Construction of the Balloon Project

SCIPP Interns

Project Objectives

- Design and build a relatively simple detector
- Weigh less then 5 kg
- Collect Muon count rate data at altitude

Challenges

- Weight limit to fit on balloon
- Data transmission/storage
- Physical structure
- Getting counts to get significant data

Weight

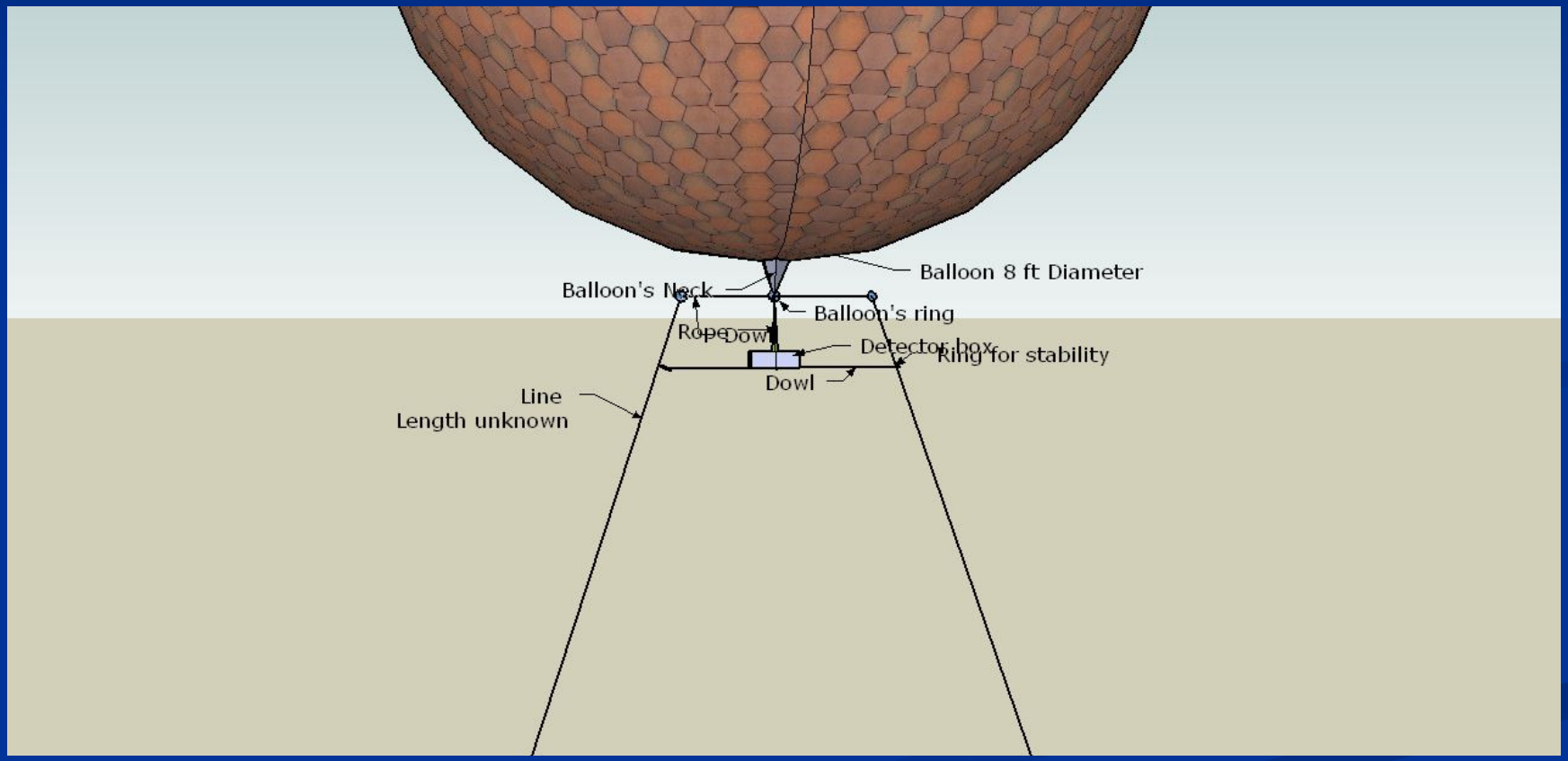
- FCC requirements
  - Balloon must be under 6 feet in diameter
  - Payload must be less then 5kg

Objects

- Scintillator Panels with PMTs and basses- 1kg
- Balloon-.3kg
- Quarknet Board-.3kg
- Line-1kg
- Physical structure-1.5 kg
- Batteries-.15 kg
- Extra lift- .5kg

- Total weight: 4.75kg

Original Design



Specifications

- One Scintillator panel with two PMTs
- Two Xbee wireless Transmitter/receivers to transmit live data to the ground
- Battery with power supply board
- Lightweight box made of balsa wood

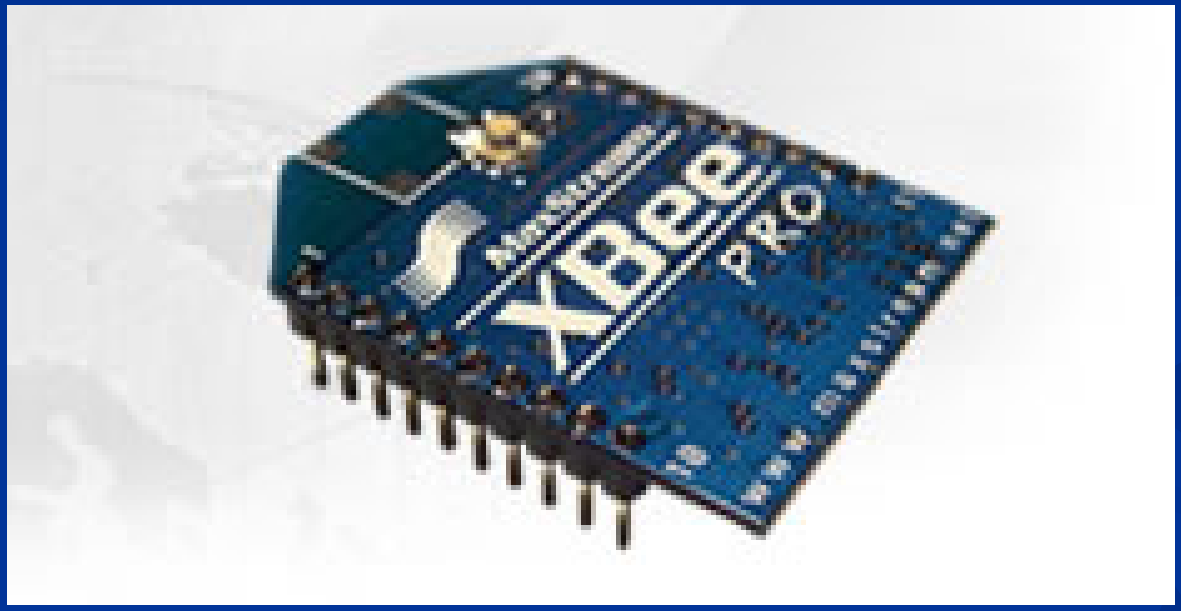
Scintillator Panel

- One ¼ Panel
- 35cm*35cm square
- Two PMTs attached to apposing corners to reduce noise.

Wireless Transmitter

- Requirements:
  - Must transmit at least 1000ft
  - Must be small and light weight
  - Must have low power consumption

Solution?

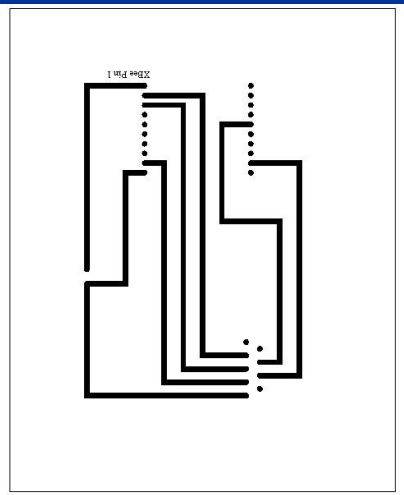


Special Operation Requirements of Xbee

- Needed a special circuit
- Needed non standard headers to connect to board
- Solution:
  - Build our own board

Etching PC Boards

1. Layout traces on computer
2. Print traces to glossy photo paper
3. Iron on traces to copper clad board
4. Etch off copper with FeCl2 acid solution
5. Rinse board and clean off ink



Problems Using the Xbee

- Needed a Complex culture to properly communicate with the computer

Solution:

- Use a Basic Stamp as a Data logger

Basic Stamp Data Logger

- Function
  - Basic stamp is in sleep mode at launch
  - After 15 min. Stamp turns on and sends signal to board to start counting
  - After an experiment is finished, the stamp reads the count data from the quarknet board and goes into sleep mode.
  - On the ground the data is read out on a computer.

Power

- Power requirements
  - Xbee transmitter – 3.3v at 215mA
  - Each PMT – 8v at 20mA
  - Quarknet board – 5v at 800mA
- Total of 1075mA

Battery

- Must be light
- Must provide at least 8v
- Must have at least 2000mAh rating

Solution

- 3 cell Li-ion battery at 11.1v
- We found a battery with:
  - 11.1v
  - 2200mAh
  - Weight of .15kg

Power Supply board

- Made from scratch
- Uses:
  - 2 NTE 964 positive 8v voltage regulators
  - 1 NTE 960 positive 5v voltage regulator
  - 1 TI 5cc85r9 positive 3.3v voltage regulator
- All of the components have T022o Packaging and can handle 1A each

BOX

- Requirements
  - Must be light
  - Must be sturdy enough to protect scintillator
  - Must enclose PMT bases
  - Must hold all electronics

Quarknet Board

- Uses:
  - Counts solo and coincidence data from the scintillator
  - Discriminates signal
  - Sends data through a serial port to Computer/Transmitter/Data Logger

Problems with Quarknet board

- Power supply malfunction burnt capacitor.
- Board was rendered useless for the balloon project

Solutions

- Use the ccrt Board
  - Add coaxle cables to LED output on CCRD board
  - Use FPGA to read signal from LEDs and count coincidences and display counts.