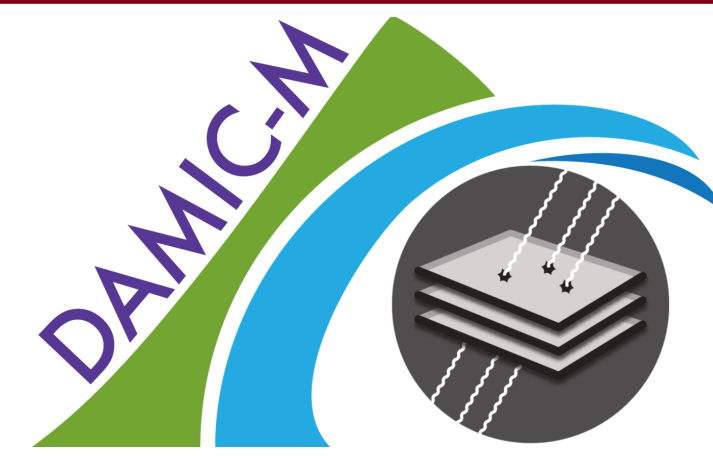


DAMIC-M: Characterization of Skipper CCDs

by: Julian Cuevas-Zepeda



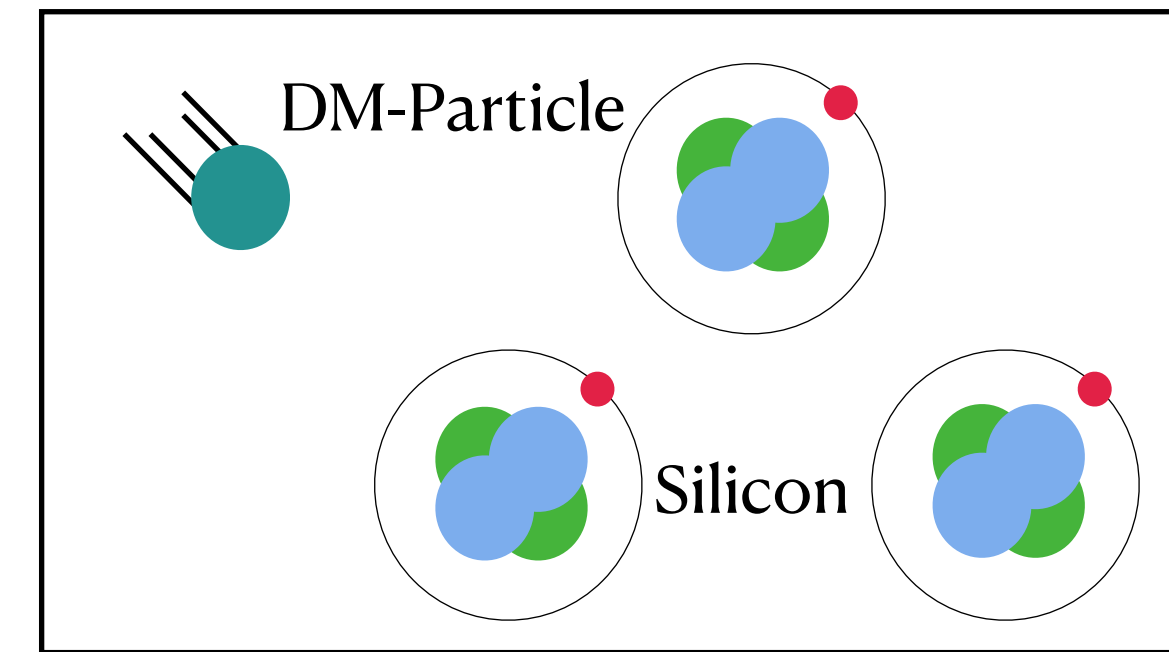
Illinois URM Physics Workshop Autumn 2020



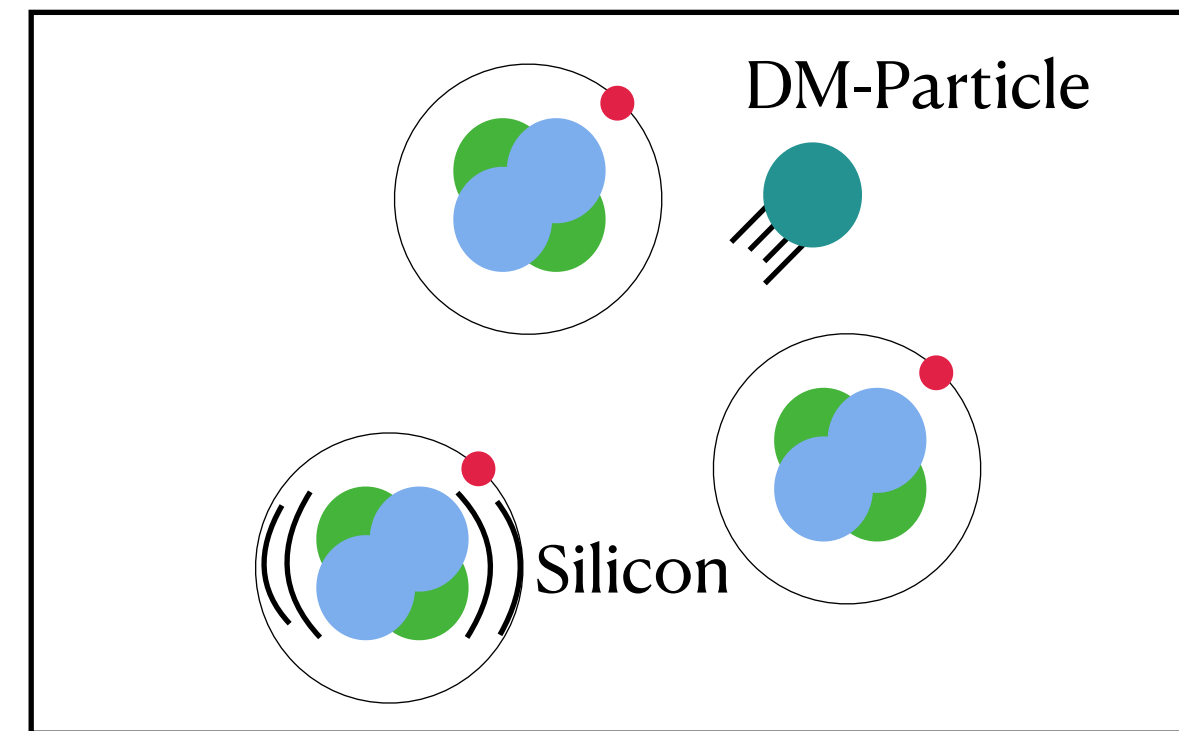
DAMIC-M

- [Da]rk [M]atter [I]n [C]CDs
 - Located at Laboratoire Souterrain de Modane in France
- Using Silicon CCDs to detect particles
 - Charge is collected in individual pixels and read out to form images
- Implement novel Skipper CCDs
 - 675 micron thick, 1K x 6K Skipper CCDs
 - Single e- resolution!
- Sensitive to DM-Nucleus interactions and DM-Electron interactions

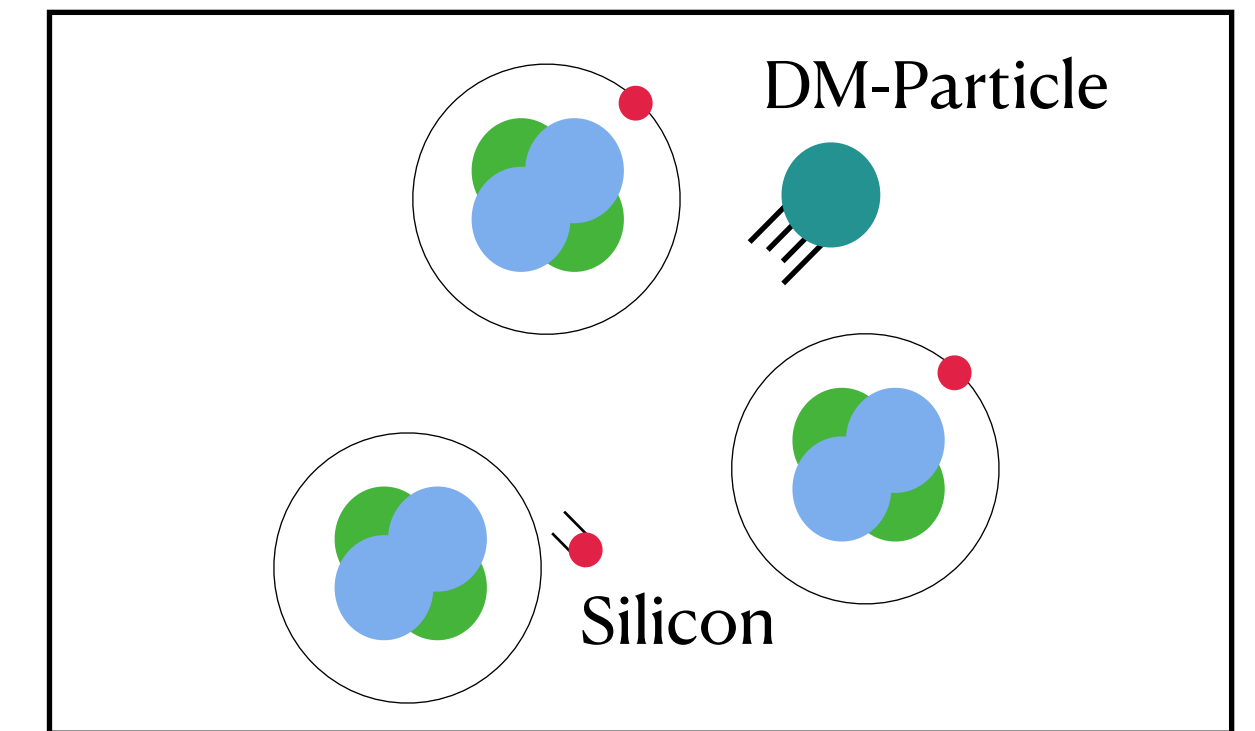
Incoming DM-Particle



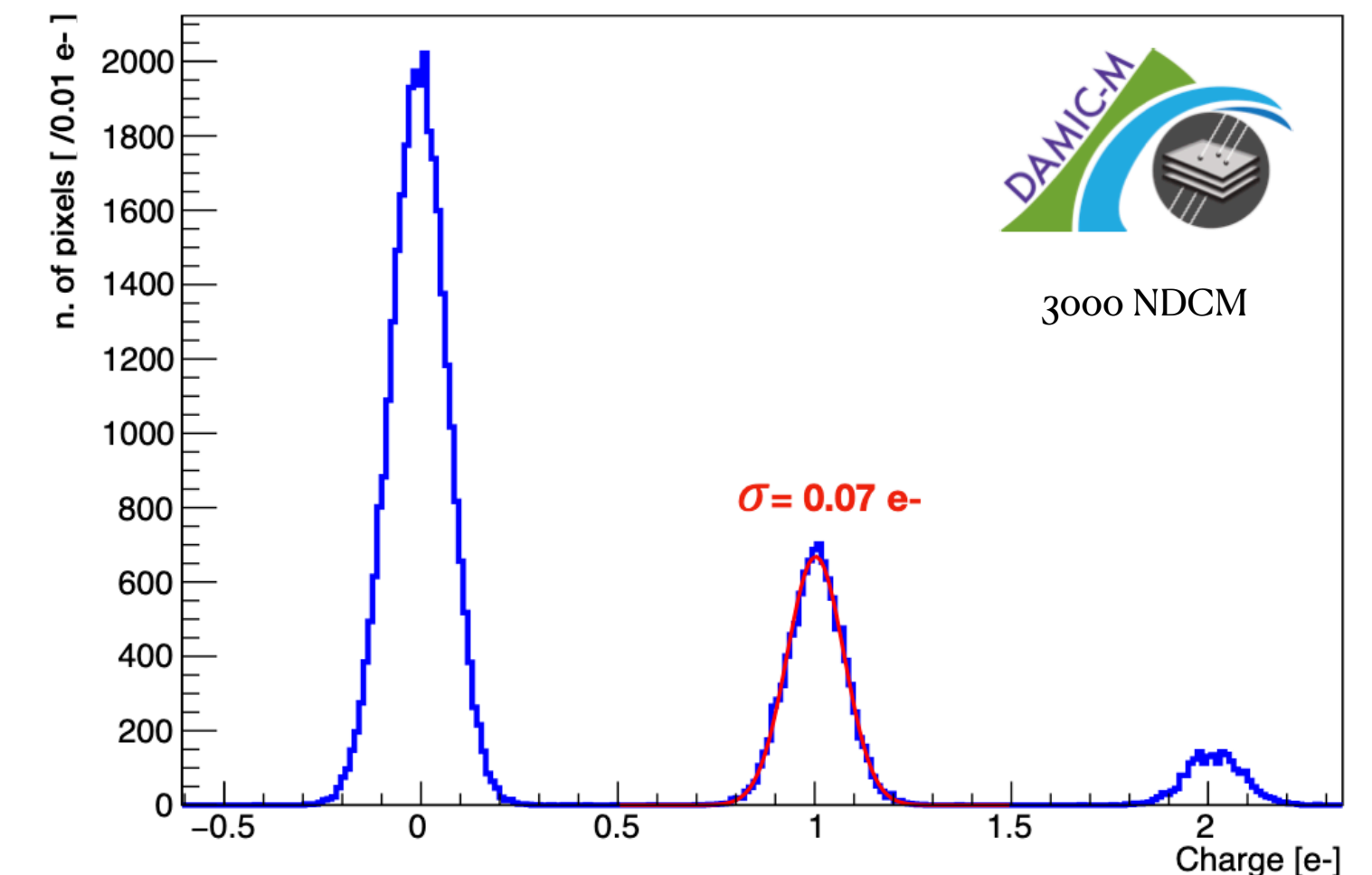
DM-Nucleus Collision



DM-Electron Collision

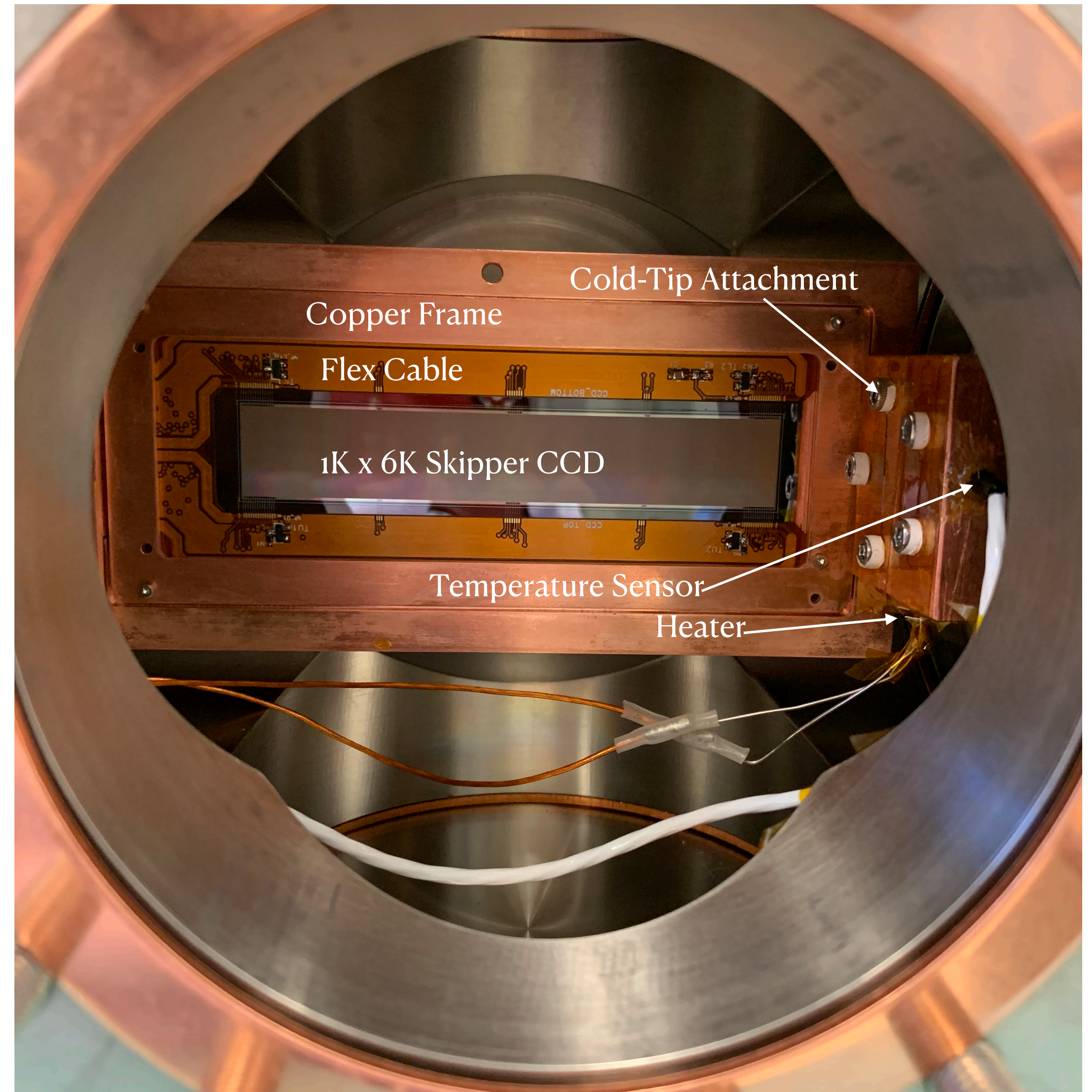


Single Electron Resolution



Calibration Chamber

- CCDs must be operated in vacuum and cooled to $\sim 130\text{K}$
 - Cooling decreases dark current
- $1\text{K} \times 6\text{K}$ skipper CCD required design of copper frame
- Currently taking data to categorize Skipper CCDs at low-energies:
 - Gamma-ray sources to study Compton scattering energy spectrum
 - Photoneutron source to determine energy response of nuclear recoils



Slow Control & Test Chambers

Slow Control

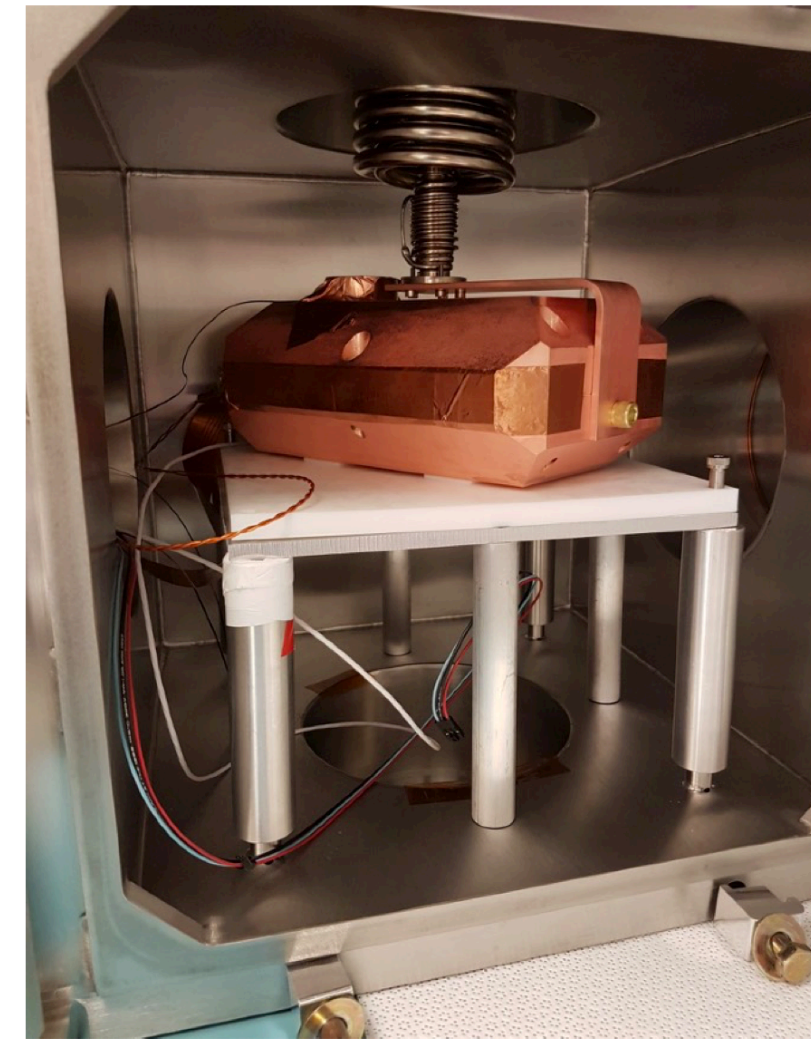
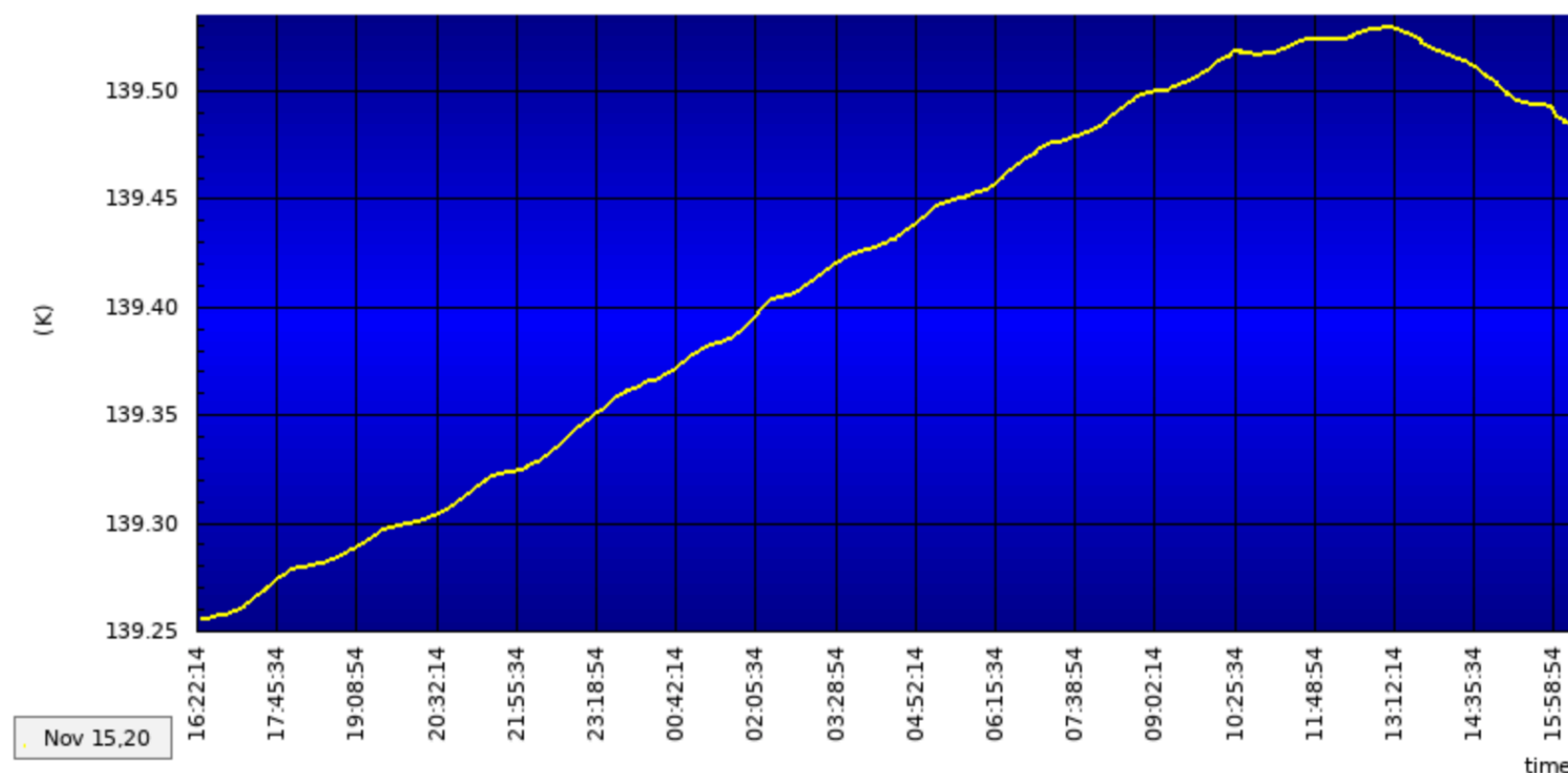
- Full remote operation
- Monitor and control instruments of each vacuum chamber
- Tracks and logs environmental data (ie. pressure, temperature, etc) to ensure stable conditions

You are logged into Test Chamber 1

PDU: PowerSupply: Pressure: Sys: Temperature: UPS:

End time/date: 16:22:59 Nov 16, 20

Temperature Input A (Temp_A)



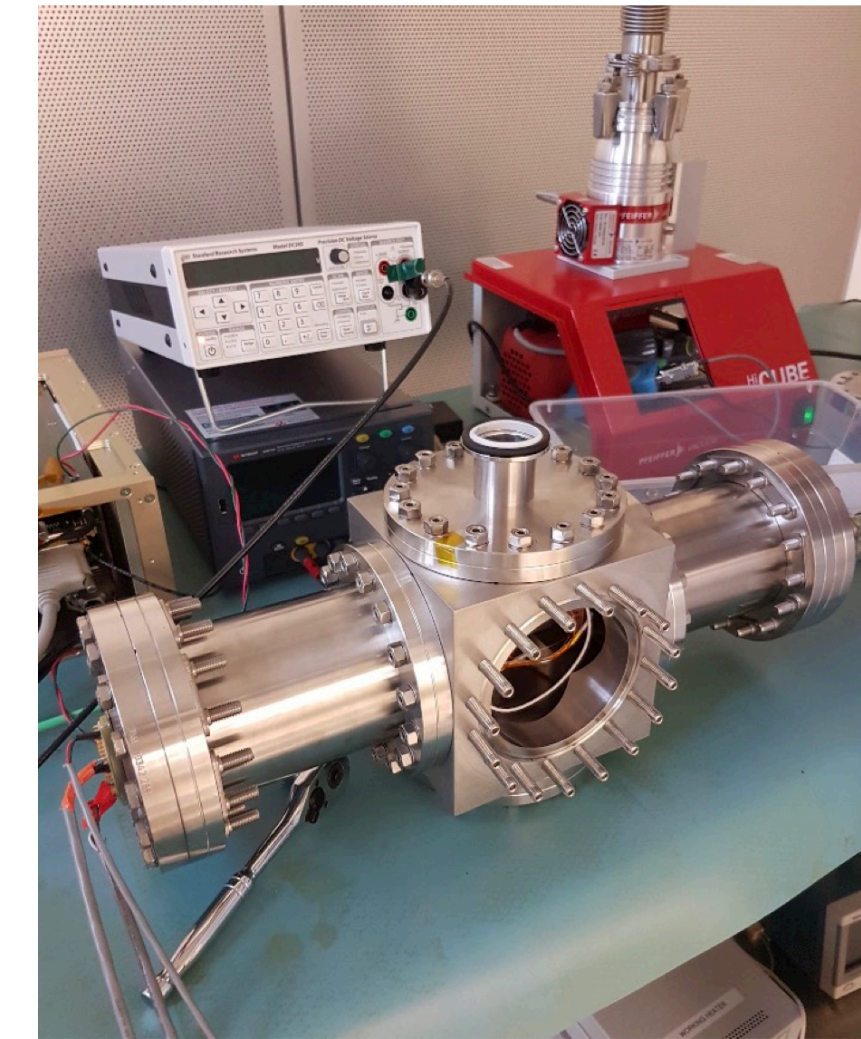
Test Chamber 1

- Used for testing new CCDs
- Thick copper box reduces background by order of magnitude



Test Chamber 2

- Used for Characterization of 6K x 4K CCDs
- Used for testing new electronics



Calibration Chamber

- Compton Measurement
- Photoneutron Measurement

Thank You

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