# ALL-SKY SUPPORT VECTOR MACHINE SELECTION OF WISE YOUNG STELLAR OBJECT CANDIDATES

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YOUNG STELLAR OBJECTS

- Class 0/I/II mostly observable at mid- and far-IR wavelengths (AKARI, Herschel, WISE, Spitzer, etc.)

- IR excess shrinks - near IR, optical wavelengths become dominant (WISE, 2MASS, Gaia, etc.)
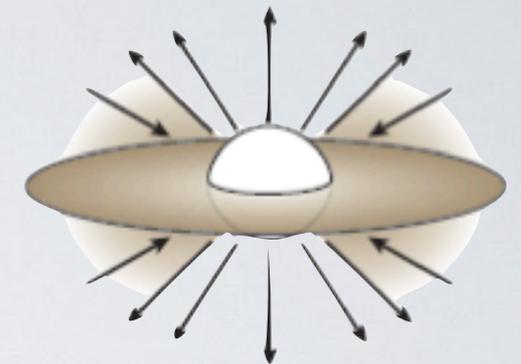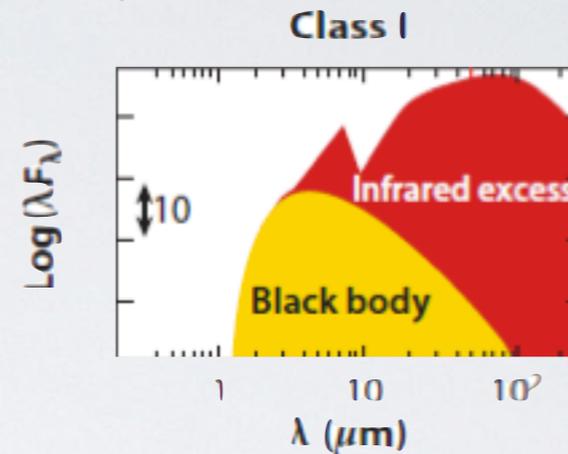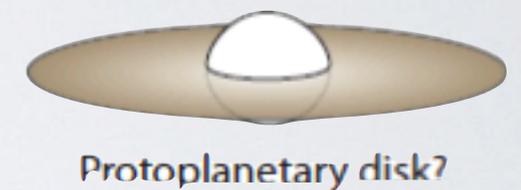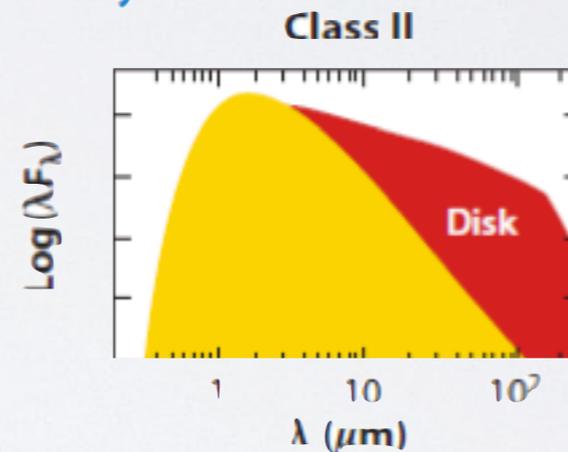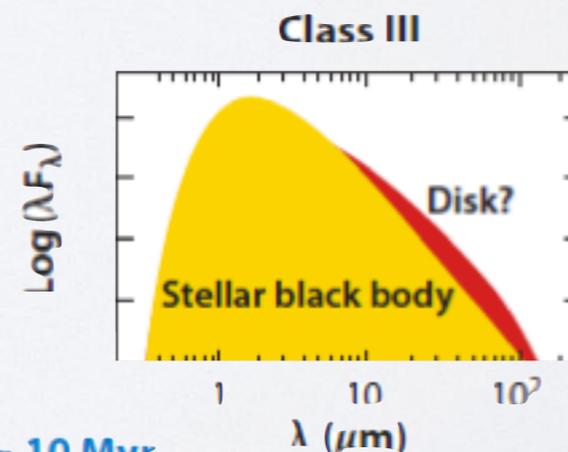
MOTIVATION

- Major questions of modern astronomy

  (http://www.astronet-eu.org/FP6/astronet/www.astronet-eu.org/spipca9c.html?article40)

  - Do we understand the extremes of the universe?

  - How do galaxies form and evolve?

  - **What is the origin and evolution of stars and planetary systems?**

  - How do we fit in?

# WHERE ARE THE YOUNG STARS? WHERE DO THEY FORM? HOW TO FIND THEM?
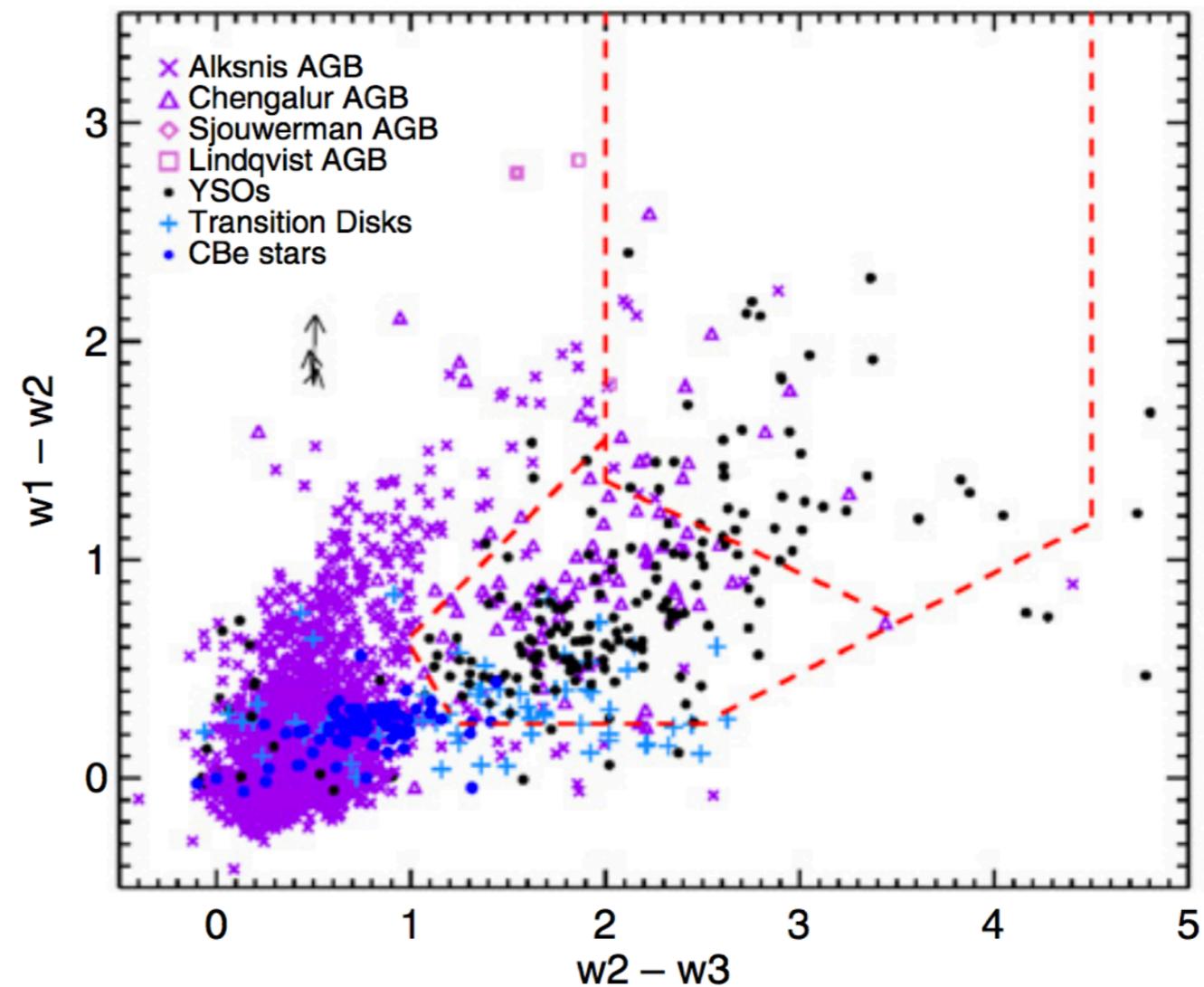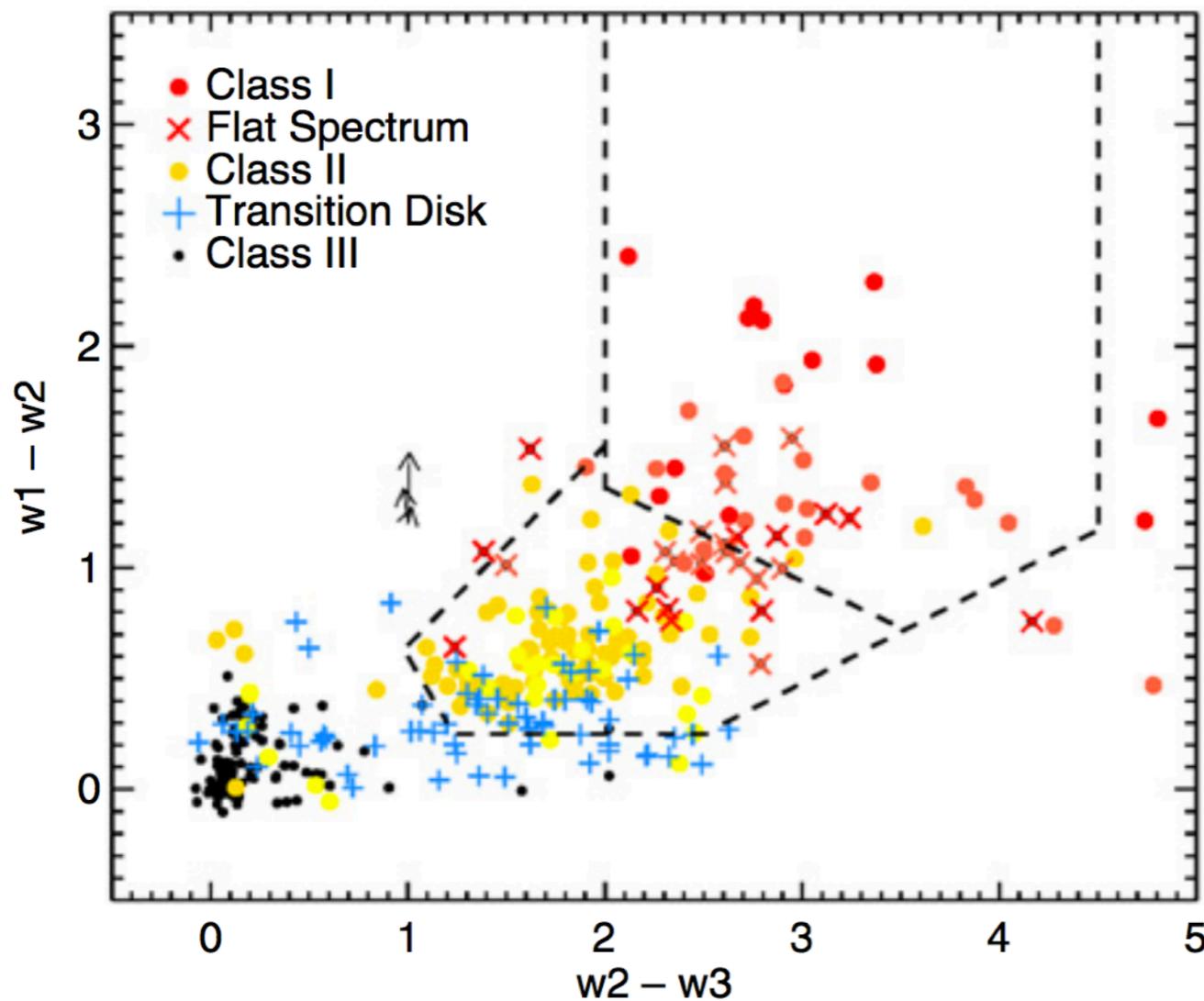
"Dashed lines show our YSO class divisions" - Koenig et al. 2014

CLASSIFICATION TECHNIQUES

- Linear and Quadratic Discriminant Analysis

  - Tóth, Marton, Zahorecz et al. 2014 - based on AKARI FIS + WISE
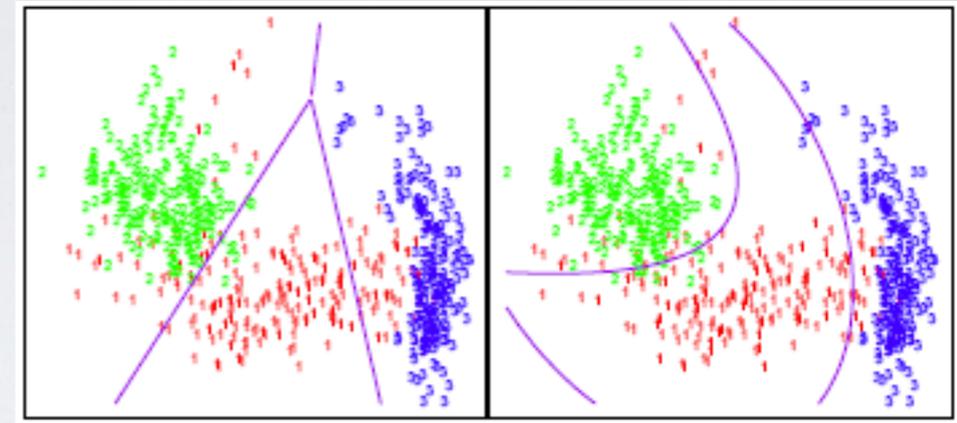
- QDA and SVM

 - **Marton, Tóth, Paladini et al. 2016, MNRAS, 458, 3479** - **2MASS and WISE data**
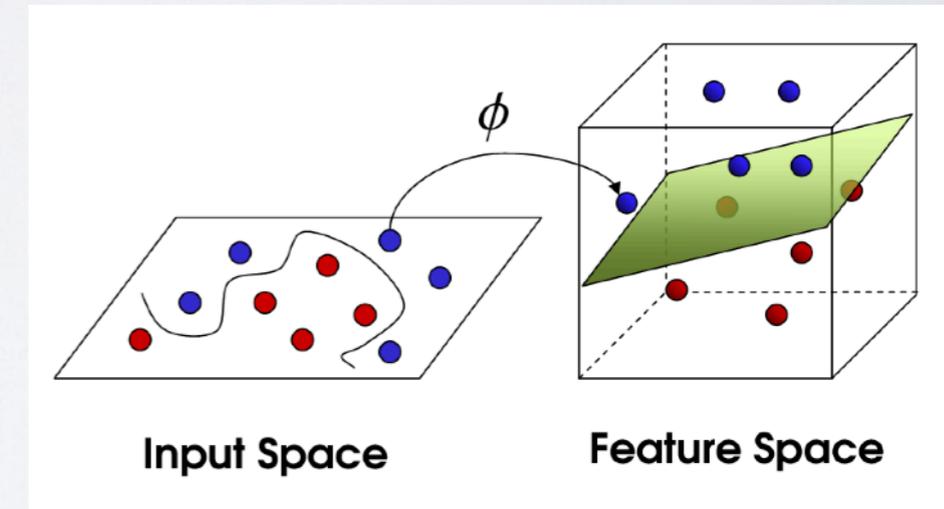
- SVM and ???

  - Gaia + 2MASS + WISE - see poster S2.16

DATA & TRAINING SAMPLE

- AllWISE catalogue

  - S/N>=3 in all WISE bands

 - 2MASS photometric error < 0.1

  - 747 million ➞ 9 million

- Planck dust optical depth

- Training sample - x-match with the SIMBAD database
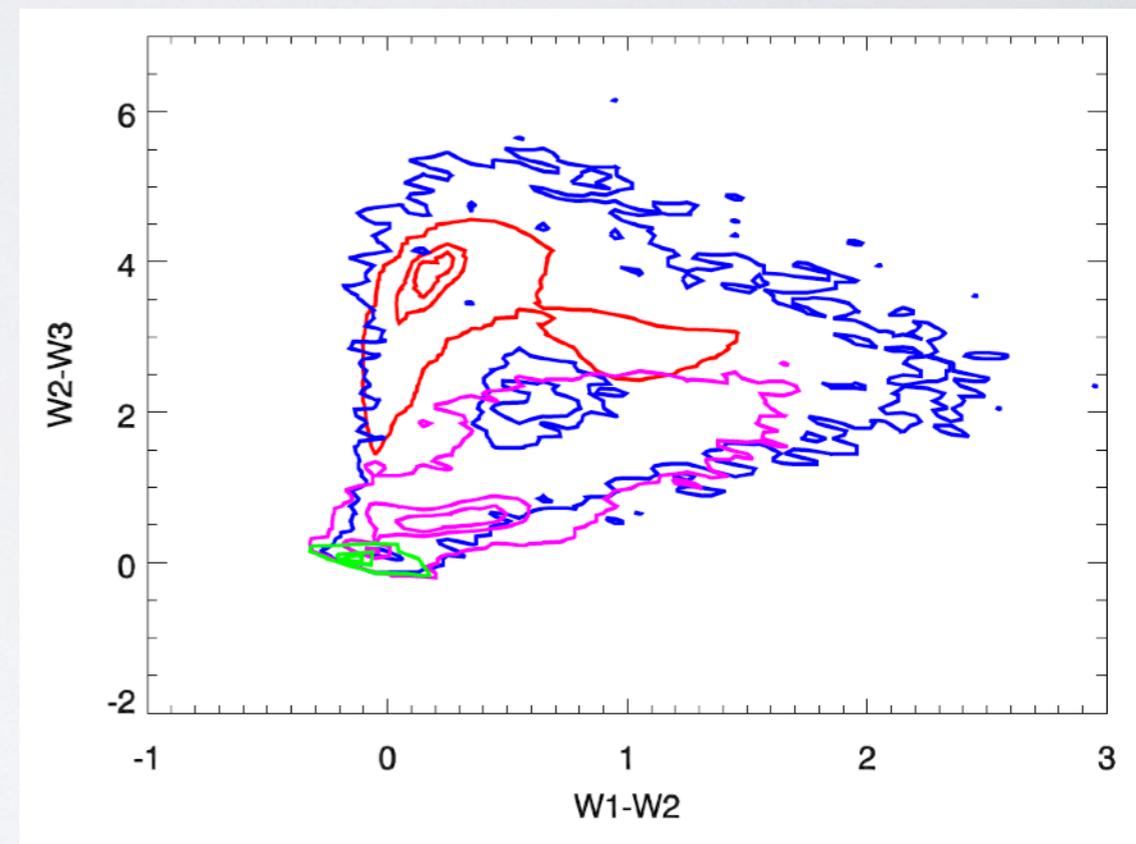
Green: MS stars, red: extragalactic objects, magenta: evolved stars, blue: YSOs

# FAKE SOURCE IDENTIFICATION
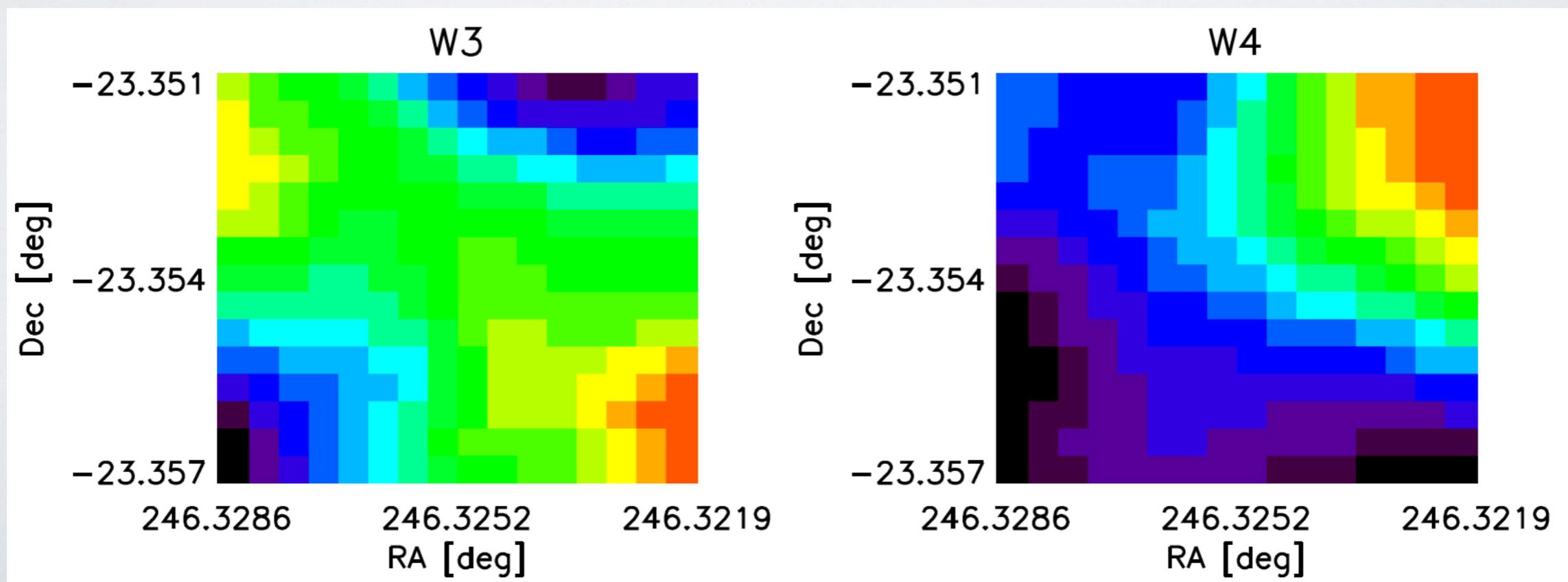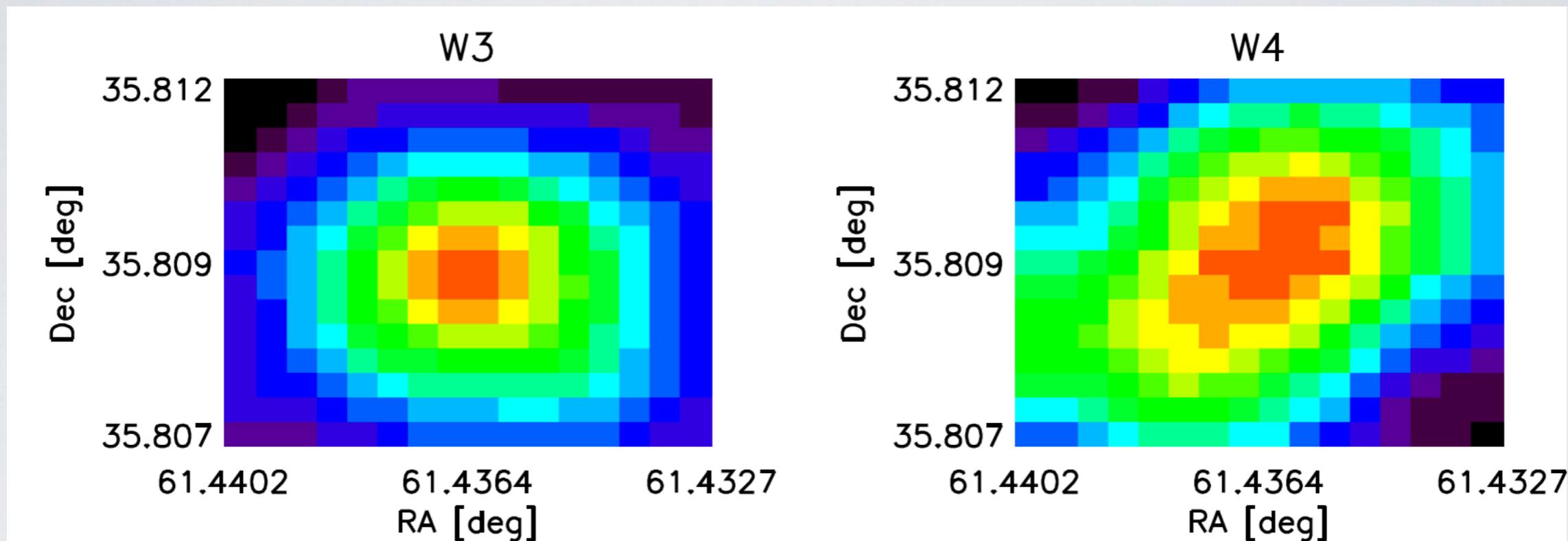
WORKFLOW
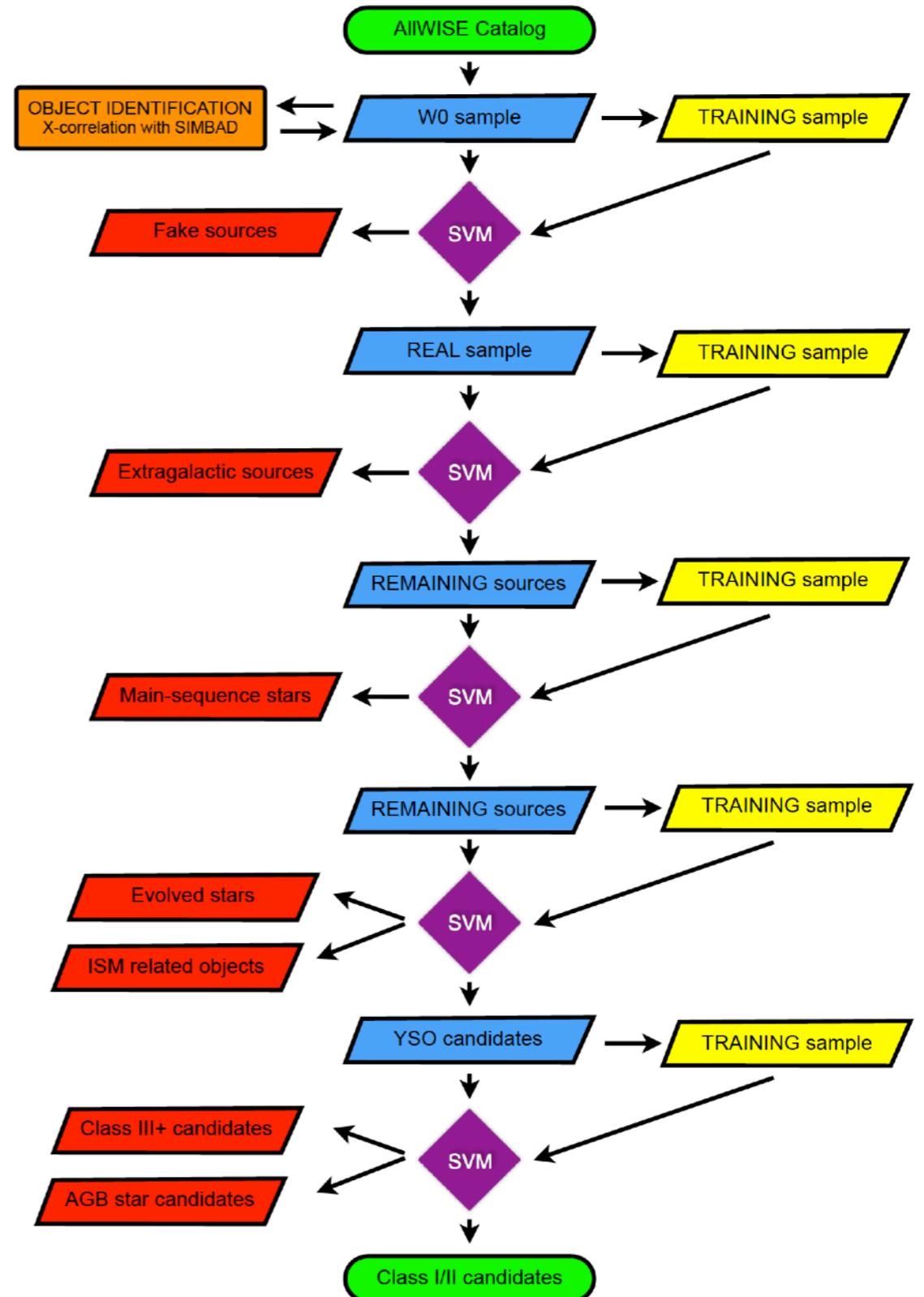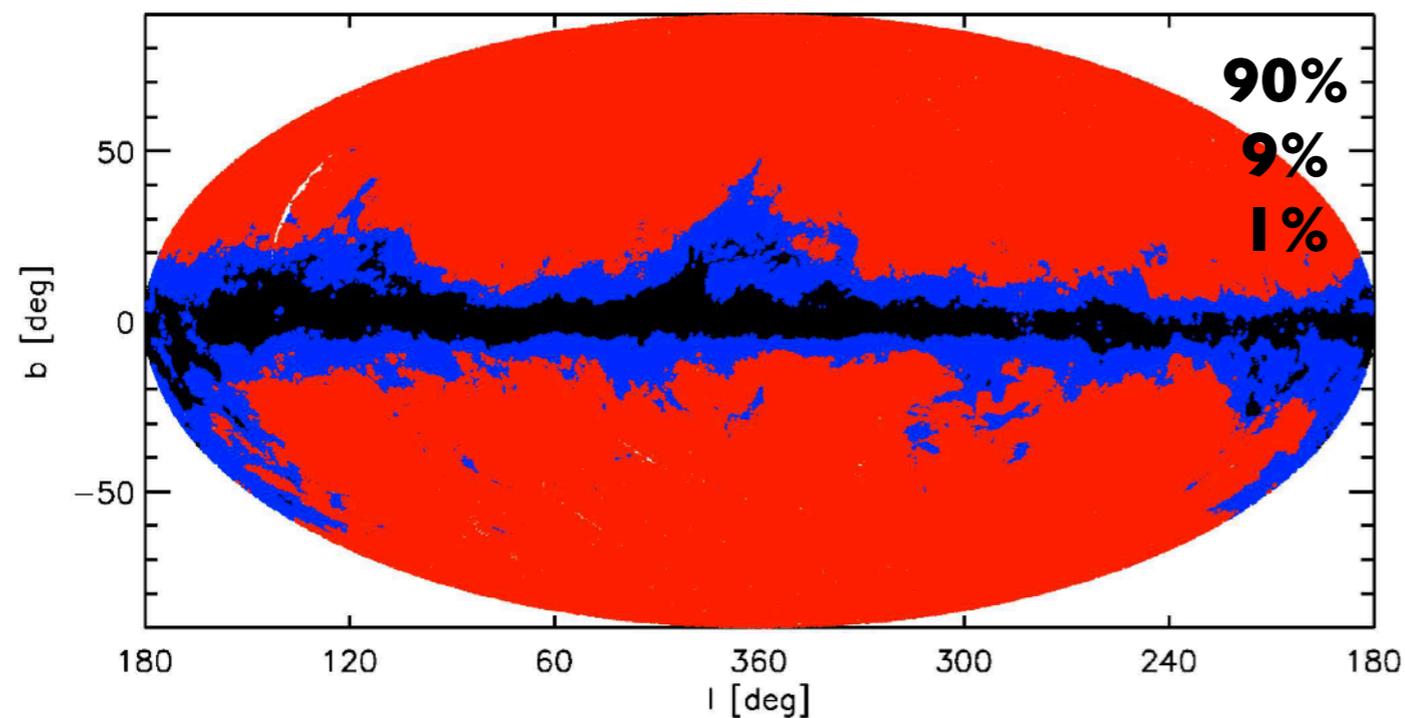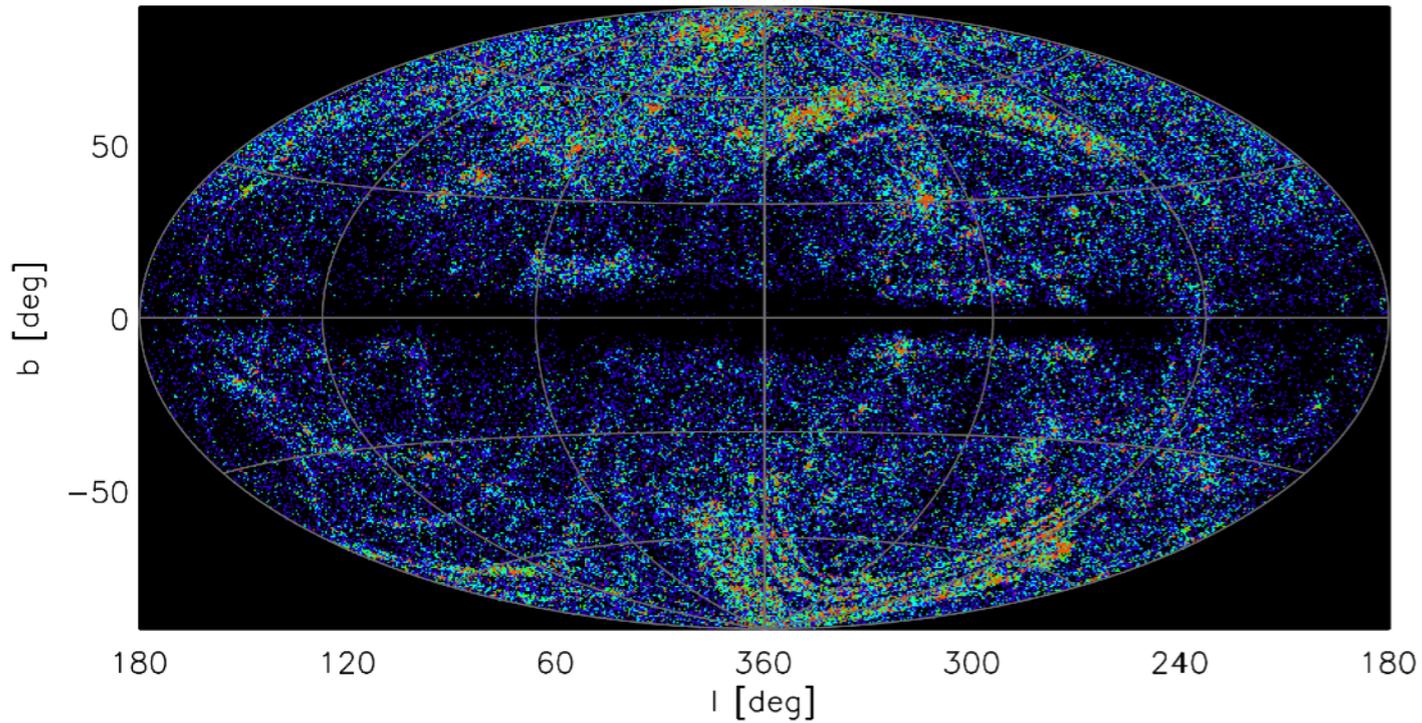
# RESULT - 133980 CLASS I/II YSO CANDIDATES
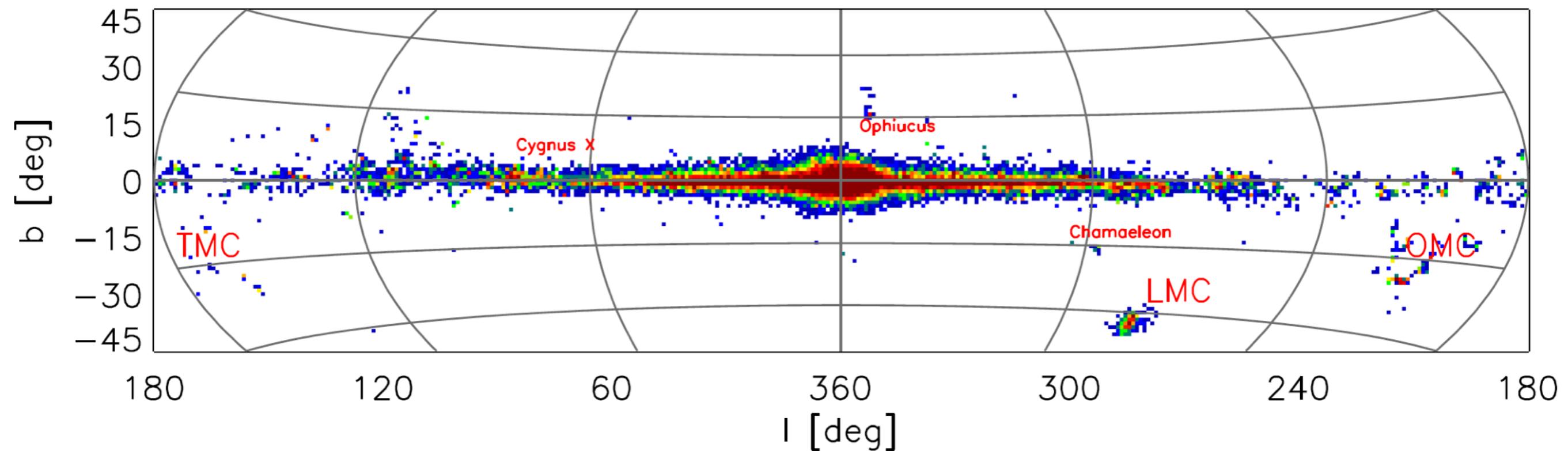
## Based on literature - low number of false negatives

	Literature YSOs classified as real	Classified as Class I/II	%
Photometric YSO Catalogues	2336	2154	92,2
Spectroscopic YSO Catalogues	475	434	91,4

Based on SIMBAD - low fraction of false positives

	Sources classified as real	Sources classified as Class I/II	%	Koenig+ 2014	%
Extragalactic sources	105 564	101	0,1	5589	5,3
Evolved stars	15 971	1792	11,2	687	4,3
ISM related objects	1064	356	33,5	140	13,2
Stars	932733	11990	1,3	1043	0,1
YSOs	5685	4342	76,4	3345	58,8

Star formation on GIRLs (2014PASJ,66,17)
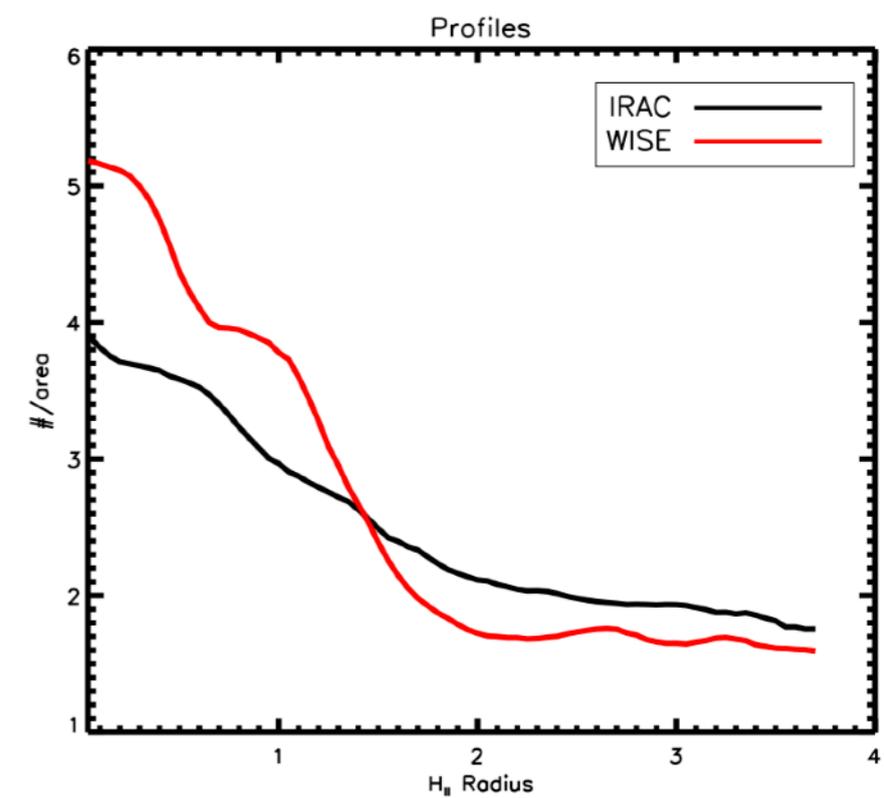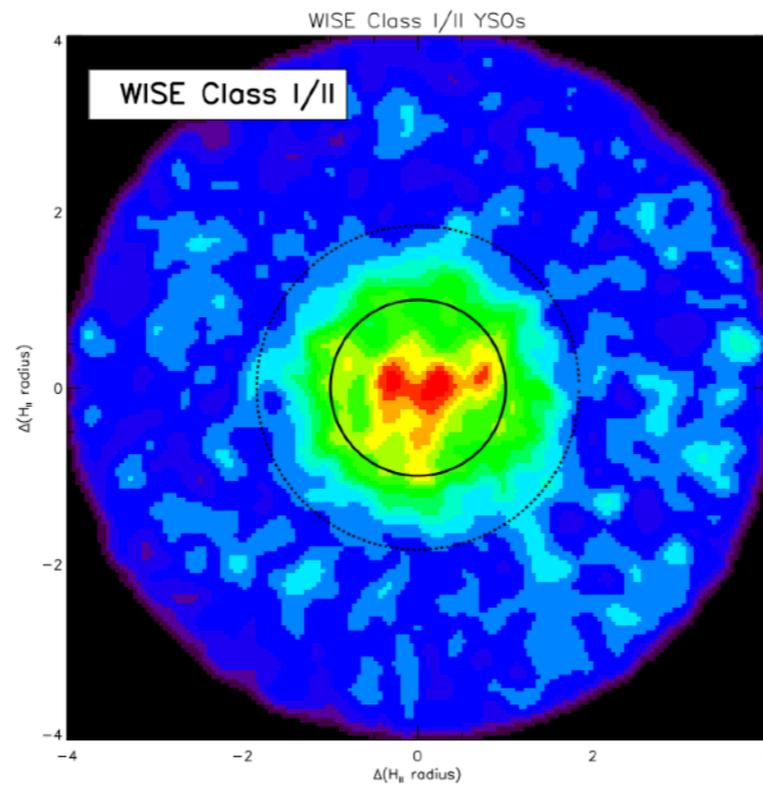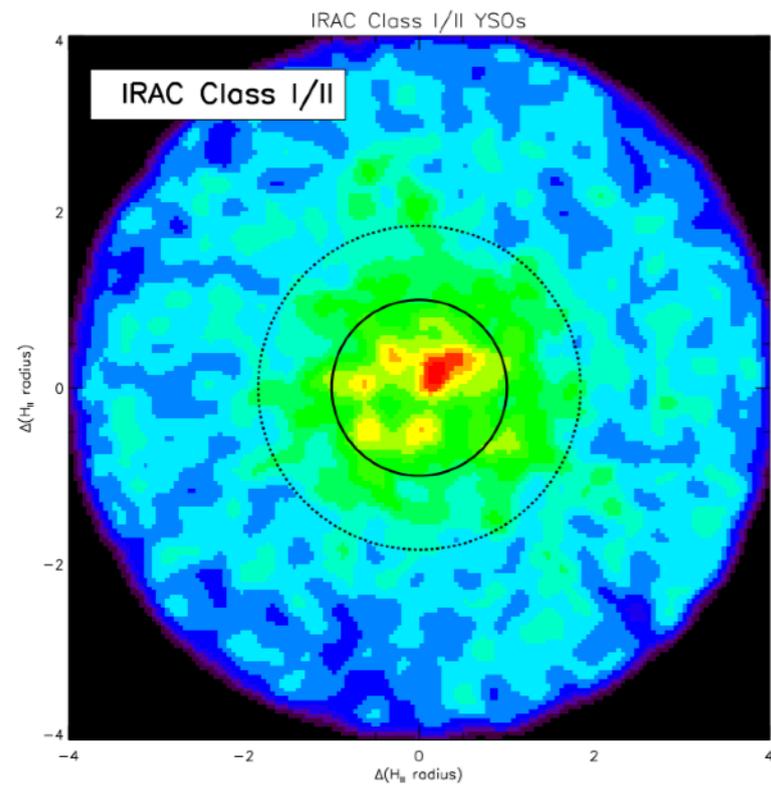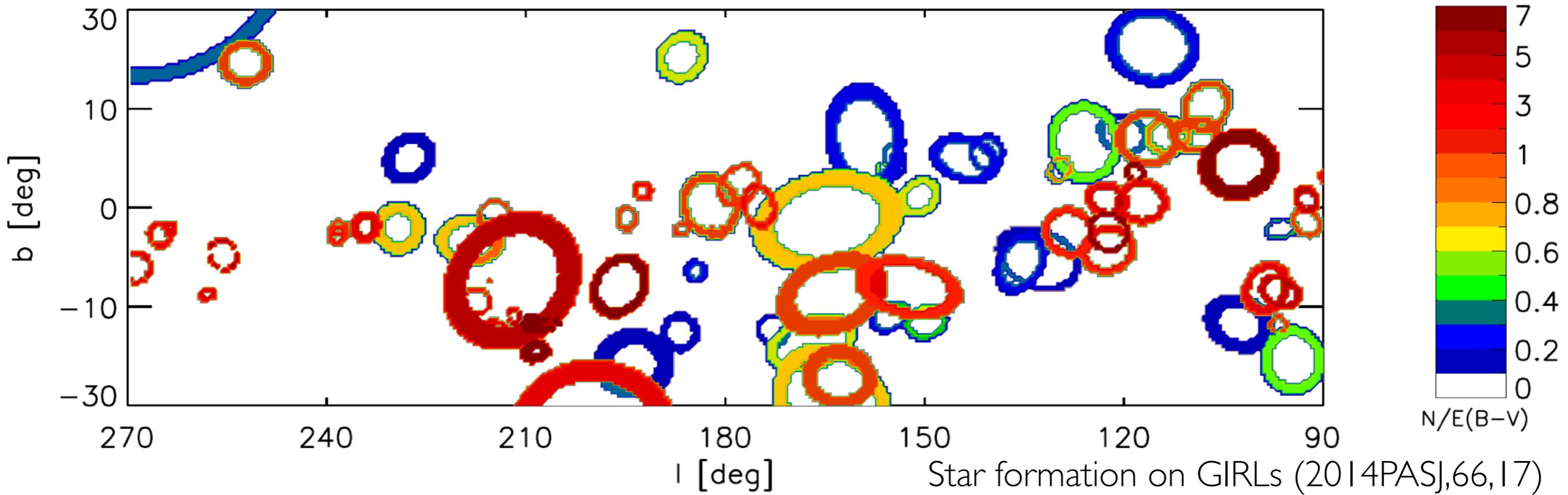
Star formation in galactic plane bubbles (Palmeirim et al., in print)

FUTURE - YSOS WITH GAIA

14: Classified as extragalactic

14: Classified as YSO

14: Classified as evolved star

14: Classified as MS star
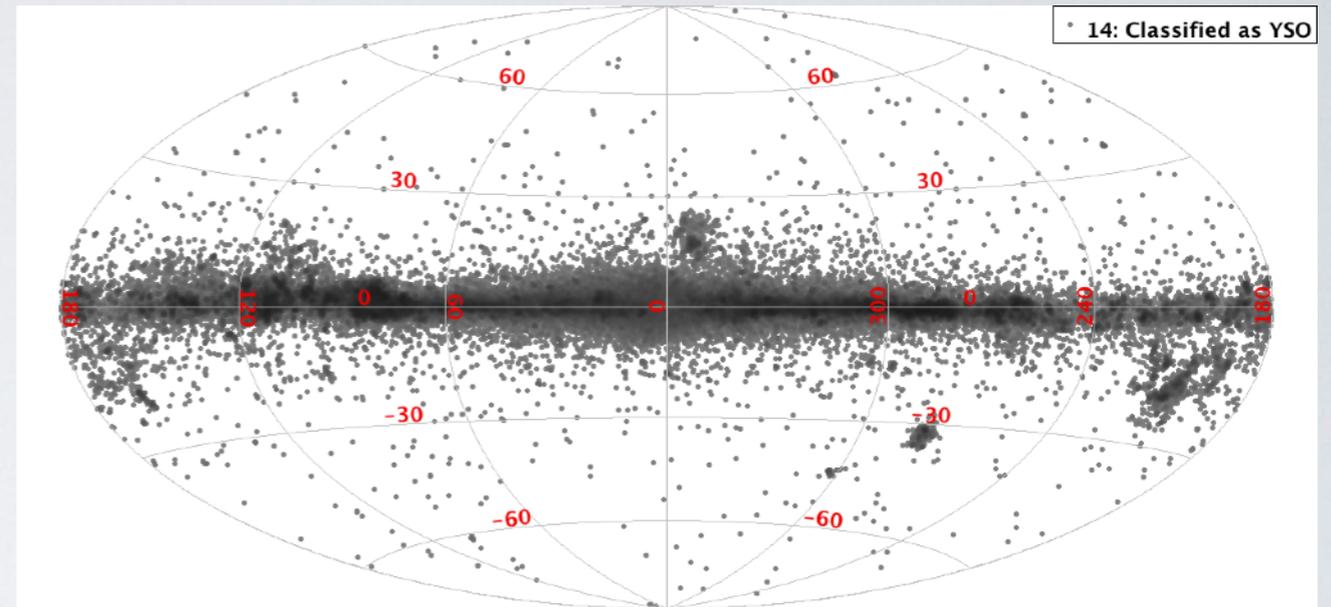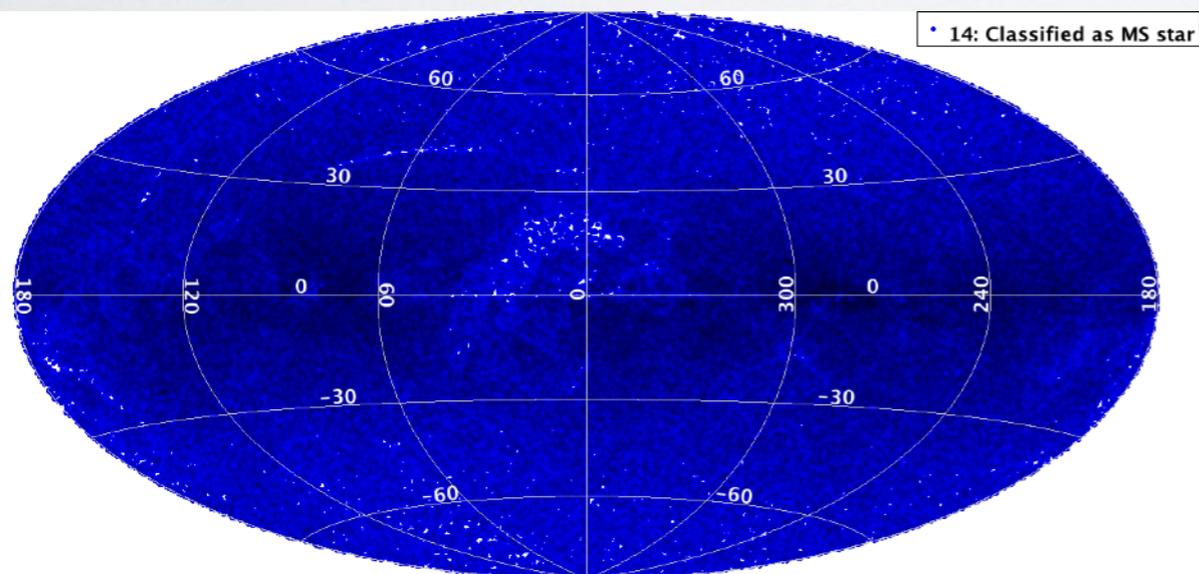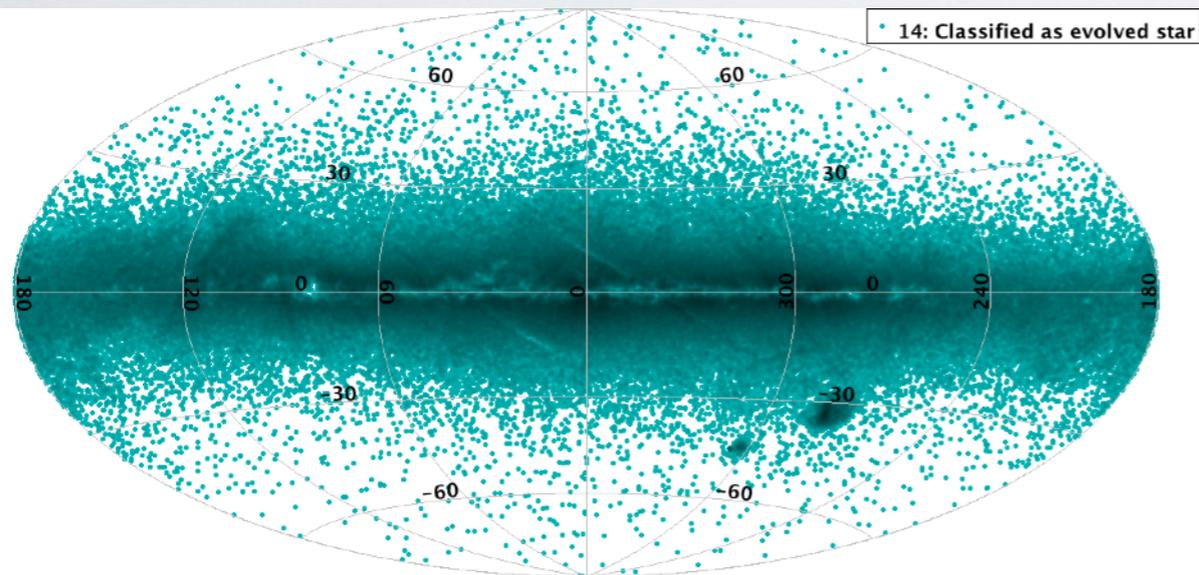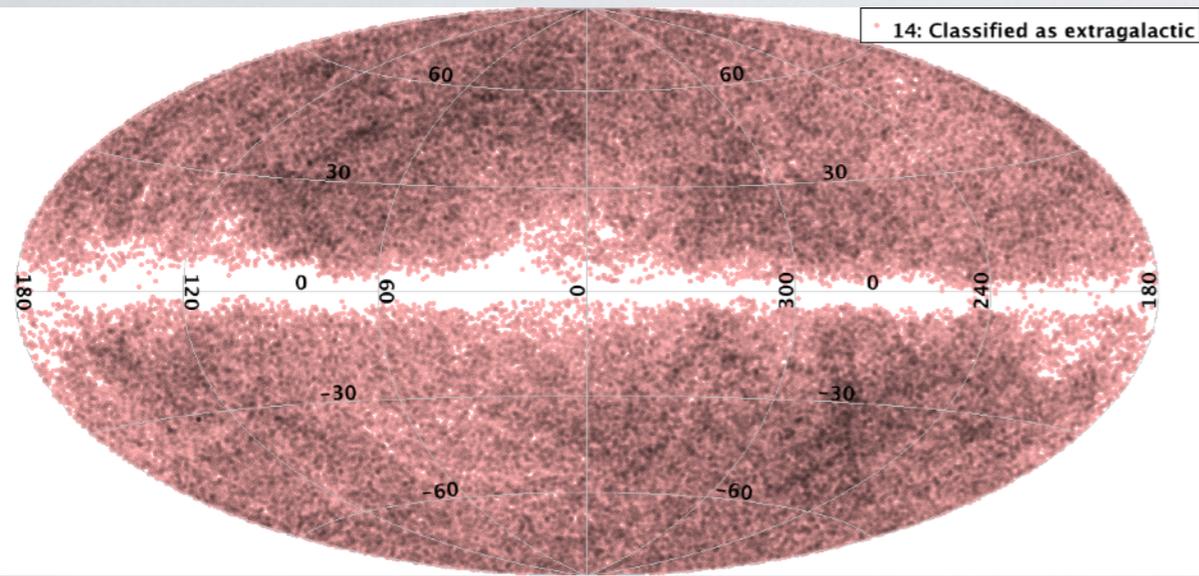
	*	EVO	G	YSO
*	98.01	1.99	0.00	0.80
EVO	0.84	94.14	0.09	2.94
G	0.01	0.28	99.35	2.06
YSO	1.14	3.60	0.55	94.20

Poster S2.16
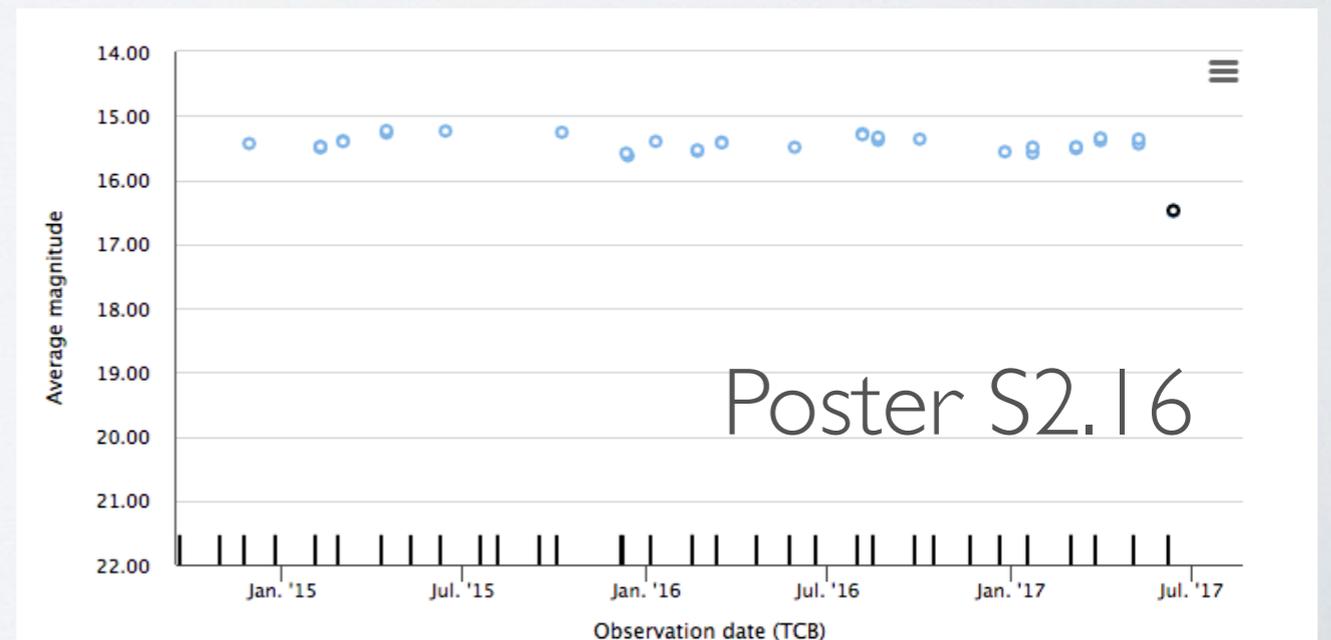
Light curve for alert Gaia17bnl. The black circle shows a 0.5 mag dip in the brightness of the known YSO V1701 Cyg.