European Network for Light Ion Therapy - M. Dosanjh

European Network for Light Ion Therapy
ENLIGHT

Manjit Dosanjh
ENLIGHT Coordinator
CERN

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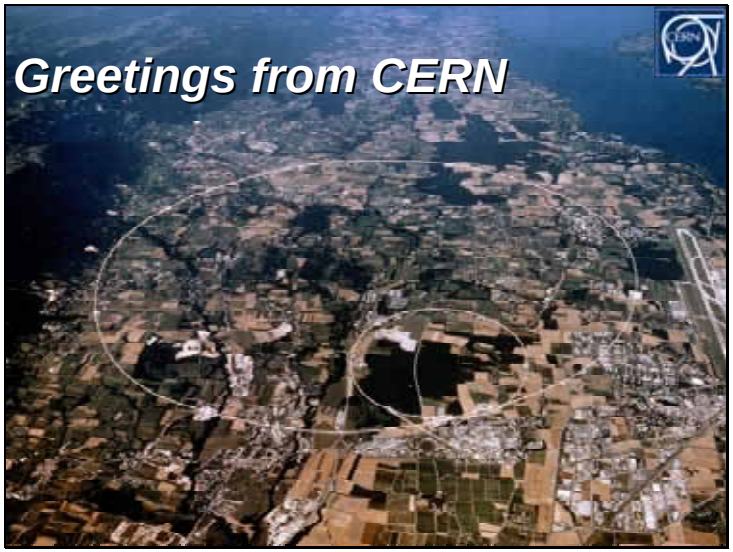
Greetings from CERN

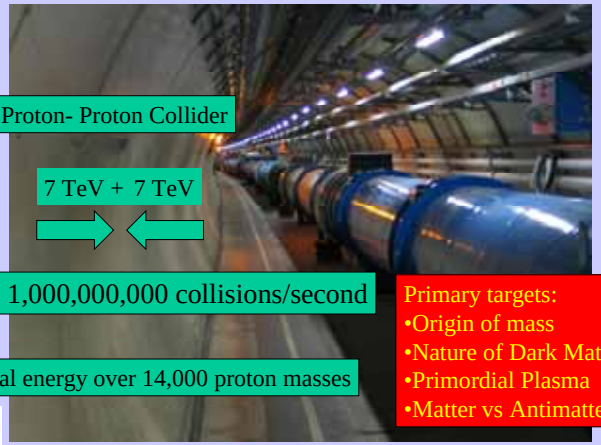


CERN in Numbers

- 2300staff
- 700 Fellows and Associates
- 10000 users

- Member States: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. Romania*
- Observers to Council: India, Israel, Japan, the Russian Federation, the United States of America, Turkey, the European Commission and Unesco

The Large Hadron Collider (LHC)



Proton- Proton Collider

7 TeV + 7 TeV

1,000,000,000 collisions/second

Total energy over 14,000 proton masses

Primary targets:
- Origin of mass
- Nature of Dark Matter
- Primordial Plasma
- Matter vs Antimatter

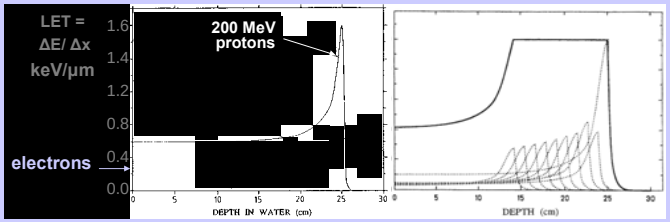
All started in 1946 by Wilson….

Founder and first director of Fermilab

In 1946 Robert Rathbun Wilson :

- **Protons can be used clinically**
- **Accelerators are available**
- **Maximum radiation dose can be placed into the tumour**
- **Proton therapy provides sparing of normal tissues**

(*) Wilson, R.R. (1946), "Radiological use of fast protons," Radiology 47, 487.



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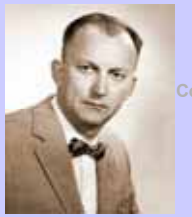
The 184-inch cyclotron - 1946



Cornelius Tobias

1918-2000

At the Berkeley Laboratory

First treatment of pituitary glands:	**1954**
Treatment of pituitary tumors:	**1956**
1000 patients by the end of the program	**1974**

"Irradiation Hypophysectomy and Related Studies Using 340-MeV Protons and 190-MeV Deuterons" Tobias CA, Roberts JE, Lawrence JH, Low-Beer BVA, Anger HO, Born JL, McCombs R, Huggins C. *Peaceful Uses of Atomic Energy* 10:93-106, 1956

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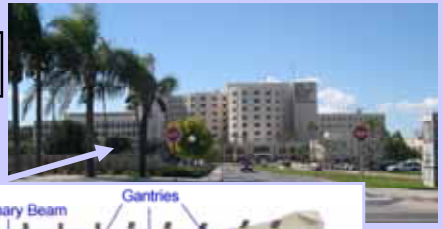
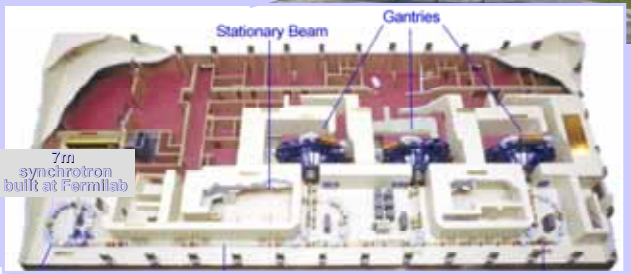
First hospital centre :Loma Linda University Medical Center

- **Dr. James Slater MD**
- **First patient: 1992**





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Radiotherapy in the 21st Century

- RT is, nowadays, the least expensive cancer treatment method
- There is no substitute for RT in the near future
- The rate of patients treated with RT will likely increase in the years to come

Present Limitation of RT: 30% of patients still fail locally after curative RT

(Acta Oncol, Suppl:6-7, 1996)

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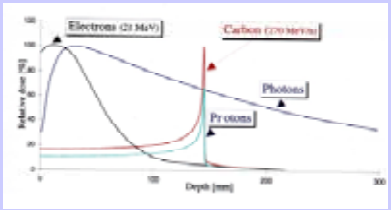
How to overcome failures?

- Physics & treatment technology: dose escalation
- Imaging: MRI, PET, image registration
- Biology: altered fractionation, radiosensitization

Raymond Miralbell, HUG

Hadrontherapy vs. radiotherapy



- Tumours close to critical organs
- Tumours in children
- Radio-resistant tumours

Photons and Electrons	vs.	Hadrons
• Physical dose high near surface		• Dose highest at Bragg Peak
• DNA damage easily repaired		• DNA damage not repaired
• Biological effect lower		• Biological effect high
• Need presence of oxygen		• Do not need oxygen
• Effect not localised		• Effect is localised

Numbers of potential patients

From studies in Austria, France, Germany and Italy

X-ray therapy

every 10 million inhabitants 20,000 pts/year

Proton therapy

12% of X-ray patients 2,400 pts/year

Therapy with **Carbon ions** for radio-resistant tumour

3% of X-ray patients 600 pts/year

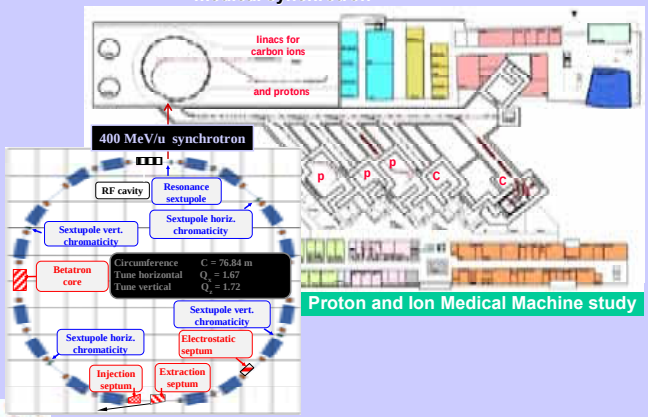
TOTAL for **hadron therapy** for 10 M 3,000 pts/year

The PIMMS Collaboration

- Collaboration was formed in 1996 following an agreement between Med-AUSTRON (A) and TERA (I)
- CERN agreed to host and support the study in PS-Division
- The study was later joined by ONKOLOGY 2000 (CZ)
- Close contacts were kept with GSI (D)
- Work started in January 1996 and continued for 4 years.
- Final report is now available (CD ROM;CERN Yellow Report)

PIMMS at CERN in 1996 - 2000

CERN–TERA–MedAustron Collaboration for optimized medical synchrotron



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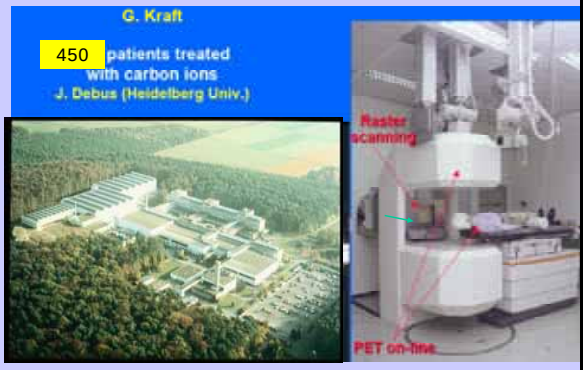
G. Kraft

J. Debus

The Darmstadt GSI 'pilot project' (1997-2008)



Manjit Dosanjh, February 27th - March 1st, Predeal, Romania 2009

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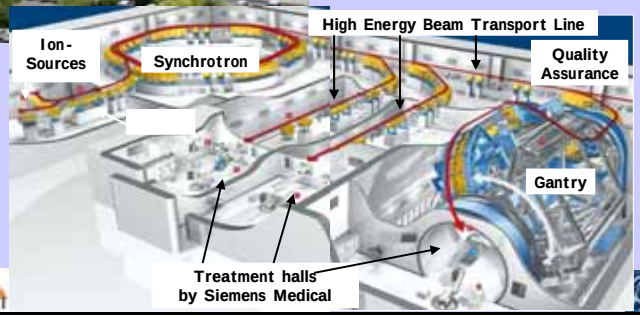
HIT - HEIDELBERG

First beam extracted in 2007

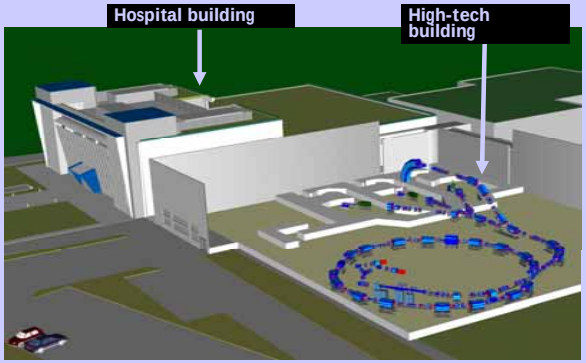
First patient: spring 2009



CNAO = Centro Nazionale di Adroterapia

Pavia (near Milan)

Medical Director: Roberto Orecchia Technical Director: Sandro Rossi



CERN Colloquium - 5.2.09 - UA

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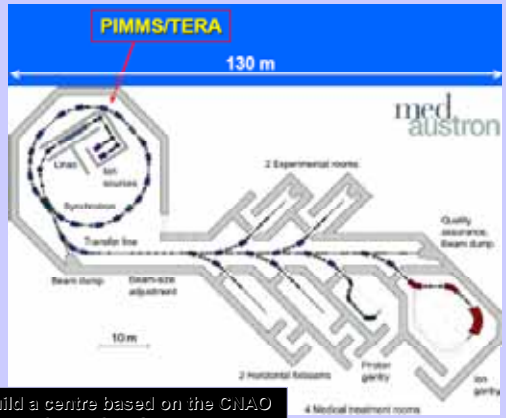
In 2007 MedAustron has been approved for Wiener Neustadt

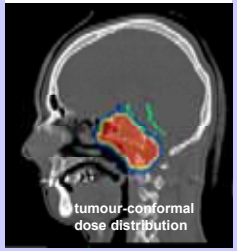
Approved in 2007 by the Government of Lower Austria



MedAustron will build a centre based on the CNAO construction drawings (CERN-CNAO-INFN Agreement)

Hadrontherapy goals

- Provide the irradiation technologies and the detection systems to optimally use the advantages of charged particles
- Optimize the dose to the tumour by beam scanning and adaptation of the delivery e.g. organ motion, respiration
- Treat 1000 patients per year and perform clinical trials using low-LET (p, He) and high-LET (C, O) beams
- Conduct technical, physical and clinical R+D



European Network for Light Ion Hadron Therapy (ENLIGHT)

Questions?

Why did we need a network?
Why the timing 2001?
What was necessary for a network?
Which activities were needed to catalyse ENLIGHT?
Which were the key starting points?

ENLIGHT

Hadrontherapy complex undertaking, therefore ENLIGHT established to

- Create common multidisciplinary platform
- Share knowledge
- Share best practices
- Harmonise data
- Provide training, education
- Identify challenges
- Innovate

ENLIGHT

The ENLIGHT network opened the discussion on

- Clinical studies
- Epidemiological studies
- Cancer incidence
- Economical dimensions
- ...

Funded as a network by the European Commission until 2005

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ENLIGHT

- ENLIGHT provides a powerful multidisciplinary European collaboration amongst partners interested in hadrontherapy
- ENLIGHT acts as a platform for defining research needs
- Developing projects and securing funding and collaboration
- ENLIGHT is a useful resource for communities interested in hadron therapy

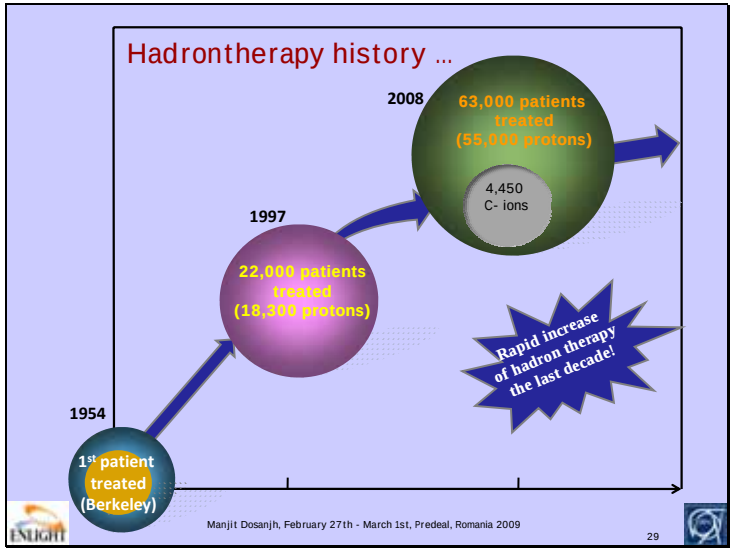
Points to consider for hadrontherapy in Greece

- Define the problem: patient cancer data
- Identify stakeholders (existing network of radio-oncologists, technology experts.....)
- Initiate open discussions
- Collect basic data for all aspects: cancer epidemiology, type of treatment (numbers), number and type of radiation facilities (distribution), diagnostics, PET, PET/CTI/MRI

Points to consider for hadron therapy in Greece

- Establish a multidisciplinary (accelerator physicists, detector specialists, doctors,...) dialogue
- Get champions (medical doctors, key personalities,..?)
- Get the physicians involved from the outset
- Get involved in existing infrastructures outside Greece, e.g. ENLIGHT, PTCOG

EXTRA SLIDES


Hadrontherapy history …
2008
63,000 patients treated (55,000 protons)
4,450 C- ions
1997
22,000 patients treated (18,300 protons)
Rapid increase of hadron therapy the last decade!
1954
1st patient treated (Berkeley)
Manjit Dosanjh, February 27th - March 1st, Predeal, Romania 2009
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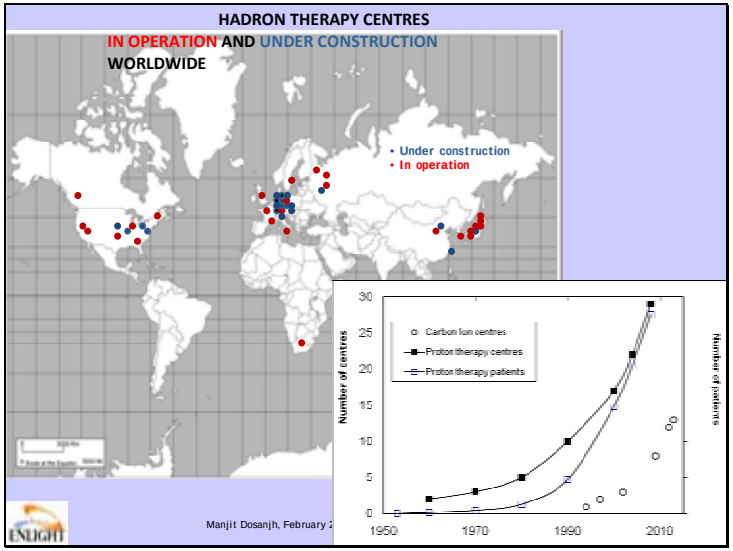
HADRON THERAPY CENTRES
IN OPERATION AND UNDER CONSTRUCTION
WORLDWIDE
• Under construction
• In operation
Carbon Ion centres
Proton therapy centres
Proton therapy patients
Number of centres
Number of patients
0
5
10
15
20
25
30
1950
1970
1990
2010