

WHO IS KAISER OPTICAL SYSTEMS ?



- Formed in 1979, as a division of Kaiser Aerospace and Electronics.
- Headquarters in Ann Arbor, MI, USA
- Became a Division of Rockwell Collins, Inc in 2000.
- Our historical Expertise is in the area of holographic optical technology.



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OPTICAL SYSTEMS, INC.**
A ROCKWELL COLLINS COMPANY

RAMANRXN SYSTEMS™
REACTION ANALYSIS, MONITORING AND CONTROL

WHO IS KAISER OPTICAL SYSTEMS ?



- Since 1990, KOSI has been a major supplier to the Raman community.
- The Spectroscopic Products Division represent the largest single division of KOSI.
- We are Global - having offices or representation in North America, Caribbean, Europe, and Asia.



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More About Kaiser

Kaiser is an engineering development and manufacturing firm with over 30 US Patents on Raman Instrumentation / Applications (25 current).

The most recent patent was issued for the AirHead™ gas-phase process Raman probe.

Kaiser first to deploy Raman system's for 24/7 process control - in early 1990's. Now the ATEX certified **RAMANRXN3** is being used in validated applications worldwide.

Raman Expertise widely recognized (both Kaiser's and individual employee's):

- Authored USP general chapter on Raman 1120.
- Authored two books on Raman and Raman Applications.
- Chair ASTM E13.08 (Raman).
- Chair Spectroscopy & Imaging Group – CPAC.
- Participate in ASTM E55 (PAT).
- Participate as founding members in IFPATma (PAT).
- Organize various scientific meetings involving Raman.
- Reviewers for numerous scientific Journals.



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Kaiser Technology Introductions 1990-99

- 1991 – Holographic Notch Filter
- 1992 – Holographic Laser Bandpass Filter
- 1993 – HoloSpec f/1.8i Imaging Spectrograph
- 1994 – HoloProbe Process Raman Analyzer
- 1994 – HoloPlex Volume Phase Transmission Grating
- 1995 – Universal Fiber Optic Probehead
- 1996 – Confocal Raman Microscope
- 1997 – Internal Calibration Option for Raman Products
- 1997 – Immersion Probe Optics
- 1998 – Raman Calibration Module and Calibration Transfer
- 1999 – **RAMANRXN SYSTEMS** Analyzers / HL5000R Modular Systems

A HISTORY OF MEETING THE MARKET'S NEEDS & CHALLENGES!



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Kaiser Technology Introductions 2000- Present

- 2000 – Invictus NIR Laser
- 2000 – HoloReact and HoloMap Software
- 2001 – MR Probe / Pilot Probe Line of Process Probes
- 2002 – HTS System for Wellplate Analysis
- 2003 – MRA analyzer, and Pilot-E Probe Line
- 2004 – **RAMANRXN3** Classified Raman Analyzer and Invictus 532 nm Laser
- 2005 – **RAMANRXN3L** Laboratory Analyzer
- 2006 – *PhAT System* for Representative Solid-State Analysis and ATEX certification
- 2007 – **RAMAN WORKSTATION**
- 2007 – iC Raman V2.0
- 2008 – AirHead Gas-phase Probe Head
- 2008 – Transmission analysis for the **RAMAN WORKSTATION**
- 2008 – iC Raman V3.0
- 2009 – **RAMANRXN4** Gas-phase Raman analyzer
- 2009 - **RAMANRXN2 HYBRID** Laboratory analyzer

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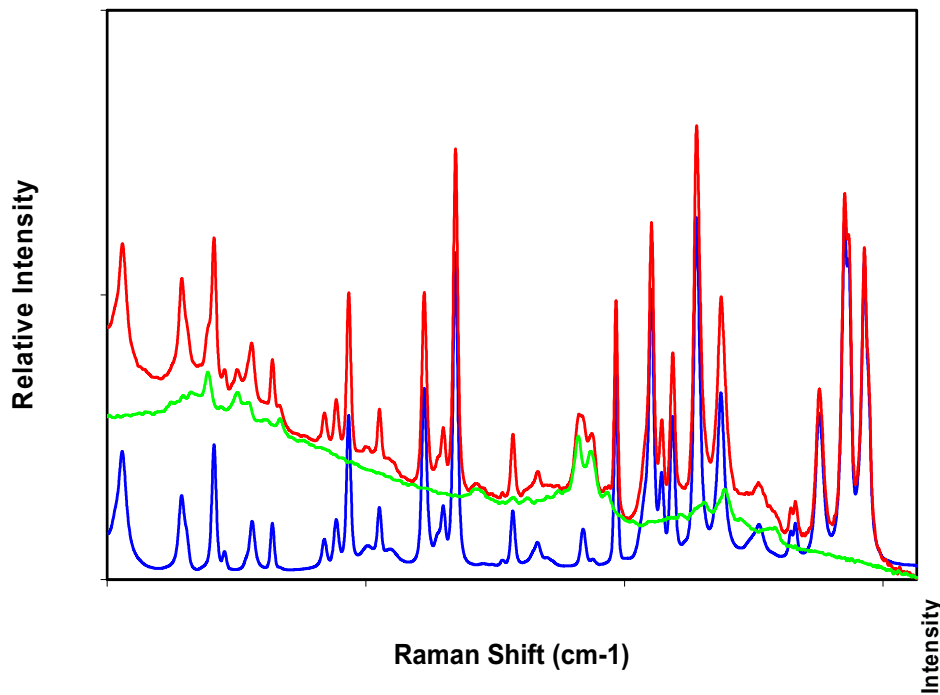
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Why Raman?

1. Composition and Structural Information with Fiber Optic Sampling – the specificity of mid-IR, but with the ease of use of near-IR
2. Raman is a specific and selective technique providing well resolved information leading to...**BETTER PROCESS UNDERSTANDING**
3. Flexible sampling (remote sampling)
4. In-situ – **Eliminate Grab samples**, Sampling through containers
5. Measurement of various types of samples (liquids, slurries, pastes, solids, powders, etc.)
6. Ease of use – no longer requires an expert



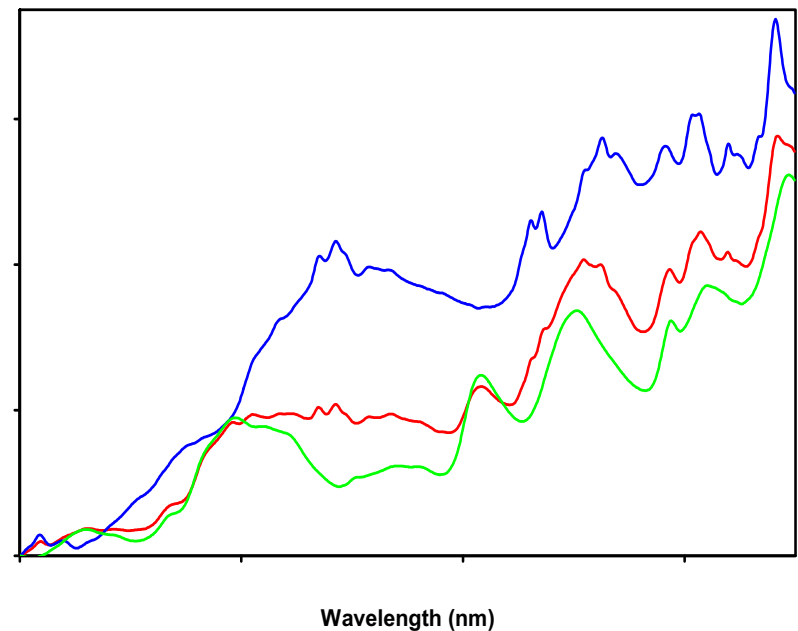
Why Raman ? – Chemical Specificity



90 mg Tablet
Avicel Powder (Excipient)
Acetaminophen Powder (API)

Majority of signal from Crystalline API

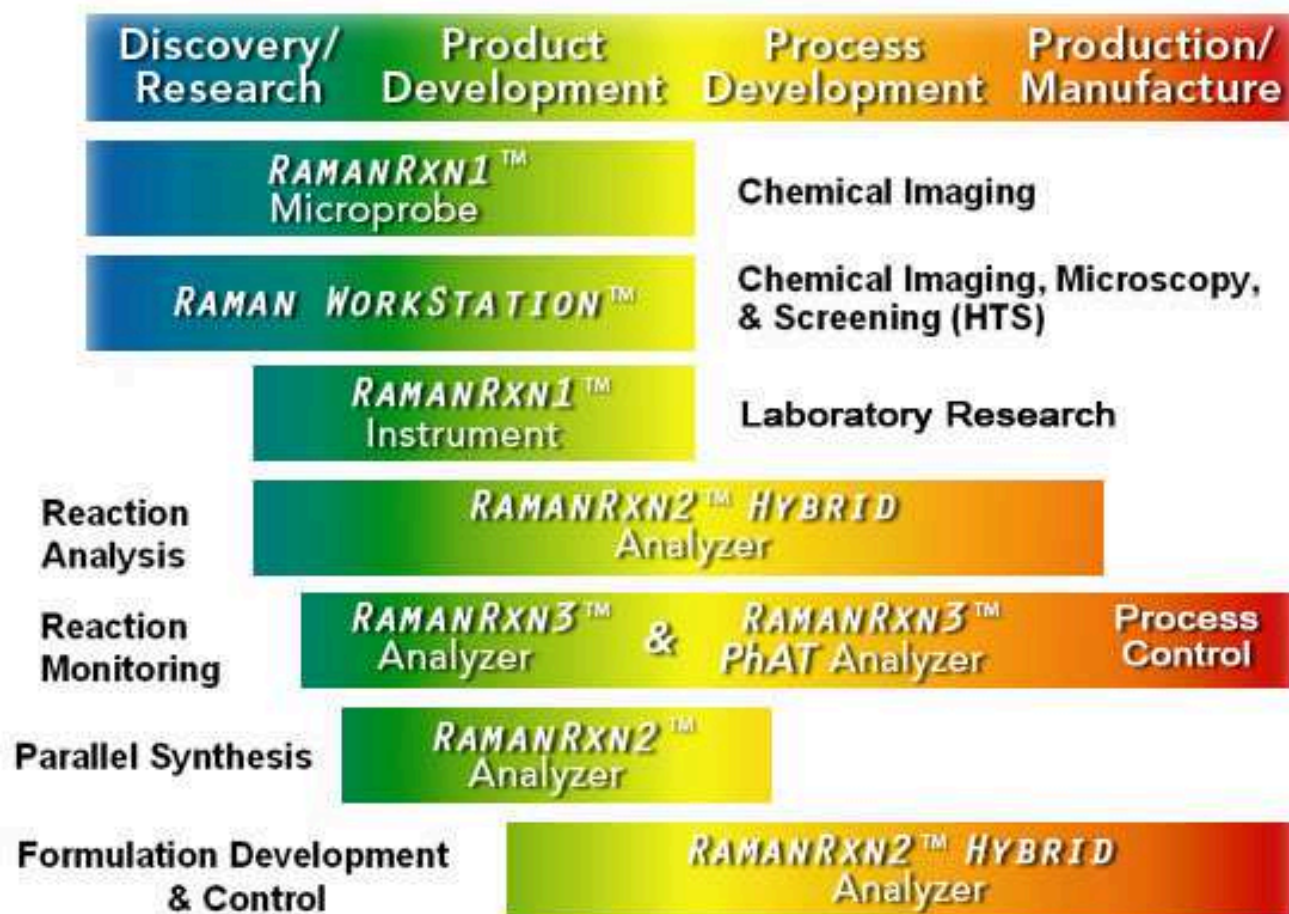
Majority of signal from Excipient



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Your Products Lifecycle - where can Kaiser Raman Analyzers Provide Value



Why choose *RAMANRXN SYSTEMS* Analyzers ?

- **Optimized System Development from Kaiser Controlled Components**
- **Fiber Optic Flexibility**
- **Proven Analyzer Track Record in the Laboratory and Plant (13 Years, Reliable 24/7 Operation)**
- **Demonstrated Successful Calibration Protocols and Transferability Lab-to-Plant**
- **Product Developed with Years of Tier 1 Customer Feedback**
- **Fast, reproducible, reliable**
- **More than 600 spectrographic units in the field**
- **Your Team of Raman Installation Experts!**

