ON THE ORIGIN OF THE HIGH-VELOCITY FEATURES IN THE HALO OF THE MILKY WAY

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in collaboration with
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Multiphase high-velocity features in the MW

Lehner et al 2012

Sembach+03, Savage+03

van Woerden et al 2004

warm c

UV abso

CIV, Si

4.3<le

Highly

Many a

hot c

OVI ab

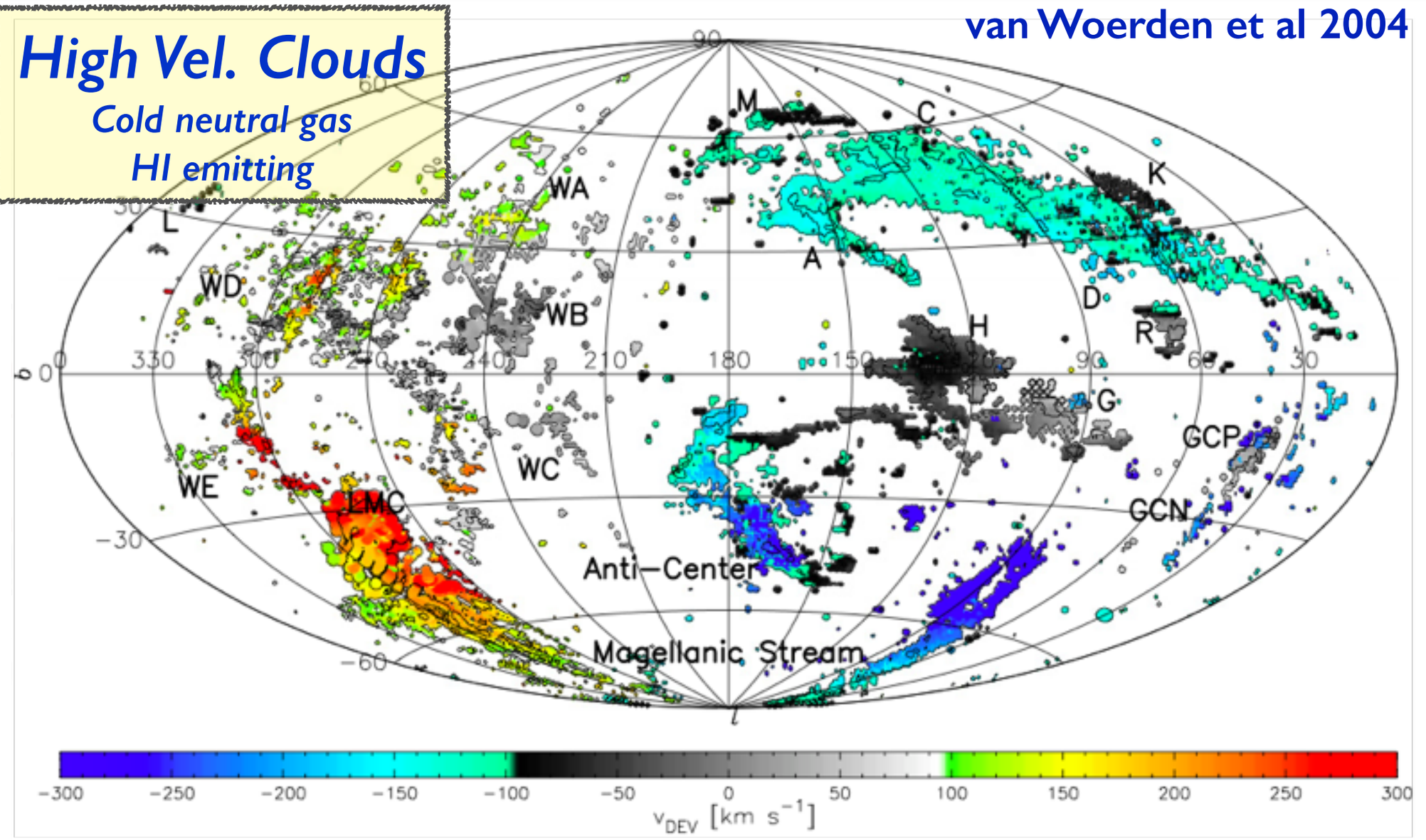
5.3<

High

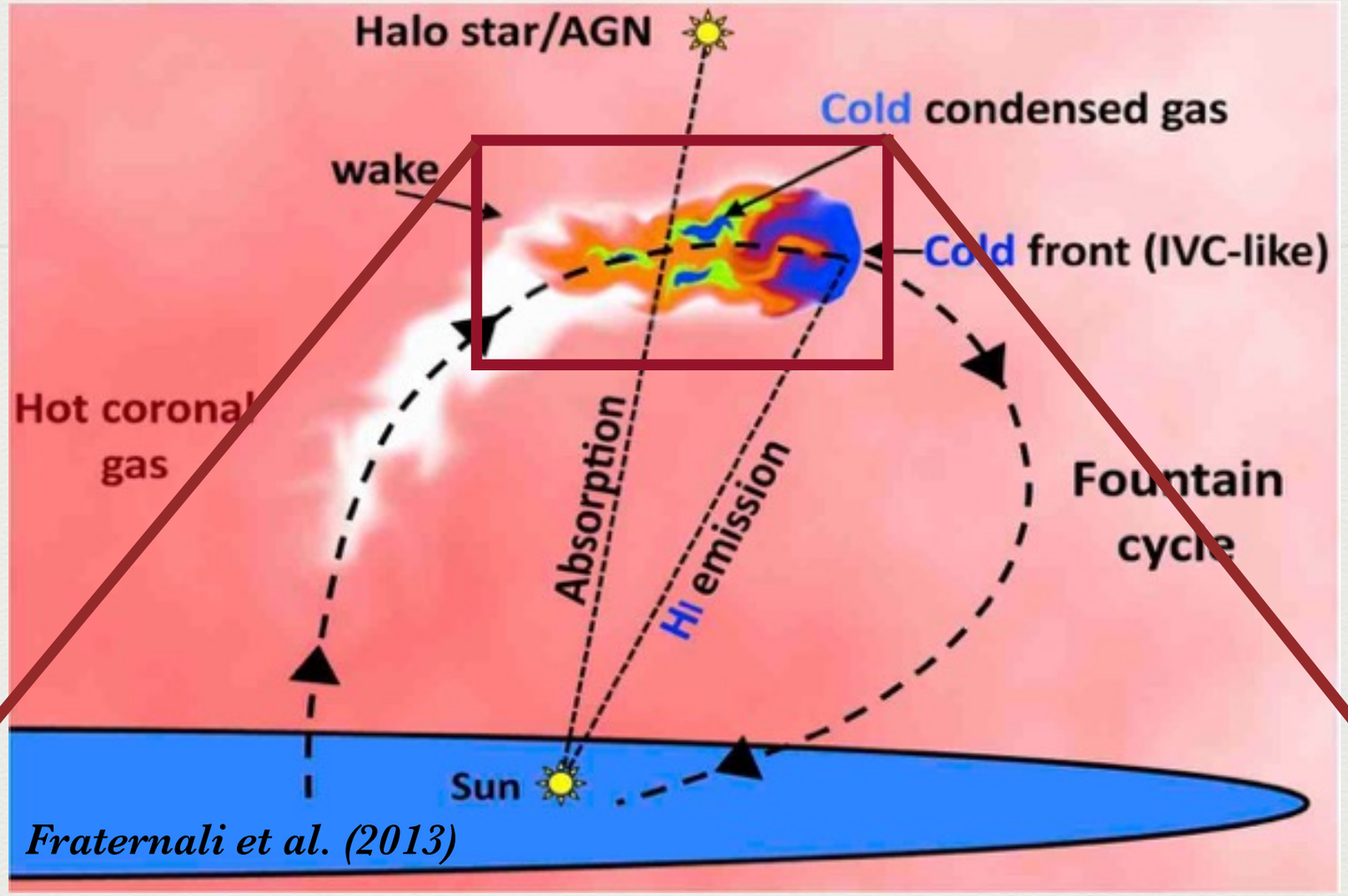
High Vel. Clouds

Cold neutral gas

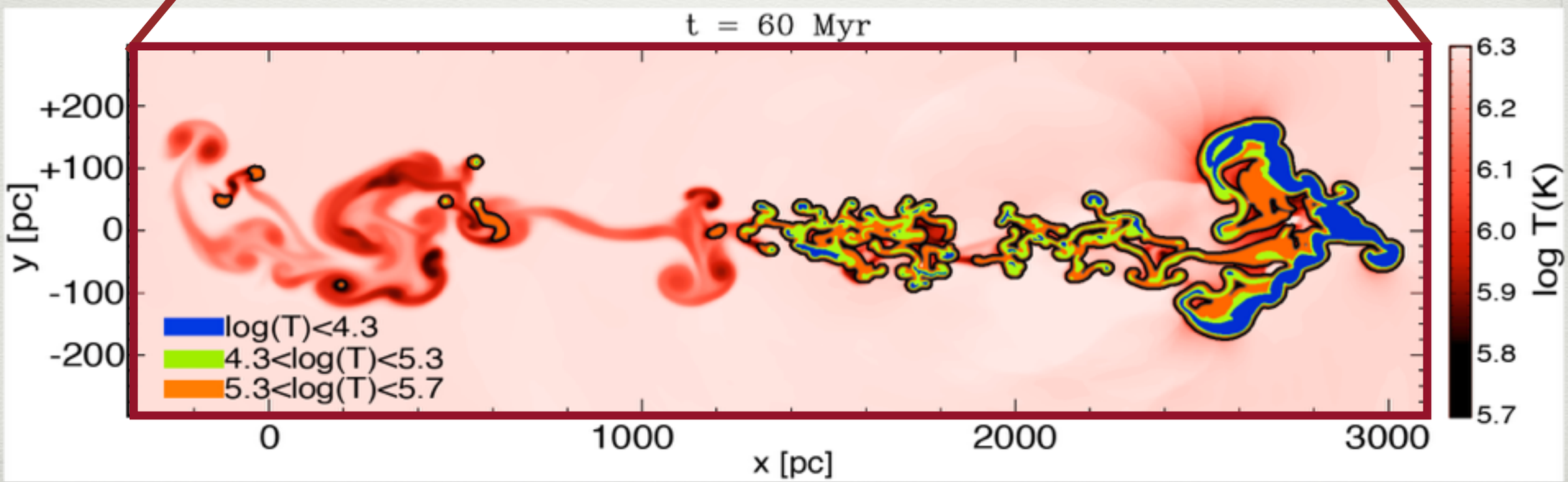
HI emitting



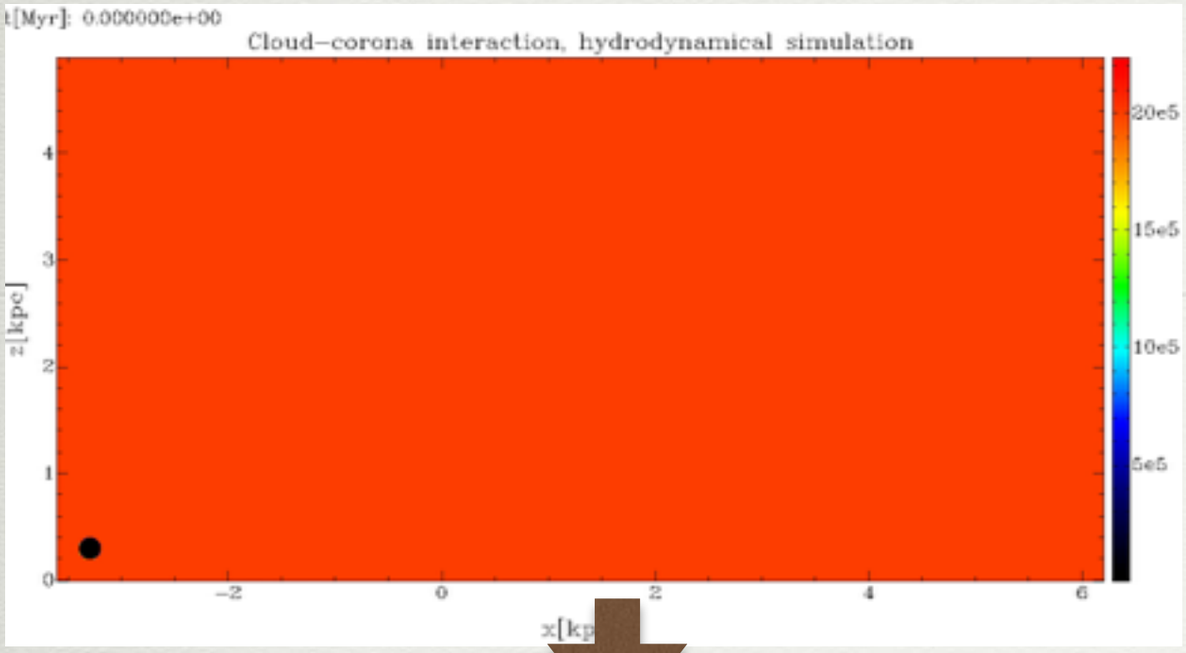
Our framework

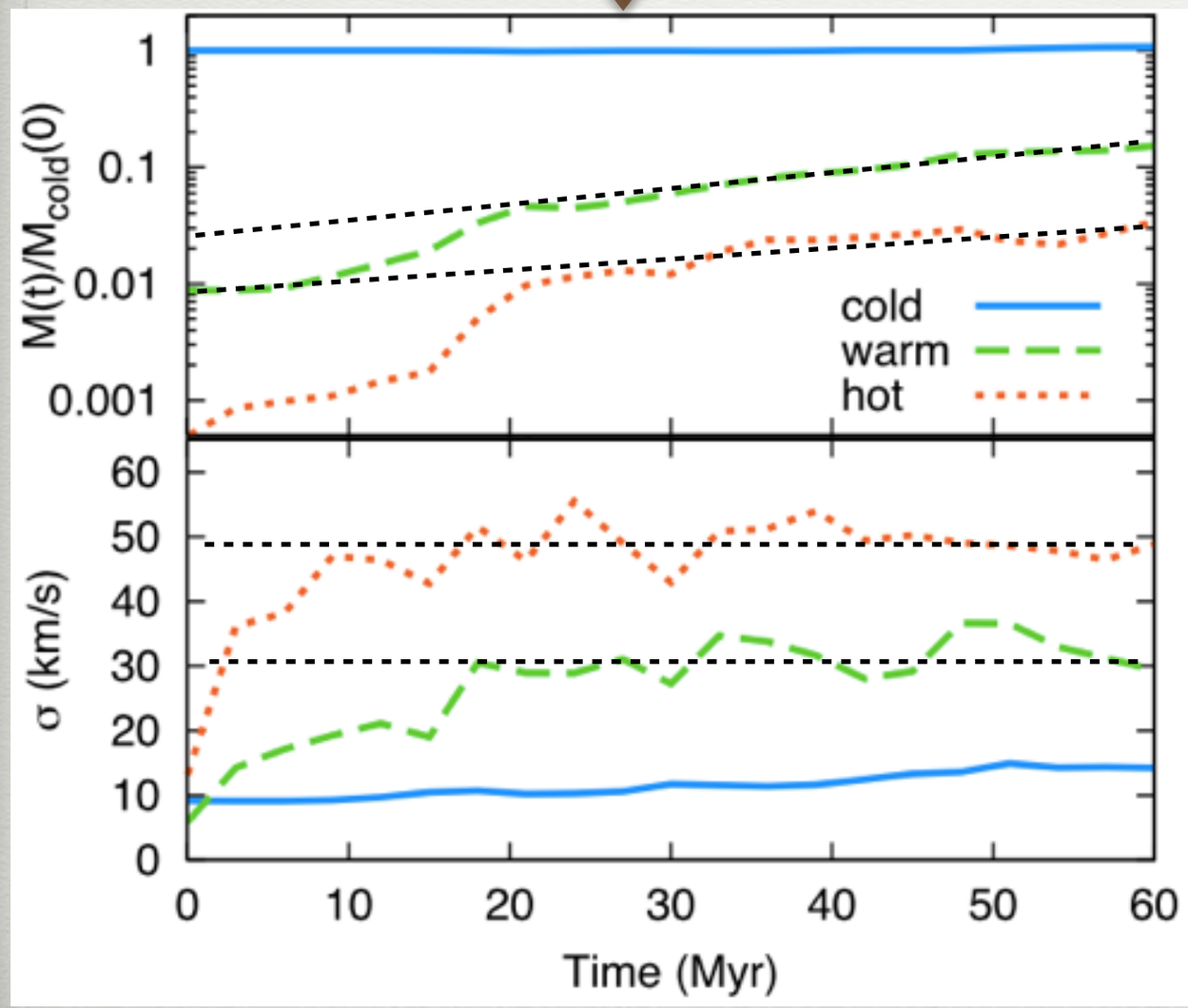


Fraternali et al. (2013)

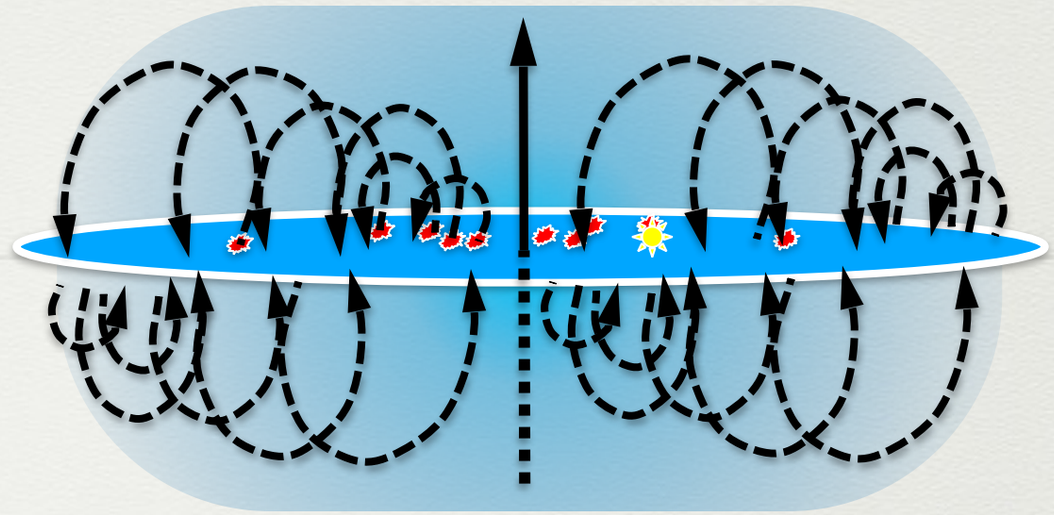


hydrodynamical simulation



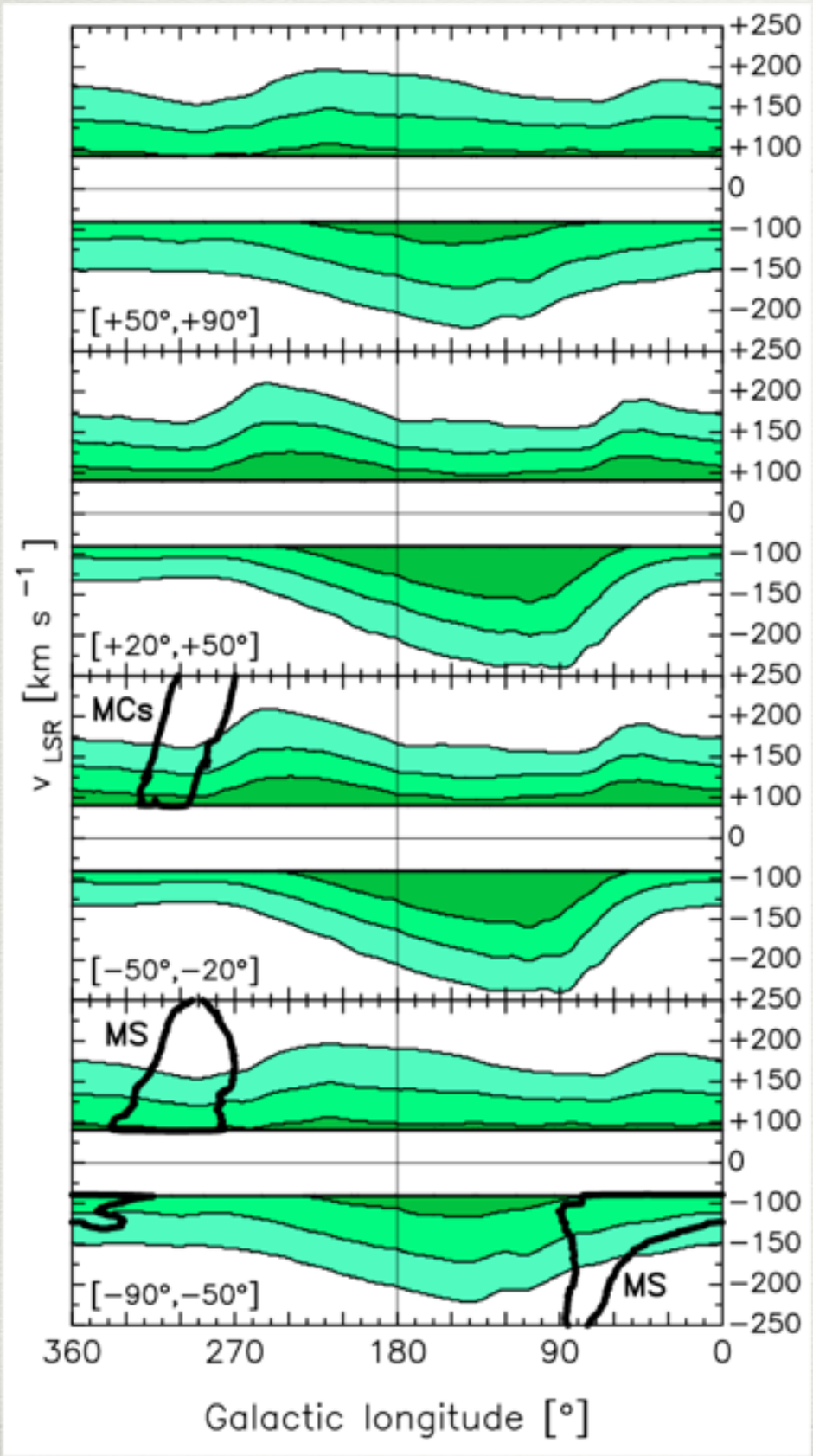


dynamical model of cold gas



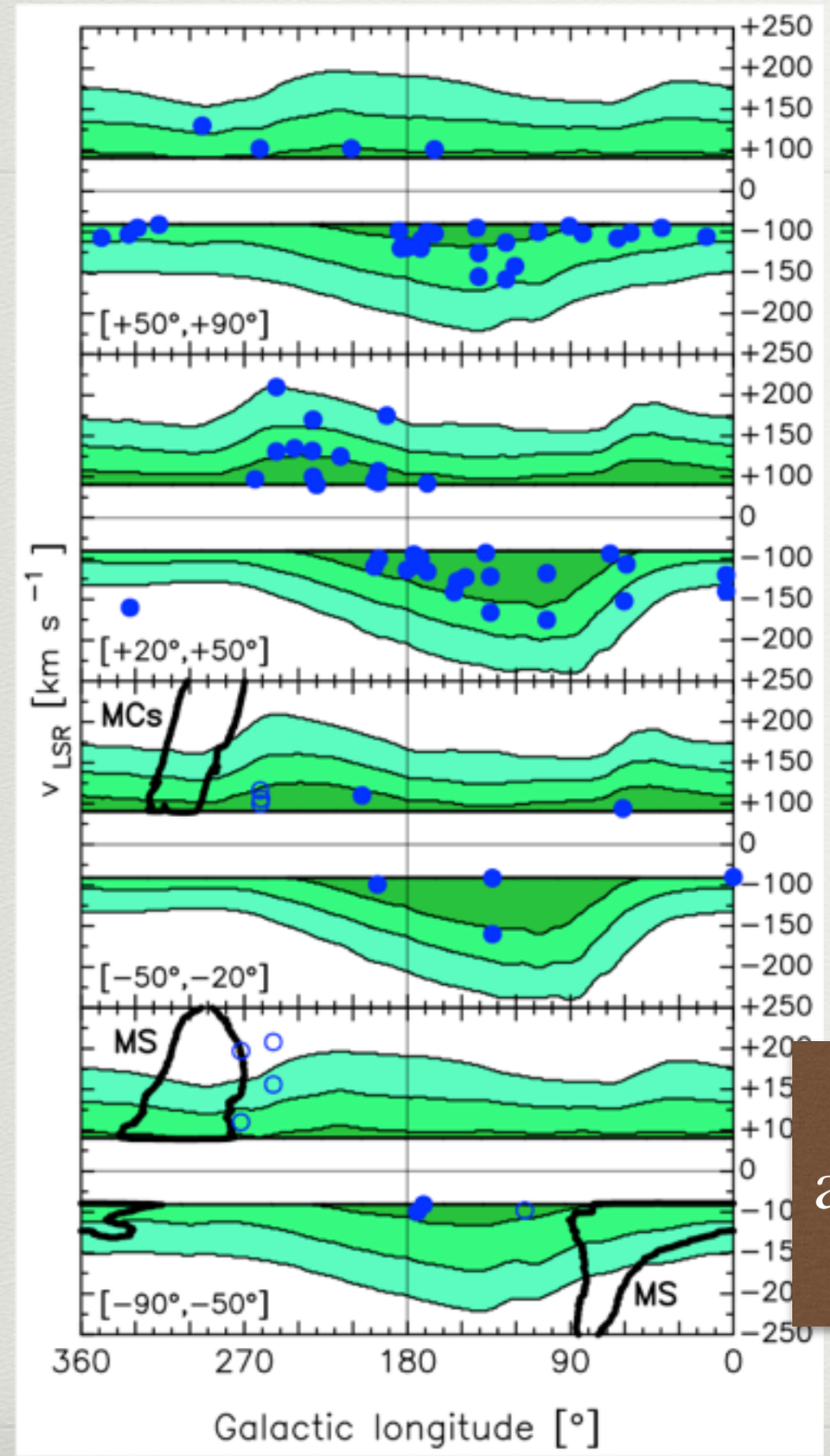
dynamical model
of warm-hot gas
NO FREE PARAMETERS

Application to the **warm** gas

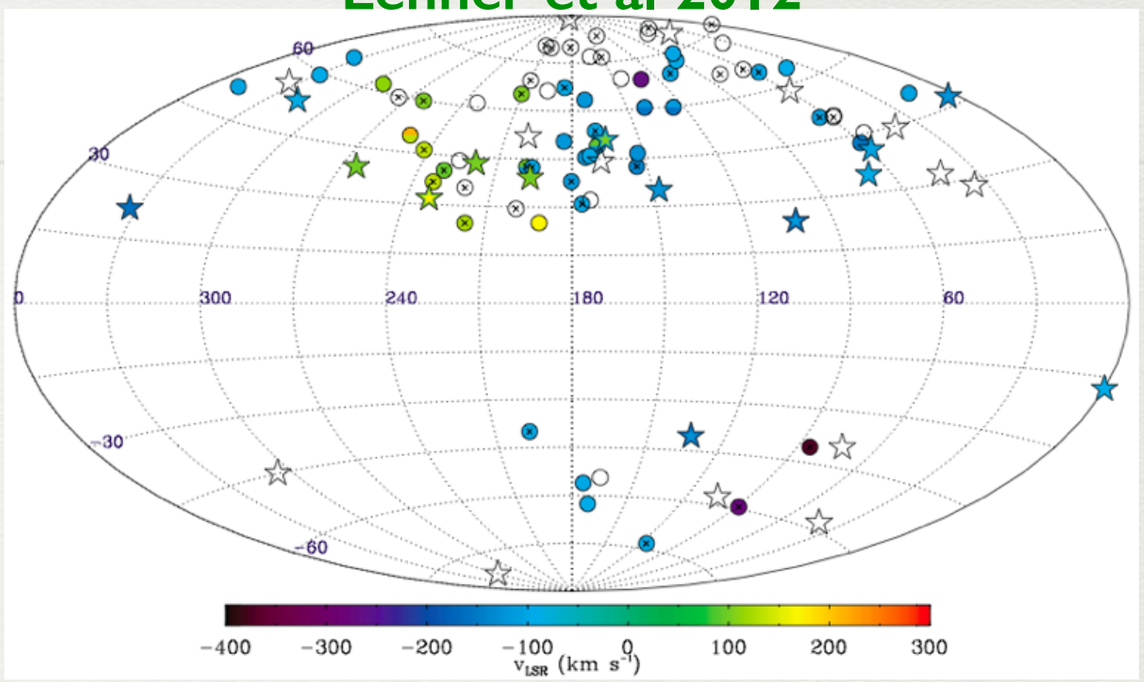


Marasco et al. (2013)

Application to the **warm** gas



Lehner et al 2012



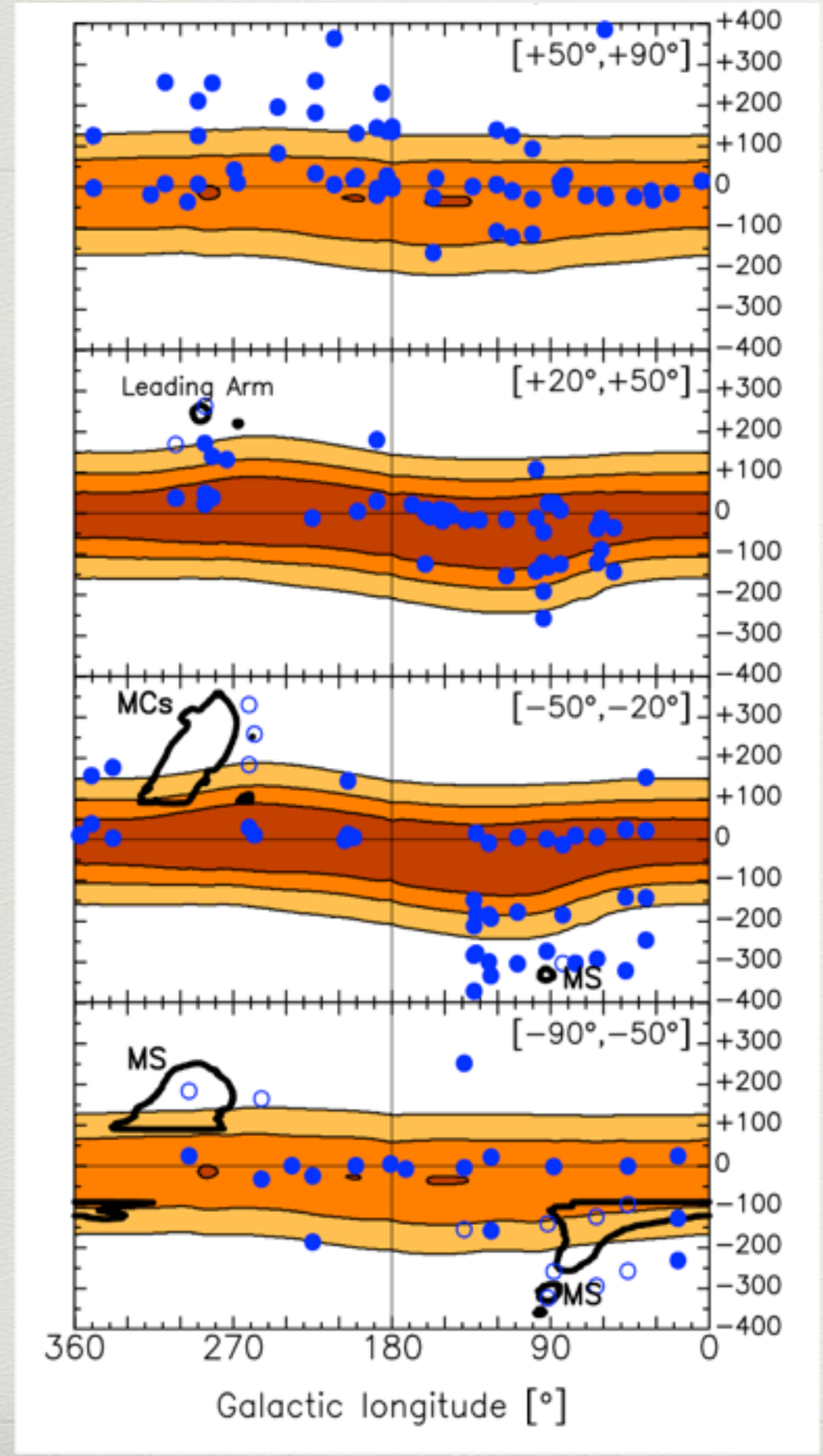
KS test: ~ 95% in agreement

$$\langle \log N_{SiIII} \rangle = \begin{matrix} 13.44 \pm 0.36 \text{ (predicted)} \\ 13.42 \pm 0.21 \text{ (Shull+09)} \end{matrix}$$

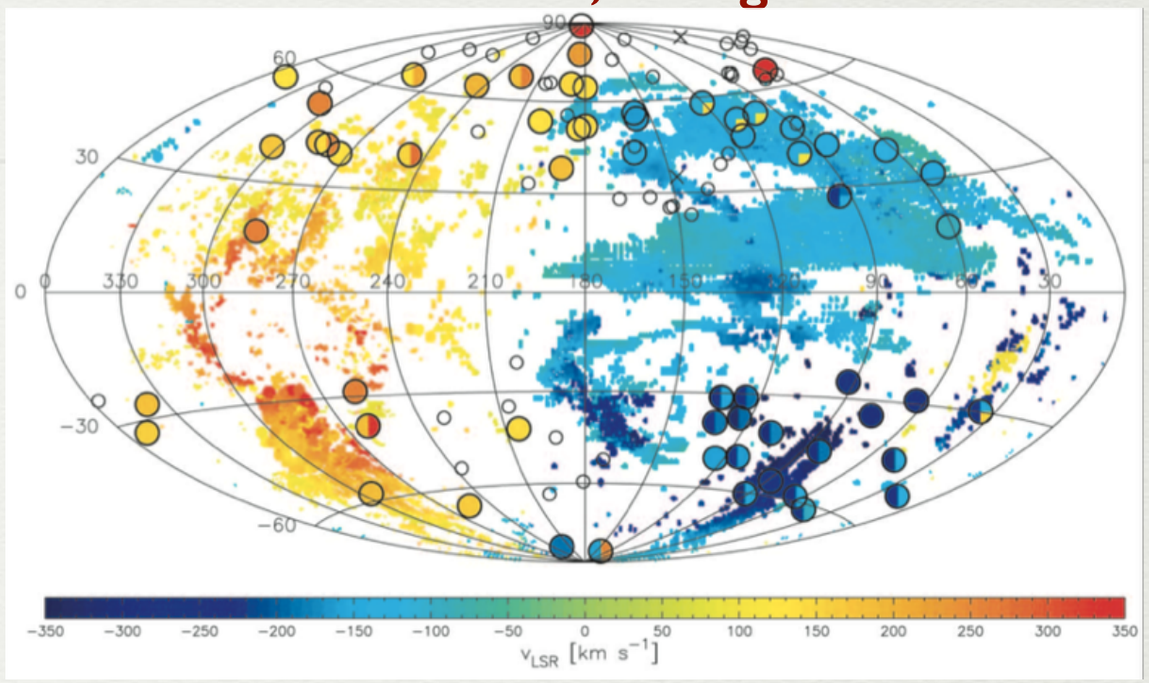
Most warm absorptions in the MW are produced at the disc-corona interface by the Galactic fountain

Marasco et al. (2013)

Application to the **hot** gas



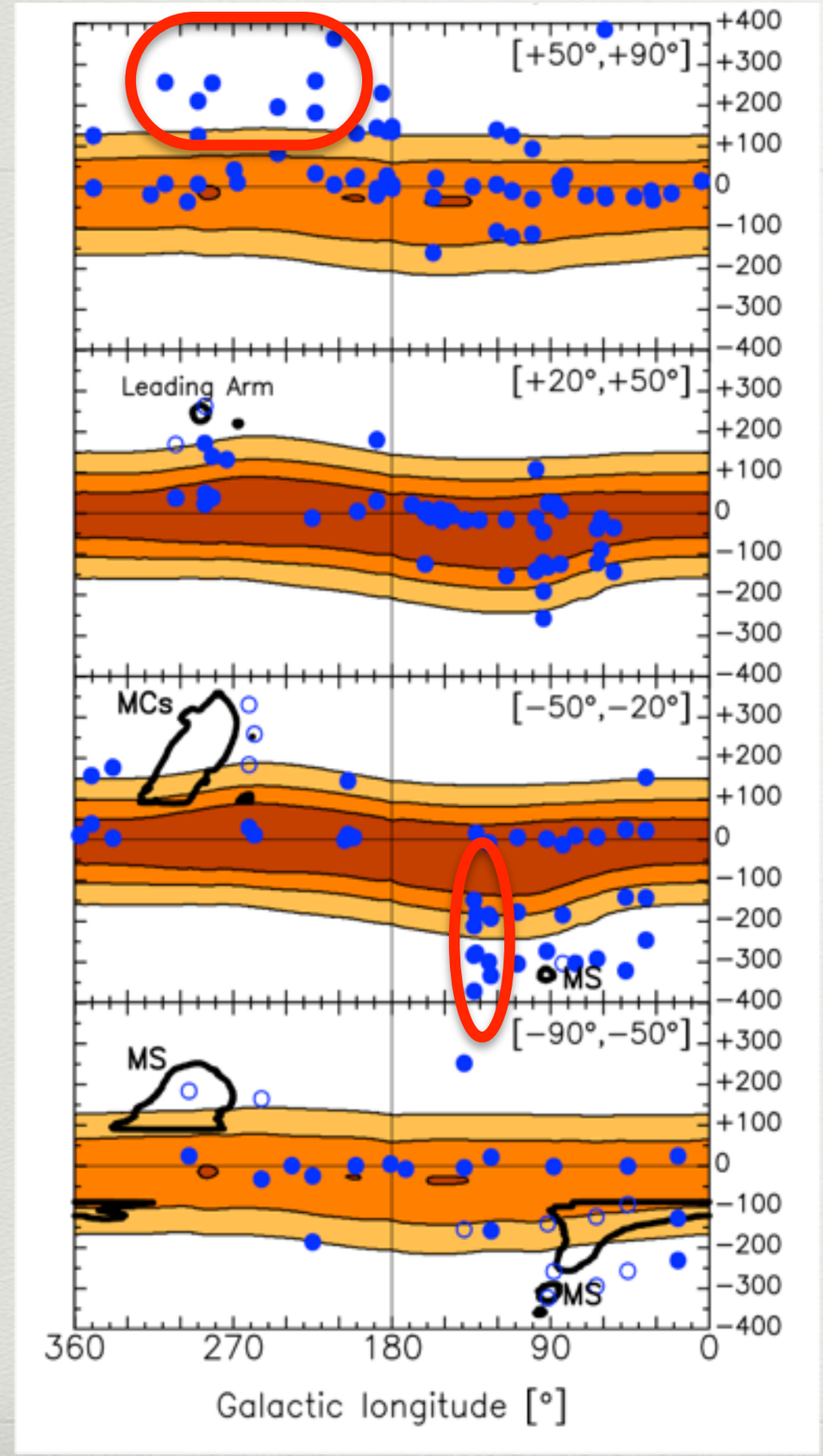
Sembach et al 2003, Savage et al 2003



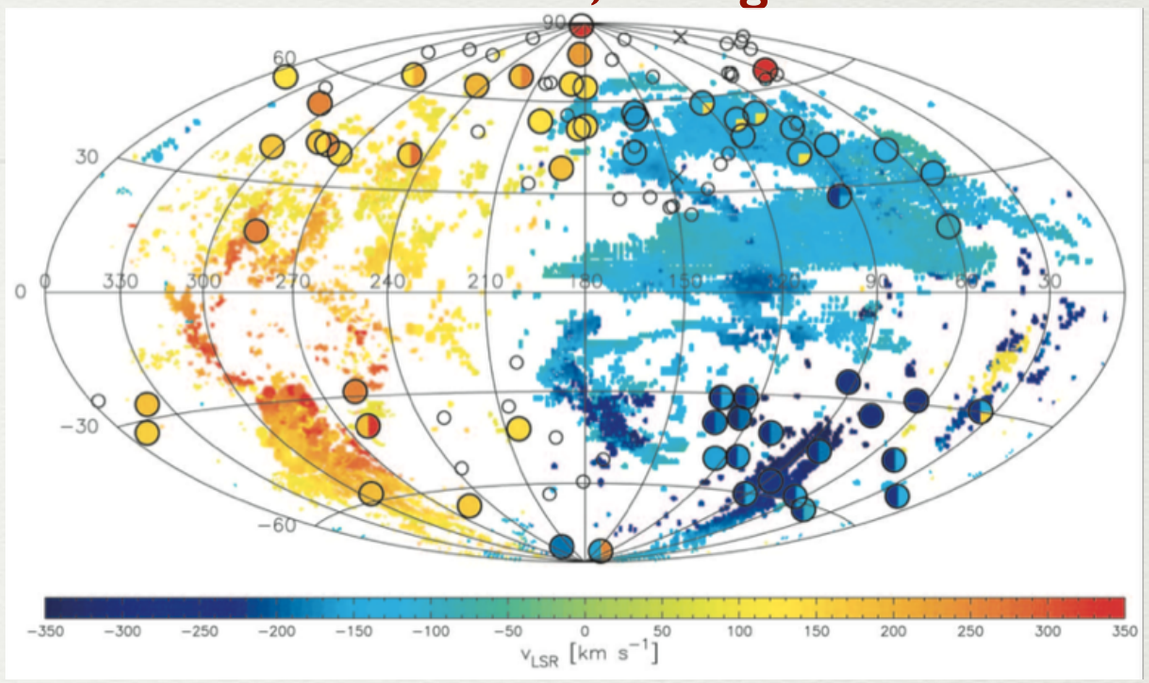
KS test: ~ 55% in agreement

Marasco et al. (2013)

Application to the **hot** gas



Sembach et al 2003, Savage et al 2003



KS test: ~ 70% in agreement

(after removing features related to external galaxies)

A fraction of O_{VI} features lies above 3-4 kpc from the disc

Marasco et al. (2013)

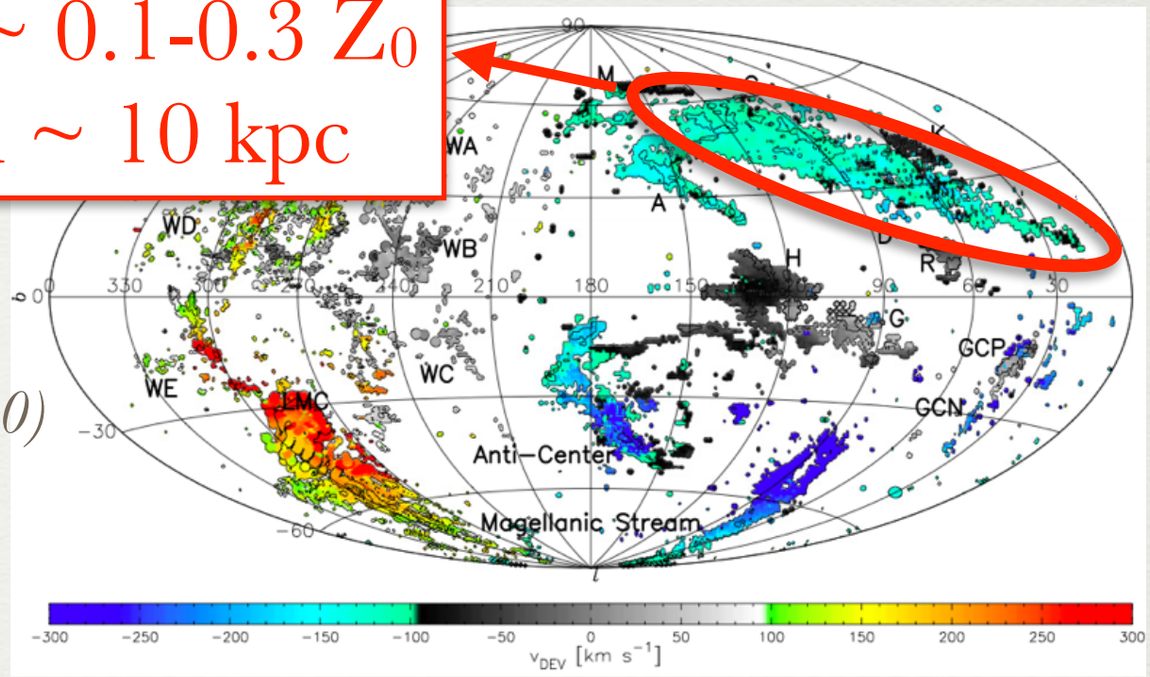
Application to the **HVC Complex C**

Powerful galactic fountain

Extended coronal gas condensation

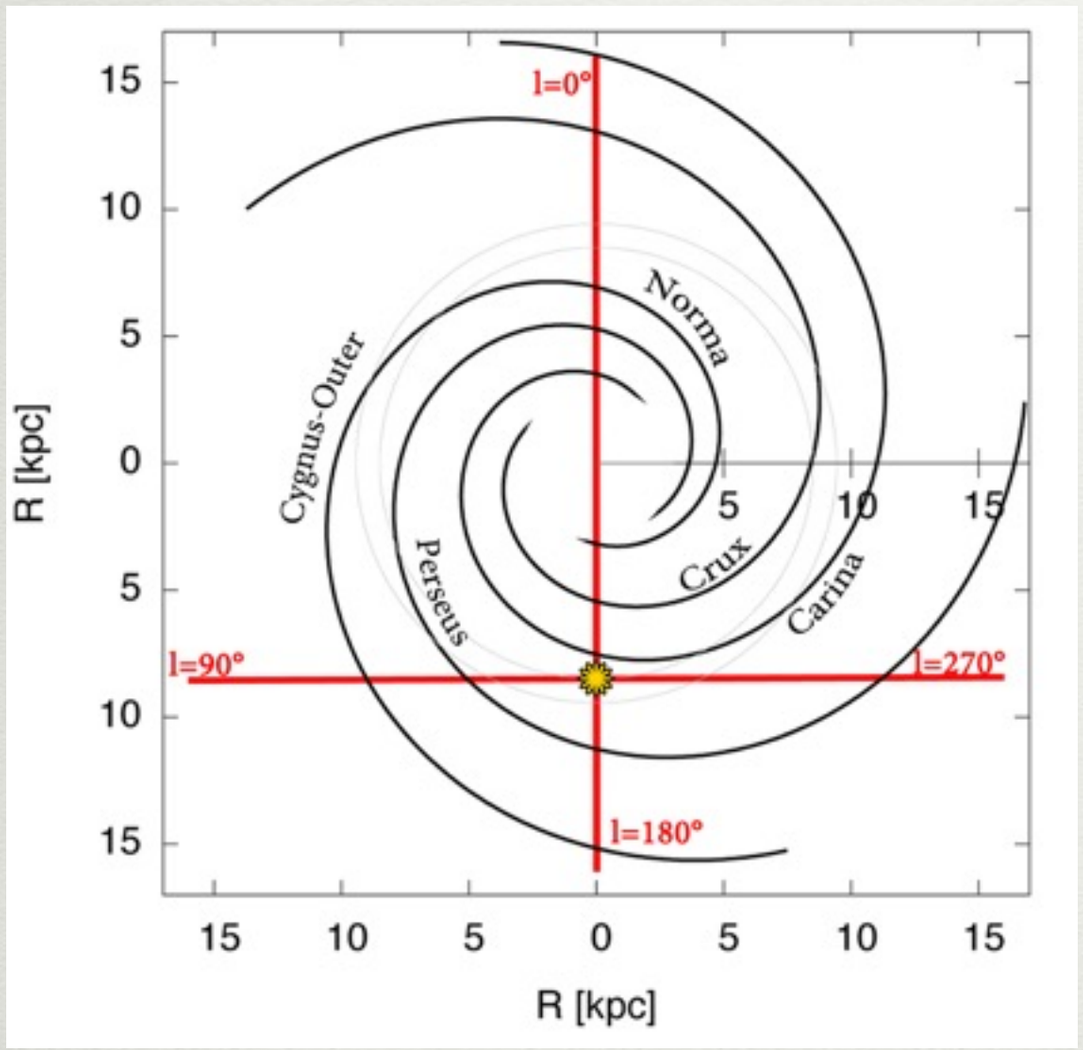
$Z \sim 0.1\text{-}0.3\ Z_0$

$d \sim 10$ kpc



New ingredients:

- Spiral arm model (*Steiman-Cameron et al. 2010*)
- Pattern speed: 25 km/s (*Gerhard 2011*)



Free parameters:

- ejection velocity
- location
- size
- look-back time
- duration
- condensation rate

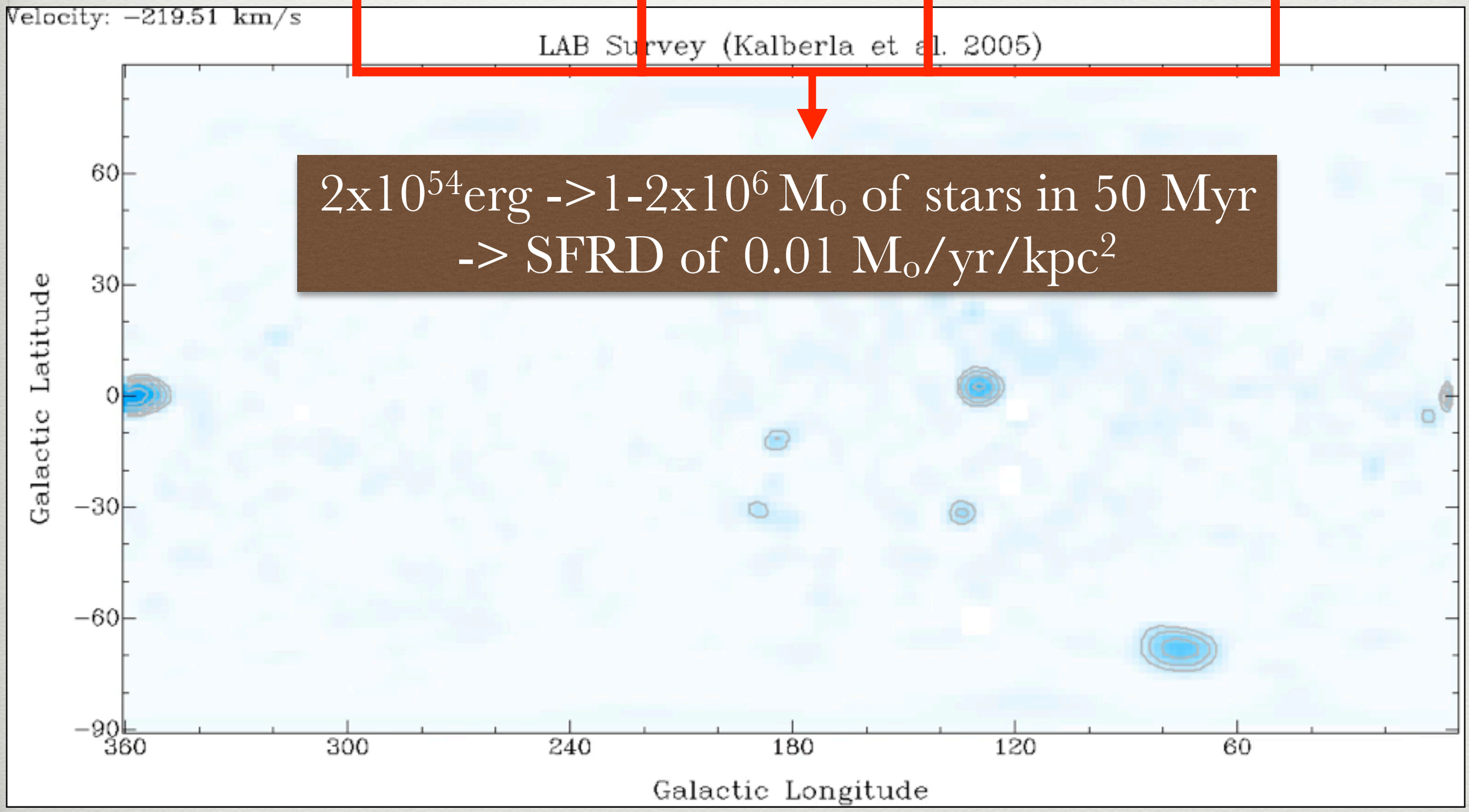
Best-fit to HI data via MCMC

Fraternali et al. (2015)

Best-fit model to Complex C

	v_0 ($\mathrm{km\,s^{-1}}$)	R_0 (kpc)	$\delta_{\rm arm}$ (kpc)	t_0 (Myr)	$\Delta_{\rm t}$ (Myr)	$t_{\rm delay}$ (Myr)	$M_{\rm HI}$ (seed) ($10^6\,\mathrm{M_\odot}$)	$M_{\rm HI}$ (final) ($10^6\,\mathrm{M_\odot}$)
Best-fit	211	9.5	2.9	150	53	46	3.4	6.8
MCMC $2-\sigma$ level	$203-216$	$9.4-9.6$	$2.6-3.7$	$145-152$	$49-56$	$43-52$	$3.0-3.8$	$6.2-7.5$

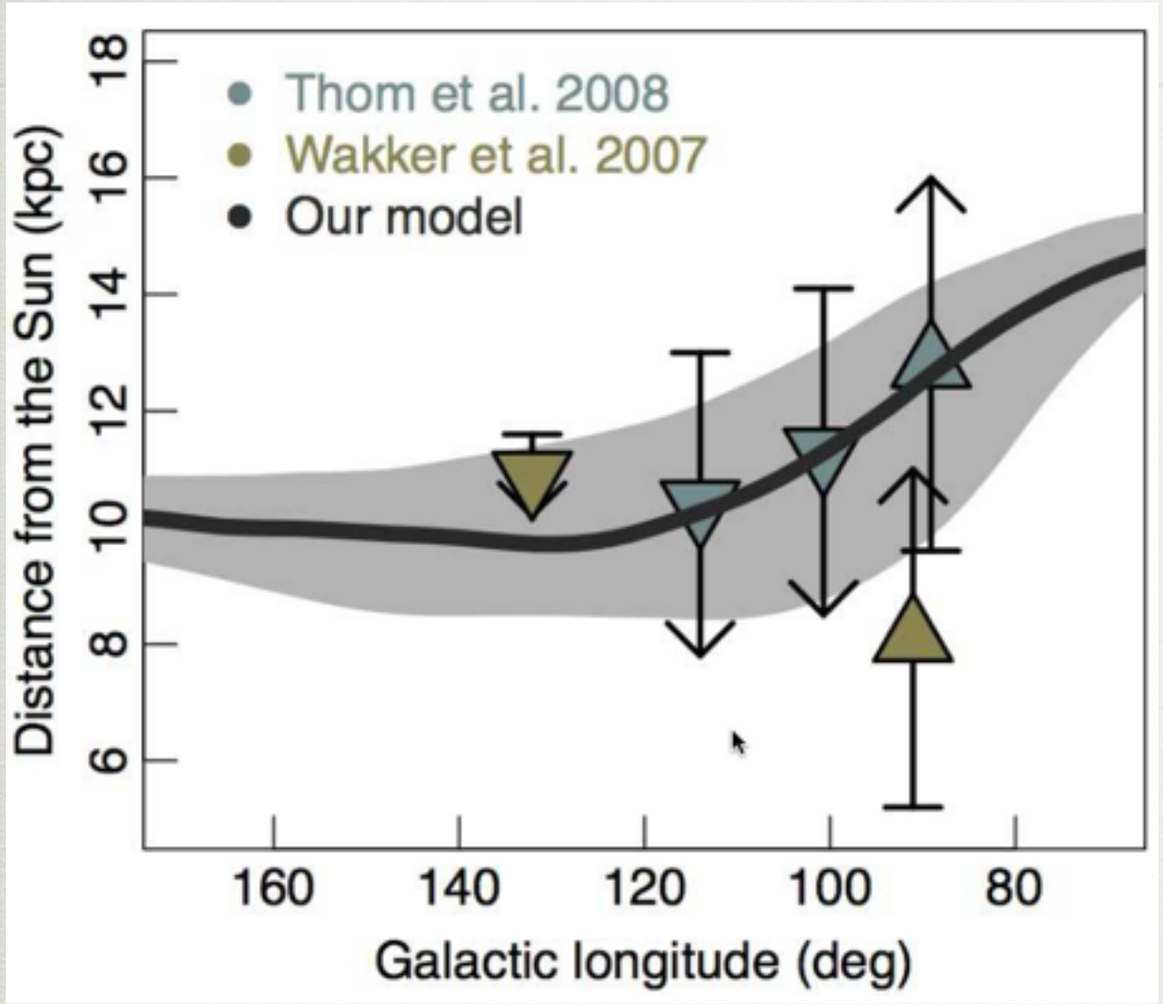
2×10^{54}erg ->1-$2\times10^6\,M_o$ of stars in 50 Myr
-> SFRD of 0.01 M_o/yr/kpc^2



Predictions

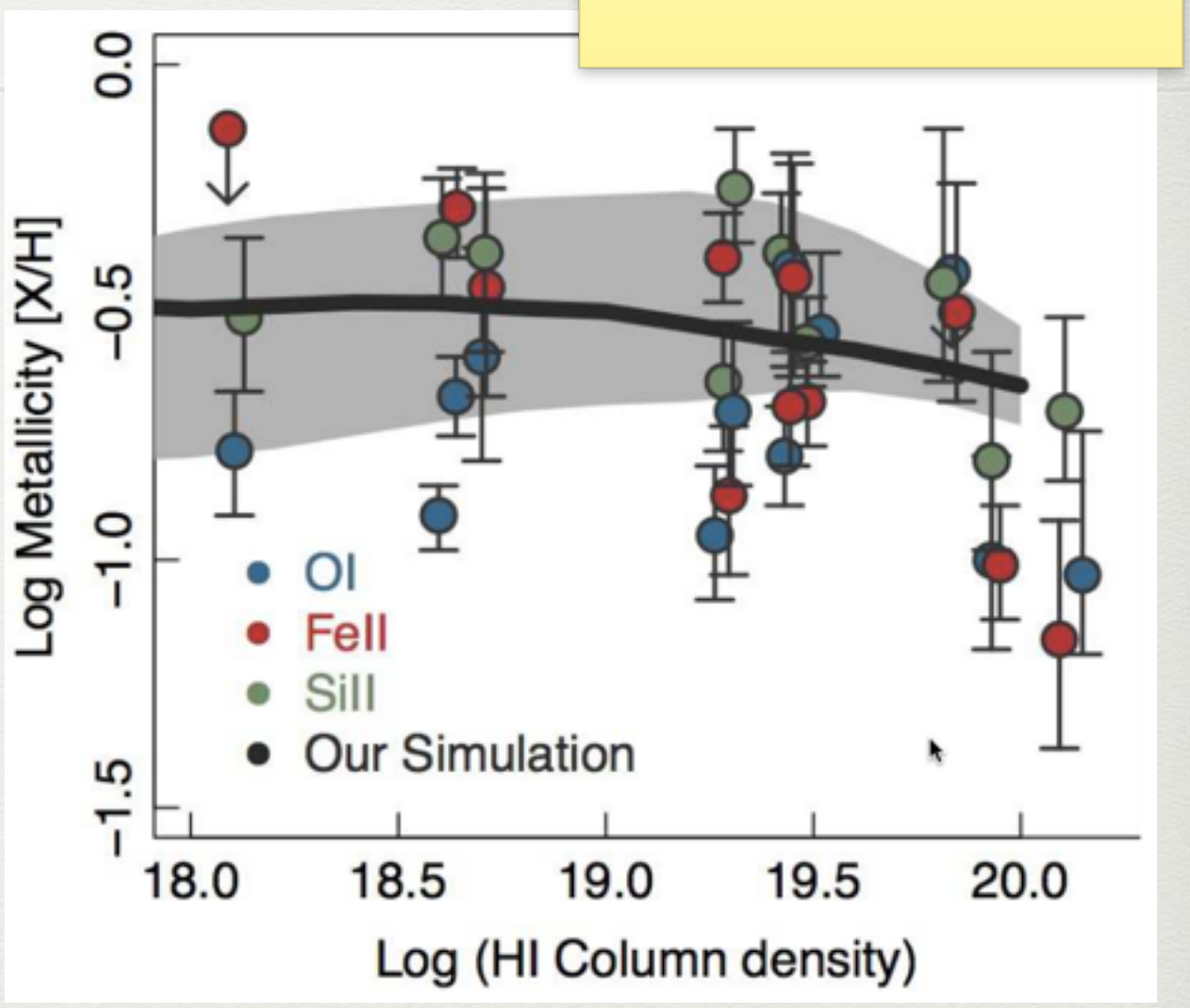
The 2 most important constrains. We are not using them in the fit!

Distance



from the dynamical model

Met



from the hydrodynamical simulation for $Z_{cloud}=0.8\ Z_o$; $Z_{corona}=0.1\ Z_o$

Conclusions

Fountain cloud - corona interactions
can explain many observables
of the multiphase gaseous halo of the Milky Way

- intermediate-velocity extraplanar HI
  (see Filippo Fraternali's talk)
- the vast majority of warm absorbers
- at least half of the hot absorbers
- metal-poor HVC complex C

…and provides low Z gas accretion at a rate similar to SFR