# The VLITE-VLASS Commensal Sky Survey (VCSS)

*A 340 MHz Companion to the VLA Sky Survey (VLASS)*

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## VLITE

- The VLA Low-band Ionosphere and Transient Experiment is a commensal system using the VLA 330 MHz feeds and receivers and dedicated real-time DiFX software correlator:
  - ➢ 320<$v$<364 MHz,
  - ➢ $\Delta v_{ch}$=100 kHz,
  - ➢ FOV = 2°
- Expanded in summer 2017 to 16 antennas.
- Real-time ionosphere pipeline and astrophysics/transient pipeline on 24 hour delay.
- Archive: raw data, final self-calibrated visibilities, images, source catalog and light curves.
- Data are currently made available through NRL.
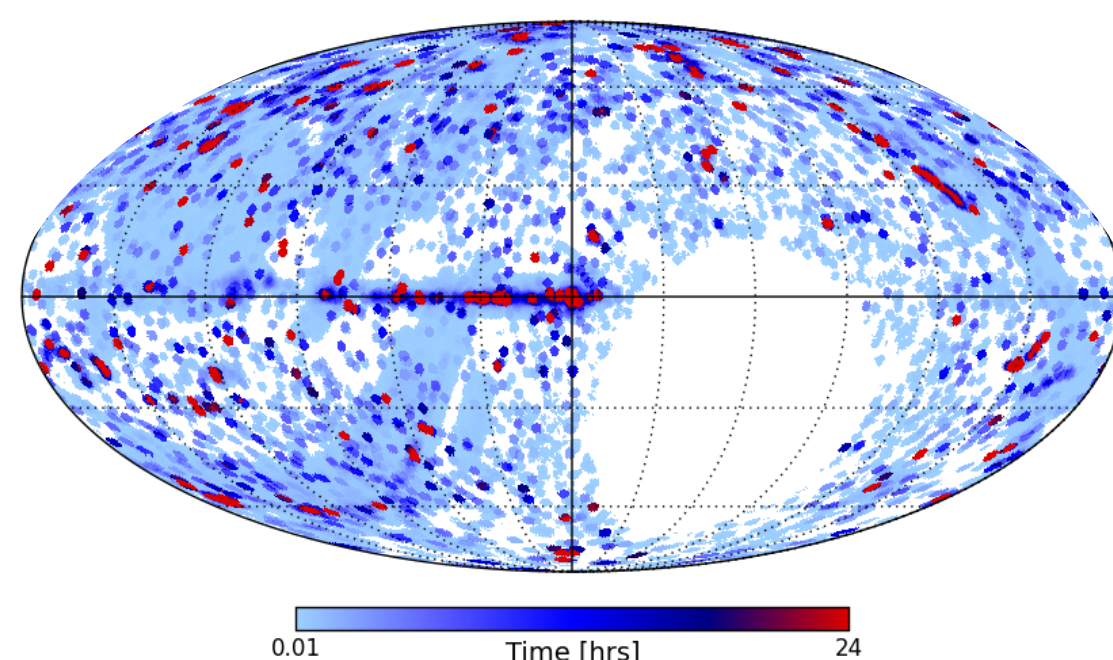
Sky coverage of VLITE after 3.1 years of operations. Approximately 90% of the visible sky at dec > -40° has been observed for 30 seconds or longer.

*For more information on VLITE, please see posters: 354.11, and 354.15*

## VLASS

- The VLA Sky Survey (VLASS; https://science.nrao.edu/science/surveys/vlass ), is an ongoing survey of the entire sky visible to the VLA at a frequency of 2-4 GHz
- Observations started 7 September 2017
- 3 epochs total, 32 months apart
- Sky above dec>-40° is tiled with 10° x 4° observation squares
- Observations are made by continuous "on-the-fly" scanning along lines of constant declination with 7.25' separation
- Data products include: raw data, calibration tables, images and image cubes, and source catalogs
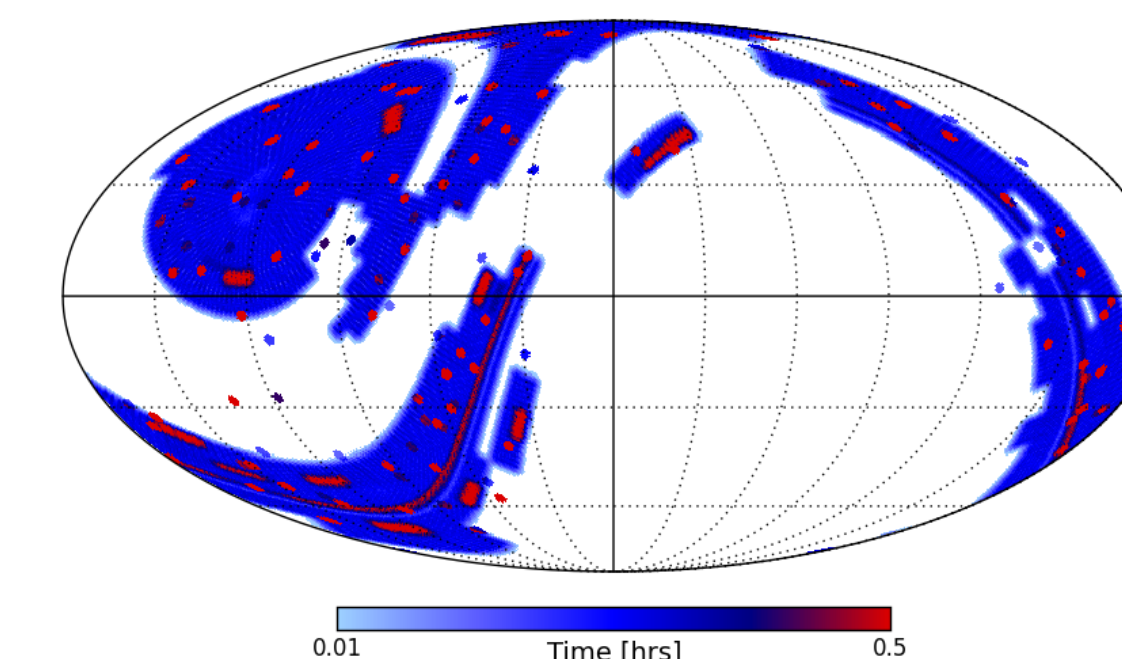
VLASS sky coverage between 9/7/2017 and 1/7/2018; red areas are generally calibrators.

*For more information on VLASS, please see presentations 321.02*

## VCSS

3°
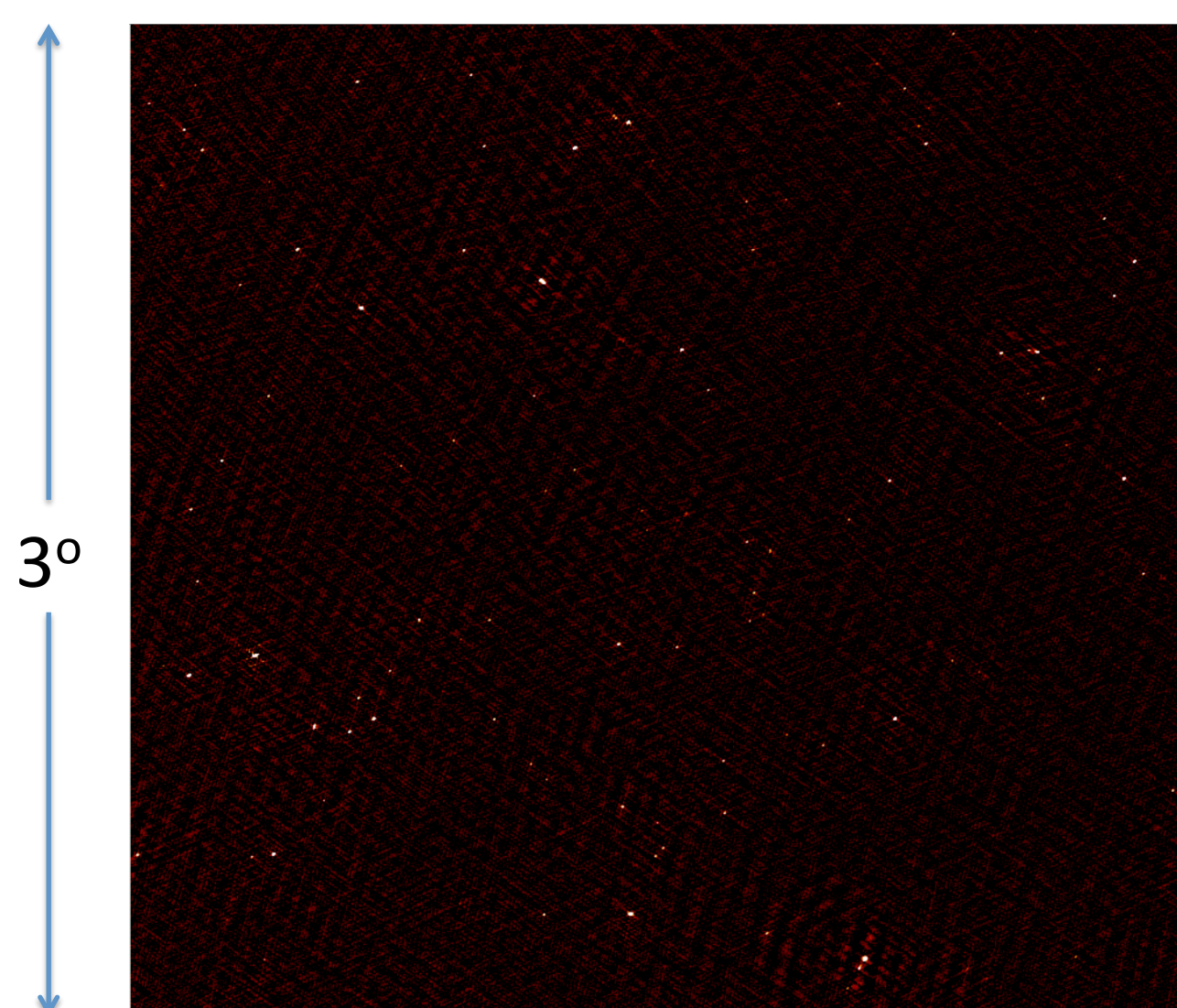
(above) Sample VCSS combined mosaic from an early processing. The has ~20" resolution and ~3 mJy/bm rms, and combines 140 overlapping pointing images. The source density is roughly 10 per sq. degree. (below) Double-double radio galaxy J1835+6204 in the VCSS (left) and VLASS (right); this linear source extends about 4.25'

VCSS    VLASS
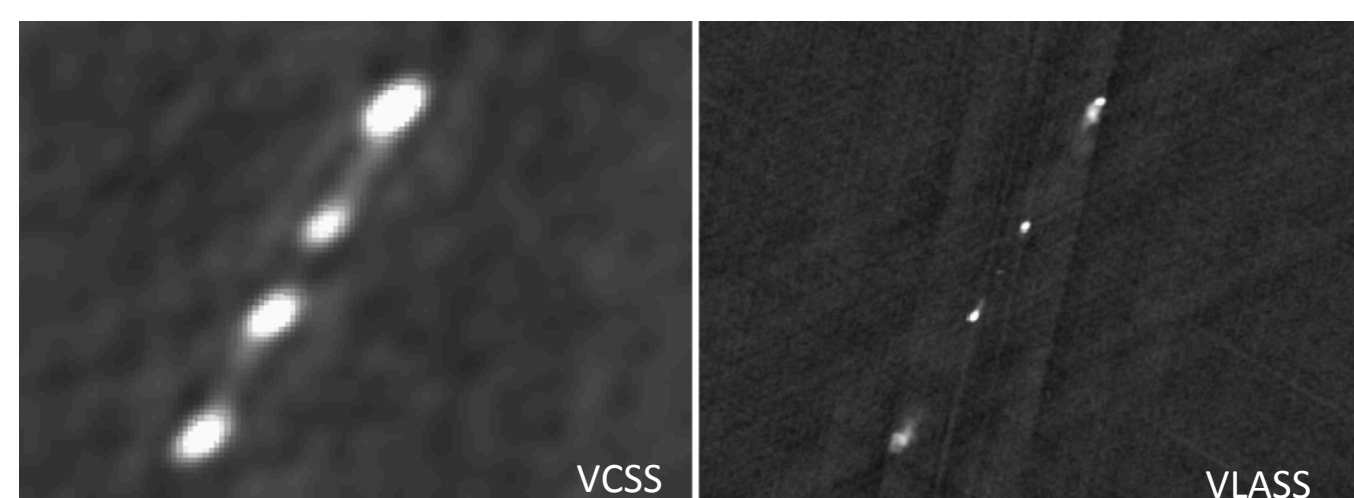
### Observations and Data Reduction

- VLITE breaks the OTF scans into 2-second integrations
- Data are correlated every 1.5° in RA, 7.25' in Dec
- 2° radius FOV - good overlap in RA, huge overlap in declination
- All data for each correlator position is imaged separately, using a common restoring beam for each observation square.
- Images are corrected and weighted by an appropriately elongated primary beam model, and then combined to create a mosaic of the sky.
- All processing performed using dedicated pipelines written in python and using software from Obit and AIPS.

### Quick Facts

- 3° square mosaics
  - 1° overlap,
  - 20" resolution and
  - 3 mJy/bm sensitivity
- 1.75° radius pointing images
  - 10 mJy/bm sensitivity
- 7σ source reliability
- 4 months of data = 570 hrs

4.03688 deg
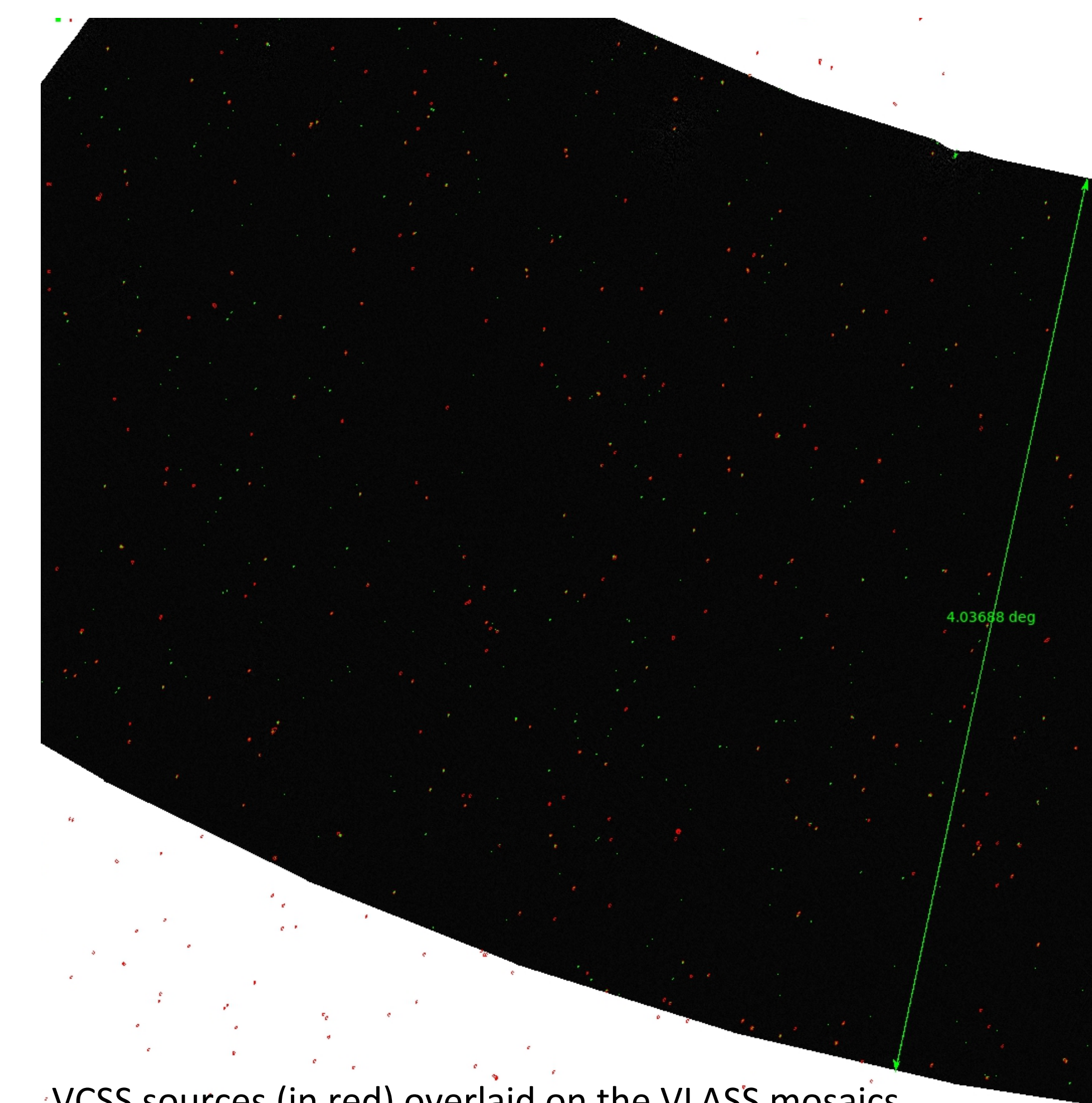
VCSS sources (in red) overlaid on the VLASS mosaics with VLASS sources marked in green for a portion of a high declination 4deg x 10 deg square. All VCSS sources identified at 7σ or higher significance have a VLASS counterpart.

## VCSS Future Work

- Finish first-pass image processing
- Refine primary beam model to be 3 GHz focal position specific using standard VLITE observations
- Create a catalog to provide a 340 MHz sky mode, and for spectral index studies to 3 GHz.
- Search each 24 second pointing image for transients

*Interested in using early VCSS data products? Please contact me! wendy.peters@nrl.navy.mil*
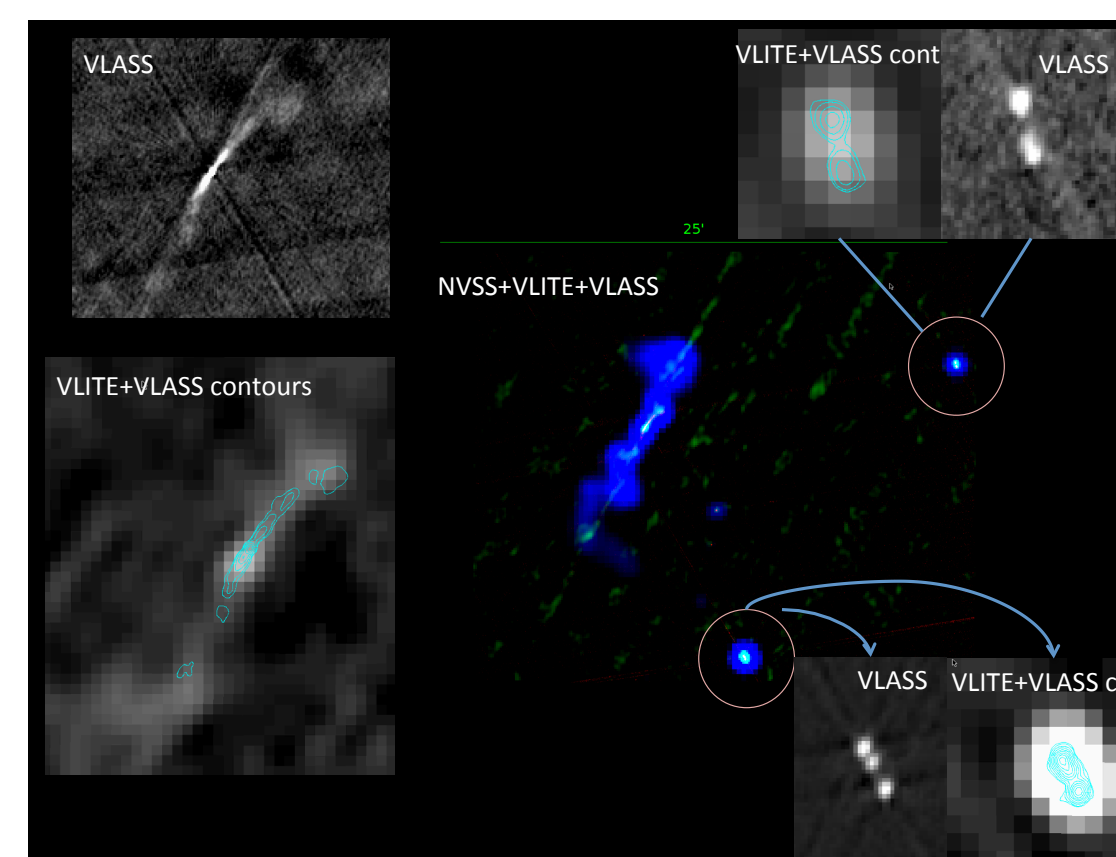
Comparison between VCSS, VLASS, and NVSS in a mosaic field with an extended source. VLASS is in grey-scale, VLITE is contours, and NVSS is blue.

## Funding