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Symptom-based Troubleshooting Guide

This is a partial list of trouble symptoms, some possible causes, and fixes.

Trouble contacts:

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Please try the fixes listed below before calling.

Detection system:

1. No counts in MCA, mapping or EXAFS:  
You may be getting no beam. Check I0. If I0 is low or zero (after subtracting offset), see the Optics section.  
  
Detector HV may be off. This power supply is in the hutch. Check LN2 level before turning on.  
  
LN2 may have run dry. The auto-fill system control box is just outside the hutch, sitting on a yellow safety box. Its readout shows you how much (0-100) LN2 is left. If it's low, check:  
LN2 dewar empty? The level gauge can't be trusted - check the pressure instead.  
  
LN2 dewar valve closed? It tends to be left closed when the dewar is refilled.  
If LN2 ran dry, correct the problem and let the detector fill. Turn off the high voltage and wait 12-24hrs before turning it on and trying again.
2. Plenty of counts showing in MCA, but no edge jump recorded in fluorescence channel in EXAFS.  
When you edit the scaler map to switch to a new edge, you have to stop and restart the EXAFS program to make the program read in the new scaler map.
3. You find a hotspot in XRF mapping, but don't get any counts.  
Make sure you're above the edge.  
  
Make sure you did a move-to-crosshair in the Manual Stage Control.
4. You try to change the gain on I0 or transmission, but nothing happens.  
You have to turn the knob on the Keithley VI and then hit the blue Set button. Nothing happens until you hit that button.

Software - General

1. Buttons 'push' but nothing happens and they don't 'pop out' again when they should.  
When you invoke a program, it's in a dormant state. A small icon in the upper left will hold a white arrow

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if it's in that state. Push that arrow, and it will turn black, signifying that the program has started.

The EXAFS and XY map programs have 'pop-up' subroutines (e.g. Measure and Scan Editor) which need to be Returned from before the rest of the program will work.

2. Data-taking computer completely locked up  
If you exit from all the stage programs, you can tickle a bug in the stage-control drivers (vendorware). This bug locks the computer. Hard-boot it. It's UXASES and it's in the half-rack labeled 'BRUKER AXS'. The login and password are posted at the line.
3. You stopped one of the programs, but another program thinks it's still running.  
If you use the small stop-sign icon to stop a program rather than its stop button, it doesn't have a chance to turn off the flag which says that it's running. Cure: You can start and stop the offending program properly, or you can use the desktop shortcut marked "No, it's NOT running!", which turns off that flag.
4. The data analysis computer shows a green screen without the icons to which you've become accustomed.  
That monitor is connected to three different computers via a KVM (Keyboard-Video-Mouse) switch. To switch to Computer 1, hit the sequence <Alt><Ctl><Shift>1<Enter>. Computer 1 is UXAS\_DATA, the analysis computer. This is a similar situation to what obtains with the right (data-taking) screen, which is connected to two computers. The two-port KVM switch has a simpler sequence for switching - <Ctl><Ctl> toggles between the two machines.
5. You rebooted and now face a login/password screen.  
Logins and passwords for the computers are posted above the left-hand screen. Each computer also has on its desktop a text file 'logins.txt' with this information. You can therefore look on one of the other computers for the 'key' to the one you're trying to open.
6. You try to print and nothing happens.  
This is a stupidity of our server system. All printing, even to the printers right at the beamline, goes through a server, XRAYS-1. If the connection is broken, it won't automatically re-establish itself. Go into Computers Near Me and double-click on XRays-1. It will want a login and password. Leave them blank and click OK. Printer icons should appear. Close the window and try again to print.
7. You try to use the executable analysis programs from home and they don't work right.  
Check to see that the file lvalys.dll is present in the same directory as the executable. Odd bugs can result from its absence.

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If your computer is European, make sure that the Use Localized Decimal Point option is un-selected. In some countries, a comma is used instead of a period. If this option is selected, then the programs will attempt to read and write files this way, which will conflict with the way they're written at the beamline.

Software - EXAFS program:

1. Scan editor won't let you return  
You've entered something it doesn't understand or thinks makes no sense. Example: leaving the edge code off an edge-relative energy ("ge" instead of "gek").
2. Scan keeps aborting and restarting  
Dump level may be set incorrectly. If the dump level is too high, it will call a dump even if there isn't one.  
If the dump level is OK, then the channel for dump detection may have gotten set incorrectly. This should be set to 0 (default configuration) because that's the channel on which I0 comes in. This control is in the Scan Editor, under Dump.
3. EXAFS curve is very strange, but not due to 4) above.  
Make sure Differentiate switch is OFF.  
  
Make sure offsets were done correctly. Offset for detector channels should be 0. If not, then initialize detector and try again.  
  
Make sure your plot specification is correct (usually, 2/0).
4. Start button is grayed and disabled.  
Make sure MCA isn't running and that a fluorescence map isn't being taken. Indicators should pop up to tell you about these conditions.
5. Start button and mono-control buttons are grayed and disabled.  
If you change the mono energy from outside the program (say, using Motor Monitor) or have disabled the mono motor, the program gets confused and thinks there's a motion problem and that the mono is trying to get where it's told. Press the 'Mono really got there!' button on the Operations page to clear this.  
  
It sometimes happens that the communication with the server program on 1032\_BL\_CONTROLS is lost. In that case, no monochromator functions work. Stop and restart the EXAFS program to reconnect.
6. When doing a multi-point scan (automatic move), the stage doesn't go to the point you expected.  
The first position on the list is #0, the next #1, etc.  
The position it moves to when starting a scan is determined



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or scan steps.

5. You added a channel to the Regions of Interest Settings area but no counts appear there.  
You have to stop and restart the program to make additional channels work.
6. Normalization doesn't seem to be working.  
Did you do an I0 offset?
7. One or two lines on your map are horizontally offset from the others.  
This is a known stage problem with no known cure except re-running the map. It's random.
8. The more-uniform areas of your map are speckled with defects consisting of one light pixel with a dark pixel immediately to its right.  
Another known stage problem. The stage 'catches' at random places instead of moving uniformly. You can try changing the dwell time to change the motion speed and see if that helps, but there's no known cure.

Stage

1. Stage doesn't run.

If stage stopped when you were moving it, you probably hit a limit. If the Unidex program is on the taskbar, then click on it and see if there are any error conditions showing. Press the Fault Ack button on the bottom of the screen, then press the Enable button on the left corresponding to whichever axis had the problem. Note that what the mapping program thinks of as Y is Z in the Unidex program. If this works, you don't need to reset or home anything.

If the Unidex program isn't on, then start it using the icon which looks like

```
      ^
     / \ <--- blue
    ===
     \ / <--- black
      v
```

Both axes will be disabled. Rack the stage back a couple of inches, Enable X, then press its Home button (top of screen), then do the same for Z. This does the homing cycle. The stage will now move to its limits, so there had better be nothing in the way.

Whenever the stage has been homed, it's in a position far from where you might want it. Pull up the manual stage control and hit Move to Start. This should move it to someplace reasonable. It sometimes happens that only one axis moves. In that case, hit it again and

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the other axis should go.

If it still doesn't run, check the circuit breaker on the Aerotech controller on the right side of the electronics rack, under the notation "BR1032-06". This affects the Z axis.

If the X-axis won't run and everything else seems OK, the problem may be the fuse inside the Aerotech controller. The Unidex program will complain about a velocity or position error when you try to move and will then disable the axis. Also, you will be able to move the stage horizontally by hand and there will be no holding torque. This fuse is in the leftmost of the three unpluggable modules in the Aerotech driver box, next to the fan. Pull out the module, inspect the fuse and if need be, replace it. If the Unidex program is still on, it will know where it is and not need to be homed, though it will need to be enabled. This happens only if the stage hit something during a move, so be sure to clear any obstructions before trying the stage again.

2. You hit the Jog button in the Manual Stage Control and nothing happened.

The buttons are a little flaky (some subtle timing problem) and don't always give you one and only one step at a time. Watch the current-position numbers to be sure.

#### Optics and X-rays

1. I0 jumps up and down 2-6% on a regular basis  
This is due to an EPU (probably #4) switching. You can't do much about it except try to get the normalization to work really well.
2. Beam is not well focused in the vertical direction at low energies.  
This is due to scatter off of M2 and you can't do much about it, either.
3. Normalization isn't good or data noisy  
Check offsets (dark counts).

Make sure you're on a local max or min of count rates with respect to position.

Try reducing the slit size if it isn't already somewhat down from full open.

Try steering beam through roll slits with M1.

If  $I0 < 1V$ , try raising the I0 gain, remembering to do

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offset again.

Check to see that the I0 gas, if any, is appropriate. If I0 was set up for Br with a rich Ar/N2 gas mixture, it will cause strange noise when running at lower energies. Similarly, if He is running and the energy is high, the I0 will be weak and noisy. The former error is harder to notice just by inspection of the signals.

If you're using a gas mixture, try switching to a single gas. The mixing panel sometimes doesn't produce a stable mixture.

4. Fluorescence data shows strange dips or peaks in the scan  
Check the total counts (4th channel) and see if there's a big peak. If so, you may have a Bragg diffraction peak being thrown into the detector. This can cause a deadtime-related dip by swamping one detector element with scattered light, or a peak in Fe or Cu by virtue of a beam hitting something in the detector. The latter case can be sneaky because the scattered beam causing the problem may not be directly detected.

Fix: Go to the energy at which this occurs. Use the MCA utility and look at each detector element. There will be one or two which show anomalously high counts in elastic, Fe or Cu bins. Go into the hutch and disconnect the BNC cable from the preamp whose number corresponds to the affected channel. The preamps are in two rows along the snout of the detector and each have a BNC and RJ connector on them. Then, check the MCA to see that the offending channel is truly disabled.

When doing deadtime correction, adjust the deadtime from 0.46us to 0.54us (1 detector disabled) or 0.64us(2 disabled).

\*\*\* Don't forget to reconnect it afterward! \*\*\*

5. Mono energy calibration drifts  
Check cooling water level in mono chiller.

Make sure the hutch door doesn't stand open for a long time. Temperature fluctuations may affect calibration.

6. Data shows 0.1%-1% jumps at regularly-spaced energies (60eV interval at Cu edge; 80eV at Zn).

This is a known problem with the monochromator and optics. What's happening is that a picomotor controls the gap between the two crystals to get a constant height offset in the mono. This motion is quantized in units of about 0.5um. For reasons unknown, when one of these steps occurs, the data can be affected, especially when the sample is highly inhomogeneous.

The fix is to disable the motion during the scan. This is done as follows:

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1. Under the rack marked 'BR1032-04', between the 10.3.2 and 10.3.1 beampipes is a black box with switches and connectors. It's fairly well-hidden.
  2. On the upper right of the front panel of this box is a row of 4 switches, labeled 'Closed/Open-Loop Select'.
  3. Move to mid-scan and flip the leftmost (#1) switch to the up position. This will freeze the motion. The problem should now go away.
  4. IMPORTANT! Restore the switch position before moving to a different edge.
7. Little or no beam at all.
- Several possible causes for this. Check to see if there's been a beam dump (yes, that's obvious). Check to see if the Be-foil monitor (middle readout on DPMS) is zero. If so, it's possible the slits are closed down and you don't know it. Open them to 2000um each way and see if beam shows up. If it does, close them gradually until beam starts to be cut off. See if adjusting M1 roll and tweak do anything good. If M1 is centered, then the problem may be that one or both of the slits has an incorrect idea of where it is. Close down one of the slits until the beam just goes away. If the size shown on Motor Monitor isn't nearly zero, reset it to zero. You may have initially hit Reset instead of Move and cause this problem in the first place.
- Suppose the monitor shows beam but you still don't get any in I0. The mono may be excessively detuned. If the Picomotor control box (black thing with knob on left and red pilot light on right) is set to channel 2 (mono tweak active), it seems to pick up some disturbance and move the tweak. Retune it and leave it set to an inactive channel (say, 1).
- If the flux is good at one energy and dies at others, the problem may be the mono servo switch mentioned in 6) above. If this switch is left in the up (freeze) position and you move to a very different energy, the beam out of the mono will move off the input acceptance of the KB pair and the output flux will drop. The cure is to put the switch down when changing edges or otherwise making a big energy move.
8. I0 pre-amp shows 'OVERLOAD'.  
If running He/N2 mix, you can't use the full 600V on I0 as it breaks down. Go down to 300V (connect to middle connector on battery box instead of end).
  9. You're using the PIN diode for transmission and it has glitches  
It's made of single-crystal Si and has diffraction peaks.

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You can move these around by tilting and rotating, but you can't get rid of them altogether.

Workaround: Use an ion chamber (there's a long one in the hutch somewhere) instead.

10. You're using an ion chamber for transmission and the signal is noisy.
  - If the end windows aren't capped, slap some Kapton tape on them. You don't want the breezes blowing into it.
  
  - If you're using Ar at energies below ~8keV, switch to N2. The absorption length at 7keV is about 3cm. You don't want all the beam absorbed in the first couple of cm because then much of the signal will come from places with nonuniform fields in the ion chamber.
  
  - If you're not using Ar at energies above 10keV, switch.
  
11. All of a sudden, you see a rising or falling background
  - If you're using a gas in I0 or another ion chamber, check the tank. You may have run dry.

#### Data and Analysis

1. Individual EXAFS scans look good, but average looks noisy or glitches don't normalize.
  - The likely cause is that the sensitivity of the detection system, that is how much signal you get for a given I0 and absorbance, isn't the same between files. This has three common causes:
    1. The I0 gain was changed between scans.
    2. The detector was moved in or out between scans.
    3. The concentration of the element of interest isn't the same from scan to scan. This is usually due to the spot moving on the sample, either intentionally (taking different spots to avoid radiation damage) or unintentionally.
  - The EXAFS Editor has an option for changing the gain on a channel, that is, multiplying the counts in a scaler by a constant. If I0 is much quieter than the fluorescence or transmission (usually the case) then you want to do this adjustment on I0. For Cause 1, you obviously want to adjust the gain of the I0 channel so it's the same in all files. Thus, if some files were taken on the 1E-9 scale of the I0 current amp, and others at 1E-10, then use the Change Gain option to increase the I0 counts (scaler 0) in the 1E-9 files by 10x. This should make F/I0 or It/I0 come to about the same value in all files. For the other causes, if I0 is less noisy than the fluorescence or transmission (whichever you're using), then change the I0 gain so that the files all match in edge jump. It sounds a little odd to adjust I0 when it's the fluorescence channel which changed, but it's statistically sounder to do it this way if I0 is quieter, which it usually is.

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A similar thing seems to happen if the time/point was changed for a region in one or more of the scans. I'm not sure why this is. Use the Jump Correct feature in the EXAFS Editor to 'fix' this.