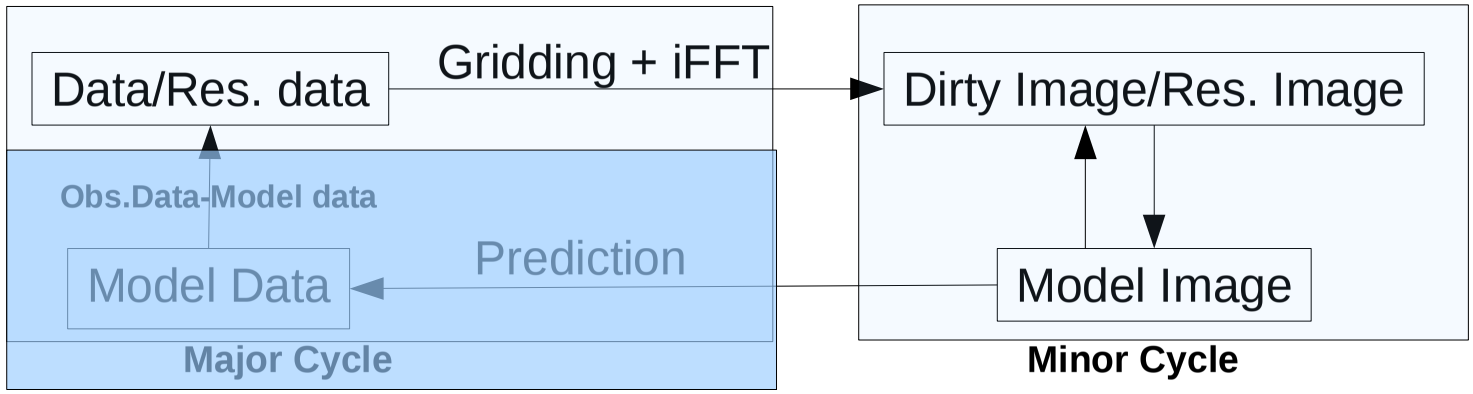
Hogbom Clean

- Purely image plane deconvolution
- Does not iterate between data and image domain



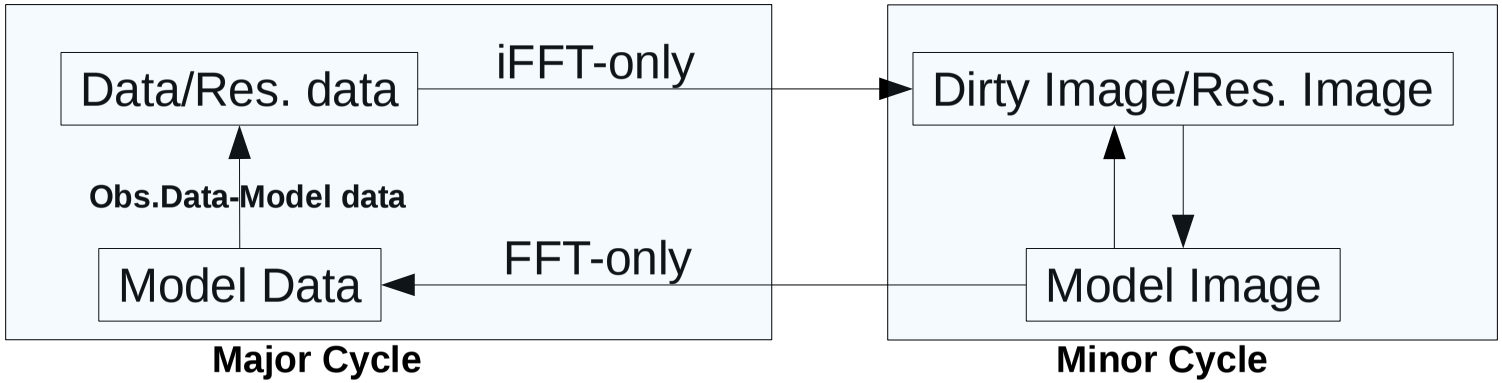
- Uses full PSF to compute residuals in the image domain
- Fastest but least accurate (not useful with modern telescopes)

$$I_i^M = I_{i-1}^M + \alpha\, max(I_i^{Res}); \qquad I_i^{Res} = I^d - \alpha I_i^M$$

- Typically constitutes the Minor Cycle of modern algorithms

Clark Clean

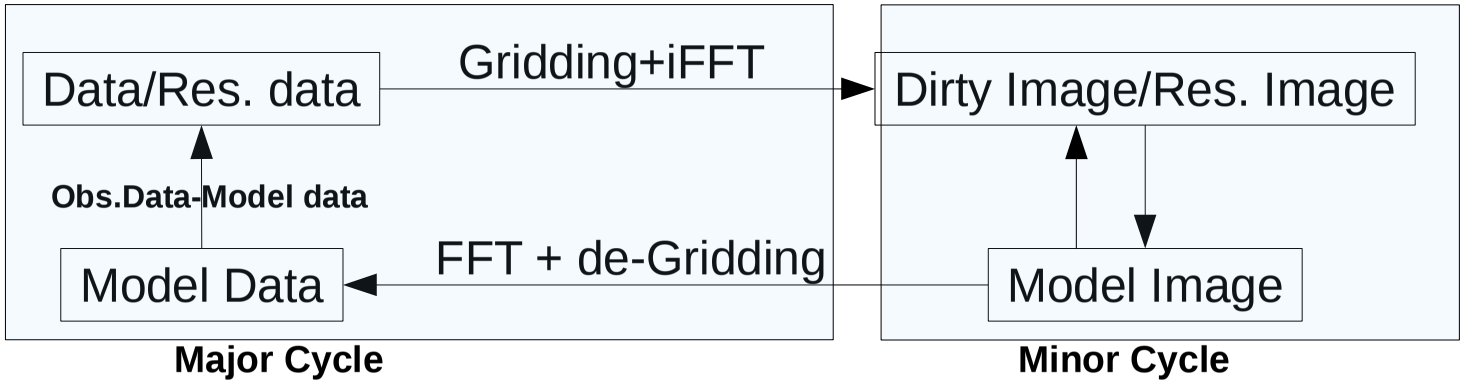
- Compute residual on a grid
  - No Gridding and de-Gridding during major-cycle iterations



- Hogbom Clean-style minor cycle: Uses a truncated PSF
  - Stopping criteria determined by the highest PSF sidelobe and "cyclefactor"
  - Beware of slower convergence with "bad PSFs" (e,g. ALMA 7-antenna)
- More accurate than Hogbom Clean, but not good enough for modern telescopes
- Sometimes used to reduce the number of expensive major cycles

CS Clean

- Compute residual using original data
  - Needs Gridding and de-Gridding during major-cycle iterations



- Most commonly used algorithm
- Every major cycle access the entire data base
  - Significant increase in I/O and computing load
- Assumes, co-planar, time- and freq-independent Measurement Equation
- Cannot account for wide-field wide-band and time variability issues

Major-Minor Cycles

- Minor cycle is usually all in the image domain
  - Always with gridded data (Images or gridded visibilities)
  - The Model Image update step – determines the “Clean Components”
  - The “location cycle”
- Major Cycle computes the residuals in the visibility domain
  - Clark Clean: Uses gridded visibilities
  - CS-Clean: Uses the visibility database
    - Computing cost: gridding and de-gridding + 2FFT
    - I/O cost: full data access per major cycle
- User control on the number of major and minor cycles
  - Minor cycle ends when threshold or max. iterations (“niter”) is achieved
  - A major cycle is triggered if the max. residual > cf*(max. PSF sidelobe)
    - The “cyclefactor” is a user parameter to trigger more or less major cycles
    - Direct control on number of major cycles via interactive mode

MS Clean

- A Minor Cycle algorithm
- Models the sky as a collection of “blobs” (think of tapered Gaussians)
  - More expensive than scale-less algorithms (Hogbom, Clark), but more accurate for extended emission
- Major cycles used, typically in the CS-Clean way
  - DFT prediction possible
- Most commonly used when deconvolution of extended emission is important
  - Also for high dynamic range imaging in the presence of strong compact sources
- Can be combined with major cycle algorithms to account for PB effects, non co-planar arrays (A-, W-, AW-Projection)
- Memory footprint an issue for very large images

Multi-term Clean

- Minor cycle algorithm to account for frequency dependence
- Models the sky as a collection of components whose amplitude follow a polynomial (in frequency for MFS)
  - Computing load scales linearly with number of terms
  - Memory footprint scales linearly with number of terms
- Most accurate where wide-band time-invariant ME is appropriate
- MS-MFS: Uses MS-Clean for each term of the polynomial expansion
  - Computing load and memory footprint scales as $N^2_{terms} * N^2_{scales}$
- Can use any of the major cycle algorithms to account for time variability, non co-planar issues (A-, W-, AW-Projection)
- Minor cycle can be as expensive as major cycles
- Memory footprint a bottleneck for large images