Exoplanet Observing Using AstroImageJ

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AstroImageJ (AIJ)

- All-in-one freeware developed and maintained by Dr. Karen Collins

- Can be used for image calibration, differential photometry, exoplanet transit modeling

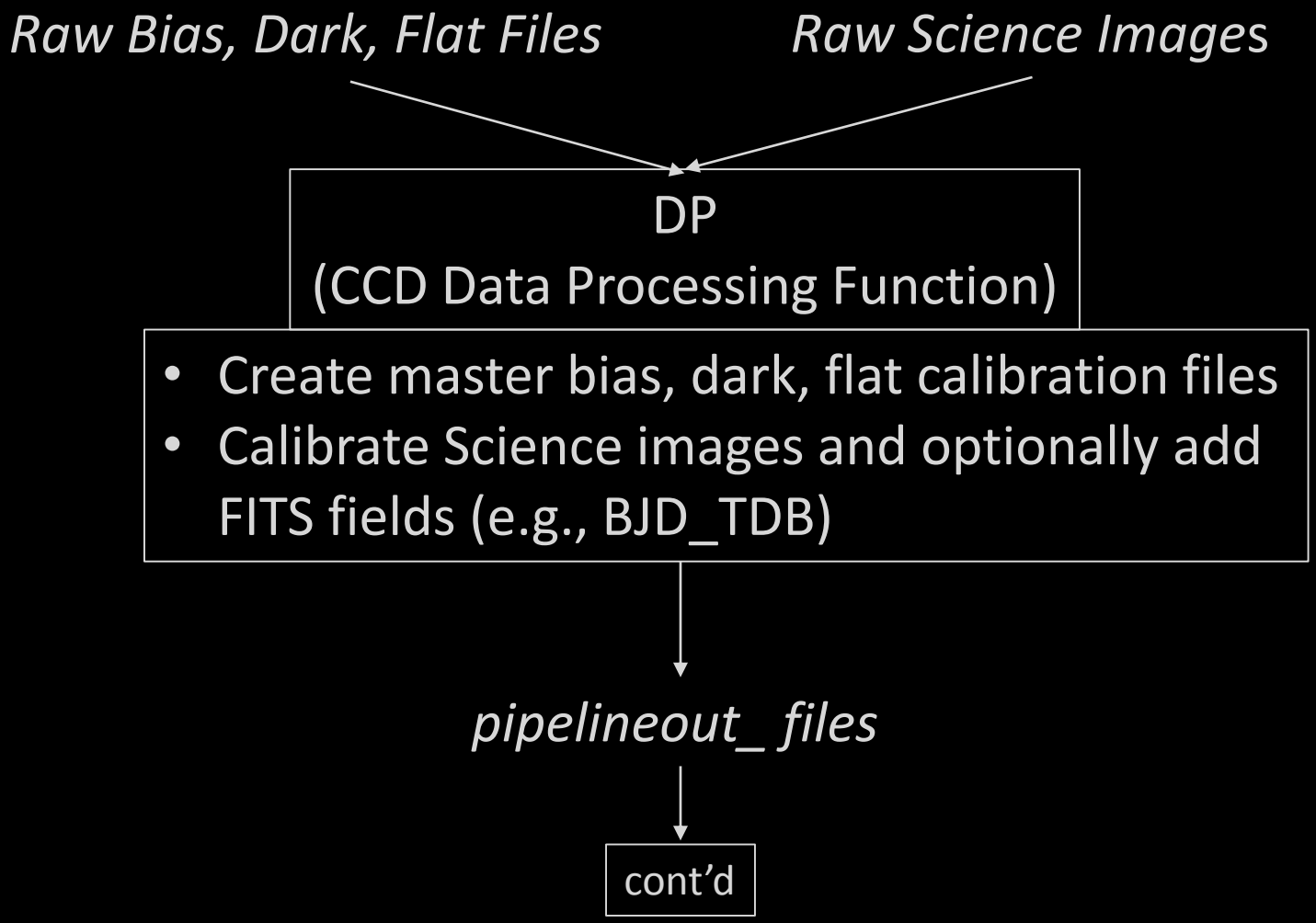
- Latest version can be found at: http://www.astro.louisville.edu/software/astroimagej/

- A step-by-step guide to using AIJ for exoplanet observing can be found in “A Practical Guide to Exoplanet Observing” at: http://astrodennis.com

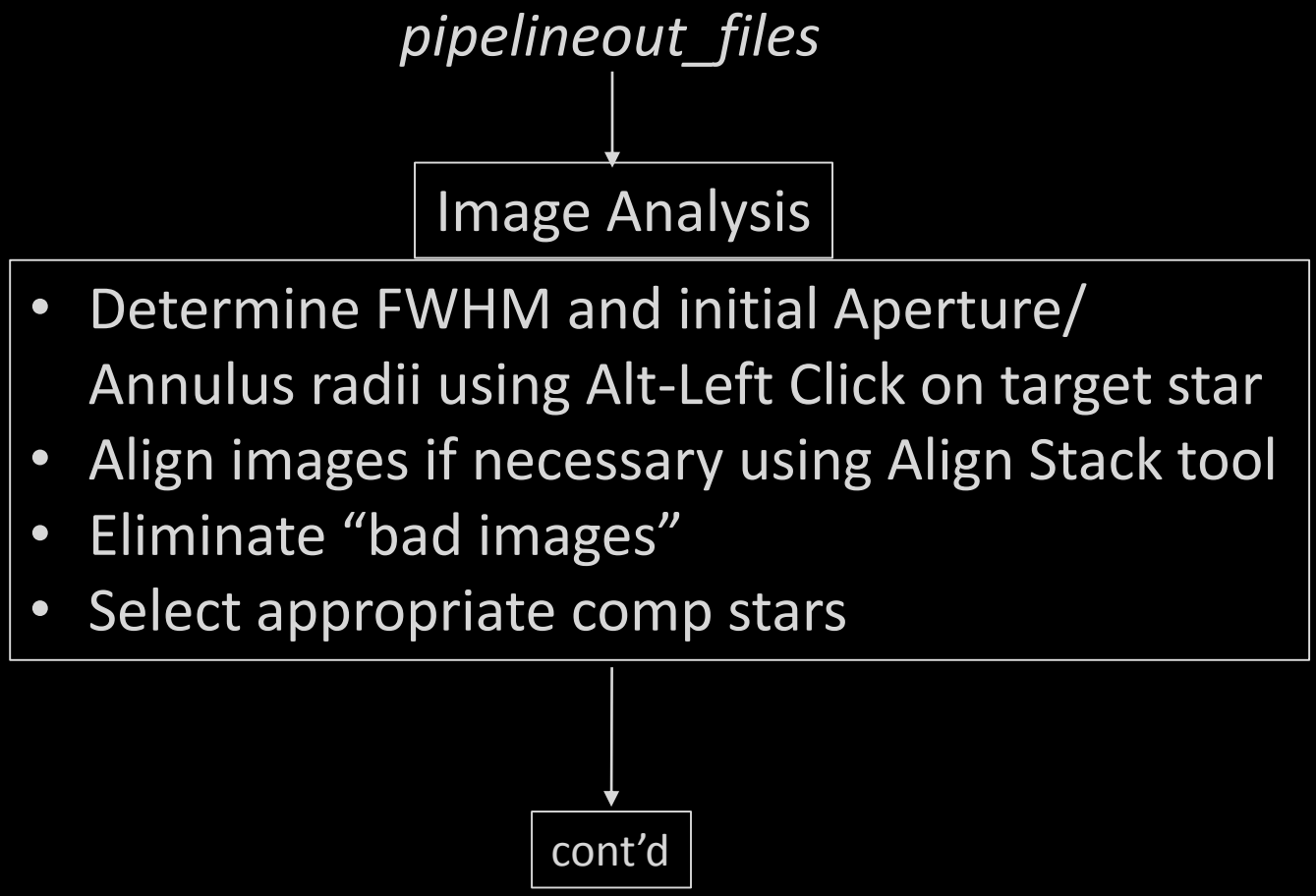
Worksheet

		Exoplanet:	**WASP-12b**		
		Observer:	**Dennis Conti**		
Item	Host Star/Exoplanet Information:	(click here)			
1	RA:	06:30:32.79			
2	Dec:	29:40:20.4			
3	Period (days):	1.0914			
4	R_*:	1.63			
5	T_{eff} :	6300			
6	V mag:	11.7			
	Suggested range of comp stars:	11.26 to 12.45 mag			
7	Link to Reference Paper (optional):	https://arxiv.org/abs/1512.00464			
8	Date of Observation (UT):	01/5-6/2016			
			BJD_TDB		
9	Predicted Ingress:		2457393.53948		
10	Predicted Egress:		2457393.66431		
	Predicted midpoint:		2457393.60190		
11	Model fit midpoint (T_c) in BJD_TDB:		2457393.60123		
		Approximate difference:	1.0	minutes	
	Observing Location:				
12	Latitude:		38:55:48.51 N		
13	Longitude:		76:29:17.78 W		
14	Altitude (m):		0		
15	Aperture (mm):		280		
16	Focal length (mm):		3010		
17	Make/model of CCD Camera:		SX694M		
18	Gain (e-/ADU):		0.3		
19	Readout noise (e-):		5.0		
20	Dark current (e-/pixel/sec):		0.003		
21	Point of where CCD goes non-linear (ADUs):		45,000		
		X	**Y**		
22	No. of pixels (unbinned):	2750	2200		
23	Pixel size (microns -unbinned):	4.54	4.54		
24	Binning used for this observation:	2	2		
25	Exposure time (secs):	45			
26	Filter used:	V			
	Limb darkening coefficients:	(click here)			
27	Quadratic LD u1:	0.39056081			
28	Quadratic LD u2:	0.3026992			
	Image scale (arcsec/pixel):	0.62	0.62		
	FOV (arcmin):	14.26	11.41		
29	FWHM (arcseconds):	2.68			
	FWHM (pixels):	4			
	Initial Settings:				
30	FWHM pixel multiplier:	3			
	Aperture radius:	13			
31	Inner annulus radius:	14			
	Outer annulus radius:	29			
	Final Settings:				
32	Aperture radius:	13			
33	Inner annulus radius:	14			
34	Outer annulus radius:	29			
		# of Science Images:			
35	Original #:	336	Final #:	336	
36	Images not used:				

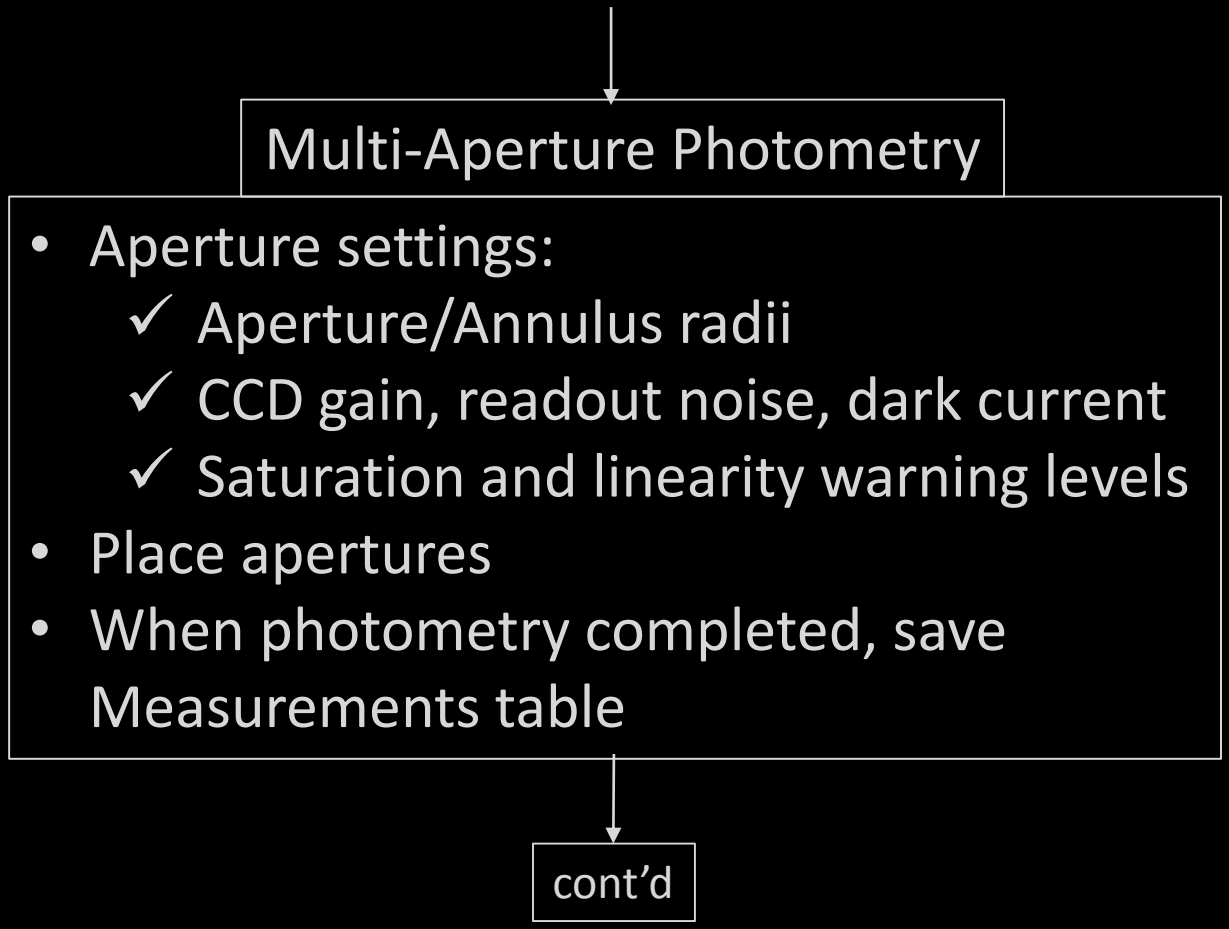
AIJ Pipeline



AIJ Pipeline (cont'd)



AIJ Pipeline (cont'd)



Important AIJ Terms

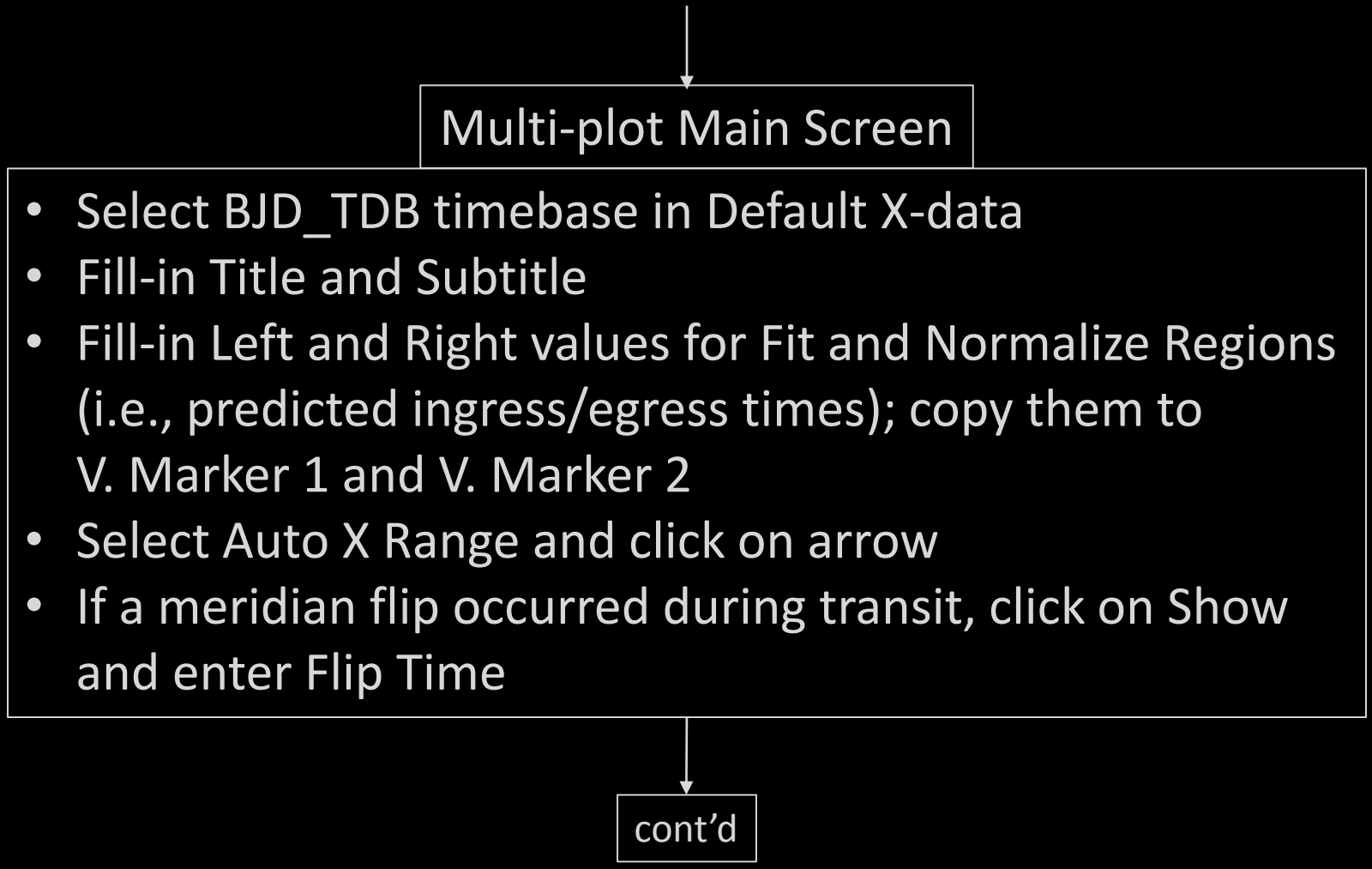
- T1: refers to target star
- Ci: refers to comparison star
- Source-Sky_xx: ADU counts in the aperture for star xx after the sky background is taken out (e.g., Source-Sky_C2)
- tot_C_cnts: the sum of the Source-Sky counts for all the comparison stars
- rel_flux_T1: the relative flux of target star T1
  = Source-Sky_T1/tot_C_cnts
- rel_flux_Ci: the relative flux of comp star Ci
  = Source-Sky_Ci/total cnts of all other C stars

AIJ Plotting

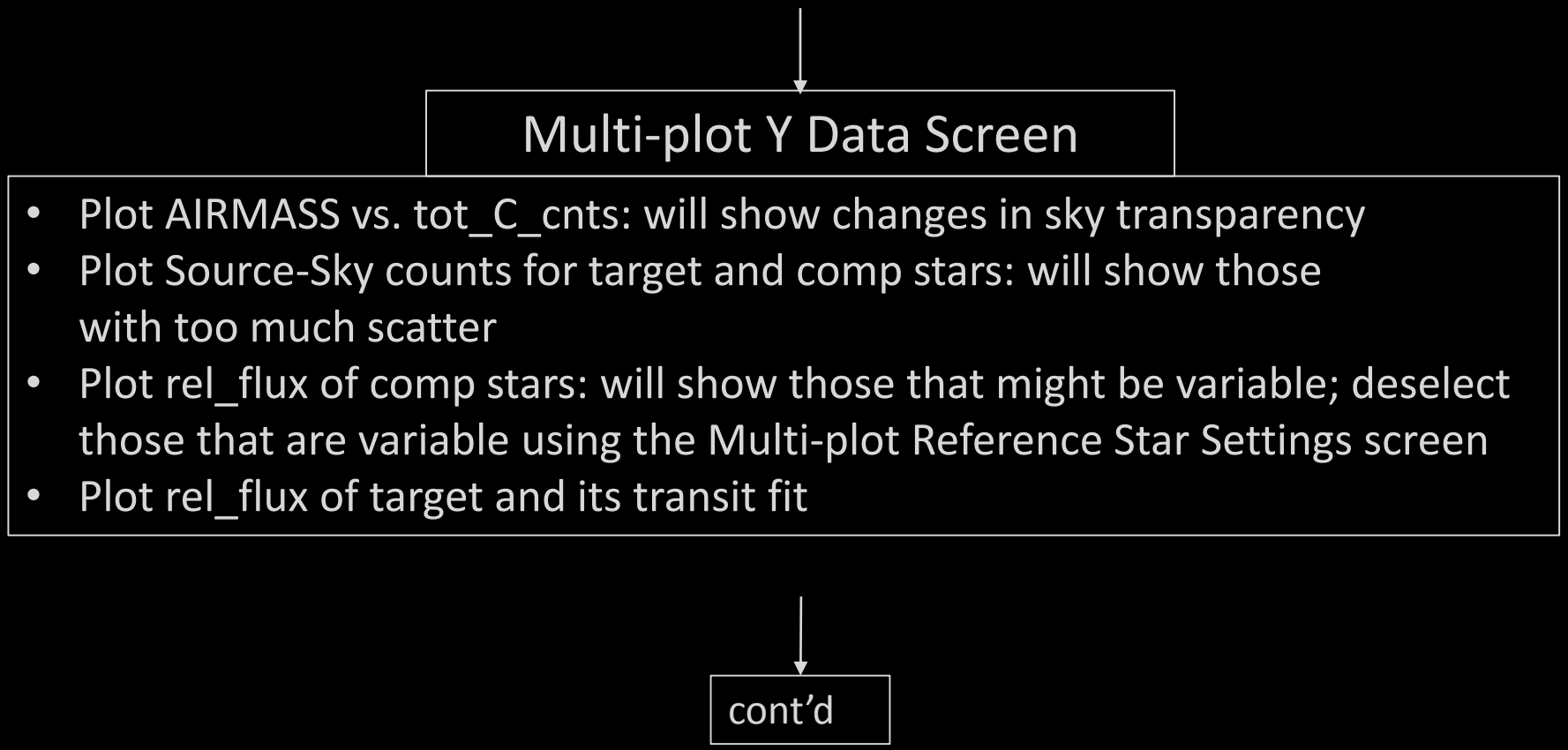
- Uses a plot configuration file with an extension of .plotcfg

- A sample plot configuration file,
  Measurements_Template.plotcfg,
  can be downloaded from http://astrodennis.com

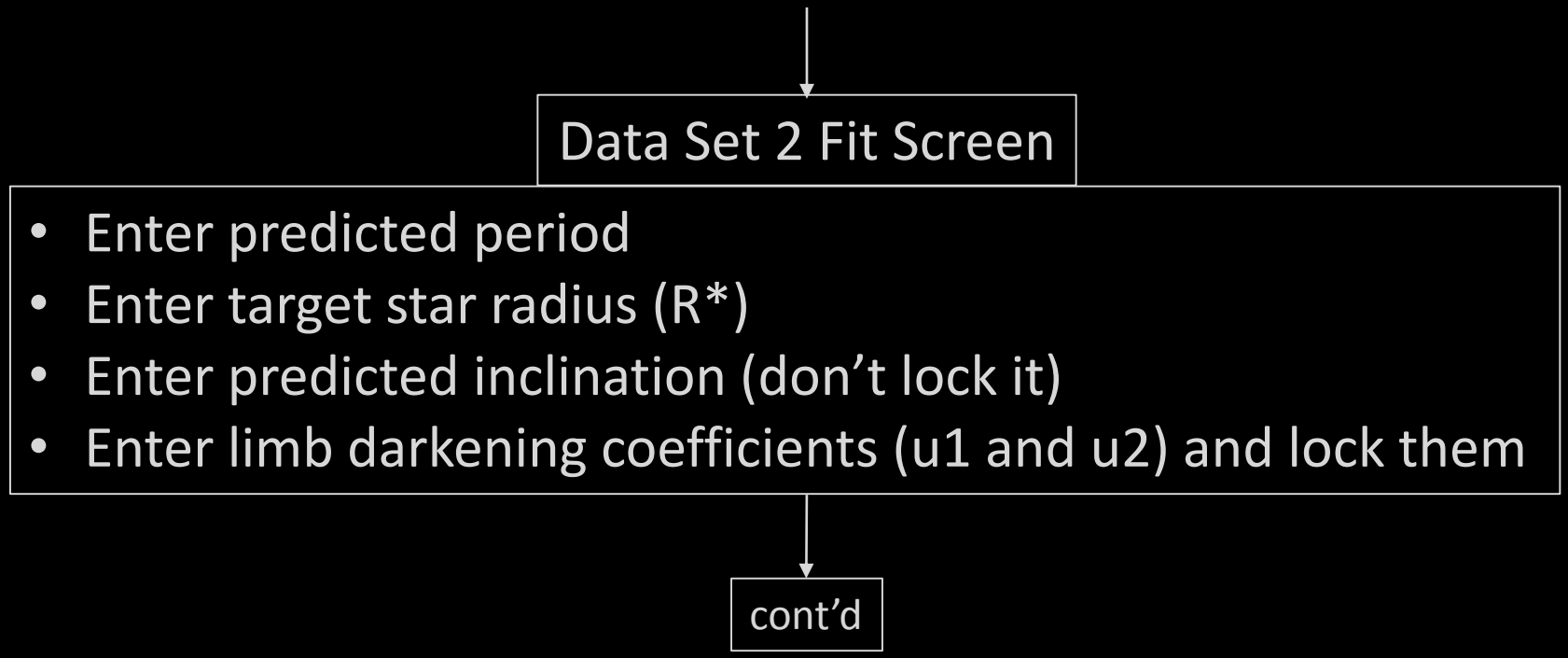
AIJ Pipeline (cont'd)



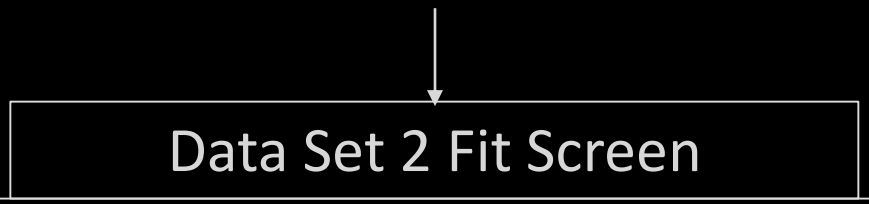
AIJ Pipeline (cont'd)



AIJ Pipeline (cont'd)



AIJ Pipeline (cont'd)



- If a meridian flip occurred during transit, select Meridian Flip as a detrend parameter
- Set detrend parameters (at most 3) that result in a reduction in BIC by more than 5 (start with AIRMASS)
- Sequentially deselect comp stars until a minimum RMS is obtained
- See "A Practical Guide to Exoplanet Observing" for further optimization guidelines and how to create a dataset for input to external programs