



AWA Needs and Opportunities Workshop

chaired by Manoel Conde (Argonne), John Power (Argonne National Lab)

from Wednesday, August 21, 2019 at **13:00** to Friday, August 23, 2019 at **12:00** (US/Central)
at Argonne, Building 360 (A-224)

High Average Current, Thermionic RF Gun with Gridded Cathode

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(AWA) to provide

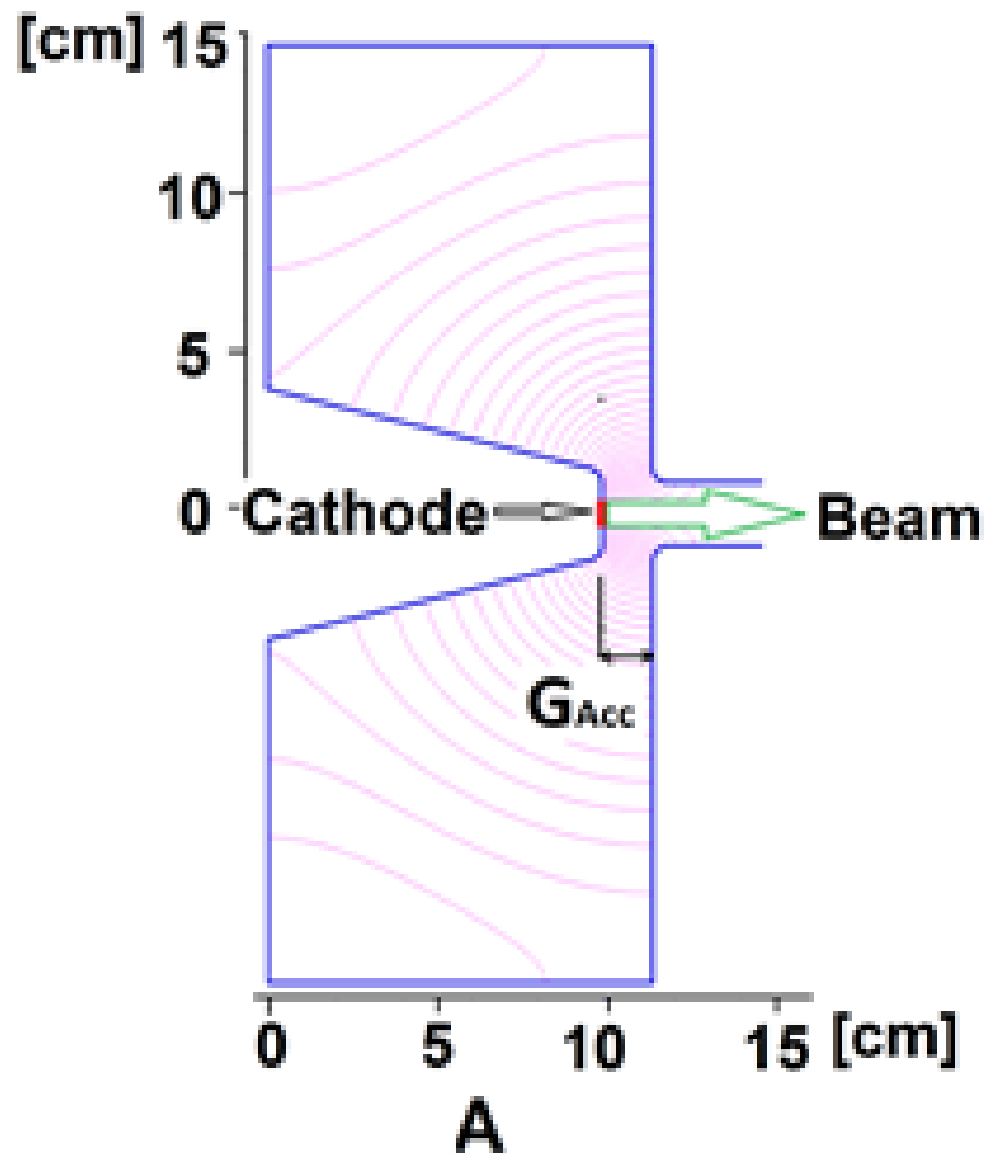
microwave power at frequencies other than 1.3 GHz...

... e.g. at 325 MHz, or in (subharmonics of 1.3 GHz)

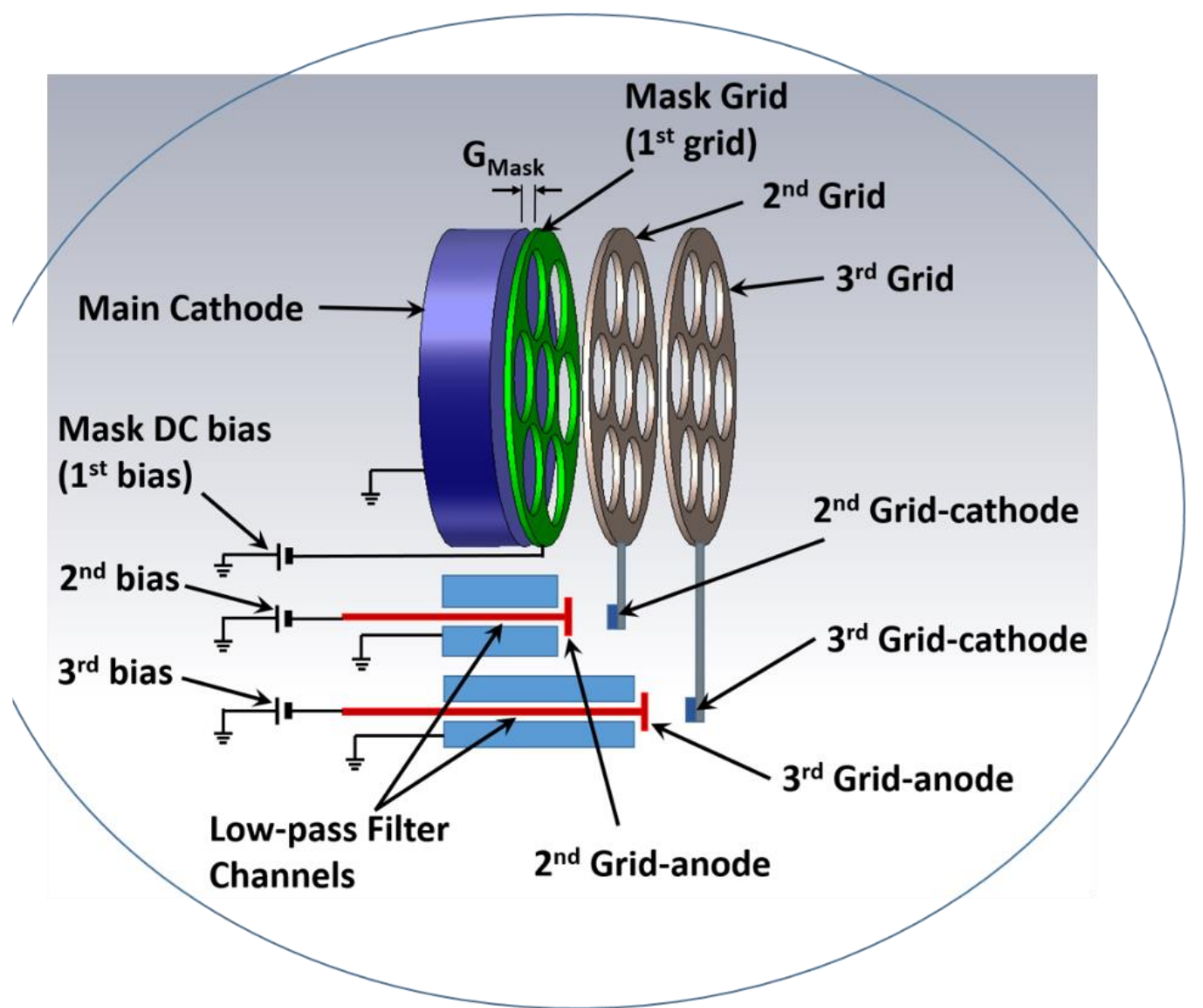
... the range of 200- 500 MHz.

to keep

... “good work” in providing/ maintaining excellent bunch diagnostics, such as beam –
emittance /phase space characterization



Copper cavity at 476 MHz with the accelerating gap of 1.5 cm, peak field on cathode $E_{Cathode}=13.6$ MV/m, cavity wall loss power of 9.4 kW, and wall deposited peak power density of 22 W/cm^2 .



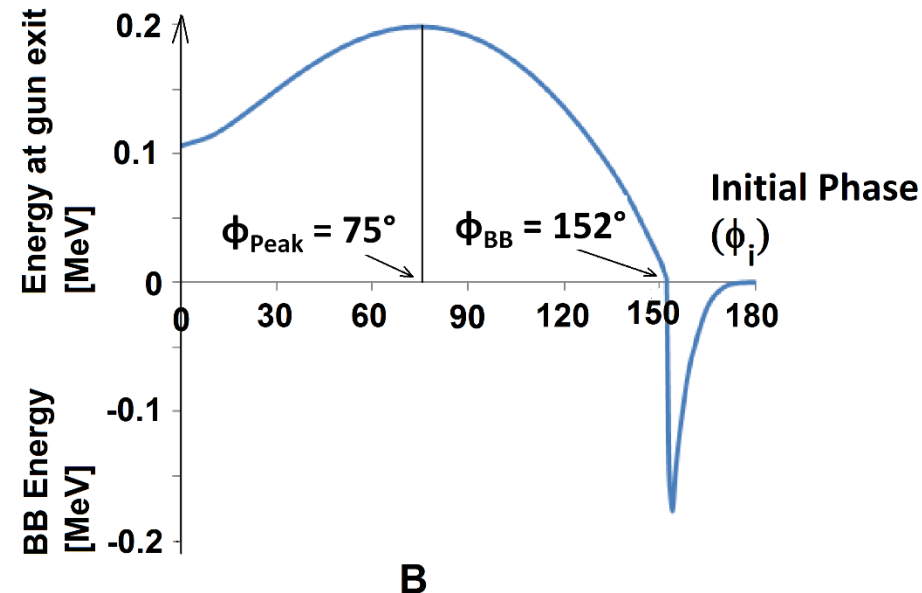
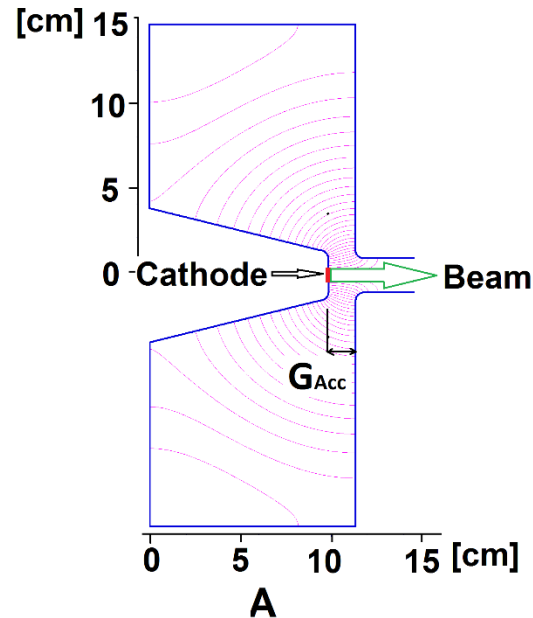
Triple-grid thermionic cathode system.

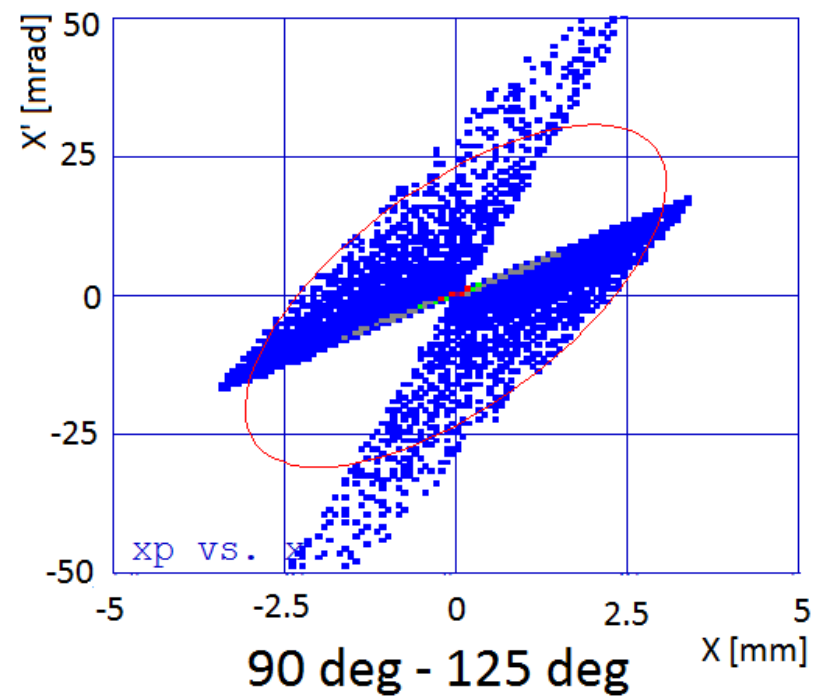
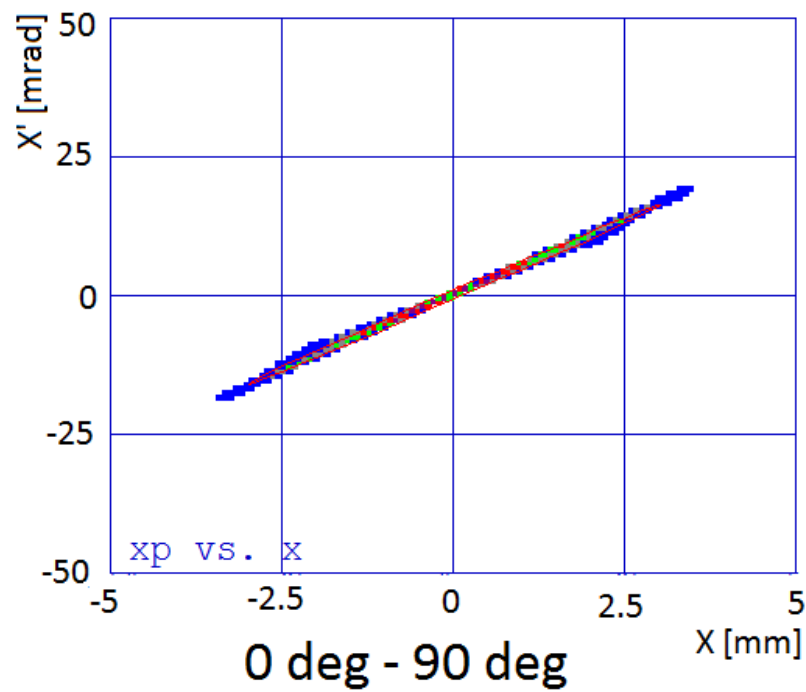
The first aspect concerns with making the accelerating gap (G_{acc}) in an RF gun short in comparison to the RF wavelength (λ). This aspect results in three direct effects.

first: one can achieve high field gradients on the cathode at a given limited RF power;

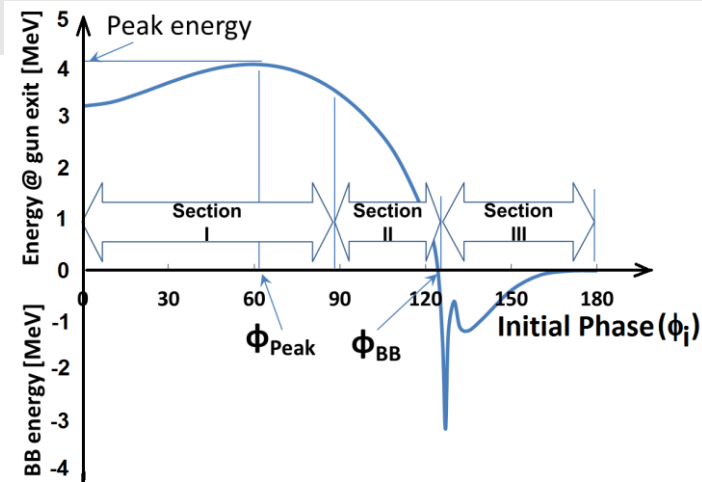
second, the starting phase ϕ_{BB} of back-bombardment, and the initial phase ϕ_{Peak} corresponding to the peak energy are pushed toward 180° ;

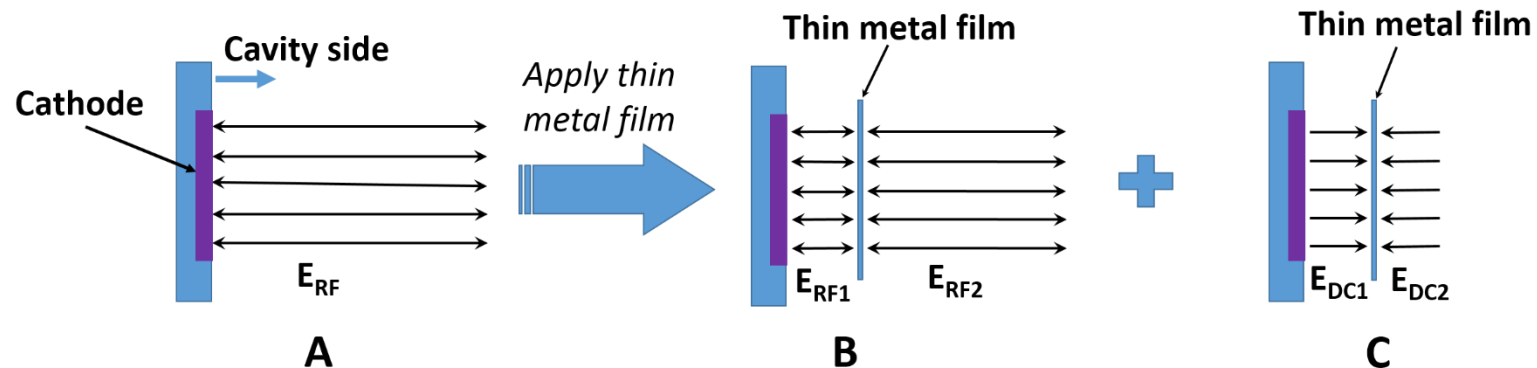
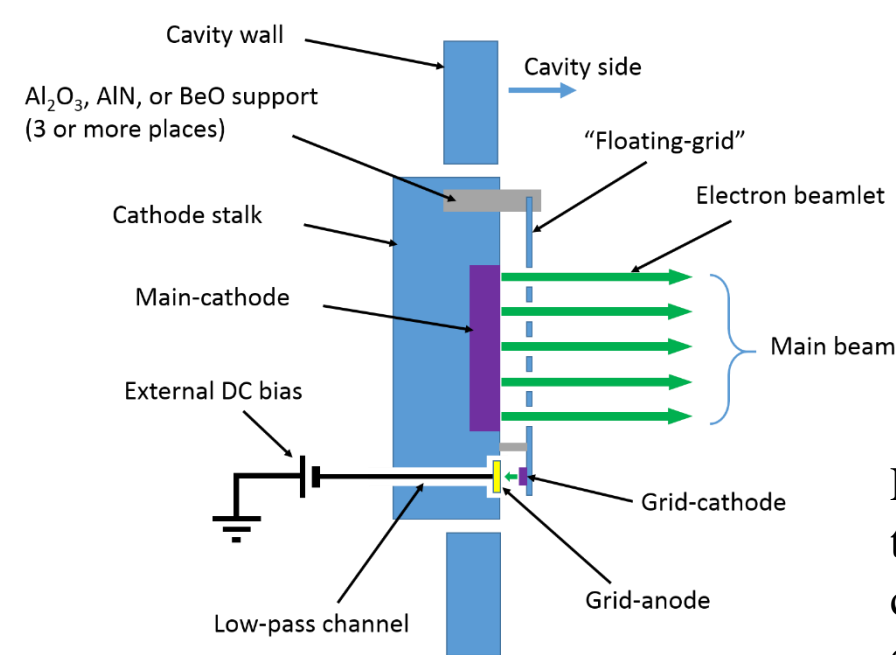
third, the back-bombardment power is slightly reduced





Transverse phase space at the exit of the gun shown in Fig. "Before". **left**) ...of the "good" (Section I) part of the beam with ϕ_i between 0° and 90° , and **right**) ...of the "bad" (Section II) part of the beam with ϕ_i from 90° to ϕ_{BB}

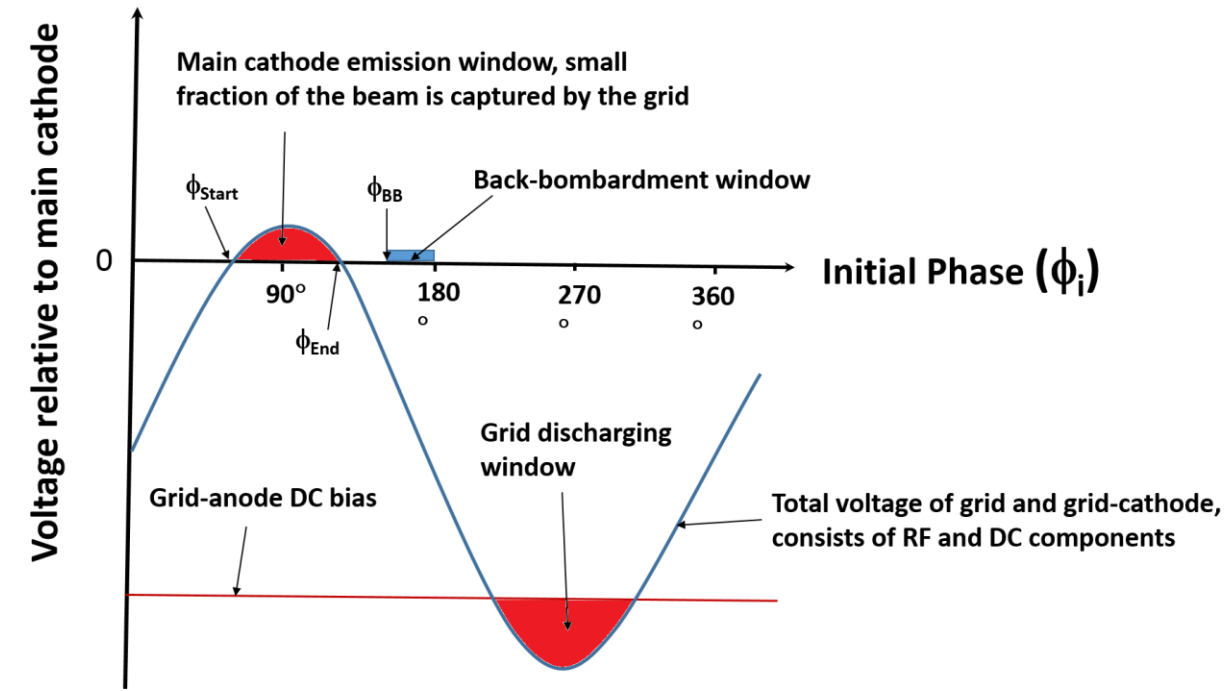


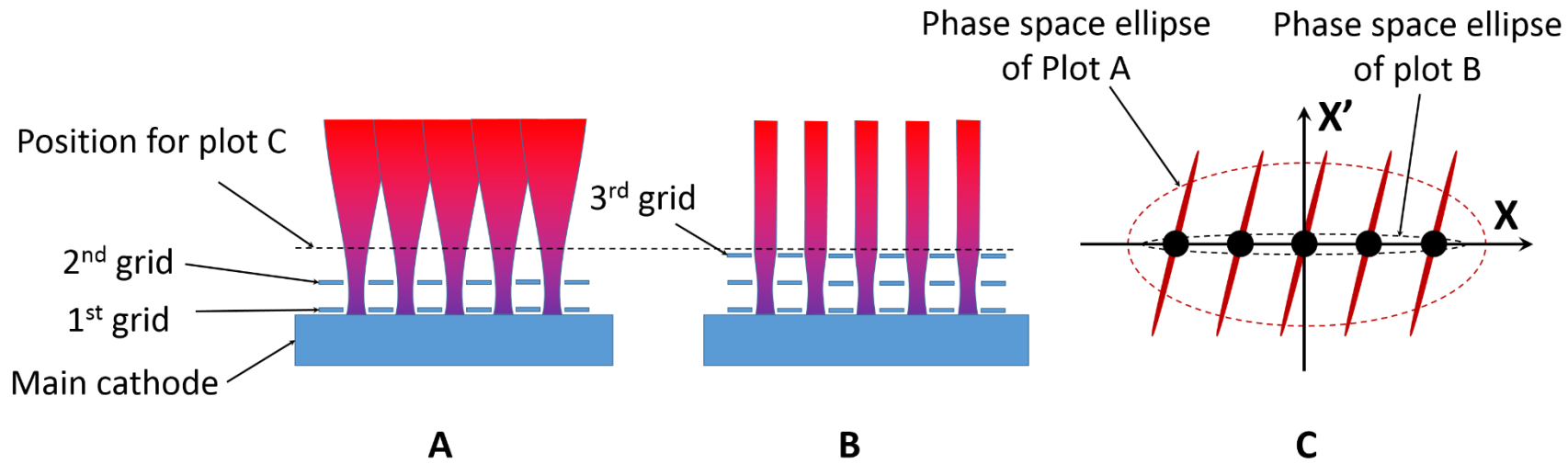


Electric fields with and without an electrically floating thin metal film. **A**) without the film, E_{RF} is the RF field in cavity. **B**) with the film, E_{RF1} (E_{RF2}) is the RF component on left (right) side of the film. **C**) with the film, E_{DC1} (E_{DC2}) is the DC components on left (right) side of the film.

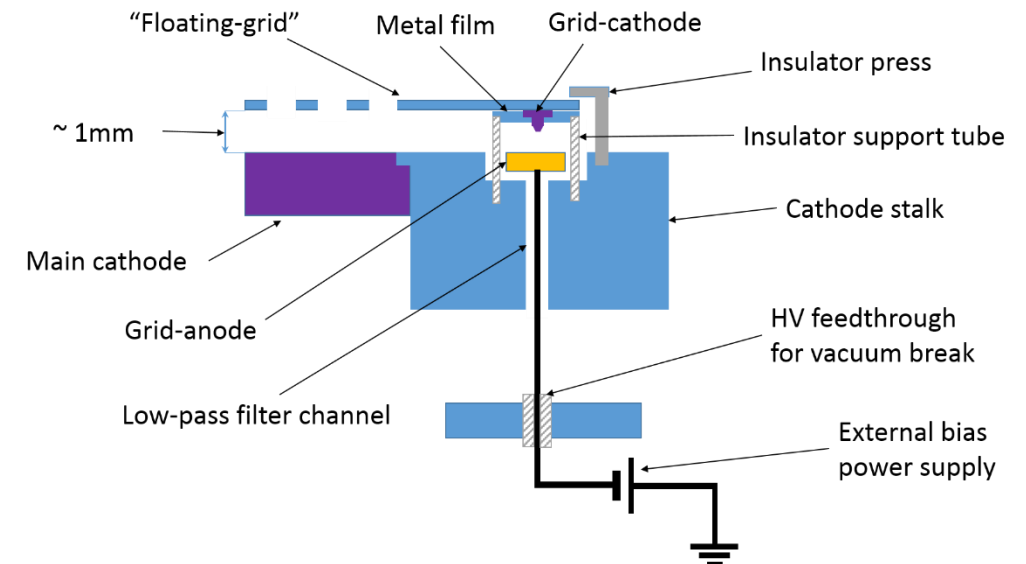
Thermionic cathode
"floating-grid"
structure.

$$E_{Cathode} = E_{RF1} + E_{DC1} \approx E_{RF} + kQ_{Net},$$





A) Beam emission from a system that has a cathode and one floating-grid. **B)** The beam emission from a system that has a cathode and two floating grids. **C)** The phase space corresponding to the beam shown in A), and B). Here, each skew red ellipse represents the phase space of one beamlet as seen in plot A at the indicated location. The dashed red line ellipse is the phase ellipse of the entire beam. Each black circle represents the phase space of one beamlet as seen in plot B; the dashed black line ellipse is the phase ellipse of the entire beam (corresponding to plot B.)



(AWA) to provide

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... e.g. at 325 MHz, or in

... the range of 200- 500 MHz.

Level

...a few MW

* Movie: Field of Dreams