Using batchcorr.exe to Iteratively Calibrate Images taken with the GE a-SI Detectors

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I. Introduction:

GE has provided a function, correctImages.exe, which will calibrate a single image file taken with one of the APS' GE amorphous silicon detectors. The calibration utility runs on 32-bit Windows PCs and corrects images for bad pixels, gain, and dark response. Documentation for the function is available on the Detector Pool web page:

https://subversion.xor.aps.anl.gov/trac/detpool/browser/GE_a-Si_Detector/DetectorData/How_to_Correct_GE_images_GermanVera_August2010.pdf?format=raw

At the APS, the function should be invoked selectively on a few files during data acquisition to verify image quality. However, bulk application (to all images in a scan or to complete data sets) should be done off-line in order to avoid heavily taxing the data acquisition computers and disk resources being used to acquire images.

batchcorr.exe was written to facilitate calibration of large numbers of data images. As the correctImages.exe function calibrates only one image at a time, batchcorr.exe iteratively invokes this function over all images in a specified data-set.

This document provides a brief guide to using batchcorr.exe. Section II explains the purpose and main features of batchcorr.exe. Section III discusses an image file naming convention which, if followed, will simply use of batchcorr.exe. Section IV explains how to install batchcorr.exe, while Section V discusses how to run batchcorr.exe at the Windows command prompt. Finally, Section VI gives detailed information on available command-line options.

II. Overview

When launched at the Windows command prompt, batchcorr.exe searches the specified data directory for data and dark image files. Once a set of data files have been identified, batchcorr.exe analyzes time stamps to determine which available dark file is most appropriate for the data being calibrated. It prompts the user to approve the selected dark file or suggest an alternate. It will then iteratively invoke correctImages.exe to calibrate each data image.

Other features include:

1. Capacity to calibrate select portions of an image series by specifying beginning and ending image numbers.
2. Support for data taken with single or multiple detector panels.
3. Minimal command-line input by extracting information required by correctImages.exe

from data file names or headers

4. Automatic deletion of ".cor" output files.
5. Command line help option.

III. A word about file names

batchcorr.exe is flexible enough to work with a variety of image file name formats. However, we assumed a simple naming convention when optimizing the code:

<imagestub>_<panel#>_<image#>

<imagestub> is the root file name applied to multiple files in a series of images. It can be anything supplied by the user - it may identify the sample being studied, information about data-taking conditions, etc - but it should be the same string applied to a large number of files. This string should change appropriately to identify a dark image file.

<panel#> is the GE detector used to take the data. This should be a number from 1 to 4 corresponding to the naming of the GE detectors at Sector 1-ID.

<image#> is the serialized image number appended to the file name by EPICS.

Following this convention will allow batchcorr.exe to properly extract the panel and image numbers from the file name. It is not recommended that a file extension be used. batchcorr will support a ".dat" file extension, but other extensions will crash the code.

IV. System Requirements and Installation

As the GE calibration utility has only been distributed as a 32-bit Windows executable, batchcorr.exe has also been compiled on a 32-bit Windows platform. It may also run on 64-bit Windows machines, but compatibility is not guaranteed. 438.05 MB of disk space is required to install batchcorr.exe and the associated GE detector calibration files.

batchcorr.exe is distributed as a .zip compressed archive file. The file contains:

1. DetectorData folder containing both detector calibration data. correctImages.exe and batchcorr.exe also live within this folder at the top level.
2. install.exe installation utility
3. README.pdf which is a copy of this instruction document.

To install batchcorr.exe, simply download the batchcorr archive from the Detector Pool web page (http://wiki.aps.anl.gov/bts/index.php/GE_a-Si_Detector_Information). Open and unpack the archive using WinZip, then navigate into the top-level directory, and launch the installation executable. The installation program will install the required files onto your computer's hard drive, and set required environment variables. Proper execution of the installation program will

require administrative privileges. If batchcorr.exe is to be run from an account other that that used for installation, then it is recommended to add “C:\DetectorData\” to the PATH environment variable (“setx Path C:\DetectorData” at the Windows command prompt).

GE’s calibration function requires that a set of files be located in a particular directory named “C:\DetectorData\” on whatever PC is performing the calibration. If such a directory already exists on your computer, the installation executable will ask for permission to overwrite it. If permission is not given, then the script will exit without having installed the software.

V. Running batchcorr.exe

1. Launch a Windows command prompt (For Windows XP: Start > Run > type “cmd” in the “Open” field and click on “OK).

2. Command line usage: batchcorr.exe <options>

For example:

```
D:\GESoftware\scripts>batchcorr.pl --imgstub ceria2 --panel 1
```

Available options are discussed in the next section.

3. batchcorr.exe will check the validity of the command line options and stop execution if anything is out of place.

4. batchcorr.exe will display a list of data files to be calibrated and list of available dark images:

```
Processing data for panel 1.

List of files to process:

1. ceria2_15239.dat
2. ceria2_15240.dat
3. ceria2_15241.dat
4. ceria2_15243.dat
5. ceria2_15244.dat
6. ceria2_15246.dat
7. ceria2_15247.dat


List of possible dark images:

1.  d:\GESoftware\trial_data\ceria2_dark_15242.dat
2.  d:\GESoftware\trial_data\ceria2_dark_15245.dat
```

4. bathcorr.exe attempts to identify a suitable dark image that was taken before the earliest data image. If no such image is found, then a warning is displayed and the program will ask the user for direction:

```
Available dark images taken after beginning of data set.
How do you wish to proceed?
e = Exit to examine limits of data range before trying again.
f = Force calibration.

Please enter "e" or "f":
```

Here, option “f” forces the program to proceed anyway, but option “e” allows the user to abort the calibration.

5. batchcorr.exe will suggest an appropriate calibration file and prompt the user for approval:

```
Calibration image d:\GESoftware/trial_data\ceria2_dark_15242.dat
taken closes in time to start of data images.
Calibrate data with proposed image? (y/n)
```

6. If the user agrees, the program will then proceed with the calibration. If the user disagrees with the selected dark image, then the program will ask the user to select a different dark image from the list. The image file is selected by entering the number next to the desired dark image.

```
Select index of desired calibration image from above list:
```

7. Once the dark file has been selected, the program will proceed with the calibration.

VI. Command line option reference

1. --help: Prints a usage/help memo and exits.

```
d:\GESoftware\scripts>batchcorr.exe --help

batchcorr.pl
Correct and calibrate image files for GE a-Si detectors
using GE's CorrectImages.exe function.

It's preferable to use batchcorr with the "--multi" commandline
option and follow the associated image file naming convention.
This option parses image file names for the panel #, eliminating the
possibility of mis-assigning the panel # for a data file.
"--multi" can be used to correct data taken with only one panel;
the script will simply skip panels with no associated data
```

Alternatively, if the naming convention has not been followed, a panel # may be supplied manually with the "--panel" commandline option. Once invoked, the script assumes that all files in the data directory with the appropriate stub were taken with the specified panel. File names are not parsed for a panel #, so a possibility for mis-calibration exists. Please be careful with the "--panel" option.

If invoking the "--multi" option, data file names must be of the form:

filestub_<panel#>_<image#>

Commandline options:

--help Print this message
--datadir Path to directory containing image and dark files.
--imgstub File stub for data images (Default= "img").
--drkstub File stub for dark images (Default= "dark").
--gain Gain setting for data images (h/m/l).
Do not use switch for no gain correction.

--low Beginning image in series.
--hi Ending image in series.
--multi Iteratively process data for all 4 panels.
--panel Specify specific panel (1-4).
Must declare panel if not using "--multi".
--ndel Do not delete ".cor" files.

2. --datadir <directory>: Specify directory path for data files. Dark and data images must be in the same directory.

3. --imgstub <fileprefix>: Specify stub for data file names. This argument indicates the fixed portion of filenames for a data-set to be calibrated. For example, a series of images consist of files “feb11_sample1_1_1233 “ to “feb11_sample1_1_1256,” where the user complied with the naming conventions discussed in Section III. In this case, “Feb11_sample1” is the file stub, followed by the panel number (1), and then the serialized image number (1233, 1234...).

4. --drkstub <fileprefix>: Specify stub for dark file names. This is similar to the “--imgstub” option discussed above, but the file prefix here is used to identify dark files. Continuing the example from the “--imgstub” option, a sample dark file may be named “feb11_sample1_dark1233” where the file stub may be “feb11_sample1_dark”. batchcorr.exe uses the “--drkstub” argument to identify dark image files in the data directory. The handling of dark files is much looser than it is for image files, so it may not be necessary to supply the entire file prefix. The code will successfully find the example dark file if only “--drkstub dark” is supplied. Supplying less information to barchcorr.exe through the “--drkstub” will cause batchcorr.exe to grab a more general list of dark files in the data directory. This may

be acceptable if only a few dark images are available.

5. --gain <h/m/l>: Specify gain setting for data images. There are three gain modes (h = high, m = medium, l = low) that can be set during calibration. Gain was set on the EPICS Medm screen at some point during data acquisition, and the gain should be noted and communicated to batchcorr.exe during calibration with this command line option. If "--gain" is not set on the batchcorr.exe command line, then no gain correction will be performed during the calibration.

6. --low <image#> and --hi <image#>: Specify lower and upper limits of image indices. These two options allow a user to calibrate subsets of a run of images. The arguments here are the serialized indices of the first and last images to be calibrated. For example, you have a data set consisting of images "feb11_sample1_1233" to "feb11_sample1_1256," but you only want to calibrate the first few images. Then, you would invoke batchcorr.exe with "--low 1233 --high 1234".

"--low" and "--high" can be used independently of each other; both options needs not be specified on the command line.

7. --multi: This option instructs batchcorr.exe to iteratively process data for all 4 GE panels at Sector 1-id. In order to use this option, the data file names must comply with the conventions discussed in Section III. "--multi" is intended for use with data acquired using all 4 detectors of the "Hydra" array, but it may be used to also calibrate images taken with a single panel (provided that the naming conventions have been followed). When using "--multi", batchcorr.exe is careful to employ only dark images for the appropriate panel being corrected.

8. --panel <1-4>: Manually specify panel number used to take data. If file names do not follow the conventions discussed in Section III, then this option must be invoked to manually supply the panel number to batchcorr.exe. Care must be taken to supply the correct panel used when taking data. Either "--panel" or "--multi" must be used on the command line.

9. --ndel: Do no delete ".cor" files. The GE calibration routines produce numerous output files. The ".cor" files output a calibrated version of each image in a data file, while the ".avg" and ".sum" files contain the average and sum of all images. As it is preferable to work with the ".avg" and ".sum" files, batchcorr.exe deletes the ".cor" files by default. This option preserves the ".cor"output files.