

# The PAIR Round

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## It's Not your Grandfather's FT-IR!

PAIR Technologies, LLC, was founded in July, 2005 to develop and market a mid-infrared analytical instrument using planar array detectors.

These detectors are similar to those in commercially available CCD video cameras, except they operate in the mid infrared rather than the visible spectral region.

One advantage of using a planar array is that it is extremely fast

– much faster than conventional detectors – and it allows monitoring of rapid transitions and non-reproducible events.

Another advantage of planar arrays is their ability to simultaneously collect a sample and reference spectrum. This means that changes such as instrument drift are automatically eliminated as sources of errors.

The use of this “double beam” approach also means that background interferences can be removed reducing the need for delicate and time consuming manipulation of the data after collection.

You can now observe smaller time windows in your reactions than ever before. Instead of assuming that things happen in a linear fashion, now you can prove—or disprove—it!

## How Does a Planar array Spectrometer Work?

In a Planar Array spectrometer, light enters through a slit (A) and is focused on the grating (C) by an infrared lens (B). The dispersed light

from the grating is directed by a mirror (D) and sent to the planar array detector (E).

This is a simplified schematic; in practice, bandpass filters can be

used to isolate spectral regions and different gratings can be used to select the wavelength range/resolution combination desired. At

*(Continued on page 2)*

### Special points of interest:

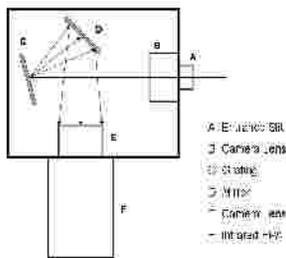
- How Does Planar Array Work
- The developers of Planar Array
- Planar Array at work
- Planar Array developments
- Scientific Advisory Board

## How Does a Planar Array work *(cont'd)*

the present time, spectral resolutions from 0.8 to 10  $\text{cm}^{-1}$  are available.

Because the sample measurement is pre-dispersive, opaque samples can benefit from increasing the amount of light that falls on them.

By "stacking" the sample beam and reference beam on the detector, both are measured simultaneously. So, the time delay in collecting a reference spectrum from and FT-IR is eliminated. Since both sample and reference are subject to the same environmental conditions, the need for



Typical schematic of a Planar Array spectrometer. (not to scale)

purging is eliminated.

Sampling is done using conventional sampling accessories, transmission, ATR, diffuse reflection, and specular reflection techniques are all available and work exactly the same as they do in a conventional FT-IR.

By removing the sample compartment entirely, a Planar Array spectrometer can become a very sensitive single beam emission spectrometer, using external sources.

**PA-IR = POWER IR!!!**

## The Developers of PAIR Technologies' Planar Array

A Planar Array spectrometer was developed at the University of Delaware by Dr. John Rabolt and Dr. Bruce Chase as part of their investigations into various material characterization studies.

Between them, Rabolt and Chase have over 65 years of experience in the characterization of materials using vibrational spectroscopy. They have authored or co-authored over 300 peer reviewed publications in the field and have given invited talks at most of the major national and international spectroscopy and materials meetings.

Chase and Rabolt have a long history of working together having collaborated on the development of FT-Raman spectroscopy

"Materials usually fail quickly after some stress is applied. Why can't we see what is going on at that failure point?"

in the mid 1980s while at DuPont (Chase) and IBM (Rabolt). FT-Raman revolutionized the study of "colored" materials and those containing fluorescent impurities and is currently found in over 2000 laboratories worldwide. Chase and Rabolt co-edited a book on this subject entitled "Fourier Transform Raman Spectroscopy: From Con-

cept to Experiment", which was published in 1992 by John Wiley and Sons. Together, they have developed the first working prototype of the PAIR Technologies instrument and expect to formally introduce this product at Pittcon 2010.



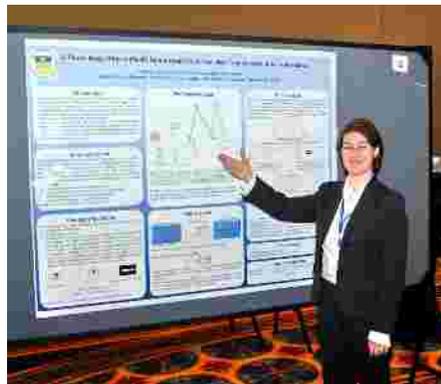
Bruce Chase (L) & John Rabolt - The developers of the PAIR® Systems at FACSS '09.

## Planar Array At Work

At the FACSS Show in Louisville, KY, Planar Array, several planar array applications were presented.

Idaho) presented an interesting look forward of developments in infrared spectroscopy—including planar array techniques..

Roberta Colombo (University of Delaware) presented a poster on the use of planar array techniques for real time analysis of tears and saliva. She described how the differences in the amide I and Amide II bands vary with individuals but are the same in both tears and saliva. She also indicated a possible diagnostic use for the technique.



Roberto Columbo with Poster.

Dr. Peter Griffiths (University of

Dr. John Rabolt (University of Delaware) presented data showing how the sensitivity of planar array spectroscopy could be used to measure difficult samples such as cellular membranes, biopolymers, and the dynamics of polymer organization during assembly of Langmuir films at the air/water interface.

Dr. Bruce Chase (Pair Technologies, LLC) discussed the development of a double beam capability in planar array spectroscopy. He showed the advantages of collecting sample and reference scans simultaneously.

## Planar Array—what's Next?

Now that the basis of the technique has been demonstrated, the next developments will be developing a commercial instrument that can use standard sampling accessories such as transmission, ATR, Diffuse reflectance, and others.

red analysts, Planar Array techniques will be expanded.

In addition to sampling techniques, work continues on the software

line stability, some interesting new information is waiting to be discovered.

Very stable baselines will also prove beneficial in chemometric analyses. One of the chief requirements for monitoring small concentration changes, is a very high S/N ratio. Since Planar Array techniques offer very high S/N ratios, developments in this area are expected.

By incorporating standard sampling techniques that are well known to infra-

"Planar Array is the most important development in infrared spectroscopy since the utilization of the interferometer."

front. Since Planar Array can collect a series of spectra in a very short time frame—or with very good base-

## The Scientific Advisory Board

One of the most critical aspects of introducing a new analytical technique is ensuring that it offers real benefits to users.

lowing members on it Scientific Advisory Board:

One of the best ways to do this is to solicit input and advice from critical thinkers and innovators. Pair Technologies is pleased to have the fol-

Dr. Peter Griffiths, University of Idaho, Chair of the Department of Chemistry

Dr. Ira Levin, Deputy-Chief, National Institute of Digestive Diseases and the Kidney (NIDDK), NIH,

Dr. Neil Lewis, Chief Scientist, Malvern Industries, a manufacturer of process and quality control analyzers for the pharmaceutical industry,

Dr. Rina Dukor, Founder and CEO, BioTools Inc. a pharmaceutical instrumentation and consulting firm.

## PAIR TECHNOLOGIES, LLC

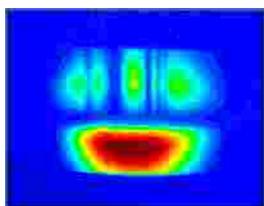
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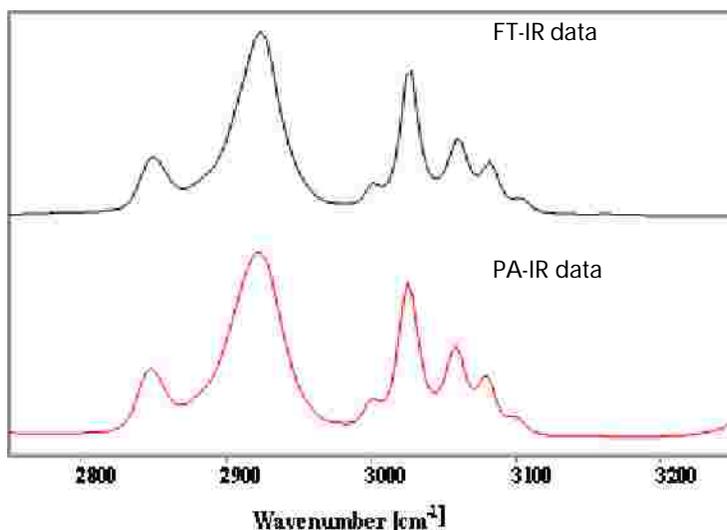
Where Photons and Samples Meet

Visit us at:  
[www.pairtech.com](http://www.pairtech.com)



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.



*Comparison of FT-IR and PA-IR spectra (the same sample)*

## Want to see if Planar Array can solve Your analytical problems?

We understand that investing in analytical instruments is difficult in the current economic climate. To justify a 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 that there is real, measurable economic benefit to your organization from this information.

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 that can be obtained with Planar Array 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 also have experienced staff who have worked in your environment and 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 justification, you can join the forefront of analytical infrared spectroscopy.



Caption describing picture or graphic.