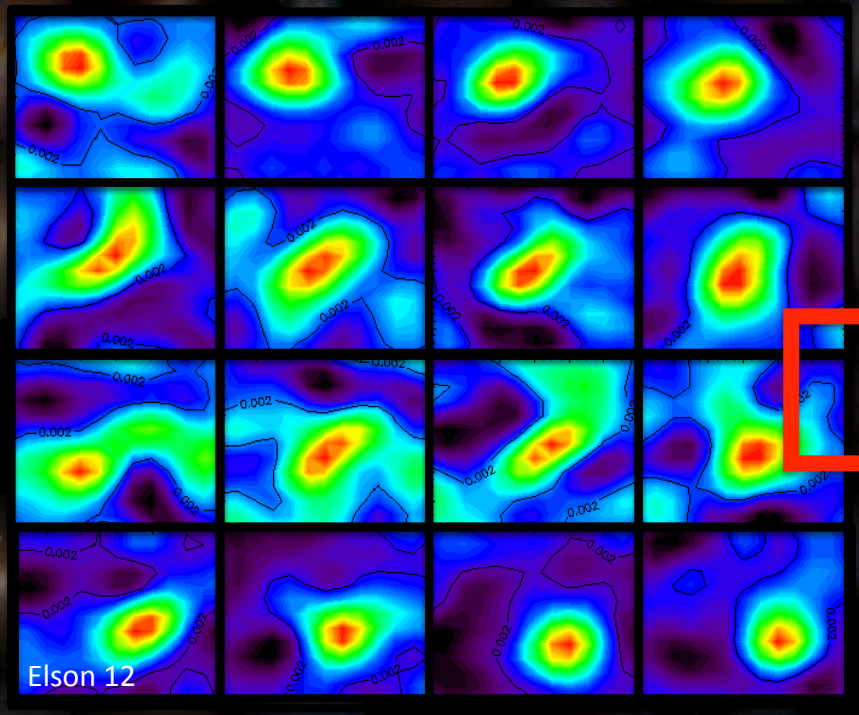
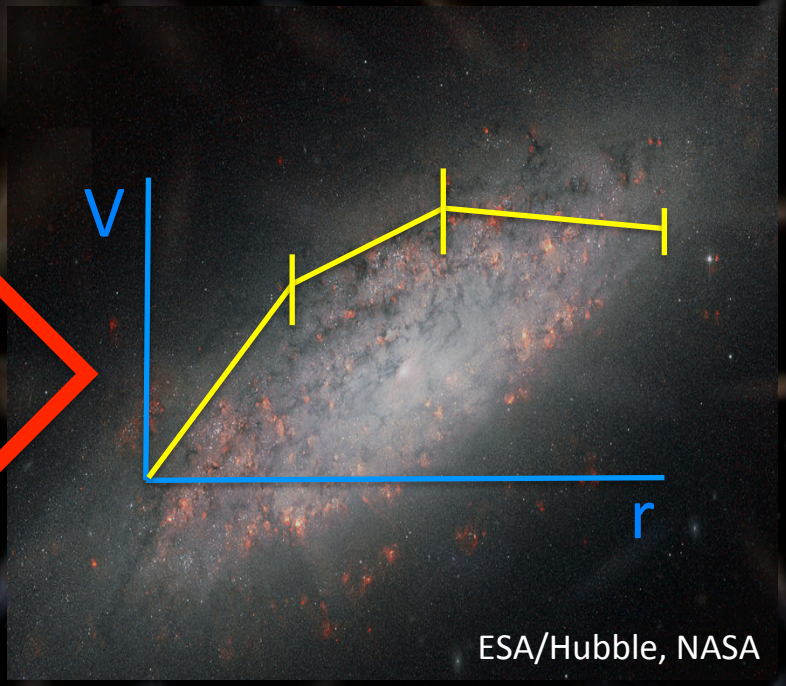
Measuring Disk Galaxy Kinematics From Future HI Surveys



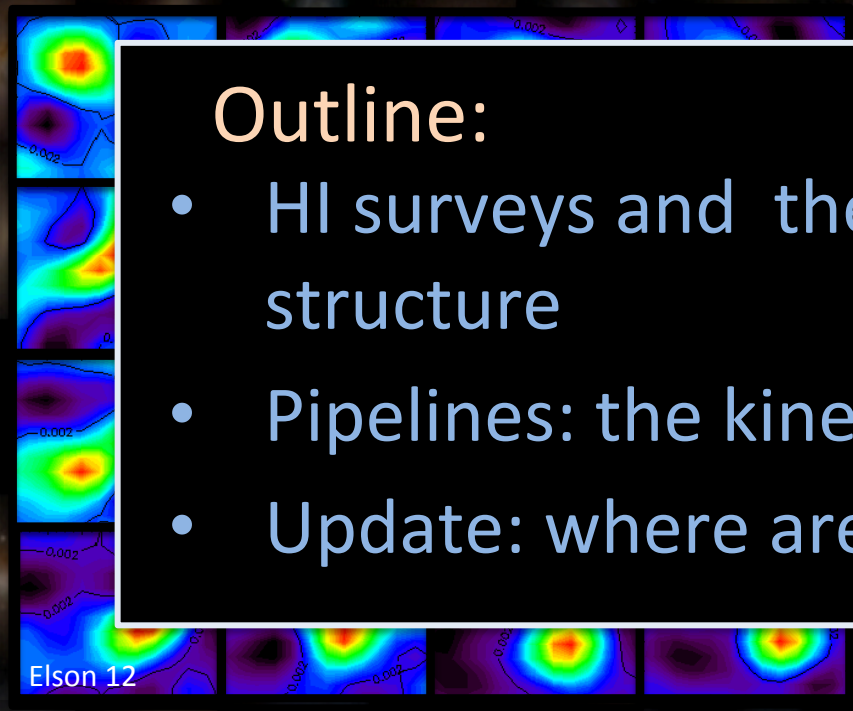


Kristine Spekkens
(for the kinematics group)

Royal Military College of Canada
RMC CMR

PHISCC 2016, Cape Town

Measuring Disk Galaxy Kinematics From Future HI Surveys



Outline:

- HI surveys and the statistics of disk galaxy structure
- Pipelines: the kinematics group approach
- Update: where are we now?

ESA/Hubble, NASA

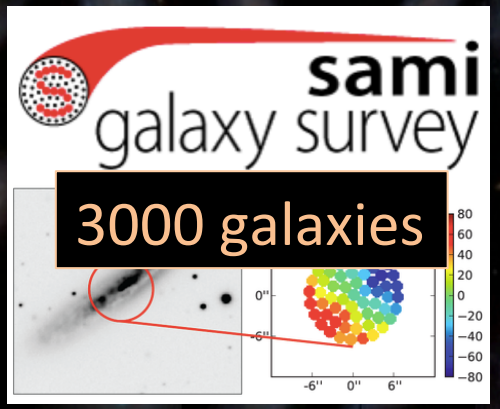
Kristine Spekkens
(for the kinematics group)

Royal Military College of Canada

PHISCC 2016, Cape Town

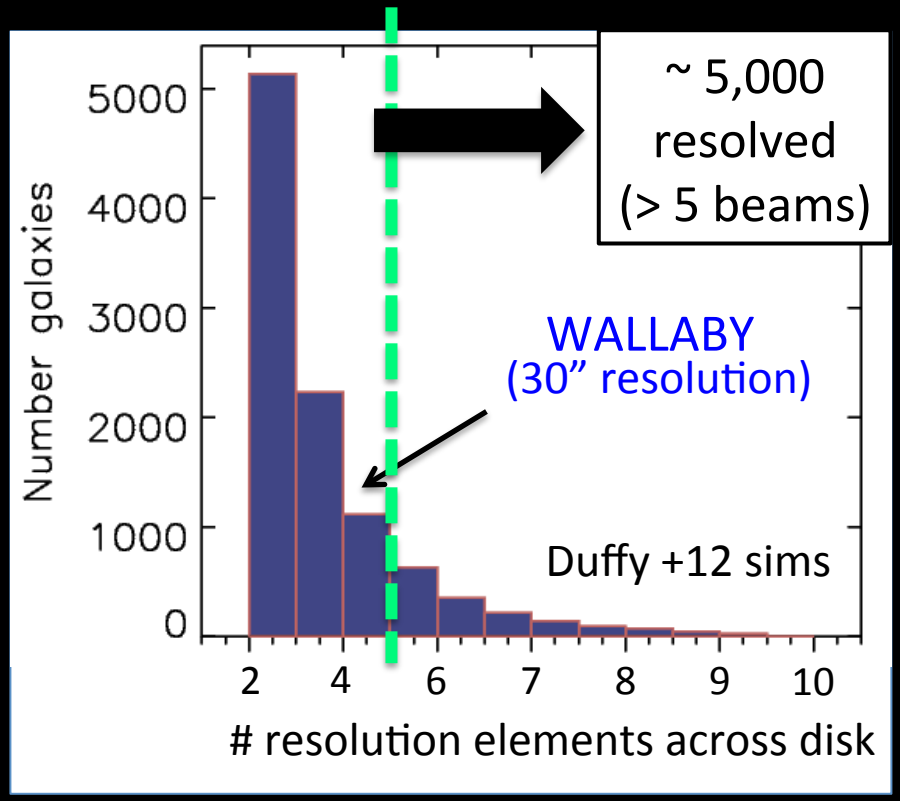
A bright future: large spectroscopic surveys

What are the statistics of nearby disk galaxy structure?



Widefield SKA pathfinder surveys

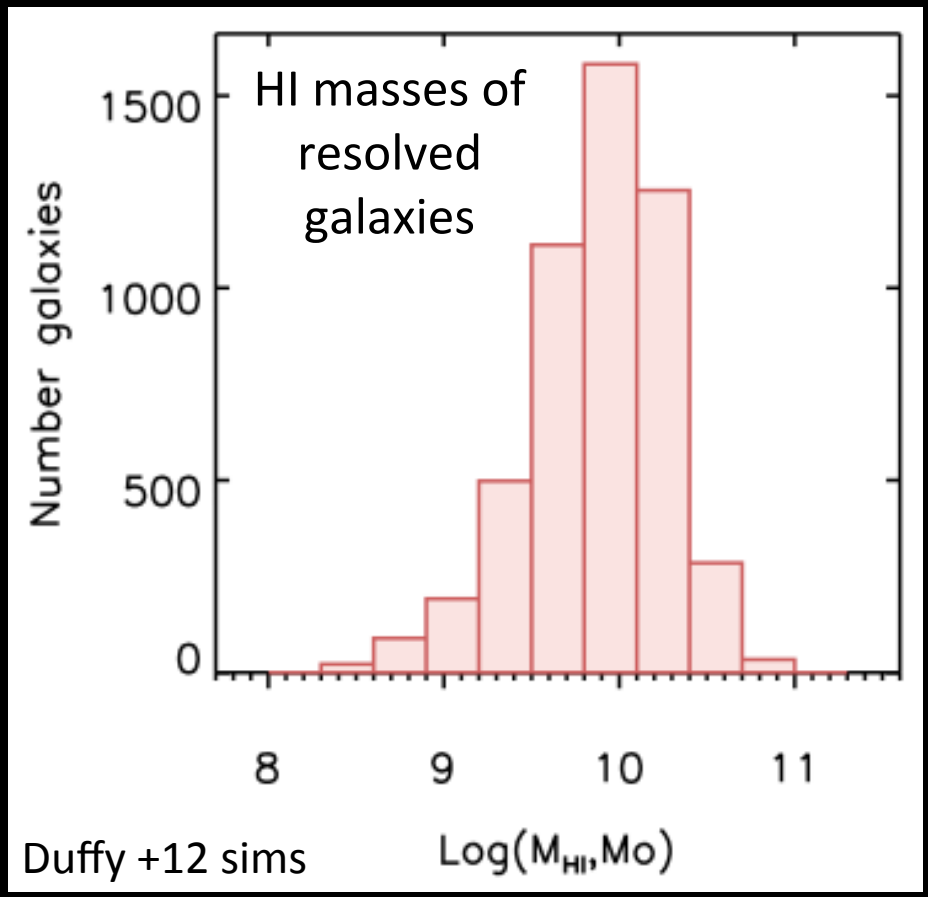
- 3π (ASKAP + WSRT) HI survey at 30”, 5km/s resolution



WALLABY+WNSHS: ~5,000 resolved HI detections

Widefield SKA pathfinder surveys

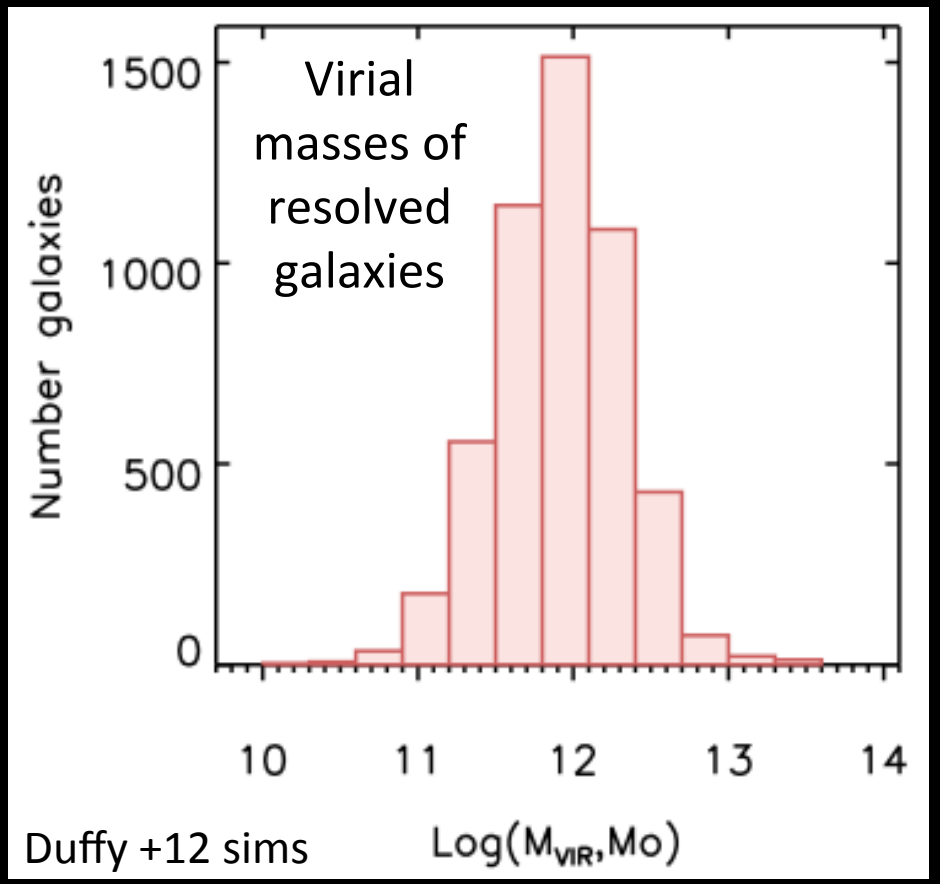
- 3π (ASKAP + WSRT) HI survey at 30”, 5km/s resolution



WALLABY+WNSHS: ~5,000 resolved HI detections

Widefield SKA pathfinder surveys

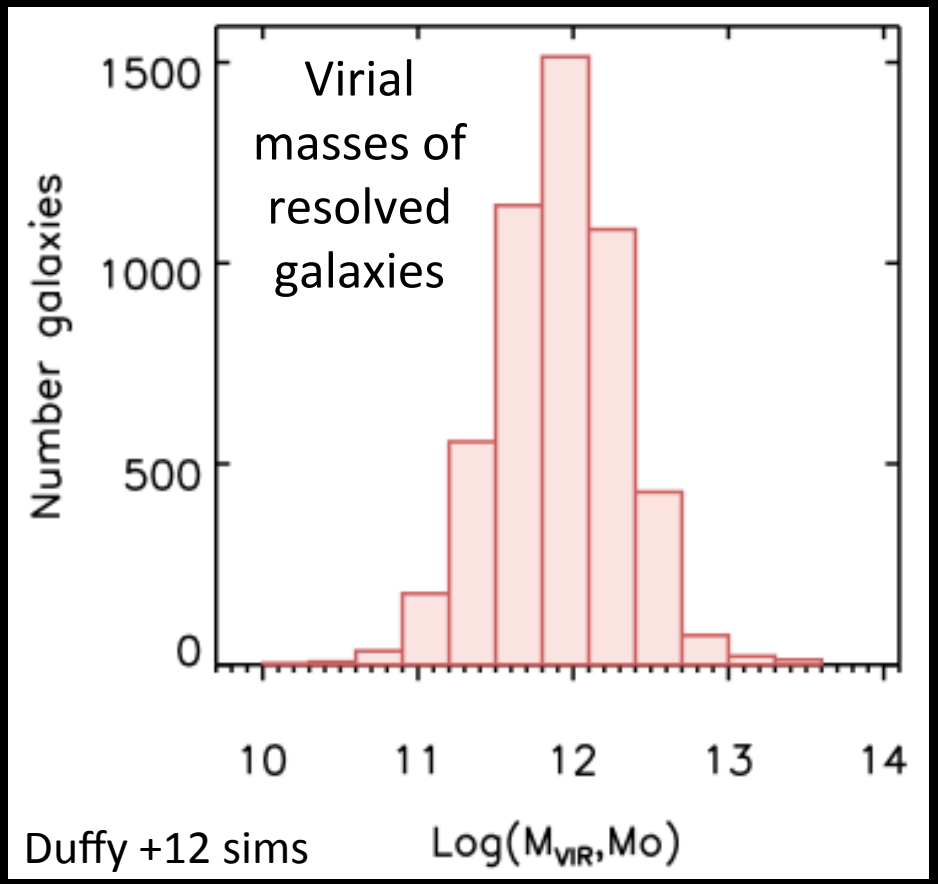
- 3π (ASKAP + WSRT) HI survey at 30”, 5km/s resolution



WALLABY+WNSHS: ~5,000 resolved HI detections

Widefield SKA pathfinder surveys

- 3π (ASKAP + WSRT) HI survey at 30”, 5km/s resolution

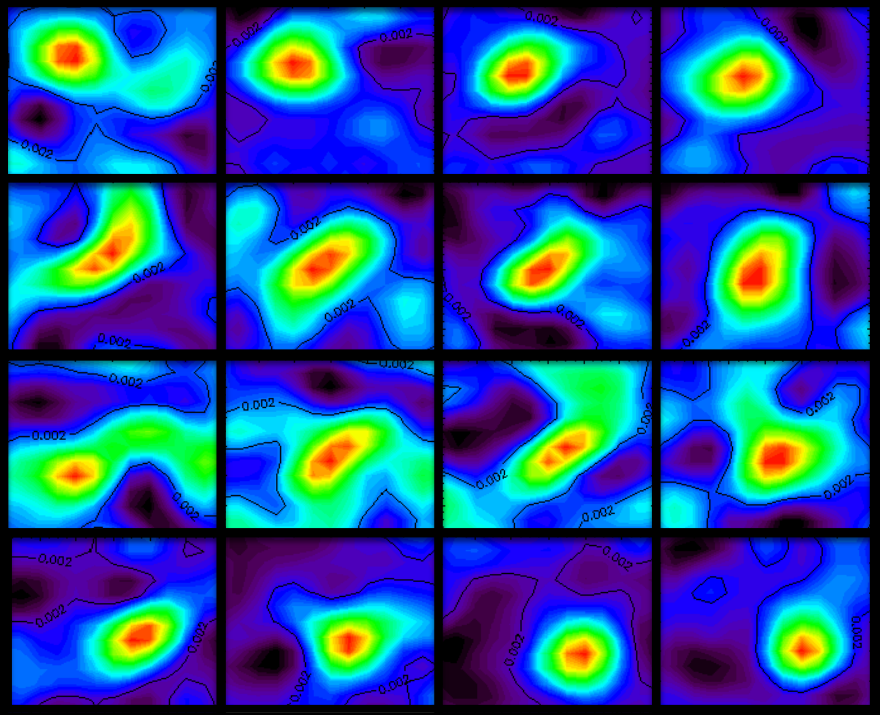


WALLABY+WNSHS: ~5,000 resolved HI detections

Widefield SKA pathfinder surveys

- 3π (ASKAP + WSRT) HI survey at 30”, 5km/s resolution

Typical channel maps

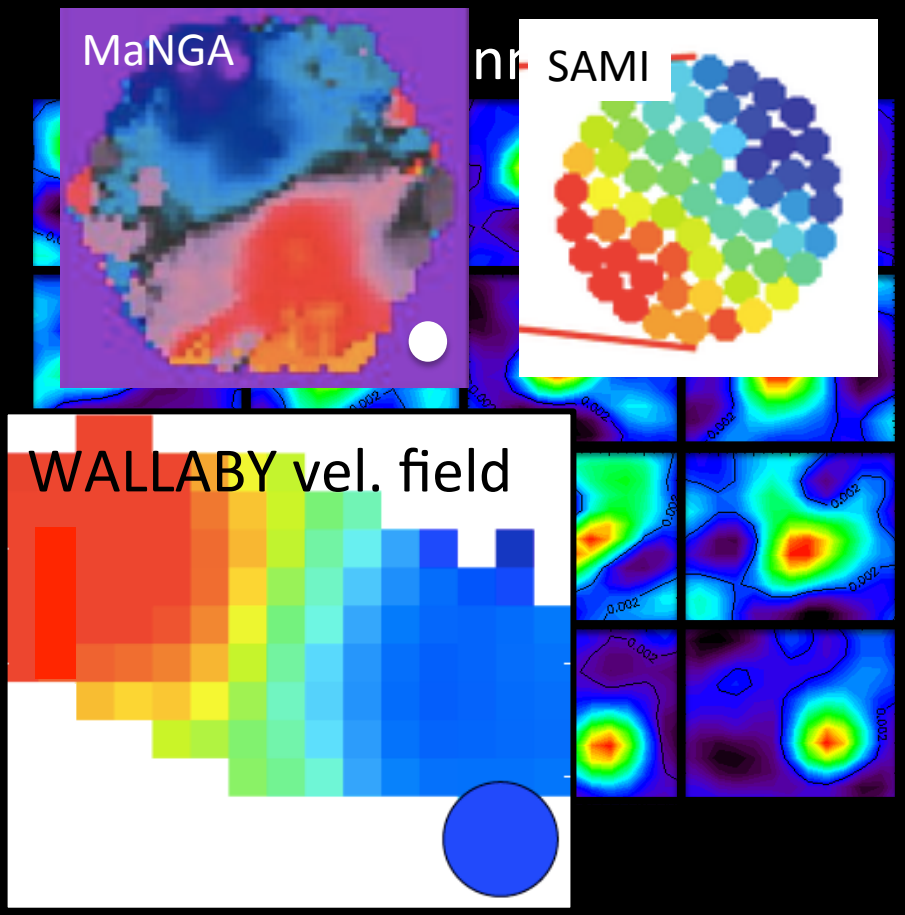


Elson 2012

WALLABY+WNSHS: ~5,000 resolved HI detections

Widefield SKA pathfinder surveys

- 3π (ASKAP + WSRT) HI survey at 30”, 5km/s resolution

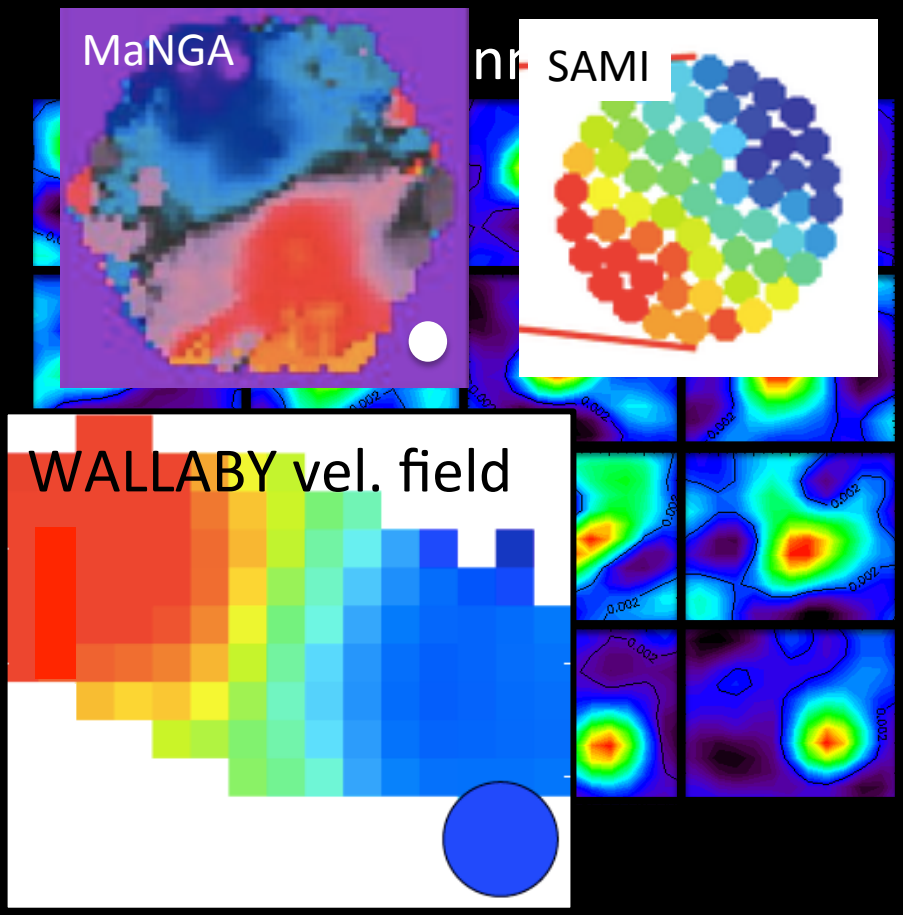


WALLABY+WNSHS: ~5,000 resolved HI detections

Widefield SKA pathfinder surveys

Modelling needs to be:

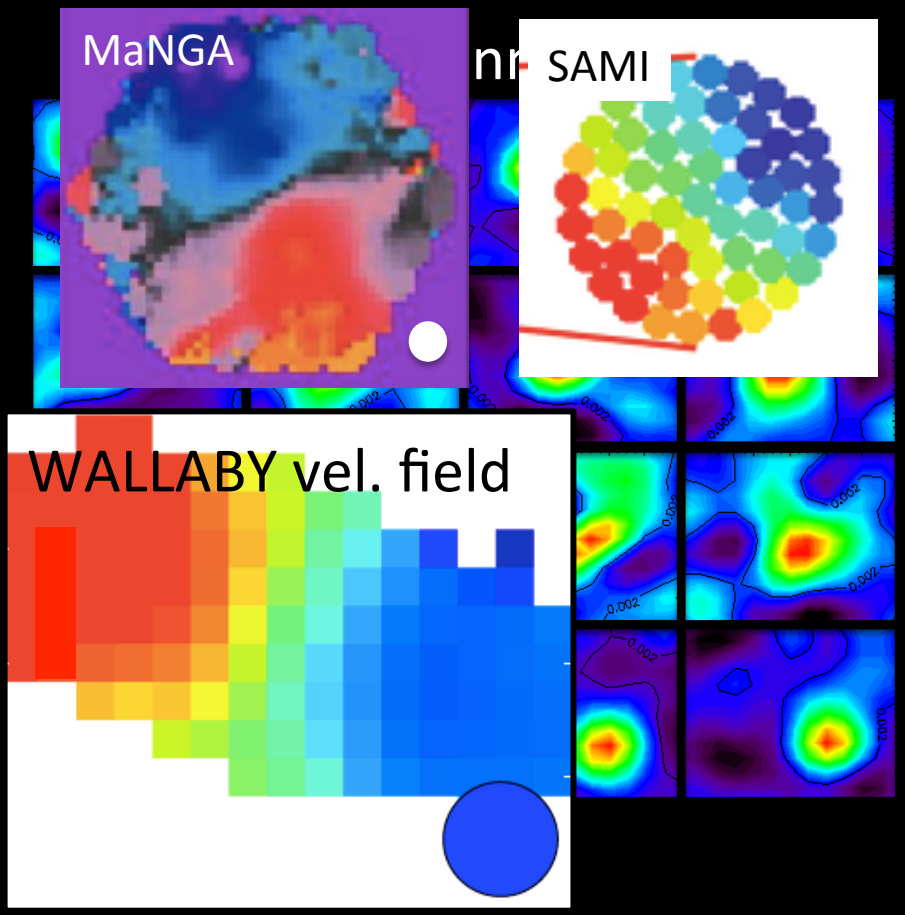
- Flexible, tractable
- Statistically robust
- Automated



Widefield SKA pathfinder surveys

Kinematics group:

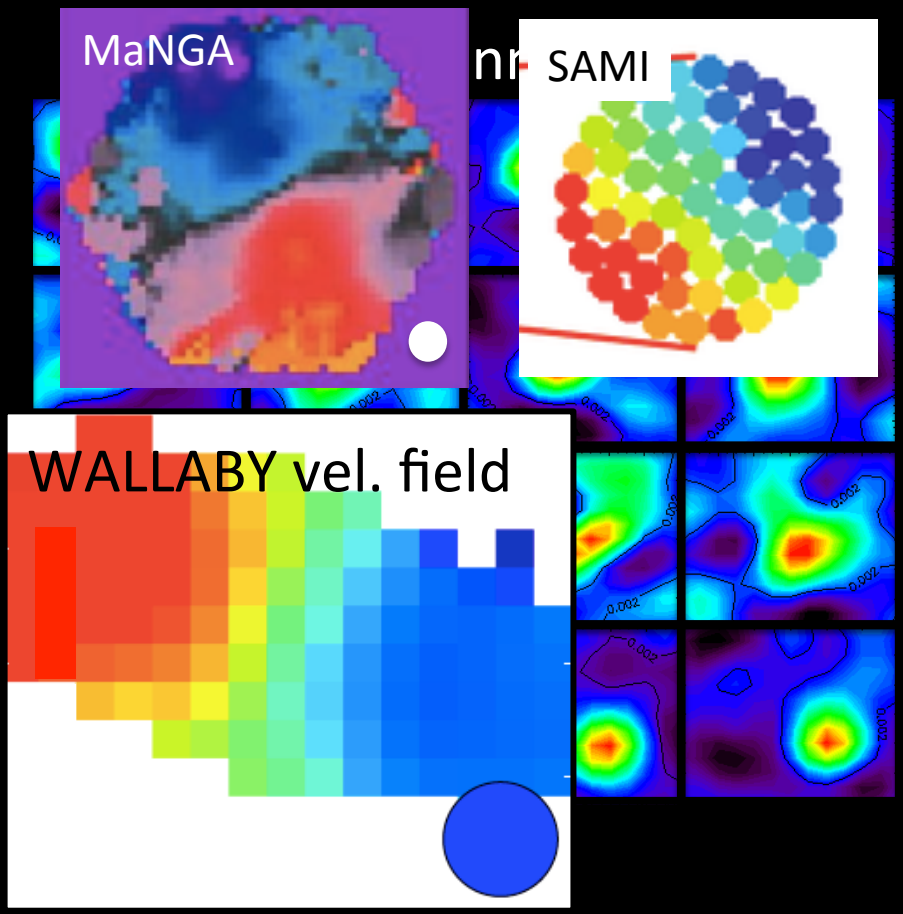
Devise and implement a pipeline for measuring galaxy structure from resolved widefield HI survey detections



Widefield SKA pathfinder surveys

Kinematics group:

Devise and implement a pipeline for measuring galaxy structure from resolved widefield HI survey detections



2D: ROTCUR Rogstad+74

DiskFit Spekkens+Sellwood 07

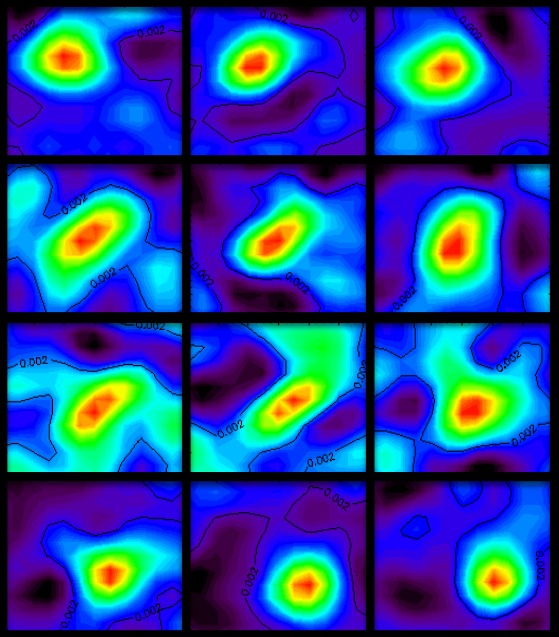
gbkfit Bekiaris+ 15

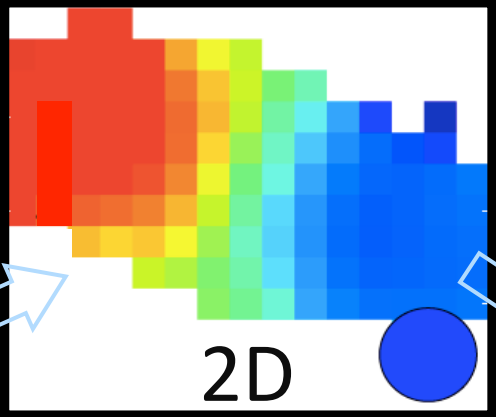
3D: TiRiFiC Jozsa+ 07

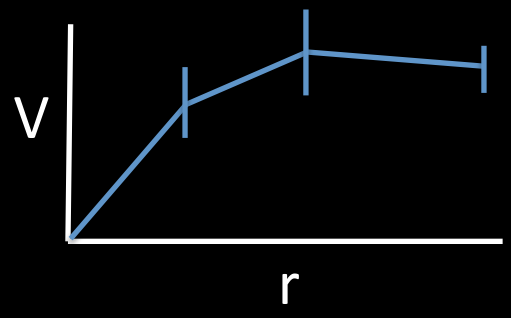
BBAROLO di Teodoro+Fraternali 15

Towards a Wallaby/WNSHS pipeline

Well-resolved,
intermediate-incl disks







PIPELINE ➔

i, PA, Vsys
xc, yc

3D

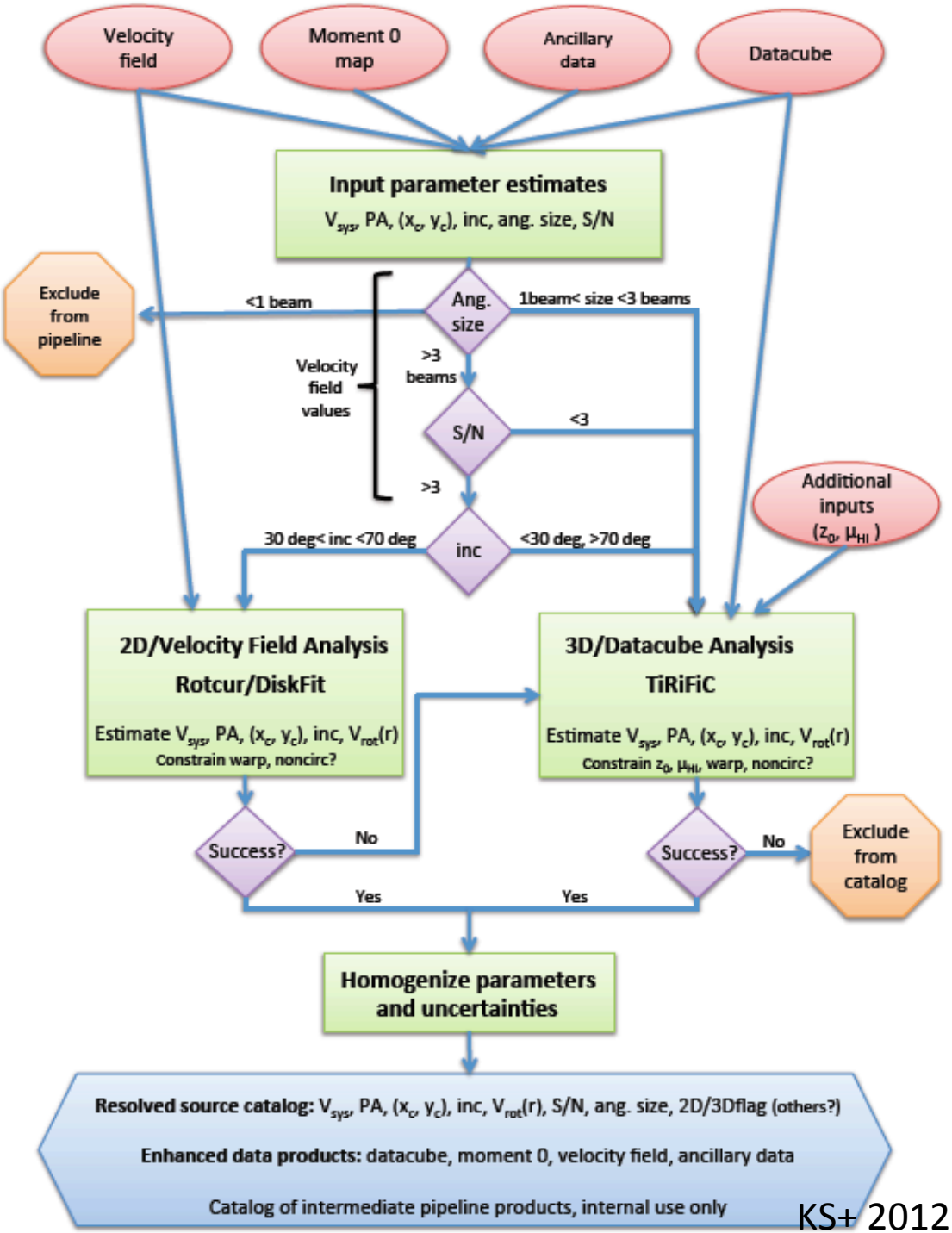
Poorly resolved,
edge-on, disturbed disks

~5,000 resolved HI disks

Conceptual Pipeline

Kinematics group:

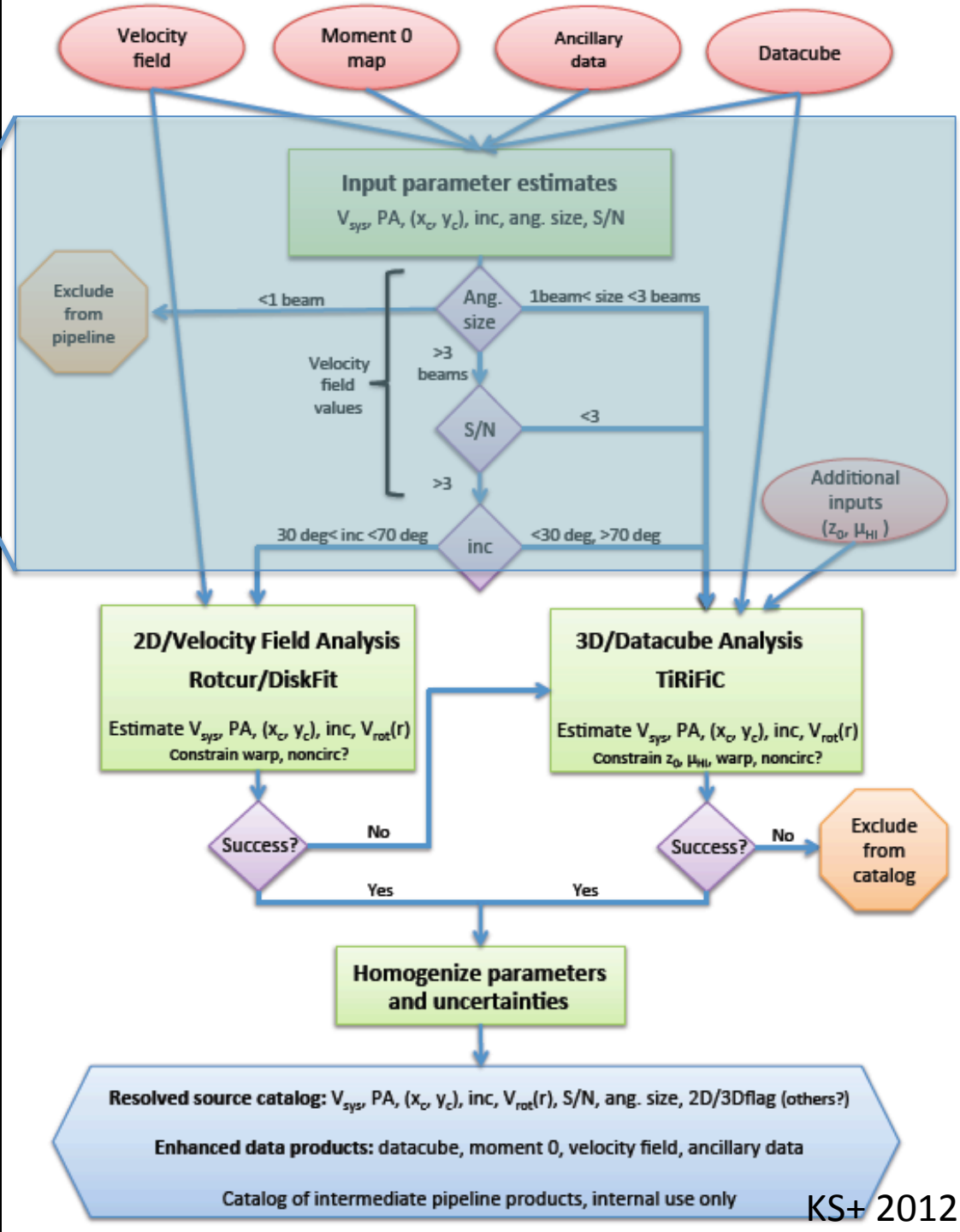
E. de Blok, E. Elson, M. Johnson, G. Jozsa, P. Kamphuis, B. Koribalski, S.-H. Oh, P. Serra, K. Spekkens, L. Staveley-Smith, M. Verheijen, J. Wang, T. Westmeier



KS+ 2012

Conceptual Pipeline

Choose 2D or 3D approach



KS+ 2012

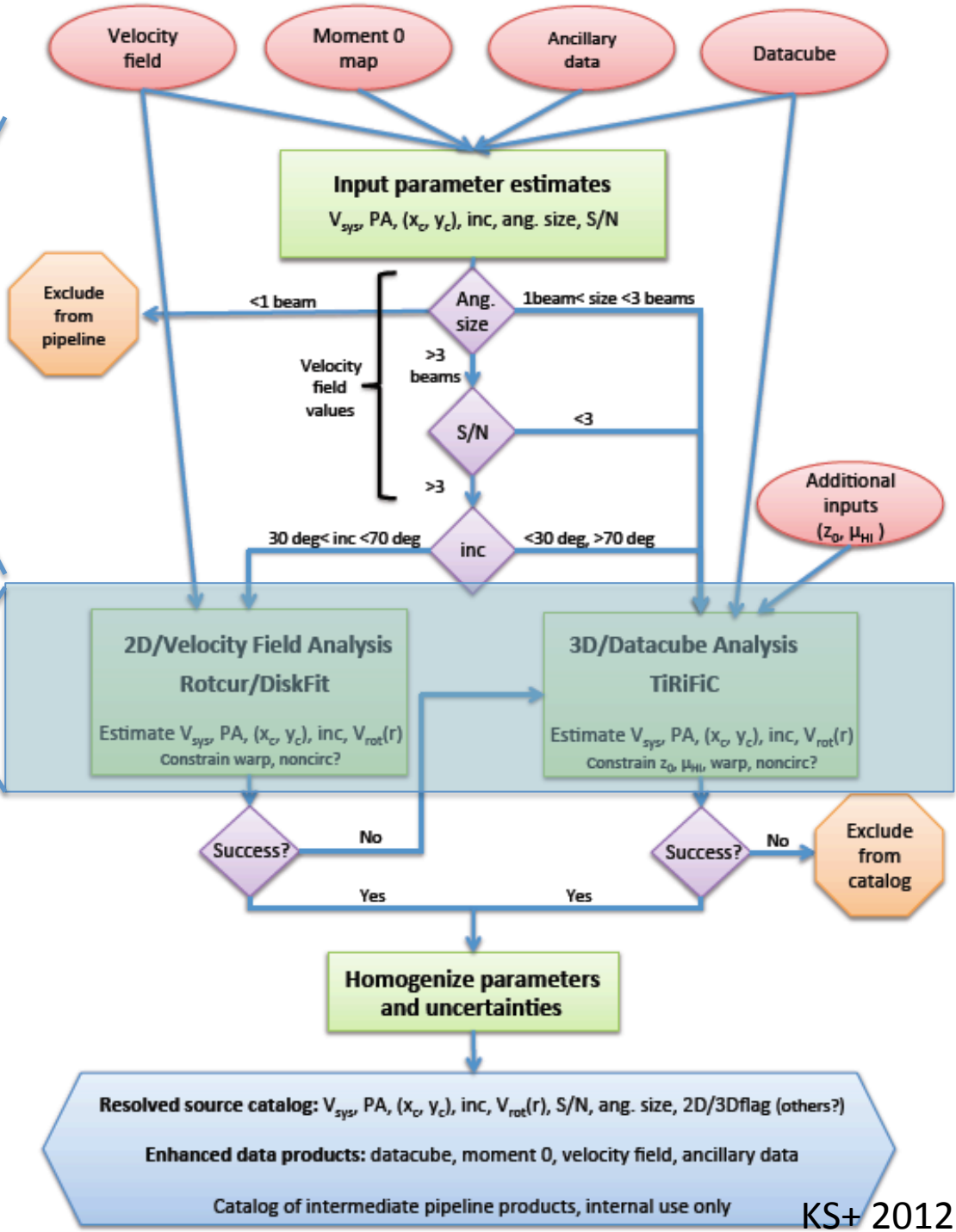
Kinematics group:

E. de Blok, E. Elson, M. Johnson, G. Jozsa, P. Kamphuis, B. Koribalski, S.-H. Oh, P. Serra, K. Spekkens, L. Staveley-Smith, M. Verheijen, J. Wang, T. Westmeier

Conceptual Pipeline

Choose 2D or 3D approach

Compute parameters + uncertainties



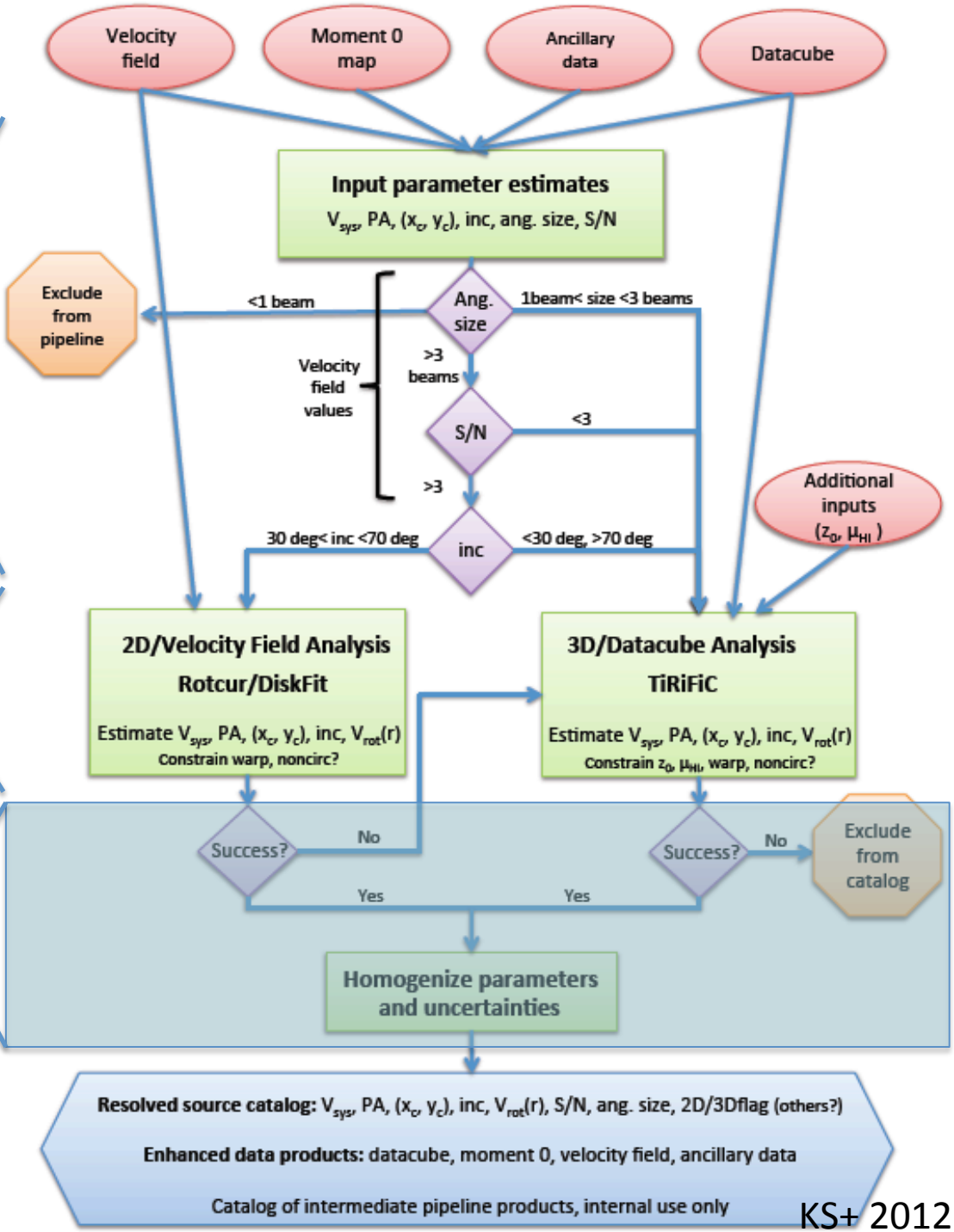
KS+ 2012

Conceptual Pipeline

Choose 2D or 3D approach

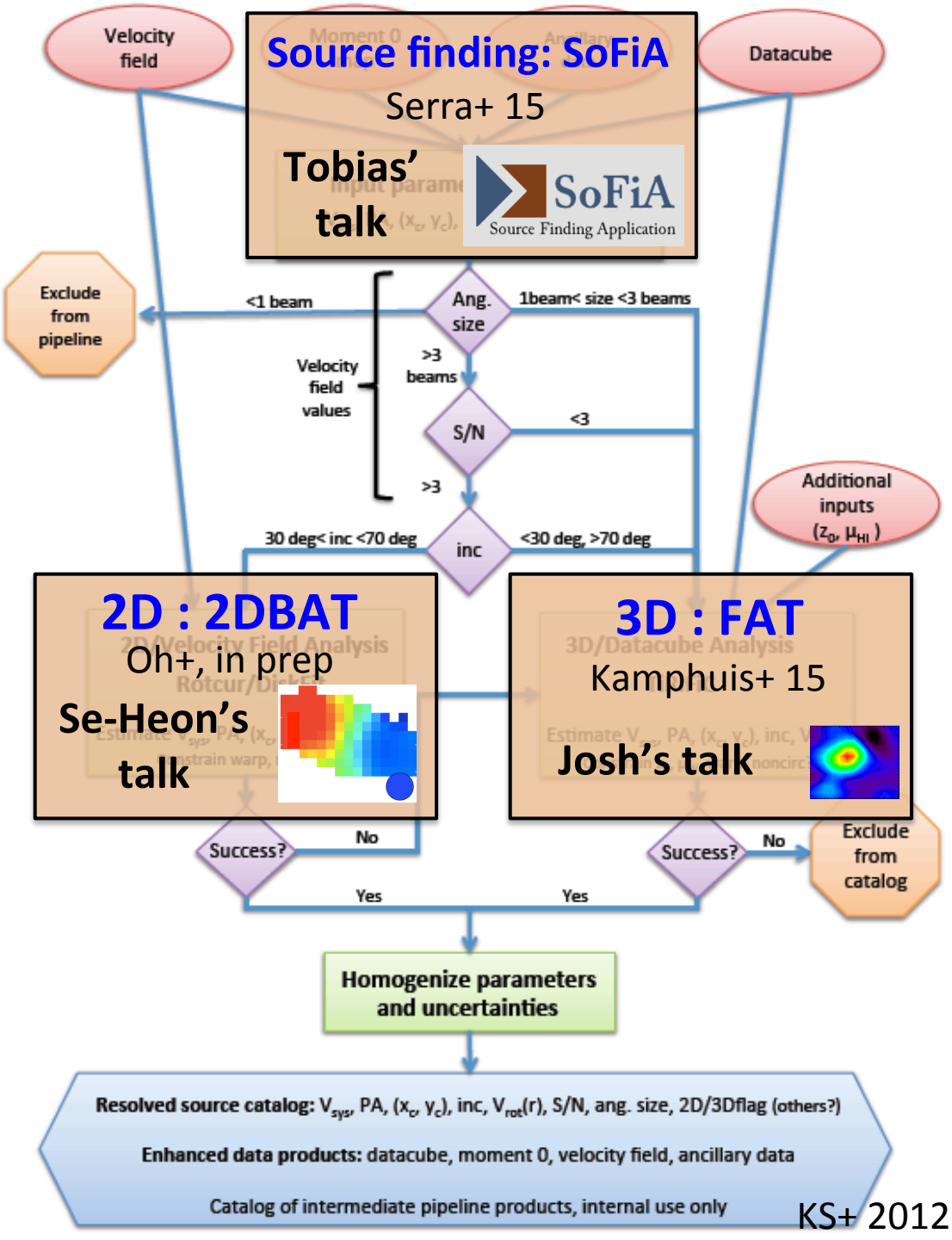
Compute parameters + uncertainties

Evaluate success, homogenize outputs



KS+ 2012

Conceptual Pipeline

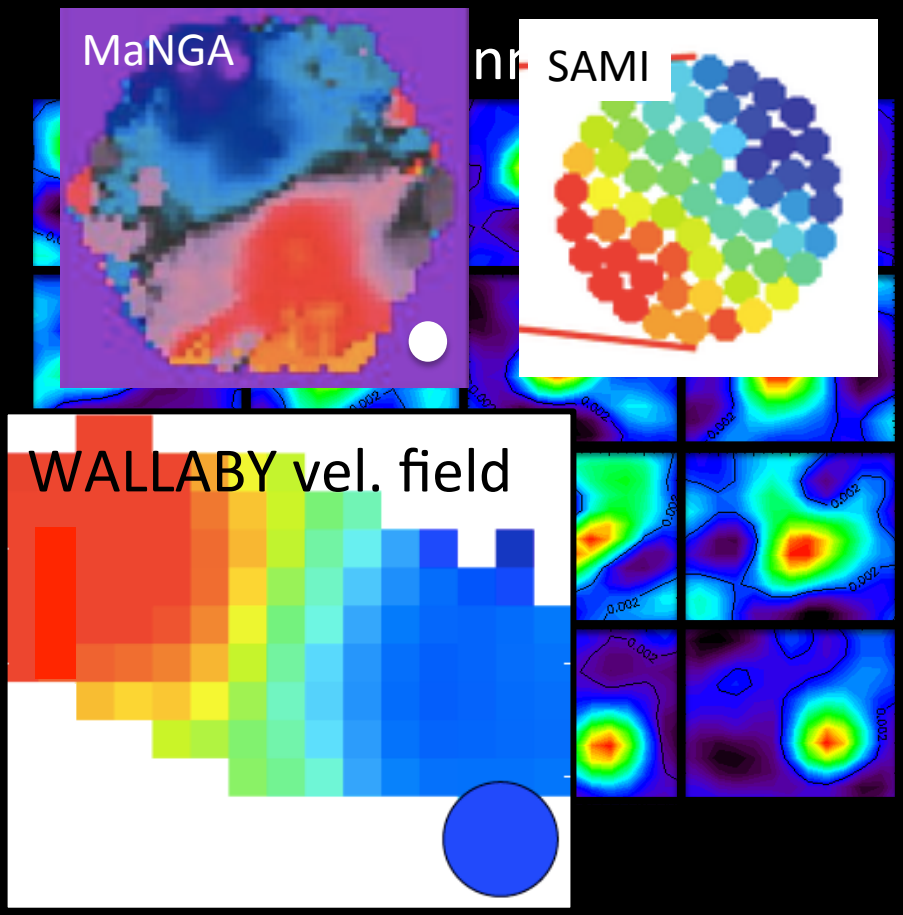


KS+ 2012

Widefield SKA pathfinder surveys

Modelling needs to be:

- Flexible, tractable
- Statistically robust
- Automated



Wallaby/WNSHS: where are we now?

Modelling needs to be:

- Flexible, tractable
- Statistically robust
- Automated

Wallaby/WNSHS: where are we now?

Modelling needs to be:

- ✔ Flexible, tractable
- Statistically robust
- ✔ Automated

Wallaby/WNSHS: where are we now?

Modelling needs to be:

- Flexible, tractable ✔
- Statistically robust
- Automated ✔

Wallaby/WNSHS: where are we now?

Modelling needs to be:

- Flexible, tractable ✔
- Statistically robust
- Automated ✔

How to identify fit failures?

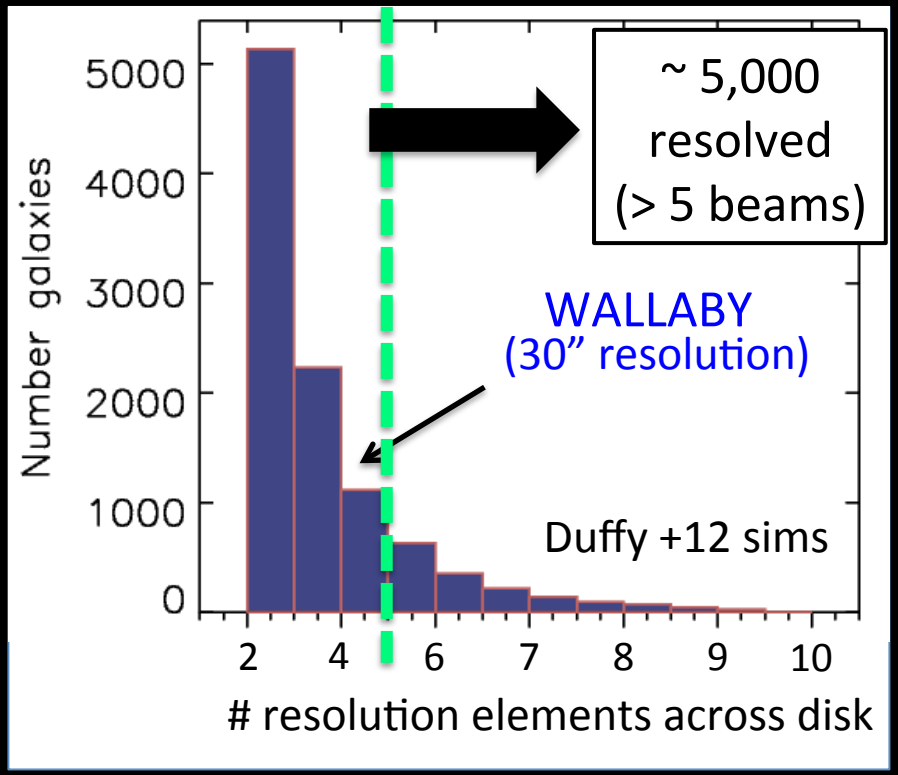
How to generate uncertainties?

How to homogenize 2D+3D outputs?

The frontier: marginally resolved galaxies

Modelling needs to be:

- Flexible, tractable ✔
- Statistically robust
- Automated ✔



How to identify fit failures?

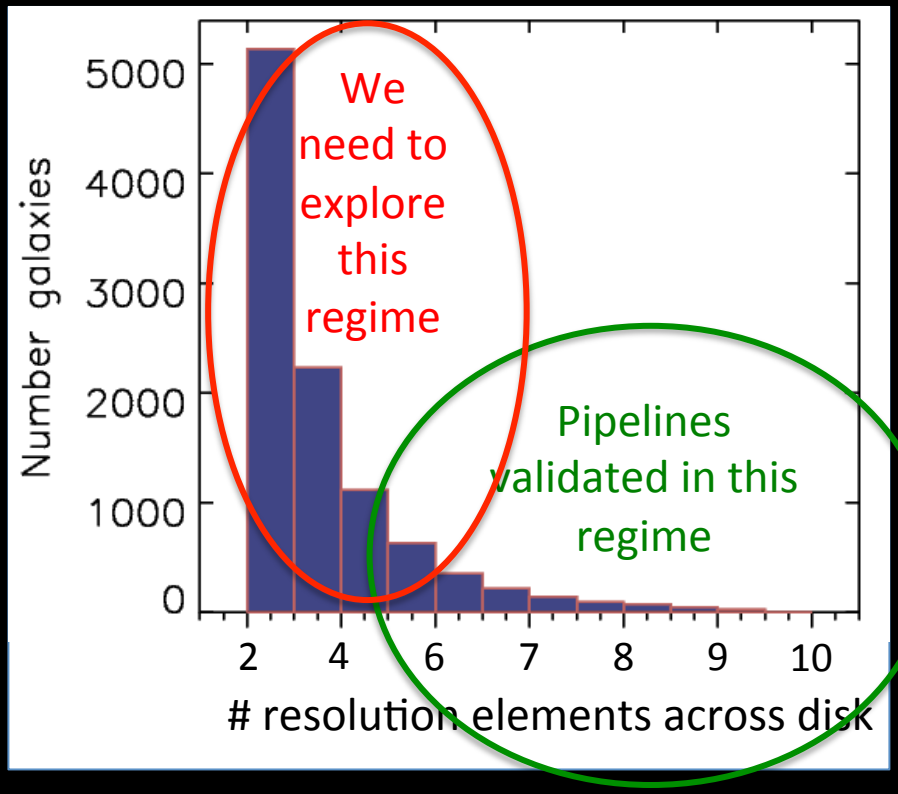
How to generate uncertainties?

How to homogenize 2D+3D outputs?

The frontier: marginally resolved galaxies

Modelling needs to be:

- Flexible, tractable ✔
- Statistically robust
- Automated ✔



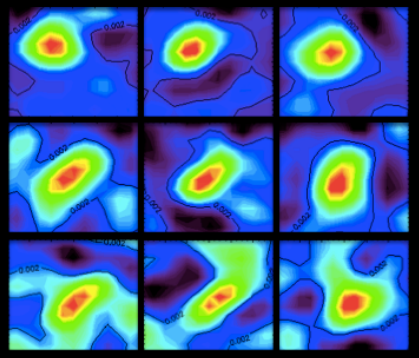
How to identify fit failures?

How to generate uncertainties?

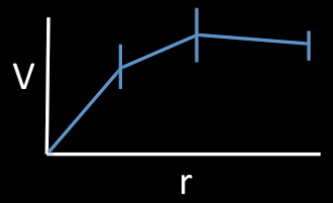
How to homogenize 2D+3D outputs?

Conclusions

- Future spectroscopic surveys will allow us to explore the statistics of disk galaxy structure: HI has an important role.



- The kinematics group is working on a resolved galaxy pipeline for widefield HI surveys.



- Status: pipeline elements in place; working on benchmarking + uncertainties. Frontier is in the marginally resolved regime.