LAT Muon Data Taking During Environmental Test at NRL

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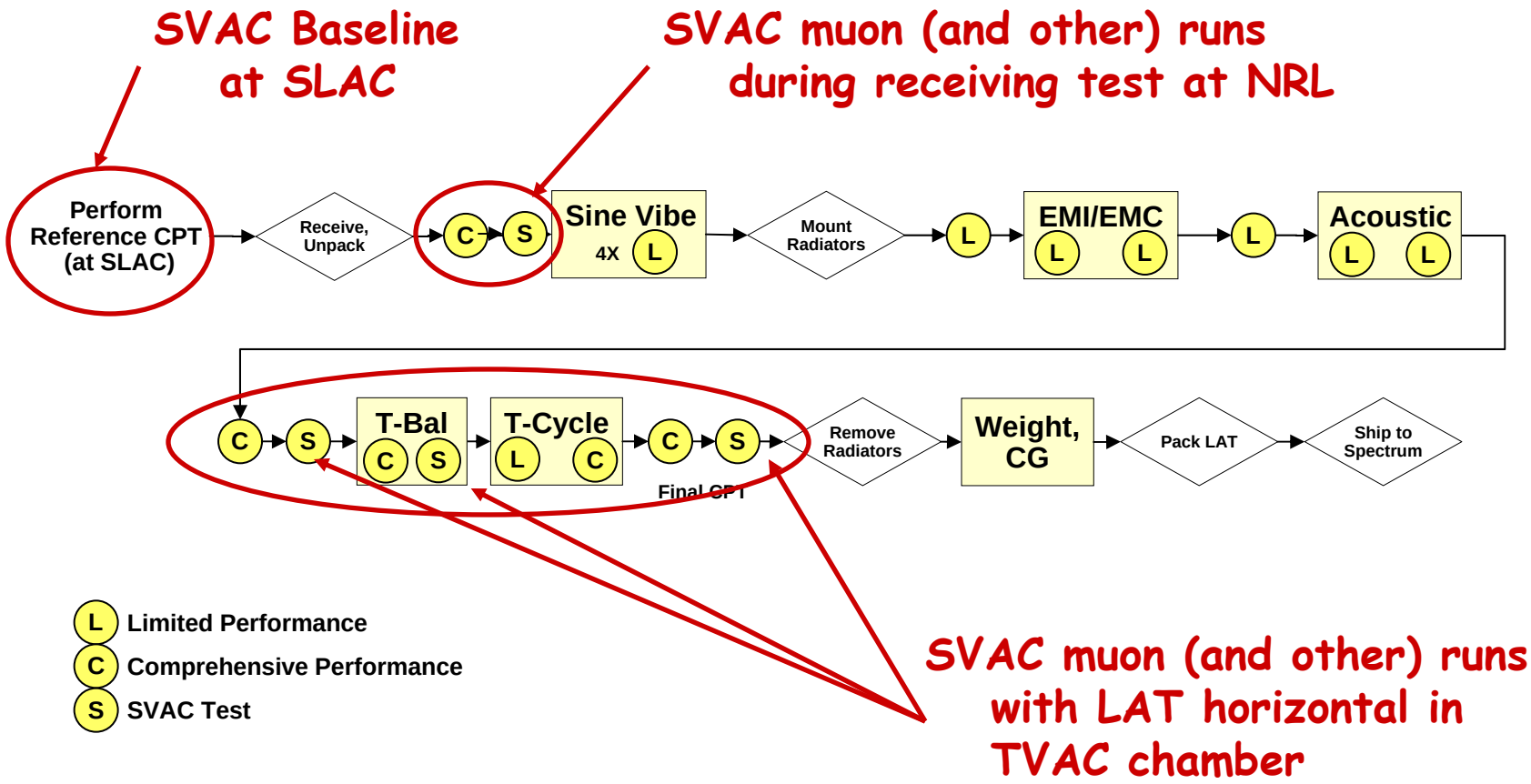
SVAC runs at NRL

- How do muon collections fit in to LAT environmental test plan?
- Two purposes
  - Calibrate the LAT after it leaves SLAC
  - Verify LAT performance in variety of conditions
- Controlling documents
  - LAT Environmental Test Sequence
    - LAT-MD-02717
  - LAT Performance and Operations Test Plan
    - LAT-MD-02730
- Note: Electronic calibrations too!
  - Perform electronic calib at same epochs as "Muon Calibration"
    - ACD, CAL, and TKR scripts
  - Don't forget these!

Environmental Test Sequence



Agrees with LAT-MD-02717-01, "LAT Environmental Test Sequence" Release 9 May 2005

Baseline at SLAC

- Before LAT leaves SLAC, "Baseline" tests must be completed

- LAT baseline performance and calibration at SLAC
  - Detector CPTs, LAT full functional tests, and SVAC runs
    - SVAC muon runs identified in Performance and Operations Test Plan
      - LAT701 (LAT702)
        - » Flight configuration on ground (redundant side)
      - LAT711
        - » Muon calibration, same as LAT701 but CAL in muon gain
      - LAT801 (LAT811)
        - » Same as LAT701 but at min (max) input voltage
      - LAT821
        - » Same as LAT701 but with added high-rate periodic triggers
      - LAT841 (LAT851)
        - » Same as LAT821 but at min (max) input voltage
      - LAT852
        - » Same as LAT701 + high-rate triggers, at max input voltage, on redundant side

Detector configuration

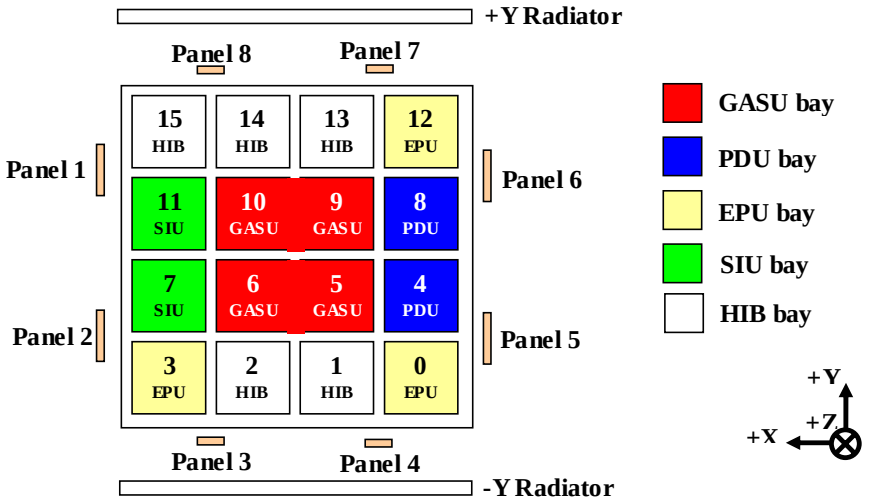
- LAT701, Flight Configuration on Ground
  - Derived from B-2 configuration, but improved
    - Use multiple trigger engines
      - See engine and scheduler talks
      - https://confluence.slac.stanford.edu/download/attachments/2629/TriggerEnginesAndRates_060203.ppt
    - Use ACD as veto with tower-shadow (tower-local) regions of interest
      - Note that veto is not performed in hardware
      - i.e. events with TKR and local ACD veto are mapped to trigger engine that causes readout, not to a trigger engine that is inhibited
    - Use improved ACD, CAL, and TKR thresholds
  - Why the "on ground" distinction?
    - Trigger engine that gives muons on ground is not prescaled
    - Same engine will give protons on orbit, but will be prescaled
  - Practice LAT701 runs were taken last week

Please look at these runs

- LAT711, Muon Calibration
  - Same as "Flight Configuration on Ground" except
    - CAL HE ranges are in muon gain
    - CAL readout is 4-range (but still zero suppressed)
  - Request for practice run is in process…

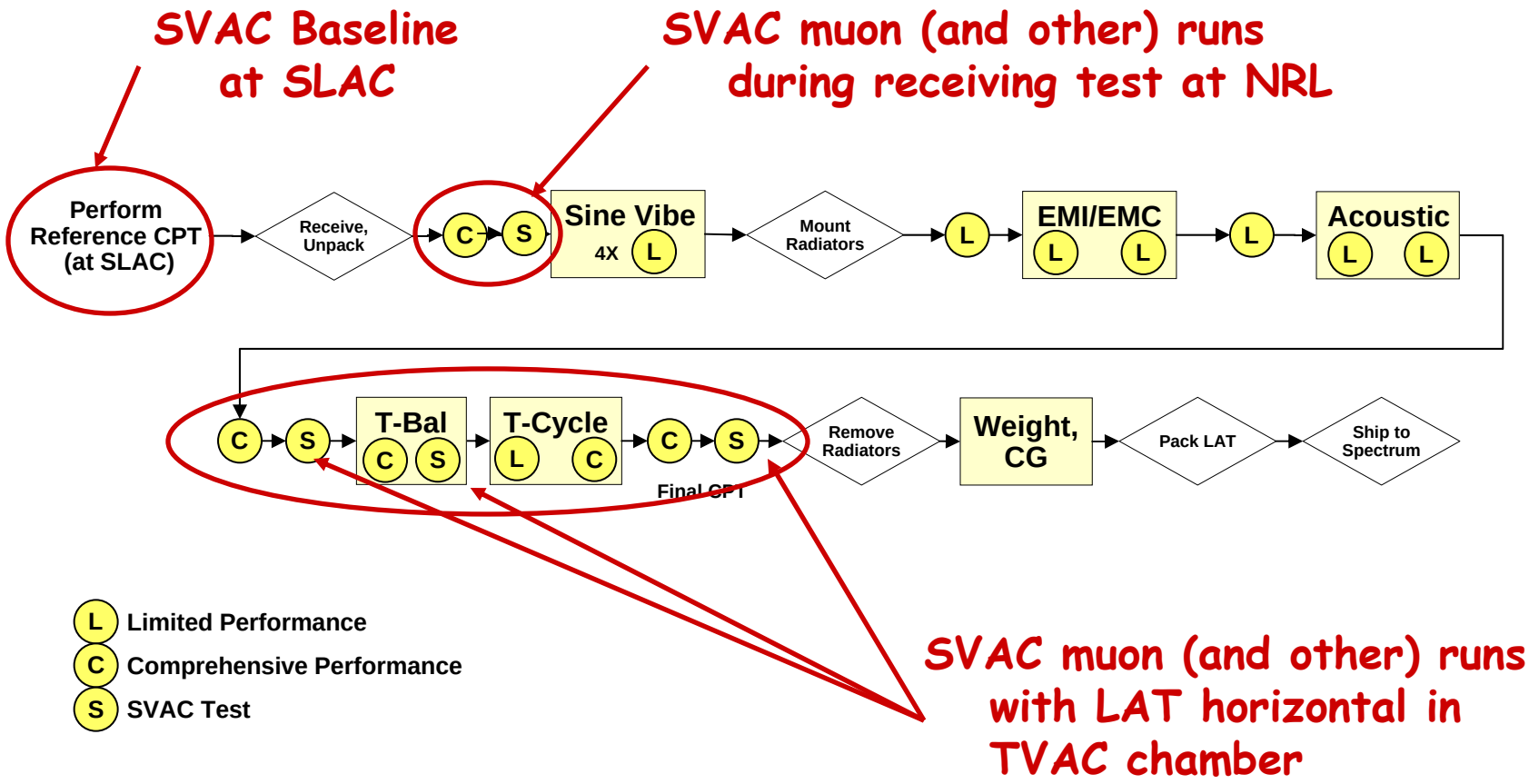
Redundancy configurations

- LAT provides redundant electronics configurations
  - Each config needs
    - 1 GASU (two bays)
    - 2 EPUs
    - 1 SIU
    - 1 PDU
- SVAC runs are taken in two configurations
  - "Primary"
    - Primary GASU, EPUs, SIU, PDU
  - "Redundant"
    - Redundant GASU, (one) EPU, SIU, PDU
    - Shares one EPU with Primary
  - Run time strategy
    - More time on Primary than Redundant



- EPU = Event Processing Unit
  - CPU for event formation, filter
- GASU = Global electronics, ACD, and Signal distribution Unit
  - Trigger decision, GEM, AEM
  - Event builder
- PDU = Power Distribution Unit
  - LAT power
- SIU = Spacecraft Interface Unit
  - Commanding and housekeeping

Environmental Test Sequence



Agrees with LAT-MD-02717-01, "LAT Environmental Test Sequence" Release 9 May 2005

LAT muons during Receiving Test

- Test sequence on arrival at NRL
  - Detector CPTs to verify functionality
  - Detector timing-in
  - Muon runs
    - LAT701 and LAT702
      - Flight Configuration on Ground on primary and redundant side
    - LAT711
      - Muon Calibration
    - Total muon run time ~ 2 days (?)
      - Schedule pressure to keep this as short as possible
      - These are only long muon runs at NRL with LAT z-axis vertical
  - Electronic calibration

LAT muons in TVAC

- Majority of SVAC muon runs will be performed in thermal-vacuum chamber
  - Pre-TVAC
    - In chamber, door open
  - Hot thermal balance (or maybe hot proto-flight) and hot cycle 4
    - ACD ~ +20C, CAL ~ +10C, TKR ~ +25C
    - If in thermal balance, by definition temperature is not changing
    - Total run time is ~ few days
  - Cold thermal balance (or maybe cold proto-flight) and cold cycle 4
    - ACD ~ -5C, CAL ~ 0C, TKR ~ 0C
    - (same comments about thermal balance and run time)
  - Post-TVAC
    - In chamber, door open
    - This is *final* SVAC muon run before shipment to General Dynamics Spectrum Astro

- Note: All TVAC muon runs are taken with LAT on its side
  - i.e. Z axis is horizontal, +Y axis is vertical
  - Required by LAT thermal control system
    - Radiators on +-Y surfaces must be horizontal in gravity
  - Need to gain some experience with muon calibration in this orientation!

Summary

- Muon runs at NRL during environmental test
  - Total run time is modest
    - Essential runs identified in Test Plan
      - Receipt at NRL
      - During TVAC
    - Other muon runs will occur as convenient
  - Majority of run time is with LAT turned on its side
- Electronic calibrations too