

# PROJECT 8

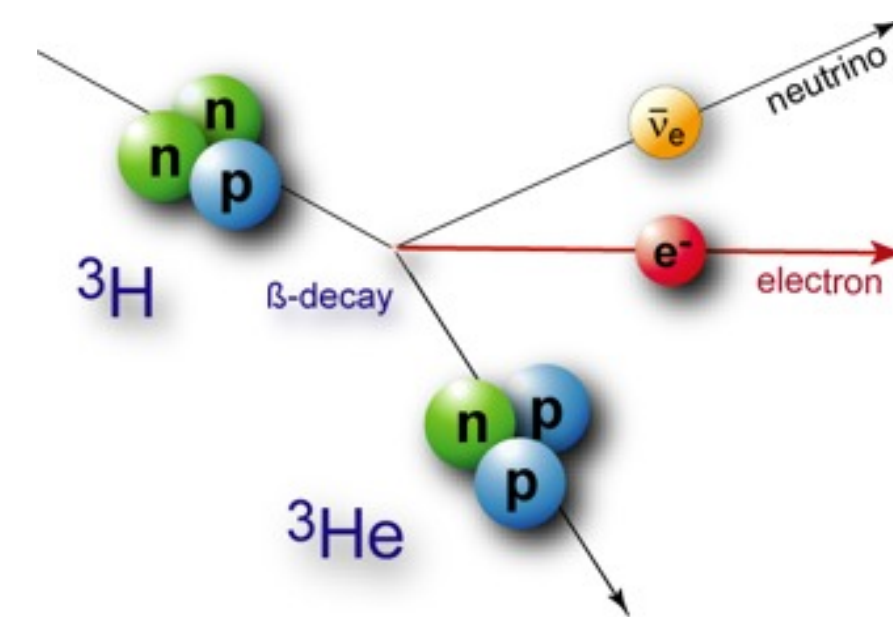
# An Active Radio Frequency Technique for Electron Spectroscopy

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## Beta Decay and Neutrino Mass Measurements

- Are direct (independent of cosmological model, the Majorana or Dirac nature of the neutrino, etc.)
- Require a very precise measurement of the electron energy spectrum near its endpoint

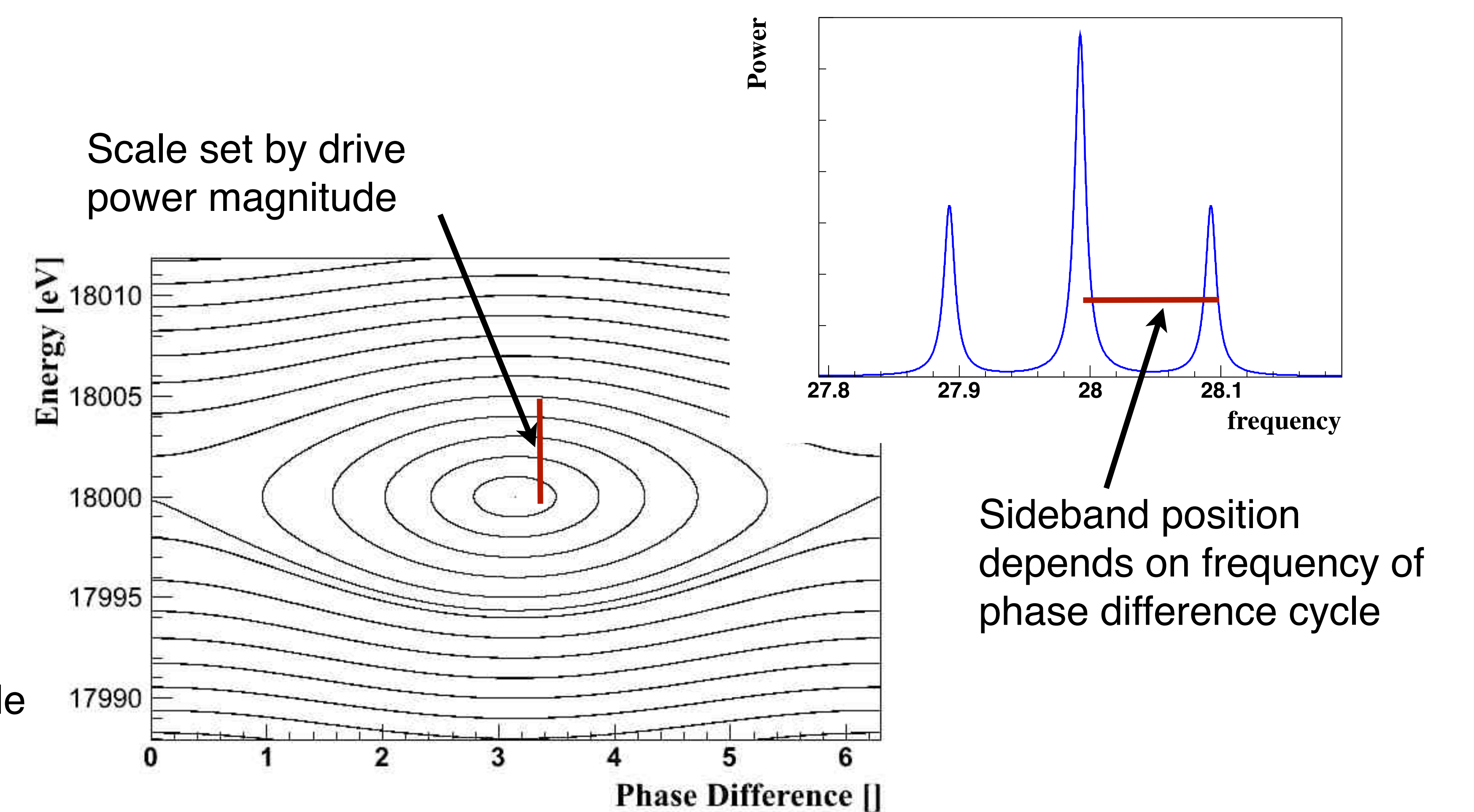
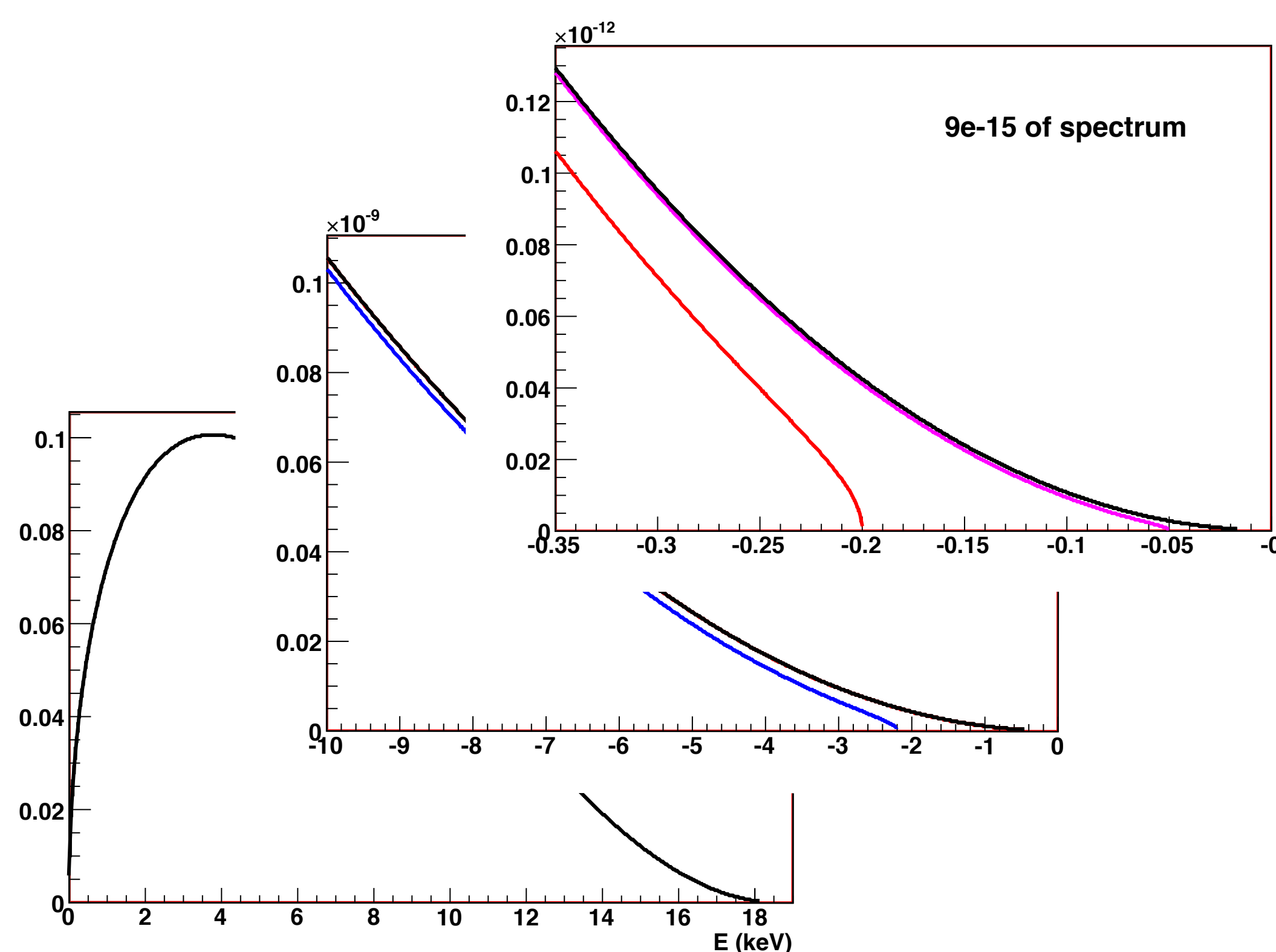


## Can an Active Technique be used in Project 8?

- Passive detection of microwaves has a relatively small signal to noise ratio
- A microwave “probe” beam might interact with the electron, causing absorption/reemission
- The probe beam is perturbed (at high signal-to-noise) when an electron is present. The perturbation is energy-sensitive and has distinguishable frequency and phase properties

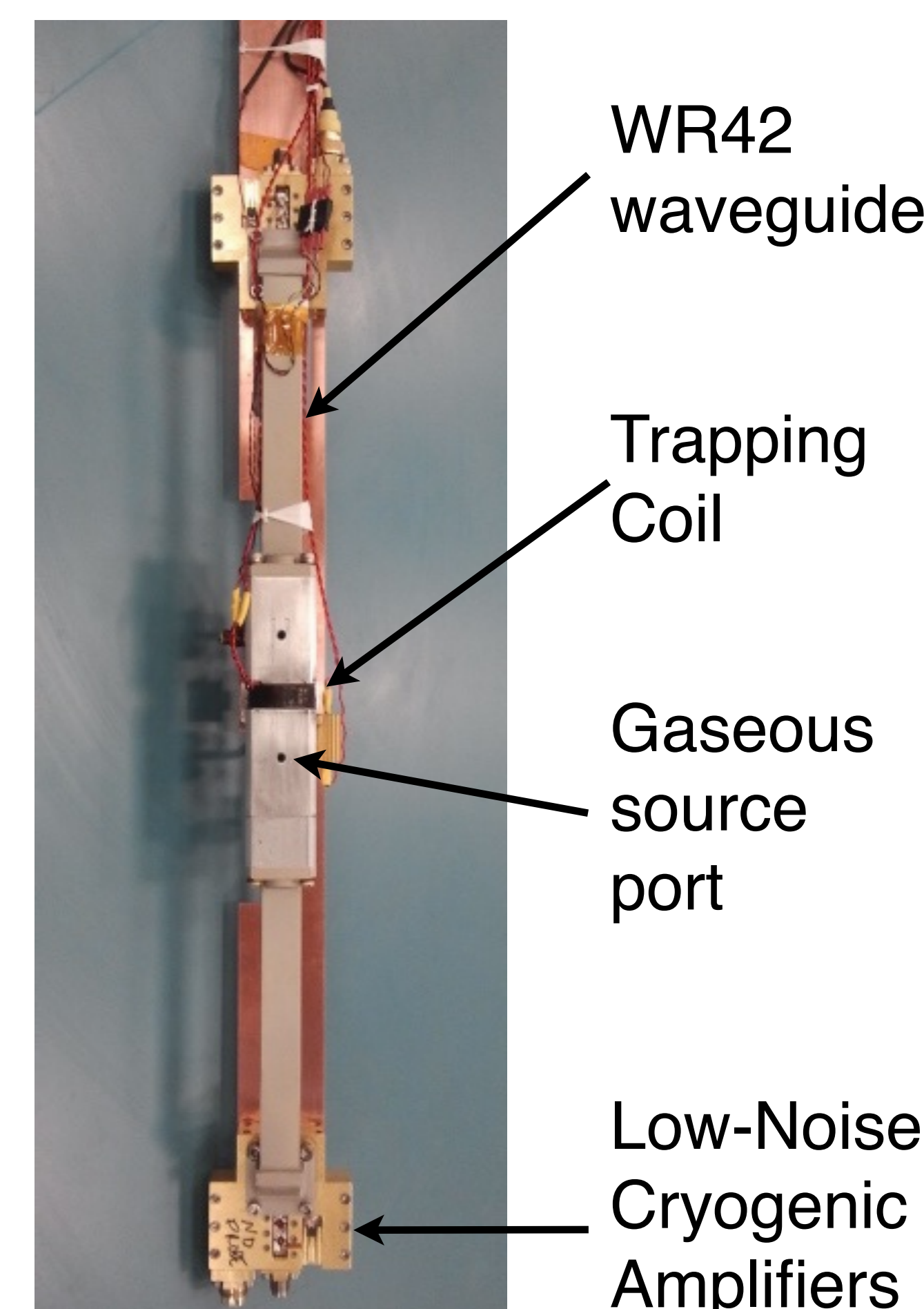
## Electrostatic Spectrometers

- Provide the current direct mass measurement limit (< few eV)
- Should be able to extend that limit to < 0.2 eV in the current generation of experiments
- Are not practical to scale into the last order of magnitude available from lower bounds placed by mixing (> 0.005)



## Project 8

- Traps decay electrons in a strong local magnetic field
- Detects the cyclotron radiation of trapped electrons to determine their energies
- Scaling for greater sensitivity should depend on the amount of source required and not the size of spectrometer needed.
- A prototype is currently being commissioned at the University of Washington (see talk by G. Rybka)



## Expected Limitations

- Background power will come from thermal sources and the shoulder of the injected drive signal
- Increasing the drive power will increase the signal strength but also expands the range of energies which enter closed orbits (ie poorer energy resolution)

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