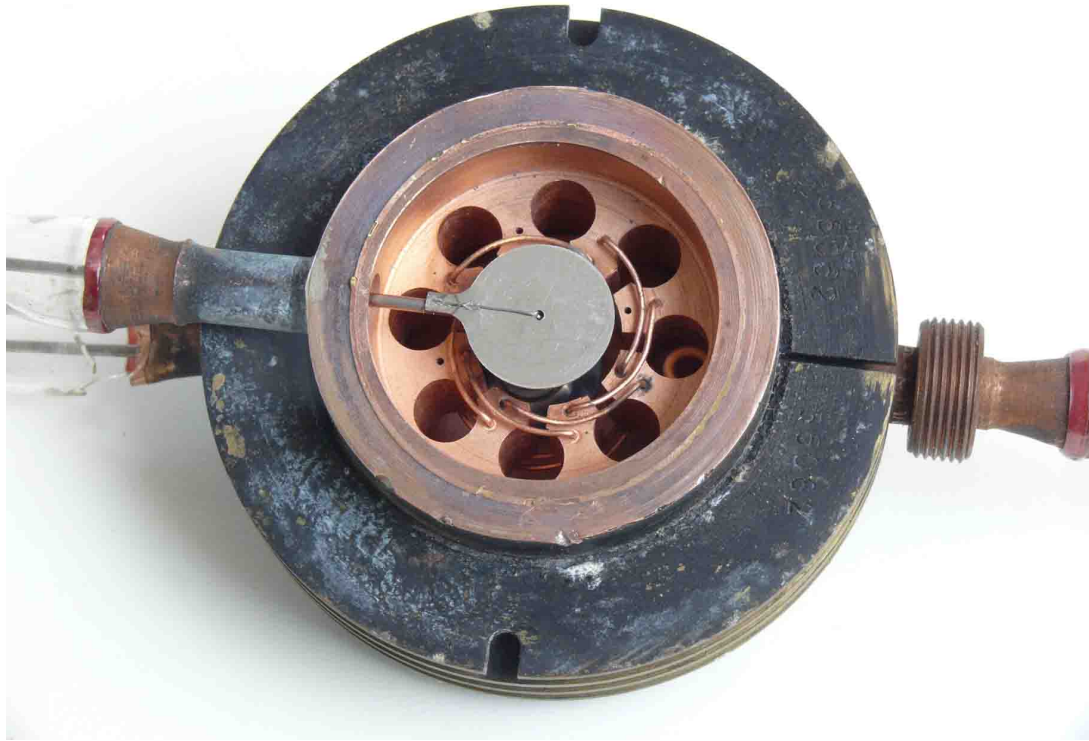


What is this?



- What is it used for?
- How much power does it output?
- When is it used instead of a Klystron?
- Why is a Klystron used instead of it?

- This is a picture of a (old) magnetron.
- The magnetron is used to supply power to the accelerating waveguide.
- Magnetrons are still used in some low energy linacs or on machines in which the entire linac rotates with the gantry (Elekta, Tomo, etc.).
- Klystrons are generally used for higher energy machines (higher peak power output).

Magnetron

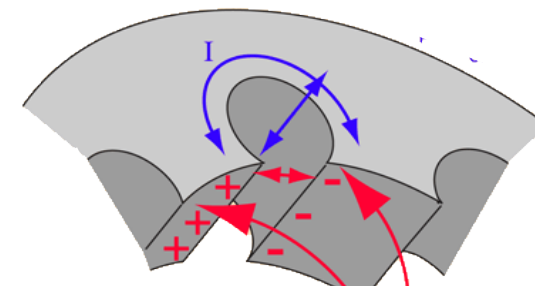
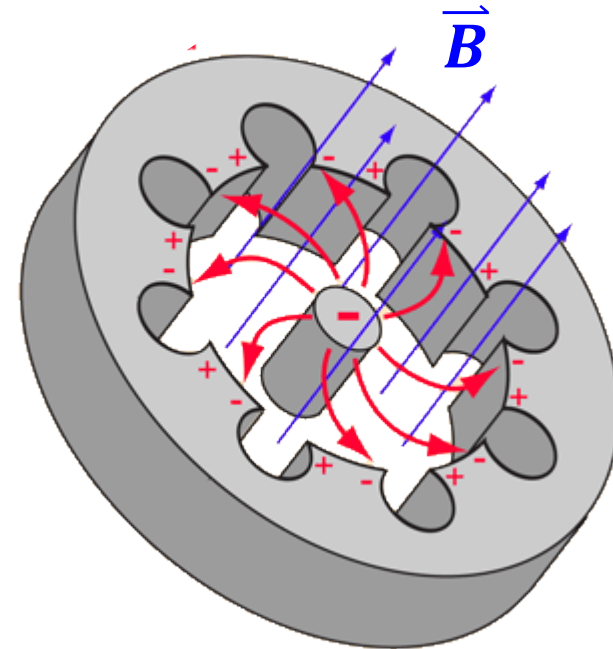


= Microwave generator

- Electrons accelerate from cathode to anode in trajectories curved by the magnetic field
- Resultant oscillating electric fields + magnetic field result in electrons forming space charge spokes

→ High power microwaves (up to ~5 MW)

- Frequency determined by structure dimensions (thermal expansion, sagging)
- Plunger can be used to slightly vary frequency (AFC)



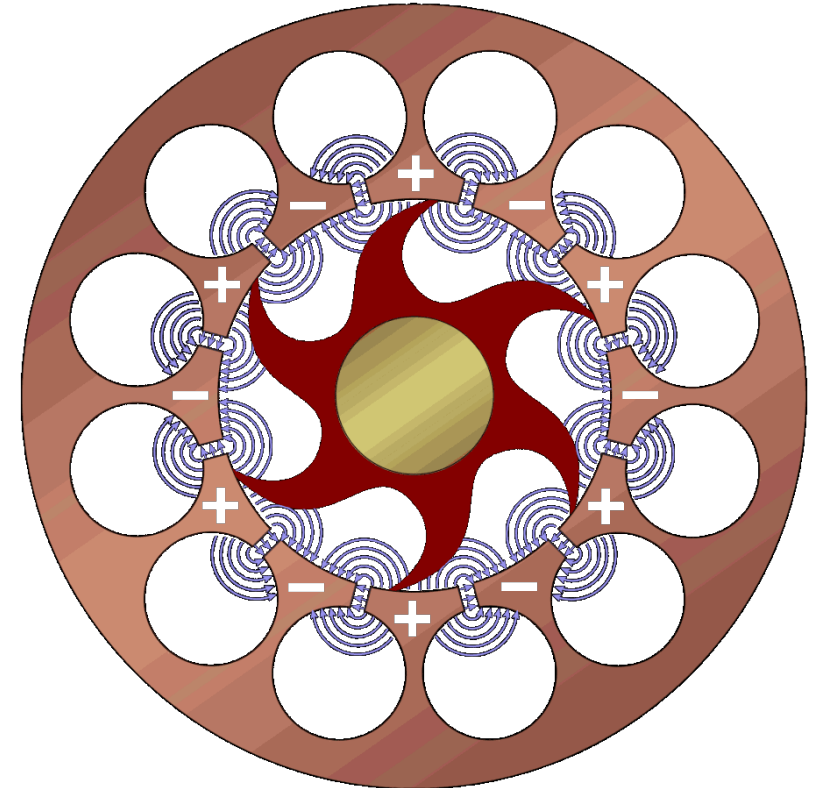
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Magnetron

= Microwave generator



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- Copper anode block with resonant cavities
- Central cylindrical coaxial cathode
 - Thermionic emission of electrons
- Electrons accelerate toward anode, trajectories curved by magnetic field
- Microwave oscillations in cavities caused by currents induced electrostatically by moving electrons
 - Frequency determined by structure dimensions (thermal expansion, sagging)
 - Plunger can be used to slightly vary frequency (AFC)
- Electrons circulate and are bunched due to acceleration/deceleration at oscillating cavity mouths
 - Form space charge clouds like spokes
 - Increases amplitude of oscillations
 - Peak power determined by electron emission and applied voltage (up to 5 MW)
- Coupled to rectangular waveguide (TM mode)

Microwave System Comparison

Magnetron

- Used in lower energy linacs (4-8 MeV)
 - Lower peak power (3-5 MW)
- Smaller
 - Can mount on gantry
- Lower operating voltage (~50 kV)
- Less expensive
- Less stable
- Shorter life

Klystron

- Used in higher energy linacs
 - Higher peak power (5-7 MW)
- Requires RF input
- Larger/Bulkier
 - Must be in gantry stand, requiring rotating joint in waveguide
- Higher operating voltage (~100+ kV)
- Frequency more stable
- Oil tank insulation