Final Focus / Compression

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"Issue" List

Bag of Tricks

Plasma Considerations

Compression Considerations

Lense Concepts

Focal Schemes

Stripping Problem

$\sigma \sim 3 \times 10^{-17}$ $Ne^{+} \rightarrow Ne^{++}$ on H

say $P = 1.0$ mT H

stripping distance $= \frac{1}{n\sigma} = 1000$ cm

$\Rightarrow$ $P \ll 1.0$ mT for charge state $= 1.0$

Equilibrium State $= 7 \pm 1$

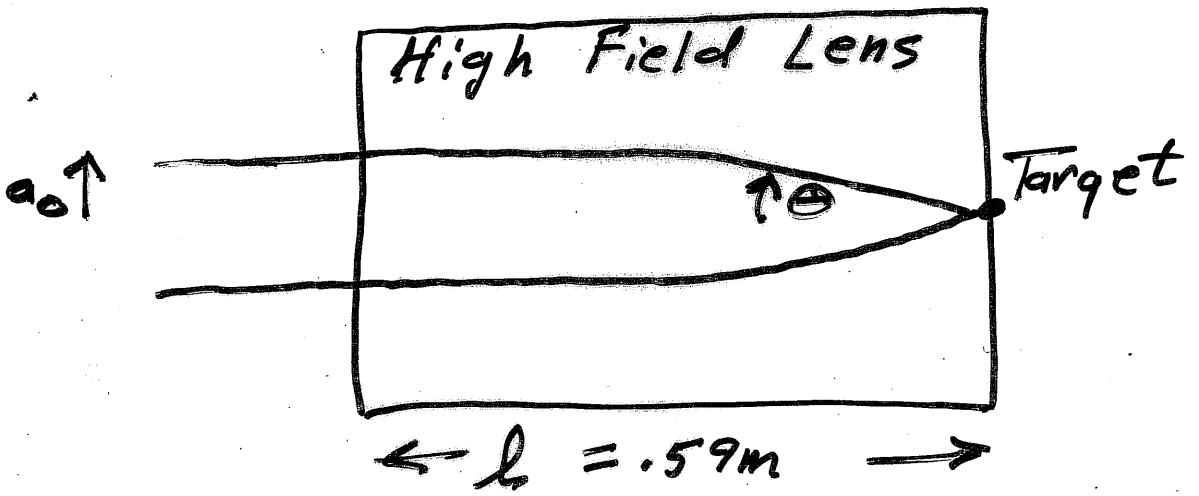
should be prestrip to $+7$??

- Loss of ~50% of beam
- Good for final focus

Strong Solenoid Final Lens

$B = 15\ T \rightarrow$ Beam Stripping Not Essential

But ion rigidity $B\rho = 2.8\ T\text{-}m$ results in magnet length $= .59m$



$a_0 = 1.0\ cm \rightarrow \theta = \underline{27\ mr}$

No tilt:

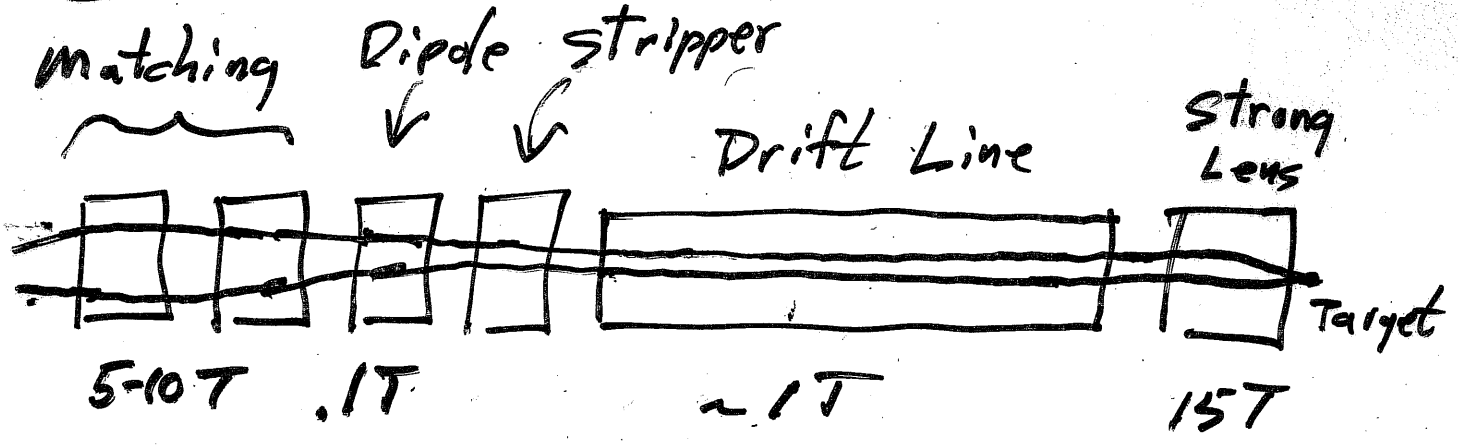
$\epsilon = 2\times10^{-5}\ m\text{-}r \rightarrow a_s \approx \frac{\epsilon}{\theta} = .75\ mm$

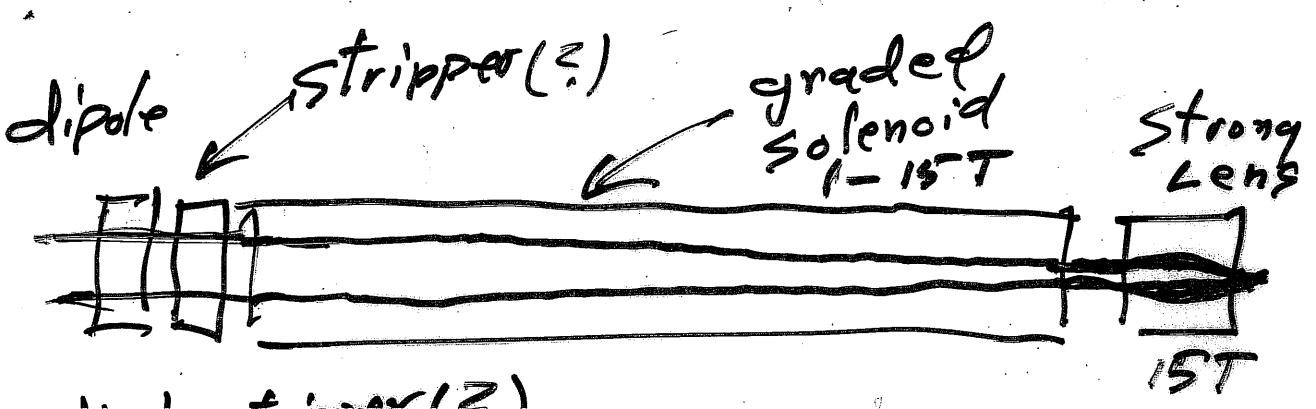
No emittance:

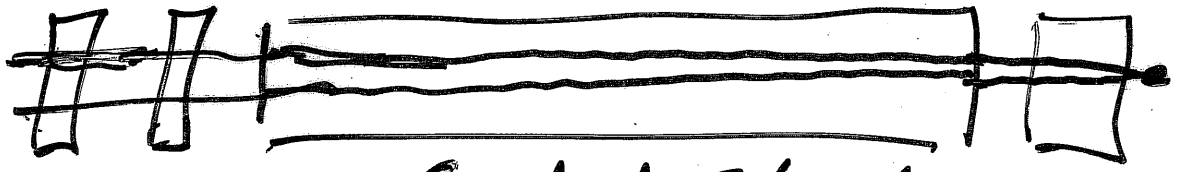
tilt $\Delta = \pm .05 \rightarrow a_s \approx 1.5\, a_0 \Delta = .75\ mm$

Combine tilt and emittance $\rightarrow a_s \approx 1.06\ mm$

Single Beam With Tilt







Graded Solenoid + Graded Plasma

Strong Lens 15T

10-20 m

RF Accelerator — Scheme #1

18 beams in a ring pattern

tilt = ∓ .035

200 ns → 1.0 ns

Initial pulse length = $\beta c \tau_p = 2.7\,m$

→ Compression distance = $\frac{2.7\,m}{.07} = \underline{39\,m}$

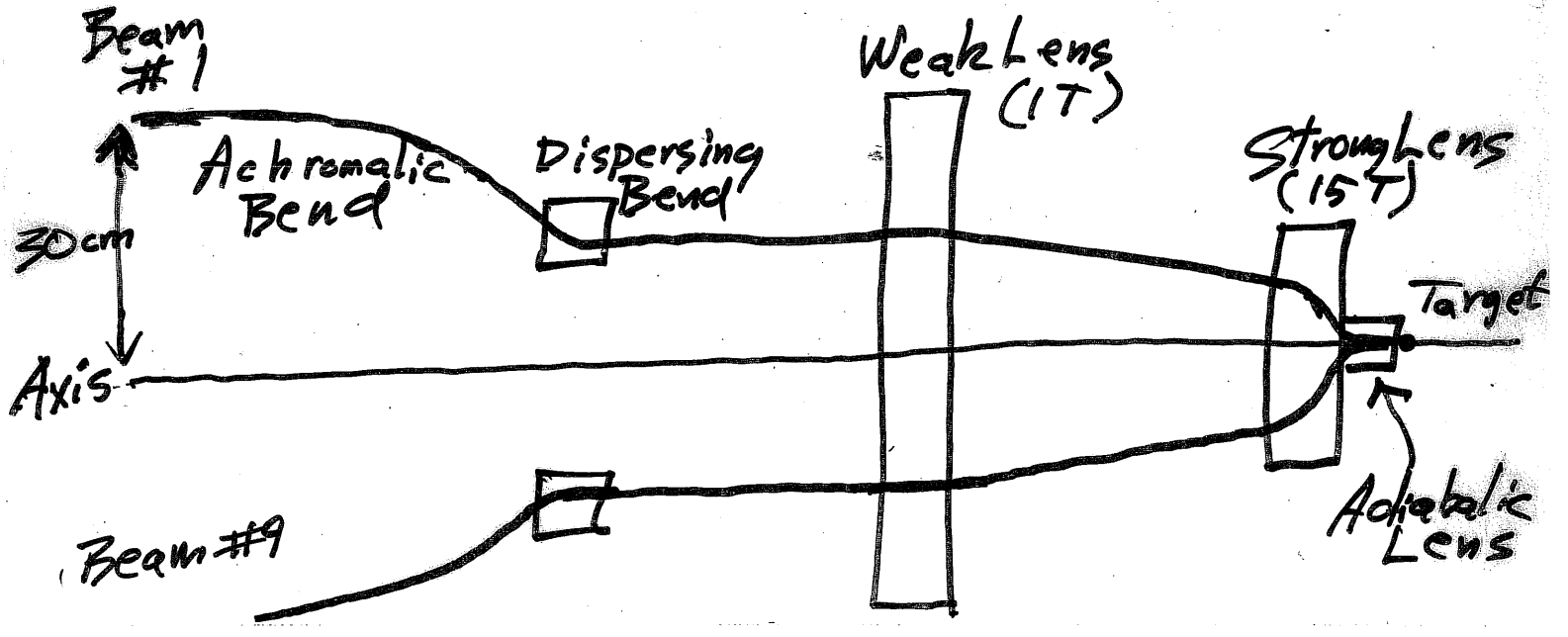
rms normalized emittance = 3 (π) mm-mr

→ $\epsilon_{edge} = \frac{4}{\beta} \times (3 \times 10^{-6}) = \underline{2.7 \times 10^{-4}}$ m-r

Large!!

Use Strong Lens → $r_s \approx 1.0$ cm

+ Follow with adiabatic lens → $r_s \approx \underline{1.0\,mm}$



Multi Beam ~~RF~~ Accelerator Scheme #2

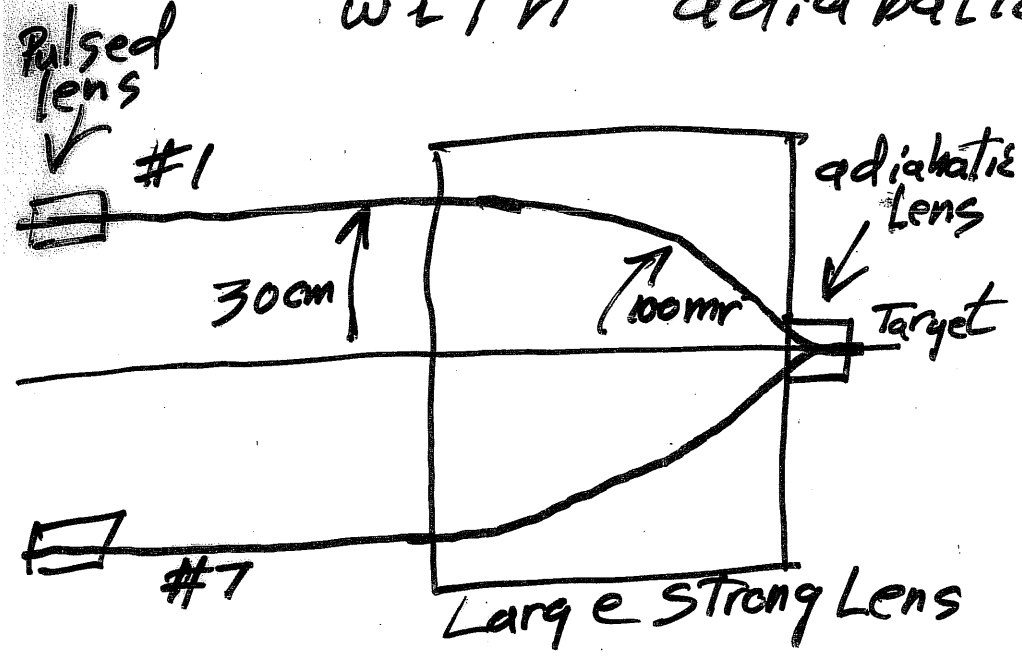
- Merge 12 beams into One -

Emittance blows up to

$\epsilon \approx 2 \times 10^{-3}$ m-r

To achieve small $r_s \approx 1.0$ mm:

- Compensate tilt with pulsed focal elements upstream (Vacuum)
- Focus to $r_s \approx 1.0$ cm with large strong lens
  $\Theta \approx 200$ mr
- Focus to $r_s \approx 1.0$ mm with adiabatic lens



Tilt = ±.05

30 cm → 1 cm in ~ 3.0 m

Keep only "good" pulse center