

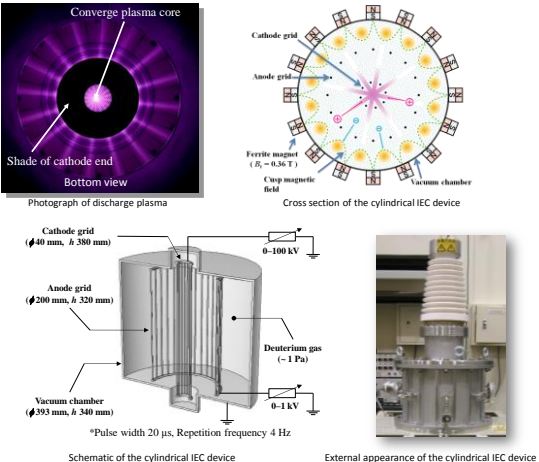
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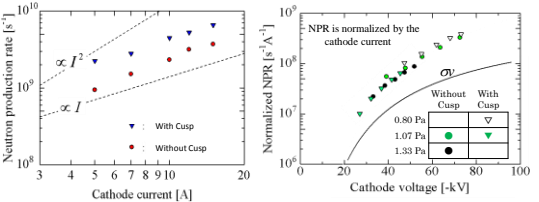
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### Cylindrical IEC device with axial cusp magnetic field

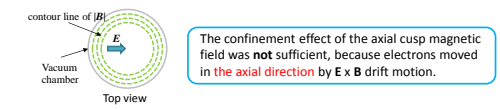
- To reduce pressure  
 The axial cusp magnetic field confined electrons near the chamber wall and ions were produced and accelerated efficiently in a low pressure operation.
- To increase cathode current  
 The high current pulsed operation was attempted.



✓ The pressure, cathode voltage and current can not be controlled independently.

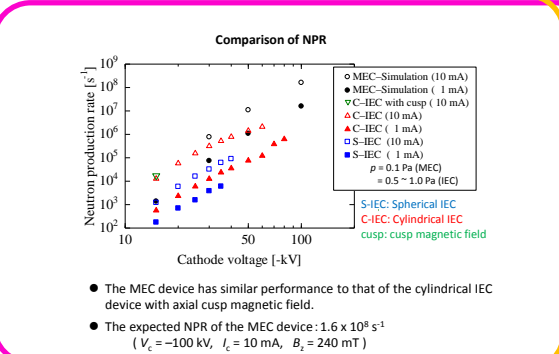


- Beam-cathode, beam-background reaction were dominant.
- The cusp magnetic field and the anode biasing were effective to enhance the NPR.
- The maximum NPR was  $7.4 \times 10^8 s^{-1}$  ( $V_c = -80 kV, I_c = 15 A$ )
- As the pressure decreased, the normalized NPR became high.

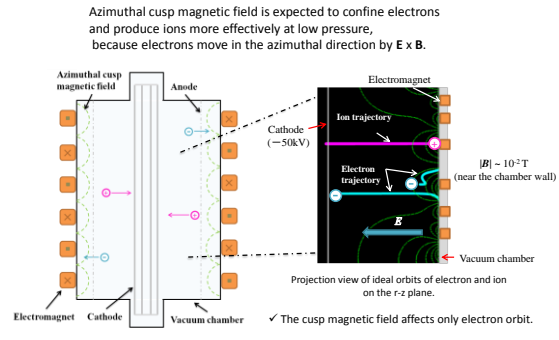


### The ways to improve NPR

- ◆ To increase ion density
  - To increase cathode current **with cusp**
  - To improve ion confinement **MEC**
- ◆ To increase ion energy
  - To reduce pressure **with cusp** **MEC**
  - To increase cathode voltage



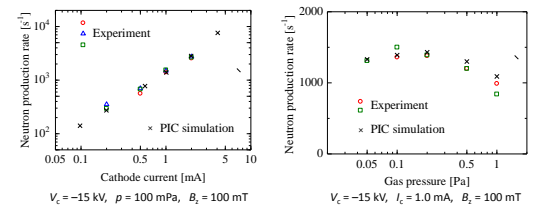
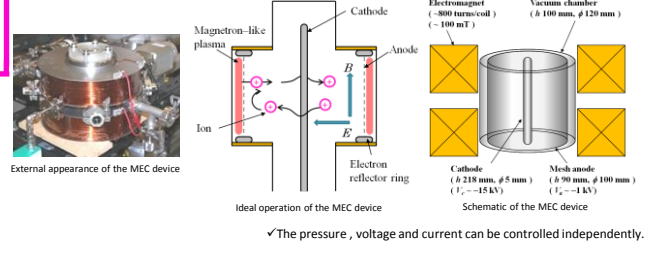
### New trial Azimuthal cusp magnetic field



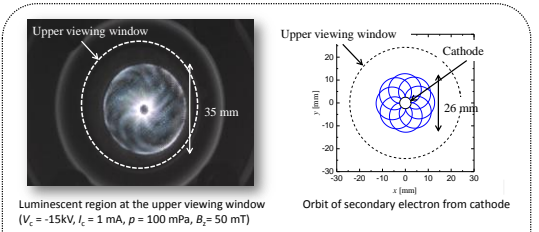
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### MEC (Magnetic-assisted Electrostatic Confinement)

- To increase ion density in a low pressure and low current operation
- To improve ion confinement  
 An axial uniform magnetic field was applied to prevent ions from hitting the central cathode rod.
- Ion source-assisted operation  
 The magnetron motion and electron reflector rings confined electrons near the anode and enhanced ion generation was expected at low pressure. Production of a localized plasma was suppressed near the cathode.



- The maximum NPR was  $2.6 \times 10^8 s^{-1}$  ( $V_c = -15 kV, I_c = 2 mA$ )
- The cathode current was limited by the space charge limitation. ( $V_c = -15 kV \Rightarrow I_c < 4 mA$ )
- Beam-cathode reaction was a dominant fusion type, assuming the deuterium density in the electrodes  $3 \times 10^{23} m^{-3}$  in the PIC simulation.



Ion generation occurred near the cathode, because a lot of secondary electrons were trapped around the cathode by the uniform magnetic field.