

INTRODUCTION TO FARADAY CUP DETECTORS

Kimball Physics designs and manufactures a variety of Faraday Cups. The models in the first catalog section are basic Faraday Cups with no moving parts. A number of different types of mechanically or pneumatically actuated Faraday cups are also available; most mount directly on the housing of electron or ion guns, for direct sampling of the beam. The Faraday cups included should be considered as representative samples of the many types that have been made. Consult Kimball Physics Engineering for other possible custom designs.

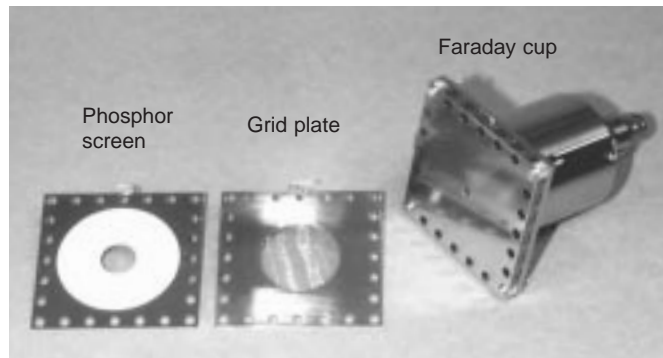
A Faraday cup connected to an ammeter or electrometer is used to collect and measure charged particle current, such as the beam emitted from an electron or ion gun. The Faraday cup consists of a hollow metal cavity, with an appropriately sized aperture for collecting the charged particles on one end. An outer, grounded cylinder provides shielding. An electrical connection conducts the current through the vacuum wall to an ammeter. A Faraday cup can be completely separate from a gun, or it can be part of an assembly mounted to the end of a gun. Most Kimball Physics Faraday cups are UHV compatible and bakeable.

GUN-MOUNTED FARADAY CUPS

Many Kimball Physics Electron and Ion Guns have the option of having a Faraday Cup Assembly mounted directly on the front end of the gun. This Faraday cup can be moved into and out of the beam while the gun is being operated, allowing easy measurement of the beam current actually being produced. A gun-mounted Faraday cup is manipulated remotely using either a manual rotary feedthrough or a computer-controllable pneumatic actuator. The particular style of Faraday cup, its mounting, and the type of control are uniquely designed for each gun model.

OPTIONAL PHOSPHOR SCREENS FOR FARADAY CUPS

A phosphor screen made with high luminosity P22 phosphor (ZnS:Ag) is available as an option on the front plate of many Faraday cup models. The use of a grounded phosphor target screen allows visual, real-time observation of the spot produced by the beam. The phosphor screen emits blue light (photons) when bombarded by high energy particles. The threshold value is approximately 500 eV for electrons and 1000 eV for ions. The screen can be used for gun alignment and to set the proper operating parameters necessary to obtain maximum beam uniformity or desired spot size. Note that excessive current or exposure may cause phosphor screen damage.



A basic stand-alone Faraday Cup (FC-72) with optional Phosphor screen and optional Grids

ENERGY ANALYZING GRIDS ON FARADAY CUPS

Some Kimball Physics Faraday cups are equipped with a set of three grids which allows the cup be used as an energy analyzer. The grids, in the order that the particles pass through them, are: a ground grid, a retarding grid, and a suppression grid.

The ground grid shields the field-free beam region from the retarding grid, and forces the retarding field to be parallel with the beam axis.

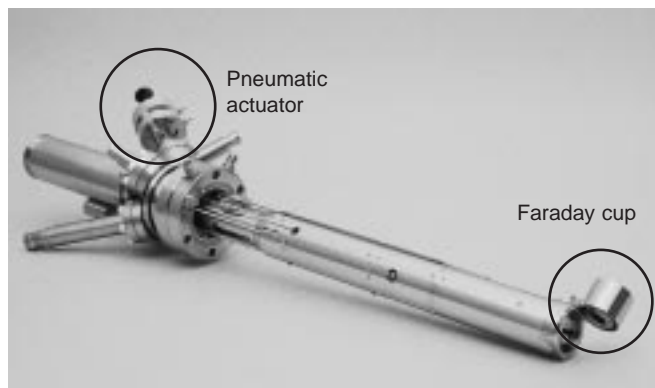
A variable potential is applied to the retarding grid to analyze the energies of electrons or ions. The beam current into the Faraday cup is measured while the retarding grid voltage is swept up to a voltage that completely cuts off the current. The cup current at any given retarding potential represents the current due to particles with kinetic energies greater than that potential. Data, such as that as shown in the graph below, can then be differentiated to yield an energy spectrum.

A small negative voltage (about 10 volts) is applied to the suppression grid to prevent the escape of low energy secondary electrons generated inside the Faraday cup. The suppression grid also reduces capacitive coupling between the retarding grid and the Faraday cup.

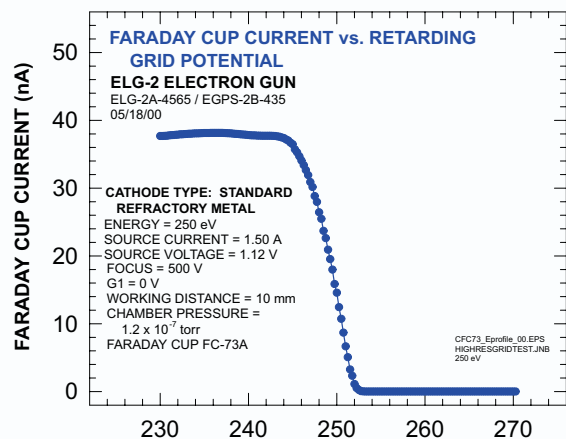
Faraday cups not equipped with suppression grids can be electrically biased with a battery to reduce secondary electron escape.

OTHER FARADAY CUP OPTIONS INCLUDE:

- User changeable Entrance Apertures
- Pneumatic or Mechanical Actuation
- High Power Density (> 10 kW/cm²) / Water-cooling
- Custom designs -- Consult Kimball Physics Engineering



Gun-Mounted Faraday Cup Assembly with Pneumatic Actuator mounted on an EMG-12 Electron Gun



Typical performance; RETARDING POTENTIAL (V) data for guidance only.

It is not necessarily possible to achieve all maximum specifications simultaneously. Specifications Subject to Change Without Notice.