TREASURE: **Tr**aining **R**esearchers for South-**EAS**t e**UR**ope with **E**nlight for the Future

Manjit Dosanjh, CERN

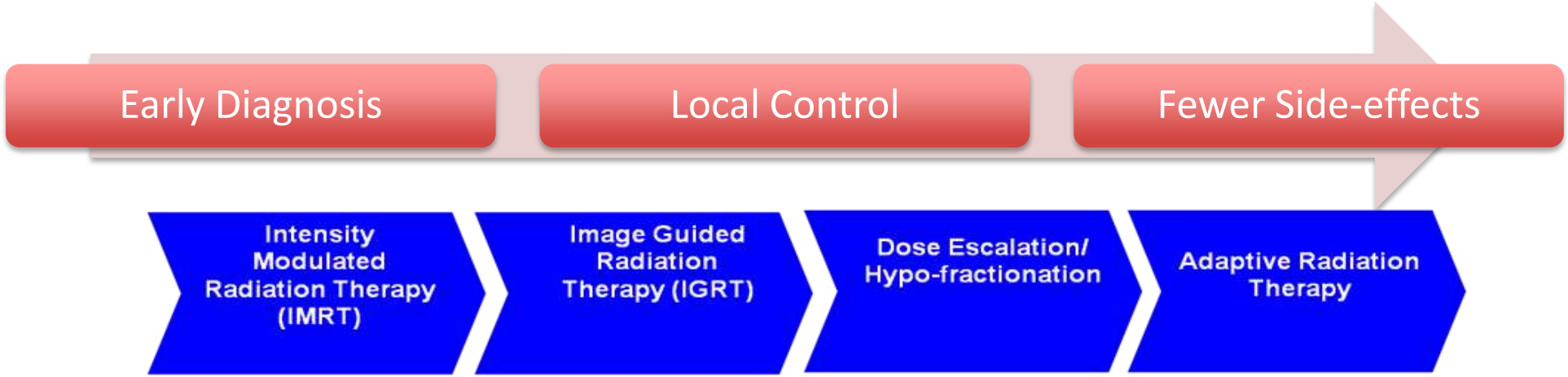
SEEIIST, IAEA, November 2018

Why cancer and research?

It is a large and a growing societal challenge:

- More than 3 million new cancer cases in Europe in 2015
- Nearly 15 million globally in 2015
- This number will increase to 25 million in 2030
- Currently around 8 million deaths per year
- This will increase to about 13 millions in 2030

Improving Cancer Outcomes



- New Technologies
- Advanced radiotherapy
- Radiobiology, Biology, Clinical
- Multi-disciplinary collaboration

Radiotherapy in 21st Century

3 "Cs" of Radiation

Cure (40-50% cancer cases are cured)

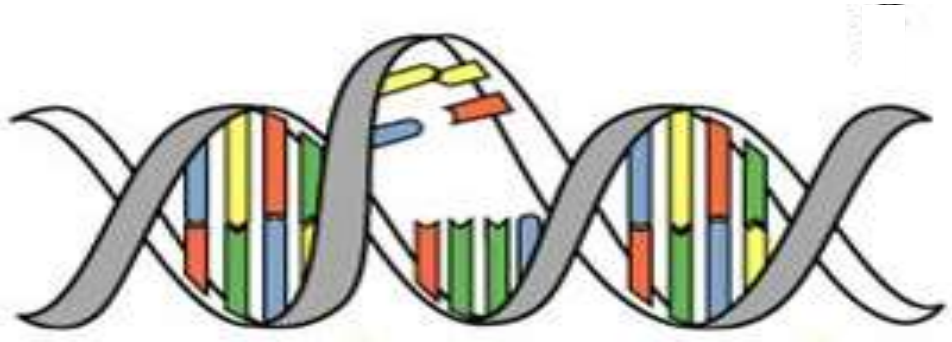
Conservative (non-invasive, fewer side effects)

Cheap (about 10% of total cost of cancer on radiation)

(J.P.Gérard)

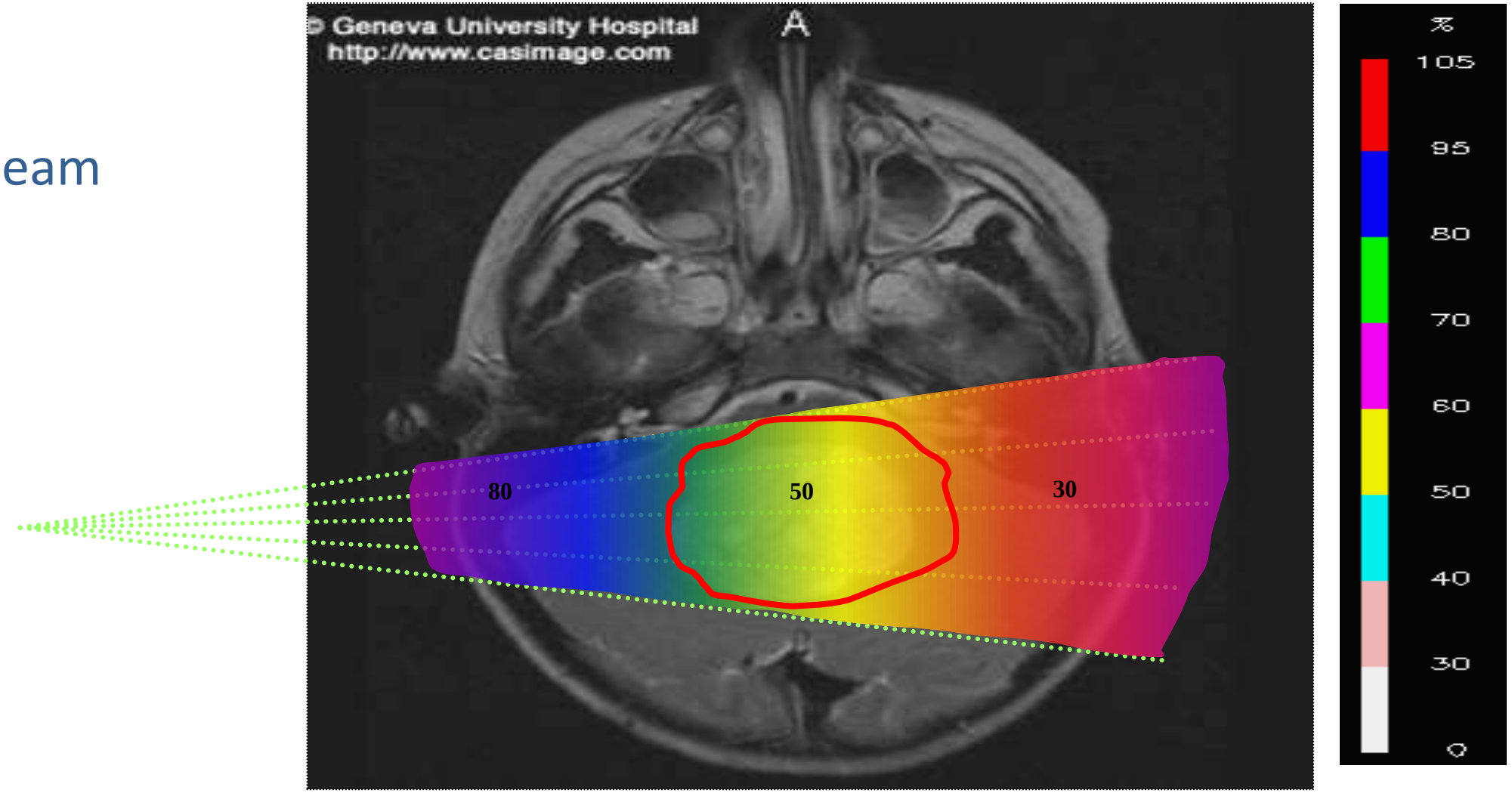
- About 50% patients are treated with RT
- No substitute for RT in the near future
- No of patients is increasing

About 30% of patients cancer comes back in the same location after RT

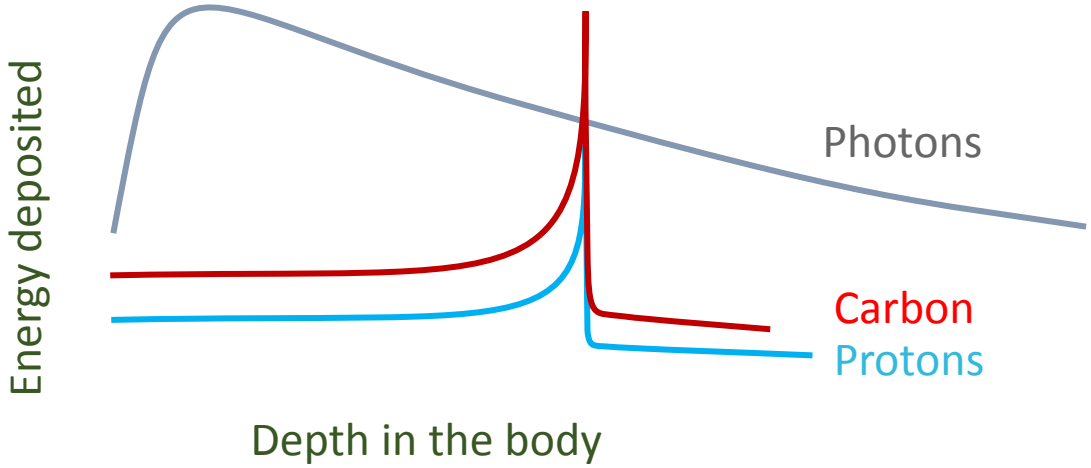


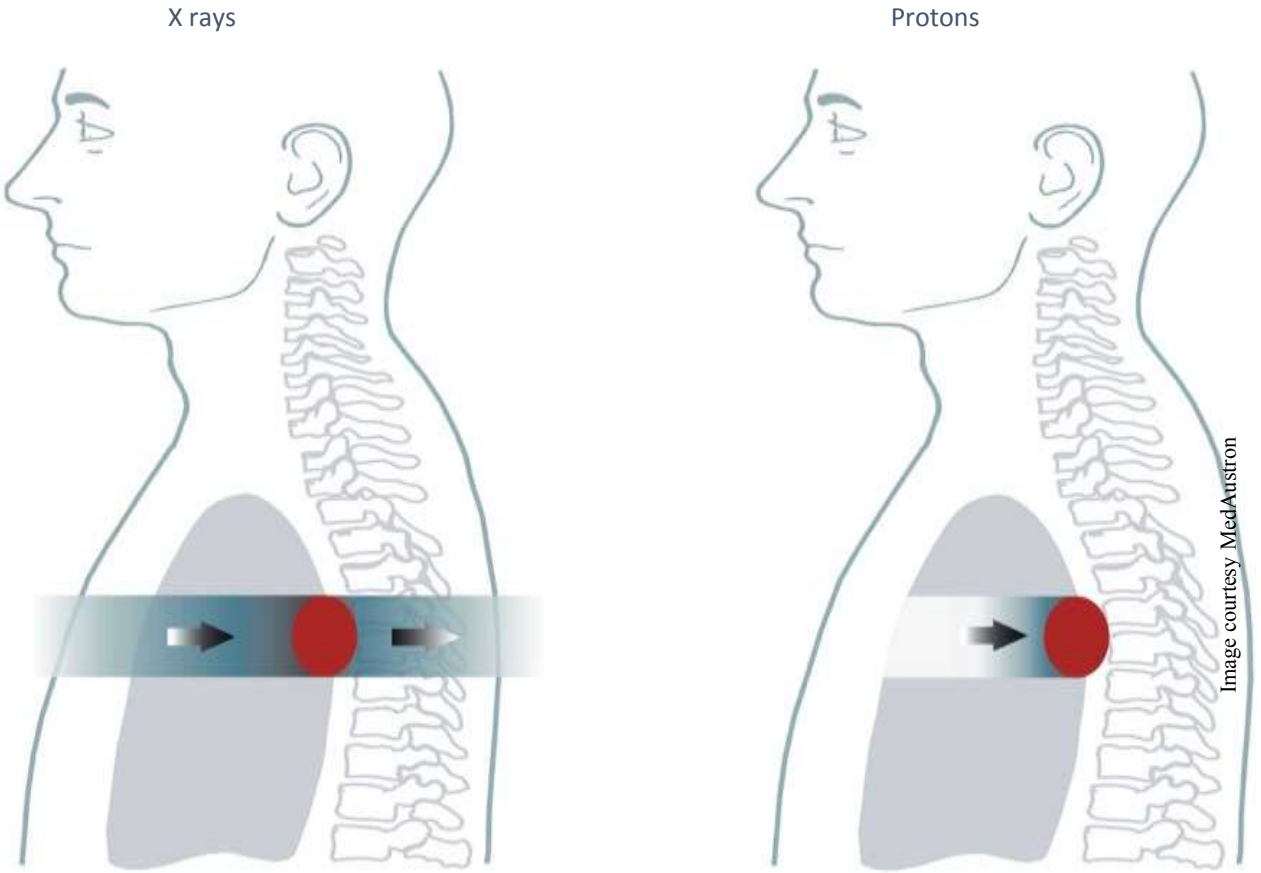
Classical Radiotherapy with X-rays

single beam



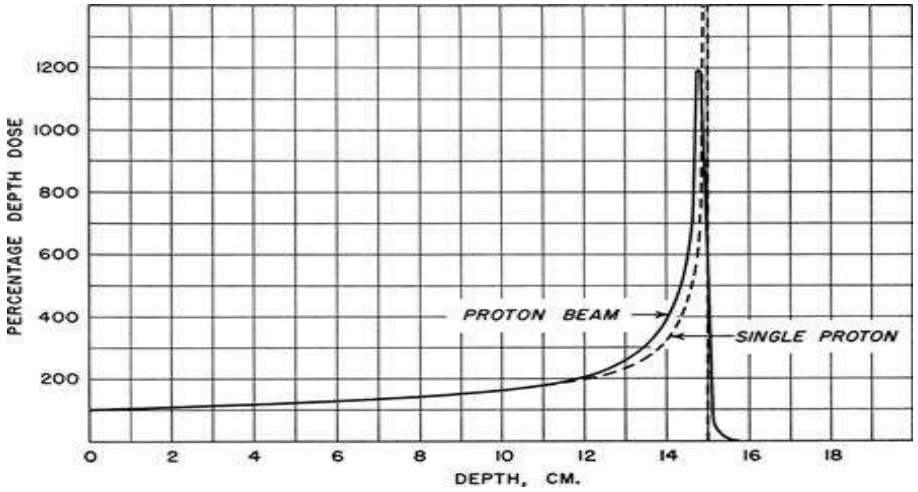
Hadrontherapy





1932 - E. Lawrence
First cyclotron

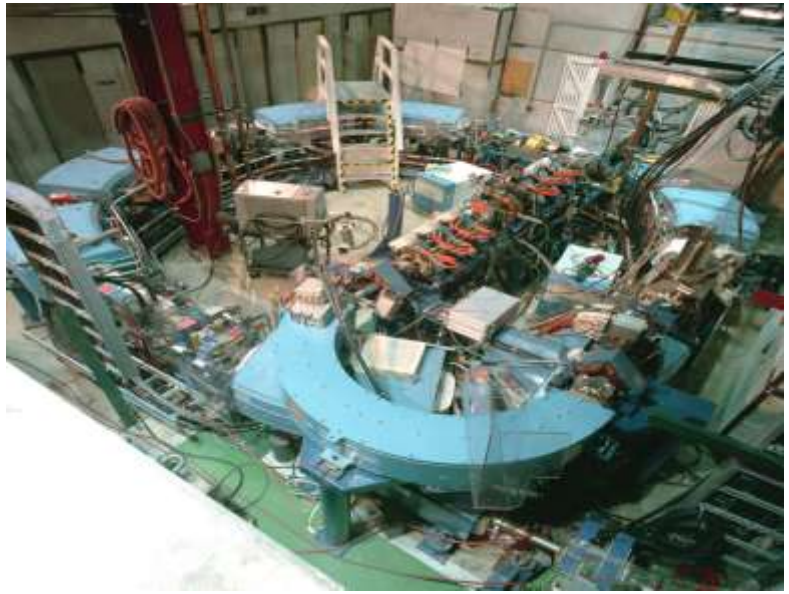
1946 – proton therapy
proposed by R. Wilson



1954 – Berkeley treats
the first patient

From physics……

1993- Loma Linda USA (proton)



First dedicated clinical facility

1994 – HIMAC Japan (carbon)

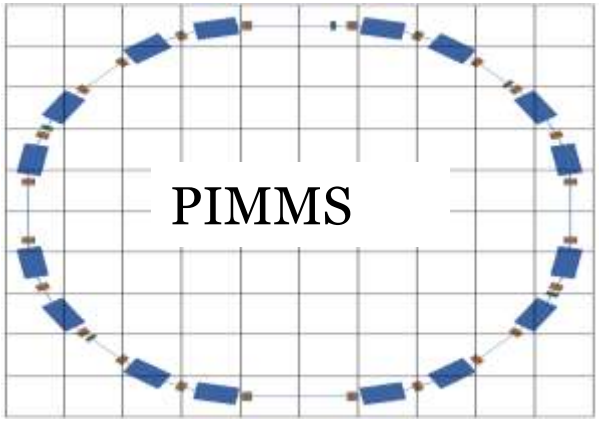
1997 – GSI Germany (carbon)

.....to clinics

PIMMS study at CERN (1996-2000)

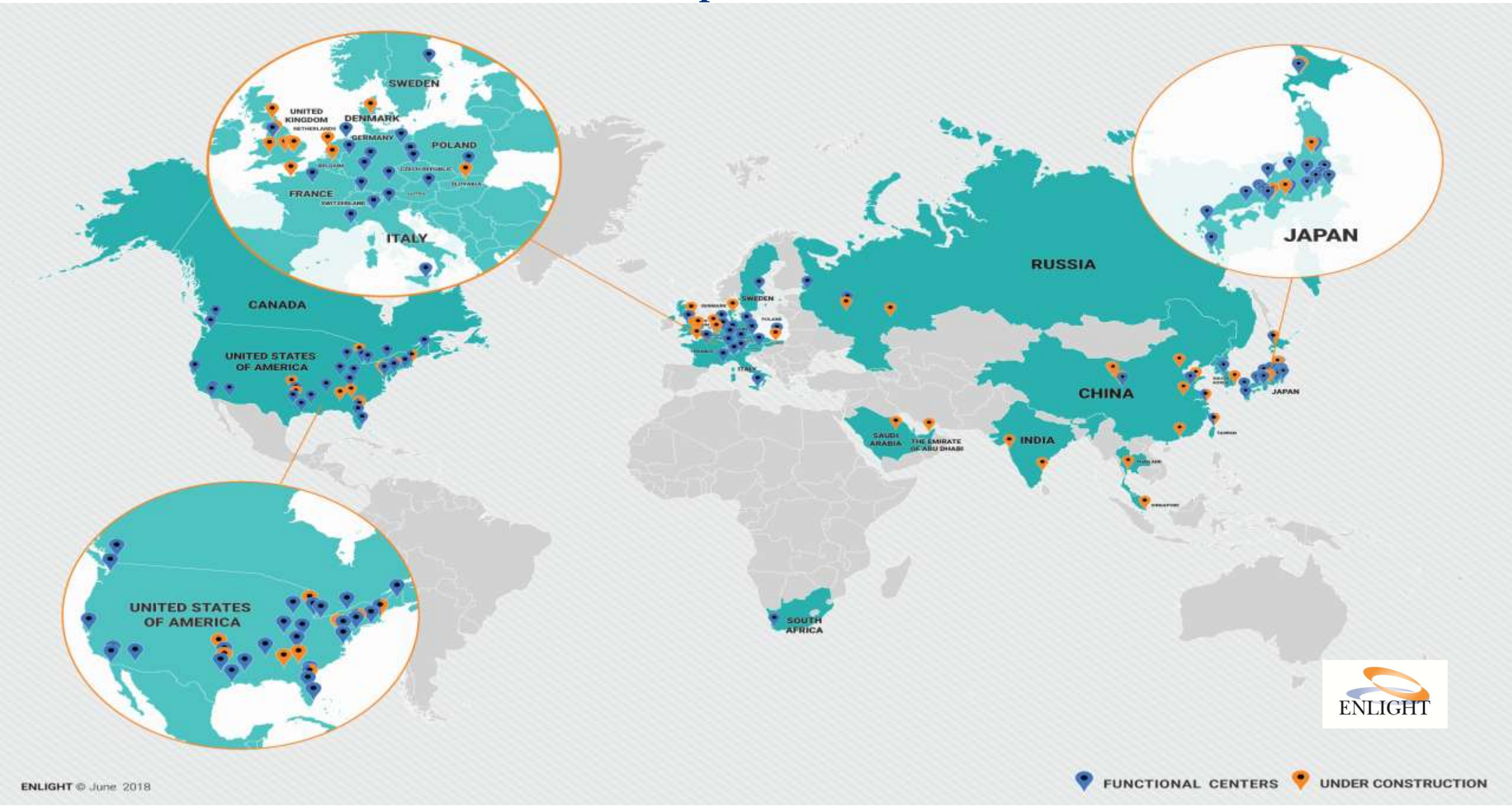
Treatment , CNAO, Italy 2011

1996-2000
PIMMS study



MedAustron, Austria 2016

Facilities in operation now – 2018



Why SEEIIST is essential?

ENLIGHT

Main Goals And Benefits For SEE Region

- more than 40 millions people could benefit from this project
- possibility for education and training
- more effective cancer treatment using the cutting-edge technologies and innovative treatment options
- participate in clinical trials Europe-wide
- one of a **unique facility in Europe which will have more than 50% time for basic, translational, clinical innovative research**
- attractive for external research community: beam time, cheaper research and living costs
- possibility to boost the regional development and create a new generation of young scientists and advanced compact facility

Key needs for SEE developing SEEIIST

Education, Training, Capacitance Building,

- creation of young and future generation of scientists/experts
- importance of "reverse brain drain"
- benefits from training

(a) funding fellowships for young people – traineeships outside of SEE

(b) building *“in situ”* expertise

(c) training events in SEE with experts from outside

(d) staff exchanges

(e) workshops and seminars for future users

Preparing Marie Curie ITN Project

TREASURE

Training **R**esearchers for South-**EAS**t e**UR**ope with **E**nlight for the Future

Marie Curie projects are embedded in training, excellent science, mobility

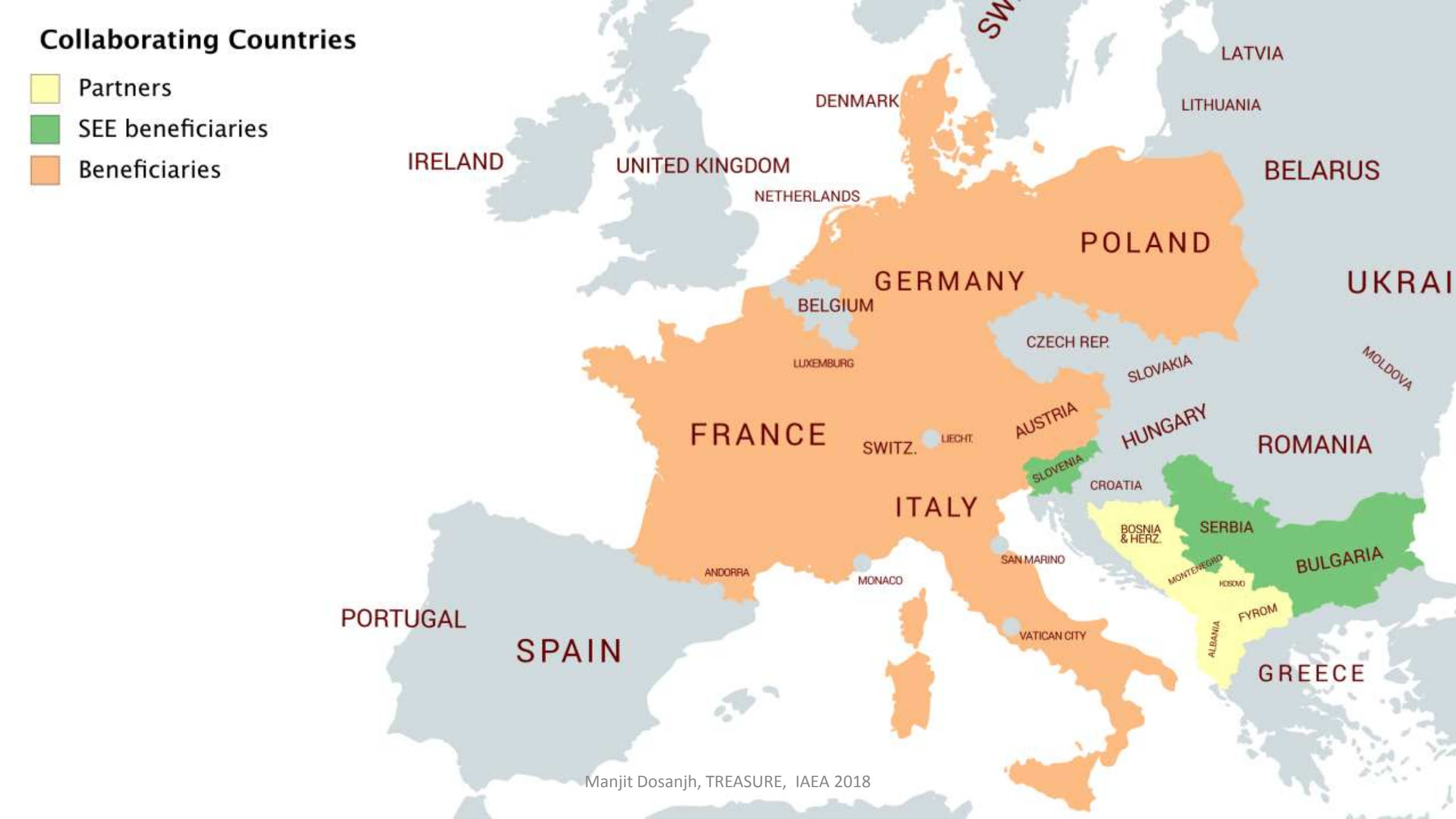
What is the idea of TREASURE?

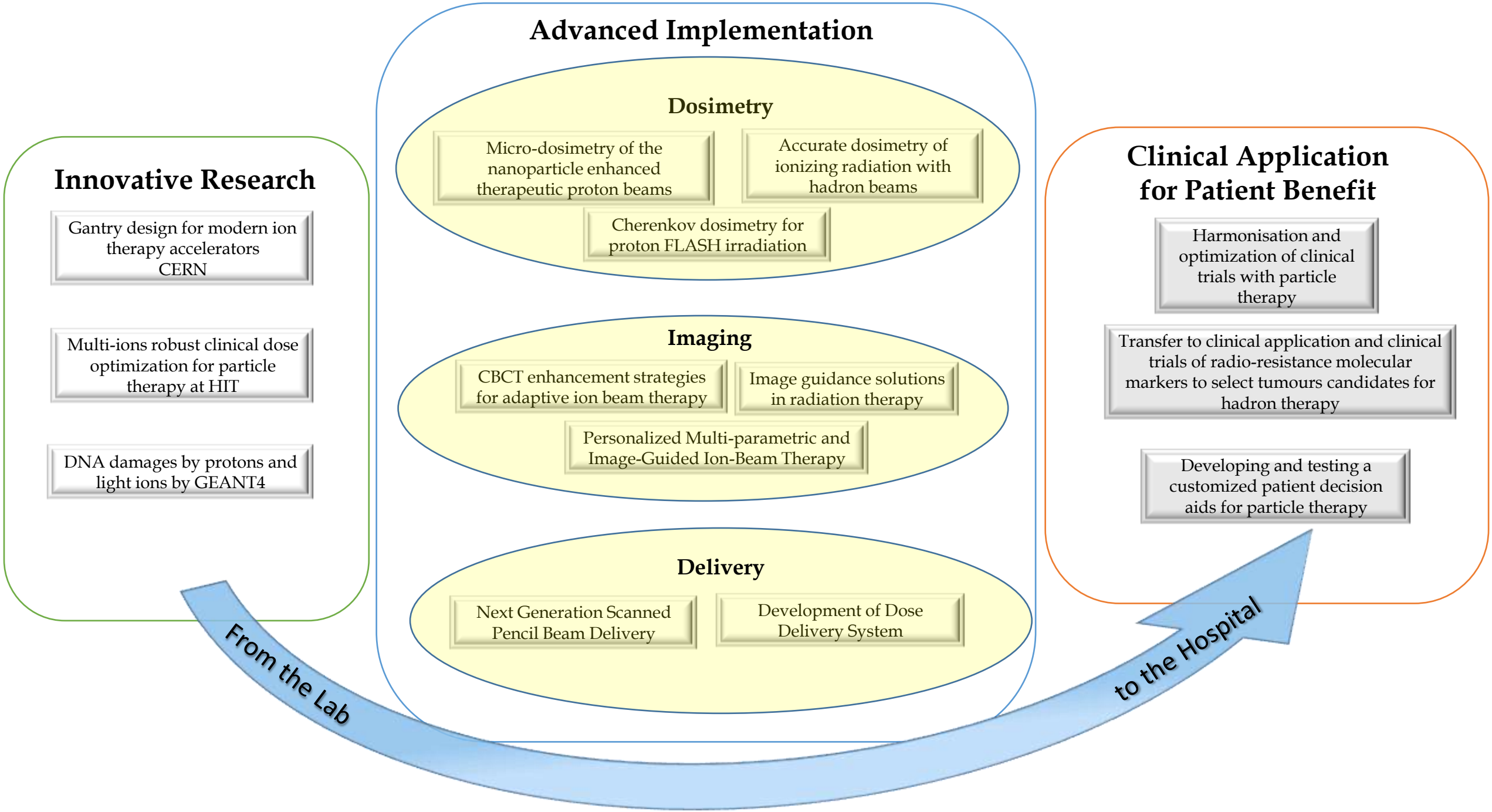
Brings together participants from **XX countries** who want to promote multidisciplinary training, education, networking for excellence, fostering collaboration of countries that possess PT facilities and those that are in the process of acquiring them, with a specific focus on South East Europe region (SEE).

TREASURE will **innovate** through **excellent research**, enhance **knowledge/technology transfer** for the advanced design of the future PT facilities, provide a **sustainable platform** among the multi-faceted stakeholders (researchers, doctors, engineers, technicians, IT engineers, industrial partners).

Participating organisations

No	Name	Short name	Country
1	EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH	CERN	Switzerland
2	HEIDELBERG UNIVERSITY	HIT	Germany
3	AARHUS UNIVERSITY	AARHUS UNIVERSITY	Denmark
4	Fondazione Centro Nazionale di Adroterapia Oncologica - Fondazione CNAO	CNAO	Italy
5	University of Caen - UNICAEN / ARCHADE	ARCHADE	France
6	GSI HELMHOLTZZENTRUM FUER SCHWERIONENFORSCHUNG Gmbh	GSI	Germany
7	INSTITUTE OF NUCLEAR PHYSICS PAN	IFJ PAN	Poland
8	LUDWIG-MAXIMILIANS-UNIVERSITAET MUENCHEN	LMU MUENCHEN	Germany
9	EBG (Entwicklungs- und Betriebsgesellschaft) MedAustron GmbH	EBG MedAustron GmbH	Austria
10	medPHOTON GmbH	medPHOTON	Austria
11	MAASTRICHT UNIVERSITY	MAASTRICHT UNIVERSITY	Netherlands
12	VINČA INSTITUTE OF NUCLEAR SCIENCE	VINČA INS	Serbia
13	COSYLAB	COSYLAB	Slovenia
14	SOFIA UNIVERSITY	SU	Bulgaria


Collaborating Countries
Partners
SEE beneficiaries
Beneficiaries
IRELAND
UNITED KINGDOM
DENMARK
NETHERLANDS
LATVIA
LITHUANIA
BELARUS
POLAND
GERMANY
BELGIUM
LUXEMBURG
CZECH REP.
SLOVAKIA
MOLDOVA
UKRAI
FRANCE
SWITZ.
LIECHT.
AUSTRIA
HUNGARY
ROMANIA
SLOVENIA
CROATIA
ITALY
BOSNIA & HERZ.
SERBIA
BULGARIA
SAN MARINO
ANDORRA
MONACO
MONTENEGRO
KOSOVO
FYROM
ALBANIA
VATICAN CITY
PORTUGAL
SPAIN
GREECE


Innovative Research
Gantry design for modern ion therapy accelerators CERN
Multi-ions robust clinical dose optimization for particle therapy at HIT
DNA damages by protons and light ions by GEANT4
Advanced Implementation
Dosimetry
Micro-dosimetry of the nanoparticle enhanced therapeutic proton beams
Accurate dosimetry of ionizing radiation with hadron beams
Cherenkov dosimetry for proton FLASH irradiation
Imaging
CBCT enhancement strategies for adaptive ion beam therapy
Image guidance solutions in radiation therapy
Personalized Multi-parametric and Image-Guided Ion-Beam Therapy
Delivery
Next Generation Scanned Pencil Beam Delivery
Development of Dose Delivery System
Clinical Application for Patient Benefit
Harmonisation and optimization of clinical trials with particle therapy
Transfer to clinical application and clinical trials of radio-resistance molecular markers to select tumours candidates for hadron therapy
Developing and testing a customized patient decision aids for particle therapy
From the Lab
to the Hospital

TREASURE IMPLEMENTATION: Five Working Groups

Desired Outcome:

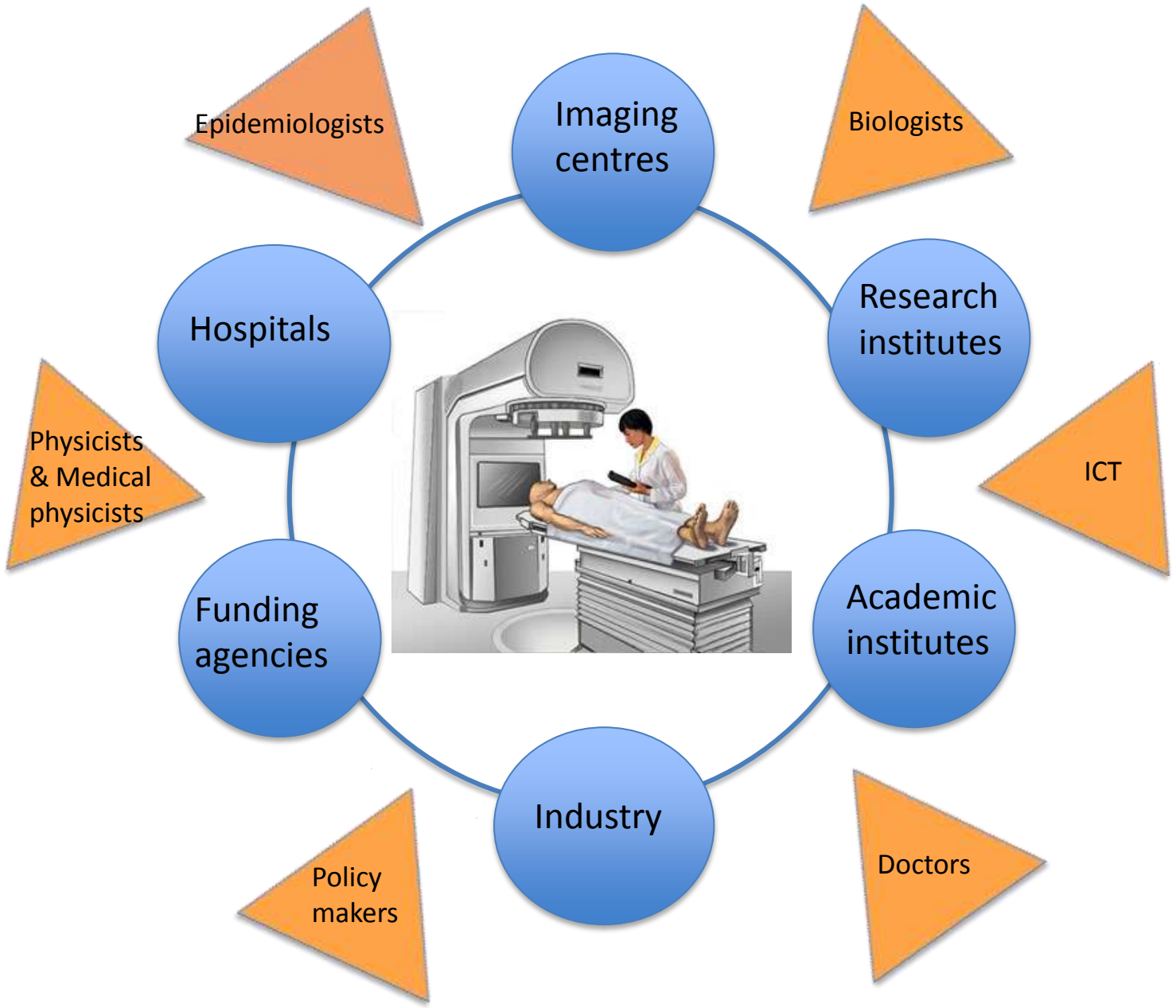
Creation of the critical mass of the trained researchers with multidisciplinary expertise in PT. Creation of the multidisciplinary network of the scientists, researchers, medical doctors, engineers, the business community, and other relevant experts as a platform for knowledge exchange.

Current and future needs

Many questions still need need to be addressed:

- precise knowledge of the ***physical interactions*** **with biological tissues of carbon ions** and other ions;
- **Real time** imaging and dosimetry;
- ***in vitro*** **radiobiology experiments** to determine the differential radiobiology and RBEs of ions with a range of energy levels;
- ***in vivo*** **determination of the RBE of range of ions**
- **clinical comparisons of the outcomes of proton and carbon ion treatments** and other ions – in collaboration with other centres
- **Cost** must be affordable: ideally come down to the **price per patient for the top of the range conventional radiotherapy** (IMRT), including operational costs

Need for collaboration



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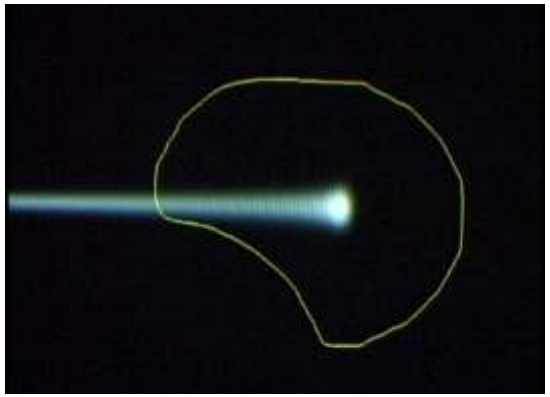
- Launched at CERN in 2002, following PIMMS study
- Create common **multidisciplinary platform**
- Cancer treatment
- Identify **challenges**
- Share **knowledge** and best practices
- Harmonise data
- Provide **training**, education
- Innovate to improve
- Lobby for funding



Leveraging Physics collaboration philosophy into a multidisciplinary medical environment

EU funded projects

ENLIGHT

PARTNER

- Marie Curie Initial Training Network
- 12 institutions
- 29 trainees

2008-2012

ULICE

- Infrastructures for hadron therapy
- 20 institutions

2009-2013

ENVISION

- R&D on medical imaging for hadron therapy
- 16 institutions

2010-2014

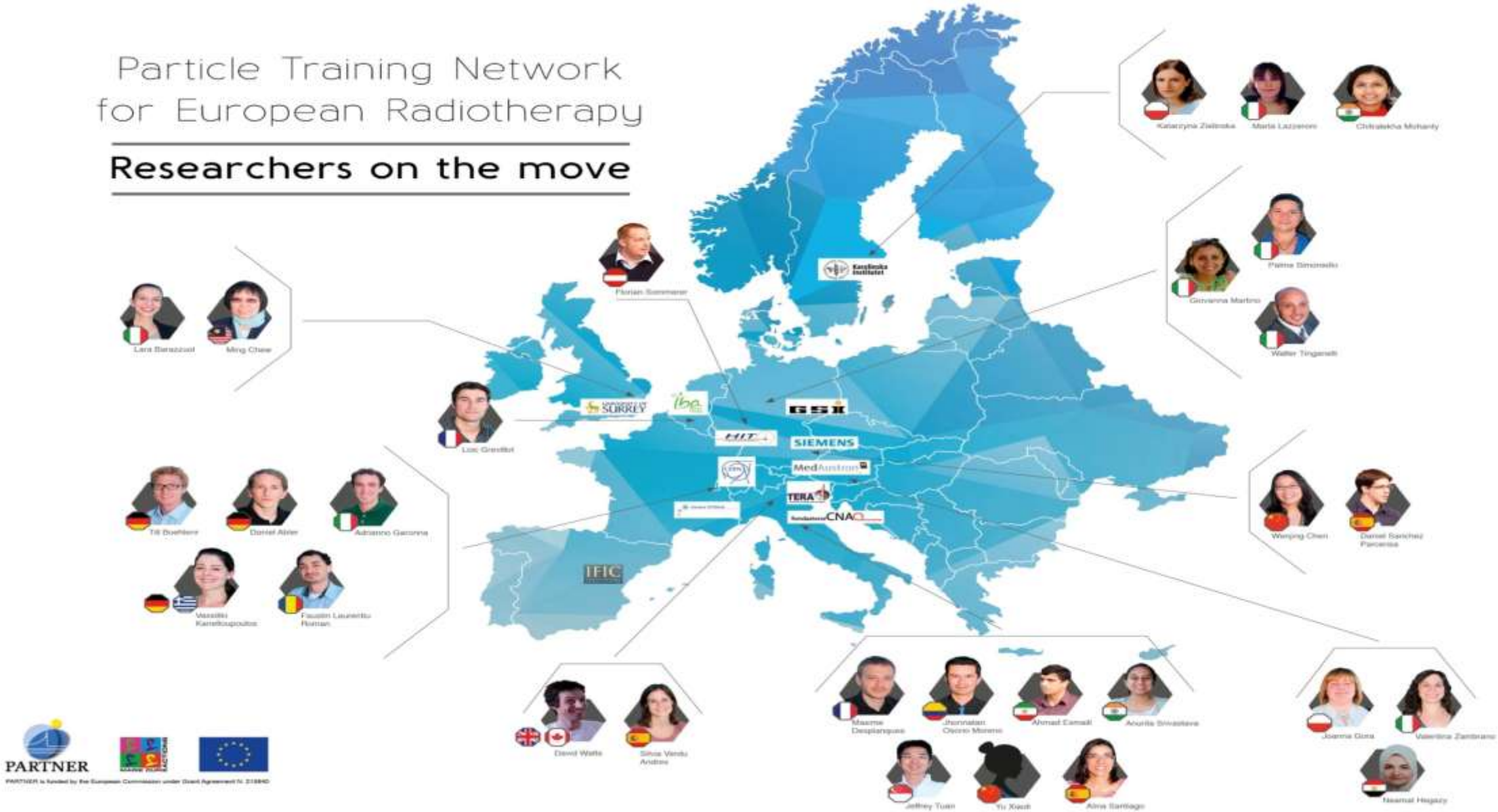
ENTERVISION

- Marie Curie ITN
- 12 institutions
- 16 trainees

2011-2015

Particle Training Network for European Radiotherapy

Researchers on the move



PARTNER

PARTNER is funded by the European Commission under Grant Agreement N. 215840

ENLIGHT

- ***Annual meeting***, open, free
- Latest developments in the field
- Oral presentation for winning posters
- Networking
- Collaboration
- Sharing and building bridges
- Raising awareness at international level
- Special session dedicated to training
- Biannual Magazine – ***Highlights***
- **@ENLIGHTNETWORK**

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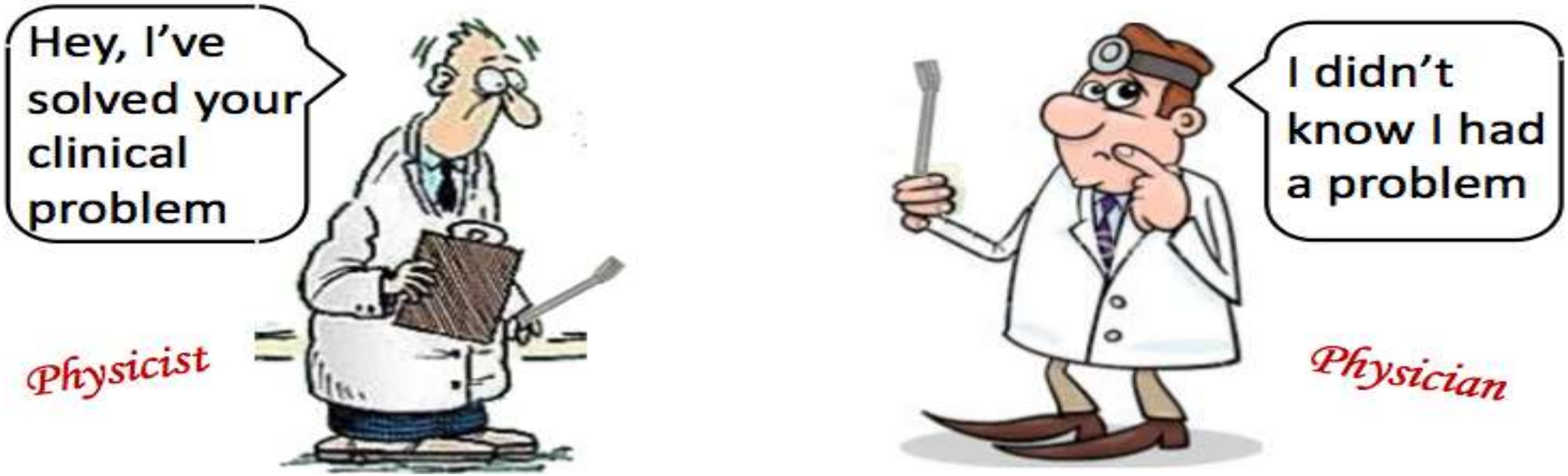
Linked in Groups

www.cern.ch/enlight



Courtesy D. Townsend