Full relativistic definition of sigma includes enthalpy

sigma, including enthalpy

$$\sigma_w = \frac{\frac{m_i}{m_e} + 1}{\underbrace{\frac{m_i}{m_e}\left(1 + \frac{\hat{\gamma}_i}{\hat{\gamma}_i - 1}\frac{k_B T_i}{m_i c^2}\right) + \left(1 + \frac{\hat{\gamma}_e}{\hat{\gamma}_e - 1}\frac{k_B T_e}{m_e c^2}\right)}} \frac{B^2}{4\pi \underbrace{(n_i m_i + n_e m_e) c^2}}$$

≈ 1 for a cold plasma

$$\approx \frac{B^2}{4\pi n_i m_i c^2} \equiv \sigma_i$$

For a high-beta (thermally 'hot') plasma, the contribution from the thermal pressure is non-negligible

One more important definition: Alfvén velocity, which describes the speed of magnetic waves

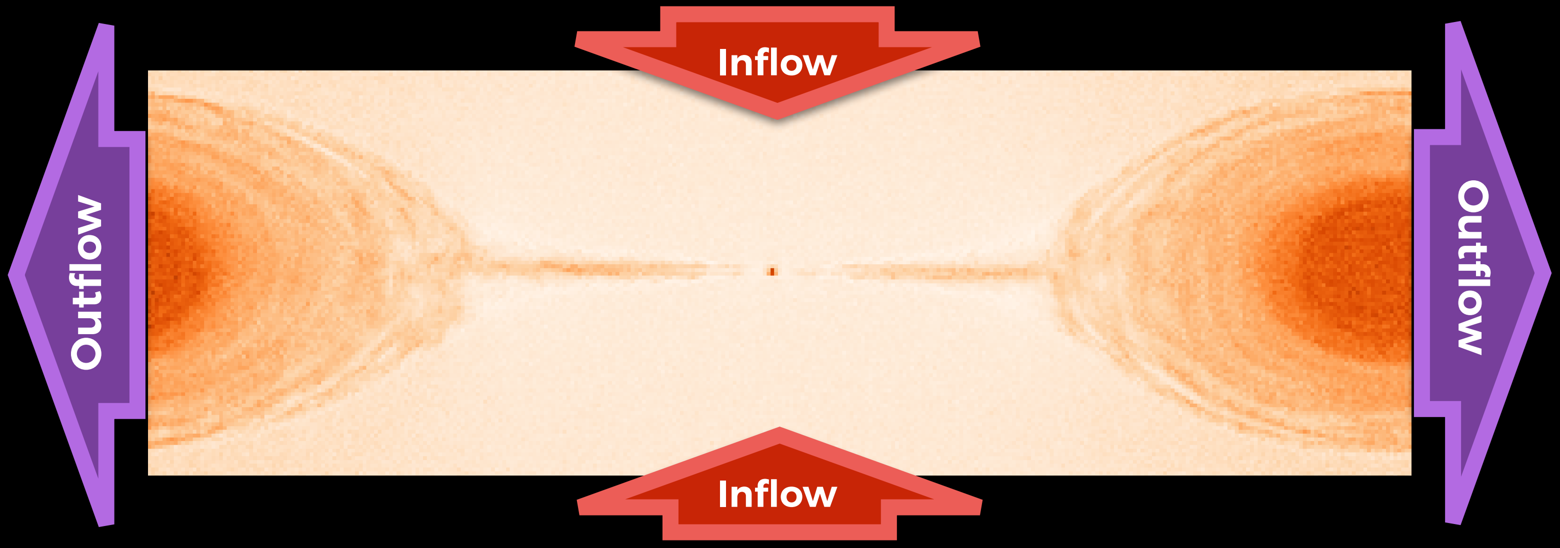
Alfvén velocity

$$\frac{v_A}{c} = \sqrt{\frac{\sigma_w}{1 + \sigma_w}}$$

Characterization of heating

A useful number we can extract from each simulation is the following dimensionless ratio:

$$M_{Te} = \frac{k_B T_{e,out} - k_B T_{e,in}}{B^2/(4\pi n)}$$



This is the ratio of increase in temperature to magnetic energy available for dissipation. It can be thought of as the 'efficiency' of reconnection.