# Observation software development in Metsähovi Radio Observatory

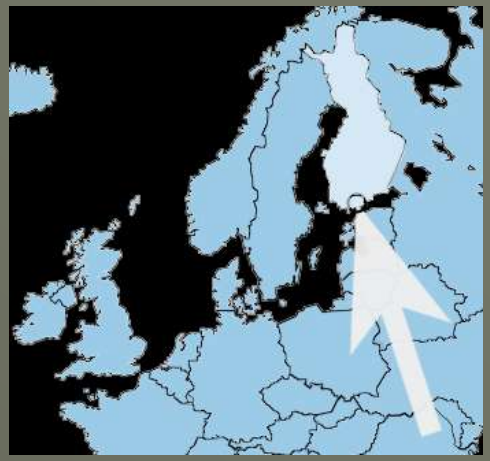
Niko Lavonen

# Overview

- Basic info about Metsähovi Radio Observatory
- Quasar research in MRO
- Current state of observation software/system in Metsähovi
- Future prospects

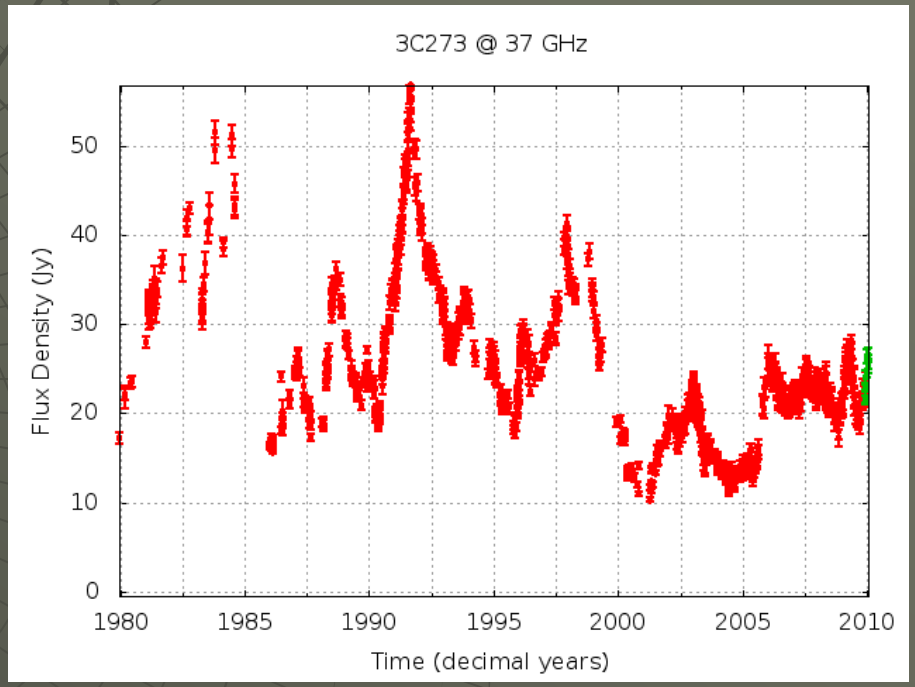
# Metsähovi Radio Observatory (MRO)

- Separate institute of Aalto University
- Founded in 1974
- Located in Kirkkonummi, Finland
- 13,7-meter radio telescope
- ~20 personnel
- Activities:
  - Long term, high frequency monitoring of quasars (main project)
  - Planck co-operation
  - VLBI
  - Solar observations
  - Education
  - Instrument development



# Quasar research at Metsähovi

- Long term quasar observations since 1980.
- Frequencies: 22, 37, 87 GHz
- → Time series data for studying the variability and structure of Quasars



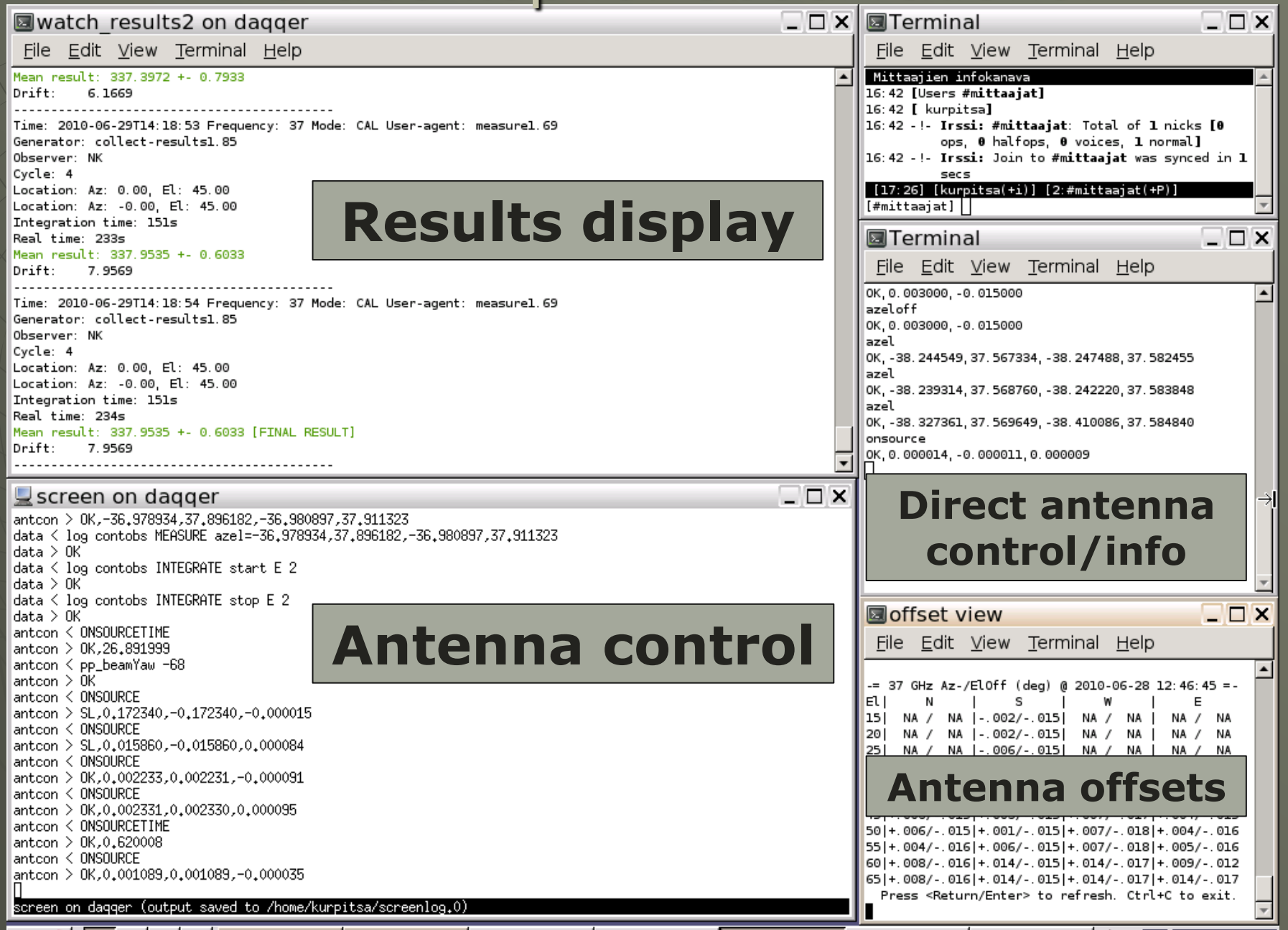
# Quasar observations

- 24 h/day, year round → Good data points often enough
- Independently developed observation software
  - Renewing in progress
- No dedicated observers → Staff observes among other work
  - Different skill levels → Flexibility needed from observation software
  - Observing shifts: 1-7 days / person
- Climate and weather challenges:
  - Snow, ice, moisture → Dome & dome heater

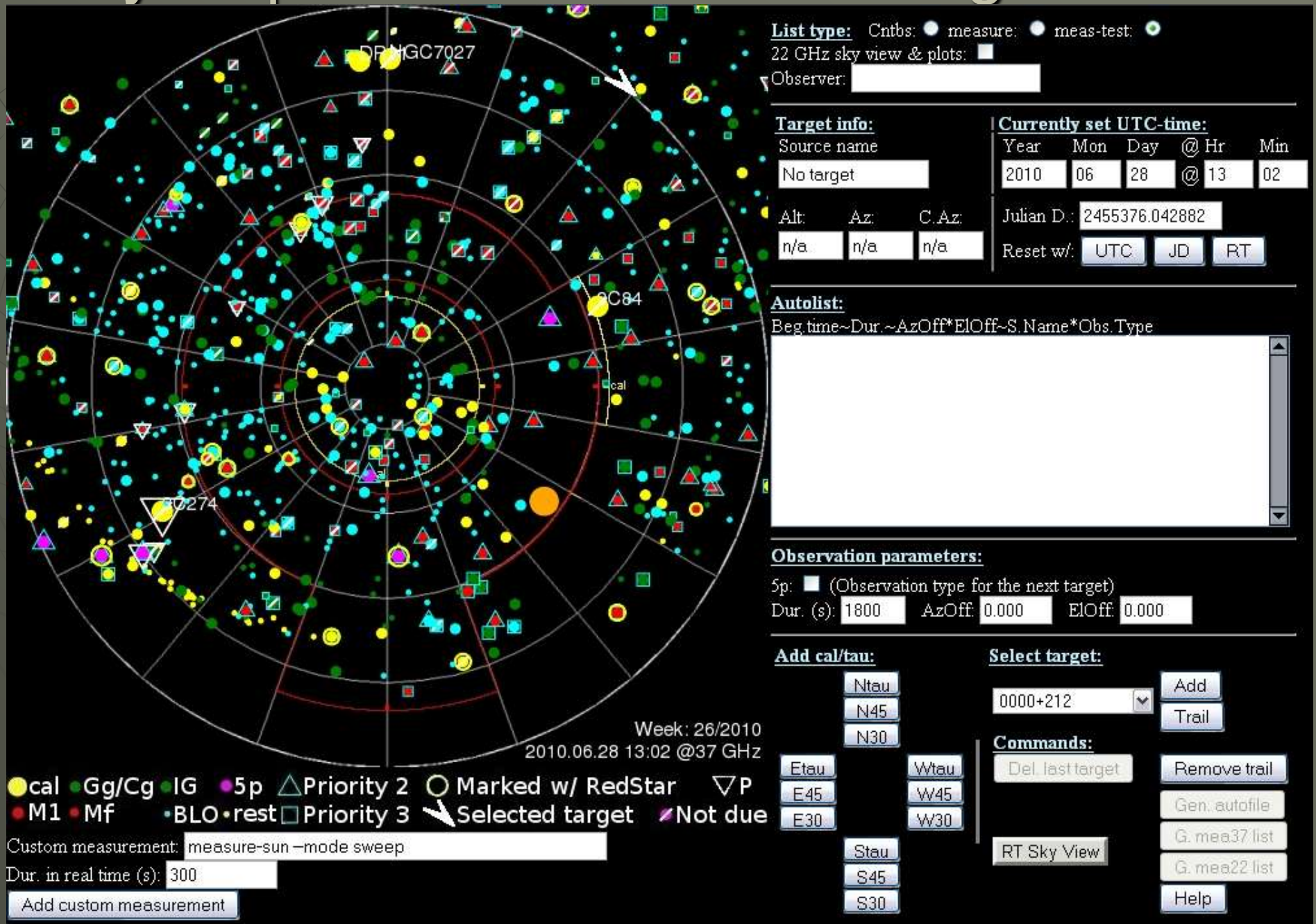
# Current observation system & software

- UI: A Linux VNC remote desktop
- Observations can be made remotely from basically anywhere
- Semi-Automatic observations possible with an observer-defined list
- New low level observation tool operational for ~ 1 year (“Measure”, command line tool)

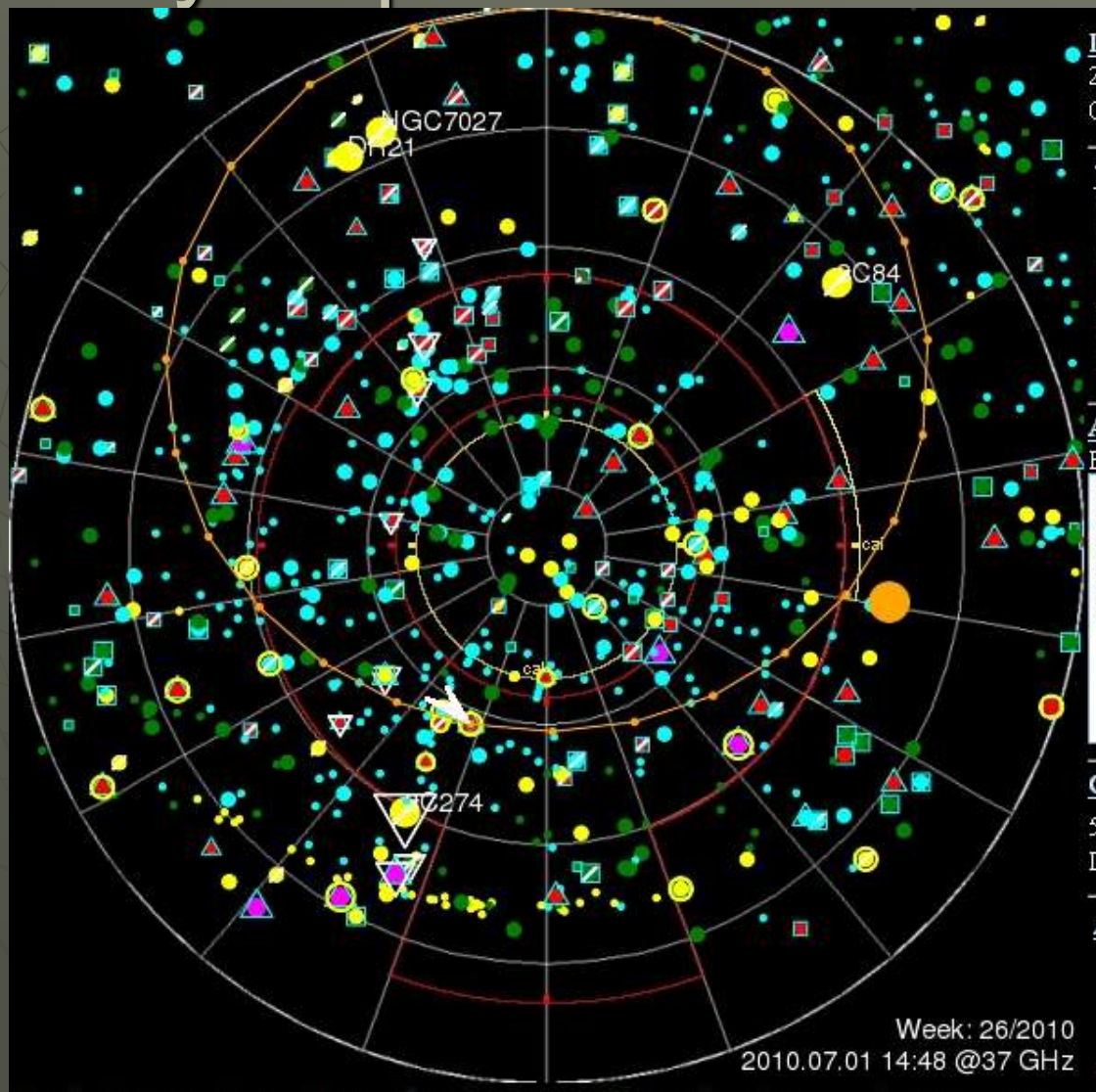
# VNC desktop for observations:



# Sky map & sources + “autolist” generator:



# Sky map & sources + “autolist” generator:




**List type:** Cntbs: ○ measure: ○ meas-test: ◉
22 GHz sky view & plots: ☐
Observer: NL

**Target info:**
Source name: No target
Alt: n/a Az: n/a C.Az: n/a

**Currently set UTC-time:**
Year 2010 Mon 07 Day 01 @ Hr 14 Min 48
Julian D.: 2455379.1167360
Reset w/: UTC JD RT

**Autolist:**
Beg.time~Dur.~AzOff*ElOff~S.Name*Obs.Type

```
10.07.01@14.09~1800~0.015*-0.012~4C39.25*1p
10.07.01@13.30~1800~0.015*-0.012~OJ287*1p
10.07.01@13.27~180~0.015*-0.012~CAL*W45
10.07.01@12.48~1800~0.015*-0.012~0552+398*1p
10.07.01@12.09~1800~0.000*0.000~0355+508*1p
```

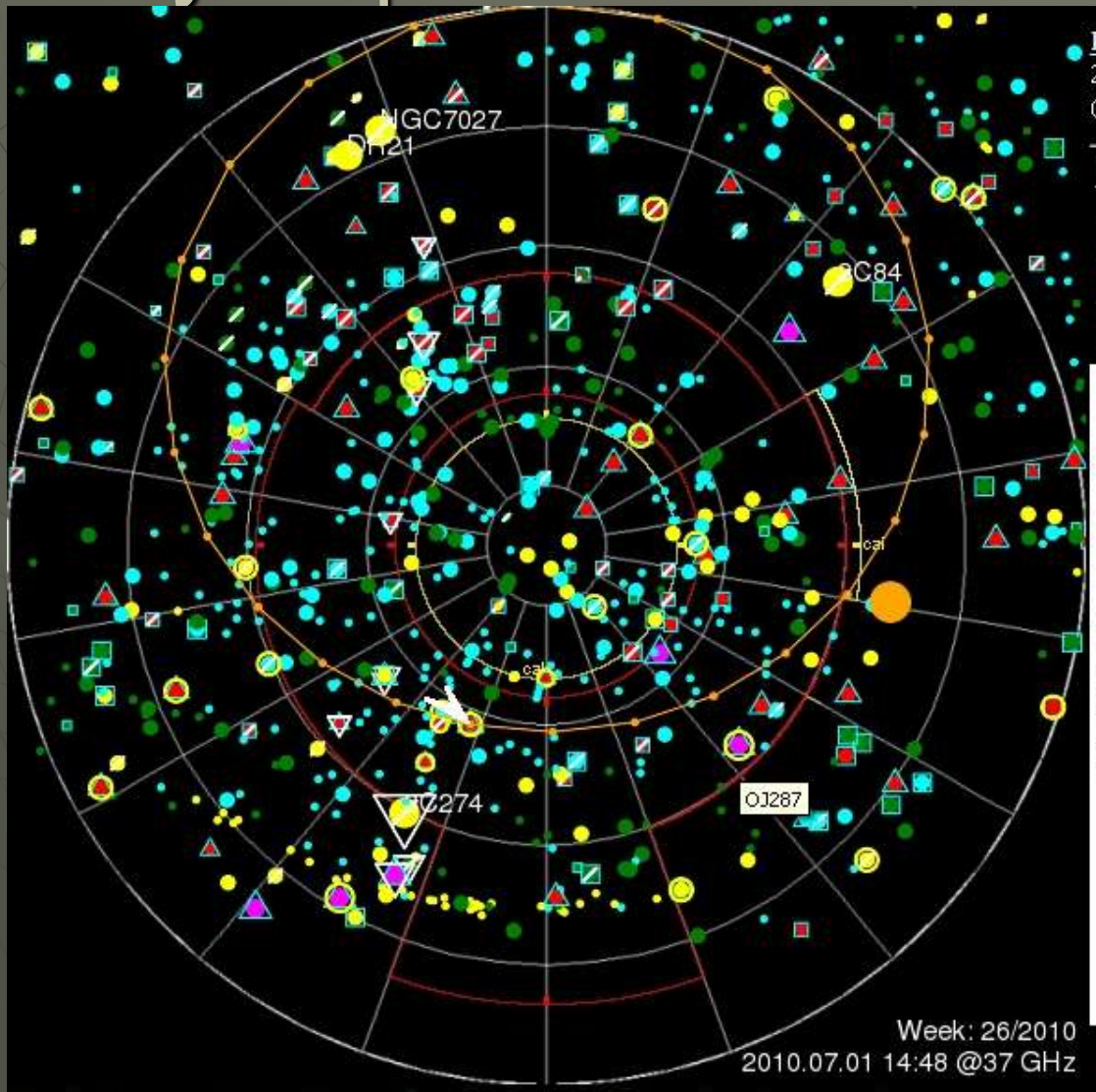
**Observation parameters:**
5p: ☐ (Observation type for the next target)
Dur. (s): 1800 AzOff: 0.015 ElOff: -0.012

**Add cal/tau:**
Ntau N45 N30
Etau E45 E30 Wtau W45 W30
Stau S45 S30

**Select target:**
4C29.45 Add Trail

**Commands:**
Del. last target Remove trail
Gen. autofile
RT Sky View G. mea37 list
G. mea22 list
Help

# Sky map & sources + “autolist” generator:




Week: 26/2010
2010.07.01 14:48 @37 GHz

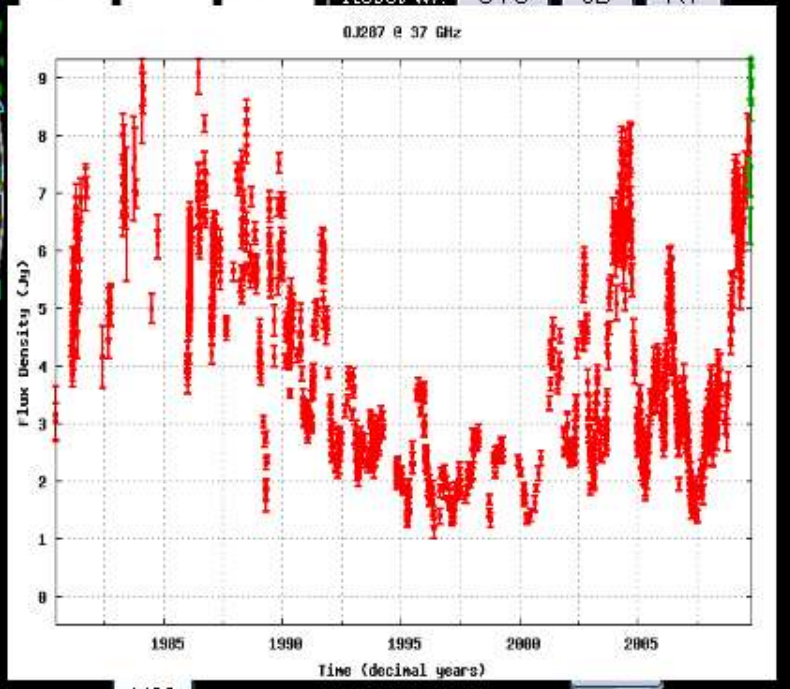
cal Gg/Cg IG 5p Priority 2 Marked w/ RedStar P
M1 Mf BLO rest Priority 3 Selected target Not due

Custom measurement: measure-sun –mode sweep
Dur. in real time (s): 300
Add custom measurement

**List type:** Cntbs: measure: meas-test:
22 GHz sky view & plots:
Observer: NL

**Target info:**
Source name: OJ287
Alt: 43.5938 Az: 224.196 C.Az: 44.1968

**Currently set UTC-time:**
Year 2010 Mon 07 Day 01 @ Hr 14 Min 48
Julian D.: 2455379.11673603
Reset w/: UTC JD RT




N30
Etau Wtau
E45 W45
E30 W30
Stau
S45
S30

**Commands:**
Del. last target
Remove trail
Gen. autofile
G. mea37 list
RT Sky View
G. mea22 list
Help

# Problems & solutions

- Adding sources for observing not flexible enough
  → A dynamic list
  - Automatic or manual adding of sources while antenna is observing
- Info on conditions plentiful but scattered:
  → A.I. to interpret data from weather & other sensors
- No real time info on flux calibrated results compared to long term results:
  → Automatic real time “result interpretation”

# Future prospects for obs. software

- More autonomous, more flexible to use
- Moving towards completely automatic observations
  → System observes using:
  - Weather,  receiver parameters, source priorities, observation history, antenna offsets…

→ High Quality data from quasars with a fraction of current workload

# Thank you!

# QUESTIONS?