wprojection

Algorithm & implementation

Usual Equation

$$V(u,v,w)=\int \frac{I(l,m)}{\sqrt{1-l^2-m^2}} e^{-2\pi i\ [ul\ +vm\ +w(\sqrt{1-l^{\ 2}-m^{\ 2}}-1)]}\, dldm$$

$$V(u,v,w)=\int \frac{I(l,m)}{\sqrt{1-l^2-m^2}} G(l,m,w)\, e^{-2\pi i\ [ul\ +vm\ ]}\, dldm$$

where

$$G(l,m,w)=e^{-2\pi i\ [w(\sqrt{1-l^{\ 2}-m^{\ 2}}-1)]}$$

Usual equation - different view

- Or using convolution theorem

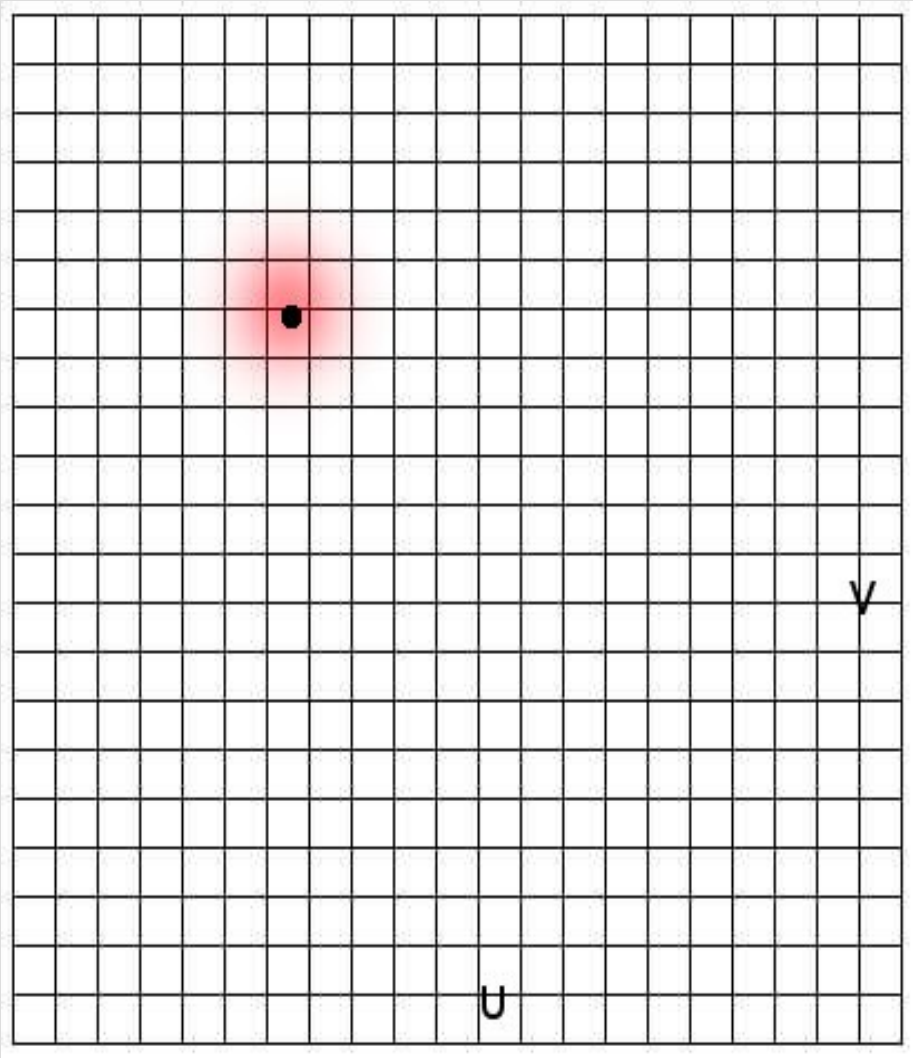
$$V(u,v,w) = V(u,v,0) * \widetilde{G}(u,v,w)$$

$$\widetilde{G}(u,v.w) = FT(G(l,m,w))$$

Griding-Convolution

- We use FFT and we resample (grid/degrid) the visibilities in the process of making images or predicting the visibilities.
- Usually use spheroidal function to reduce aliasing due to sampling on the grid
- Effectively doing/undoing a convolution to/from the grid

griding revisited



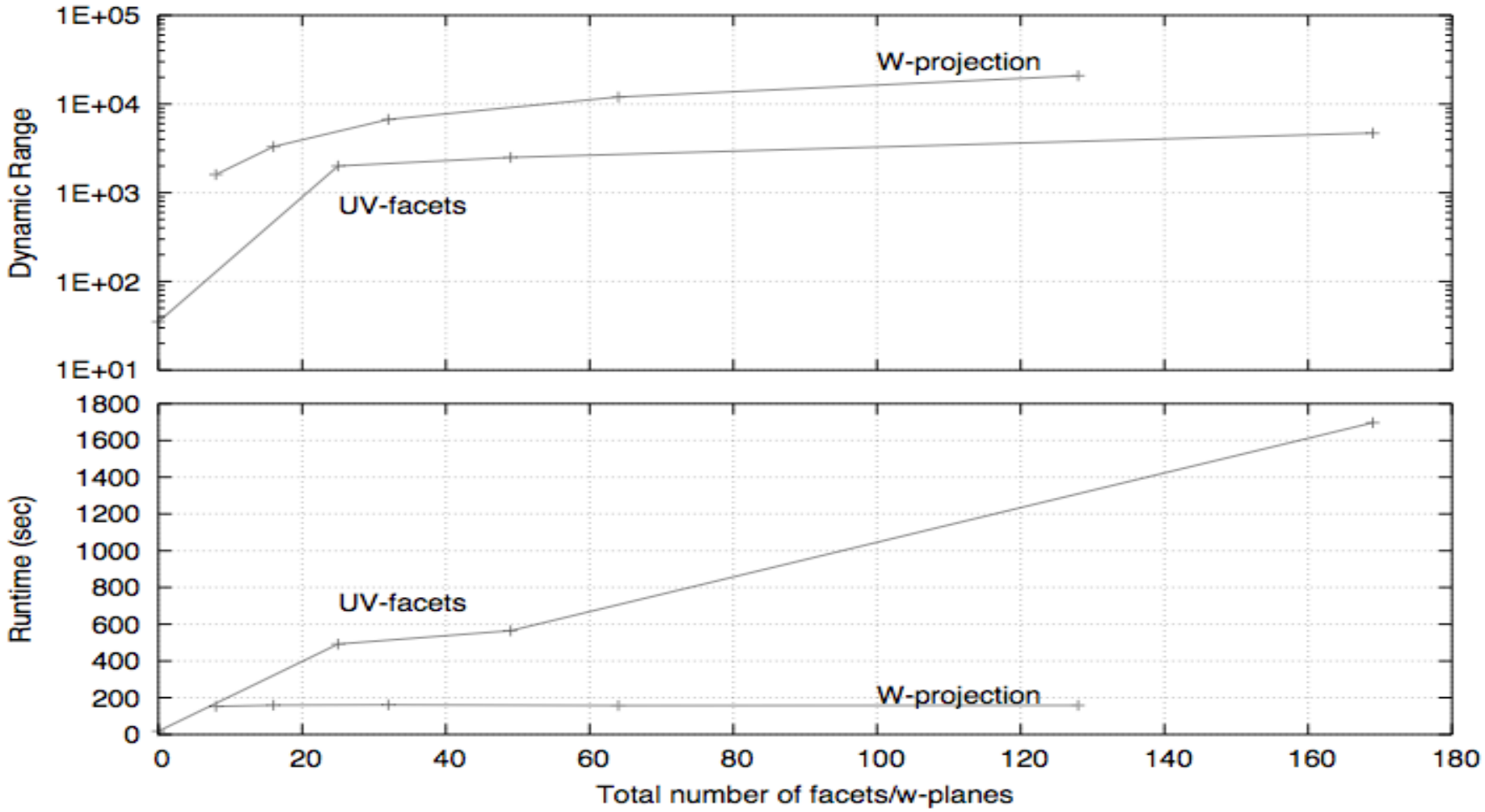
- V(u,v,w) – locate u,v
- Use w to get right $\tilde{G}(u,v,w$
- Use this along with spheroidal function to grid and degrid
- Note each u,v,w sample need its own

$$\tilde{G}(u,v,w)$$

Implementation in AIPS++

- User specify number of planes
- Determine range of w
- Steps in $\sqrt{w}$ (empirically found)
- Calculate a cube of $G(l,m,w)$ with w as 3rd axis
- FT it and keep it in memory (one time computing cost)

Performance



Example on real data