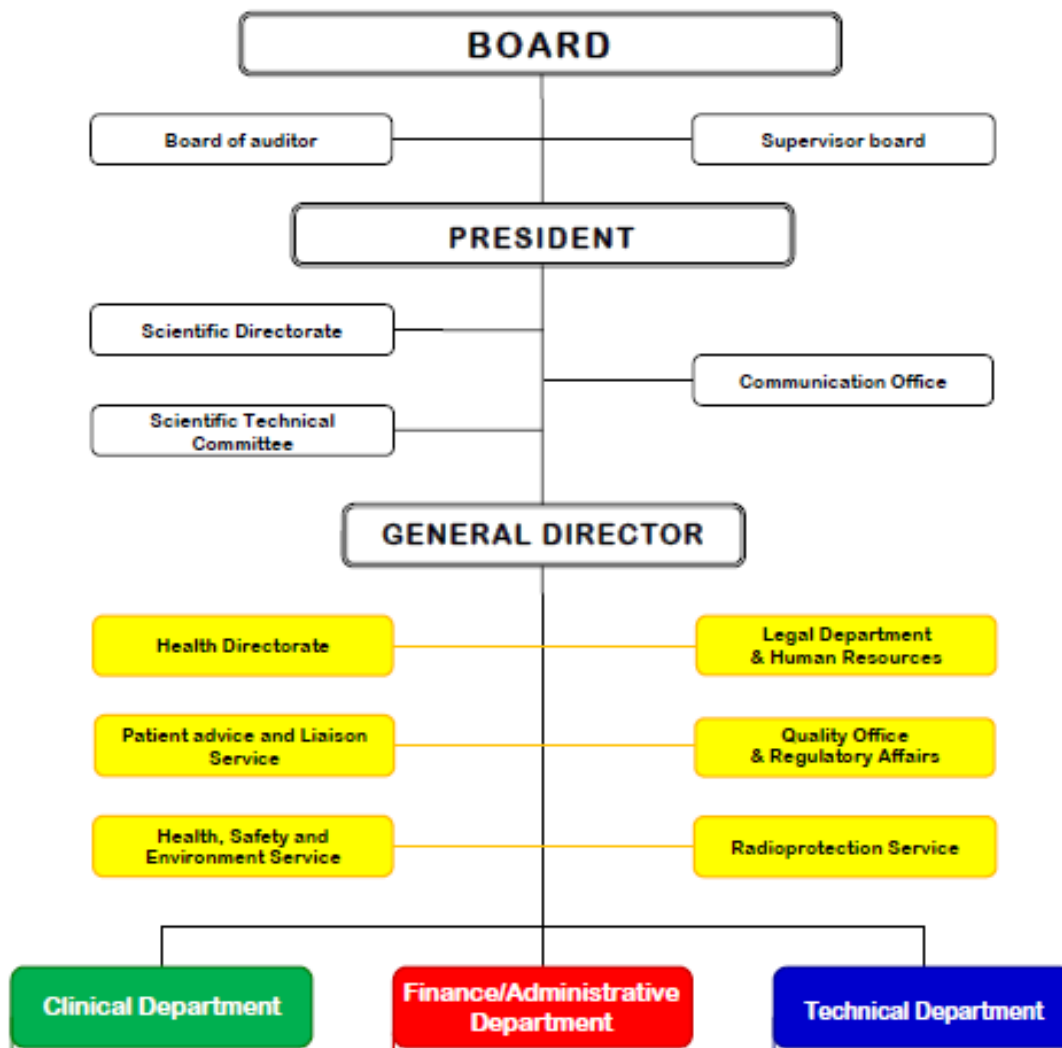


Years: 2010 - 2013

**Phase 3: running**



Years: 2014 - ...



**Synchrotron Operation: H24, 7/7**  
**Maintenance: 4/year - 5 days each (Thursday to Tuesday)**  
**Treatments: Mon to Fri - 8:00 to 21:00**  
**QA: Mon to Fri - 6:00 to 8:00**  
**Beam time for research during nights and week-ends**

***Collaborating Institutes:*** *a network for construction and research*

**NATIONAL**

**TERA Foundation: final design and high tech specifications**

**INFN: technical issues, radiobiology, research, formation**

**University of Milan: medical coordination and formation**

**University of Pavia: technical issues, radiobiology, formation**

**University of Catania: medical physics**

**University of Florence: medical physics**

**University of Turin: interface beam-patient, TPS**

**Polytechnic of Milan: patient positioning, radioprotection, authorisations**

**European Institute of Oncology: medical activities, authorisations**

**San Matteo Foundation: medical activities, logistics**

**Town of Pavia: land and authorisations**

**Province of Pavia: logistics and authorisation**



## ***Collaborating Institutes:*** a network for construction and research

### **INTERNATIONAL**

CERN (Geneva): technical tasks, PIMMS

GSI (Darmstadt): linac and special components

LPSC (Grenoble): technical tasks

Med-Austron (Wien): technical and clinical collaboration

Roffo Institute (Buenos Aires): medical activities

NIRS (Chiba): medical activities, radiobiology, formation

HIT (Heidelberg): research issues

IFJ PAN (Krakow - Poland): medical activities

Uni Essen (Germany): medical activities

Sykehuspartner (Norway): medical activities

**ANSTO (Australia): MoU on R&D**

# PARTNER



**PARTNER**  
Particle Training Network for European Radiotherapy

## SEVENTH FRAMEWORK PROGRAMME

### Marie Curie Networks for Initial Training (ITN)

Project acronym: PARTNER

Project full title: *A PARTicle Training Network for European Radiotherapy*

Grant agreement no.: 215840 - PARTNER - Marie Curie ITN

**Durata:** 4 anni; iniziato a Settembre 2008.

**Finanziamento totale CE:** 5,6 milioni di euro.

**Finanziamento a CNAO:** 874.000,00 euro.

**Project leader:** CERN

**Partners:** 10 Istituti accademici e di ricerca; 2 compagnie leader nel settore (vedi tabella seguente)

**Struttura del progetto:** formazione in ambito di adroterapia per 25 giovani ricercatori (biologi, ingegneri, fisici, medici).

A CNAO: un fisico (Colombia); due medici radioterapisti (Singapore e India); due ingegneri (Francia ed Iran).

Network Participants	Legal Entity	Department	Scientist-in-charge
<b>CERN (Coordinator)</b>	<b>European Organization for Nuclear Research</b>	<b>DSU</b>	<b>Prof. Manjit Dosanjh</b>
CNAO (IT)	Fondazione CNAO	Medical Director	Prof. Roberto Orecchia
GSI (DE)	Gesellschaft für Schwerionenforschung	Biophysics	Prof. Wilma Weyrath er-Kraft
HIT (DE)	Heidelberg Ion Therapy Inc	Director	Prof Juergen Debus
Karolinska (SE)	Karolinska Institutet	Oncology- Pathology	Prof. Anders Brahme
Surrey (GB)	University of Surrey	Director of Science IBC	Prof. Karen Kirkby
TERA (IT)	TERA Foundation	President	Prof. Ugo Amaldi
MedAustron (AT)	Ebg MedAustron	Medical Director	Prof. Ramona Mayer
IBA (BE)	Ion Beam Applications	R&D Manager	Dr. Damien Bertrand
Siemens Medical (DE)	Siemens Medical Solutions	Director, Product Management	Claus Hoeppner
<b>Associated Partners</b>			
ETOILE (FR)	ETOILE Project	Scientific Direction	Prof. Jacques Balosso
IFIC (ES)	IFIMED Project	Project Leader	Prof. Jose Bernabeu

# ULICE

## SEVENTH FRAMEWORK PROGRAMME

*Capacities Specific Programme*

*Research Infrastructures*

Project acronym: **ULICE**

Project full title: *Union of Light-Ion Centres in Europe*

Grant agreement no.: **228436 – ULICE – Integrating Activities**

**Durata:** 4 anni; iniziato a Settembre 2009.

**Finanziamento totale CE:** 8,4 milioni di euro.

**Finanziamento a CNAO:** 1,844 milioni di euro.

**Project leader:** CNAO

**Partners:** 19 Istituti Europei (vedi tabella seguente)

**Struttura del progetto:** tre pilastri

**Joint Research Activities**

**Transnational Access**

**Networking Activities**



# ULICE



N	Beneficiary name	Country
1	Centro Nazionale di Adroterapia Oncologica	Italy
2	Medical University of Vienna	Austria
3	University Hospital of Heidelberg	Germany
4	European Organization for Nuclear Research	Switzerland
5	MedAustron	Austria
6	Philipps-Universität Marburg	Germany
7	Gesellschaft für Schwerionenforschung	Germany
8	Karolinska Institute	Sweden
9	Oxford University	UK
10	Technical University of Dresden	Germany
11	Siemens AG - MED PT PLM P	Germany
12	European Society for Therapeutic Radiology and Oncology	Belgium
13	Université Catholique de Louvain	Belgium
14	Medical University Aarhus	Denmark
15	Stichting Katholieke Universiteit	Netherlands
16	Ion Beam Applications SA	Belgium
17	Istituto Nazionale di Fisica Nucleare	Italy
18	Henryk Niewodniczanski Institute of Nuclear Physics Polish Academy of Sciences	Poland
19	Archade	France
20	Université Claude Bernard Lyon 1	France

# HORIZON 2020 – Marie Skłodowska-Curie actions Research networks (ITN): support for Innovative Training Networks

## Two Projects active at CNAO

### ☐ MARIE SKŁODOWSKA-CURIE ACTIONS

**Innovative Training Networks (ITN) Call: H2020-MSCA-ITN-2014**

***“MEDICIS-PROMED”***

### ☐ MARIE SKŁODOWSKA-CURIE ACTIONS

**Innovative Training Networks (ITN) Call: H2020-MSCA-ITN-2015**

***“OMA”***


**OMA School on Medical Accelerators. 5-9 June 2017, CNAO, Pavia, Italy**

	Monday 5 <sup>th</sup> June	Tuesday 6 <sup>th</sup> June	Wednesday 7 <sup>th</sup> June	Thursday 8 <sup>th</sup> June	Friday 9 <sup>th</sup> June	
8:30 - 9:30	<b>Welcome</b> Sandro Rossi (CNAO) <b>Admin/logistics</b> Monica Necchi (CNAO) <b>OMA – Introduction</b> Magda Klimontowska (ULIV)	<b>Ion Sources</b> Gabriel Gaubert (PANTECHNIK)	<b>Simulation Codes</b> Sven Reiche (PSI)	<b>Radiobiology</b> Emanuele Scifoni (INFN)	<b>Supervisory Board (SB) Annual Meeting</b> – joint session with introduction to fellows	
9:30 - 10:30	<b>History of Medical Accelerators</b> Tomas Vrba (CVUT)	<b>Low Energy Beam Transport including the RFQ</b> Simon Jolly (UCL)	<b>Accelerator Control Systems</b> Luigi Casalegno (CNAO)	<b>Treatment Planning System</b> Adam Aitkenhead (CHRISTIE)	<b>CNAO – challenges and perspectives</b> Sandro Rossi (CNAO)	<b>SB Annual Meeting</b>
<b>COFFEE BREAK</b>						
11:00 - 12:00	<b>Introduction to Radiation Therapy</b> Roberto Orecchia (CNAO)	<b>Beam Manipulation</b> Angeles Faus-Golfe (LAL-CNRS)	<b>Beam Delivery System</b> Oxana Actis (PSI)	<b>Image-guided Radiotherapy</b> Guido Baroni (CNAO)	<b>Patient Imaging</b> Georgios Dedes (LMU)	
12:00 - 13:00	<b>Beam Physics Fundamentals</b> Javier Resta Lopez (ULIV)	<b>Cyclotron</b> Eric Forton (IBA)	<b>Regulations governing the application of medical accelerators</b> Marko Mehle (COSYLAB)	<b>Study Session</b> <i>split in 4 groups</i>	<b>Industry talk: High-speed optical 3D surface scanning for medical use</b> Roland Hoefling (VIALUX) <b>Industry talk: Control systems</b> Mark Plesko (COSYLAB) <b>Industry talk</b> Julien Smeets (IBA)	
<b>LUNCH</b>						
14:30 - 15:30	<b>Beam Diagnostics I</b> Adam Jeff (A.D.A.M.)	<b>Synchrotron</b> Fadmar Osmic (MEDAUSTRON)	Lunch until 14.00  <b>Afternoon: Hike in Casteggio with a guided tour of a vineyard</b> (start between 15.00 – 15.30 – tbc on the day)	<b>Poster session and industry display</b>	<b>14.00 - DEPARTURE</b>	
15:30 - 16:30	<b>Beam Diagnostics II</b> Ralph Fiorito (ULIV)	<b>Study Session</b> <i>split in 4 groups</i>		<b>OMA SC meeting</b> (start at 15:00)		
<b>COFFEE BREAK</b>						
17:00 - 18:00	<b>Q&amp;A</b> Guided by J.R.Lopez	<b>Beam Extraction</b> Adriano Garonna (TERA)		<b>Seminar: New X-ray Sources and Approaches for Imaging during Therapy and Intervention</b> Gil Travish (ADAPTIX)	<b>OMA SC meeting</b>	
Evening	<b>19:15 Dinner</b> at CNAO	<b>18:00 Adroterapia all'avanguardia al CNAO – public talk (slides in English)</b> Marco Pullia (CNAO)  <b>19:45 Dinner</b> at Rosengarten	<b>19:30 Dinner</b> at Rosengarten	<b>20:30 Formal dinner</b> at Ristorante Bardelli		

Sunday 4th June: 17:45 – Tour of CNAO, 19:00 Welcome reception





# Thank you and enjoy the School

*"Real progress happens only when advantages of a new technology become available to everybody"*  
H. Ford