

MWAX Modes

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Introduction

This page helps researchers understand the different modes and data rates of the new MWAX Correlator and Voltage Capture System (VCS) at a time when the number of used tiles in the MWA is expanding beyond the original 128T (128 tiles) which has been the standard since science commissioning in 2013. With the advent of new receivers, MWA will incrementally expand the number of tiles (nominally 8 per receiver) over time of Phase 3.

Voltage Capture System (VCS)

VCS Modes

The MWAX VCS system has the following modes:

- MWAX_VCS - This is the standard voltage capture mode where incoming voltages from the receivers are written to disk (each MWAX server writes 1.28 MHz of the 30.72 MHz bandwidth).
- MWAX_BUFFER - In this mode, voltages are captured from receivers, but not written to disk unless triggered to do so by the M&C system (this could be via a VO event trigger or with human intervention).

VCS Data Rates

The below table summarises the Voltage Capture (VCS) data rates with 1.28 MHz channels, 0.781 s critically sampled.

Tiles	1 Channel		24 Channels	
	GB/s	TB/hr	GB/s	TB/hr
128	0.66	2.37	15.83	56.98
136	0.70	2.52	16.82	60.54
144	0.74	2.67	17.81	64.10

Correlator

Correlator Modes

The MWAX Correlator has been designed to be flexible with the frequency and time averaging modes available to researchers. Each mode combines a frequency averaging setting and an time averaging setting.



The MWAX software is flexible and is able to handle all available modes, but is limited by the hardware the software runs on. As a result, for any particular MWA configuration of N tiles, not all modes are able to be run in real time.

Frequency:

Fine Channel Width (kHz)	0.2	0.4	0.8	1.0	1.6	2.0	3.2	4.0	5.0	6.4	8.0	10.0	12.8	16.0	20.0	25.6	32.0	40.0	51.2	64.0	80.0	128.0	160.0	256.0	320.0	640.0	1280.0
Number of fine channels per coarse	6400	3200	1600	1280	800	640	400	320	256	200	160	128	100	80	64	50	40	32	25	20	16	10	8	5	4	2	1

Time:

Integration time (seconds)	0.25	0.50	1.0	2.0	4.0	8.0
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Correlator Data Rates

Legend:

The value in each cell is the total of all data from all coarse channels, in gigabytes, generated in 1 second (GB/s). Multiply by the duration of your observation to get total size of your observation in the mode chosen.

Blue cells	Supported	Modes identical to the legacy correlator
Green cells	Supported	Modes which are new to MWA and which are supported
Orange cells	Unsupported	Modes which take much more than 8 seconds to process 8 seconds of input data, or which generate more than 100 Gbp/s (thus not sustainable), and thus not selectable normally
Yellow cells	Limited support	Modes which take more than 8 seconds to process 8 seconds of input data but can be sustained for a limited duration



Note: when in extended / long baseline configuration, most science cases will require the 10 kHz, 0.5 sec mode at a minimum unless fringe stopping feature is enabled

Data Rates at 144T

cell values = Total data size (GB/s)			Time Resolution (s)					
fscrunch	fine chans per coarse	fine chan width kHz	0.25	0.5	1.0	2.0	4.0	8.0
1	1280	0.2	204.55	102.28	51.14	25.57	12.78	6.39
2	640	0.4	102.28	51.14	25.57	12.78	6.39	3.20
4	320	0.8	51.14	25.57	12.78	6.39	3.20	1.60
5	256	1.0	40.91	20.46	10.23	5.11	2.56	1.28
8	160	1.6	25.57	12.78	6.39	3.20	1.60	0.80
10	128	2.0	20.46	10.23	5.11	2.56	1.28	0.64
16	80	3.2	12.78	6.39	3.20	1.60	0.80	0.40
20	64	4.0	10.23	5.11	2.56	1.28	0.64	0.32
25	51.2	5.0	8.18	4.09	2.05	1.02	0.51	0.26
32	40	6.4	6.39	3.20	1.60	0.80	0.40	0.20
40	32	8.0	5.11	2.56	1.28	0.64	0.32	0.16
50	25.6	10.0	4.09	2.05	1.02	0.51	0.26	0.13
64	20	12.8	3.20	1.60	0.80	0.40	0.20	0.10
80	16	16.0	2.56	1.28	0.64	0.32	0.16	0.08
100	12.8	20.0	2.05	1.02	0.51	0.26	0.13	0.06
128	10	25.6	1.60	0.80	0.40	0.20	0.10	0.05
160	8	32.0	1.28	0.64	0.32	0.16	0.08	0.04
200	6.4	40.0	1.02	0.51	0.26	0.13	0.06	0.03

256	5	51.2	0.80	0.40	0.20	0.10	0.05	0.02
320	4	64.0	0.64	0.32	0.16	0.08	0.04	0.02
400	3.2	80.0	0.51	0.26	0.13	0.06	0.03	0.02
640	2	128.0	0.32	0.16	0.08	0.04	0.02	0.01
800	1.6	160.0	0.26	0.13	0.06	0.03	0.02	0.01
1280	1	256.0	0.16	0.08	0.04	0.02	0.01	<0.01
1600	0.8	320.0	0.13	0.06	0.03	0.02	0.01	<0.01
3200	0.4	640.0	0.06	0.03	0.02	0.01	<0.01	<0.01
6400	0.2	1,280.0	0.03	0.02	0.01	<0.01	<0.01	<0.01

Data Rates at 136T

cell values = Total data size (GB/s)			Time Resolution (s)					
fscrunch	fine chans	fine chan	0.25	0.5	1.0	2.0	4.0	8.0
	per coarse	width kHz						
1	1280	0.2	182.49	91.25	45.62	22.81	11.41	5.70
2	640	0.4	91.25	45.62	22.81	11.41	5.70	2.85
4	320	0.8	45.62	22.81	11.41	5.70	2.85	1.43
5	256	1.0	36.50	18.25	9.12	4.56	2.28	1.14
8	160	1.6	22.81	11.41	5.70	2.85	1.43	0.71
10	128	2.0	18.25	9.12	4.56	2.28	1.14	0.57
16	80	3.2	11.41	5.70	2.85	1.43	0.71	0.36
20	64	4.0	9.12	4.56	2.28	1.14	0.57	0.29
25	51.2	5.0	7.30	3.65	1.82	0.91	0.46	0.23
32	40	6.4	5.70	2.85	1.43	0.71	0.36	0.18
40	32	8.0	4.56	2.28	1.14	0.57	0.29	0.14
50	25.6	10.0	3.65	1.82	0.91	0.46	0.23	0.11
64	20	12.8	2.85	1.43	0.71	0.36	0.18	0.09
80	16	16.0	2.28	1.14	0.57	0.29	0.14	0.07
100	12.8	20.0	1.82	0.91	0.46	0.23	0.11	0.06
128	10	25.6	1.43	0.71	0.36	0.18	0.09	0.04
160	8	32.0	1.14	0.57	0.29	0.14	0.07	0.04
200	6.4	40.0	0.91	0.46	0.23	0.11	0.06	0.03
256	5	51.2	0.71	0.36	0.18	0.09	0.04	0.02
320	4	64.0	0.57	0.29	0.14	0.07	0.04	0.02
400	3.2	80.0	0.46	0.23	0.11	0.06	0.03	0.01
640	2	128.0	0.29	0.14	0.07	0.04	0.02	0.01
800	1.6	160.0	0.23	0.11	0.06	0.03	0.01	0.01
1280	1	256.0	0.14	0.07	0.04	0.02	0.01	<0.01

1600	0.8	320.0	0.11	0.06	0.03	0.01	0.01	<0.01
3200	0.4	640.0	0.06	0.03	0.01	0.01	<0.01	<0.01
6400	0.2	1,280.0	0.03	0.01	0.01	<0.01	<0.01	<0.01

Data Rates at 128T

cell values = Total data size (GB/s)			Time Resolution (s)						
fscrunch	fine chans per coarse	fine chan width kHz	0.25	0.5	1.0	2.0	4.0	8.0	
1	6400	0.2	161.69	80.85	40.42	20.21	10.11	5.05	
2	3200	0.4	80.85	40.42	20.21	10.11	5.05	2.53	
4	1600	0.8	40.42	20.21	10.11	5.05	2.53	1.26	
5	1280	1.0	32.34	16.17	8.08	4.04	2.02	1.01	
8	800	1.6	20.21	10.11	5.05	2.53	1.26	0.63	
10	640	2.0	16.17	8.08	4.04	2.02	1.01	0.51	
16	400	3.2	10.11	5.05	2.53	1.26	0.63	0.32	
20	320	4.0	8.08	4.04	2.02	1.01	0.51	0.25	
25	256	5.0	6.47	3.23	1.62	0.81	0.40	0.20	
32	200	6.4	5.05	2.53	1.26	0.63	0.32	0.16	
40	160	8.0	4.04	2.02	1.01	0.51	0.25	0.13	
50	128	10.0	3.23	1.62	0.81	0.40	0.20	0.10	
64	100	12.8	2.53	1.26	0.63	0.32	0.16	0.08	
80	80	16.0	2.02	1.01	0.51	0.25	0.13	0.06	
100	64	20.0	1.62	0.81	0.40	0.20	0.10	0.05	
128	50	25.6	1.26	0.63	0.32	0.16	0.08	0.04	
160	40	32.0	1.01	0.51	0.25	0.13	0.06	0.03	
200	32	40.0	0.81	0.40	0.20	0.10	0.05	0.03	
256	25	51.2	0.63	0.32	0.16	0.08	0.04	0.02	
320	20	64.0	0.51	0.25	0.13	0.06	0.03	0.02	
400	16	80.0	0.40	0.20	0.10	0.05	0.03	0.01	
640	10	128.0	0.25	0.13	0.06	0.03	0.02	0.01	
800	8	160.0	0.20	0.10	0.05	0.03	0.01	0.01	
1280	5	256.0	0.13	0.06	0.03	0.02	0.01	<0.01	
1600	4	320.0	0.10	0.05	0.03	0.01	0.01	<0.01	
3200	2	640.0	0.05	0.03	0.01	0.01	<0.01	<0.01	
6400	1	1,280.0	0.03	0.01	0.01	<0.01	<0.01	<0.01	