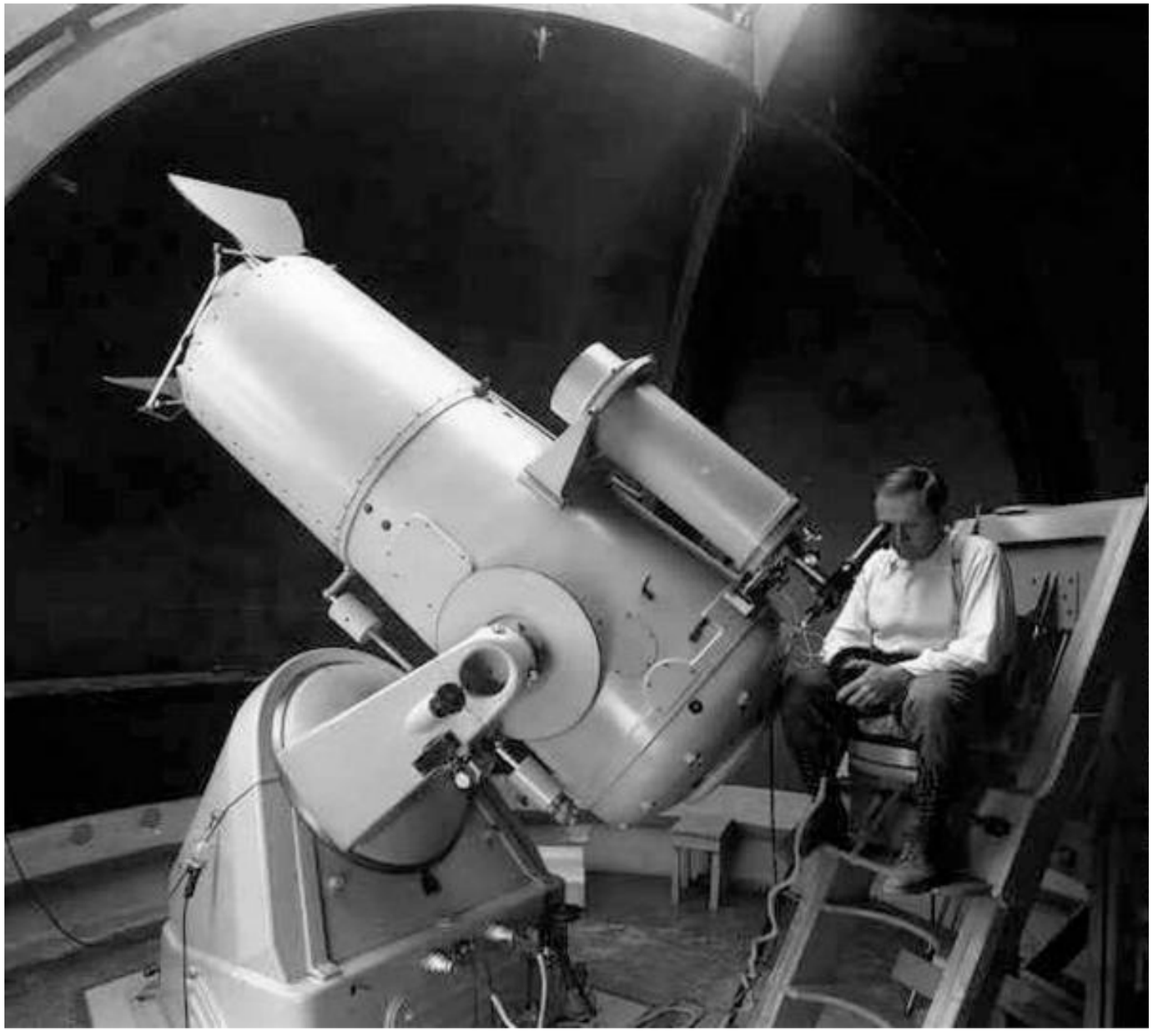


The Zwicky Transient Facility (ZTF)

Eric Bellm

on behalf of the ZTF collaboration

ZTF builds on PTF experience at Palomar.

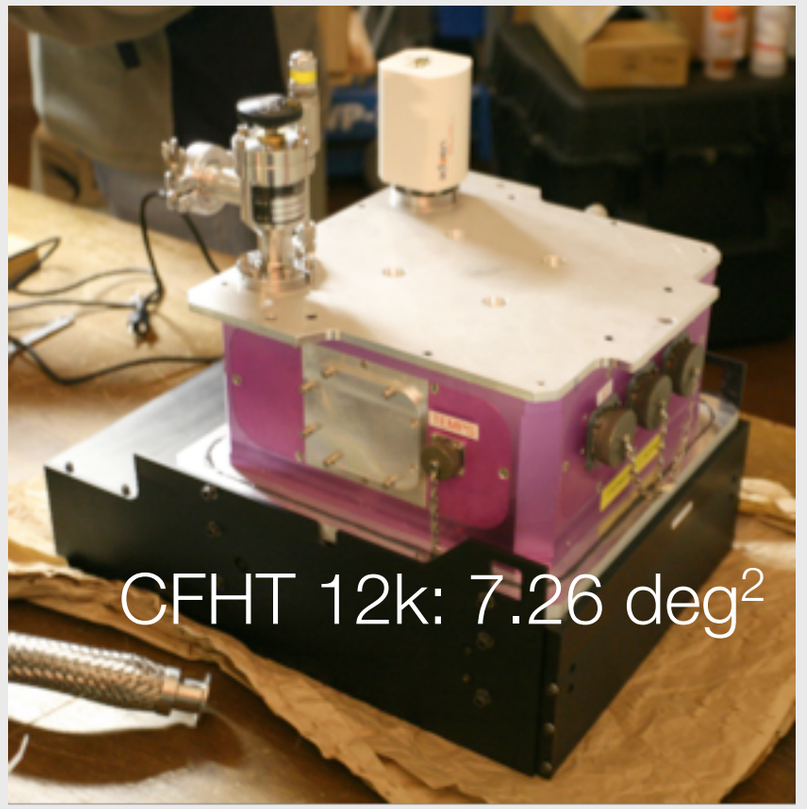
Moderate aperture survey matched to followup resources.

The PTF survey family has three phases.

PTF *yesterday*

The Palomar Transient Factory
(2009-2012)

General synoptic transient survey



iPTF *today*

Intermediate Palomar Transient Factory
(2013-2015)

Focused mini-surveys

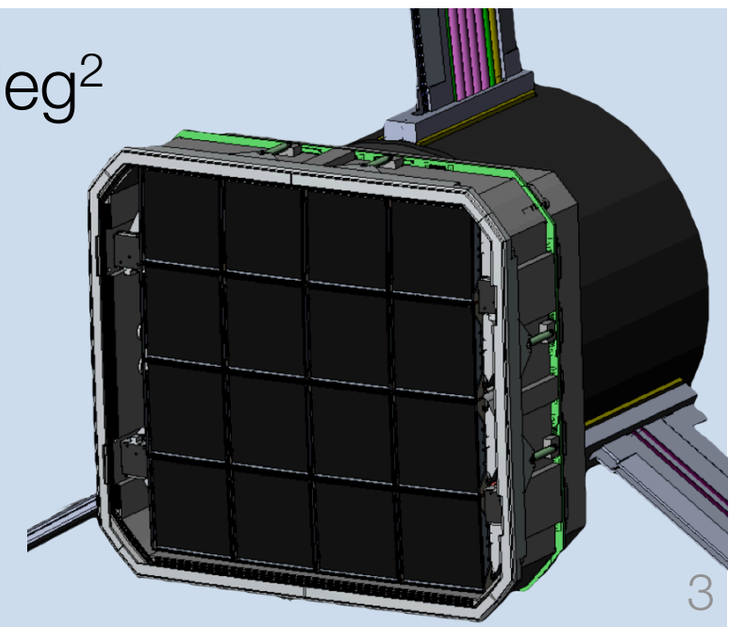
88+ papers, >2549 citations

ZTF *tomorrow*

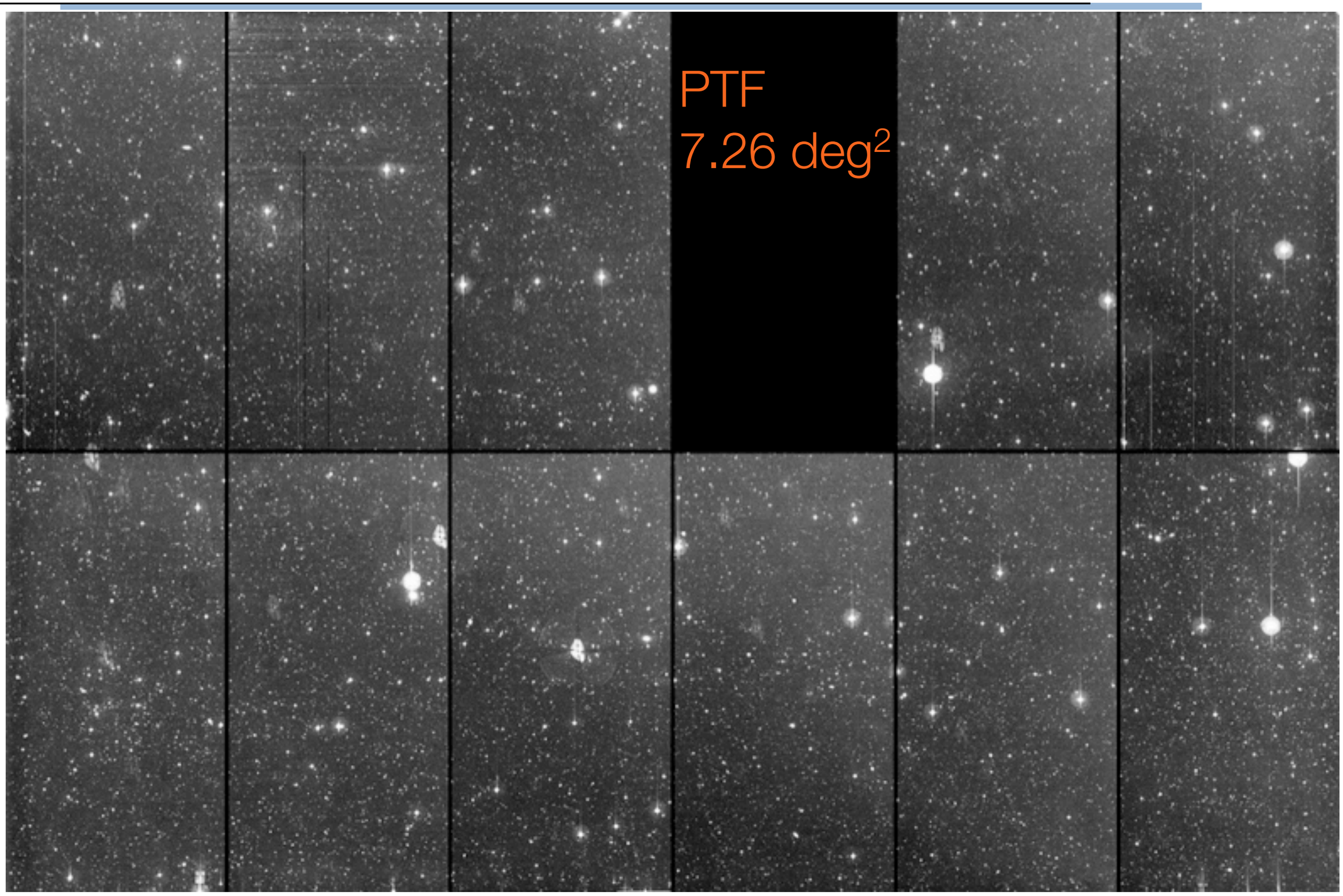
The Zwicky Transient Facility
(2017-2019)

High-cadence survey

new 47 deg^2
camera



A new camera will fill the P48 focal plane.



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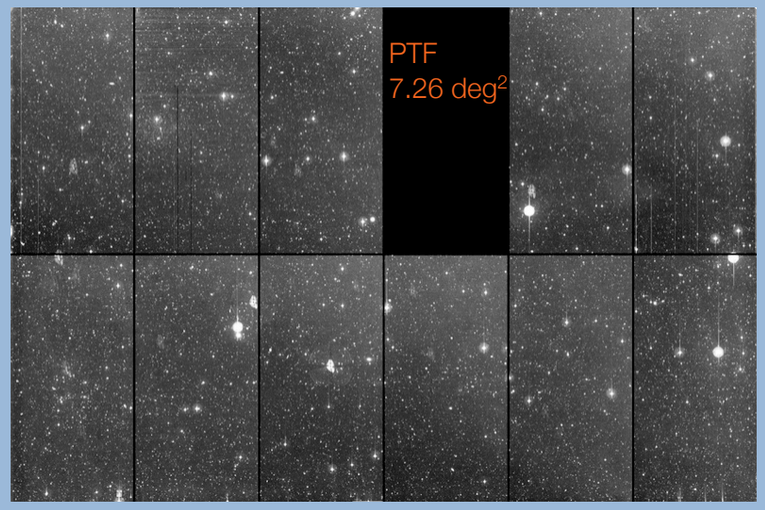
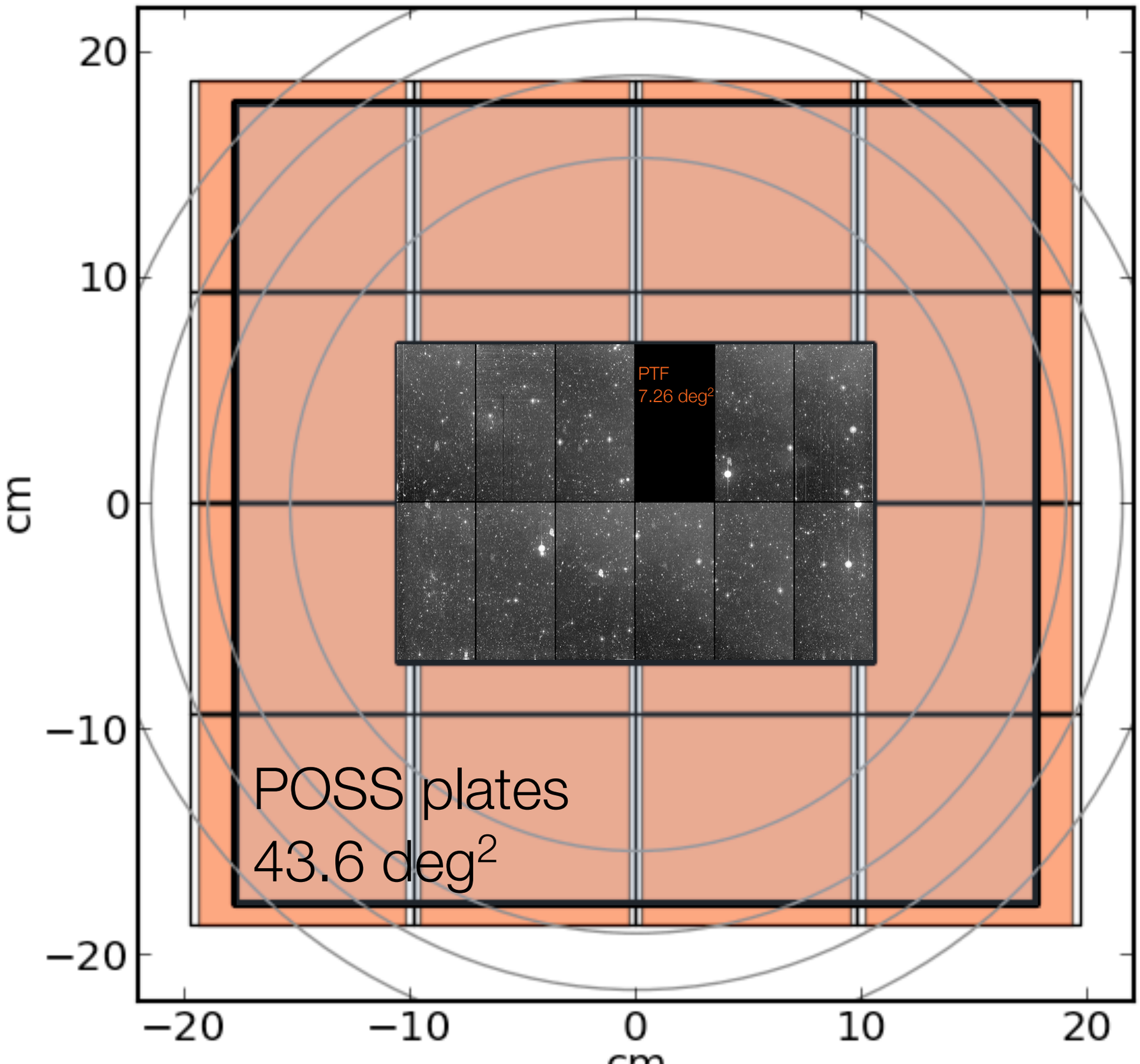


POSS plates
43.6 deg^2

A new camera will fill the P48 focal plane.



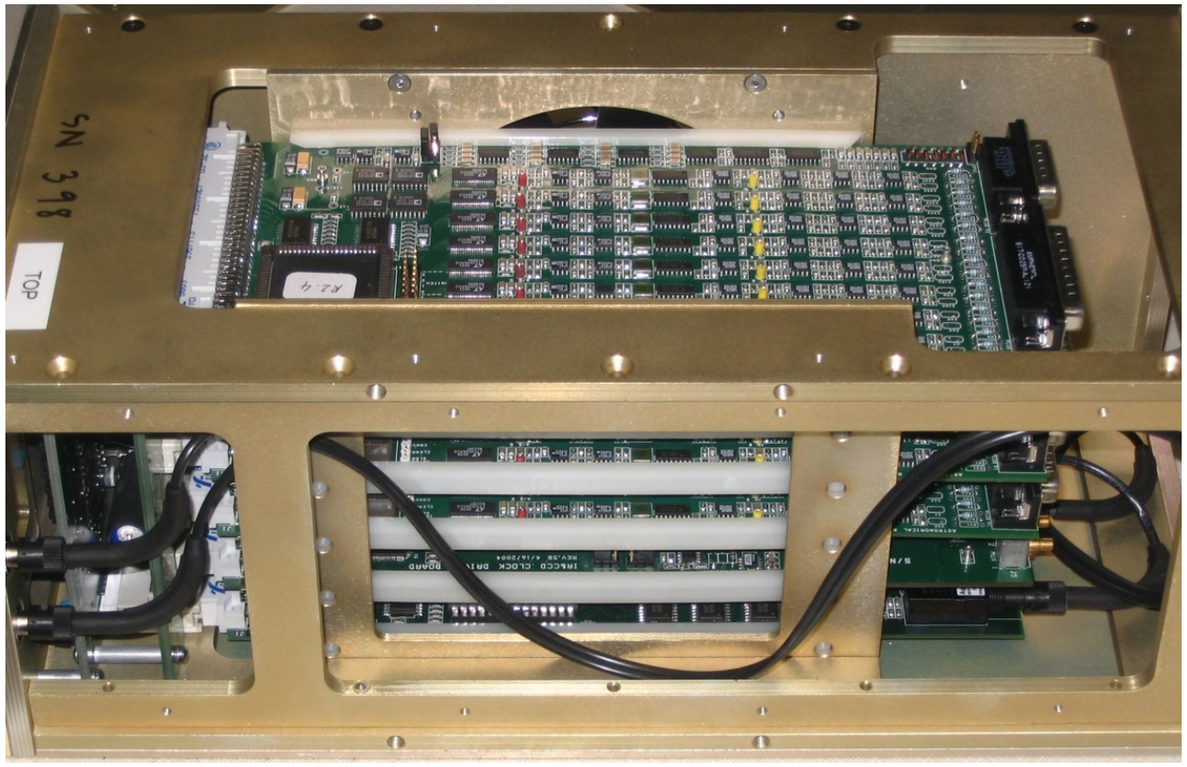
Affordable wafer-scale CCDs make ZTF possible.

[CCD231-84 is illustrated here; CCD231-C6 is similar]

e2v	
dimension	9.2 x 9.2 cm
pixels	6.1k x 6.1k
pixel size	15 micron
pixel scale	1”/pixel
outputs	4

5 CCDs fabricated and delivered.

Moore’s Law reduces overhead.



PTF
2000-era Leach Gen-II controller
36 second readout of 96 Mpx

ZTF
2014-era (e.g., STA Archon)
10 second readout of 576 Mpx

“Volumetric survey speed” is a useful figure of merit.

Volumetric survey speed: $$\dot{V}_M = \frac{\Omega_{\rm fov}}{4\pi} \frac{V_{\rm c}(z_{\rm lim})}{t_{\rm exp} + t_{\rm OH}}$$

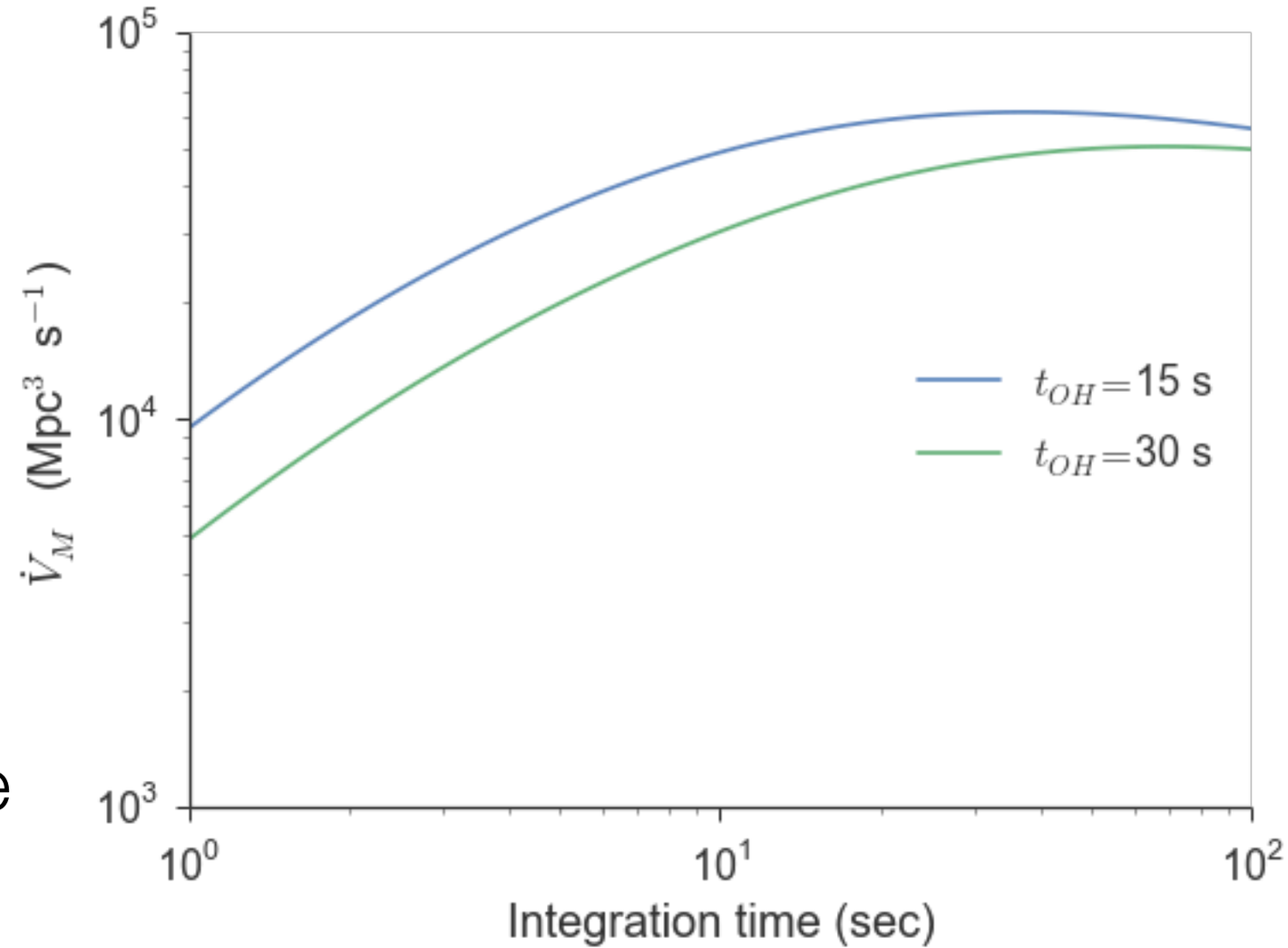
Spatial volume within which a transient of fixed absolute magnitude can be detected, divided by exposure + overhead time

roughly **proportional to transient detection rate**

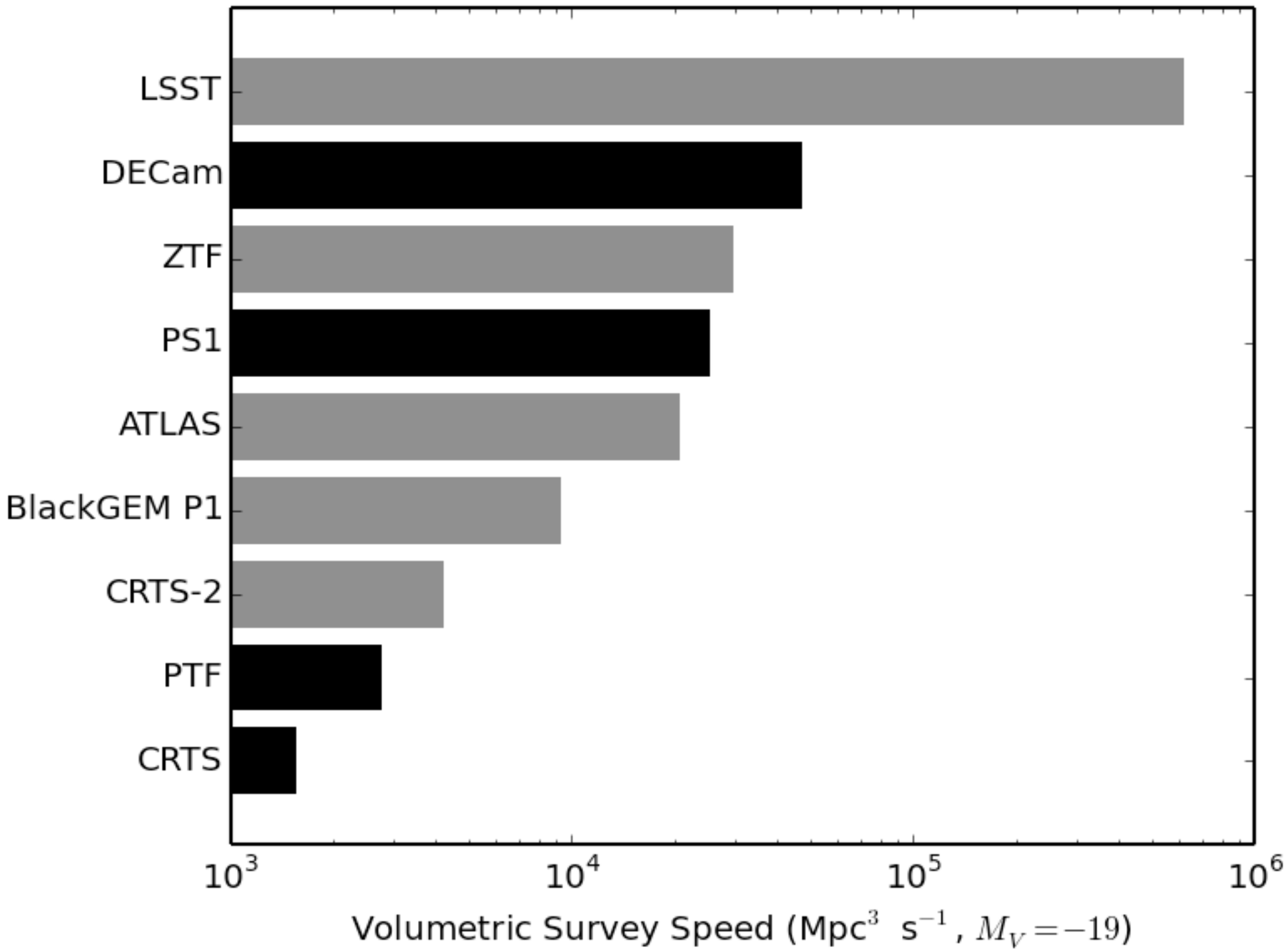
captures:

- field of view
- limiting magnitude
  - aperture
  - image quality
  - sky background
  - throughputs
- readout & slew overheads

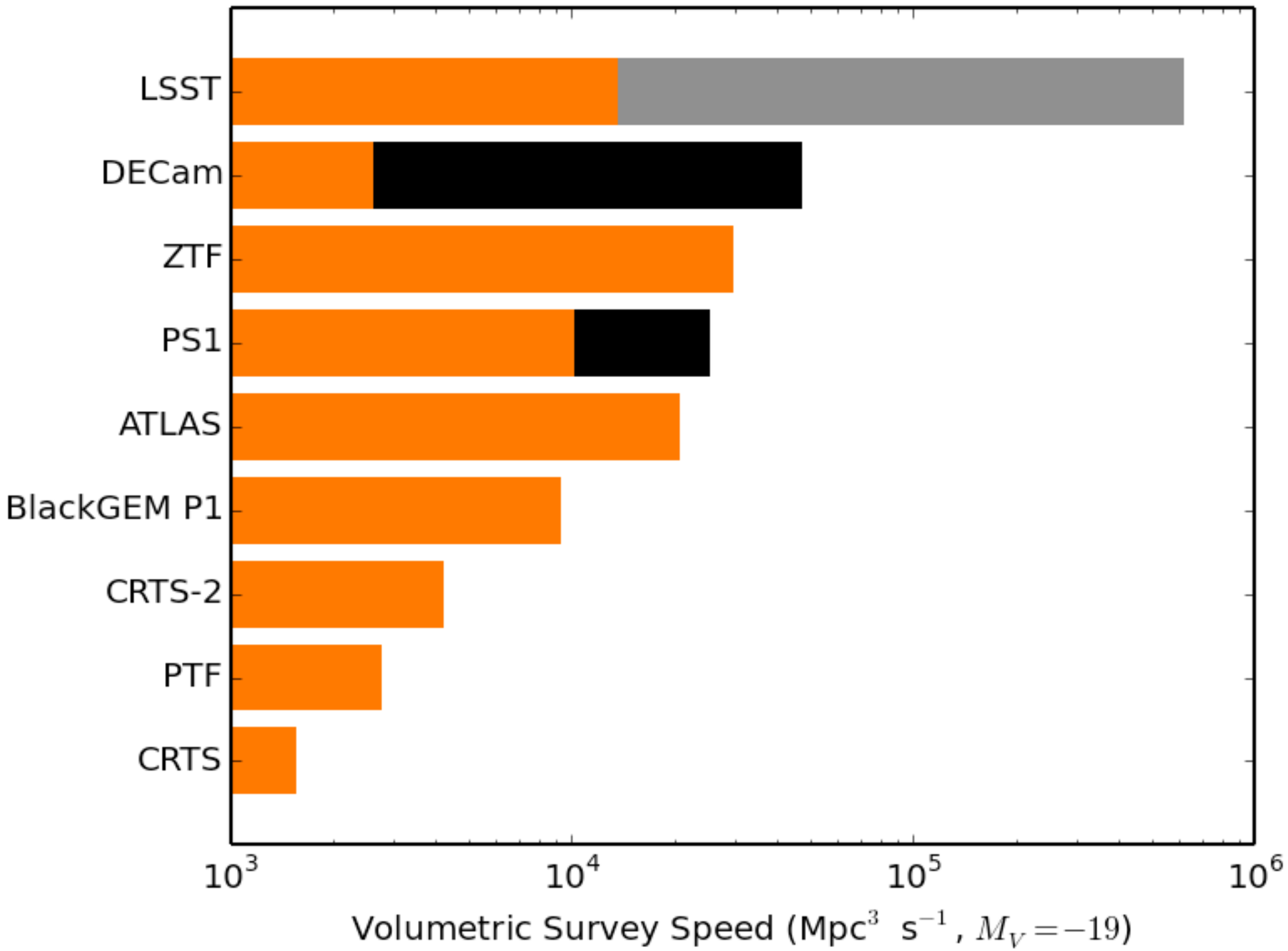
implies optimal exposure time



ZTF will have world-leading speed in finding spectroscopically-accessible transients.



ZTF will have world-leading speed in finding spectroscopically-accessible transients.



ZTF will survey an order of magnitude faster than PTF.

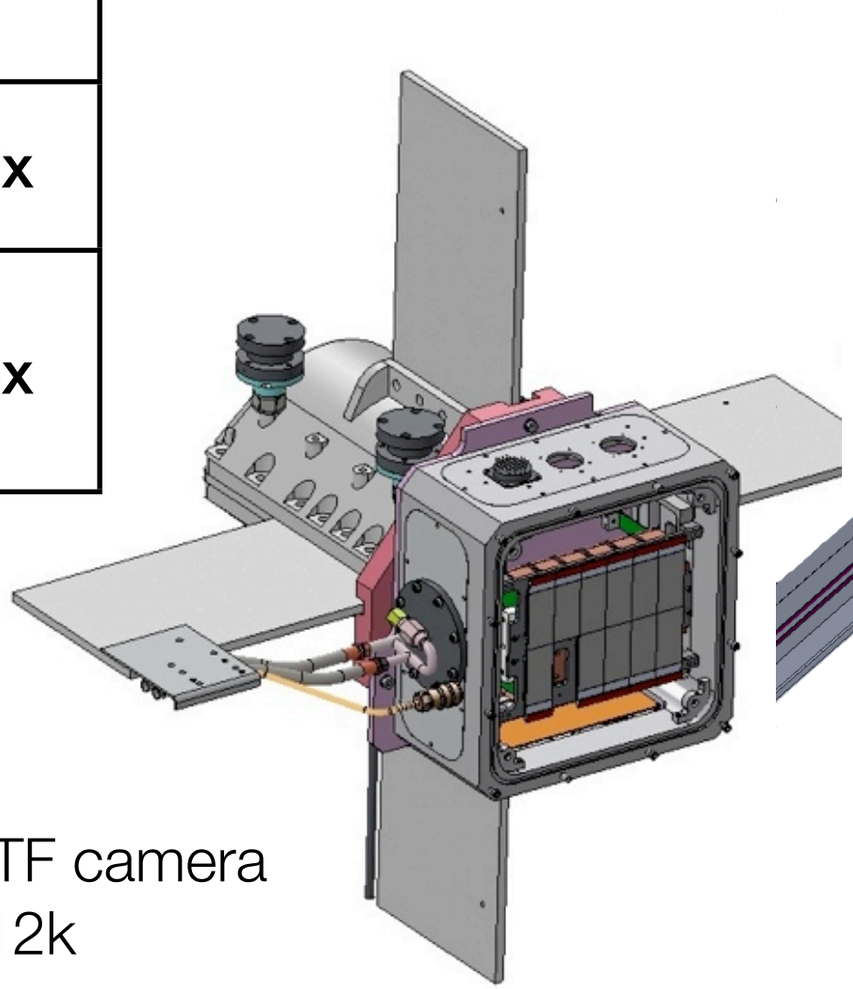
	PTF	ZTF
Active Area	7.26 deg^2	47 deg^2
Overhead Time	46 sec	<15 sec
Optimal Exposure Time	60 sec	30 sec
Relative Areal Survey Rate	1x	**14.7x**
Relative Volumetric Survey Rate	1x	**12.3x**

3800 deg^2/hour

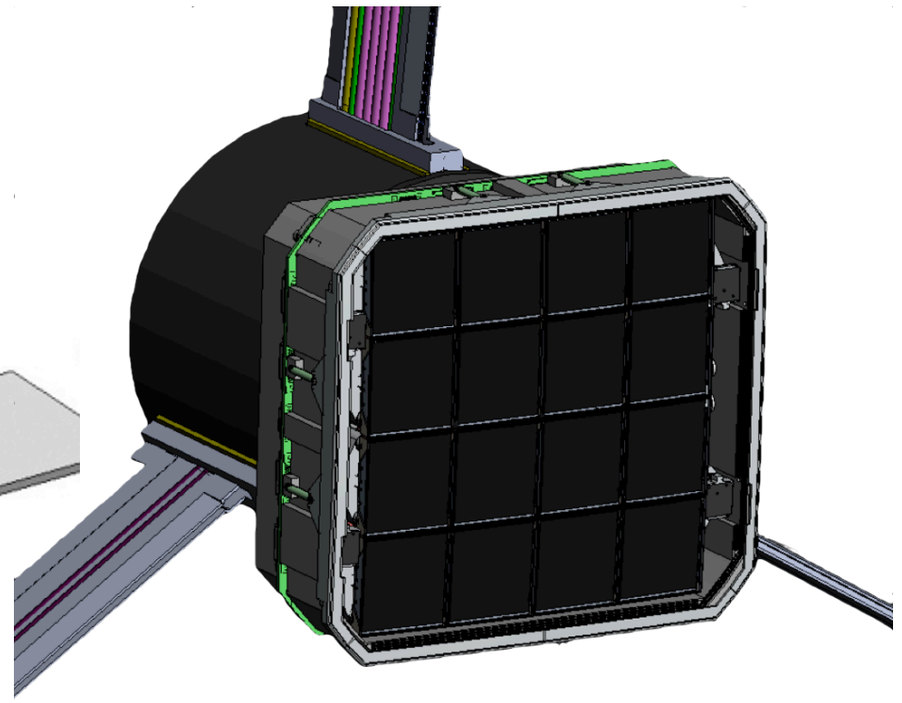
⇒ 3π survey in 8 hours

>250 observations/field/year

for uniform survey

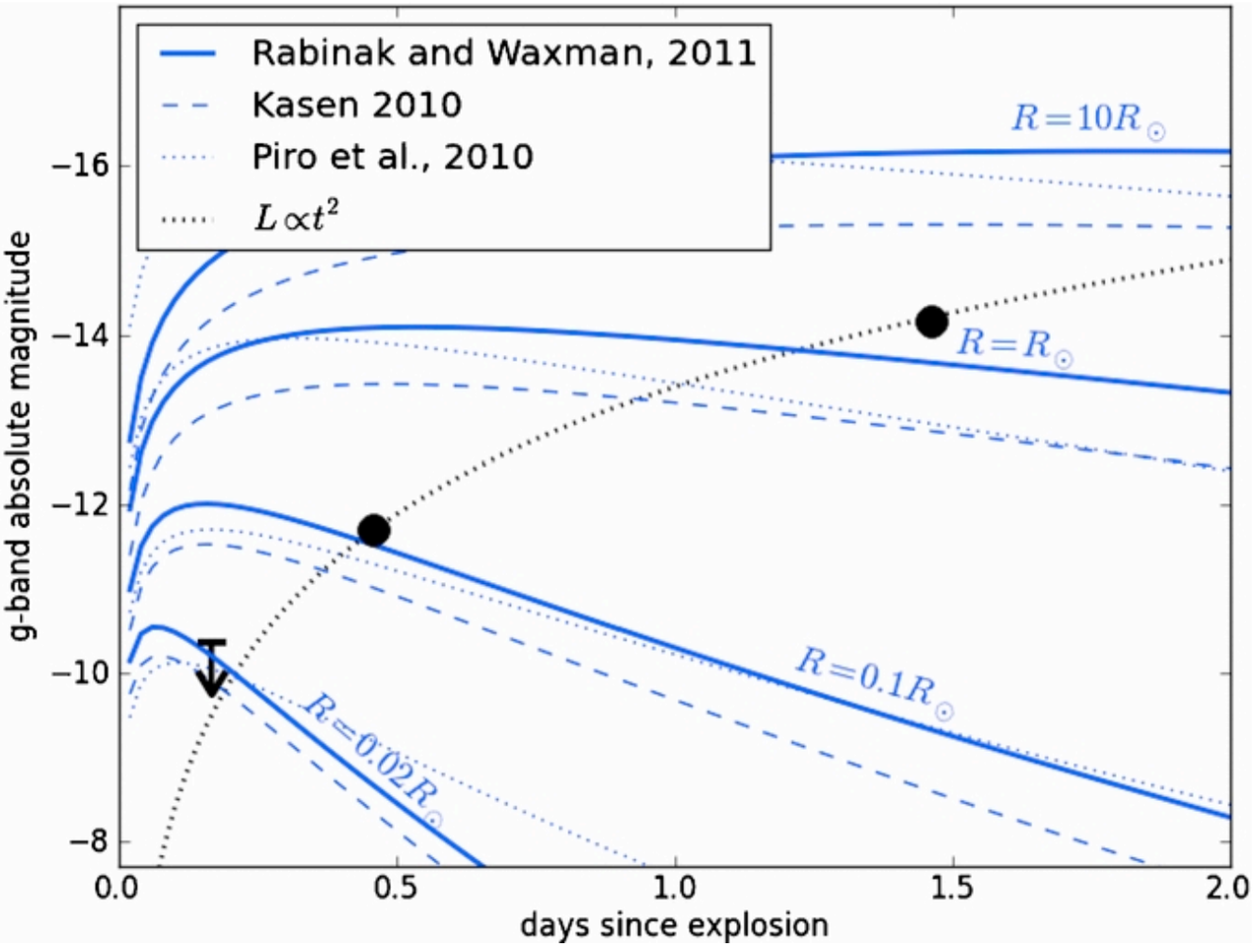


Existing PTF camera
MOSAIC 12k

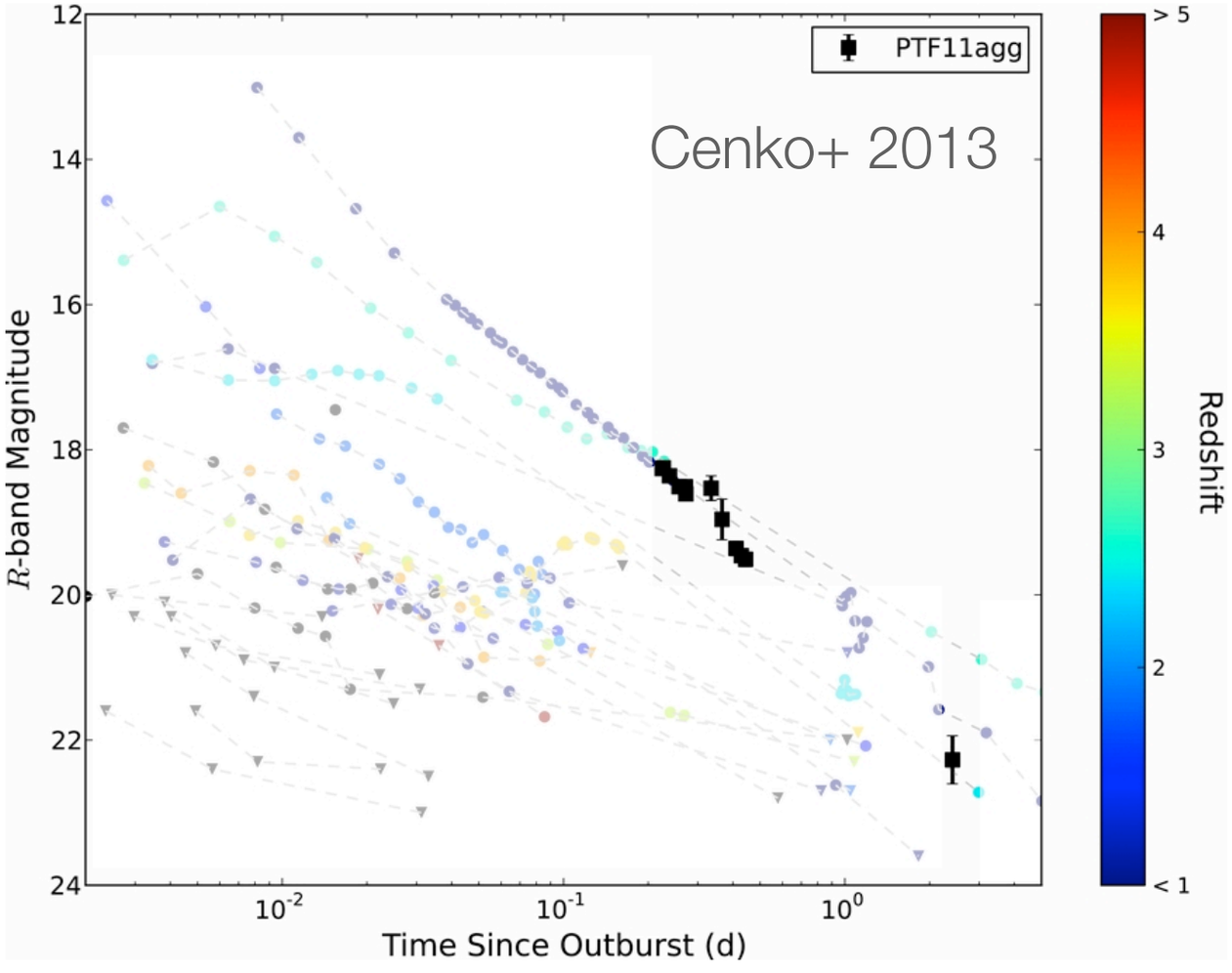


New ZTF camera:
16 6k x 6k e2v CCDs

ZTF will break new ground in the study of transients.



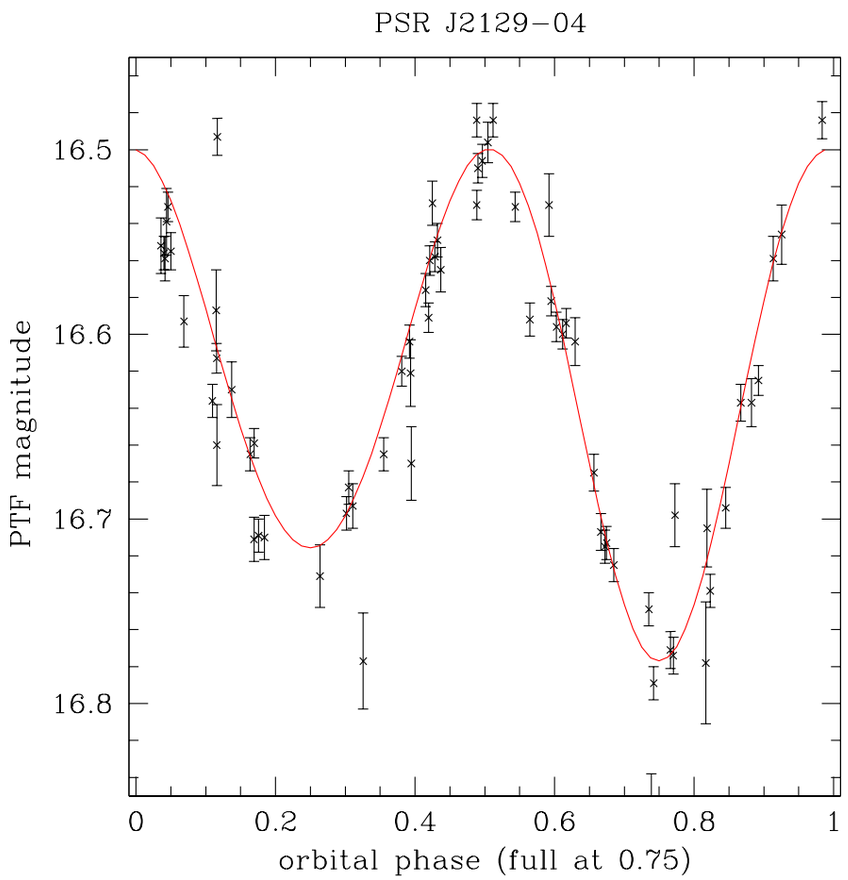
PTF11kly/SN 2011fe (Ia)
Bloom+ 2012



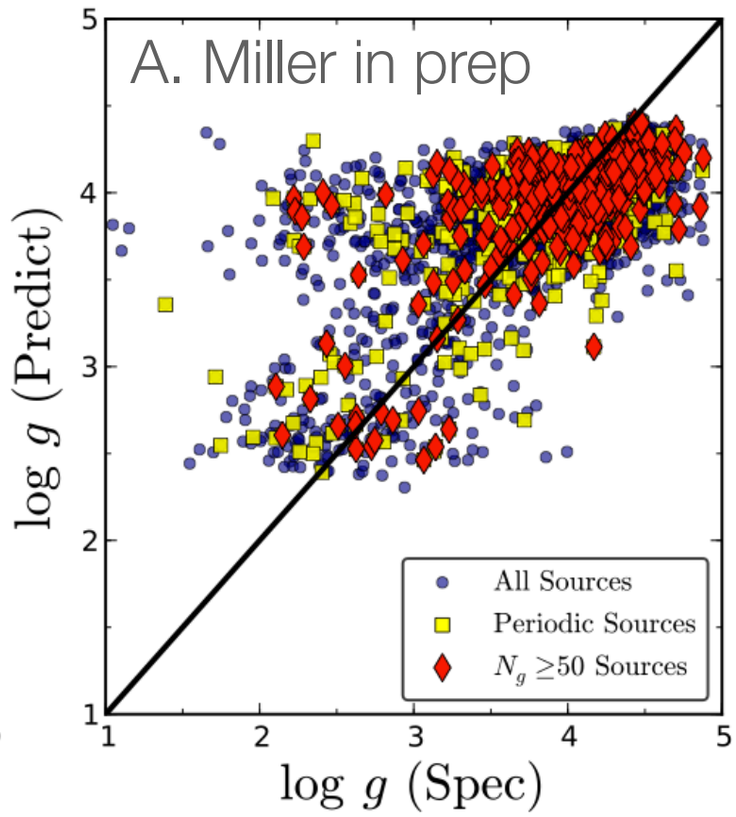
ZTF will discover a supernova < 24 hours old *every night*

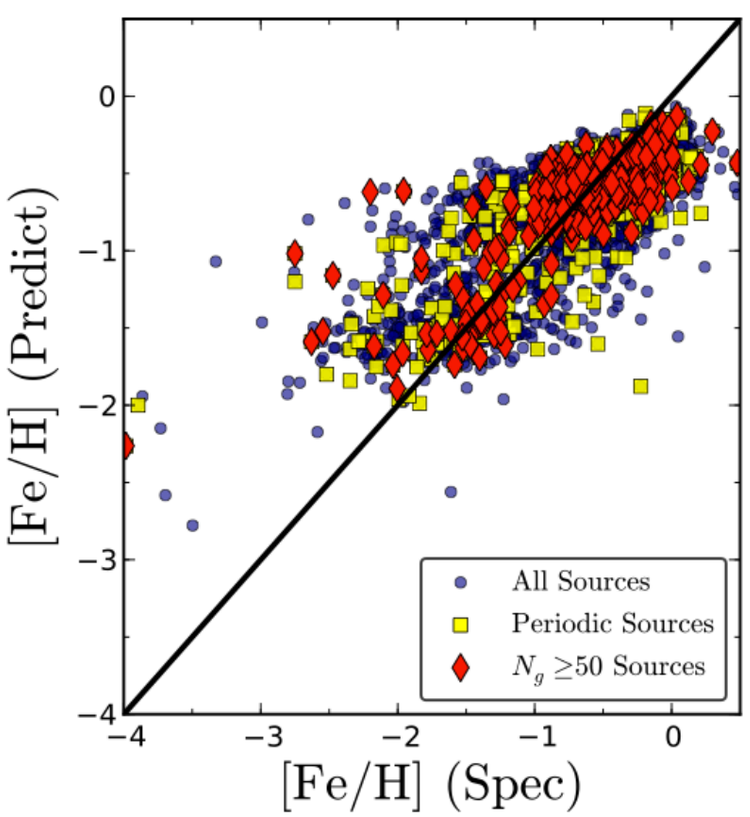
ZTF will:
Discover 5 GRB orphan afterglows each year
Discover >20 PTF11agg-like dirty fireballs each year

ZTF's variability catalogs will enable great science.

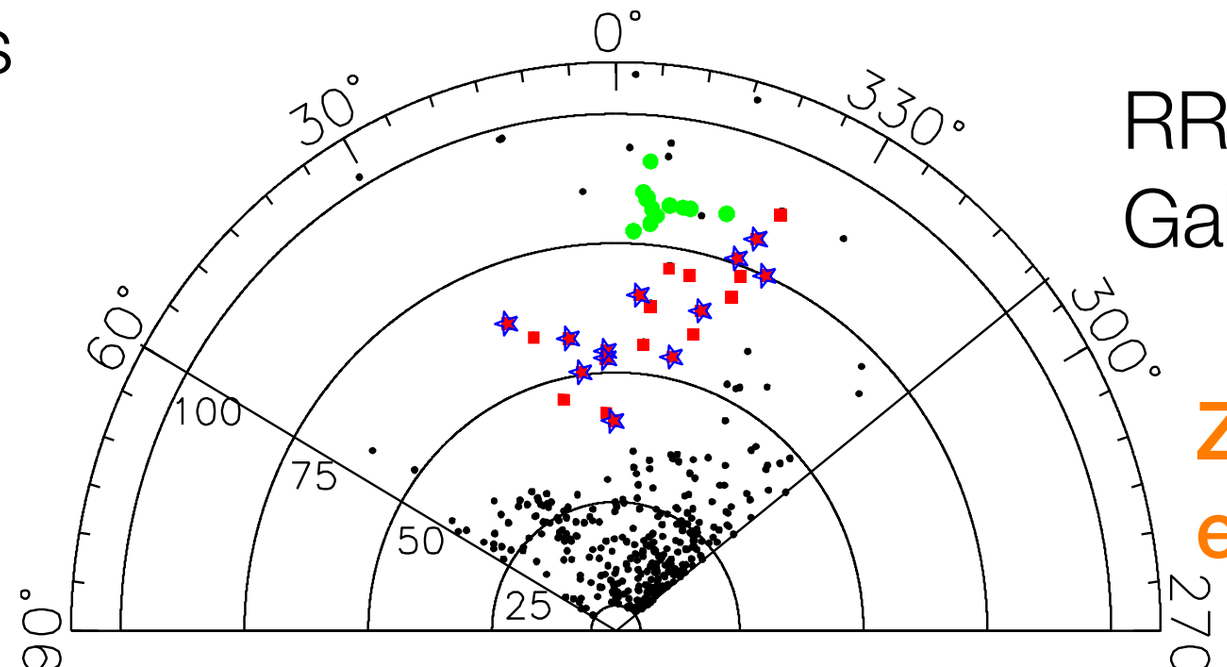


identifies compact binaries





variability predicts stellar parameters



B. Sesar

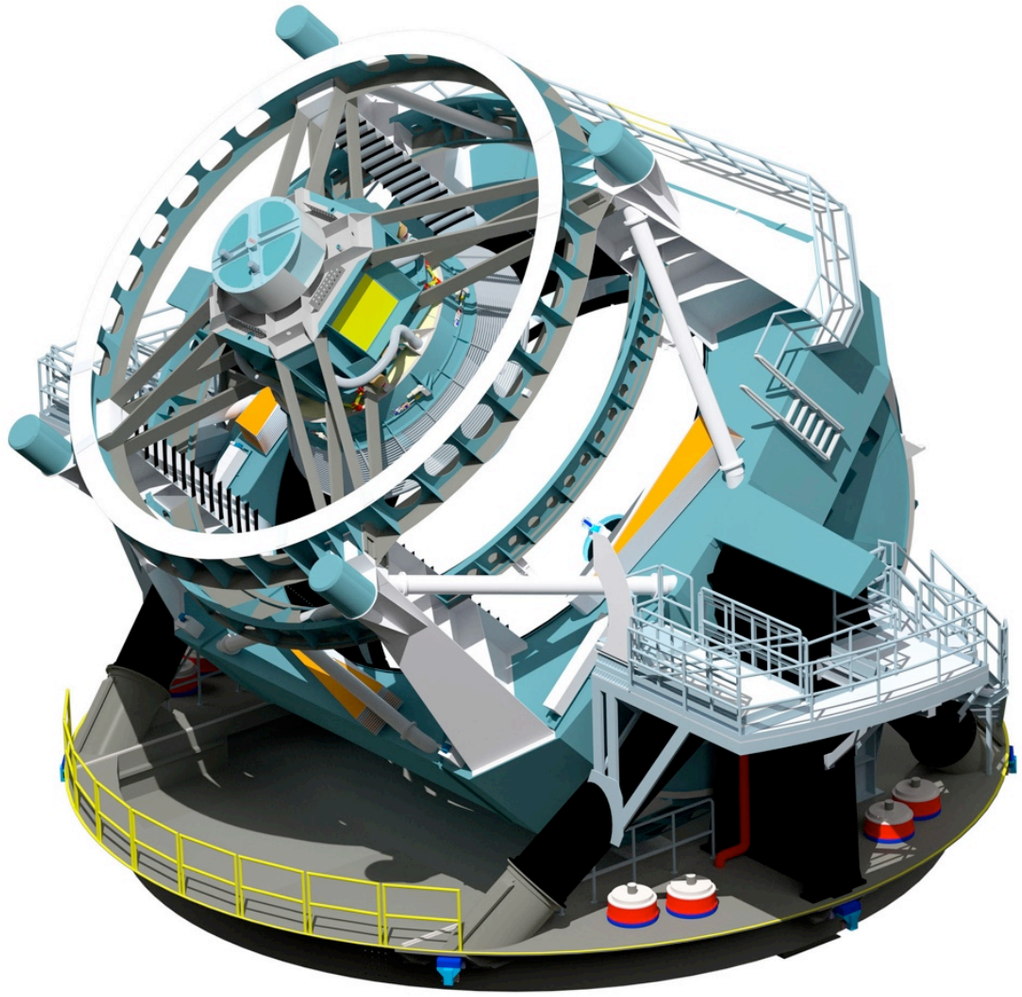
RR Lyr trace
Galactic Structure

ZTF will obtain hundreds of epochs each year over 3 pi

ZTF provides the US community a stepping stone to LSST.

PTF: 4 x 10^4 events/night
ZTF: 3 x 10^5 events/night
LSST: 2 x 10^6 events/night

Technical	develop algorithms & software for detection & classification
Scientific	discover new transient & variable phenomena
Organizational	organize collaborations and followup strategies with real data



NSF-sponsored summer schools and direct student involvement in ZTF development will prepare a new generation of researchers!