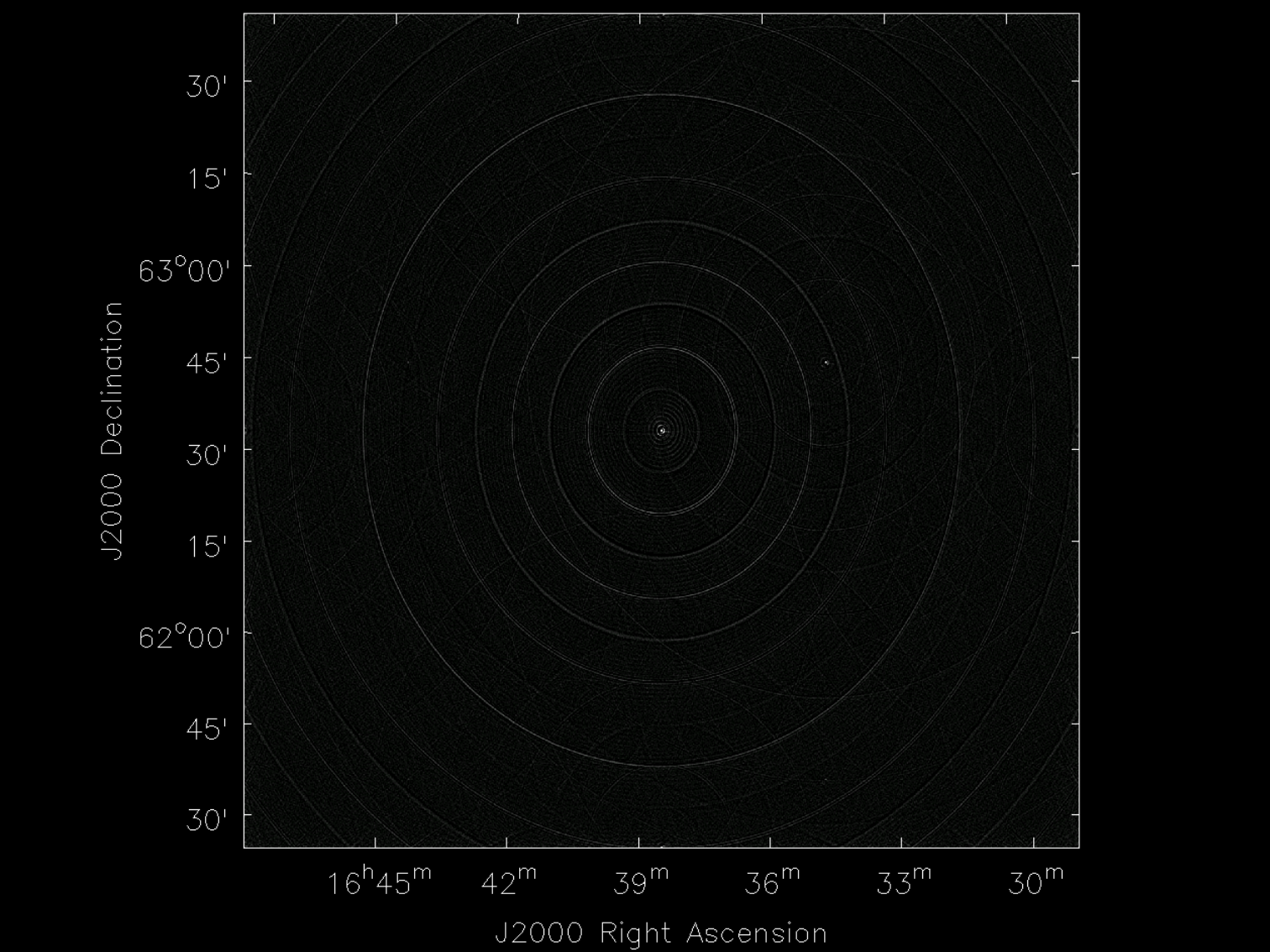
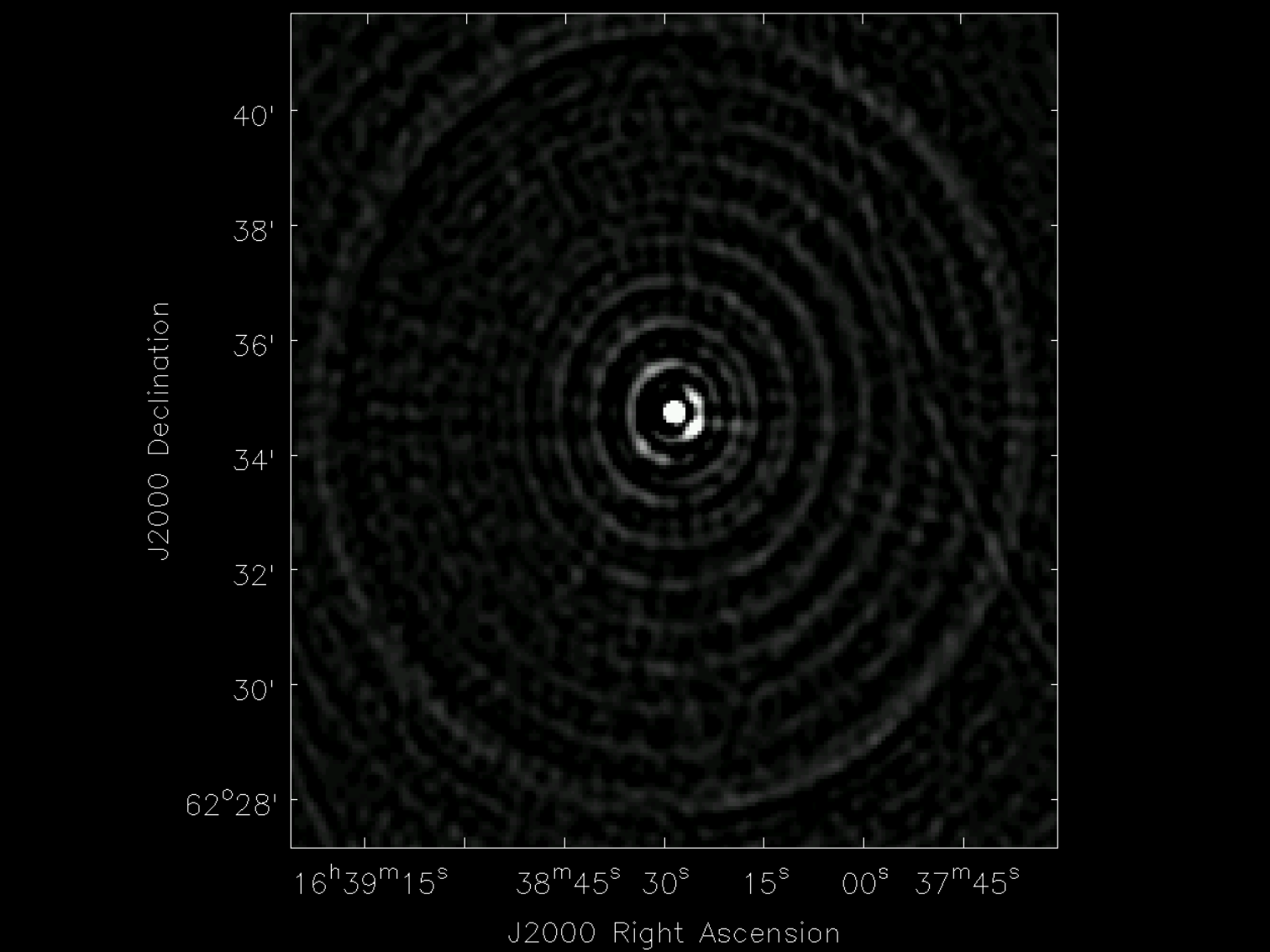
Operation 343

Simple dataset

- WSRT dataset
- 20 MHz around 1175 MHz
- Bright (6 Jy) pointsource at phase centre (3C 343.1)
- Bright (1.8 Jy apparent) pointsource at flank of beam (3C 343)
- Thermal noise level in single channel: 0.3 mJy/beam


30'
15'
63°00'
45'
30'
15'
62°00'
45'
30'
J2000 Declination
16h45m
42m
39m
36m
33m
30m
J2000 Right Ascension


40'
38'
36'
34'
32'
30'
62°28'
J2000 Declination
16h39m15s
38m45s
30s
15s
00s
37m45s
J2000 Right Ascension

Reduction procedure - preprocessing

- Coarse flagging (Aips++ autoflag tool)
- Flagged on time- and frequency median filter on abs XY and YX
- Bandpass, gain, pol.leakage calibration using 3C 295 (Aips++)

Reduction procedure - selfcal

- Polynomial source flux fit in uvplane on preprocessed data (MEQ)
- Fit for one phase for full FOV (30s) (MEQ)
- Flux fit (full domain) (MEQ)
- Flagging on amplitude of residuals (Aips++)
- Phase fit (30s)(MEQ)
- Gain fit (15 min, linear polynomial in time)(MEQ): both sources independently

Measurement Equation

$$\tilde{\mathrm{V}}_{ij} = \mathrm{G}_i \left(\sum_k \mathrm{J}_{ik} K_{ik} \mathrm{E}_{ijk} K^*_{jk} \mathrm{J}^\dagger_{jk} \right) \mathrm{G}^\dagger_j \tag{1}$$

For every station and source we first evaluate

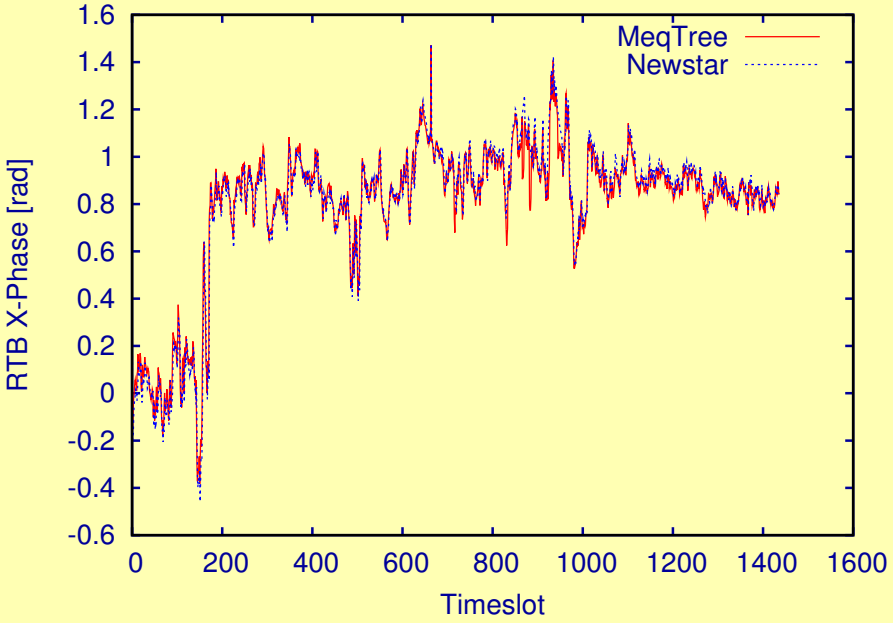
$$\mathrm{T}_{ik} = \mathrm{G}_i \mathrm{J}_{ik} K_{ik} \tag{2}$$

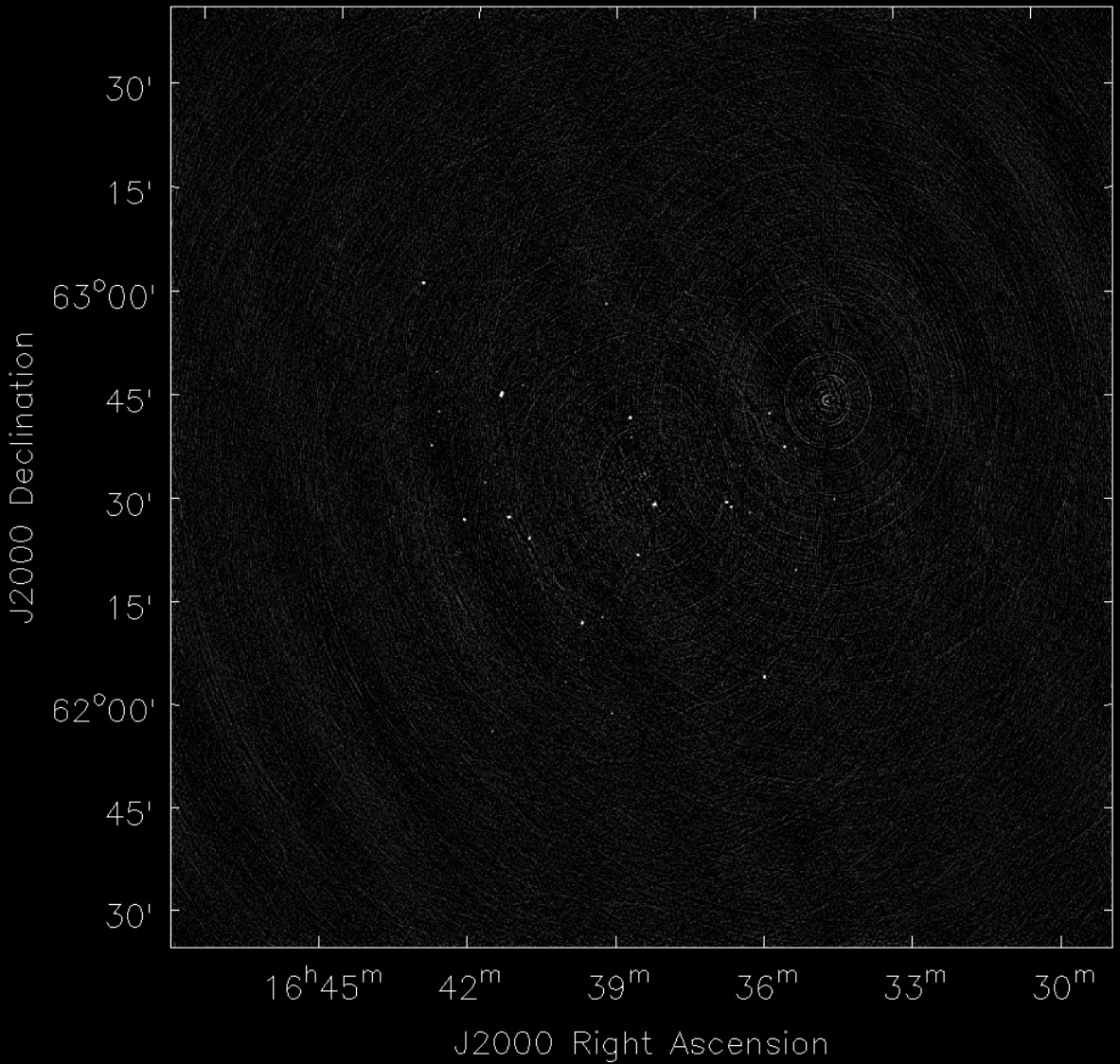
Which is then combined:

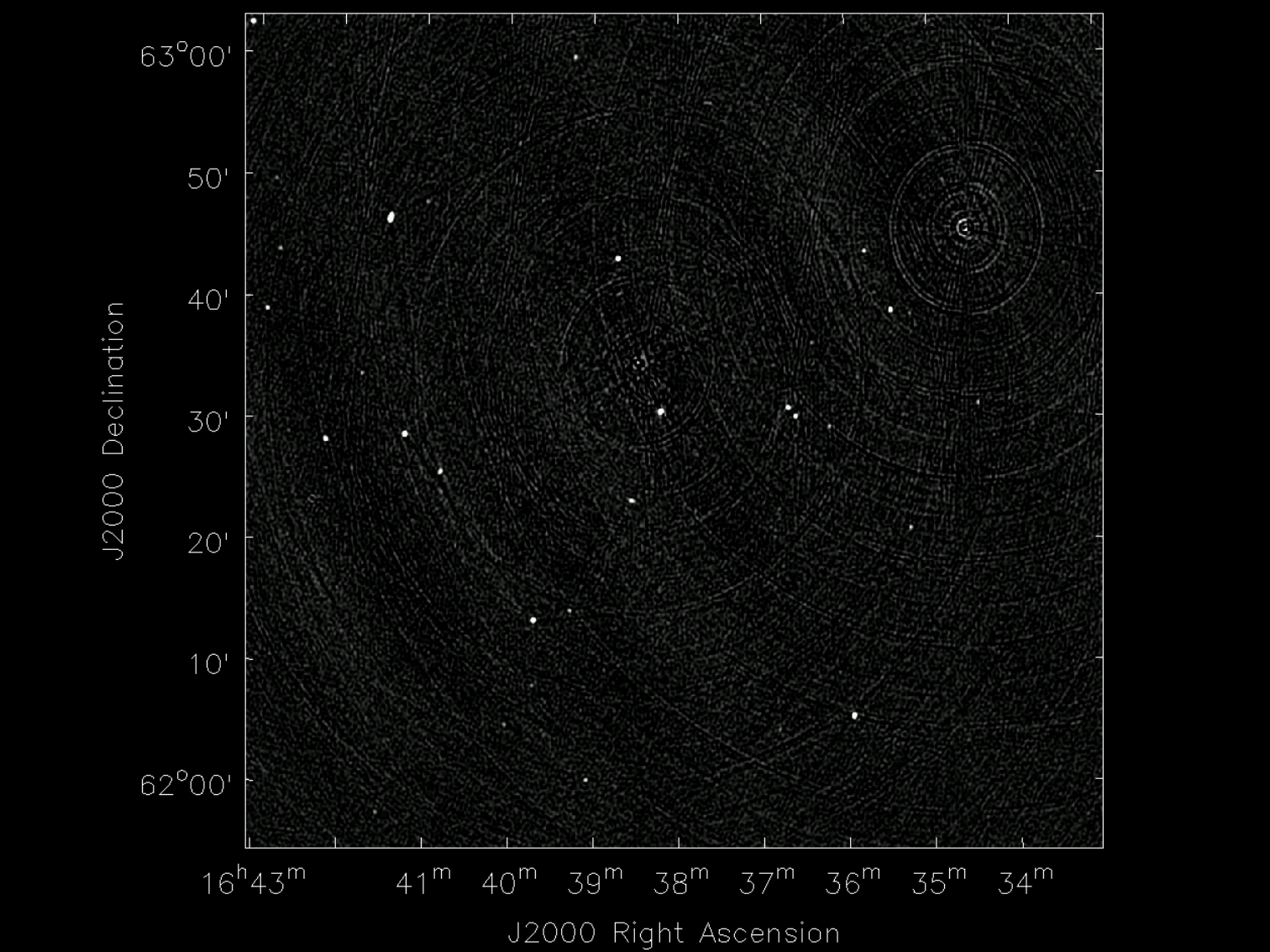
$$\tilde{\mathrm{V}}_{ij} = \sum_k \mathrm{T}_{ik} \mathrm{E}_{ijk} \mathrm{T}^\dagger_{jk} \tag{3}$$

- $\mathcal{O}(N)$ cos / sin instead of $\mathcal{O}(N^2)$, with N stations

Phase solution comparison




30'
15'
63°00'
45'
30'
15'
62°00'
45'
30'
J2000 Declination
16h45m
42m
39m
36m
33m
30m
J2000 Right Ascension


63°00'
50'
40'
30'
20'
10'
62°00'
J2000 Declination
16h43m
41m
40m
39m
38m
37m
36m
35m
34m
J2000 Right Ascension

Properties of image

- 6 channels
- thermal noise: 0.12 mJy/beam, max DR≈ 50 000:1
- actual map noise: 0.4 mJy/beam, DR ≈ 15 000:1

Conclusions

- IT WORKS !!!
- Ability to modify ME easily in MeqTree system is very powerful
- For large domains, MeqTree is about twice as fast as Newstar
- For domains smaller than about 600 datapoints, overhead dominates run-time currently in our unoptimized system