

# CHILES VERDES

The Radio Transient Sky at Incomparable Depth  
(An update)

Evangelia Tremou (Michigan State University)

## Team

- C. Hales (NRAO, Socorro),
- A. Stewart (University of Oxford),
- L. Chomiuk (PI, Michigan State University),
- R. Fender, (University of Oxford),
- C. Peters (University of Wisconsin-Madison)

# CHILES : COSMOS HI Large Extragalactic Survey

## VERDES : V<sub>ariable</sub> & E<sub>xplosive</sub> Radio D<sub>ynamic</sub> Evolution Survey

---

- Deep survey for transient and variable objects in the radio sky, searching for explosions, collisions, and disruptions



PI: Jacqueline van Gorkom  
(Columbia)

- 20 cm survey centered at the COSMOS field
- HI properties as function of redshift ( $0 < z < 0.45$ ), galaxy mass, color and location in the large scale structure



PI: Chris Hales (NRAO)

- Full-polarization continuum radio survey
- Nature of intergalactic magnetic fields and their potential origins in the early Universe

Source Class	Expected Number
Type II SN	~10
NS – NS Mergers	0.001–7
NS - BH Mergers	0.003–6
GRB Orphan Afterglows	6
Tidal Disruption Events	12
“Mystery” Transients	15–800

- Deepest survey up to date
- Significant test for future transient surveys

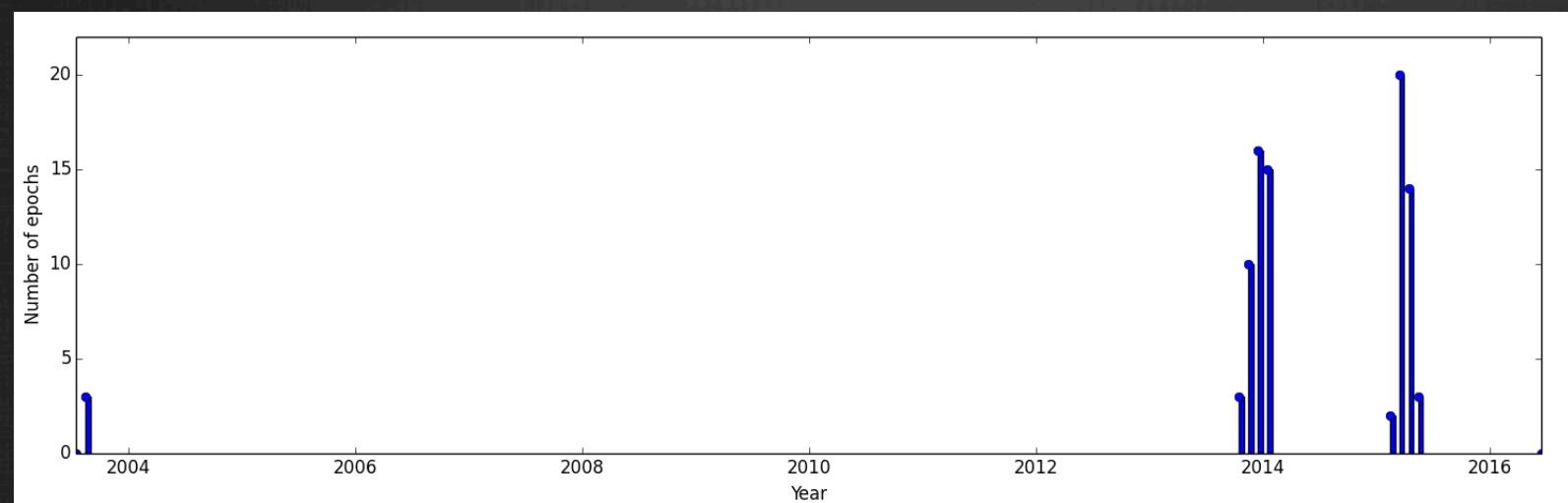
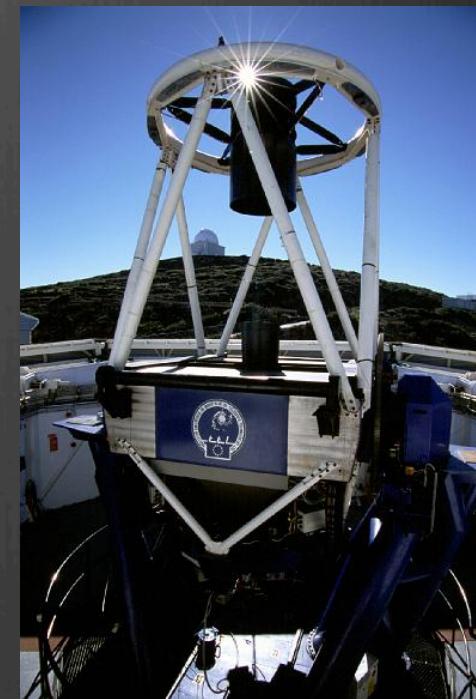


- VLA, B- configuration
- ~1000 hours (2013-2016)
- 4 sub bands, 64 channels, 128MHz bandwidth each
- Full polarization over 512MHz
- Image rms noise  $\sim 0.5\mu\text{Jy}/\text{beam}$ ,
- 4" resolution
- 8 seconds integration time
- One pointing, 0.5 deg in diameter (0.25 sq.deg in area)

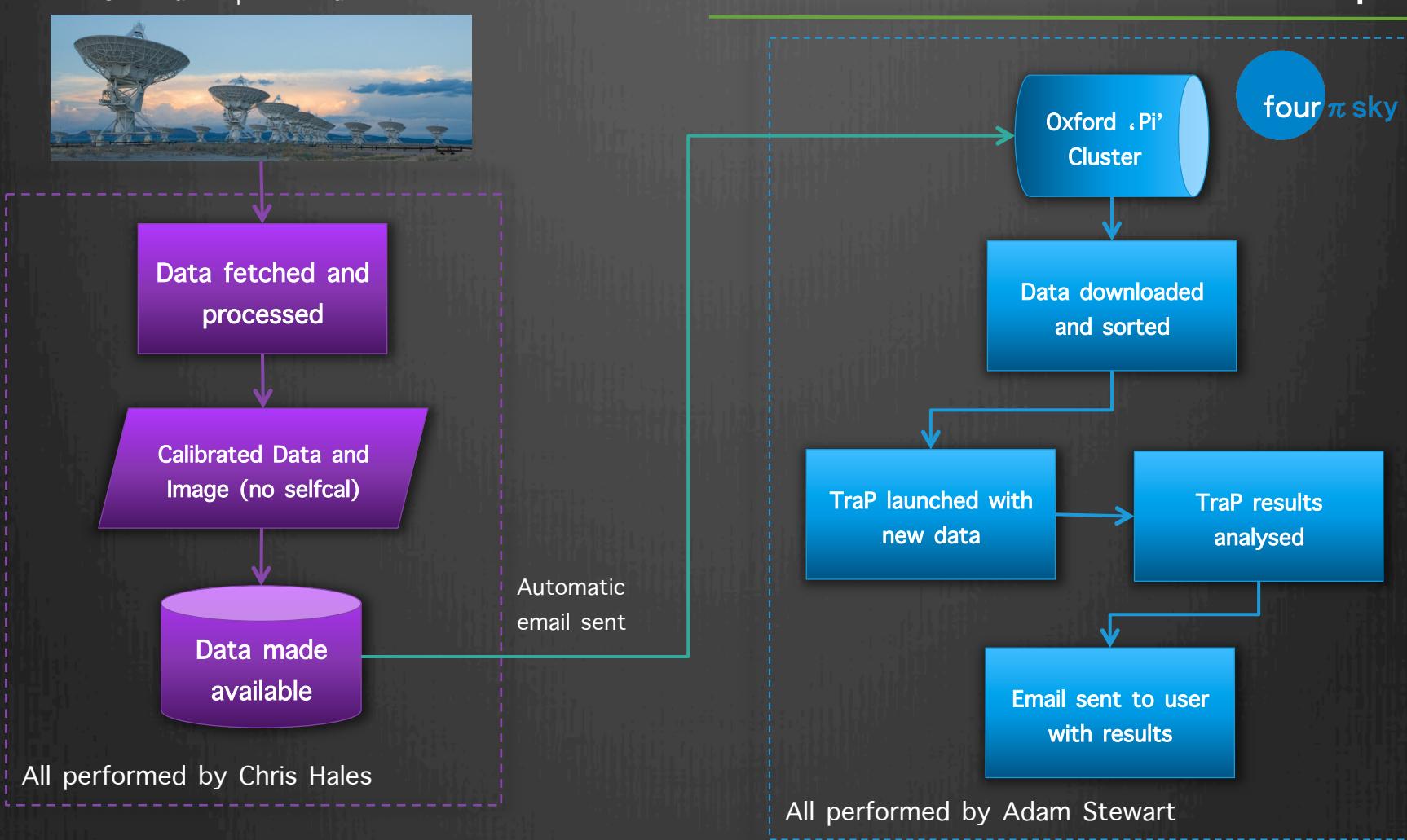
- ✓ Multi-wavelength COSMOS data  
(deep optical imaging for identifying transient hosts)
- ✓ Optical : 2m Liverpool telescope data in r band  
(Thanks to Teo Munoz-Darias for setting up the observations!)

30 epochs were performed on the same day as a radio observation  
145 epochs in total!

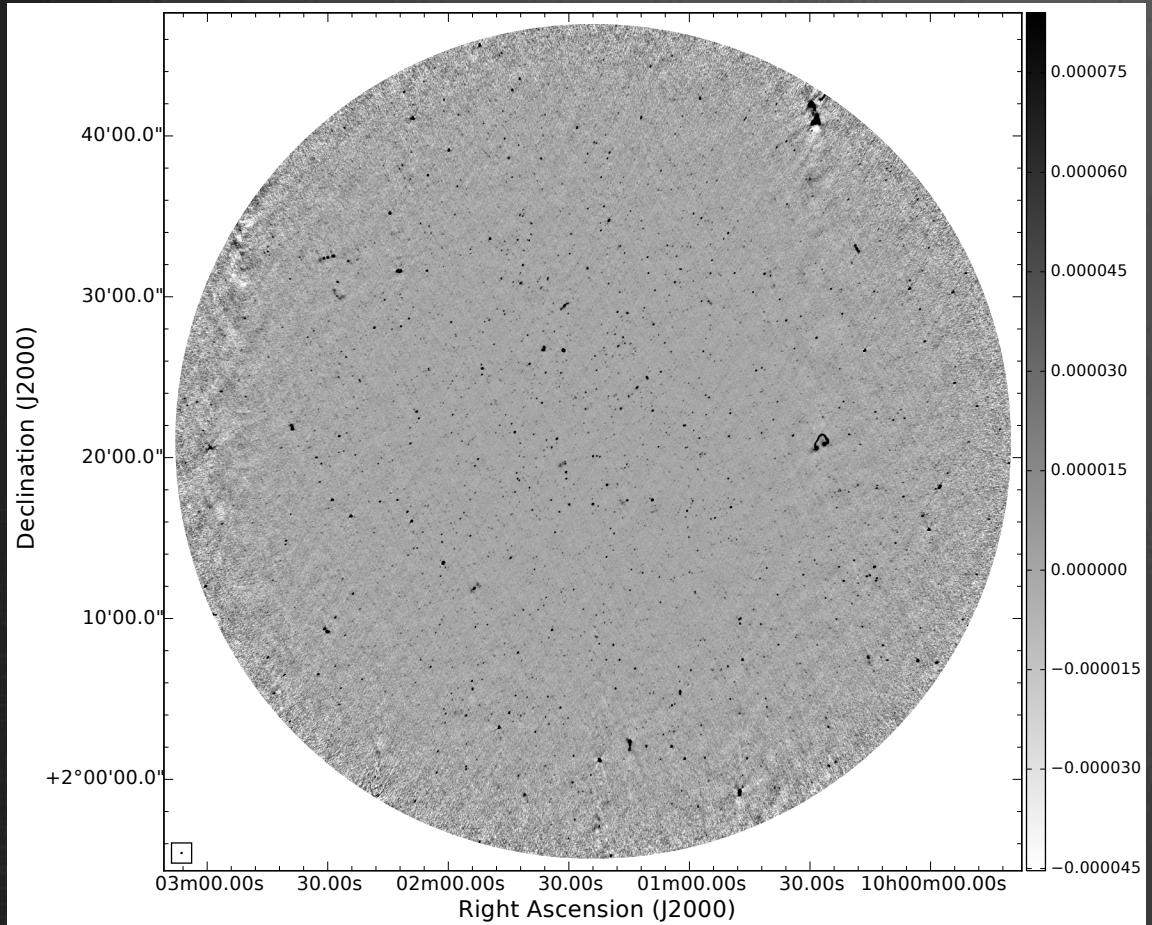
- ✓ Radio : ~ 180 hours VLA data (2013/01~2015/05)
- + Old VLA data



# CHILES 2015 Data Automated Transient Pipeline

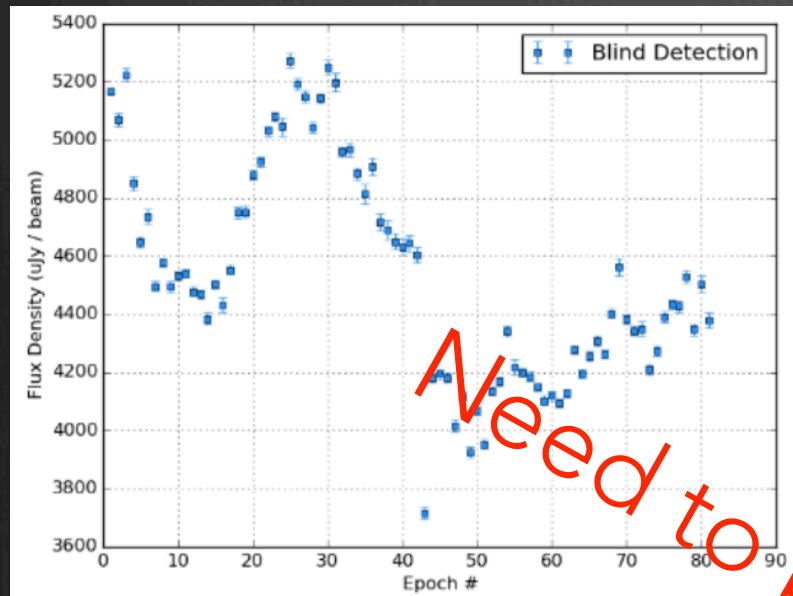


- Aim was to test how quick, and automatic, could an initial transient search be performed with what we had.
- A high threshold is used for this search - to catch transients but minimize false positives.
- Deeper manual search performed offline.
- Hope to iterate on process for future runs.

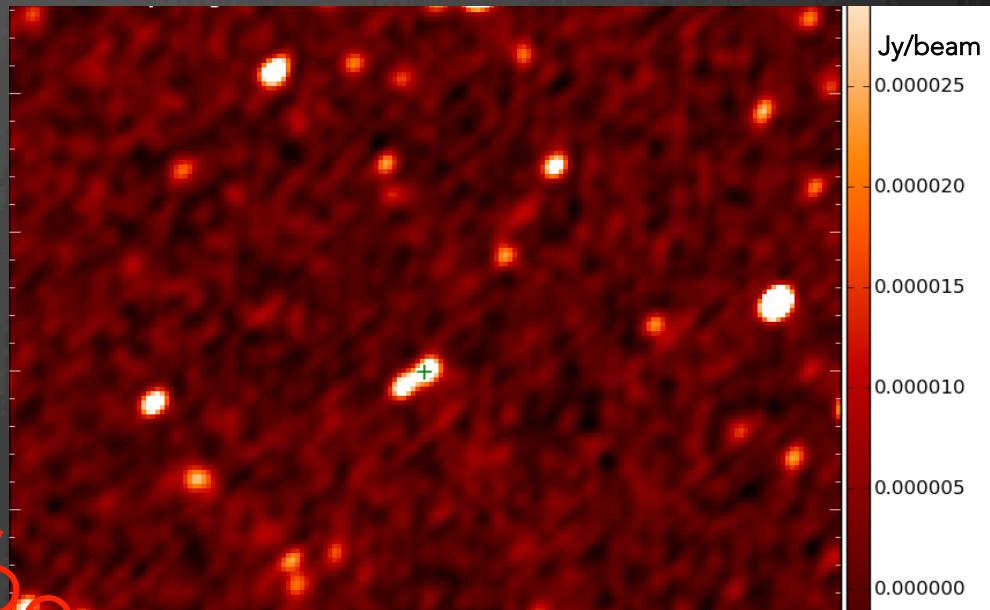


- First test image, 180 hours
- rms =  $\sim 3 \mu\text{Jy}/\text{beam}$
- Better imaging coming soon (self cal)
- CHILES Con Pol DR is planned for early 2016 (PI: Chris Hales)
- Sources down to  $10\mu\text{Jy}$  will be catalogued at greater than 5 sigma

## Variables



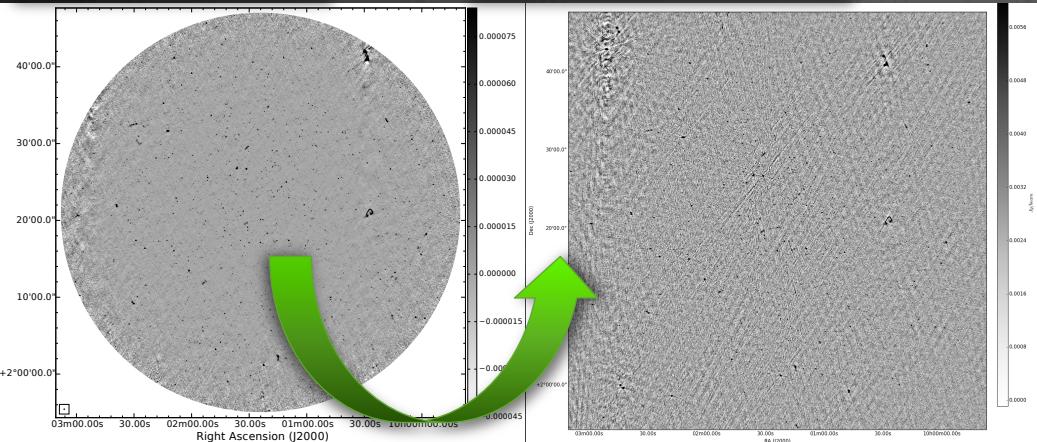
## Transients



Need to be confirmed

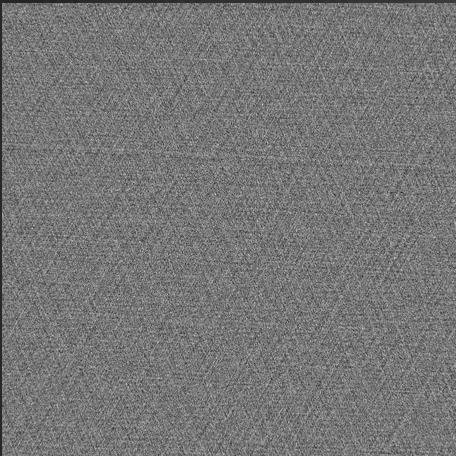
~180 hours  
model image

Calibrated Data and  
Image (no selfcal)



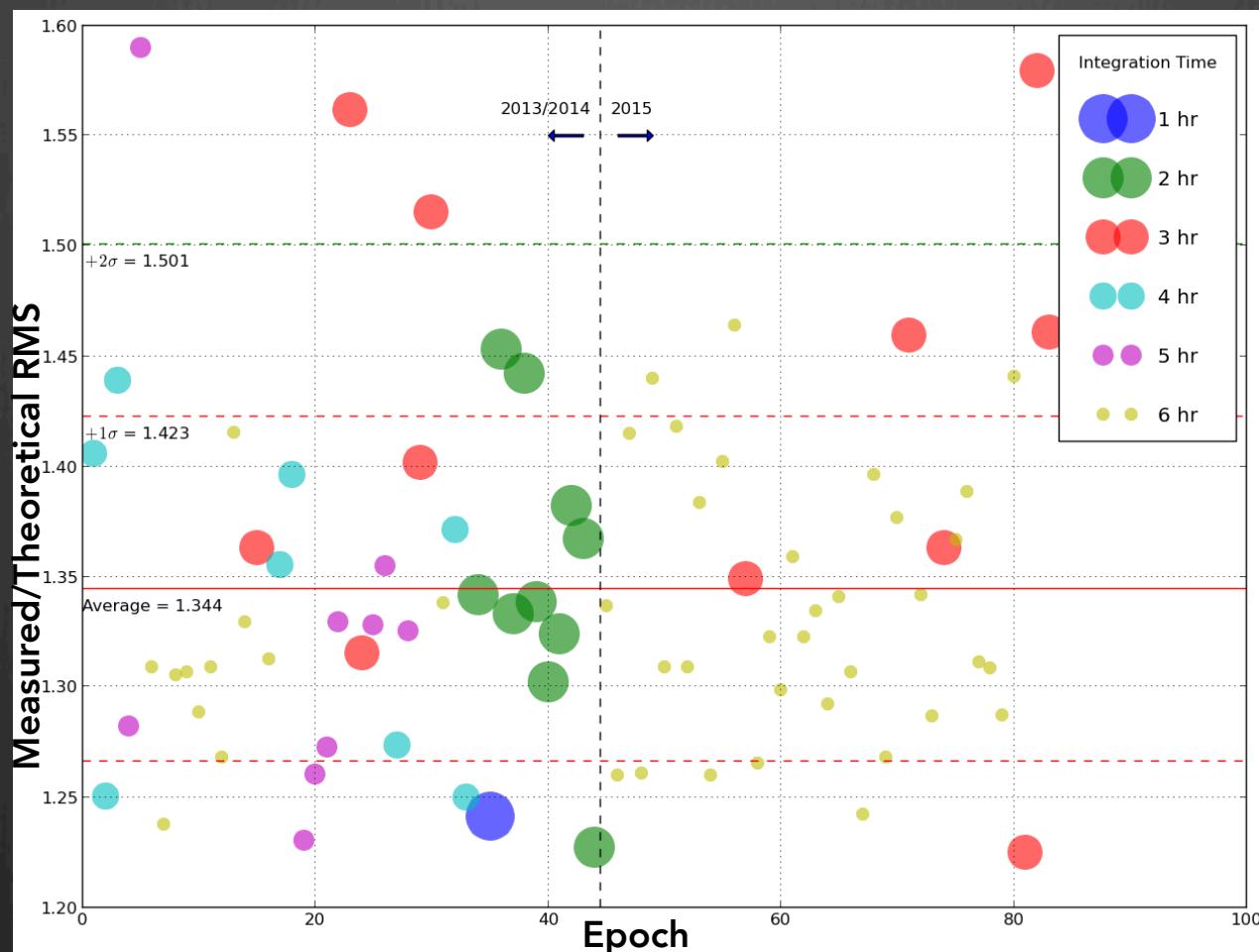
The model

UV subtracted  
(residuals left)



Splitting in short integrations  
(10 sec <timescale< epoch)

Images  
& Statistical  
Analysis



- Identifying “poor” observations
- Only 4 epochs above the  $2\sigma$  line (3, 3hr & 1, 5hr)!
- 3 hours epochs show high distribution

is bright!

- Optical data analysis (2m Liverpool telescope)
- Search on shorter timescales with TraP
- Apply source finding tools  
(AEGEAN, Hancock et al. 2012)
- More data coming, next B - configuration VLA May - October 2016
- Multi-wavelength follow up
- Continuum data release ~ Early 2016

Stay Tuned !