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# The NEWS-G Experiment

SEF 2024-07-31

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for the NEWS-G collaboration

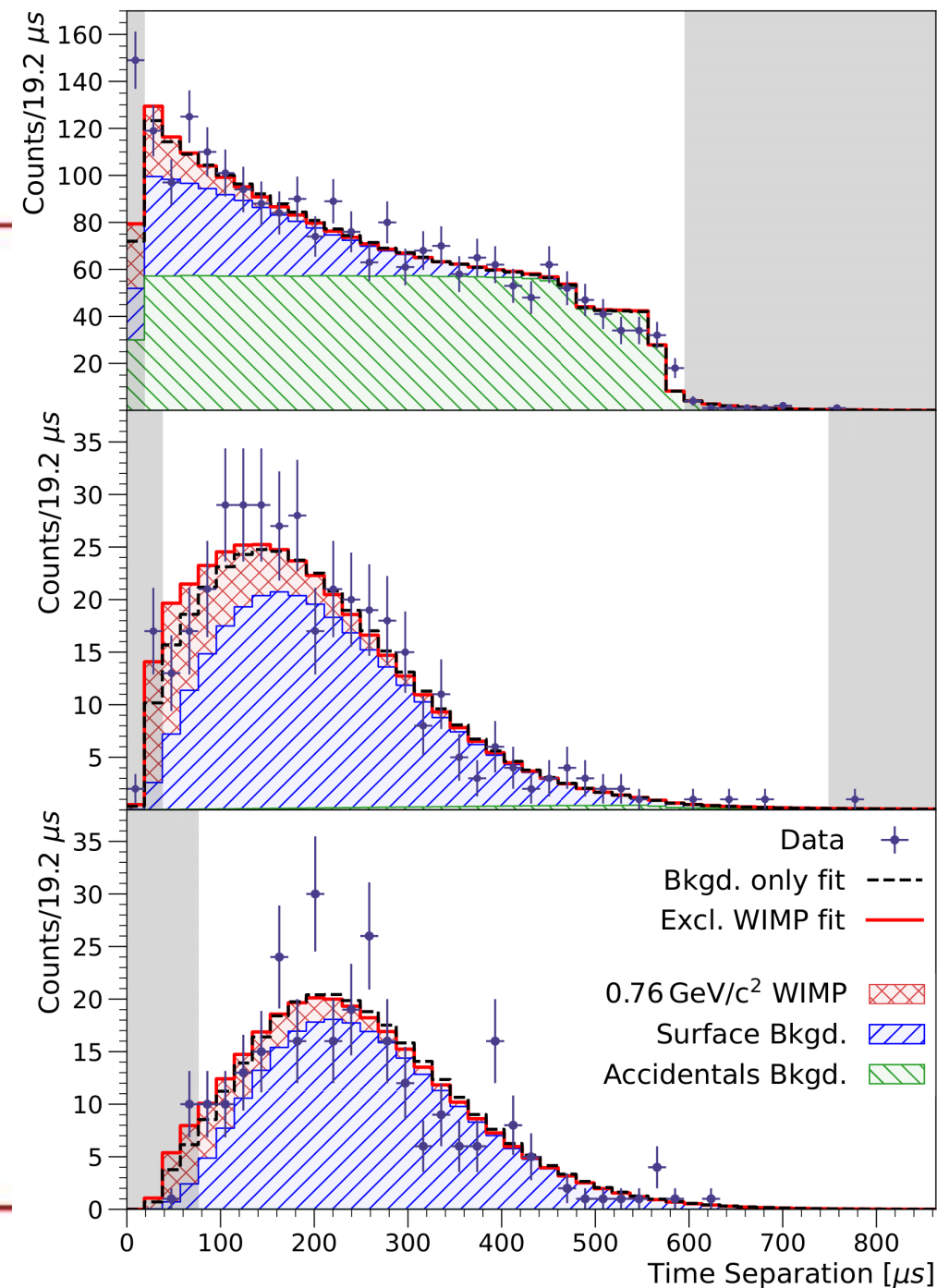
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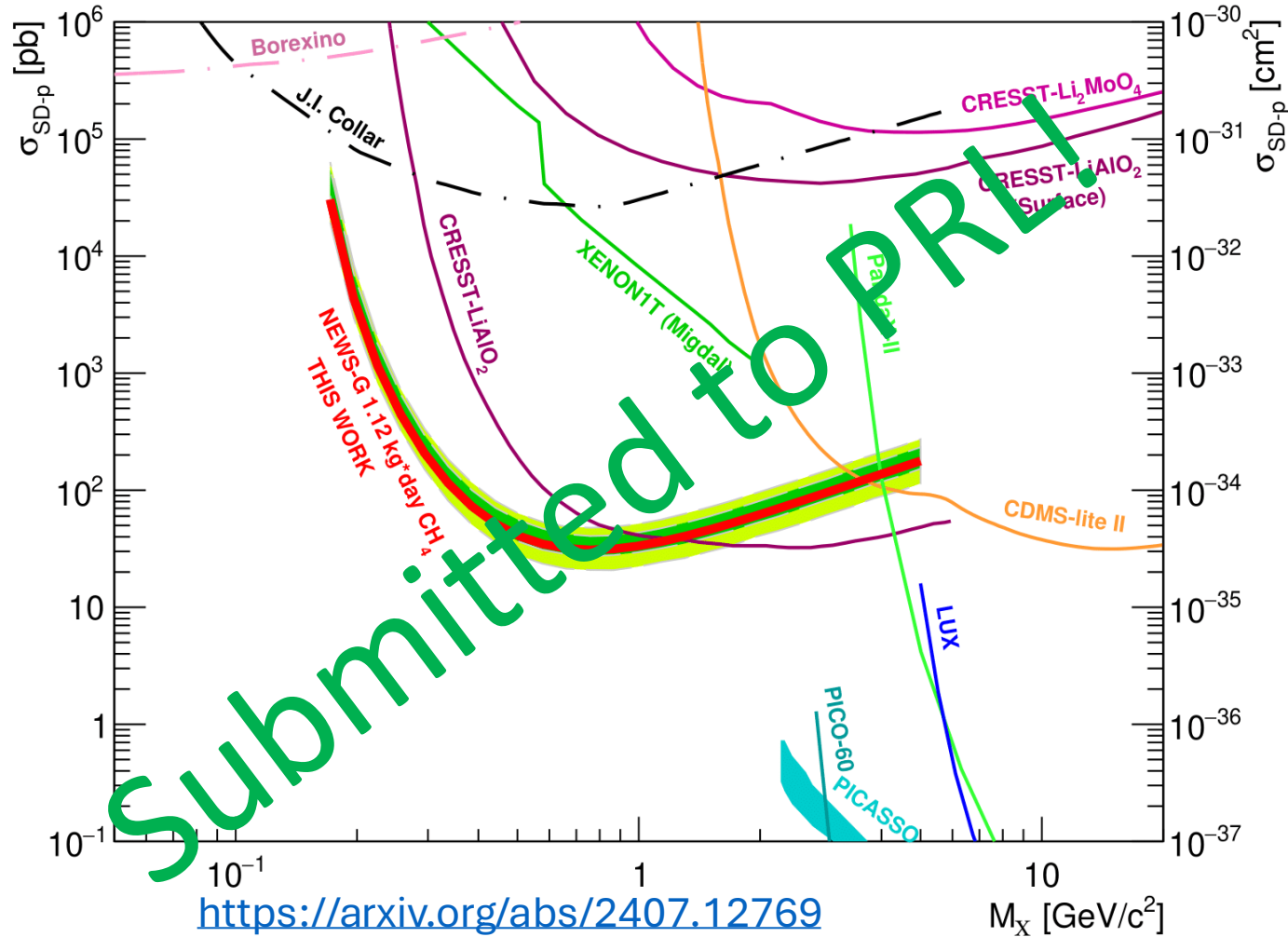
# Analysis results



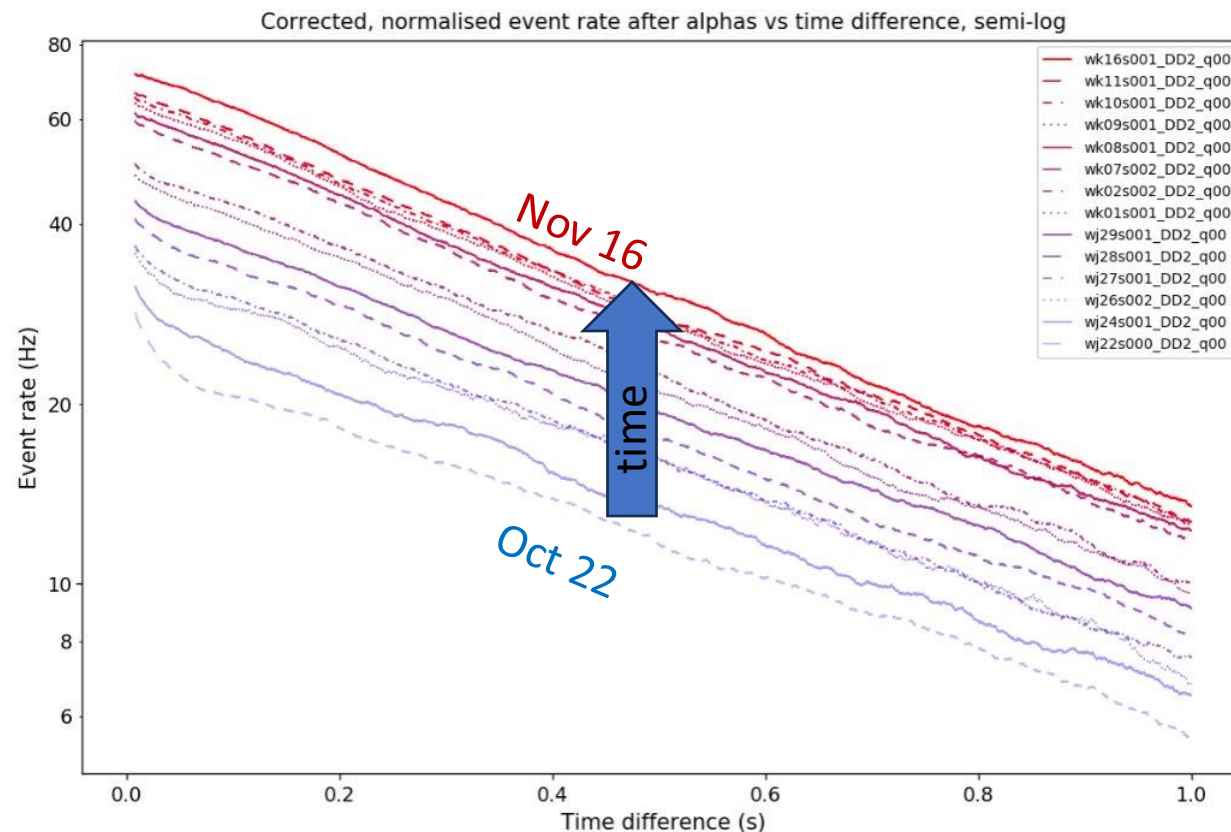
# Analysis of LSM data 2019

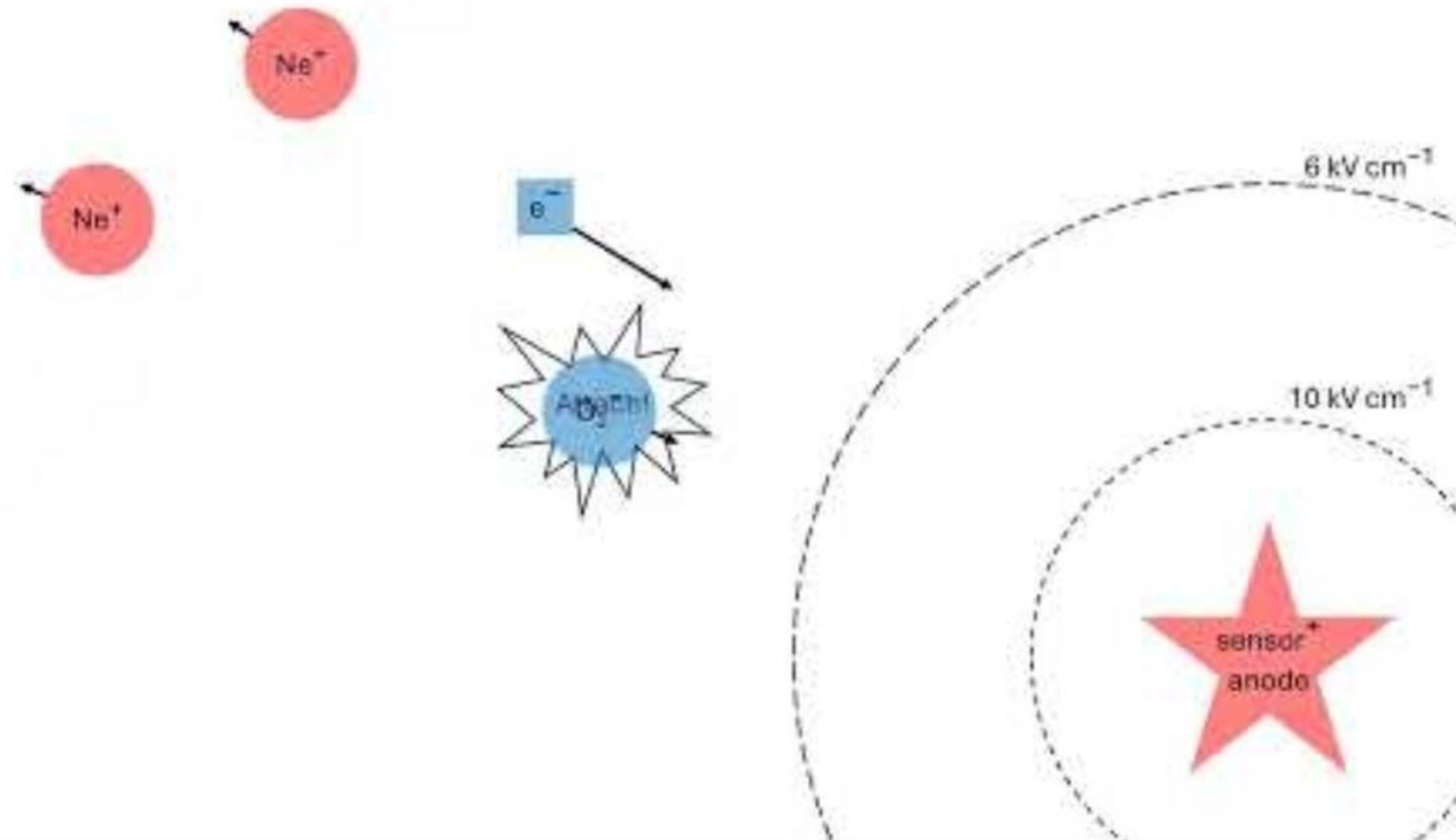
- Data taken in fall 2019 with temporary shield at LSM
- Gas: 135mbar pure CH<sub>4</sub>
- Electron counting possible
- Negative induced pulses of 2nd channel allows rejection of electronics noise
- Time separation between electrons allows surface noise rejection
- 30% of test data, 70% blinded





- Single electron events follow high energy alpha events
  - Rate increase from a couple seconds
- The effect increases with gas degradation (using runs with small leak in detector)
- "Single electron events" are negative ions drifting slower







# Ongoing analysis in neon



- Physics data taken in 2022
- Neon + 2% CH<sub>4</sub> at 1bar
- Better noise and BG conditions than LSM
- Better analysis focus now that LMS2019 data is submitted
- Will benefit from experience with previous dataset

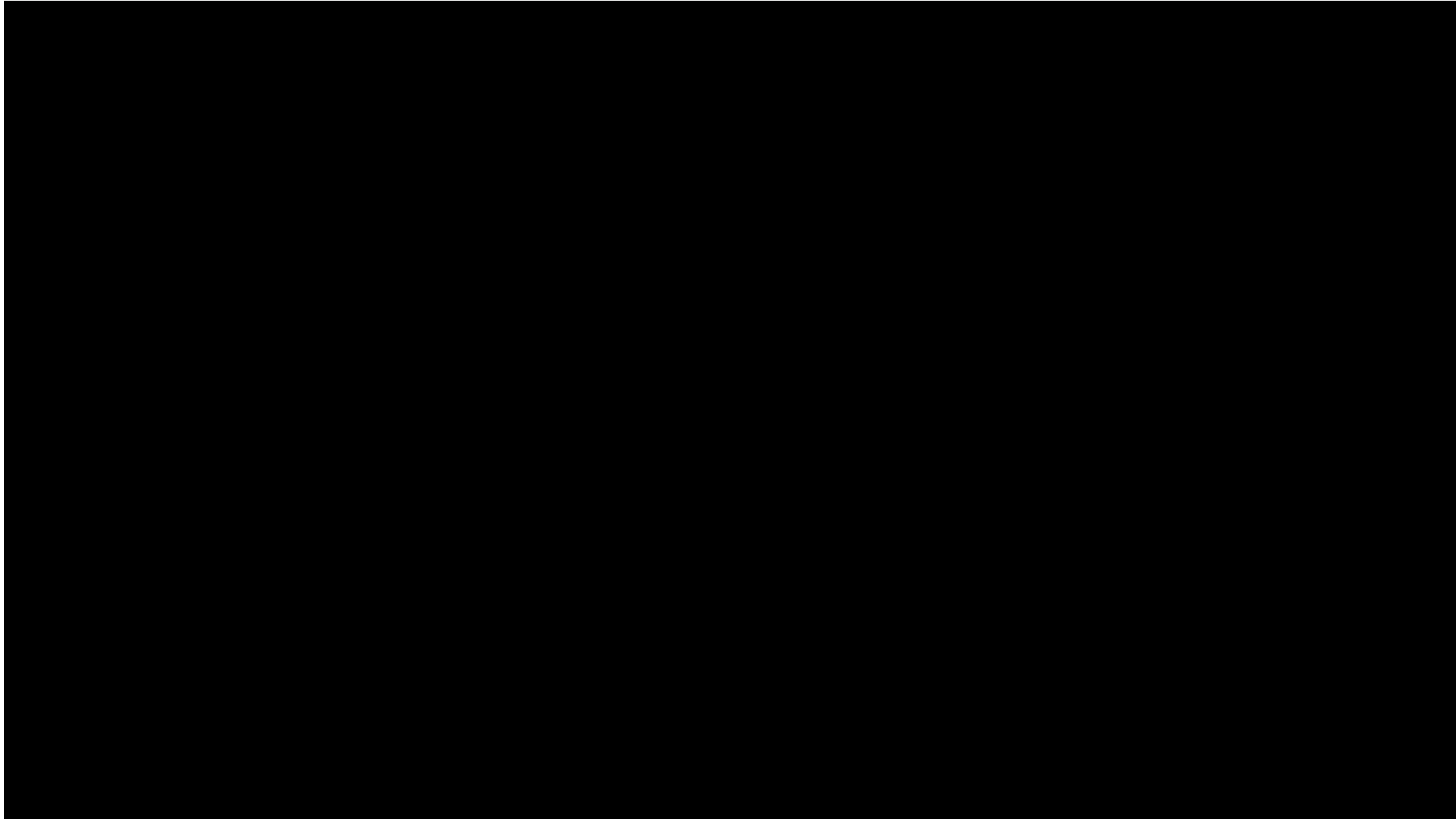
# Acitivities at SNOLAB



- January 2024
- In situ etching
  - Spray inner surface with etchant (3% peroxide, 2% sulfuric)
  - ~10L circulated with diaphragm pump
  - Solution extracted from sphere bottom using nitrogen pressure (~500mbarg)
- Visual inspection of sphere using fish cam
  - Fishing camera borrowed from SNOLAB
  - Taking advantage of open configuration



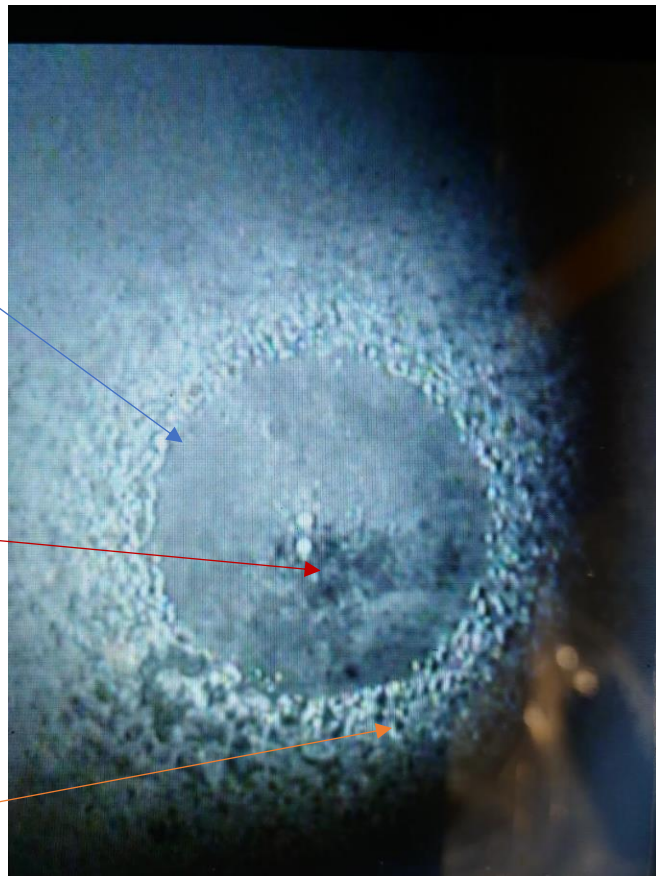
# In situ etching



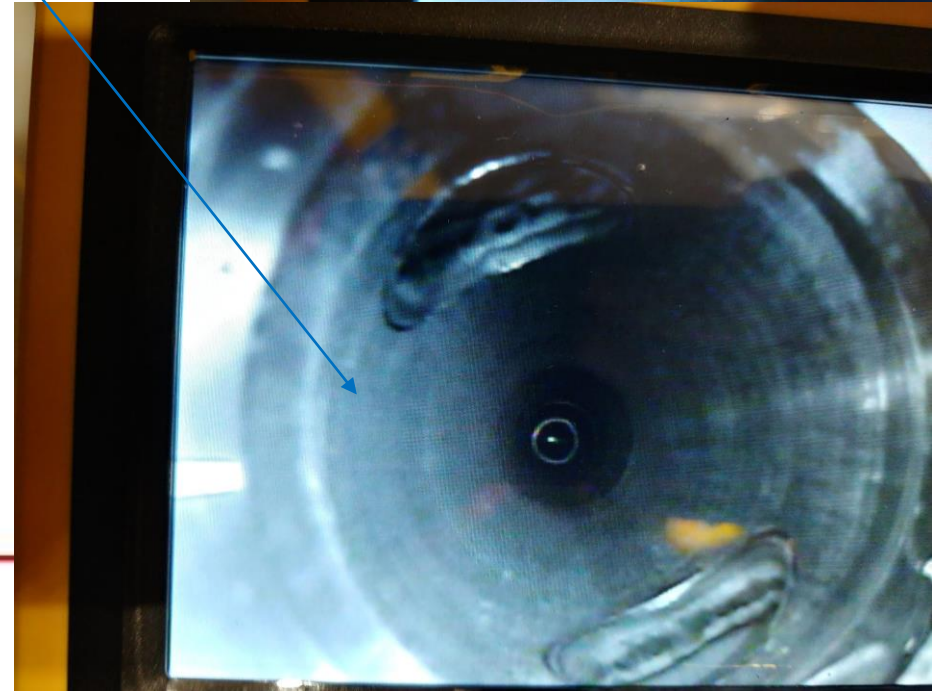
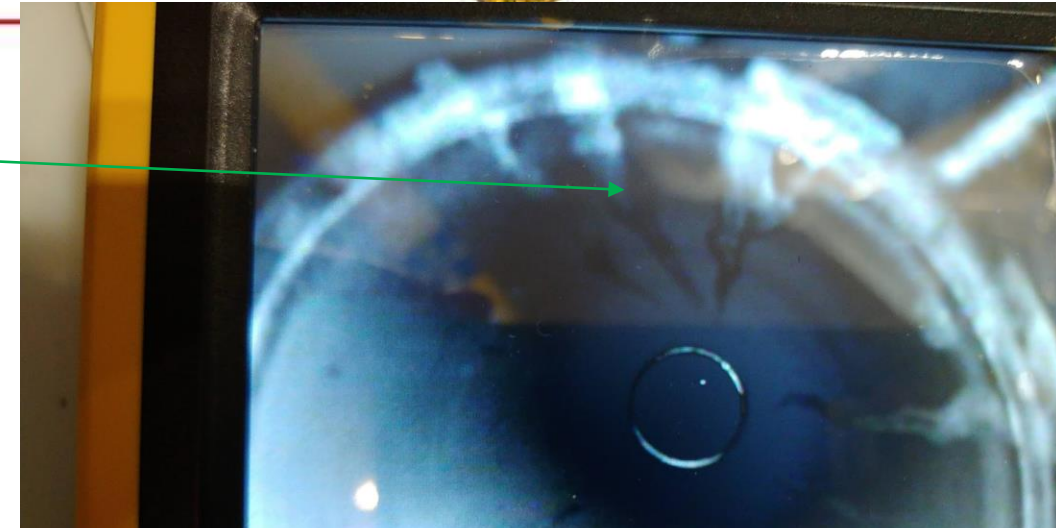
Water puddle

Unknown dark residue

Rough copper surface



Dripping along copper nozzle, unknown origin  
No visible in stainless section



- Sensor replacement
  - Previous sensor unstable at high voltage
  - Problem from poorly insulated wire soldering
  - Sensors tested in transparent tube
- Better performance
  - Noise appeared after a couple months, unexplained
  - Good for alpha, cannot reach high gain
  - Possible issue with HV feedthroughs
- Alpha rate measurements
  - No significant reduction from etching
  - Dominated by radon (with surface components from daughters)

- Old sensor

- High current from  $\sim 2000V$
- Discharge from base of north wire to DLC



- New sensor

- Ramp to 5000V
- Discharges start at  $\sim 5000V$
- From ball to DLC, along wire
- Extra cleaning after test



- More purification needed because of negative ion BG
- Circulation through purifier and radon trap
  - Small turbine for circulation
  - Flow  $\sim 1\text{L}/\text{min}$ , not sufficient
- Radon trap removes radon from purifier
  - Not enough flow to remove radon from source inside sphere
- Needs better circulation pump
  - Pressure for flow in  $\frac{1}{4}$ " tubing
  - Clean
  - Operable at low pressure
  - ???



# Pure methane operation

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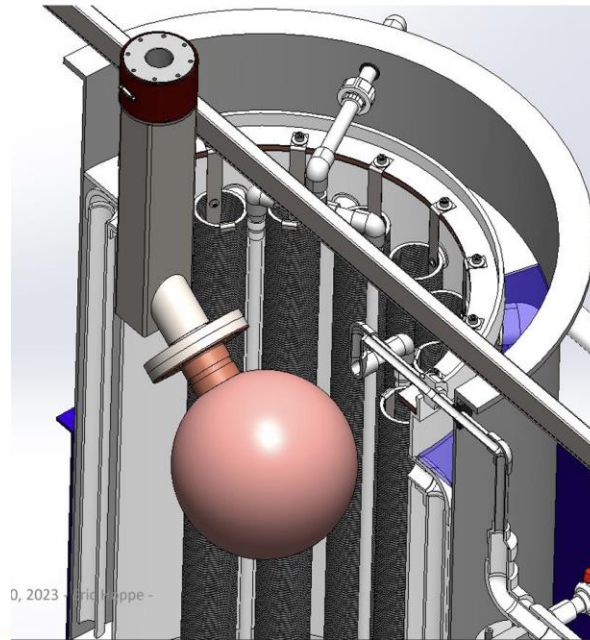
- HAZOP completed summer 2023
- Stalled due to missing regulation for methane storage UG

# MiniECuME: A 30-cm intact underground-electroformed SPC prototype

- Copper and acids samples from plating on a cylindrical mandrel reveal that lower-grade (10X cheaper) acid is viable option
- Mini-ECuME mandrel holder assembled
- Spherical acrylic mandrel was fabricated but present defects in copper non-electro forming and does not correspond to fabrication drawings
- PNNL will proceed with electroforming on spherical mandrel to learn from the experience of plating a spherical object



The ECA electroforming bath at PNNL

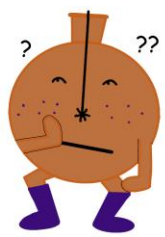


MiniECuME mandrel holder



MiniECuME acrylic mandrel





# Questions?

