Improving matter distribution mapping through the development of an Emission Line Finder (ELF)

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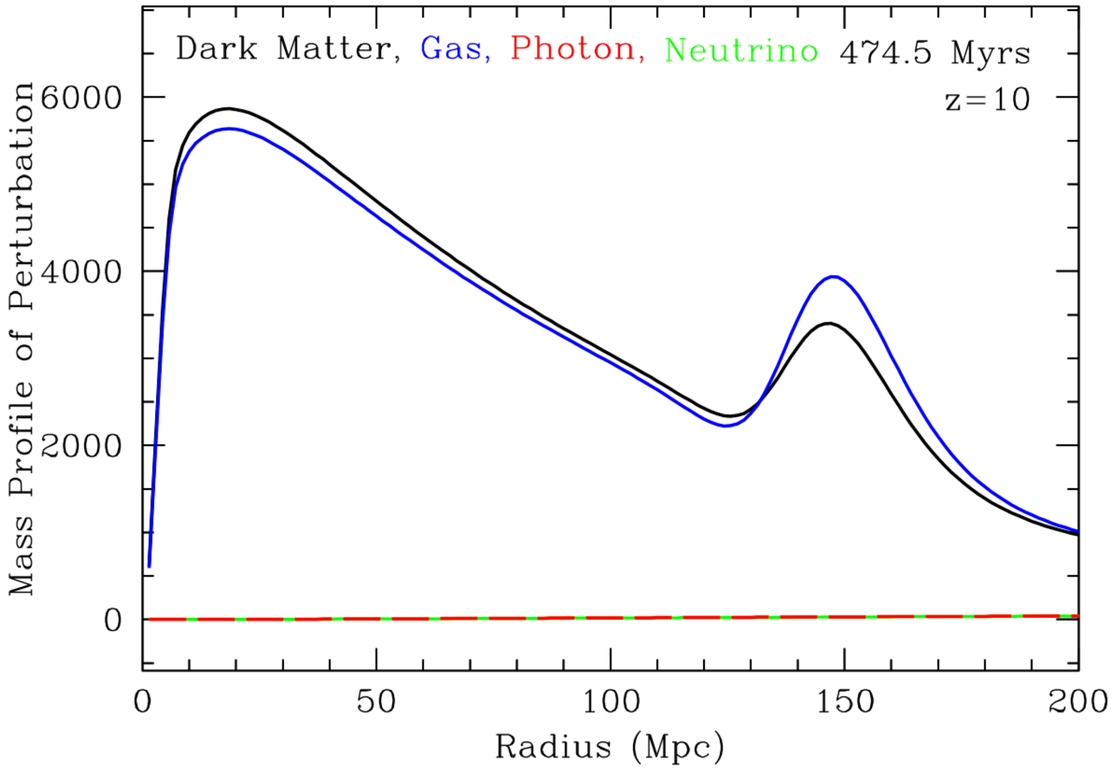
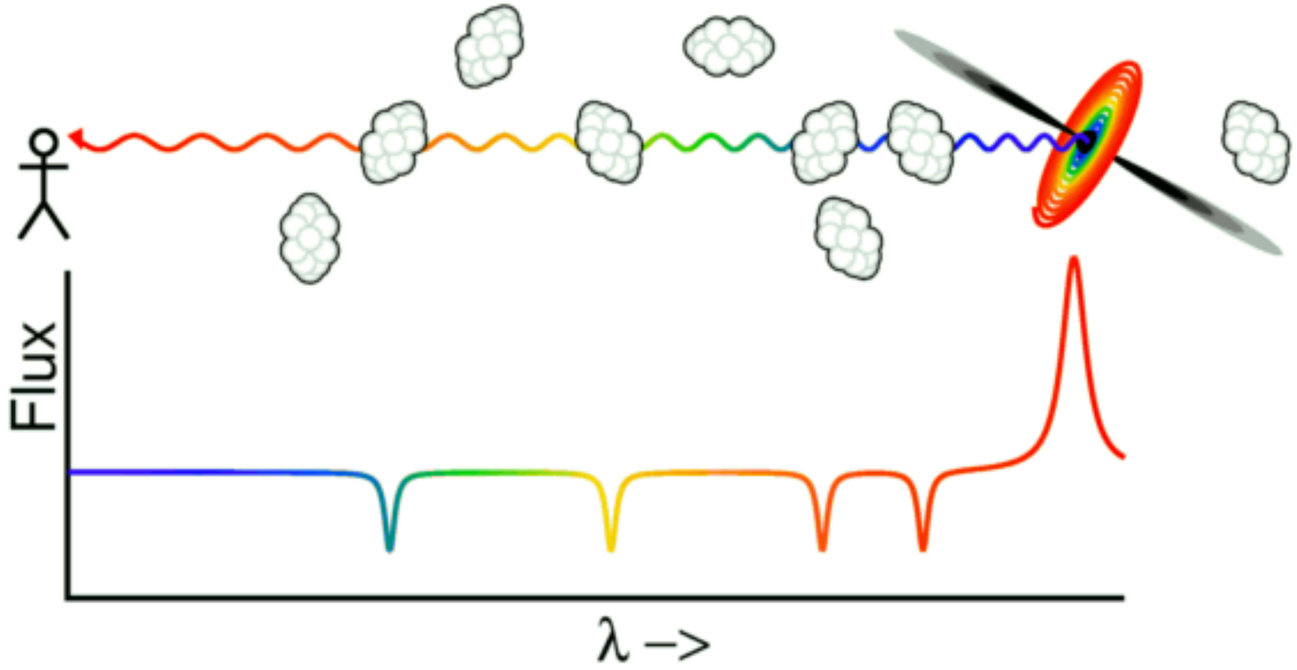
Constraints on dark energy with Lyman-α data from the eBOSS and DESI surveys

Baryon Acoustic Oscillation: imprint left in the matter density field by sound waves propagating in the primordial universe.

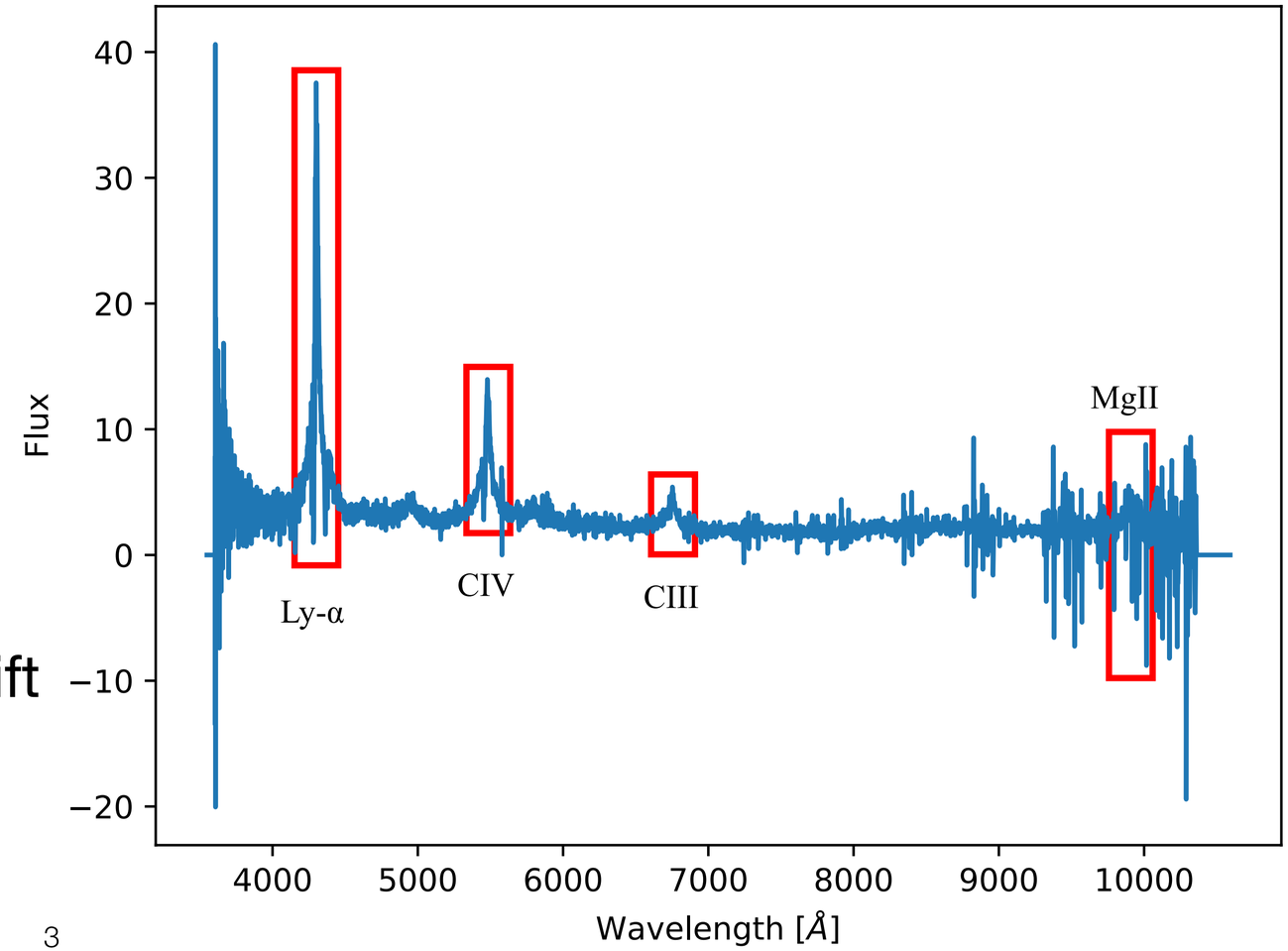




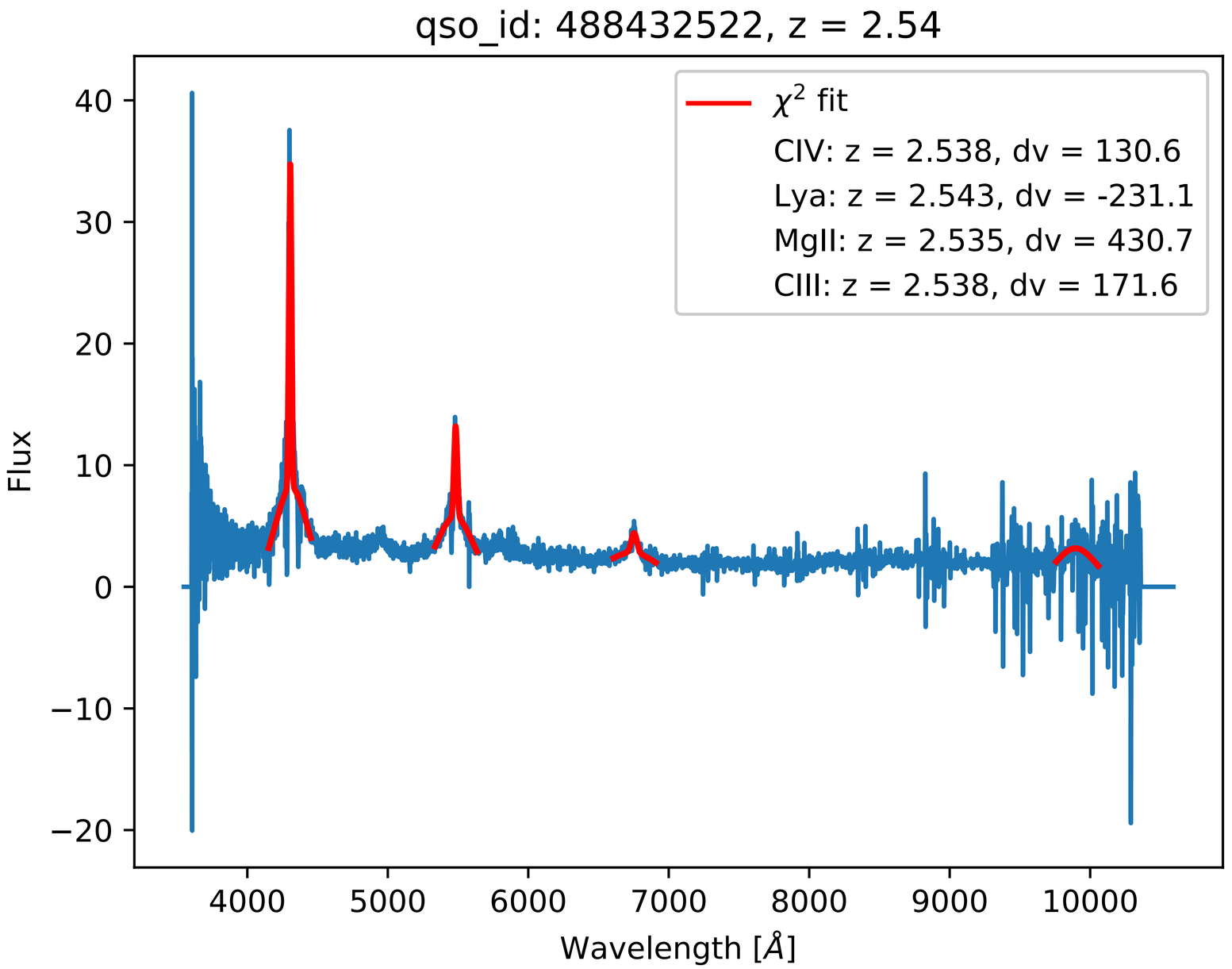
Mass tracers: Lyman-α forest

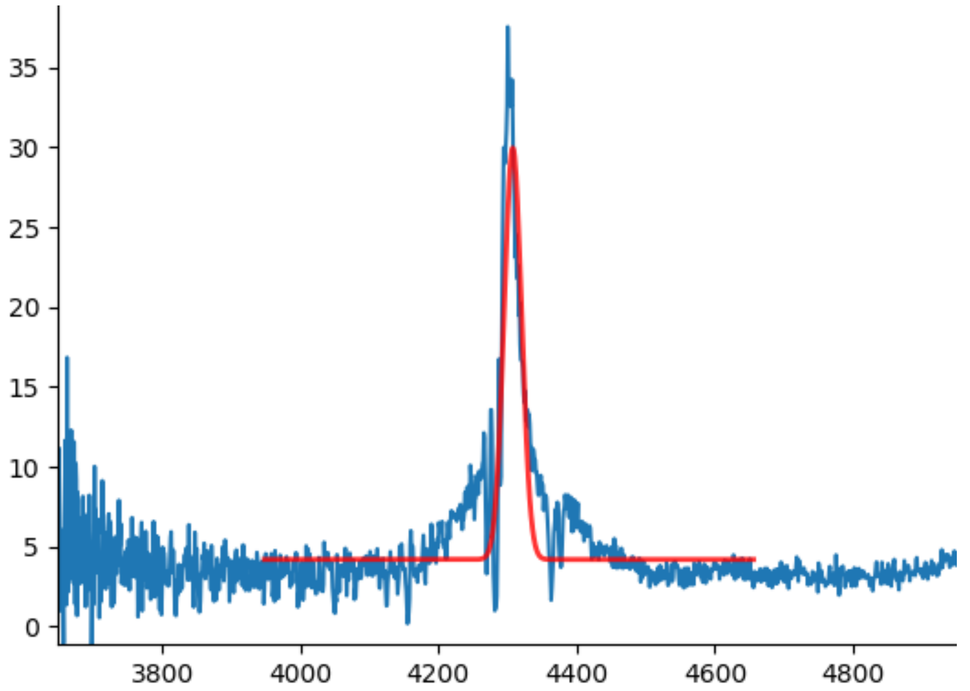
Quasar redshift determination

- Emission Line Finder on GitHub: https://github.com/jvstermer/elf
- Ly-α (1215Å), CIV (1549Å), CIII (1908Å) and MgII (2799Å)
- Position of lines in LF from survey catalog
- 85Å around line peaks for fitting procedure
- Model each line with 2 gaussians
- Minimize χ^2
- Maximum of combined gaussians -> redshift



Basic χ^2 fit

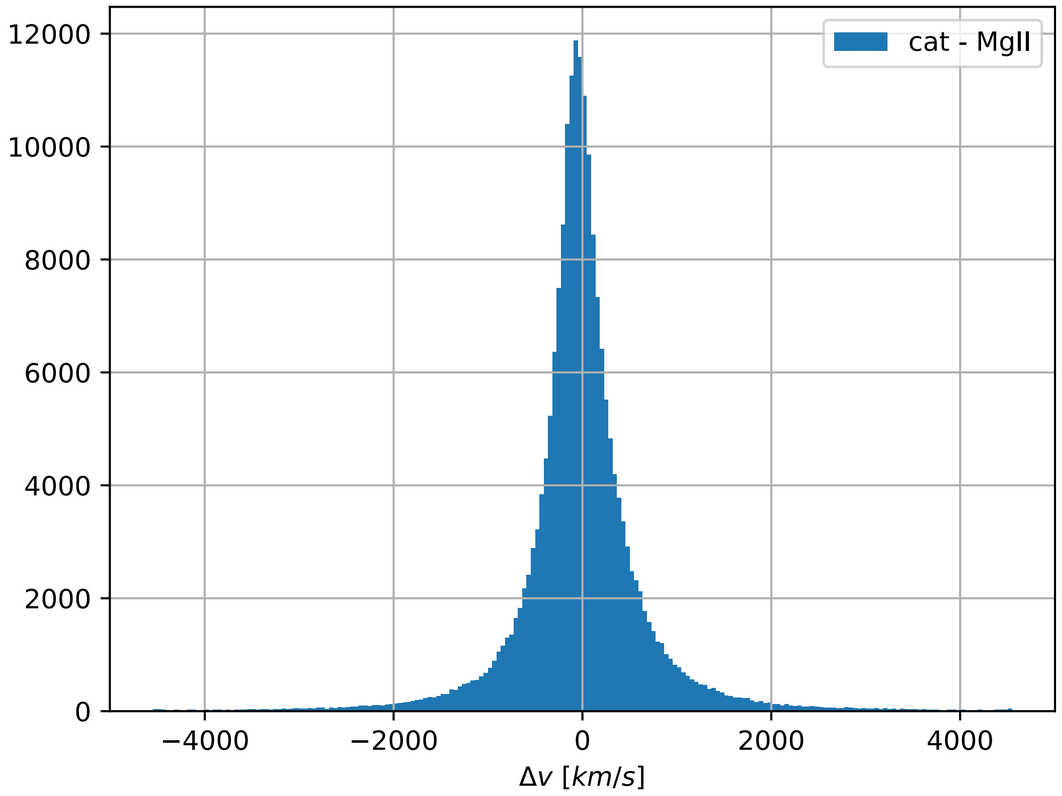




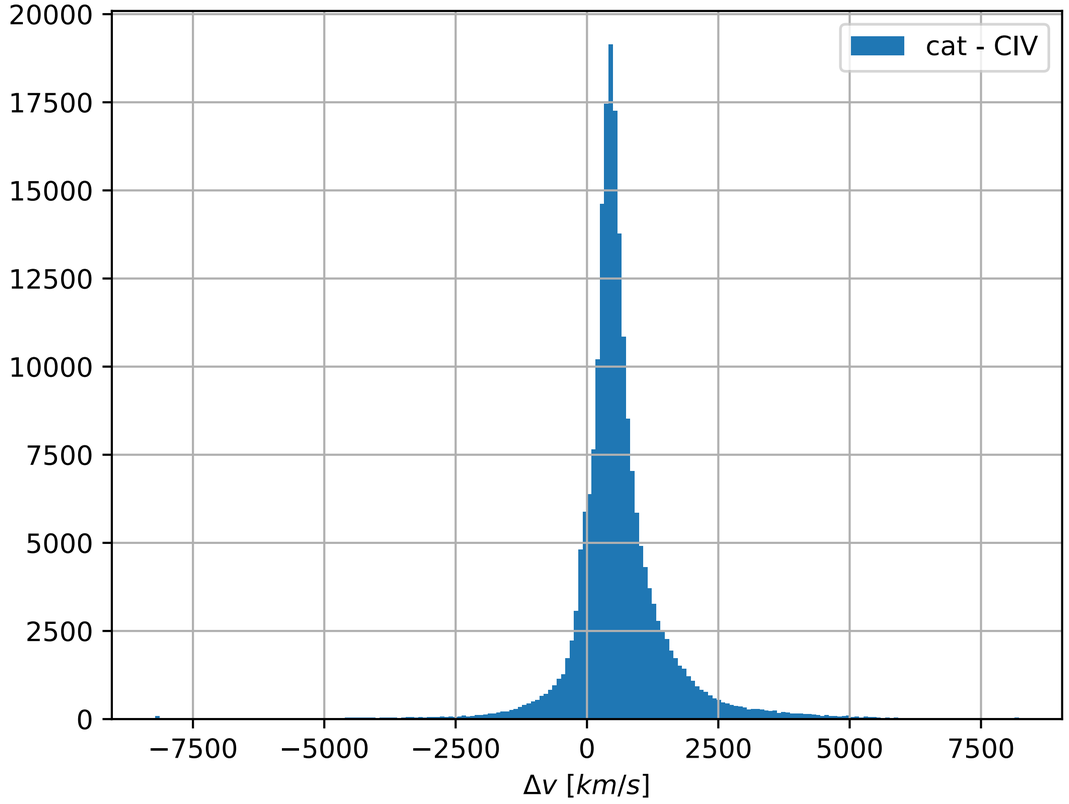
Quality of fit

The **quality of redshift characterization** is determined by the distribution of the **velocity difference** between catalog and fit as: $\Delta v = \frac{z_{cat} - z_{fit}}{1 + z_{fit}} \times c$

MgII: Velocity distribution is centered at zero and symmetrical



CIV: Distribution is neither centered at zero nor symmetrical



Efficiency

Fitter efficiency by calculating two quantities: **completeness** and **purity**.

<u>Conditions</u>

- Quality flag z_{warn} <- comparing fit to data average

$$Positive : z_{warn} = 0$$

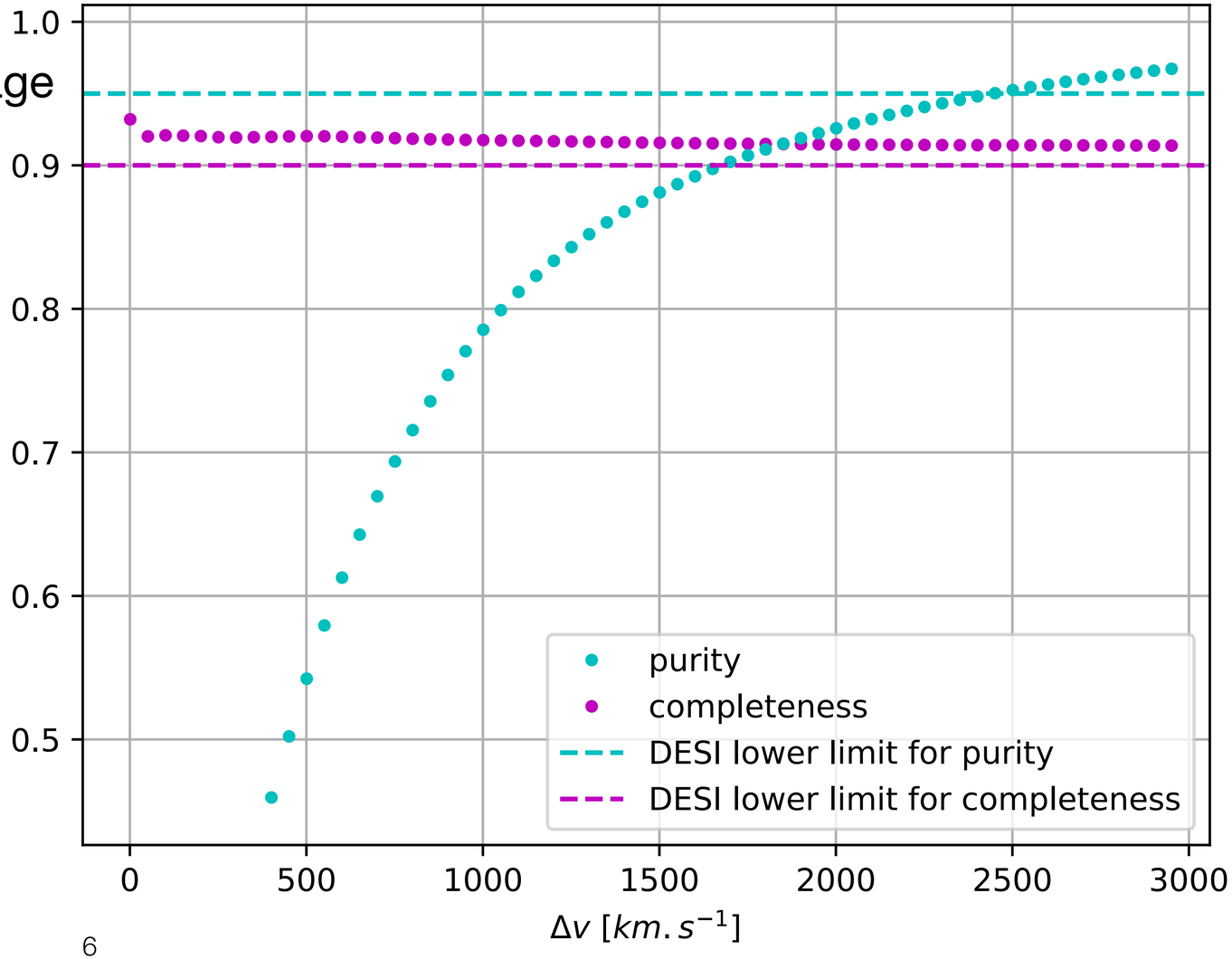
- Upper bound for redshift acceptance

$$True : \Delta v < 1000\ km\,.\,s^{-1}$$

<u>Assessment variables</u>

- N_p : number of Positive events
- N_t : number of True events
- N_{tp} : number of True & Positive events

<u>Calculation</u> $Completeness = \frac{N_{tp}}{N_t}$ $Purity = \frac{N_{tp}}{N_p}$



Future Plans

- Dedicated incorporation of BAL effects

    1. Implementation of likelihood function that gives more weight to upwards fluctuations in spectra than downwards.

    2. Identification and masking of BAL pixels.

- Refine conditions for quality flags in efficiency calculations

- Optimize window selection to improve signal-to-noise ratio