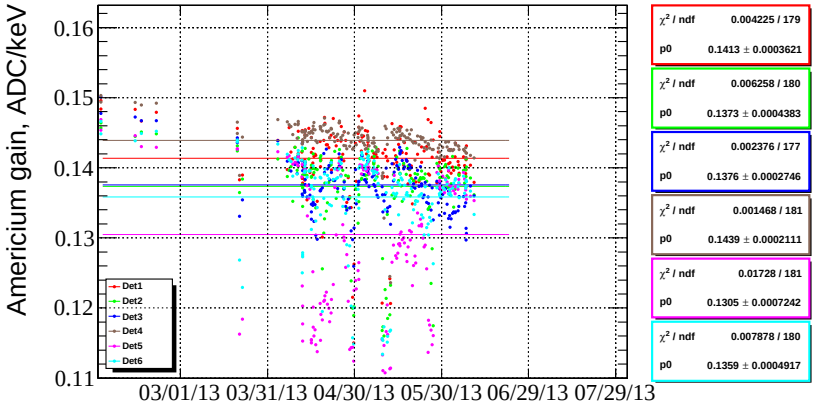
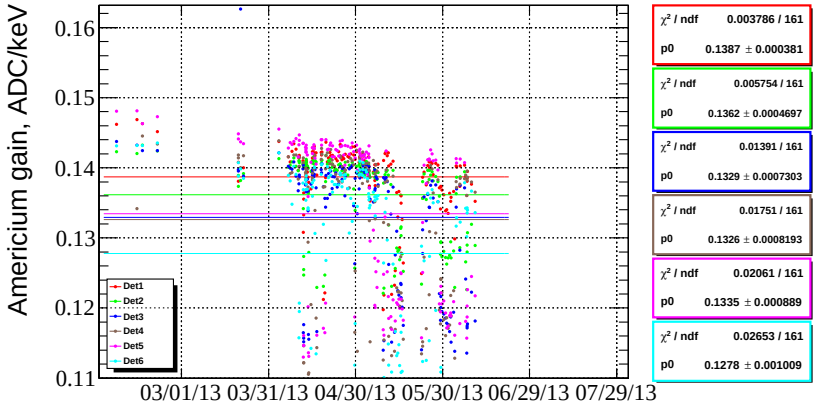
Alpha note

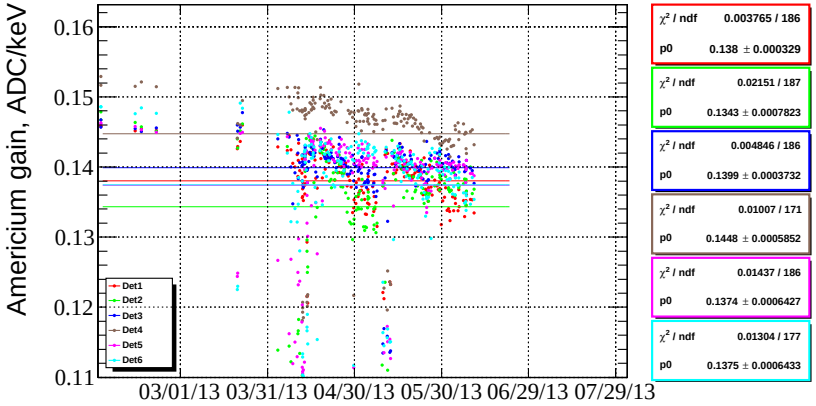
Latest version is always on the wiki:
`https://wiki.bnl.gov/rhicspin/File:PC-alpha-analysis-note.pdf`



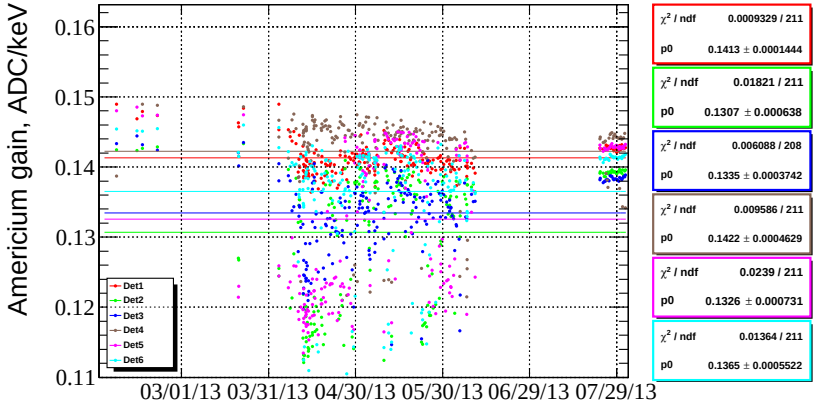
(a) B1U



(b) Y1D

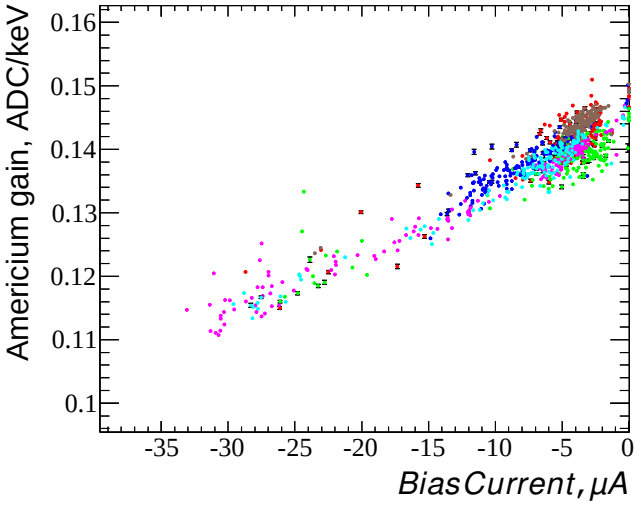


(c) B2D

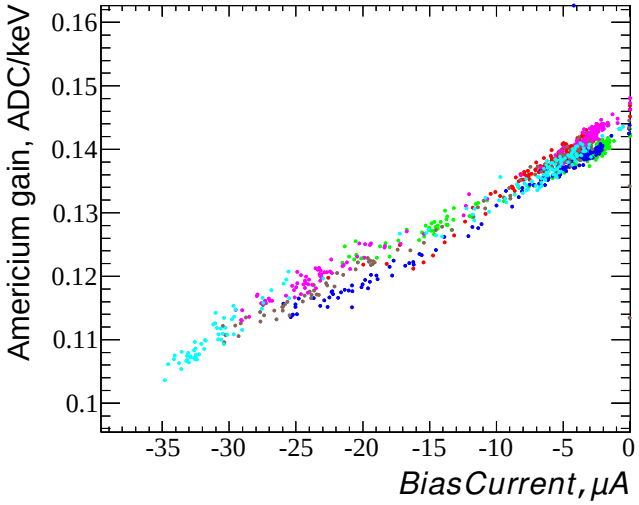


(d) Y2U

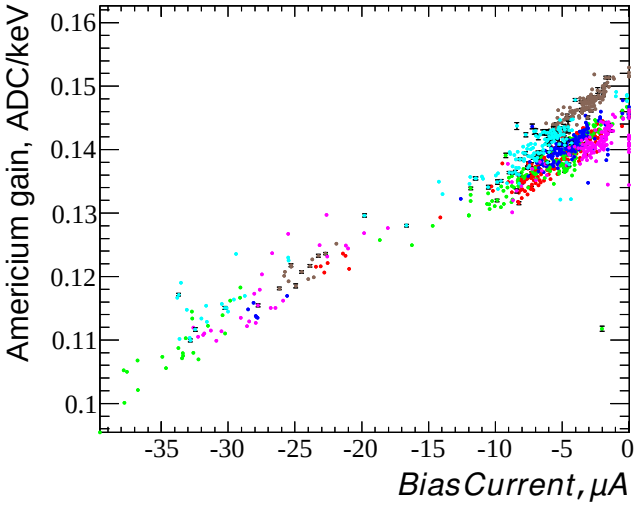
Figure: Time dependence of the detector gain g_{Am} as measured with α-particles emitted by the Am source. Colors represent individual detectors.



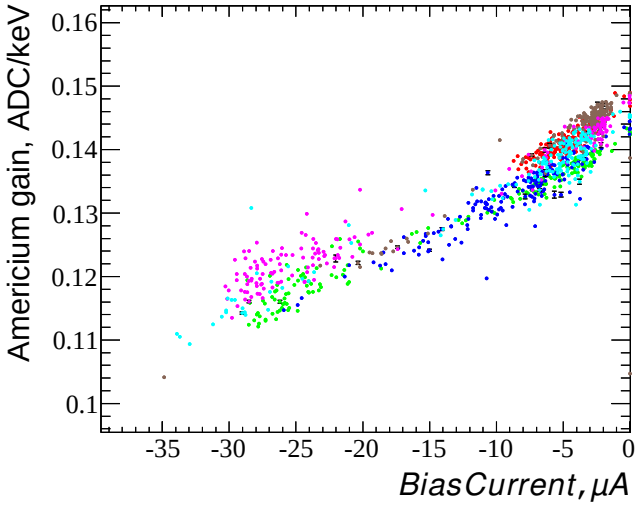
(a) B1U



(b) Y1D

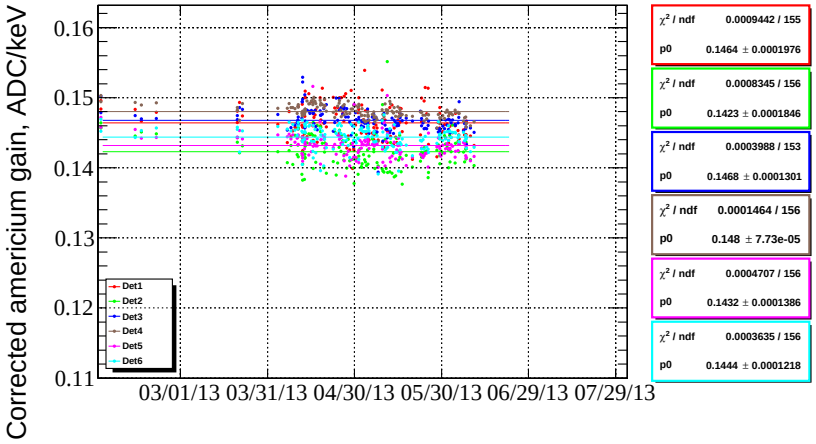


(c) B2D

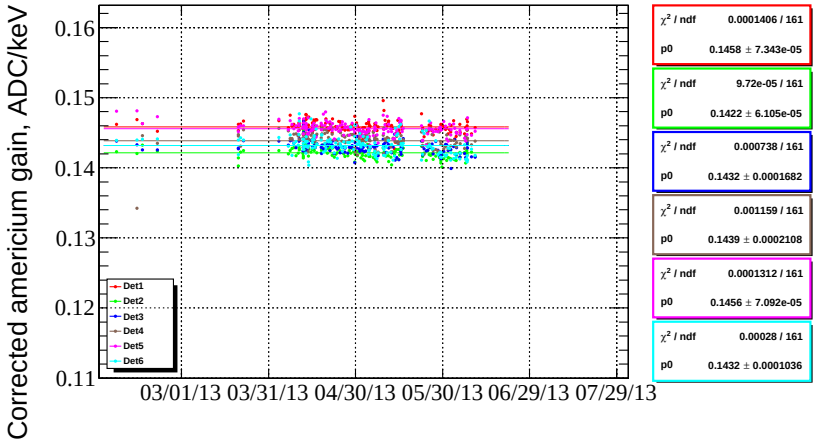


(d) Y2U

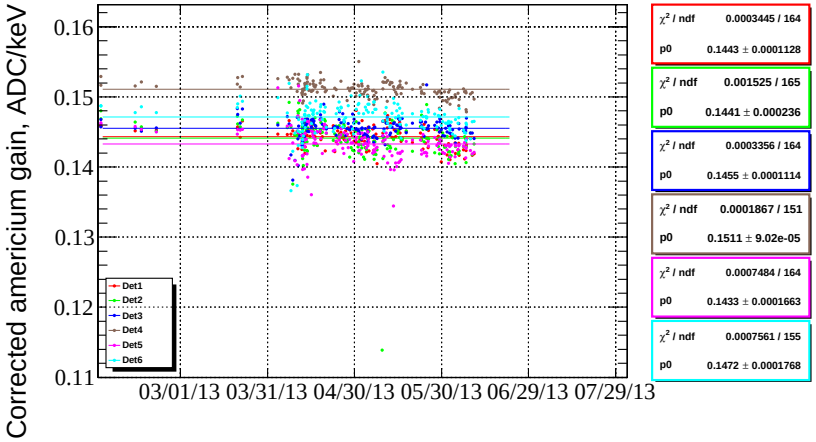
Figure: Bias current versus americium gain ($\mu_{\mathrm{Am}}/E_{\mathrm{Am}}$) dependency. The colors represent different detectors.



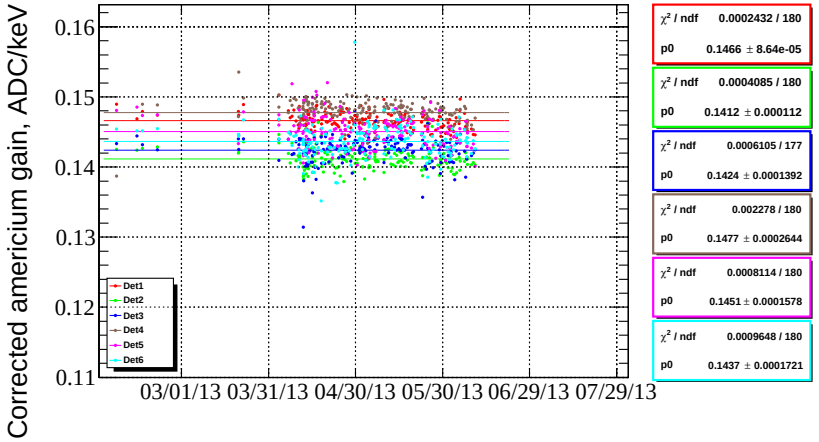
(a) B1U



(b) Y1D



(c) B2D



(d) Y2U

Figure: Time dependence of the detector gain g_{Am} that was corrected to zero bias current.

Y2D alpha gains in 2013

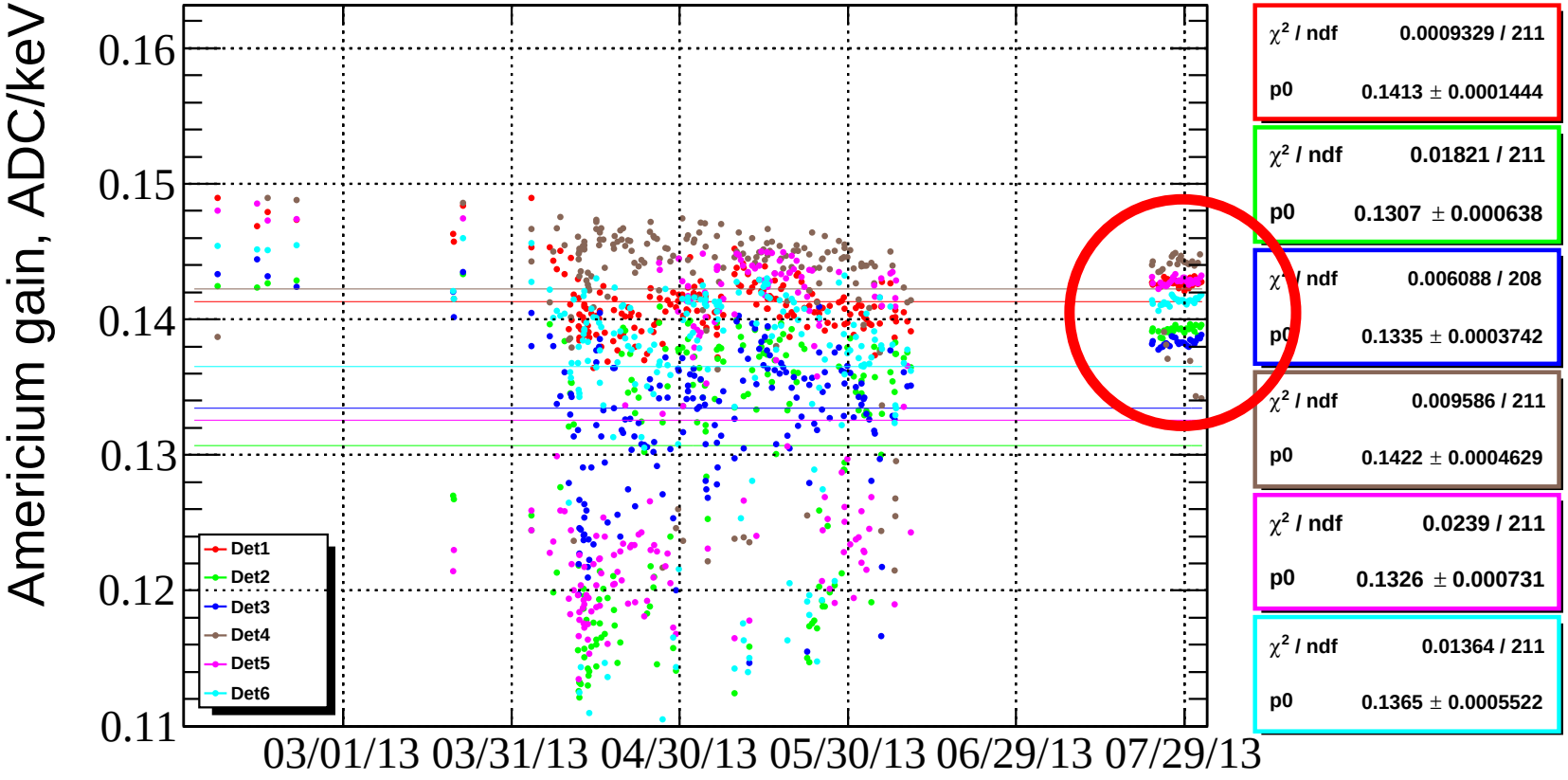


Figure: Alpha gains at Y2D taken before, during and after run13. Special measurements taken after run13 are circled in red.

Y2D alpha gains after run13 (zoom)

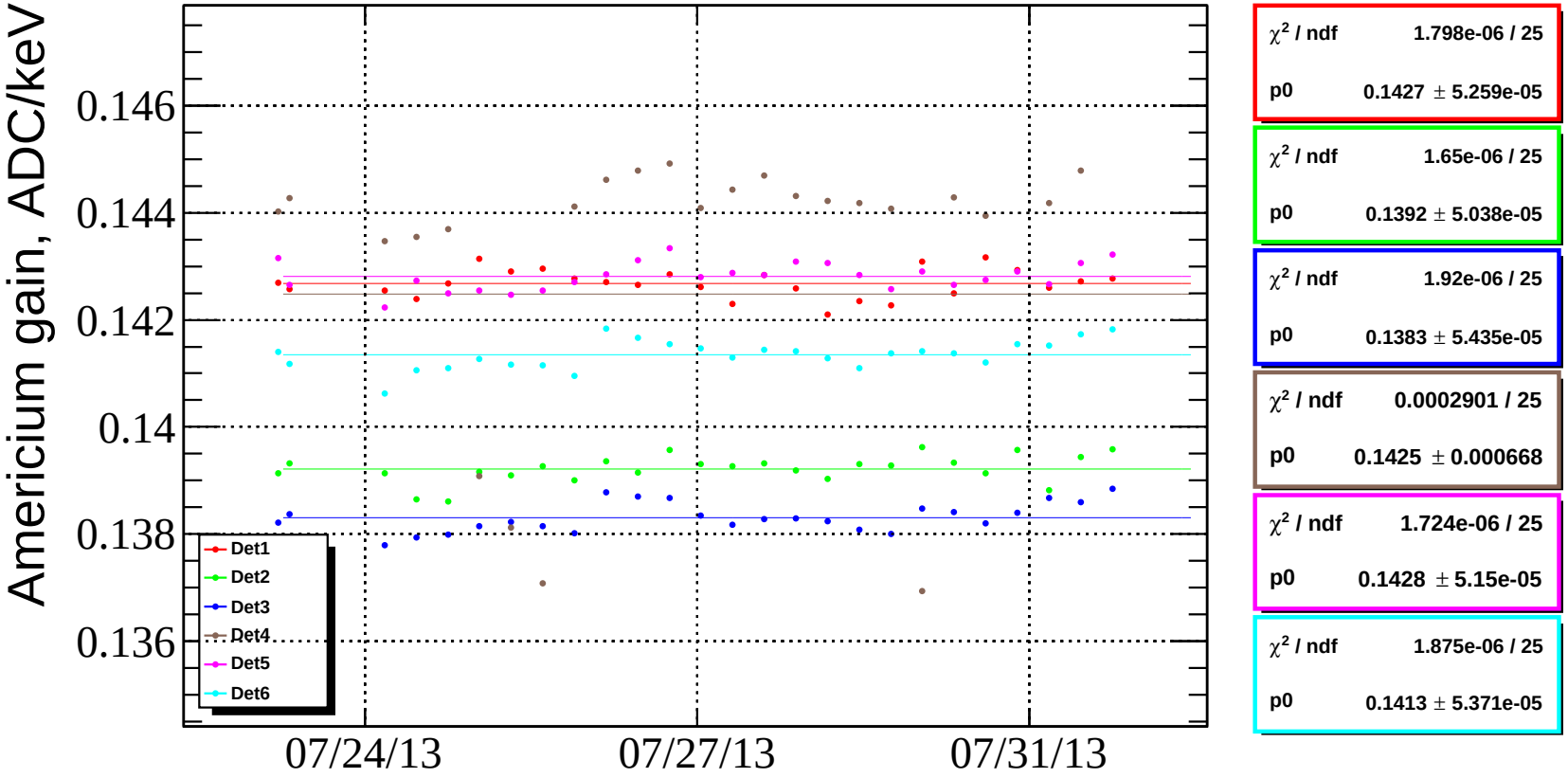
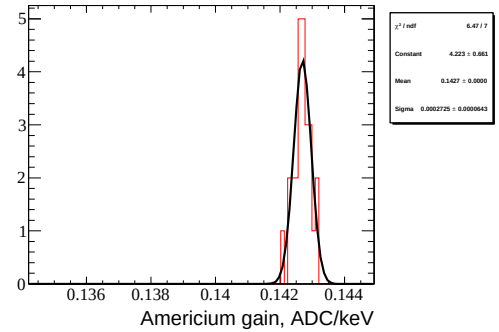
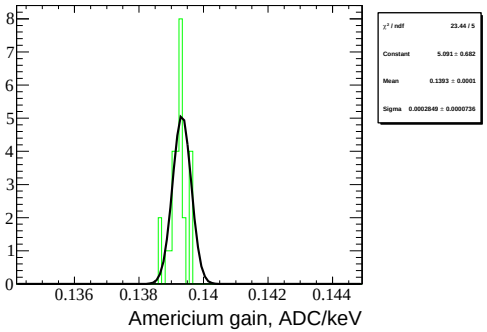
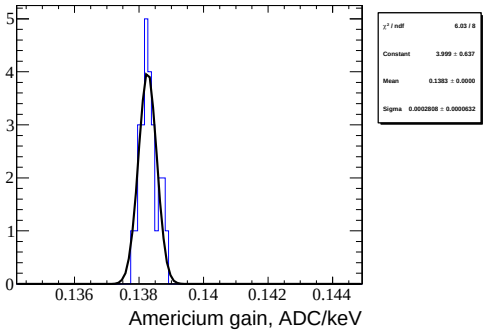


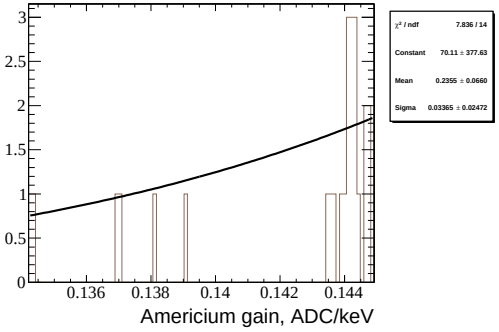
Figure: Alpha gains from special measurements taken after run13.

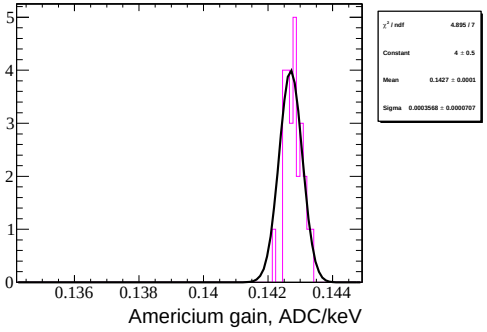
Reference plots

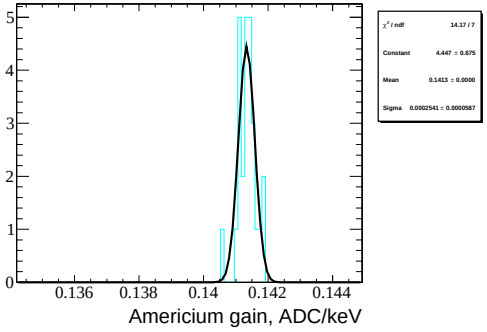












Bias current corrected gains

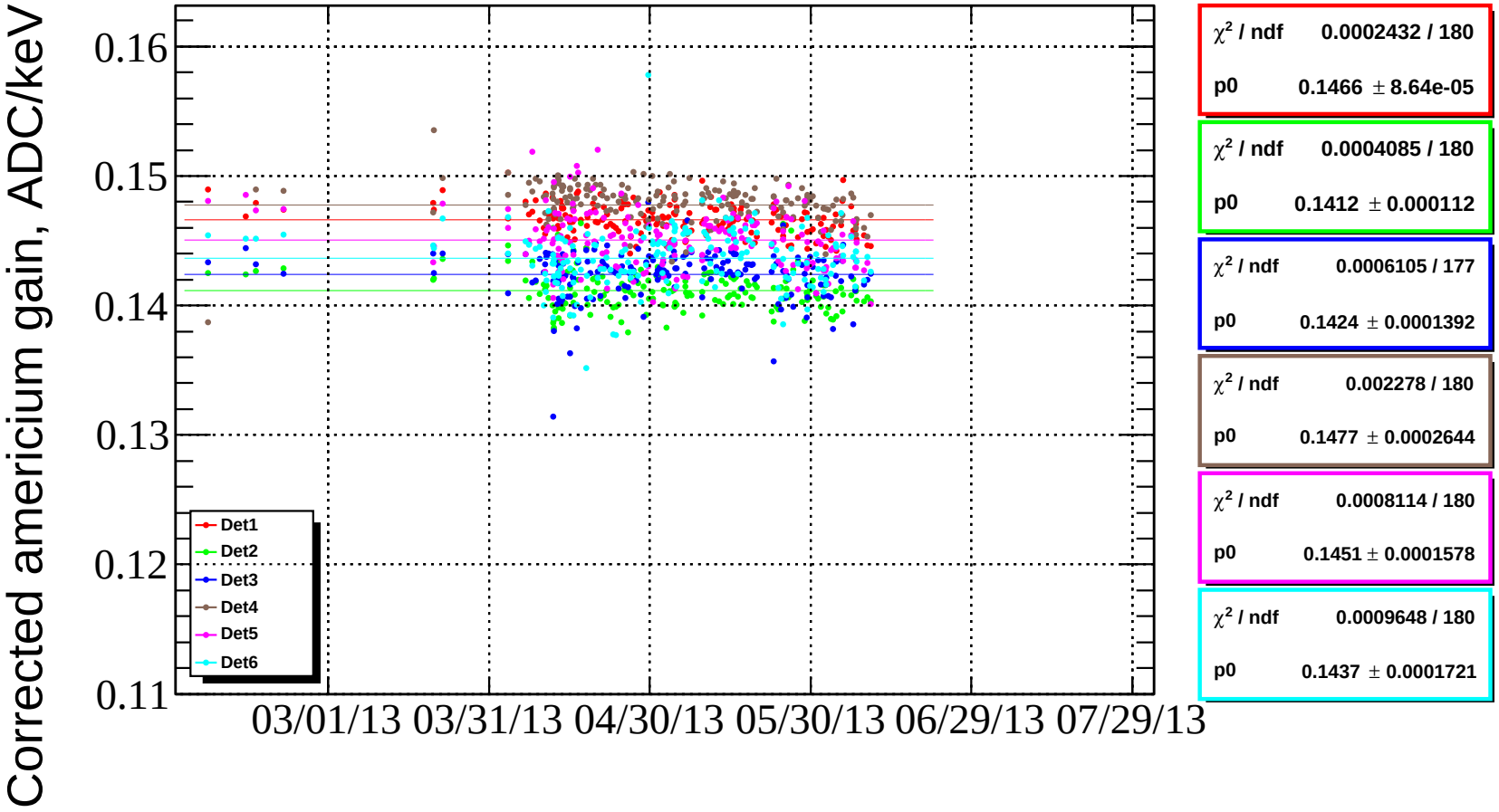
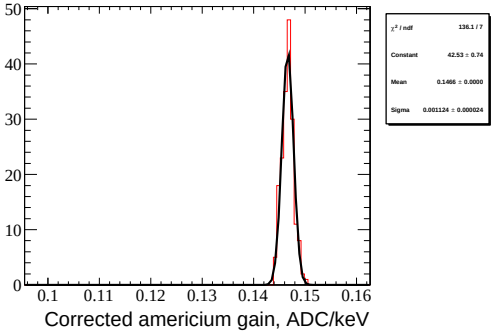
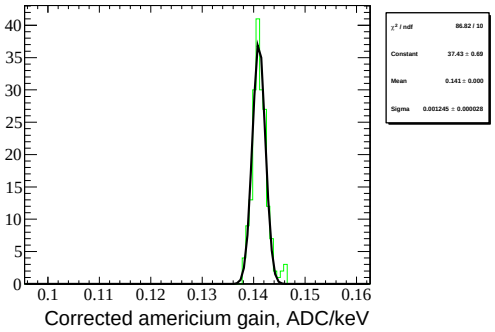
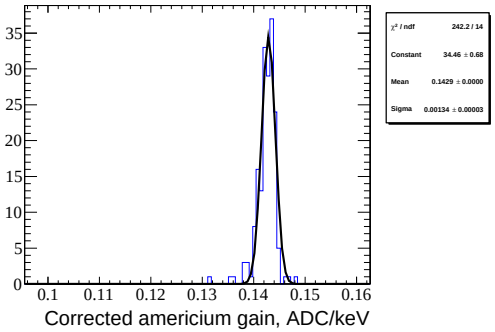


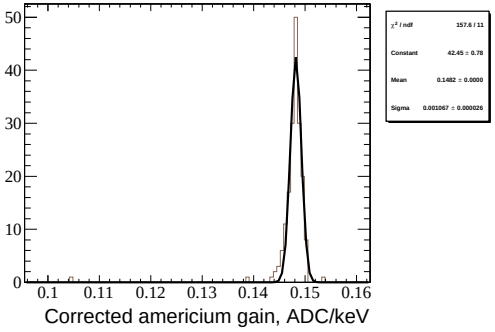
Figure: Y2D alpha gain corrected to zero bias current using slope of the bias current vs alpha gain correlation. Alpha study points are not present because bias current measurements weren't recorded for them.

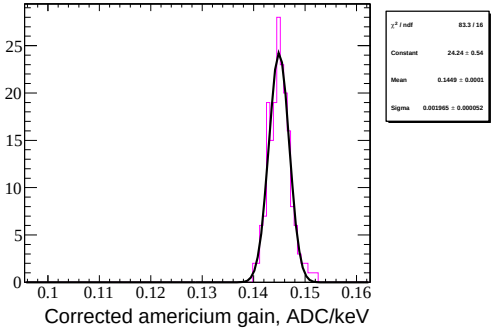
Reference plots

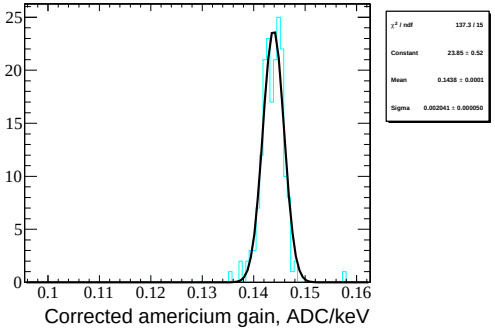












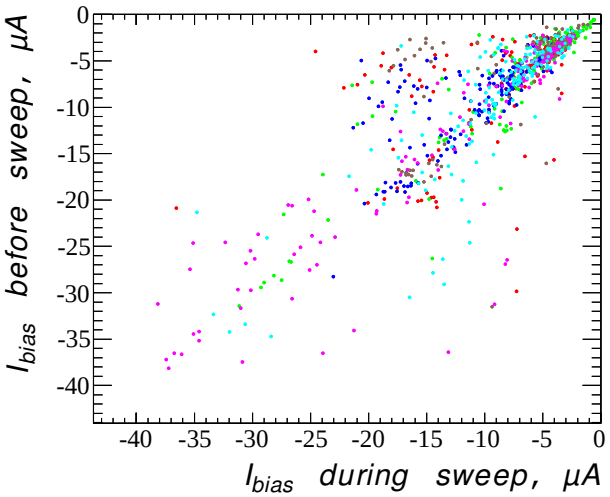
Summary table

	Det1	Det2	Det3	Det4	Det5	Det6
Width (bc corr) ADC/eV	1.12	1.24	1.34	1.06	1.96	2.04
Width (no beam) ADC/eV	0.27	0.28	0.28	0.54	0.36	0.25
Their relation	4.1	4.4	4.8	2.0	5.5	8.0

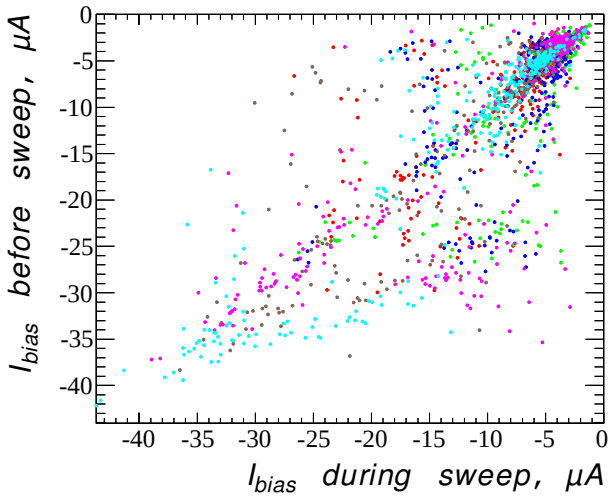
So we implement bias current gain correction.

- Typical sweep measurement takes minutes.
- Bias current measured every 5 minutes.
- Most measurements won't have BC measurement in their time windows.
- $\rightarrow$ Must extend bias current query window somewhere.
- Two options: to the past or to the future.
- Which best correlates with BC during the sweep?

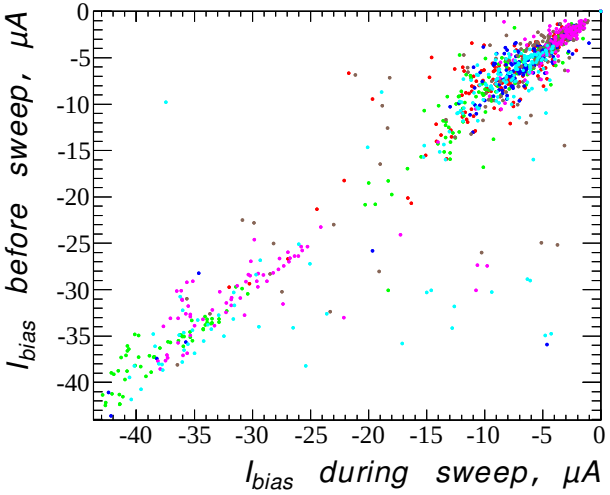
Correlation with bias current before sweep



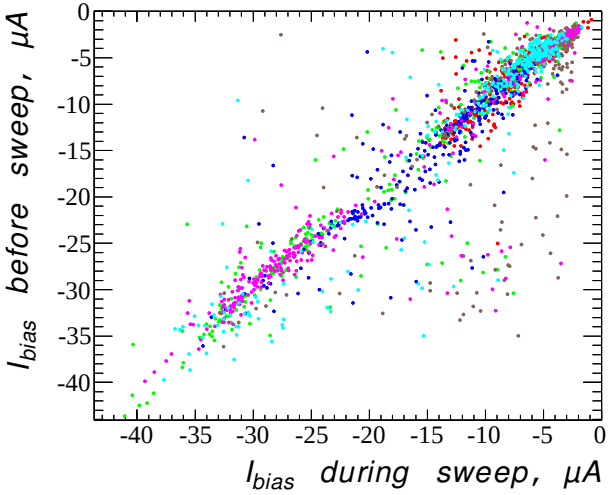
(a) B1U



(b) Y1D



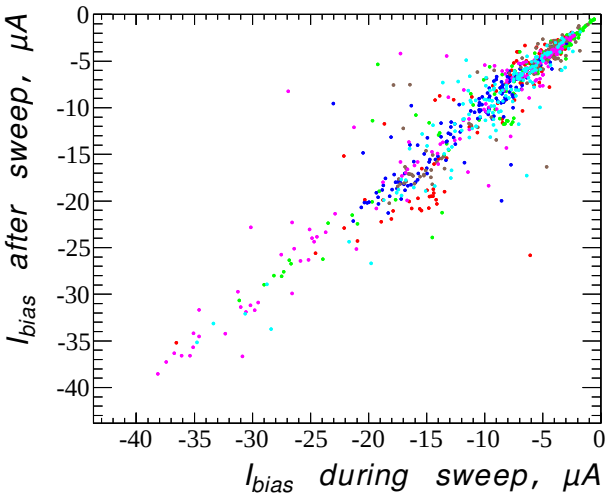
(c) B2D



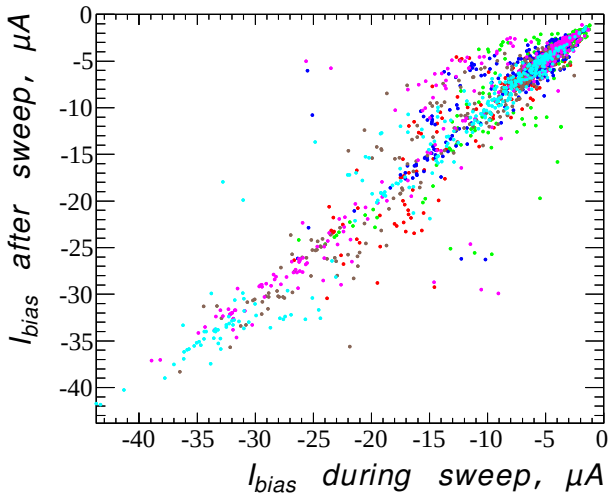
(d) Y2U

Figure: Correlation of bias currents that fall in windows $[\text{starttime}, \text{endtime}]$ and $[\text{starttime} - 5\text{ min}, \text{starttime}]$

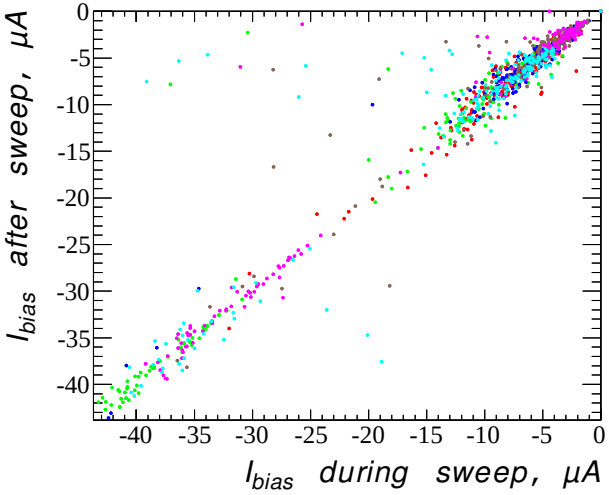
Correlation with bias current after sweep



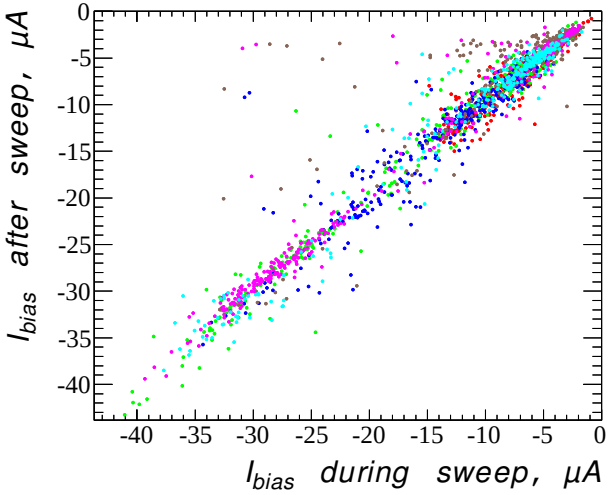
(a) B1U



(b) Y1D



(c) B2D



(d) Y2U

Figure: Correlation of bias currents that fall in windows $[\text{starttime}, \text{endtime}]$ and $[\text{endtime}, \text{endtime} + 5\ \text{min}]$

Implementation

- Window of $[\text{starttime}, \max(\text{endtime}, \text{starttime} + 500 \text{ sec})]$ is used to extract bias current values.
- Each alpha measurement is brought to it's zero bias current value and saved.
- For each sweep measurement, zero bias current gain from the appropriate alpha measurement is taken, then it is corrected to sweep measurement bias current.

Extraction of the bias current measurements

- All slow control measurements go through CDEV and can be obtained in realtime: `http://www.cadops.bnl.gov/Controls/doc/usingCdev/remoteAccessCdevData.html`.
- Measurements are grouped into loggers (e.g. `RHIC/Polarimeter/Blue/biasReadbacks` contains measurements for 6 detectors).
- Measurement contains value and it's timestamp.
- This data is stored on CAD cluster machines.
- But

  A CDEV interface for logger data retrieval has been suggested but there are no plans at the moment.

- Instead log records can be browsed using `LogViewer` GUI tool, non-interactive access can be done using `exportLoggerData` utility.

exportLoggerData

- `http://www.cadops.bnl.gov/Controls/doc/FillData/`
- Can query measurements during specified fill or time range (input in NewYork time).
- Outputs tab separated values or SDDS binary file.
- Con: Sudden crashes – needs sophisticated detection for mass export.
- Con: Can be runned only on CAD machines – where the data is accessible.

Firewall breaching

- pC data is on eic cluster, slow loggers data is on CAD cluster
- eic0005 is behind rssh.rhic.bnl.gov, CAD machines (e.g. acnlina5) are behind ssh.pbn.bnl.gov
- `ssh acnlina5.pbn.bnl.gov "uname -a"` won't work
- Start ssh tunnel: `ssh -l dkalinkin ssh.pbn.bnl.local -L 8022:acnlina5.pbn.bnl.gov:22`
- Create alias `acnlina5_tunnel` that will use that tunnel:

```
Host acnlina5_tunnel  # these lines are in .ssh/config
        IdentityFile    ~/.ssh/cad_rsa
        User            kalinkin
        HostName        localhost
        Port            8022
        CheckHostIP     no
        HostKeyAlias    acnlina5 # see 'man ssh_config'
        BatchMode       yes
```

- Now we can do something like `ssh acnlina5_tunnel "exportLoggerData -logger RHIC/BeamIons -fill 12345"`.

First implementation

- Dmitri's script to export beam ions, snake and rotator currents.
- `https://github.com/rhicspin/cnipol/blob/9c627c32d/script/cdev_info.py`
- `https://github.com/rhicspin/cnipol/blob/9c627c32d/script/get_fill_info.sh`
- Exported whole fills. The result is located at `/eicdata/eic0005/runXX/cdev_info/`.

Second implementation

- Same thing, but queries could be made at analysis runtime through a C++ interface.
- `https://github.com/rhicspin/cnipol/blob/master/src/SshLogReader.cxx`
- Cons: Slow. (Partially solved by caching the values in a local database).
- Cons: Still needs SSH tunnel setup.
- Cons: Not multiprocess friendly (ok for alpha study, bad for production analysis)
- Cons: Still some exportLoggerData crashes.

opencdev

- Log data stored in two parts:
- Metadata (timestamp-fill_id-filename correspondence) stored in Sybase database at acnsun05.pbn.bnl.gov.
- Values stored in binary SDDS format files (`/operations/app_store/RunData/run_fy13/17106/RHIC/Polarimeter/Blue/biasReadbacks/2013-02-25.1050.36.sdds`)
- One tool to dump logger metadata from database and copy SDDS files to eic cluster (`/eicdata/eic0005/cdev_log`).
- One library to query local copy (basically reimplementation of what exportLoggerData).
- Disk usage: 57MB for all bias currents in run13, $\sim$ 700MB for BeamIons, $\sim$ 4.5GB for all loggers of our interest.
- `https://github.com/rhicspin/opencdev`
- Documentation to be provided if there is a demand.