

VISTA SV Orion Survey



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M. Irwin, J. Lewis, E. Hatziminaoglou, + ESO Survey Team, +
Paranal VISTA Science Operations**

Goals and Observing Strategy

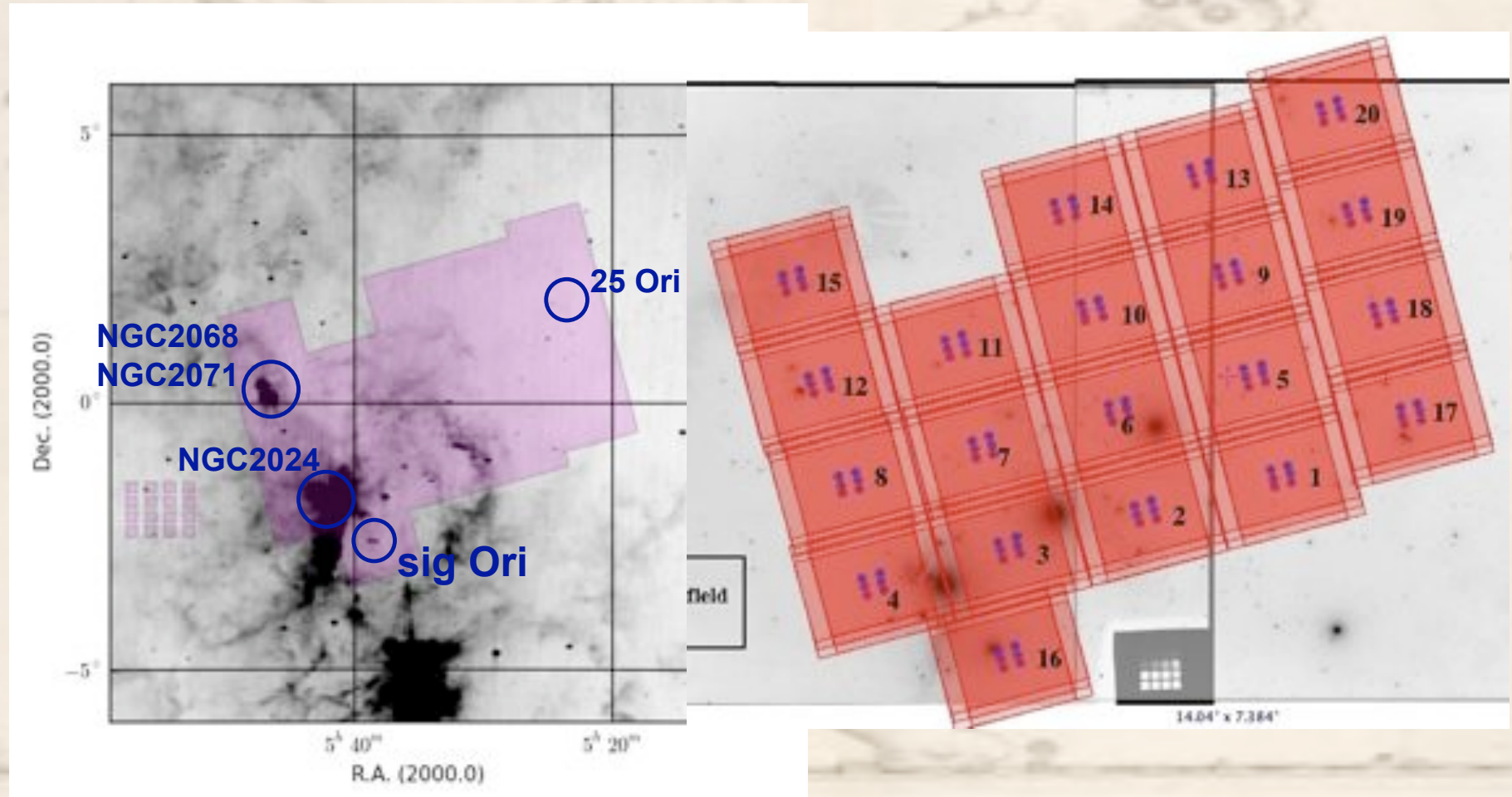
- ❖ **Deep imaging at Z,Y,J,H,Ks**
- ❖ **Including regions:**
 - Ori OB 1a (~10 Myr)
 - 25 Ori (~10 Myr)
 - Ori OB 1b (~5 Myr)
 - sigma Ori (~3 Myr)
 - embedded clusters (<1 Myr)
- ❖ **Aim: explore the young stellar/substellar pop.**
 - study low-mass IMF down to brown dwarf masses of $\sim 10 M_{\text{jup}}$
 - study circumstellar disk evolution
 - protostellar envelopes
 - YSO variability in 25Ori cluster



VISTA Orion Survey: Phase 1

Specific Pointings

- ❖ 20 tiles (pointings), overlap is 60" in x and 100" in y
- ❖ Each tile consists of 6 pawprint positions



Details of Observing Strategy

Three main types of observations:

1. **Deep imaging**

Sequential execution of **OB1** KsJZ **OB2** HYZshort (~2 hrs execution time)
for each tile. Sky is obtained from combining the indiv. pawprints

Filter	Z	Z	Y	Y	J	H	Ks
DIT (sec)	30	6	30	6	4	2	2
NDIT	5	4	2	4	8	12	12
Min. Exp. Time (sec) per pixel	900	48	240	96	128	96	96

Limiting magnitudes (5σ) aimed at:

22.7 (Z) 21.0 (Y) 20.2 (J) 19.2 (H) 18.4 (Ks)

(which is 12M_Jup at 10 Myr)



Details of Observing Strategy

But: Tile 4 (containing NGC2024) has an associated sky field, sequence sky (5 jitters) → Tile 4 → Tile 8 (for each filter), hence no nearly simultaneous photometry at all bands

2. Shallower, repeated imaging of Tile 19 (25 Ori group)

To detect variability of sources in the 25 Ori group

At least one epoch per night, sometimes 2 with minimum separation 1hr

	J	H
DIT	8	4
NDIT	2	3
Min.Exp.Time per pix (sec)	32	24

3. Extra OBs observing Tile 16 (sigma Ori)

To improve the sensitivity limits at Z- and J-band in the sigma Ori cluster

$T_{\text{exp}} \sim 3\text{min. per OB}$

VISTA Orion Survey:
Observations

Observing Summary

- ❖ 14 nights between Oct 16 and Nov 02, 2009 with all nights CLR except for one night with THN conditions
- ❖ All tiles fully observed in all filters
2175 single exposures obtained for Orion (559 Gb)
- ❖ 19 epochs for Tile19 (25 Ori) and 5 extra OBs on Tile16 (sig Ori)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Z	2844	3294	2844	3120	2844	2844	2844	2844	2844	2844	2844	2844	2844	2844	2994	6084	2844	2844	2844	2844
Y	1128	1380	1008	1200	1788	1068	1068	1068	1068	1068	1068	864	1008	1008	1464	1008	1008	1008	1008	1008
J	544	608	384	384	768	384	384	384	384	384	384	384	384	384	384	2112	384	416	2528	384
H	416	288	288	288	288	312	288	288	288	288	288	288	288	288	288	288	288	288	1884	288
Ks	288	360	288	288	312	288	288	288	288	288	312	288	312	288	288	288	288	288	288	288

Raw data publically available at:
http://www.eso.org/sci/activities/vistasv/VISTA_SV.html

Total exposure time per tile and filter

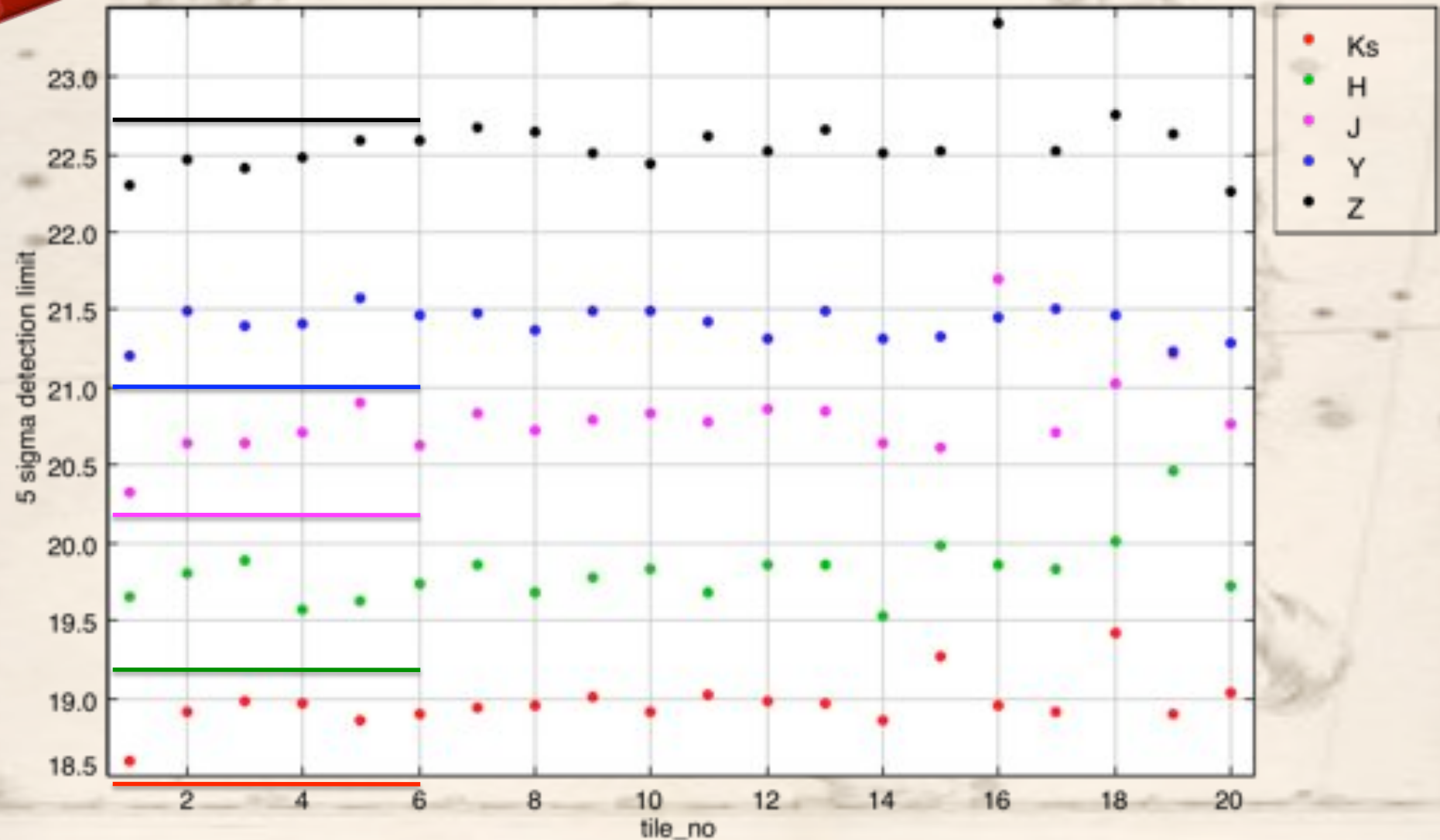
Data reduction

- ❖ **Reduction performed via VDFS pipeline at CASU**
 1. Pawprint level reduced data products
(made available to ESO SV team on disks +
access via Vista Science Archive)
 2. Stacking of pawprints to tiles + catalog creation
from tiles + band-merged full survey catalog
3×10^6 sources !!
(CASU, E. Gonzalez, S. Hodgkin – 15. Jan. 2010)
- ❖ **Currently ongoing: inspection of pawprint level products and of the full survey band merged catalogue**

VISTA Orion Survey:
first analysis

Detection limits


Detection limits on the deep stacked full survey



VISTA Orion Survey:
first analysis

3-color images

NGC2071+NGC2068



VISTA Orion Survey:
first analysis

3-color images



NGC2071

VISTA Orion Survey:
first analysis

3-color images



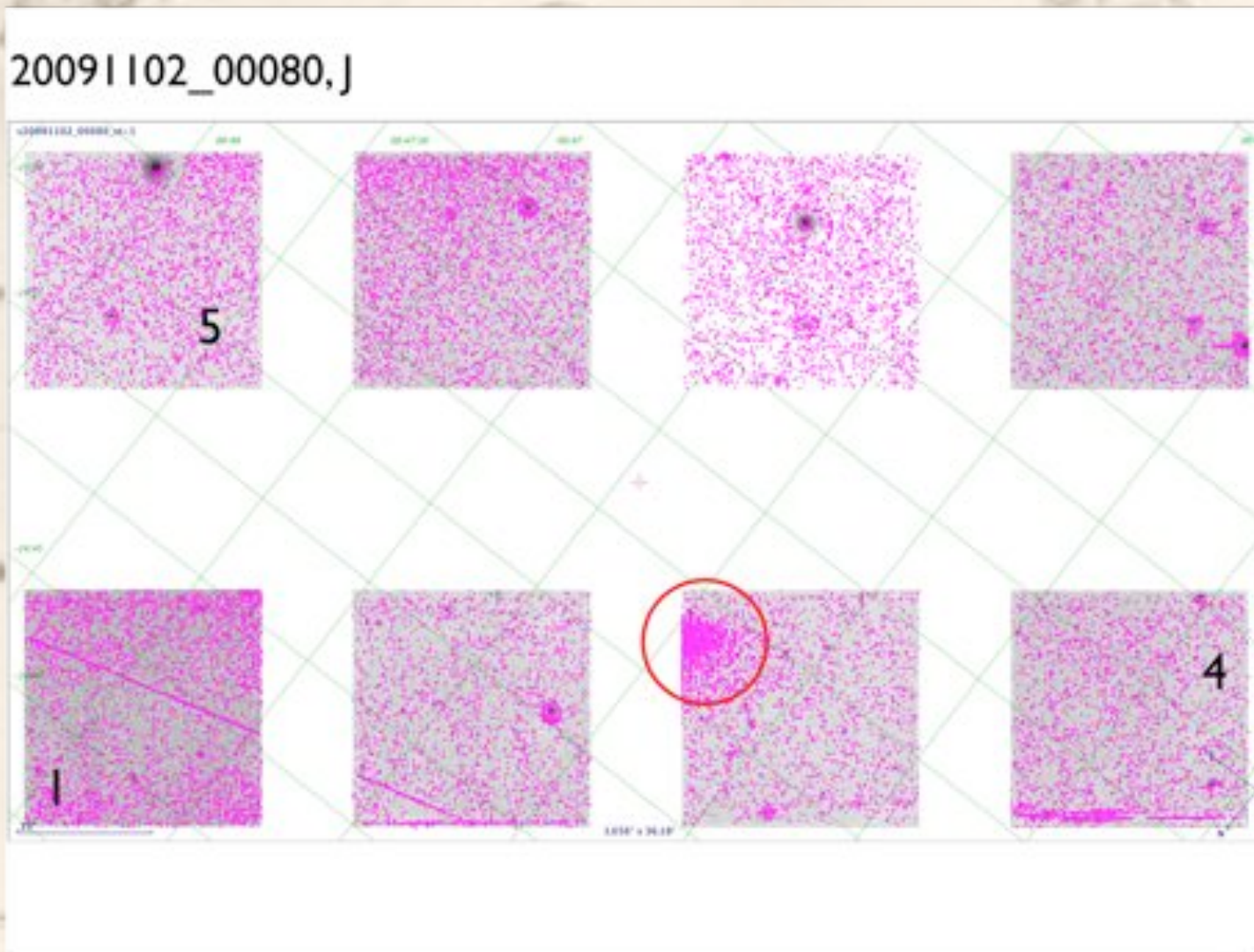
NGC2023

VISTA Orion Survey:
first analysis

Spurious source extraction

(E.Hatziminigolou)

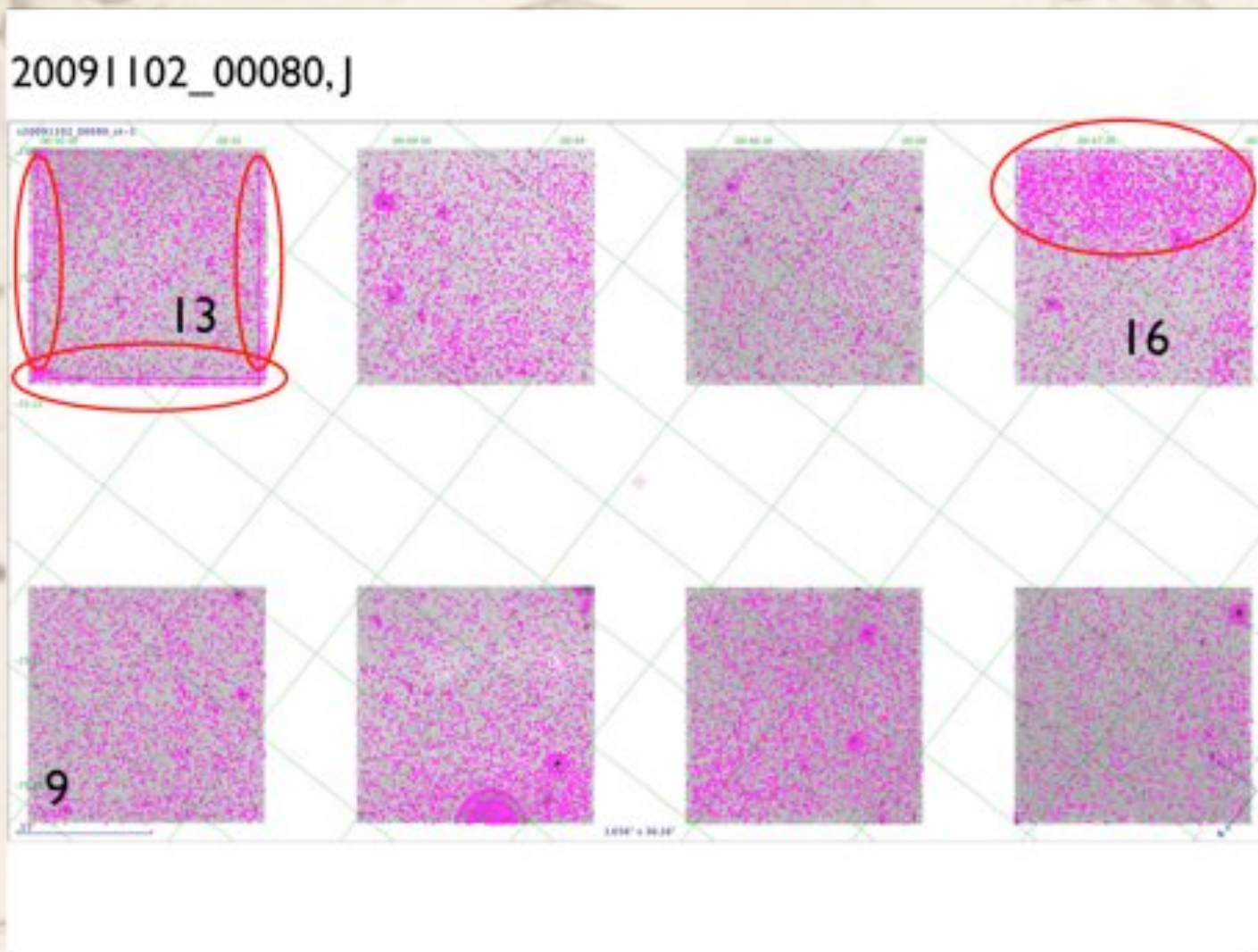
Checking location of sources contained in pawprint catalog



VISTA Orion Survey:
first analysis

Spurious source extraction

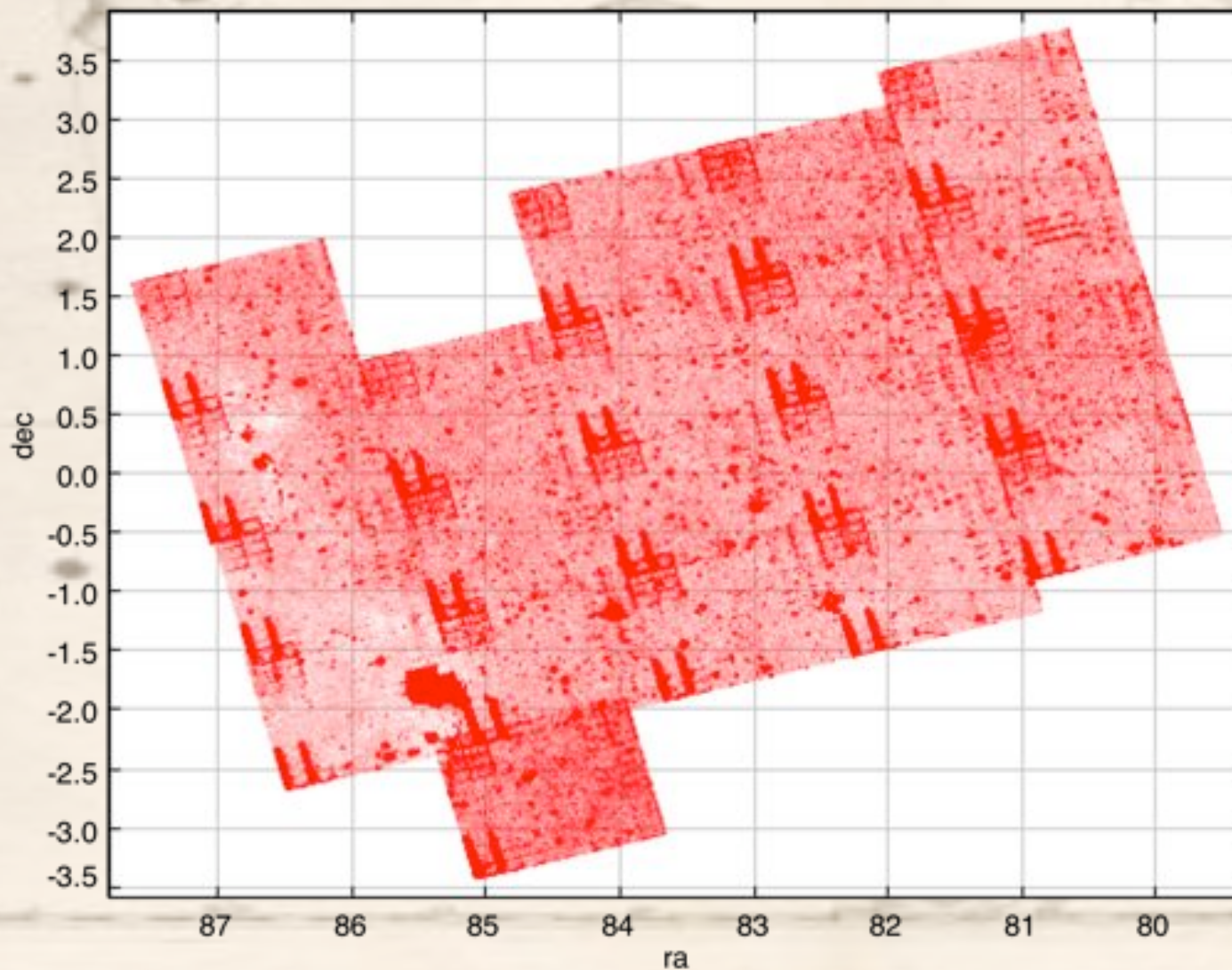
→ noise detections on det 3, 13, 16 !!



VISTA Orion Survey:
first analysis

Spurious source extraction

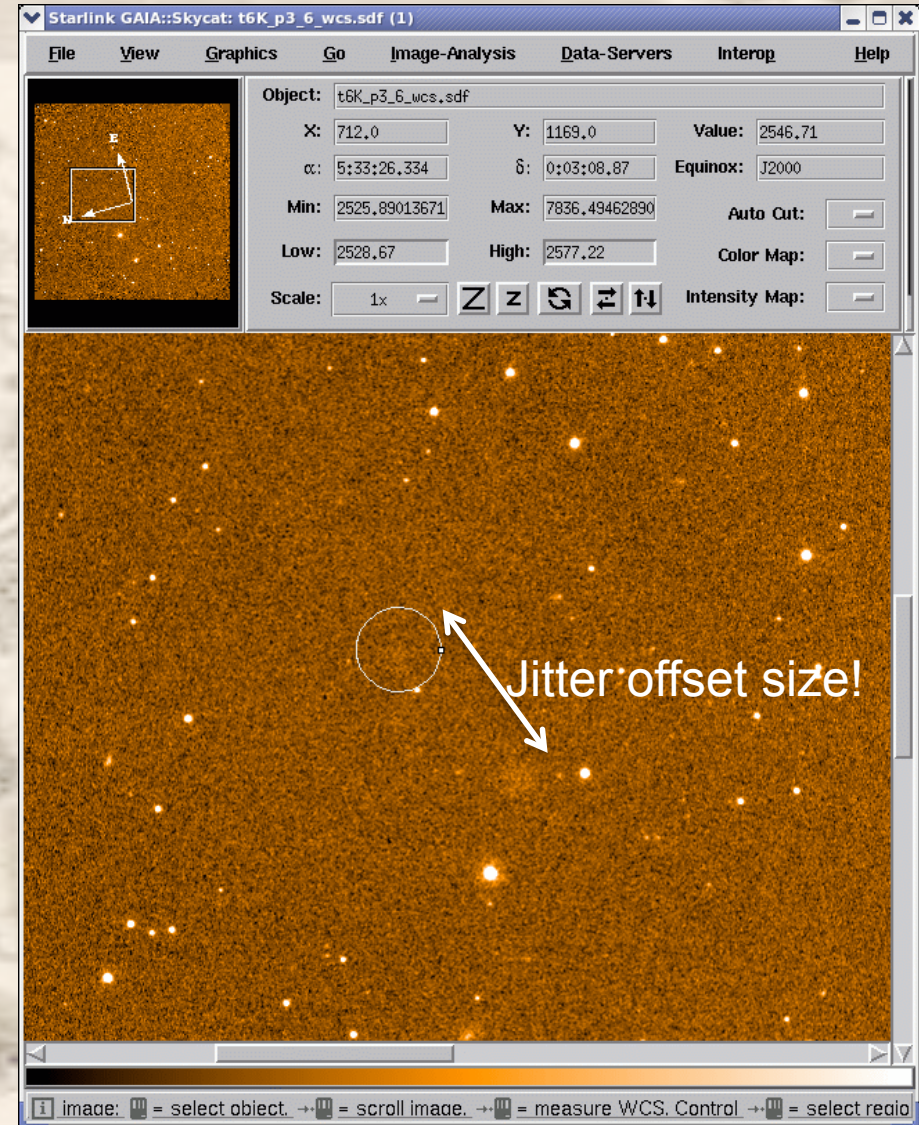
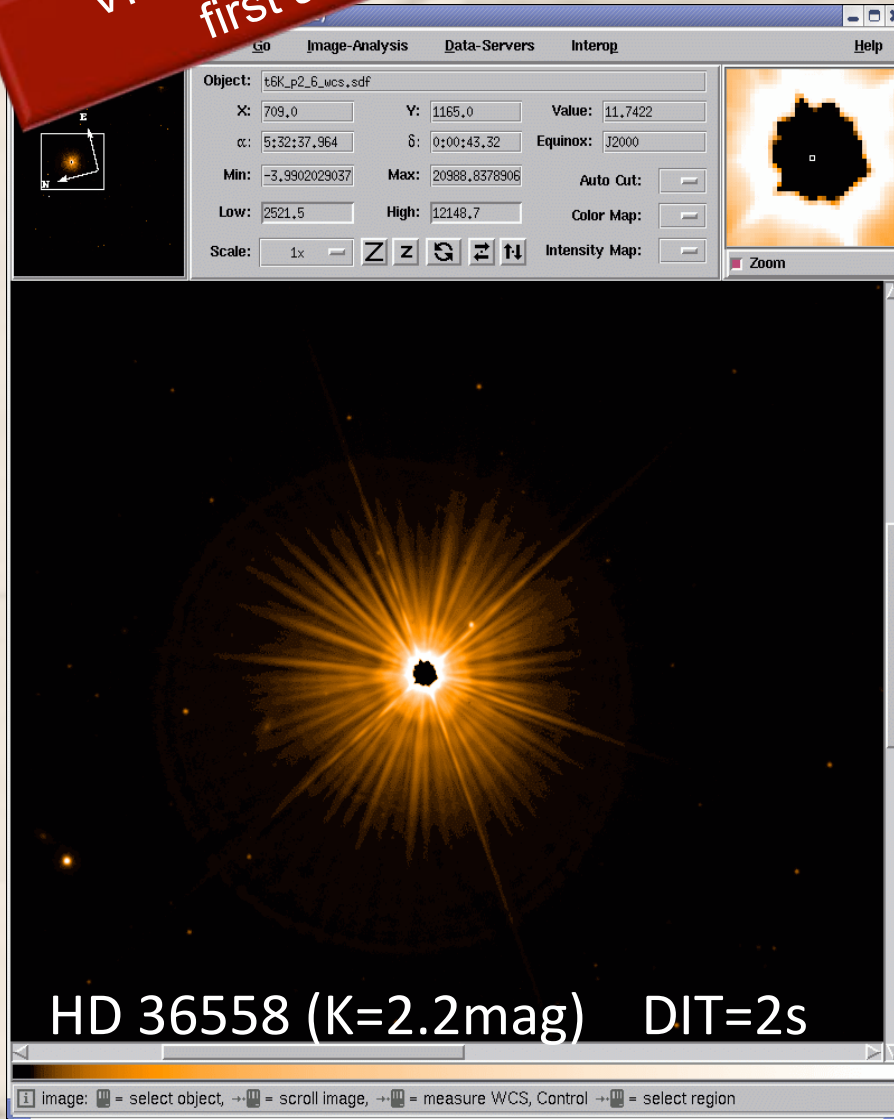
Effects of spurious detections on det 3, 13, 16 on mosaiced
full survey



VISTA Orion Survey:
first analysis

Persistence

(G.Hussain, M. Petr-Gotzens)



flux level: ~0.2% of background

VISTA Orion Survey:
first analysis

Persistence

- ❖ **1 minute after saturation occurred:
persistence signal is $\sim 1.5\sigma$ above the background**
- ❖ **2 minutes after saturation occurred:
persistence completely gone**

VISTA Orion Survey:
first analysis

Astrometry

(L. Spezzi, J.M. Alcalá)

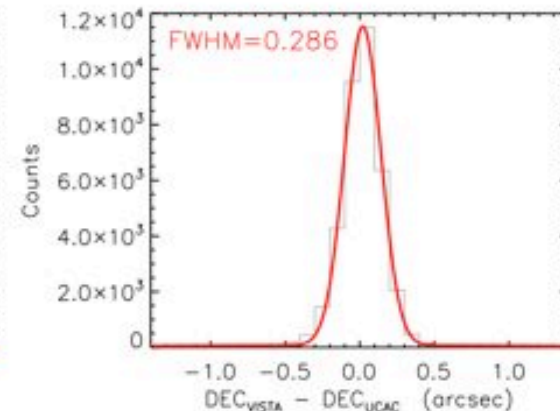
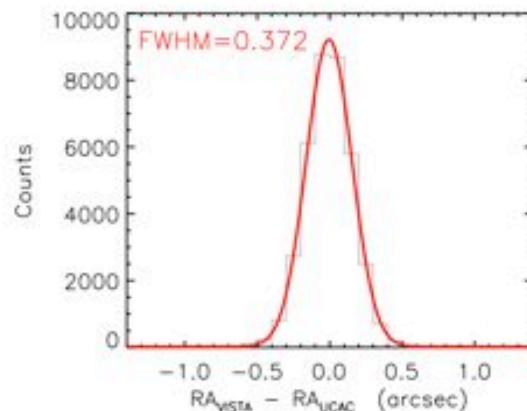
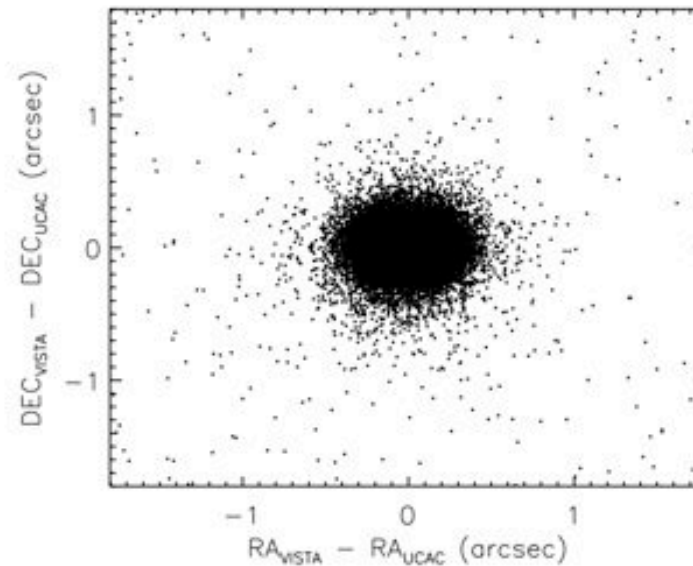
- ❖ Match UCAC3 sources with VISTA sources of the deep mosaiced Orion catalog



$\sigma \sim 0.3''$

for **ABSOLUTE** astrometry

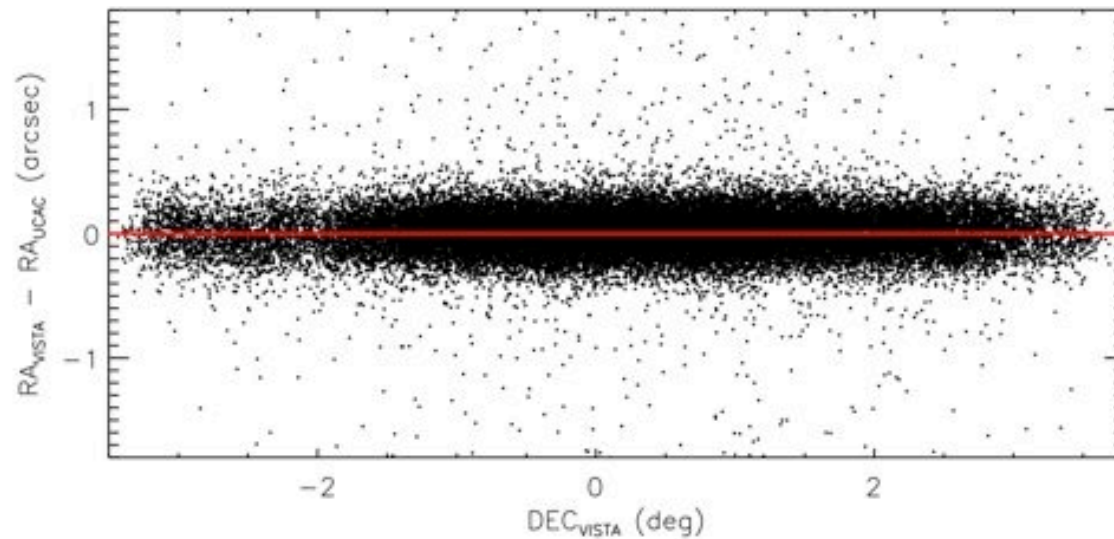
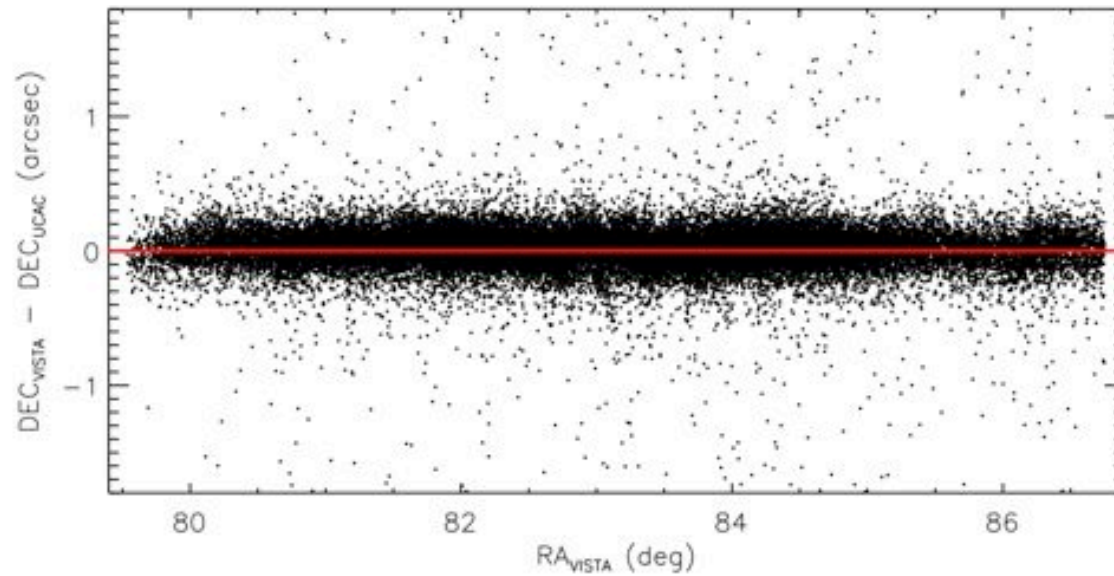
But may be even better, because use of single precision RA, DEC in the Orion source catalog



VISTA Orion Survey:
first analysis

Astrometry

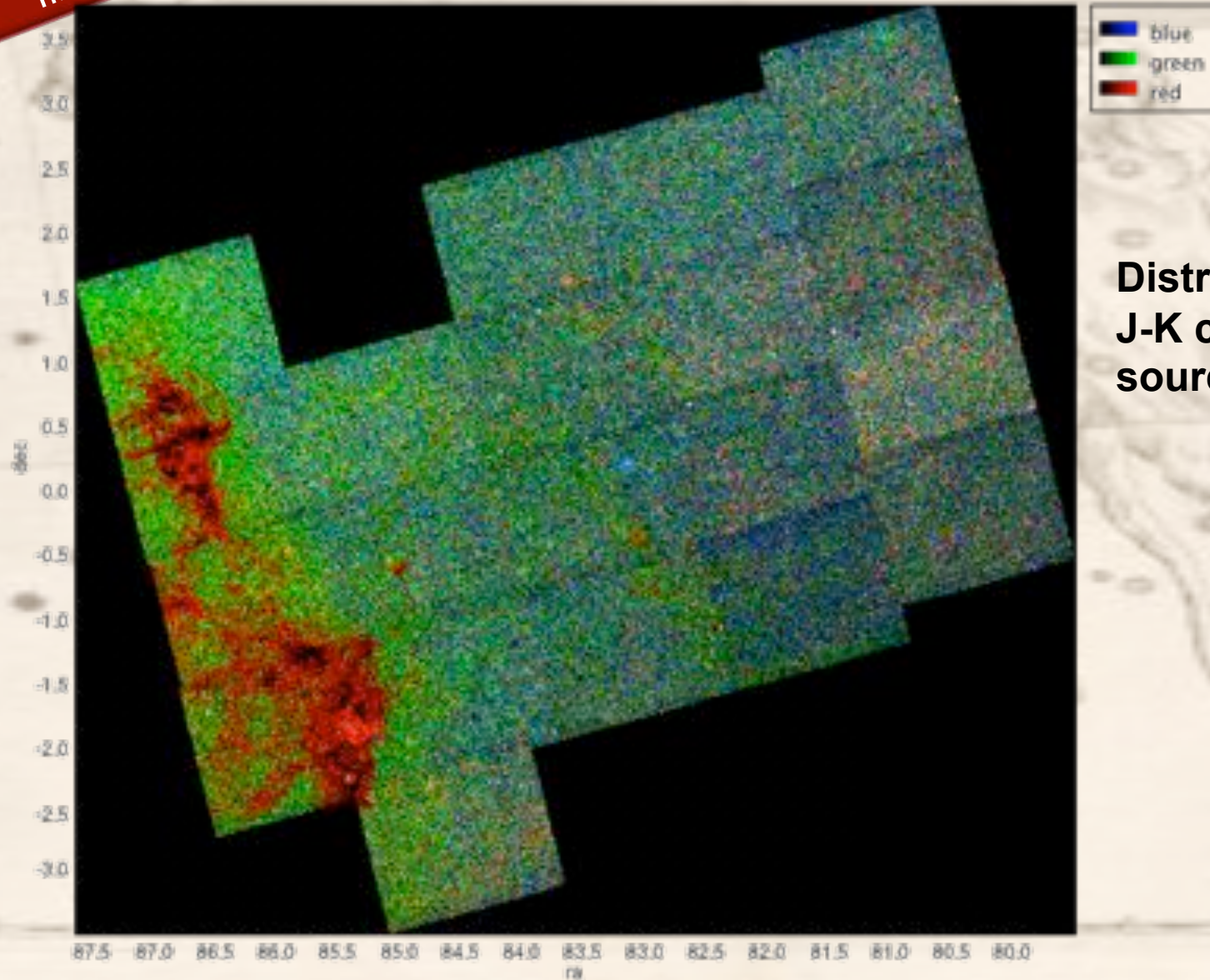
No systematics with
RA or DEC



VISTA Orion Survey:
first analysis

Color map of Orion Survey

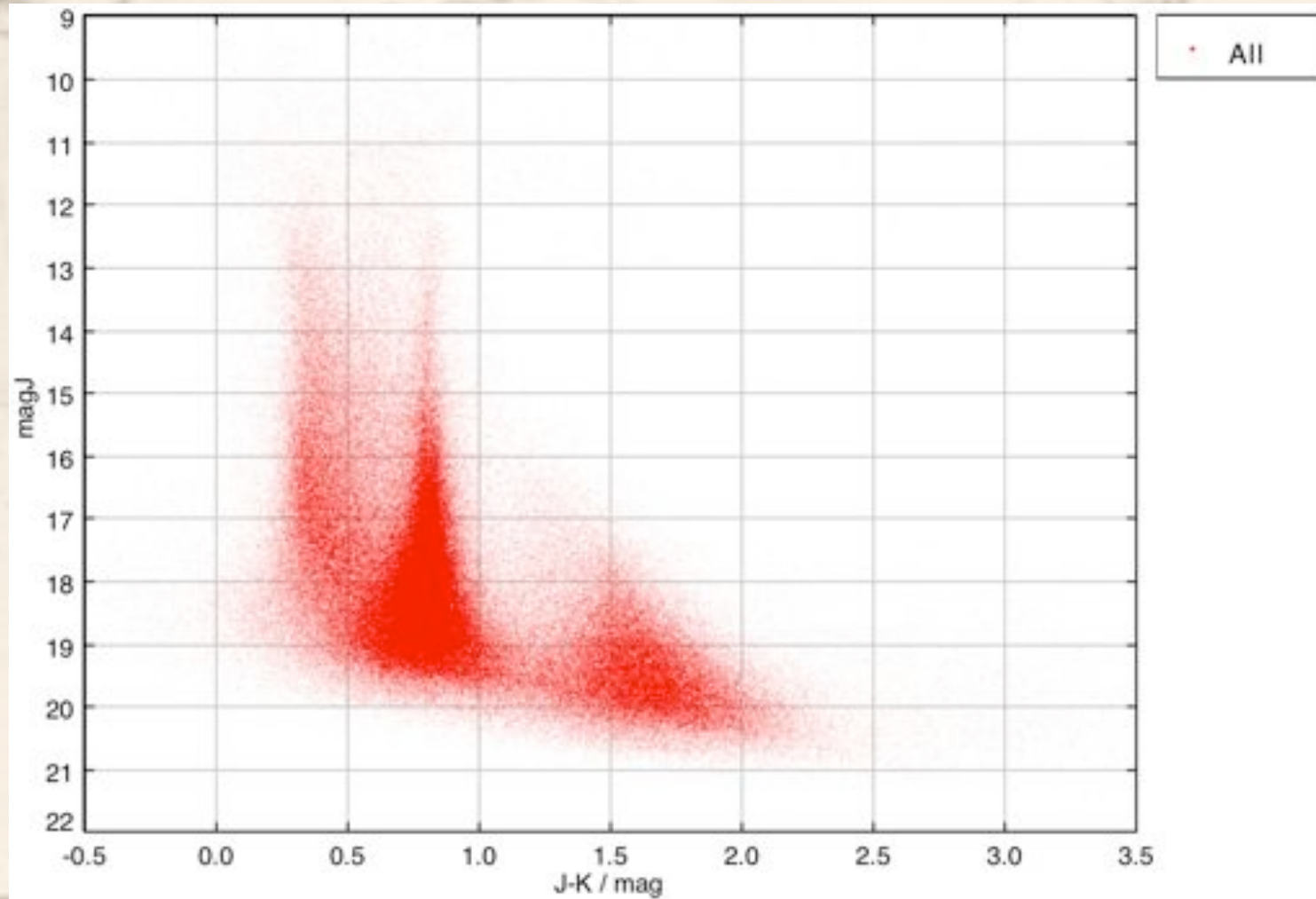
(E. Gonzalez, S. Hodgkin)



**Distribution of
J-K color of all
sources**

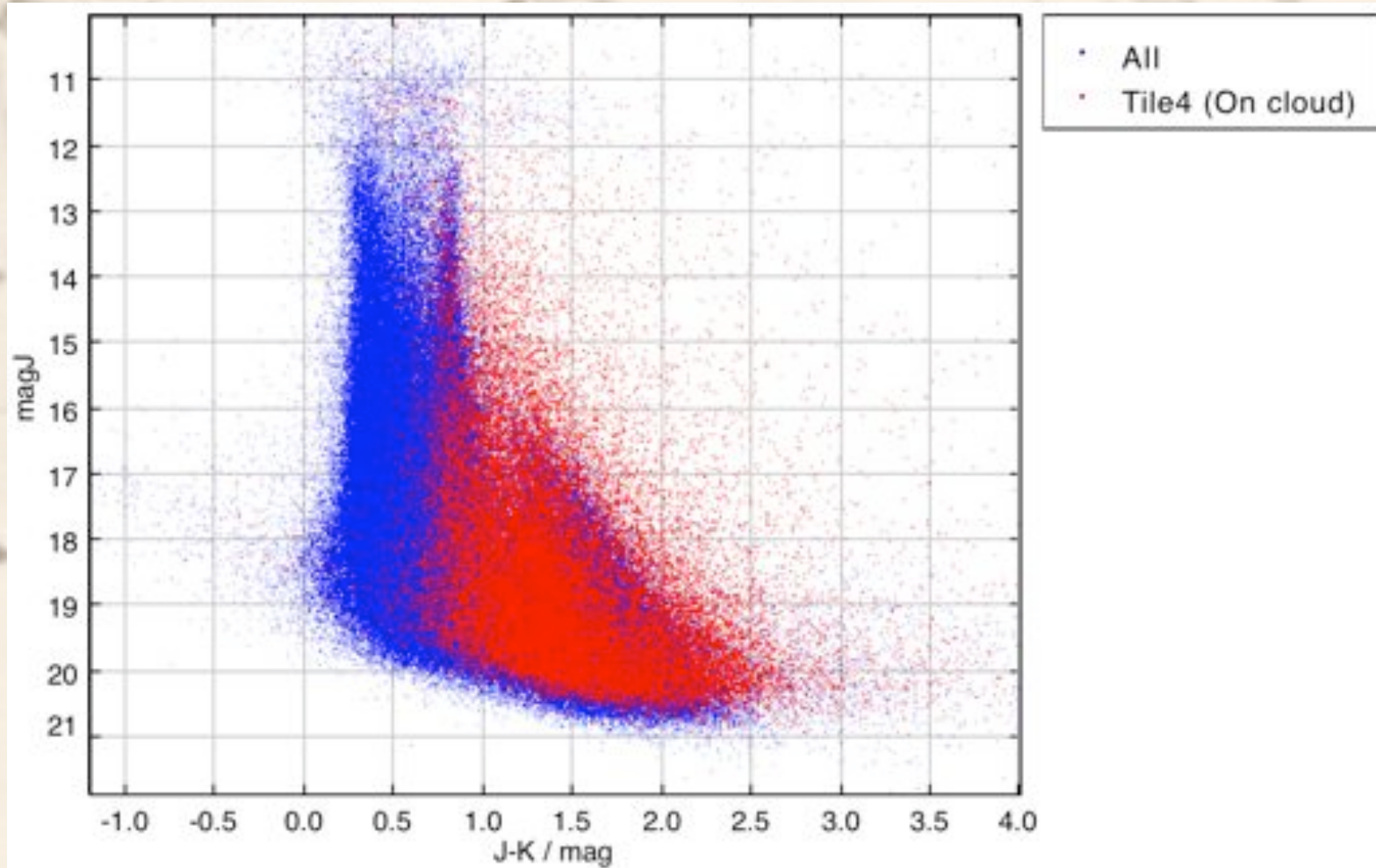
VISTA Orion Survey:
first analysis

J-K/K Color Magnitude Diagram



VISTA Orion Survey:
first analysis

J-K/K Color Magnitude Diagram

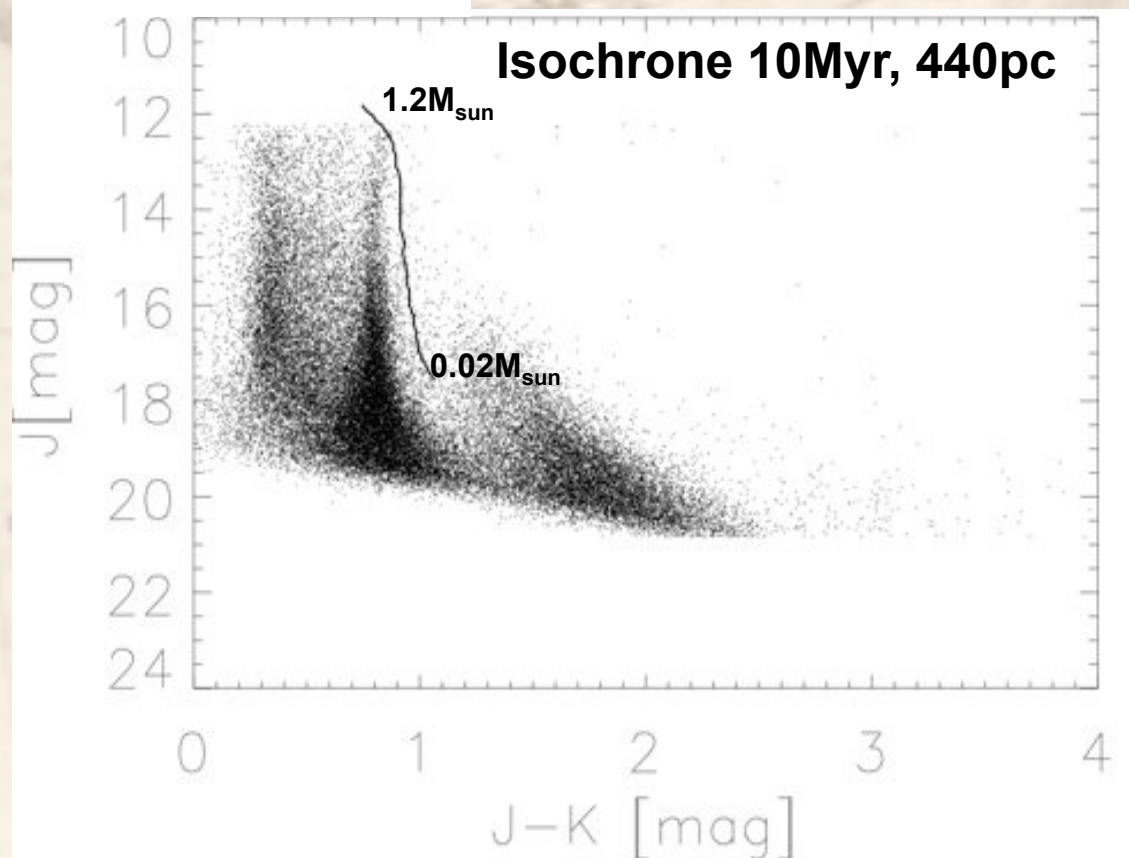


VISTA Orion Survey:
first analysis

J vs J-K Color mag diagram

Young Orion sources?

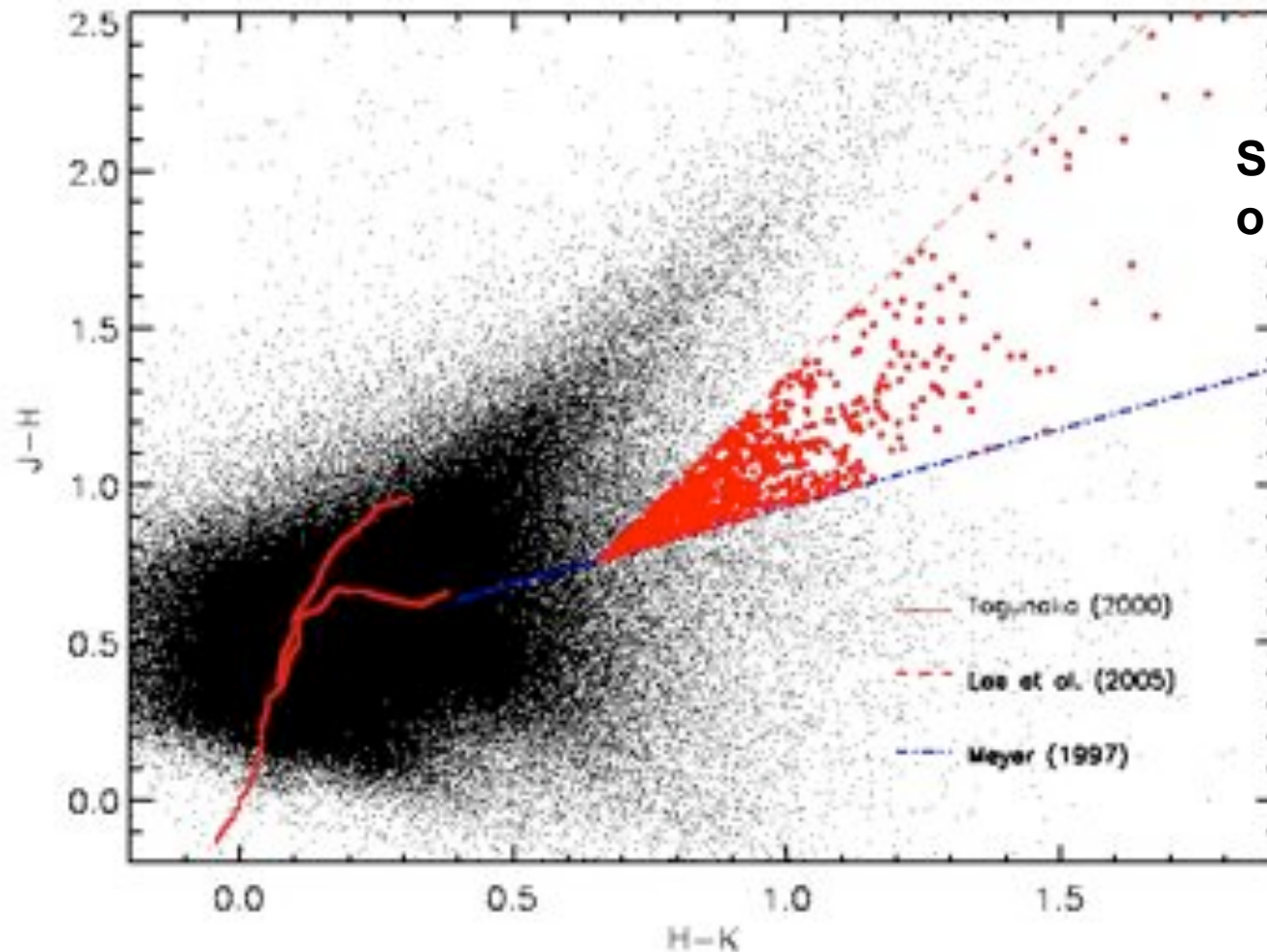
CMD of 25Ori Tile



VISTA Orion Survey:
first analysis

Candidate young stellar objects with circumstellar disks

(L. Spezzi, J.M. Alcalá)



**Selection of IR-excess
objects:**

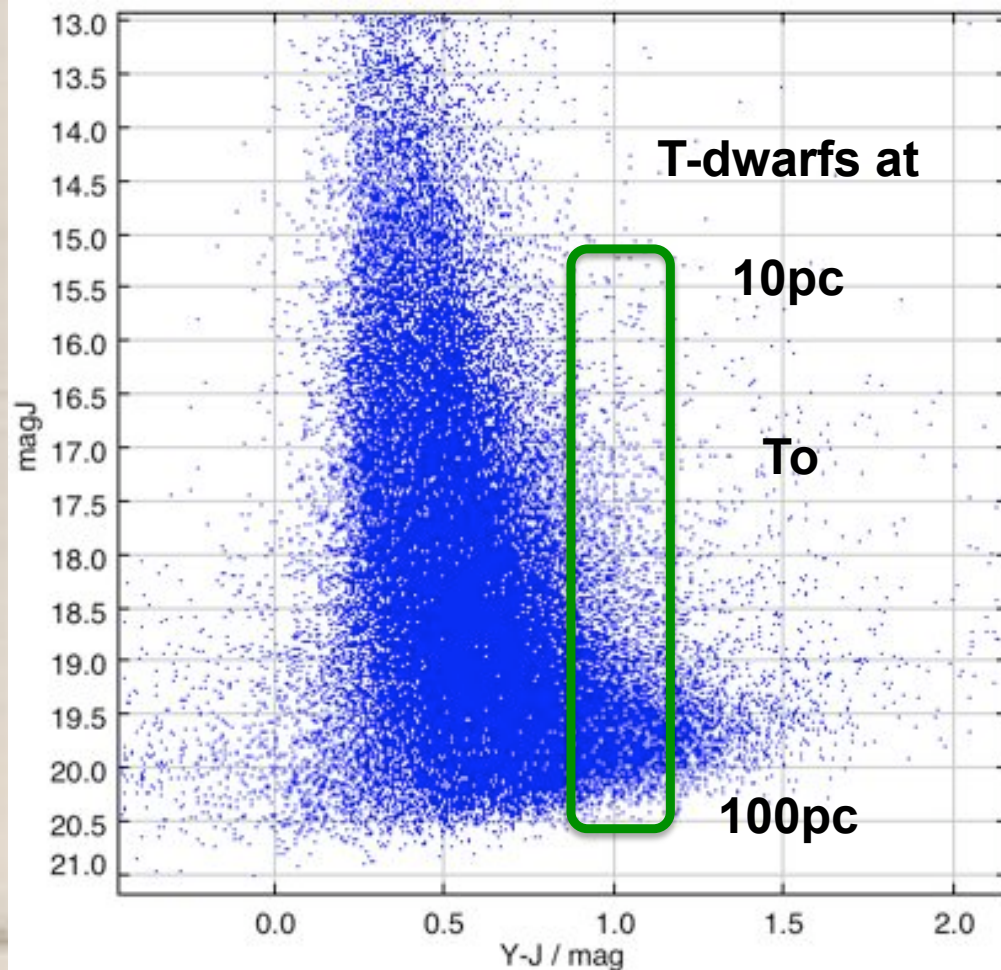
**YSO or
Extragalactic?**

**More work (bands)
needed**

VISTA Orion Survey:
first analysis

The coolest objects: T-dwarf candidates

(M. Petr-Gotzens)



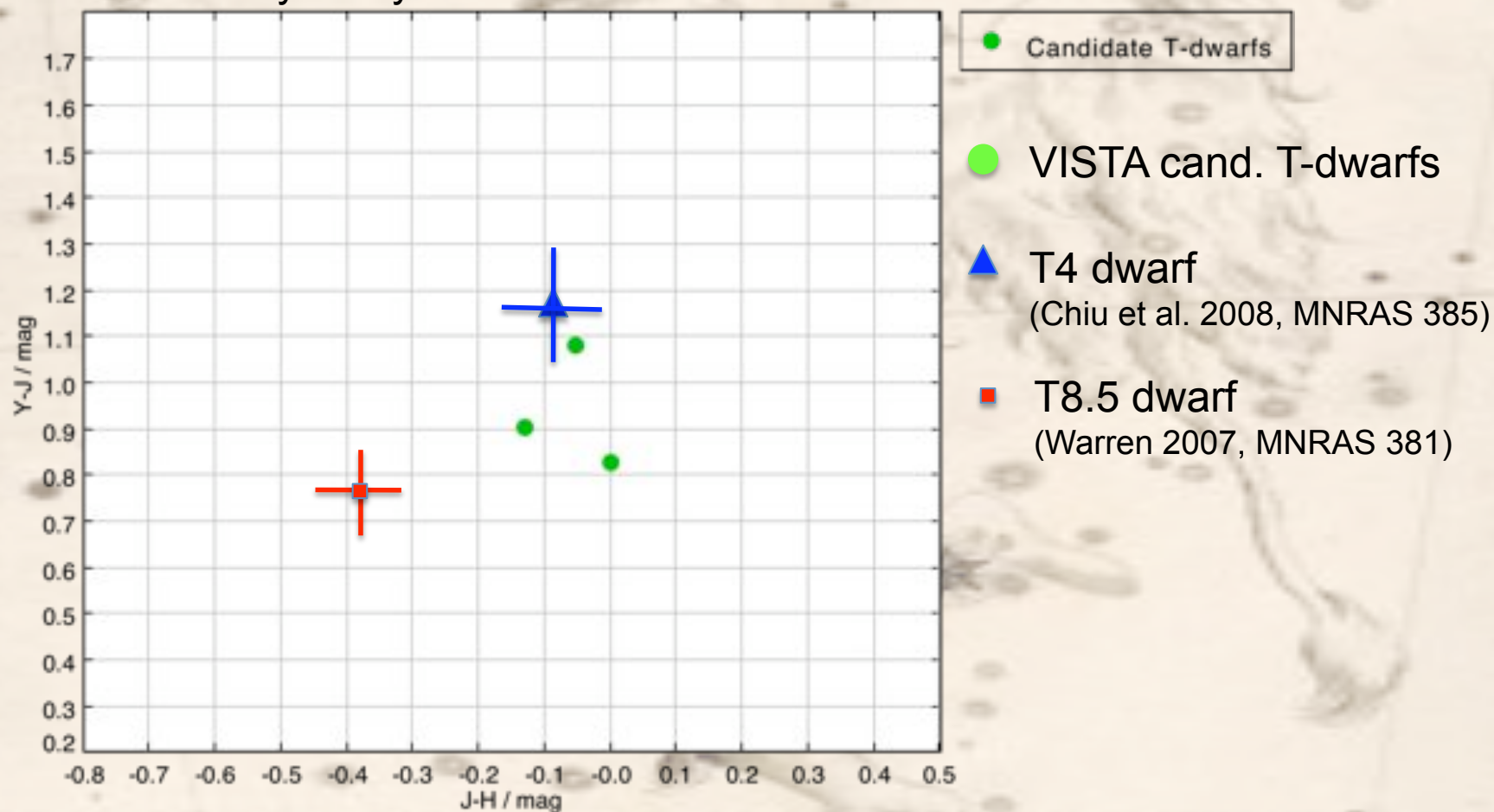
Photometric selection of:

- Z-band drop-outs
- K-band drop-outs
- J-H color < 0.0 mag

VISTA Orion Survey:
first analysis

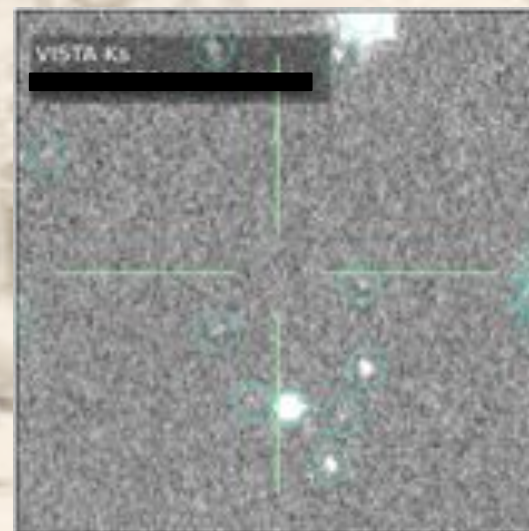
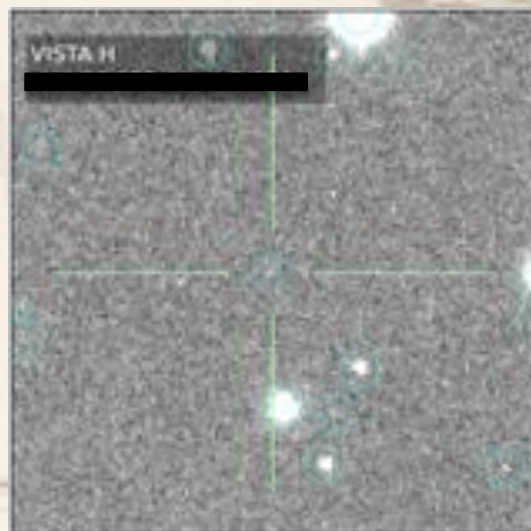
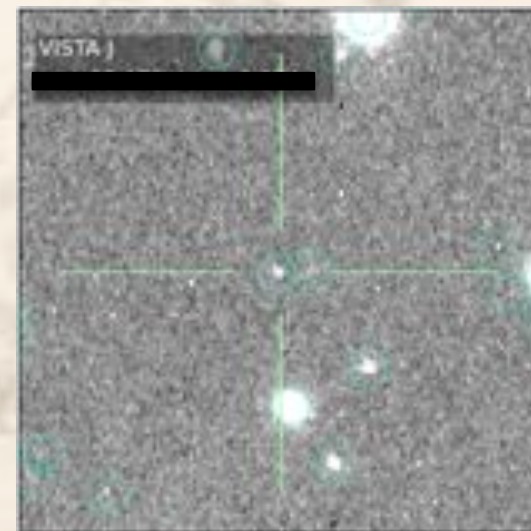
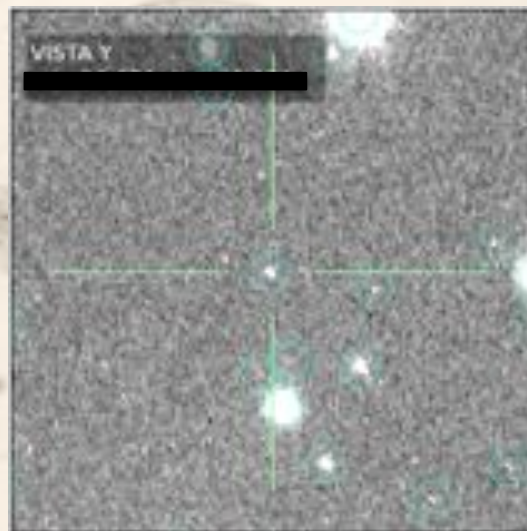
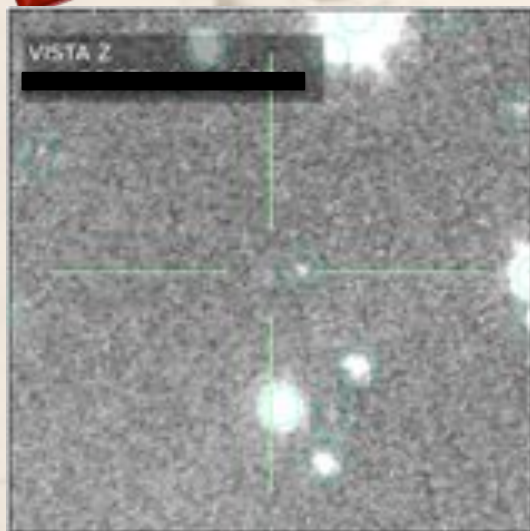
The coolest objects: T-dwarf candidates

Preliminary analysis:



VISTA Orion Survey:
first analysis

The coolest objects: T-dwarf candidates



VISTA Orion Survey:
first analysis

Protostars in OMC B: Circumstellar envelopes

(T. Stanke)

Scattered light mission



All sources at the centers
are Spitzer identified
protostar





**All things shown is work in
progress!**

Data under inspection!