

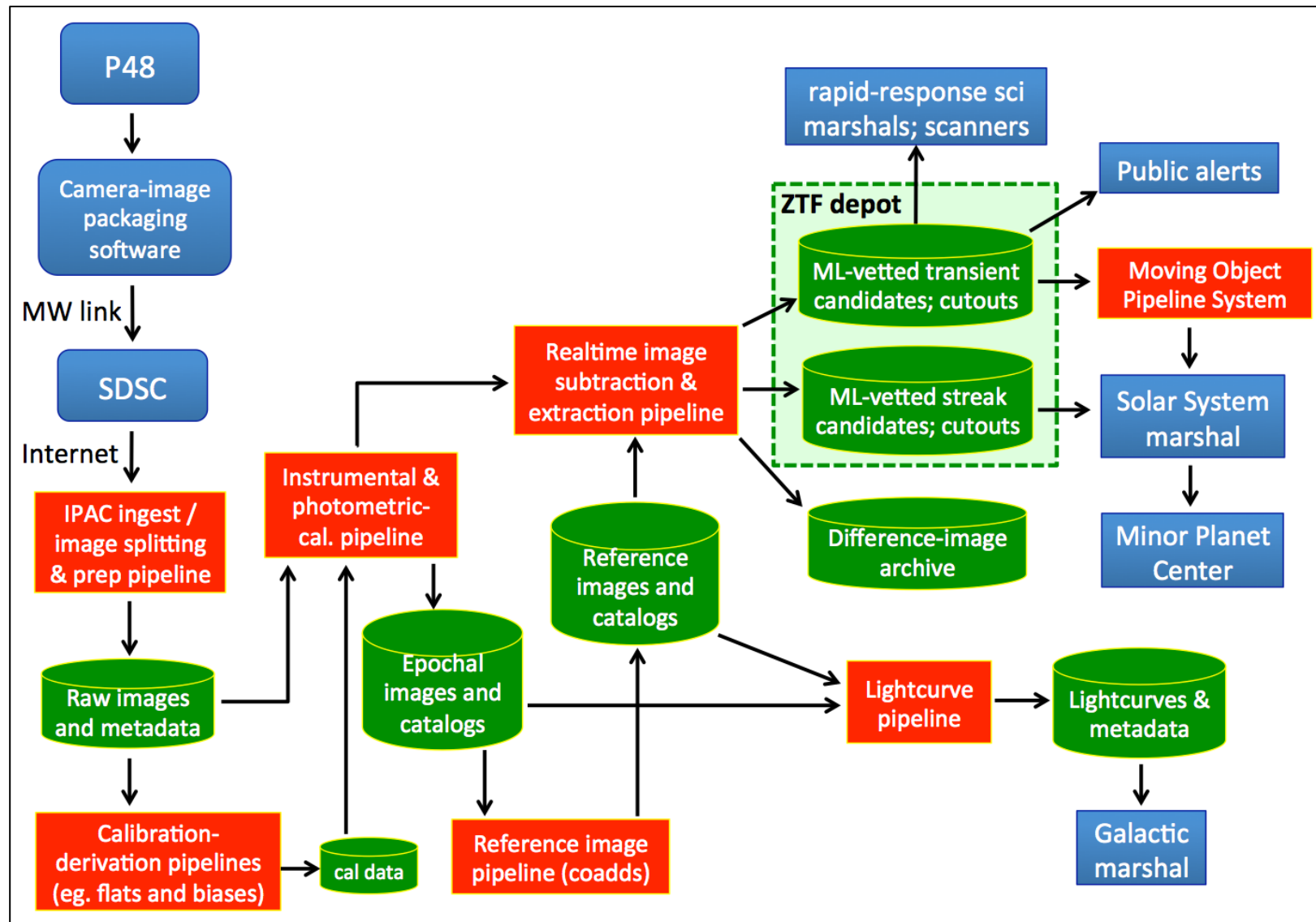
ZTF Pipelines Status and Deliverables

Frank Masci & the IPAC-Caltech ZTF Team

Status update, February 27, 2017



Overview of the ZTF Data System



ZTF Pipeline Status: ✓ => done

Overall, there are 10 inter-dependent pipelines (one is TBD):

Raw data ingestion/processing:

- ✓ 1. Raw data ingest, archival of raw images and storage of metadata in database *[realtime]*
- ✓ 2. Raw-image decompression, splitting into readout-quadrant images, floating bias correction, simple QA *[realtime]*

Calibration generation:

- ✓ 3. Bias-image derivation from stacking calibration images acquired in afternoon *[made before on-sky operations]*
- ✓ 4. High-v flat (pixel-to-pixel responsivity) from stacking calibration images *[made before on-sky operations]*
- 5. TBD: Low-v flat from either long-term ZPVM or dithered-star observations *[every week, month or longer?]*

Real-time:

- ✓ 6. Instrumental calibration of readout-quadrant images: astrometry and photometric cal *[realtime]*
- ✓ 7. Image subtraction and transient discovery (point sources / streaks), metadata and cutouts *[realtime]*

Ensemble-based processing:

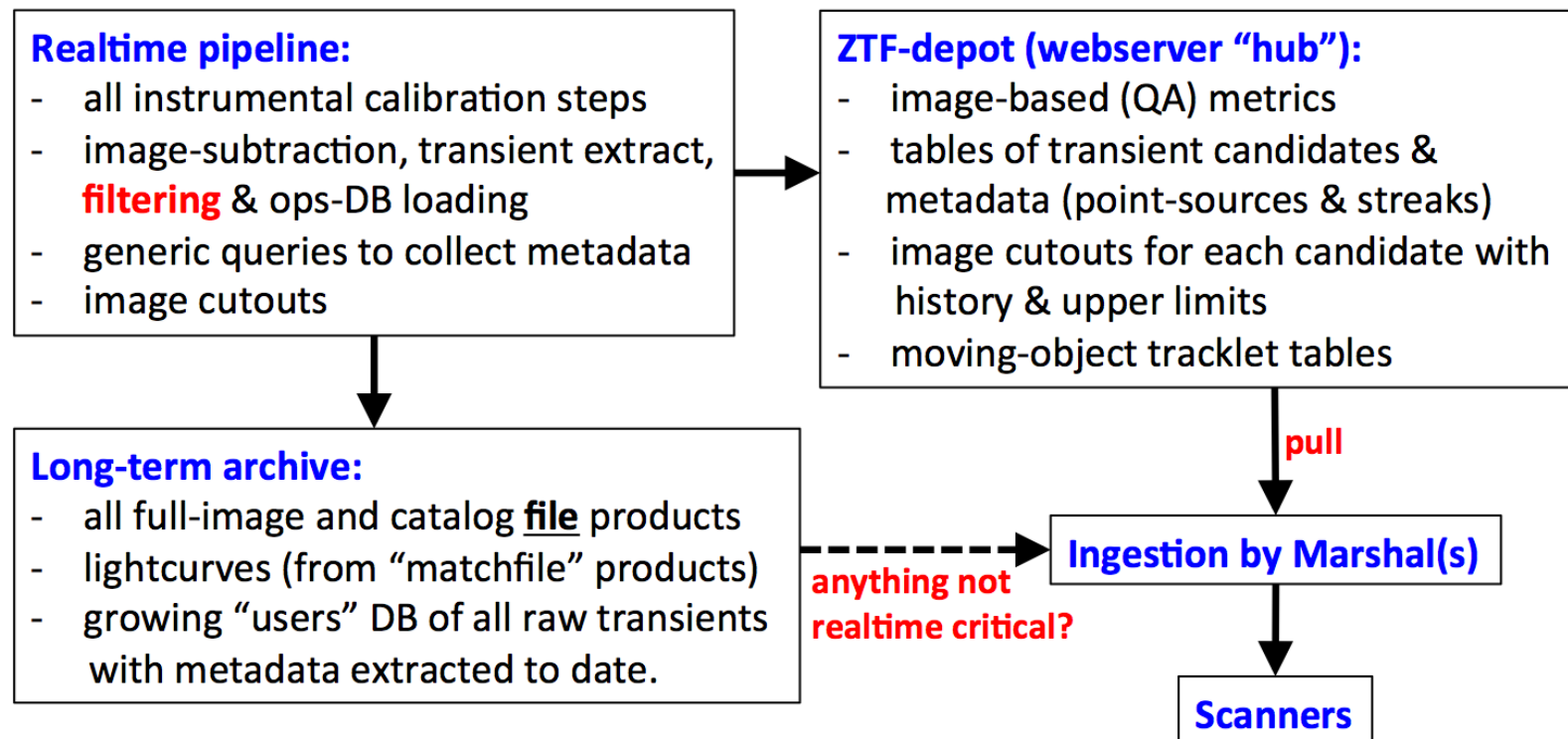
- ✓ 8. Reference-image generation (co-addition of epochal images from 6) *[as needed: when good quality data available]*
- ✓ 9. Source-matching with relative photometric refinement for lightcurves; inputs from 6 *[every two weeks or longer?]*
- 10. Moving object pipeline system (MOPS): tracklets from linking transients from 7 *[every 3 or 4 hours during night]*

Deliverables and Products (reminder)

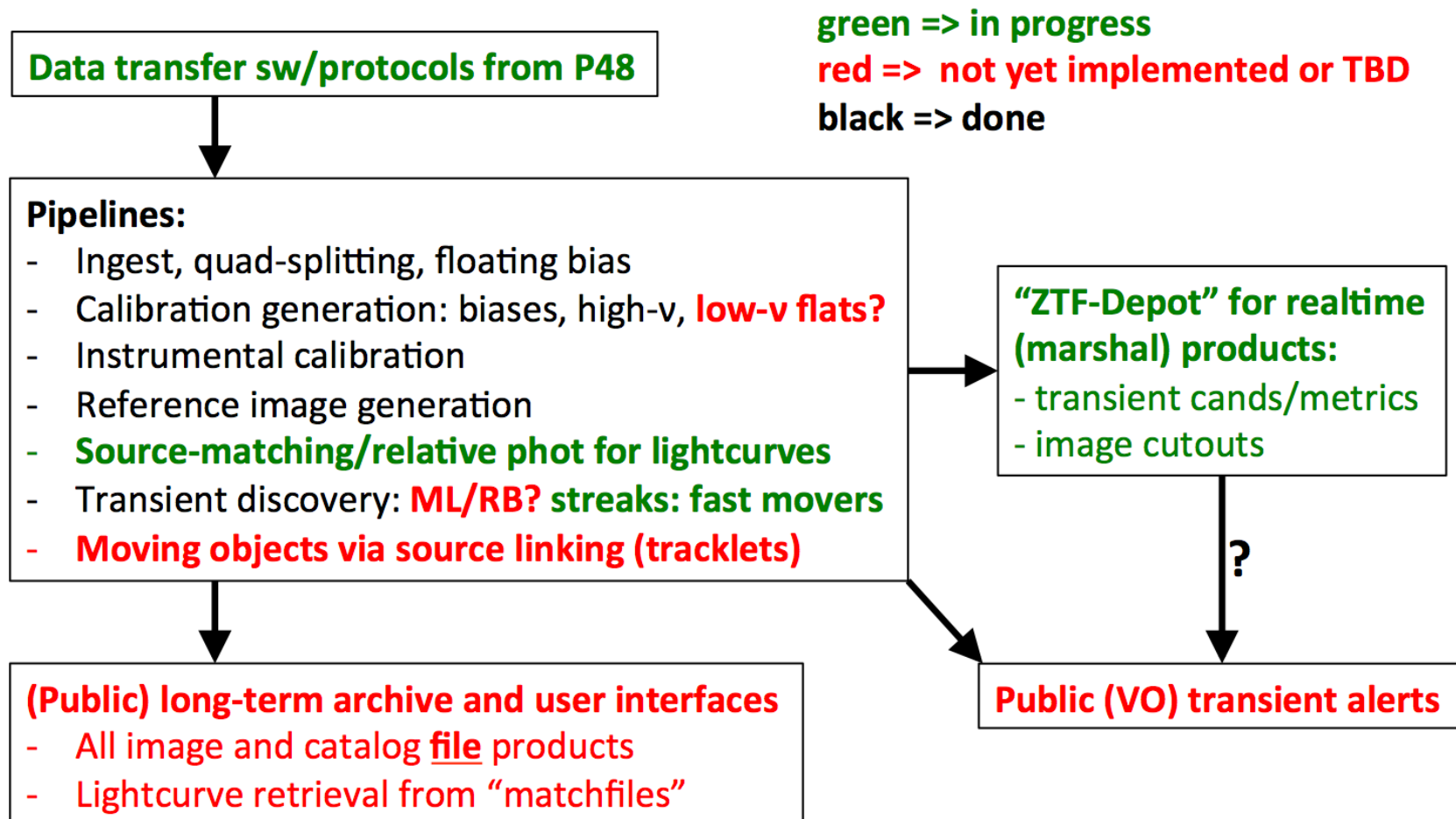
1. **Instrumentally calibrated, readout-quadrant based epochal image products:**
 - images with photometric zero-points derived from PTF-fit photometry
 - bit-mask images
 - two source catalogs per image: PSF-fitting and aperture photometry: only PSF-fit catalog is absolutely calibrated
 - difference images with QA metadata
2. **Reference images (co-adds), coverage, unc maps, and two source catalogs per image:** PSF-fitting and aperture
3. **Match-files from source-matching and relative photometry of epochal extractions:** based on epochal PSF-fit photometry catalogs; to support “object-based” lightcurve database
4. **Products to support near real-time discovery:** *thresholded* transient candidates (point sources and streaks) with metadata and image cutouts
5. **Historical (users) database of all transient candidates and metadata generated from real-time pipeline**
6. **To commence soon after survey start:** transient alert (event) stream extracted from real-time pipeline
7. **Products to support Solar System/NEO discovery and characterization:**
 - moving object tracks from linking point-source transients; known objects are tagged.
 - delivered to the IAU’s Minor Planet Center following human vetting.

In progress: archive and depot development

- To support “fast response science”: plan is to deliver a generic transient stream (following any automated RB vetting or filtering in pipeline) to a webserver for collection by all marshals.
- Other (historical) products, including transient candidates can be retrieved from growing archive.



Development status as of today



Near future: collaboration visibility and assistance

- Within the next month: move all pipeline software and configuration/parameter files to GitHub, and link to ZTF-GitHub account. Now located in a local CVS repository
- Once archive system is in place, allow collaboration to access products (simulations for now)
- Includes “ztf-depot” portal hosting real-time products for marshal access
- Pipeline operations file-system: access limited to select individuals; contingent on compute-cluster availability
- New pipeline modules are welcome once identified; i.e., following more camera / optical system characterization in lab and from commissioning (Python, Perl, C, C++, Java, Fortran!, R, ...)

Short term schedule

For full schedule and tasks, see:

http://web.ipac.caltech.edu/staff/fmasci/home/junk/ZTFproj/ZTF_IPAC_Milestones-frank022317.pdf

Tasks	Start	End	Status	Notes	Primaries	yr2				yr3				yr4			
						9/1/15 - 8/31/16				9/1/16 - 8/31/17				9/1/17 - 8/31/18			
						Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA
ZTF Data System Development																	
acquire lab camera data; define/sketch xfer protocols	3/10/17?	3/20/17		check metadata/interface specs	conform to PL needs Camera team												
timing review (camera/summit - ipac - products?)	3/15/17	3/17/17		need Ben's b'width perf plots; PL timing plots													
s/w to package/transfer data from summit to IPAC transfer simulated image/camera data to IPAC	4/1/17	4/30/17		* includes s/w for raw archival * transfer protocol agreed * explore bandwidth/compression params	Ben, Steve, Eugene? camera team												
final method/software for low spatial frequency flats	4/1/16	5/10/17		contingent on science & testing	Frank + collaboration												
improve img-sub pipeline (continued from inst. Cal	4/20/16	4/31/2017		* need to finalize ZOGY details * Machine learned vetting code for point sources? & streaks?	Frank												
source-matching for LC generation in production PL	7/1/16	2/28/17		to support lightcurve database	Dave, Ben												
convert cov-map generation s/w from IDL to python	6/1/16	2/28/17		to support nightly cov-maps	Ben												
Moving-object pipeline (non-streaking)	9/1/16	7/1/17		with MPC-report generation	Frank, Russ												
upgrade streak-detection in real-time pipeline with RB	9/1/16	4/30/17		need MPC interface specs	Frank												
ZTFdepot (webserver) infrastructure and user access	12/1/16	8/15/17		user-access control as well includes finderchart service	Russ, Frank, Steve, DaveF												
Archive and interfaces for all data retrieval	12/1/16	9/15/17		includes matchfile retrieval, LC database (object model) & GUI for spatial searches	Steve, Dave F...												
Infrastructure for transient (VO-event) alert stream	8/1/17	1/1/2018?		subset of ZTFdepot events?	Russ, Steve, Frank												
outline "day in the life" activities / task orchestration	12/1/16	8/1/17		identify personell, process flow dependencies across system	All												
Profiling, more nodes (high RAM)? Other hardware?	12/1/16	5/1/17		contingent on depot, MOPS, LC pipeline integration													
Documentation: algorithms, deliverables, access	12/1/16	8/1/17			Frank												