A3 - FCC-EE INJECTION TEAM

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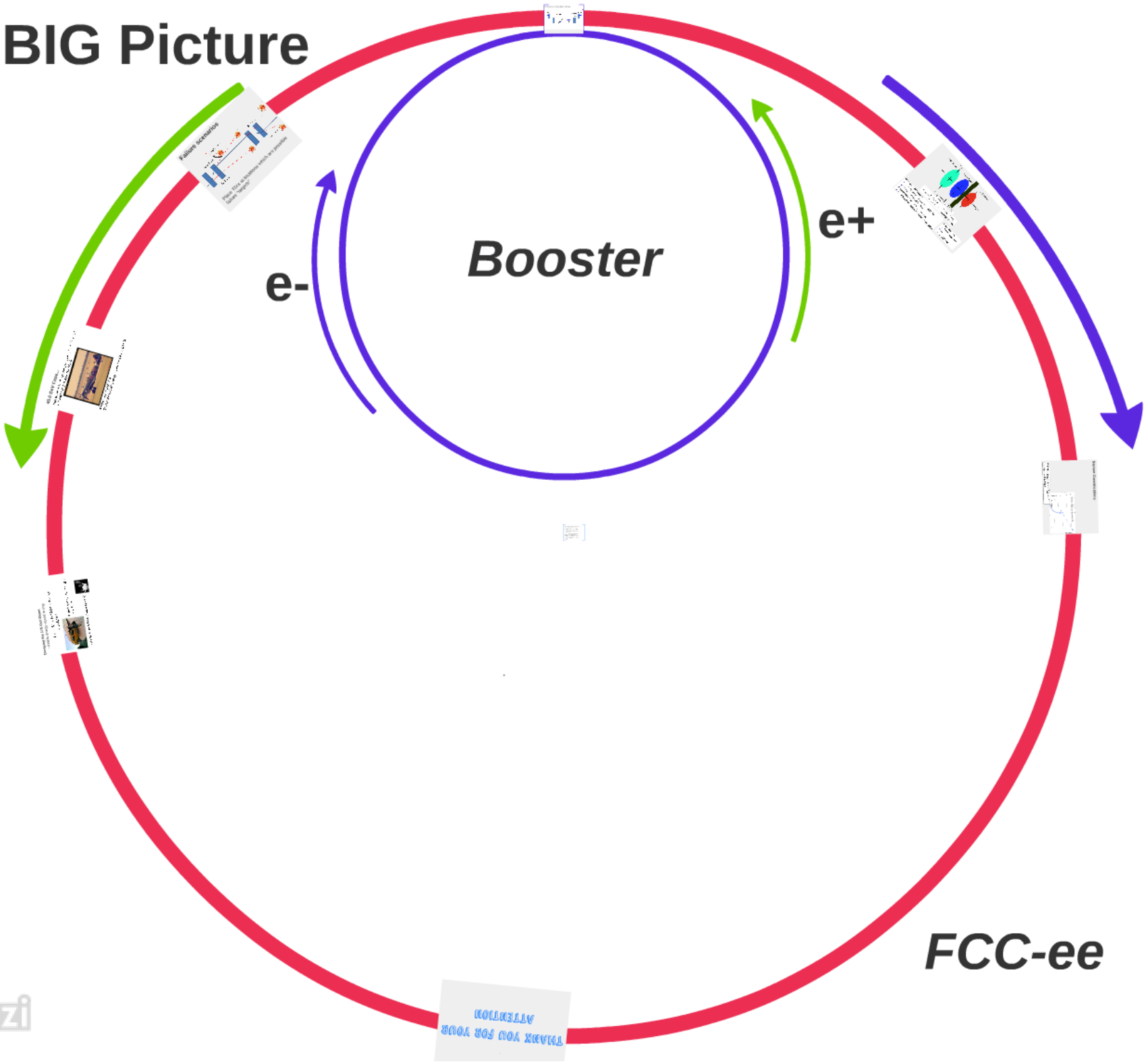
The BIG Picture



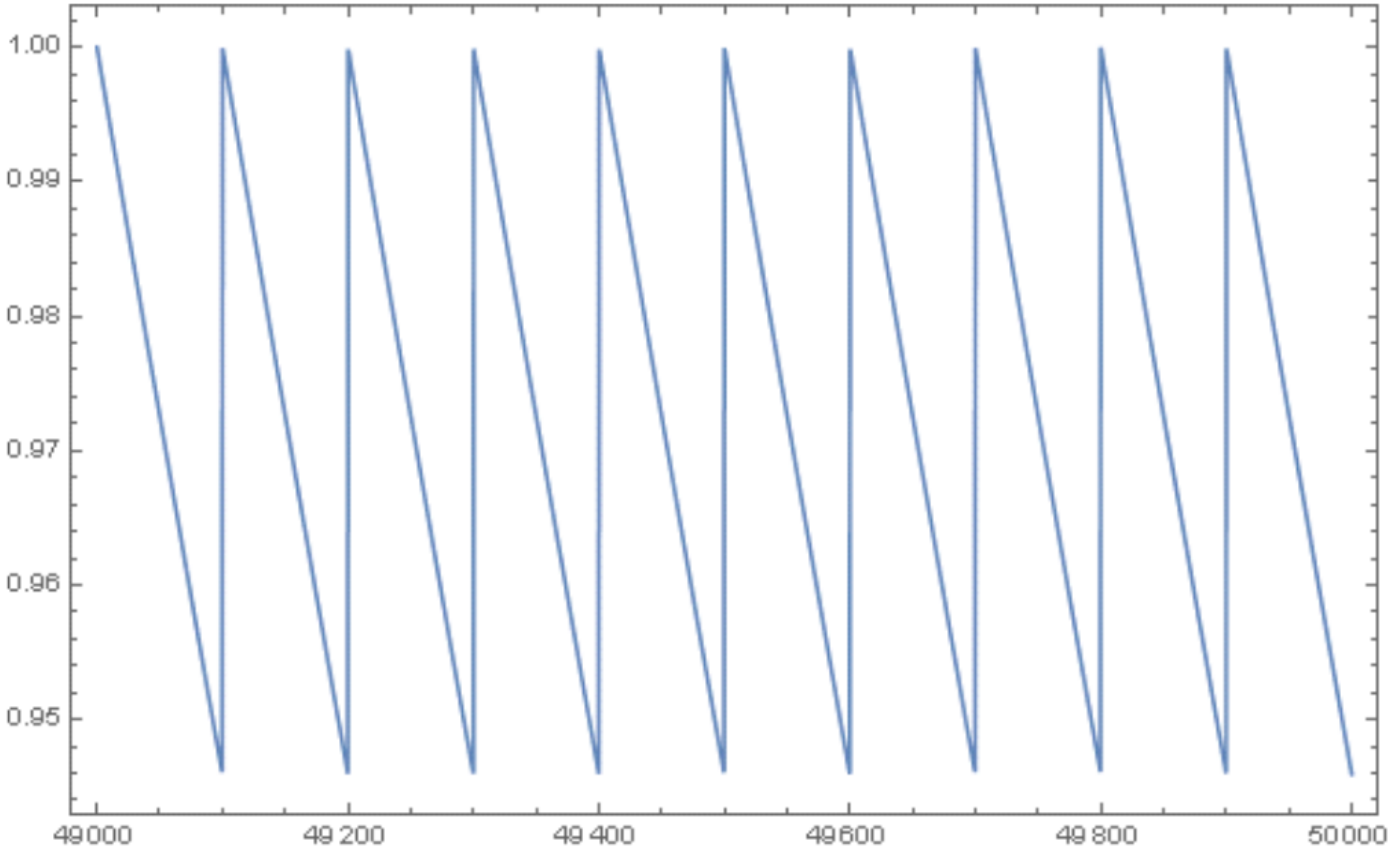
Tasks to solve / questions to be answered

- Repetition scheme of injection
- How about conventional injection scheme?
- Ring optics parameters required for injection?

- Requirements for kicker and septa
- Provide kicker / septa design
- Discussion of stored beam stability

- Failure scenarios with given beam energy

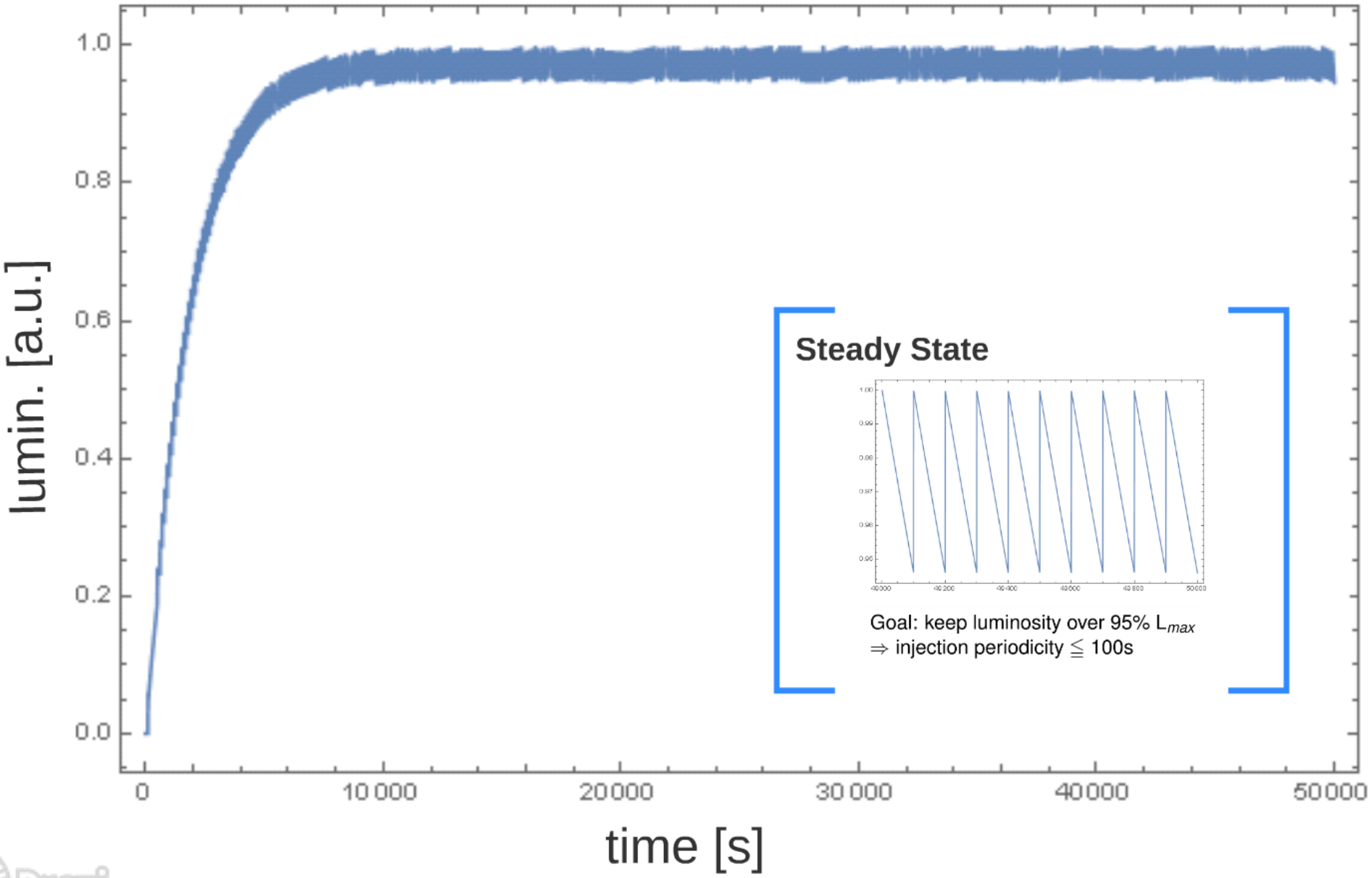
Steady State



Goal: keep luminosity over 95% L_{max}

$\Rightarrow$ injection periodicity $\leqq$ 100s

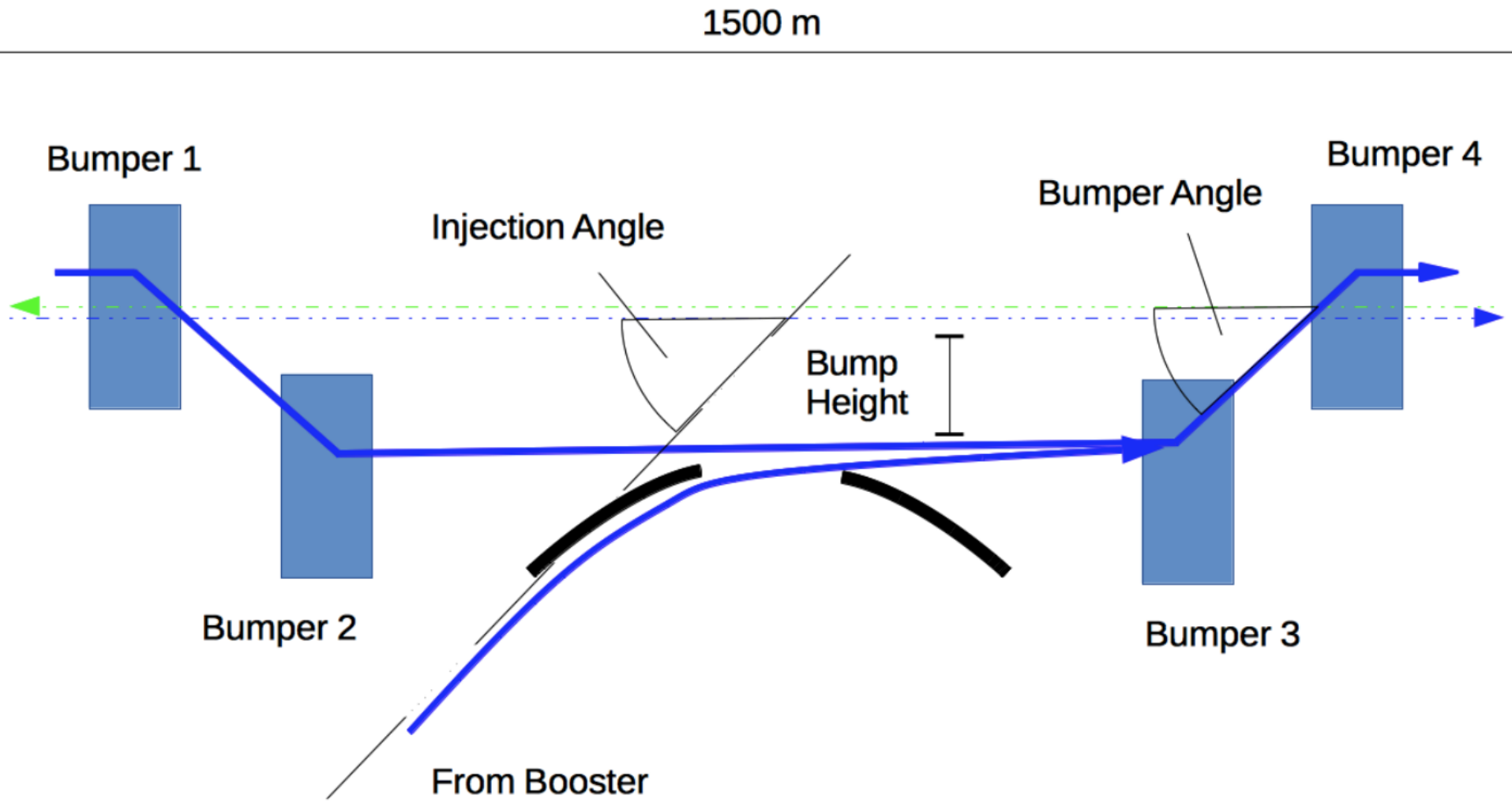
Filling of the Ring

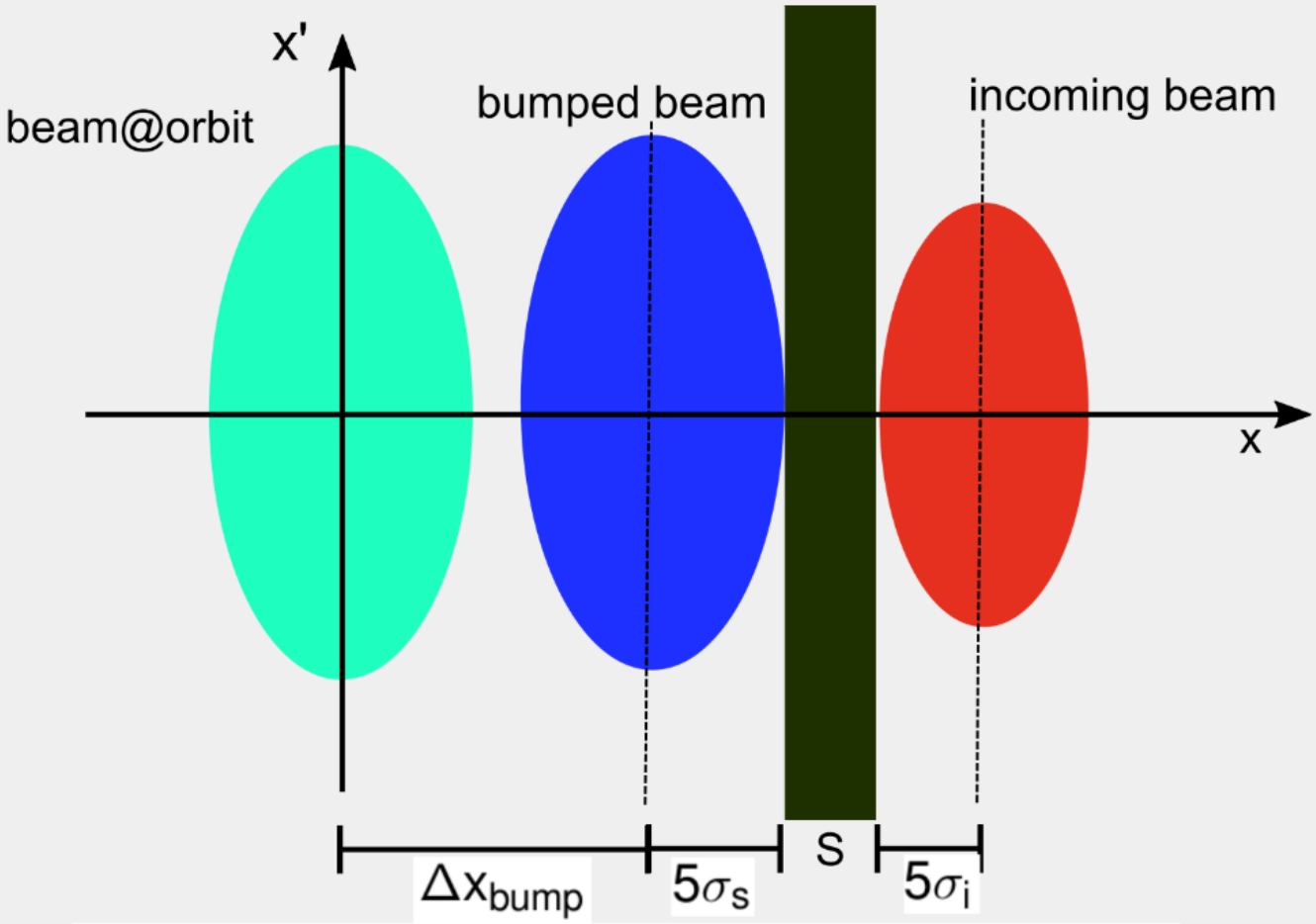


Steady State

Goal: keep luminosity over 95% L_{max}
⇒ injection periodicity ≦ 100s

Conventional Injection Scheme





$$\Delta x_{bump} = \begin{cases} 10\sigma_s + S & \text{on-axis, off-energy} \\ 10\sigma_s + S + \delta x & \text{on-energy, off-axis} \end{cases}$$

Assumptions on bumping:

- beam rigidity at 175 GeV: $B\rho$ = 583.7 Tm
- dispersion is zero at injection
- bump angle / kicker strength: 44 μrad
- usable length of injection per particles type: 500 m

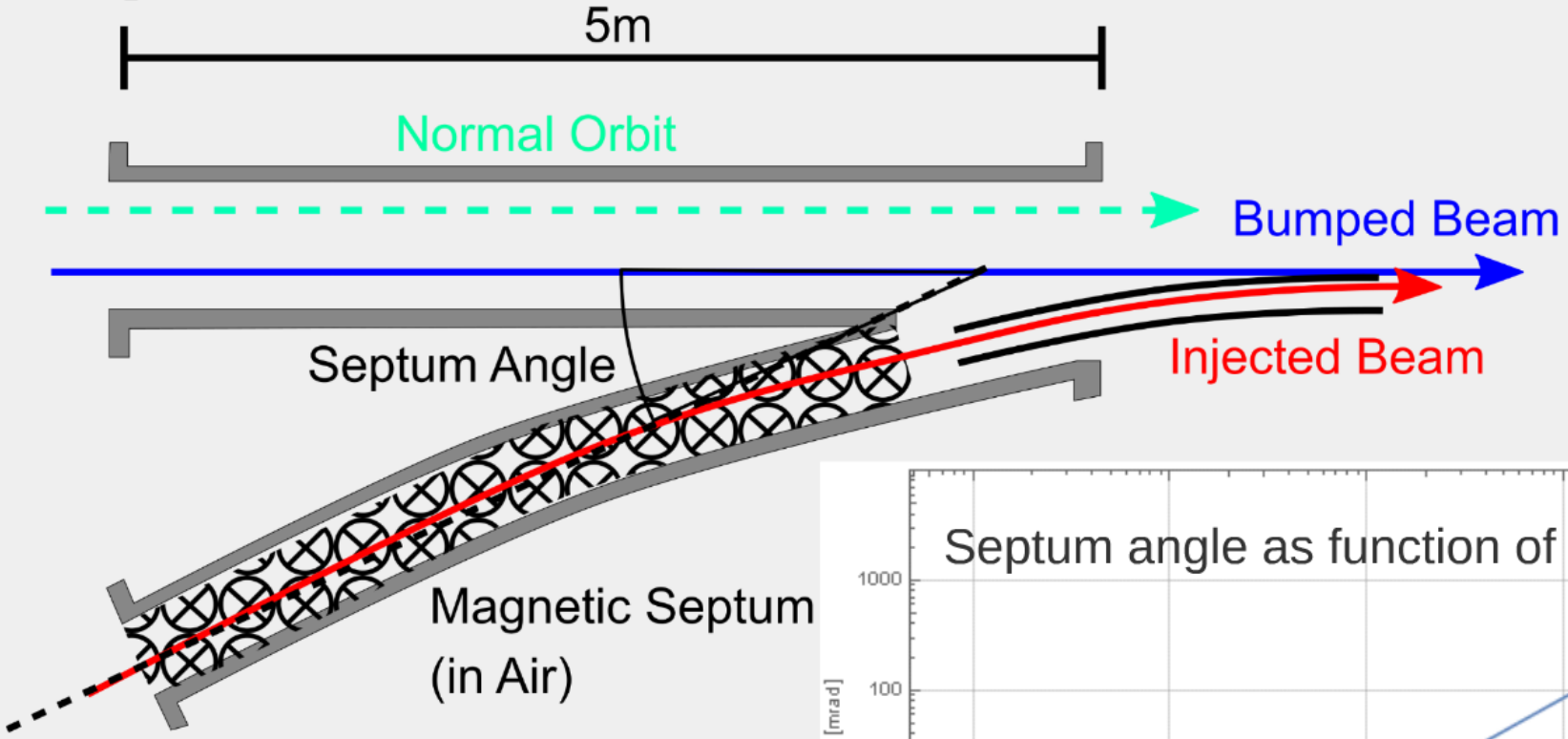
At injection point:

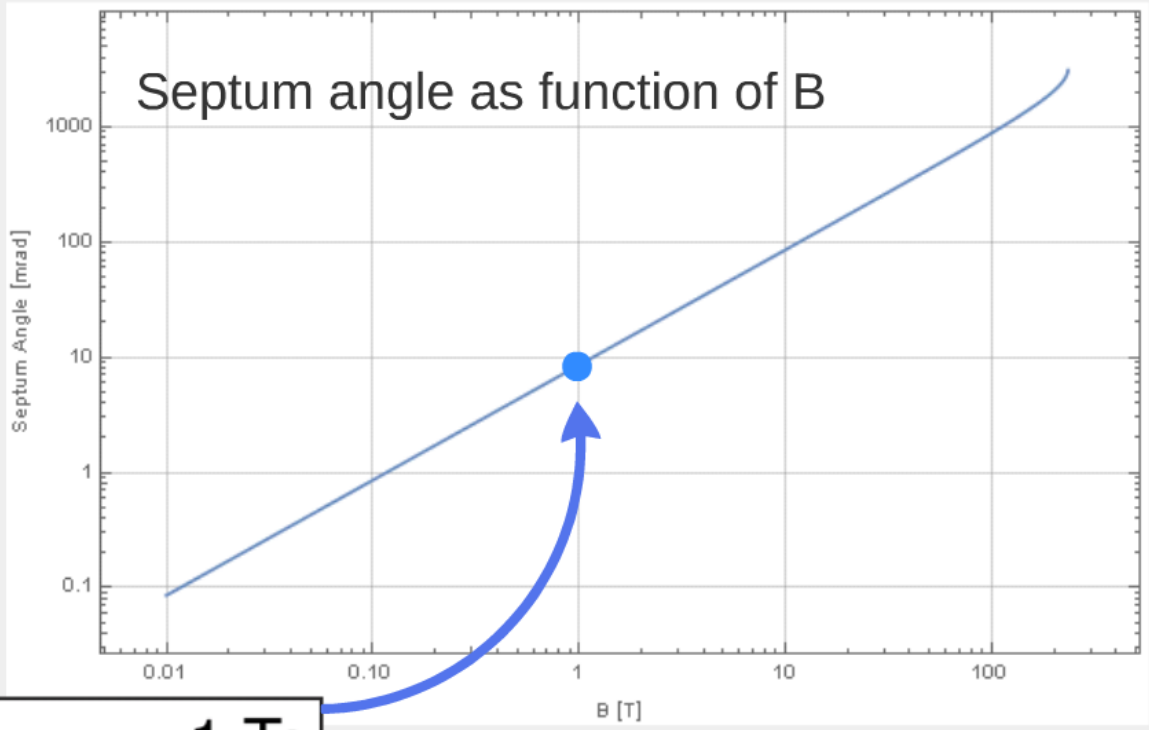
⇒ Bump height: 22 mm

⇒ σ_s: 1.7 mm

⇒ β_x: 2223.1 m

Septum Considerations





With $B\rho$ = 583.7 Tm and B_{septum} = 1 T:

$\Rightarrow \Theta_{septum}$ = 8.57 mrad

Dumping the 175 GeV Beam

- Kinetic energy stored in ring:

$$E_{kin} = 81 \times 175 GeV \times e \times N_B$$
$$= 386.1 kJ$$

Corresponds to car driving at

$\approx$ 80 km/h

...or you can heat 1 liter of water by 94 °C

45.6 GeV Case...

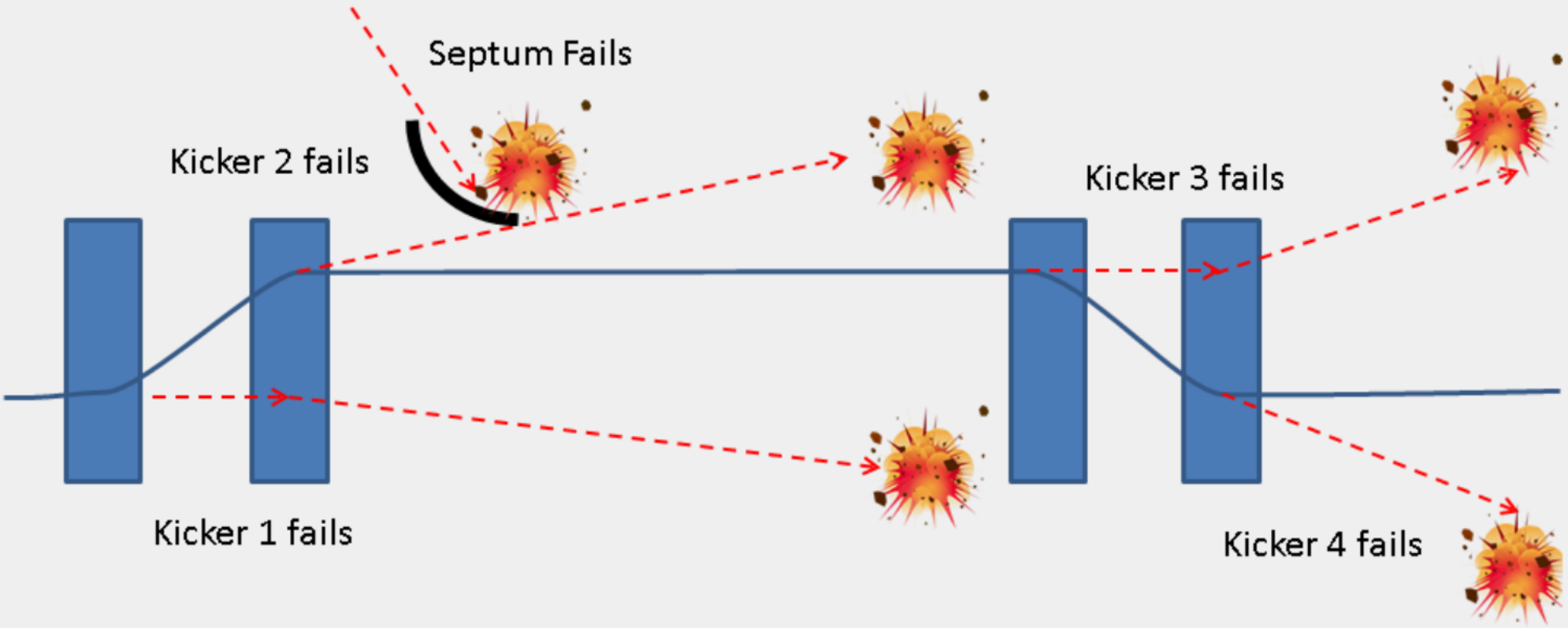
Now we have 30180 bunches per beam, 1×10^{11} particles

$\Rightarrow$ stored energy is now 22.5 MJ (!)

Which corresponds to a

Supermarine Spitfire flying at 286 miles/h = 460 km/h

Failure scenarios



Place TDIs at locations which are possible failure "targets"

THANK YOU FOR YOUR ATTENTION

SEE YOU AGAIN IN ERICE,
ON A CAS,
...OR ELSEWHERE