Calibrations for radio interferometric data

Shih-Ping Lai

- NO calibrations
  - → NO meaningful scientific data

- NO calibrations
  → NO meaningful scientific data

- ALMA will provide fully calibrated visibilities!!

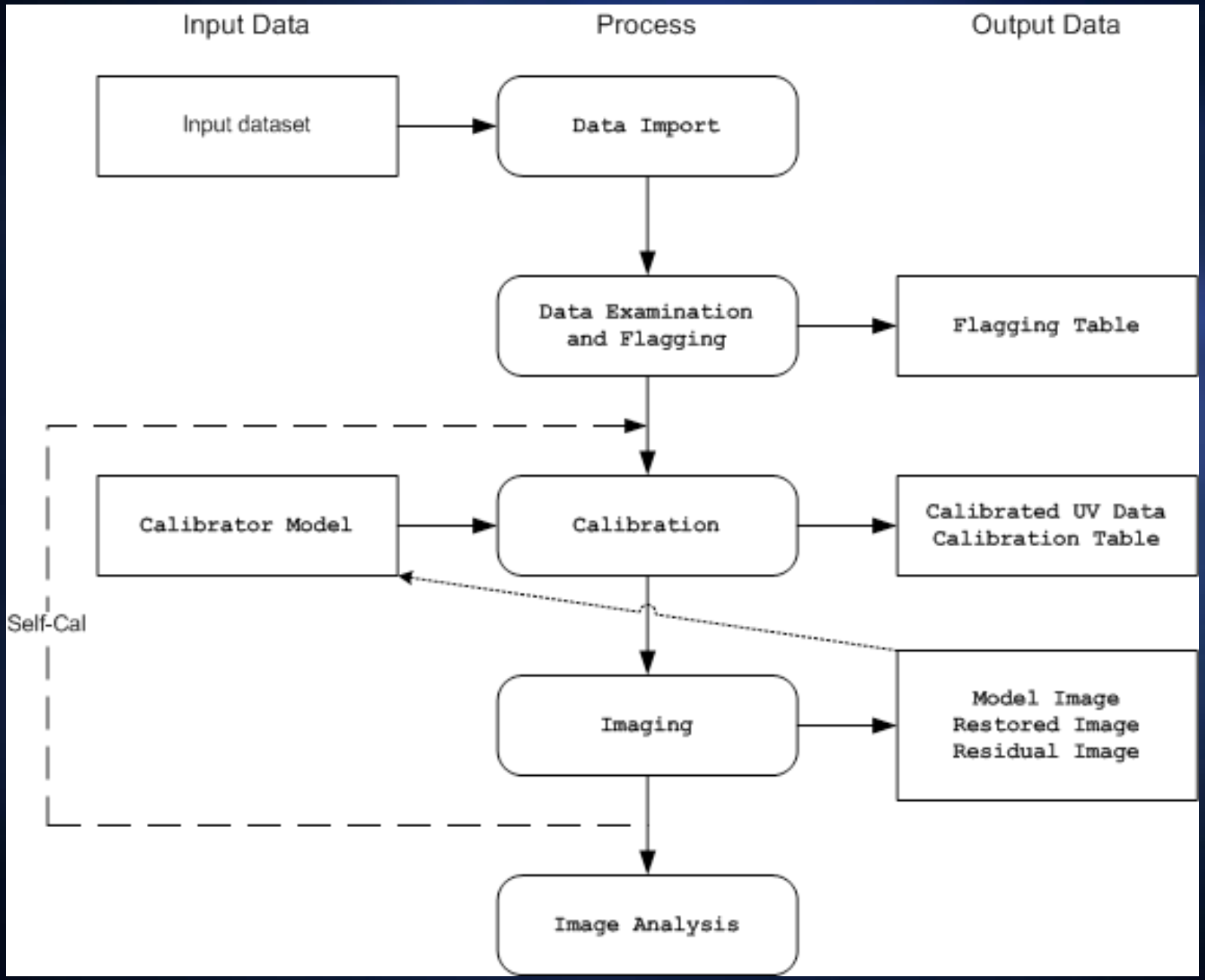
Input Data
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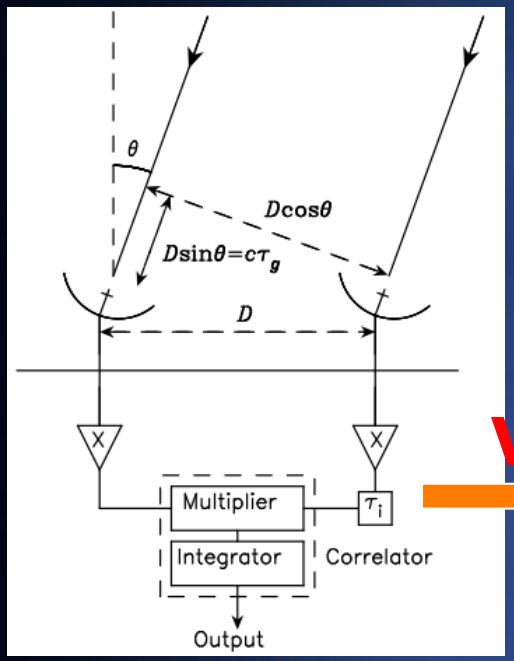
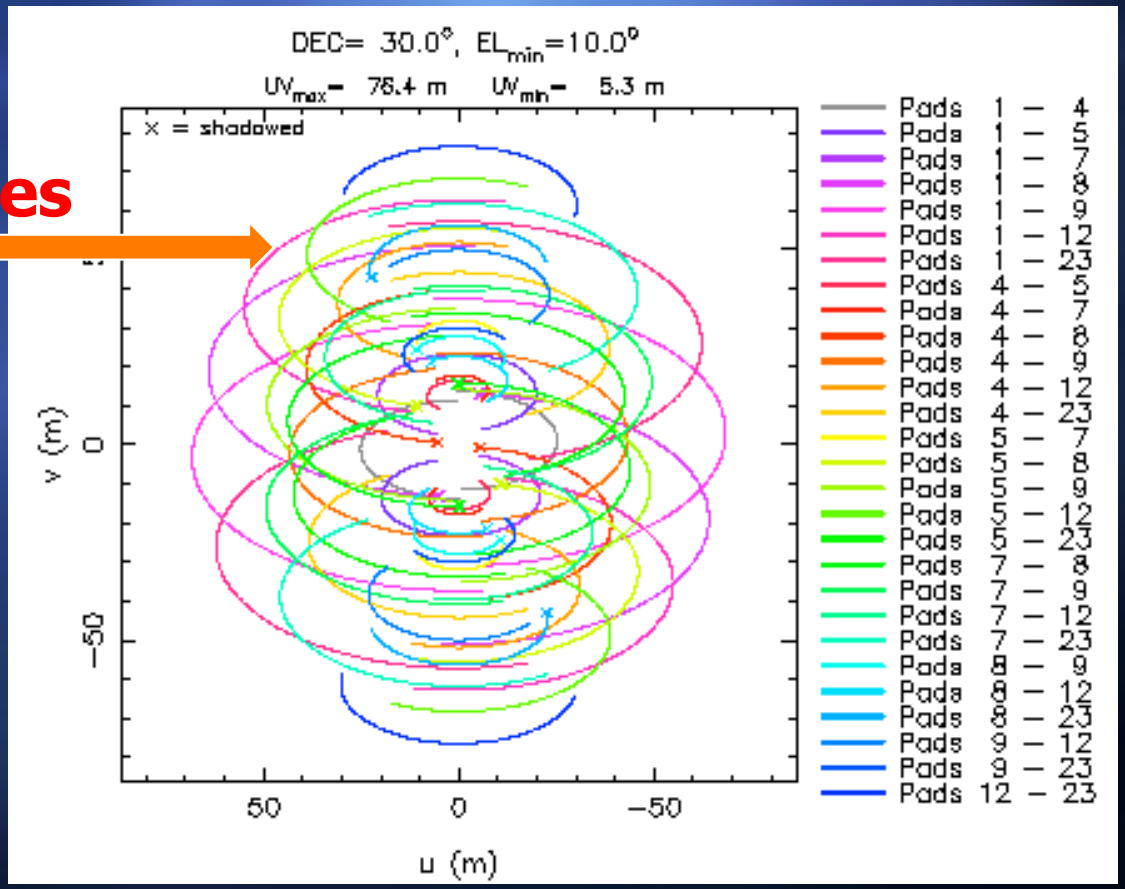
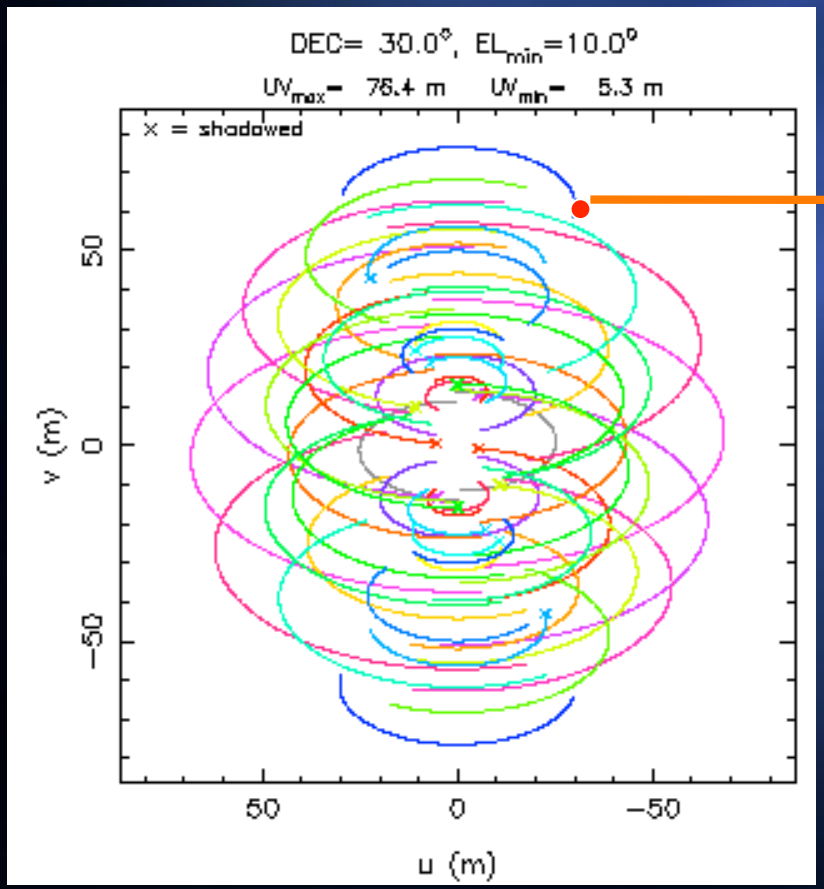
Image Analysis

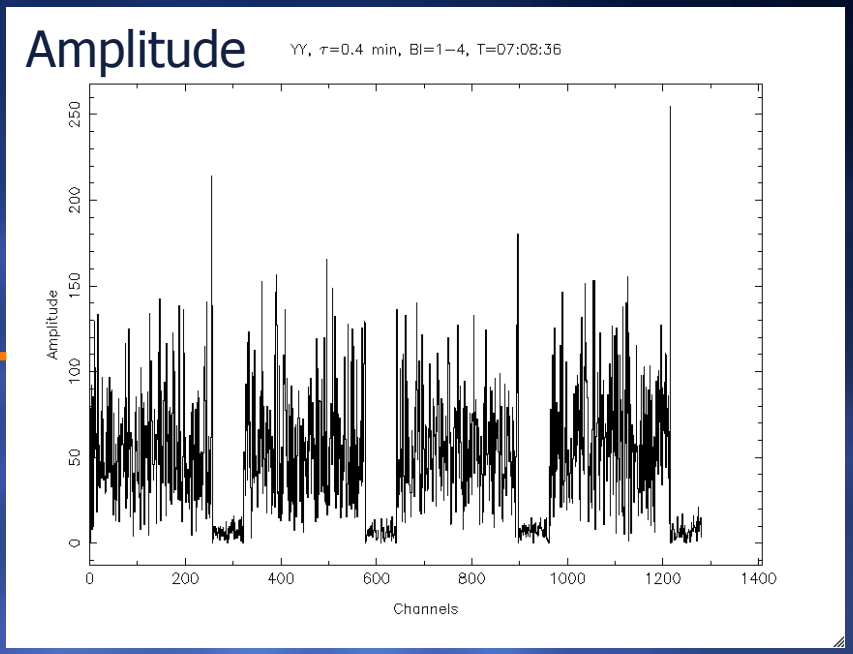


Visibilities

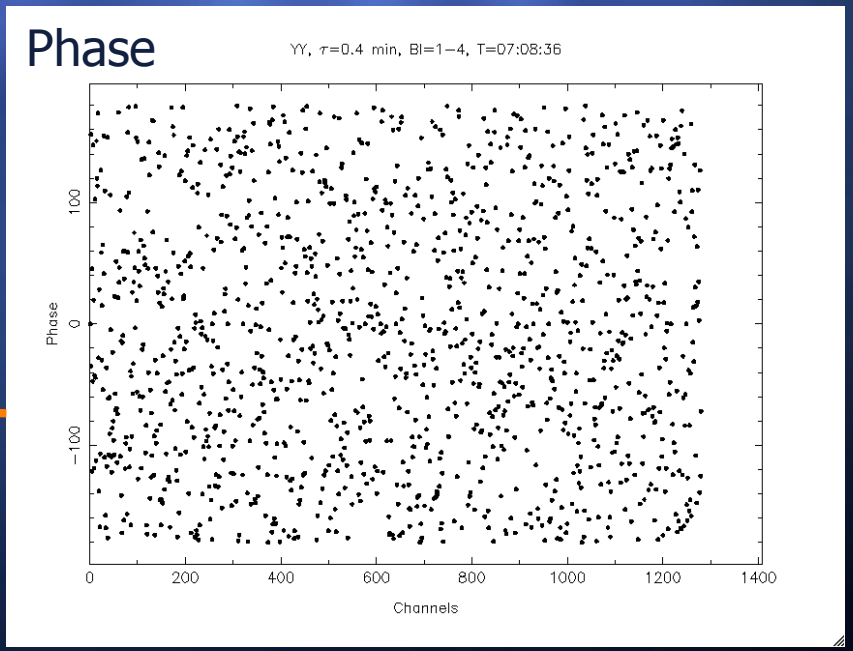




Amplitude

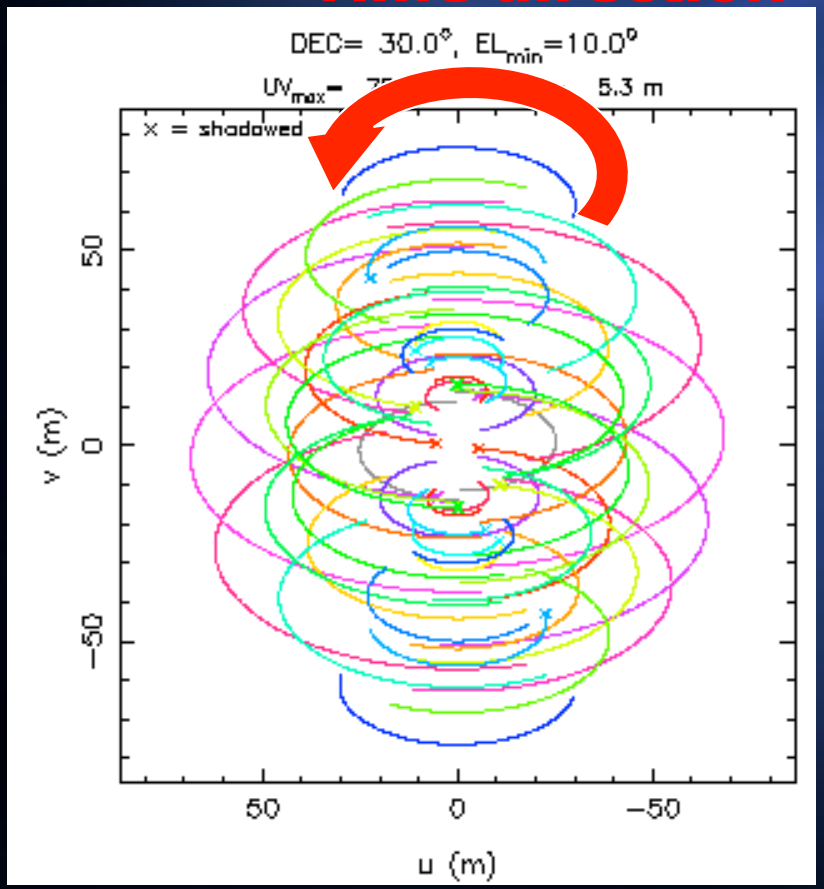


Phase

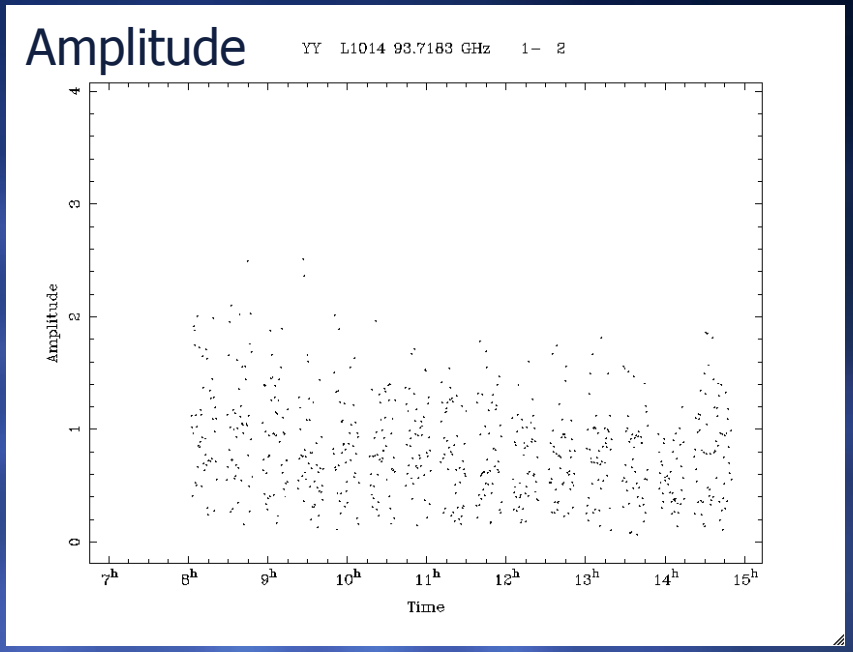


Channels = frequency bins

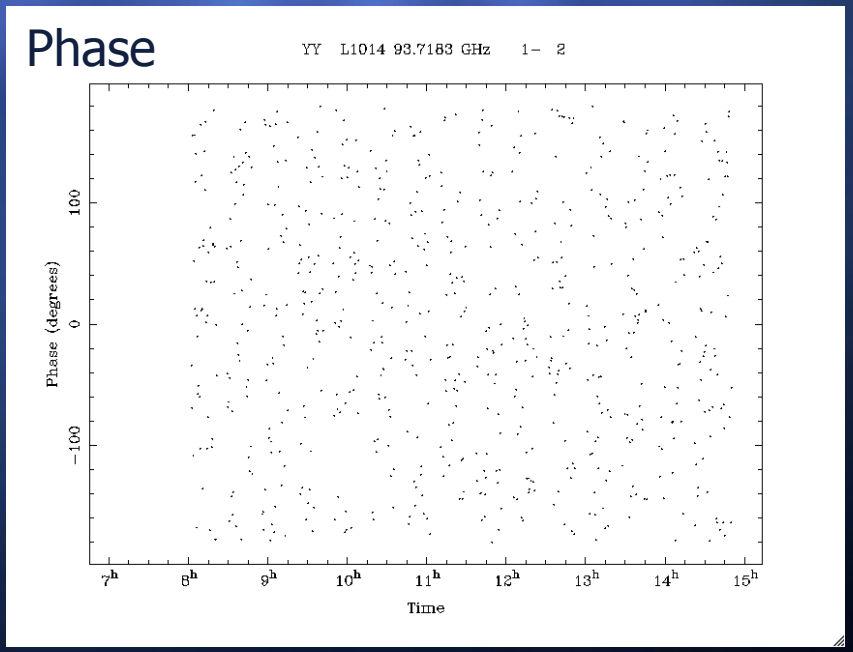
Time direction



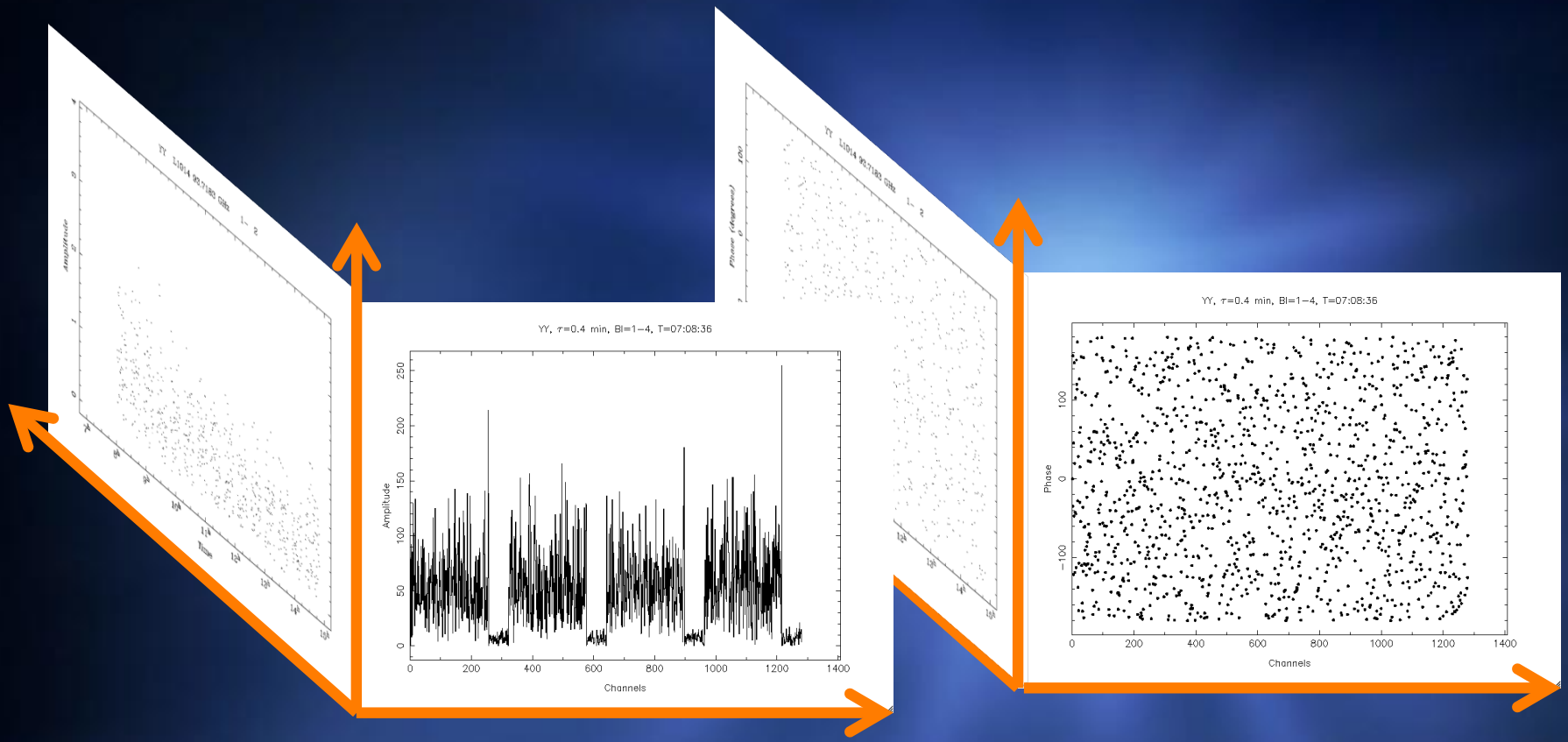
Amplitude



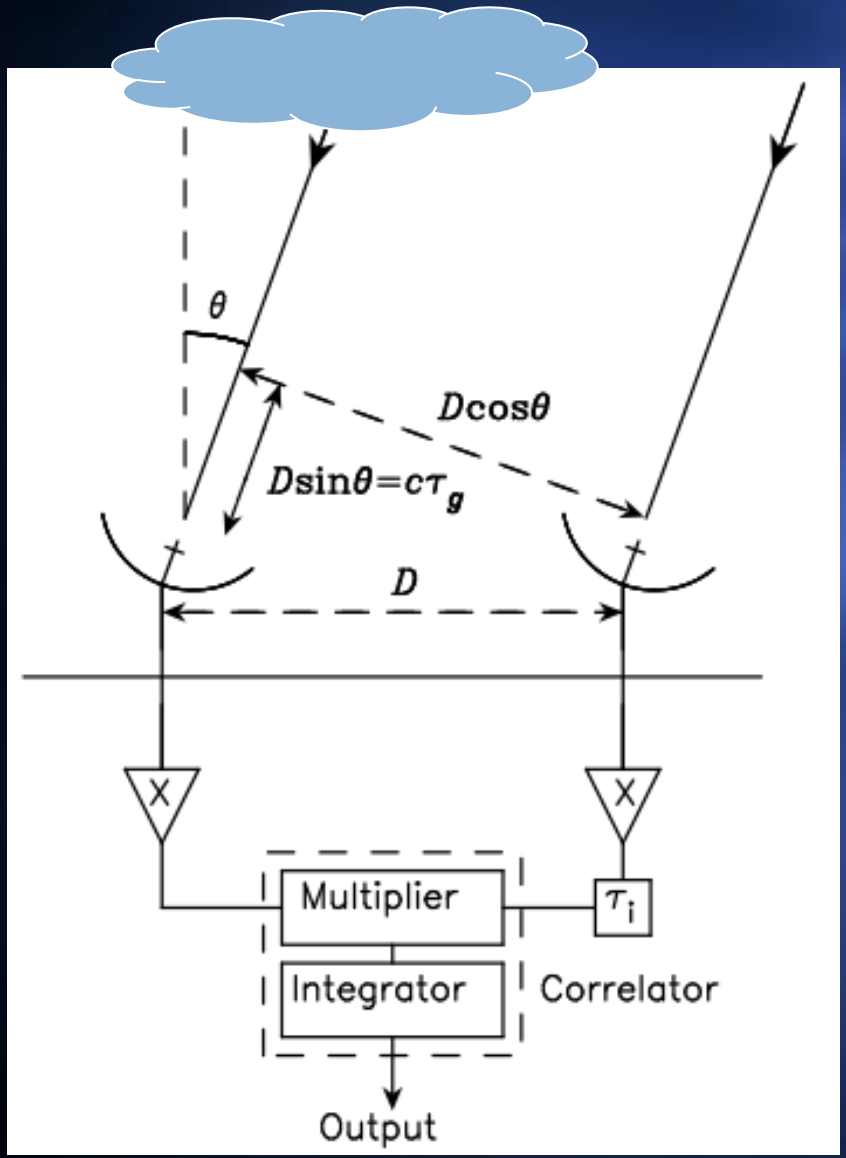
Phase



Time



$$V_{mn}(u,\mathrm{v},v,t) = Ae^{-i\phi}$$



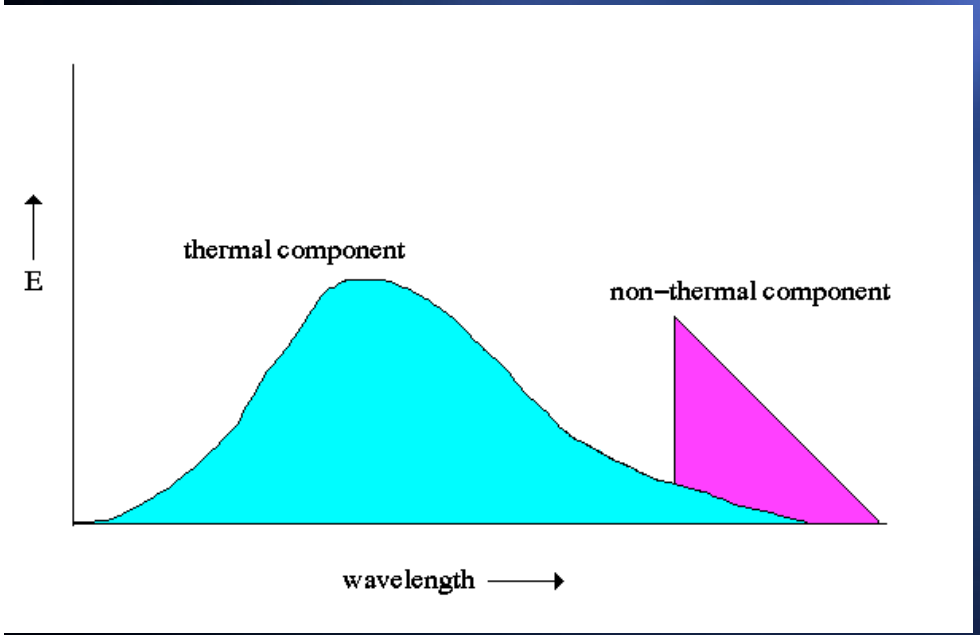
- Atmospheric variation
- change of cable lengths
- receivers are not perfect
- frequency dependence

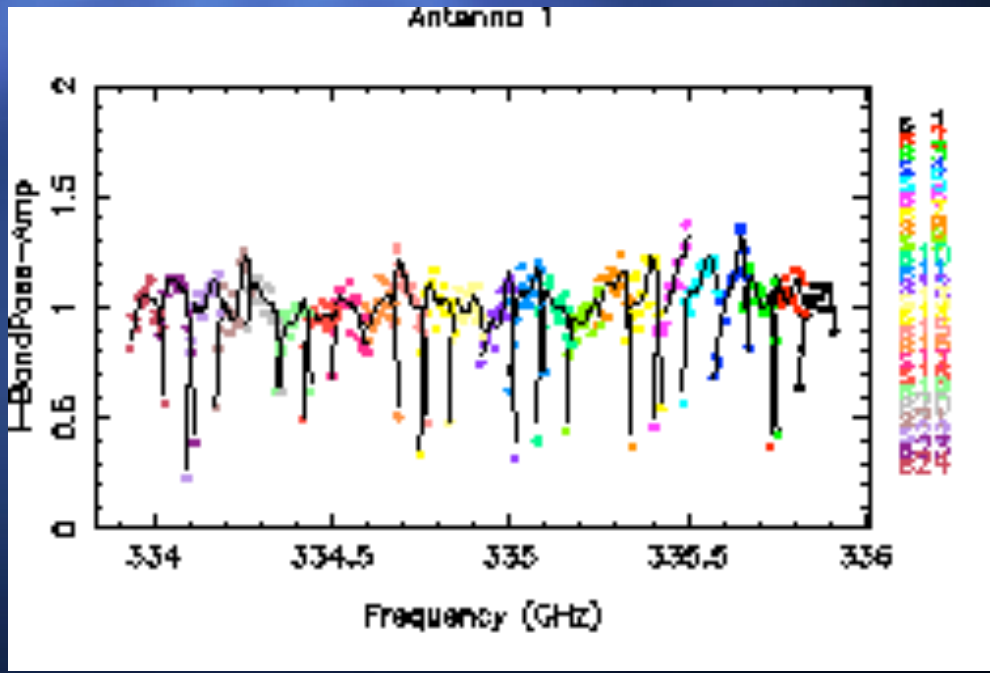
Type of calibrations

- bandpass calibration
- Flux Calibration
- Gain/Phase calibration
- Instrumental polarization (leakage) calibration
- Self-calibration

Ultimate calibrator – Quasar!!

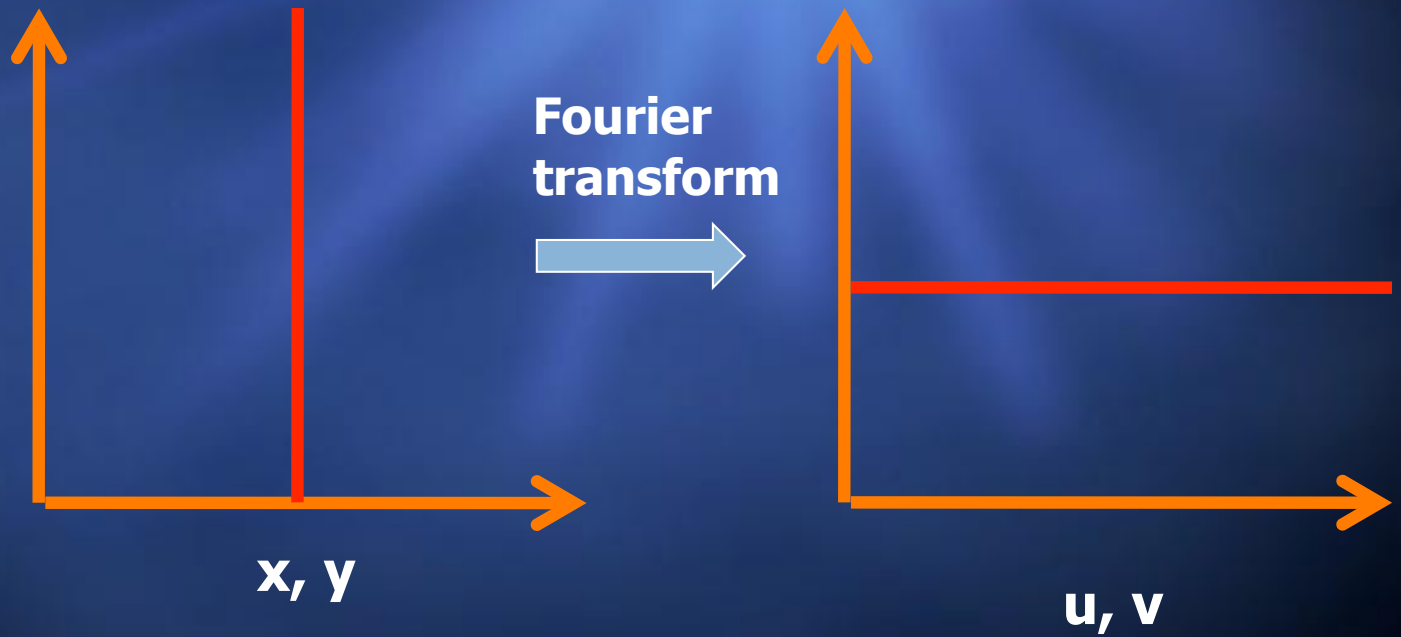
- Bright sources with featureless spectrum → bandpass calibration

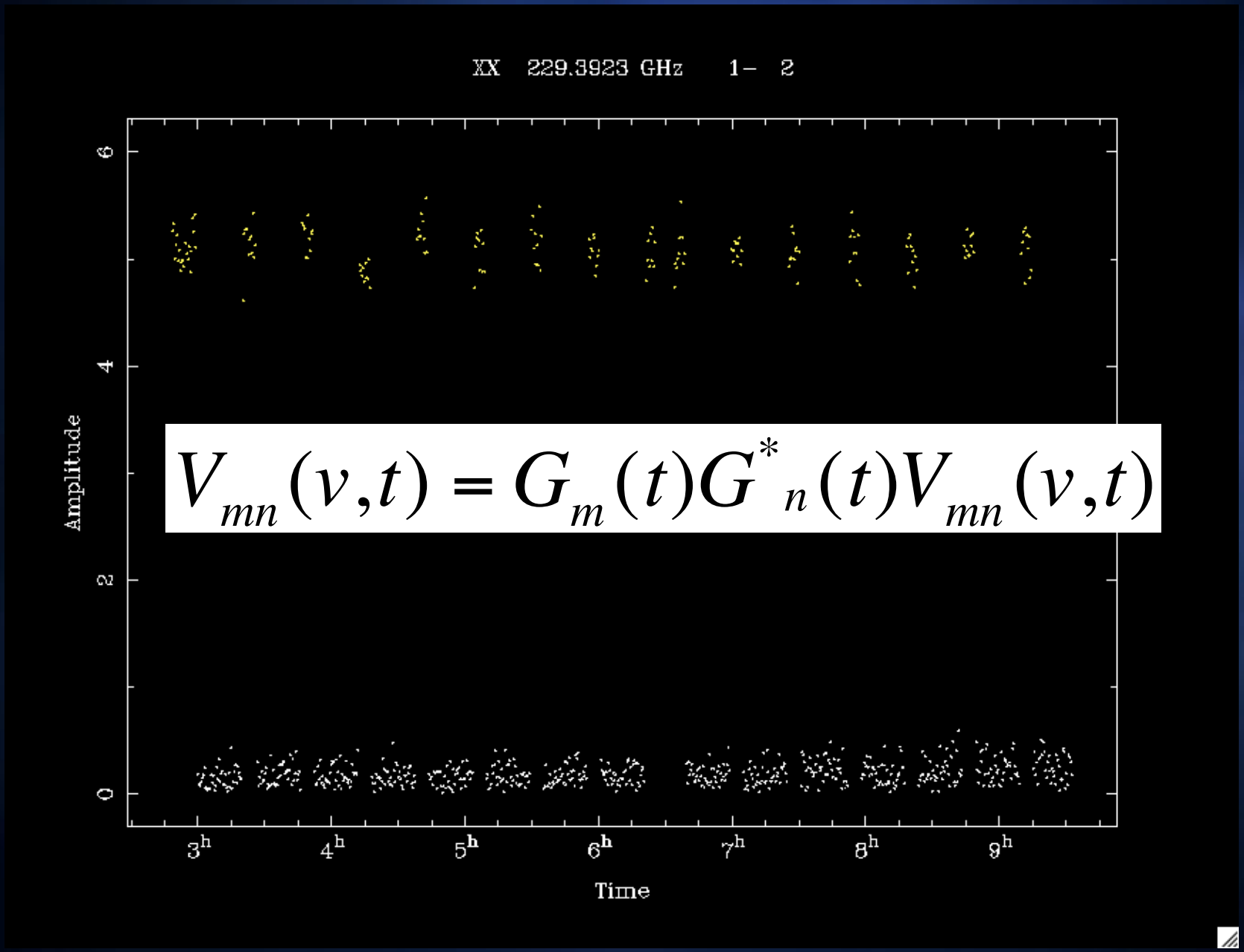




Ultimate calibrator – Quasar!!

- Point sources!!



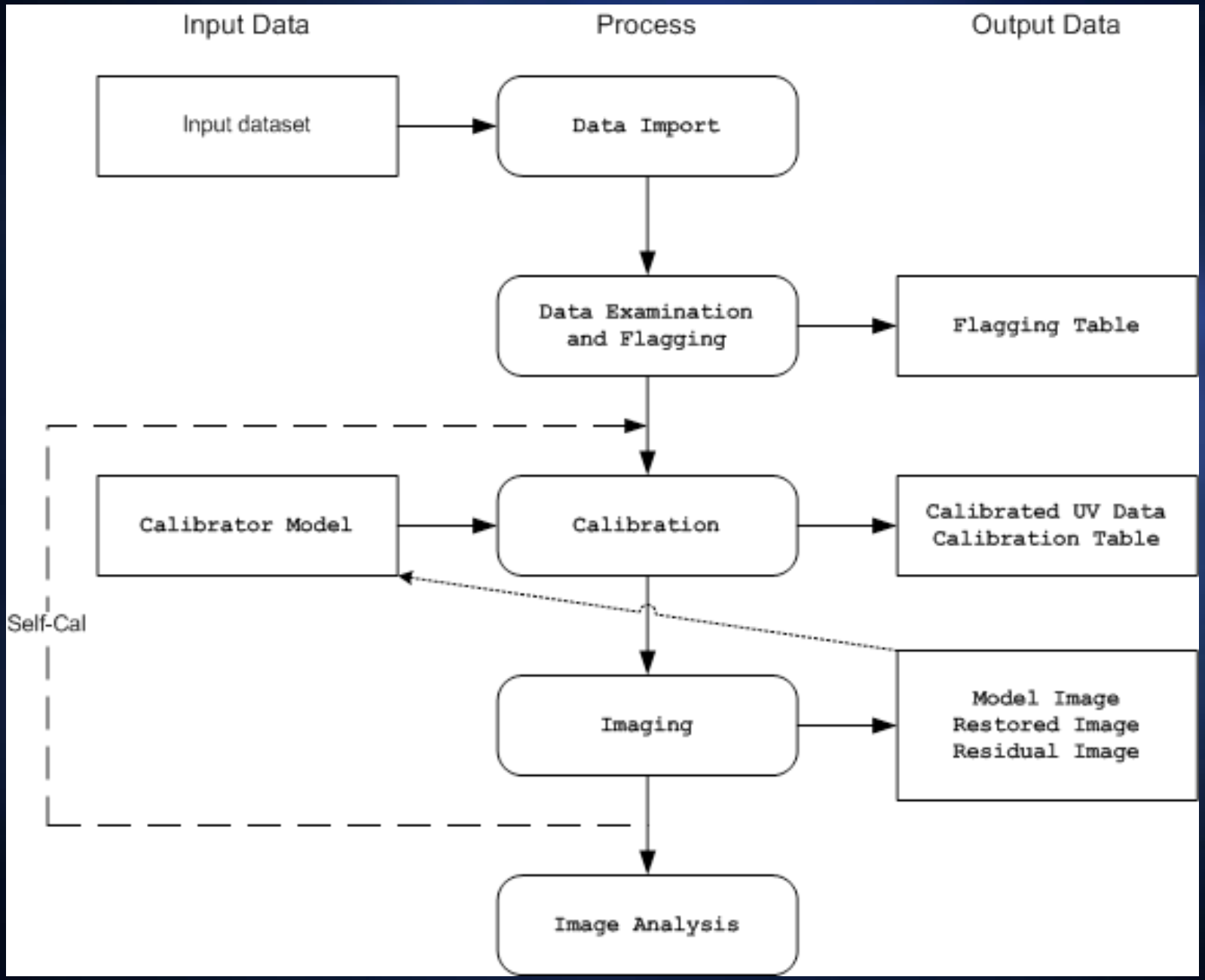


$$V_{mn}(v,t) = G_m(t)G^*{}_n(t)V_{mn}(v,t)$$

Flux calibration

- Planets/Solar System Objects emitting thermal emission at radio wavelengths
- Their brightness are well modeled

Planets
Mars, Jupiter, Uranus, Neptune, Pluto [1]
Moons
Jupiter: Io, Europa, Ganymede, Callisto *Saturn:* Titan *Neptune:* Triton
Asteroids
Ceres, Pallas[2], Vesta[2], Juno[2], Victoria[2], Davida[2]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