CCD – mirror alignment and measurement preparations

1. Turn on alignment laser using switch on its USB connector at Debian PC.
2. Verify laser beam passes through both apertures in collimator tube.
3. Use x and y direction linear motors and software on Windows PC to align output beam from collimator tube with crosshair target on mirror stand at Debian PC.
4. Record x and y position of motor
5. Turn off alignment laser using switch on its USB connector.
6. Use hand screws to ensure mirror stand mount vertical arm and horizontal arm can move freely in both directions
7. Find mirror stand drawing for mirror to be tested
8. Adjust bottom mounting brace on mirror stand to match drawing.
9. Adjust top mounting brace on mirror stand to be slightly higher than drawing
10. Unpack mirror
11. Place mirror on mirror stand according to drawing
12. Adjust top mounting arm on mirror stand to securely hold mirror
13. Put horizontal arm and vertical arm at center of rotation
14. Turn off light in room (lamp/flashlight can be used to see for following steps)
15. Turn on d0 source by plugging in USB cable to Debian PC
16. Plug in d0 CCD USB cable to USB 3.0 port on Debian PC
17. Align d0 source image with d0 CCD using mirror stand hand screws
18. Remove CCD lens cap
19. Use xiCamTool to center d0 spot in center of CCD
    a. Linux terminal command: *xiCamTool*
    b. When program opens, click “Play” button at top, left of screen
    c. Spot will be seen on screen.
20. Use z direction linear motor to find minimum d0
    a. Adjust z position linear stage using software on Windows PC
21. Record z position of linear motor.
    a. Note: for the rest of the procedure, this z position will be referred to as Z_{start}
22. Create directory on Debian PC where data will be stored.
23. Move to directory created in step 22.
24. Link PlotD0.C to current working directory
    a. Version of program we used is at /home/lab/data/RICH-II/PlotD0.C
    b. Command syntax: ln –s /home/lab/data/RICH-II/PlotD0.C
25. Use ximea-shot command to find an exposure where the maximum number of counts in a CCD pixel is ~900 (note for the rest of the procedure, the exposure found in this step will be referred to as T_{exp}).
    a. Command syntax: ximea-shot 0 <exp>
    b. <exp> will most likely be anything from 0.3 ms – 5 ms.
26. Turn off d0 source by unplugging its USB connector from Debian PC
27. Repeat ximea-shot command with T_{exp}
    a. Command syntax: ximea-shot 0 T_{exp}
    b. Output file will be called “grey.txt”
28. Rename “grey.txt” to “bkg1.txt”

a. Command syntax: mv grey.txt bkg1.txt

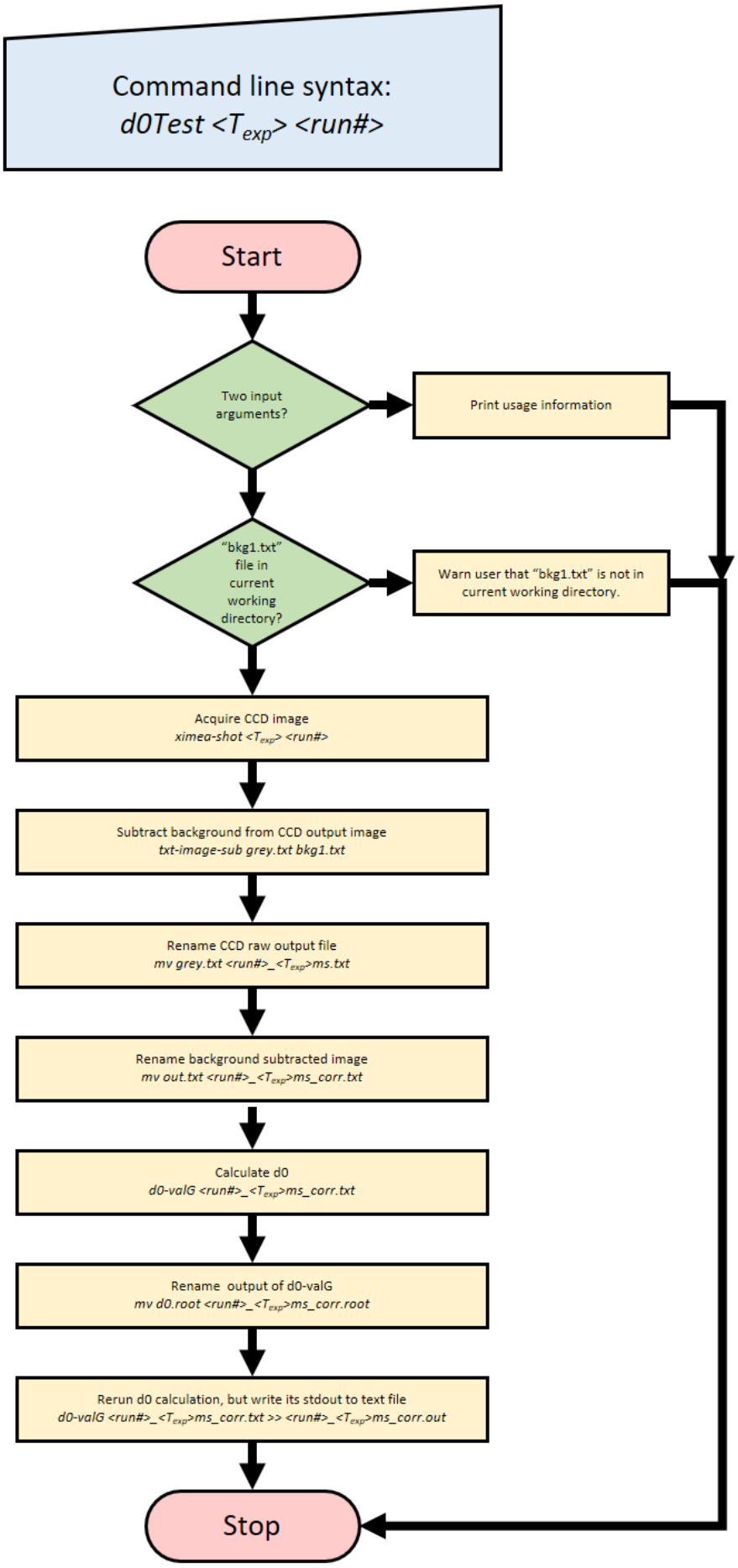
29. Turn on light source by plugging its USB connector into Debian PC
30. Use *whatZ* command to print out what z positions will be used for measurements
    a. Command syntax: whatZ Z_{start}
    b. Example output is below for Z_{start} = 100 mm (spacing between z column and run column is one tab character [“\t”])

z[mm]	run
79	1
84	2
87	3
90	4
93	5
96	6
98	7
100	8
102	9
104	10
107	11
110	12
113	13
116	14
121	15

31. Copy and paste output from *whatZ* into a text document called “D0Log.dat”

d0 Test Procedure

1. If system is not aligned, do "Optical System Alignment" procedure.
2. Make sure lights are off in clean room.
    a. *Light should be off for all measurements*
3. Make sure d0 source is on
4. Make sure CCD lens cap is off
5. For every row in D0Log.dat (skip the header row):
    a. Move z axis CCD stage to z position in row
    b. What for stage to reach position
    c. Run d0Test command
        i. *d0Test* is a bash script that automates some of the command line entries used to gather data. If desired, the user can type in the same commands manually into the command line instead
        ii. sequence of *d0Test* in flow chart below
        iii. Command syntax: d0Test T_{exp} <run # in row>
6. Run PlotD0.C in ROOT
    a. Command syntax: root -l -b -q 'PlotD0.C("D0Log.dat",T_{exp}, *<z for run # 6>*,*<z for run # 10>*)'
    b. From example output of *whatZ*, *<z for run # 6>* = 96 and *<z for run # 10>* = 104
7. Convert PlotD0.ps (output of PlotD0.C) to PDF
    a. Command syntax: ps2pdf PlotD0.ps


Command line syntax:
d0Test <T_exp> <run#>
Start
Two input arguments?
Print usage information
"bkg1.txt" file in current working directory?
Warn user that "bkg1.txt" is not in current working directory.
Acquire CCD image
ximea-shot <T_exp> <run#>
Subtract background from CCD output image
txt-image-sub grey.txt bkg1.txt
Rename CCD raw output file
mv grey.txt <run#>_<T_exp>ms.txt
Rename background subtracted image
mv out.txt <run#>_<T_exp>ms_corr.txt
Calculate d0
d0-valG <run#>_<T_exp>ms_corr.txt
Rename output of d0-valG
mv d0.root <run#>_<T_exp>ms_corr.root
Rerun d0 calculation, but write its stdout to text file
d0-valG <run#>_<T_exp>ms_corr.txt >> <run#>_<T_exp>ms_corr.out
Stop