

ALMA Offline Requirements - Priority 1's only

NAME:

Offline Testers for TST1.1: Please review the requirements list. If possible replace '1' in 'Test 1.1' column with a grade based on your testing experience. Grade on functionality *only*, not useability.
 Grades: **A** = adequate, **E** = enhancement desired, **I** = inadequate, **U** = unable to evaluate
 If grade=**E** or **I**, please comment on why.
First audit and user test 1 grades are shown for reference

Sect.	Req. No.	Severity	Requirement description	1st Audit Grade	Test 1 Grade	Test 1.1 Grade	Comments
1.1			General Rqmts & relation to the Pipeline				
1.1	R1		An offline data processing pkg must fulfill the rqmts in this document	A			
1.1	R2		All std obs modes supported by ALMA must be processable by the pkg.	U			
1.1	R3		Pkg shall be installable at users inst and available at ALMA centers	U	A	1	
1.1	R4		Pkg performance shall be benchmarked and meet ALMA rqmts	U			
1.2			Operational Issues				
1.2	R1		Installation of pkg shall be easy	A	A	1	
1.2	R2.1	Low	Error reporting messages shall be written for end users, not programmers.	Inadequate	I	1	
1.2	R2.2		Must be provision for job ctrl (interrupt & abort)	A	I	1	
1.2	R3.1	Med	Logging of commands and user inputs shall be provided	Inadequate	A/E	1	
1.2	R3.2		Logging of tool results shall be provided (errors, files written, timing)	A	A/E	1	
1.2	R4		There shall be comprehensive handling of multi users/tasking	A			
1.2	R5		There shall be support for the pkg (bug fixes done according to priority)	U	A	1	
1.2	R6		Improvements & updates based on user feedback shall be done	A	A	1	
2.1			General User Interface Rqmts				
2.1	R1.1		A command line interface (CLI) shall be provided	A	A		
2.1	R1.2		A GUI shall be provided - GUI actions shall be scripted	A			
2.1	R2		The user shall be able to run host operating system commands (ls, rm)	A	A/E	1	
2.1	R3		Multi-tasking for all interfaces shall be available where appropriate	A			
2.2			Graphical User Interface (GUI)				
2.2	R1.1		GUI window updating must be fast (less than 0.1s)	U			
2.2	R1.2	low	Windows shall not take up excessive screen space (<=800x800 pixels)	Inadequate			
2.2	R2		It must be easy to run GUIs remotely	A			
2.3			Command Line Interface (CLI)				
2.3	R1		Command files for batch CLI processing shall be possible	A	A		
2.3	R2		The CLI shall have command-line recall & editing w/ name completion	A/E	A/E	1	
2.3	R3		All GUI functionality must be available in CLI mode	A			
2.4			Interface programming, parameter passing & feedback				
2.4	R1.1		The UI must have variable assignment & evaluation	A			
2.4	R1.2		The UI must have array handling	A			
2.4	R1.3		The UI must have conditional statements	A			
2.4	R1.4		The UI must have control loops	A			
2.4	R1.5		The UI must have string manipulation	A			
2.4	R1.6		The UI must have user-defined functions & procedures w/ arguments	A			
2.4	R1.7		The UI must have process control, interrupts, error handling	A			
2.4	R1.8		The UI must have std mathematical operations & functions	A			
2.4	R2		Commands executed will be logged with provision to re-execute	A			
2.4	R3	med	Input parm. & syntax checking shall be done when a function is called	Inadequate			

2.5			Documentation & Help Facility				
2.5	R1.1	high	User cookbooks with extensive examples shall be available	Inadequate	A	1	
2.5	R1.2	med	Application help & ref manual (w/ all fctn & tool inputs) shall be available	Inadequate	A/E	1	
2.5	R1.3		On-line help, FAQs, e-mail contact info shall be available	A	A	1	
2.5*	R1.4	low	Release history, bug reports/tracking, patch descriptions shall be available	I	A	1	
2.5	R2	high	Documentation must be up-to-date & complete for all parts of the pkg.	Inadequate	I	1	
2.5*	R3.1	med	Help mtlis shall be available in std document print format (pdf, postscript)	I	A/E	1	
3.1			Data Handling - General Data Requirements				
3.1	R1		The pkg must support data taken in any std ALMA hdw modes	A			
3.1	R2.1		The pkg should handle program header info	A	A/E	1	
3.1	R2.2		The pkg should handle obs status info (and schedules)	A			
3.1	R2.3		The pkg should handle field info	A	A		
3.1	R2.4.1		The pkg should handle SD&Interf. data organized by position	A	A		
3.1	R2.4.2		The pkg should handle SD&Interf. data organized by subreflector state	A			
3.1	R2.4.3		The pkg should handle SD&Interf. data organized by polarization products	A	A		
3.1	R2.4.4		The pkg should handle SD&Interf. data organized by spectral channels	A	A		
3.1	R2.4.5		The pkg should handle SD&Interf. data organized by frequency bands	A	A/E		
3.1	R2.4.6		The pkg should handle SD&Interf. data organized by lfs	A	A		
3.1	R2.4.7		The pkg should handle SD&Interf. data organized by subarrays	A	A		
3.1	R2.5.1		The pkg should handle cross-correlations	A	A		
3.1	R2.5.2		The pkg should handle auto-correlations	A			
3.1	R2.5.3		The pkg should handle uncorrected &/or on-line WVR corrected data	A			
3.1	R2.5.4		The pkg should handle phase-array data (if chosen by user)	A			
3.1	R2.6		The pkg should handle total power from antennas in SD mode	A			
3.1	R2.7		The pkg should handle weights &/or data uncertainties	A	A/E	1	
3.1	R2.8.1		The pkg should handle OTF scanning mode	A			
3.1	R2.8.2		The pkg should handle subreflector switching mode	A			
3.1	R2.8.3		The pkg should handle frequency switching mode	A			
3.1	R2.9		The pkg should handle flagging data or masks	A	A	1	
3.1	R2.10		The pkg should handle diagnostic data & errors	A	I	1	
3.1	R2.11.1		The pkg should handle bandpass calibration data	A	A		
3.1	R2.11.2		The pkg should handle source flux density cal data	A	A		
3.1	R2.11.3		The pkg should handle antenna polarization leakage cal data	A			
3.1	R2.12.1		The pkg should handle gain tables	A	A		
3.1	R2.12.2		The pkg should handle flux bootstraps	A	A/E	1	
3.1	R2.13		The pkg should handle images &/or models produced from data	A	A		
3.1	R2.14		The pkg should handle processing history	A	A		
3.1	R3.1	med	The user should be able to select srcnames, etc (w/ wildcarding)	Inadequate			
3.1	R3.2		The user should be able to select mosaic or scanning pointing centers	A			
3.1	R3.3		The user should be able to select polarization products or channels	A	A		
3.1	R3.4		The user should be able to select bands (e.g. frequency bands, lfs)	A	A		
3.1	R3.5		The user should be able to select spectral channels	A	A/E	1	
3.1	R3.6		The user should be able to select frequency-switched data	A			
3.1	R3.7		The user should be able to select interferometer subarrays	A			
3.1	R3.8		The user should be able to select interf. WVR-corrected/uncorrected BLs	A			
3.1	R4		Multiple pointing centers for mosaics must be supported	A			
3.1	R5		Image transformation to desired Stokes parameters must be provided	A			
3.1	R6	med	Averaging of data over time, bands and spectral channels shall be possible.	Inadequate	I	1	
3.1	R7		Data taken in arbitrary scanning patterns must be dealt with	A			

3.1	R8.1		Universal Time (UT) shall be supported	A	A		
3.1	R8.2		Coordinated Universal Time (UTC) shall be supported	A			
3.1	R8.3		International Atomic Time (IAT) shall be supported	A			
3.1	R8.4		Local sidereal time (LST) shall be supported	A			
3.1	R8.5		Greenwich Mean Sidereal Time (GMST) shall be supported	A			
3.1	R8.6		Julian date (JD) & Modified Julian Date (MJD) shall be supported	A			
3.1	R8.7		Dynamical Times (TDT, TDB) shall be supported	A			
3.1	R9.1		Equatorial coordinates (RA,Dec) shall be supported	A	A		
3.1	R9.2		Ecliptic coords (ELON, ELAT) shall be supported	A			
3.1	R9.3		Heliocentric coords (GLON, GLAT) shall be supported	A			
3.1	R9.4		Galactic coords (GLON, GLAT) shall be supported	A			
3.1	R9.5		Supergalactic coords (SLON, SLAT) shall be supported	A			
3.1	R9.6		Terrestrial coords (Az, El) shall be supported	A			
3.1	R10.1		J2000 equinox (and other FK5 equinoxes) shall be supported	A	A		
3.1	R10.2		B1950 (and other FK4 equinoxes) shall be supported	A	A		
3.1	R10.3		Geocentric apparent place ref frame & coords of date shall be supported	A			
3.1	R10.4		Topocentric coords shall be supported	A			
3.1	R10.5		International celestial ref system (ICRS) shall be supported	A			
3.1	R11.1		Radio velocity definition shall be supported	A	A		
3.1	R11.2		Optical velocity definition shall be supported	A			
3.1	R11.3		Redshift velocity definition shall be supported	A			
3.1	R12.1		Std velocity frames shall be supported, including: topocentric	A			
3.1	R12.2		Std velocity frames shall be supported, including: geocentric	A			
3.1	R12.3		Std velocity frames shall be supported, including: barycentric	A			
3.1	R12.4		Std velocity frames shall be supported, including: heliocentric	A			
3.1	R12.5		Std velocity frames shall be supported, including: kinematic LSR	A			
3.1	R12.6		Std velocity frames shall be supported, including: dynamic LSR	A			
3.1	R12.7		Std velocity frames shall be supported, including: galactocentric	A			
3.1	R12.8	low	Std velocity frames shall be supported, including: local group	Missing			
3.1	R13.1		Coords/locations defined w/ respect to topocentric frame shall be supported	A			
3.1	R13.2		Coords/locations defined w/ respect to geocentric frame shall be supported	A			
3.1	R14		Flagging mask/tables must be maintained with the data during all ops	A	A		
3.1	R15		Calib & ancillary monitoring data in ALMA format must be preserved	U			
3.1	R16		Multiple bit depths (16/32bits) & compressed data must be transparent	U			
3.1	R17	med	Processing history info must be maintained & exportable (tables & text).	Inadequate	I	1	
3.1	R18		Users should be able to change all aspects of the data, including header	A	A		
3.1	R19		Pkg should support locking data files: "one writer, multiple readers"	A	A		
3.1	R20.1		Extraction of subsets of data (src,time,subarray) shall be supported	A/E	A/E	1	
3.2			Data Import and Export				
3.2	R1.1		ALMA std archive data format must be fully supported for input/output	U			
3.2	R1.2		Other std data formats designated by ALMA project shall be supported too	U			
3.2	R2		Disk & offline data storage must be supported (+ proj list of what's available)	A	A		
3.2	R3		Pkg should efficiently handle datasets larger than main host memory	U			
3.3			Images and Other Data Products				
3.3	R1.1		Package must support spectra and image slices (1D)	A	A		
3.3	R1.2		Package must support planar images (2D)	A	A		
3.3	R1.3		Package must support spectral and time cubes (3D)	A	A		
3.3	R2.1		Point (CLEAN) models must be supported	A	A		
3.3	R2.2		Pixel (gridded image) models must be supported	A	A		
3.3	R2.3		Elliptical Gaussian models must be support	A			

3.3	R3		Pixel blanking shall be maintained through image processing	A			
3.4			Foreign Data - No priority 1 items here				
3.5			Interaction with the Archive				
3.5	R1		Access from the archive must be supported	U			
3.5	R2		Pkg/archive interaction must not interfere w/ other access to the archive	U			
3.5	R3		Security/integrity of the archive must be ensured during access/interface	U			
4.1			General Calibration & Editing Requirements				
4.1	R1		The pkg shall be able to handle all ALMA std cal modes	U			
4.1	R2		Cal, editing, & data correction shall be easily reversible	A	A/E	1	
4.1	R3	high	Cal solution intervals should be optimized for the data (e.g. scan-based sols)	Missing	A		
4.1	R4.1	med	Data editing shall be possible based on pointing data	Missing			
4.1	R4.2	med	Data editing shall be possible based on array tracking info (encoders);	Missing			
4.1	R4.3		Data editing shall be possible based on weather data	Inadequate			
4.1	R4.4		Data editing shall be possible based on Tsys data	Inadequate			
4.1	R4.5		Data editing shall be possible based on WVR data	Missing			
4.1	R5	high	Data average cal solns should be possible w/ controlled interpolation, etc.	Inadequate	I		
4.1	R6.1.1		Editing display tools shall include specification by antenna	A	A		
4.1	R6.1.2		Editing display tools shall include specification by baseline	A	A		
4.1	R6.1.3		Editing display tools shall include specification by timerange	A	A		
4.1	R6.1.4		Editing display tools shall include specification by uvrange	A	A		
4.1	R6.1.5	low	Editing display tools shall include specification by pointing center	Inadequate			
4.1	R6.1.6	med	Editing display tools shall plot versus Az, El	Missing			
4.1	R6.1.7	med	Editing display tools shall plot versus HA range	Missing			
4.1	R6.1.8		Editing display tools shall plot versus parallactic angle	Missing			
4.1	R6.1.9		Editing display tools shall plot a slice through a data cube	Missing			
4.1	R6.2		Data editing tools should display spectra and spectral cubes	Inadequate	A/E	1	
4.1	R6.3	low	Data editing tools should display closure quantities	Missing			
4.1	R6.4	med	Data editing tools should display & select monitor data (e.g. T _{atm} , T _{amb})	Missing			
4.1*	R6.5	med	Data editing tools shall be able to plot all the above vs. BL, time, band, chan	N (missing)	I	1	
4.1	R6.6	med	Edt tools shall plot amp/ph. vs time, vs time-BL w/ zoom, select, & clipping	Inadequate	A	1	
4.1	R6.7.1	high	Editing shall be possible for a data point vs a running mean over a timescale	Missing	I	1	
4.1	R6.7.2	low	Editing shall be possible for a data point versus a median over a timescale	Missing	I	1	
4.1	R6.7.3		Editing shall be possible based on an rms scatter in a time range	Missing	I	1	
4.1	R6.7.4		Editing shall be possible based on a difference versus a model	Missing			
4.1	R6.8		Editing display tools shall have auto-scaling & user-specified axis scaling	A	A		
4.1	R6.9		Editing display tools shall have auto-scaling & user-spec color/greyscale	A	A		
4.1	R6.10		Editing display tools shall include/mark flagged data in plots & auto-scaling	A	A		
4.1	R7.1		Non-interactive edit tools w/ all capabilities for interactive editing shall exist	A	A/E	1	
4.2			Atmospheric Calibration				
4.2	R1	high	A std atm model for Pipeline data processing shall exist-User-supplied too	Missing			
4.2	R2.1	high	Atm abs, emission, pathlength shall be based on temp, pressure, humidity	Missing			
4.2	R2.2	med	Atm abs, emission, pathlength shall be based on measured atm emission	Missing			
4.2	R3	high	Atm models shall derive T _{sys} corrected for atm absorption to correct amps	Missing			
4.2	R4	high	Atm models shall convert WVR data to astronomical phase in all bands.	Missing			
4.3			Interferometer data calibration				
4.3	R1.1		Default ant-based cal solutions shall be available for antenna gains	A	A		
4.3	R1.2		Default ant-based cal solutions shall be available for polarization leakages	A			
4.3	R1.3		Default ant-based cal solutions shall be avail for ant-dependent bandpasses	A	A		
4.3	R2.1		BL-based cal solutions shall be available for WVR corrections to some BLs	A			

4.3	R2.2	med	BL-based cal solutions shall be available for closure errors	Missing			
4.3	R2.3	med	BL-based cal solutions shall be available for BL-dependent bandpasses	Missing			
4.3	R3		Gain corrections based on models shall be possible w/ automatic editing	A/E	A/E		
4.3	R4	high	Cal quantities shall be transferable between srcs &/or freq bands	Inadequate	A/E	1	
4.3	R5	low	Determining time-variable cmplx bandpass & transfer to srcs shall be simple	Inadequate	I		
4.3	R6		Full polarization calibration shall be possible	A			
4.4			Single Dish data calibration				
4.4	R1		Fitting of spectral bandpass from cal src obs should be available	A			
4.4	R2	med	De-stripping/adjust must exist for SD OTF obs w/ overlap/crossing scans.	Inadequate			
4.5			Mosaicing Considerations for calibration				
4.5	R1		Determination of pting offsets & polarized primary beam must be available	U			
4.6			Ancillary & Diagnostic Data considerations for calibration				
4.6	R1		Output from atm monitoring (WVR, FTS) shall be importable to cal sftw	U			
4.6	R2	med	Cal solns/correction based on pting, focus, subreflector status shall exist	Missing			
5.1			General Imaging Requirements				
5.1	R1		Imaging of all ALMA exported data must be provided	U			
5.1	R2		Efficient selection of subsets of imaging data must be provided	A	A/E	1	
5.1	R3.1		Provide 'dirty' images with selectable weighting	A	A	1	
5.1	R3.2		Provide residual images after model subtraction	A	A	1	
5.1	R3.3		Provide single-scale CLEAN deconvolution (Hogbom, Clark, Cotton-Schwab)	A	A	1	
5.1	R3.4		Provide maximum entropy deconvolution (MEM)	A	A	1	
5.1	R3.5		Provide linear mosaicing algorithms	A		1	
5.1	R3.6		Provide non-linear mosaicing algorithms	A			
5.1	R4		Image pixel and spectral channel blanking must be supported	A			
5.1	R5		Interactive graphical selection of deconvolution region masks shall exist	A	A/E	1	
5.2			Interferometric Imaging				
5.2	R1	high	Incorporation of the polarized primary beam response of the array is required	Inadequate		1	
5.2	R2		Imaging of RR, LL, RL, LR or I,Q,U,V must be selectable and interchangeable	A/E	A		
5.2	R3		Imaging data from multiple epochs/configurations must be possible	A/E	A/E	1	
5.2	R4		Simultaneous multiple-field imaging & deconvolution must be supported	A		1	
5.2	R5	med	Cont. subtraction in uv & image planes shall be available & flexible	Inadequate	A/E	1	
5.2	R6	high	Include zero-spacing/short-spacing data (ALMA & non-ALMA) w/ weighting	Inadequate			
5.3			Mosaicing and Single Dish Imaging Considerations				
5.3	R1		Combine interferometer & single dish in mosaic imaging	A/E			
5.3	R1.1		The ACS must be integrally supported (if it is scoped as part of ALMA)	U			
5.3	R2	high	Incorporate (polarized) primary beam & pointing correction in mosaics.	Inadequate			
5.3	R2.1		Primary beam calcs & corrections must take into account OTF effects	U			
5.3	R2.2		ALMA std beam images will be made available and distributed with the pkg	U			
5.3	R3		Image & uv-plane gridding parms/interpolation shall be selectable	A/E		1	
6.1			General Analysis Requirements				
6.1	R1.1		Provide analysis tools based on goodness-of-fit to models in uv & image pln	A			
6.1	R2.1		Polynomial baseline fitting shall be supported	A			
6.1	R2.2	high	BL fitting based on image stats (e.g. median filtering) shall be supported	Inadequate			
6.2			Spectral Line Analysis				
6.2	R1.1		Automatic & user-controlled measurement fo line parms shall be available	A			
6.2	R2		User shall be able to specify vel or freq windowing region for line fitting	A			
6.2	R3.1		Line fitting shall include Gaussians for single & multiple lines	A	A	1	
6.2	R4		ALMA std line catalogs shall be available & distributed with the pkg	U			
6.3			Image Cube Analysis & Manipulation				

6.3	R1.1		Image cube axes shall include time	A			
6.3	R1.2		Image cube axes shall include position	A			
6.3	R1.3		Image cube axes shall include fourier coords (uv)	A			
6.3	R1.4		Image cube axes shall include channel (freq, vel, chan no., band, IF)	A			
6.3	R1.5		Image cube axes shall include polarization	A			
6.3	R2	med	faces.	Inadequate			
6.3	R3	med	Be able to define multi-dim cube regions interactively & manually.	Inadequate			
6.3	R4.1		ID & report image features in pixel coords (e.g. row, column)	A			
6.3	R4.2		ID & report image features in world coords (e.g. RA, Dec, vel)	A			
6.3	R5.1		Be able to extract 'cubical' sub-structures aligned with original cube axes	A			
6.3	R5.2	med	User selection of extraction criteria must be possible through GUI & script.	Inadequate			
6.3	R6		Data 'moments' shall be possible along any direction cube axis direction	A			
6.3	R7		Be able to assemble lower-dimensional structures into higher-dim cubes	A			
6.3	R8		Maintain pixel blanking through the analysis process	A			
6.3	R8.1		Be able to turn on & off different blanking (mask) levels	A			
6.3	R9.1.1		Provide smoothing & convolution with Uniform kernel (box car or top-hat)	A			
6.3	R9.1.2		Provide elliptical Gaussian filtering kernel	A			
6.3	R9.2		Provide clipping	A			
6.3	R9.3		Provide windowing & boxing with regions recordable & passable	A			
6.3	R9.4.1		Provide arithmetic operations including addition of a uniform level	A			
6.3	R9.4.2		Provide arithmetic operations including multiplicative scaling	A			
6.3	R9.5.1		Provide statistical ops of a defined region including mean	A			
6.3	R9.5.2		Provide statistical ops of a defined region including RMS	A			
6.3	R9.5.3		Provide statistical ops of a defined region including std deviation from mean	A			
6.3	R0.5.4		Provide statistical ops of a defined region including median	A			
6.3	R9.6.1		Be able to do a Fourier transform on cube or cubical sub-region	A			
6.3	R9.6.2		Be able to calculate a power spectrum	A/E			
6.3	R09.6.3		Be able to calculate an autocorrelation	A/E			
6.3	R9.7.1		Provide scalar arithmetic between different regions: sum (difference)	A			
6.3	R9.7.2		Provide scalar arithmetic between different regions: product (division)	A			
6.3	R9.7.3		Provide scalar arithmetic between different regions: spectral index	A			
6.3	R9.8.1		Be able to construct & compare polarization (E) vector at each pt in cube	A			
6.3	R9.8.2		Be able to construct & compare rotation measure between diff frequencies	A			
6.3	R9.9.1		Provide vector arithmetic between different regions: sum (difference)	A/E			
6.3	R9.10	med	Provide Interpolation across blanked or masked regions	Missing			
6.3	R9.11.1		Be able to fit polynomial functions over regions	A/E			
6.3	R9.11.2	med	Be able to fit exponential functions over regiois	Inadequate			
6.3	R9.11.3	med	Be able to fit Fourier modes in an image	Inadequate			
6.3	R9.11.4		Be albe to fit elliptical Gaussian components in an image	A			
7.1			General Visualization & Plotting Requirements				
7.1	R1		Plotting/display capabilities shall be integrated into GUIs throughout pkg	A/E			
7.1	R2.1		Support x-y plots	A	A		
7.1	R2.2		Support histogram plots	A	A		
7.1	R2.3		Support contour plots	A	A		
7.1	R2.4		Support vector plots	A	A		
7.1	R2.5		Support 2D images	A	A		
7.1	R2.6	low	Support wireframe 3D surfaces;	Missing			
7.1	R3	high	Support "blinking" 2 images/stepping thru set of images w/ user-adjusts	Inadequate	A/E	1	
7.1	R4.1		Support at least one std output format (e.g. postscript)	A	A		

7.1	R5	low	Identification of cursor position shall be available for interactive plots.	Inadequate	A/E	1	
7.2			Display Appearance & Interactivity				
7.2	R1	med	Plot selection parms (axes, limits, colormap) shall be easily controllable.	Inadequate	I	1	
7.2	R2	med	Provide interactive display zooming/unzooming within plot windows.	Inadequate	A/E	1	
7.2	R3	high	Benchmark plot update speed, make commensurate with other plot pkgs.	Inadequate			
7.2	R4		Provide diff line style/size/thickness/color. Be able to adjust/save/reload	A	A/E	1	
7.2	R5.1	med	Be able to plot Logarithmic amplitude and intensity scale	Inadequate	A		
7.2	R5.2	med	Be able to plot different time/coord units & formats (e.g. hrs, hhhmss)	Inadequate			
7.2	R6.1		Be able to overlay images w/ same axes, size, orientation	A/E	A/E	1	
7.2	R6.2		Overlay layer style shall be selectable, e.g. contours, grayscale	A/E	A		
7.2	R6.3	low	Overlay of selectable coordinate grids (e.g. J2000, galactic) shall exist	Inadequate			
7.3			Visibility Data visualization				
7.3	R1.1		Be able to plot real and/or imaginary data	A	A		
7.3	R1.2		Be able to plot amplitude and/or phase	A	A		
7.3	R1.3		Be able to plot delay and/or rate;	Missing			
7.3	R1.4		Be able to plot data vs time	A	A		
7.3	R1.5	med	Be able to plot data vs. hour angle;	Missing			
7.3	R1.6	med	Be able to plot data vs. parallactic angle;	Missing			
7.3	R1.7	med	Be able to plot data vs uv distance;	Inadequate	A/E	1	
7.3	R1.8	med	Be able to plot data vs u and/or v;	Inadequate	A/E	1	
7.3	R1.9		Be able to plot data vs baseline	A	A		
7.3	R1.10		Be able to plot data vs channel, freq, or vel	A	A		
7.3	R1.11	med	Be able to plot data vs azimuth and/or elevation;	Missing			
7.3	R2	med	select	Inadequate			
7.4	R1.1	high	Be able to plot ancillary data amps or single dish power vs AZ and EL	Inadequate			
7.5			Image Cube Manipulation				
7.5	R1	low	Histograms of pixel values must be produced for selected regions of cube.	Inadequate			
7.5	R2.1		Be able to view subsets or cube slices for axes aligned with cube faces	A			
7.5	R3		Be able to plot a pixel value in diff. cube layers/images against each other	A			
7.5	R4		Data cubes must be viewable as movies with selectable rates & directions	A	A		
8.1			Special Features: Simulations - no priority 1 requirements				
8.2			Special Features: VLBI - no priority 1 requirements				
8.3			Special Features: Solar System Object Observing				
8.3	R1.1.1		Ephemerides must be provided for the sun	A			
8.3	R1.1.2		Ephemerides must be provided for the moon	A			
8.3	R1.1.3		Ephemerides must be provided for the planets	A			
8.3	R1.1.4	low	Ephemerides must be provided for major asteroids (all >50km dia.);	Missing			
8.3	R1.1.5	low	Ephemerides must be provided for known short period comets;	Missing			
8.3	R1.2		Ephemerides must be calculated in all available reference frames	A			
8.3	R2		The pkg must carry out astronomy for moving sources	A			
8.3	R3	med	Compute visibility amp correction for dist from ephemeris or user-supplied	Missing			
8.2			Special Features: Pulsar Observing - no priority 1 requirements				