Fermilab

U.S. DEPARTMENT OF ENERGY | Office of Science

# Status of CLARA at ESB

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Meeting on CLARA

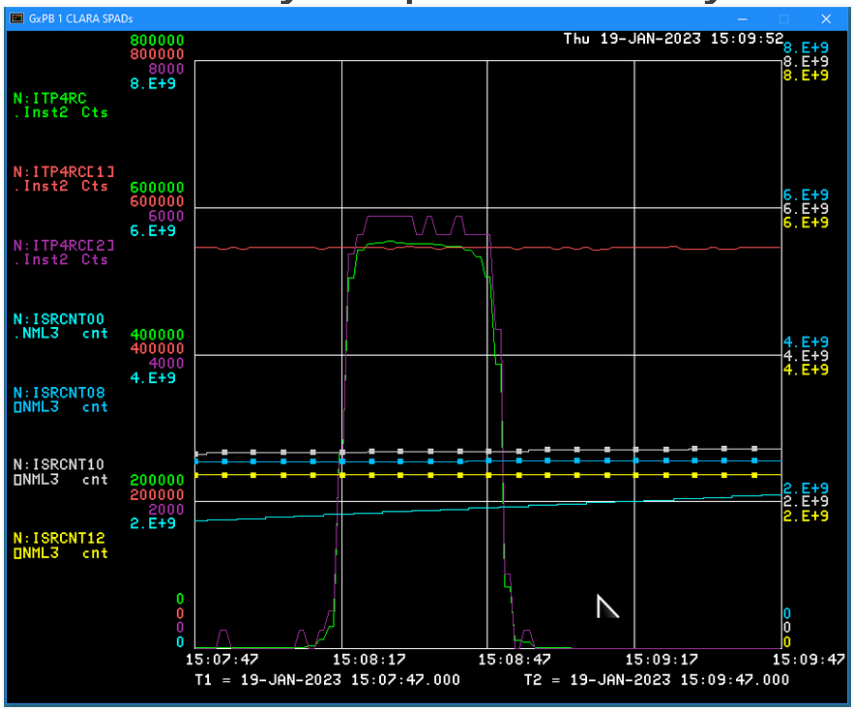
20 January 2023

# Reliability issues

- Three instances when operation was affected by mechanical devices not working properly
  - Likely the cause was quality of electrical connections
  - Worked fine yesterday evening; not clear whether the root cause is corrected

# Tuning: SPAD focusing

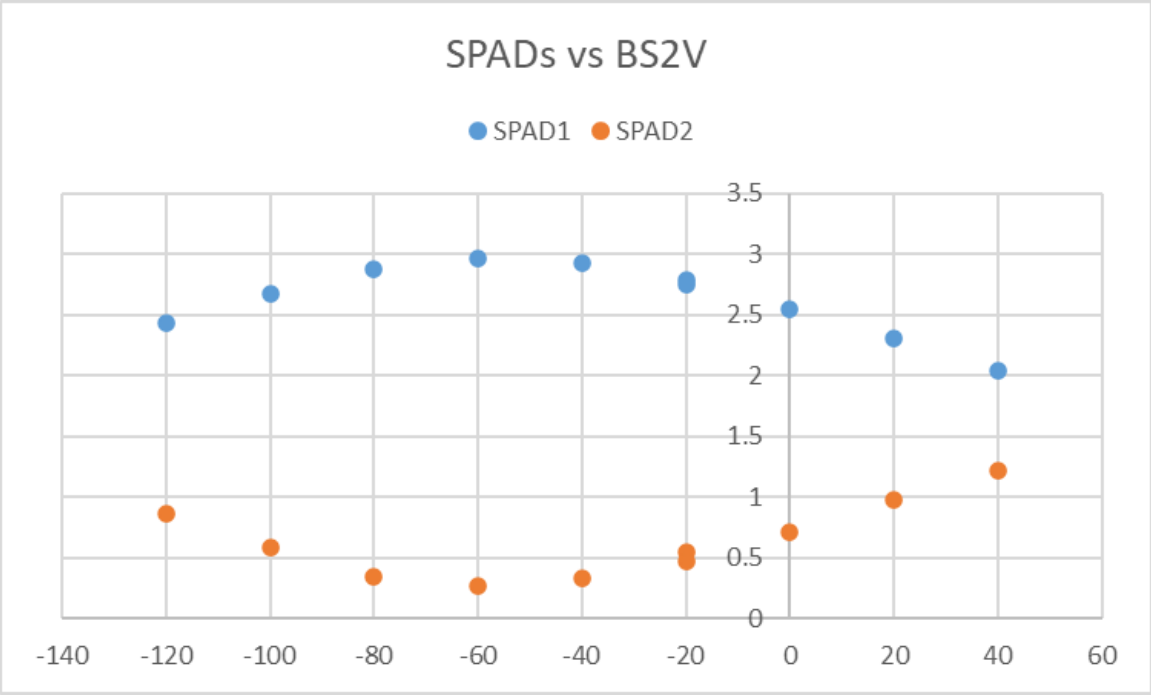
- With systematic tuning of SPAD positions in 3D, the profiles (SPAD rate) vs (transverse position) became rectangular
  - Indicating that the light spot is significantly smaller than the active SPAD area
  - Likely helped with day-to-day stability




SPAD1 rate (green) vs vertical position. 19-Jan-23.

# Tuning: BS2 angles

- Systematic scans of BS2 angles helped to improve visibility
  - Resolvable ~10 µrad (as expected)
  - Angles to maximize SPAD1 and minimize SPAD2 are the same
    - No explanation for different visibility in SPADs

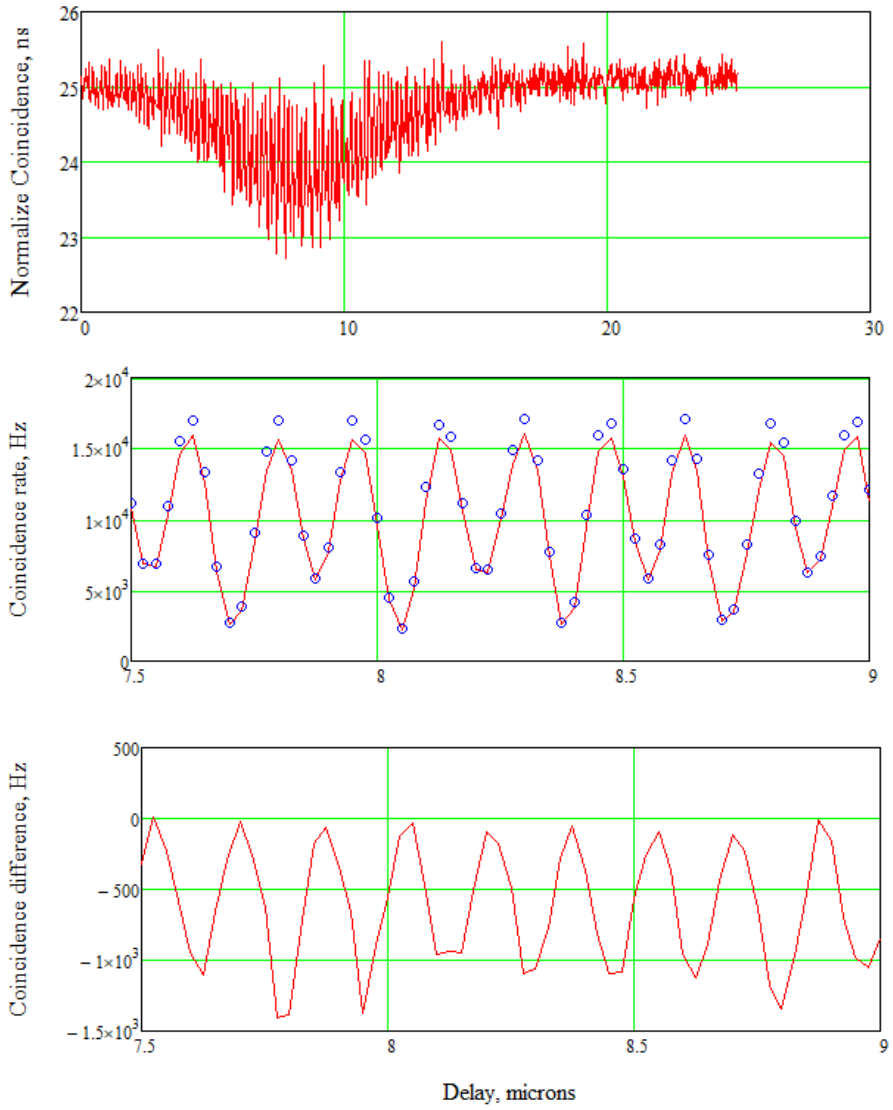



SPAD rates, in MHz, (green) vs vertical BS2 angle (in counts of picomotor). Delay is optimized in each point to maximize SPAD1 rate. 18-Jan-23.

# Measurements

- Giulio took a set of measurements with time-stamped data
  - LD currents 5 – 50 µA and 0.8 – 22 mA
- Several long stage scans were recorded
  - LD currents 10 µA, 20 µA, 5 mA, 22 mA
- Data are being analyzed
- All measurements were made below the assumed lasing threshold of 43 mA (68 mA nominal)
  - May try to go to this level today

# Observations on the “dip” in normalized coincidence rate




- At least most of the observed effect might be explained by vibrations
  - Model for the relative difference between W12 and $f_1 \cdot f_2 \cdot \tau$ :
    - $^{\Delta f}/_{f_o^2 \tau} = -V_1 V_2 \frac{(k\sigma)^2}{4} (\sin kx)^2$
    - Requires $(k\sigma)$ ≈0.5, or rms vibration amplitude ~8% of λ
    - Correct width of the dip

Long stage scan on18-Jan-23, I_LD = 20 μA.

Top: normalized coincidence rate W12 $= \frac{f_{coinc}}{f_1 \cdot f_2}$.

Middle: comparison of the coincidence rate (red) and $f_1 \cdot f_2 \cdot 25.1ns$ (blue). Bottom: difference between two data sets in the middle plot.

# Suggestion

- Try taking high LD current measurements today
- Proceed with starting to move the box to IOTA on Monday