

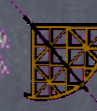
calibration

(interferometric data - very simple
approach)

dalle slide del corso....



ALMA MATER STUDIOSISSIMA
UNIVERSITAS BOLOGNENSIS



Real interferometry:

*An interferometer samples the Visibility Function as **transmitted** by the **atmosphere** and the **instrumentation** (antenna, receiver, electronics, cables, correlator, etc.)*

$$V_{obs}^{ij} = V_{true}^{ij} G^i G^j$$

*With a number of fair assumptions, **CALIBRATION** is the process to determine G^i aiming at transforming the observed quantities to the proper scale.*

*All the quantities are **COMPLEX**, and therefore we need to find two values, **AMPLITUDE** and **PHASE**, for each **antenna**, **polarization**, **sub-band**, channel, possibly **as a function of time***

esplicitando le dipendenze

$$\mathbf{V}_{\text{obs}_{ij}}(\nu, t) = \mathbf{G}_{ij}(\nu, t) \mathbf{V}_{ij}(\nu, t) + \text{noise}$$

- most of the effects are antenna-based (pointing, focus, antenna position, atmosphere, receiver noise, receiver bandpass) →
 - Gain decomposition

$$\mathbf{V}_{\text{obs}_{ij}} = \mathbf{G}_{ij} \mathbf{V}_{ij} = g_i g_j \mathbf{V}_{ij}$$

- baseline dependent effects?

- observation of a point source of flux S (V)
 - $V_{obs} = G_{ij} * S$ $G_{ij} = V_{obs} / S$
- antenna based gains $\rightarrow g_i * g_j = V_{obs} / S$
- can solve for antenna gain with 3 antennas

$$(g_1)^2 = V_{obs_{12}} V_{obs_{31}} / S V_{obs_{32}}$$

- system is over determined, solved by χ^2 or least square

calibration in mm interferometry

- Bandpass (Amp, phase vs. freq)
- Phase (Phase vs. time)
- Amplitude (Amp vs. time)
- Flux scale (K/Jy)

Data Reduction (Calibration)

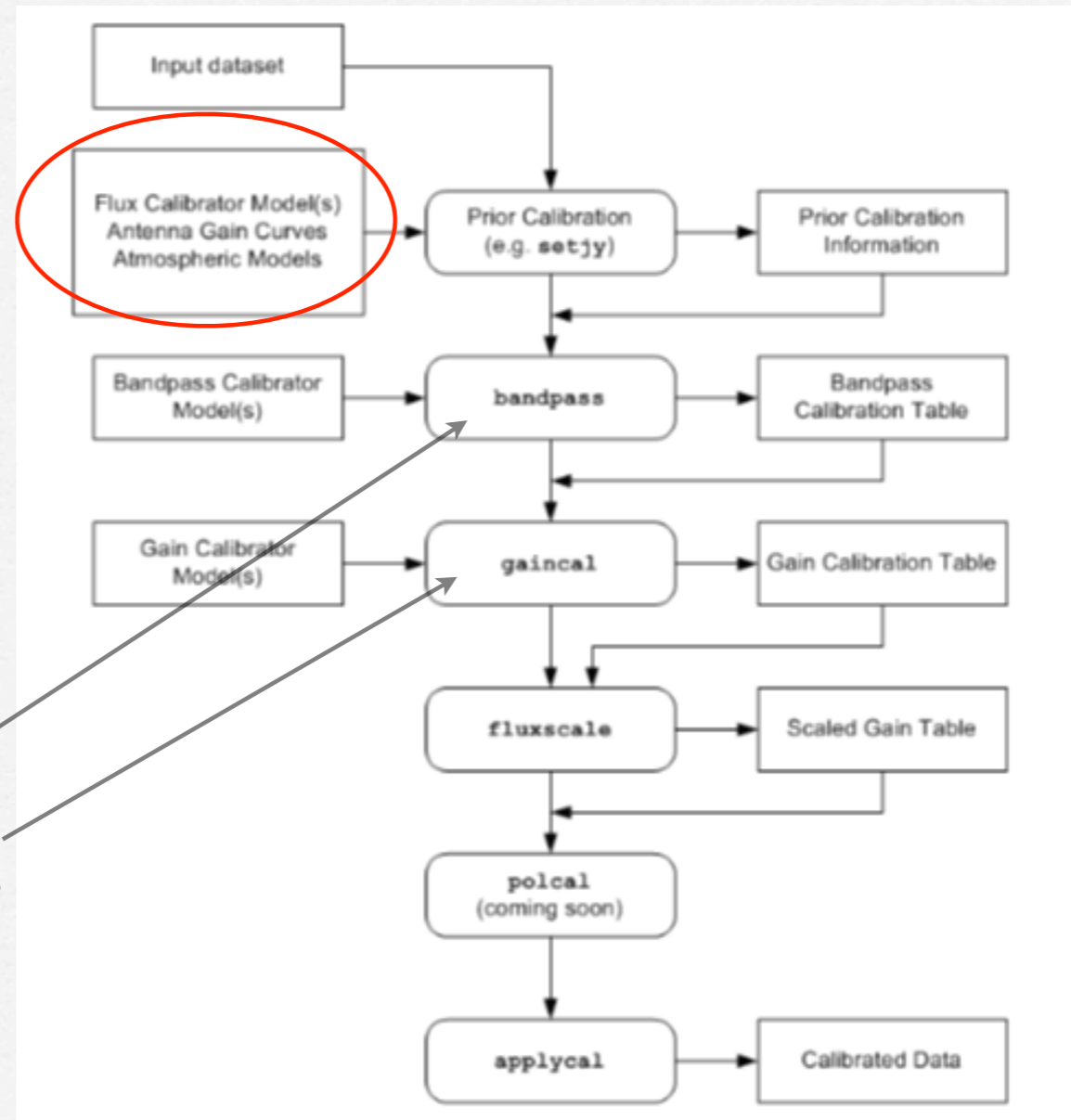
Measurement Equation

$$\vec{V}_{ij}^{obs} = \vec{B}_{ij} \vec{G}_{ij} \vec{D}_{ij} \vec{P}_{ij} \vec{T}_{ij} \vec{F}_{ij} \vec{V}_{ij}^{ideal}$$

Calibration steps

Opacity correction: observe (every 20 minutes or more often) hot load, cold load, sky and determine T_{sys} , T_{rec} and receiver gain

- BPass calibration on a strong qso
- Phase calibration on point-like qso
- Real-time phase correction
- Flux calibration



Calibration in CASA

- prior calibration: `setjy`
- solvers: `gaincal`, `bandpass`, `blcal`, `fringecal`
- manipulation: `plotcal`, `accum`, `smoothcal`
- application: `applycal`, `split`
- other: `uvcontsub`, `uvmodelfit`

