

MIGHTEE-HI DATA ANALYSIS

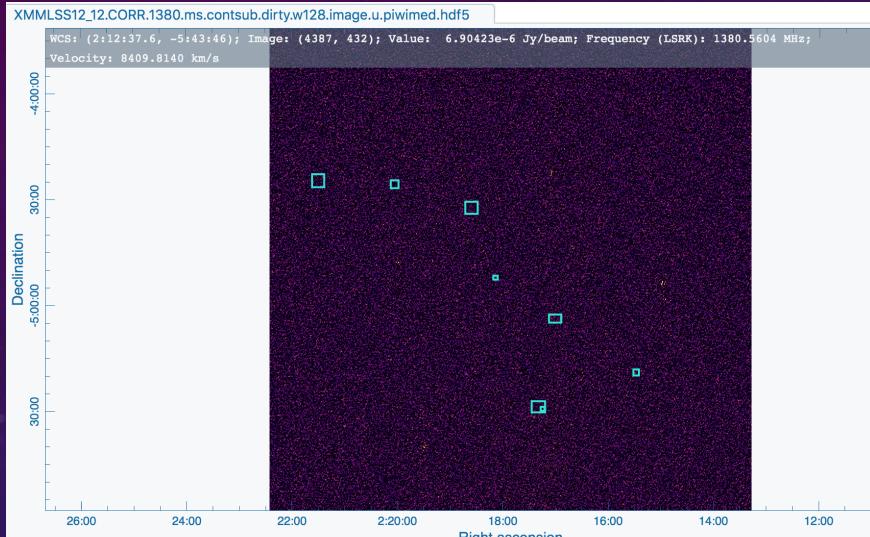
By Sambatra Rajohnson, HI meeting 2020 – 06 – 19

Tested cube: XMMLSS_12 1380 – 1420 MHz

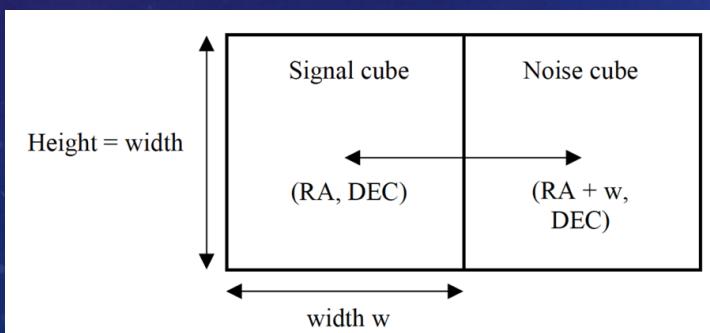
- ★ Cube generation
- ★ Baseline fitting
- ★ Flux extraction
- ★ HI mass calculation
- ★ Moment maps
- ★ Additional analysis

CUBE GENERATION

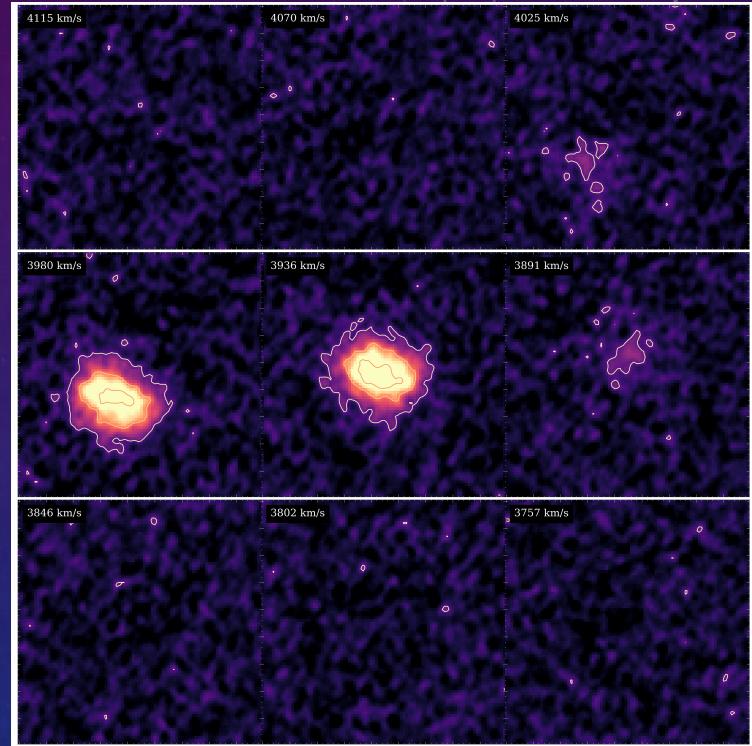
CARTA: Visual source finding + detections list



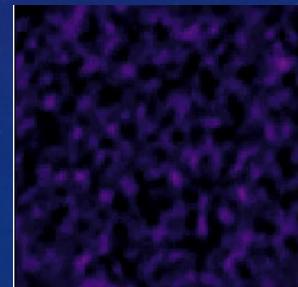
- ★ PB correction: HI cube / PB cube
- ★ Subcubes extraction at RA, DEC, FREQ
- ★ Convolve into common beam



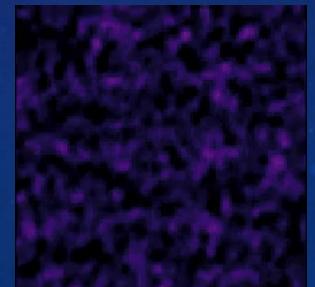
Channel map



Signal cube



Noise cube (for rms)

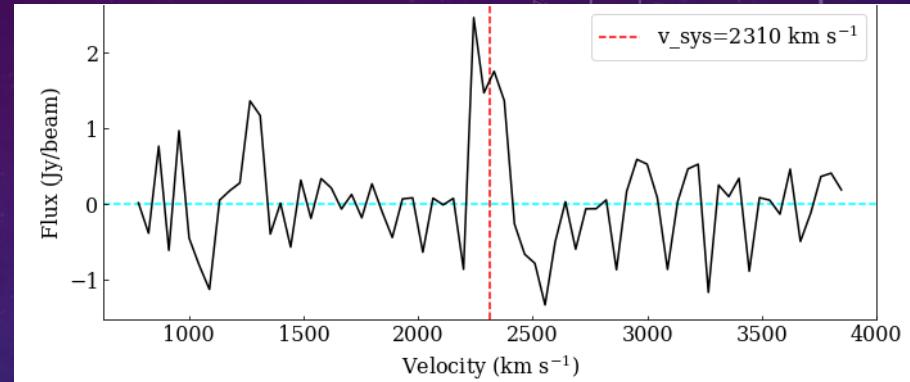


BASELINE FITTING

Main goal: correct for any residual continuum

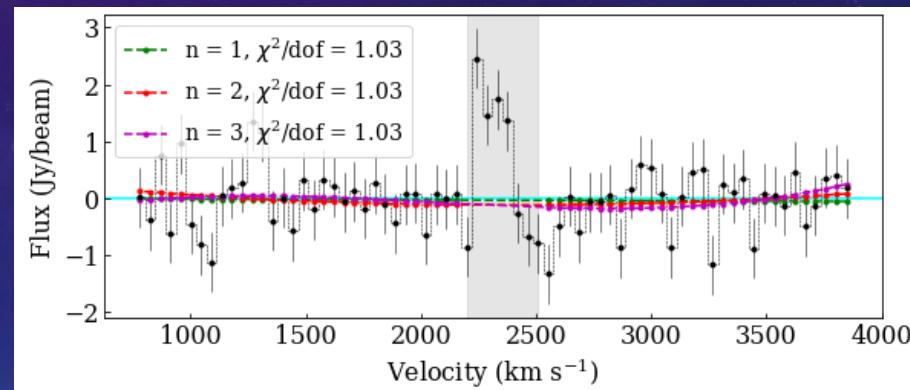
RAW SPECTRUM

- ★ Raw flux values (Jy/beam)
- ★ Velocity limits



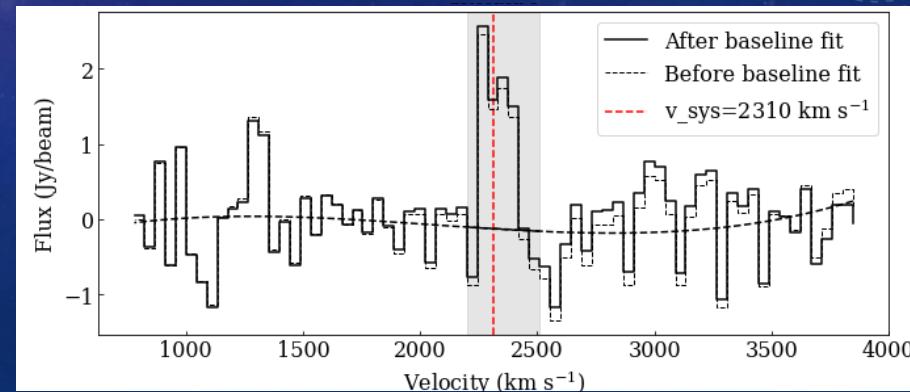
BASELINE FITTING

- ★ Polyfit outside the emission
- ★ Chi-square



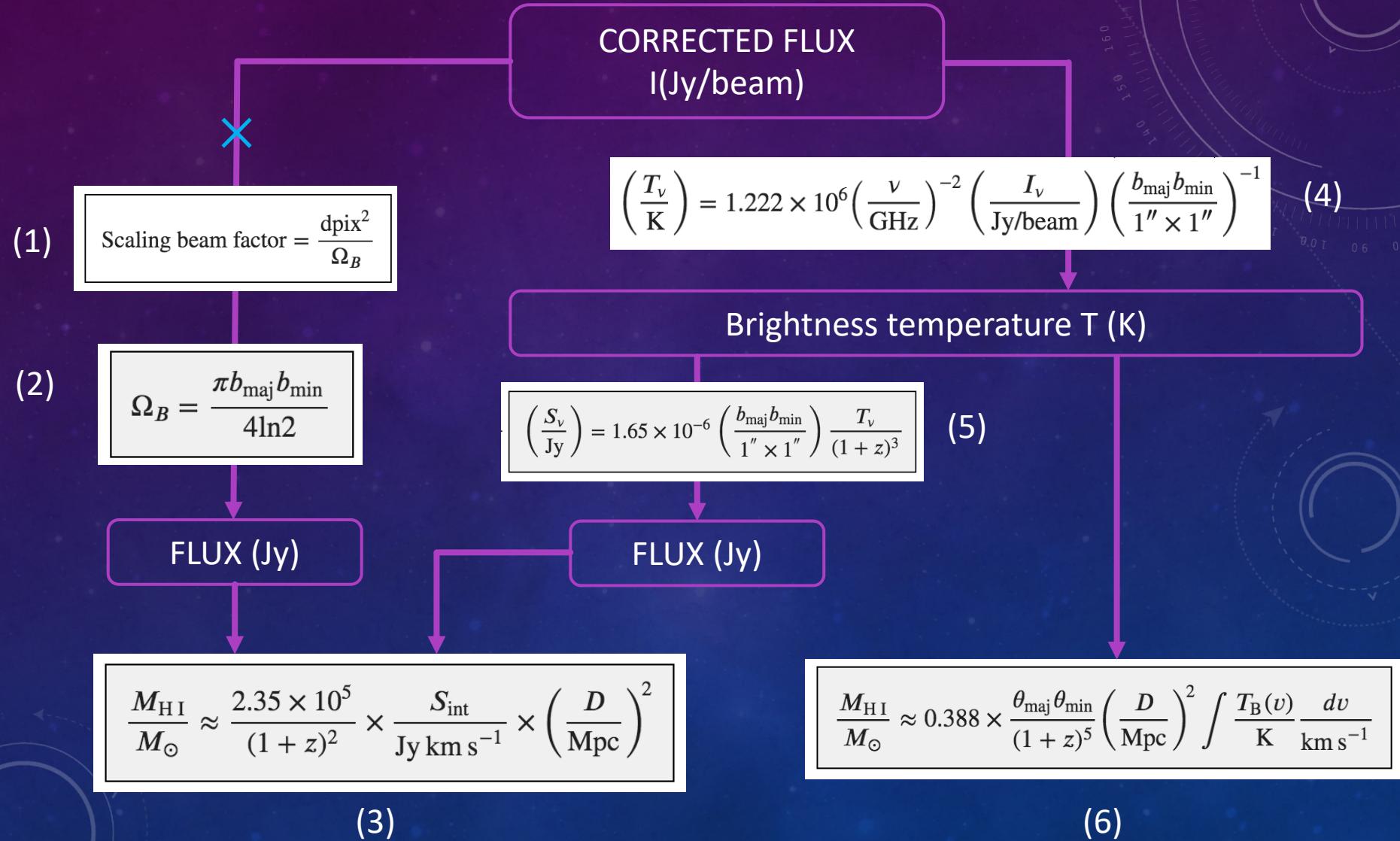
CORRECTED HI PROFILE

- ★ Correct the baseline
- ★ Corrected fluxes (Jy/beam) generally higher



FLUX DENSITY & HI MASS

Method 1: NO MASKING, DIRECT (flux from spectrum)

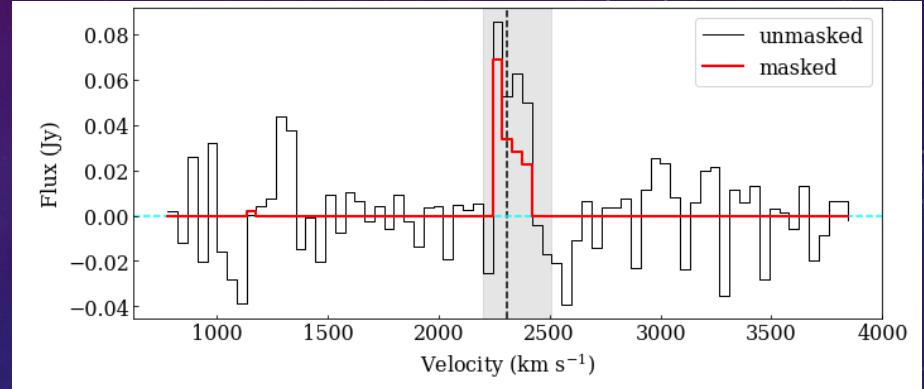


FLUX DENSITY & HI MASS

Method 2: MASK APPLIED TO COMMON BEAM SUBCUBES

Mask: 3 sigma level smoothed to 20 arcsec subcube.

- Low S/N emission: masked flux lower
- High S/N: masked flux higher



Masked flux (Jy)

DIRECT

(3)

$$\frac{M_{\text{HI}}}{M_{\odot}} \approx \frac{2.35 \times 10^5}{(1+z)^2} \times \frac{S_{\text{int}}}{\text{Jy km s}^{-1}} \times \left(\frac{D}{\text{Mpc}} \right)^2$$

MOM 0 of the emission only

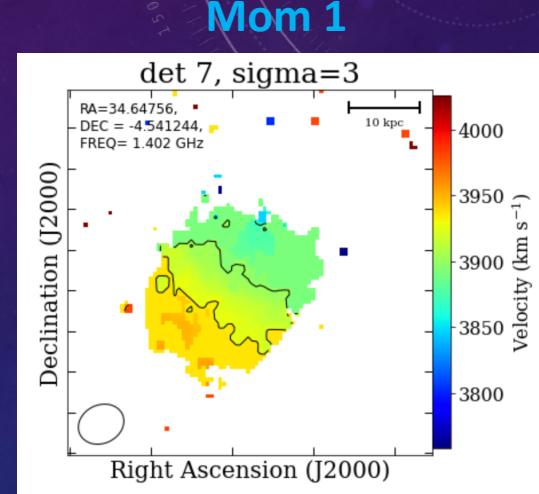
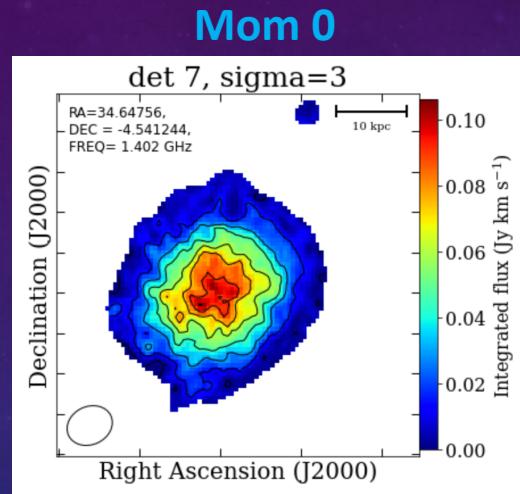
- Jy/beam km/s
- X by Scaling beam
- Sum all the fluxes in the image plane
=> S_{int}

MOMENT MAPS

- **N.B: No need to multiply the moment maps with the scaling beam factor (Only for HI masses)**
- **Bigger beams are more sensitive to low column density emissions**

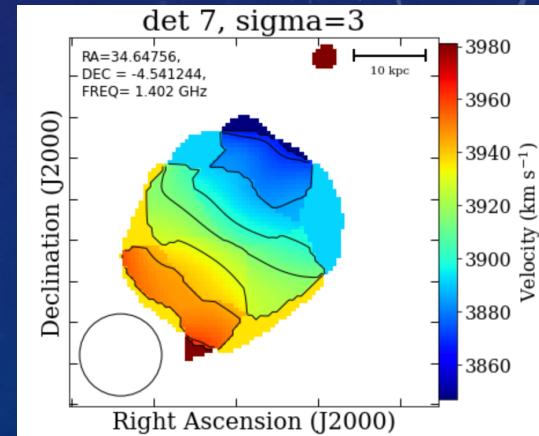
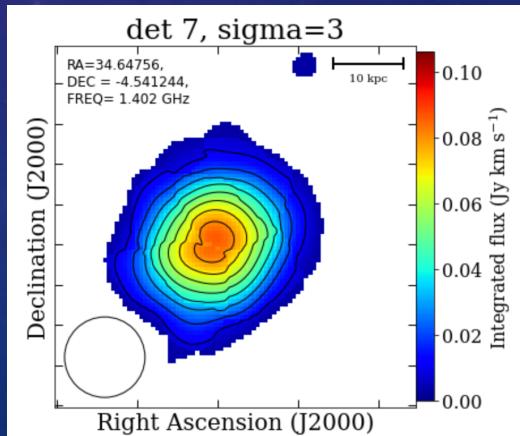
Common beam cube

- Mask for mom 0: smoothed cube
- Mask for mom 1: common beam cube



Circular beam cube

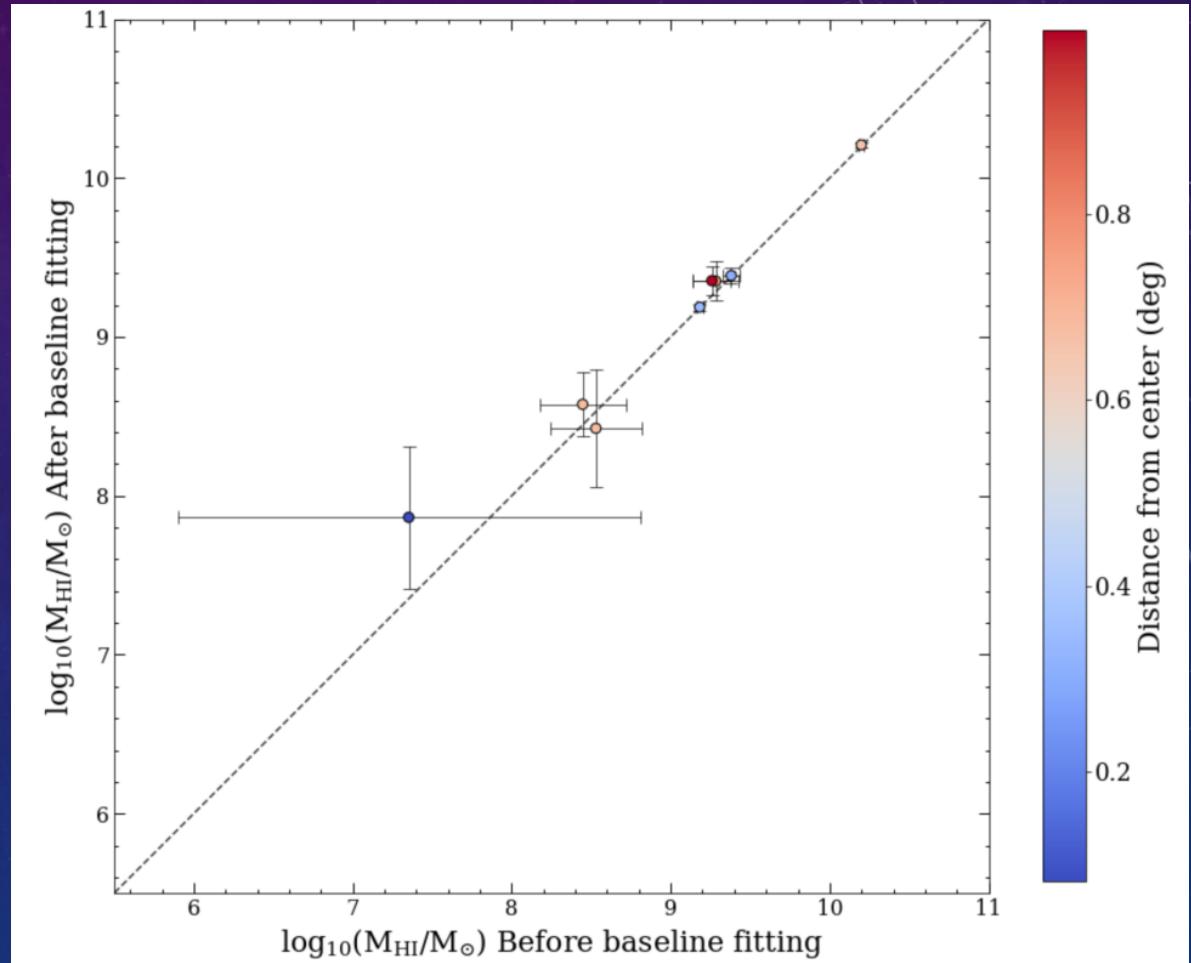
- Mask for mom 0: smoothed cube
- Mask for mom 1: smoothed cube



OTHER ANALYSIS

HI masses before and after baseline fitting

- Mass errors and baseline fit correction do not depend on the distance from the center
- low S/N: higher mass error and bigger baseline fit correction.



OTHER ANALYSIS

Sensitivity curve: detections detectability

- ✿ Cube center more sensitive to lower masses
- ✿ Cube edge sensitive to higher mass detections
- ✿ Low masses and low S/N emission tend to have bigger mass errors.

