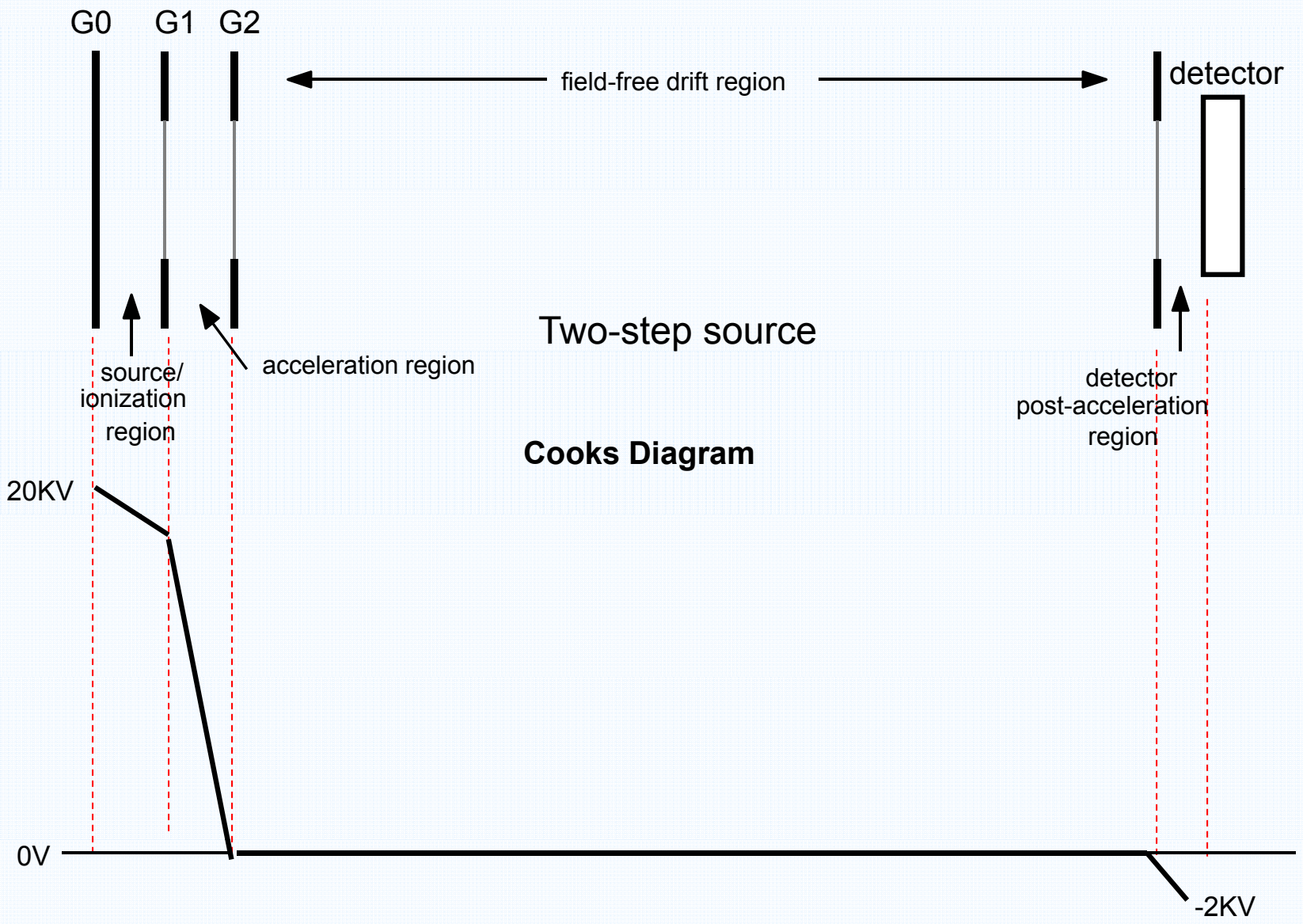
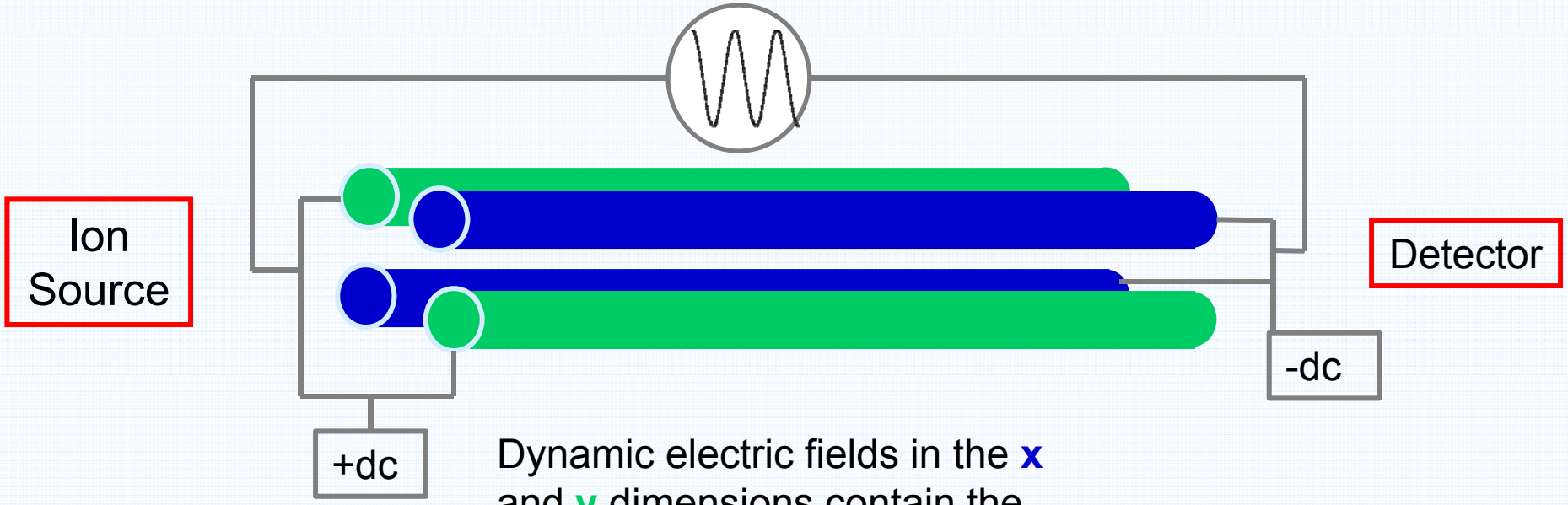
Mass Analyzers

Type	max. m/z	m/Δm	Mass accuracy
Time-of-flight	“Unlimited” (>1,000,000)	500 - 35,000	1 - 500 ppm
Magnetic Sector	5,000 -10,000	500 -100,000	10 - 500 ppm
Quadrupole mass filter	1,000 - 4,000	500 - 2,000	100 - 500 ppm
Quadrupole ion trap	2,000 - 6,000	1000 - 5,000	100 - 500 ppm
Ion Cyclotron Resonance	5,000 -10,000	>10,000,000	0.1 - 5 ppm
Orbitrap	2,000 - 4,000	>200,000	1 - 5 ppm

Linear Time-of-Flight

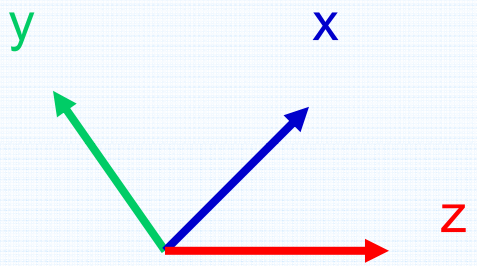


Quadrupole mass filter

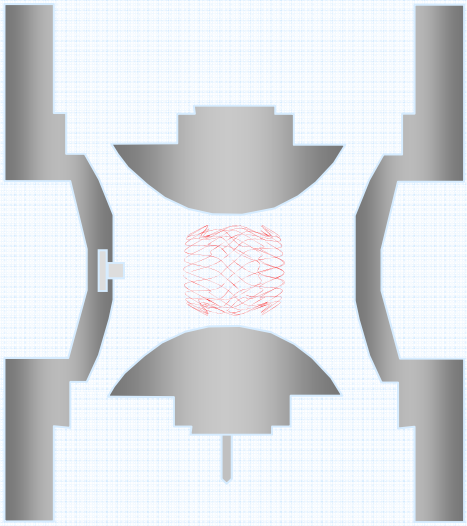


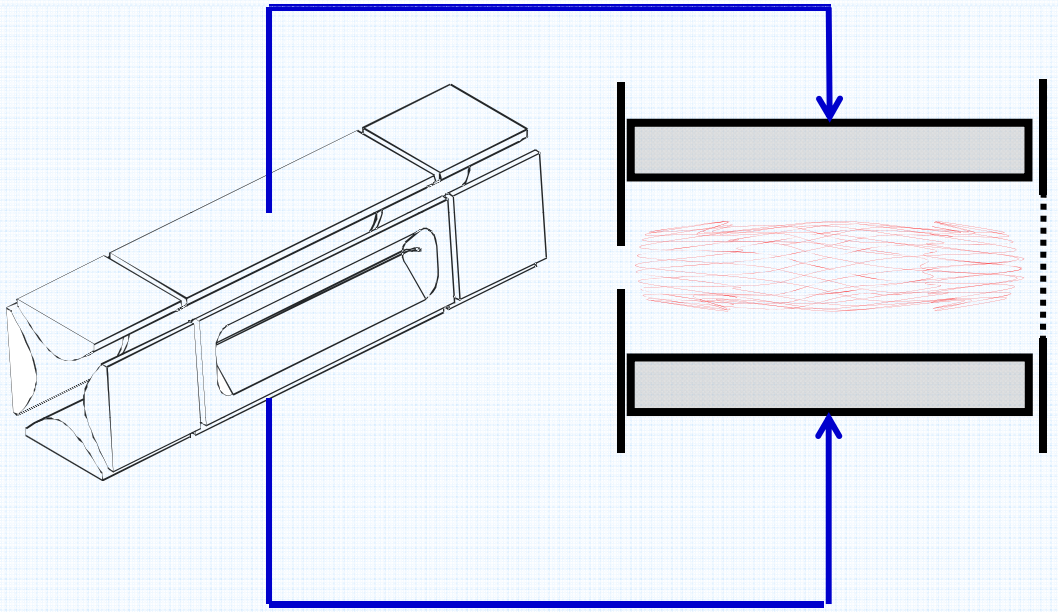
Dynamic electric fields in the **x** and **y** dimensions contain the ions within the rods

Axial (**z** dimension) kinetic energy allows ions to traverse through the rod assembly



Quadrupole ion trap

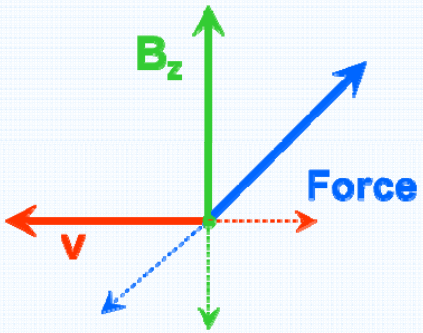




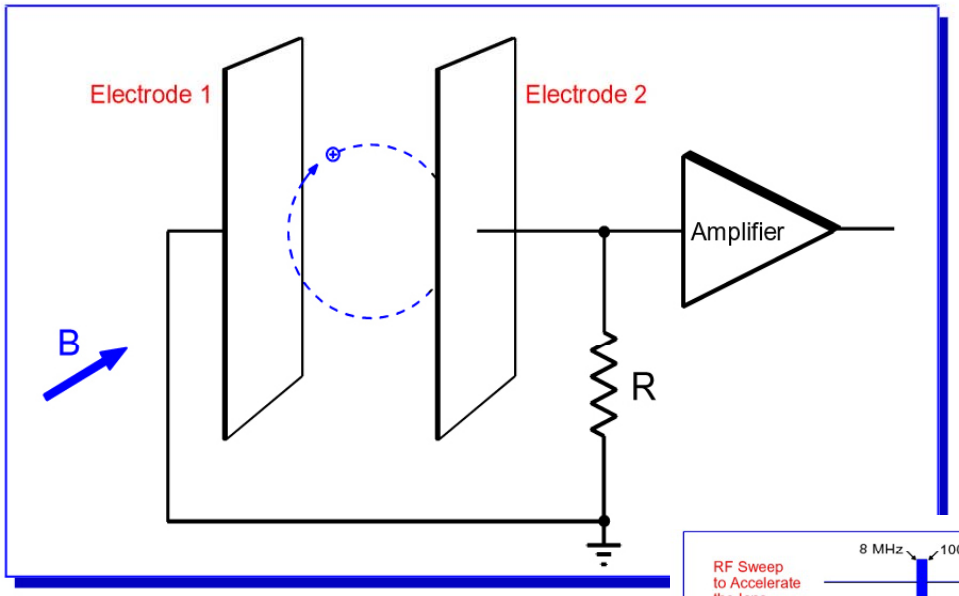
3D Ion Trap: RF voltage applied to ring electrode generates field in 3 dimensions

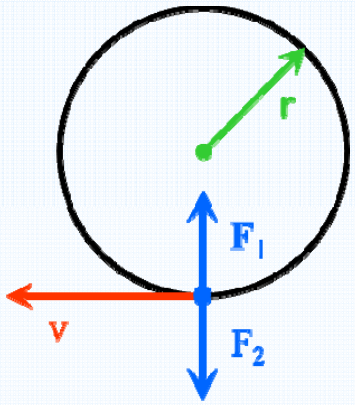
2D Ion Trap: RF voltage applied 180^{o} out of phase to opposing rods of the quadrupole generates field in 2 dimensions. Trapping in the 3rd dimension is achieved with DC voltage on electrodes at the end

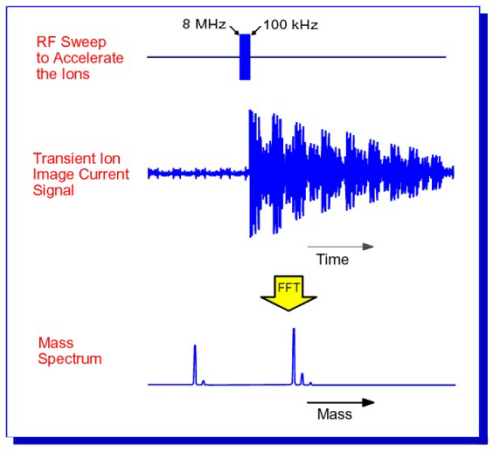
FT-ICR



Force = q v B

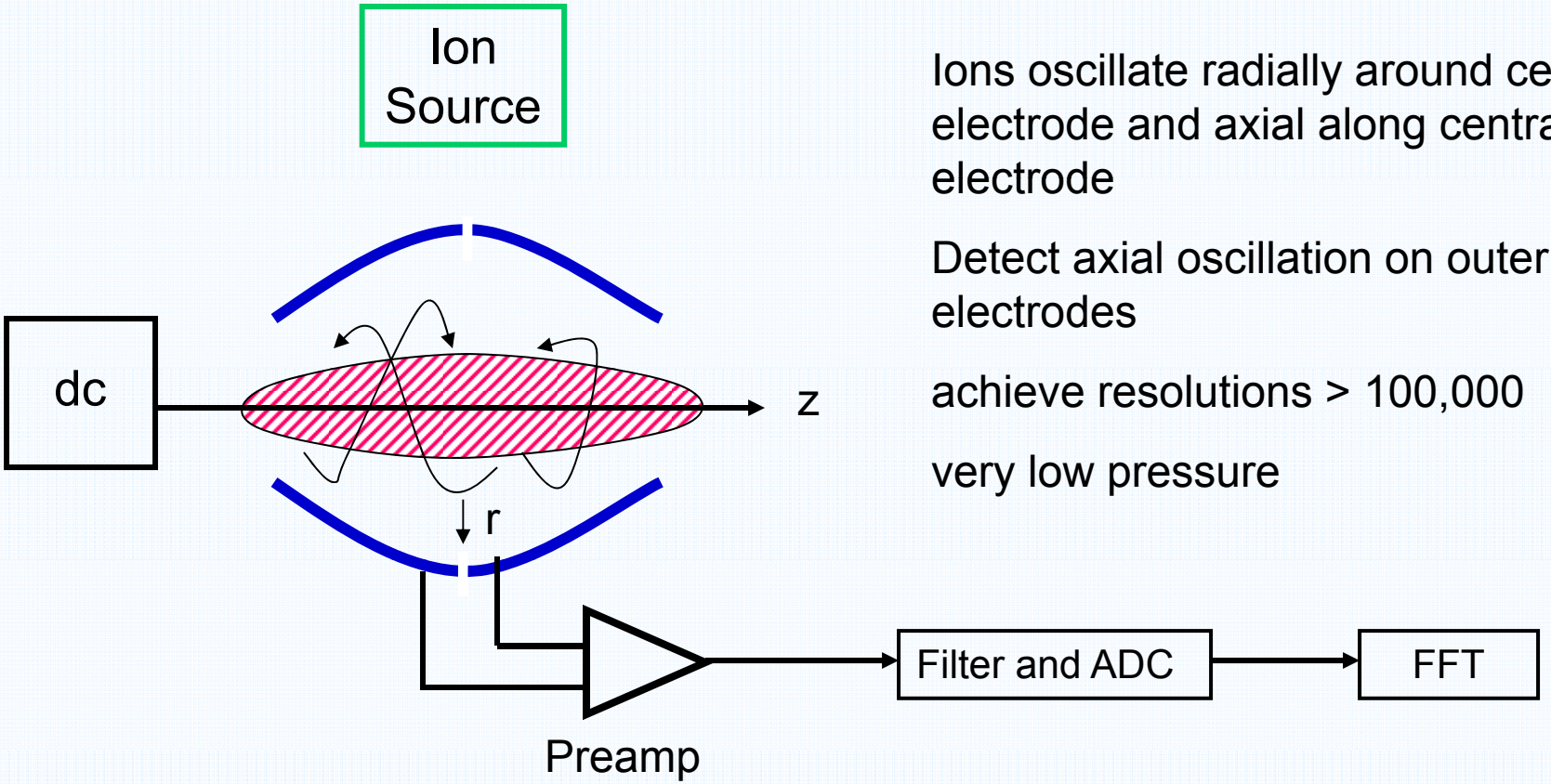






ω = qB/m … a mass spectrometer!

Orbitrap



Ions oscillate radially around central electrode and axial along central electrode

Detect axial oscillation on outer electrodes

achieve resolutions > 100,000

very low pressure

$$\omega_z = (kq/m)^{1/2}$$