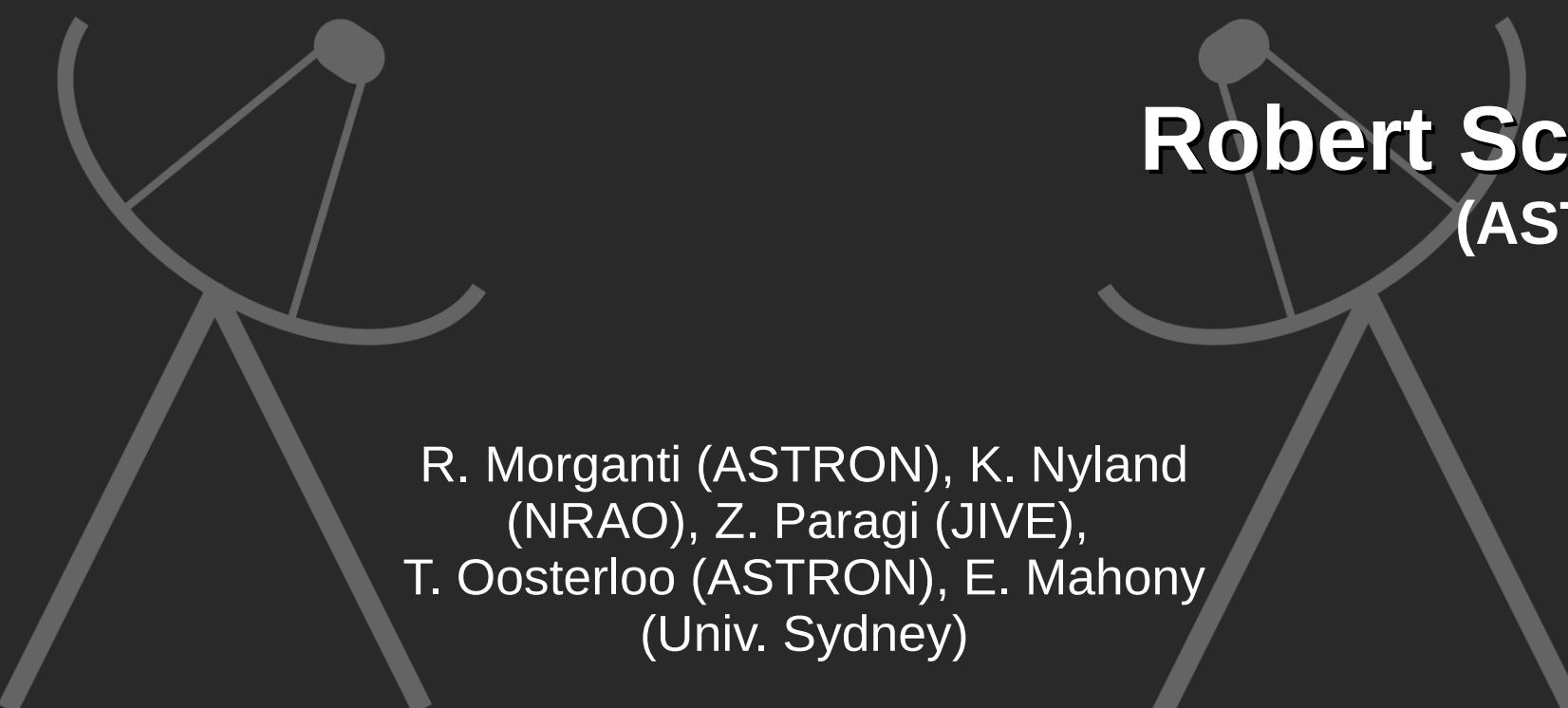


# (Jet-driven) HI outflows in radio galaxies - A VLBI perspective



A faint gray watermark of a VLBI array is visible in the background, consisting of several large parabolic dish antennas connected by lines.

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(ASTRON)

R. Morganti (ASTRON), K. Nyland  
(NRAO), Z. Paragi (JIVE),  
T. Oosterloo (ASTRON), E. Mahony  
(Univ. Sydney)

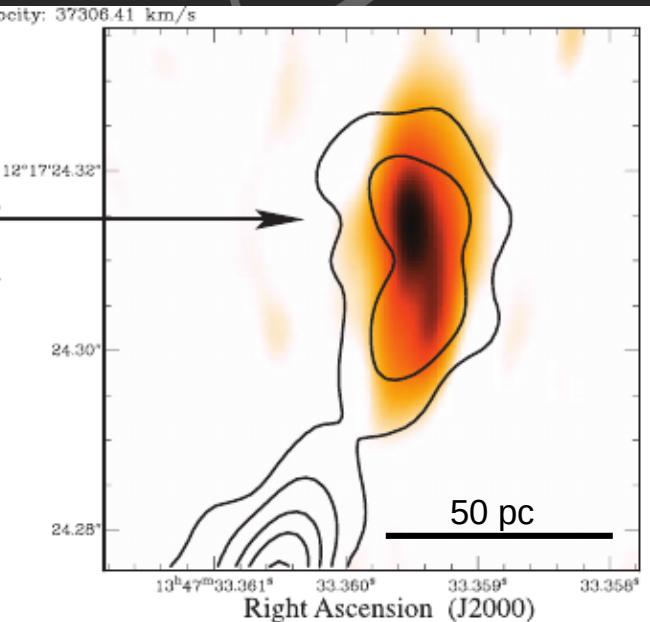
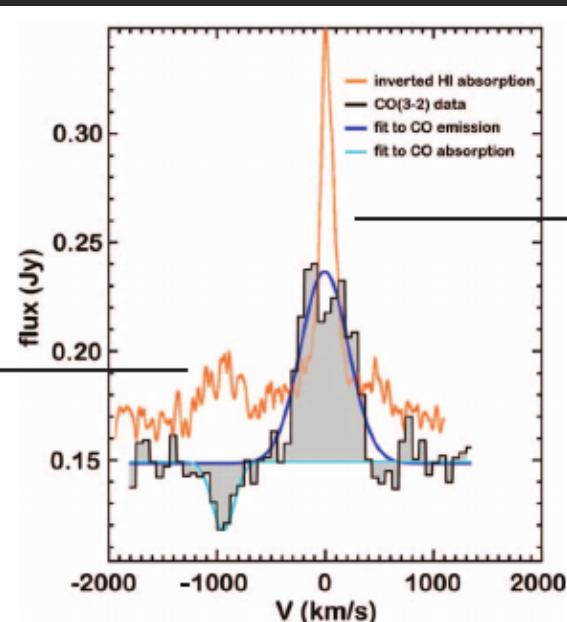
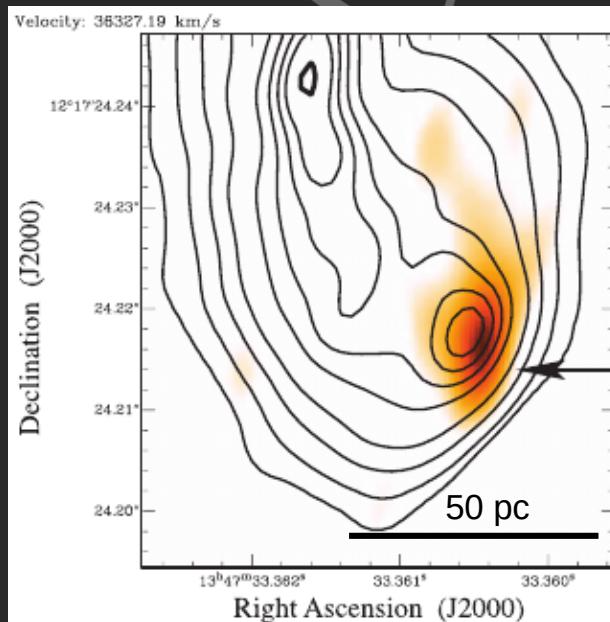


# HI outflows

Massive outflows of HI detected in powerful radio galaxies  
(e.g., Morganti et al. 2005)

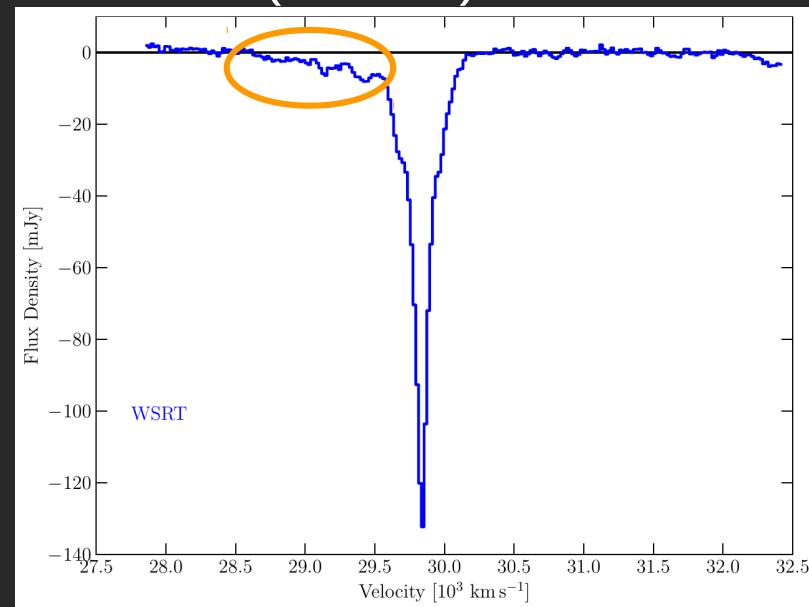
What is driving them – radio jet or radiative winds?  
=> Requires mas-resolution observations (VLBI)

Best example so far: 4C +12.50 (Morganti et al. 2013)



# The “sample”

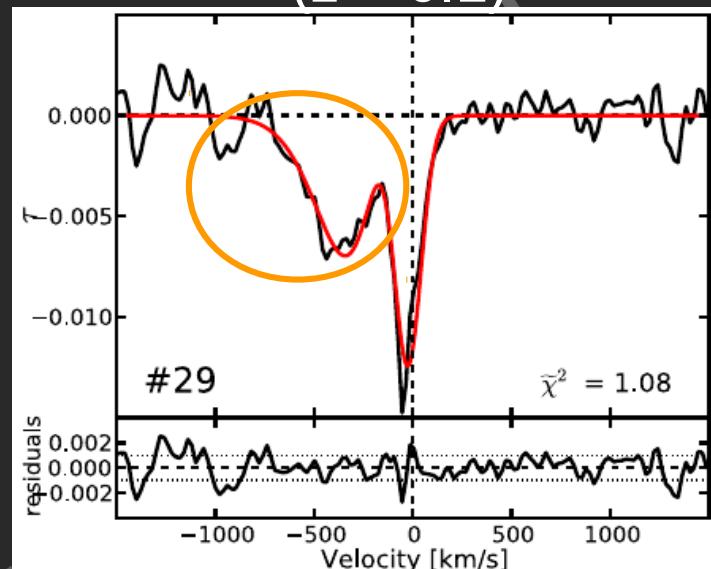
3C 236  
( $z = 0.1$ )



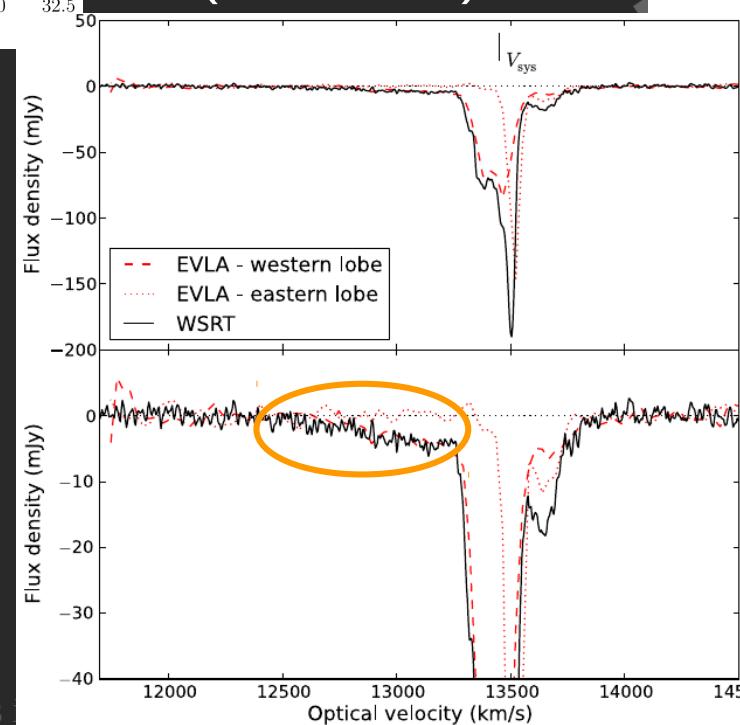
Credit: Morganti et al. 2005

4C +12.50

4C +52.37  
( $z = 0.1$ )

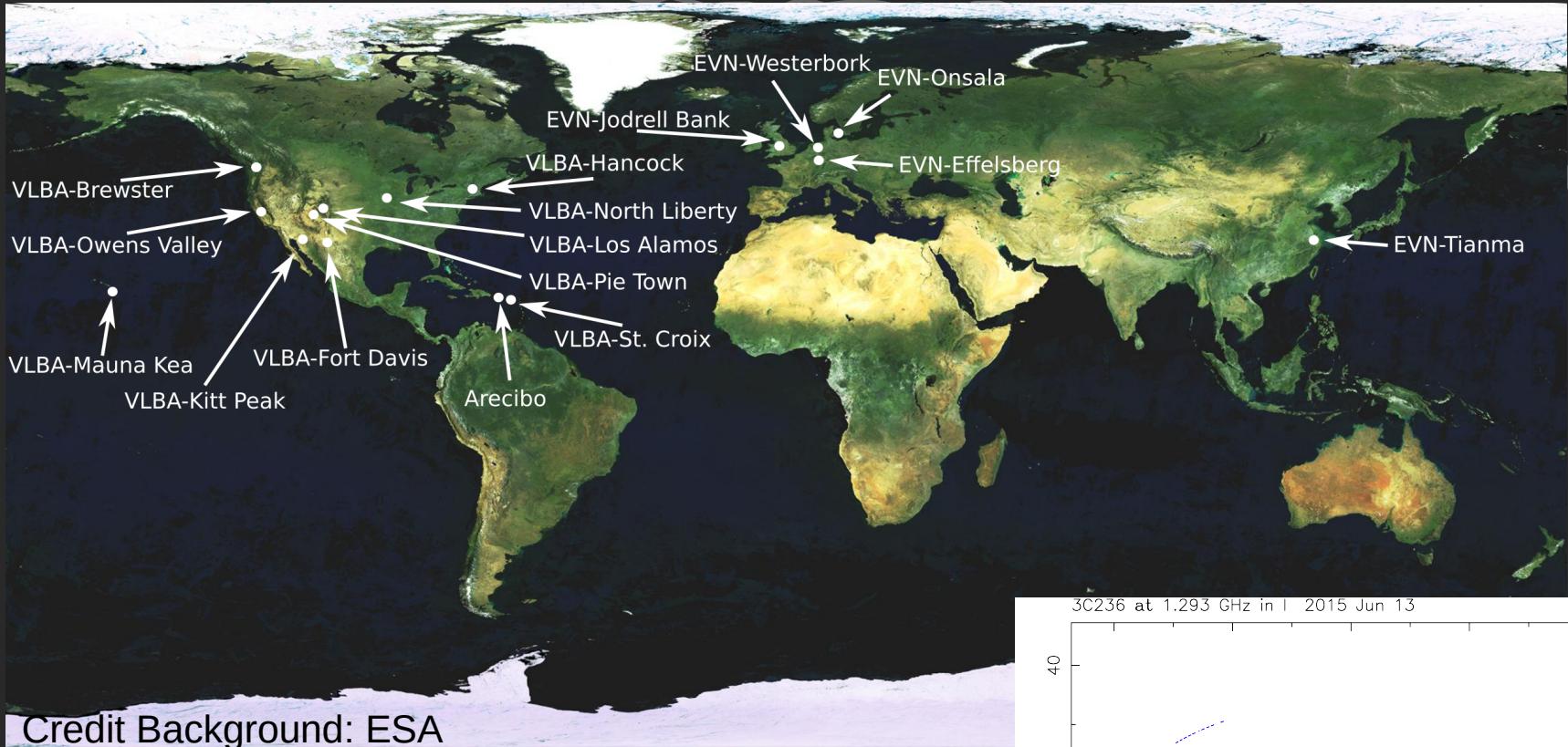


3C 293  
( $z = 0.045$ )



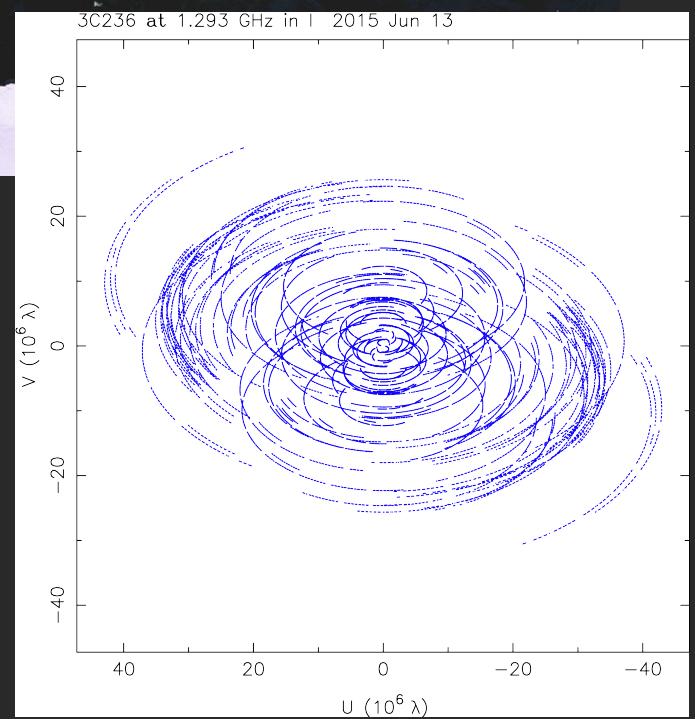
Credit: Gereb et al. 2015

# Global VLBI HI Observation

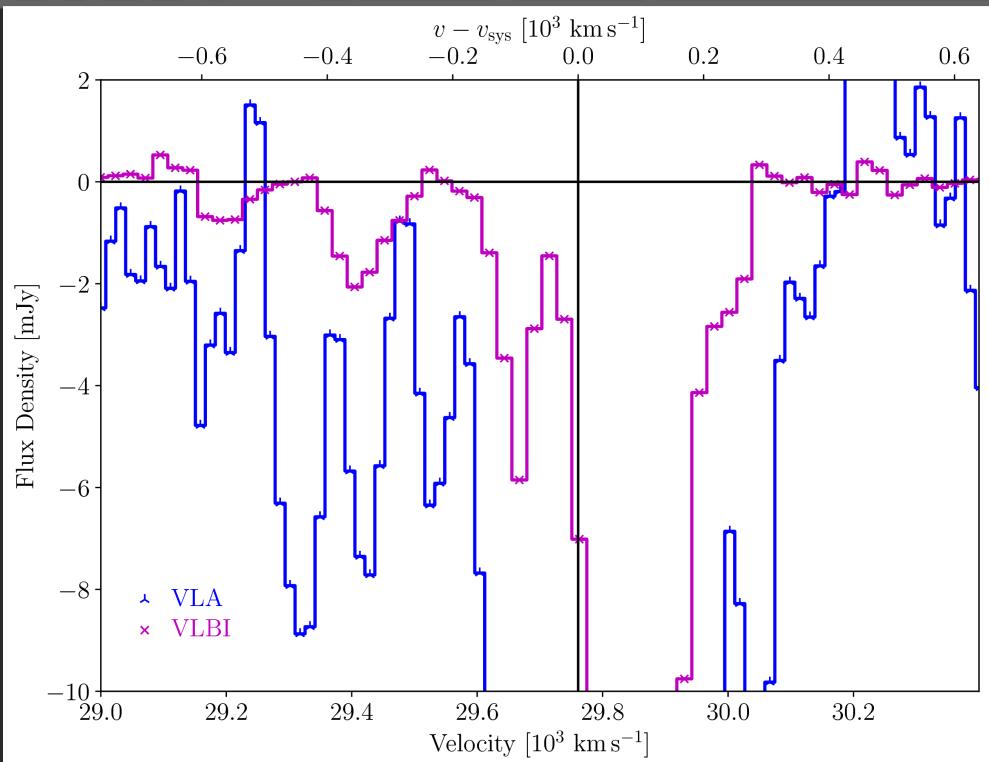


EVN + VLBA + Arecibo  
Phase-referencing  
Angular resolution: <20 mas  
BW 16 MHz (512 channels)

Redshift limit of VLBI: ~0.1

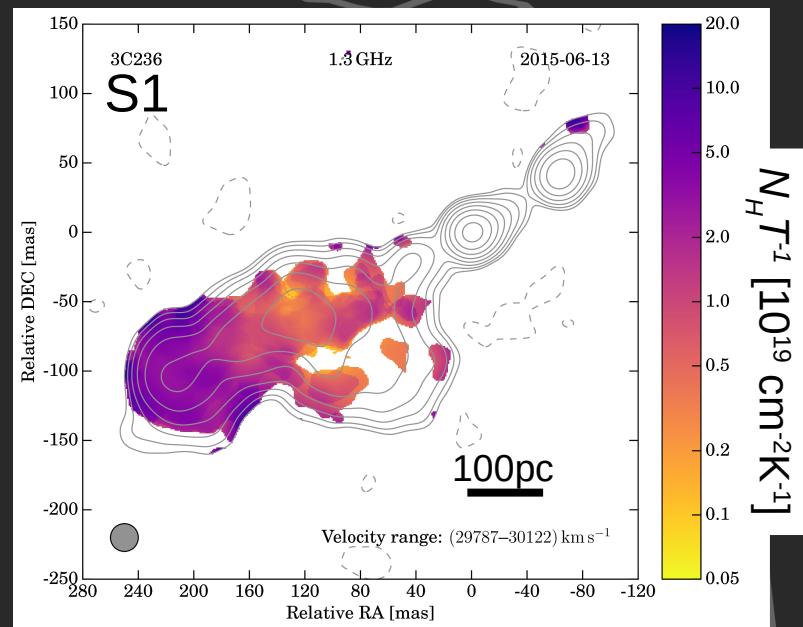
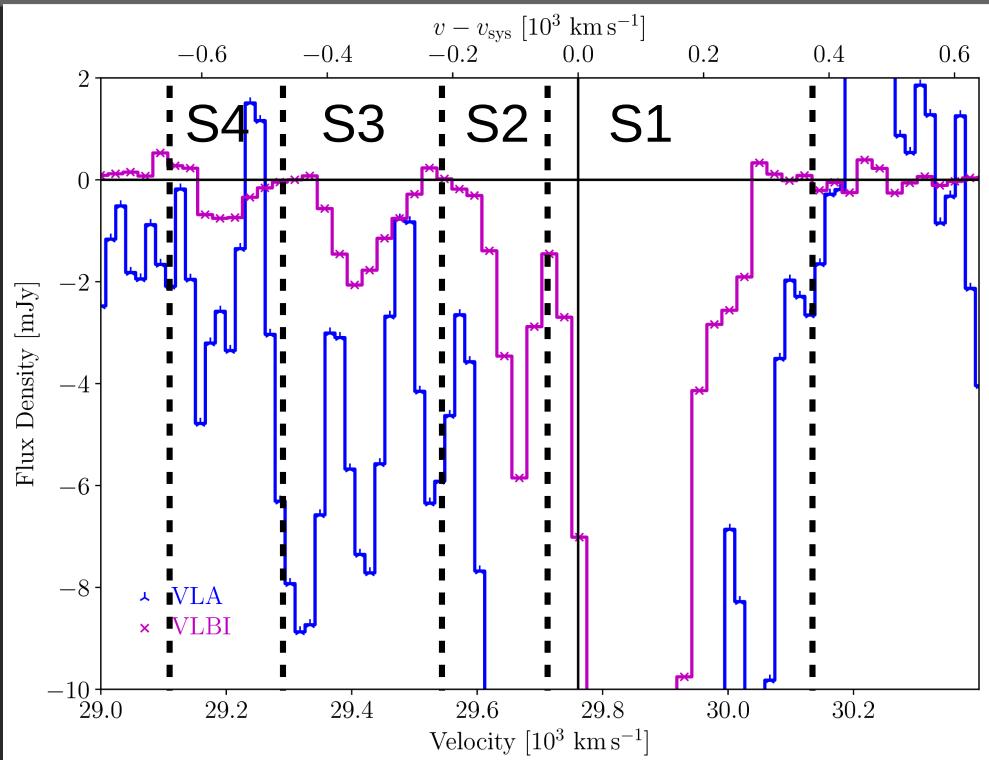


# 3C 236



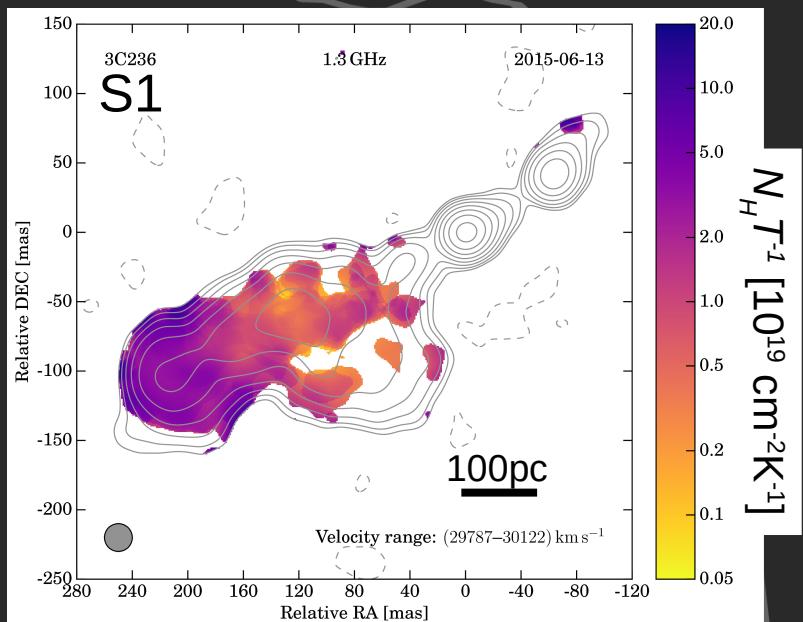
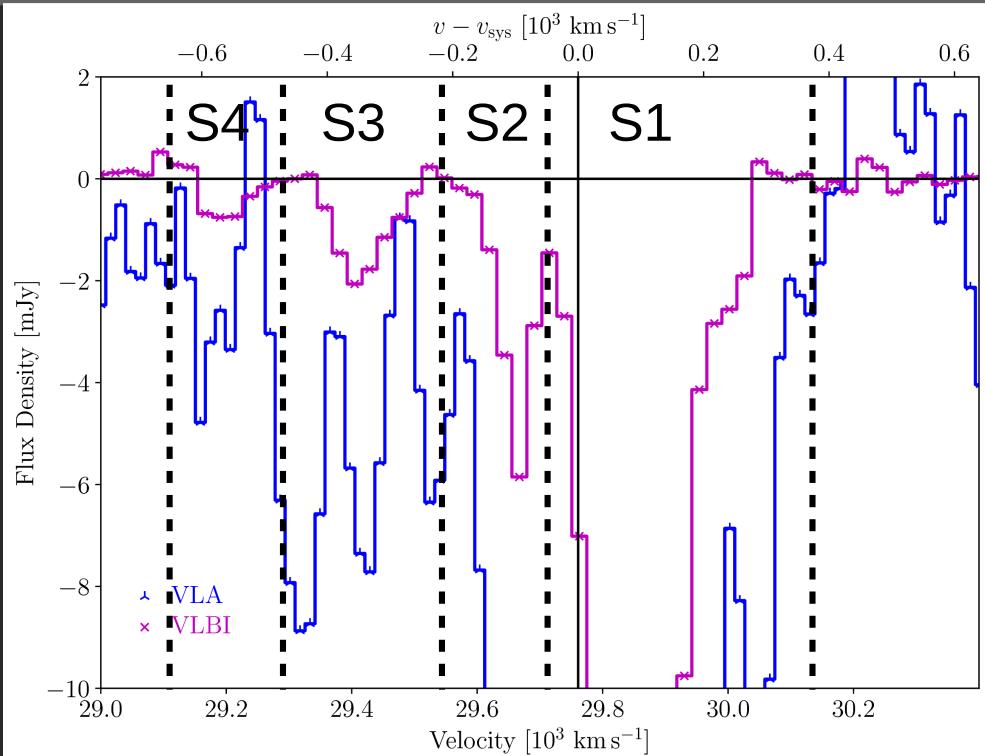
Schulz et al. in prep

# 3C 236

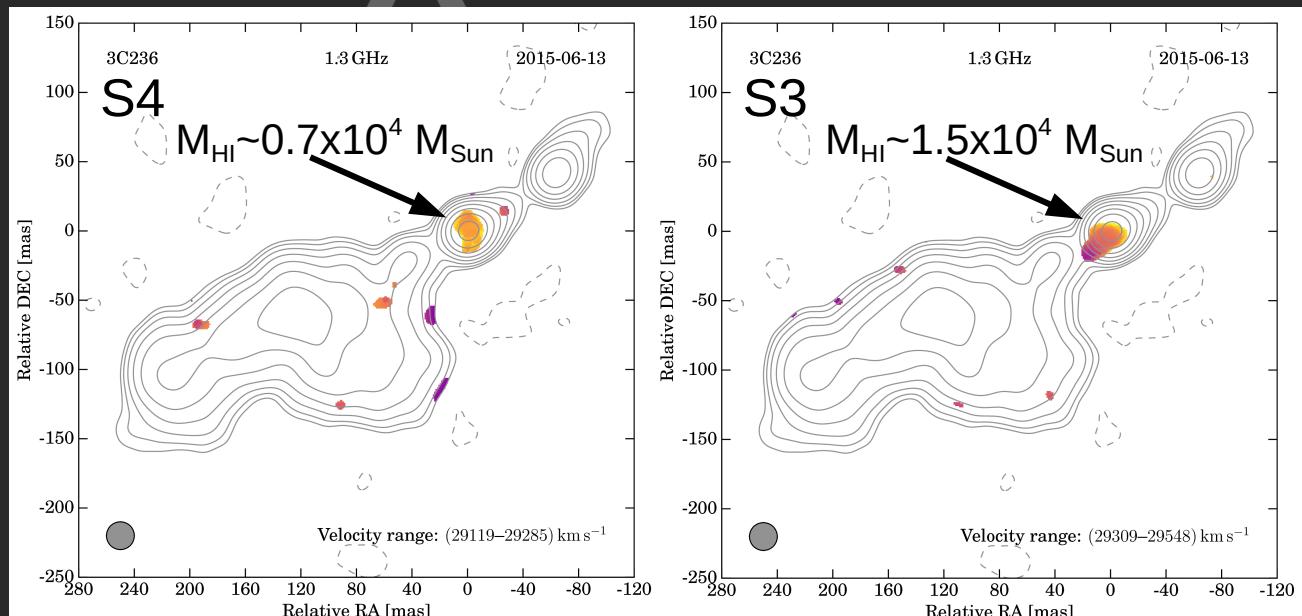


Schulz et al. in prep

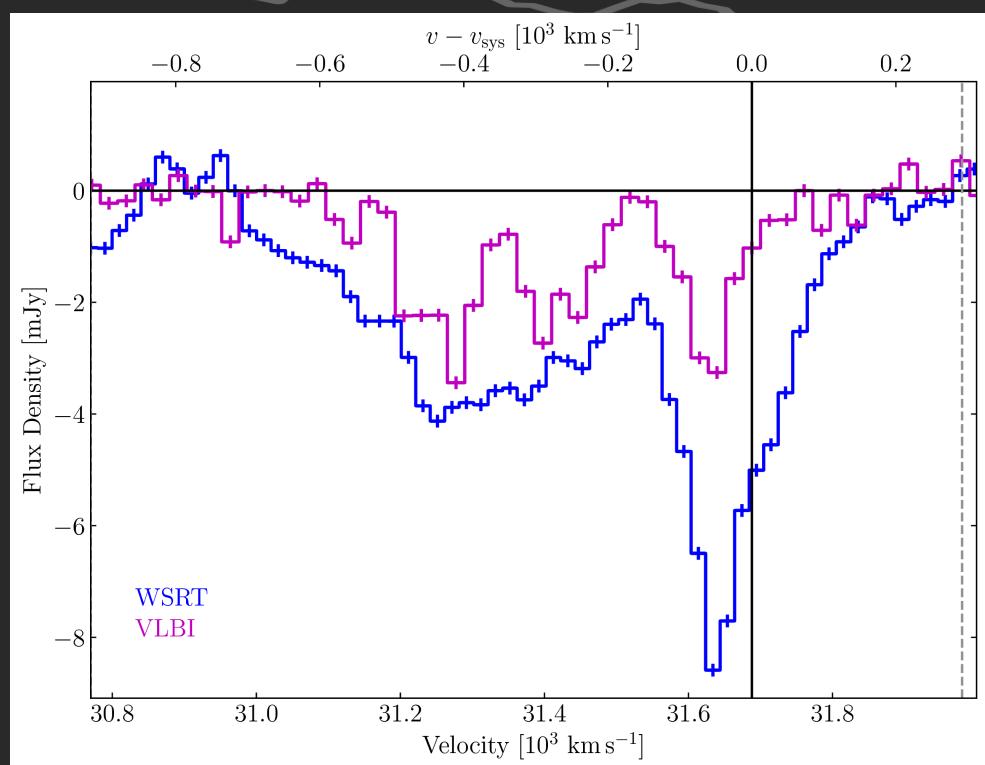
# 3C 236



Schulz et al. in prep

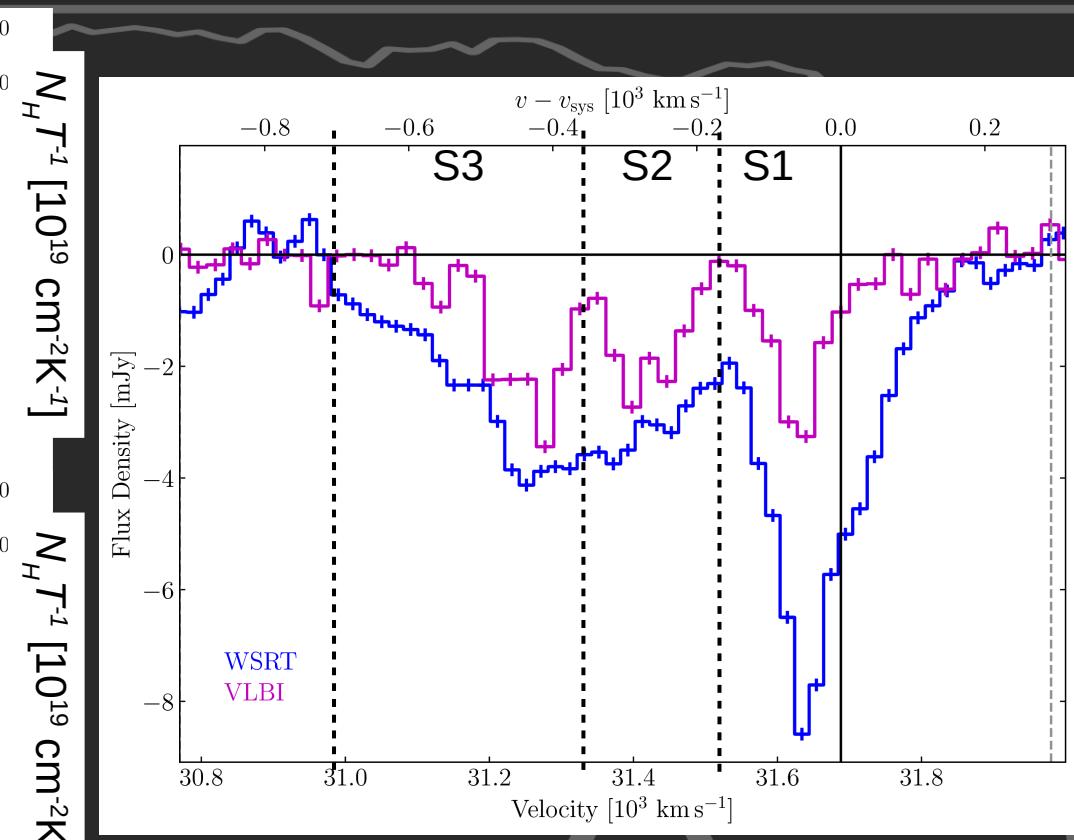
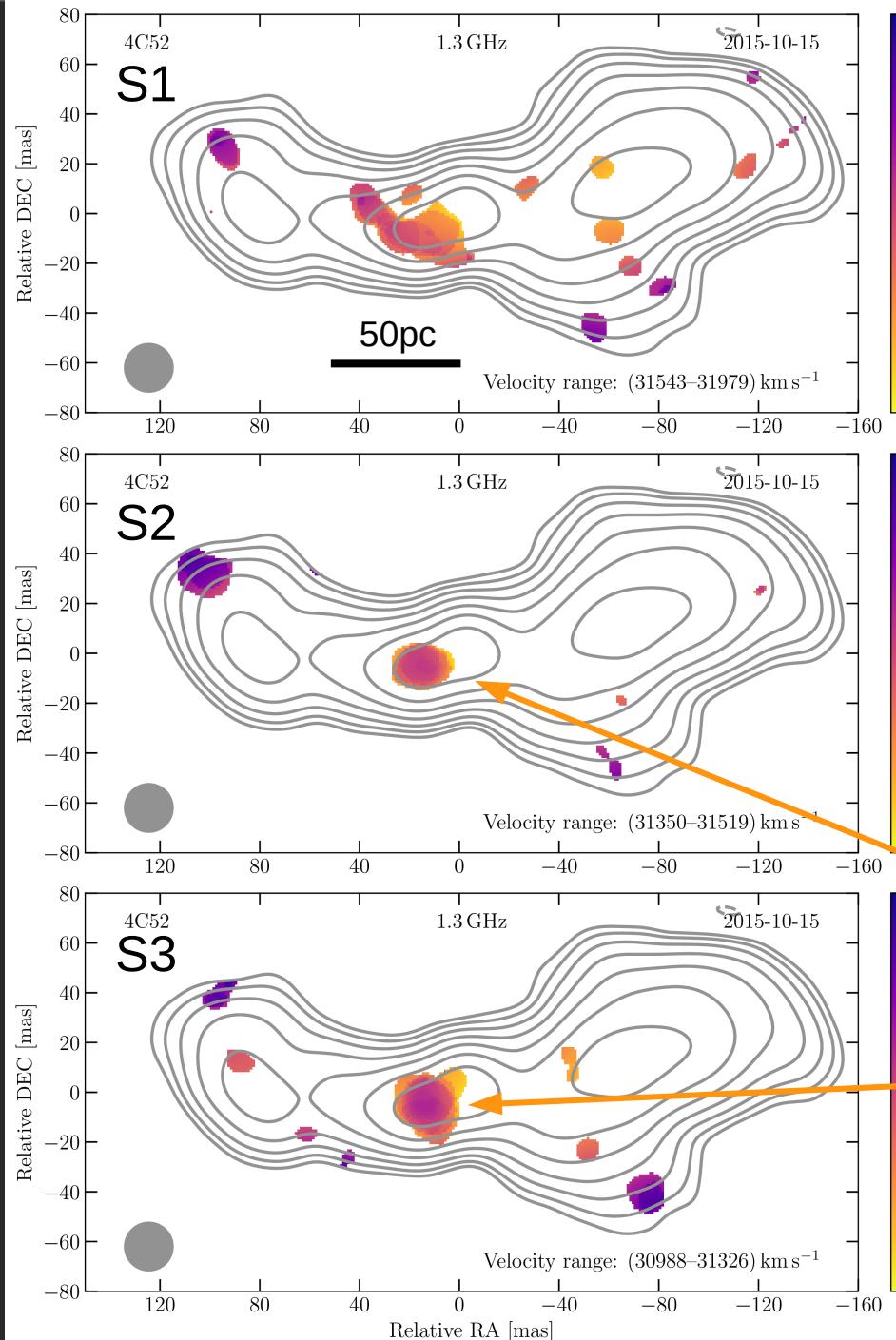


# 4C +52.37



Schulz et al. in prep

# 4C +52.37



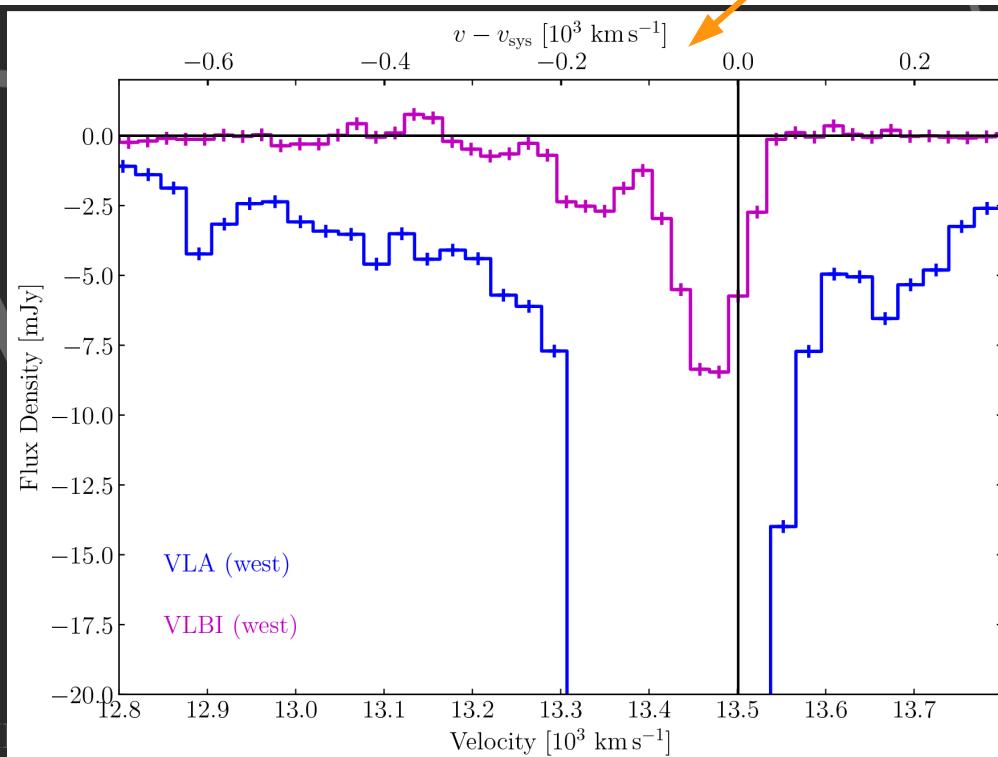
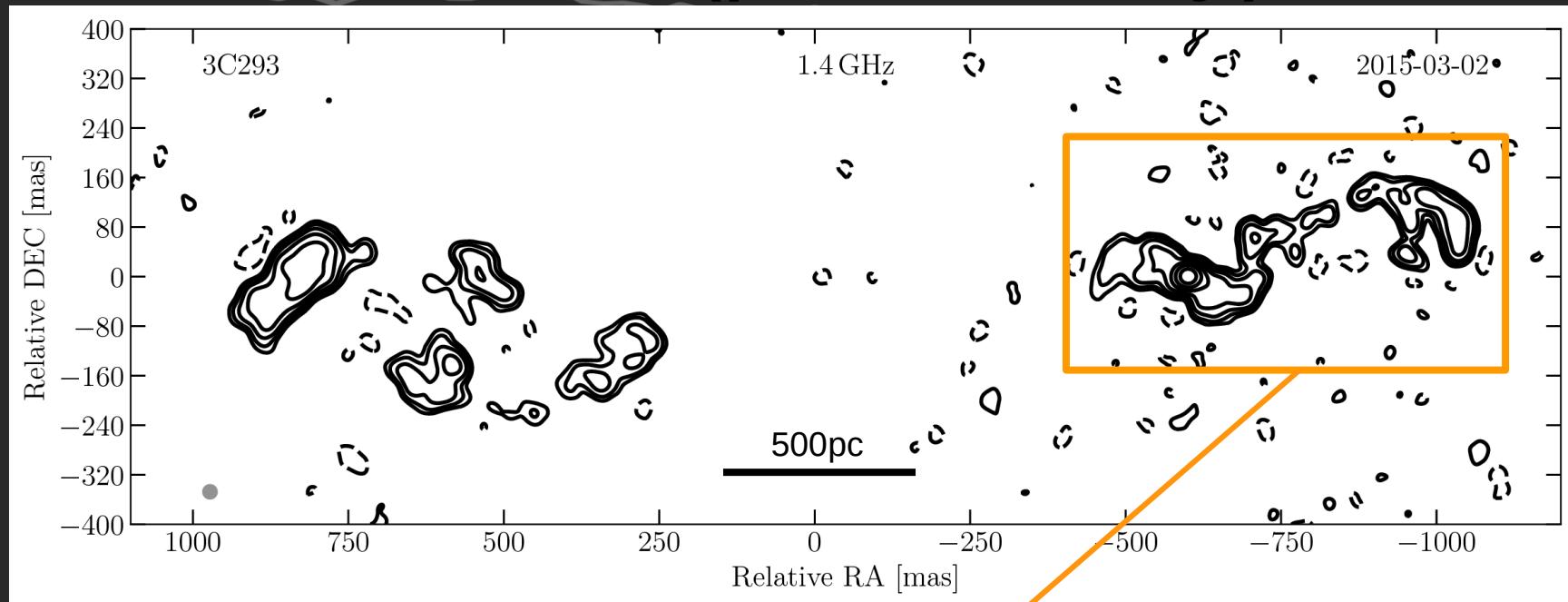
$$M_{\text{HI}} (\text{S2}) \sim 1.7 \times 10^4 M_{\text{Sun}}$$

$$M_{\text{HI}} (\text{S3}) \sim 0.2 \times 10^4 M_{\text{Sun}}$$

Schulz et al. in prep

VLBI perspective

# 3C 293 (preliminary)



# Summary

HI absorption VLBI observation of 3C 236, 4C +52.37, 3C 293

Most of the outflow only partially recovered suggesting a clumpy and a diffuse component

Part of the outflow concentrated close to the nucleus (< 40pc)

VLBI follow-up important for upcoming HI absorption surveys