

Status of PRAE beamline

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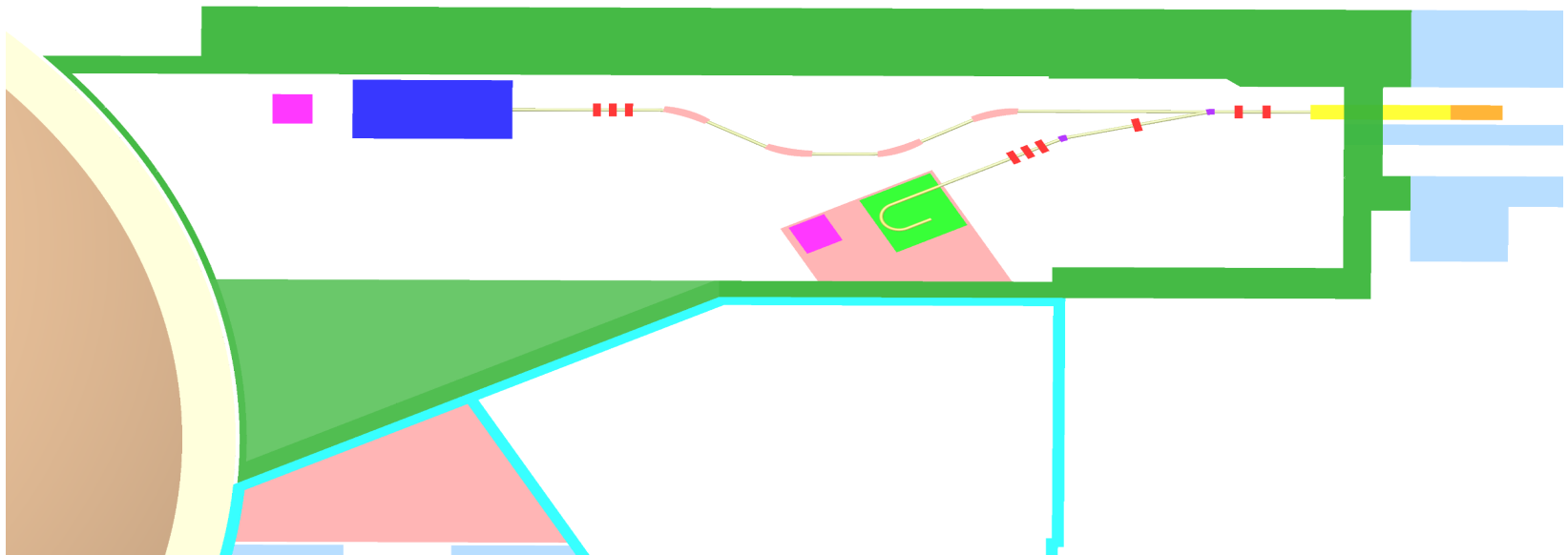
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With the support of



Task

- Design the entire beam line
 - Provide the proper beam for end user
 - Fit the geometry requirement
- Perform the realistic start-to-end simulation



End user requirement

ProRad Experiment Requirements:

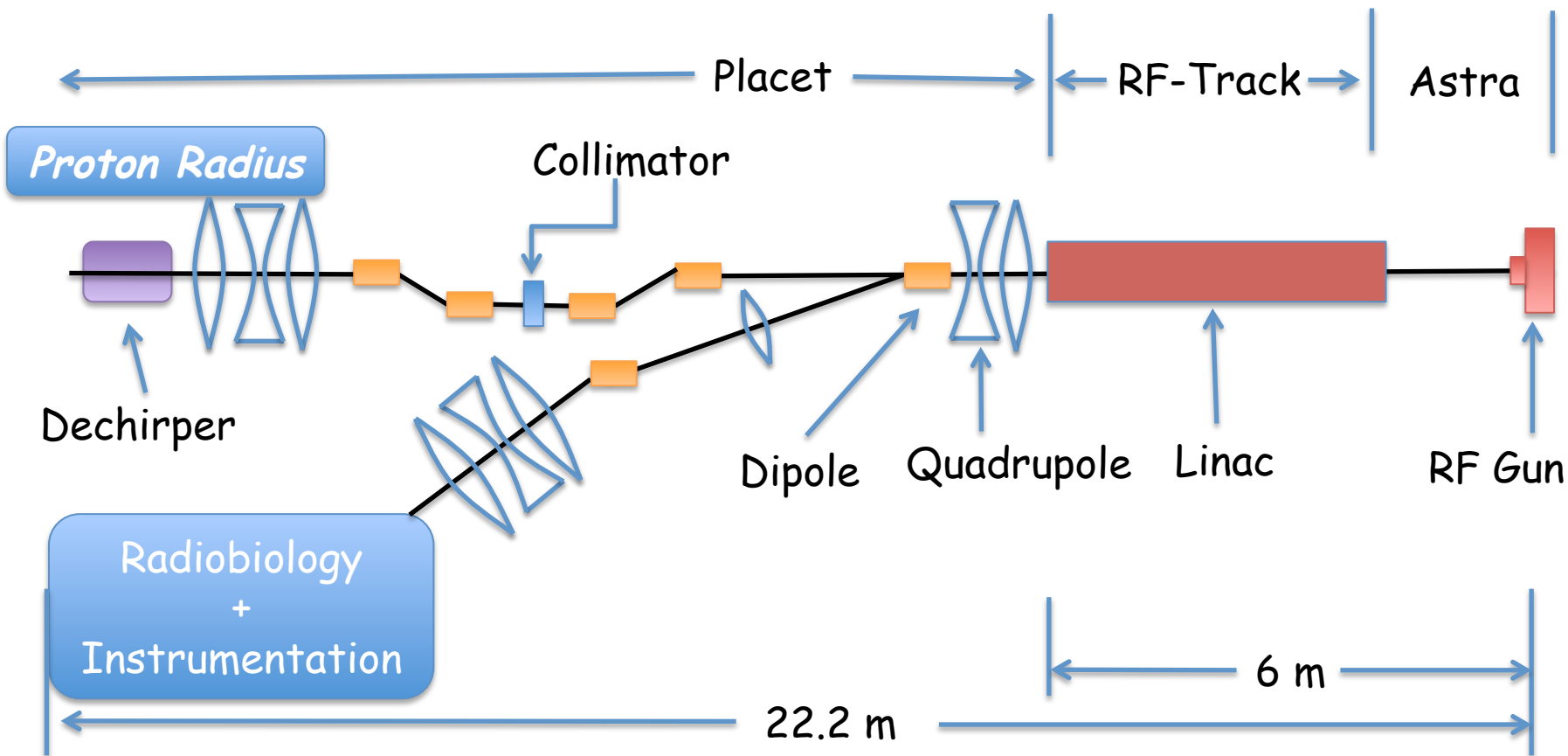
- Energy: 30, 50 70 MeV → Wide energy range
 - $\sigma_x = 20 - 30 \mu\text{m}$
 - $\sigma_y = 100 - 200 \mu\text{m}$
 - $\sigma_{x',y'} < 50 \mu\text{rad}$
 - $\sigma_E / E < 5 \times 10^{-4}$ → The most difficult requirement: we need the energy compressor systeme
 - $Q = 10 - 100 \text{ pC}$
- Need extremely small emittacne

Radiobiology Experiment Requirements:

- Mini Beam
 - $\sigma_{x,y} = 400 - 700 \mu\text{m}$ after 10 cm air + 3 cm water
 - Low divergencce
 - FLASH beam
 - $\sigma_{x,y} = 10 \text{ mm} \times 10 \text{ mm}, \Delta t = 100 \text{ ms}$
 - $\sigma_{x,y} = 26 \text{ mm} \times 18 \text{ mm}, \Delta t = 500 \text{ ms}$
- Wide beam size range

Simulation Environment

Lattice design: Madx



Radiobiology simulation: BDSIM

Status & Future

Status:

- A beamline has been designed
- A simulation environment has been setup
- In ideal case:
 - The energy spread requirement for ProRad can be reached at 70 MeV beam
 - The requirement for radiobiology
 - Mini beam: can be met at 140 MeV beam
 - FLASH Beam: can be met with drift and defocusing quadrupole

Future:

- Reoptimize the RF injector
- start-to-end optimization for RF Gun and Linac
- Evaluate and simulate the CSR effect
- Study the misalignment and the imperfection of all components
- Investigate the passive dechirper structure