

Refraction survey

Here is the details about the refraction survey from the article. All the 3D files have been developed in CREO and are available in the 3D_files directory.

Goals

- Compare our system with the well proven *Geode* from geometrics (first arrivals and complete seismograph)
- Test the custom 3 components sensor package

Integration of the electronics

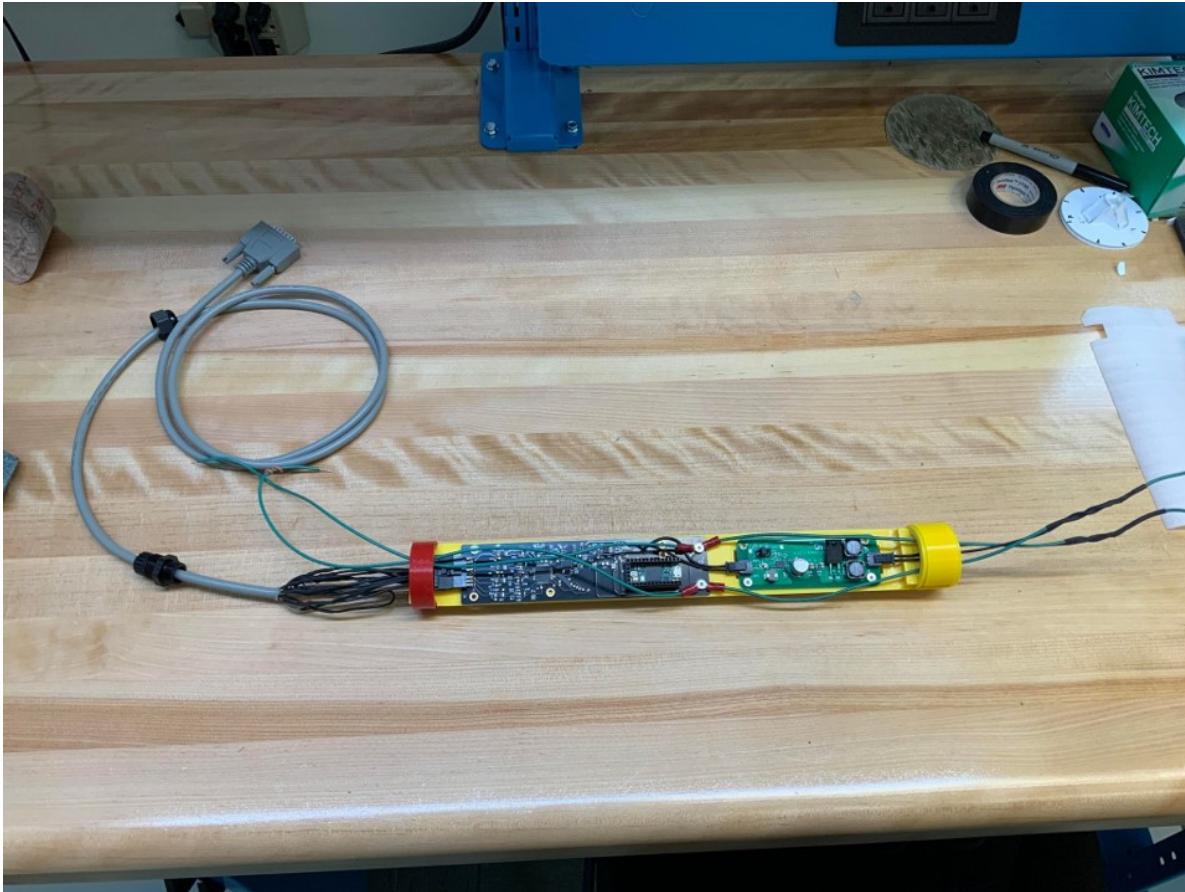
Sensor package

The SI 1521L are soldered on the sensor board and jumper wires are soldered to the PCB. A 3D printed box with tapered insert allow to fix the PCB in an orthogonal arrangement. Every board are connected to a wall mount DB15 connector.



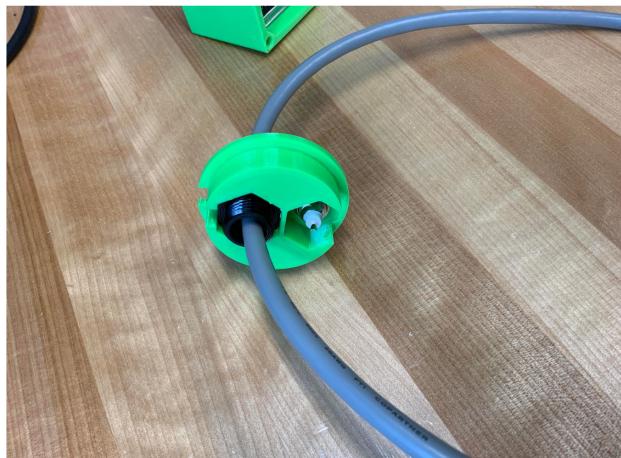
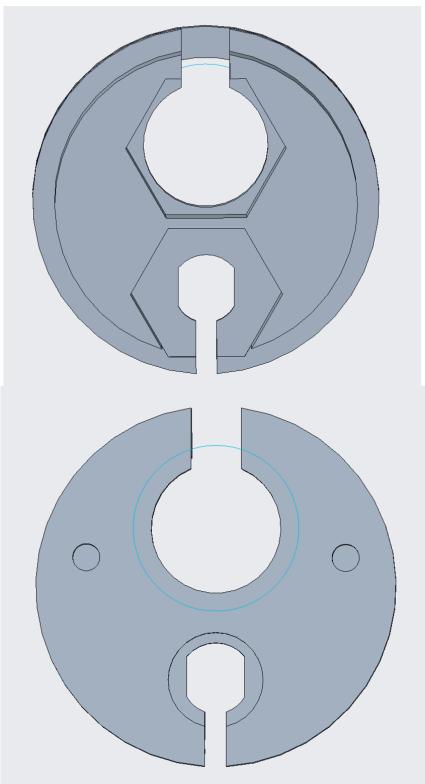
Main board and power supply

The main board and the power supply board were integrated onto an 3D printed frame via screws. On one end of the frame is a custom expander plug mechanism and on the other end a printed TPU (flexible) ring. These allow to slide the frame inside an 2 inch aluminium tube and lock the frame so it doesn't move. A custom cable is assembled based on a DB15 cable. Wires for the sensor package that come from the main board are soldered into the pre-assemble DB15 cable and wrapped around heat-shrink.



End cap

A custom end cap is designed and 3D printed. This cap has some threaded insert so it can be fixed by a screw through the tube wall. These caps have a cavity for a cable gland for the DB15 cable and for the coax wall mount connector.



Master box

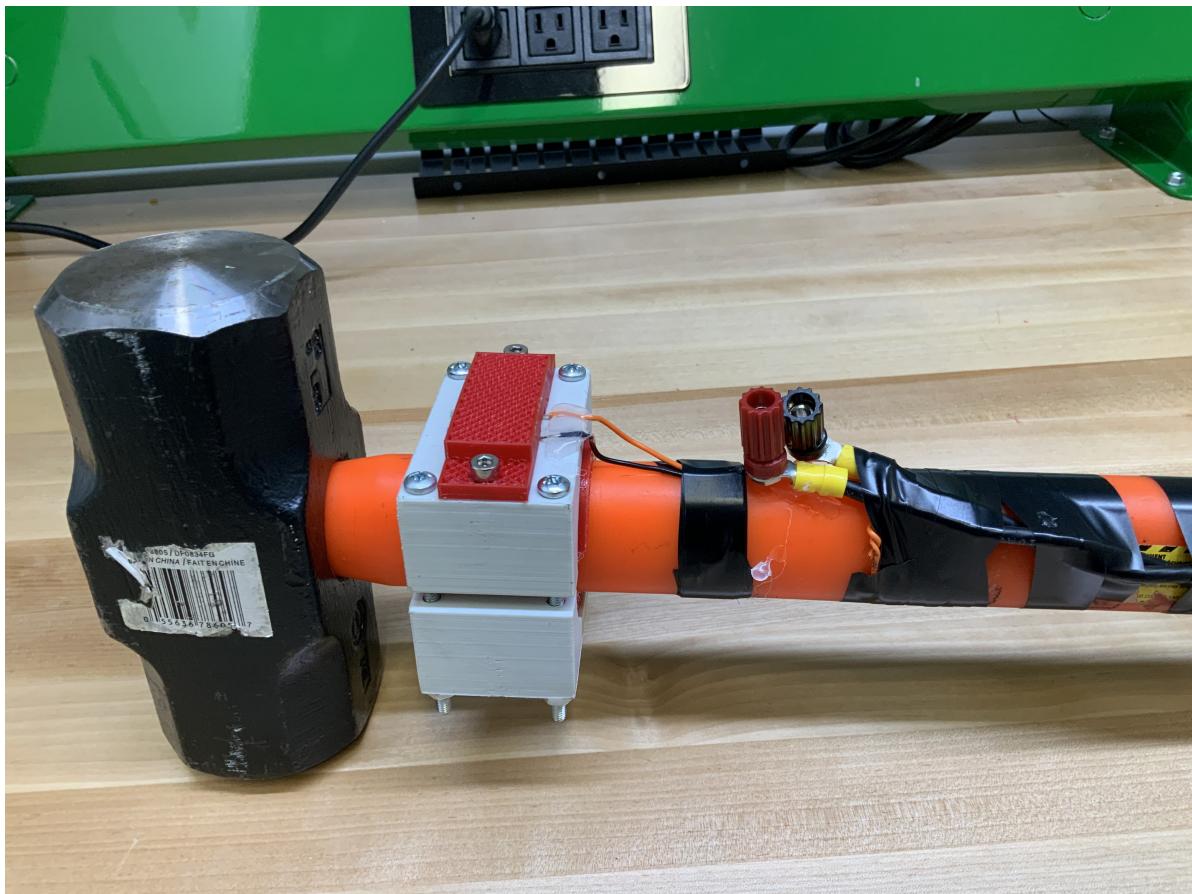
The master unit is bolted into a simple 3D printed box with a removable cover. The box has a wall mount coax connector and a slot to allow the passage of the USB cable. Banana jacks are included to connect the external power supply. Wires for the trigger are accessed from a hole in the box cover.



Custom trigger

A custom trigger system composed of a piezo-electric ([Sparkfun](#)) element is mounted onto a sledgehammer. The mount is 3D printed and is divided in 3 main parts:

- 2 pieces clamp in rigid plastic (CPE)
- 2 half-circle TPU ring that provides damping and reduce stress on the CPE plastic
- 1 TPU top cap to keep the piezo in place



Material used

- Voltage source (HMP4040 from Rhode and Schwarz)
- Generator to power the voltage source

- Laptop with the custom software for the tool
- Sledgehammer and metal plate
- Measuring tape
- Geode from geometrics and associated cables
- Laptop with proper geometrics software
- 12 V battery
- Geophones (ION 28 Hz)

Geometry

See images in the article.

Data

Raw data are stored in .txt files and are available on request.