

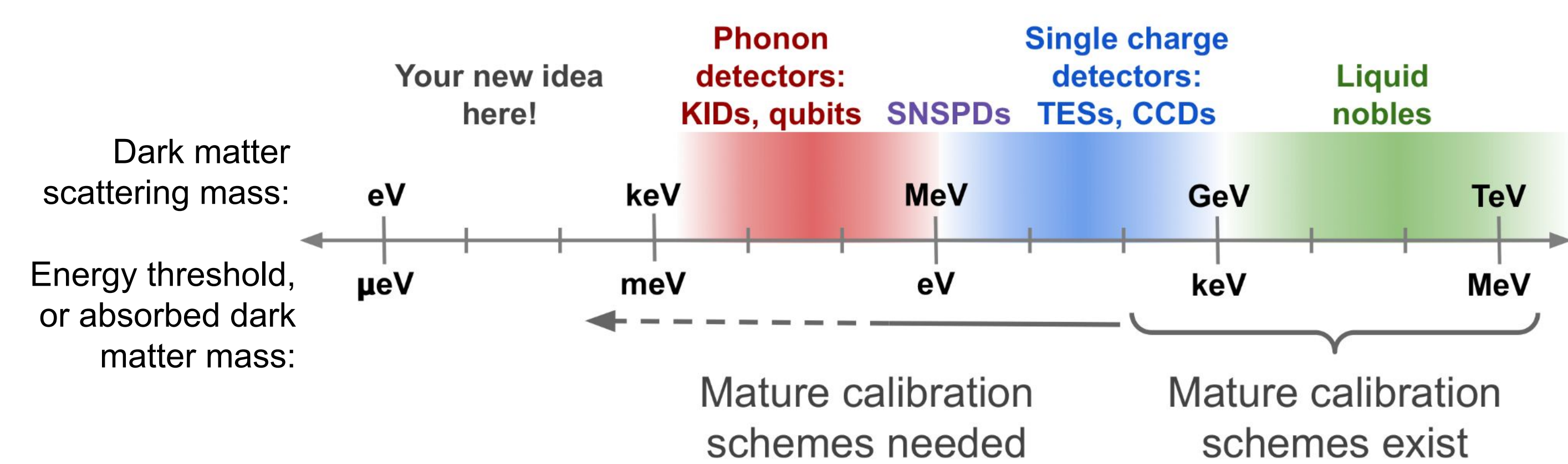
# Low-energy calibration and characterization of solid-state dark matter detectors



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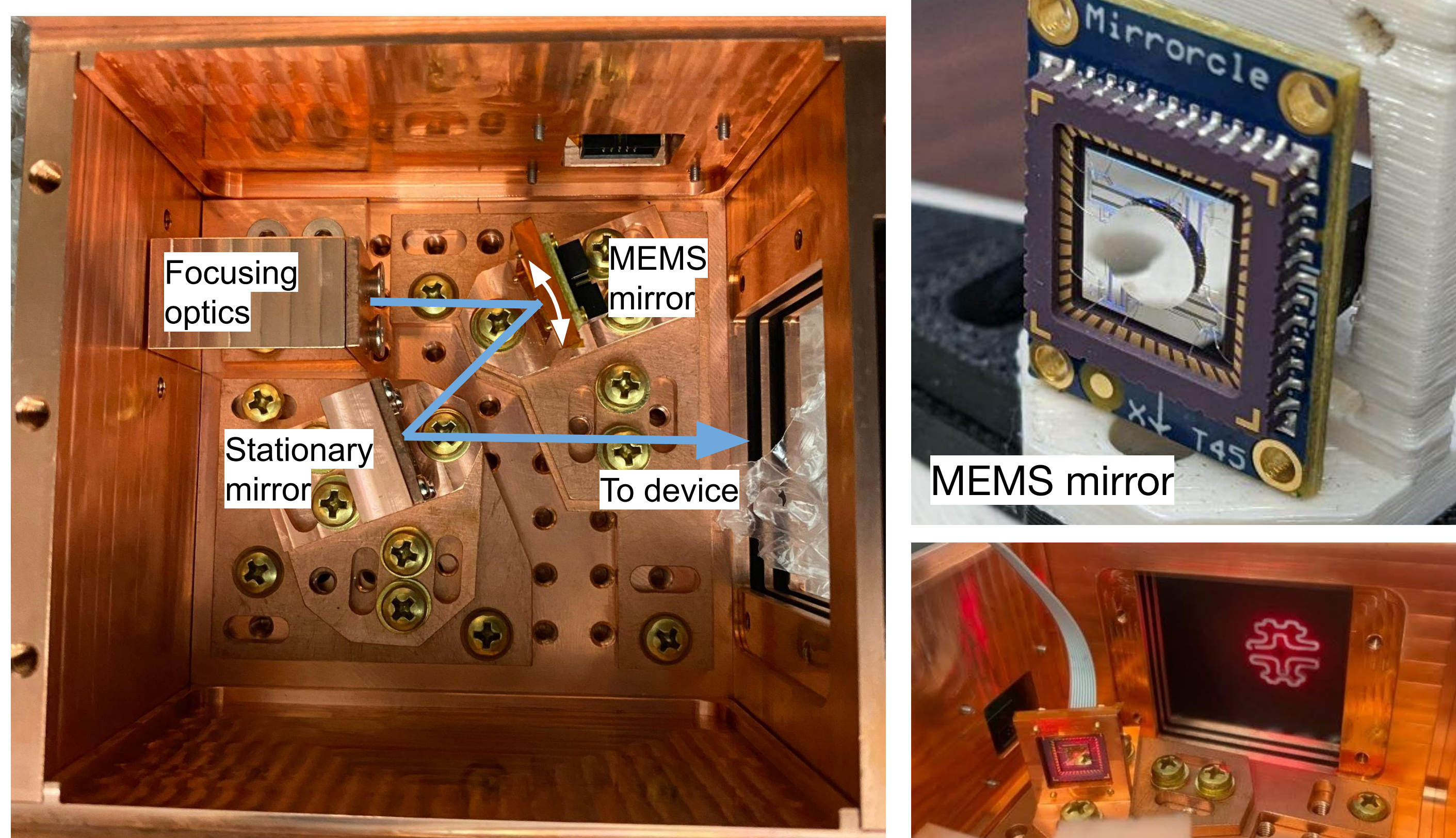
## Near-threshold calibration is required for novel, low-threshold dark matter detectors:



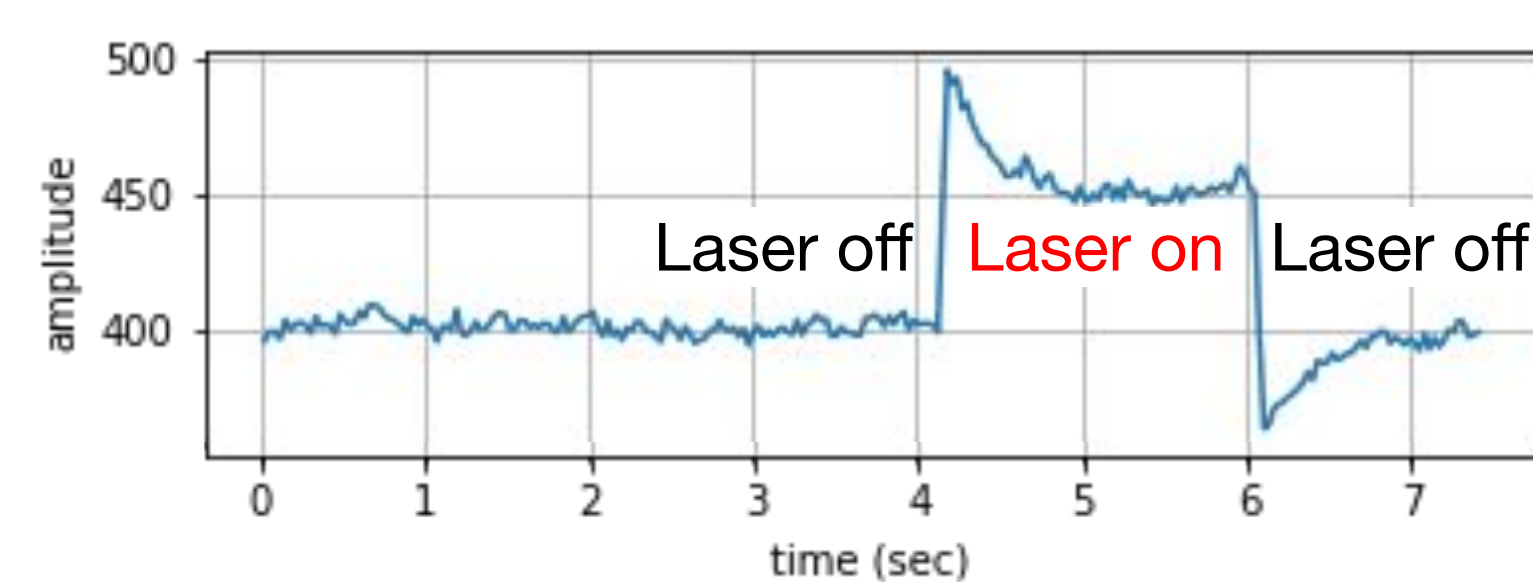
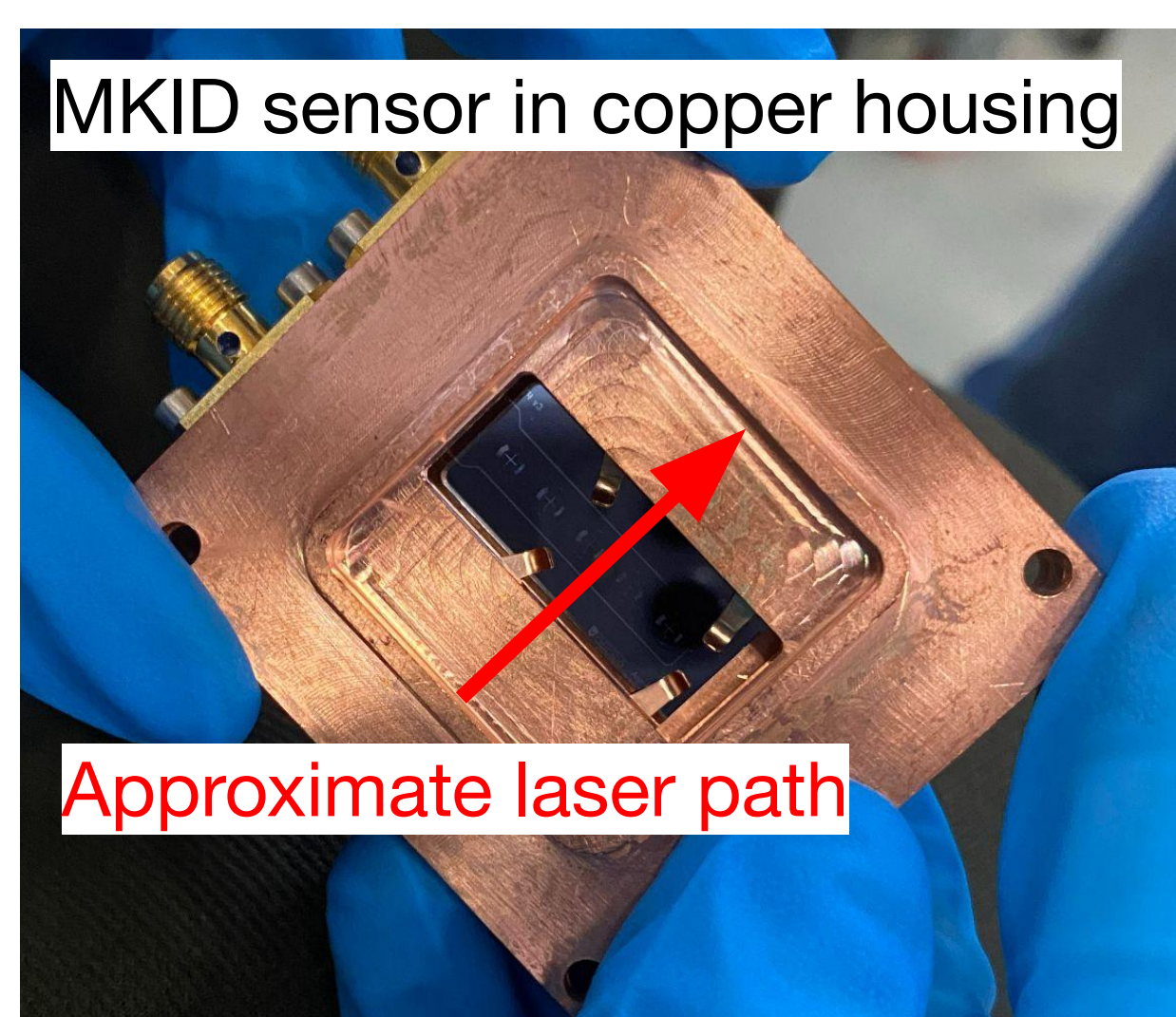
## We have developed a pulsed, steerable laser device for calibration of cryogenic devices:

- Can deliver photons over an energy range of 60meV - 5eV
- Scans over  $\sim 1.5'' \times 1.5''$  with  $\sim 100\mu\text{m}$  precision
- Produces time-resolved, low-intensity pulses
- Operates *in situ*: functional at 10mK, dissipates  $\sim \text{nW}$  of power, and limits parasitic backgrounds
- Is device independent, flexible, and modular

## Successful warm and 10mK tests of MEMS mirror-based design:



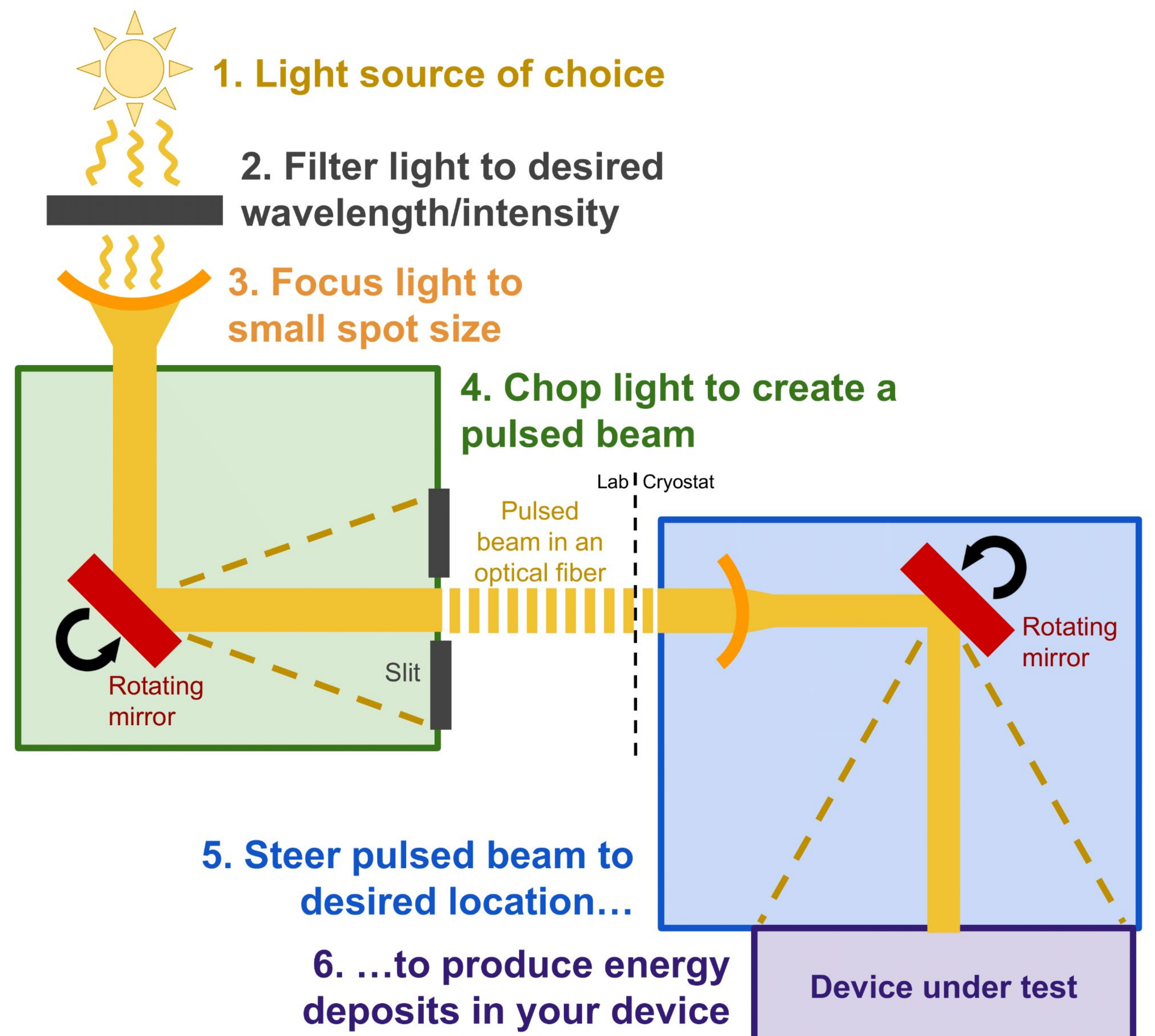
Design of scanning unit (above) incorporates modified MEMS mirror (upper right) to allow for 10mK operation. Able to create arbitrary pattern of light (lower right) in  $\sim 1.5'' \times 1.5''$  scanning region.



Clear response from MKID device (above) when laser scanned over surface (left). Confirms scanning operation at 10mK.

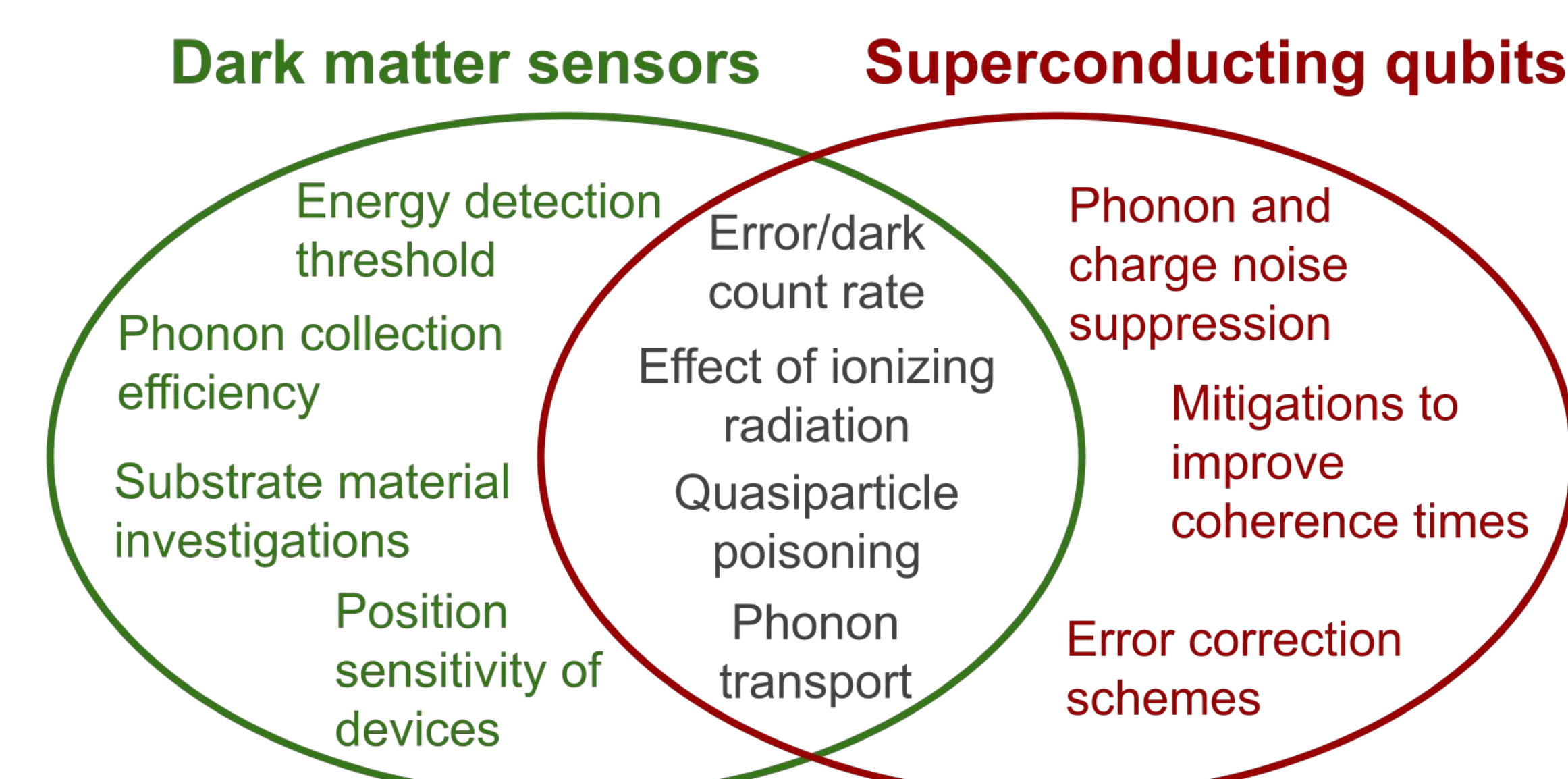
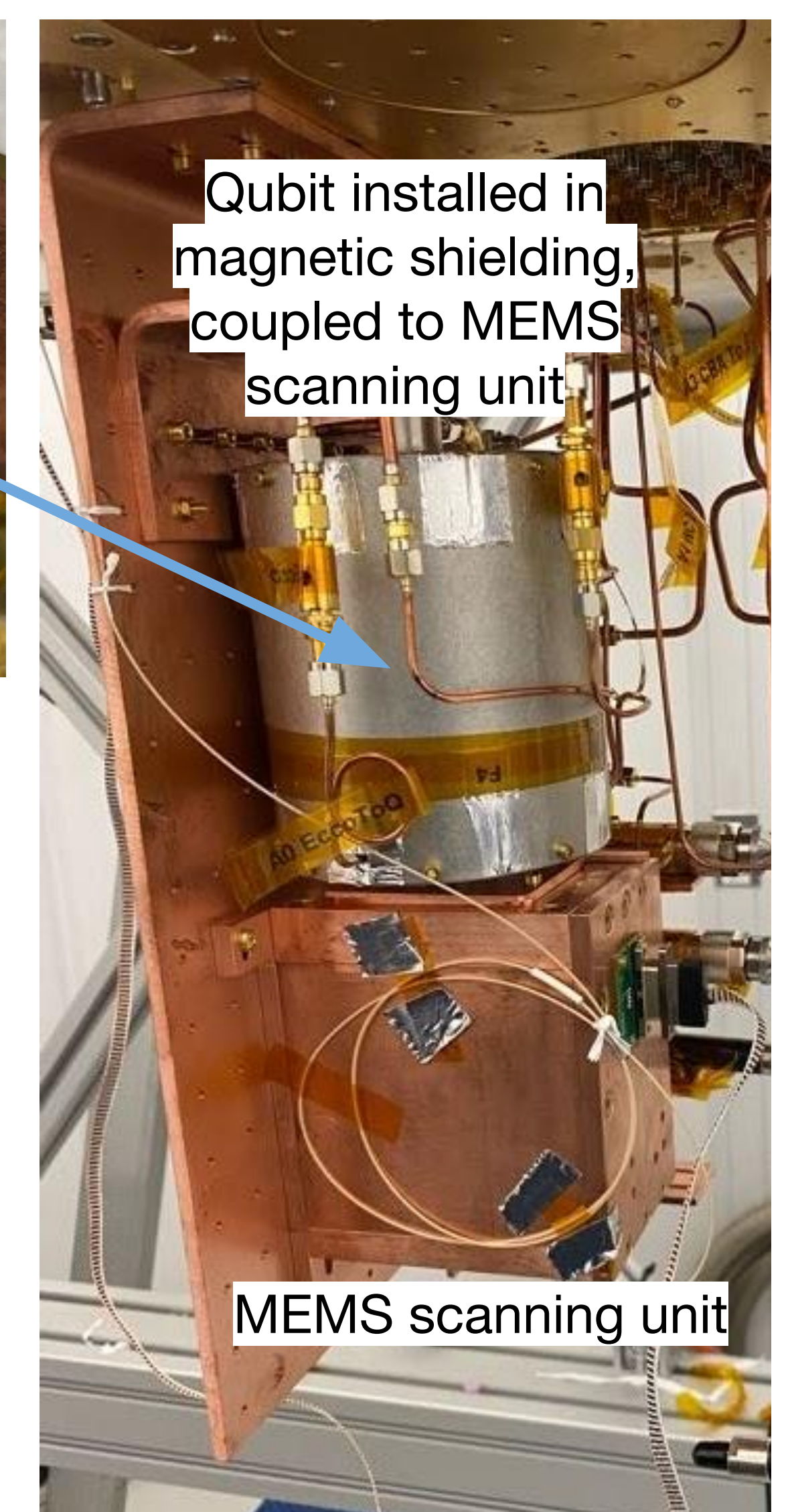
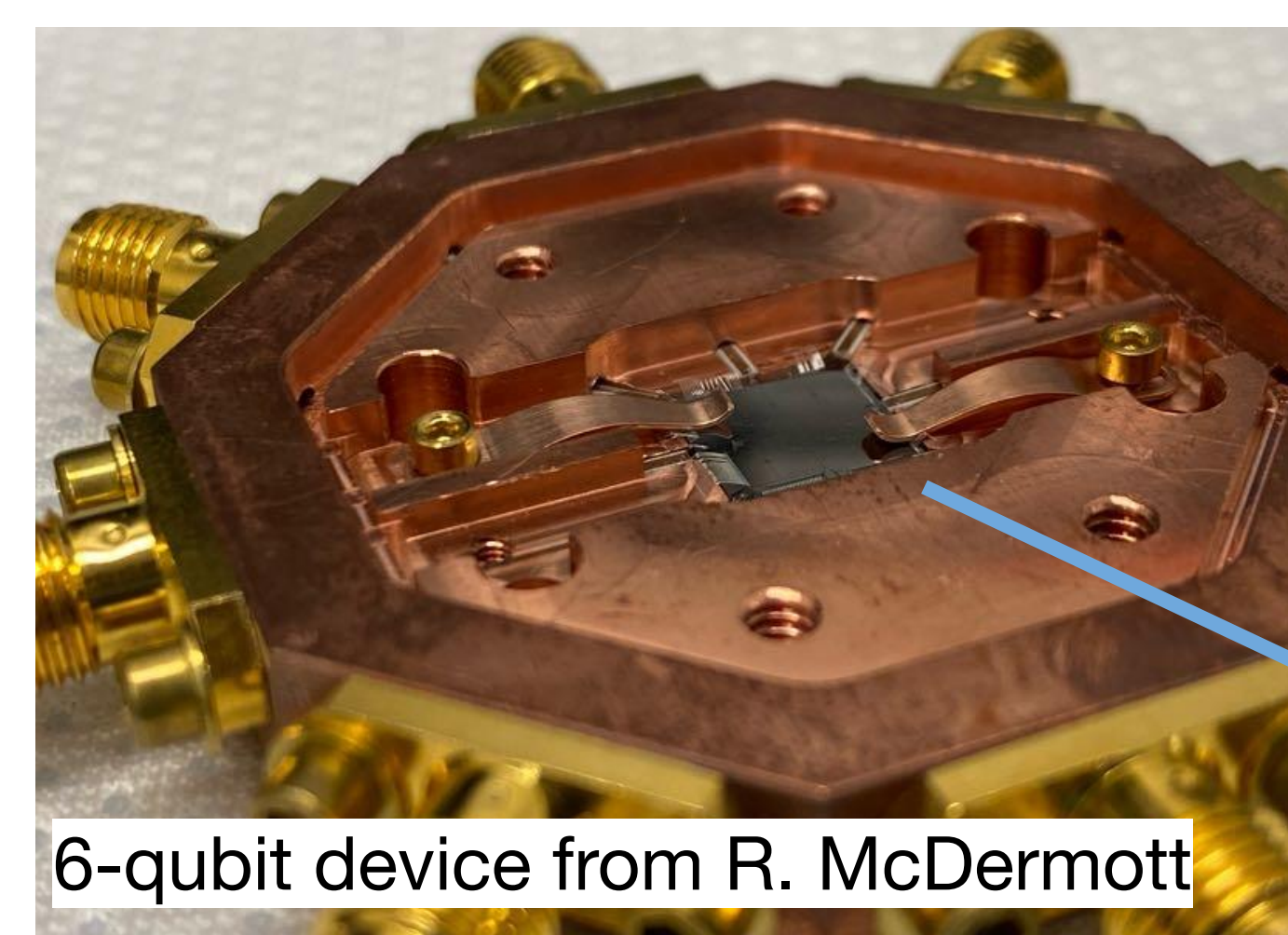
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## Pulsed, steerable laser calibration schematic:



## MEMS calibration is key functionality of new quantum device program at Fermilab:

Qubit + calibration scheme installed in LOUD to investigate many compelling science questions. See poster by R. Linehan for details.



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