

LOFAR Scheduling

From hardware, software, and astronomical constraints towards an optimized schedule

Alwin de Jong

June 2010

- Goals of LOFAR scheduling
- Resources that need scheduling
- Scheduling constraints
- Hands-on demonstration
- What's next on LOFAR Scheduling?
- LOFAR Scheduling workshop

Scientific and Astronomical goals

- To use the LOFAR telescope to its fullest potential, both in capabilities as well as maximizing scientific observing time
- To be able to generate schedules that maximize scientific value (prioritization)
- Maximize observational flexibility
- To maintain reliable operation
- To be able to conduct parallel observations

Goals of LOFAR scheduling

Translating to scheduling system goals:

- Maximize use of the LOFAR resources
- Maximize useful observing time
- Automatic constraints and conflicts resolving
- Create flexible and fast scheduling with possibility of short term override
- Minimize CEP overload probability
- Present different scheduling solutions and sufficient feedback for user to make scheduling decisions (scheduler uses specialised simulated annealing algorithm)

Resources that need scheduling

- Stations (antenna fields, data slots)
- Blue-gene P-Sets (compute cores and I/O nodes)
- Storage nodes (capacity)
- Offline cluster resources (CPU, storage) are timely coupled to online processes

Some scheduling constraints...

- Station constraints which cannot be different amongst parallel observations:
 - Different grades of parallelization
 - Clock modes i.e. 160MHz / 200MHz
 - Antenna pass-band filter types
 - RSP Data slots can only be assigned to single subband & beam
- Parallel observing CENTRAL Processing constraints
 - P-Set partitioning scheme (assigning compute-cores to observation)
 - Storage nodes read/write interleaving (especially important for MS³)
 - Storage nodes available capacity during schedule lifetime
 - Bit mode (16, 8, 4 bits) constraint
- Observational constraints
 - Source visibility
 - Allowed time window (Δ LST) for observation

Additional (future) scheduling constraints

- observations with different bit mode (16, 8 and 4 bits) cannot run in parallel on the same station because of CEP correlator and RSP data-slot assignment
- Might be possible to run parallel observations on different stations in different bit-mode

Hands-on demo

The LOFAR Scheduler (D:/Eclipse_work/test_van_LOFAR_9.pro)

File Edit Actions SAS Settings View Help

Graphic schedule view

Zoom in Zoom out Now Type color mode

Wed 2 Jun, 2010 Thu 3 Jun, 2010 Fri 4 Jun, 2010 Sat 5 Jun, 2010 Sun 6 Jun, 2010 Mon 7 Jun, 2010 Tue 8 Jun, 2010 Wed 9 Jun, 2010 Thu 10 Jun, 2010 Fri 11 Jun, 2010

Table schedule view

task ID	SAS ID	project name	task name	task description	contact name
119	17	7784		Test observation for MAC update LBA many stations	
120	16	7783		Test observation for MAC update LBA many stations	
121	15	7777		Copy of 7759 minus CS101	
122	14	7775		Copy of 7759 minus CS101	
123	13	7774		Copy of 7759 minus CS101	
124	12	7773		Copy of 7759 minus CS101	
125	11	7772		Copy of 7759 minus CS101	
126	10	7771		Copy of 7759 minus CS101	
127	9	7769		3C196,LBA,11CS,5RS,2DE,244subbans	
128	8	7768		test after update SAS, 3C196, LBA,4 stations,244 subbands	
129	7	7767		3C196,LBA,11CS,5RS,2DE,244subbans	

Schedule loaded from D:/Eclipse_work/test_van_LOFAR_9.pro | #S:13, #US:9, #INACT:114, #ERR:0

Task 9 "

Schedule Station settings Station beams Processing Storage Extra Info

Station clock frequency: 200MHz Number of subbands: 0

Station antenna mode: LBA INNER Channels per subband:

Station filter: LBA 30-90MHz

Available stations

- UNSPECIFIED
- LBA 10-70MHz
- LBA 30-70MHz
- LBA 10-90MHz
- LBA 30-90MHz**
- HBA 110-190MHz
- HBA 170-230MHz
- HBA 210-250MHz

Assigned stations

- ...C5001
- ...C5002
- ...C5006
- ...C5007
- ...C5021
- ...C5024
- ...C5030
- ...C5032
- ...C5101
- ...C5103
- ...C5302
- ...DE602
- ...DE603
- ...R5205
- ...R5208

Close Apply Ok

What's next on LOFAR scheduling?

- Move to parallel observations:
 - storage nodes raid sets need 'parallel' specification
 - RSP dataslot assignment needs to be differentiated on station level
- Storage capacity prediction and planning
- Offline pipelines scheduling of post-processing coupled to online pipeline observations
- Resource claim system for reservations needs further implementation
- MS³ scheduling system (many sub-observations)
- Automatic 'leveling' of resources to prevent possible overloads (CPU and storage leveling)
- 'New' observation modes might require different type of scheduling (different or additional constraints)

- Within couple of weeks a scheduling workshop will be organized (1 or 2 days)
- Intended audience: Observers, Science Support and Astronomers
- Interested to join the LOFAR scheduling workshop?
Please send me an e-mail: jong@astron.nl