

European Network for Light Ion Therapy - M. Dosanjh



European Network for Light Ion Therapy ENLIGHT

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ENLIGHT Coordinator
CERN



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Greetings from CERN



CERN in Numbers

- 2300 staff
- 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....

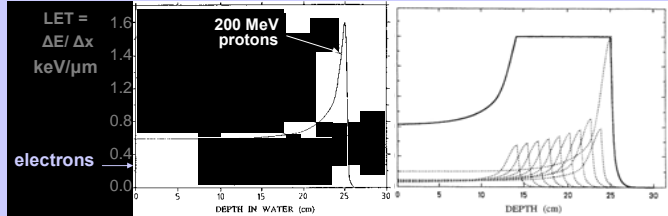


Founder and first director of Fermilab

In 1946 Robert Rathbun Wilson :

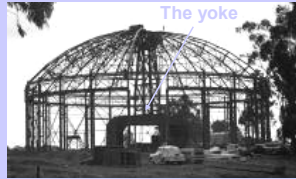


- Protons can be used clinically
- Accelerators are available
- Maximum radiation dose can be placed into the tumour
- Proton therapy provides sparing of normal tissues

(*) 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

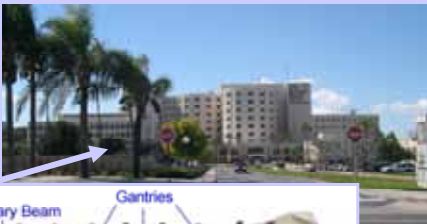
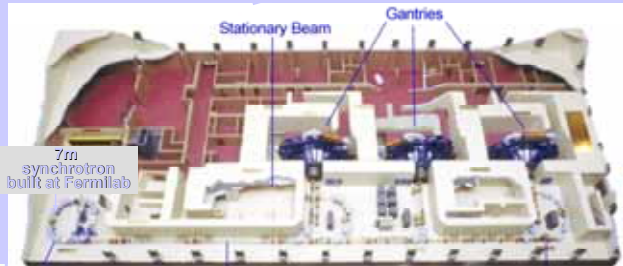
First treatment of pituitary glands:	1954
Treatment of pituitary tumors:	1956
1000 patients by the end of the program	1974

"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

7m synchrotron built at Fermilab

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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

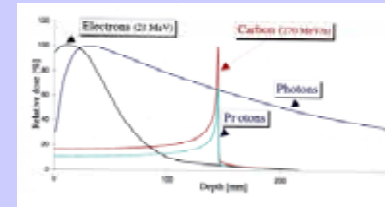


Manjit Dosanjh, 27 November 2008, Thessaloniki- Greece

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Hadrontherapy vs. radiotherapy



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

Photons and Electrons

- Physical dose high near surface
- DNA damage easily repaired
- Biological effect lower
- Need presence of oxygen
- Effect not localised

vs. Hadrons

- Dose highest at Bragg Peak
- DNA damage not repaired
- Biological effect high
- Do not need oxygen
- Effect is localised



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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



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

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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)



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PIMMS at CERN in 1996 - 2000

CERN-TERA-MedAustron Collaboration for optimized medical synchrotron

linacs for carbon ions and protons

400 MeV/u synchrotron

RF cavity

Resonance sextupole

Sextupole vert. chromaticity

Sextupole horiz. chromaticity

Betatron core

Electrostatic septum

Injection septum

Extraction septum

Circumference $C = 76.84$ m
Tune horizontal $Q_x = 1.67$
Tune vertical $Q_y = 1.72$

Proton and Ion Medical Machine study

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

G. Kraft

J. Debus

450 patients treated with carbon ions

J. Debus (Heidelberg Univ.)

Master scanning

PET on-line

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HIT- HEIDELBERG

First beam extracted in 2007
First patient: spring 2009

Ion-Sources

Synchrotron

High Energy Beam Transport Line

Quality Assurance

Gantry

Treatment halls by Siemens Medical

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CNAO = Centro Nazionale di Adroterapia

Pavia (near Milan)

Medical Director: Roberto Orecchia Technical Director: Sandro Rossi

Hospital building

High-tech building

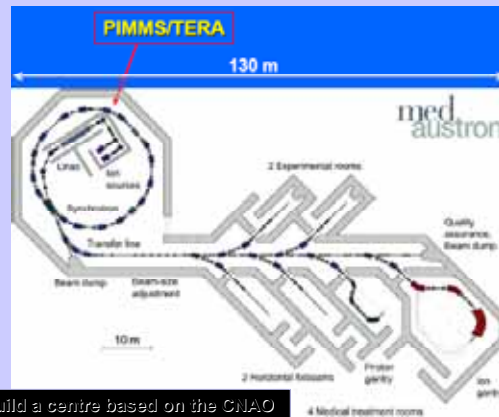
CERN Colloquium - 5.2.09 - UA

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In 2007 MedAustron has been approved for Wiener Neustadt

Approved in 2007
by the Government of
Lower Austria



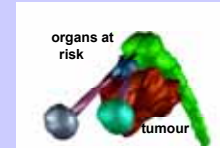
MedAustron will build a centre based on the CNAO construction drawings (CERN-CNAO-INFN Agreement)



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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



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European Network for Light Ion Hadron Therapy (ENLIGHT)



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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?



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Hadrontherapy complex undertaking, therefore ENLIGHT established to

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



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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

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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



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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

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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

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EXTRA SLIDES

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