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LIQUID WATER ISOTOPE ANALYZER PULSE SHAPE DICTIONARY -- DIAG...



**Aaron Van
Pelt**

Liquid water isotope analyzer pulse shape dictionary -- diagnosing problems from injected pulse shapes

[/3400?destination&tc](#)

Product Performance Isotopic H2O

Topic started by Aaron Van Pelt on September 11, 2019 - 2:33pm

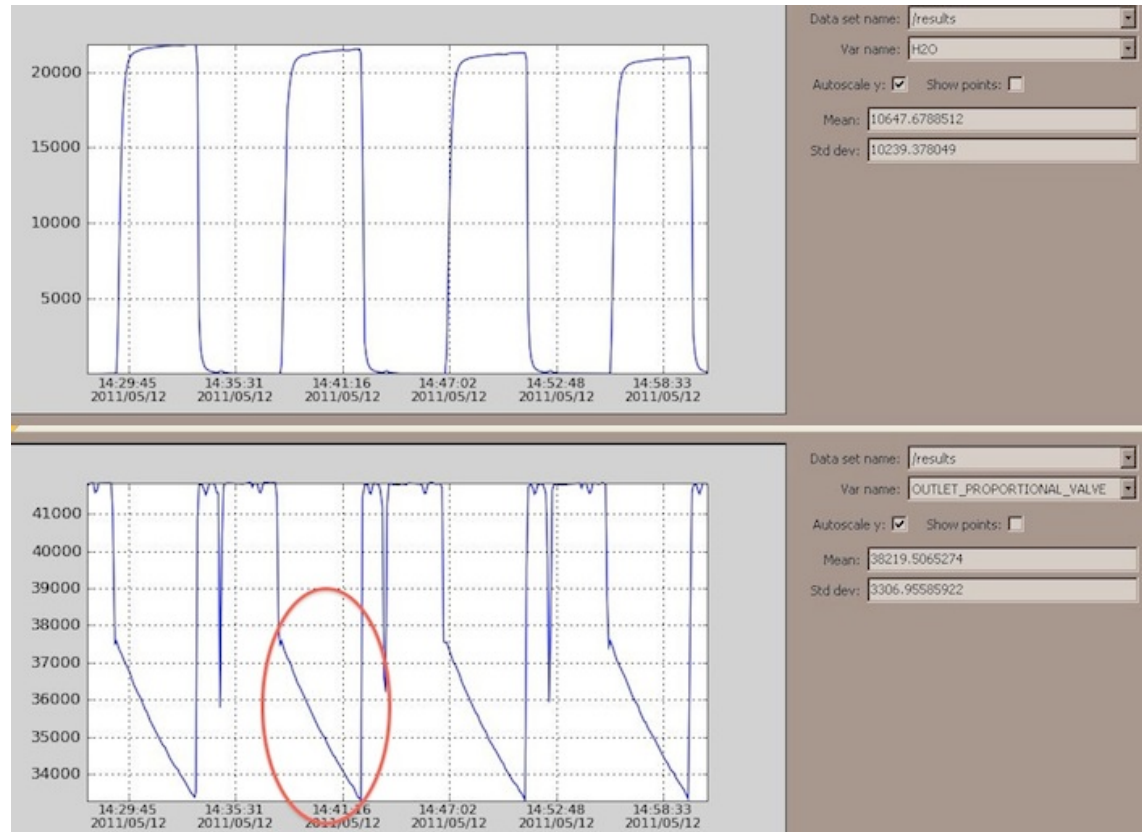
After an injection of liquid into the water isotope analyzer, the shape of the square "pulse" (in the water concentration versus time graph) gives much information about the quality of the injection and if there are any problems that can lead to poor data.

This [schematic \(/support/community/vaporizer-a0211-operation-schematic/\)](/support/community/vaporizer-a0211-operation-schematic/) showing how vaporizer A0211 works can be useful to reference along with below pulse shapes. They're examples of good and bad pulse shapes along with common causes and solutions for each scenario. It is helpful to also look at the "outlet proportional valve" setting during the analysis. The outlet proportional valve is the valve in the analyzer that is continuously adjusted to maintain a constant cavity pressure. When a liquid injection is delivered from the fixed gas volume in the vaporizer to the analyzer, the pressure at the inlet of the analyzer decreases steadily during the analysis of the pulse (as it draws gas out of the fixed volume) -- the outlet proportional valve is therefore slowly adjusted to compensate and to keep the analyzer cavity pressure constant. Plotting the outlet valve position and water concentration is a good way to identify problems like plumbing leaks.

You can access the outlet valve position from the GUI (see [this post \(https://www.picarro.com/videos_pics_got_leaks_isowater_analyzers\)](#)) and by

looking in the *data.dat files in c:\userdata (1xxx analyzers) or in the "private" data files of 2xxx analyzers. Some analyzers also include this in the user data log files. If it's unclear how to get this data, let us know and we can help you set up your analyzer to provide it in the user files. In 2xxx analyzers, you can use the "setup tool" to include the outlet valve in your user data files.

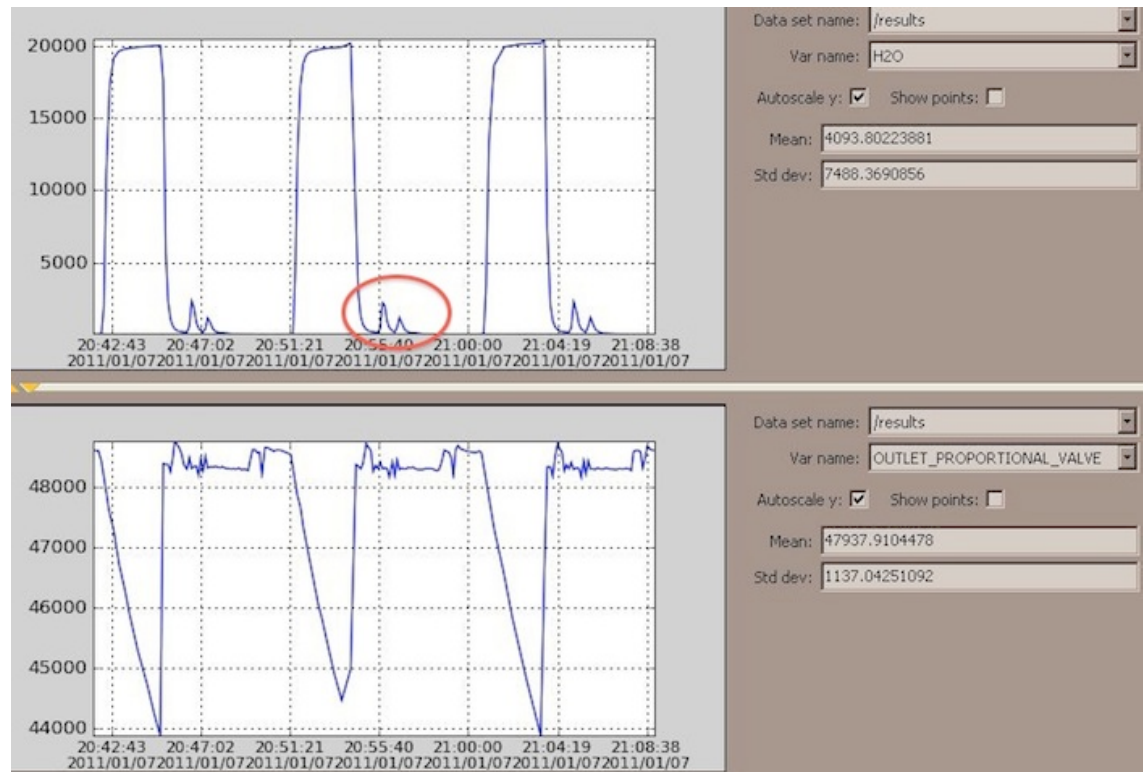
In each plot below, I show the **water concentration (top)** and **outlet proportional valve position (bottom)**. Ideally, the water pulse should be square, and the outlet proportional valve position should gradually decrease (close) during the analysis of the pulse (i.e. at the flat top of the water pulse) as shown below:



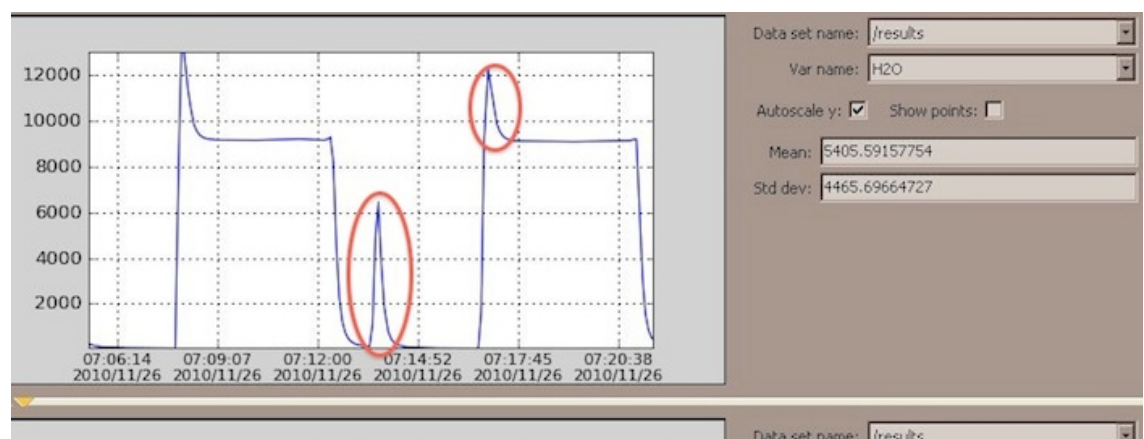
For a proper analysis, the concentration of the background gas should be <500ppm H₂O. Always use metal tubing to deliver the dry gas to the vaporizer (the WLM purge can be plastic tubing). If you use teflon or plastic tubing for the vaporizer dry gas supply, it will be hard to get it to deliver dry enough gas. Other reasons for not seeing dry gas in the vaporizer can be incorrect hookup of any external solenoid valves on the back of the vaporizer (in the case of the auto-switching liquid/vapor configuration on some analyzers).

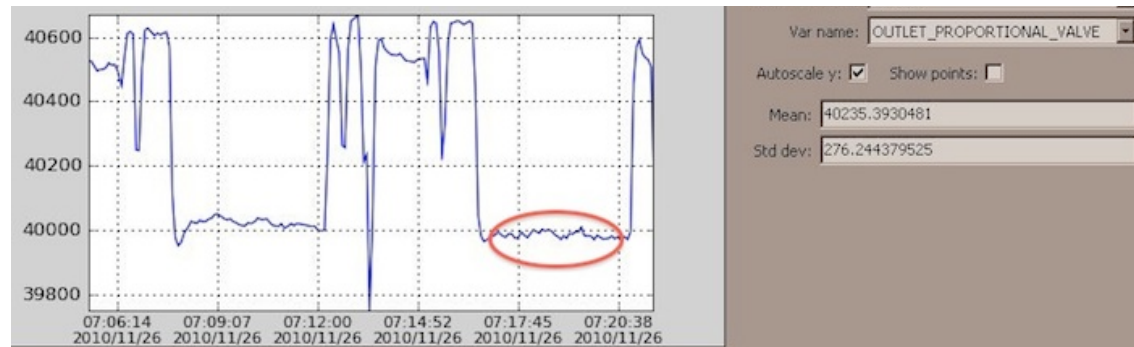
The image below shows extra little "pulses" after the main pulse. They should not be there. Causes of this can be: 1) a leaky vaporizer septum (change after every ~300-400 injections) or 2) a bad vaporizer vacuum pump (if it has >10,000 hours on its hour meter, it might be dying) or 3) a bad connection between the vaporizer vacuum pump and the vaporizer (check the swage connections and the tubing for cracks near

the metal connections, but don't over-tighten the swage or you can cut through the tubing!). Note in the image below, the main peaks look ok, and the outlet valve is operating normally, so it's just a problem during the cleanout cycle of the vaporizer, not during sample delivery.

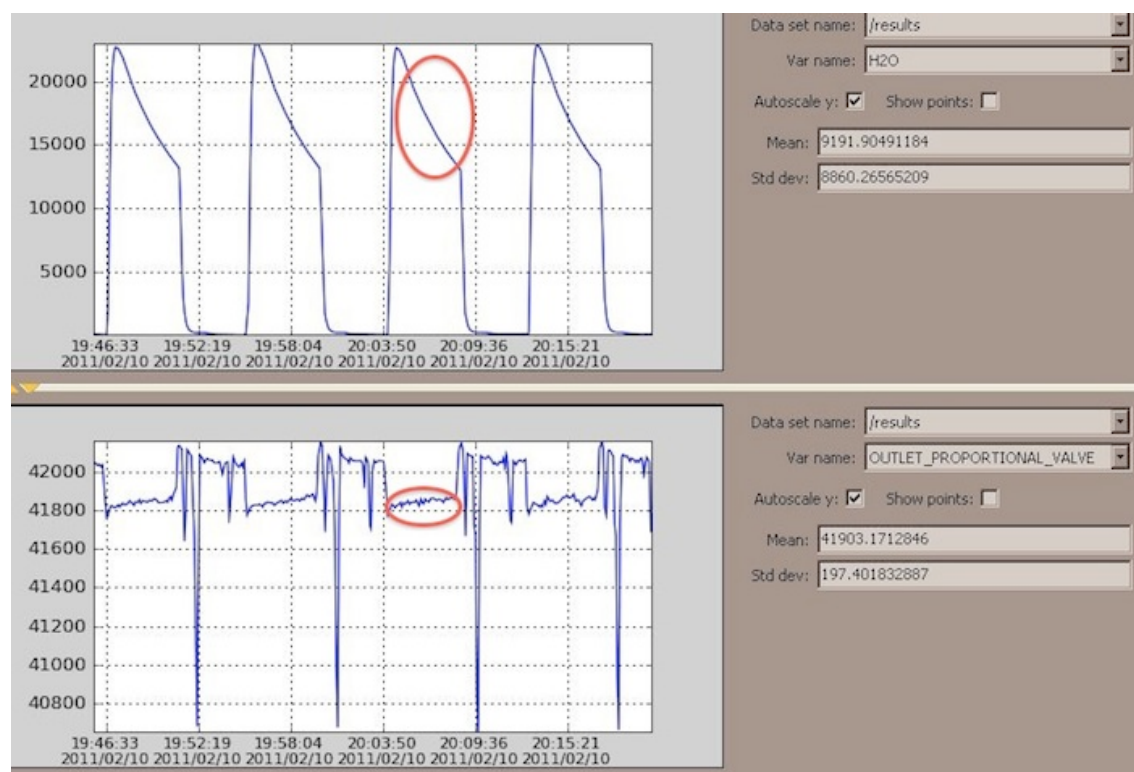


In the image below, we may have two problems -- we have the extra little peak after the main peak, so it could be one of the three problems above, but we also have a "spike" at the beginning of the main peak. Note also that we have a FLAT outlet proportional valve. This indicates that during the time the analyzer is drawing air from the vaporizer's internal fixed volume, the pressure on the inlet of the analyzer is not changing (the outlet valve is constant). This means we have a leak between the analyzer and the vaporizer. The spike could be moist ambient air being drawn in the leak (it's only 12,000ppm -- in a dry climate a leak might look like a slope going upwards from left to right -- it depends on the ambient concentration relative to the nominal 20,000ppm concentration of the vaporized sample). A VERY leaky septum could also look similar.

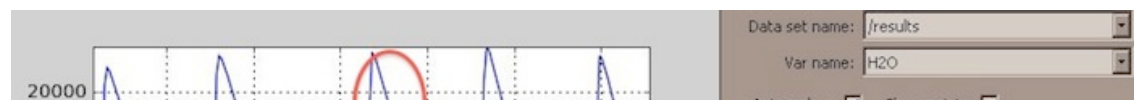


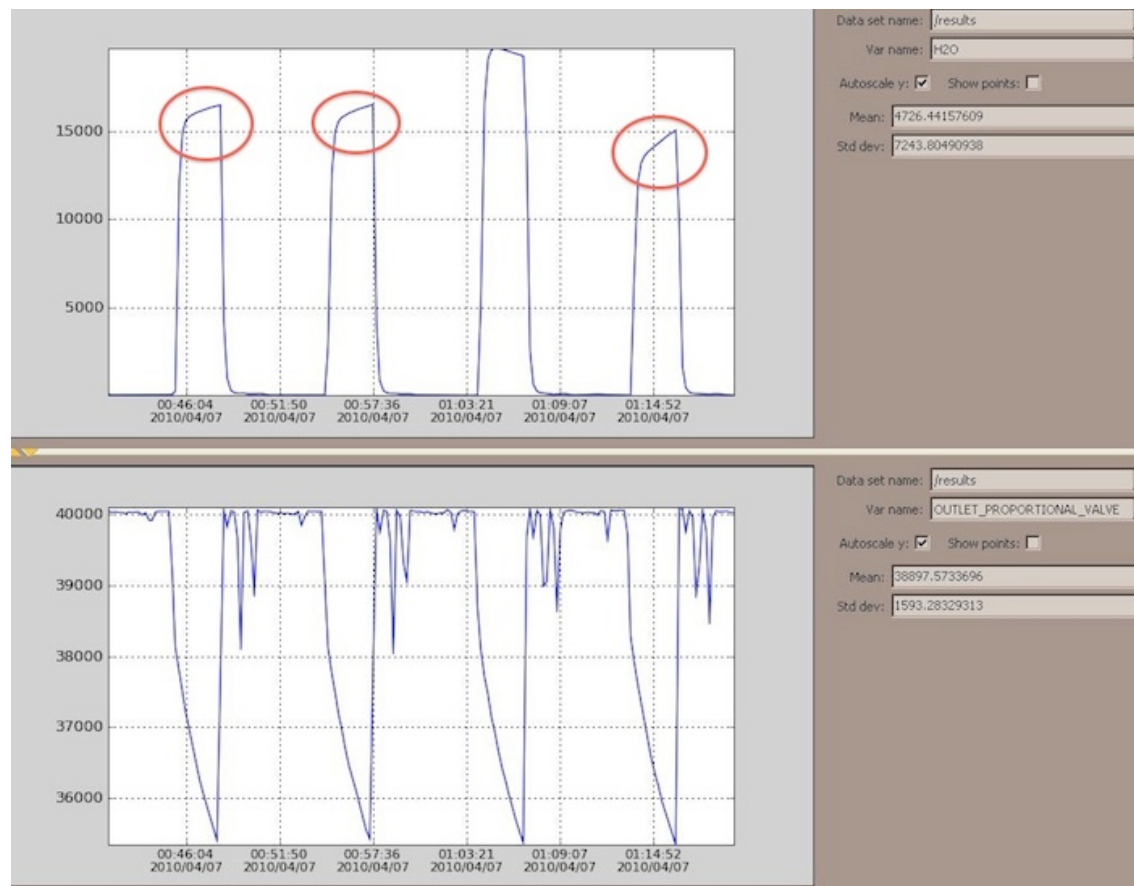
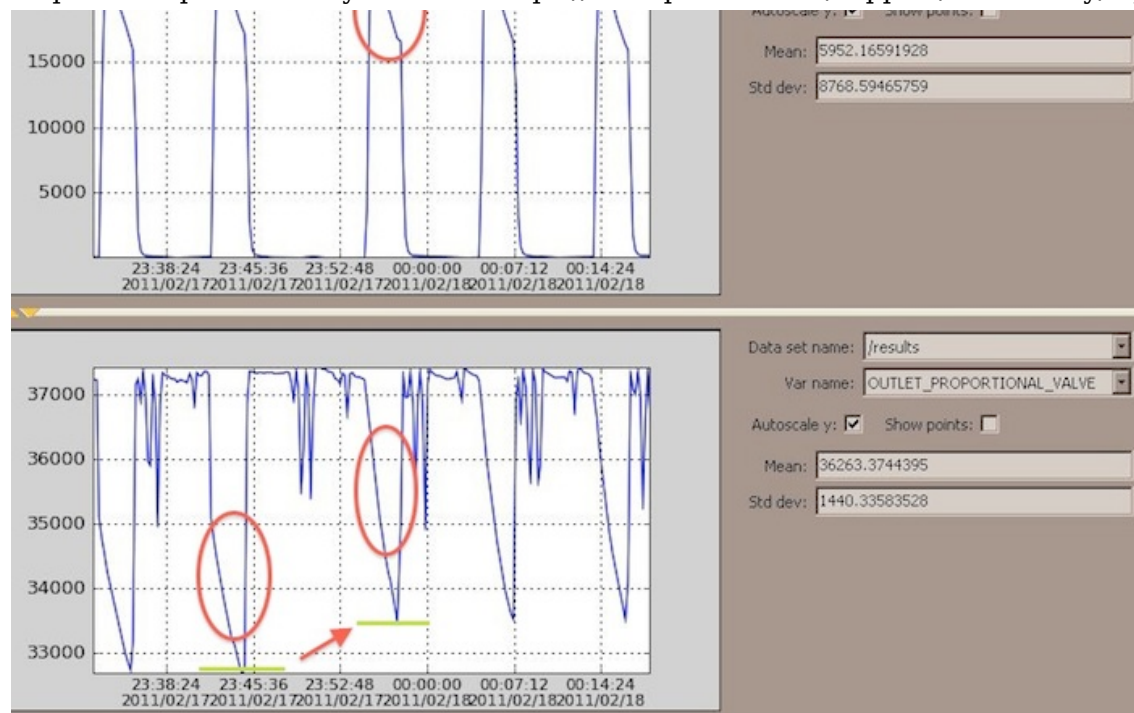


In this next example, we again suspect a leak because the outlet valve is flat (constant) during the pulse, but the pulse has a decreasing concentration. This is consistent with a leak of lower-concentration ambient air into the analyzer during analysis. This leak is likely at the connection from the vaporizer to the analyzer. (See [this post \(https://www.picarro.com/videos_pics_get_leaks_isowater_analyzers\)](https://www.picarro.com/videos_pics_get_leaks_isowater_analyzers) for more information on how to address this).



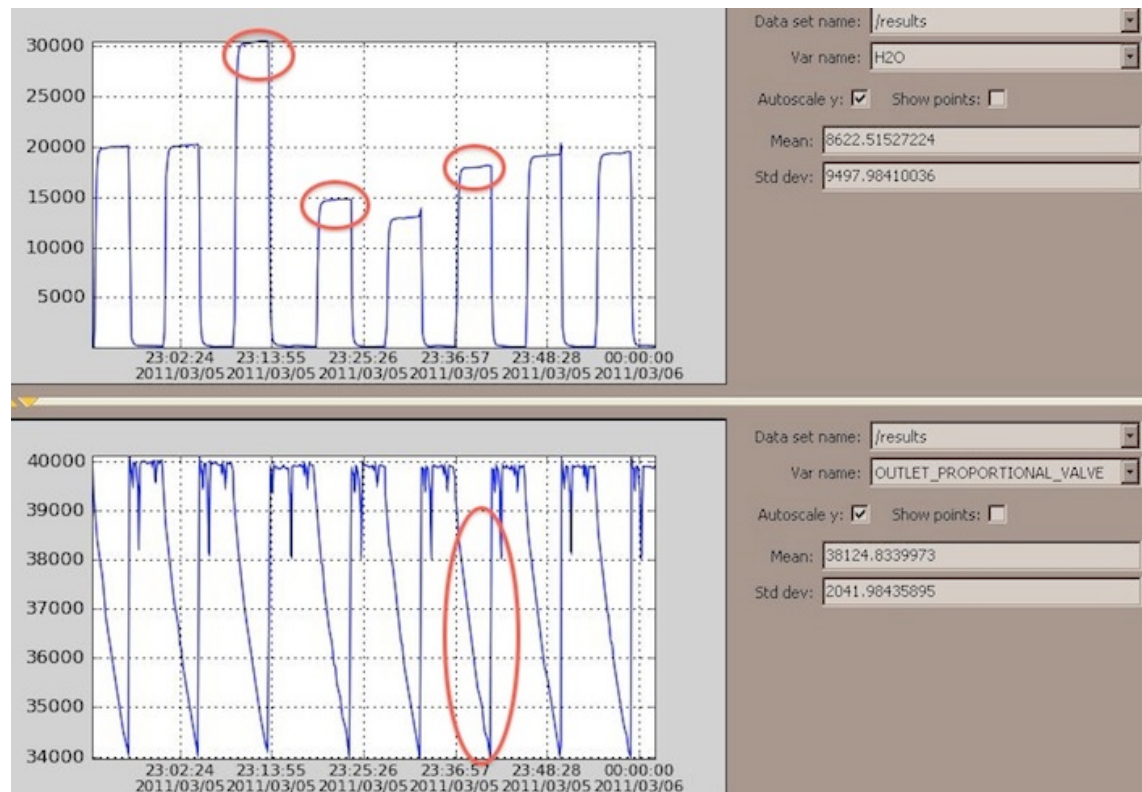
The next two examples are indicative of a problem with the valve inside the vaporizer that injects dry gas. The outlet valve position is basically normal, so we don't have a leak, but the slope (particularly a slope going upwards, as in the second example) on the pulse indicates poor mixing inside the vaporizer (this can happen if the vaporizer valve is not working perfectly). Further, in one of these two examples, there is a change in the nominal outlet valve position, indicating inconsistent filling of the vaporizer (it fills to different pressures with each pulse), consistent with a vaporizer valve problem. If this happens, contact support@picarro.com (<mailto:support@picarro.com>) and we can help diagnose and repair if necessary.



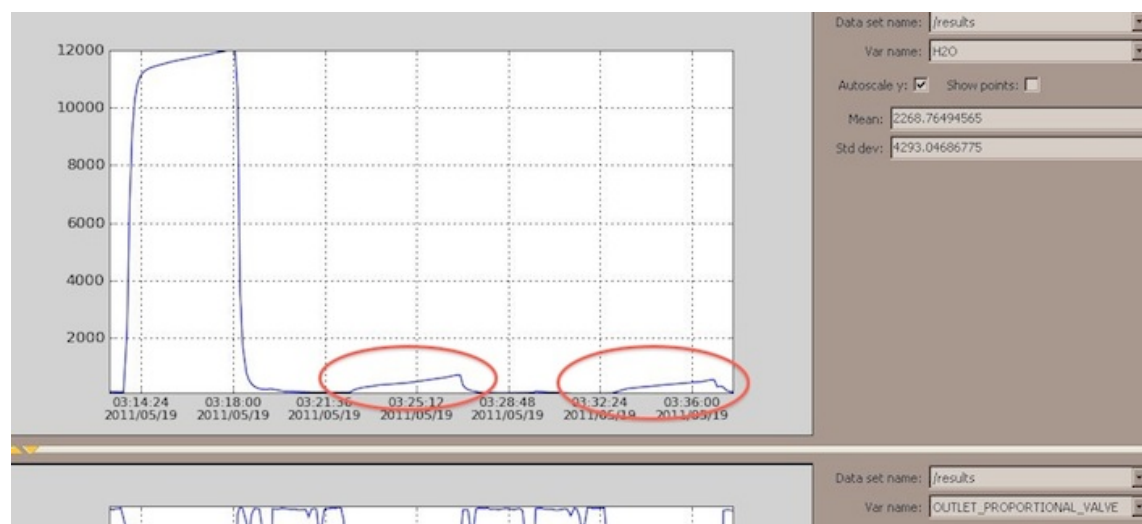


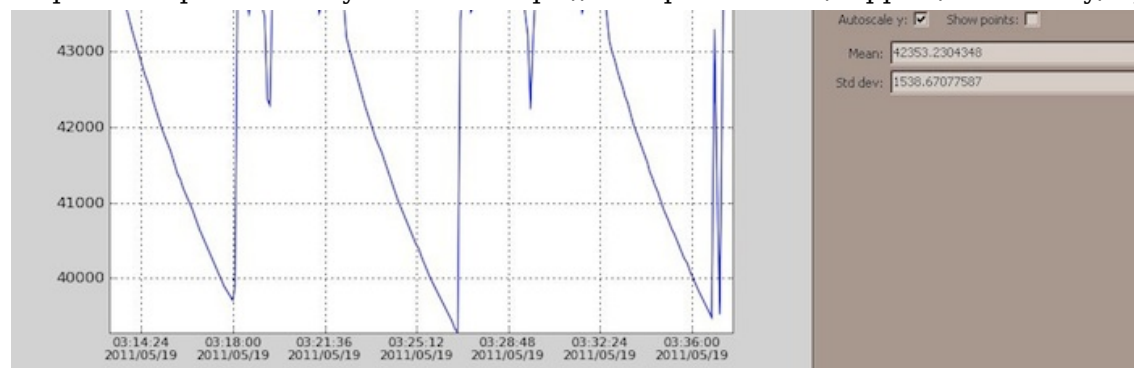
The next example shows what can happen if either the injected volume of water is inconsistent (a clogged or dying syringe) or what could be the result of a bad gas supply (inconsistent pressure or flow on the inlet dry gas supply, perhaps due to a failing regulator or another piece of equipment using the same dry gas supply). Other problems associated with sample delivery are 1) overfilling or pressurizing the liquid in the vials 2) significant contamination of the samples 3) not getting the needle sufficiently deep into the sample (picking up air bubbles) or 4) an inconsistent

"bubble" in the syringe. Contrary to popular belief, it's not actually necessary to worry much about how well "primed" the syringe is. The injections can be quite consistent even if there is a "bubble" at the top of the syringe. Often, efforts to get rid of the bubble (by changing the autosampler method from the recommended Picarro default method) can actually introduce such inconsistencies in the injected volume. **Remember to adjust the volume of the injection in the autosampler method. Before each run, and any time you change a syringe or see the concentration stay consistently far from 20,000ppm, do a test injection to see if it is near 20,000ppm (+/-1000ppm) and if not, scale the injection volume by the appropriate percentage.**

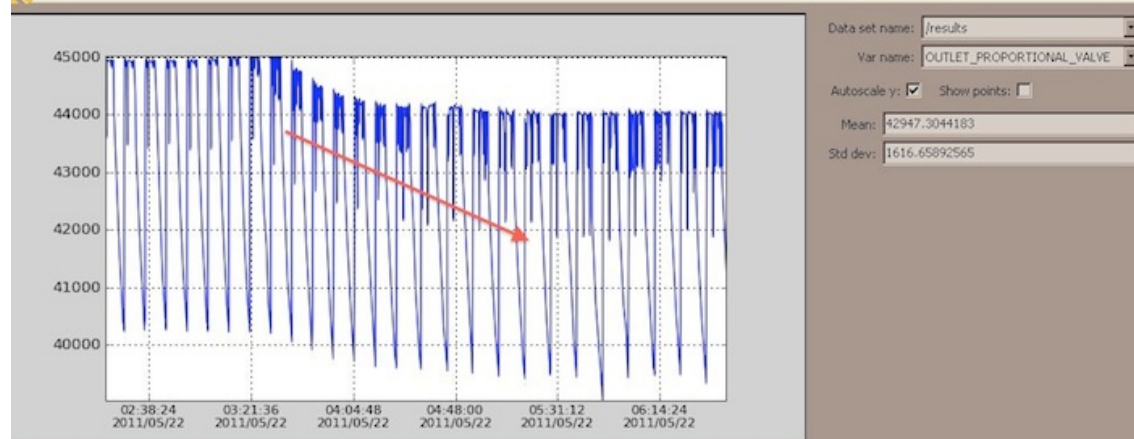
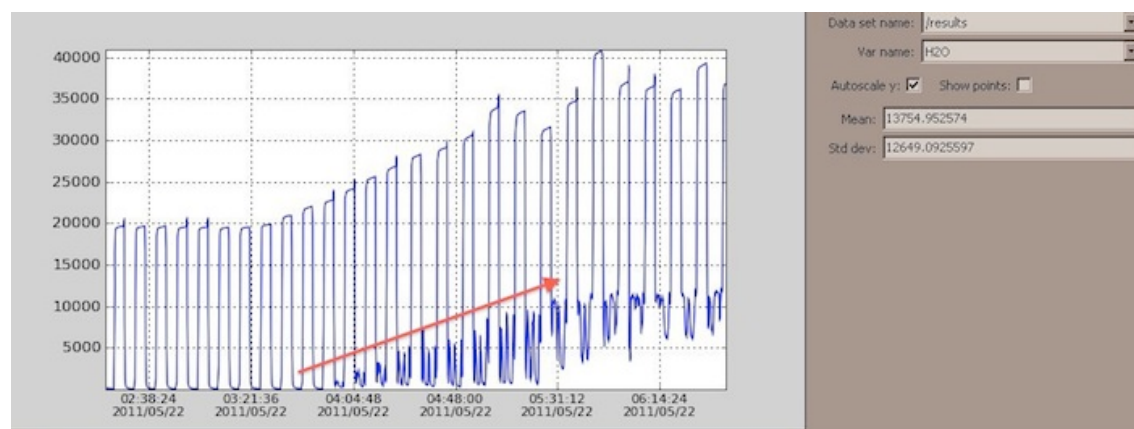


The next example is what happens if your needle penetration depth into the vaporizer somehow changes and isn't deep enough to get the sample into the vaporizer. The tall peak at left is "kinda" an injection, but the subsequent peaks indicate nearly no water got in.



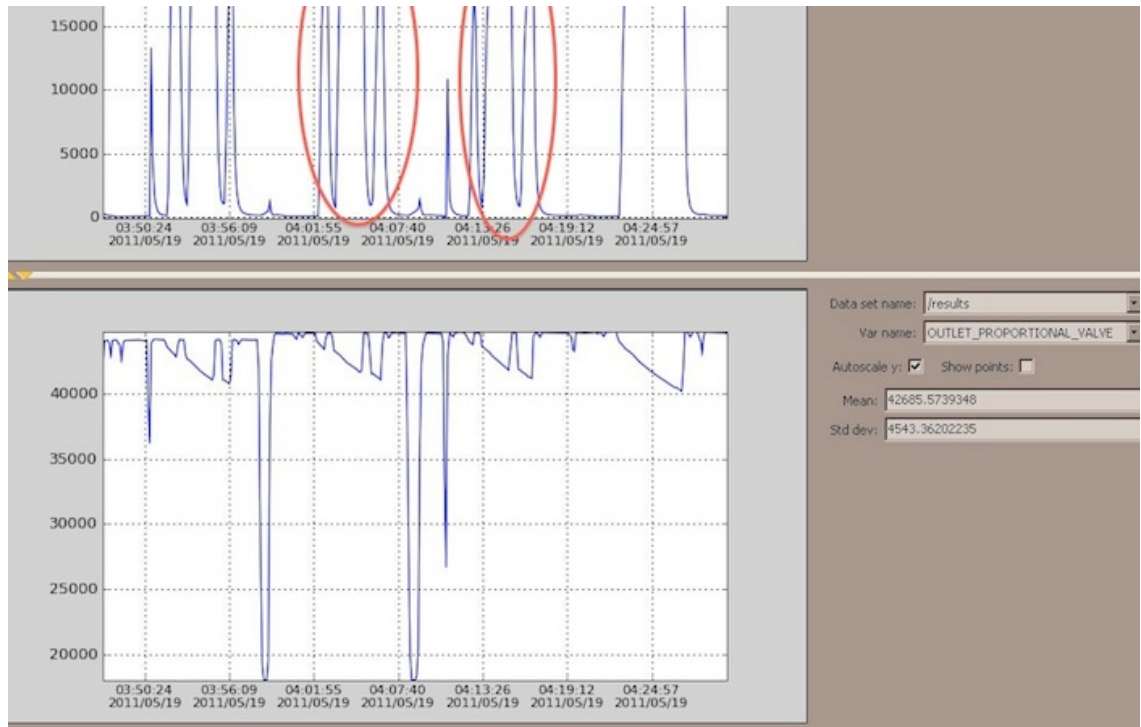


The following example is what happens when an otherwise good run simply runs out of dry air from the dry air cylinder (or if there is a large gas leak in your cylinder). As the cylinder gas pressure goes to zero, the vaporizer is forced to take in moist room air either from the leak or backwards through the WLM purge. The nominal dry baseline rises to the level of the room air. Also, the outlet valve position decreases since the vaporizer isn't being pressurized as much from the cylinder gas.



The final example shows what happens if the analyzer's solenoid valve sequencer (which is generally, but not always, disabled by default for most water analyzers) is running at the same time the coordinator is. The sequencer and coordinator fight for control of the valves and basically make a mess of the pulses. After the sequencer is turned off, you can see that the last pulse returns to normal.





For more information on diagnosing and fixing leaks, see [this post](#).
(https://www.picarro.com/videos_pics_got_leaks_isowater_analyzers).

Tag: pulse dictionary

Posted on November 17, 2011 - 7:03am



**Antonio J
Prado
Perez**

Aaron, as I have just sent to u by mail, we are now facing an issue with the outlet proportional valve. Its signal is over 65000 (when it usually was around 40000, as in these pictures).

Moreover, the raw data are quite much lighter than they used to be (10-20 delta units in deuterium)

I hope anybody to tell me what do you think about it.

Posted on November 17, 2011 - 10:34am



**Aaron Van
Pelt**

An outlet valve setting that high means either you have a vacuum line leak (vac pump to analyzer, not vaporizer) or the pump has died. Please check those things and the hours on the pump.

Posted on November 18, 2011 - 12:37am



Thanks Aaron, I have just checked it:
hours on the pump: 82147 but there is a blinking signal in the
hourmeter.

**Antonio J
Prado
Perez**

Do you know what does it mean?

Posted on November 18, 2011 - 12:38am



8214.7 horas I meant

**Antonio J
Prado
Perez**

Posted on November 18, 2011 - 12:41am



7700hours, sorry. 8214 are the hours of the analyzer, so the vac.
pump has been working for 7700 hours.

**Antonio J
Prado
Perez**

Posted on November 18, 2011 - 8:25am



**Aaron Van
Pelt**

well, that's a bit young to die but not unheard of, If the outlet valve
position remains high even when 1) the inlet is connected to
nothing but ambient air and 2) after you've carefully checked the
vacuum line for cracks near the swage fittings then the pump is
probably needing new diaphragms (or worse). To check this, swap
the vaporizer and analyzer pump and see if the outlet valve goes to

a lower, normal position with that pump. Do the same with the vacuum lines.

Posted on December 23, 2013 - 8:40am



**Brittany
Duncan**

Hi Aaron,

I am new to working on the Picarro L1102-i. My graphs have been way off, and I have been trying to adjust the connections on the machine to make them work. The attachment displays the best graphs that I have been able to get. I was curious what you thought, and if you have any ideas on how I can make them better. I have tightened all of the connections down and am worried that if I tighten them any further, I might ruin a hose.

Thanks,
bdunsan

| | |
|--|--------|
| picarrographs3.pdf (/sites/default/files | 132.16 |
| /picarrographs3.pdf) | KB |

Posted on August 18, 2014 - 4:57am



**Melanie
Behrens**

Hi all,

just a general question. Is this dictionary also valid for the High Throughput Vaporizer A0212? And could someone provide a schematic for this one too?

Cheers, melanie

Posted on August 18, 2014 - 10:49am



Danthu Vu

Hi Melanie,

We don't have one to post just yet. Meanwhile, let me re-direct you to a new post I had just created:

http://www.picarro.com/community/picarro_community/high_throughput_vapo... (<https://www.picarro.com/community>

[/picarro_community](#)

[/high_throughput_vaporizer_a0212_how_it_works](#)

Best regards,

Danthu

Posted on October 3, 2014 - 3:51am



Hello! I need your help.

where to see the clock on the pump?

**Tatiana
Voilokova**

Posted on October 14, 2014 - 3:53pm



Tatiana,

On the stand-alone pump (such as pumps for the G2000/L2000 series analyzers or vaporizer/SSIM pumps), the hour meter is on the back of the pump. On the G1000 or L1000 series analyzer pump, the hour meter is on the back of the CPVU.

Danthu Vu

Cheers,

Danthu

@Picarro, Inc.

Posted on October 1, 2019 - 1:37pm



What happened to the photos in this post?

[Edit \(/comment/2066/edit\)](#)

**Andy
Schauer**

Posted on October 1, 2019 - 2:21pm



Jonathan Bent

Andy, a customer noted that this post had dead links last month, so we updated the links. If you're not able to see them at the moment, that suggests to me we need to ensure the links are visible to external audiences--they work for me, but I suspect that's because I work here. Let me get our web and media specialist on it. Cheers, Jonathan

Posted on October 1, 2019 - 2:28pm



Jonathan Bent

Andy, a customer noted that this post had dead links last month, so we updated the links. If you're not able to see them at the moment, that suggests to me we need to ensure the links are visible to external audiences--they work for me, but I suspect that's because I work here. Let me get our web and media specialist on it. Cheers, Jonathan

Posted on October 10, 2019 - 11:27am



Andy Schauer

I see them now. Thank you. Super valuable page. -andy

[Edit \(/comment/2071/edit\)](#)

Posted on August 5, 2020 - 6:05pm



CSE CAServices

I believe the image links are down as I cant seem to see the pictures, is there a backup of the images anywhere?

Posted on August 6, 2020 - 1:42am



**Arthur
Schaeps**

Thanks for pointing out the issue with the pictures, I will ask our web and media specialist to look into it.

Posted on August 6, 2020 - 1:47am



**Arthur
Schaeps**

While the pictures are currently missing, here is a PDF copy of the Pulse Shape Dictionary.

| | |
|--|-----------|
| Pulse shape dictionary.pdf (/sites/default/files/forums/2020-08/Pulse%20shape%20dictionary.pdf) | 696.29 KB |
|--|-----------|

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