LhARA Stage 2 Nominal Beam

Current estimates

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Introduction (1)

- LhARA will use a novel laser driven charge particle source for proton and ion beams (He, Li, C, O, etc.)
- At Stage 1 proton beams up to 15 MeV will be used for in-vitro studies
- At Stage 2 Fixed Field alternating gradient Accelerator (FFA) will be used as a post-accelerator to deliver ion beams (with 20-127 MeV proton equivalent magnetic rigidity) for further in-vitro and in-vivo studies.

Introduction (2)

- Beam emittance is dictated by the laser source feeding the Stage 2
- Beam energy at the output at the Stage 2 is dictated by the injection energy (variable from the source)
- Energy spread at Stage 2 is limited by the RF voltage of the ring. It can be manipulated at the RF gymnastics
- Bunch length depends on the energy spread and can be controlled to certain level by RF manipulations
- Intensity is limited by the source from below and by the space charge limit at injection to the ring from the above. The space charge limit depends on the injection emittance and the bunch length.
- The parameters provided here are subject to further study and most likely will undergo an evolution

Nominal, 127 MeV proton beam at Stage 2

- Physical RMS emittance: 0.137 π.mm.mrad
- Relative energy spread (RMS): ±0.002
- Bunch length (total): 40 ns
- Beam size in the in-vitro end station ($\pm 2\sigma$): ±0.5cm
- Beam size in the in-vivo end station ($\pm 2\sigma$) *): ±0.05cm
- Beam divergence in the in-vitro end station ($\pm 2\sigma$)**): ±109 urad
- Beam divergence in the in-vivo end station ($\pm 2\sigma$)**): ±1090 urad
- Bunch intensity***): 5.7×10^8
- Repetition rate: 10 Hz

*) Subject to a further optimisation to compensate for the space charge effects

**) No scattering in the vacuum window, detectors nor the cells container wall taken into account.

***) At the space charge limit