

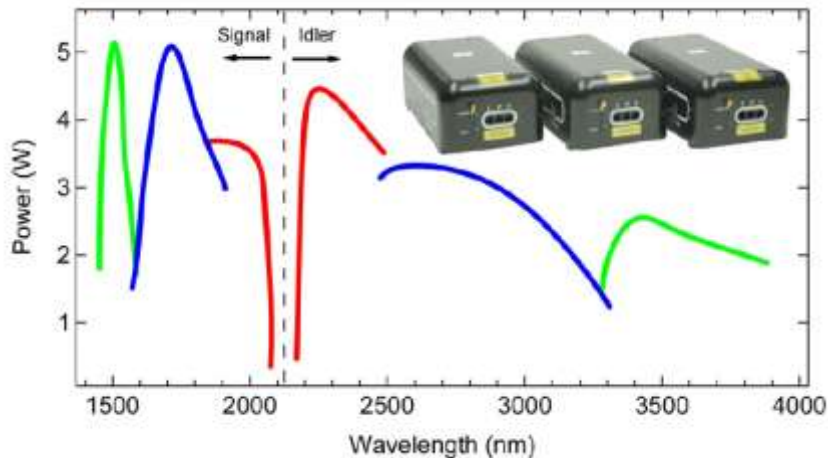
Automatic Tuning of an Aculight cw-OPO

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Lockheed Martin Aculight cw-OPO



Singly Resonant PPLN-OPO

> 1 Watt Idler output

2.4 to 3.8 micron

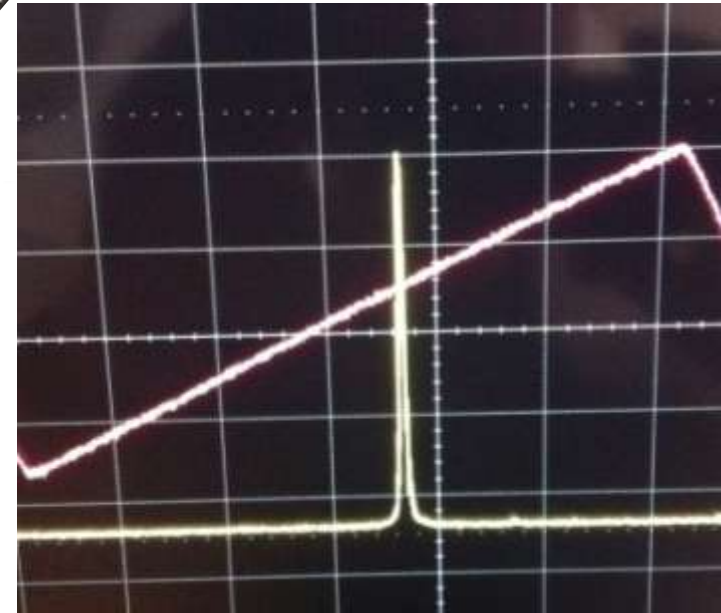
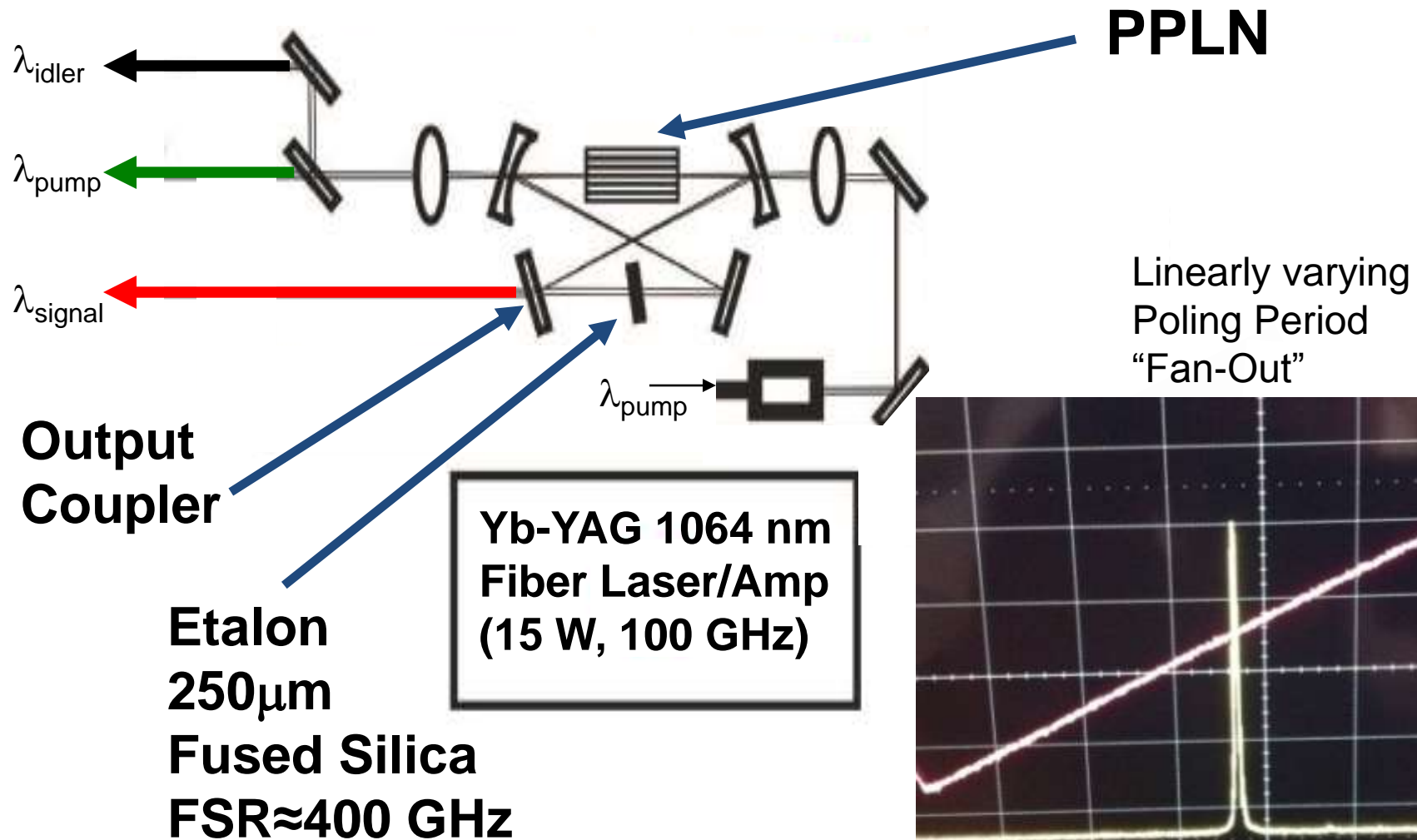


OPO module, controller and IPG fiber amplifier

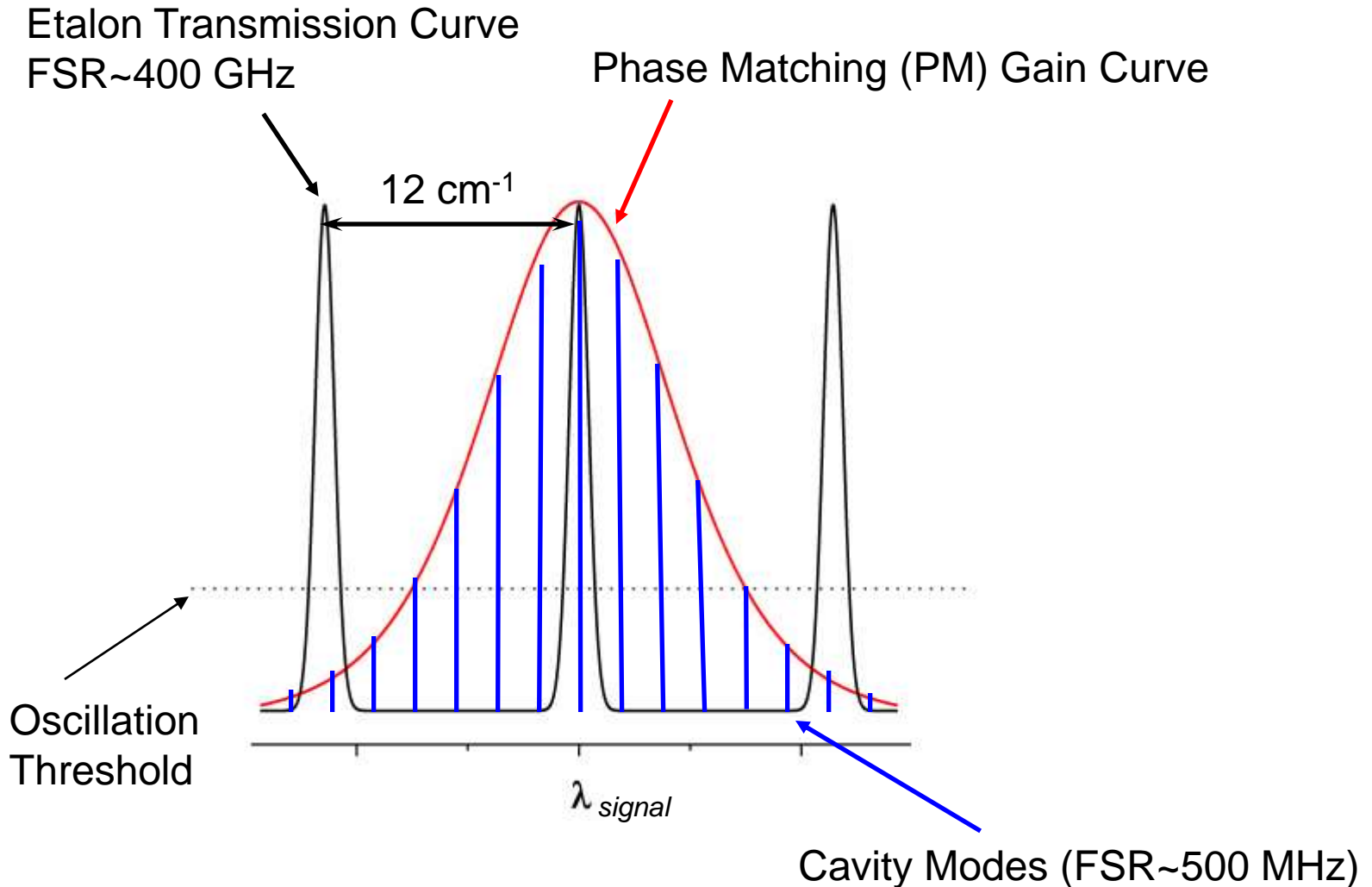


NKT Photonics Yb-YAG Fiber seed laser (100 GHz continuous tuning)

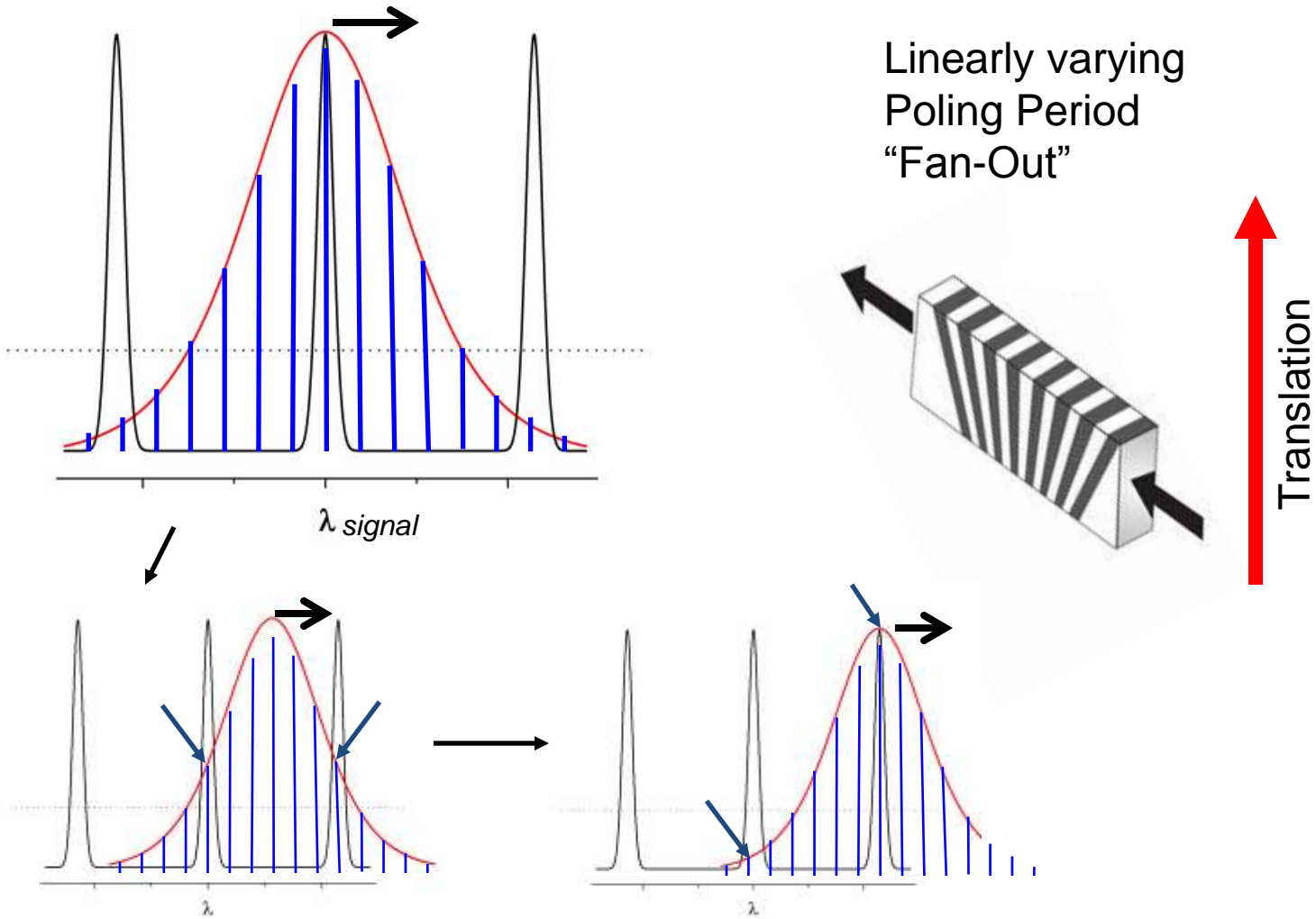
Singly Resonant cw-OPO



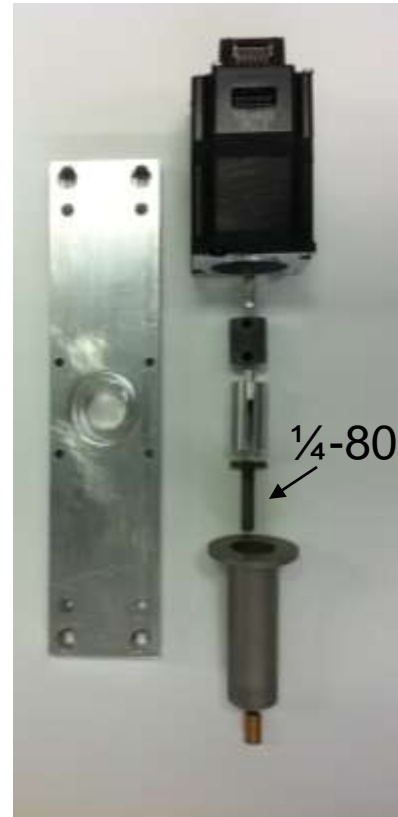
PPLN-PM and Etalon Gain curves



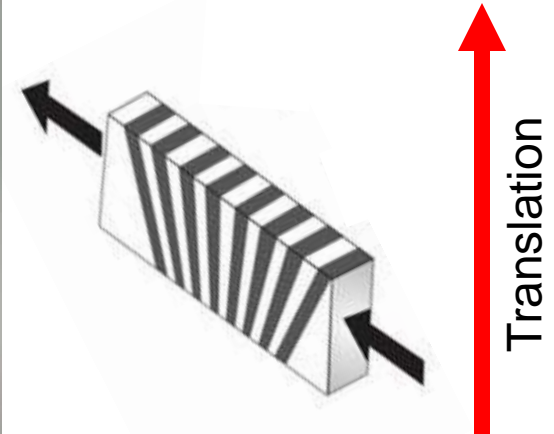
PPLN-PM and Etalon Gain curves



Tuning the PPLN Phase Matching Gain Curve



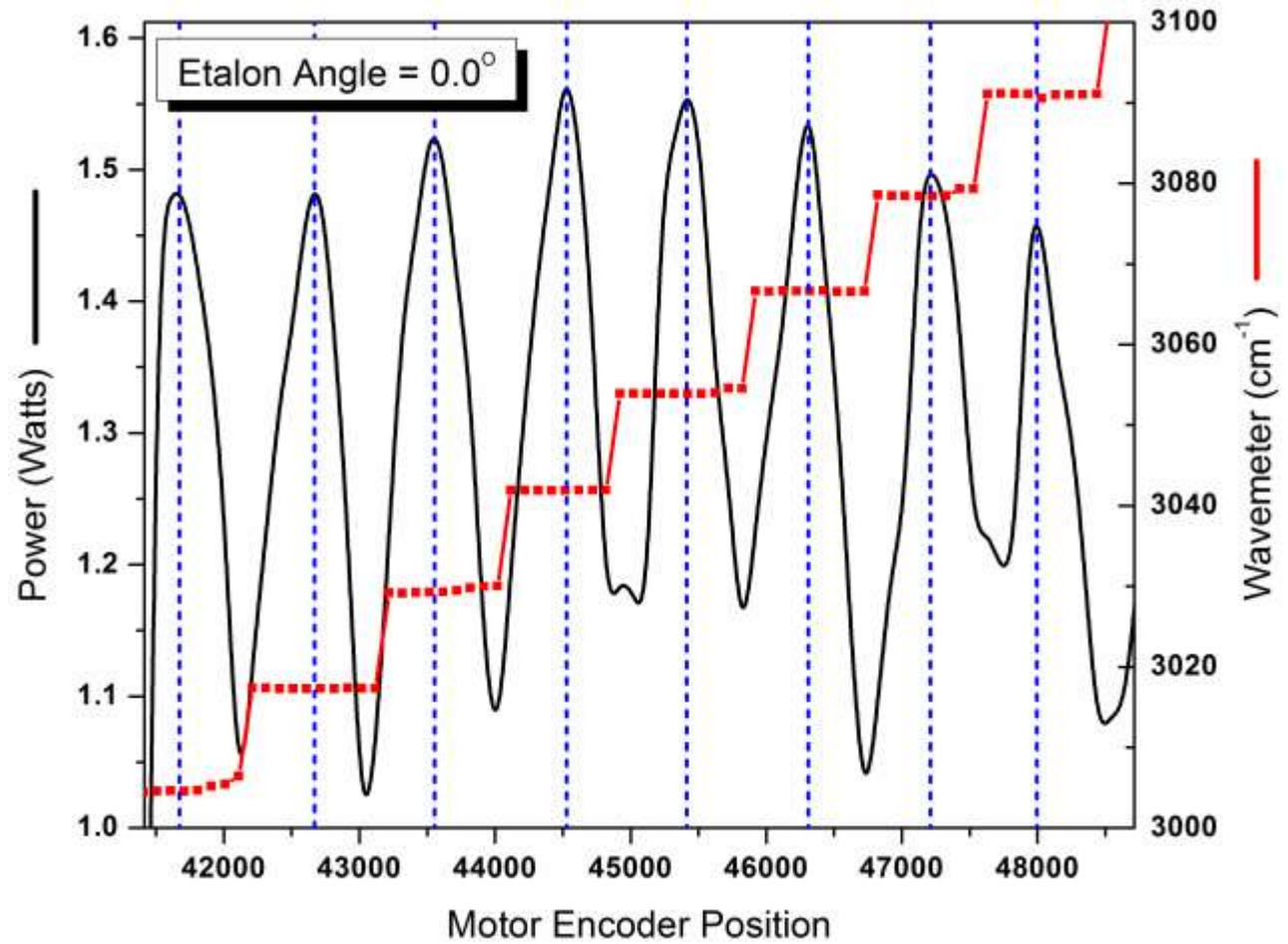
Linearly varying
Poling Period
"Fan-Out"



Homemade linear actuator system used to translate the PPLN crystal and shift the central frequency of the phase matching gain curve.

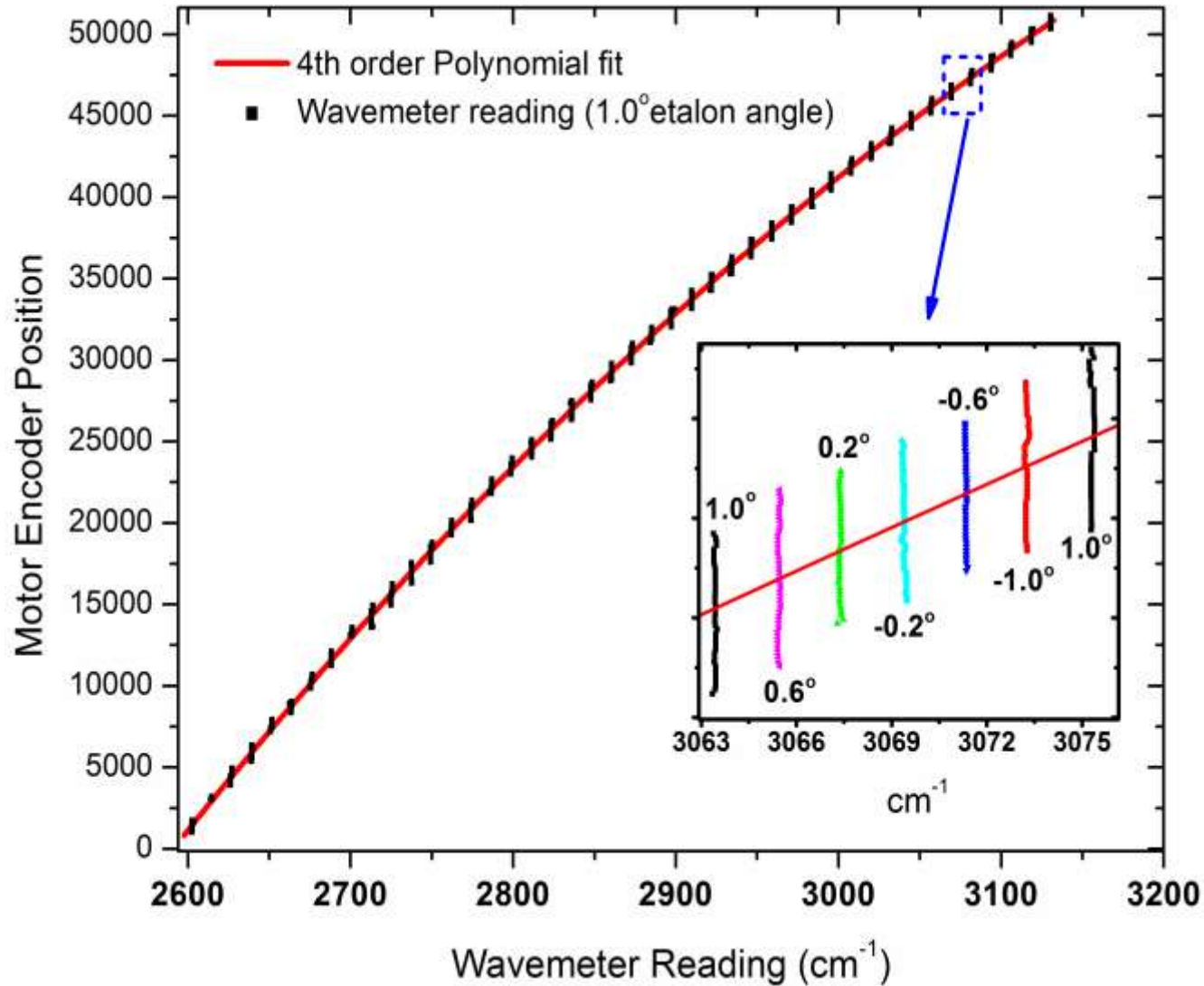
Translate the PPLN crystal and shift the central frequency of the phase matching gain curve.

Hop one FSR of the intracavity etalon. Power is maximized when the PPLN phase matching and etalon gain curves are overlapped.



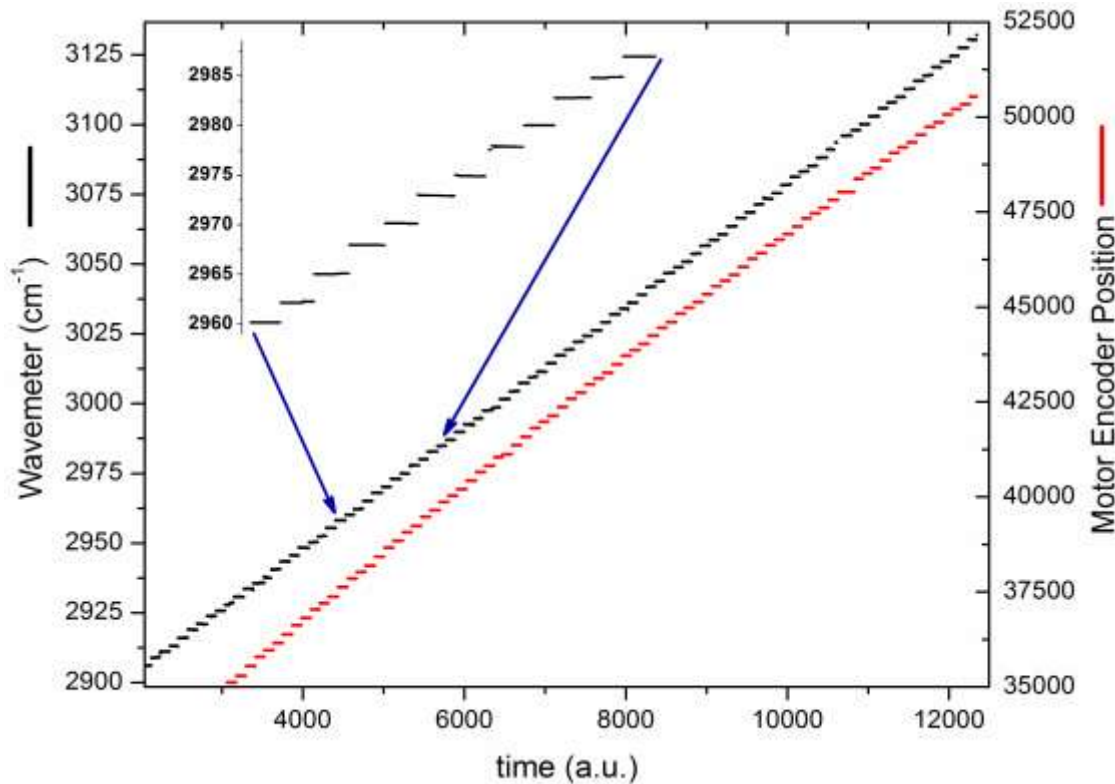
Vertical Translation

Motor Curve for PPLN translation



Synchronize PPLN translation and Etalon Tuning

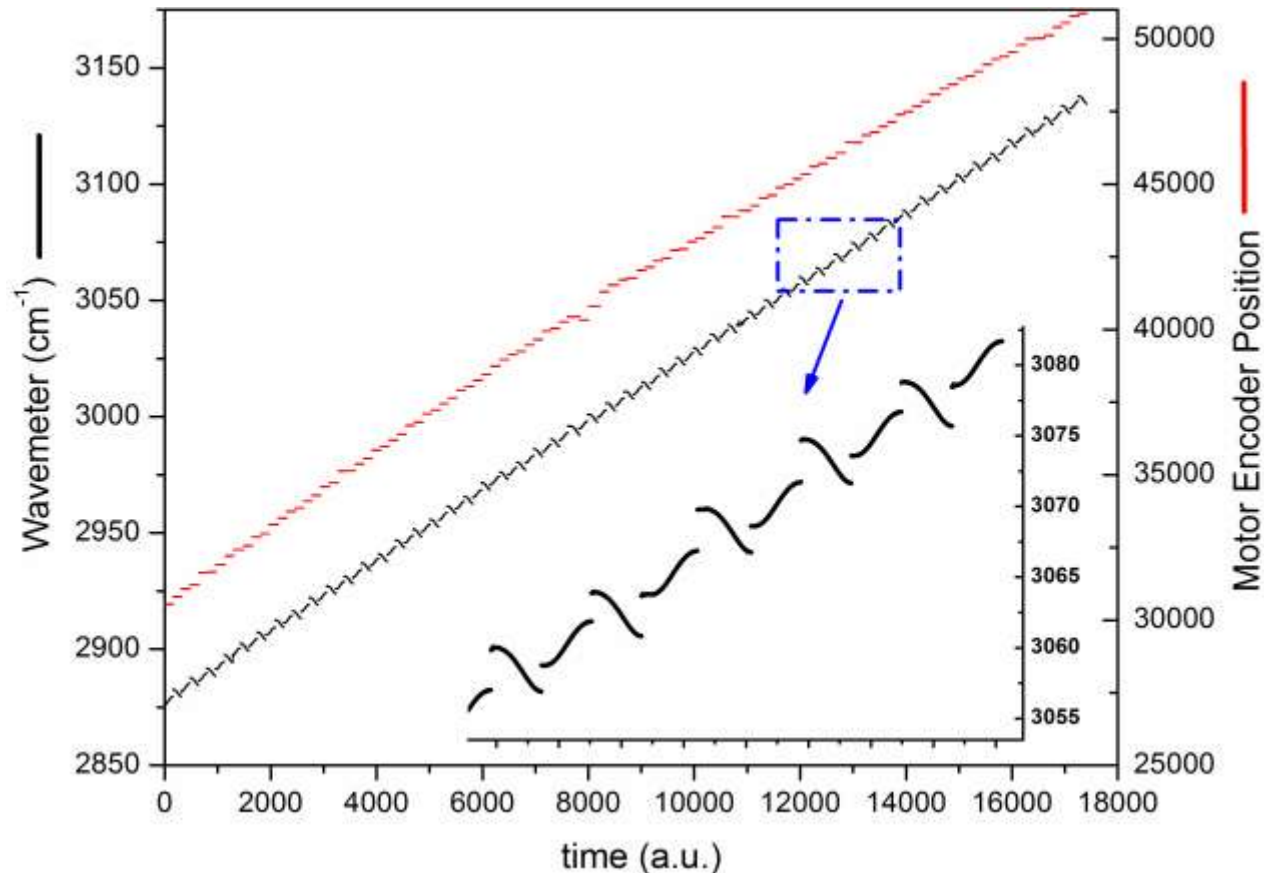
Scan ~18
FSRs of the
ICE



Scan Etalon from -1.0° to $+1.0^\circ$ in 0.2° increments
(One FSR $\sim 12 \text{ cm}^{-1}$). $\sim 1.5 \text{ cm}^{-1}$ hops

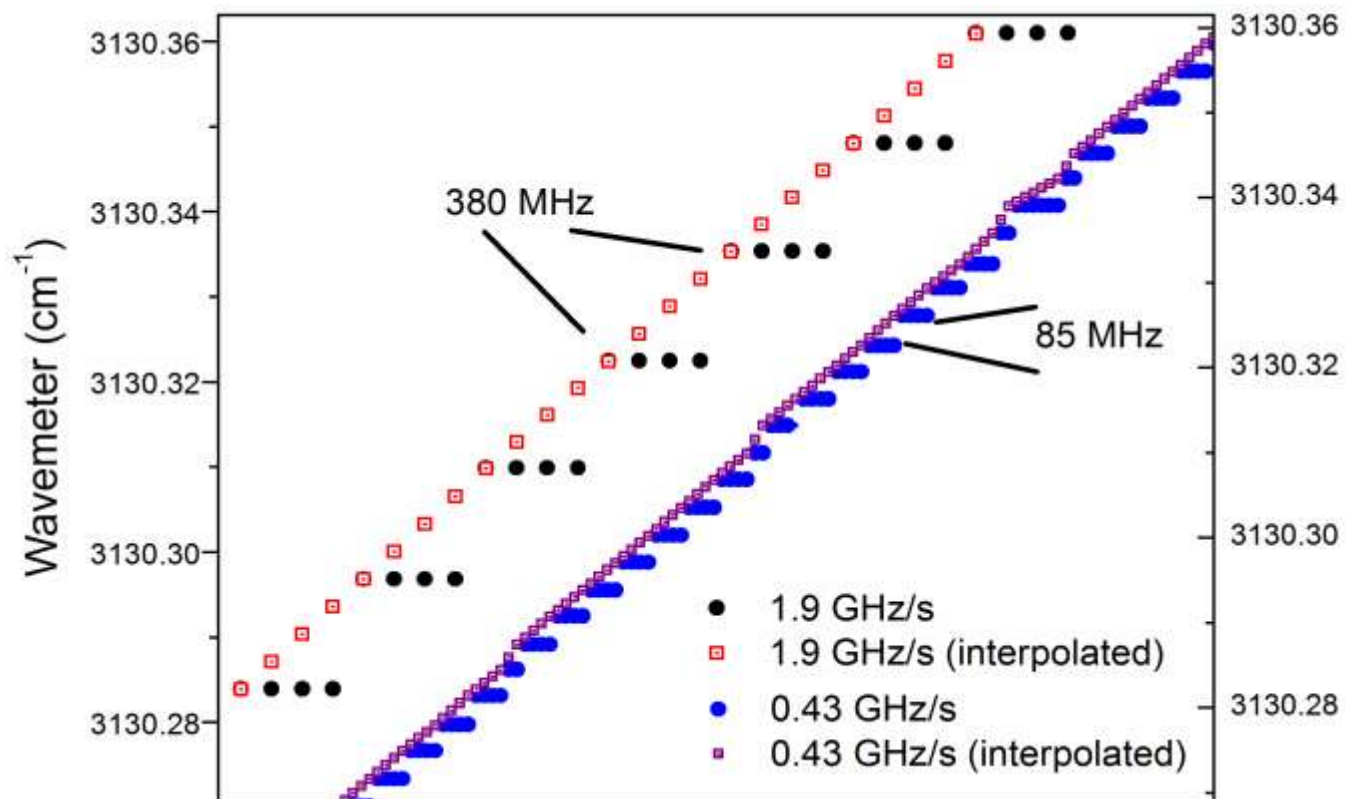
At each Etalon hop, read wavemeter and adjust PPLN position.
Track PPLN-PM and Etalon Gain Curves.

Synchronize PPLN translation, Etalon Tuning and Piezo tuning of λ_{pump} (therefore λ_{idler})



- Scan Piezo (sine or triangle wave) continuously. ($\sim 3 \text{ cm}^{-1}$)
- Hop Etalon position at each peak and trough of piezo scan.
- Read motor curve and adjust PPLN position.

Bristol Instruments 621A wavemeter



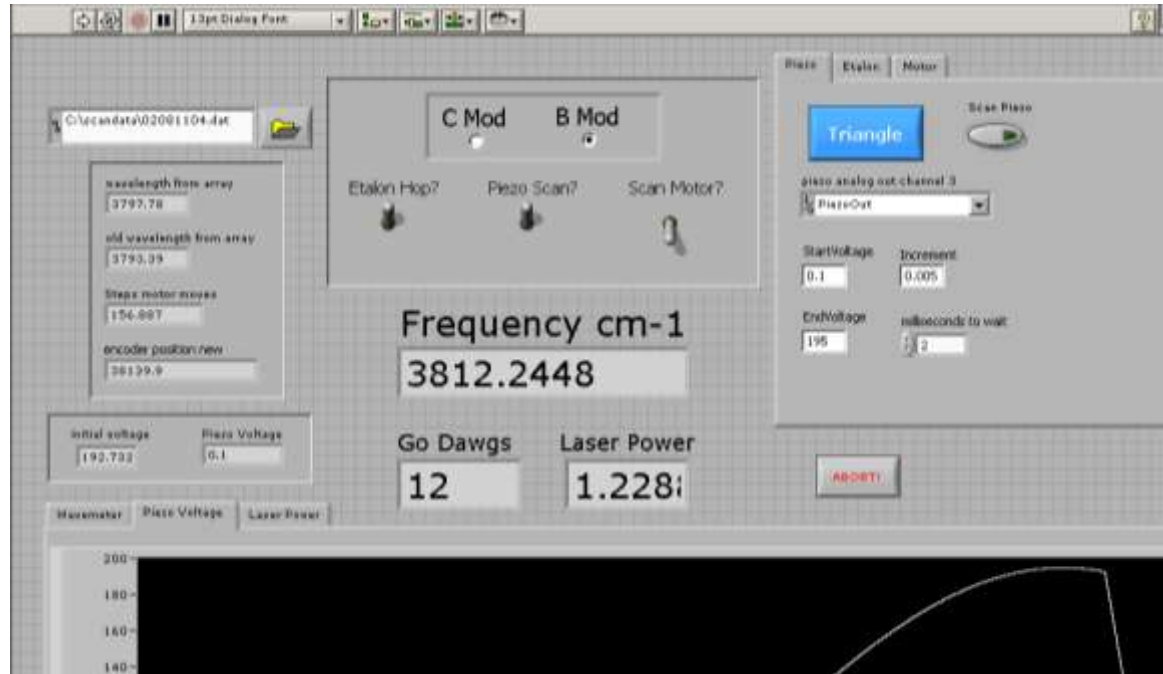
Wavemeter: Bristol Instruments 621A

Absolute accuracy: 15 MHz

Repeatability: ± 7 MHz

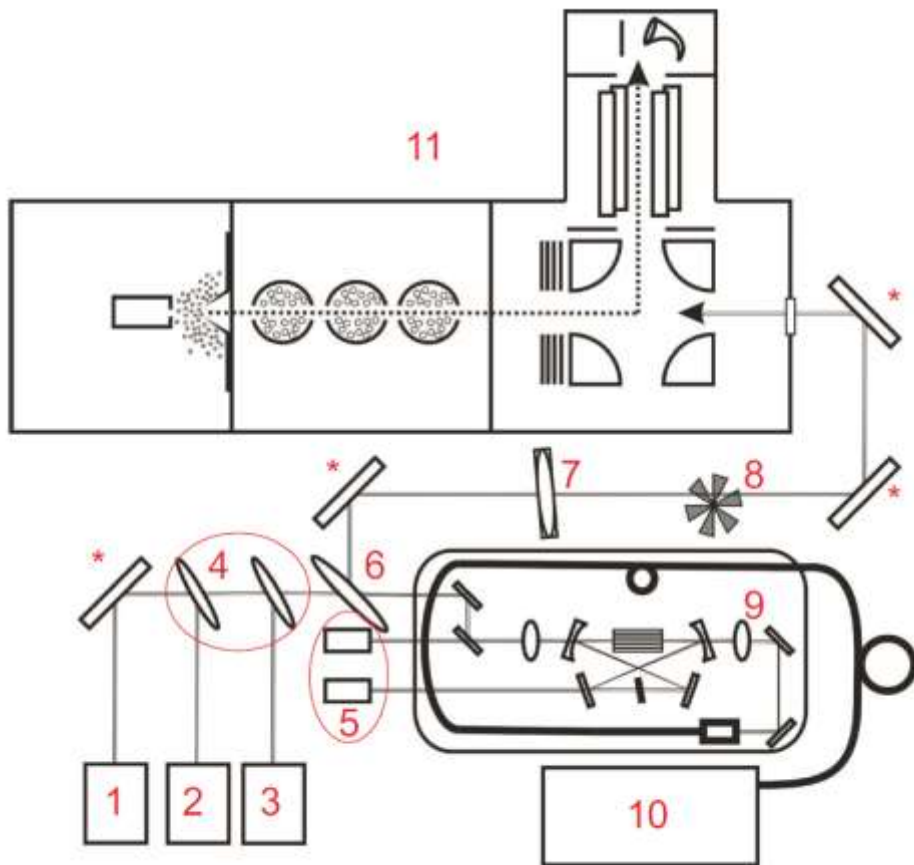
5 Hz update rate

LabView and your imagination...



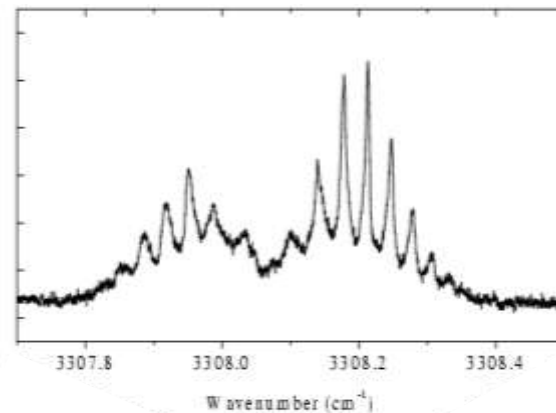
Front Panel of our LabView program that synchronizes the λ_{pump} , Etalon and PPLN tuning. The user can switch on and off the three separate tuning elements.

Helium Nanodroplet Isolation

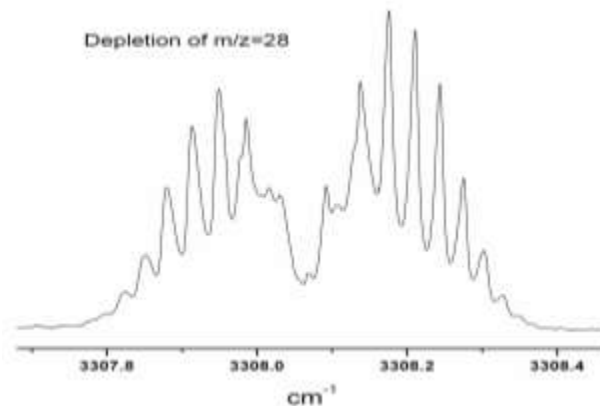


Power Meter
Wavemeter
Fabry Perot interferometer

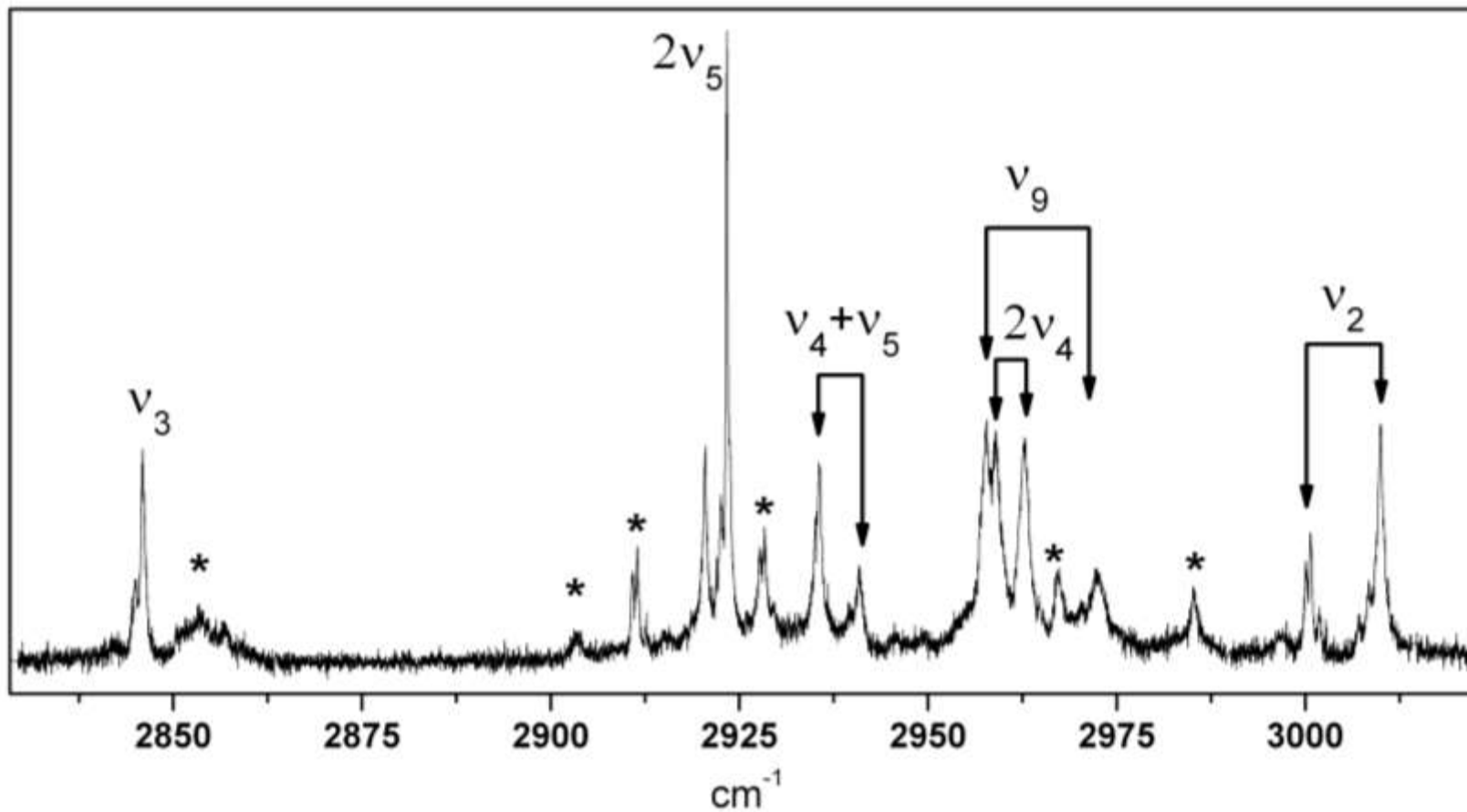
Chapel Hill (Bolometer Detection,
F-Center laser ~10 mW)



Athens (Mass Spec Detection,
OPO ~400 mW)



Demonstration of Automatic Tuning



Helium Nanodroplet Isolation
CH stretch region of the CH_3OH spectrum

Summary

- Automated Tuning of cw-OPO commercially available from Lockheed Martin Aculight: see Angus Henderson
- Our algorithm depends on the continuous feedback from a high precision wavemeter: see Brian Samorski (Bristol Instruments)
- Email me or see our website for details regarding the hardware and tuning / post-processing software. douberly@uga.edu

Acknowledgments

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