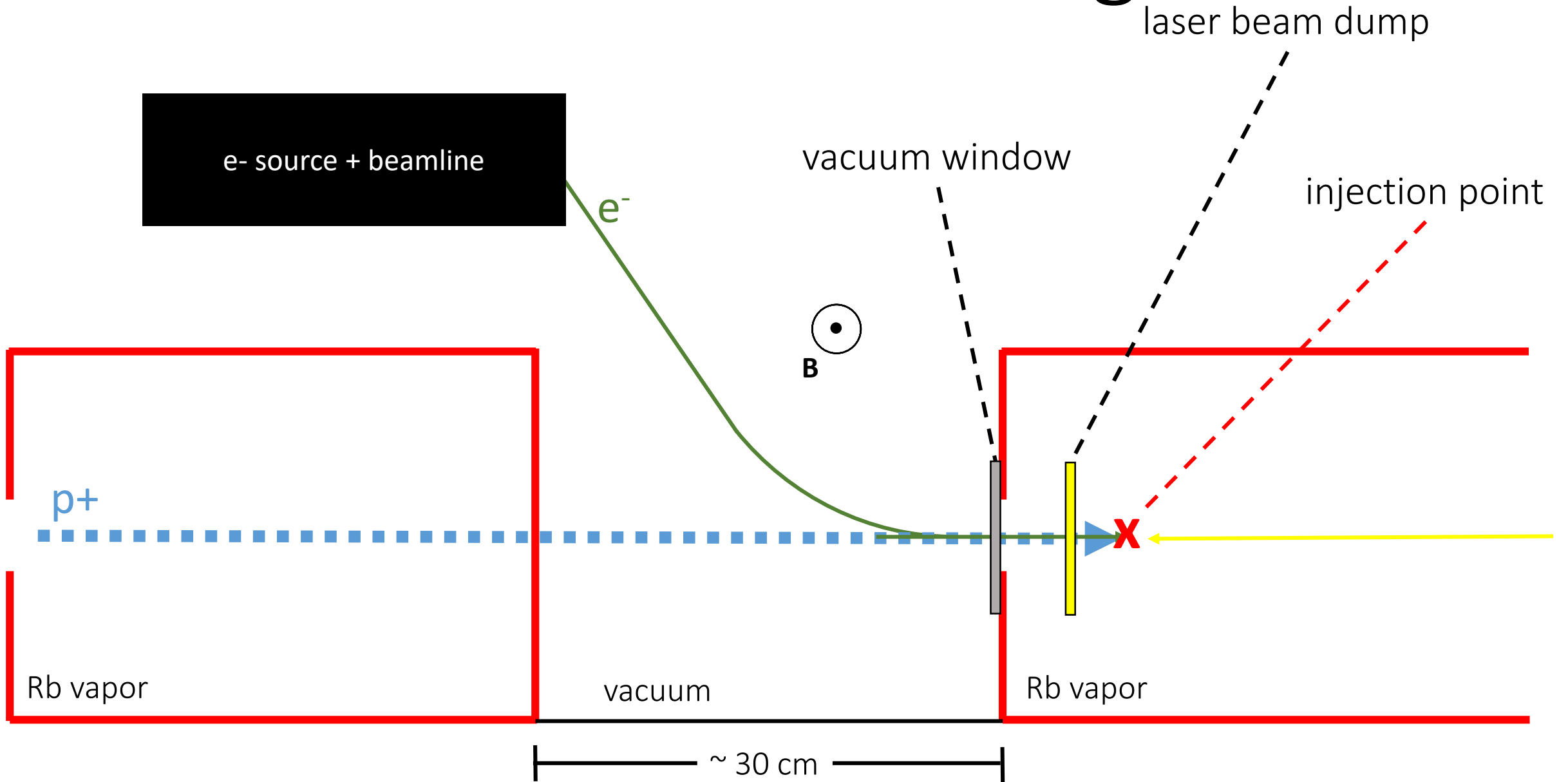# Electron beam final focusing

Given:

- 30 cm gap between sources
- 70 μm aluminum vacuum window
- 100 μm aluminum laser beam dump
- β function at the window = 7.13 mm
- ε_N = 14 μrad (ε_g = 0.04 μrad)
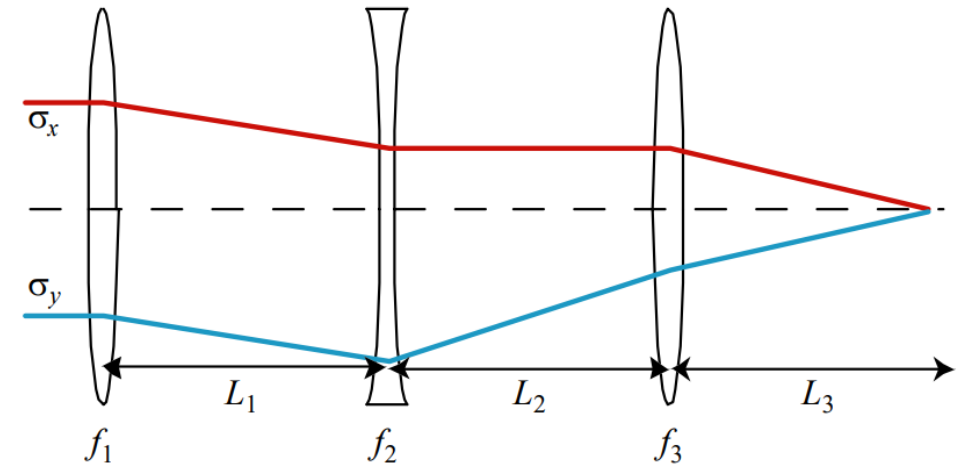
What final focusing system should we use??

Permanent magnet quadrupole (PMQ) triplet could be a solution:

PROS:

- very high magnetic gradient (100s T/m)
- short focal length (order of cm)
- short physical magnet length

CONS:

- difficult tuning & alignment

$f_2 = f_3 = L_1 = L_1 = L_3$
$f_1 = 2f_2$

Maximum compression of the beam size:

$$\frac{\sigma^*}{\sigma_0} \approx \frac{\delta_p}{p}$$

if σ_0 = 250 μm, σ^* = 18 μm, ratio = 7.2 % < δ_p / p ~ 0.5%

focal length with this scheme: f = 6 cm
if magnets are 2 cm long: G = 458 T/m

Also the protons pass in this system,
but f = 121 m → the effect on micro-bunches should be negligible

Many details to study:

- effect of momentum spread

- tuning for different beam parameters

- technical realization

- …