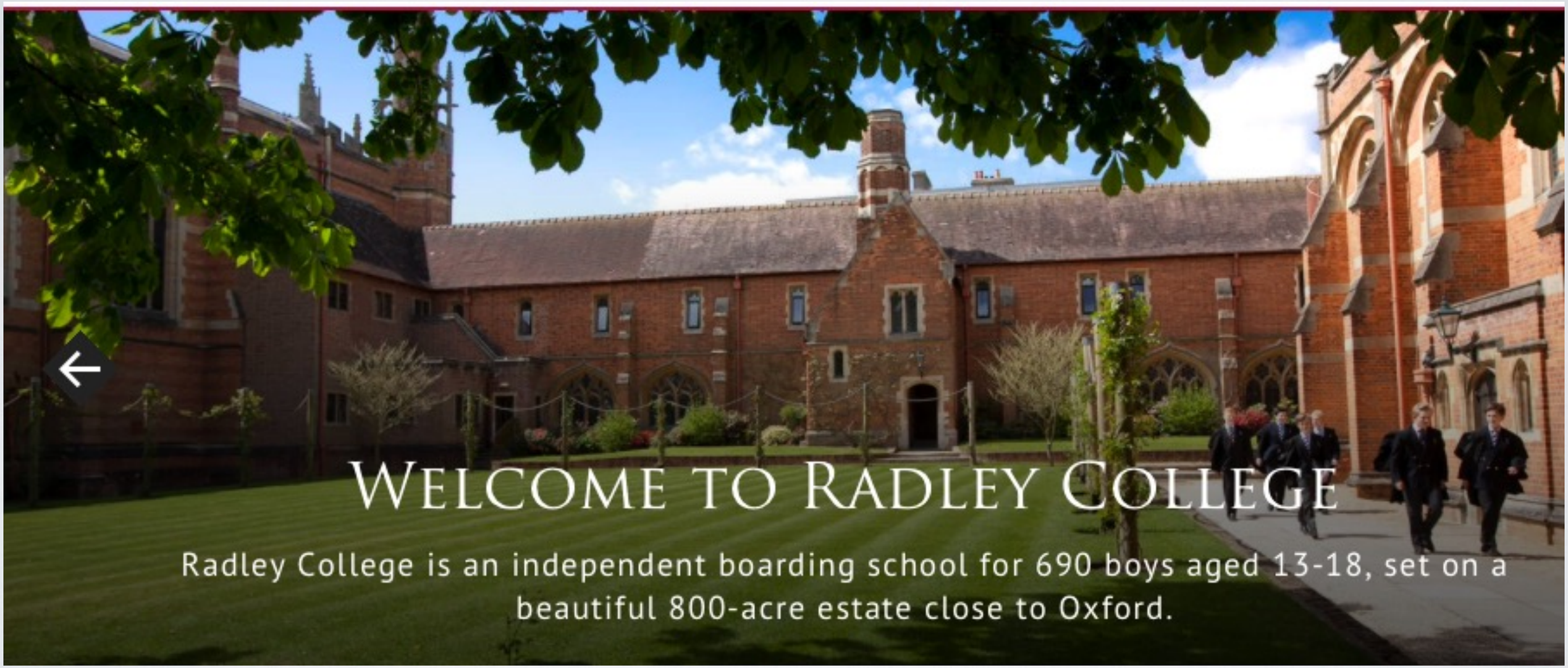
SEARCHING FOR COSMIC RAYS

Reflections on the Cosmic Ray e-lab experience in a UK High School

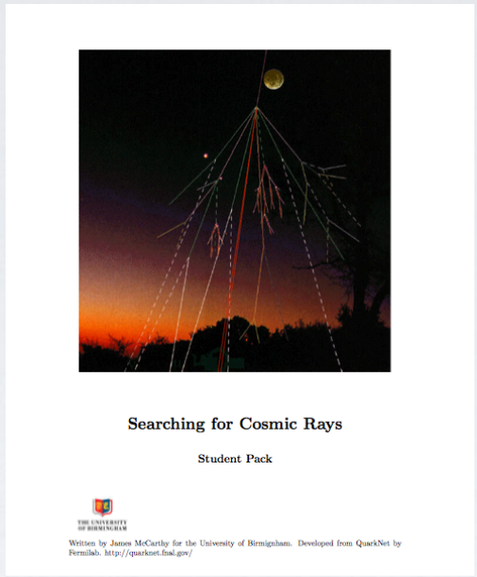
RADLEY

RADLEY COLLEGE

4 miles outside Oxford



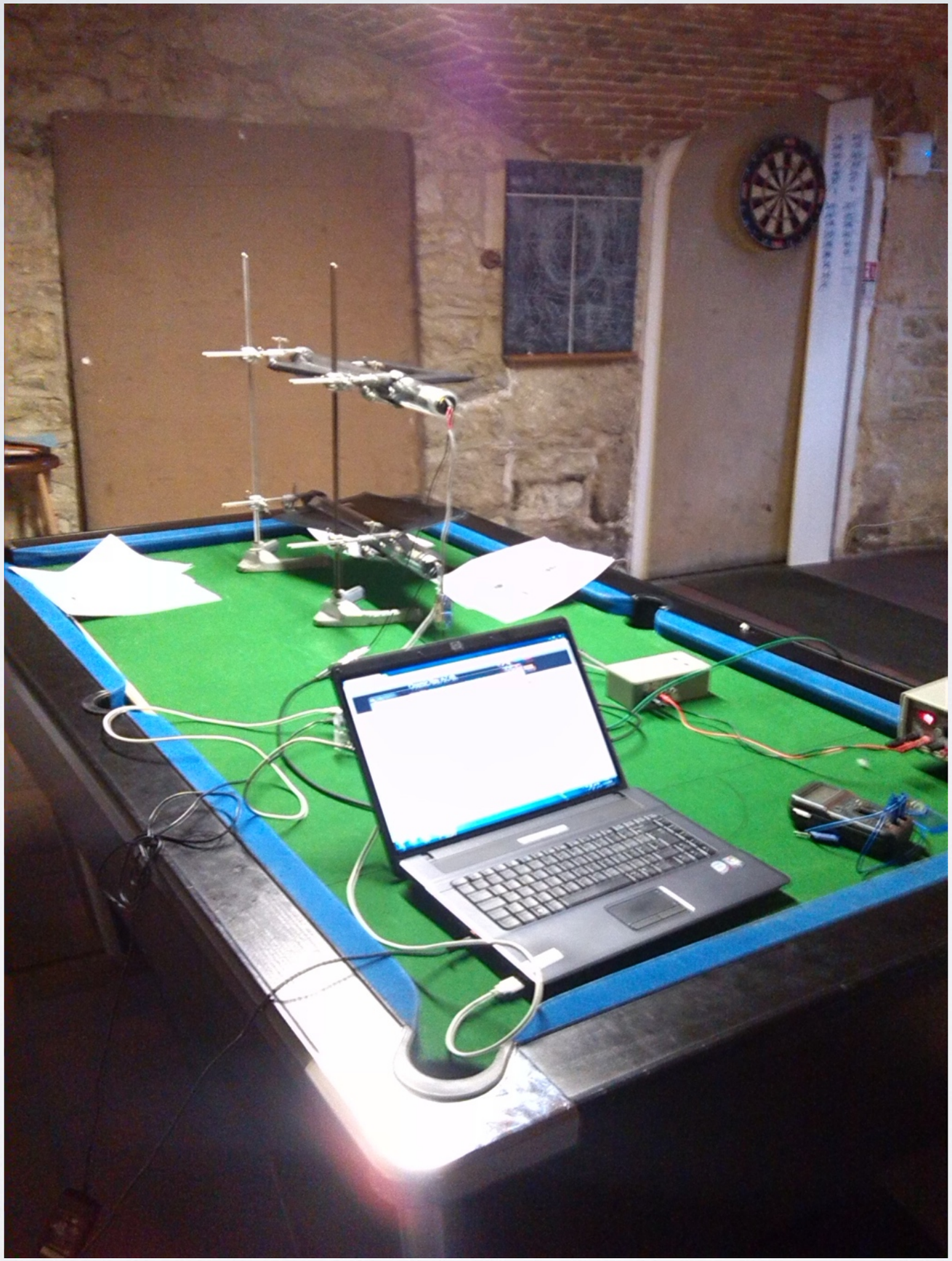
THE COSMIC RAY PROJECT



- January - March for the last 4 years
- 2 hours once a week after lessons on a Wednesday for about 10 sessions plus some other times that suit the students.
- Usually about six year 12 students studying Physics A level
- Culminates in a presentation at an International Student Science Conference

AN OUTLINE SCHEDULE

- Intro to cosmic rays & the project
- Setting up the detectors



AN OUTLINE SCHEDULE

- Intro to cosmic rays & the project
- Setting up the detectors
- Plateauing the detectors

Two of the students from the 2017 group plateauing the detectors

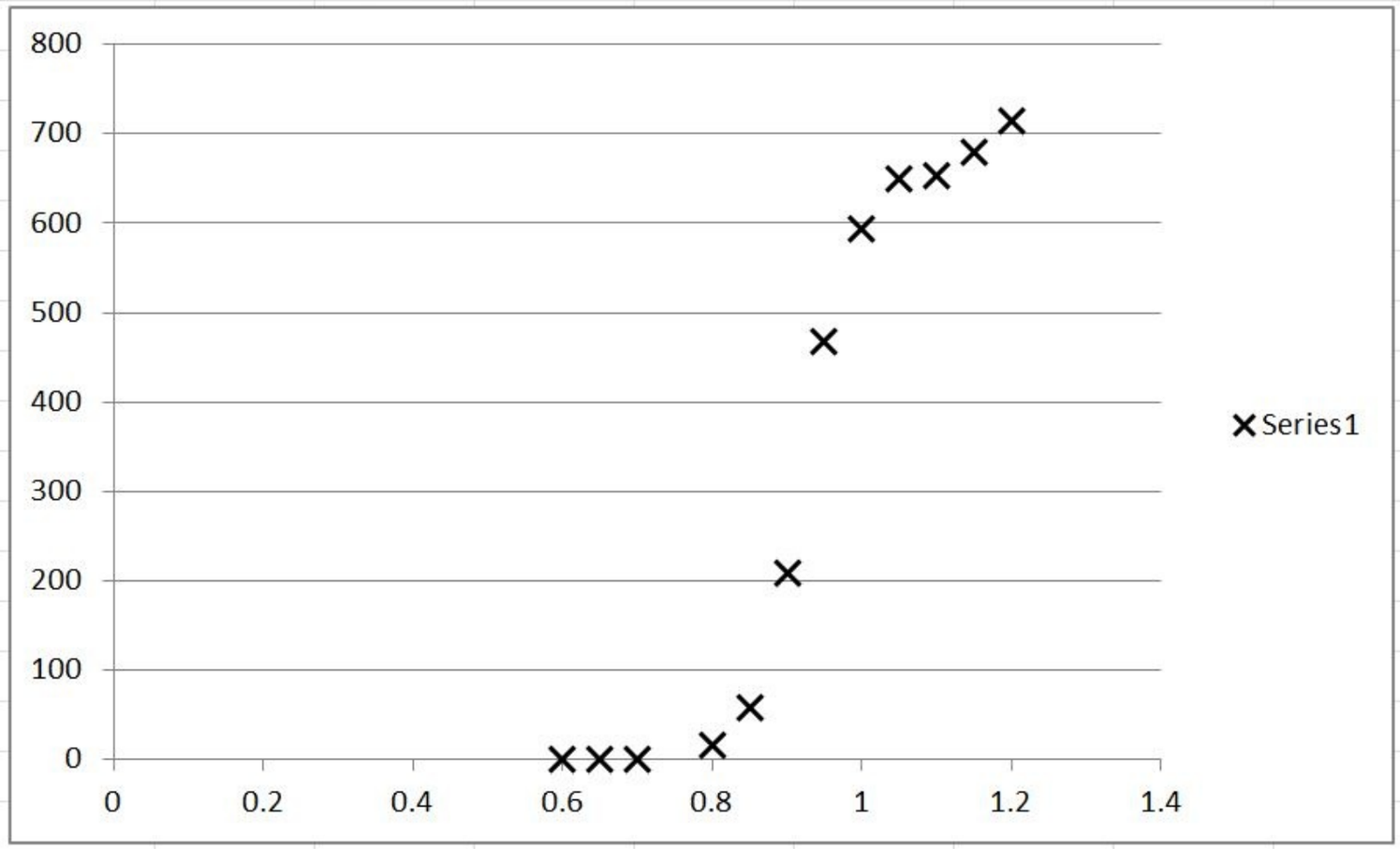
DetectorPlateauData.xls [Compatibility Mode] - Microsoft Excel

File | Home | Insert | Page Layout | Formulas | Data | Review | View

B19

	A	B	C
1	PMT voltage (V)	Counts (Hex)	counts (base 10)
2	0.6	0	0
3	0.65	0	0
4	0.7	0	0
5	0.8	10	16
6	0.85	3A	58
7	0.9	D0	208
8	0.95	1D3	467
9	1	251	593
10	1.05	289	649
11	1.1	28E	654
12	1.15	2A8	680
13	1.2	2CA	714

PMT S7



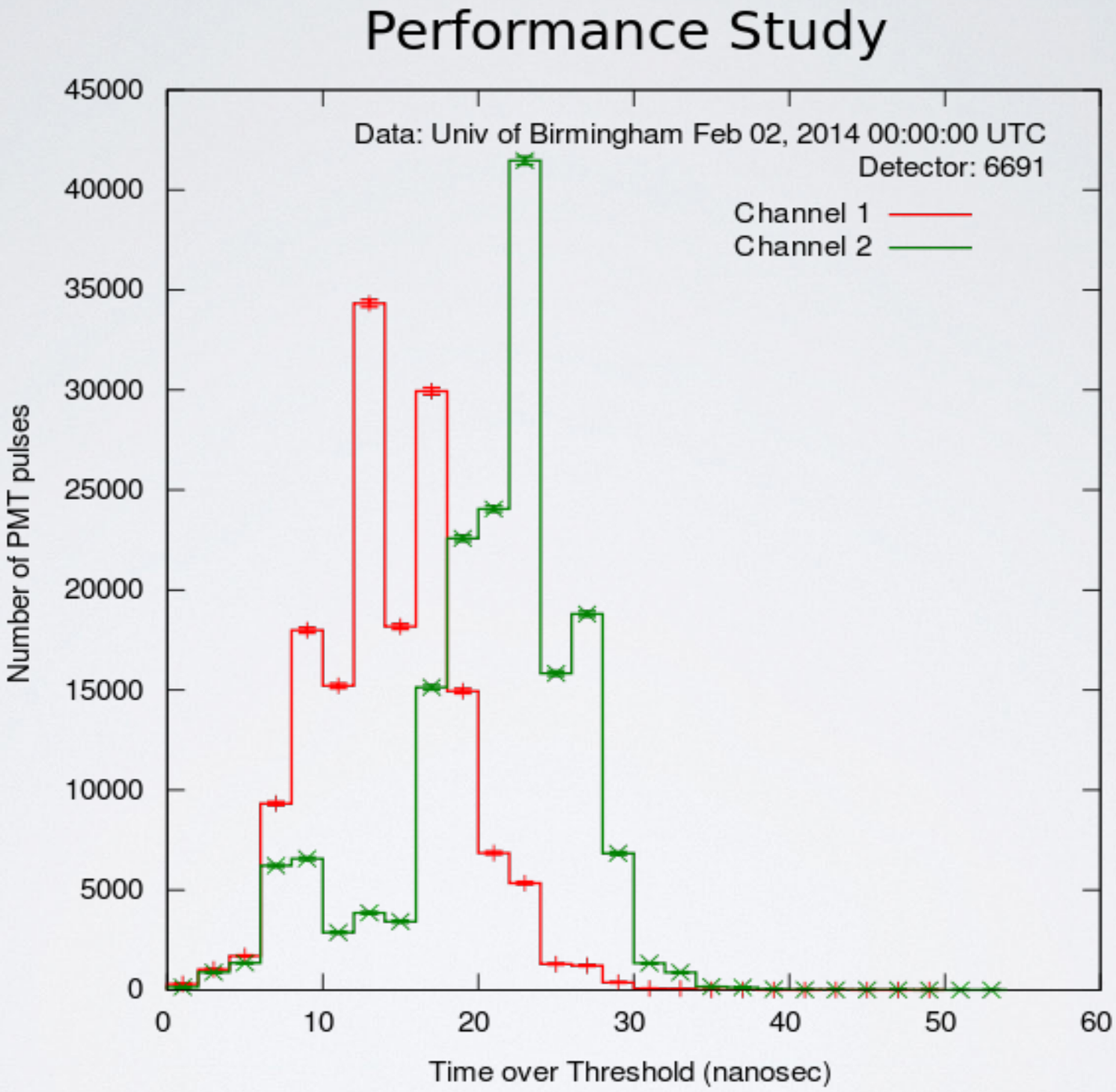
Sheet1 Sheet2 Sheet3

Edit

160%

AN OUTLINE SCHEDULE

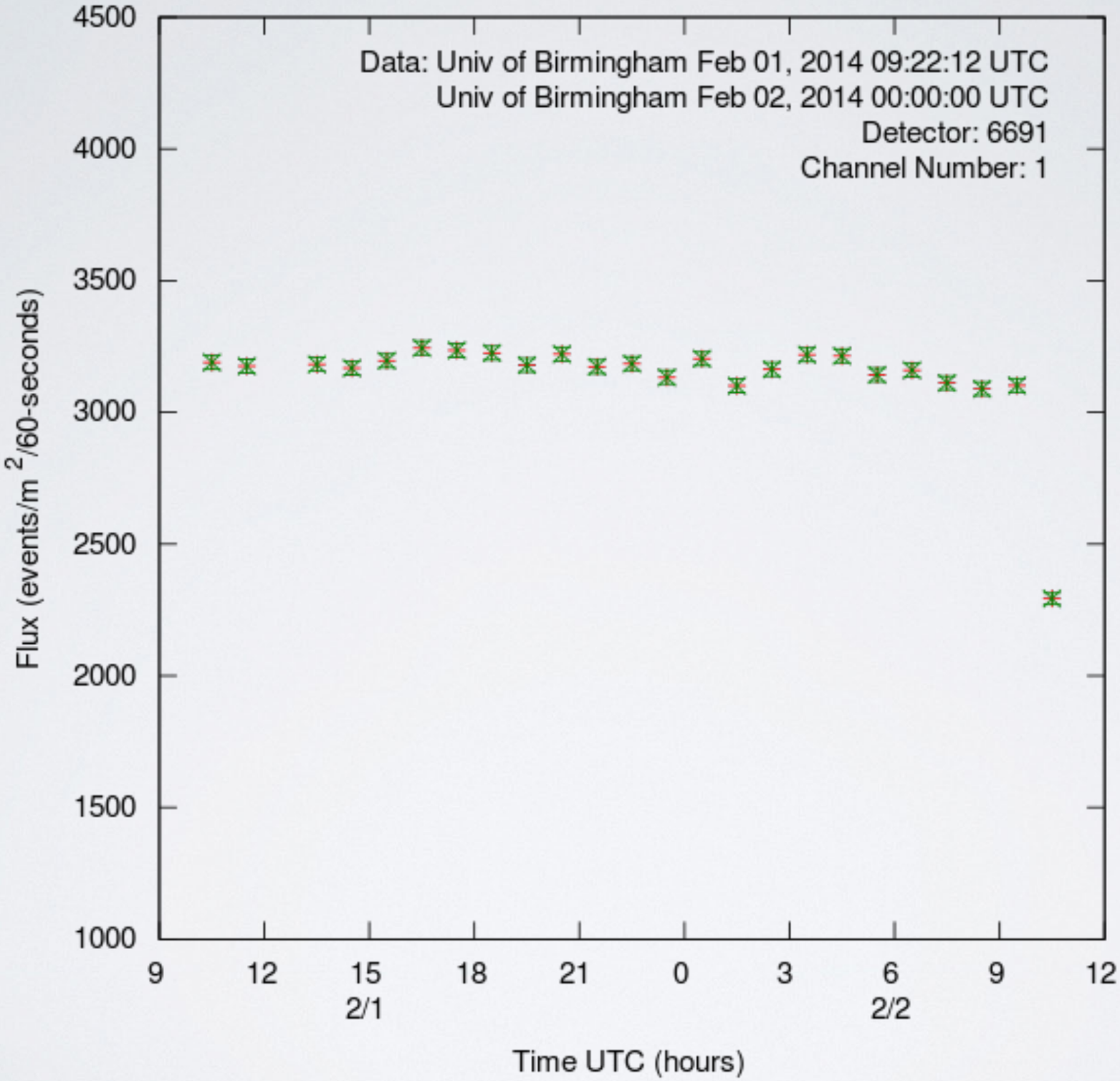
- Intro to cosmic rays & the project
- Setting up the detectors
- Plateauing the detectors
- Performance Study


Performance Study
Data: Univ of Birmingham Feb 02, 2014 00:00:00 UTC
Detector: 6691
Channel 1
Channel 2
Number of PMT pulses
Time over Threshold (nanosec)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
10
20
30
40
50
60

AN OUTLINE SCHEDULE

- Intro to cosmic rays & the project
- Setting up the detectors
- Plateauing the detectors
- Performance Study
- Flux study
  - 24 hour study. Day/night comparison

Flux Study

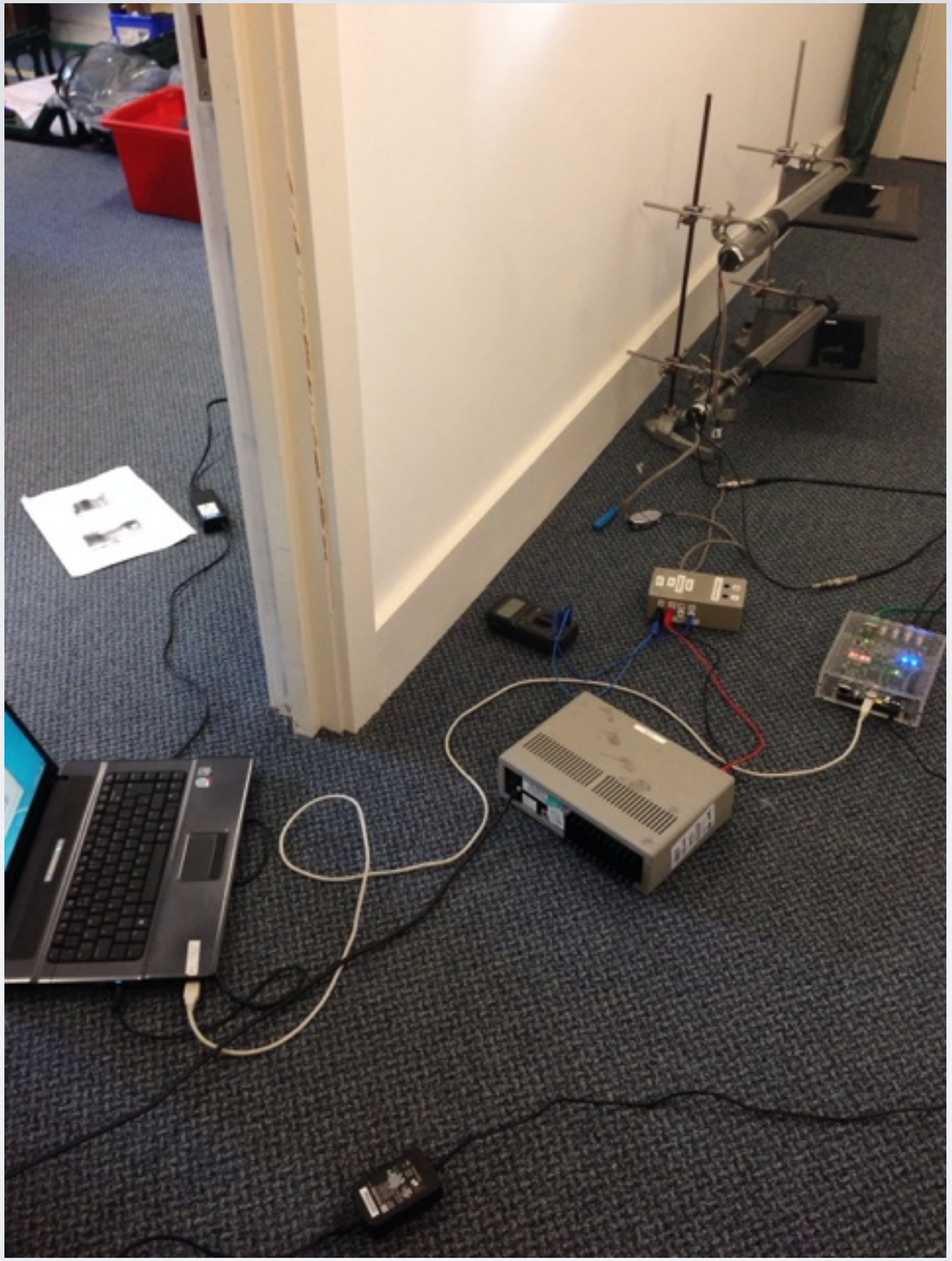

Data: Univ of Birmingham Feb 01, 2014 09:22:12 UTC
Univ of Birmingham Feb 02, 2014 00:00:00 UTC
Detector: 6691
Channel Number: 1
Flux (events/m 2/60-seconds)
4500
4000
3500
3000
2500
2000
1500
1000
9
12
15
18
21
0
3
6
9
12
2/1
2/2
Time UTC (hours)

AN OUTLINE SCHEDULE

- Intro to cosmic rays & the project
- Setting up the detectors
- Plateauing the detectors
- Performance Study
- Flux study
  - 24 hour study. Day/night comparison.
- Project

PROJECT LOCATION

Comparing flux just below roof level with flux in the basement

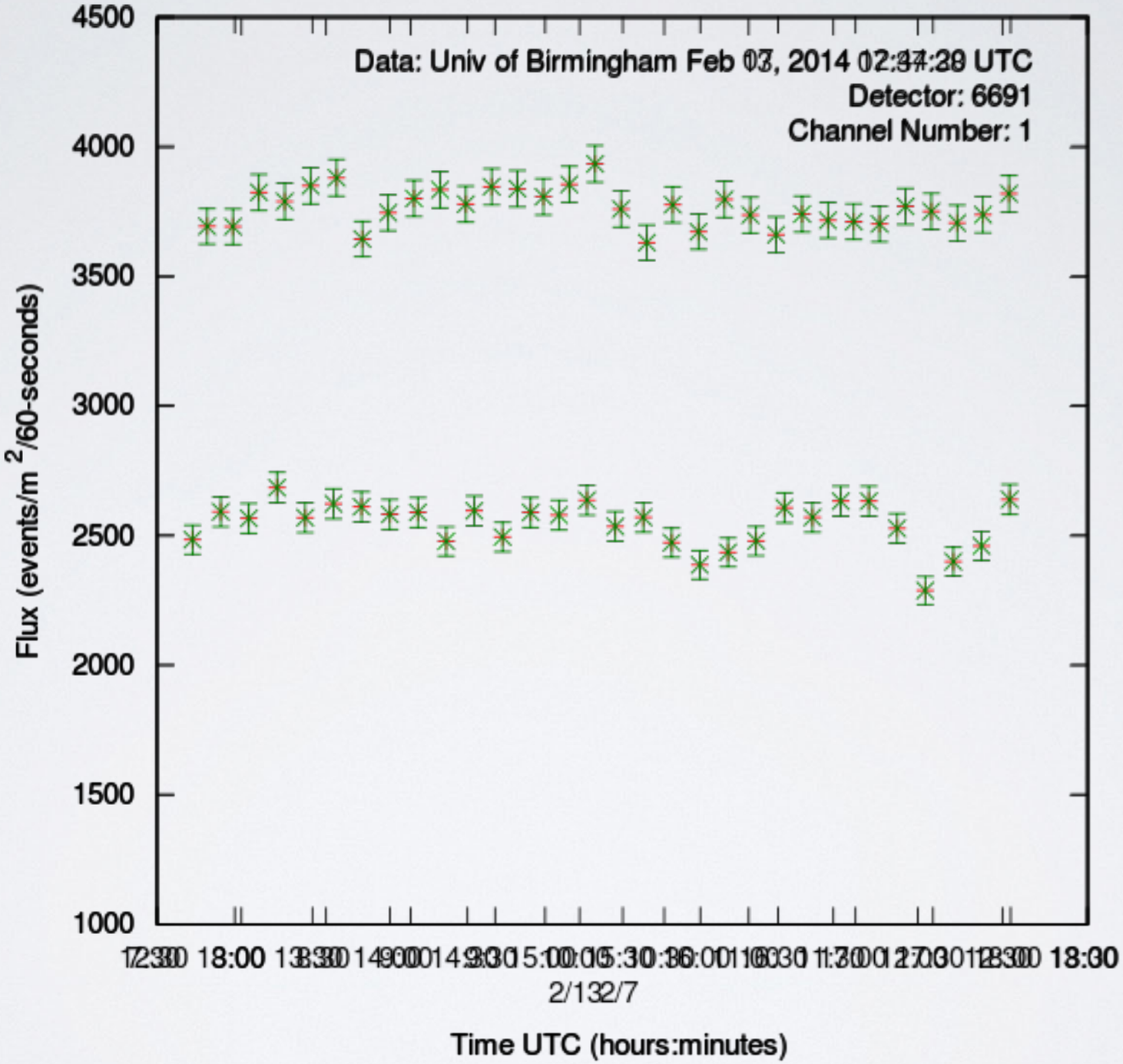


THIRD INTERNATIONAL SCIENCE CONFERENCE FOR STUDENTS

ST PAUL'S SCHOOL, LONDON

7TH MARCH 2014

Flux Study


Data: Univ of Birmingham Feb 07, 2014 02:34:28 UTC
Detector: 6691
Channel Number: 1
4500
4000
3500
3000
2500
2000
1500
1000
Flux (events/m 2/60-seconds)
18:00
18:30
2/13
2/7
Time UTC (hours:minutes)

THINGS I'VE LEARNT FROM THE PROJECT

- Get cracking as soon as possible with the equipment and weave the theory in as you go along
- Use the equipment with all the classes I teach to run simple experiments. If possible get year 12 students to do the explaining.
    - Flux for 1 minute as an introduction to uncertainty
    - Introduction to hexadecimal
    - Rotate counters so they are not horizontal to show cosmic rays are coming from the sky
    - Place detectors next to each other not stacked to show idea of coincidence detection
- Pretend not to know the answers to as many questions as possible from the students. I often don't need to pretend.....!
- Have a definite goal at the end. A conference or school presentation
- Worry a bit less about not understanding everything

EXTENDED PROJECT QUALIFICATION

An Extended Project Qualification (EPQ) is a qualification taken by some students in the United Kingdom, where it is equivalent to half an A level. They are part of level three of the National Qualifications Framework. It is currently graded A* to E.

- 5000 to 8000 words
- 120 hours of work
- Scope for scientific investigations
- Cosmic ray projects would be ideal
- Watch this space in 2017.....!!