RHD simulations

of stochastic, torus-scale accretion

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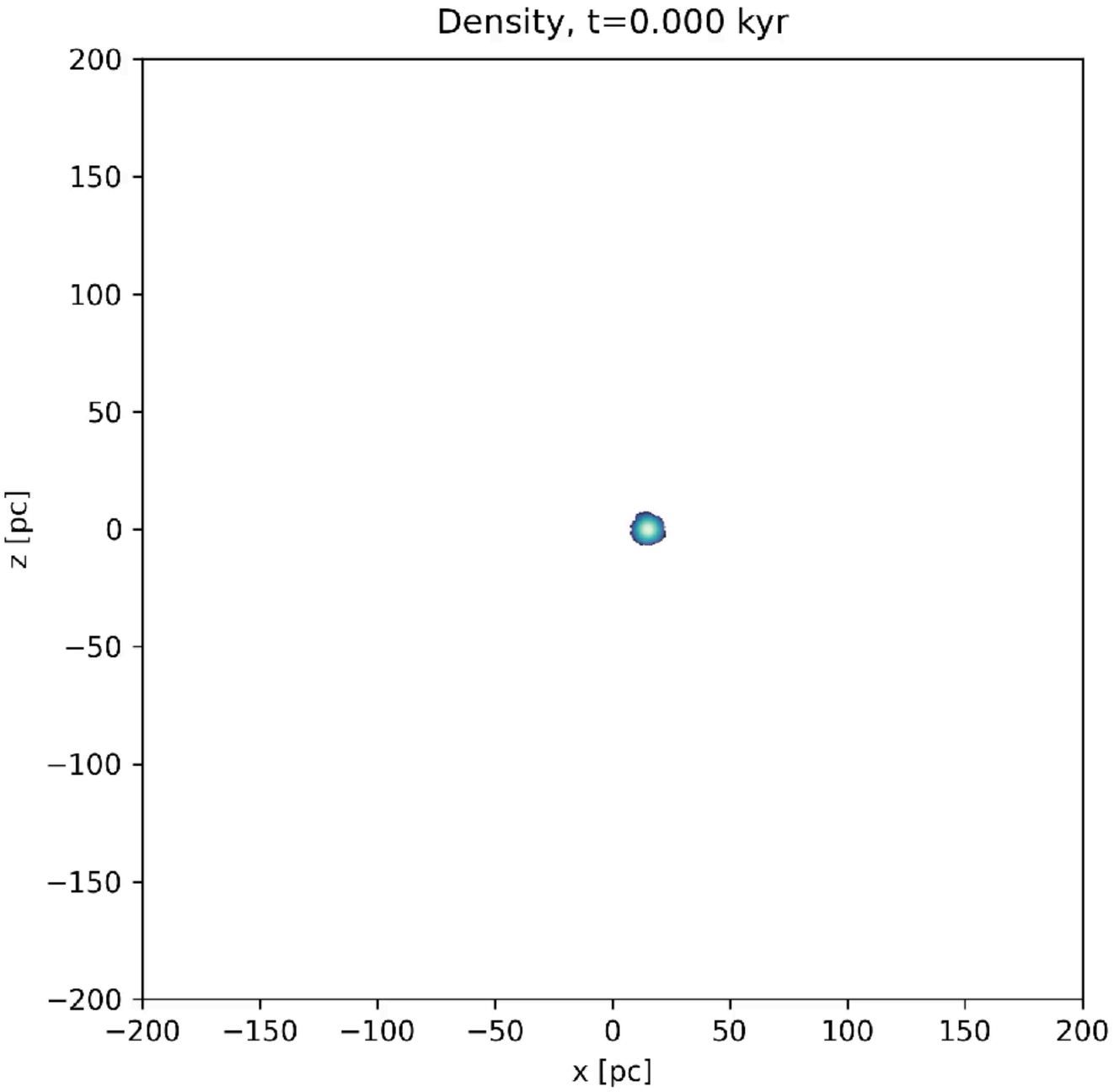
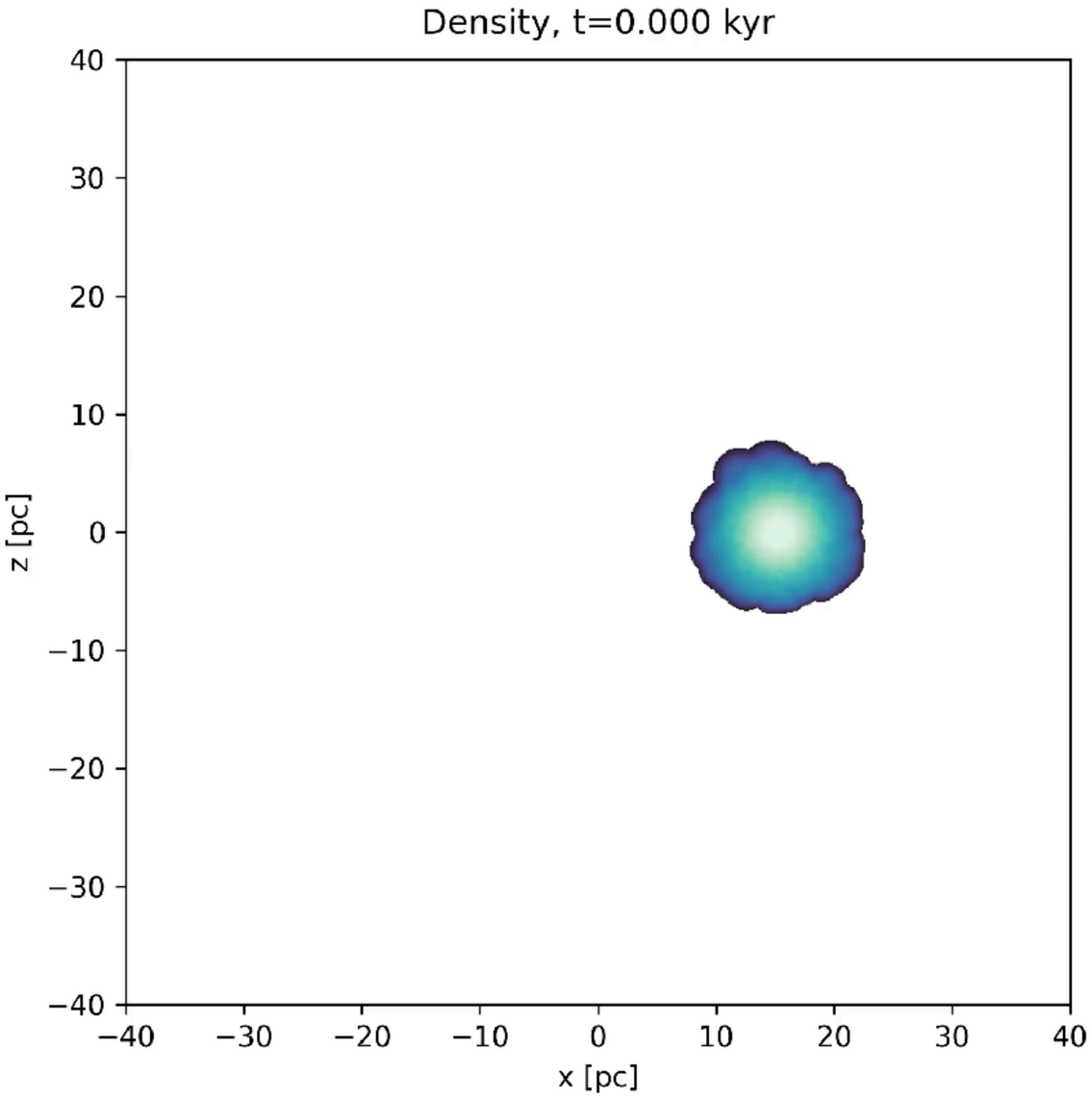
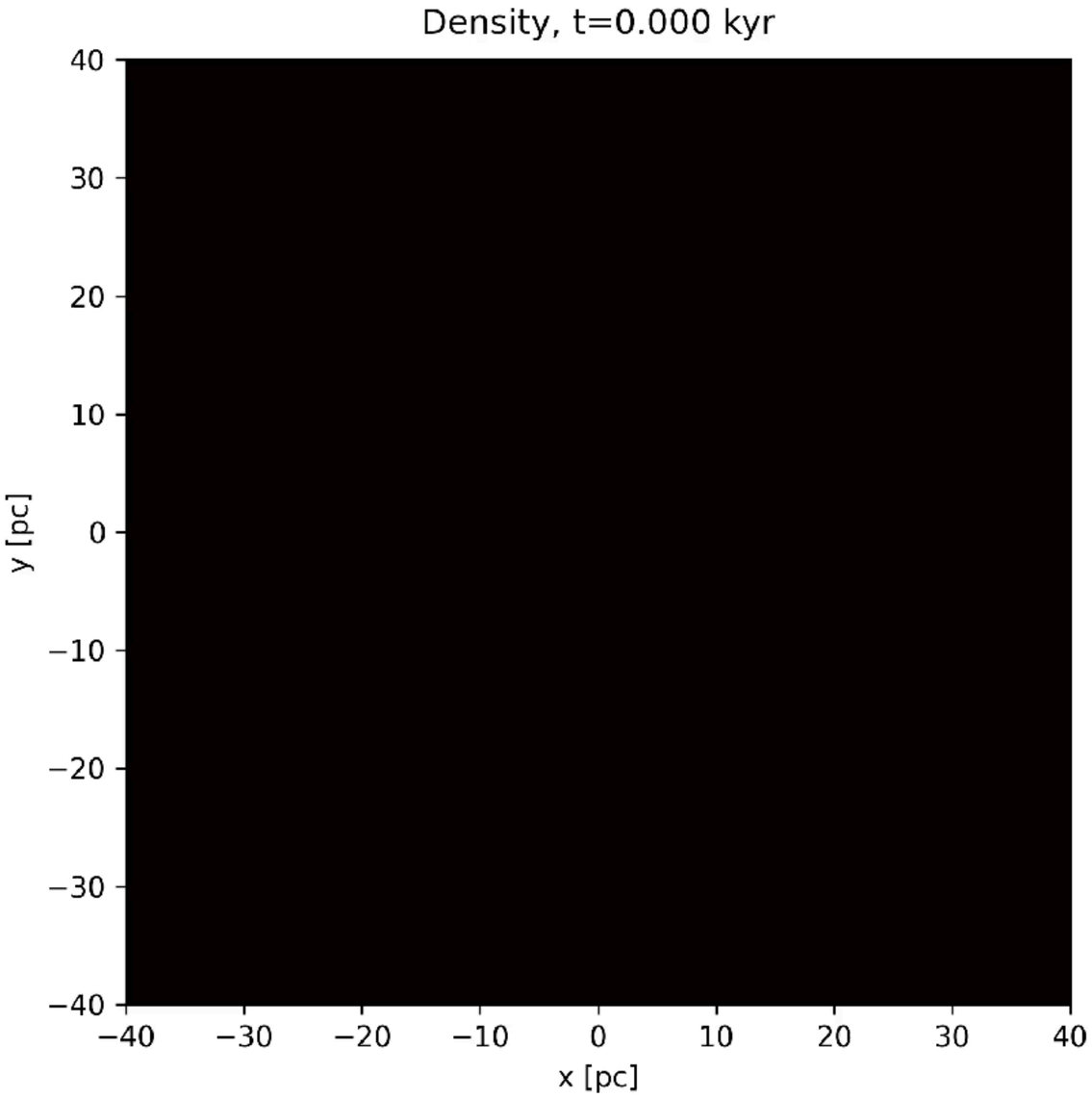
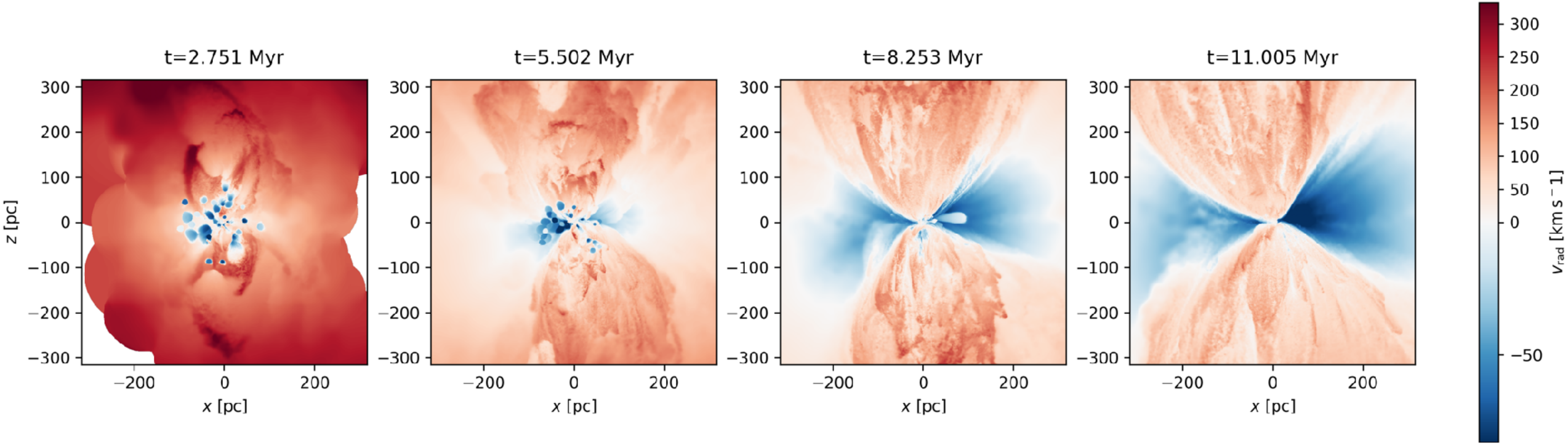
Stochastic accretion

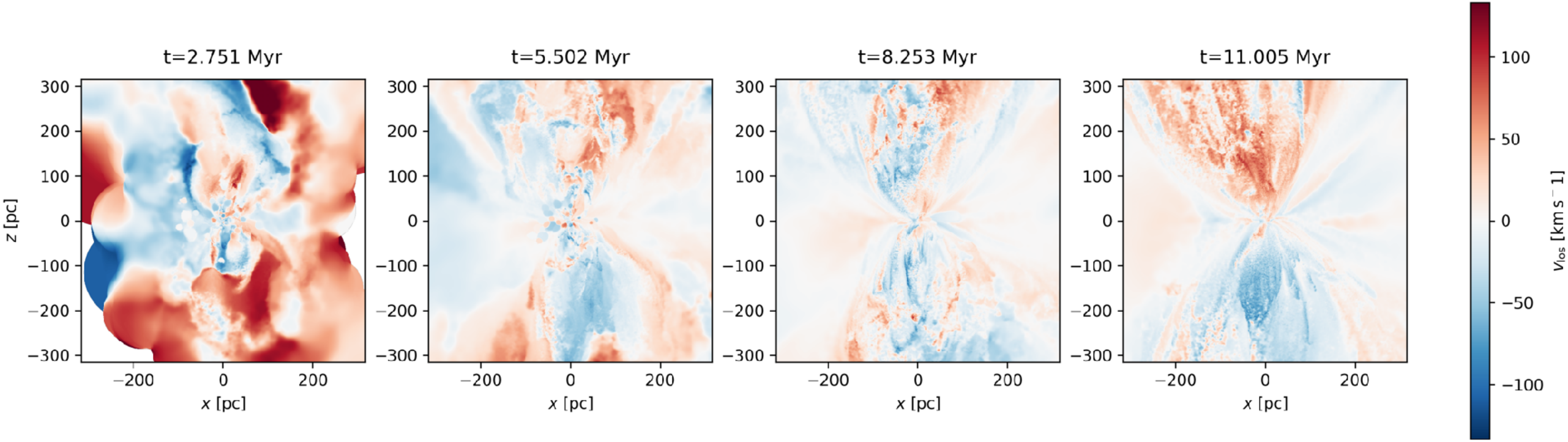
- Self-gravity, hydro, radiation pressure
- Discrete clouds with $M=10^4$ M_{sun}, r=6 pc (~GMC)
- Introduced at constant rate (1 M_{sun}/yr), on in-falling orbits
- AGN activates on first cloud accretion ($M_{BH}=2\times10^6$ M_{sun}, $f_{edd}=0.01$ -> $L_{BH}\sim10^{42}$ erg/s)
- Generate clouds for ~5.5 Myr (“active accretion”), then continue for “passive accretion” phase of same length

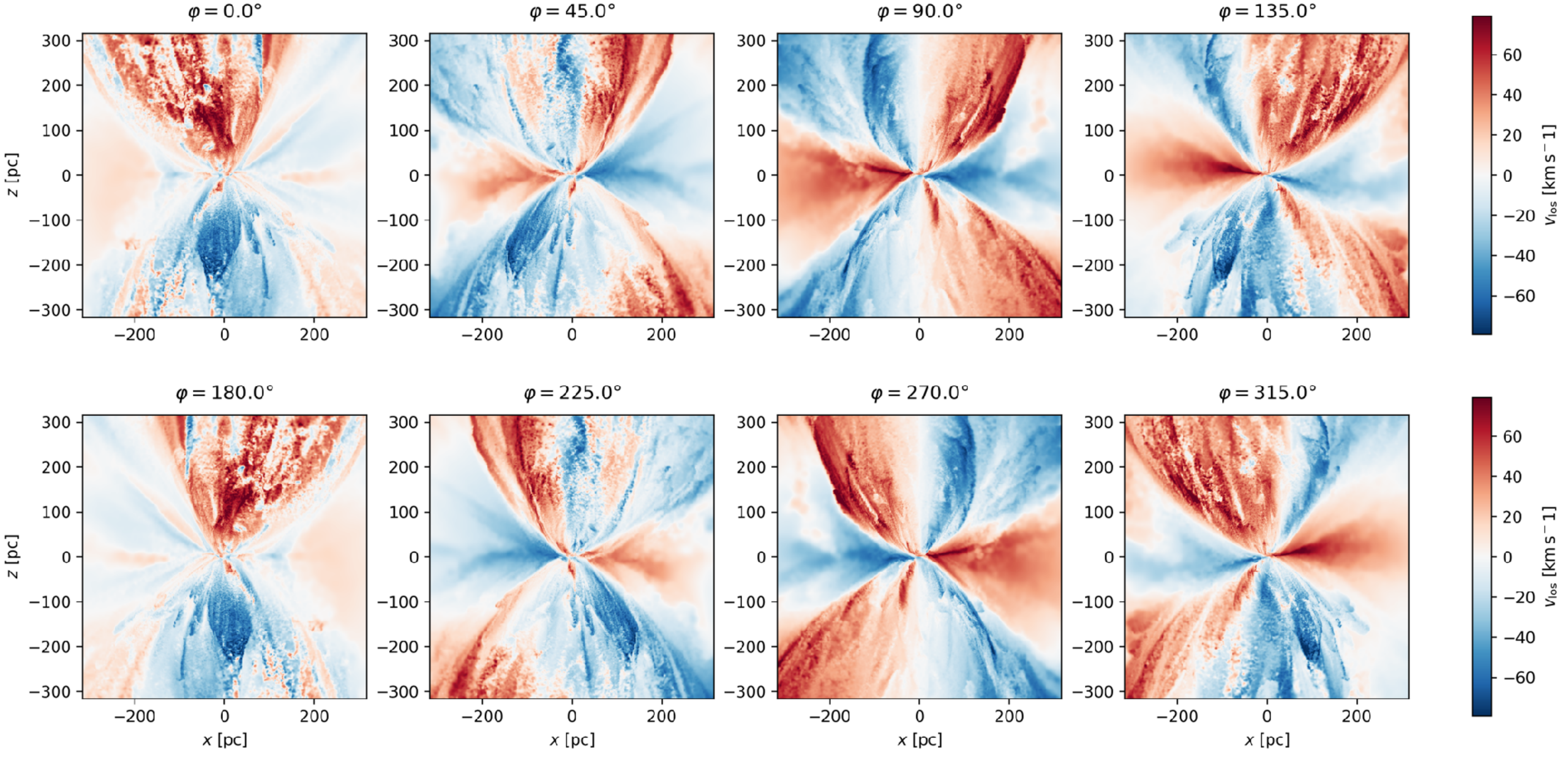


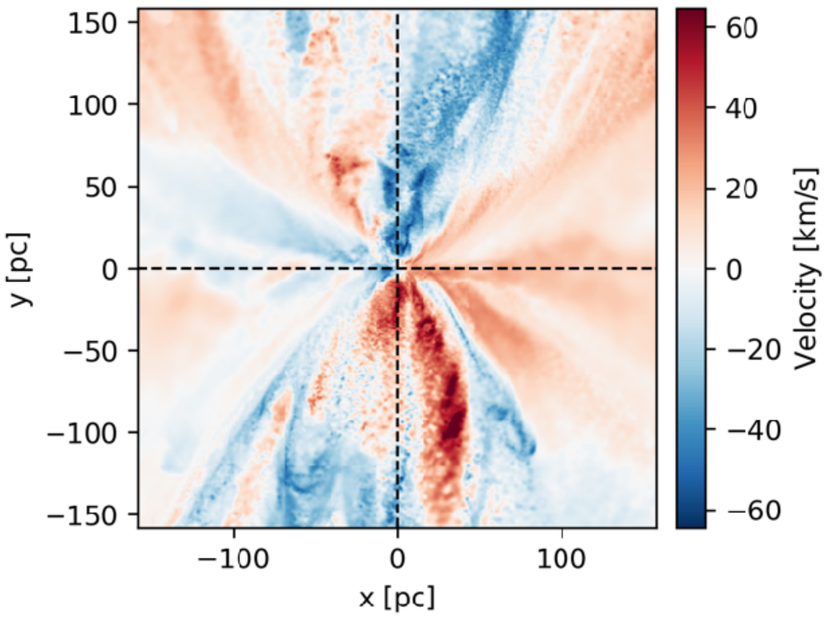

Density, t=0.000 kyr
40
30
20
10
0
−10
−20
−30
−40
z [pc]
−40
−30
−20
−10
0
10
20
30
40
x [pc]

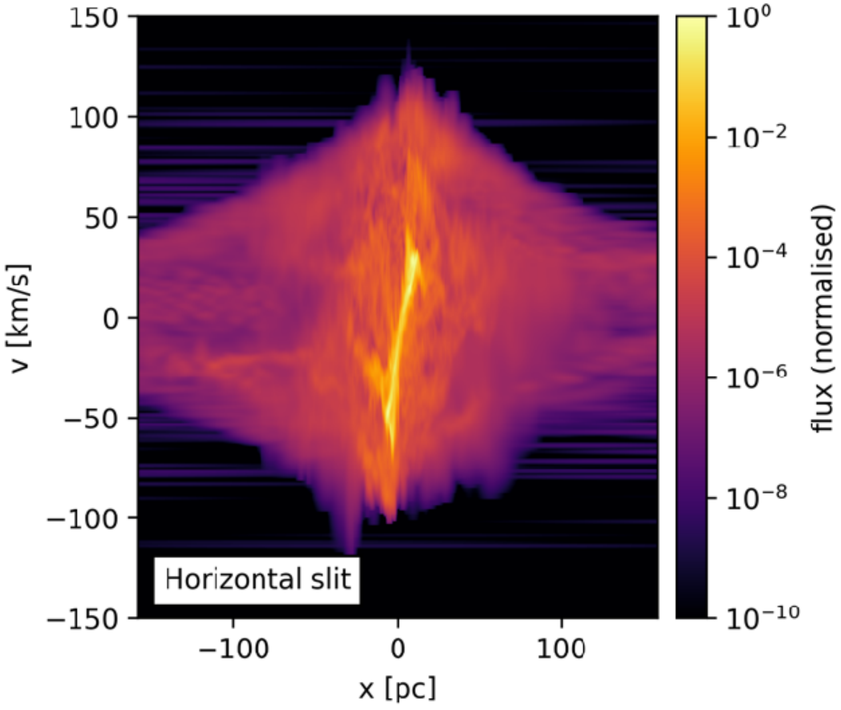

Density, t=0.000 kyr
40
30
20
10
0
−10
−20
−30
−40
y [pc]
−40
−30
−20
−10
0
10
20
30
40
x [pc]

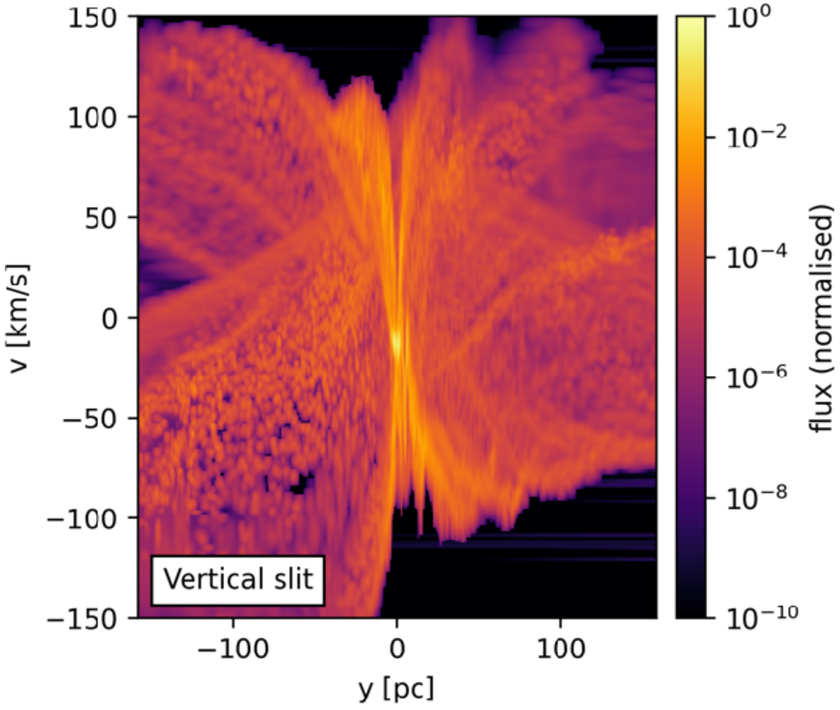

t=2.751 Myr
t=5.502 Myr
t=8.253 Myr
t=11.005 Myr
z [pc]
x [pc]
300
200
100
0
−100
−200
−300
−200
0
200
v_{rad} [km s^{-1}]
300
250
200
150
100
50
0
−50

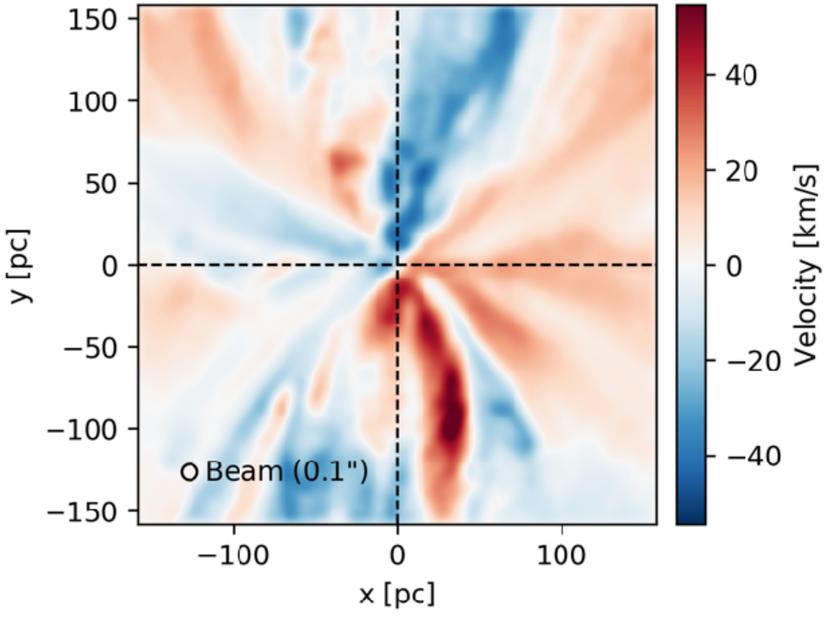

t=2.751 Myr
t=5.502 Myr
t=8.253 Myr
t=11.005 Myr
z [pc]
x [pc]
300
200
100
0
−100
−200
−300
−200
0
200
100
50
0
−50
−100
v_{los} [km s^{-1}]

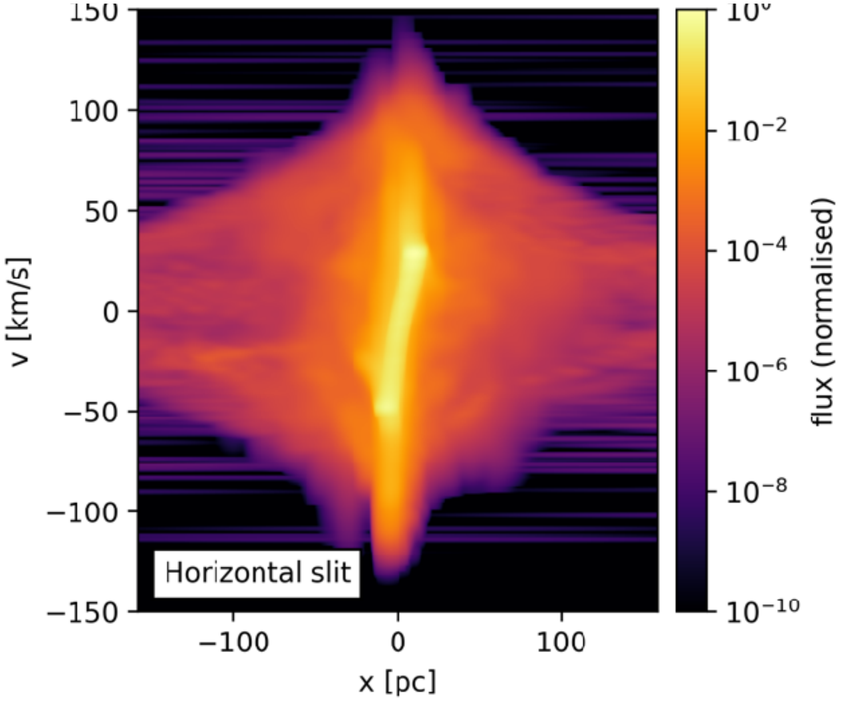

φ = 0.0°
φ = 45.0°
φ = 90.0°
φ = 135.0°
φ = 180.0°
φ = 225.0°
φ = 270.0°
φ = 315.0°
z [pc]
x [pc]
300
200
100
0
−100
−200
−300
−200
0
200
60
40
20
0
−20
−40
−60
v_los [km s^−1]

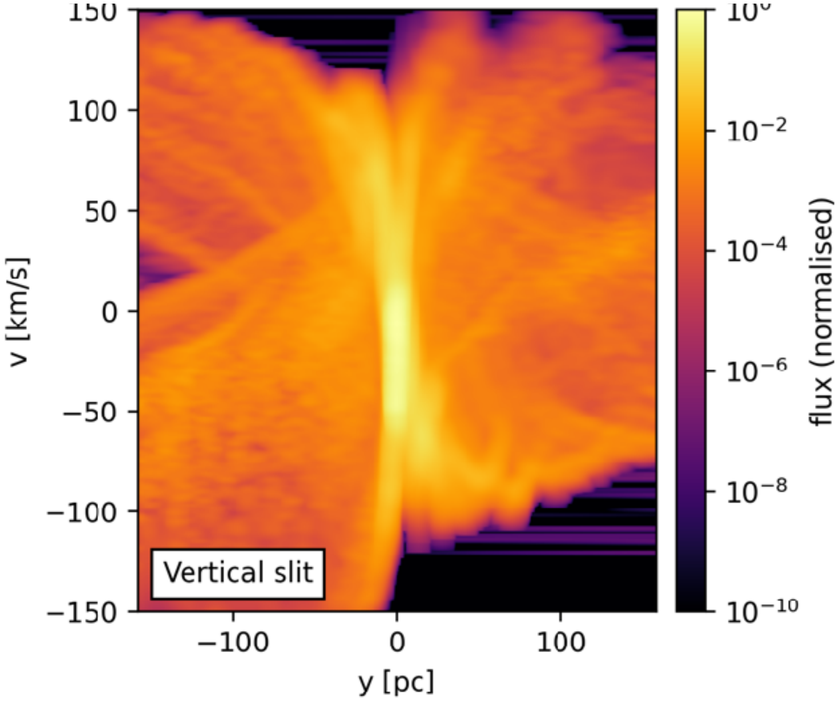

y [pc]
x [pc]
Velocity [km/s]

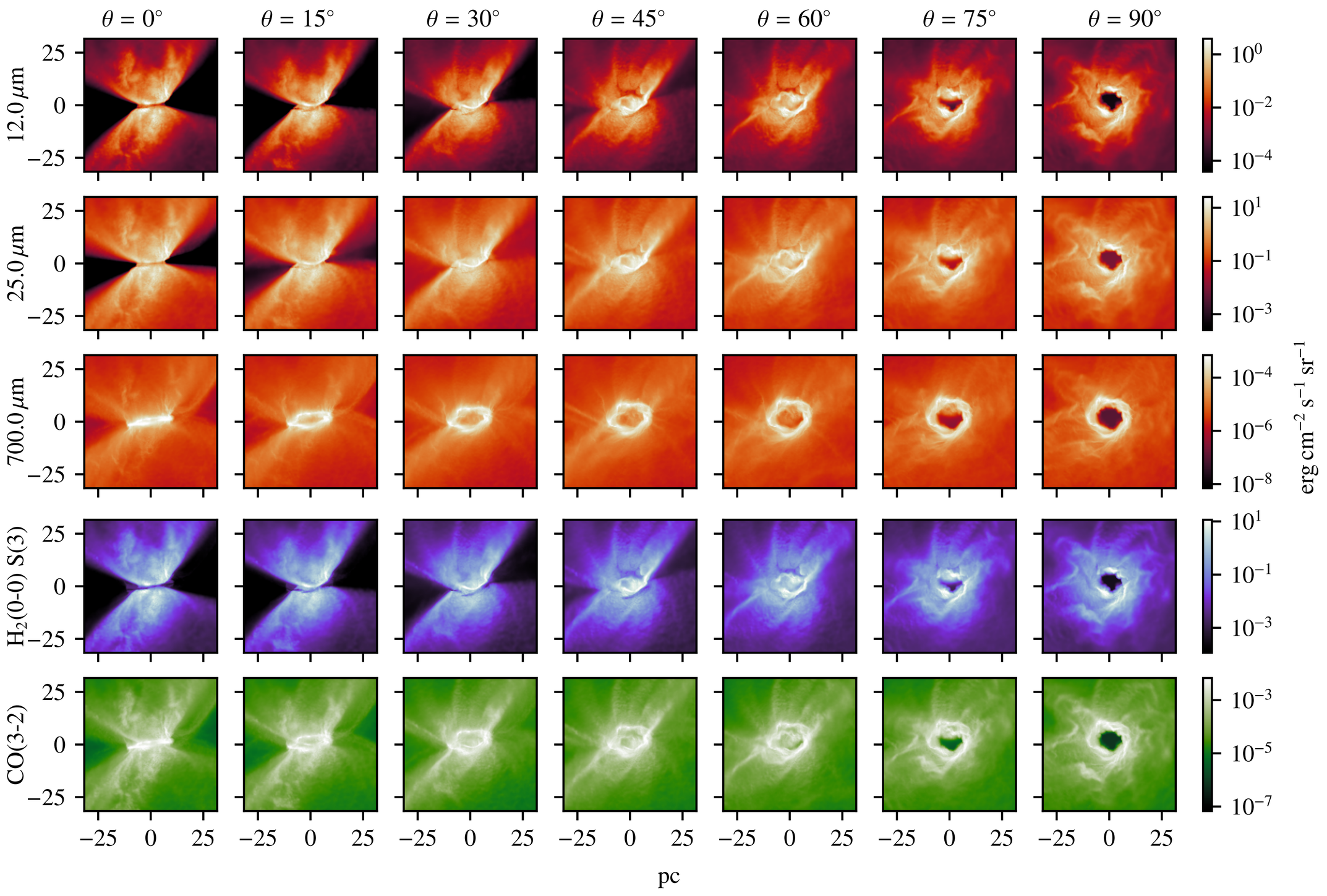

Horizontal slit
v [km/s]
x [pc]
flux (normalised)

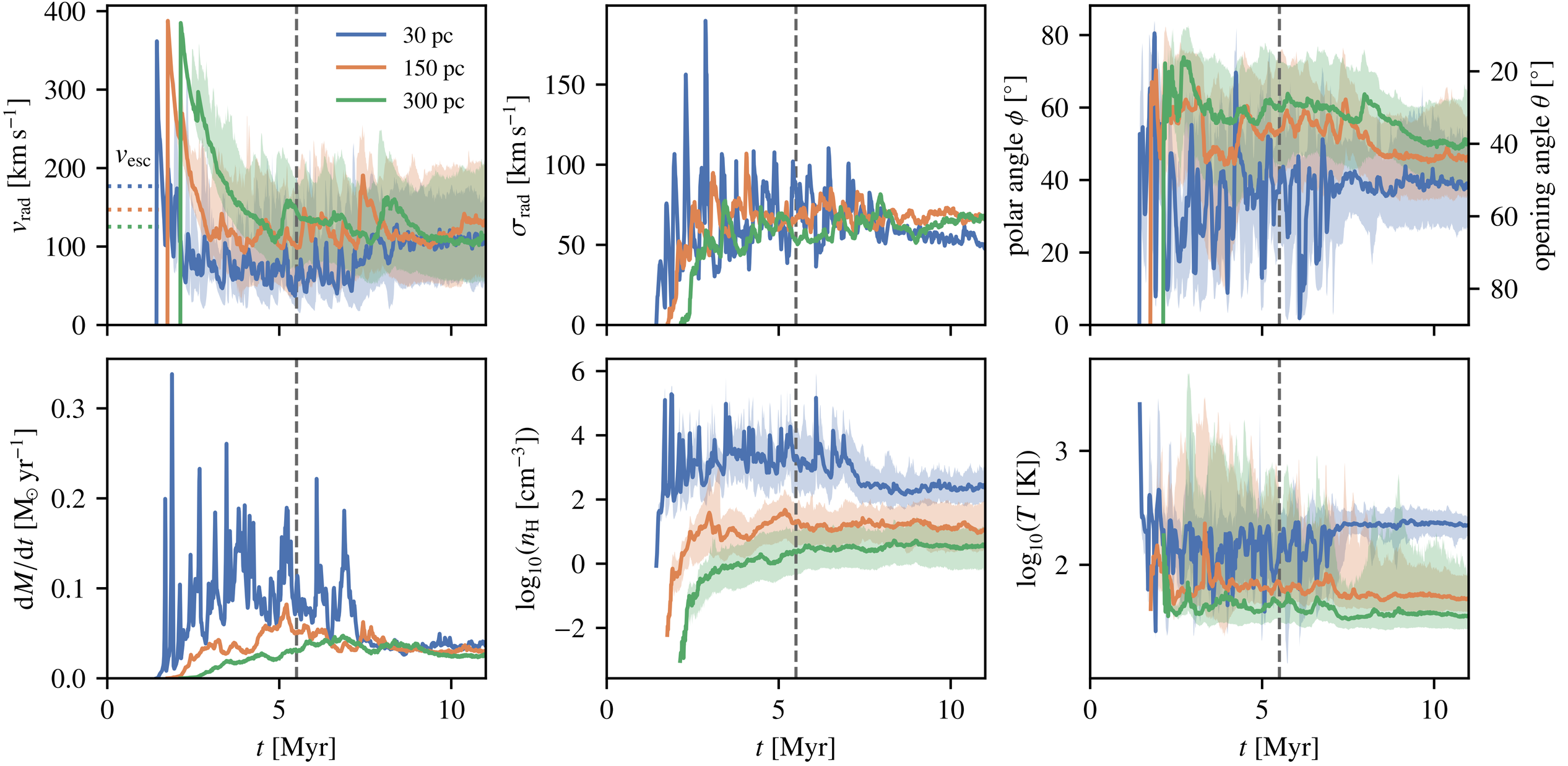

Vertical slit
v [km/s]
y [pc]
flux (normalised)

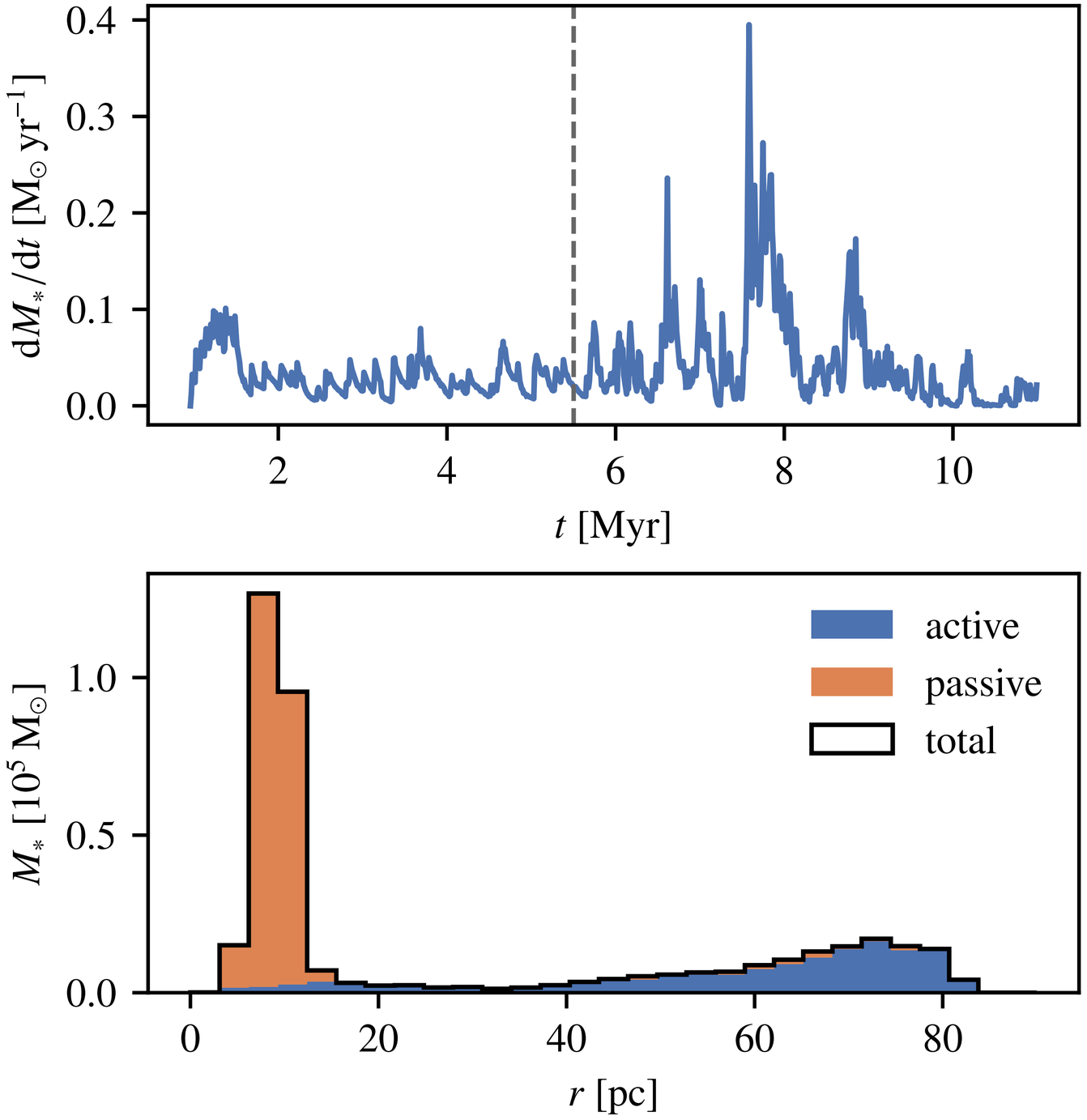

Beam (0.1")
y [pc]
x [pc]
Velocity [km/s]


Horizontal slit
v [km/s]
x [pc]
flux (normalised)


Vertical slit
v [km/s]
y [pc]
flux (normalised)


θ = 0°
θ = 15°
θ = 30°
θ = 45°
θ = 60°
θ = 75°
θ = 90°
12.0 μm
25.0 μm
700.0 μm
H2(0-0) S(3)
CO(3-2)
25
0
−25
10^0
10^−2
10^−4
10^1
10^−1
10^−3
10^−4
10^−6
10^−8
10^1
10^−1
10^−3
10^−3
10^−5
10^−7
erg cm^−2 s^−1 sr^−1
pc


30 pc
150 pc
300 pc
$v_{\rm esc}$
$v_{\rm rad}$ [km s^{-1}]
$\sigma_{\rm rad}$ [km s^{-1}]
polar angle ϕ [°]
opening angle θ [°]
dM/dt [M$_\odot$ yr^{-1}]
$\log_{10}(n_{\rm H}$ [cm^{-3}])
$\log_{10}(T$ [K])
t [Myr]
t [Myr]
t [Myr]


0.4
0.3
0.2
0.1
0.0
$\mathrm{d}M_*/\mathrm{d}t$ [$\mathrm{M}_\odot\,\mathrm{yr}^{-1}$]
2
4
6
8
10
t [Myr]
1.0
0.5
0.0
M_* [$10^5\,\mathrm{M}_\odot$]
active
passive
total
0
20
40
60
80
r [pc]