EXTENDING THE RUN04 BAD AREA CUT

Kr-83m injection data

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RUN04 ^{83M}KR DATASETS

- Using single-scatter ^{83m}Kr injection data from Run04:
  - kr83minjections_TB1.mat
  - kr83minjections_TB2.mat
  - kr83minjections_TB3.mat
  - kr83minjections_TB4.mat
    - Evan created these with filter code
- Plan: Use ^{83m}Kr data to extend the bad area cut as this provides high statistics dataset of 32.1 keV + 9.4 keV IC electrons.
  - May merge within an event to look like a 41.5 keV signal.

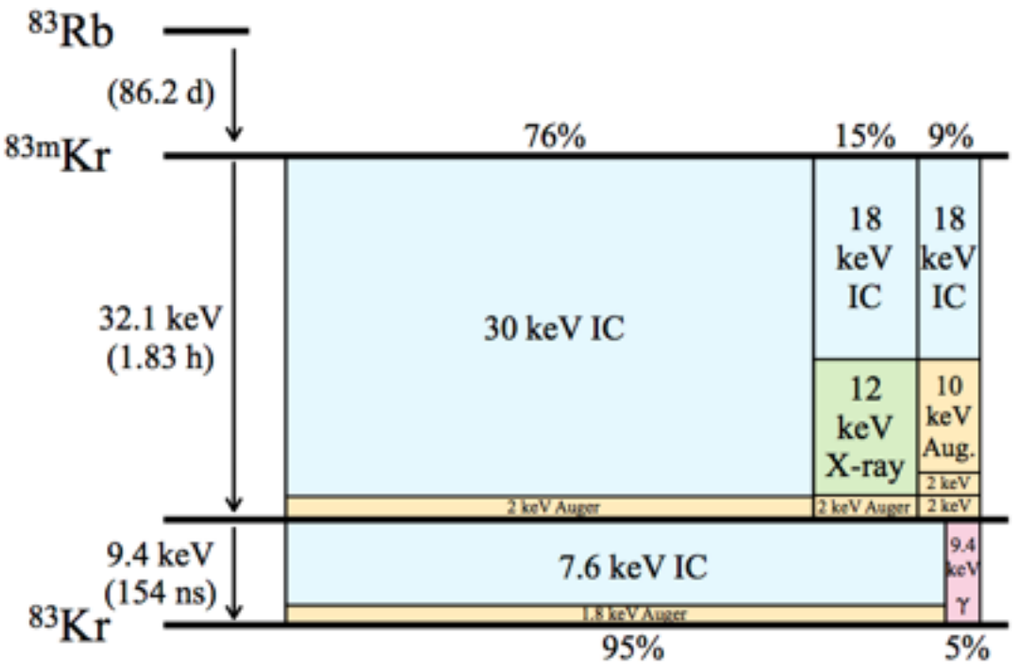
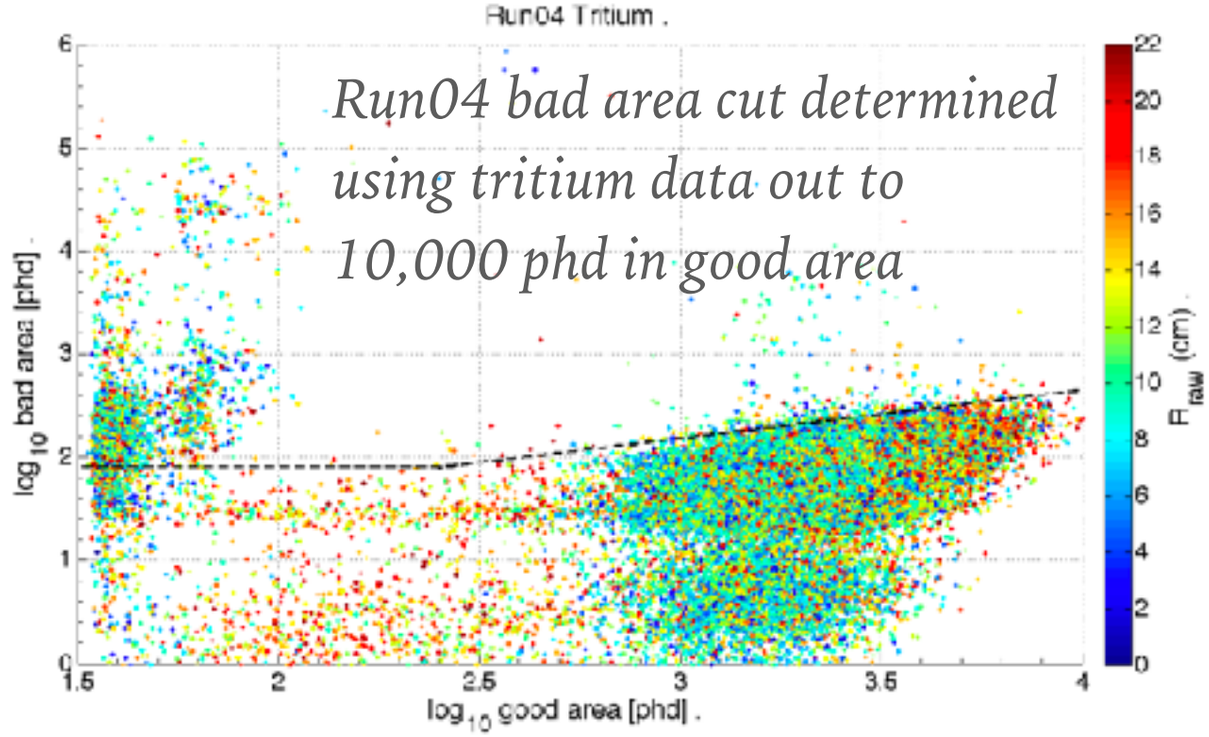


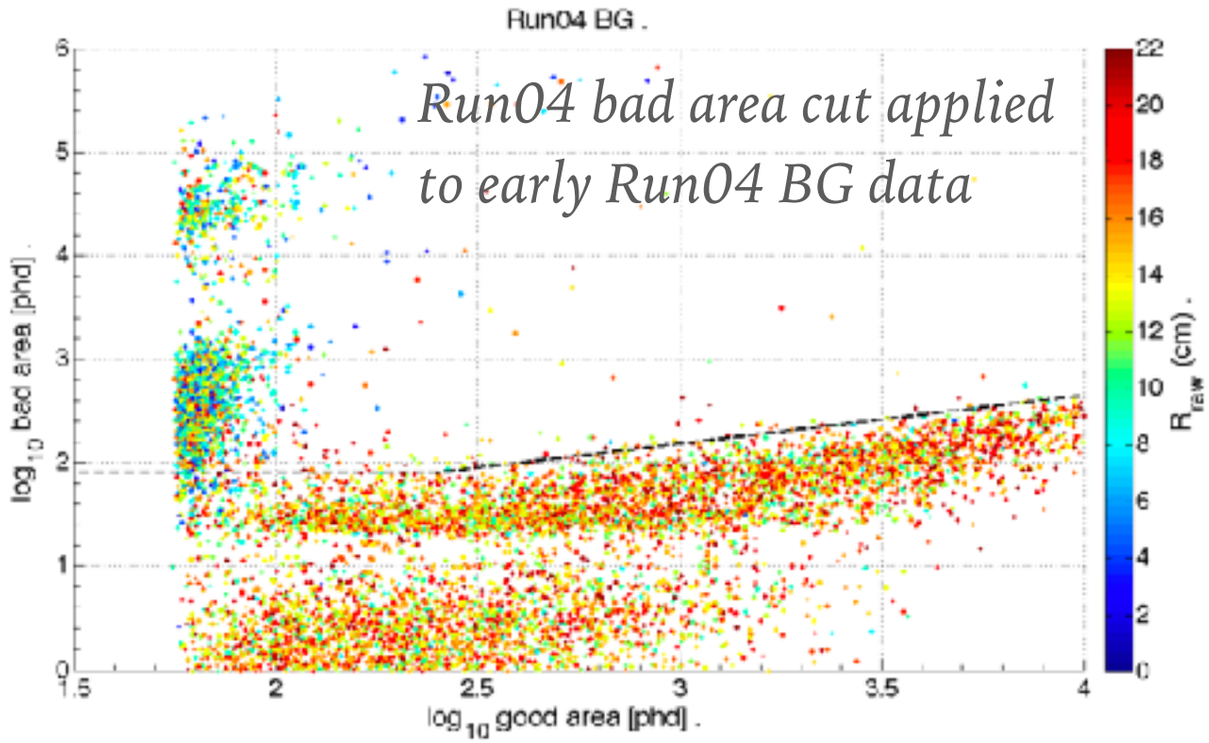
FIG. 1. Decay schematic of ^{83m}Kr . The width of each column is proportional to the branching fraction of that decay mode, the vertical divisions are proportional to energy partitioning among internal conversion electrons, Auger electrons, x-rays, and gamma-rays. Numerical values from Reference [2].

arXiv:0905.1766

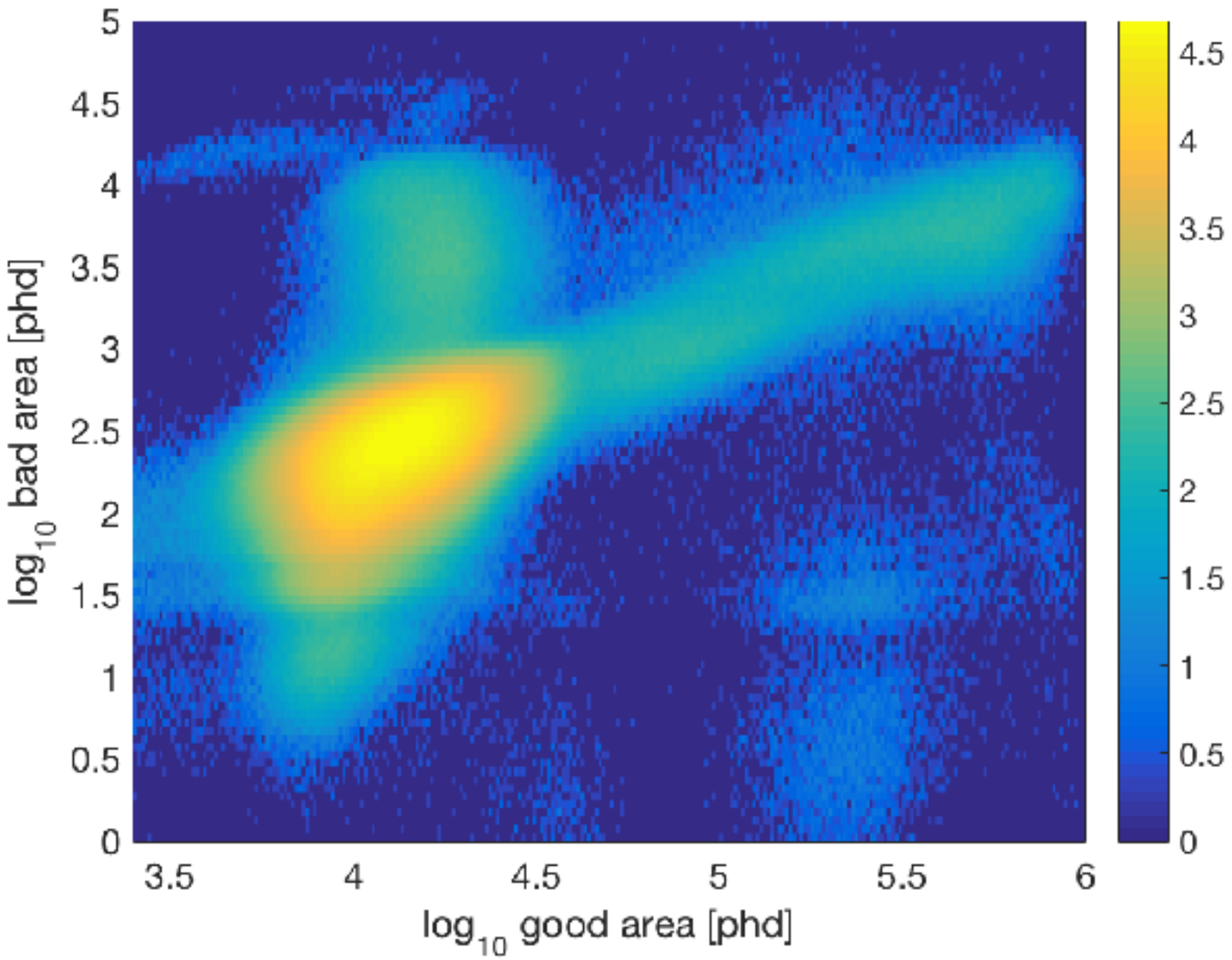
GOOD AREA AND BAD AREA

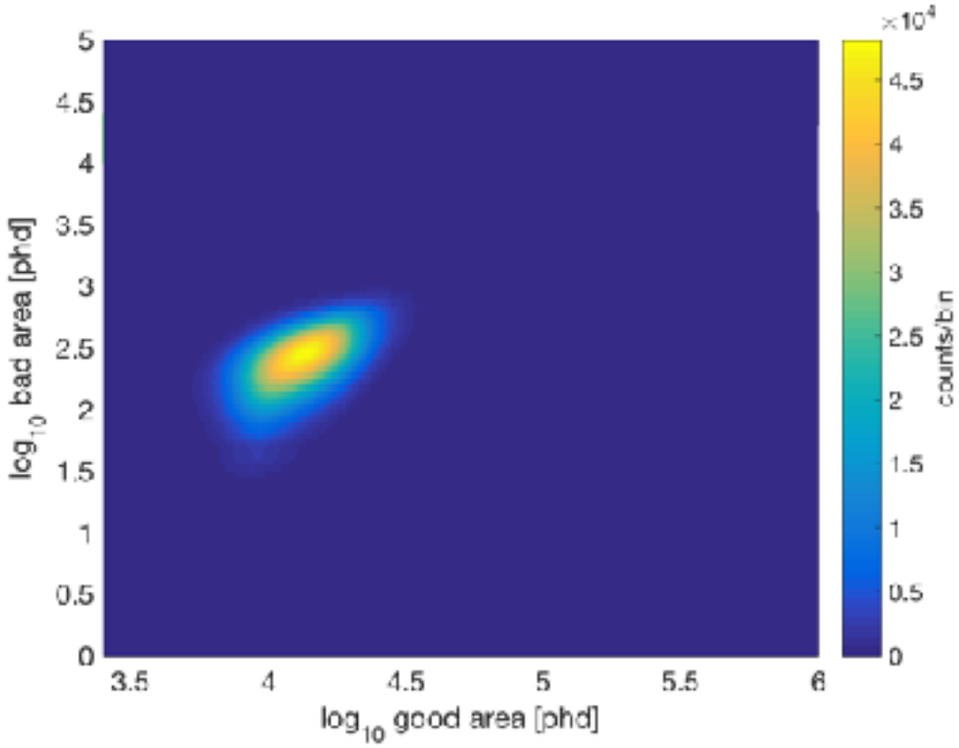
- Good area = S1 + S2;
- Bad area = full event area - good area;
- Bad area cut removes events where the event window has anomalies such as electron trains, glow, etc.
  - LUX only keeps 10 pulses/event, so using the full_event_area_phe RQ captures the area of all signal area above baseline, even if the PulseFinder did not classify it as a pulse.
  - Designed for single-scatter events.
  - Calibrate bad area cut using high statistics datasets such as tritium (*earlier incarnation of Run04 bad area cut*) or ^{83m}Kr (*now*).
- Filter code creates “goodarea” and “badarea” RQs using uncorrected, raw S1 and S2 areas.





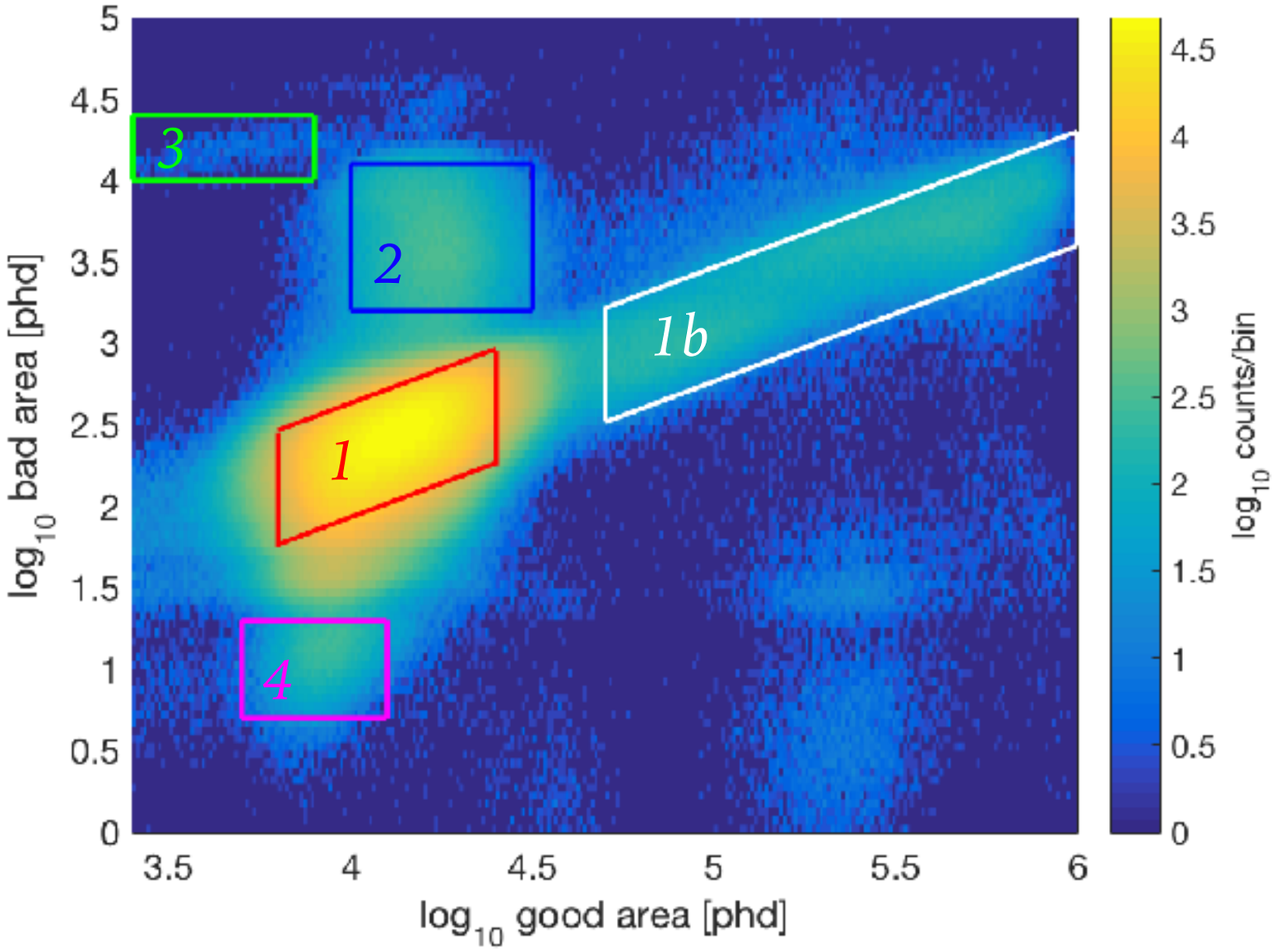
LOG_{10}(BAD AREA) VS. LOG_{10}(GOOD AREA)





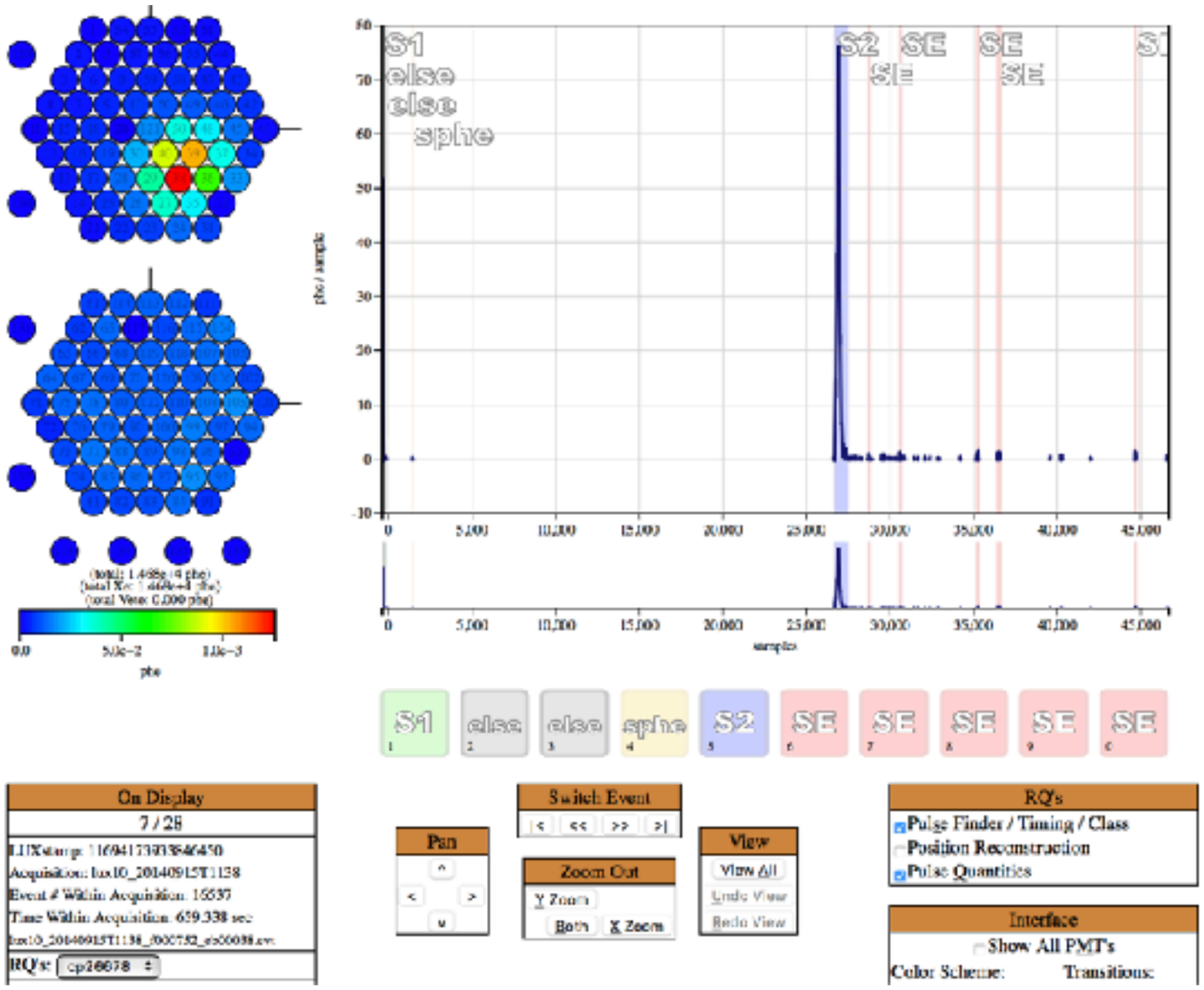
- Plot $\log_{10}$(bad area) vs. $\log_{10}$(good area) for the Run04 Kr-83m injection data.
  - *(left)* Color scale is in units of $\log_{10}$(counts/bin).
  - *(above)* Color scale is in units of counts/bin.

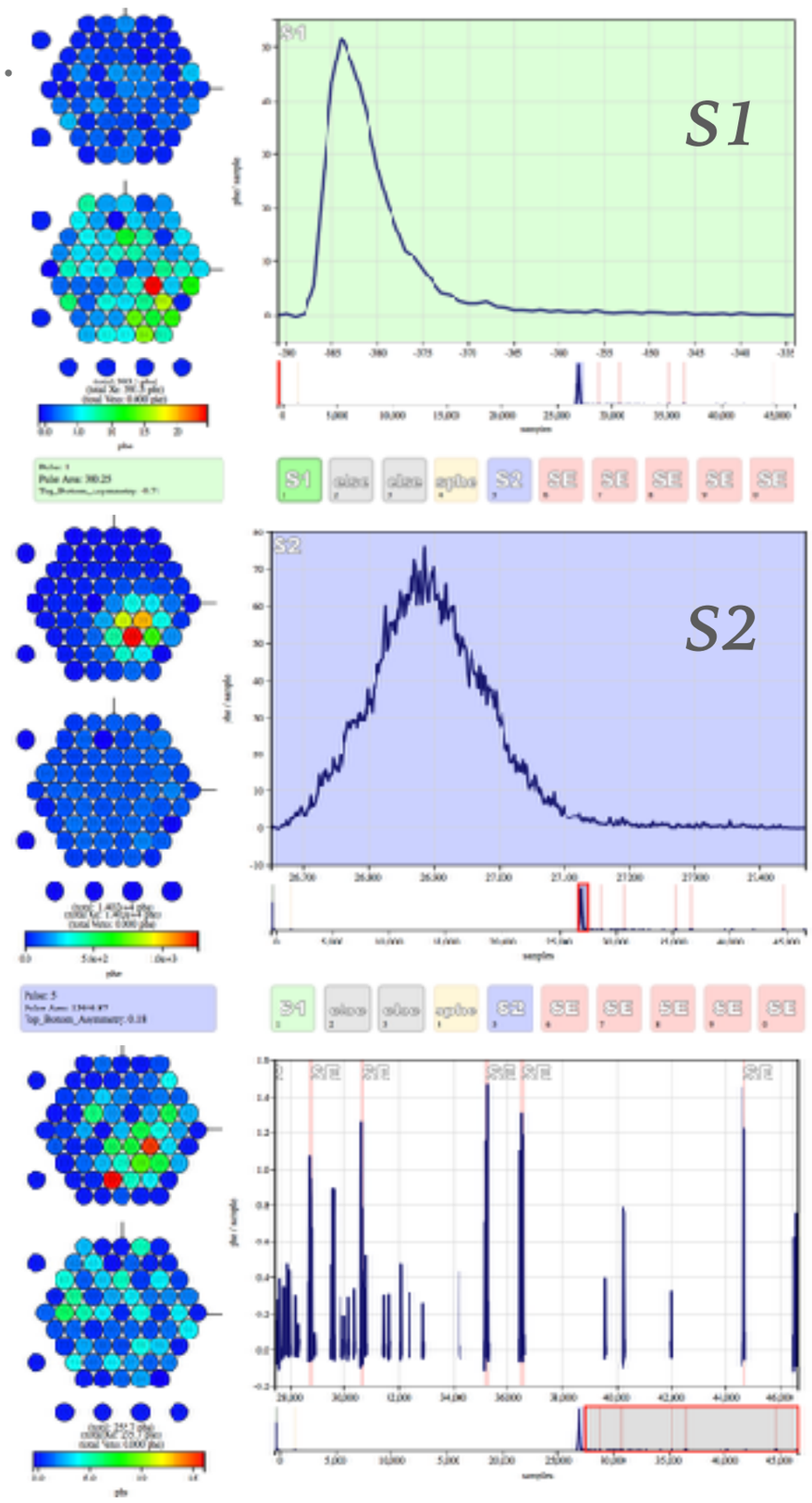
LOG_{10}(BAD AREA) VS. LOG_{10}(GOOD AREA)



- Roughly classify events into populations to study S1 & S2 areas, energies, and any anomalies in Visualux.
  - *(red)* Population 1
  - *(white)* Population 1b
  - *(blue)* Population 2
  - *(green)* Population 3
  - *(magenta)* Population 4

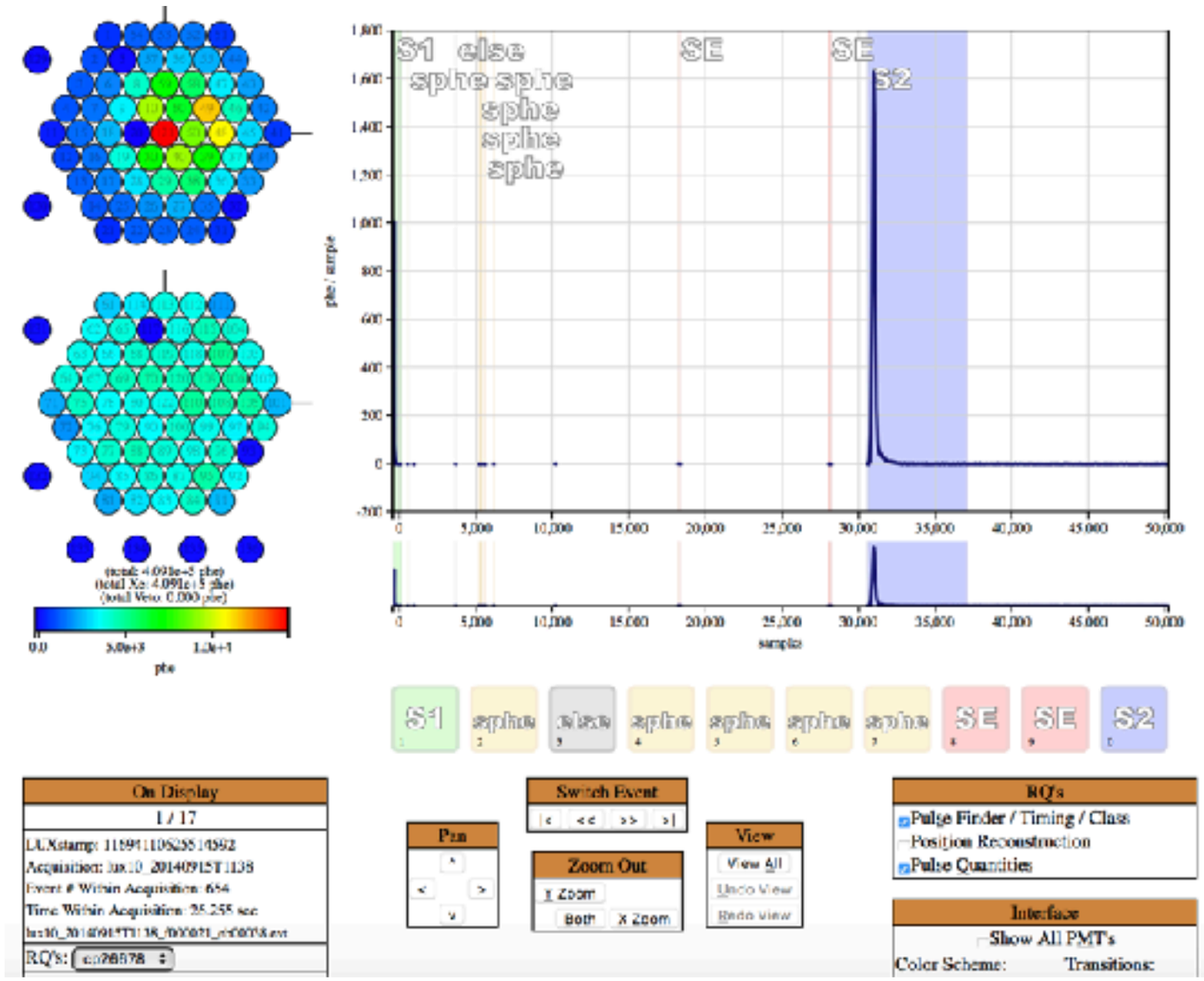
VISUALUX: POPULATION 1

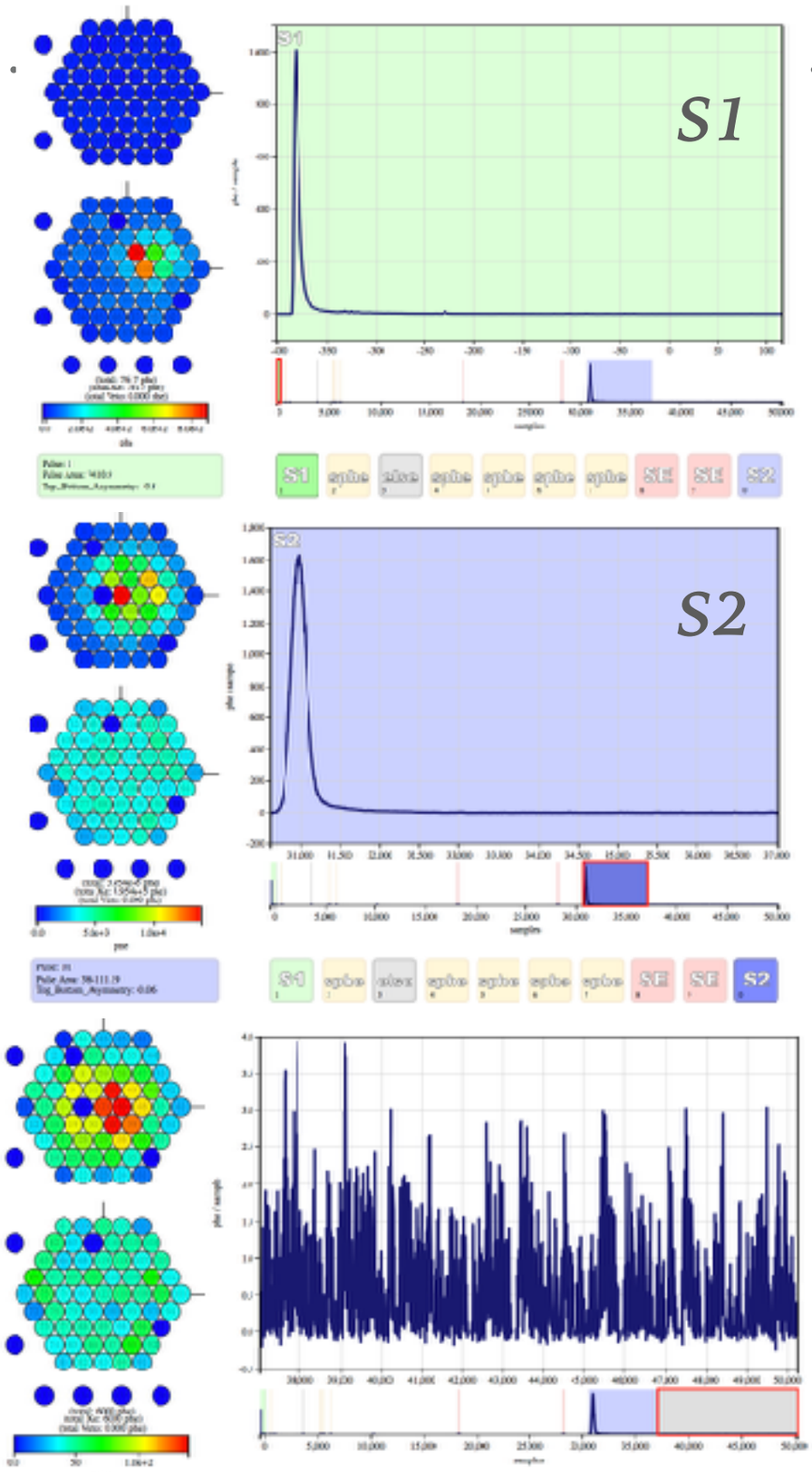




- Scanned 100 events of pop1 in VisuaLux. Events are single-scatter with the S2 followed by several-to-dozens of SE and SPE.
- *(lower right)* View of typical pulses following an S2. These don't qualify as e-trains, but there are likely to be >10 pulses/event.

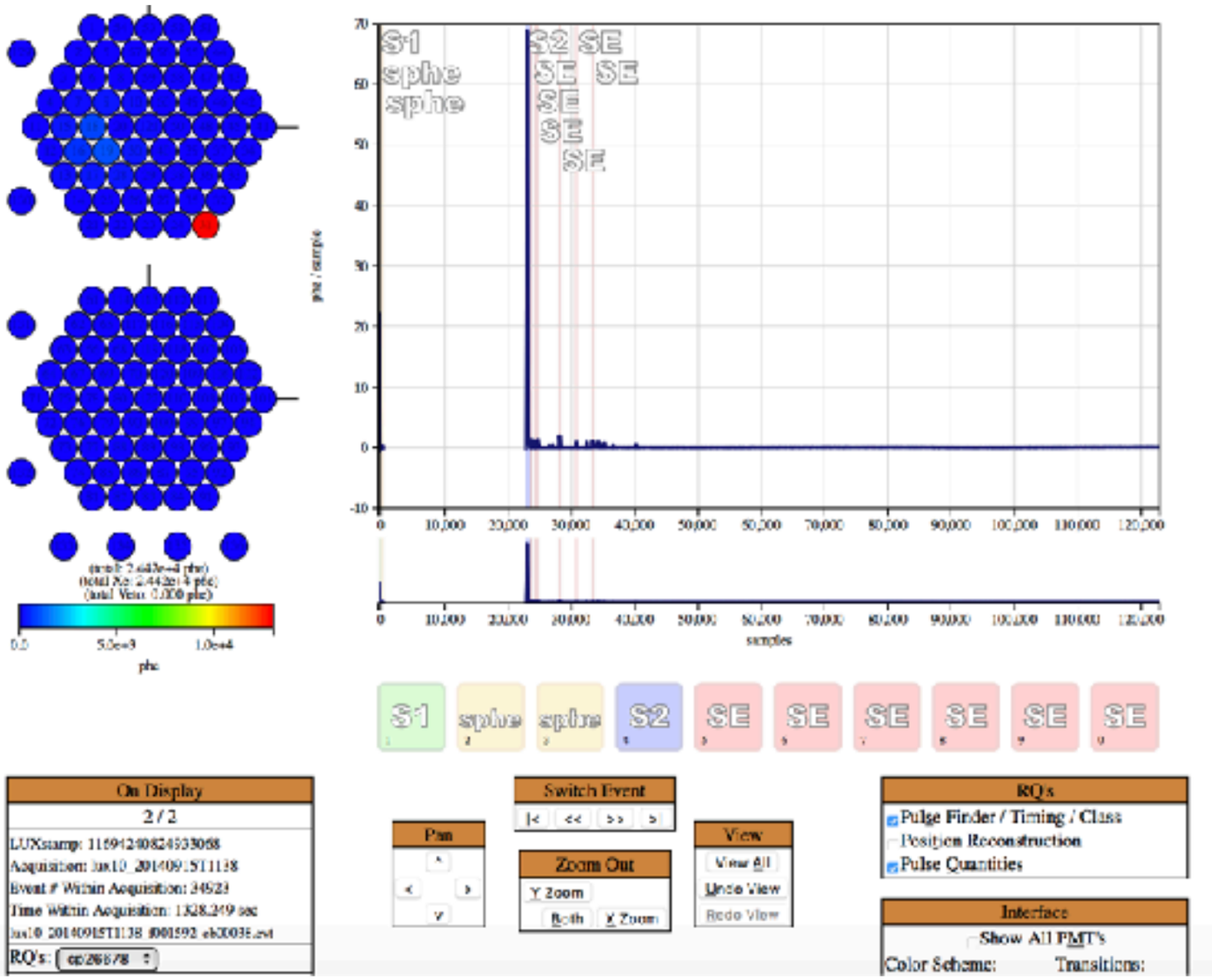
VISUALUX: POPULATION 1B

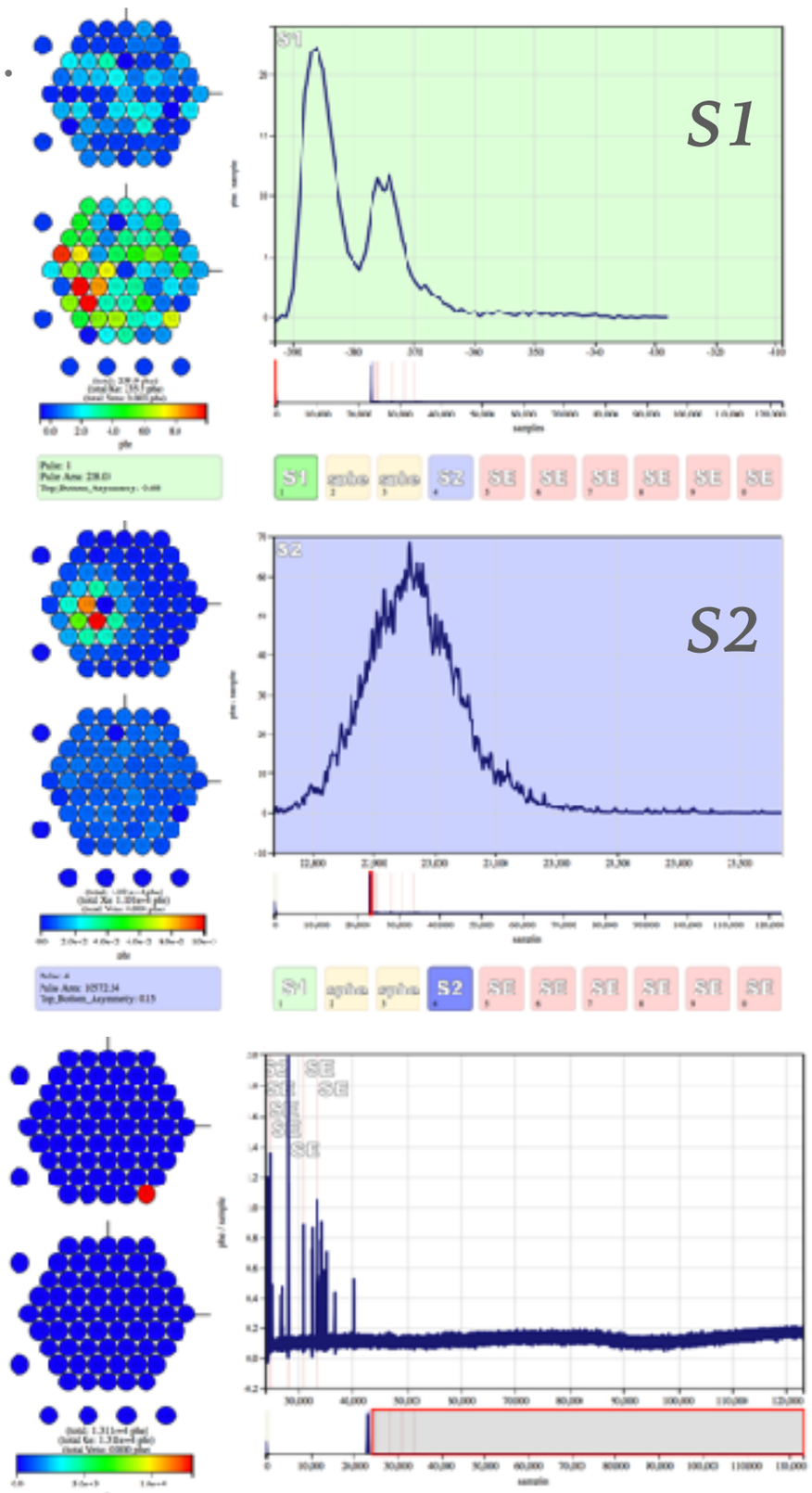




- Scanned 100 events of pop1b in VisuaLux. Events are largely single-scatter with the S2 followed by electron trains.
- *(lower right)* View of typical pulses following an S2. This is an e-train.

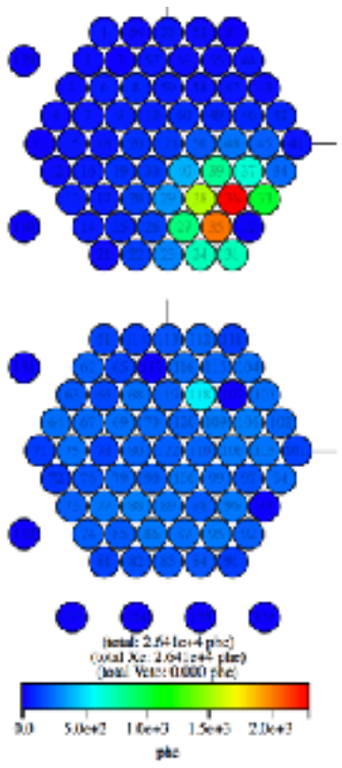
VISUALUX: POPULATION 2

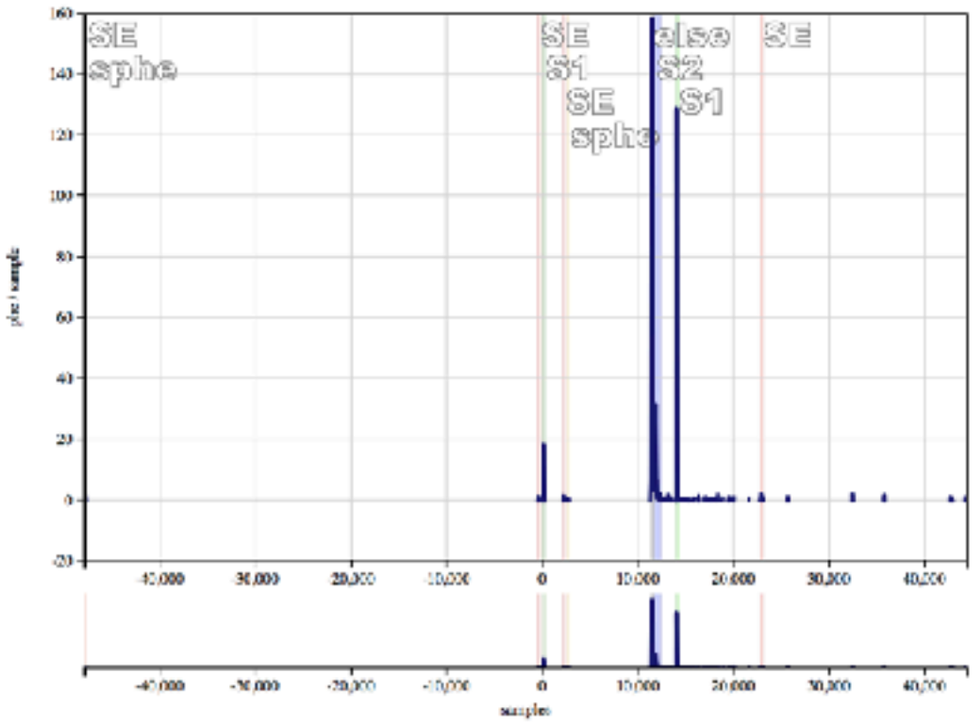


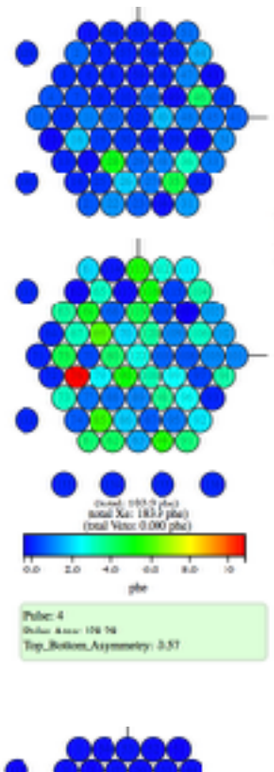


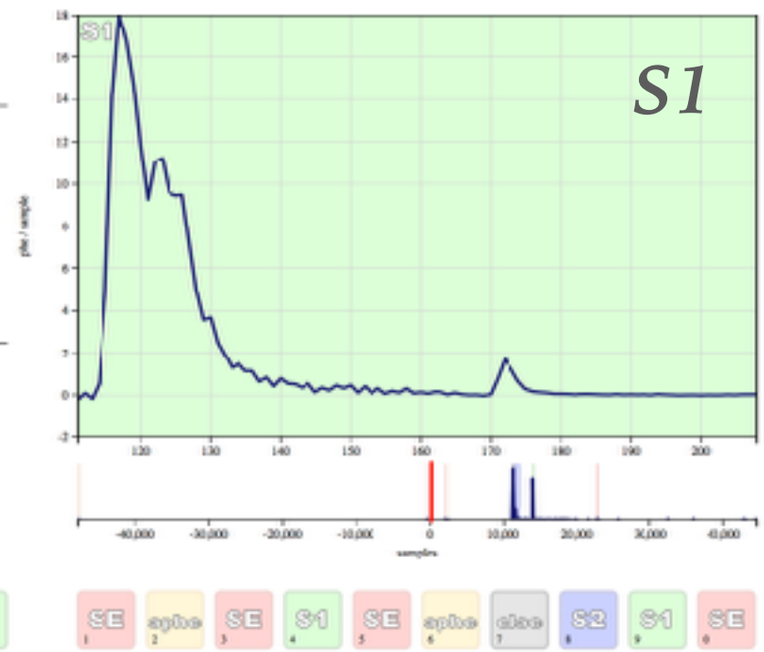
- Scanned 100 events of pop2 in VisuaLux. Events are largely single-scatter with the S2 followed by a baseline shift in the rest of the event window. 95% of scanned events had baseline problems.
- *(lower right)* View of typical pulses following an S2. This is a baseline shift.

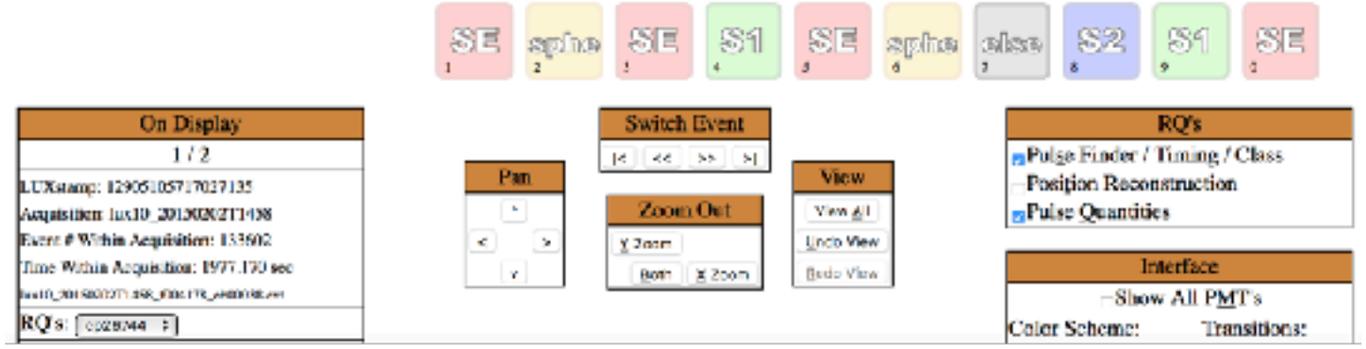
VISUALUX: POPULATION 3

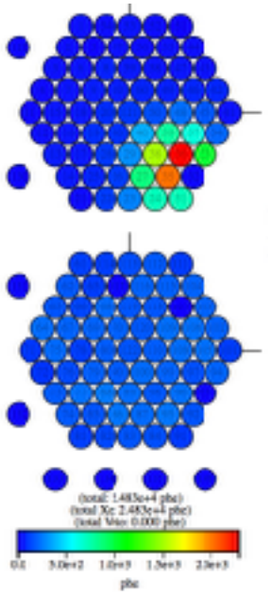


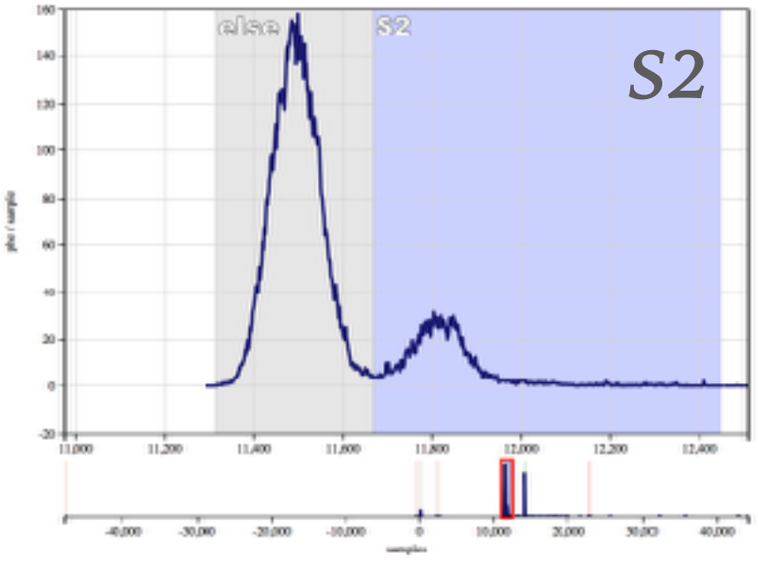






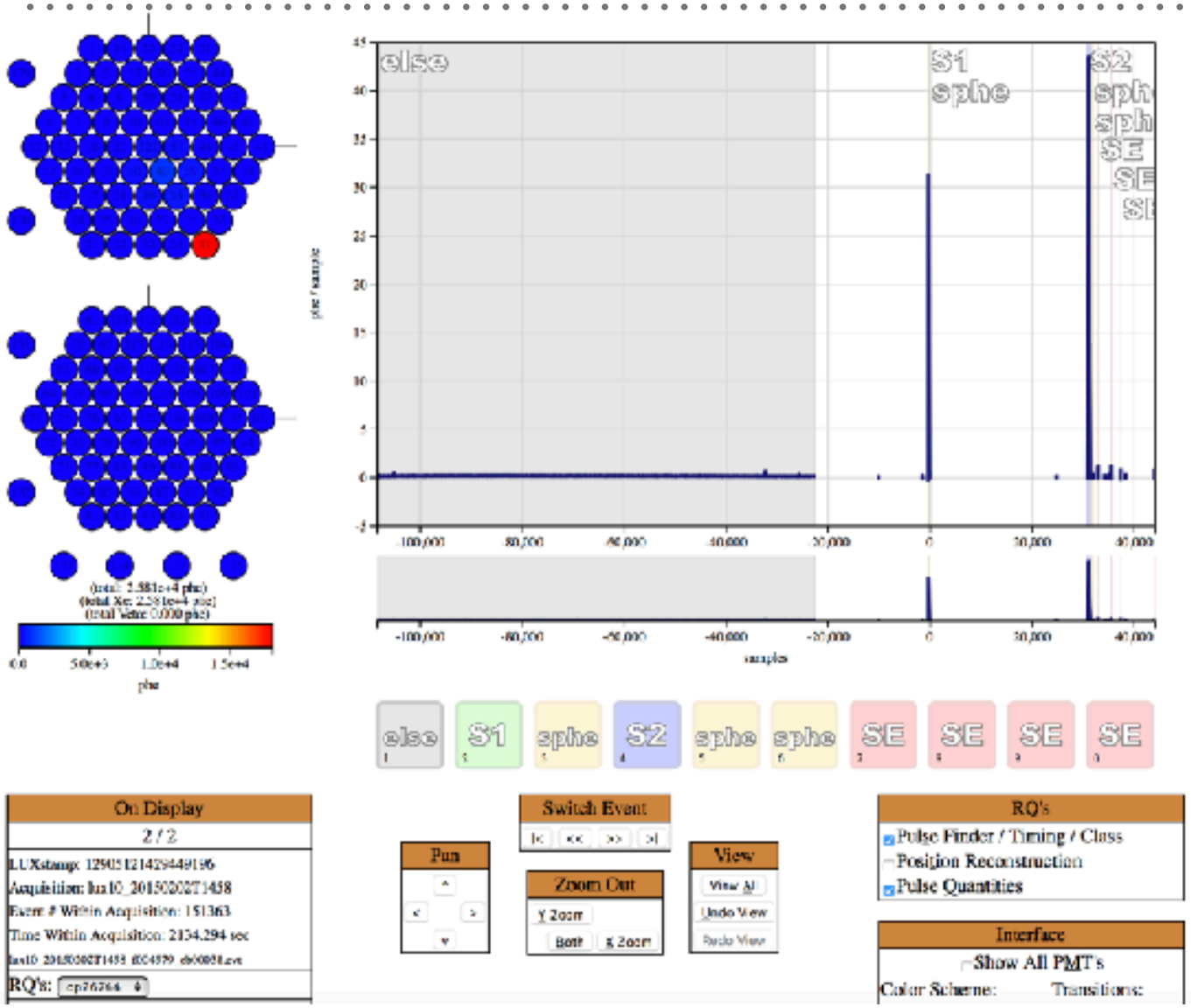


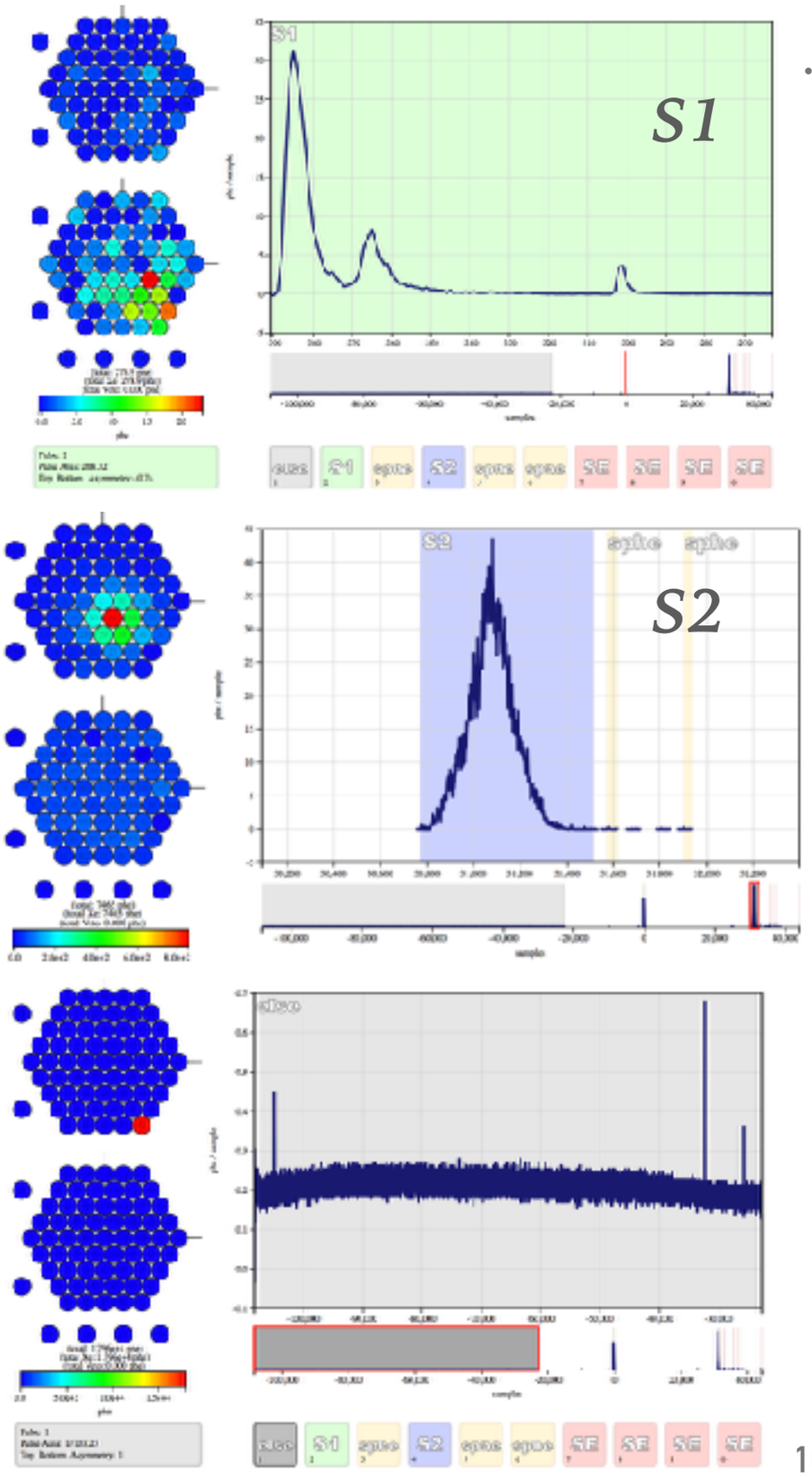




- Scanned 100 events of pop3 in VisuaLux. Events are *classified* as single-scatter, but 91% of the events looked like a double-scatter with the 1st S2 misclassified as an “else” or class 5 pulse. The S1 often, but not always, looked like 2 discernible S1 pulses.
  - The “else” pulse contributes to the “bad area!”

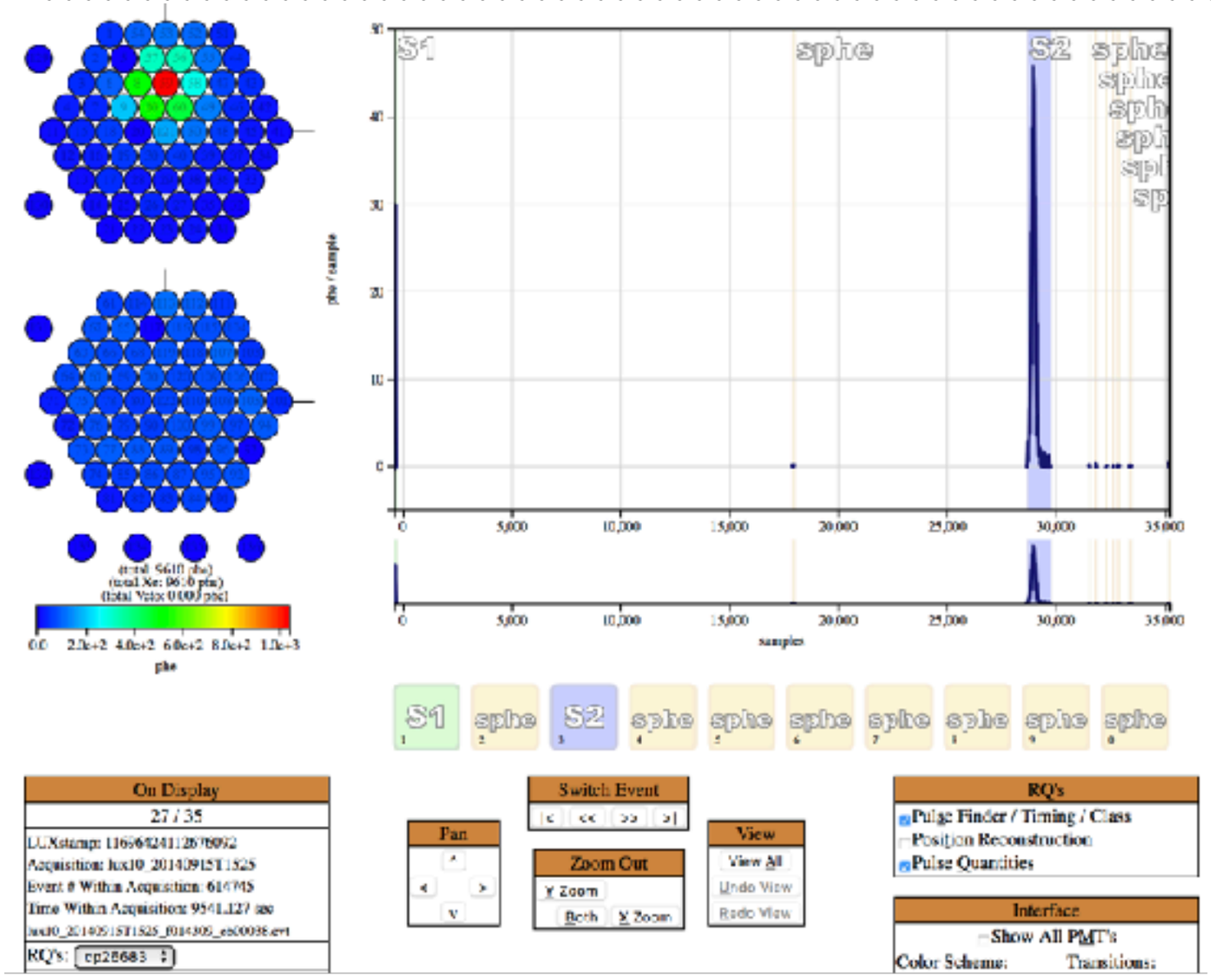
VISUALUX: POPULATION 3, CONTINUED

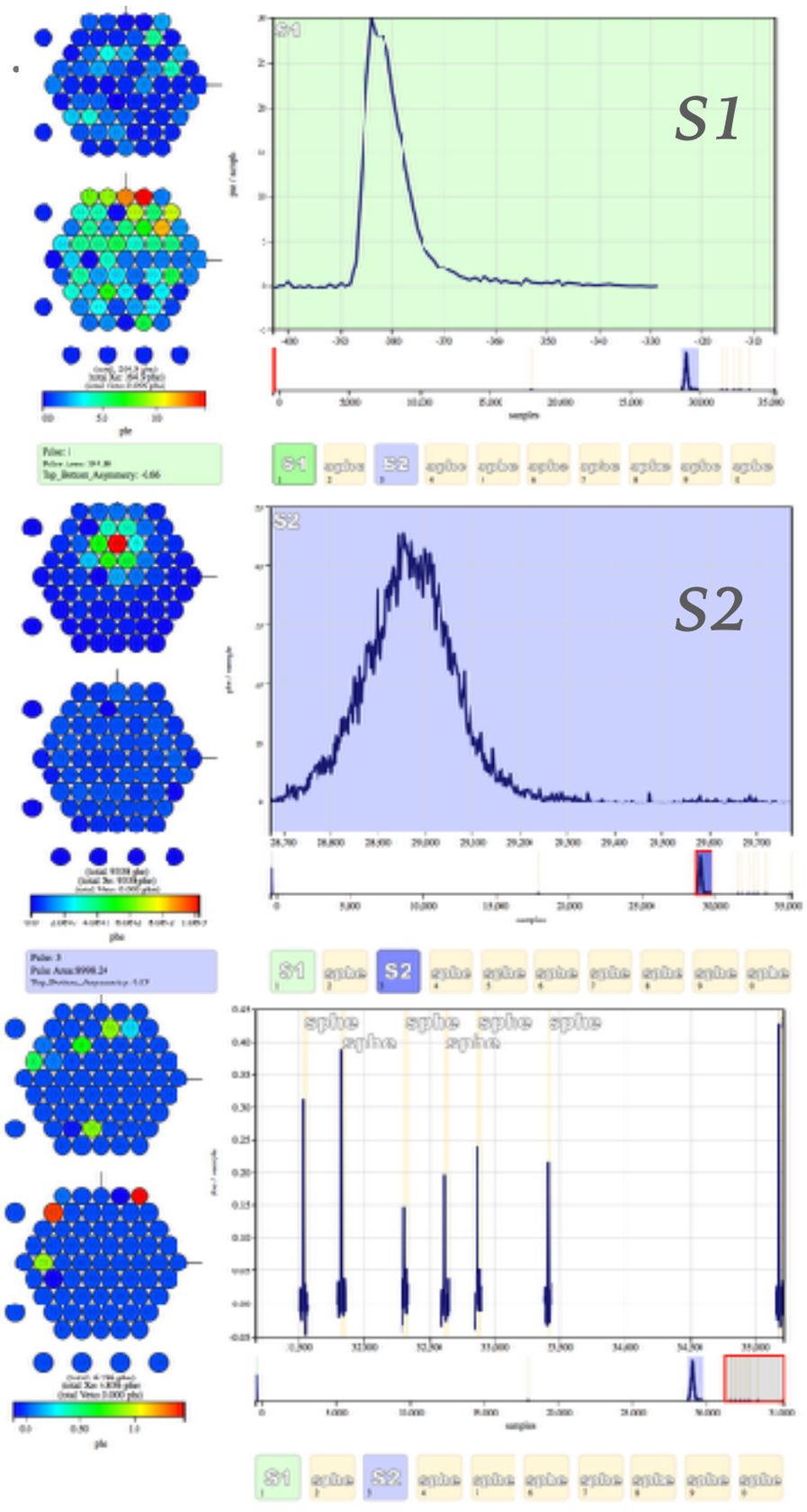




- Scanned 100 events of pop3 in VisuaLux. 7% of scanned events had baseline problems either before or after the S2 pulse.
- *(lower right)* View of a baseline shift early in the event window before the S1 pulse.
- 2% of events simply had a super large S1 pulse after the S2 contributing to the bad area. The pattern was S1, S2, big S1.

VISUALUX: POPULATION 4





- Scanned 100 events of pop4 in VisuaLux. Events are largely nice-looking single-scatter events where the S2 is followed only by SPE. Occasionally (3-4 events scanned), a SE followed the S2, but this typically had a small area of ~10 phd.
- *(lower right)* View of the single photoelectrons (SPE) following an S2.