

LhARA Pre-CDR

Biological End Stations

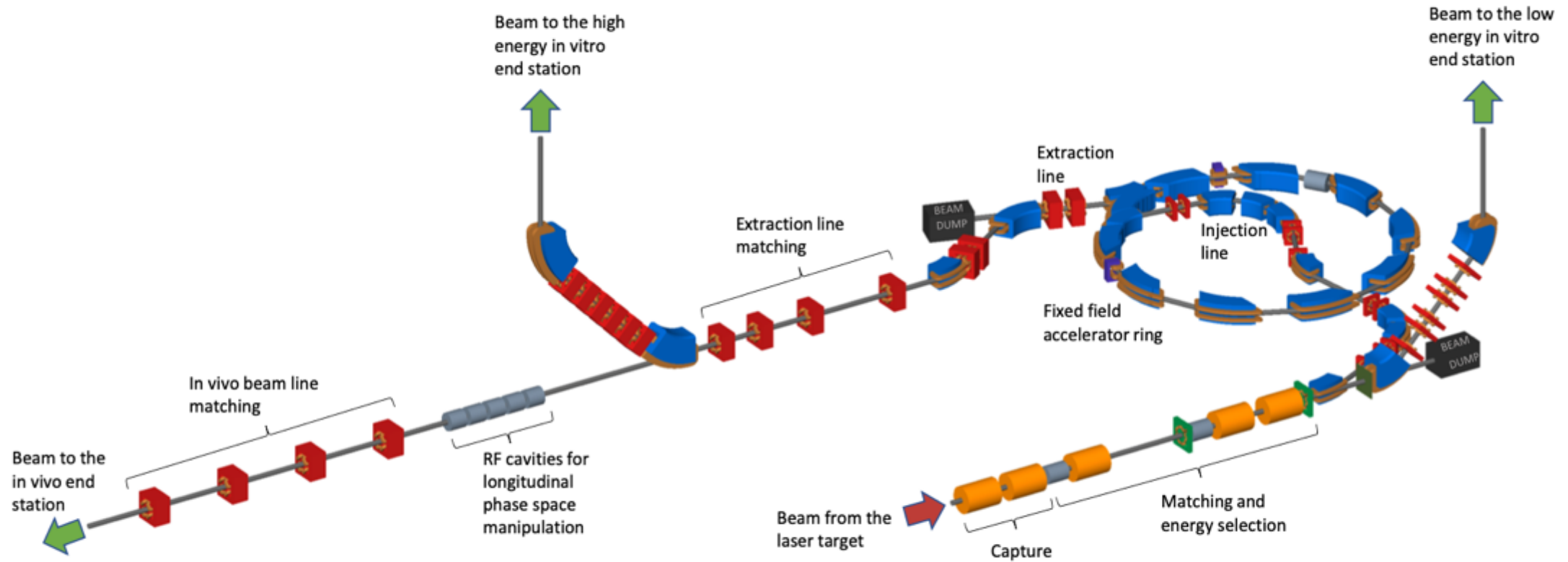
31/03/20

Jonathan Hughes

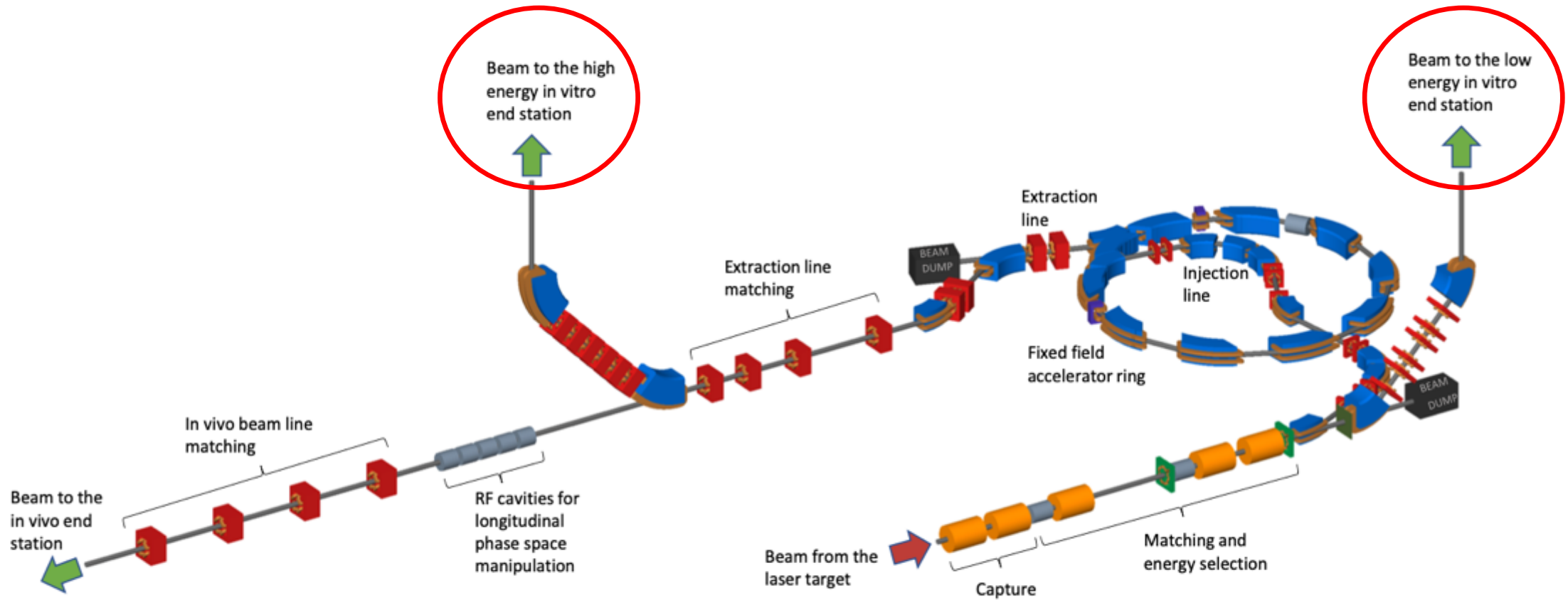
LhARA Biological End Stations

- Three biological end stations (two *in vitro* and one *in vivo*)
- Low energy *in vitro* – proton beams between 12 – 15 MeV
- High energy *in vitro* – proton beams between 15 – 127 MeV
– ion beams (including C⁶⁺) up to 33 MeV/u
- High energy *in vivo* – proton beams between 15 – 127 MeV
– ion beams (including C⁶⁺) up to 33 MeV/u

LhARA Biological End Stations



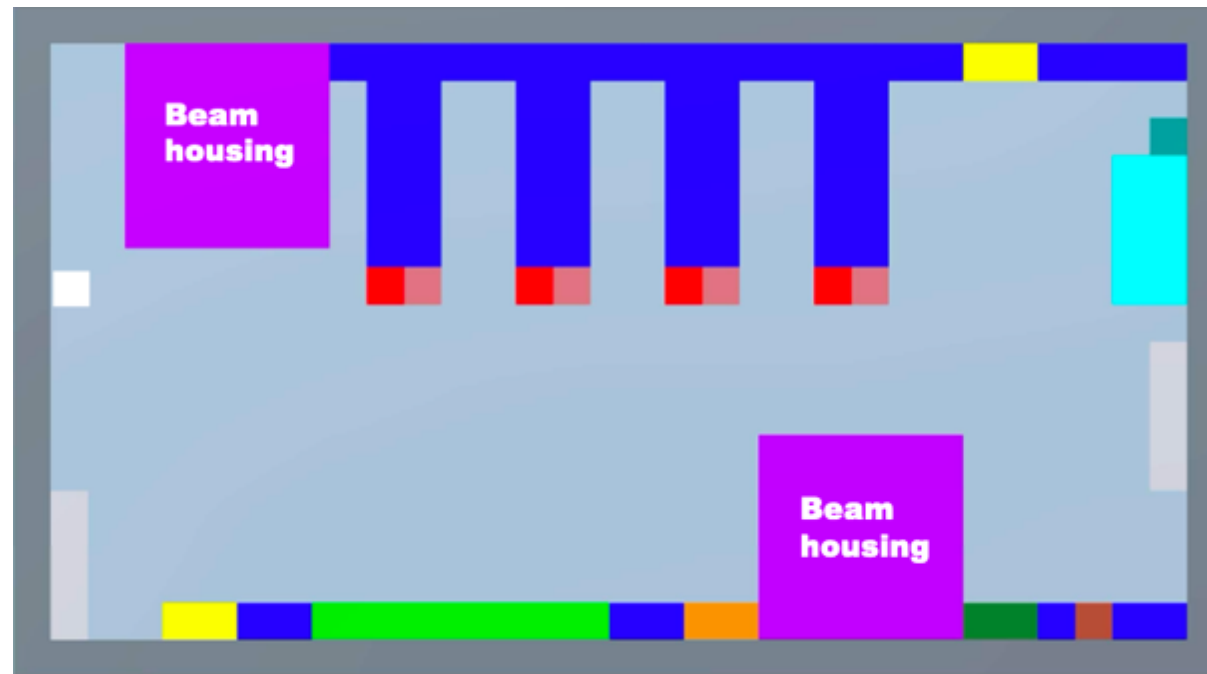
In vitro Biological End Stations



In vitro Biological End Stations

- Two *in vitro* end stations – high and low energy
- Located within a state-of-the-art laboratory
- Fully equipped, with various work spaces
- Investigation of the biological response of 2D monolayer and 3D cells to PBT

In vitro Biological End Stations

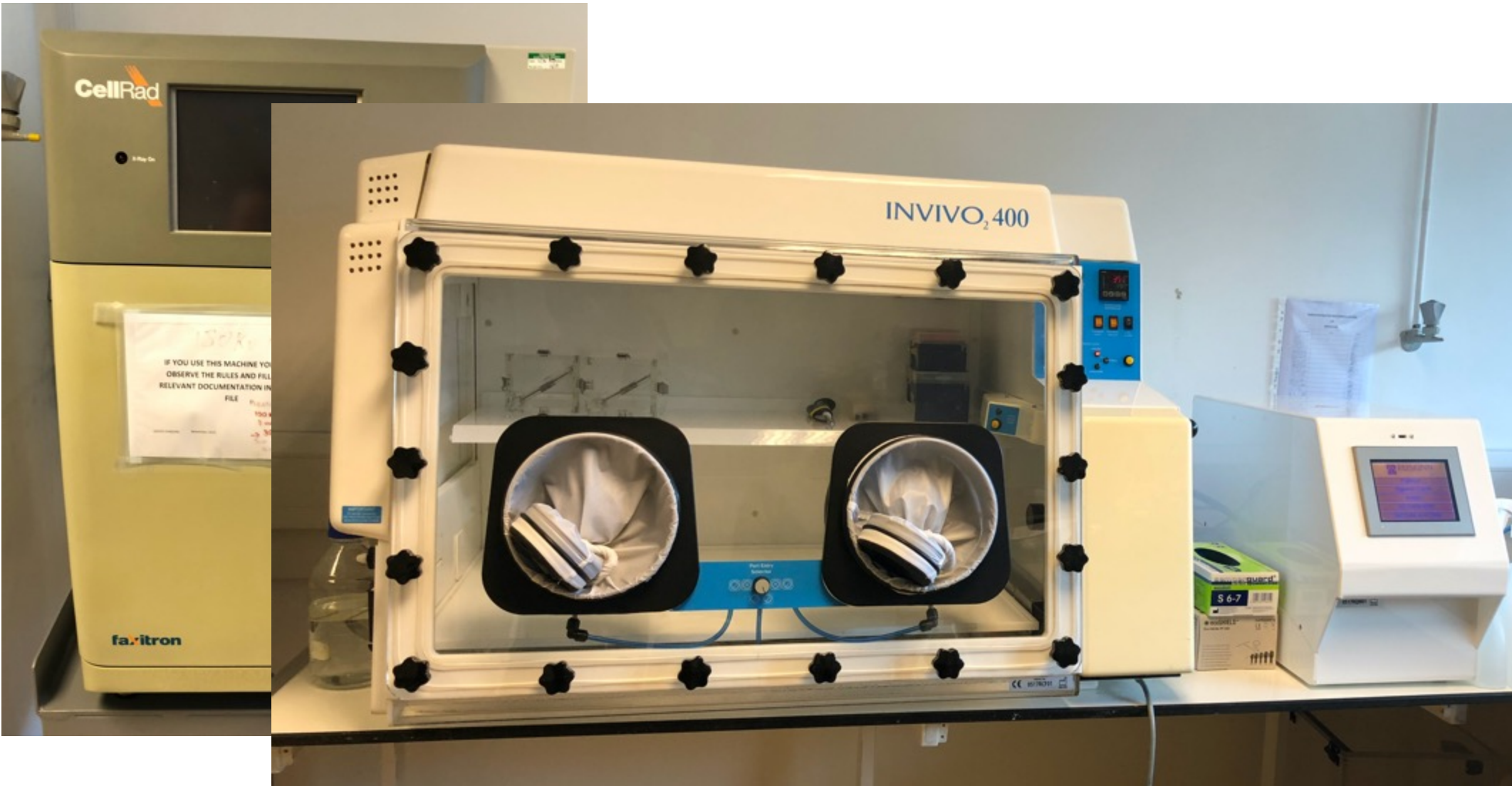


Shielding
Benching
Class II cabinet (4)
Sink/MilliQ (2)
Handwash
Ice
-80°C Freezer (2)
-20°C Freezer (4)
Fridge (4)
X-ray irradiator
Robotics
Hypoxia chamber
Storage

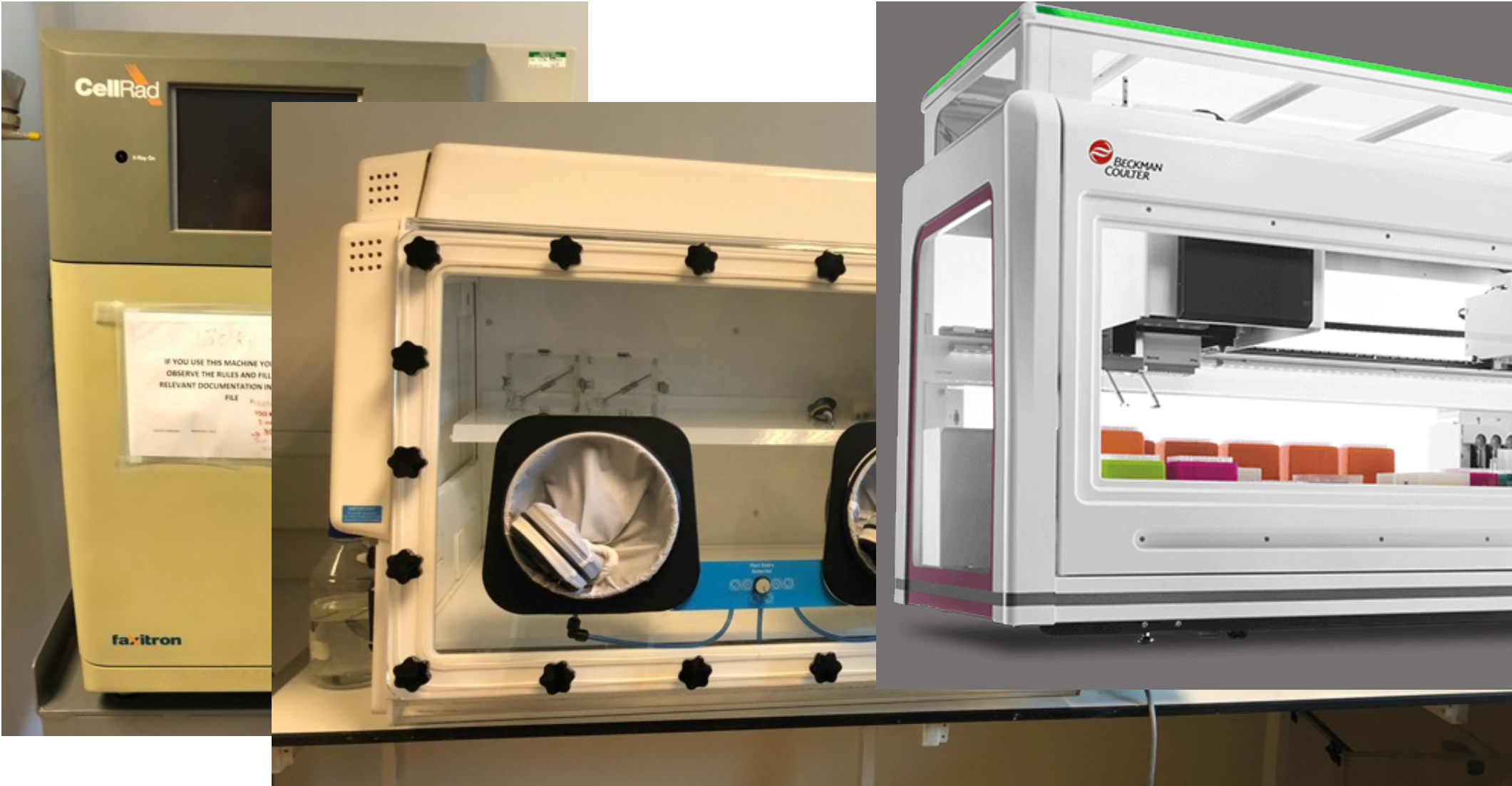
In vitro Biological End Stations



In vitro Biological End Stations



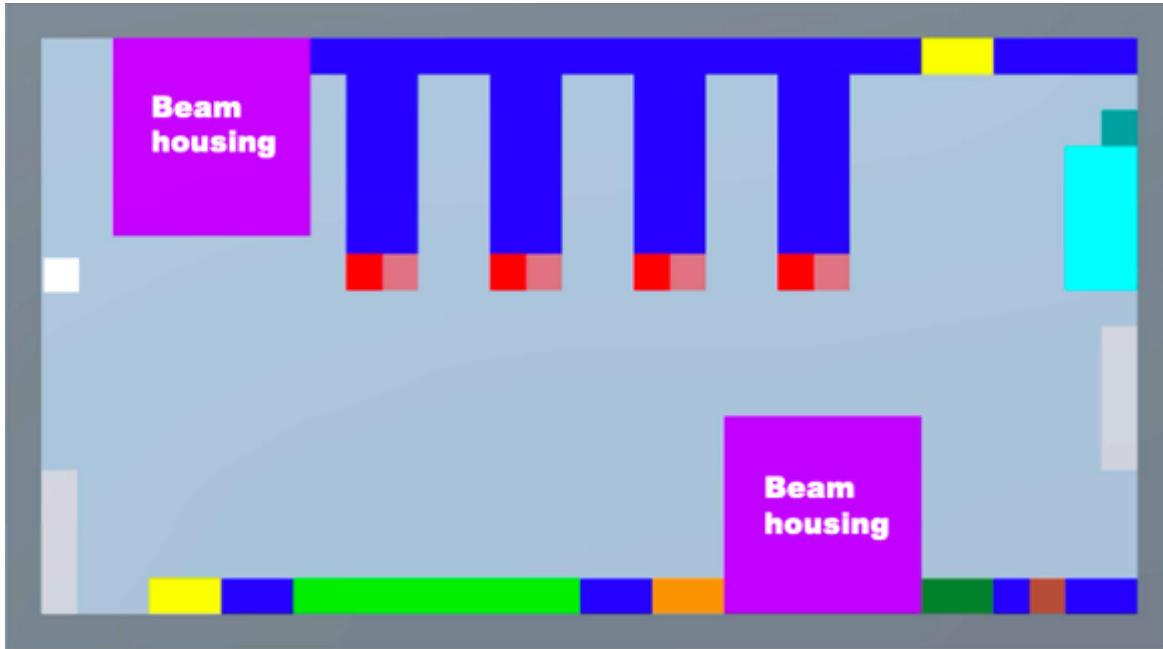
In vitro Biological End Stations



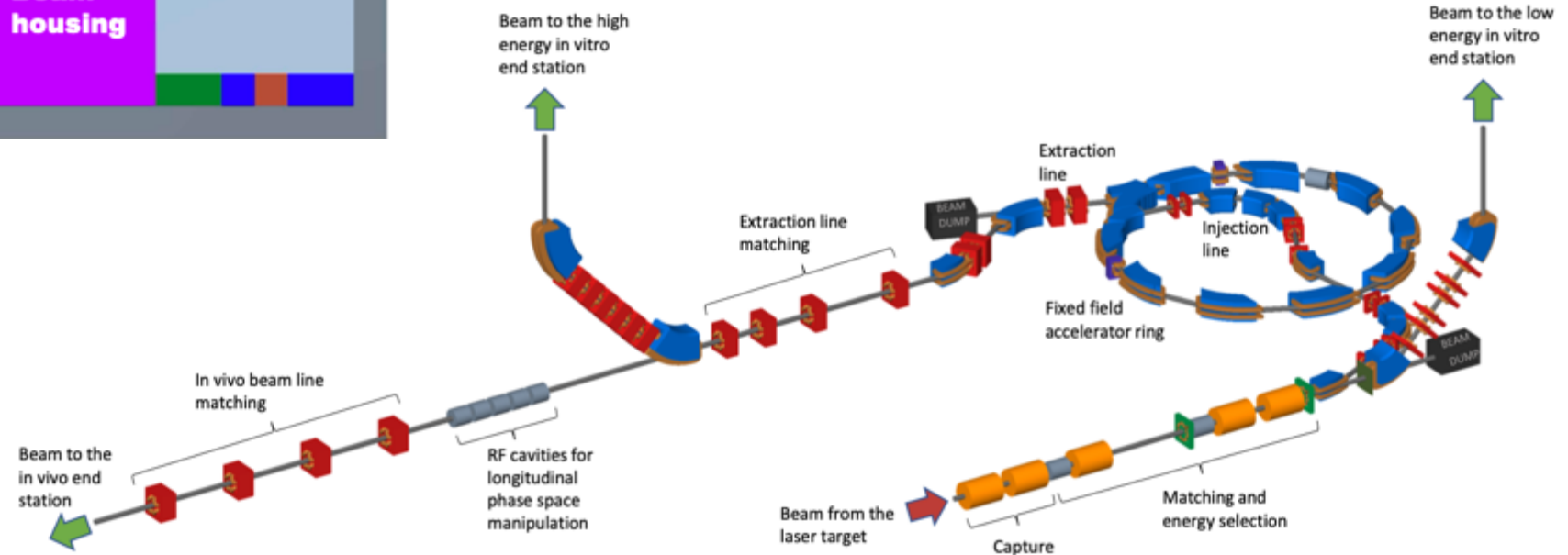
Clatterbridge Cancer Centre (CCC) – Clinical proton beam



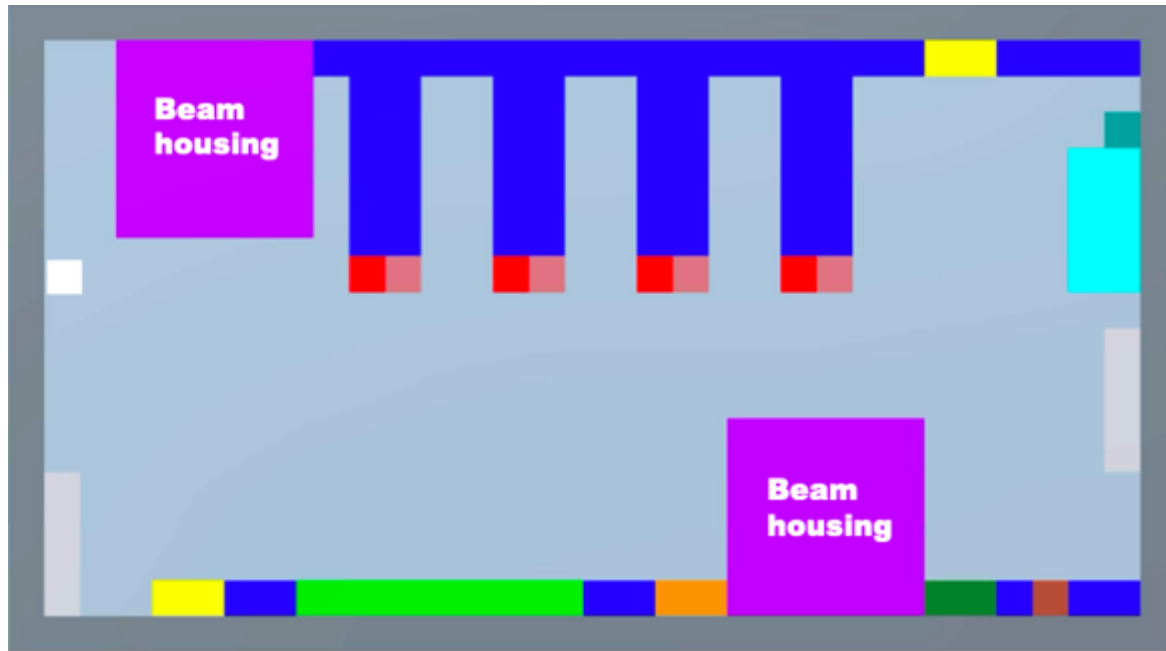
In vitro Biological End Stations



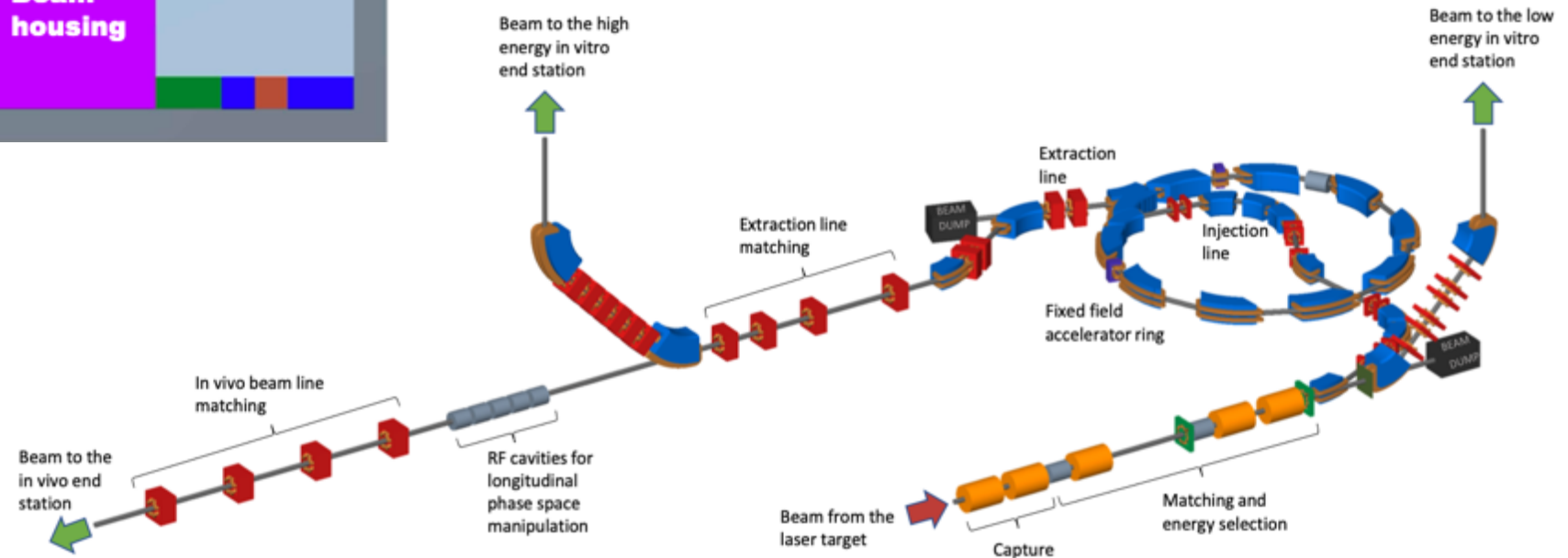
- Vertical beam allows culture vessels to be flat



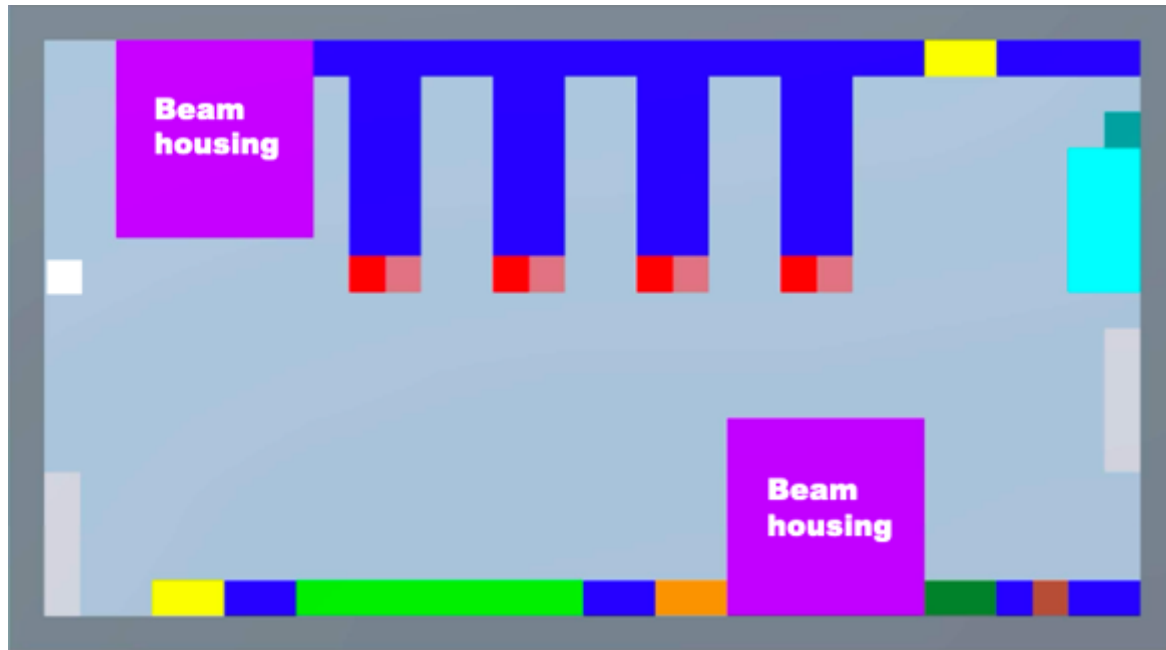
In vitro Biological End Stations



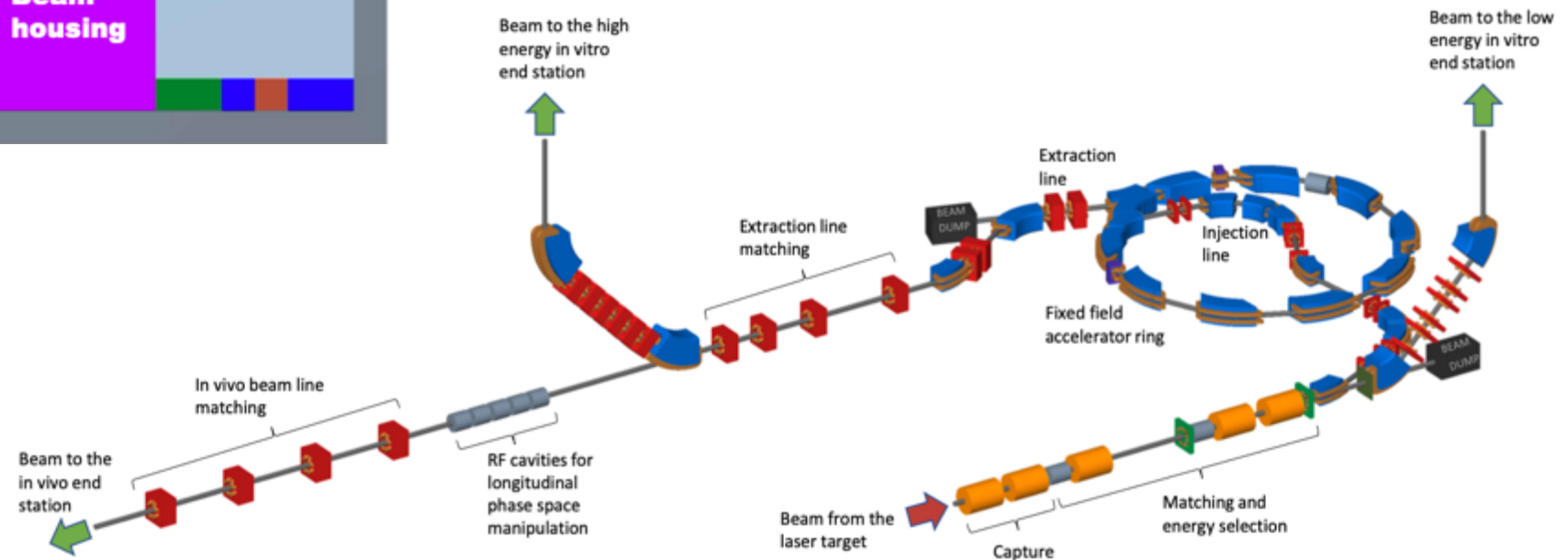
- Vertical beam allows culture vessels to be flat
- Beam line within the end stations to be sealed within units supplied with gases (CO_2 , N_2), act as hypoxia chamber



In vitro Biological End Stations



- Vertical beam allows culture vessels to be flat
- Beam line within the end stations to be sealed within units supplied with gases (CO_2 , N_2), act as hypoxia chamber
- Robotic arm within sealed units to position culture vessels in front of and away from the beam line



In vivo Biological End Station

- High energy protons (up to 127 MeV) and ions (up to 33 MeV/u)
- Located on the basement floor
- Irradiation of small animal models to investigate the effect on PBT on appropriate biological end points (e.g. tumour growth)
- Beam flexibility - passive scattering, pencil beam scanning, micro beams
- Animal handling area within end station for anaesthetisation of animals
- CT scanner to guide targeting
- Animal holding facility off site for long term biological measurements

Conclusion

- Three biological end stations, fully equipped to fulfil radiobiological research requirements
- Multiple energies (high and low), particle irradiation types (proton, carbon ions), dose rates (conventional vs FLASH)
- Capable of irradiating a wide range of biological models to investigate a myriad of biological end points (tumour growth, high throughput drug screens, hypoxia, inflammation)
- Translation into future effective patient treatment