

The University of Manchester

e-MERLIN data set

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Native format

- The native output from the e-MERLIN correlator is FITS-IDI http://www.aips.nrao.edu/FITS-IDI.html
- A single file containing all information, data and tables.
- Traditionally processed using AIPS, working with UVFITS format
- Currently, we import FITS-IDI to MEASUREMENT SET to work in CASA
- In the future, native format will be MS directly

```
[1]: from astropy.io import fits
2]: with fits.open('./LE1006 C 005 20180526 01.fits') as hdul:
        hdul.info()
ename: ./LE1006 C 005 20180526 01.fits
                Type
                          Cards
                                                Format
             GroupsHDU
                             11
                                           0 Groups 0 Parameters
 PRIMARY
                                   ()
 ARRAY GEOMETRY BinTableHDU
                                      6R x 7C [8A, 3D, 3E, 1J, 1J, 3E, 1E]
                                            [1J, 16A, 1J, 4A, 1J, 4E, 4E, 4E, 4E, 4E, 4E, 4E, 1D, 1D, 8A
 SOURCE
             BinTableHDU
                                  5R x 23C
  1D, 4D, 8A, 8A, 4D, 1D, 1D, 1E]
 FREQUENCY
             BinTableHDU
                                            [J, 4D, 4E, 4E, 4J, 4J]
                                   6R x 13C
                                            [1D, 1E, 8A, 1J, 1J, 1J, 1J, 1A, 1E, 2E, 1A, 1E, 2E]
 UV DATA
             BinTableHDU
                                  2037R x 11C
                                                 [1D, 1D, 1D, 1D, 1D, 1J, 1J, 1J, 1E, 16E, 16384E]
                                                 [1D, 1D, 1D, 1D, 1D, 1J, 1J, 1J, 1E, 16E, 16384E]
 UV DATA
                                   2037R x 11C
 UV DATA
             BinTableHDU
                                   2037R x 11C
                                                 [1D, 1D, 1D, 1D, 1D, 1J, 1J, 1J, 1E, 16E, 16384E]
 UV DATA
             BinTableHDU
                                   2037R x 11C
                                                 [1D, 1D, 1D, 1D, 1D, 1J, 1J, 1J, 1E, 16E, 16384E]
 UV DATA
             BinTableHDU
                                   2037R x 11C
                                                 [1D, 1D, 1D, 1D, 1D, 1J, 1J, 1J, 1E, 16E, 16384E]
```

Where is the raw data stored?

- e-MERLIN internal archive
- Only accessible from inside JBO
- Catalog of all projects, sources and configurations observed
- Scriptable. Can export data in batch mode.

But...

- Catalogue and archive not browsable from outside
- Working on a full data archive so data will be accessible (not ready yet).

 End OID ID File Size Start Status Experiment Target Group Frequency Note Ready q2 cycle CBand-Low 24.098 GiB 008 20180318 18 Mar 2018 11:59:02 18 Mar 2018 13:20:56 ePI C 008 20180318 LE1004 0543+2326 008 20180318 18 Mar 2018 12:10:02 18 Mar 2018 13:31:56 ePI C 008 20180318 Ready LE1004 10542+2330 g2 cycle CBand-Low 24.098 GiB 008 20180318 LE1004 0319+415 (3C84) CBand-Low 24.098 GiB 18 Mar 2018 13:56:33 18 Mar 2018 14:26:29 ePI C 008 20180318 Ready C-Band 5GHz 12 C 006 20180318 18 Mar 2018 15:02:28 18 Mar 2018 15:41:57 CY6212 C 006 20180318 Ready CY6212 0319+415 (3C84) 38.268 GiB C-Band 5GHz CY6212 38.268 GiB 12 C 006 20180318 18 Mar 2018 15:42:03 18 Mar 2018 19:36:56 CY6212 C 006 20180318 Ready 0112+3522 (CY6212ref) cycle CY6212 C-Band 5GHz 12 C 006 20180318 18 Mar 2018 15:44:33 18 Mar 2018 19:41:56 CY6212 C 006 20180318 Ready 0109+3543 (CY6212targ) cycle 38.268 GiB 12 C 006 20180318 18 Mar 2018 19:42:03 18 Mar 2018 20:11:56 CY6212 C 006 20180318 Ready CY6212 1331+305 (3C286) C-Band 5GHz 38.268 GiB 12 C 006 20180318 18 Mar 2018 20:12:02 18 Mar 2018 20:34:59 CY6212 C 006 20180318 Ready CY6212 1407+284 (00208) C-Band 5GHz 38.268 GiB 13 C 012 20180318 18 Mar 2018 20:45:12 18 Mar 2018 21:44:56 CY6213 C 012 20180318 Ready CY6213 0319+415 (3C84) C-Band 5GHz 58.312 GiB 13 C 012 20180318 18 Mar 2018 21:45:02 19 Mar 2018 04:43:57 CY6213 C 012 20180318 Ready CY6213 1331+305 (3C286) C-Band 5GHz 58.312 GiB 13 C 012 20180318 18 Mar 2018 22:15:03 19 Mar 2018 05:11:59 CY6213 C 012 20180318 Ready CY6213 1407+284 (00208) C-Band 5GHz 58.312 GiB CY6213 1311-2329 (CY6004ref) C-Band 5GHz 13_C_012_20180318 18 Mar 2018 22:44:02 19 Mar 2018 04:08:26 CY6213_C_012_20180318 Ready cycle 58.312 GiB 13 C 012 20180318 18 Mar 2018 22:46:02 19 Mar 2018 04:11:26 CY6213 C 012 20180318 Ready C-Band 5GHz CY6213 1309-2322 (CY6004targ) cvcle 58.312 GiB 13_C_012_20180318 18 Mar 2018 23:11:32 19 Mar 2018 04:13:56 CY6213_C 012 20180318 Ready CY6213 1259-2310 (CY6004targ2) cycle C-Band 5GHz 58.312 GiB 08 C 009 20180319 19 Mar 2018 05:15:11 19 Mar 2018 05:44:58 DD5008 C 009 20180319 Ready DD5008 1407+284 (00208) C-Band 5GHz 10.365 GiB C-Band 5GHz 08_C_009_20180319 19 Mar 2018 05:45:03 19 Mar 2018 06:14:56 DD5008_C 009 20180319 Ready DD5008 1331+305 (3C286) 10.365 GiB 08 C 009 20180319 19 Mar 2018 06:15:02 19 Mar 2018 06:44:59 DD5008 C 009 20180319 Ready DD5008 1415+1320 (CY4215ref) C-Band 5GHz 10.365 GiB ve 0319+415 19 Mar 2018 09:13:57 19 Mar 2018 17:21:52 Observe 0319+415 0319+415 (3C84) C-Band 5GHz 56.353 GiB Ready 13 C 013 20180319 19 Mar 2018 20:40:12 19 Mar 2018 21:39:58 CY6213 C 013 20180319 Ready CY6213 0319+415 (3C84) C-Band 5GHz 58.292 GiB 13 C 013 20180319 19 Mar 2018 21:40:03 20 Mar 2018 04:38:56 CY6213 C 013 20180319 Ready CY6213 1331+305 (3C286) C-Band 5GHz 58.292 GiB 13 C 013 20180319 19 Mar 2018 22:10:02 20 Mar 2018 05:06:59 CY6213 C 013 20180319 Ready CY6213 1407+284 (00208) C-Band 5GHz 58.292 GiB 13 C 013 20180319 19 Mar 2018 22:39:03 20 Mar 2018 04:03:27 CY6213 C 013 20180319 Ready CY6213 1311-2329 (CY6004ref) cycle C-Band 5GHz 58.292 GiB 1309-2322 (CY6004targ) cycle C-Band 5GHz 13 C 013 20180319 19 Mar 2018 22:41:03 20 Mar 2018 04:06:27 CY6213 C 013 20180319 Ready CY6213 58.292 GiB C-Band 5GHz 13 C 013 20180319 19 Mar 2018 23:06:33 20 Mar 2018 04:08:56 CY6213 C 013 20180319 Ready CY6213 1259-2310 (CY6004targ2) cvcle 58.292 GiB Filters Sub-array job data Type -ID name number Start time 18 03 2018 End time 20 03 2018 Data status Any OID ID name number Experiment ID number type Any Group ID number Source name -Frequency ID Receiver ID Note Find Yesterday's Entries Find Today's Entries Find Entries Data Manager Entry Data Location Edit New Export Data Ouick Export Location

Help

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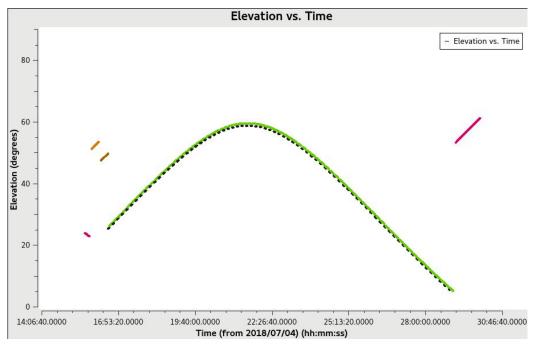
Data Finder

Typical data set: sources

- Sources observed: science target, phase calibrator, standard calibrators
- Observations in phase-reference mode
 - Target/phase reference calibrator cycles
 - Usually 2-3 minutes on phasecal and 6-10 minutes on target
- Standard calibrators:
 - 3C286 (1331+305): Flux scale calibrator/pol angle calibrator
 - OQ208 (1407+284): Bandpass calibrator
 - 3C84 (0319+415): bandpass/ leakage calibrator, check in general (very bright)

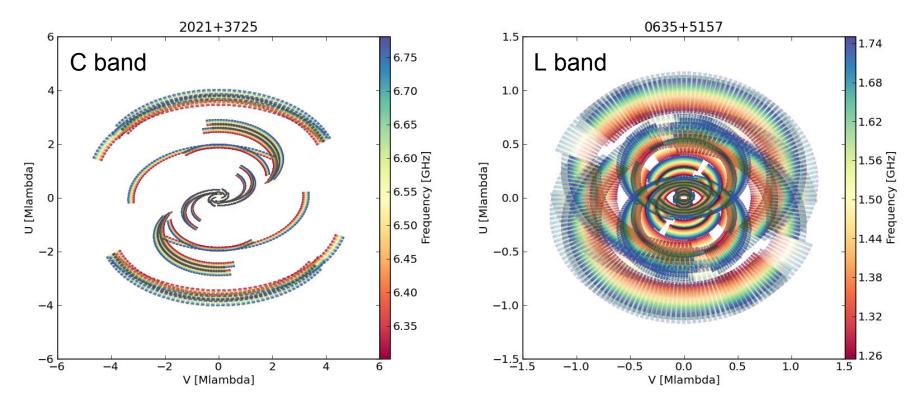
Typical data set: schedule

- Usually 100+ scans on target and phasecal
- 1 or 2 long scans on each standard calibrator



Typical data set: uv-coverage

- Long observations for image fidelity



Listobs - header and scan information

> listobs(vis='msfilename', listfile='myproject.listobs.txt')

MeasurementSet Name: /mirr	or2/sc	ratch/jmoldon/emerlin/L0631,	/L0631.ms	MS Version 2
Observer: Gravitational Lensing Observation: e-MERLIN Data records: 20055392 Total ela Observed from 05-Feb-2015/19:02:1	psed t	ct: Gravitat ime = 89866 seconds to 06-Feb-2015/19:59:59.5	(итс)	
ObservationID = 0 ArrayID =	0			
Date Timerange (UTC)	Scan	FldId FieldName	nRows	SpwIds Average Interval(s) ScanIntent
05-Feb-2015/19:02:13.5 - 19:05:01.5	1	2 0631+5311	37632	
19:05:04.5 - 19:12:00.5	2	1 0635+5157	93632	
19:12:04.5 - 19:15:00.5	3	2 0631+5311	39872	
19:15:03.5 - 19:22:00.5	4	1 0635+5157	93856	
19:22:03.5 - 19:25:00.5	5	2 0631+5311	40096	[0,1,2,3,4,5,6,7] [0.989, 0.989, 0.989, 0.989, 0.989,
19:25:03.5 - 19:32:00.5	6	1 0635+5157	93856	[0,1,2,3,4,5,6,7] [0.995, 0.995, 0.995, 0.995, 0.995,
19:32:03.5 - 19:35:00.5	7	2 0631+5311	40096	[0,1,2,3,4,5,6,7] [0.989, 0.989, 0.989, 0.989, 0.989,
19:35:03.5 - 19:42:00.5	8	1 0635+5157	93856	
19:42:03.5 - 19:45:00.5	9	2 0631+5311	40096	
19:45:03.5 - 19:52:00.5	10	1 0635+5157	93856	[0,1,2,3,4,5,6,7] [0.995, 0.995, 0.995, 0.995, 0.995,
19:52:03.5 - 19:55:00.5	11	2 0631+5311	40096	
19:55:03.5 - 20:02:00.5	12	1 0635+5157	93856	
20:02:03.5 - 20:05:00.5	13	2 0631+5311	40096	
20:05:03.5 - 20:12:00.5	14	1 0635+5157	93856	[0,1,2,3,4,5,6,7] [0.995, 0.995, 0.995, 0.995, 0.995,

0.995, 0.995, 0.995] 0.989, 0.989, 0.989] 0.995, 0.995, 0.995] 0.995, 0.995, 0.995] 0.995, 0.995, 0.995] 0.989, 0.989, 0.989] 0.995, 0.995, 0.995] 0.989, 0.989, 0.989] 0.995, 0.995, 0.995] 0.989, 0.989, 0.989] 0.995, 0.995, 0.995] 0.989, 0.989, 0.989] 0.995, 0.995, 0.995] 0.989, 0.989, 0.989] 0.995, 0.995, 0.995] 0.989, 0.989, 0.989]

listobs - source information

- Source id number
- Source name _
- Field phase center (source position) -
- Number of rows (visibilities)

Fields	: 5				
ID	Code Name	RA	Decl	Epoch	nRows
0	ACAL 1331+305	13:31:08.287300	+30.30.32.95900	J2000	806176
1	0635+5157	06:35:12.310000	+51.57.01.80000	J2000	12099136
2	0631+5311	06:31:34.685968	+53.11.27.75692	J2000	5161184
3	1407+284	14:07:00.394410	+28.27.14.68990	J2000	806400
4	0319+415	03:19:48.160110	+41.30.42.10330	J2000	1182496

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listobs - frequency information

- Number of spw
 - There can be continuum + spectral line data
- Observed frequency
- Number of channels
- Channel width and total bandwidth

Spectral	Window	s: (8 u	nique sp	ectral wind	ows and 1 uniq	ue polarizat	tion setups)				
SpwID	Name	#Chans	Frame	Ch0(MHz)	ChanWid(kHz)	TotBW(kHz)	CtrFreq(MHz)	Co	rrs		
0	none	512	TOPO	1254.462	125.000	64000.0	1286.3995	RR	RL	LR	LL
1	none	512	TOPO	1318.462	125.000	64000.0	1350.3995	RR	RL	LR	LL
2	none	512	TOPO	1382.462	125.000	64000.0	1414.3995	RR	RL	LR	LL
3	none	512	TOPO	1446.462	125.000	64000.0	1478.3995	RR	RL	LR	LL
4	none	512	TOPO	1510.462	125.000	64000.0	1542.3995	RR	RL	LR	LL
5	none	512	TOPO	1574.462	125.000	64000.0	1606.3995	RR	RL	LR	LL
6	none	512	TOPO	1638.462	125.000	64000.0	1670.3995	RR	RL	LR	LL
7	none	512	TOPO	1702.462	125.000	64000.0	1734.3995	RR	RL	LR	LL

listobs - antenna information

- List of antennas
- Antenna names

Antennas: 7	/ ·
Antennas, A	

ID	Name	Station	Diam.	Long.	Lat.	Offset fro	om array center	(m)	ITRF Geoc	entric coordinat	es (m)
				50		East	North	Elevation	х	у	Z
0	Lo	e-MERLIN	:0176.0 m	-002.18.25.8	+53.03.07.9	19400.8559	21183.6803	6369.1778	3822252.643000	-153995.683000	5086051.443000
1	Mk2	e-MERLIN	:0224.0 m	-002.18.08.9	+53.02.58.7	19713.9103	20897.1596	6334.4681	3822473.365000	-153692.318000	5085851.303000
2	Kn	e-MERLIN	:0525.0 m	-002.59.44.9	+52.36.18.4	-26733.5549	-28428.6831	6480.6814	3859711.503000	-201995.077000	5056134.251000
3	De	e-MERLIN	:0625.0 m	-002.08.35.0	+51.54.50.9	30394.6148	-105100.8391	6688.6339	3923069.171000	-146804.368000	5009320.528000
4	Pi	e-MERLIN	:0725.0 m	-002.26.38.3	+53.06.16.2	10235.7831	26985.6080	6271.3637	3817176.561000	-162921.179000	5089462.057000
5	Da	e-MERLIN	:0825.0 m	-002.32.03.3	+52.58.18.5	4186.5058	12262.8833	6330.1699	3828714.513000	-169458.995000	5080647.749000
6	Cm	e-MERLIN	:0932.0 m	+000.02.19.5	+51.58.50.2	176561.6720	-97724.9405	6660.8614	3919982.752000	2651.982000	5013849.826000

casabrowser

20180705_av	vg.ms	*	/ Juli 🦉											
vw	5													
	FLAG													
710 E FA -		_AG_CATEGOF	WEIGHT	SIGMA	ANTENNA1	ANTENNA2	ARRAY_ID	DATA_DESC_IE	EXPOSURE	FEED1	FEED2	FIELD_ID	FLAG_ROW	I
1.9, 5 [4, .	128] Boo	[0, 0, 0] Boo	[5.1743e-06	[0.25, 0.25,	0	1	0	0	4	0	0	4	0	4
905, 5 [4, 2	128] Boo	[0, 0, 0] Boo	[0.0006270	[0.25, 0.25,	0	2	0	0	4	0	0	4	0	4
.93, 3 [4, 2	128] Boo	[0, 0, 0] Boo	[1.99357e-0	[0.25, 0.25,	0	3	0	0	4	0	0	4	0	4
9.78, 1 [4, 2	128] Boo	[0, 0, 0] Boo	[16, 16, 16,	[0.25, 0.25,	0	4	0	0	4	0	0	4	0	4
588, [4, 2	128] Boo	[0, 0, 0] Boo	[0.0033846	[0.25, 0.25,	0	5	0	0	4	0	0	4	0	4
33.1, 2 [4, 2	128] Boo	[0, 0, 0] Boo	[2.02786e-1	[0.25, 0.25,	1	2	0	0	4	0	0	4	0	4
0.8, -5 [4, 2	128] Boo	[0, 0, 0] Boo	[6.4471e-13	[0.25, 0.25,	1	3	0	0	4	0	0	4	0	4
2.1, -4 [4, 2	128] Boo	[0, 0, 0] Boo	[5.1743e-06	[0.25, 0.25,	1	4	0	0	4	0	0	4	0	4
15.9, [4, 2	128] Boo	[0, 0, 0] Boo	[1.09457e-0	[0.25, 0.25,	1	5	0	0	4	0	0	4	0	4
34, -5 [4, 2	128] Boo	[0, 0, 0] Boo	[7.81302e-1	[0.25, 0.25,	2	3	0	0	4	0	0	4	0	4
5.3, -4 [4, 2	128] Boo	[0, 0, 0] Boo	[0.0006270	[0.25, 0.25,	2	4	0	0	4	0	0	4	0	4
32.7, [4, 2	128] Boo	[0, 0, 0] Boo	[1.32648e-0	[0.25, 0.25,	2	5	0	0	4	0	0	4	0	4
98.7, 1 [4, 3	128] Boo	[0, 0, 0] Boo	[1.99357e-0	[0.25, 0.25,	3	4	0	0	4	0	0	4	0	4
717, [4, 2	128] Boo	[0, 0, 0] Boo	[4.21721e-1	[0.25, 0.25,	3	5	0	0	4	0	0	4	0	4
318, [4, 2	128] Boo	[0, 0, 0] Boo	[0.0033846	[0.25, 0.25,	4	5	0	0	4	0	0	4	0	4
36.9, 5 [4, 3	128] Boo	[0, 0, 0] Boo	[5.1743e-06	[0.25, 0.25,	0	1	0	0	4	0	0	4	0	4
906, 5 [4, 2	128] Boo	[0, 0, 0] Boo	[0.0006270	[0.25, 0.25,	0	2	0	0	4	0	0	4	0	4
.39, 3 [4, 2	128] Boo	[0, 0, 0] Boo	[1.99357e-0	[0.25, 0.25,	0	3	0	0	4	0	0	4	0	4
4.53, 1 [4, 2	128] Boo	[0, 0, 0] Boo	[16, 16, 16,	[0.25, 0.25,	0	4	0	0	4	0	0	4	0	4
545, [4, 2	128] Boo	[0, 0, 0] Boo	[0.0033846	[0.25, 0.25,	0	5	0	0	4	0	0	4	0	4
- A (1997)												10		1.11
	7.78, 1 [4, 8.88, [4, 3.31, 2 [4, 0.8, -5 [4, 2.1, -4 [4, 12, 1., -4 [4, 15, 9, -5 [4, 3.4, -5 [4, 3.4, -5 [4, 3.4, -5 [4, 3.2, 7 [4, 3.4, -5 [4, 3.4, -5 [4, 3.4, -5 [4, 3.4, -5 [4, 3.4, -7 [4, 3.1, 1 [4, 3.1, 1 [4, 3.1, 3.1, 1 [4, 3.1, 3.1, 1 [4,	7.78,1 [4, 128] Boo 8.78,1 [4, 128] Boo 1.88, [4, 128] Boo 3.1,2 [4, 128] Boo 3.1,2 [4, 128] Boo 3.1,2 [4, 128] Boo 2.1,-4 [4, 128] Boo [5,5,-5 [4, 128] Boo [5,7,-5 [4, 128] Boo [34, -5 [4, 128] Boo [35, -6 [4, 128] Boo [36, -5 [4, 128] Boo [37, -5 [4, 128] Boo [39, -5 [4, 128] Boo	7.78,1 [4, 128] Boo [0, 0, 0] Boo 8.8, [4, 128] Boo [0, 0, 0] Boo 3.1, 2 [4, 128] Boo [0, 0, 0] Boo 3.1, 2 [4, 128] Boo [0, 0, 0] Boo 3.1, 2 [4, 128] Boo [0, 0, 0] Boo 3.1, 2 [4, 128] Boo [0, 0, 0] Boo 2.1, 4 [4, 128] Boo [0, 0, 0] Boo 5.7, 4 [4, 128] Boo [0, 0, 0] Boo 3.4, -5 [4, 128] Boo [0, 0, 0] Boo 3.4, -5 [4, 128] Boo [0, 0, 0] Boo 3.4, -5 [4, 128] Boo [0, 0, 0] Boo 3.7, -7 [4, 128] Boo [0, 0, 0] Boo 3.7, -7 [4, 128] Boo [0, 0, 0] Boo 3.7, -7 [4, 128] Boo [0, 0, 0] Boo 3.7, -7 [4, 128] Boo [0, 0, 0] Boo 3.8, [4, 128] Boo [0, 0, 0] Boo 3.8, [4, 128] Boo [0, 0, 0] Boo 3.9, [1	N.R. 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[4, 128] Boo [0, 0, 0] Boo [16, 16, 16, [0.25, 0.25, 0 4 8.8 [4, 128] Boo [0, 0, 0] Boo [2.02786e-1 [0.25, 0.25, 0 5 3.3</td><td>A7.8 I A128 Boo IO. 0, O Boo IO. 16, 16, 16, IO. 25, 0.25, O 4 O 88.8 </td><td>Array Lange Array Lange</td><td>Array of the series Functional functinal functinal functional functional functional functinal functiona</td><td>Array 1 Label one <thlabel one<="" th=""> <thlabel one<="" th=""> <thlab< td=""><td>Array [Arbitron [Arbitr</td><td>Array Land (A. 128] BoonExtended (A. 16.16)Extended (A. 16.16)Extended<</td><td>Arrow Arrow <th< td=""></th<></td></thlab<></thlabel></thlabel></td></t<>	93.3 [4.128] Boon [0.0,0] Boon [1.99357e-0n] [0.25,0.25,] [0 7.78, [4.128] Boon [0,0,0] Boon [16,16,1] [0.25,0.25,] [0 688, [4.128] Boon [0,0,0] Boon [0.033846] [0.52,0.25,] [0 631, [4.128] Boon [0,0,0] Boon [2.0786e1] [0.52,0.25,] [1 7.8, [4.128] Boon [0,0,0] Boon [2.0786e1] [0.52,0.25,] [1 7.8, [4.128] Boon [0,0,0] Boon [5.1743e0] [0.52,0.25,] [1 7.4, [4.128] Boon [0,0,0] Boon [1.09457e-0] [0.25,0.25,] [1 5.3, [4.128] Boon [0,0,0] Boon [1.09457e-0] [0.25,0.25,] [2 6.3, [4.128] Boon [0,0,0] Boon [1.09457e-0] [0.25,0.25,] [2 6.3, [4.128] Boon [0,0,0] Boon [1.09457e-0] [0.25,0.25,] [2 6.3, [4.128] Boon [0,0,0] Boon [1.32648e-0] [0.25,0.25,]	A7.8.1. 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