Where Have all the Sources Gone? *Towards a Light Gain Measurement*

Abbey Waldron

Imperial College London

Context

We are in the process of making a set of charge gain measurements with the ^{55}Fe source

- However light not visible from ^{55}Fe decays

In an ideal world we would make a light gain measurement and a charge gain measurement with the same process so we could directly correlate the two.

Light Gain Measurement

Enter the CERN data taking

- Only ^{241}Am sources in detector

Ideal World case:

- Find a range of E/p settings and gas mix that let us make a light gain measurement in beam off runs
- Run Ed's charge gain analysis on these runs and correlate the two (note: these runs not currently in good runs list)

Light Gain Measurement

Non-ideal World options:

- *Take new ^{241}Am only source in data in December after the ^{55}Fe running*
- Make a light gain only measurement with CERN beam on ^{241}Am data
- Make a light gain only measurement with RHUL ^{137}Cs and ^{241}Am data

Strategy - Overview

- Use Zack's method and calibration
- Missing part is figuring out which data to use from CERN

Strategy - Details

Use the hanging ^{241}Am source between cameras 0 and 1

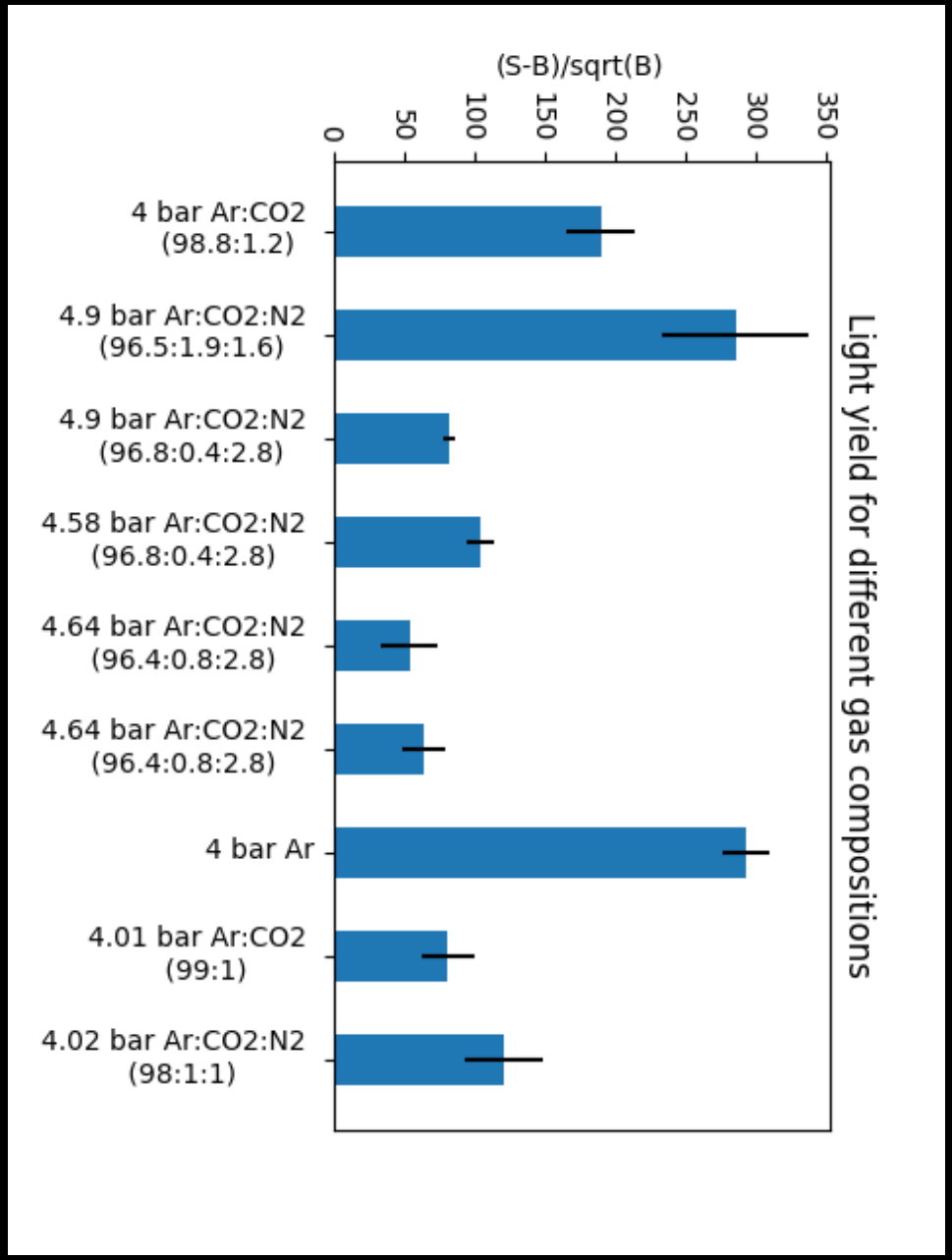
- Most visible in camera 1 - use this camera
- Select a good gas mixture (next slides)
- Find runs with a good range of E/p and beam off (in progress)
- Reject runs where anything was not working well (in progress, see next slides)
- Apply Zack's calibration
- Sum all the pixels in a small region around the source
- Plot integration time normalised sums against E/p

A Note on Use of Clustering

- Initially thought about using clustering to find pixels from events
- Then learned we expect very many (thousands?) of events per spill
- Now suspect it will give a weird thresholding systematic
- Will check but probably better to use sums in region around source

In any case it goes in the paper to demonstrate we can use it to locate the sources!

Gas Mixtures - Maria Plot



Gas Mixtures

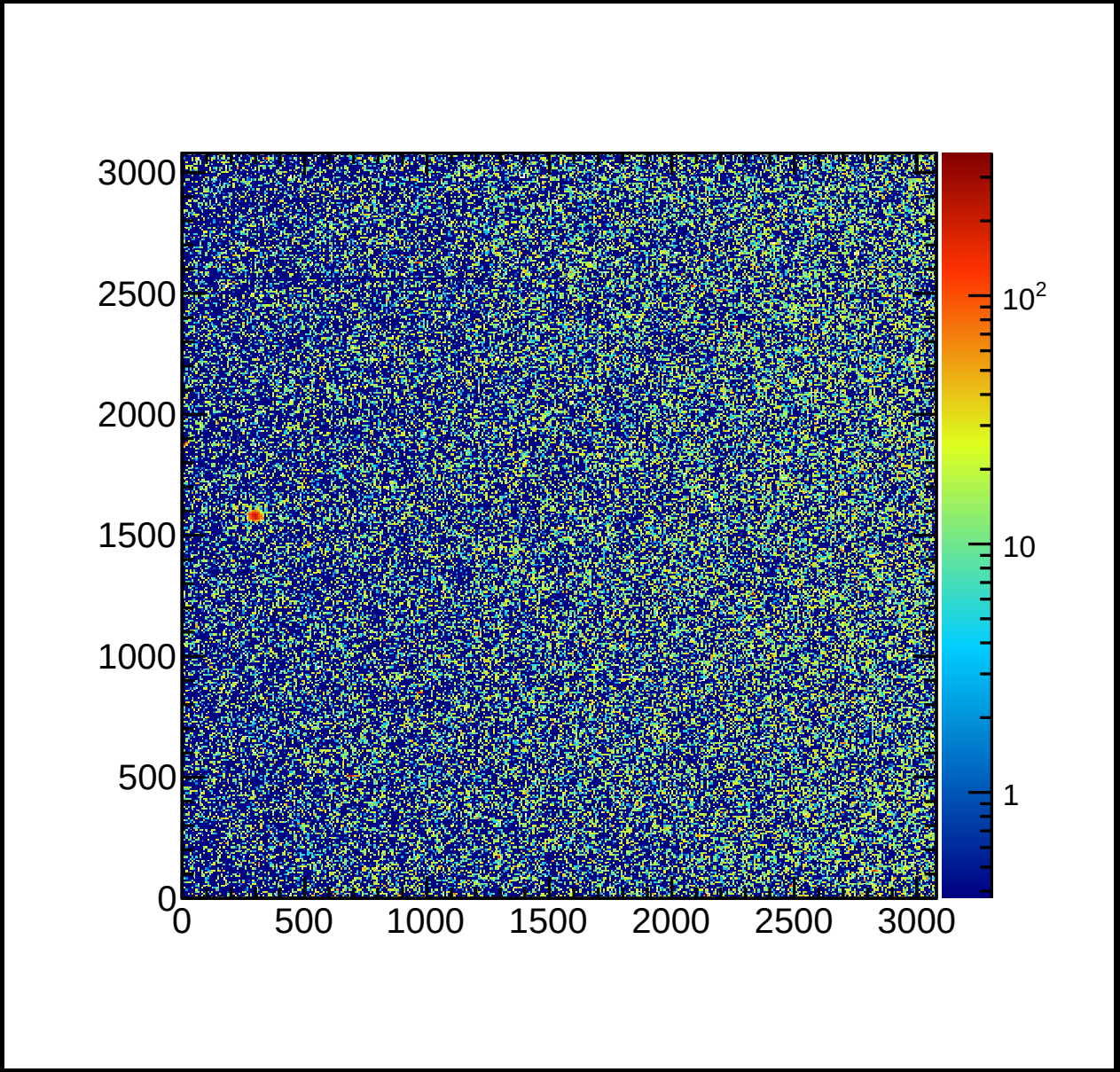
Highest light yield mixtures:

- Ar:CO_2:N_2 (96.5:1.9:1.6)
- Pure Ar

However see huge amount of sparking in the Ar:CO_2:N_2 runs and some questions surrounding the gas mixes.

- Work with the pure argon runs

R1257014 (4 bar Ar) - Hanging Source Camera 1



Run Selection

Spending a lot of time with the elog and database and harassing everyone who remembers CERN

- need a few comparable runs with different E/p
- there are some 3 and 3.4 bar pure argon runs but voltages very different across anodes
- there are many 4 bar pure argon runs but voltages very similar across anodes
- exploration ongoing!

Summary

- I have all the code ready except incorporating the calibration from Zack
- Working to see if we have the runs we need in CERN ^{241}Am data
- Depending on the answer could consider another americium only run

My Questions

- When was the hanging ^{241}Am source put in at CERN?
- When was it first visible? Before September 3rd?
- I've heard that it moved, when did it move?

									been form an Ar-CO2 premixed bottle and the second fill pure Ar. However, this does not fit with the numbers given in the logbook.
2018-09-01 09:21:00	2018-09-03 13:43:00	Ar (N5)	1.97E+00 barG	n.a.	n.a.	n.a.	n.a.	Ar (100)	440
2018-09-03 13:45:00	2018-09-03 19:05:00	Ar (N5)	1.96E+00 barG	CO2 (N48)	1.99E+00 barG	n.a.	n.a.	Ar-CO2 (99-1)	450
2018-09-03 19:19:00	2018-09-04 21:40:00	Ar-CO2 (99-1)	2.00E+00 barG	Ar (N5)	2.97E+00 barG	n.a.	n.a.	Ar-CO2 (99.25-0.75)	451
2018-09-04 21:50:00	2018-09-05 19:34:00	Ar-CO2 (99.25-0.75)	2.96E+00 barG	Ar (N5)	3.76E+00 barG	n.a.	n.a.	Ar-CO2 (99.4-0.6)	459
2018-09-05 19:35:00	2018-09-06 12:30:00	Ar-CO2 (99.4-0.6)	3.76E+00 barG	CO2 (N48)	3.81E+00 barG	n.a.	n.a.	Ar-CO2 (98.4-1.6)	470 From the log book it is not really clear if CO2 or Ar-CO2 was added. But I assume we added pure CO2 since this was avilable at the time.
2018-09-06 12:32:00	2018-09-06 19:17:00	Ar-CO2 (98.4-1.6)	3.79E+00 barG	N2 (N45)	3.87E+00 barG	n.a.	n.a.	Ar-CO2-N2 (96.8-1.6-1.6)	http://hpslow.pp.rhul.ac.uk/elog/HPTPC_Log/479
2018-09-06 23:05:00	2018-09-07 04:05:00	Ar (N5)	1.96E+00 barG	n.a.	n.a.	n.a.	n.a.	Ar (100)	483 **Analysis sheet: here**
2018-09-07 04:15:00	2018-09-07 08:59:00	Ar (N5)	1.95E+00 barG	N2 (N45)	2.05E+00 barG	n.a.	n.a.	Ar-N2 (96.7-3.3)	484
2018-09-07 09:00:00	2018-09-07 13:32:00	Ar-N2 (96.7-3.3)	2.04E+00 barG	N2 (N45)	2.06E+00 barG	n.a.	n.a.	Ar-N2 (96.1-3.9)	485 and 486
2018-09-07 14:25:00	2018-09-08 16:40:00	Ar-N2 (96.1-3.9)	2.07E+00 barG	CO2 (N48)	2.08E+00 barG	Ar (N45)	3.70E+00 barG	Ar-CO2-N2 (97.24-0.21-2.55)	487 After 20:10 the manometer was done for 2 h.
2018-09-08 16:40:00	2018-09-12 08:41:00	Ar-CO2-N2 (97.24-0.21-2.55)	3.62E+00 barG	CO2 (N48)	3.64E+00 barG	Ar (N45)	3.72E+00 barG	Ar-CO2-N2 (96.88-0.63-2.49)	494 for some periodes the manometer was not reading back sensible

2018-09-06 23:05:00	2018-09-07 04:05:00	Ar (N5)	1.96E+00 barG	n.a.	n.a.	n.a.	n.a.	Ar (100) 3bar	503 **Analysis sheet: here**
2018-09-07 04:15:00	2018-09-07 08:59:00	Ar (N5)	1.95E+00 barG	N2 (N45)	2.05E+00 barG	n.a.	n.a.	Ar-N2 (96.7-3.3)	484
2018-09-07 09:00:00	2018-09-07 13:32:00	Ar-N2 (96.7-3.3)	2.04E+00 barG	N2 (N45)	2.06E+00 barG	n.a.	n.a.	Ar-N2 (96.1-3.9)	485 and 486
2018-09-07 14:25:00	2018-09-08 16:40:00	Ar-N2 (96.1-3.9)	2.07E+00 barG	CO2 (N48)	2.08E+00 barG	Ar (N45)	3.70E+00 barG	Ar-CO2-N2 (97.24-0.21-2.55)	487 After 20:10 the manometer was done for 2 h.
2018-09-08 16:40:00	2018-09-12 08:41:00	Ar-CO2-N2 (97.24-0.21-2.55)	3.62E+00 barG	CO2 (N48)	3.64E+00 barG	Ar (N45)	3.72E+00 barG	Ar-CO2-N2 (96.88-0.63-2.49)	494 for some periodes the manometer was not reading back sensible values
2018-09-12 11:37:00	2018-09-13 21:20:00	Ar (N5)	1.96E+00 barG	n.a.	n.a.	n.a.	n.a.	Ar (100) 3bar	506 **Analysis sheet: here** ?
2018-09-13 21:29:00	2018-09-13 21:49:00	Ar (N5)	1.96E+00 barG	Ar (N5)	2.35E+00 barG	n.a.	n.a.	Ar (100) 3.4bar	509 ?
2018-09-13 22:01:00	2018-09-14 20:41:00	Ar (N5)	2.35E+00 barG	Ar (N5)	2.99E+00 barG	n.a.	n.a.	Ar (100) 4bar	509 ← good
2018-09-14 20:43:00	2018-09-15 09:01:00	Ar (N5)	2.99E+00 barG	CO2 (N48)	3.02E+00 barG	n.a.	n.a.	Ar-CO2 (99.25-0.75)	512 and 513
2018-09-15 09:03:00	2018-09-15 22:22:00	Ar-CO2 (99.25-0.75)	3.00E+00 barG	N2 (N45)	3.02E+00 barG	n.a.	n.a.	Ar-CO2-N2 (98.75-0.75-0.50)	514

beam stop unknown

RHUL data taking