Imperial College London

Science & Technology Facilities Council
ISIS

Evolution in a design of the Radiobiology Facility

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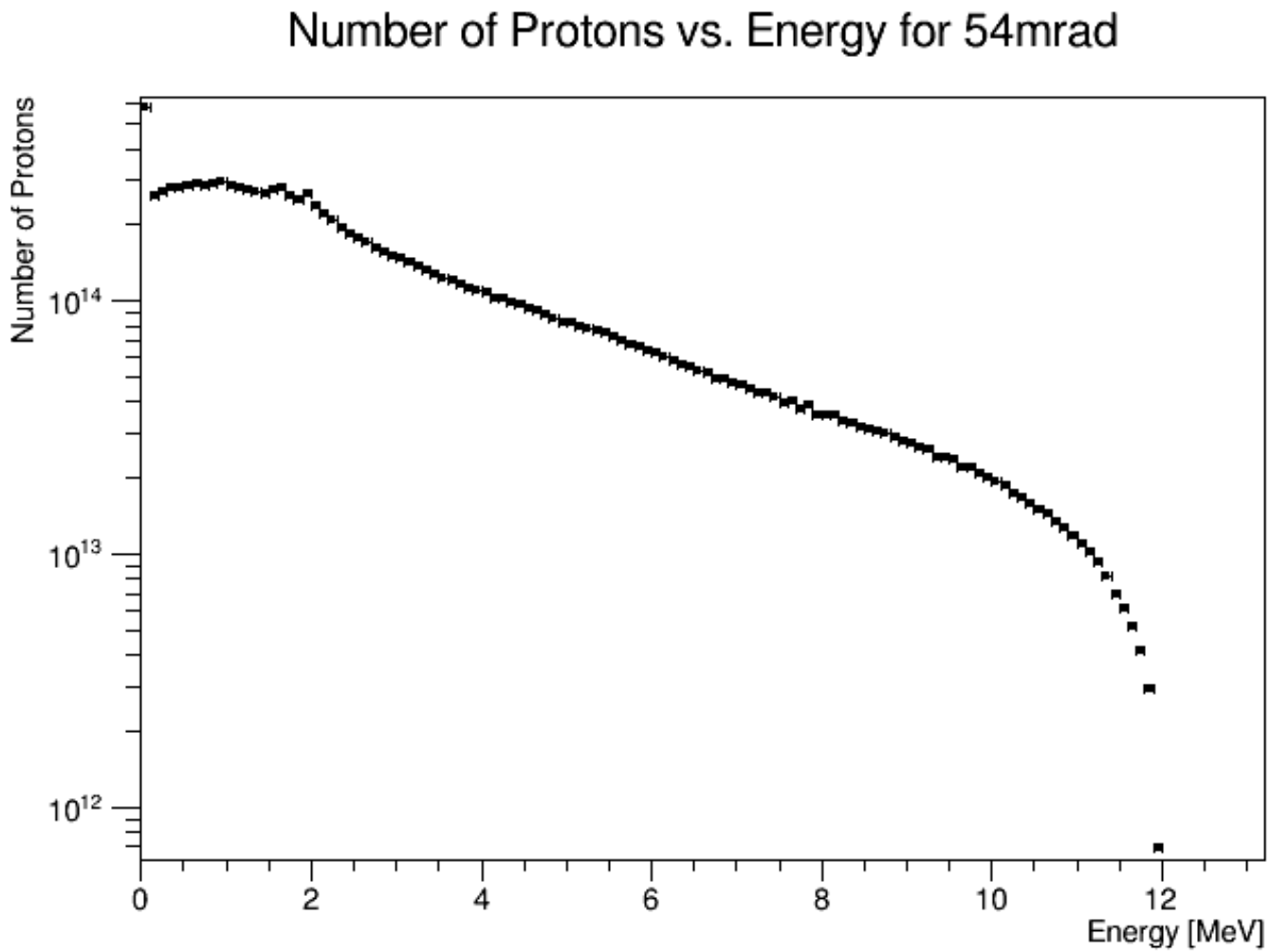
Some parameters changed …

- Some parameters assumed:
  - Proton beam energy 0.95-11 MeV (from 3 MeV useful for in vitro)
  - Initial beam with 3.4 um in radius and 48mrad max divergence assumed
  - Beam emittance of 0.163 um rad (very small).
- Wien filter seems feasible
  - 65 kV (max), 0.6m length, 0.027 T (preliminary)

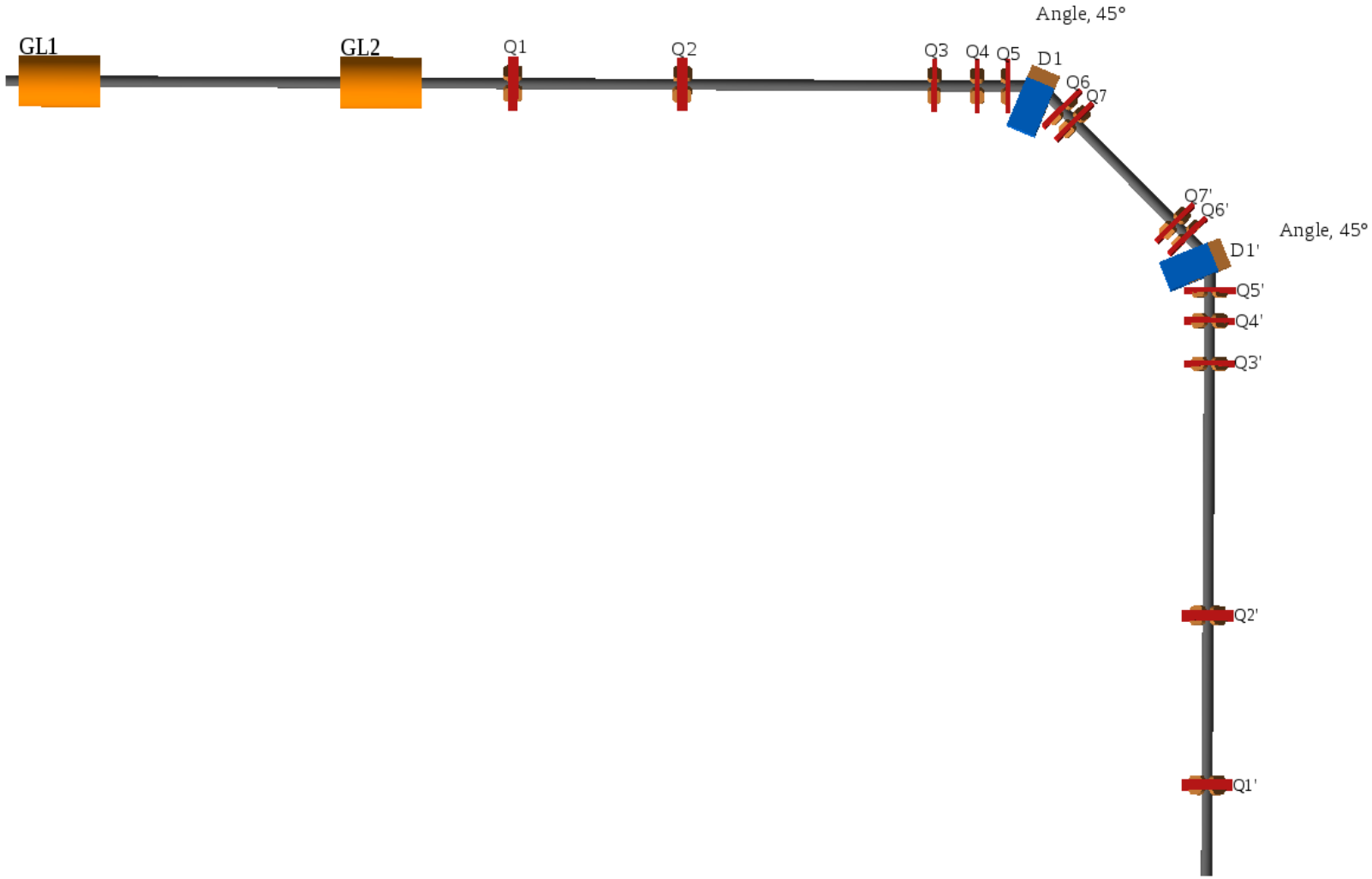
Energy spectrum from target



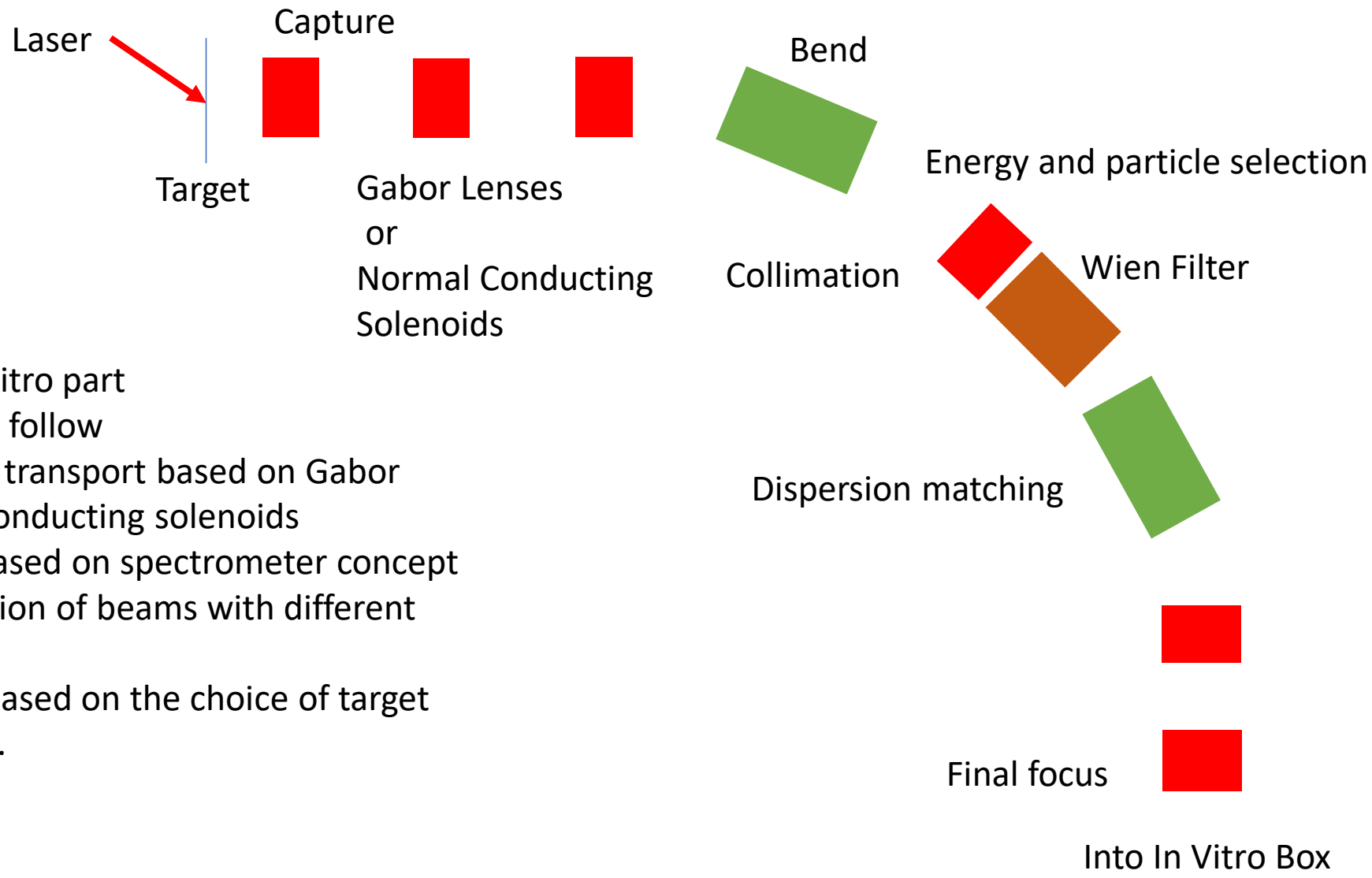
Preliminary proton parameters

Parameter	Unit	Value
Rep. rate	Hz	10
Initial pulse duration (FWHM)	fs	35
Initial spot size (FWHM)	um	4
Max. angular acceptance of capture	mrad	48
Acceptance	Pi.m.rad	0.163*10^-6
RMS physical emittance	Pi.m.rad	0.408*10^-7
Max beam size in the capture (total radius)	cm	3
Gabor Lens space charge filling factor	-	0.5
Max anode voltage in the Gabor Lens	kV	65
Energy range from target	MeV	0-11
Energy range for postaccelerator	MeV	0.95-8.6
Energy for cell irradiation	MeV	?-8 (tbc)
Relative energy spread for cell irradiation	-	±2%
Final spot size (total diameter)	cm	1-3
Mean Dose rate	Gy/min	2
Final bunch intensity	-	~10^6-10^9

Reference design (so far)

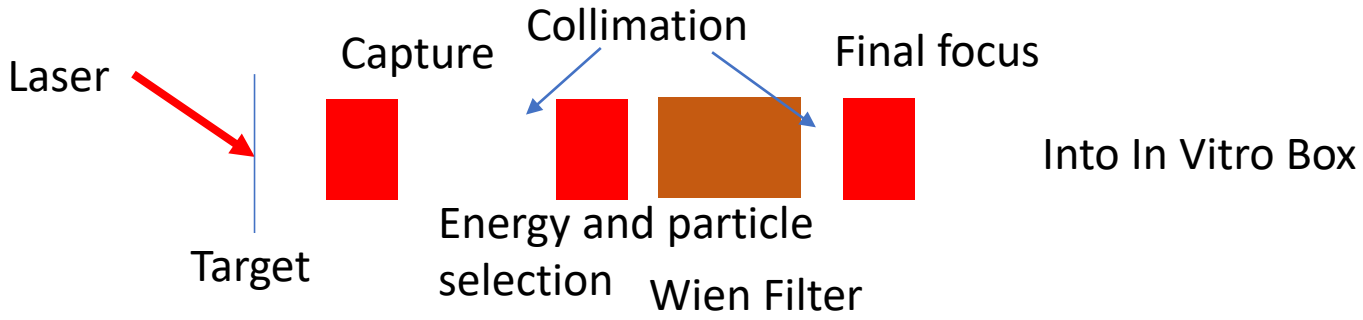


Towards more compact design



- Considered for in vitro part
  - In vivo part to follow
- Capture and beam transport based on Gabor lenses or normal conducting solenoids
- Energy selection based on spectrometer concept (dispersive separation of beams with different momenta)
- Particle selection based on the choice of target and the Wien filter.

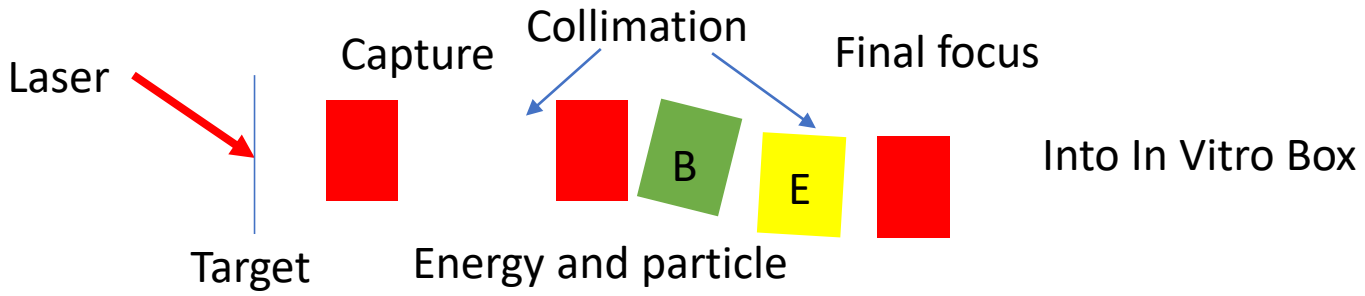
Towards even more compact design



Gabor Lenses
or
Normal Conducting Solenoids

- Considered for in vitro part
  - In vivo part to follow
- Capture and beam transport based on Gabor lenses or normal conducting solenoids
- Energy selection based on collimation and…
- Wien filter, which also helps to select particle ID

Towards even more compact design (2)



- Considered for in vitro part
  - In vivo part to follow
- Capture and beam transport based on Gabor lenses or normal conducting solenoids
- Energy selection based on collimation and…
- Magnetic end electric deflectors, which also helps to select particle ID

Thank you