SAND2012-2258 C
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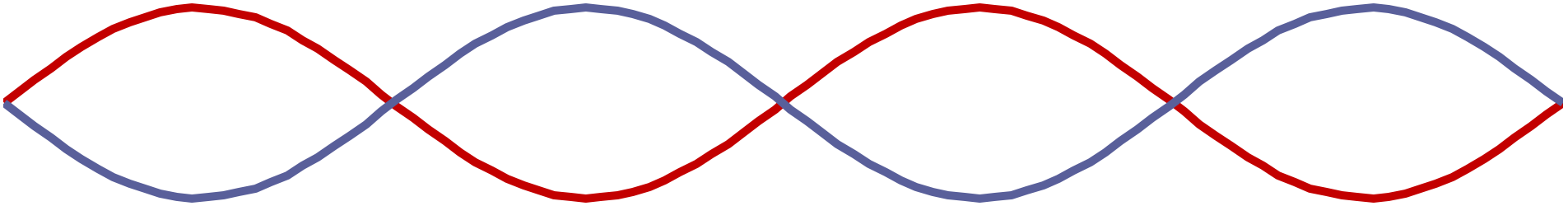
Raman Thermometry

Comparing Methods to Minimize Error



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Pam Norris (UVA)

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The Need for Thermometry

The New York Times
Friday, September 30, 2011

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June 1, 2010, 4:51 PM

Some iPads Can't Take the Heat

By NICK BILTON

When the iPad gets too hot it displays a stark warning.

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NOVEMBER 29, 2011, 3:00 AM

IPhone 'Self-Combusts' on Plane in Australia

Article | Comments (12)

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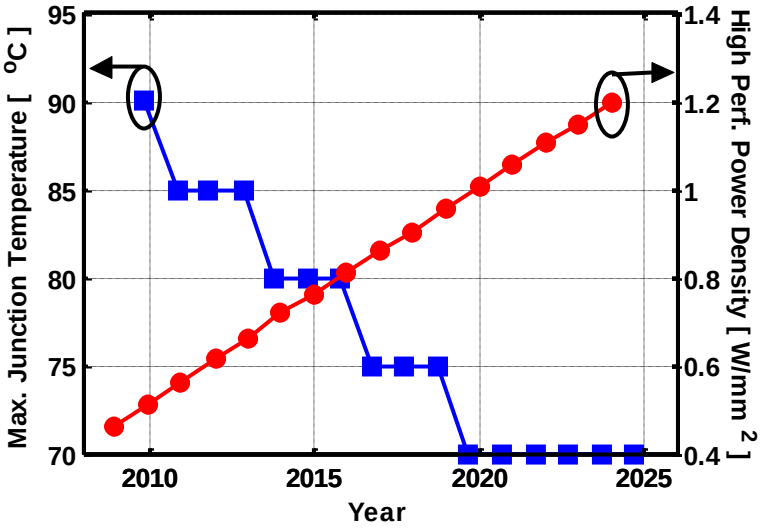
By Ross Kelly

Reuters

Too hot to handle

Apple's ubiquitous iPhone has become too hot to handle Down Under, literally. At least that was the experience of one unlucky passenger on a commercial flight to Sydney.

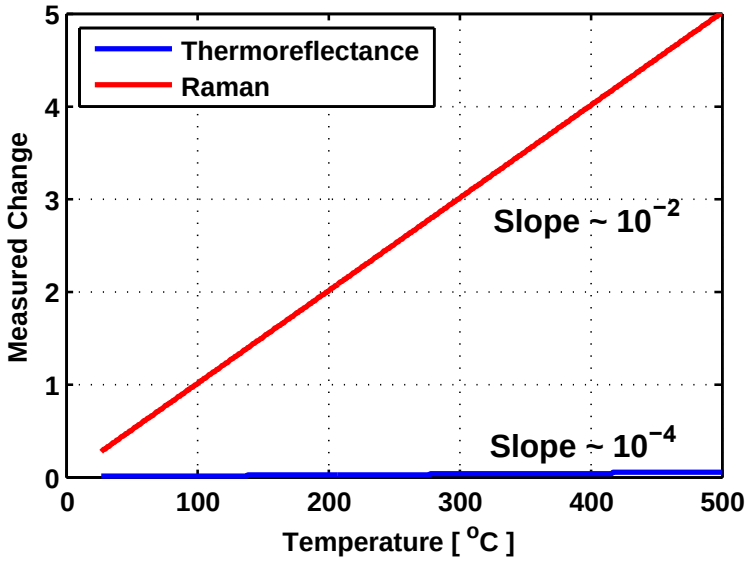
Small Australian carrier Regional Express said that a "self-combusting" iPhone 4 became red hot after a flight last week from northern New South Wales state landed in the city and had to be

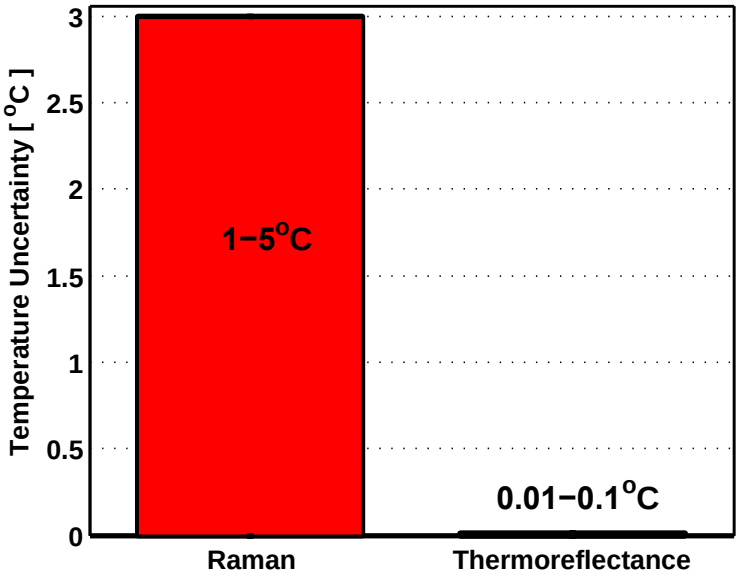


Adapted from Int. Roadmap for Semiconductors 2010

What kind of Thermometer?

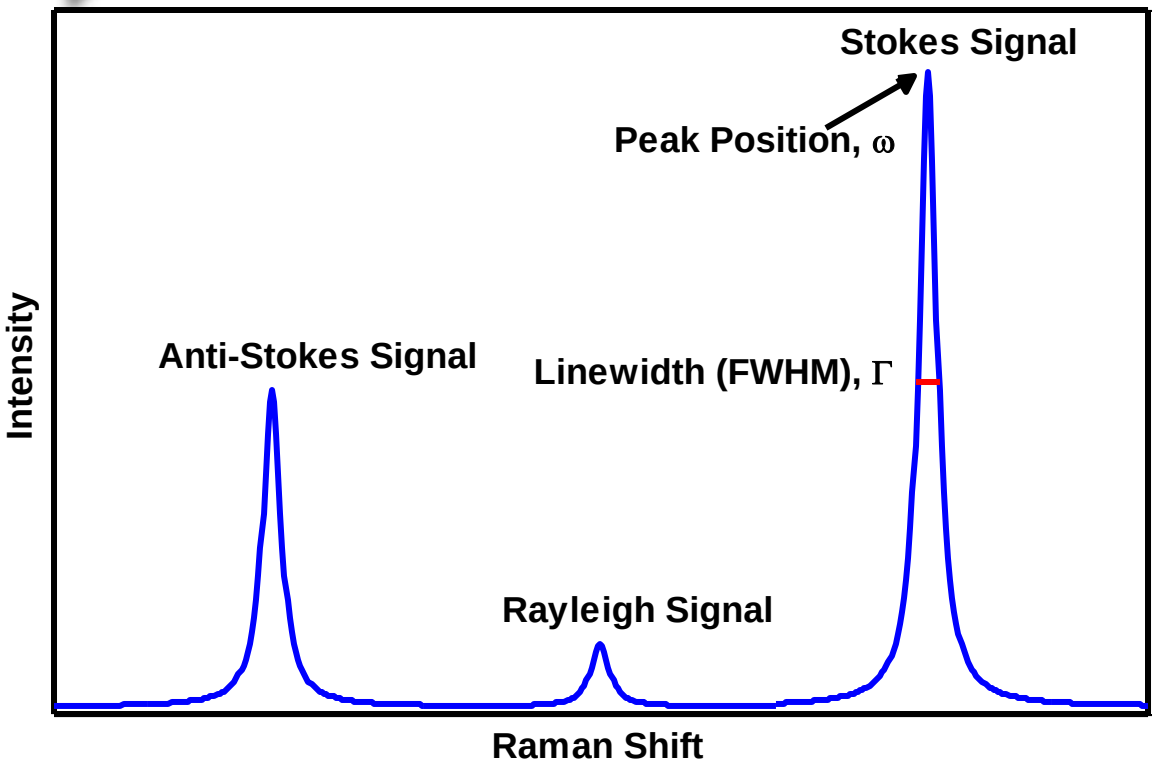
- **Needs:**
  - 1. Spatial resolution on par with device
  - 2. Material specificity
  - 3. Does not affect device
  - 4. High temperature resolution

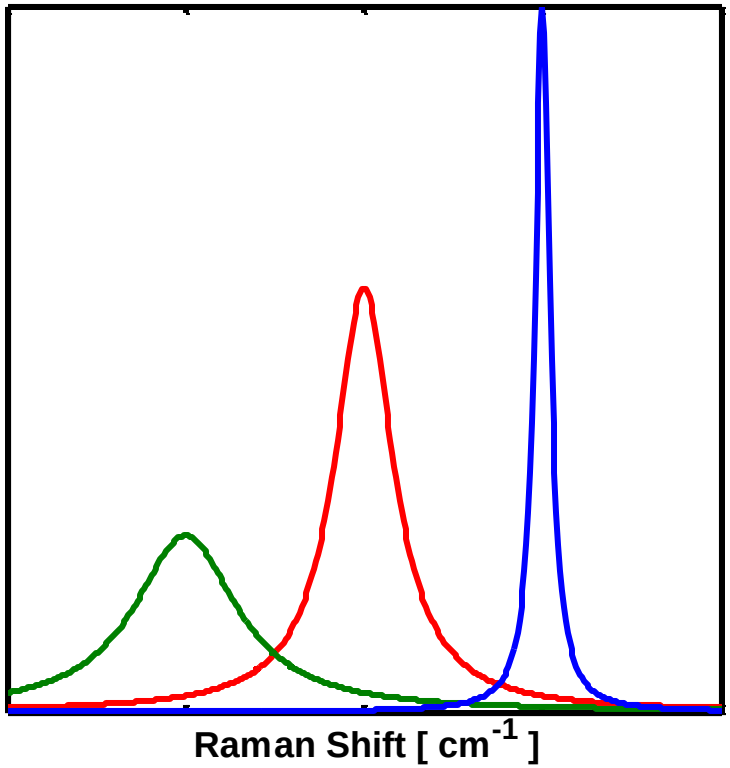




How do we reduce the uncertainty of a Raman thermometry measurement?

How & Why Phonons Change





Peak Position

- Interatomic potential

Linewidth

- Phonon lifetime

Intensity

- Number of phonons

Takeaway: **All temperature dependent, BUT...**

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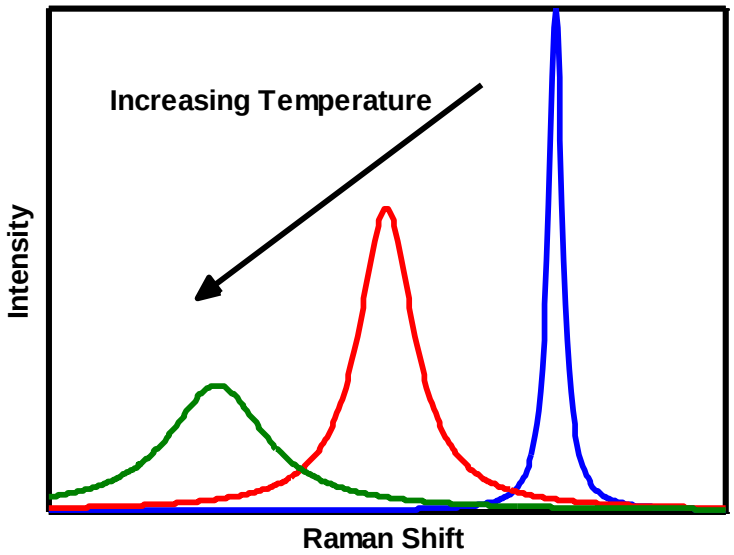
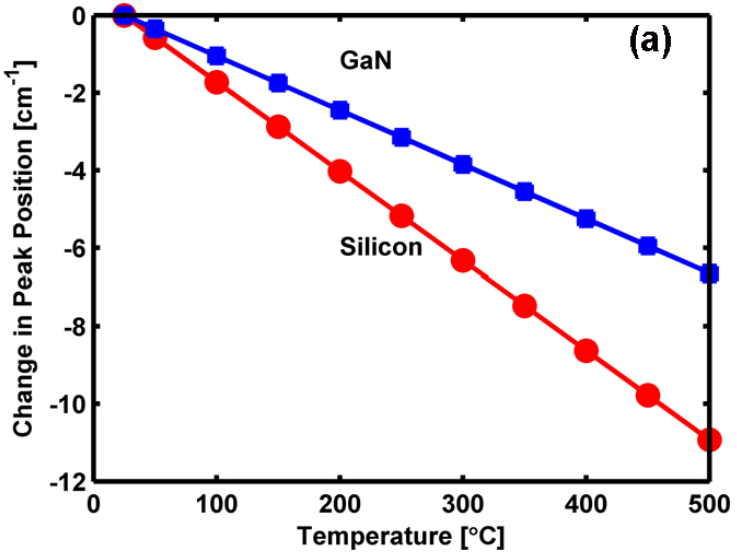
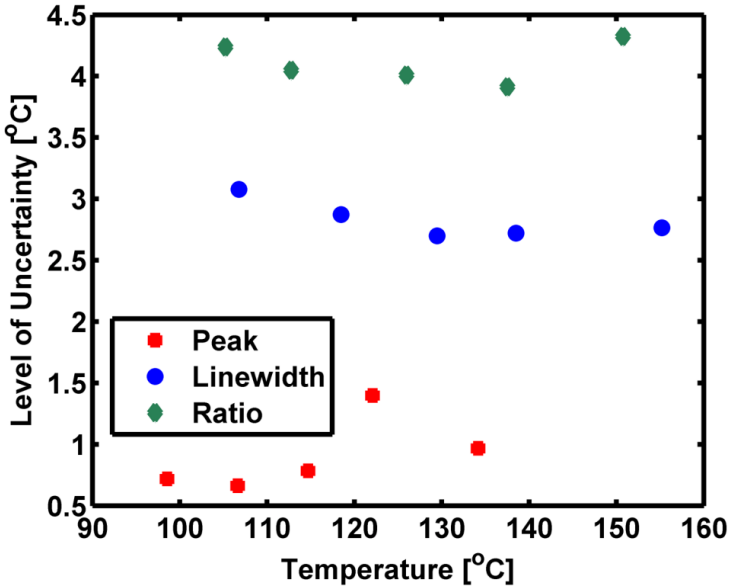
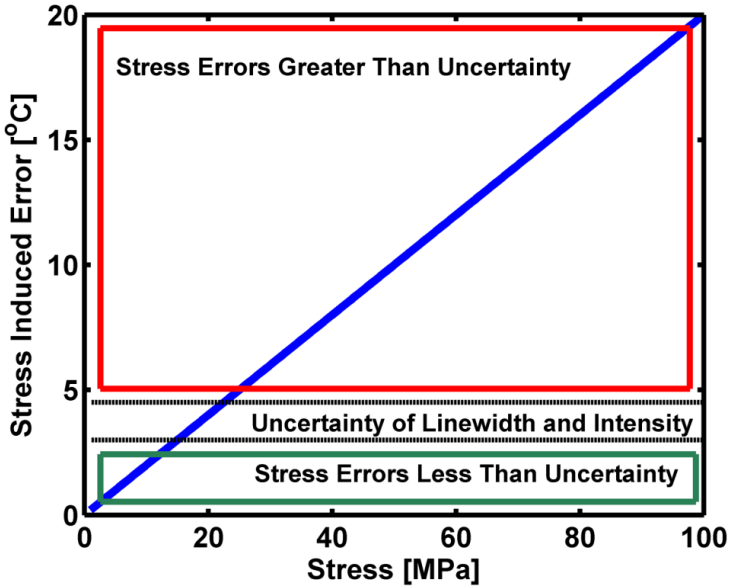
Comparing Methods & Strain Effects









Details: Beechem & Serrano. Spectroscopy (26) 33, 2011.

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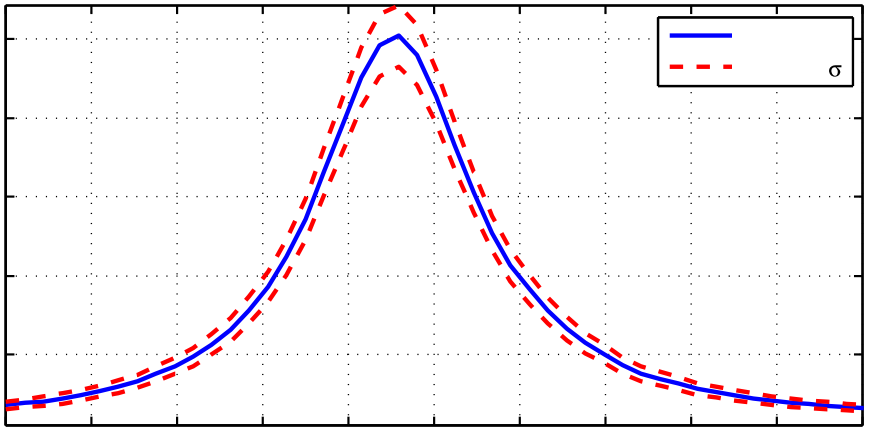
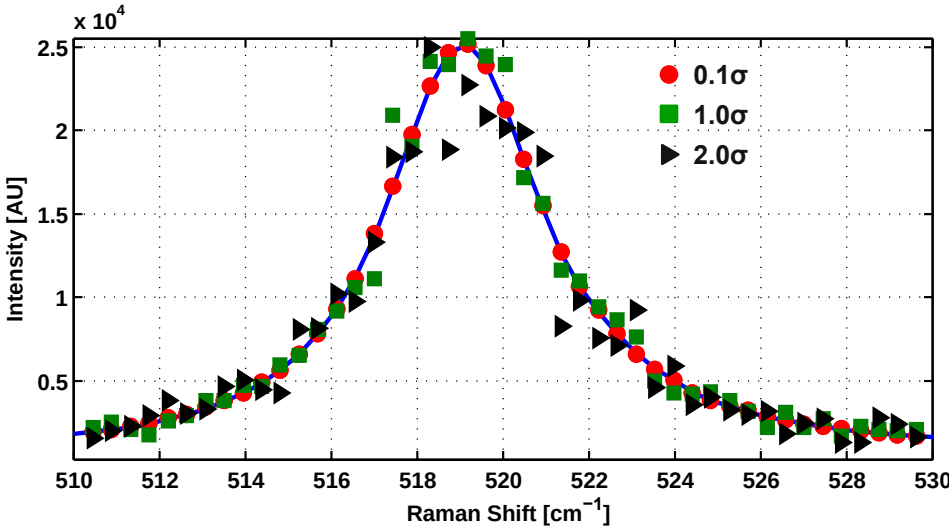
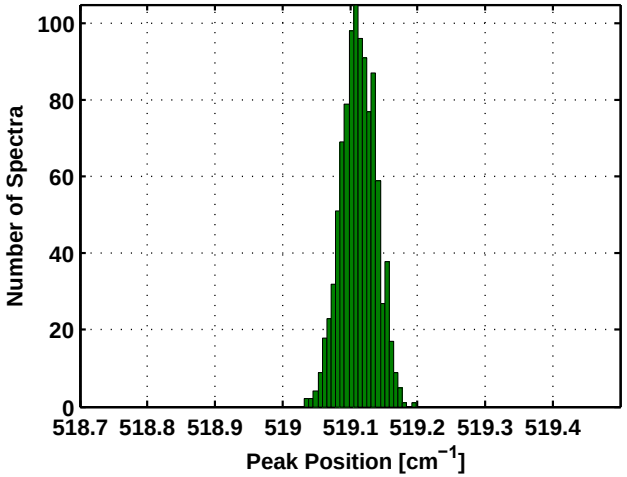
CCD Noise, “Din of Pixels”

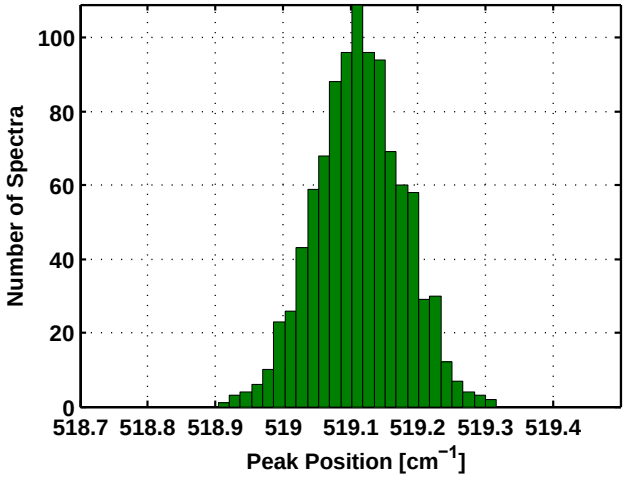




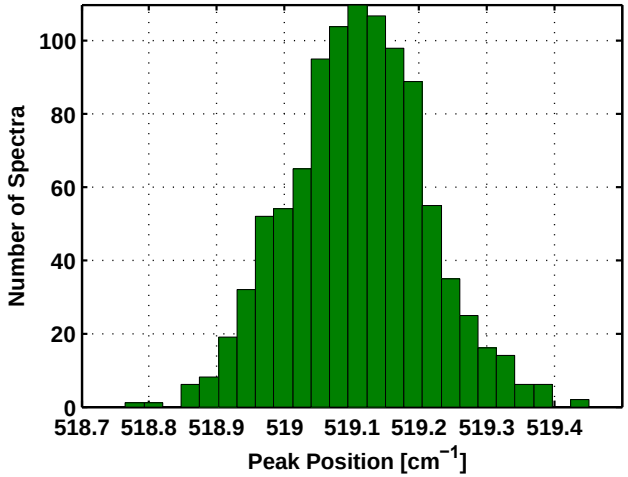
0.4 X σ



1.0 X σ



1.6 X σ



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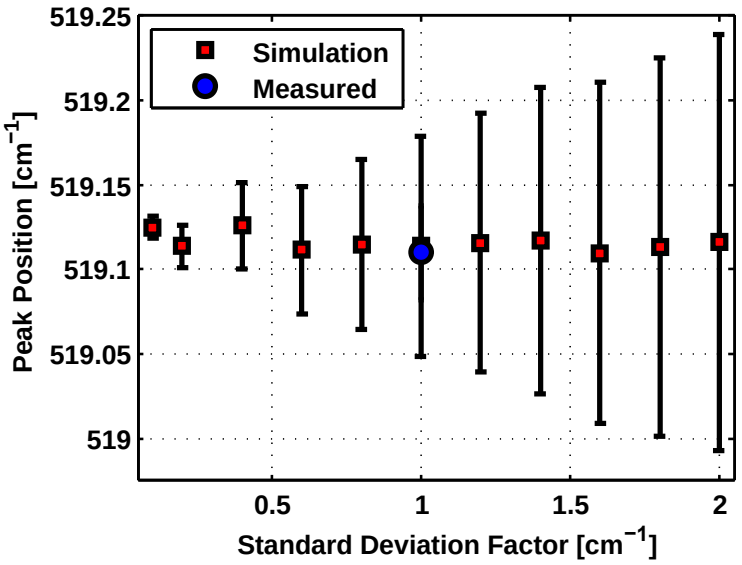
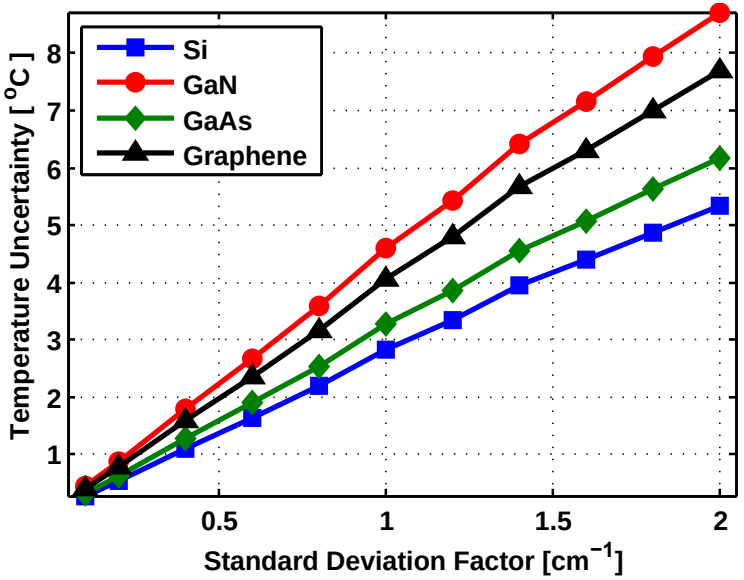
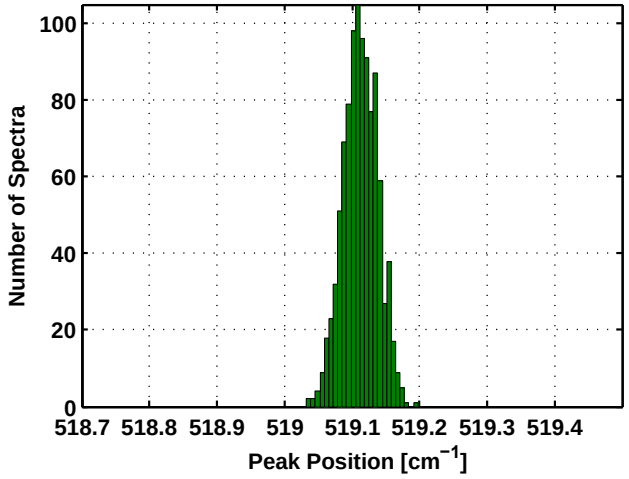
CCD Noise, “Din of Pixels”

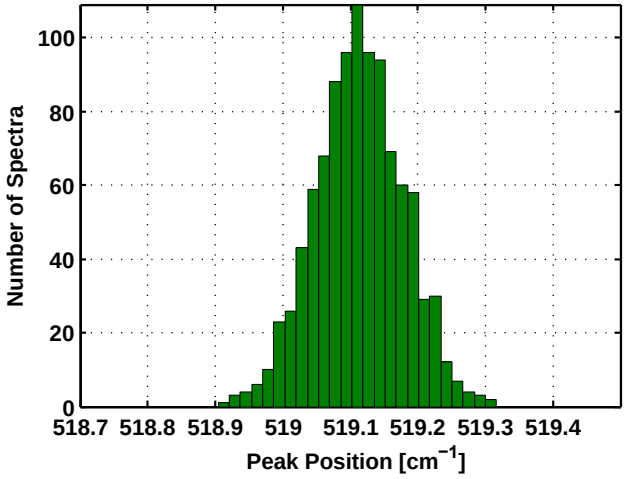




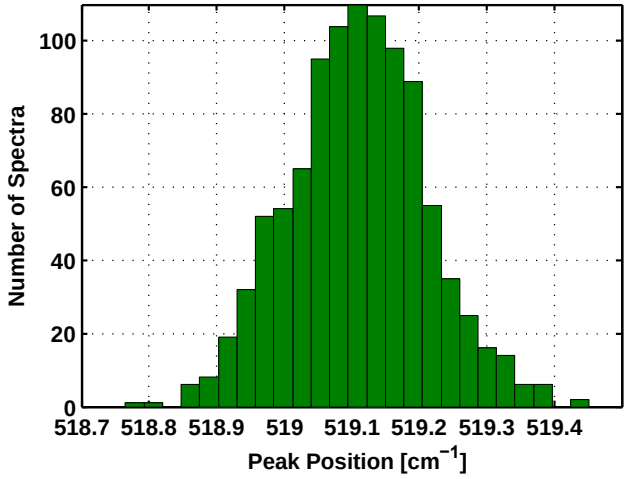
0.4 X σ



1.0 X σ



1.6 X σ



How can we get 1 noise source instead of 1600?

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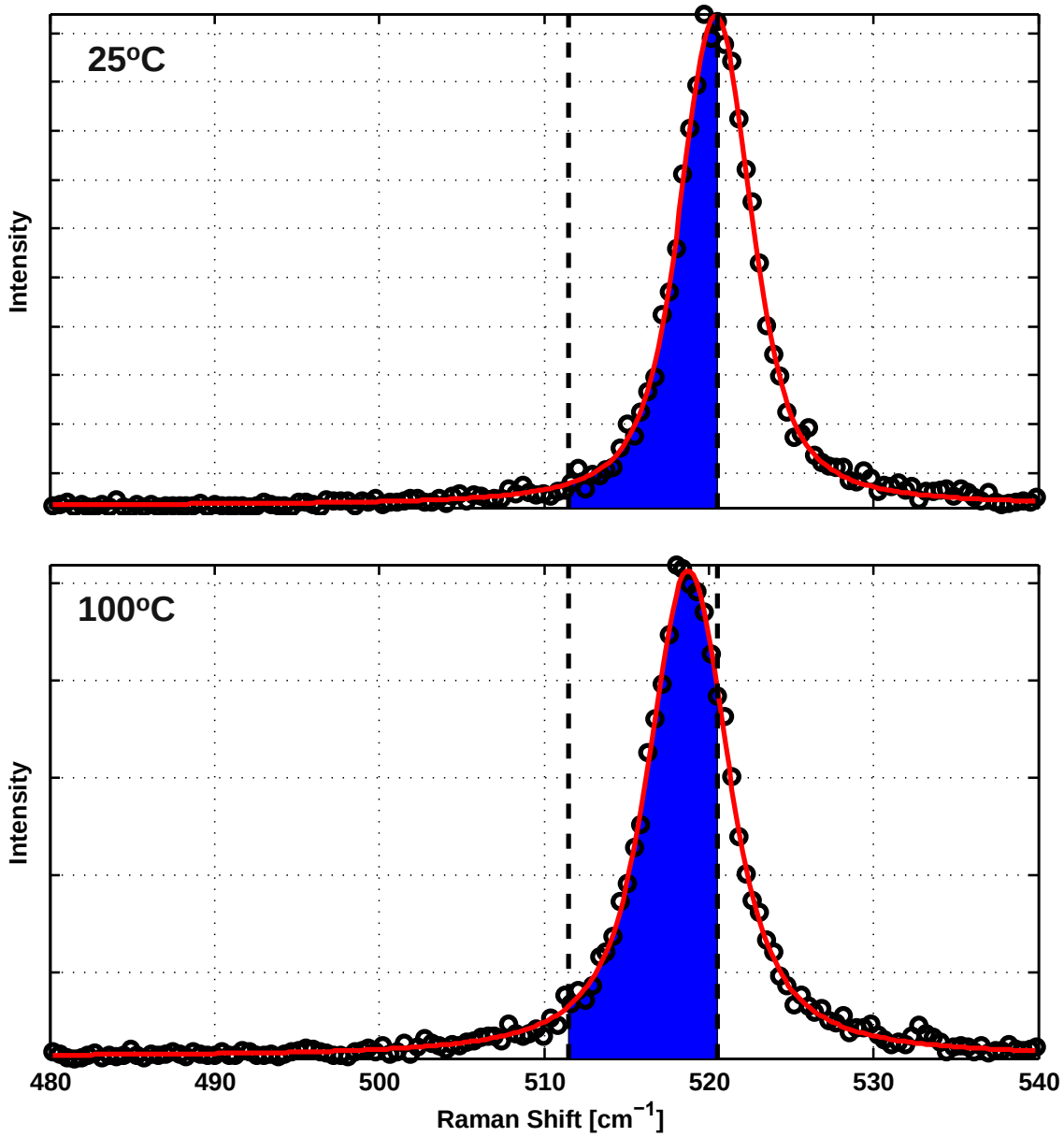
What if we just use “1 Pixel”?



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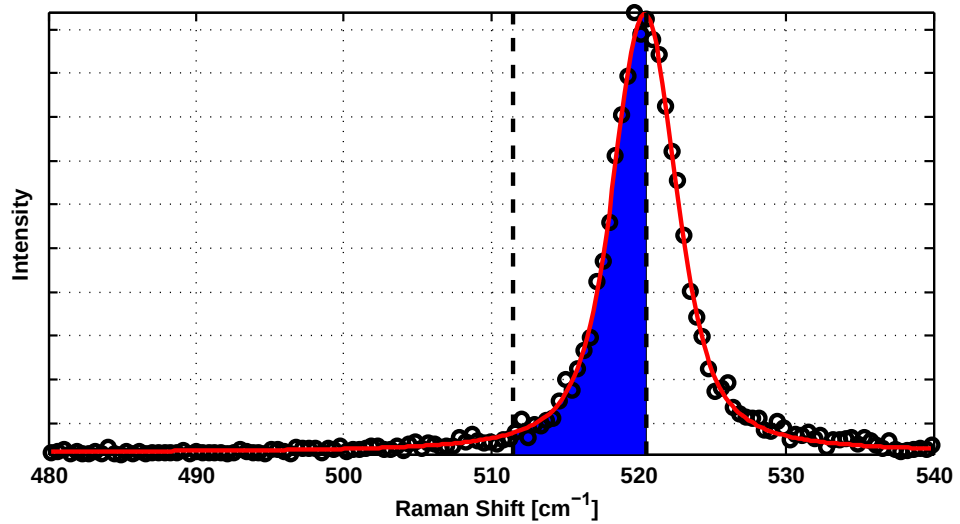
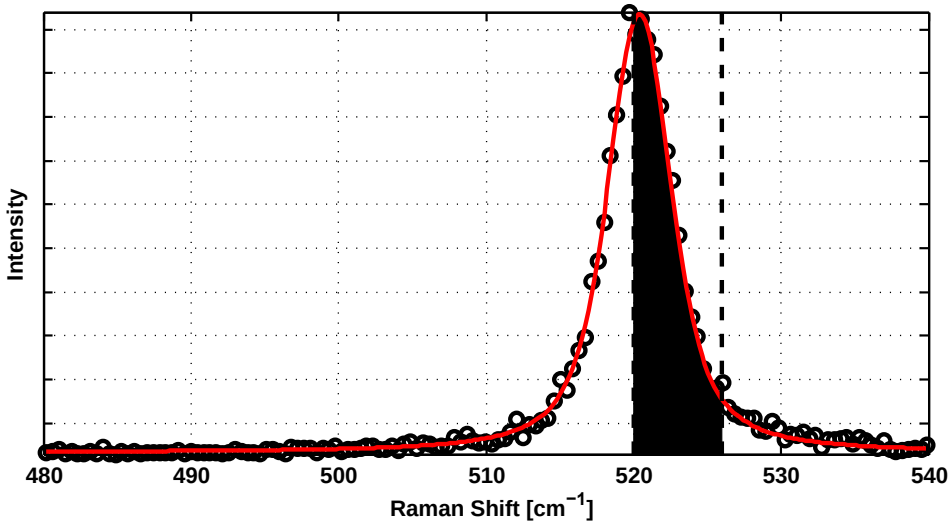
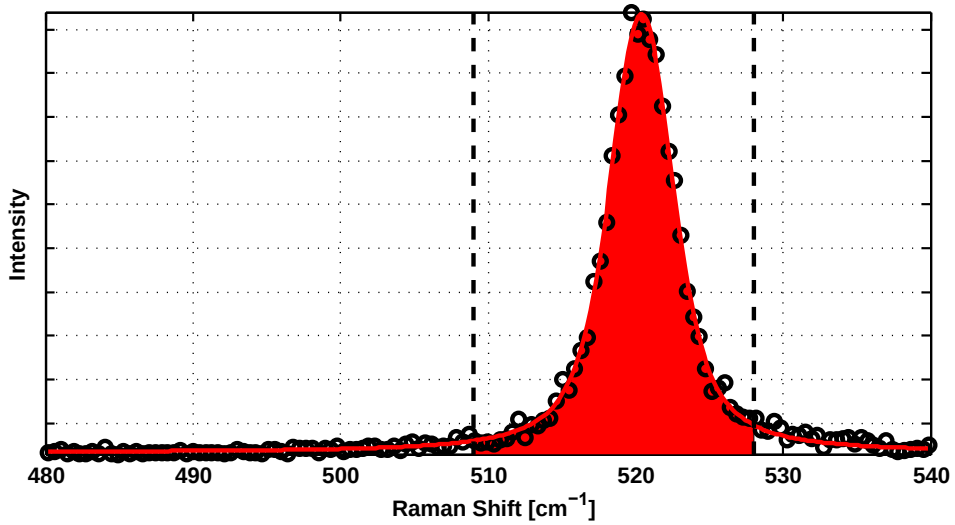
But what pixel to use?







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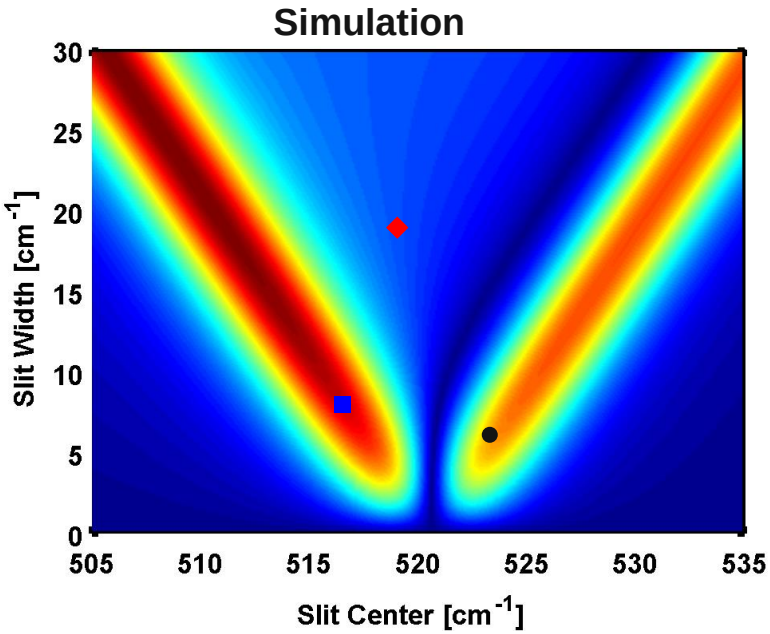
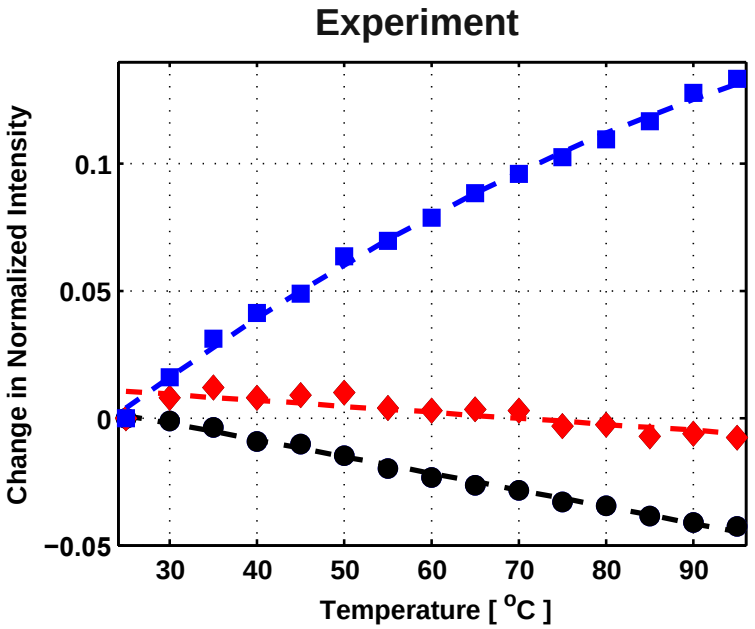
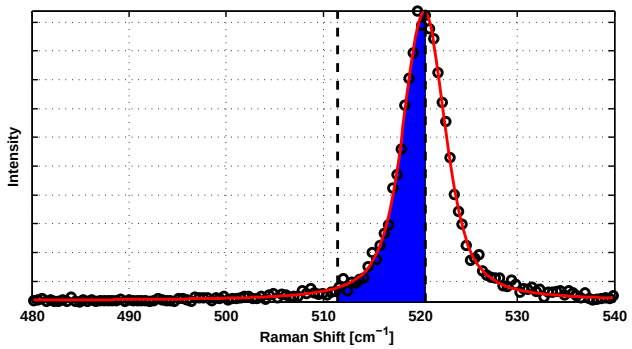
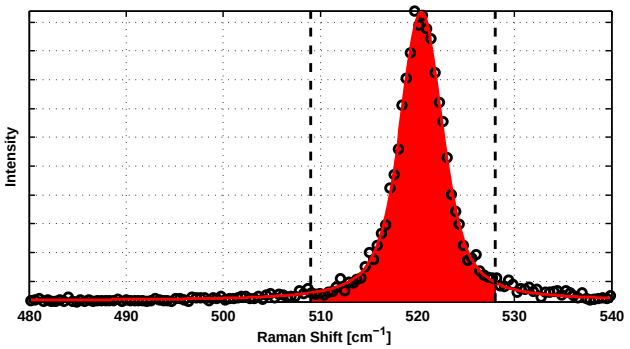
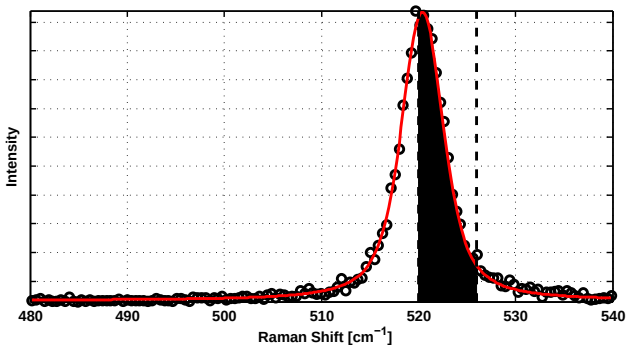
Using the “best” pixel











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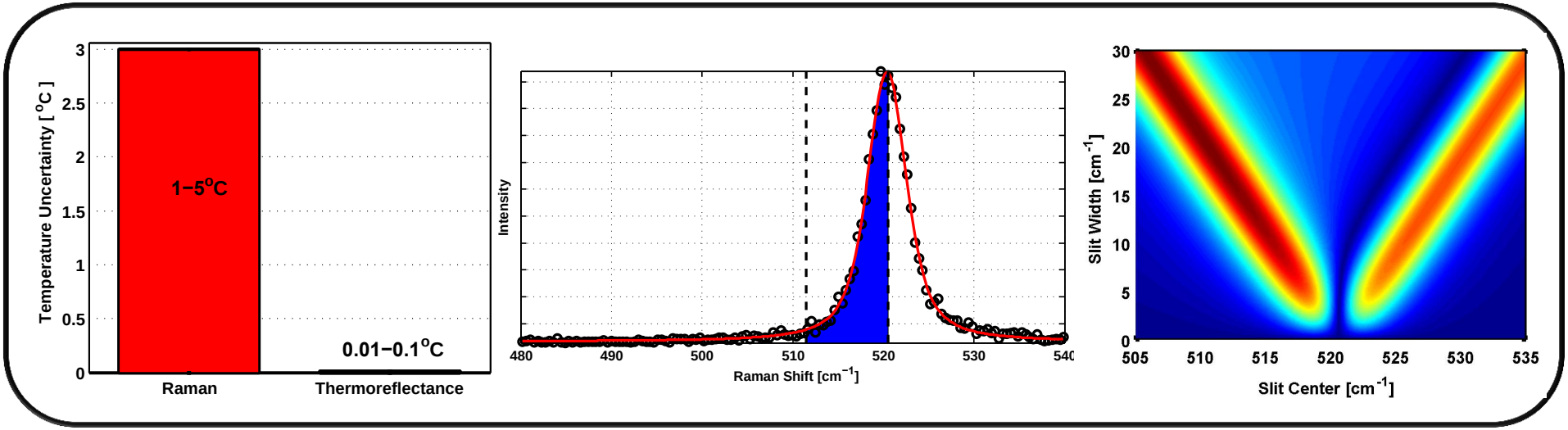
Summary



- ***Goal:***
  - **Find methods to improve Raman's temp resolution**
- ***Approach:***
  - **Reduce number of pixels to reduce error**
- ***Outcome:***
  - **Sampling "red half" of spectrum gives is promising.**

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