

# Tianlai data processing & Archive Center

## Level 0 (L0) output data (on site)

### ❖ Tianlai 16-Dish Array (T-16DA)

- ▶  $2 \times 16 = 32$  receivers, 1000 freq. channels, 528 visibilities
- ▶  $\sim 4\text{MB/sec}$  visibility data (averaged @ 1 sec. time interval)
- ▶  $350\text{ GB/day}$ ,  $\sim 1500$  files / day (if organized as 1 min time slice files)  $\Rightarrow$  1000-1500 TB L0 data / year

### ❖ Tianlai 3-Cylinder Array (T-3Cyl)

- ▶  $2 \times 3 \times 92 = 192$  receivers, 1000 freq. channels, 18 528 visibilities
- ▶  $\sim 140\text{ MB/sec}$  visibility data (averaged @ 1 sec. time interval)
- ▶  $12\text{ TB/day}$ ,  $\sim 20\,000$  files / day  $\Rightarrow$  35 PB L0 data / year

## Level 0 (L0)

*Visibility data, computed on-site ,  
using dedicated hardware (correlator), or  
by software  
ancillary / housekeeping data*

## Level 1 (L1)

Raw visibility data  
[  $V_{ij}(\nu)$  ]

(L0 output)



- First stage RFI cleaning,
- data quality monitoring
- data compression, mainly through time averaging
- transfer to TAC

Organized, Compressed,  
Time sliced visibility data

(L1 output)

### L1 output data :

- ❖ T-16DA : ~35-70 GB / day , ~1000 files / day , ~100 TB / year
- ❖ T-3Cyl: ~500 GB / day , ~10000 files / day , ~1000 TB / year

Level 2 (L2)

Raw visibility data  
[  $V_{ij}(\nu)$  ]

(L1 output)

(A) RFI cleaning, time  
dependent gain/noise  
monitoring ...

Cleaned / compressed  
visibility data [  $V_{ij}(\nu)$  ]

Cleaned / compressed  
visibility data [  $V_{ij}(\nu)$  ]

(L2-A output)

(B) Calibration on point  
sources

Calibration data (gain, phase)  
Beam,  $T_{sys}$   
Cleaned / calibrated [  $V_{ij}(\nu)$  ]

Calibration data (gain, phase)  
Beam,  $T_{sys}$   
Cleaned / calibrated [  $V_{ij}(\nu)$  ]  
Array configuration

(L2-B output)

(C) Map making

3D sky maps  $I(\alpha, \delta, \nu)$   
Synthesized beams  
noise maps ...

(L2 output)

Level 3 (L3)

(D) Component separation  
Foreground/signal maps  
and power spectrum ...

## L1: NAOC (Beijing)

- L0 output : Visibility data  $V_{ij}(v)$  computed on-line (in HW)
- Organize data sets as time sliced files , grouped with auxiliary (housekeeping) data
- Perform a first step, simple RFI mitigation
- Data compression, mainly through time averaging after RFI cleaning (factor 5-10)
- L1 output data :
  - ▶ T-16DA : 35-50 GB / day, ~1000 files / day , ~100 TB / year
  - ▶ T-3Cyl : ~1000 GB / day, ~10000 files / day , 2-5 PB / year
- Transfer raw data (L1 output) to TAC

# TAC : Tianlai Archive and computing Center Fermilab (Batavia, IL)

- **L2-A:** second stage RFI cleaning, gain/noise monitoring
- **L2-B:** phase/gain calibration
- **L2-C:** 3D map making
- **TAC:**
  - ▶ data organization and data access services
  - ▶ computation resources for L2 ( ~ few x 10 CPU-cores / MB/sec L1 data rate)

# L1,L2 processings

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- ❖ (A) : Cleaning raw visibility data (RFI removal, time dependent gain / Tsys monitoring, data compression (rebinning in time))
- ❖ (B) : Relative gain / phase calibration using single bright point sources - should be then extended to the use of multiple point sources. Will also provide single dish+feed beam response and Tsys
- ❖ (C) : Map making - 3D intensity map reconstruction