

Automated Tilted Ring Fitting of the Extremes

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Overview

- TiRiFiC (G.I.G. Józsa)
- Fit Procedure
- Preliminary Results
- To Do



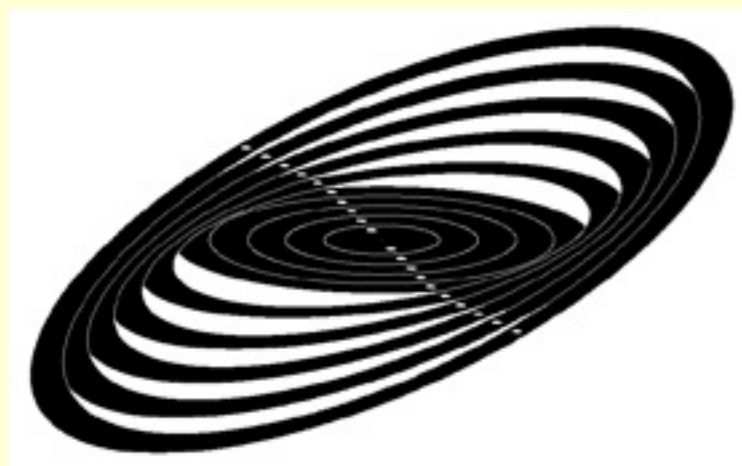
The tilted-ring model



Tilted-Ring-Model
(Rogstad et al. 1974):

parametrise rings at different radii by

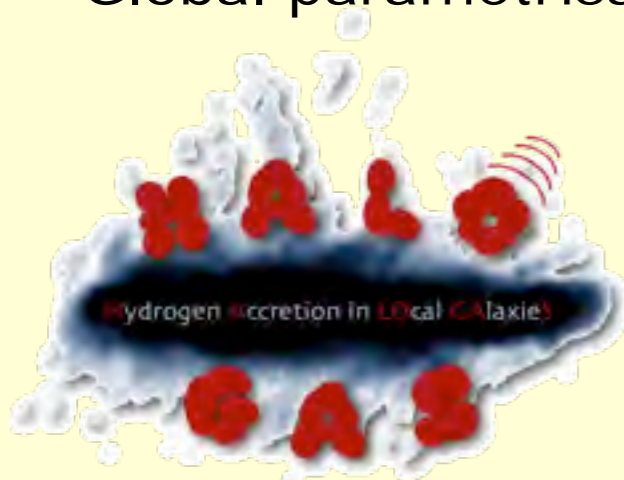
- two orientation parameters (inclination, position angle)
- central position
- surface brightness (thickness)
- rotation velocity



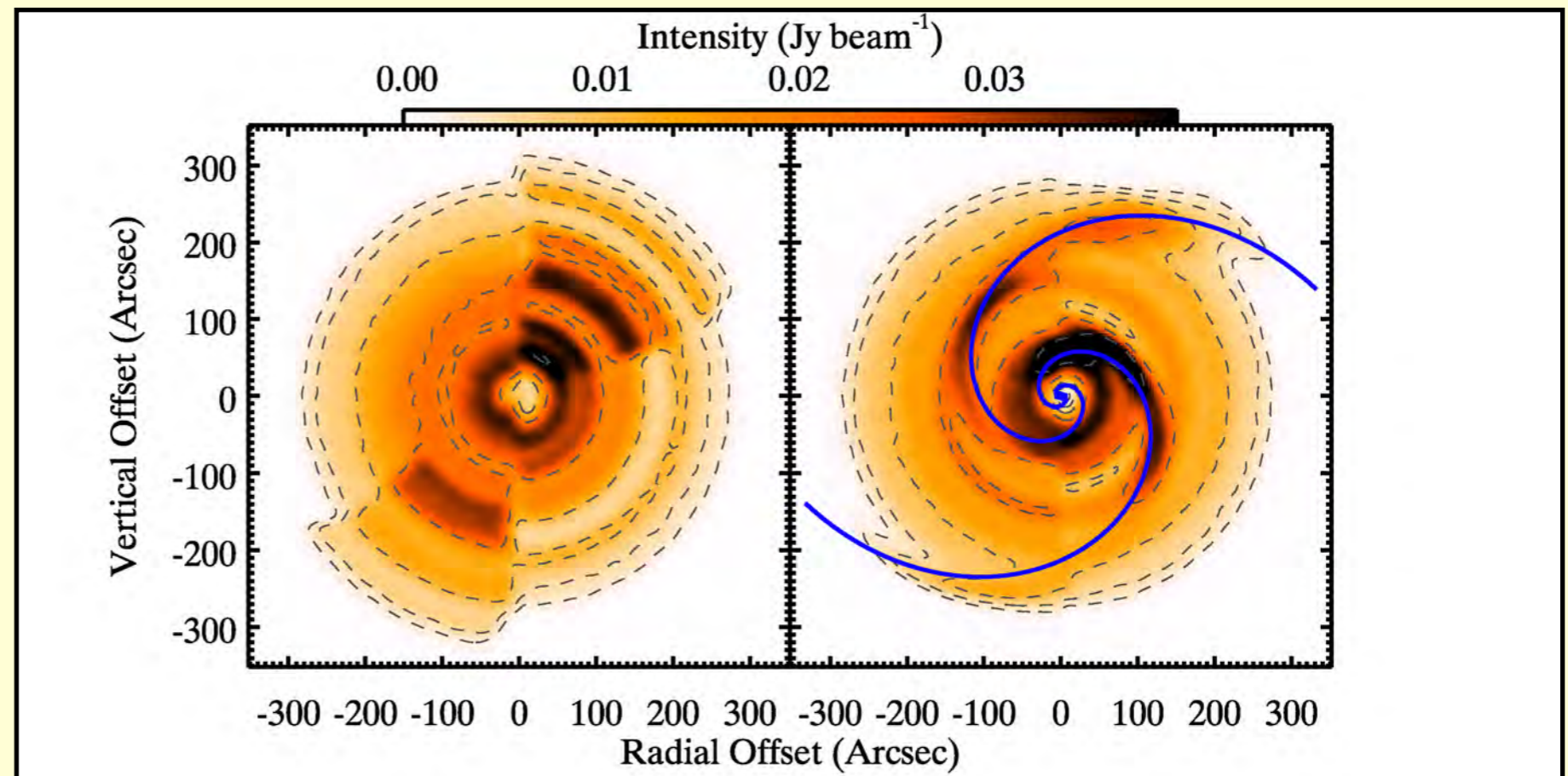
García-Ruiz 2001



- Program to fit tilted-ring model to data cubes
- Now stand-alone, able to construct 3d models
- Extended tilted-ring models used in detailed studies:
 - Spiral arms, non-axisymmetric kinematics/morphology, multiple disks (Zschaechner et al. 2012, Gentile et al. 2013, Saburova et al. 2013, Kamphuis et al., de Blok et al., Schmidt et al.)
- Highly relevant for less resolved systems (WNSHS/WALLABY) and in progress:
 - Optimal minimisation scheme
 - Global parametrisations (e.g. modified exponential disk)



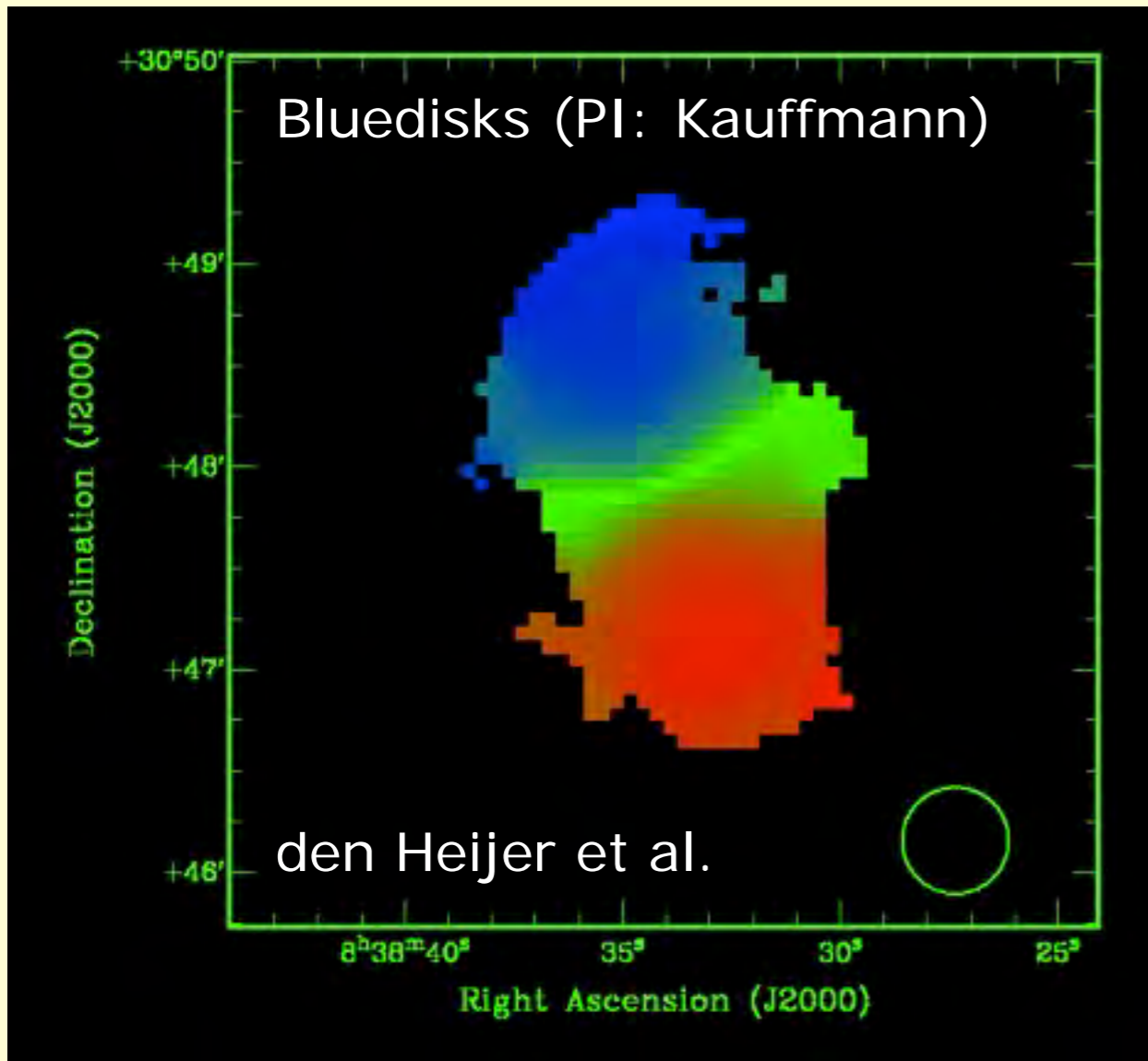
NGC 5023
Kamphuis et al.
2013





Why data cubes (reminder)

- Surface brightness variations become less relevant for velocity fields (big advantage, if well resolved, we're working on making it smaller)
- Many more independent data points for data cubes (1 additional dimension, i.e. velocity) -> modeling at smaller radii becomes possible

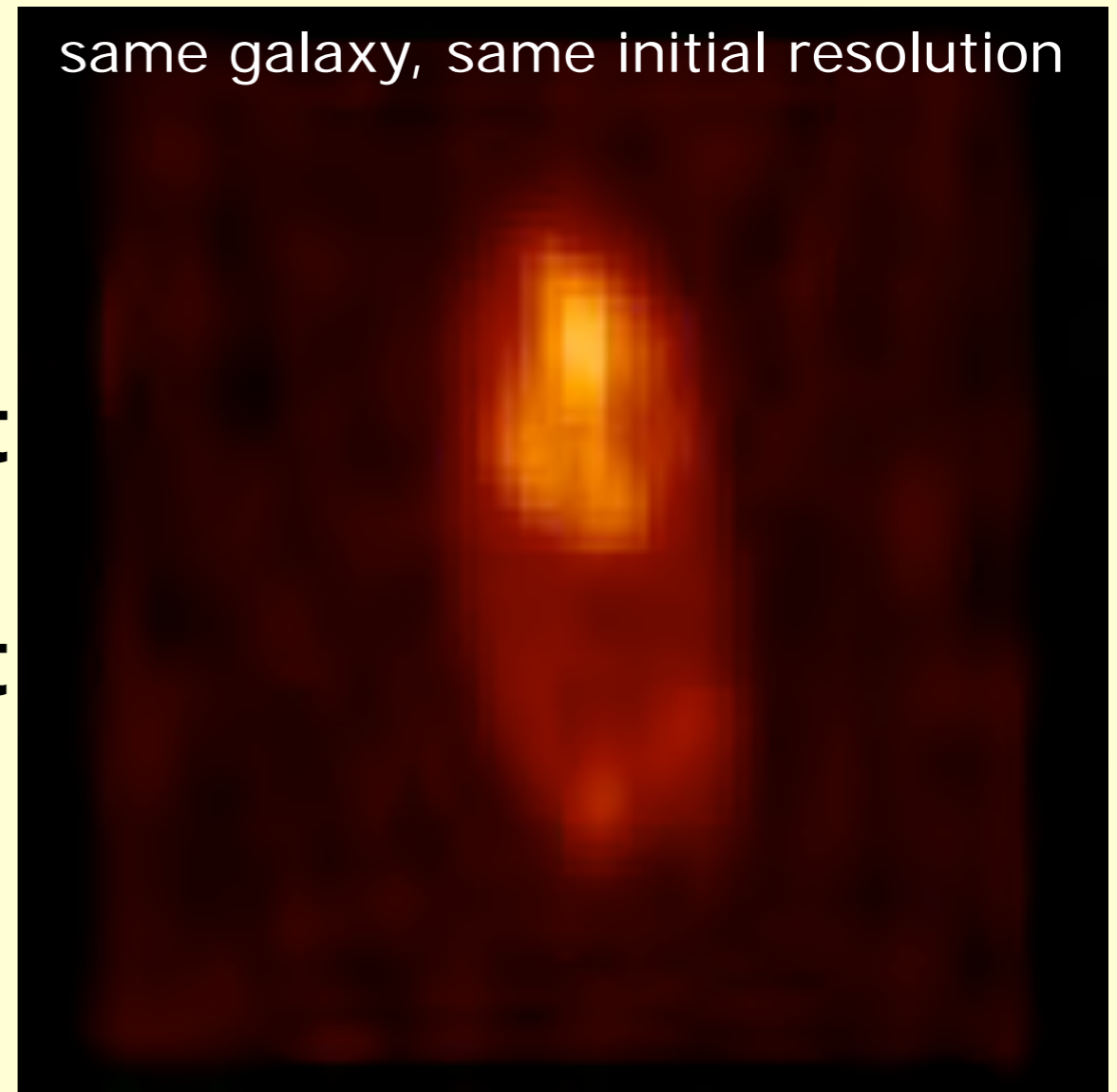


11 independent data points
(beam has to be symmetrized)

≈

but
not

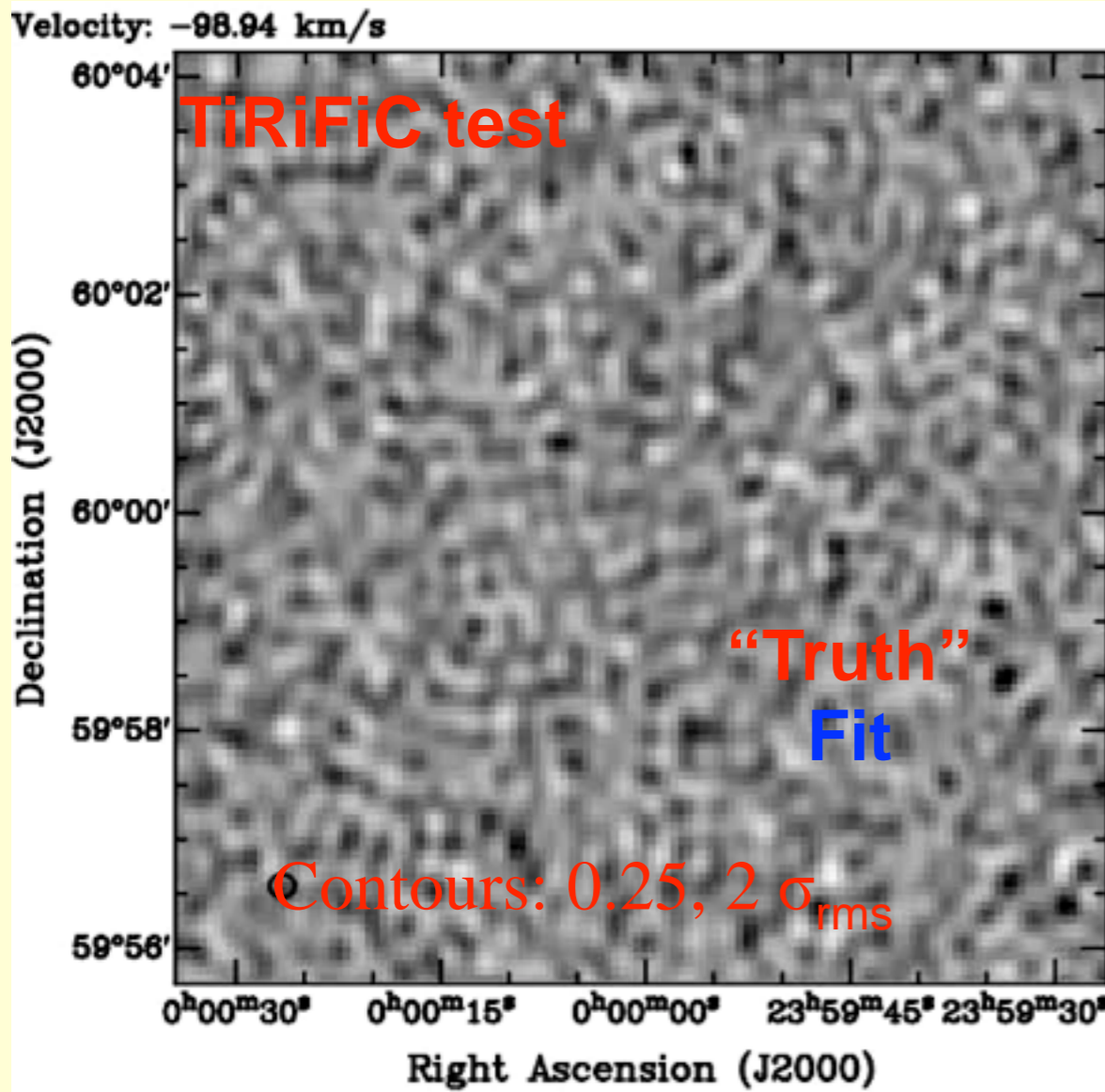
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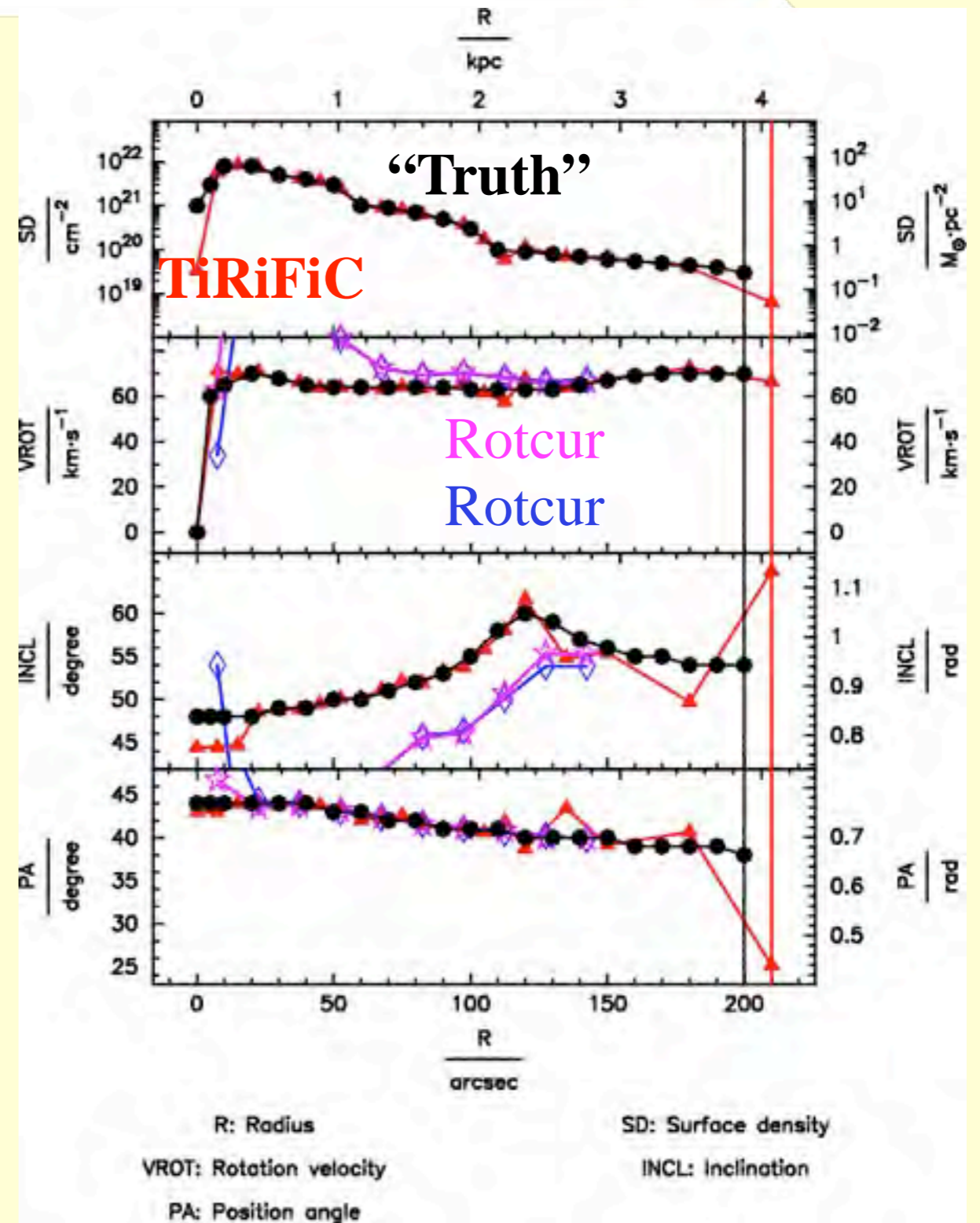
102 independent data points
(beam has not to be symmetrized)



Why data cubes (reminder)



- Tests on artificial data (but with noise), Józsa et al. 2007
- **Enhanced sensitivity** through integral approach
- Rotcur **systematic** errors due to low number of data points and beam smearing occur out to 4-5 HPBW



• TiRiFiC shows more significant random errors at **1-2 HPBW**s



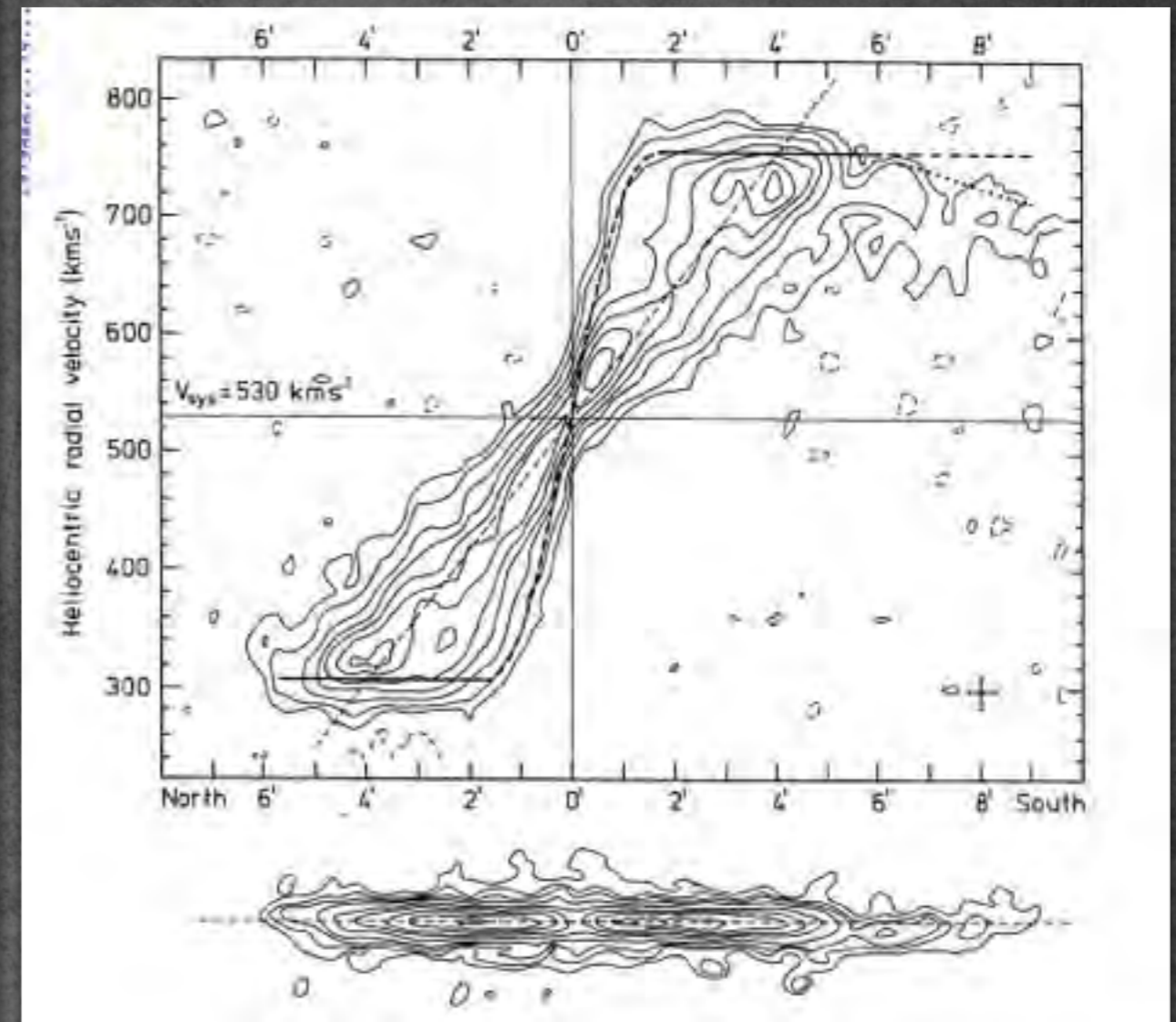
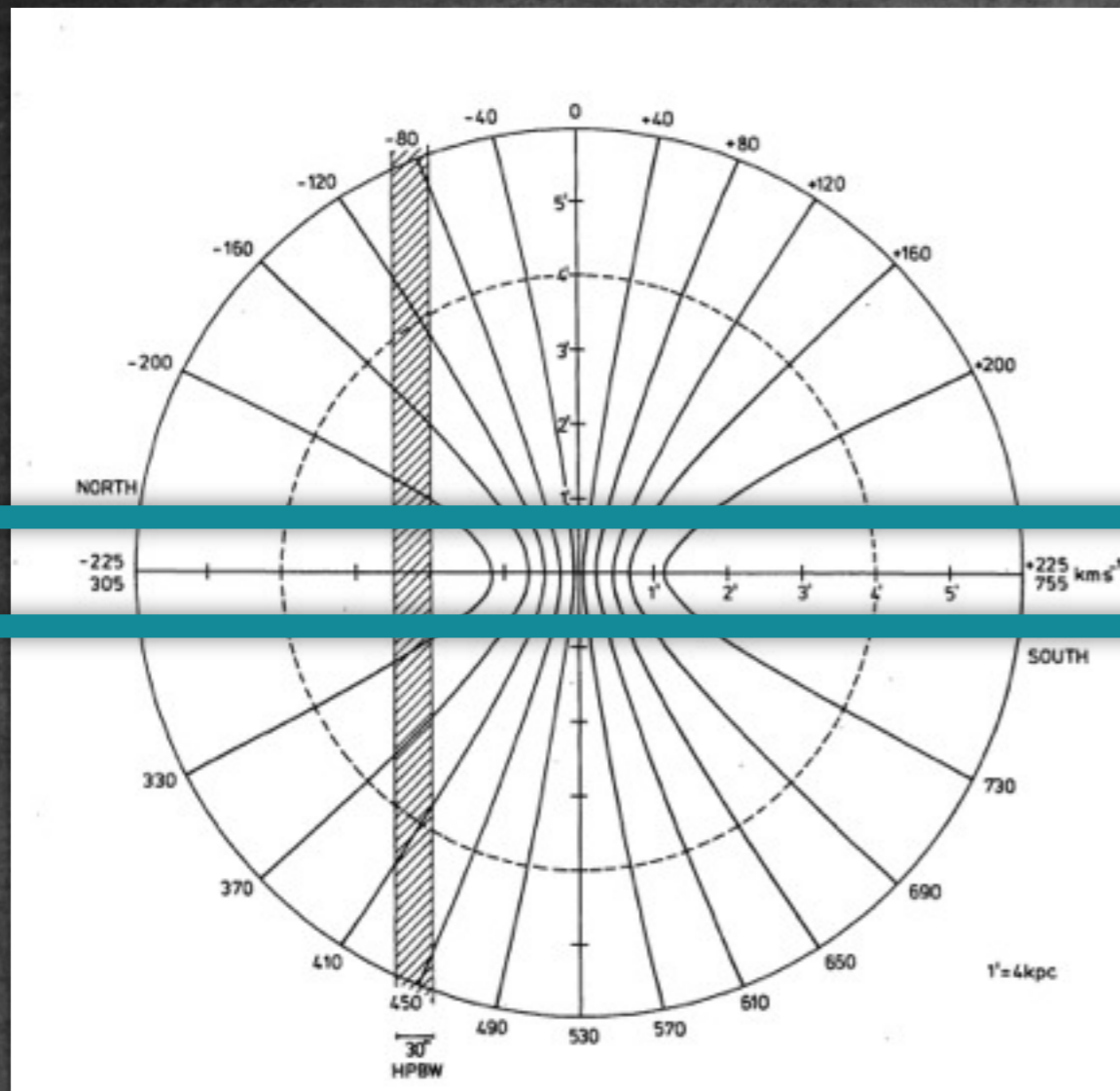
Summary and Outlook

- TiRiFiC is a standalone software to fit an extended tilted-ring model to data cubes
- Any tilted-ring fitting software fitting to data cubes is suited to push the boundaries for fitting of poorly resolved observations, highly relevant for WNSHS and WALLABY
- TiRiFiC requires a better minimiser and simplified parametrisations
- Such a minimiser exists:
 - "Galactus" by S. Peters (Kapteyn): cylindric disk model with radiative transfer
 - <http://sourceforge.net/projects/galactus/>
 - particle swarm and MCMC algorithms successful
 - minimisers will be implemented in TiRiFiC



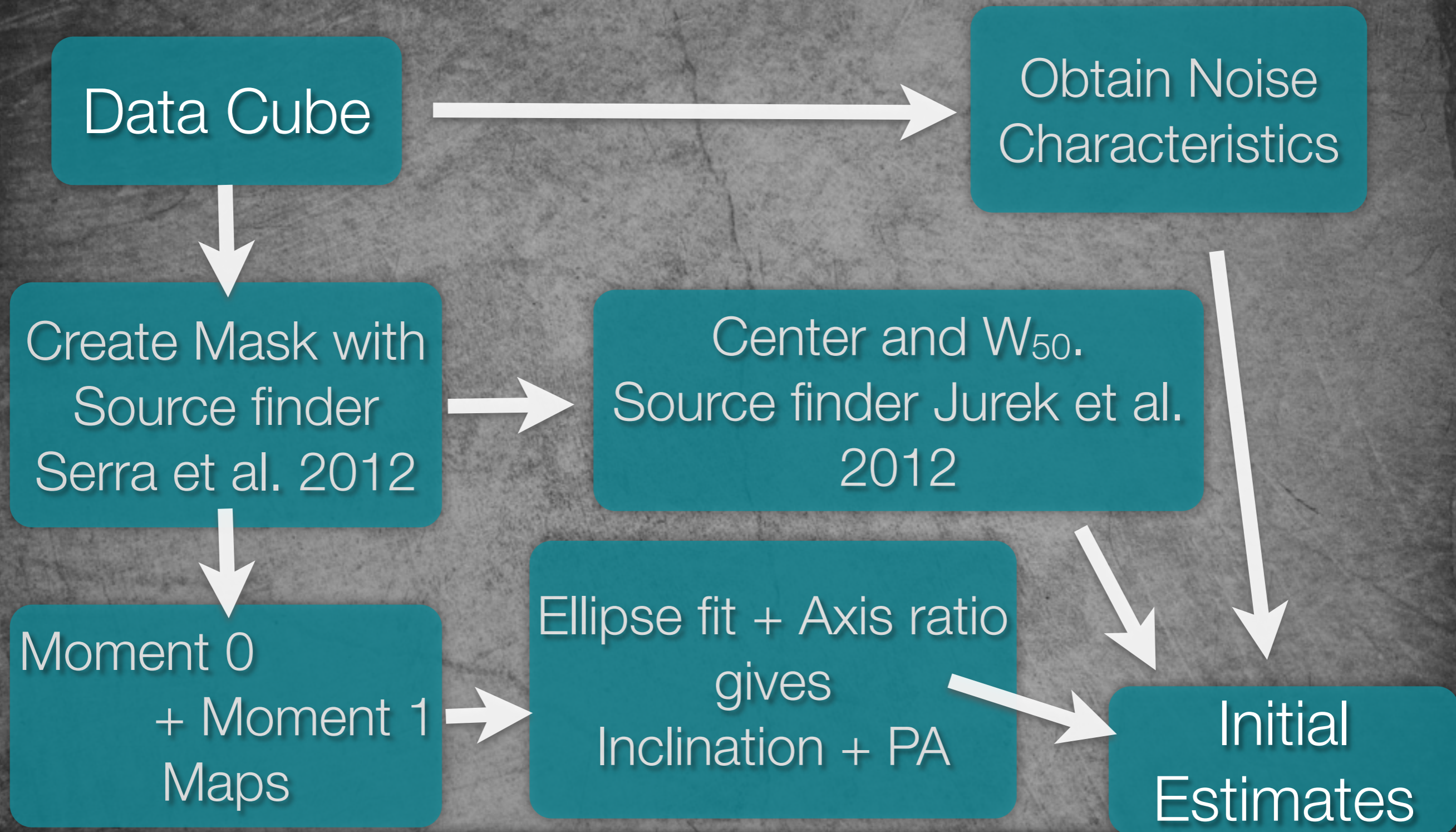
<http://www.astron.nl/~jozsa/tirific>

Drawbacks of 2D-fitting

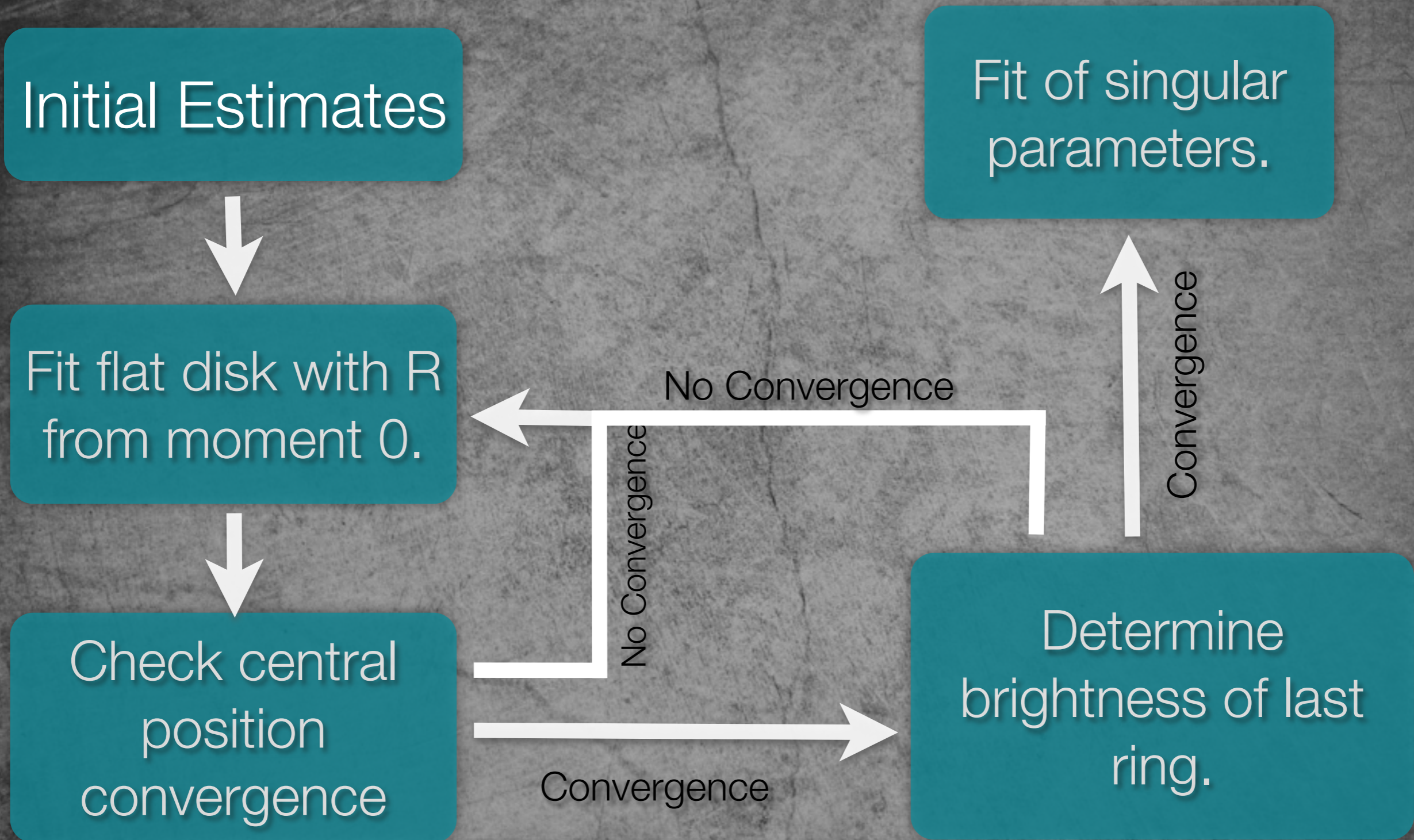


Sancisi & Allen 1979

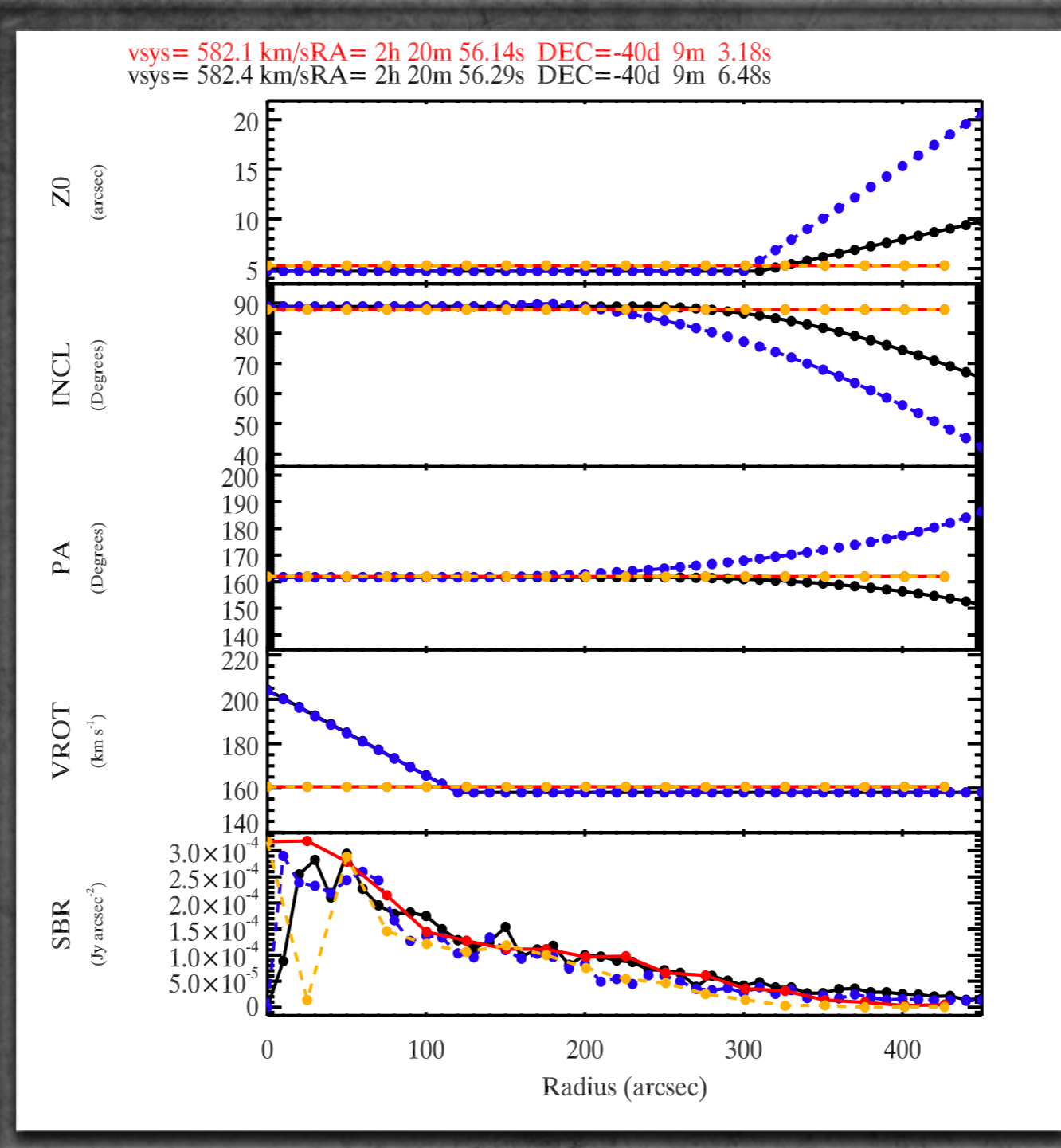
Fit Procedure



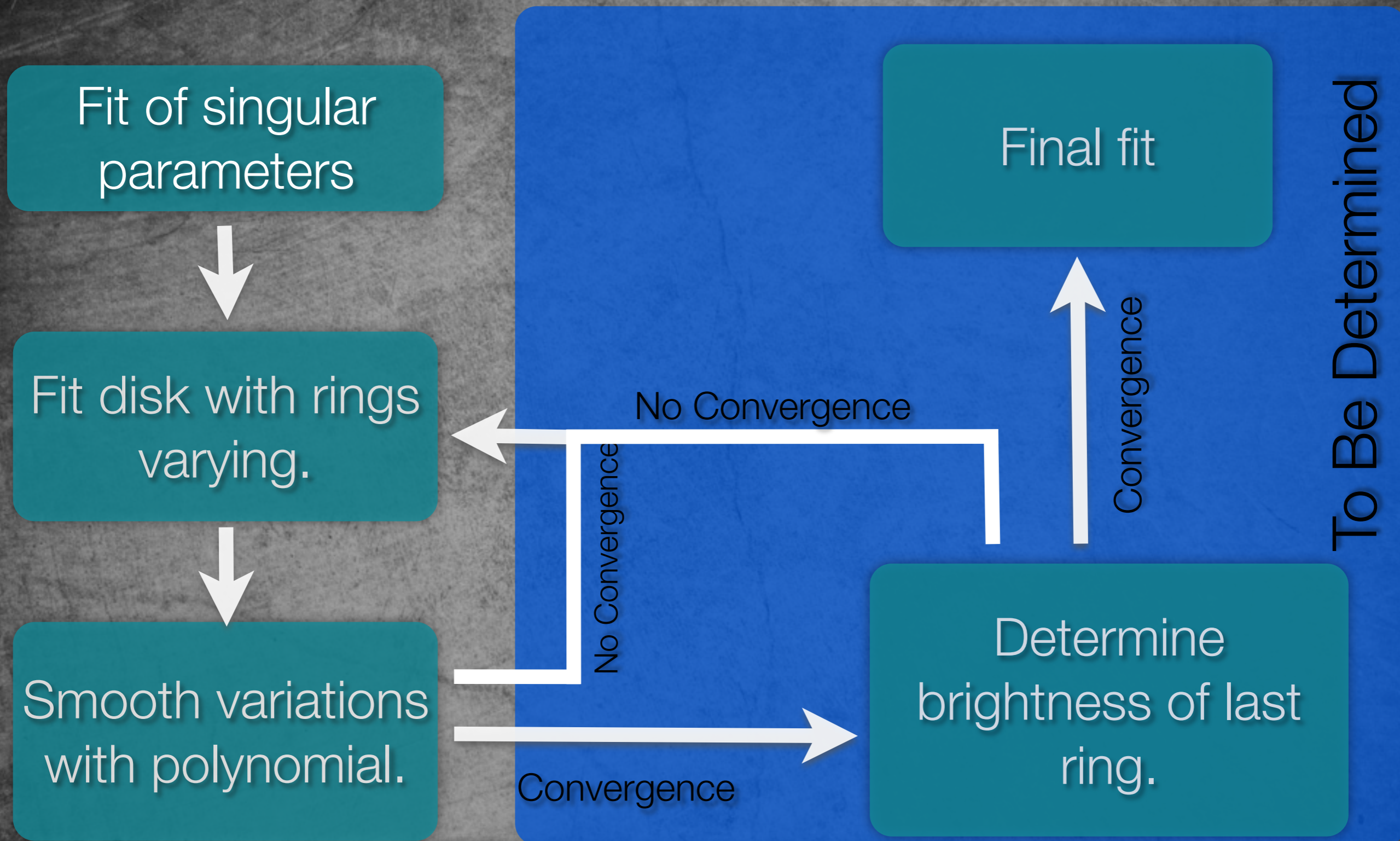
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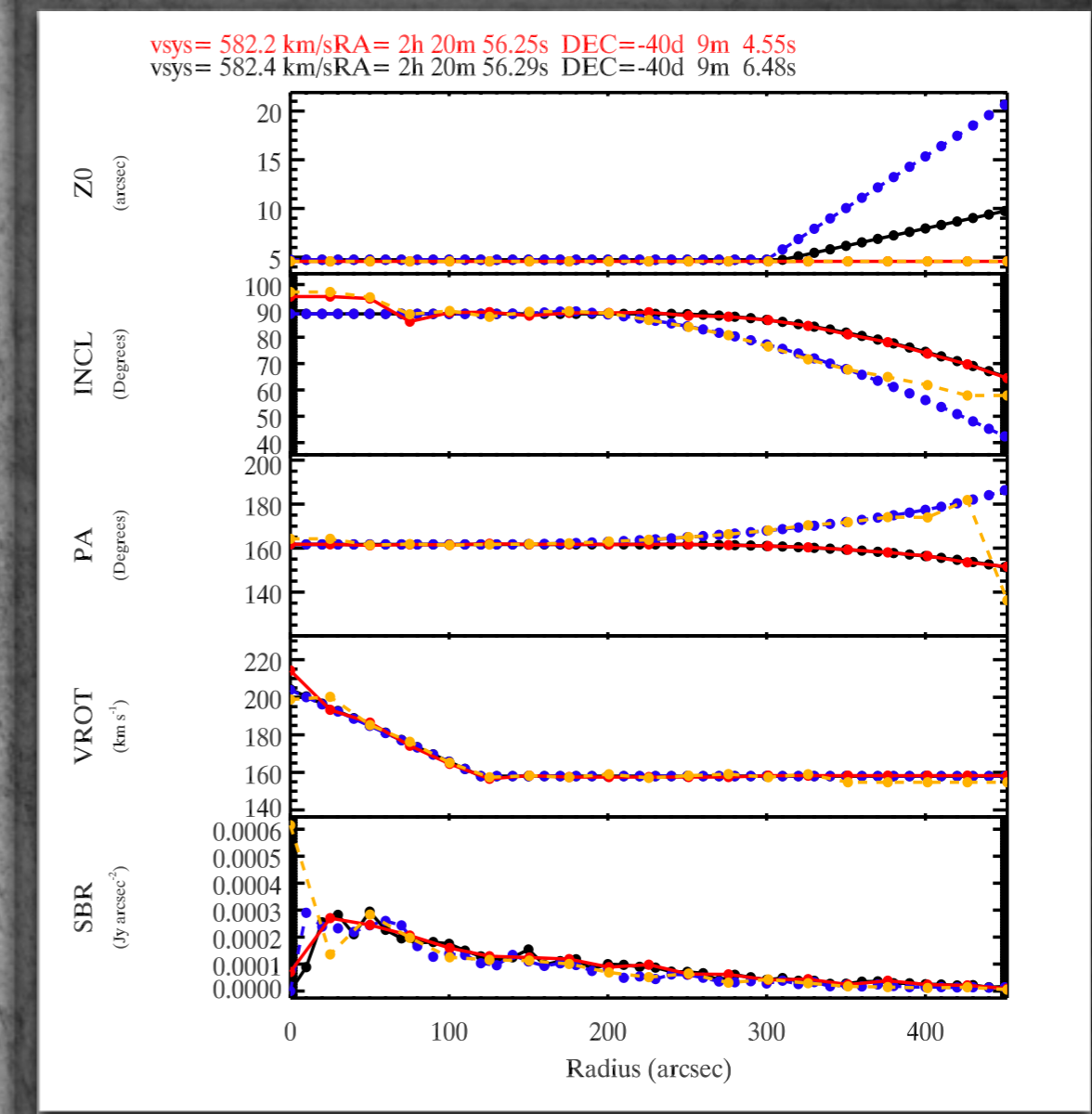
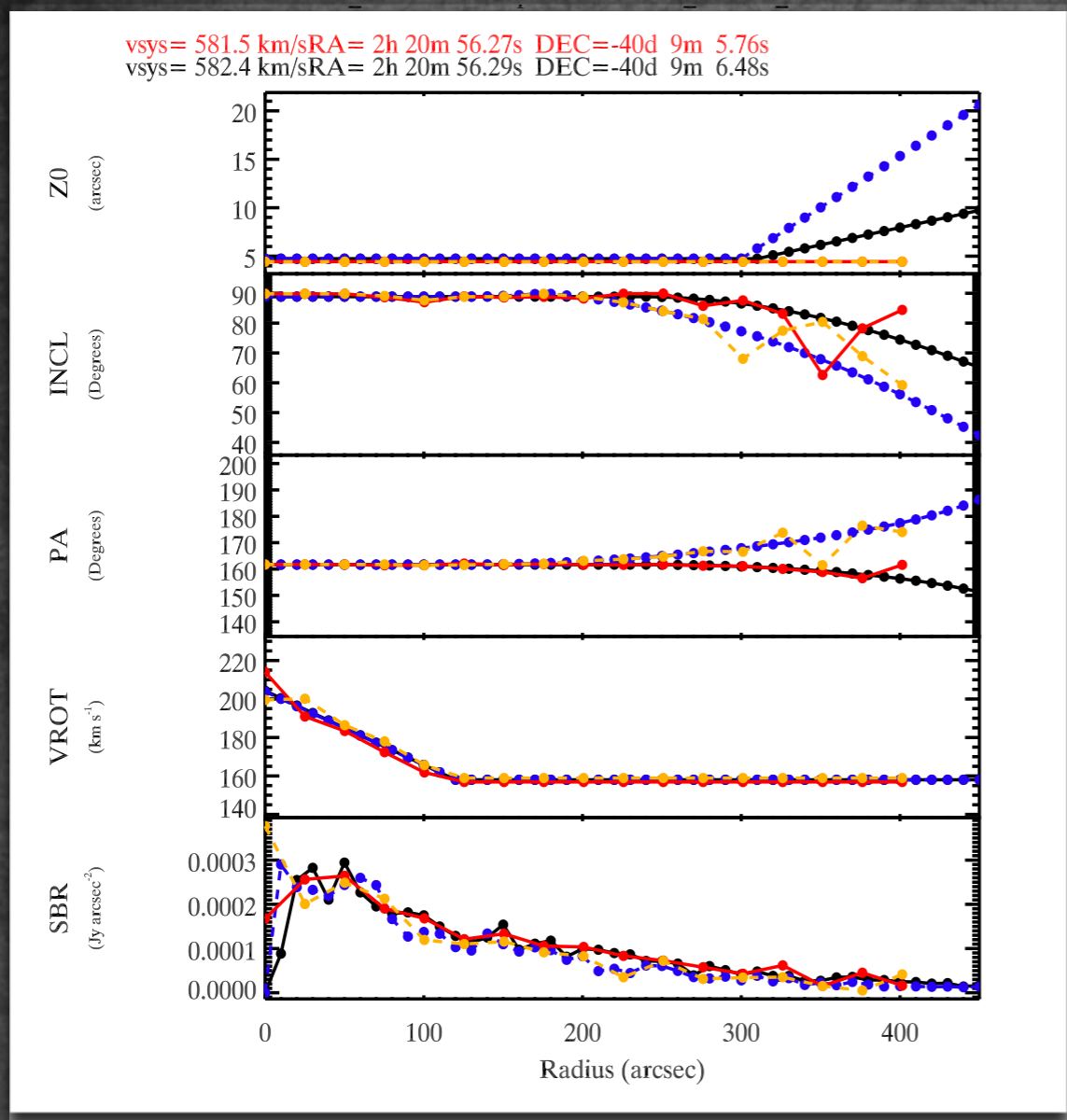
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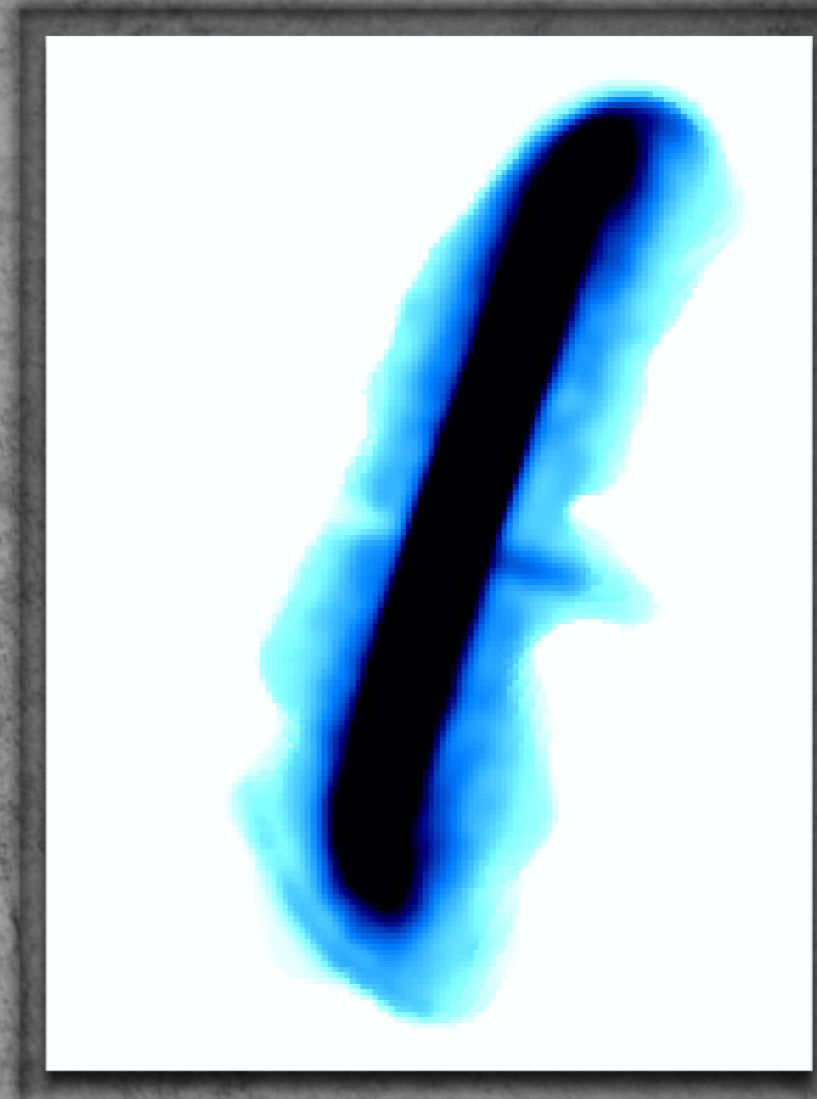
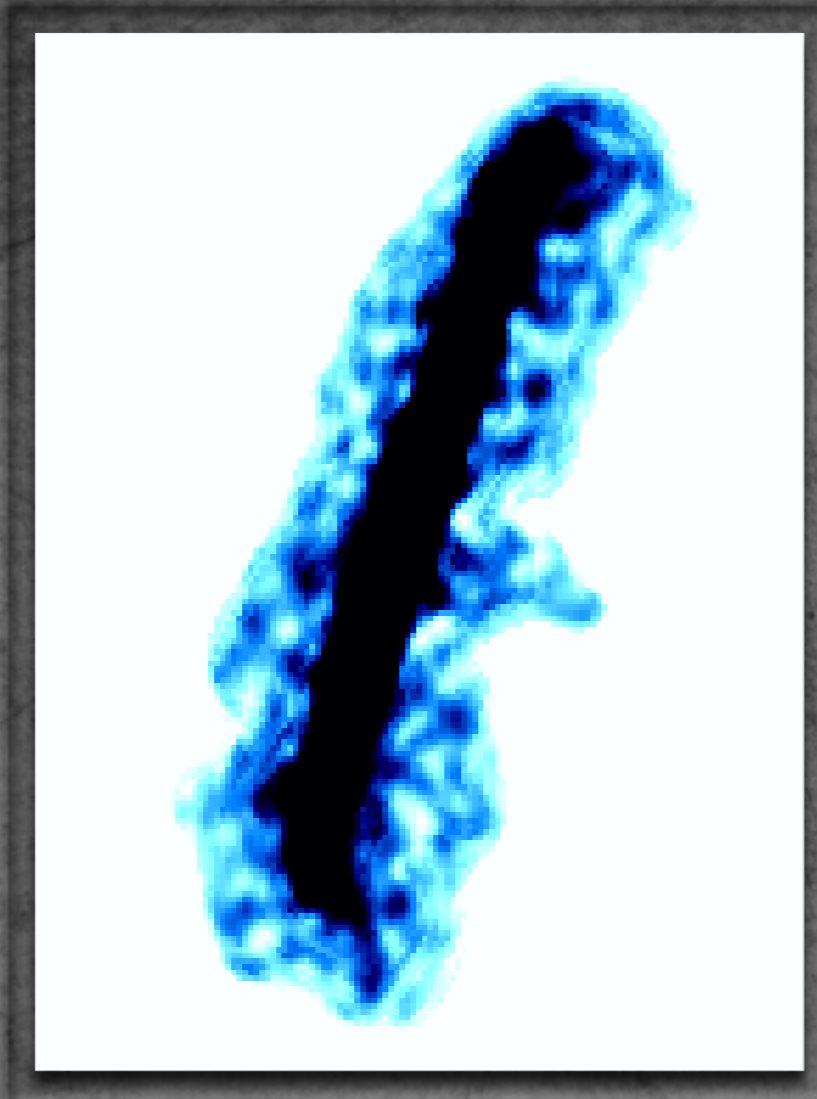
Fit Procedure



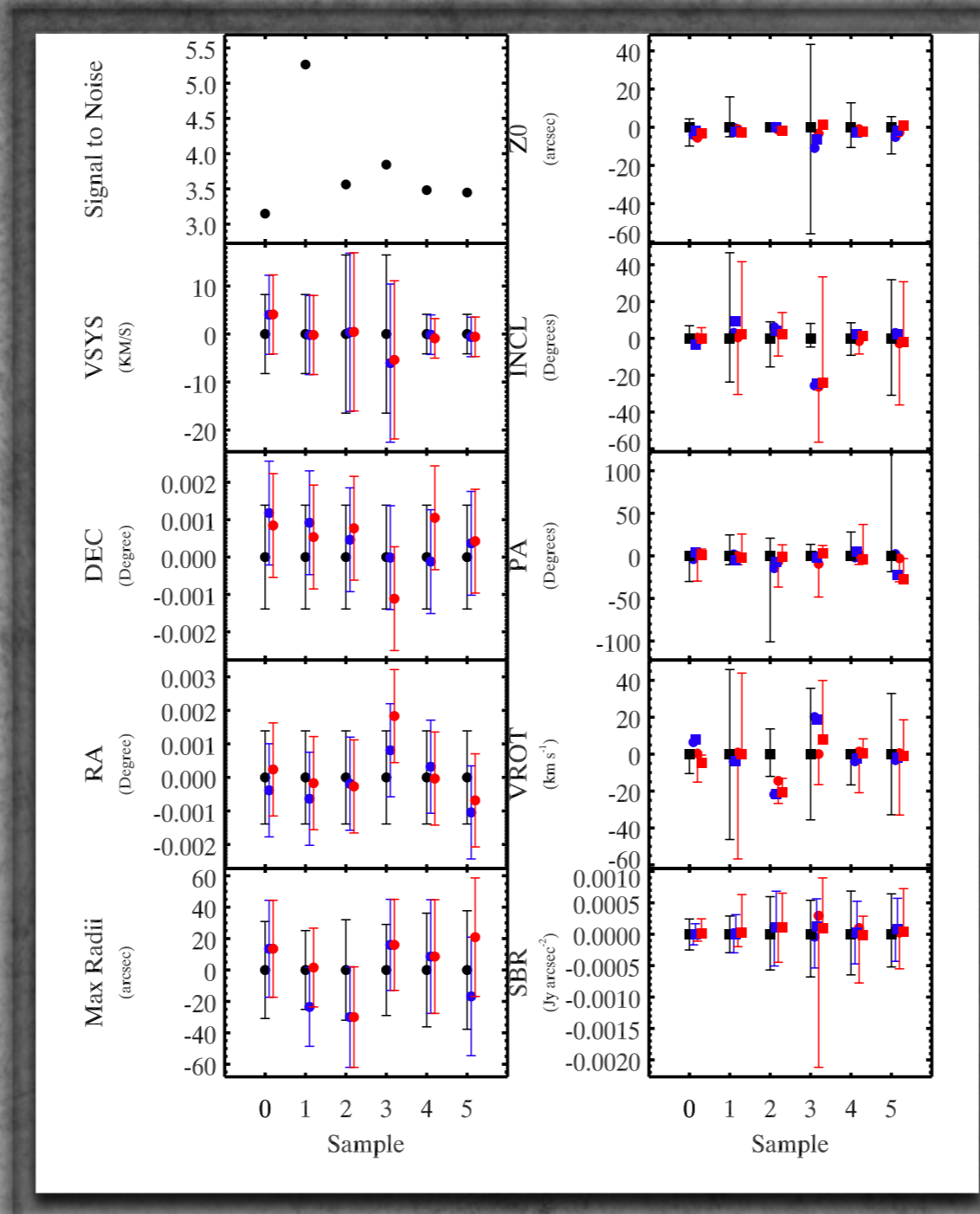
Fit Procedure



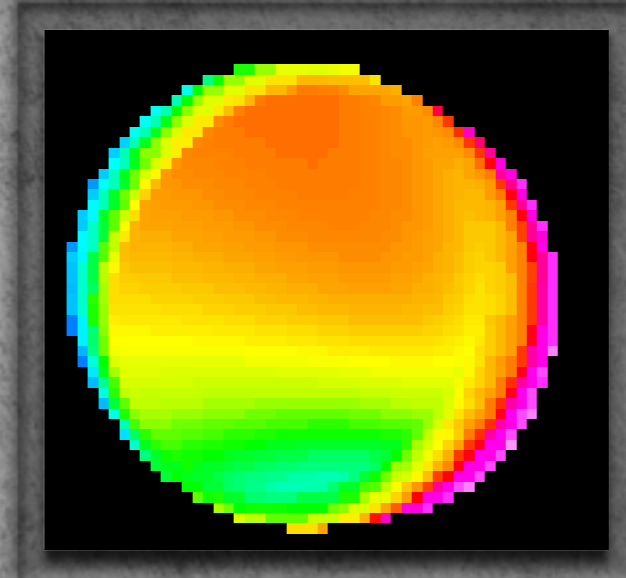
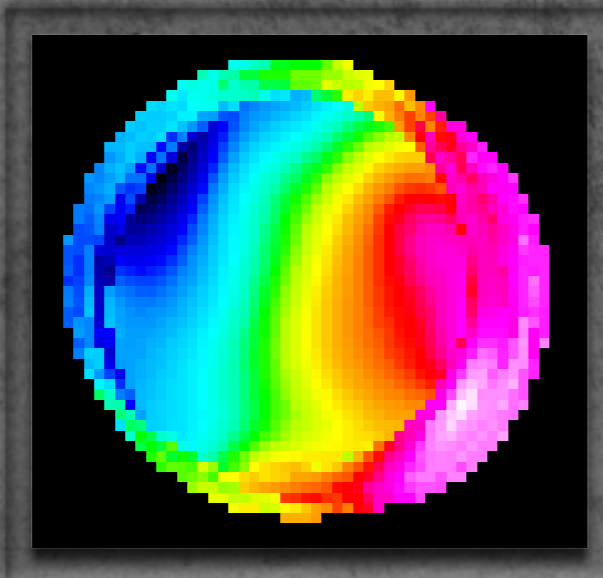
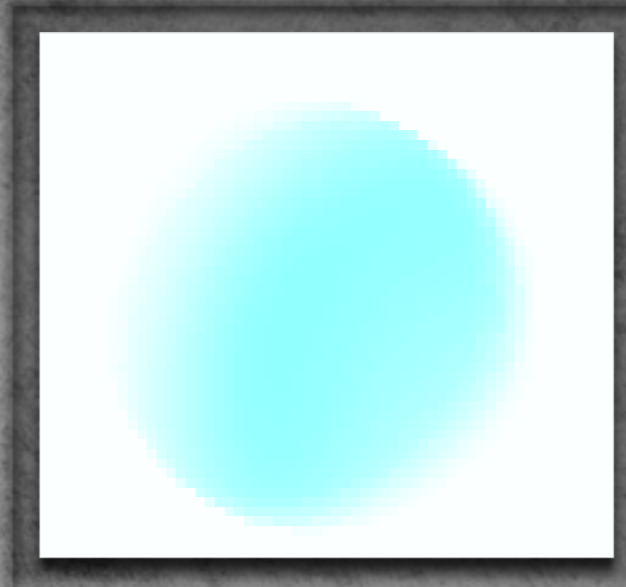
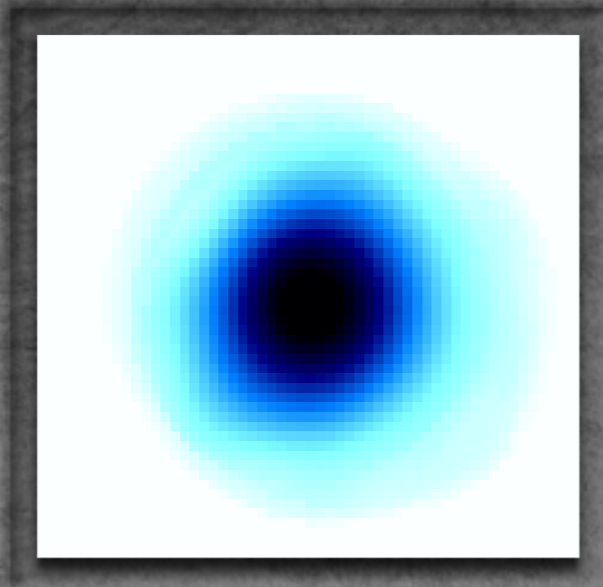
Preliminary Results



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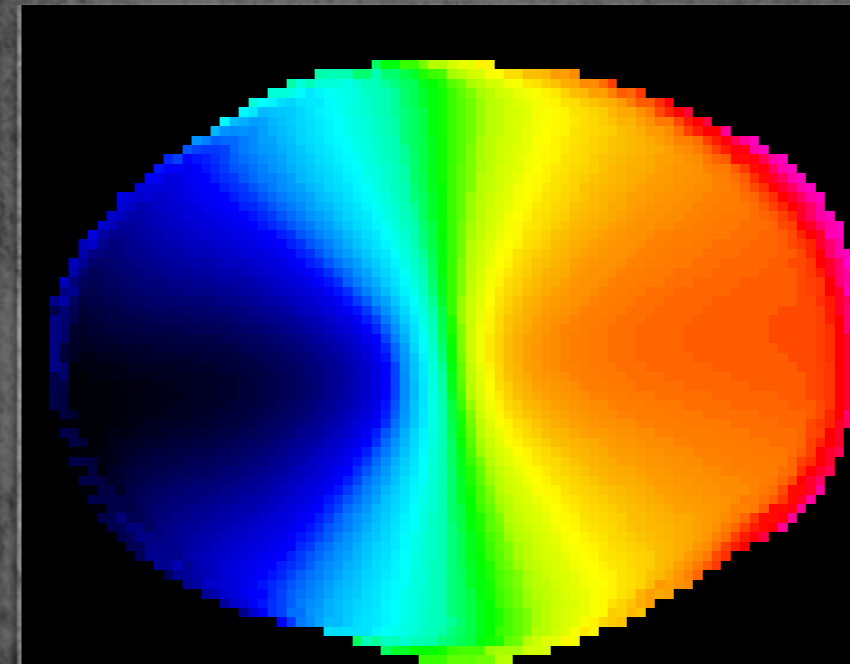
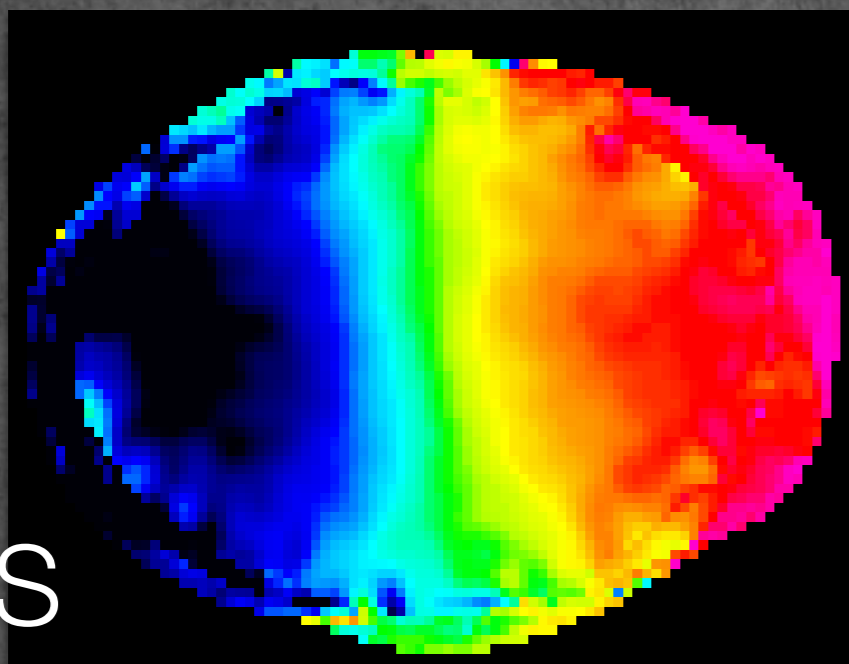
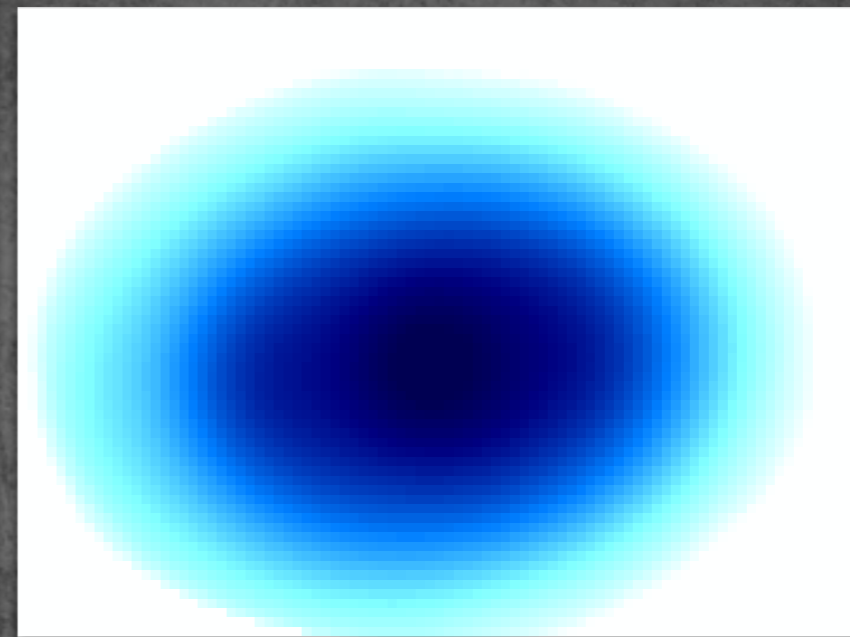
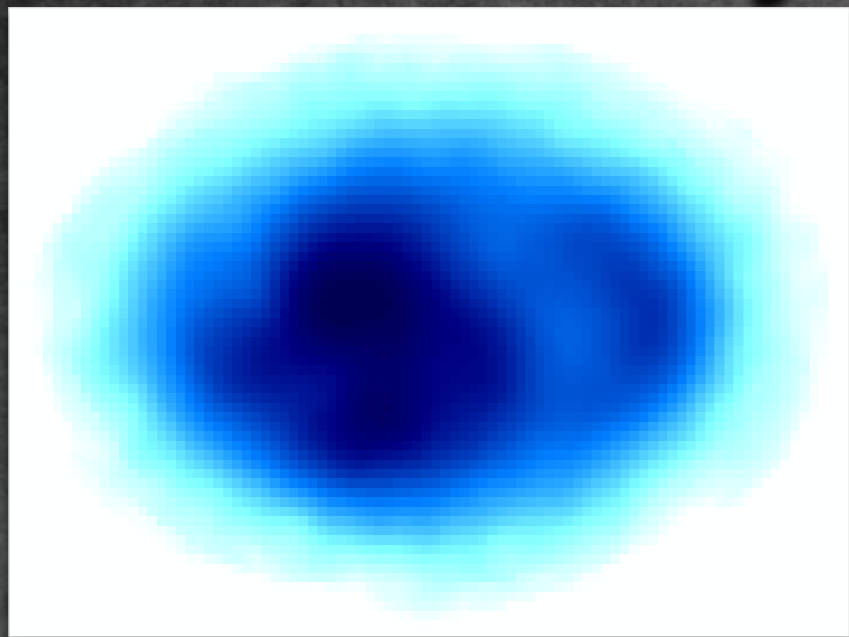
Preliminary Results



LVHIS

Koribalski et al. HIPASS J1441--62

Preliminary Results



LVHIS

Koribalski et al.

HIPASS J0705--58

To Do

- Finish LVHIS-26 tests. How many failures? Why?
- Test on extensive “Fake” database of galaxies.
- Determine the turn over from 2D to 3D fitting for SN, Minimum size, Inclination.
- Introduce error estimation.