



# TESELA

## A new tool to determine blank fields for astronomical observations

F. Jiménez Esteban (SVO - CAB)

Nicolas Cardiel (UCM)

J.M. Alacid (SVO - CAB)

E. Solano (SVO - CAB)

M. Aberasturi (SVO - CAB)

[www.iac.es/consolider-ingeno-gtc](http://www.iac.es/consolider-ingeno-gtc) CSD2006-00070



### Scientific Rationale

The correct exploitation of data is critical in astronomy

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**The correct exploitation of data is critical in astronomy**

### Image flatfielding

- Usually twilight flatfields
- Very short time windows
- Series of shifted images
- Very bright stars need to be avoided

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F. Jiménez-Esteban

- Spanish Virtual Observatory

- fran@cab.inta-csic.es

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**The correct exploitation of data is critical in astronomy**

### Image flatfielding

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### Sky subtraction

- cannot always be performed using the same target frames
- observations should be very close in time and space

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## Scientific Rationale

**The correct exploitation of data is critical in astronomy**

### Image flatfielding

- Usually twilight flatfields
- Very short time windows
  - Series of shifted images
  - Very bright stars need to be avoided

**For this purpose the use of blank fields is essential**

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## Catalogues of blank fields

- No systematic catalogue is available
- The web page created by Marco Azzaro

<http://www.ing.iac.es/~meteodat/blanks.htm>

Table of 38 blank fields for sky flats

Click on names to view the 30x30' fields

Key: **fair st** = star/s of mag > 11 or fainter, **st** = star/s of mag > 10 or brighter, **gal** = galaxy, **obj** = diffuse objects

Distances are in number of arc from field centre. **R** and **B** magnitudes may not refer to the same star.

Field Name	Coordinates (J2000)	Max R and B magnitude within 5'	Comments
MABlank1	01 00 00 +0 07 00	13.2 14.1	group of obj at 2°, faint st at 7, 10°
CABlank1	01 47 36 +0 02 20.03	13.1 13.6	11.3 12.2, 10.4 11.6 faint st at 10, 15'
MABlank2	02 15 00 -10 00 00	13.3 14.4	11.4 12.2, very blank, gal. at 10°
AAOBBlank1	02 50 04 -19 33 49	15.4 15.8	8.6 9.7, bright st, faint at 6, st. at 13, 15'
wtblank3	02 58 00 -00 06 00	11.3 12.3	10.2 11.5 faint st, 1.5° st. at 12, 15'
MABlank3	04 10 00 +0 03 50 00	10.7 11.8	faint st, <2°
BLANK1	04 29 45 +54 15 36	16.6 18.4	11.5 12.6 centered on circular dark cloud (2 diameter)

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## We need a tool to determine blank fields

F. Jiménez-Esteban - Spanish Virtual Observatory - fran@cab.inta-csic.es

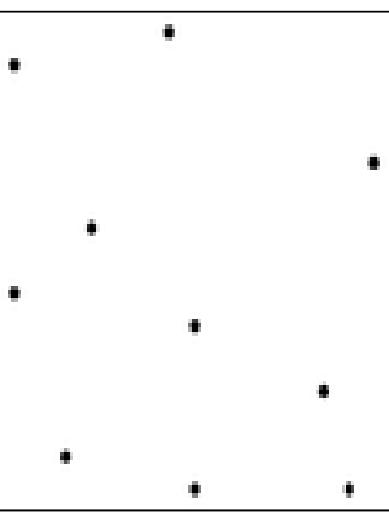
Terminado

NAME	RA	DEC	sd	faint	gal	obj
MABlank2	02 15 00	-10 00 00	[13.3, 14.4]	[14.6, 15.2]	[11.0, 12.3]	very blank, gal at 10'
AAOBlink1	02 50 04	-19 33 49	[15.4, 15.8]	[8.6, 9.7]	[8.6, 9.7]	bright st, pull at 6'; st at 13'; 15'
wfoblink3	02 58 00	-00 06 00	[11.3, 12.5]	[11.3, 12.5]	[10.2, 11.5]	faint st, 1.5'; st at 12'; 15'
MABlank3	04 10 00	+03 50 00	[10.7, 11.8]	[10.7, 11.8]	[10.7, 11.8]	faint st, <3'
BLANK1	04 29 45	+54 15 36	[16.6, 18.4]	[11.7, 12.6]	[11.5, 12.6]	centered on circular dark cloud (2' diameter)



## Tessellating the sky

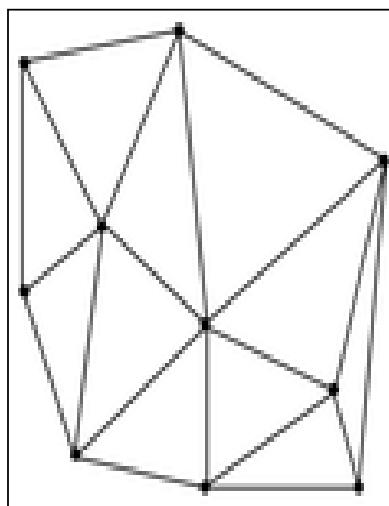
- Uses the stars as nodes of the triangulation
  - Merging closer stars than 1"



## Tessellating the sky

- Uses the stars as nodes of the triangulation
  - Merging closer stars than 1"

- Based on the Delaunay triangulation



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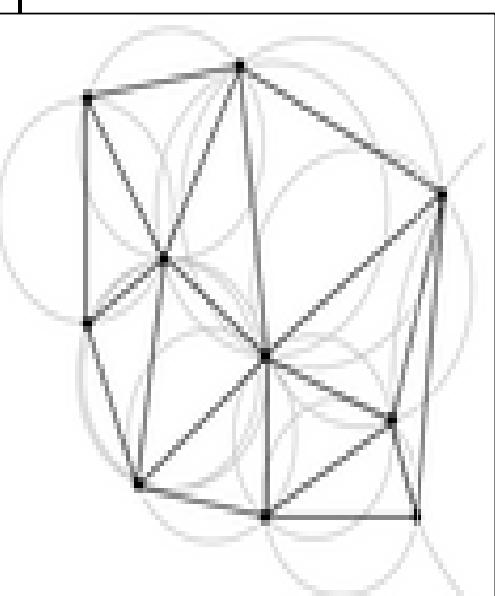
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## Tessellating the sky

- Uses the stars as nodes for the triangulation
  - Merging closer stars than 1"

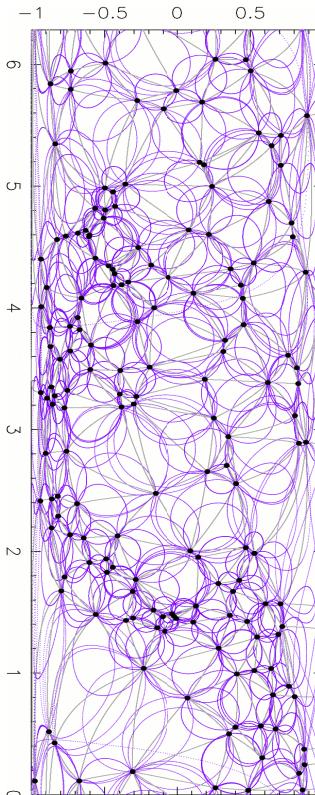
- Based on the Delaunay triangulation
- The empty circumcircle interior property





## Tessellating the sky

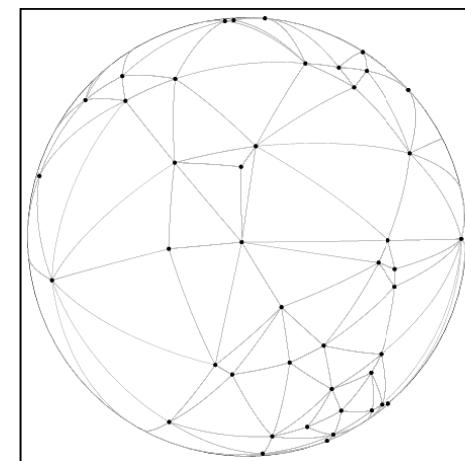
Result with stars up to 4 magnitude



F. Jiménez-Esteban

Spanish Virtual Observatory

fran@cab.inta-csic.es



## The web tool

<http://sdc.cab.inta-csic.es/tesela/index.jsp>

The most important advantage of widefield cameras is, precisely, the "widefield"; since this offers the observers the possibility of obtaining vast amounts of data in a much shorter observing time. However, for a reliable data interpretation, it is necessary a proper data reduction. Concerning the flattening of images, many times it is required to obtain several integrations in blank regions (sky patches without bright sources) nearby to the science target areas.

TESELA is a service developed to provide access to a catalogue of blank regions, based on the application of the Delaunay triangulation of the sky. The present implementation of TESELA uses as source for the star coordinates the Tycho-2 Catalogue (Høg et al. 2000).

F. Jiménez-Esteban

Spanish Virtual Observatory

fran@cab.inta-csic.es



## The web tool

<http://sdc.cab.inta-CSIC.es/tesela/index.jsp>

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Sky Position (RA, DEC (J2000)):	<input type="text" value="183.005 28.576"/>	<small>[Example: 183.005 28.576. Coordinates in decimal degrees.]</small>
Radius of field of view:	<input type="text" value="10.0"/>	<small>[decimal degrees]</small>
Minimum radius of the blankfield:	<input type="text" value="0.2"/>	<small>(decimal degrees)</small>
Threshold magnitude:	<input type="text" value="10.0"/>	<small>[decimal degrees]</small>
Filter:	<input type="text" value="Visible"/>	
<b>Fields Blank</b> <input type="button" value="▼"/>		
<input type="button" value="Submit Query"/> <input type="button" value="Reset Form"/>		

F. Jiménez-Estebam

Spanish Virtual Observatory

tran@cab.inta-csic.es

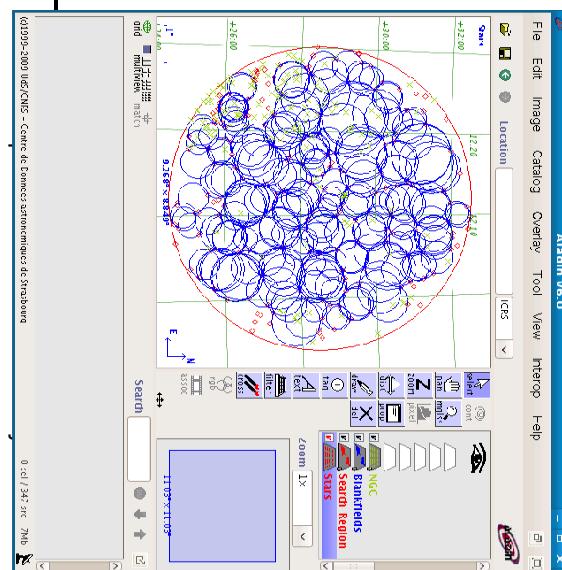


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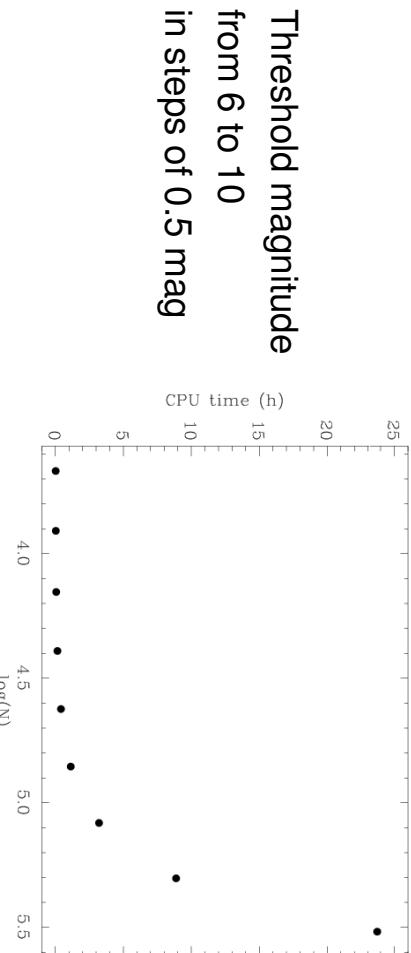
F. Jiménez-Esteban

[fran@cab.inta-csic.es](mailto:fran@cab.inta-csic.es)



## Going deeper

**Problem:** The number of stars increases exponentially with the magnitude → computer requirement



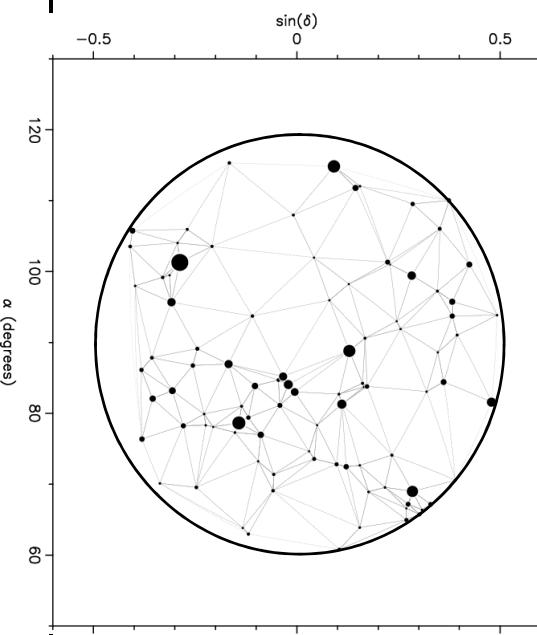
F. Jiménez-Esteban

- Spanish Virtual Observatory

[fran@cab.inta-csic.es](mailto:fran@cab.inta-csic.es)

## Going deeper

**Solution:** Tessellating many smaller regions



F. Jiménez-Esteban

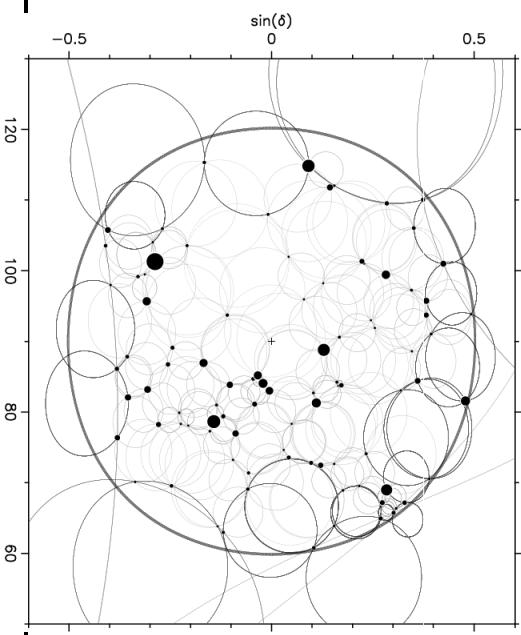
[fran@cab.inta-csic.es](mailto:fran@cab.inta-csic.es)



## Going deeper

**Solution:** Tessellating many smaller regions

Side effect



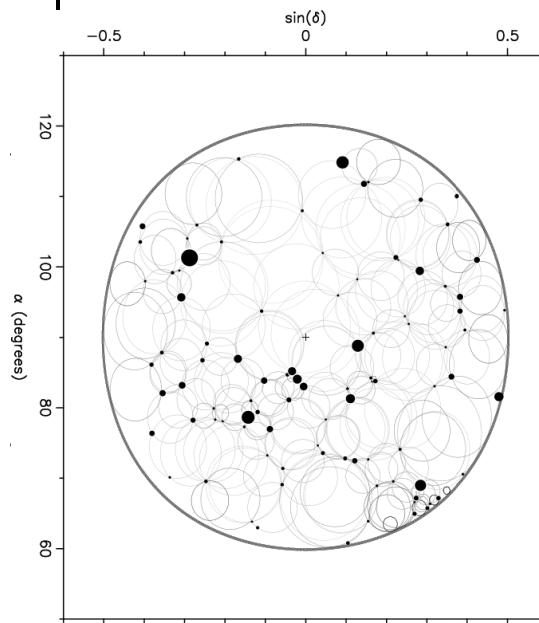
F. Jiménez-Esteban

[fran@cab.inta-csic.es](mailto:fran@cab.inta-csic.es)

## Going deeper

**Solution:** Tessellating many smaller regions

Side effect



F. Jiménez-Esteban

[fran@cab.inta-csic.es](mailto:fran@cab.inta-csic.es)



## Blank fields for the GTC

Requirements:

- $\sim(18\text{h}, 30^\circ)$
- diameter  $\sim 10'$
- 20 mag in R

## Blank fields for the GTC

### Requirements:

- $\sim(18\text{h}, 30^\circ)$
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- R filter of USNO-B1
- Progressive ↑ mag

### The search:

F. Jiménez-Esteban - Spanish Virtual Observatory - fran@cab.inta-csic.es



## Blank fields for the GTC

### Requirements:

- $\sim(18\text{h}, 30^\circ)$
- diameter  $\sim 10'$
- 20 mag in R
- R filter of USNO-B1
- Progressive ↑ mag

### The search:

- $17\text{h} < \text{RA} < 19\text{h}$
  - $15^\circ < \text{DEC} < 45^\circ$
  - ~900 square deg
  - R filter of USNO-B1
  - Progressive ↑ mag
- Result:
- 15 mag  $\Rightarrow$  136 BF with diameter  $> 10'$
  - 16 mag  $\Rightarrow$  7 BF with diameter  $> 8'$

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The search:

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result.

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## Future work

- Include the web-tool with the tessellation in small regions
- Extend to other catalogues and filters
- Continue providing GTC with new BF

# Thanks

especially to CALAMARES

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F. Jiménez-Esteban

- Spanish Virtual Observatory

[fran@cab.inta-csic.es](mailto:fran@cab.inta-csic.es)

