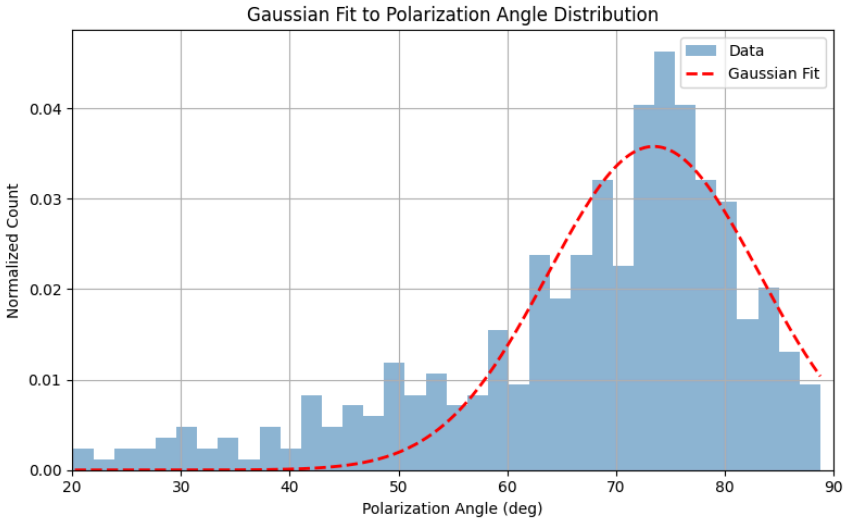
Calculating B-field strength

$$B_{\mathrm{POS}} = 9.3\sqrt{n(\mathrm{H}_2)}\frac{\Delta V}{\sigma_\theta}$$

$n(\mathrm{H}_2)$: volume density [cm-3]
ΔV: FWHM non-thermal gas velocity dispersion [km/s]
σ_θ: polarization angle dispersion [deg]
B_{POS}: Mangetic field strength in plane of the sky [μG]

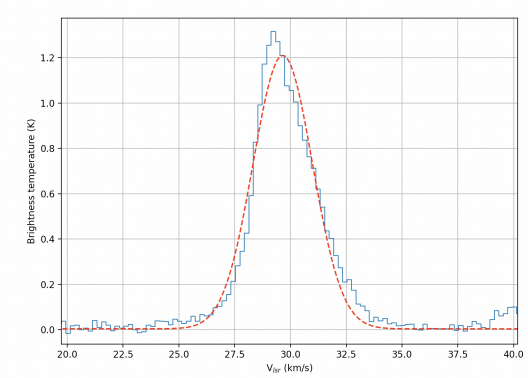
a. Calculate polarization angle dispersion



b. Calculate volume density:

The width of the filament: W = 1pc
The mean column density: $N(H_2) = 2 \times 10^{22}$ (cm^{-2})
We assume that the filament has a cylindrical shape so that the depth of the filament is equal to its width. $n(H_2) = N(H_2)/W$

c. Calculate velocity dispersion using this figure



d. Now, you can calculate mean Bfield strength of the region

Plotting B-field Orientation

1. **Important information of the FITS file**

   How many extensions (layers) does the FITS file contain?

   What is the meaning and notation of each extension?

   What is the meaning of the FITS header?

2. **Plot maps of I, Q, U, …**

3. **Calculate PI (polarization intensity), P (polarization degree) and their uncertainty**

   Polarized Intensity (PI)

   $$\mathrm{PI} = \sqrt{Q^2 + U^2}$$

   Uncertainty in Polarized Intensity (σ_{PI})

   $$\sigma_{\mathrm{PI}} = \sqrt{\frac{\sigma_Q^2 \cdot Q^2 + \sigma_U^2 \cdot U^2}{Q^2 + U^2}}$$

   Polarization Degree (%) (P)

   $$P = 100 \times \frac{\mathrm{PI}}{I}$$

   Uncertainty in Polarization Degree (%) (σ_P)

   $$\sigma_P = 100 \times \sqrt{\frac{\sigma_{\mathrm{PI}}^2}{I^2} + \frac{\mathrm{PI}^2 \cdot \sigma_I^2}{I^4}}$$

4. **Plot B-field orientation**