**Super cell removal and installment of VPI valve**

**Issue:** Power blackout on the trailer for extended periods, the generator worked for a while but then everything turned off, including the QCLAS.   
When autostart is run, the spectrum looks fine while it is trying to centre. However when it is finally finished centering, the spectrum looks very bad, and the laser power is very low.

**ARI verdict**: The light level is down to ~5mV. When switched to AD1, the reference path detector, there was still ~1100mV of light, a good indicator that it's more likely a cell issue than anything else. When power was lost, the pump likely sent contaminants back through the line and damaged the mirrors.

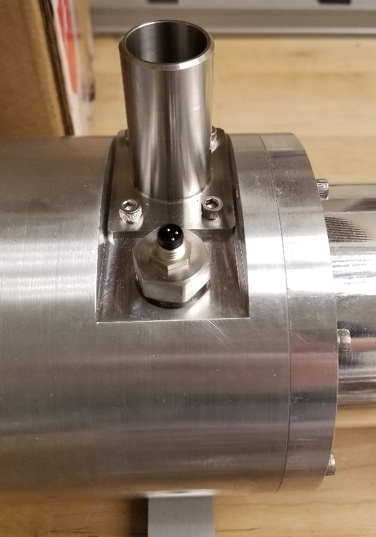
If mirrors were damaged, they would need to be replaced. Damage due to pump failure is not possible to clean; the high speed at which the air moves into the cell tends to embed anything that was carried by the air into the coating. A cleaning can (and is) still attempted, but it usually doesn't help.   
The cell would need to be sent to ARI to be looked at. For cleaning, both mirrors need to be removed from the cell body and the alignment is based on mirror position relative to each other; after a cleaning, it's necessary to verify and adjust alignment because it's practically impossible to get the mirrors back in the exact same position and you'll effectively have no way of verifying the alignment pattern.

**Prevention for reocurrence:**

Need to use a Vacuum Pump Isolation (VPI) Valve on the scroll pumps to prevent backflow in case of failure. E.g., this is Agilent's page for their VPI [valve(s)<https://www.agilent.com/en/product/vacuum-technologies/dry-scroll-pumps/scroll-pump-accessories/vacuum-pump-isolation-valve-vpi>](https://us-east-2.protection.sophos.com?d=agilent.com&u=aHR0cHM6Ly93d3cuYWdpbGVudC5jb20vZW4vcHJvZHVjdC92YWN1dW0tdGVjaG5vbG9naWVzL2RyeS1zY3JvbGwtcHVtcHMvc2Nyb2xsLXB1bXAtYWNjZXNzb3JpZXMvdmFjdXVtLXB1bXAtaXNvbGF0aW9uLXZhbHZlLXZwaQ==&i=NWZlMzY0NmMyMDVjNjQwZTE1YzFlYWFh&t=L2VDNVNDYldMSHhzdStyMitxWEdTR2IxMUVCVjdTNVhRY0hpemgvWGlwRT0=&h=51664a54e81947df8026c331e53d7dcb&s=AVNPUEhUT0NFTkNSWVBUSVab9kbL0ww6uSvUo_0X81myxnLSElOtbH5Vbeq5BeNJ0g%3e" \o "https://us-east-2.protection.sophos.com/?d=agilent.com&u=aHR0cHM6Ly93d3cuYWdpbGVudC5jb20vZW4vcHJvZHVjdC92YWN1dW0tdGVjaG5vbG9naWVzL2RyeS1zY3JvbGwtcHVtcHMvc2Nyb2xsLXB1bXAtYWNjZXNzb3JpZXMvdmFjdXVtLXB1bXAtaXNvbGF0aW9uLXZhbHZlLXZwaQ==&i=NWZlMzY0NmMyMDVjNjQwZTE1YzFlYWFh&t=L2VDNVNDYldMSHhzdStyMitxWEdTR2IxMUVCVjdTNVhRY0hpemgvWGlwRT0=&h=51664a54e81947df8026c331e53d7dcb&s=AVNPUEhUT0NFTkNSWVBUSVab9kbL0ww6uSvUo_0X81myxnLSElOtbH5Vbeq5BeNJ0g%3e) < [https://www.agilent.com/en/product/vacuum-technologies/dry-scroll-pumps/scroll-pump-accessories/vacuum-pump-isolation-valve-vpi&gt;](https://us-east-2.protection.sophos.com?d=agilent.com&u=aHR0cHM6Ly93d3cuYWdpbGVudC5jb20vZW4vcHJvZHVjdC92YWN1dW0tdGVjaG5vbG9naWVzL2RyeS1zY3JvbGwtcHVtcHMvc2Nyb2xsLXB1bXAtYWNjZXNzb3JpZXMvdmFjdXVtLXB1bXAtaXNvbGF0aW9uLXZhbHZlLXZwaSZndA==&i=NWZlMzY0NmMyMDVjNjQwZTE1YzFlYWFh&t=dC9uN0NPS2prV3J0a3JpSDBDZTVSS1ljcHpzKzF2VlRhWGxyWjk2MkdSZz0=&h=51664a54e81947df8026c331e53d7dcb&s=AVNPUEhUT0NFTkNSWVBUSVab9kbL0ww6uSvUo_0X81myxnLSElOtbH5Vbeq5BeNJ0g;" \o "https://us-east-2.protection.sophos.com/?d=agilent.com&u=aHR0cHM6Ly93d3cuYWdpbGVudC5jb20vZW4vcHJvZHVjdC92YWN1dW0tdGVjaG5vbG9naWVzL2RyeS1zY3JvbGwtcHVtcHMvc2Nyb2xsLXB1bXAtYWNjZXNzb3JpZXMvdmFjdXVtLXB1bXAtaXNvbGF0aW9uLXZhbHZlLXZwaSZndA==&i=NWZlMzY0NmMyMDVjNjQwZTE1YzFlYWFh&t=dC9uN0NPS2prV3J0a3JpSDBDZTVSS1ljcHpzKzF2VlRhWGxyWjk2MkdSZz0=&h=51664a54e81947df8026c331e53d7dcb&s=AVNPUEhUT0NFTkNSWVBUSVab9kbL0ww6uSvUo_0X81myxnLSElOtbH5Vbeq5BeNJ0g;)>.

Generally, it's preferable to incorporate a safety feature, like the VPI valve, to allow for the pump to go off on its own but still prevent backflow issues. Ultimately, without a VPI (or some other backflow prevention) even if the pump is put on the same supply, you'd still be in the same situation once power runs out.

**Removal and preparing the cell for shipping back to aerodyne**

Only the cell itself needs to be shipped, no need to send back the MKS valve. The super cell ends at the inlet tubes - the vertical tubes that the 1" nuts attached to - everything else is separate. See attached image for clarification.

**Prerequisite**: Switching between AD channels 0 and 1

This can be done by clicking on the number under "A/D", as highlighted in orange in attached screenshot. In your instrument, AD 0 is the sample cell (main) detector; AD 1 is detector for the reference path (reference cell or etalon, depending on flag state). So, switching to AD 1 (reference path) and noting the light level before removing R5 (one of the reference path mirrors); that way when reinstalling R5, you have a reference light level.  
  
 

**Removing the super cell**:

1. Remove the R5 mirror. Make note of the light level on the reference path (switch to AD1 in TDLWintel), so you have *something* to go by when it's reinstalled later. [you will likely find that someone else did this earlier, but you might add what you have at time of removal to the notes for easy access and historical record.] Outline the base of it on the table with a pencil so that you have a decent guide for where it's located. From pre-ship photos, it looks like we had actually done so at one point; you might add an X on the old lines, or try to erase it - just so you can tell which outline is the fresh one.
2. Unplug the red/black wires coming from the Super Cell at the Optics board, pull the wire back through tie wraps and make sure it is free to come out with the cell.
3. Remove the internal plumbing from the cell and from the bulkhead fittings, place them to the side. You'll need a 9/16" wrench for the 1/4" fittings, 7/8" wrench for the 1/2" fittings, and a 1-1/2" wrench for the 1" fittings.
4. Once you've got the fittings set aside, cover the inlet ports as best you can with whatever you might have available (saran wrap with an elastic, aluminum foil, etc.);
5. Unscrewing the Baratron/pressure transducer can make removal a bit easier, also. There are two screws holding the bracket to the table and can be removed with the 3/16" wrench. The Baratron can just be left hanging there; having it loose and off to the side will make getting the Super Cell foot through easier.
6. Of the four screws holding the Super Cell to the table, 3 of them are easy to get at. Just unthread them with a 3/16" hex driver (it'll need to be long) and let them fall where they may - you can grab them up after the SC is removed. The fourth is tougher to access; if you slide the driver between the fan and heatsink on the wall, you should be able to go nearly straight down and get at it. **At this point, be very careful with moving the Super Cell; with the screws out, it can now slide around.**
7. The next step is actually removing the cell. **M6 is extremely close to the front of the cell; caution must be observed.**What you'll want to do is *slowly* lift the cell up from the front to get away from M6 and, when high enough, get your other hand under the center for better/even handling. When you've got a good handle on it and it's mostly clear, you can twist and turn the cell as necessary to get it out - the twisting will likely be needed to avoid hitting the detector assembly.
8. The cell isn't outrageously heavy, but definitely isn't light be any means; coupled with the awkward positioning (possibly made worse in the field, depending on your setup), I would have a couple people available for lifting, unless you're confident in lifting the ~20 lb out.
9. Take your time, be mindful as you're lifting it out not to strike anything, but optics (M6) especially. Maybe go through the instructions as you're looking at the instrument as a sort of rehearsal in your head. If you have any questions, better to reach out than get stuck in the middle of it!
10. When you've got it out and packed, please be sure to include the RMA# in the address and any shipping documentation to prevent any delays in processing when Aerodyne receives the shipment:  
       
    Aerodyne Research, Inc.  
    Attn: Mike Moore, RMA [#6148](https://support.aerodyne.com/hc/requests/6148)  
    45 Manning Rd.  
    Billerica, MA 01821  
    USA
11. For reassembly afterwards, just as a heads up for supplies, you'll want some way of holding the screws to get them back into place. You can use teflon tape or Scotch tape, that would normally be used on pipe threads, and wrap it around the head of the driver. If you have a ball-tip hex driver, then that would, of course, do the job. Needle nose are an option to place the screws, but you'll surely note how tight everything is with the cell in place; the troublesome 4th screw is again an issue.

**Packing:**The super cell is packed in an appropriately sized box with relatively stiff foam. Cuts are made in the foam to insert the cell into, to both keep it from moving around (by sizing the cuts) and add additional protection (surrounded by the foam).