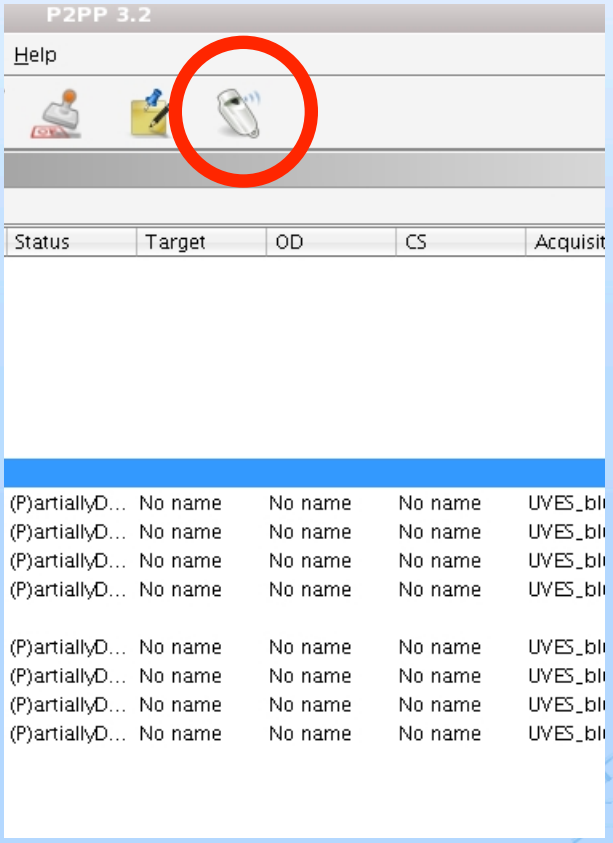
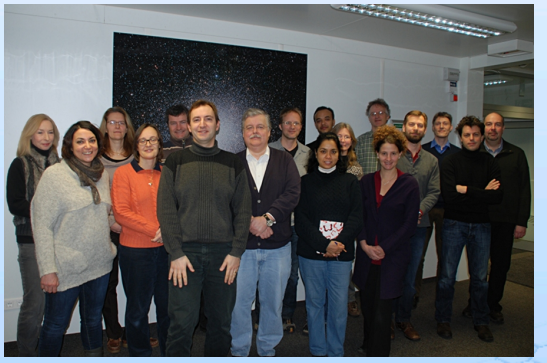
Ranking of service mode observations and relative priorities

What happens after the whistle?





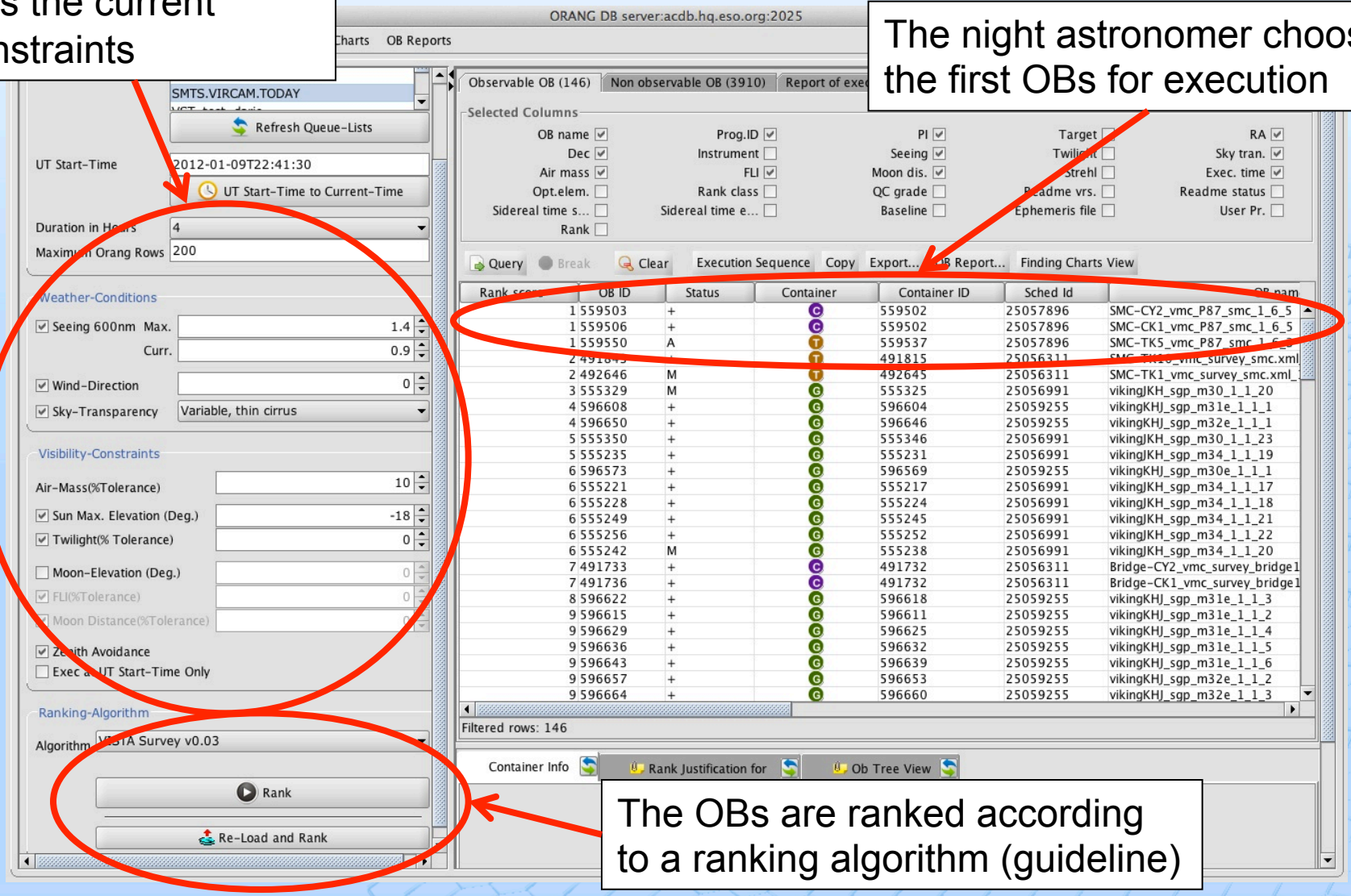
Your User Support Astronomer revises Phase 2 material

After approval the OBs are included into the observing queue

Paranal:
The Observation Tool (OT)

The night astronomer sets the current constraints

The night astronomer chooses the first OBs for execution



The OBs are ranked according to a ranking algorithm (guideline)

Filtering

1) OB is observable, i.e. above horizon

2) OB fulfills requested con-straints (airmass, seeing, moon, transparency)

3) Time windows are valid

Rank score	OB ID	Status	Container	Container ID	Sched Id	OB nam
1	559503	+	C	559502	25057896	SMC-CY2_vmc_P87_smc_1_6_5
1	559506	+	C	559502	25057896	SMC-CK1_vmc_P87_smc_1_6_5
1	559550	A	T	559537	25057896	SMC-TK5_vmc_P87_smc_1_6_3
2	491843	+	T	491815	25056311	SMC-TK10_vmc_survey_smc.xml
2	492646	M	T	492645	25056311	SMC-TK1_vmc_survey_smc.xml_1
3	555329	M	G	555325	25056991	vikingJKH_sgp_m30_1_1_20
4	596608	+	G	596604	25059255	vikingKHJ_sgp_m31e_1_1_1

Filtered rows: 146

Container Info: Con-YK_vmc_P87_smc_1_6_5

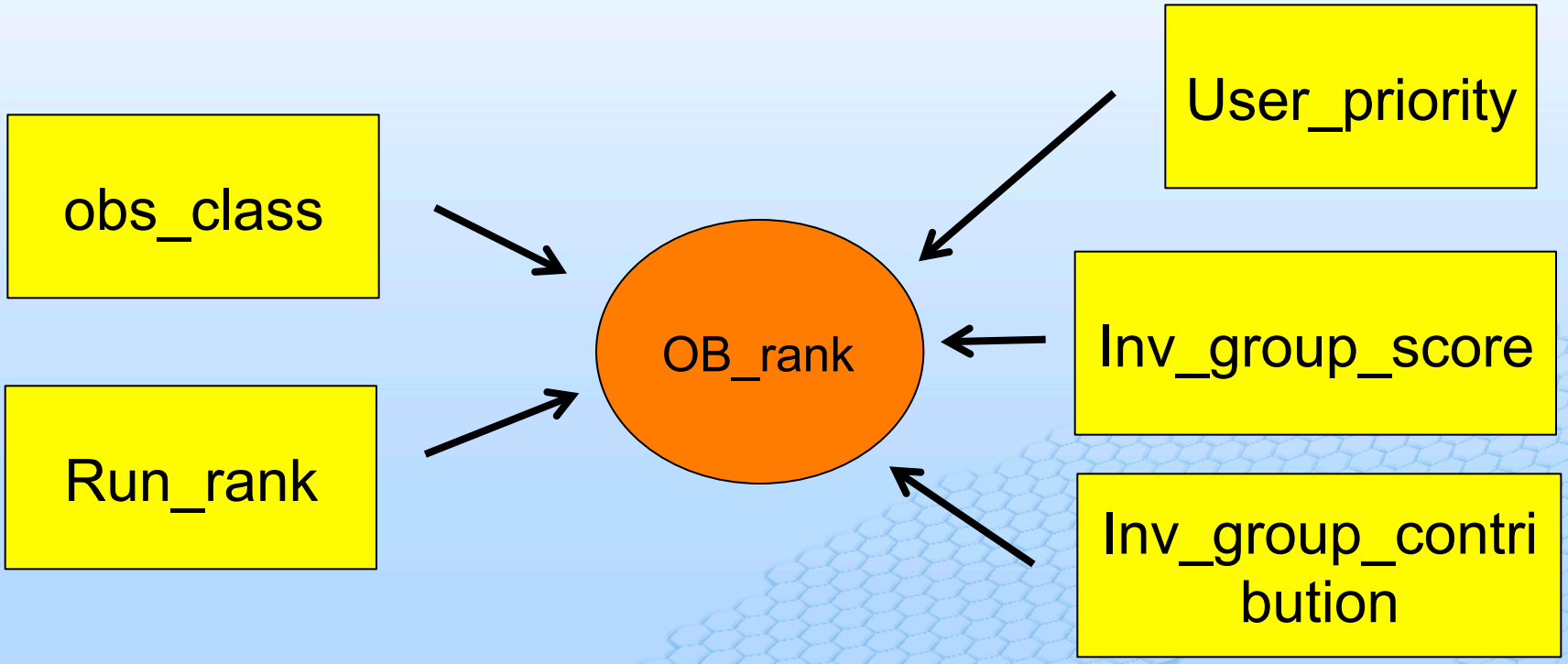
Rank Justification for 559503

Ob Tree View: SMC-CY2_vmc_P87_smc_1_6_5

```
START DATE: Mon Jan 09 22:41:30 GMT 2012| END DATE: Tue Jan 10 02:41:30 GMT 2012
RA | DEC:  01:21:22.488 | -70:46:10.920 degrees
AIRMASS AT START:1.44 |  LST AT START [hhmmss]: 01:14:53.701 | LAMBDA FILTER:1020.00
REQUESTED CONSTRAINTS: Airmass: 001.60 | Seeing: 1.200 | Seeing(@600nm): 1.153 | Seeing(@600nm,AirmassLimit): 1.152 | FLI: 1.00 | Sky
EXECUTION TIME [hhmmss]:  01:05:21.000
TEMPLATE FILTER: 'Y' BLUEST FILTER: 'Y'
LST AT DUSK [hhmmss]:  03:37:12.064
PROBABILITIES: p_z: 0.657 | p_sky: 0.900 | p_fli: 1.000 | p_set: 0.068 | p_seeing: 0.911 | p_total: 0.037
TIME RANK: 100.00%
OBSERVABILITY CLASS: 000
RANK CLASS: C
USER PRIORITY: 03
INVERTED GROUP SCORE: 100.00%
INVERTED GROUP CONTRIBUTION: 100.00%
######################

EXEC NOW OFF
seeing within constraints
sky transparency within constraints
wind within constraints
lst start date: 01:14:53.701
lst at dusk: 03:37:12.064
Twilight Delay requested:0.0 minutes(tolerance:0%).
setting time: Tue Jan 10 01:01:32 GMT 2012 rising time: Tue Jan 10 08:36:32 GMT 2012
OB observable
OB not executable.
Duration interval (hours:minute): 4:0
###################### NO TIME CONSTRAINT
```

OBs ranking

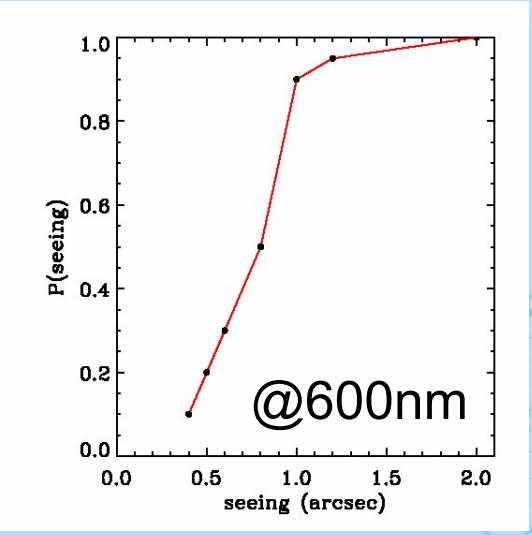


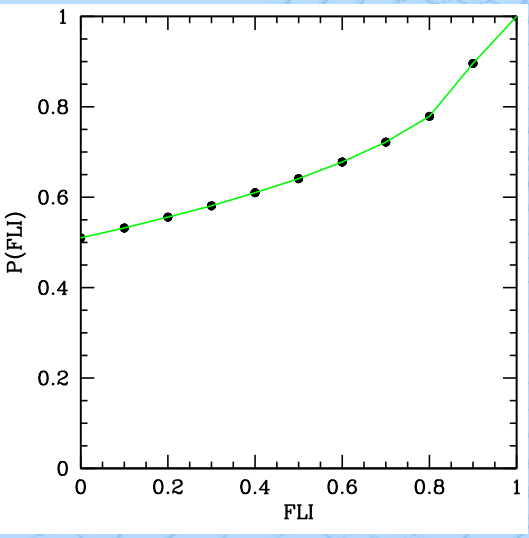
Important: Ranking algorithm works such that setting targets and OB with constraints of low probability are preferred.

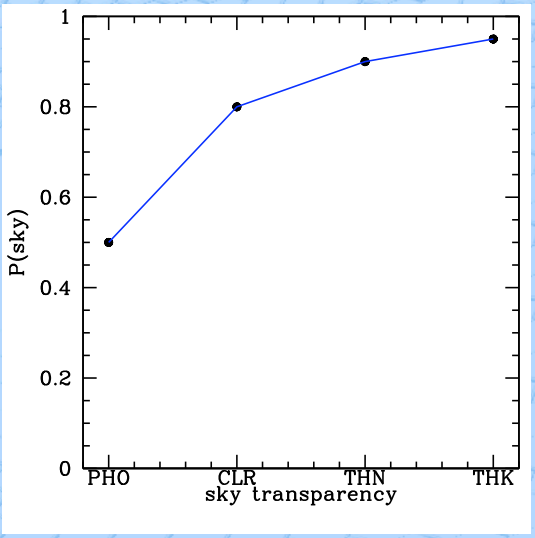
OBs ranking

$$obs\_class = 10 * NINT(10 * R_{time} * R_{constraint}) + PP$$

- PP = [-100…0…100] in order to reflect different rank classes
- $R_{time} = \min[1.0,\ (\Delta t_{TotRemaining} - \Delta t_{OBexectime}) / 30\ days]$
- $R_{constraint} = P_{seeing} * P_{FLI} * P_{sky} * P_{set} * P_z$







Rank classes among service mode programs

1. RRM (Rapid Response Mode)
2. ToO (Target of Opportunity)

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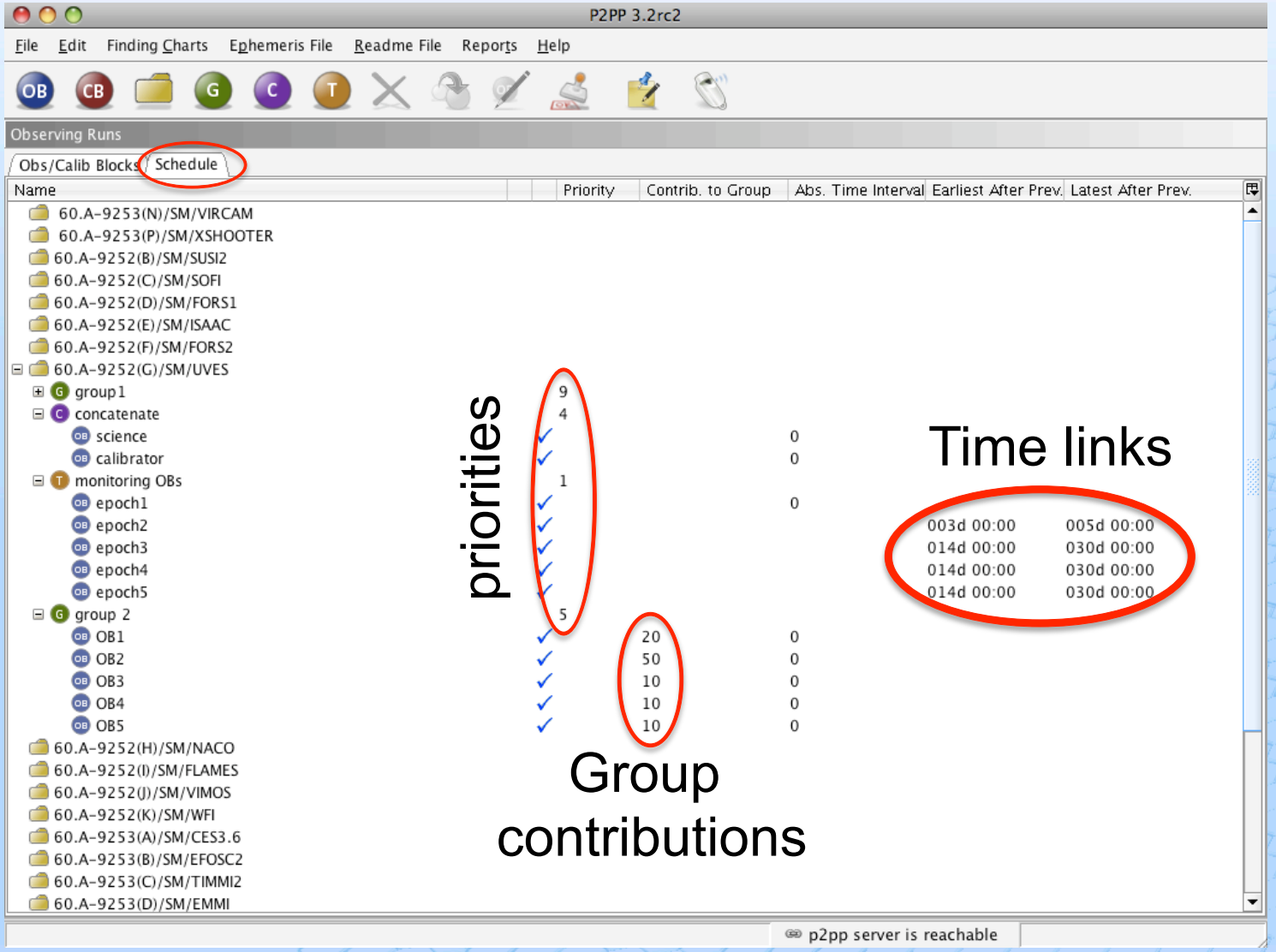
3. Carry over from previous periods
4. Large programs
5. Chilean programs
6. Normal A queue
7. Normal B queue
8. Normal C queue

So far selection of top-ranked OBs judged by the night astronomer, now help of sophisticated ranking algorithm.

Some advices



Meaningful time links

- The first OB in a sequence **may** have absolute time window
  Don't choose it too narrow, there must be a chance to meet your constraints (see ESO Observation Schedule Query Form!)
- All subsequent OBs have lower and upper time limit for execution
  As soon as the first OB in a sequence gets completed, the next OB gets an absolute time window. Make sure that those windows make sense with respect to the absolute time window of the previous OB (i.e. next OB could fall in full moon period, etc.).

Always keep in mind that OBs with absolute (and relative) time windows may **EXPIRE**! They get status "F" (failed).

In general: monitoring of a target that needs exact dates is difficult in service mode! In this case one might prefer to give each OB an absolute time window.

User priorities

- Individual OBs have a user priority. OBs in a container inherit the user priority of the container. In groups they can have different group contributions.

→ Use the full range of priorities (1-10, with 1 the highest priority) to influence the completion of preferred containers or OBs.

→ Use group contributions to prefer individual OBs within groups over others

- Note that it might happen that a container or individual OB is completed before the a container/OB with higher priority, because:

  - the target is setting soon
  - the constraints are more relaxed
  - other higher ranked programs prohibit the execution of your high priority OB

Relative contribution in group containers

- Start with two identical groups (G1 and G2)
- Both have group score 0% and the same user priority

OB Name	Group Name	Group Score	Group Contribution
OB_A	G1	0%	50%
OB_B	G1	0%	20%
OB_C	G1	0%	30%

OB Name	Group Name	Group Score	Group Contribution
OB_D	G2	0%	50%
OB_E	G2	0%	20%
OB_F	G2	0%	30%

Relative contribution in group containers

- OB_A executed → G1 increases its group score to 50%
- This now favors (raises priority) G1 OBs with respect to G2

OB Name	Group Name	Group Score	Group Contribution
OB_B	G1	50%	20%
OB_C	G1	50%	30%

OB Name	Group Name	Group Score	Group Contribution
OB_D	G2	0%	50%
OB_E	G2	0%	20%
OB_F	G2	0%	30%

Relative contribution in group containers

- If possible continue observation with G1 and execute OB_C (highest Group Contribution) → this execution raises group score of G1 to 80%

OB Name	Group Name	Group Score	Group Contribution
OB_B	G1	80%	20%

OB Name	Group Name	Group Score	Group Contribution
OB_D	G2	0%	50%
OB_E	G2	0%	20%
OB_F	G2	0%	30%

Relative contribution in group containers

- G1 OBs not observable
- G2 observation starts with OB with highest Group contribution (OB_D) & its execution raises G2 Group Score to 50%

Not-observable

OB Name	Group Name	Group Score	Group Contribution
OB_B	G1	80%	20%

OB Name	Group Name	Group Score	Group Contribution
OB_E	G2	50%	20%
OB_F	G2	50%	30%

Relative contribution in group containers

- G1 & G2 OBs observable and both have the same user priority – continue observing group with highest Group Score → G1 is completed

OB Name	Group Name	Group Score	Group Contribution
OB_B	G1	80%	20%

OB Name	Group Name	Group Score	Group Contribution
OB_E	G2	50%	20%
OB_F	G2	50%	30%

Choose constraints wisely: do not over/under-constrain

- Transparency

  - Are photometric conditions really necessary?
    They cause a lot of extra calibrations. For spectroscopy, clear/thin (CLR/THN) conditions are mostly sufficient.

  - Thin conditions often go along with good seeing

  - Too relaxed transparency (THK) might cause guide or reference stars to fail the sensitivity limits (use bright stars in this case).

Choose constraints wisely: do not over/under-constrain

- Seeing

The seeing is evaluated on the image/spectrum taken if possible.

Don't ask for unrealistic values (i.e. 0.4" seeing in U-band) but don't relax it too much (i.e. decreases the flux within a slit of point sources).

For ranking purposes the seeing of Phase-2 is converted to the equivalent value at zenith and at 600nm:

$$s_{req,norm}(z=1,\lambda=600nm)=s_{req}(z,\lambda)*[1/\cos(lat-\delta)]^{-0.4}*(\lambda/600nm)^{+0.2}$$

Choose constraints wisely: do not over/under-constrain

- Moon illumination and distance

- Consider whether FLI<0.2 (dark time) is really needed.
  This narrows the window when your OBs are observable.

- The sky is often darker 50-70 deg away from the Moon rather than >90 deg away. Moon distances of >120 deg in general make no sense, see article by F. Patat

Observing During Bright Time: Tips and Tricks

In this paper we present and discuss the effects of scattered moonlight on optical observations, the current status of the moonlit night sky modelling and the implications this has on the Service Mode observations and the maximisation of scientific outcome.

Ferdinando Patat

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