Trap comparison

- Previous Gabor plasma

Primarily Nonnenmacher *et al.* Appl. Sci. **11** 4357 (2021) ref.'s [28-34]

  - B-field 0.01-0.5T
  - Electron density near Brillouin limit often modelled
    - Although 'Pozimski Factor' ~ 0.1-0.75 quoted
  - Plasma radius = Anode radius
  - Confining voltage 2-600kV
    = space-charge
  - Load via internal discharge
  - Lifetime/confinement time <1s
    - Dynamic equilibrium
  - Reload rate >Hz

- Proposed plasma

  - B-field ~0.1T
  - Electron density at 10-20% of Brillouin limit*
  - Plasma radius ~ 0.3-0.5 Anode radius*
  - Confining voltage ~ 60kV
    > Space charge
  - Load via ext. 'beam' source
  - Lifetime* (100's s?)
  - Reload rate* (mHz?)

* to be experimentally determined

Focal length (focussing constant)

e.g. Pozimski and Meusel Rev. Sci. Instrum. 76 063308 (2005)

$$\frac{1}{f} = k^2 l = \frac{e\,\rho_e\,l}{4\,\epsilon_0 E_k}$$

- Non-relativistic, short, weak, parallel, no space-charge lens approximation
  [identical to Aymar *et al.* fphy **08** 567738 (2020)]

With expected plasma parameters:

l = plasma length (0.8-1 m)
ρ_e = plasma density [n_B] (5E15 m^{-3})
E_k = Ion Kinetic Energy (15 MeV)
e, ϵ_0 = physical constants

One finds
k = focussing constant (1.1-1.2 m^{-1})
f = focal length (0.8-0.7 m)

Also expecting:

r_p = plasma radius (3.5 cm)
r_A = anode radius (5-10 cm)
ϕ = space charge (50-85 kV)
V_A = Confining voltage (100 - 400 kV)
B = Confining magnetic field (0.1 T)
n_B = Broullion limit (~5E16)
P_F = ρ_e / n_B (~0.1)

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Also expecting

r_p = plasma rad
r_A = anode rad
ϕ = space char
V_A = Confining
B = Confining
n_B = Broullion
P_F = ρ_e / n_B (~

- Focusing strength of the GL:

$k=2V\gamma p_F/(r^2(\gamma+1)E_k)$

For the current baseline:

V=65kV

r=3.5cm

E_k=15MeV

γ=1.016

p_F=0.5 (Pozimski factor)

k=1.783m^{-2}