

Accelerator Physics short option

Problem set 12.

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Trinity 2010

1 Course questions

Would you be able to answer the following questions? (answers in the lecture)

- What are the 2 main parts of a medical linac?
- Compare the advantages of proton and electron therapy.
- What is the difference between a synchrotron light source and a free electron laser?
- How are protons produced in a spallation source?

2 Radioactive ions source

To produce radioactive ions high energy protons are sent on a target.

a) Describe a possible source for the protons.

b) The energy required for the protons is 500 MeV. Accelerating cavities accelerating proton by 1 MeV/m are available if required. Space is not a constraint. Three solutions are considered:

- An electrostatic accelerator
- A 20 MeV linac followed by a booster ring up to 800 MeV.
- A 800 MeV linac.

Compare each of the merit of each of these solutions. Are they possible? What type of beam would be delivered? Pulsed or continuous?

Using the magnetic rigidity formula calculate what should be the radius of the booster ring to always keep the magnet field below 0.5 Tesla.

You can learn more about radioactive ion sources on the website of the GSI in Darmstadt (http://www.gsi.de/beschleuniger/Beschleuniger_e.html) and of TRIUMF in Vancouver (<http://www.triumf.ca/research/research-facilities> - Note that the accelerator used by TRIUMF is outside the syllabus this year).

Answers for this problem set are available from Nicolas Delerue, office 602a in the DWB. Please try to answer the questions before coming to get the answers. If you have any questions on any problem set, feel free to come and ask the lecturers.