Deploying Quantum Sensors

SAND2016-12032PE

Exceptional service in the national interest

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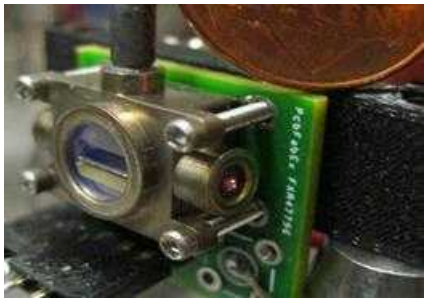

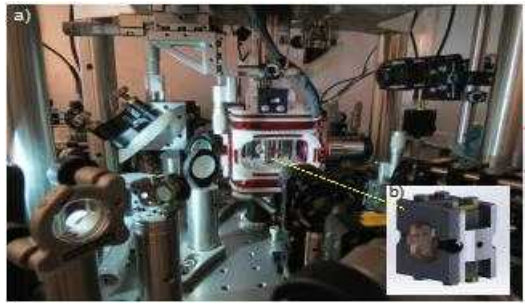

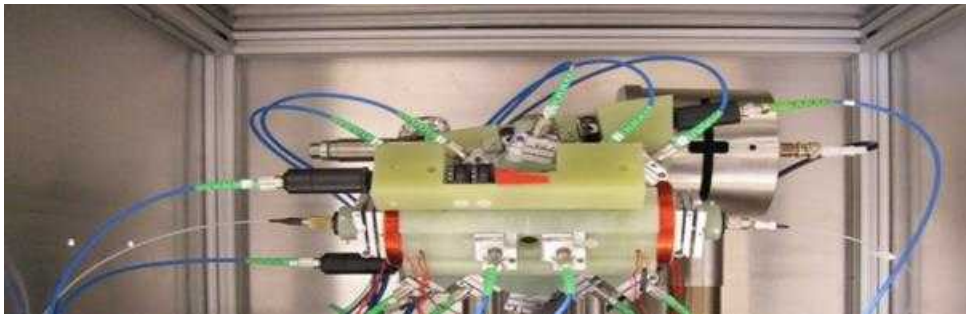

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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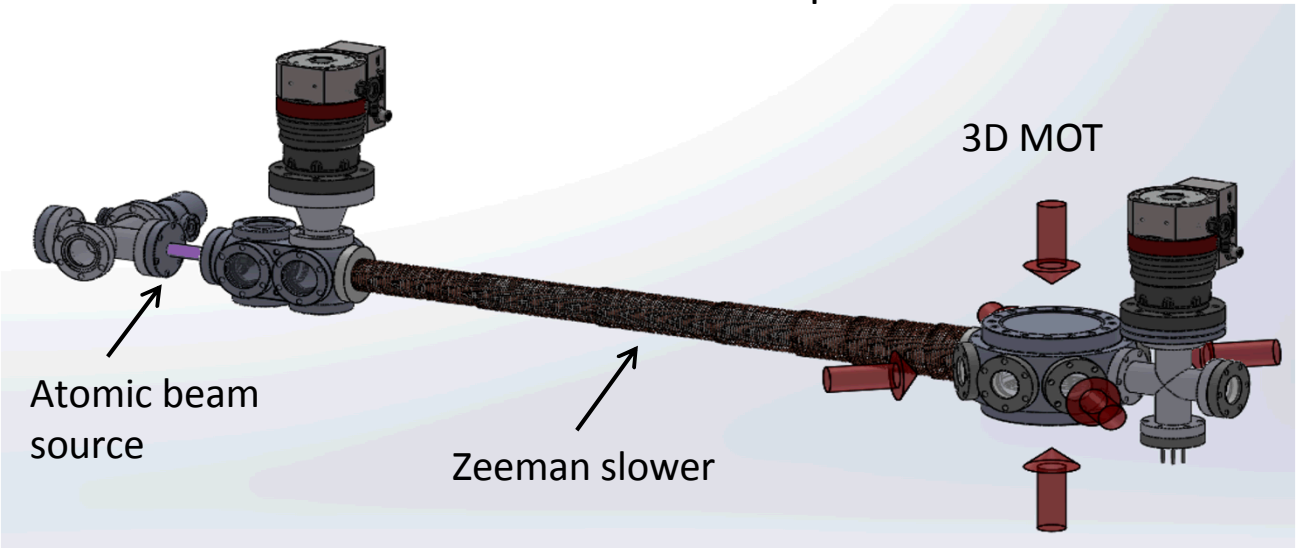
Atom Trap Trace Analysis

PI: Scott Bisson

A laboratory-based ATTA system has been developed at Sandia as a testbed for ultra-trace isotope detection and cold atom physics.

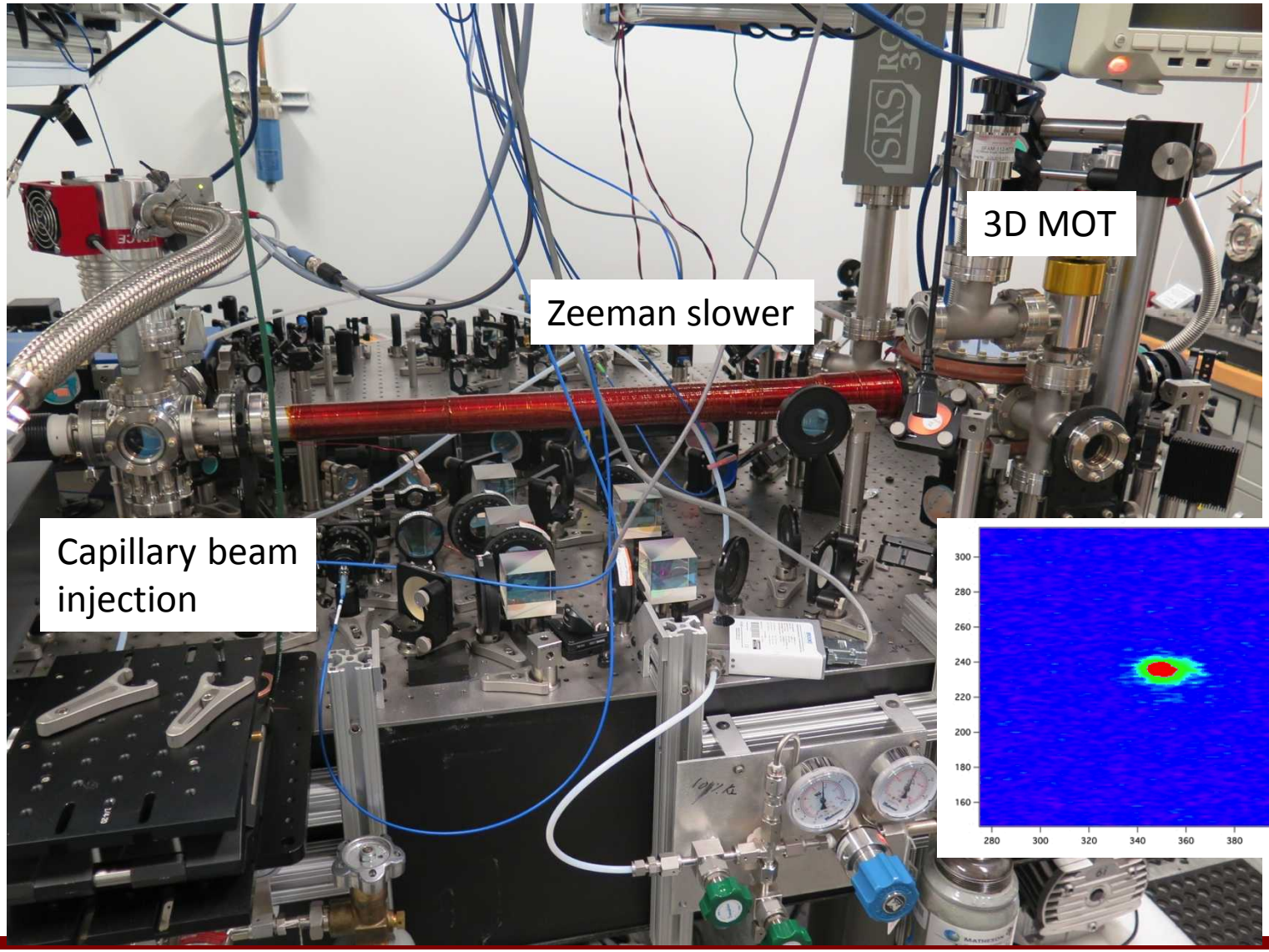
- Greater than $1/10^{12}$ single pass isotopic selectivity
- Single atom detection
- Robust, stabilized lasers

Versatile architecture for multiple missions



Zeeman slower based ATTA system

A laboratory based ATTA system has been successfully demonstrated



ATTA Summary

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A versatile benchtop scale ATTA system has been developed:

- Counts multiple isotopes with only changes in modulator frequencies
- Capture and measurement modes for optimized counting
- Adaptable to other gases with additional laser frequencies

Advantages of ATTA based system for precision isotope measurement

- Count on demand without waiting for radiological decay
- High isotopic selectivity >$1/10^{12}$ for isotope/hyperfine separations of several hundred MHz
- Count stable and non-stable species
- Count single atoms
- Small sample size required

Next Steps:

- Transition from TRL 3, laboratory based ATTA system to robust, autonomous, compact ATTA system