

**CERN Accelerator School 2015**  
**Medical application of accelerators**  
**Case study**

Group 6

Juan F. Esteban Müller (CERN)

Anthony Huggins (Varian)

Jukka Jaatinen (University of Jyväskylä)

Matthias Kronberger (MedAustron)

Alexandre Lasheen (CERN)

Martina Senzacqua (University of Rome “La Sapienza”)



# Introduction

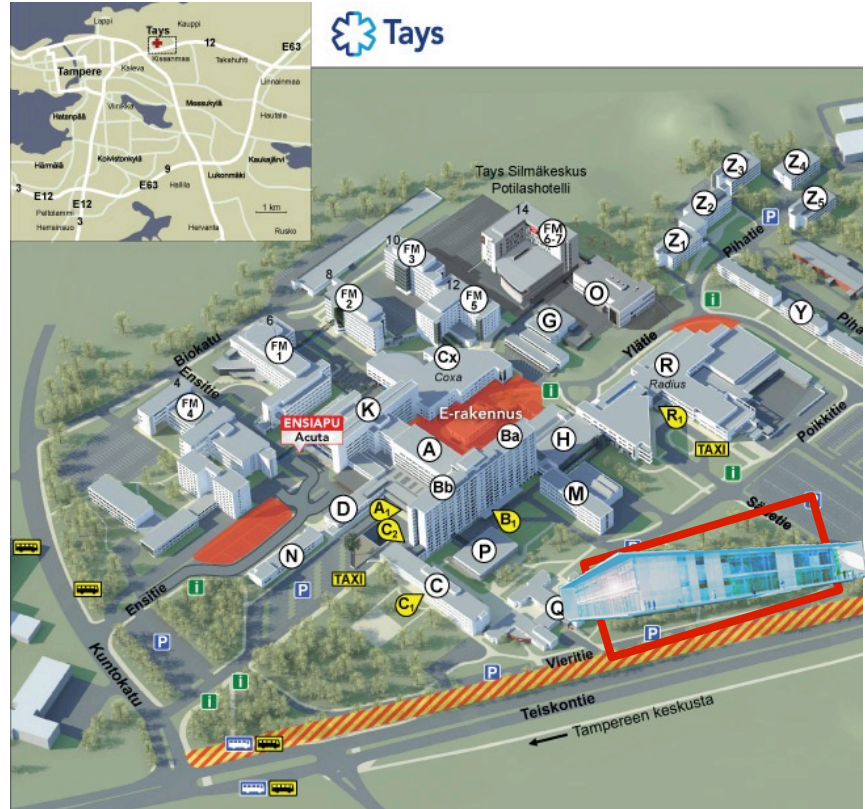
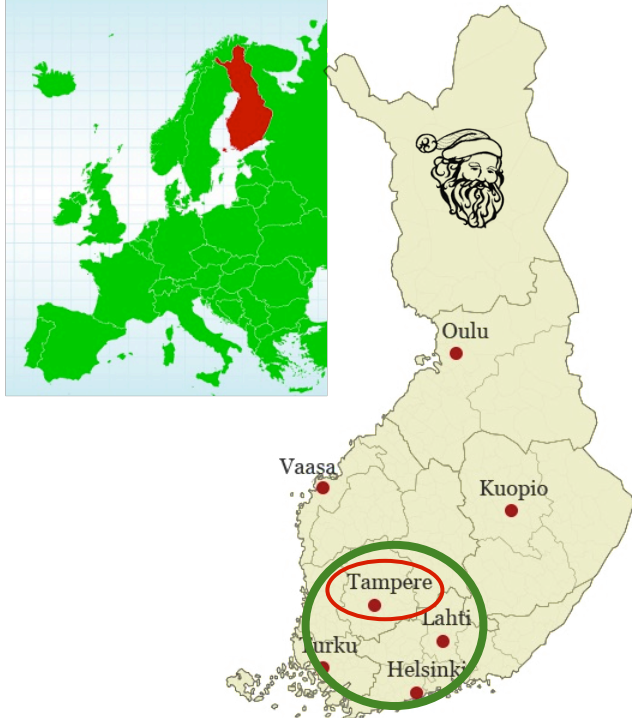
- Country: Finland (5.5M inhabitants)
- ~30,000 new cancer / year
- ~10,000 treated with radiotherapy
- ~1,000 with proton/ions
- Existing PT facilities: 0



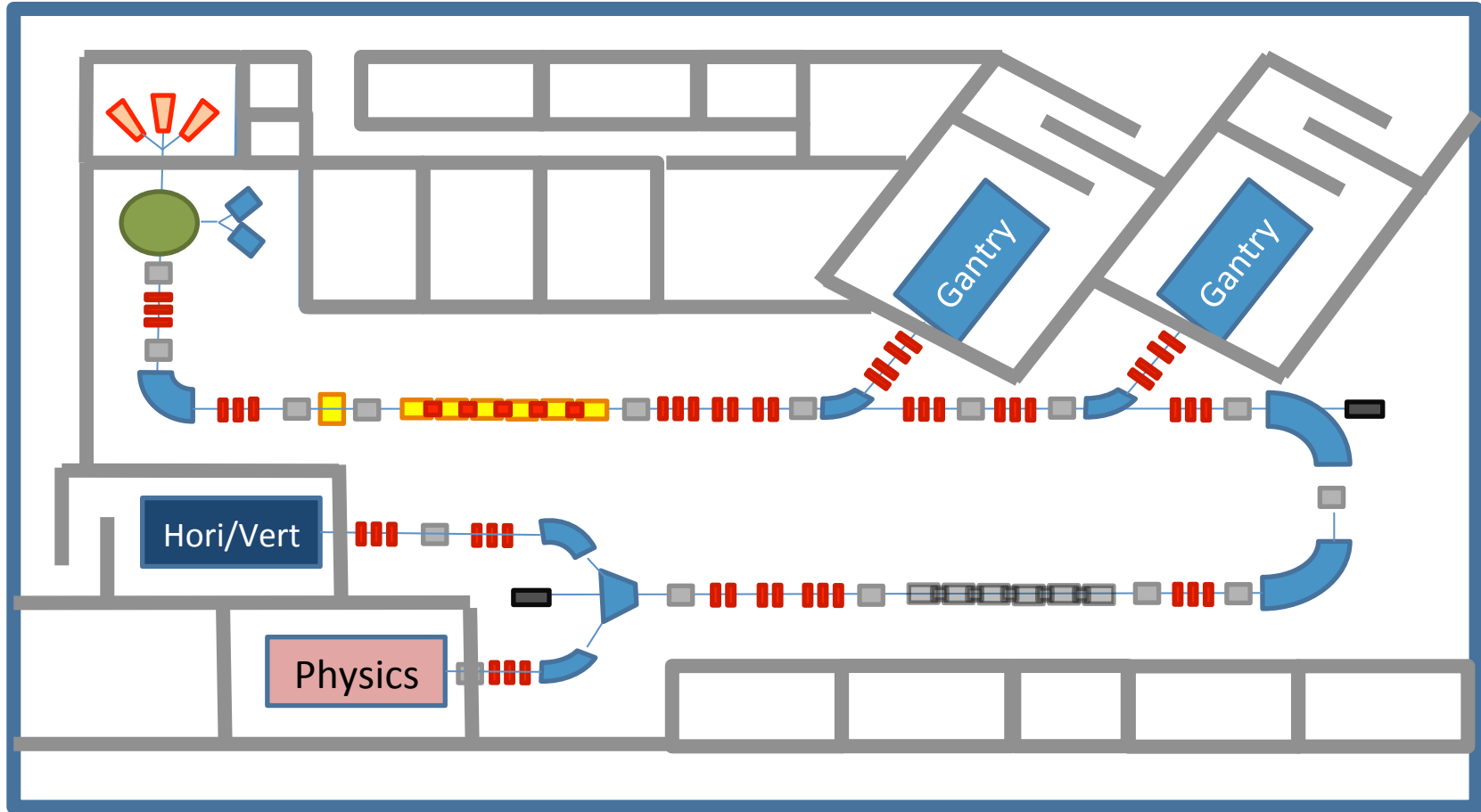
# Motivation and goals

- Lack of facilities in Finland for treatment
- Increase of x3 envisioned for PET imaging needs (3,500 -> 11,000)
- Is it possible to have both treatment and radioisotopes production in the same facility?

# Location



# Accelerator layout



# Specs



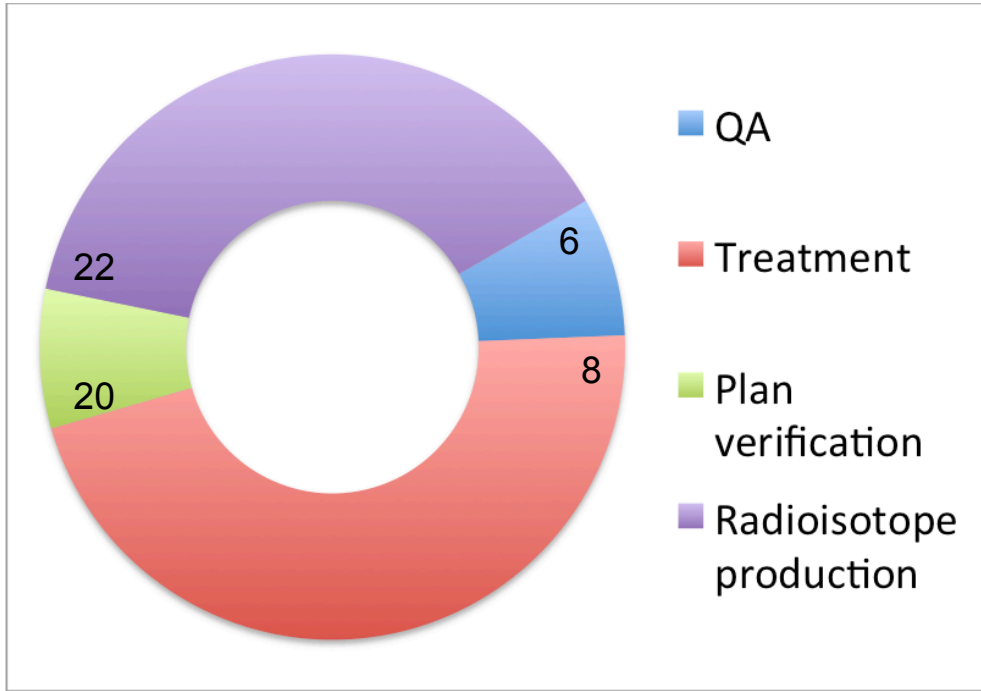
Cyclotron	70 MeV, up to 750 $\mu$ A
LINAC	CCL, 3 GHz
RF system	Klystrons, 20 MW pulsed
Beam energy	up to 250 MeV for p and up to 400 MeV for C (optional)
Clinical beam	constant 4 mm beam size (sigma) up to 4 nA (CW) $dp/p < 0.5 \%$



# Equipment

- 2 Gantries (IBA Proteus 1)
- 1 fixed horizontal and vertical line for C and p
- Room for physics experiments
- Fast pencil beam scanning
- Imaging:
  - CBCT
  - MRI
  - CT
- Targets (-> isotopes)
- Positioning system

# Applications



- Treatment at low intensity during day time
- Radioisotope production during night time





# Manpower

- Oncology (collaboration with hospital)
- Physician (3)
- Medical physicists for treatment planning (2 per room and per shift: 6)
- RTAs (2 per room per shift: 12)
- Accelerator physicists/engineers needed for commissioning and operation (8)
- Facility staff and administration (20)

# Cost



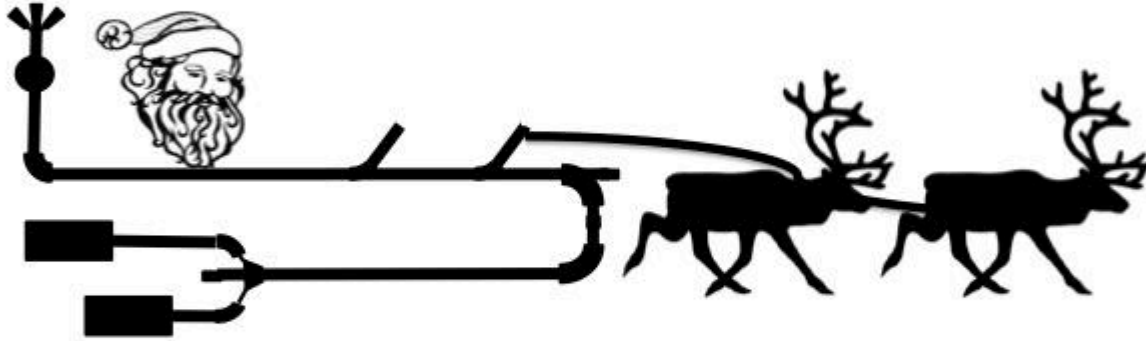
	Cost in M€
IBA 70 MeV Cyclotron incl. supplies	5
Linear Accelerator + Buncher	10
RF (Klystrons)	10
Beam Transfer Line incl. supplies	5
2 IBA ProteusOne Gantries incl. supplies	20 (10 each)
1 Fixed Beam Room (horizontal) incl. supplies	5
3 Treatment Rooms (incl. TR Control)	6 (2 each)
Radioisotope Production	3
Building	35
Medical Infrastructure	20
Project Overhead	10
<b>Total Cost</b>	<b>129</b>



# Operational Cost and Income

Cost / Income	M€ / a
Power Consumption	- 5
Staff	- 10
Service	- 5
Treatments (1,000 / a)	+ 20
Radioisotopes	+ 3

# Facility name



# **SANTA-center**

(**S**uomi **A**dvanced **N**uclear-physics and **T**herapy **A**ccelerator)

# Any questions?

