Cool Microcontroller Projects

AC Current Sensor

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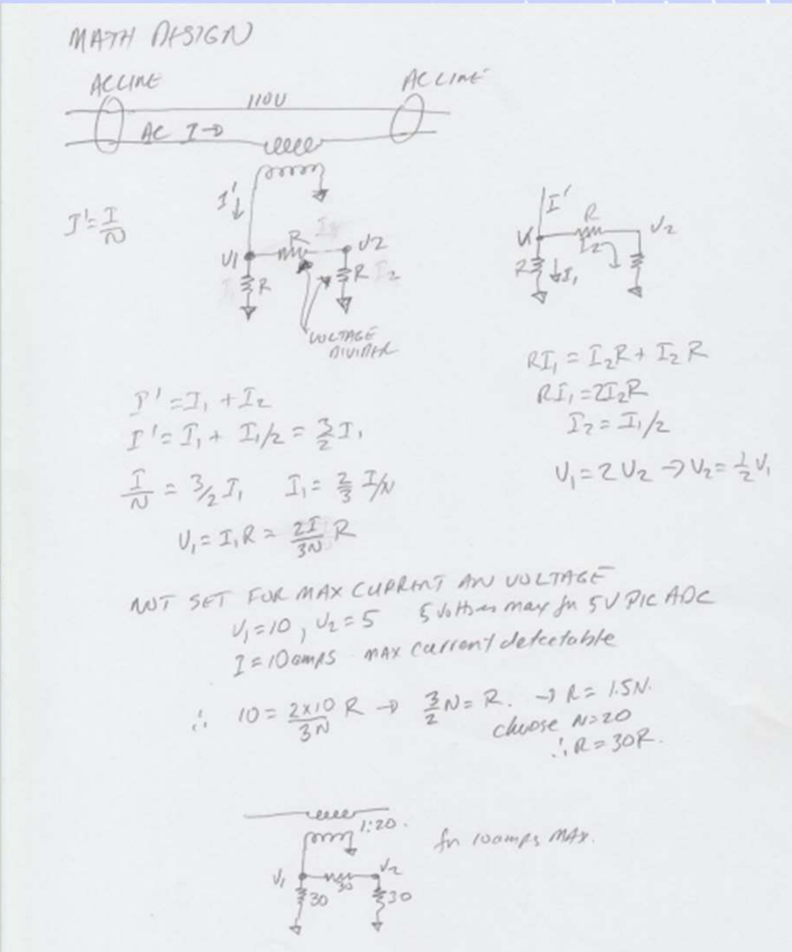
BACKGROUND

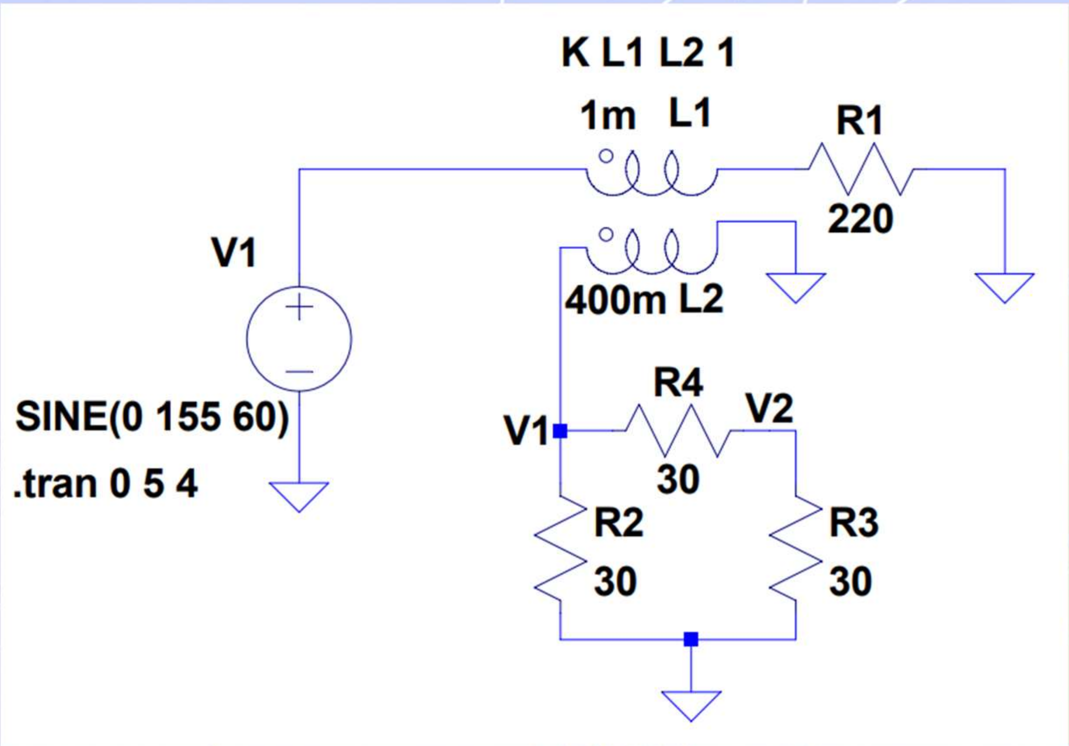
- Renovations to house 2007
- Added a large Shed (underside of deck)
- AC Heater
- Needed to estimate cost for a 110V Portable Heater
- Objective to identify time heater was on and estimate costs based on wattage

Noodling



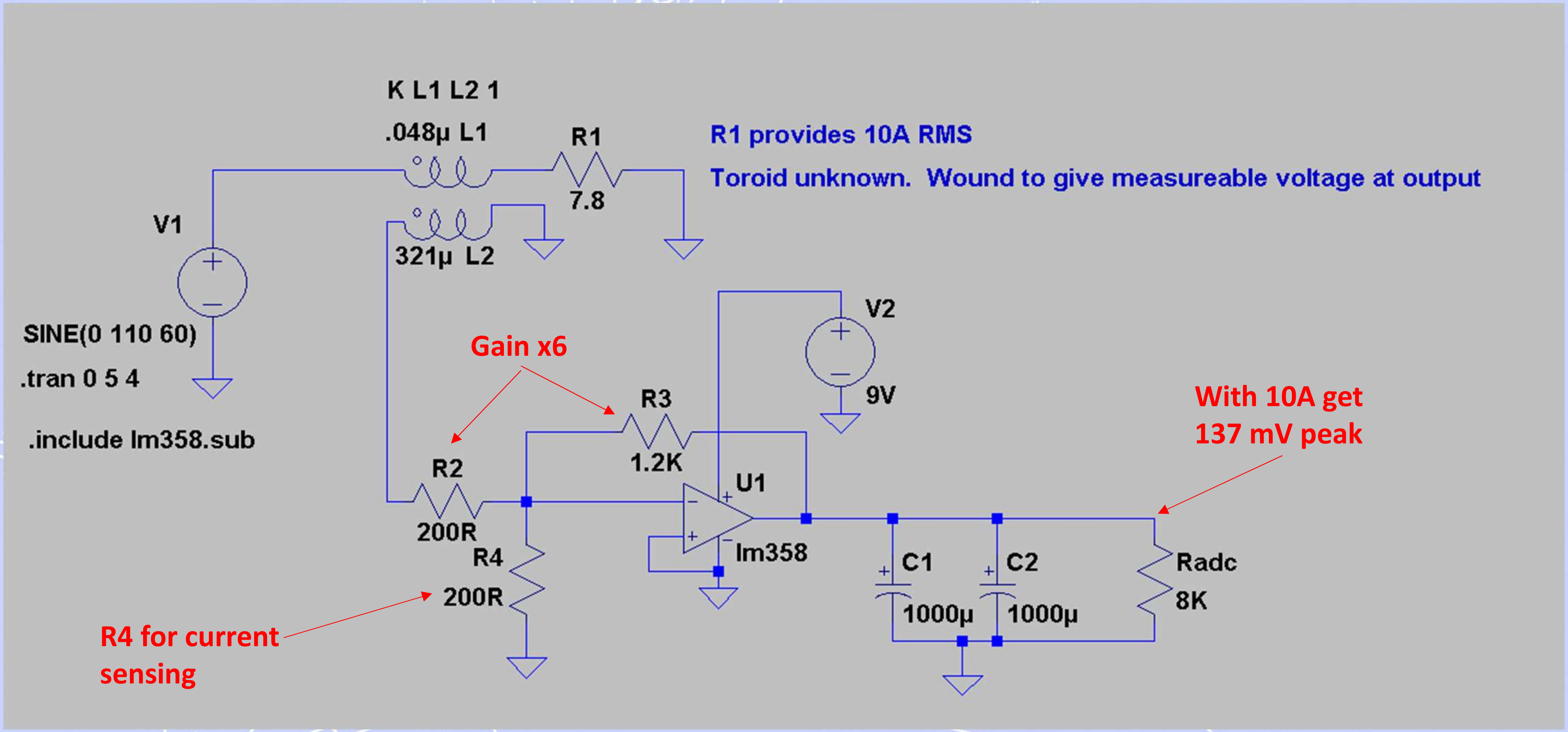
- Use similar technique for a Return Loss Bridge
  - 1 Turn through toroid and secondary pickup
- Detect voltage on pickup with PIC uController (16F88)
- Store how long current was detected

INITIAL CIRCUIT

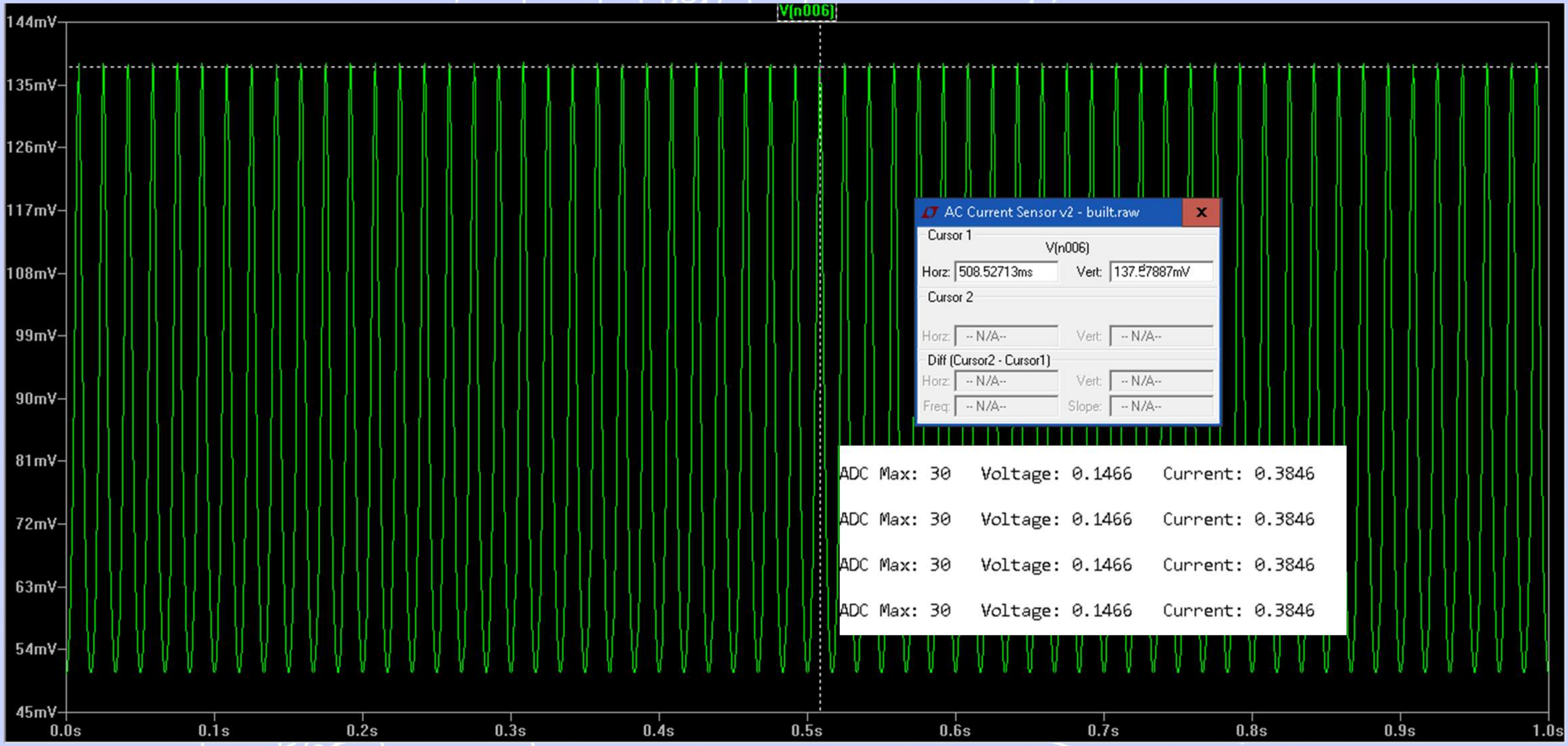


- Didn't have proper toroid for 60 Hz.
- Voltage too low on secondary to detect
- Had to wing it and use an opamp to amplify signal so uController could detect it.

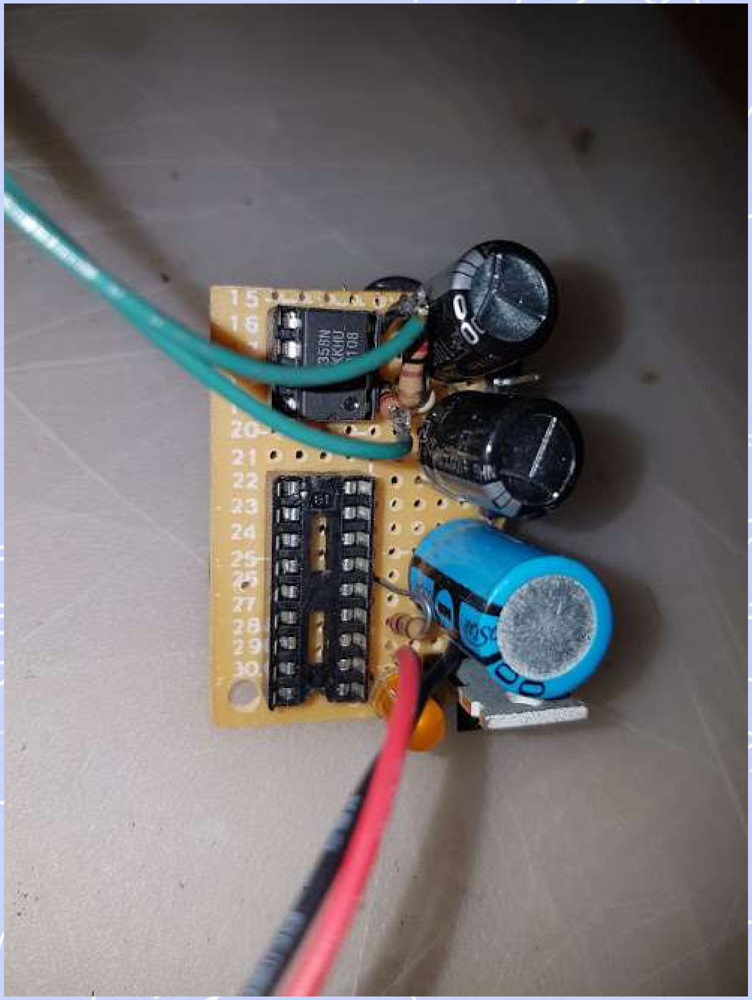
ACTUAL CIRCUIT

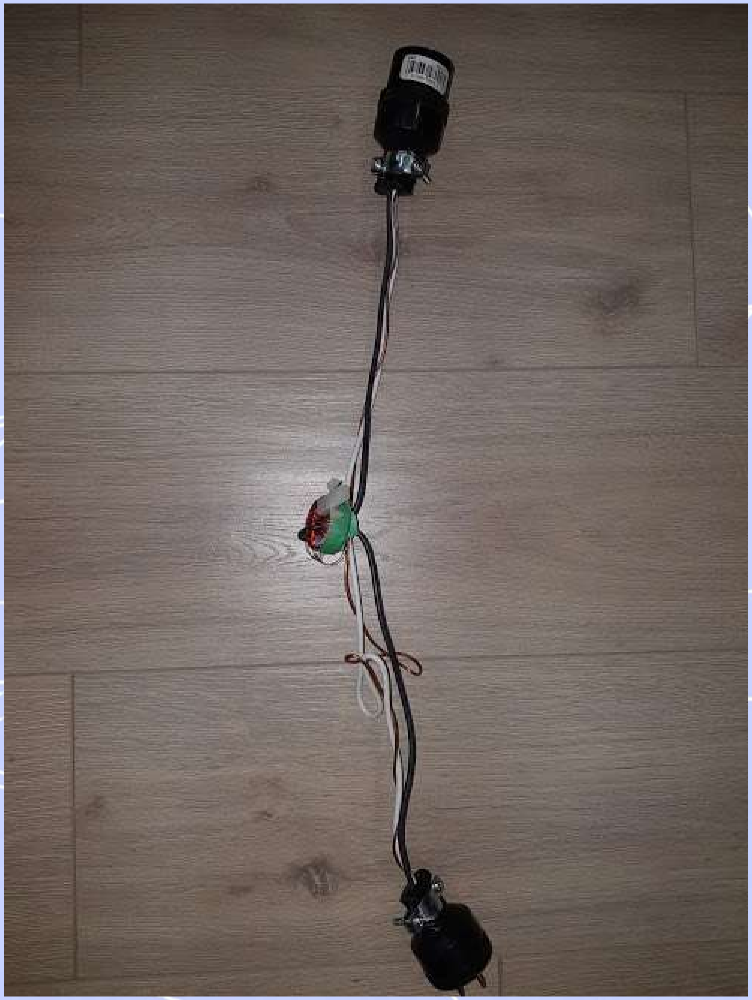


PREDICTED RESULTS



BUILD





SOFTWARE

```
if (vaverage >= VOLTAGE_THRESHOLD) {
    if (!on) {
        sendString ("Off-On\r\n");
        probe.start_minutes = minutes;
        probe.start_hours = hours;
        probe.start_days = days;
        probe.stop_minutes = 0;
        probe.stop_hours = 0;
        probe.stop_days = 0;
    }
    on = 1;
} else {
    if (on) {
        sendString ("On-Off\r\n");
        probe.stop_minutes = minutes;
        probe.stop_hours = hours;
        probe.stop_days = days;
        manageProbeStructure ( EEPROM_WRITE );
        eeaddress += sizeof(probe_measurements);
        i = EEPROM_MAXIMUM_ADDRESS - eeaddress;
        if ( i < sizeof(probe_measurements) ) {
            flags = flags | HALT;
            sendString ("Memory Full - Halting");
        }
        if (flags & DISPLAY_DATA) {
            displayProbeValues ();
        }
        probe.start_minutes = 0;
        probe.start_hours = 0;
        probe.start_days = 0;
        probe.stop_minutes = 0;
        probe.stop_hours = 0;
        probe.stop_days = 0;
    }
    on = 0;
}
```

Voltage is present and heater is ON

First time voltage detected so save start time

Set flag to know heater is ON – i.e. remember its ON

Voltage is NOT present, and heater is OFF

First time voltage detected as off so save stop time

Set flag to know heater is OFF – i.e. remember its OFF

FIN

A **cloud chamber**, also known as a **Wilson cloud chamber**, is a particle detector used for visualizing the passage of ionizing radiation.

A cloud chamber consists of a sealed environment containing a supersaturated vapor of water or alcohol. An energetic charged particle (for example, an alpha or beta particle) interacts with the gaseous mixture by knocking electrons off gas molecules via electrostatic forces during collisions, resulting in a trail of ionized gas particles. The resulting ions act as condensation centers around which a mist-like trail of small droplets form if the gas mixture is at the point of condensation. These droplets are visible as a "cloud" track that persists for several seconds while the droplets fall through the vapor. These tracks have characteristic shapes. For example, an alpha particle track is thick and straight, while an electron track is wispy and shows more evidence of deflections by collisions.

Cloud chambers played a prominent role in experimental particle physics from the 1920s to the 1950s, until the advent of the bubble chamber. In particular, the discoveries of the positron in 1932 (see Fig. 1) and the muon in 1936, both by Carl Anderson (awarded a Nobel Prize in Physics in 1936), used cloud chambers. Discovery of the kaon by George Rochester and Clifford Charles Butler in 1947, also was made using a cloud chamber as the detector.[1] In each case, cosmic rays were the source of ionizing radiation.