TU WIEN VieVS

Vienna VLBI and Satellite Software

Scheduling Geodetic VLBI using VieVS

Matthias Schartner[a]

[a]TU Wien, Department of Geodesy and Geoinformation

What is a schedule?

A schedule is basically the observing plan of a session.
It determines which station should observe which source at which time.

- What do we need?
  - parameters which describe the antenna and recording hardware
  - parameters which describe the sources
  - parameters which describe the setup of the experiment
- Where do we get it from?
  - all information are saved in the so called sked-CATALOG files

Geodetic VLBI Scheduling

Definitions

scan: a time period during which multiple stations observe the same source simultaneously

observation: a single baseline during a scan. $n_{obs} = \frac{n_{sta} \cdot (n_{sta}-1)}{2}$ ($n_{sta} = 5 \rightarrow n_{obs} = 10$)

subnet: a subset of all available stations that observe one source simultaneously

Example:

6 stations: $\underbrace{4 \text{ stations}}_{\text{subnet 1}}$ scan source 1, $\underbrace{2 \text{ stations}}_{\text{subnet 2}}$ scan source 2

Geodetic VLBI Scheduling — Catalogues

Catalogues store necessary information about antennas, sources and observing modes

- sources
  - source.cat
  - flux.cat
- antennas
  - antenna.cat
  - positon.cat
  - equip.cat
  - mask.cat
- observing modes
  - modes.cat
  - freq.cat
  - rx.cat
  - ...

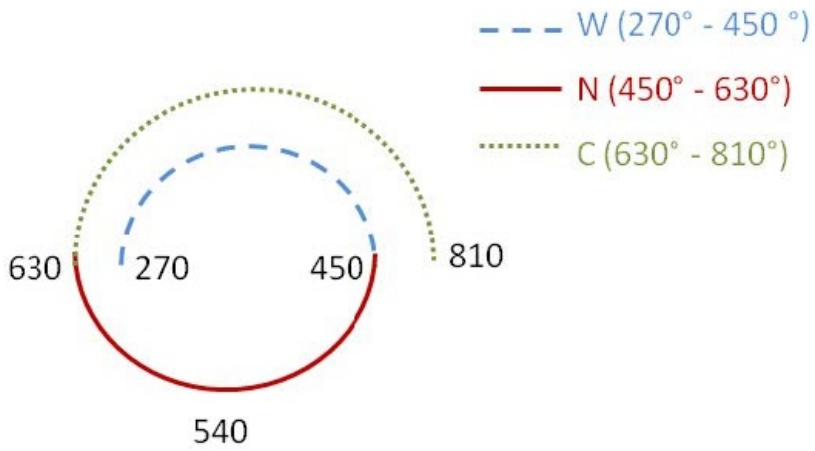
VieVS Scheduling Software

With the VieVS Scheduling Software you can:

- automatically create VLBI schedules to quasars and satellites
- use different optimization strategies with a variety of different optimization parameters
  - station based
  - source based
- (semi-) interactively enter an entire schedule using a GUI
- display statistics and plots of a created schedule

Algorithms scan start time

- slew distance
  - sources barycentric
  - antennas earth fixed
  - cable wrap
- slew time
- calibration time



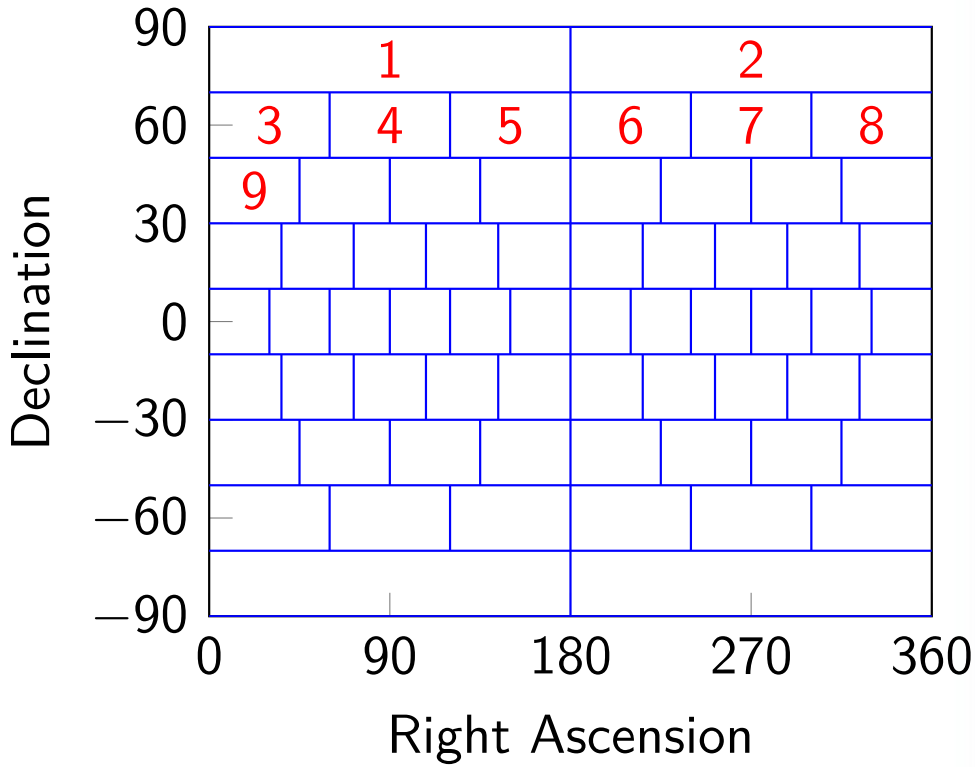
scan length:

$$scanlength = \left(\frac{1.75 \cdot SNR}{F_{obs}}\right)^2 \cdot \frac{SEFD_1 \cdot SEFD_2}{2 \cdot B \cdot N_{ch}} \qquad (1)$$

Strategies source-based

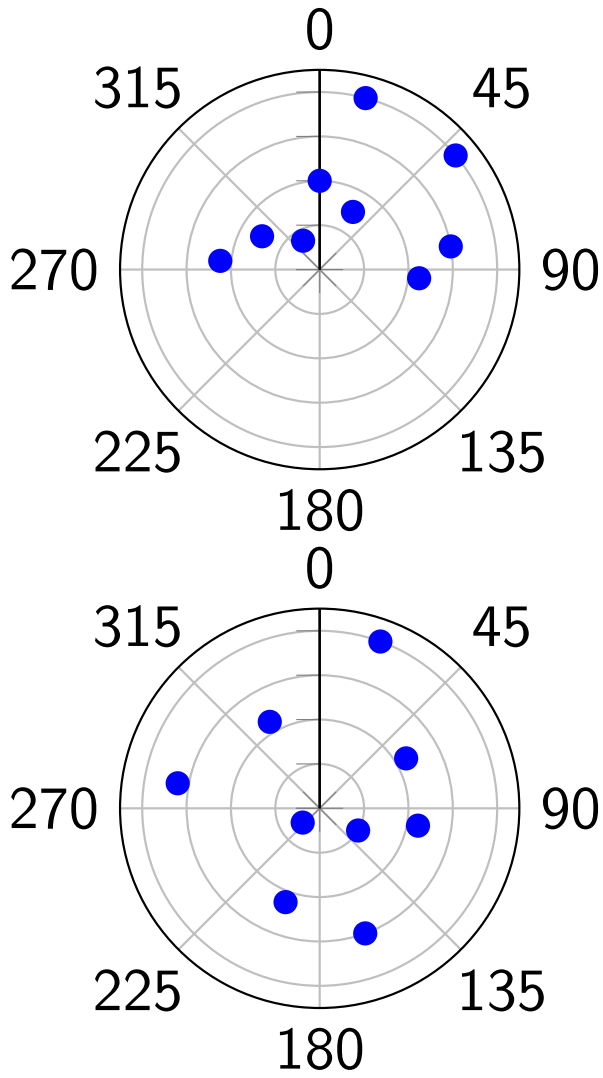
You are optimizing the distribution of observed sources on the sky.

- one source at a time
- two sources at a time
- four sources at a time



Strategies station-based

- troposphere is biggest error source
- troposphere can be better estimated, if you have observations in every direction
- $\rightarrow$ you are optimizing distribution of observed sources over each station (sky coverage)
- one or two sources simultaneously (subnetting)



Strategies fill-in modes

Are used to reduce idle time and to increase number of observations

- every station has different slew time
- every baseline (2 stations) has different scan length
- $\rightarrow$ every station could start/stop at different times
- scan start is the same $\rightarrow$ stations are idling before or after scan
- sometimes stations are not participating in the next scan
- this time could be used to squeeze in another scan

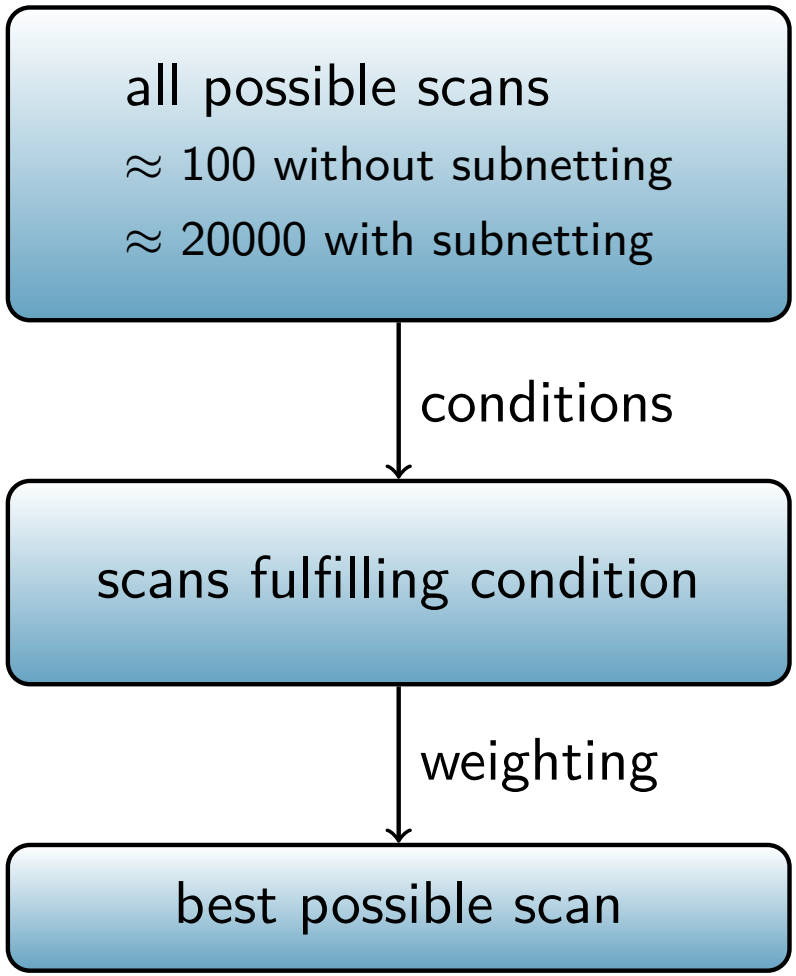
Scan selection? flowchart

Conditions:

- min sun distance
- cut-off elevation
- min source flux
- min source repeat
- max scan time
- max wait for slow antennas
- minimum station number...

Weight factors:

- sky coverage
- scan end time
- number of observations



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Lecture VLBI Scheduling

Matthias Schartner[a], matthias.schartner@geo.tuwien.ac.at

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