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The PA-IR Round

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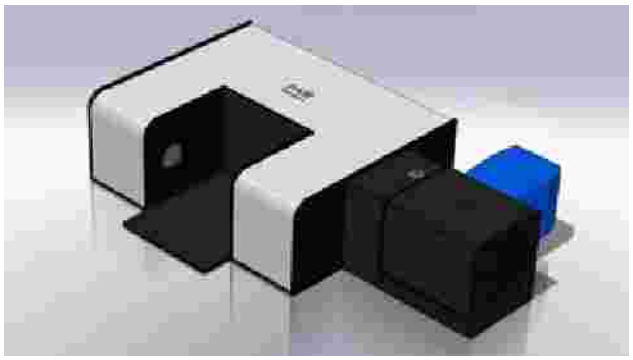
PA-IR Marches On!!!



The past 3 months have been spent on finalizing the laboratory instrument version of the Pair^2 100 Series and exploring on on-line/at line configuration..

Some of the problems to be solved include the creation of test jigs to ensure that every Pair^2 100 Series instrument meets the same performance specifications and that assembly can be done efficiently, thus controlling costs.

The use of computer generated designs has greatly aided us by allowing different configurations to be visualized and dimensions checked before actual materials are expended.

We've also hosted a number of potential customers. Without going into details, we can say that there is a great deal of interest in the technique and we're investi-

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Special points of interest:

- PA-IR Marches On!!!
- Delaware Invests!
- Planar Array at Work
- Signal-to-Noise Ratios
- Slit Curvature Correction

Delaware Invests in Pair Technologies!!

The State of Delaware's Economic Development Office recently granted Pair Technologies, LLC a "bridge" grant to continue working on the Planar Array technique.

Obtaining this grant required that we show that Pair Technologies has met the goals of the Phase I NIH STTR.

Monies from the grant will be used for general company operations as we continue to advance planar array technology.

We not only had to show that we have a working technology but that there is significant

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So What's the Big Deal about Signal to Noise ratios?

The Signal-to-Noise (S/N) ratio is arguably the single most important specification for an analytical instrument.

S/N determines, among other things, how small a difference can be reliably measured between a sample and a reference, or between two samples.

Most analysts prefer an S/N ratio of at least 10:1 to obtain reliable results, although sometimes signals with ratios as small as 3:1 can be used for survey type work.

The Pair^2 100 Series can improve the S/N ratio of a spectrum using 2 independent methods.

First, there is the well known co-add technique in which scans are added together to improve S/N. The theory is that Signal, being non-random, is enhanced while Noise, being random, is reduced. This technique provides an improvement of about the √ of the observation time—which means that longer collection times are required.

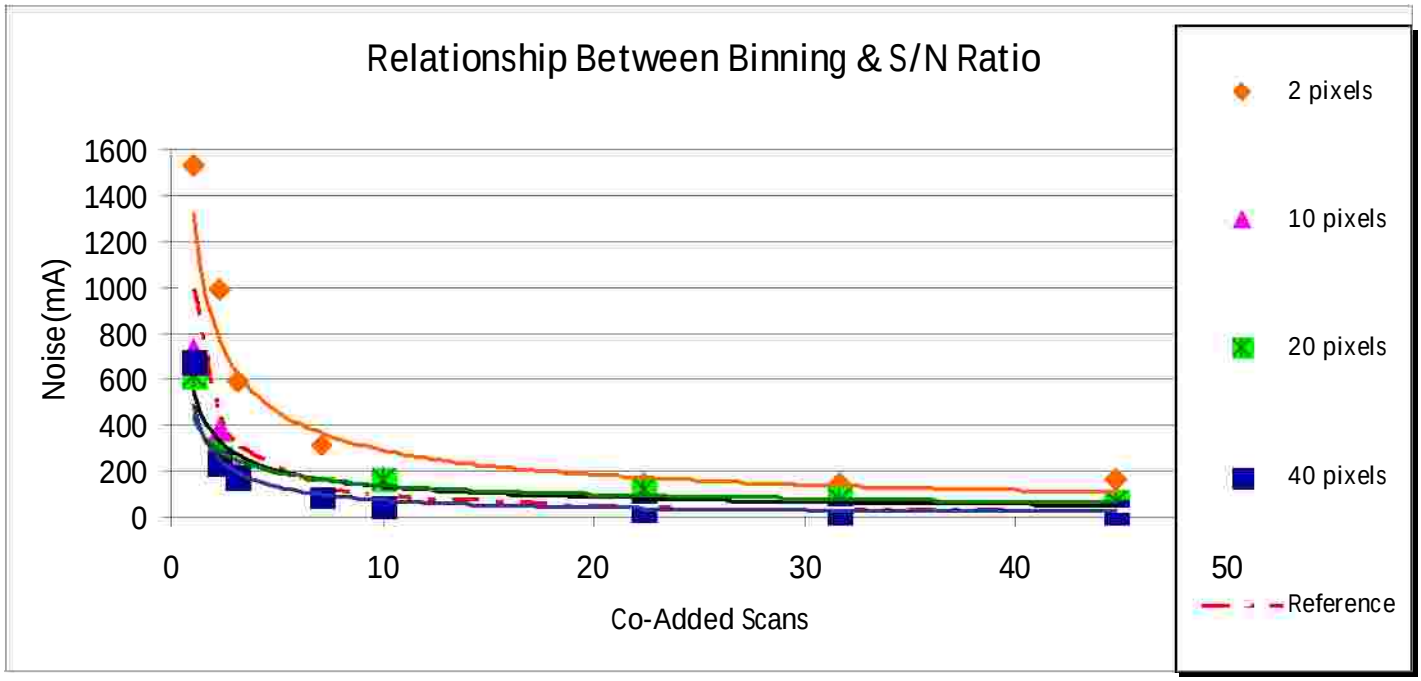
"...the signal to noise ratio is arguably the single most important specification"...

Next, we can "bin" signals by adding rows of pixels in the illuminated area of the sensor. Again, the improvement is about equal to the √ of the number of rows—but since all the signals are collected simultaneously, no time penalty is applied.

When both of the techniques are combined for a single observation, the result is an improvement of about 50X that of an FT-IR for the same observation time.

The accompanying graph illustrates how these two techniques can be combined in a Pair^2 100 series instrument to improve measurements.

Note that as the binning increases, the S/N ratio improves. Also, note how the S/N ratio improves as the



number of scans increases.

Finally, it must be noted that the total elapsed time for these 45 scans is less than 1 second. (*An FT-IR would typically take about 20 or so seconds.)*

All data was collected at 4 cm^{-1} spectral resolution . *Spectral resolutions from 0.8 to 16 cm^{-1} are available by simply selecting the appropriate grating.*

Slit curvature Correction

As we continue to develop the planar array systems, we are finding a few subtle situations that require solutions reaching in the past.

One of the old problems that is new again is the need for correcting slit curvature.

This phenomenon arises when a circular source image is reflected from a series of optics, passed through or reflected from a sample, then imaged on a vertical slit. The resulting effect is a slight curvature of the image when diffracted and focused on the planar array. (See fig 1)

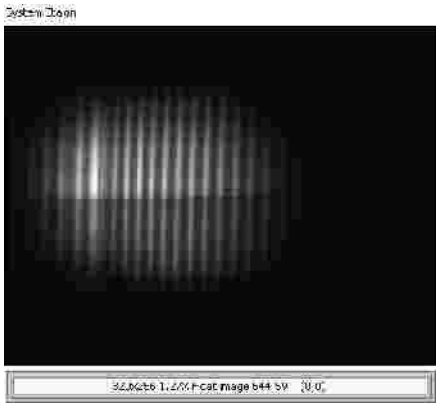


Fig. 1—uncorrected slit image

When the amount of signal is high, this doesn't present much of a problem since co-adding rows isn't needed. However, when the signal is low (as with highly absorbing samples, or with rapid data collection), co-adding rows is a great help in improving signal-to-noise in the final spectrum. With the slight curvature to the right as noted in figure 1, the data are nosier.

Enter the Etalon!!!

An Etalon has two plane parallel reflecting surfaces, which gives a precise measurement of distance or the wavelength of light between them. Since the exact distance is known, it can be compared to the image of the etalon and a correction factor developed.

Figure 2 shows the effect of applying a correction factor.

As can be seen, the slight "tilt" to the right in figure 1 is eliminated in figure 2.

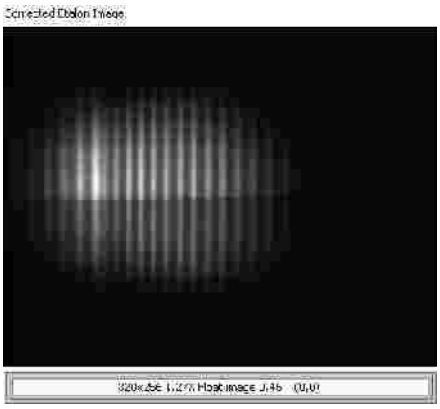


Fig 2—corrected slit image

This correction, automatically calculated for each collection routine, allows co-adding of all the rows on the planar array which further improves the signal-to-noise ratio of the resulting spectrum.

Because the etalon, included in the built-in filter wheel is independent of wavelength, the correction is applied in any spectral region in which a measurement is made.

To view our Applications or Technical Notes, please visit our website:
www.pairtech.com

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Where Photons and Samples Meet and Exchange Information.

Pair Technologies is a limited liability company (LLC) founded in July 2005 to research and design, manufacture, and market a mid-infrared analytical instruments that employs planar array detector technology.

The technique was developed and patented at the University of Delaware, which remains involved to this day.

Visit us at:
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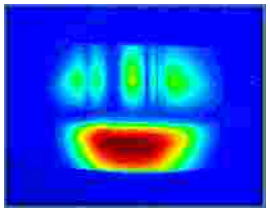

PA-IR Marches On!!! *(cont'd)*

gating some problems that current FT-IR technology simply cannot handle.

Some examples are the generation of CO—and it's dissipation in a production process, the measurement of molec - lar interactions in various zones of flames as a funct n of fuel additives, and the measurement of thin films.

Stay tuned as more applications are developed!

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interest among prospective users.

We believe in the potential of planar array technology,. However, having an outside board of business and finan e experts review our results and future plans and then vote unanimously to grant us additional funding is a strong expression of confidence in the fundamental organization and our programs.

Already we are having a small positive impact on the l cal economy with orders placed at local machine shops and some local employees being added.

We expect to grow during the coming months and years, as planar array technology solves more and more analytical problems in the process, medical, military, nd combustion areas.

Give us a call to talk about your interests—we might just be able to provide a useful tool to further your investig tions or solve those analytical problems you've been working on!

Want to see how Planar Array can solve <u>Your</u> analytical problems?

Investing in analytical instruments is difficult in the current economic climate. To justify new technology, it is necessary to build an "air-tight" case for management.

You not only need to show that you can gain new information, you must also show a real, measurable benefit to your organization.

To help you, Pair Technologies, LLC has developed a program to make your life easier.

First, we will gladly arrange to run samples or undertake investigations to show the data obtained with PA-IR and your samples. We can either host you at our facilities, or come to yours to collect the data. All data collected is treated as YOUR CONFIDENTIAL DATA—and you will retain all raw and processed files.

We have experienced staff who have successfully written economic justifications for Management. We will work with you, under non-disclosure agreements if needed, to develop your presentation.

Our services are available at no charge, regardless of outcome.

Money is tight, but with the right arguments, you can join the forefront of infrared spectroscopy.