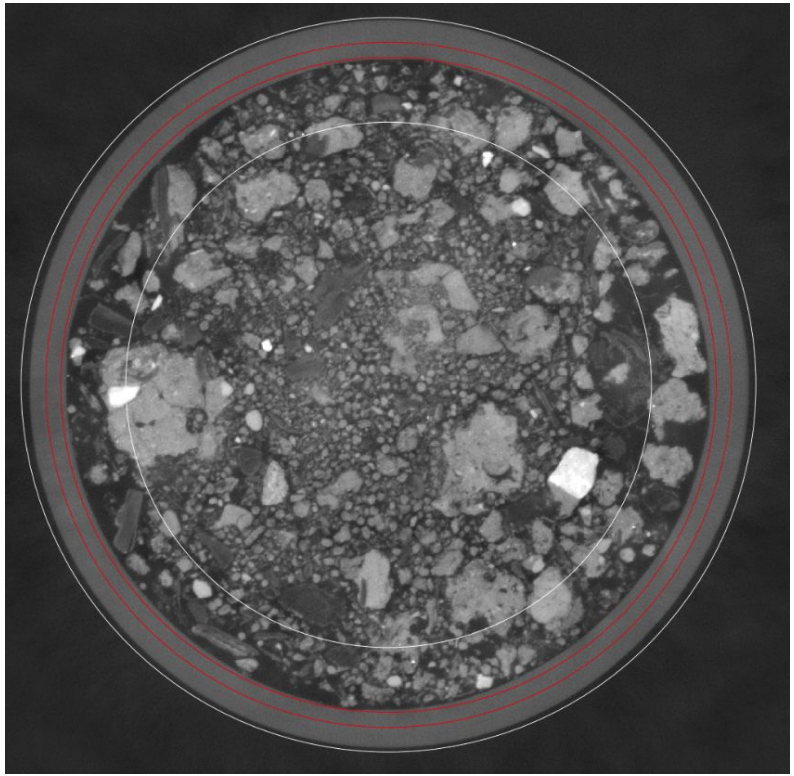
X-Ray Soil Core Preliminary Analysis

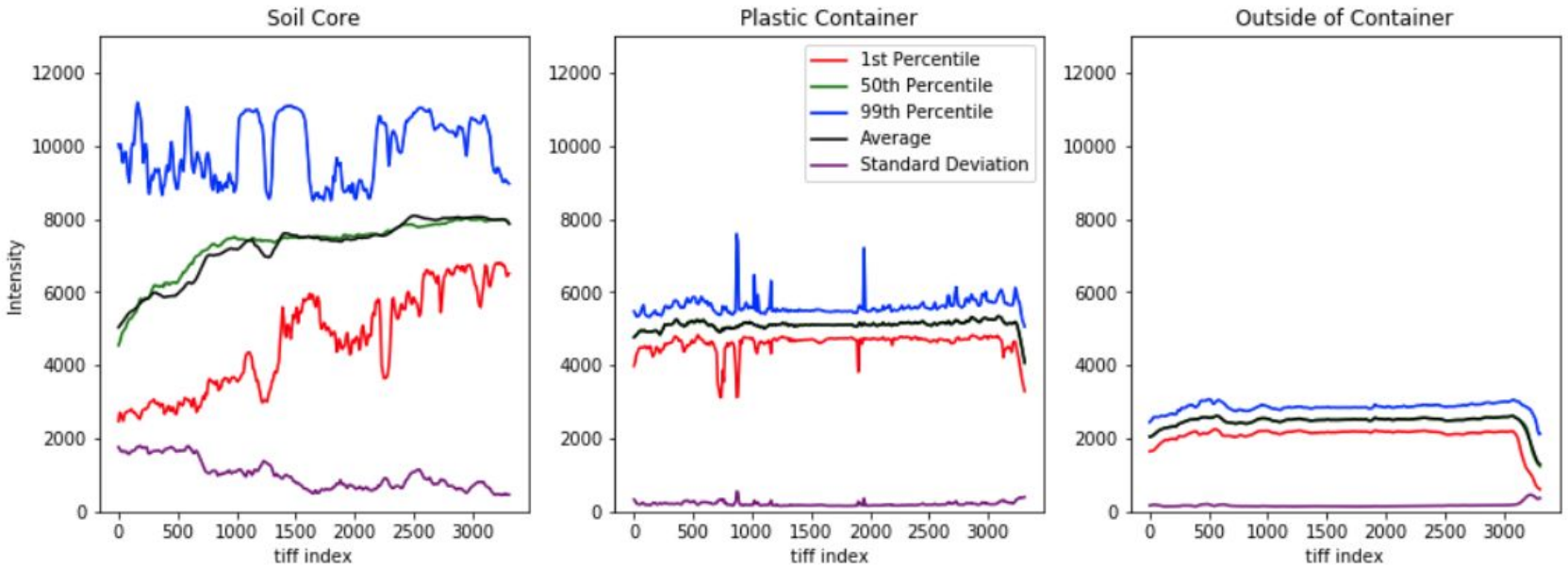
4/24/23

Overview:

- Access to X-Ray Data
  - Data is downloading ~4 hrs/scan
- Explore Preliminary Scan
  - Gather some basic statistics by depth (tiff index)
  - Split into 3 different sections
    - Inner soil core
      - Ignore the edges with the container to avoid boundary effects
    - Plastic ring
      - This should be uniform density throughout (**1.022 g/ml)**
    - Outside the container
      - Should be a density of zero? **Yes**

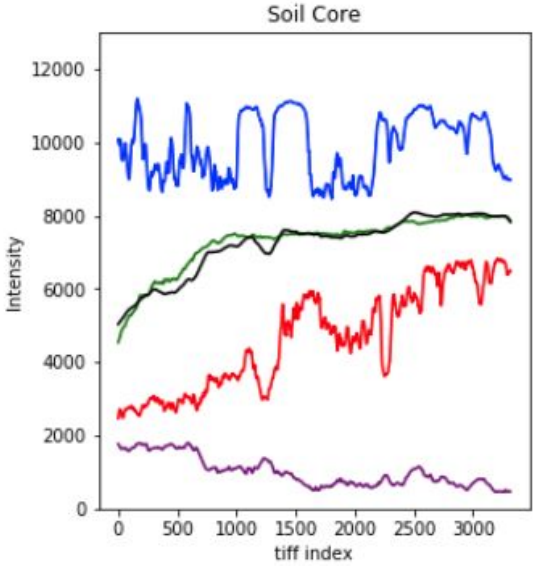


Some basic calculations: scan 14, no till, high manure

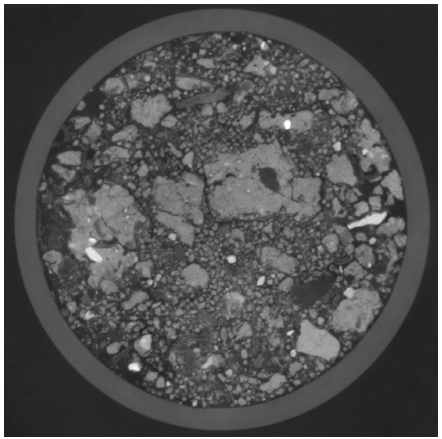


- Similar standard deviation for both plastic and outside of container, should be useful for reducing noise
- Is index 0 shallowest or deepest? **Shallowest**
- Identifying plastic container assumed a constant circular ring cross-section in the same location - cross section changes slightly, so some non-plastic pixels were inadvertently counted at higher indices. A smarter segmentation technique could be used in the future if needed.

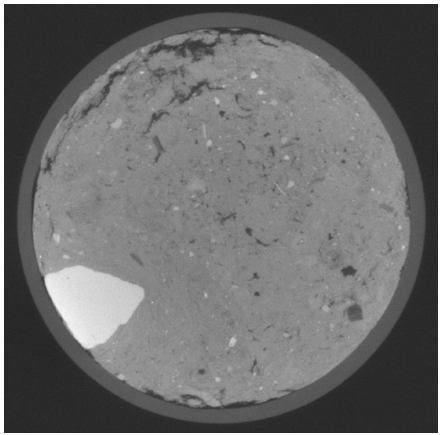
Some basic calculations: scan 14, no till, high manure



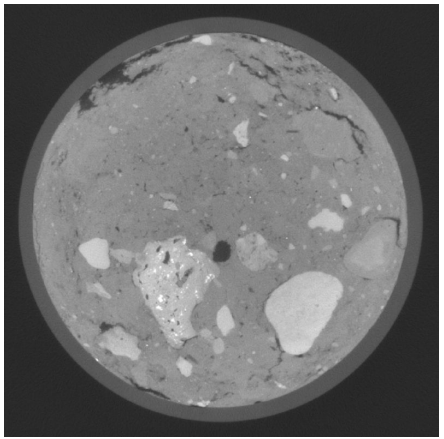
Tiff index = 100



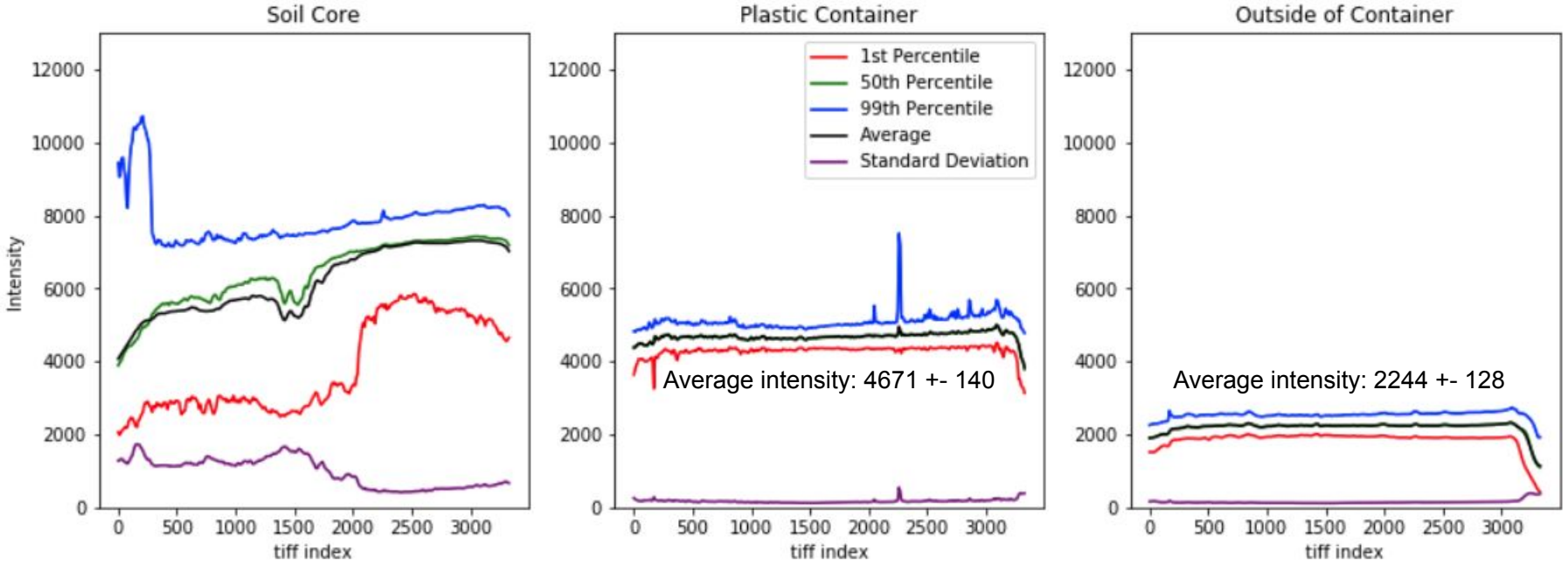
Tiff index = 1500



Tiff index = 2500

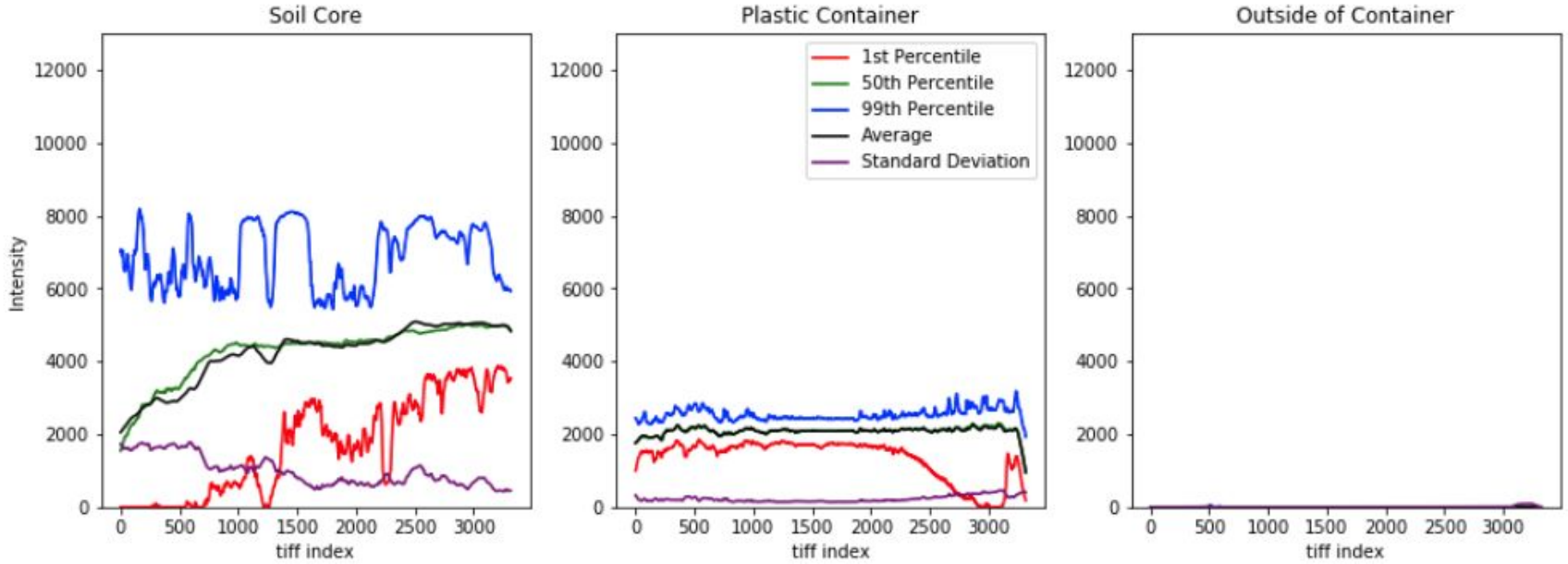


Some basic calculations: scan 3, native prairie

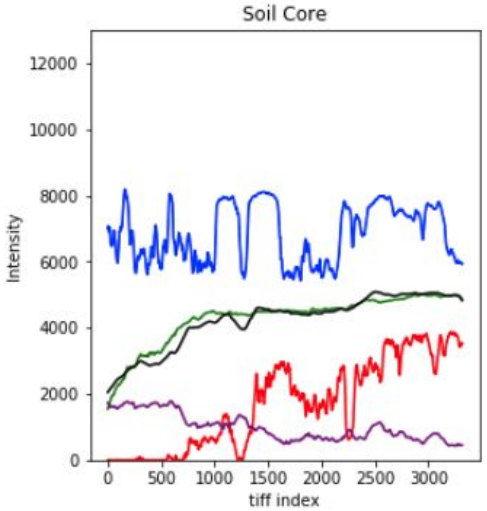


- Similar average x-ray intensity as scan 14 for container and outer section

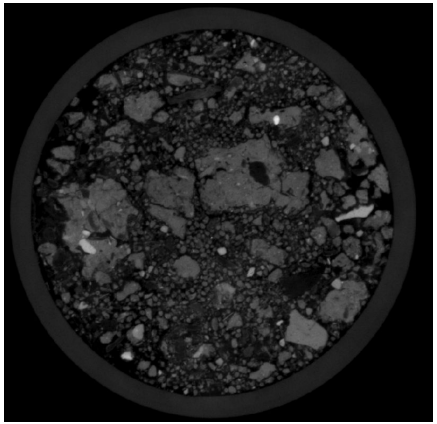
After denoising - wavelet denoising



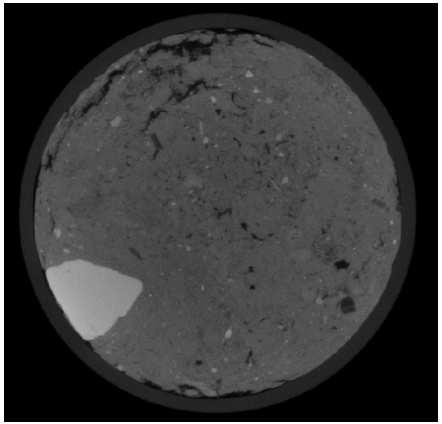
After denoising - wavelet denoising



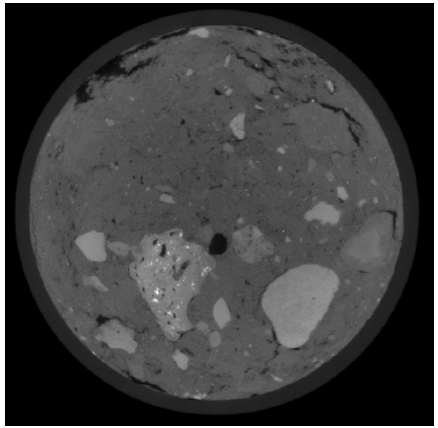
Tiff index = 100



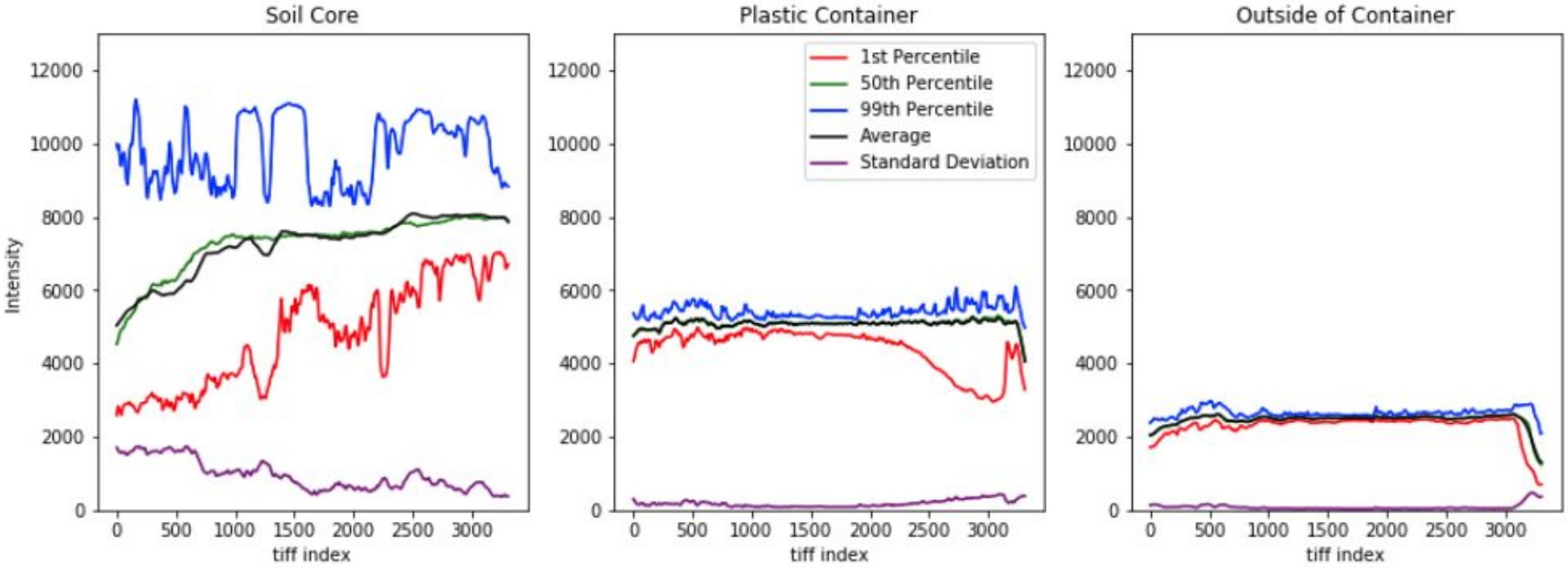
Tiff index = 1500



Tiff index = 2500

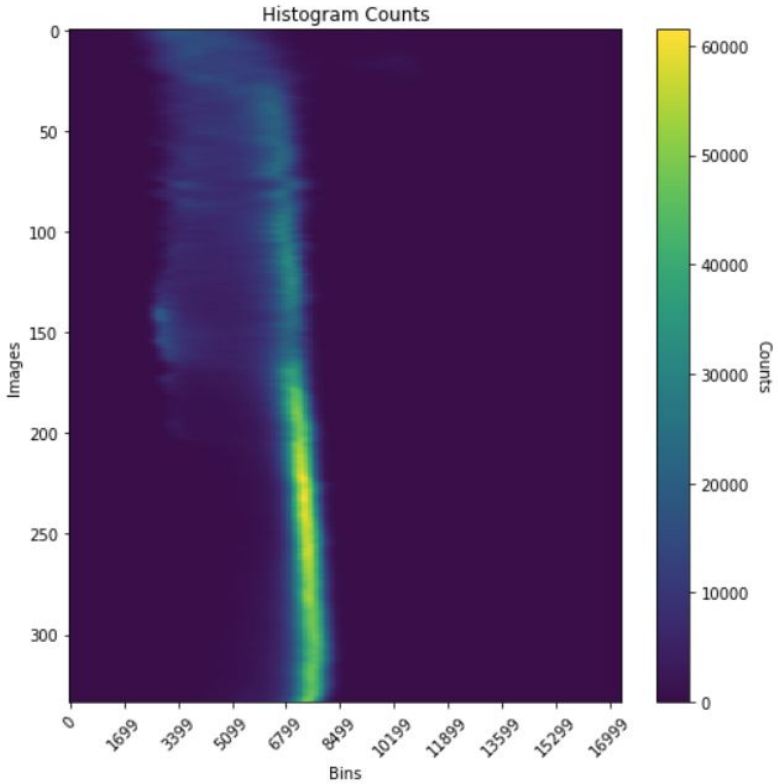


After denoising - total variation (chambolle) denoising

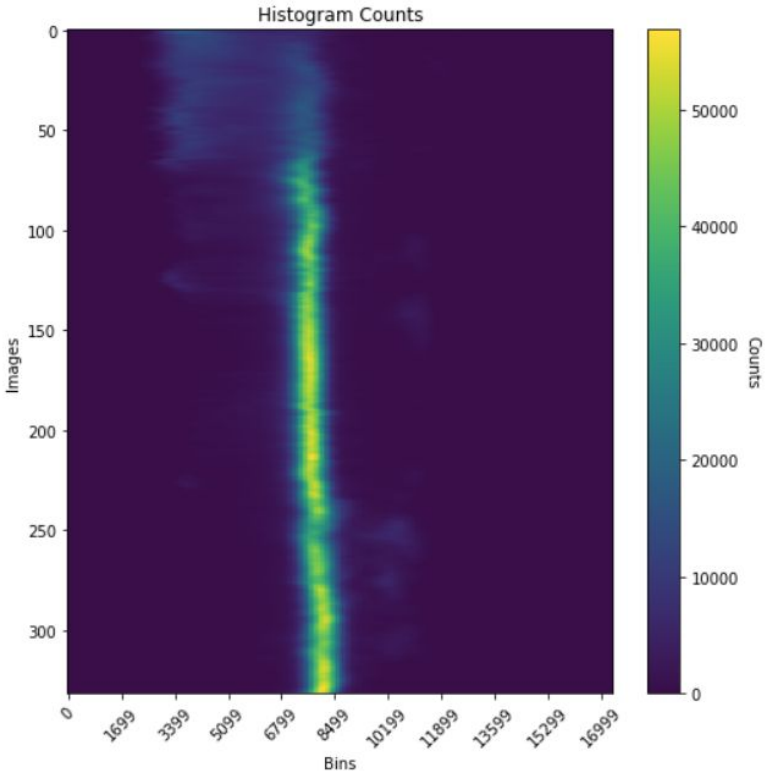


Some soil core histogram heatmaps

Scan 3: Native Prairie

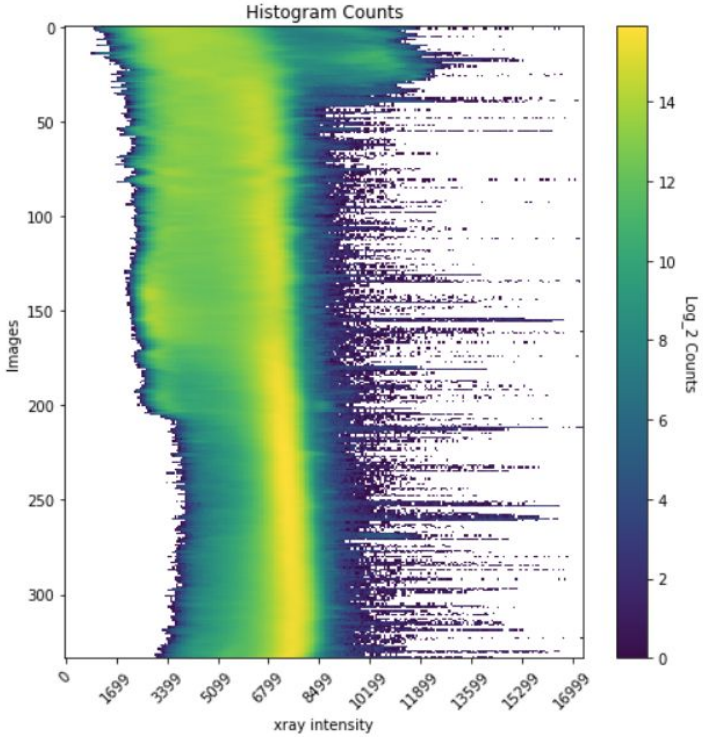


Scan 14: no till, high manure



Some soil core histogram heatmaps (log scale)

Scan 3: Native Prairie



Scan 14: no till, high manure