

VCLASS Epoch 4

Why Epoch 4?

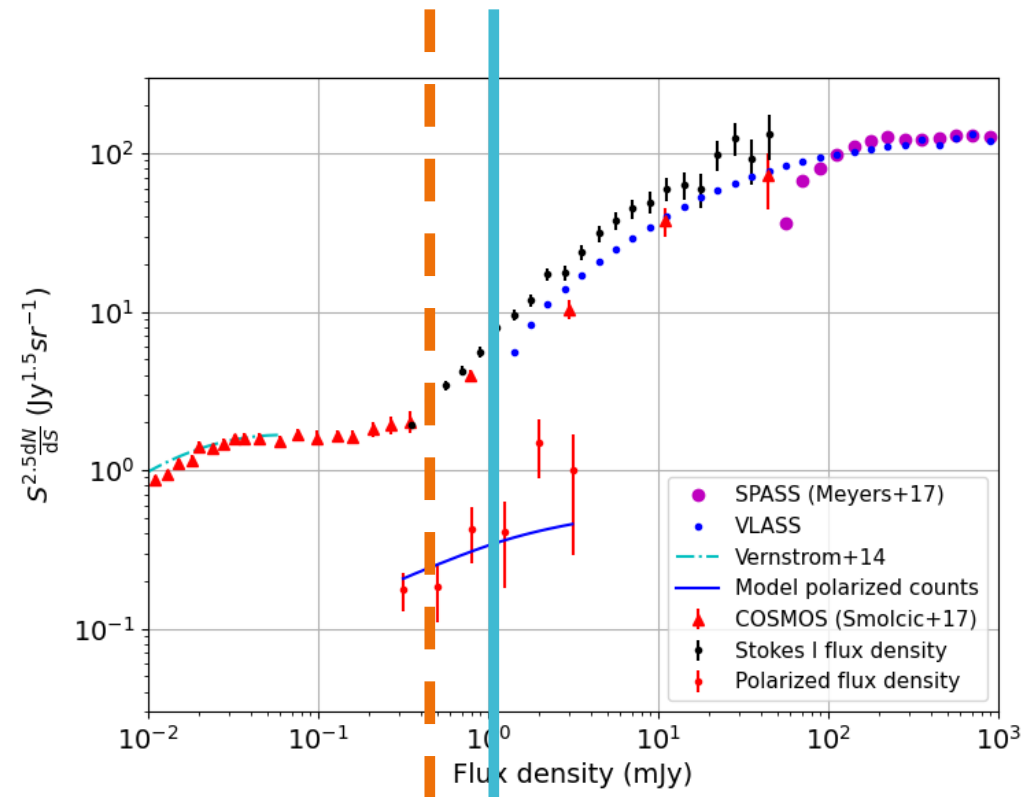
- VLASS was originally designed as a 3-epoch survey
 - ngVLA was expected to start operations mid-2020s
 - Decadal outcome was that optical 20-30m telescopes would go first, followed by ngVLA
 - Pushes ngVLA out, likely to the end of the decade (though optical telescopes also delayed).
- Allows at least one more epoch of VLASS.
 - Would need about 1900hr of array time in addition to the committed ~5600hr for the first three epochs.

Science case: transients

- VLASS has demonstrated important new science on “slow transients”
- Among discoveries:
 - A stellar merger driven supernova (Dong+21)
 - Emergent pulsar wind nebula (Dong+22)
 - AGN that change from radio-quiet to radio-loud on decade timescales (Nyland+20)
 - A dusty tidal disruption event (Somalwar+22)
- All the above used the 20 years between FIRST and VLASS as their time baseline
- Comparison of VLASS Ep1 and Ep2 will undoubtedly lead to more transients, but perhaps dominated by different populations due to the much shorter cadence.
- Epoch 4 will allow us to reduce the gap between the ~5 year time baseline of VLASS and the ~20 year FIRST/NVSS to VLASS baseline.
- VLASS remains unique compared to other surveys in terms of resolution (e.g. for nuclear vs off-nuclear transients) and high frequency (catching the transients earlier).

Other science cases

- Variations in polarimetry remain largely unexplored, a 4th epoch would again allow a longer time baseline.
- Slightly better SNR for faint sources in coadds, especially important as we begin to move into the starburst dominated regime.



Adams+ in prep

Possible implementations

- Continue with the current cadence and observing strategy
- Skip a configuration or two (allows SE products to catch up), then continue.
- Do a *C-configuration* epoch to fill in the short baselines.
- Do a *C-band* survey instead.

Programmatic considerations

- Both VLITE and COSMIC have had issues in 3.1, might be good to have a redo... CIRADA transient marshal not ready for start of Ep3. VLASS1.1 was compromised due to antenna pointing errors.
- Might be too expensive to produce and store > 3 sets of SE products. Would probably only create SE for epochs 2,3 and 4 so we can avoid processing the problematic VLASS1.1 data.
 - Cumulative products could eventually include Epoch 1, but would need aw-project.
 - On-demand processing could include epoch 1, however.
- Would need BnA in the schedule, hence need to be thinking about this now.
- VLASS could be a good transitional project from VLA to ngVLA.

VLASS timeline

VLASS timeline compared to DSA-2000 and ngVLA

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
VLASS	1.1	1.1	1.2	2.1	2.2	2.2	3.1	3.2	4.1	4.2	4.2			
DSA-2000											?	?	?	?
ngVLA												?	?	?

Next steps

- T. Beasley has requested a short prospectus led by the project outlining the case and implications for a 4th epoch (target end of the month).
- If a full proposal is requested by NRAO, the SSG would need to do the bulk of the work writing it.
- We would also seek help to mitigate the impact on the NRAO staff (DAs in particular).
 - Community plan to help with QA algorithms and/or graduate students trained/part funded for QA for example.