LST Pressures in the Green Bank Telescope Proposal Handling Tool

P. Marganian & T. Minter & K. O'Neil

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Abstract

This memo describes the way in which LST Pressures are done within the Proposal Handling Tool for the Robert C. Byrd Green Bank Telescope.

Contents

History

2.0 Original Draft (Marganian)

1 Introduction

The Robert C. Byrd Green Bank Telescope (GBT) is implementing a new Proposal Handling Tool (PHT) which will replace the current way in which GBT proposals are handled and prepared for scheduling. This document describes the LST Pressures that are calculated as part of the GBT PHT.

2 Introduction to Pressures

What are pressures? In this context, the pressure represents how loaded the GBT schedule is. In our case, we break this up by several categories. The first obvious break up is by LST. For example, there may be many more hours of desired GBT observations near the galactic center (LST's 15 -20, or so) than at other LSTs. These pressures can be further broken down by the type of observations: whether they represent pre-commited time (maintenance, testing, etc), or new proposals, etc. On top of that, we can further break down some of these numbers by the grade of the newly allocated session, and the weather it requires.

Note that the user sees this information represented in a plot, or perhaps a report. The display doesn't concern us much here - the calculations are what we're trying to describe.

So, how do we figure this out in the context of the GB PHT? Well, here's what we have to map: a database of proposal information to a presentation of the plots.

3 Definitions

Unless otherwise noted, the following terms can be represented by numbers split up by LST and poor, good, or excellent weather:

- **Semester**: NRAO breaks up the year into two segments, A and B. The A semester goes from Feb. 1 to July 31. The B semester goes from Aug. 1 to Jan 31.
- **Current Semester**: Simply the semester that we are currently in.
- **Next Semester**: This is the semester to follow the current one, and is the semester for which the TAC is considering. If today were July 1, 2012, the Current Semester would be 12A, and the Next Semester would be 12B, starting August 1, 2012.
- **Past Semesters**: Any semester before the Current Semester.
- **Future Semesters**: Any semester after the Next Semester.
- **Availability** (V): Simply the number of hours in each day/LST for the Next Semester. For 12B this is 181 days, or 181 hours per LST.
- **Pressure Category**: This refers to what 'kind' of pressure a session will count against. The following are all different categories: requested, allocated, carryover, poor-A, poor-B, etc.
- **Requested** (Q): These are all the new proposals for the Next Semester that have yet to be allocated any time
- **Allocated** (A): These are all the new proposals for the Next Semester that **have** been allocated time and grade.
- **Carryover** (C): this is basically all the other stuff from the Current and Past Semesters that's been previously allocated time on the GBT. This includes

  - **Astronomical Carryover** ($C_{\rm astro}$): Astronomy projects from previous semesters that haven't completed yet. These can be further broken down by grade's A, B and C ($C_{\rm astro,A}$, $C_{\rm astro,B}$, $C_{\rm astro,C}$).
  - **Pre-Assigned** (P): Maintenance, Shutdown and Testing Sessions.
    * **Maintenance and Shutdown** - Any session that belongs to the DSS Projects name 'Maintenance' or 'Shutdown'
    * **Testing** - These are testing sessions from the Next Semester that are of observing type 'commissioning', 'testing', or 'calibration'

- **Ignored** (I): These are all the proposals from past semesters that were never allocated time.
- **Failing Grade**: Any grade other then A, B, or C. This implies that a session with this grade won't be given time on the GBT in the Next Semester, and won't be moved over to the DSS for scheduling.
- **Time Remaining**: This refers to the DSS project and/or session field of the same name; Once a PHT proposal spawns a DSS project and begins observing, this quantity will continue to decrease, via all the complicated DSS Time Accounting rules.
- **Next Semester Time**: This is a PHT session field which the user can fill in to specify how much time the associated DSS session will still have left by the end of the current semester. These are usually based off a DSS 'lookahead' simulation.
- **Weather Types**: We break up the weather into 3 types: **Poor**, **Good**, **Excellent**. We can break up all the above terms up by weather, for example: $V_{\rm poor}$ would be the Availability for Poor Weather. We use simple ratios to break up Availability by weather (.50, .25, .25). So $V_{\rm poor}$ is simply 181 * .5 = 90.5
  - **Poor**: This is weather required by sessions observing less then 8 GHz.
  - **Good**: This is weather required by sessions observing between 8 and 18 GHz, and 26 and 50 GHz.
  - **Weather**: This is weather required by sessions observing between 18 and 26 GHz, and larger then 60 GHz.
- **Weather-Grade**: This is a subset of the allocated pressure category. Each allocated session can be assigned poor, good, or excellent weather, and also gets a grade. So $A_{\rm poor,A}$ is the total of the Sessions that have been assigned a grade A and Poor weather.
- **Remaining** (R): Simply **Availability** minus **Carryover**. This is the time available for new astronomy in the Next Semester.
- **Astronomy Available**: **Availability** - Pre-Assigned. By taking away the Maintenance, Shutdown, and Testing already pre-assinged to the Next Semester, you see how much is left for astronomy.

3.1 Arithmetic

All times can be broken down by weather type. Generically:

$$Time = Time_{\rm poor} + Time_{\rm good} + Time_{\rm excellent} \tag{1}$$

The time remaining is the difference between the availability and the carryover:

$$R = V - C \tag{2}$$

Carryover, in turn is composed of astronomical carryover and pre-assigned time:

$$C = C_{\rm astro} + P \tag{3}$$

Astronomical Carryover can be broken down by grade:

$$C_{\rm astro} = C_{\rm astro,A} + C_{\rm astro,B} + C_{\rm astro,C} \tag{4}$$

Finally, we break down the allocated time by grade **and** weather type:

$$A = A_{\rm poor,A} + A_{\rm poor,B} + A_{\rm poor,B} + A_{\rm good,A} + A_{\rm good,B} + A_{\rm good,B} + A_{\rm excellent,A} + A_{\rm excellent,B} + A_{\rm excellent,B} \tag{5}$$

4 Computing Basic Pressures

Calculating the LST pressure for a session

4.1 Basic Pressures

$$T_{\rm i} = (T_{\rm semester} w_{\rm i} f_{\rm i}) / (\sum_i w_{\rm i} f_{\rm i}) \tag{6}$$

$T_{\rm semster}$ is the time in a session that is proposed to be observed in the semester in question. Note that the value actually used for this variable depends on the sessions category (see below).

The LST range 0.0-23.99999... will be broken into a number (24) of equal length segments. The ith segment is given by $T_{\rm i}$. This represents the total amount of time the session will need in LST segment i. There will also be two weights given by $w_{\rm i}$ and $f_{\rm i}$.

$w_{\rm i}$ is a weight for what fraction of an observation can be in LST bin i.

$f_{\rm i}$ is a flag for specific constraints (Sec. 4.3) that depend on the actual time observations are scheduled.

The minimum and maximum LST are other session attributes to affect Equation 6. Within minimum and maximum LST set $w_{\rm i}$ = 1.0. Outside the minimum and maximum LST set $w_{\rm i}$ = 0.0.

4.2 LST Exclusion Range

If there is an LST exclusion then set $w_{\rm i}$ = 0.0 if the ith segment is in the exclusion.

4.3 Session Flags

The LST exclusions are for optical night time (observing only from sunset to sunrise), thermal nighttime (three hours after sunset to sunrise) and RFI night time (from 8:00 pm to 8:00 am local time). The sunrise and sunset times for the GBT (location given in the GBT Proposer's Guide) must be calculated for each day in the semester when these flags are to be used. The change between EDT/EST will have to be handled correctly also.

If any flags are set (thermal night, rfi night, daylight night) then we must calculate the fraction of time that a given LST segment meets those criteria during the semester. This will give $f_{\rm i}$ with $f_{\rm i}$ being between 0 and 1. If there are no flags set then $f_{\rm i}$ = 1.0. For example if 65 of 180 days meet the flag conditions for the ith LST segment then $f_{\rm i}$ = 65/180 =0.3611.

5 Pressure Categories and Sessions

Pressure Categories (carryover, requested, allocated, etc.) are not just required for their own sake, but also determine the actual value used for T_{semster} in Equation 6.

For details on time fields in the PHT, see [Marganian(2012)].

Here we describe how to decide what category a session belongs to, and what session attribute to use for the T_{semster} value:

if Session has a corresponding session in the DSS **and** Session's Proposal's Semester Current Semester **and** Session does not have a Failing Grade **then**

- $category$ = carryover
- T_{semester} = time remaining OR next semester time
- NOTE: as a caveat to the above rule, if the session belongs to Maintenance or Shutdown projects, then use the session's periods to determine the pressure (see below)
- NOTE: the check for failing grade should be redundant, since a PHT session with failing grade should not get allocated time, and never have an assocaited DSS session.
- NOTE: which value to use for T-semester depends on the time for which the pressures are being calculated (see below).

else if is part of a proposal for the next semester (is part of a new proposal) **and** has been allocated time **and** has been assigned a non-failing grade (A, B, C). **then**

- $category$ = allocated
-
- **if** Session has the Semester Time field set **then**
  T_{semester} = semester time
- **else**
  T_{semester} = allocated total
- **end if**
- break up the sessions into sub-categories according to grades A, B, C

else if is part of a proposal for the next semester (is part of a new proposal) **then**

- $category$ = requested
- T_{semester} = requested total
- NOTE: if a session from a new proposal has simply not been assigned a grade at all yet, then it will be in the requested category.

else

- $category$ = ignored
- T_{semester} = 0.0
- Example: sessions from proposals from past semesters that became DSS projects, and observed until completion
- Example: sessions from proposals from past semesters that got failing grades and never became DSS projects
- Example: sessions that have been assigned a semester past the 'next semester'

end if

5.1 Pressures from Periods

Sometimes we determine the pressure from a session's periods. In some ways this is much simpler then the usual case, since the period range tells us exactly which LSTs are getting blocked.

For each period:

- Find the LST start and end of the period
- Convert this LST range to the fraction that each LST bin is covered by this range.

There are special rules for Elective Sessions: For each elective group, choose only one period.

5.2 Time Remaining vs. Next Semester Time

As mentioned above, which value to use for T_{semester} depends on the time for which the pressures are being calculated. Close to halfway through a semester (close to preparations for the TAC meeting), a lookahead simulation is usually run, and the results are used as values for the sessions' next semester fields - once these values are updated, it is appropriate for next semester time to be used. When new proposals have first been imported into the PHT, it is more appropriate to use the time remaining value.

However, even once this difference is clarified, there are more devils in the details:

5.2.1 Time Remaining

If we are calculating carryover pressure via time remaining, then can get very complicated, and we need to decide how accurate we want to be. To be completely accurate, we must follow the same rules followed not just in nell's TimeAccounting class, which accurately gives us the time remainig for a given session, but we must also follow antioch's time accounting methods, which also determine whether the given session should be scheduled at all, based off the projects complete status, the session's complete status, and even such complex factors as maximum semester time [Marganian(2010)].

However, Toney has agreed that this level of accuracy is not needed here. Instead we use these simple rules:

- If the session's project is complete, time remaining = 0.0
- If the session is complete, time remaining = 0.0
- If the session's time remaining is negative, use 0.0
- Otherwise, use the time remaining as it is currenlty being calculated via nell's TimeAccounting class.

5.2.2 Next Semester Time

There are actually four next semester fields to take into account:

- project's next semester complete
- session's next semester complete
- session's next semester time
- session's next semester repeats

How to use these:

if The project's or session's next semester complete flag is true **then**
  $T_{\rm semester}$ = 0.0.
else
  $T_{\rm semester}$ = next semester time
end if

6 Pressures and Weather

Calculating the Fraction of Time Going Against Different Weather Categories

The weather group is determined by receiver: KFPA, MBA and W are in the excellent weather group. X, Ku, Ka and Q are in the good weather group. All others (342, 450, 600, 800, 1070, L, S, and C) are in the poor weather group.

Let g be the fraction of windowed session that are observed away from their default date. (These are the sessions that get moved to poor weather days.) The value of g is an input parameter for a whole semester. The value of g is between 0.0 and 1.0. This value will need to be a parameter we input for a given semster.

Let $f_{\rm poor}$, $f_{\rm good}$ and $f_{\rm excellent}$ be the fraction of time available for each weather group. We get to set what these fractions are for a given semester and the values are between 0.0 and 1.0.

6.1 Open Sessions

For open sessions the time should go only to the weather condition set for the session in the GB PHT.

6.2 Windowed Sessions

For weather monitoring sessions with widows less than or equal to 3 days:

$$T_{\rm poori} = T_{\rm i} f_{\rm poor} \tag{7}$$

$$T_{\rm goodi} = T_{\rm i} f_{\rm good} \tag{8}$$

$$T_{\rm excellenti} = T_{\rm i} f_{\rm excellent} \tag{9}$$

For monitoring sessions with windows greater than 3 days:

$$T_{\rm poori} = (T_{\rm i} g) + (T_{\rm i} f_{\rm poor}(1-g)) \tag{10}$$

$$T_{\rm goodi} = T_{\rm i} f_{\rm good}(1-g) \tag{11}$$

$$T_{\rm excellenti} = T_{\rm i} f_{\rm excellent}(1-g) \tag{12}$$

6.3 Elective Sessions

An elective session will have m observations occur within n days. The fraction of observations occuring in the proper weather conditions is given by h, were

$$h = 1 - (m/n) \tag{13}$$

T-i is determined from the LST Pressure Calculation formula. For poor weather elective sessions:

$$T_{\mathrm{poori}} = (T_{\mathrm{i}}h) + (T_{\mathrm{i}}f_{\mathrm{poor}}(1-h)) \tag{14}$$

$$T_{\mathrm{goodi}} = T_{\mathrm{i}}f_{\mathrm{good}}(1-h) \tag{15}$$

$$T_{\mathrm{excellenti}} = T_{\mathrm{i}}f_{\mathrm{excellent}}(1-h) \tag{16}$$

For good weather elective sessions:

$$T_{\mathrm{goodi}} = (T_{\mathrm{i}}h) + (T_{\mathrm{i}}f_{\mathrm{good}}(1-h))/(f_{\mathrm{good}} + f_{\mathrm{excellent}}) \tag{17}$$

$$T_{\mathrm{excellenti}} = (T_{\mathrm{i}}f_{\mathrm{excellent}}(1-h))/(f_{\mathrm{good}} + f_{\mathrm{excellent}}) \tag{18}$$

For excellent weather elective sessions:

$$T_{\mathrm{excellenti}} = T_{\mathrm{i}} \tag{19}$$

6.4 Fixed Sessions

For poor weather fixed sessions:

$$T_{\mathrm{poori}} = T_{\mathrm{i}}f_{\mathrm{poor}} \tag{20}$$

$$T_{\mathrm{goodi}} = T_{\mathrm{i}}f_{\mathrm{good}} \tag{21}$$

$$T_{\mathrm{excellenti}} = T_{\mathrm{i}}f_{\mathrm{excellent}} \tag{22}$$

For good weather fixed sessions:

$$T_{\mathrm{goodi}} = (T_{\mathrm{i}}f_{\mathrm{good}})/(f_{\mathrm{good}} + f_{\mathrm{excellent}}) \tag{23}$$

$$T_{\mathrm{excellenti}} = (T_{\mathrm{i}}f_{\mathrm{excellent}})/(f_{\mathrm{good}} + f_{\mathrm{excellent}}) \tag{24}$$

For excellent weather fixed sessions:

$$T_{\mathrm{excellenti}} = T_{\mathrm{i}} \tag{25}$$

6.5 Overfilled Weather Bins

Up to now, our arithmetic was pretty straightforward. What we would represent in a plot of the LST Pressures is a sum of the LST Pressure for each individual session under consideration. This next step breaks that rule, and is therefore done last, and is implemented as an option.

The basic idea here is to redistribute too much allocated time for poor weather, with grade A, to the allocated time for good weather, grade A. If this grade A, good weather, in turn, is too much, then redistribute some of that to excellent weather, grade A. The total amount of grade A allocated time does not change.

Availability, V, is the number of hours available in the semester. $A_{\mathrm{poor,A}}$ are the new sessions allocated time for the next semester with grade A for poor weather (see definitions above).

if $A_{\mathrm{poor,A}} + C_{\mathrm{poor}} \leq V_{\mathrm{poor}}$ **then**

- $A_{\mathrm{poor,A}}$ = V_{poor} - C_{poor}
- r_{poor} = $A_{\mathrm{poor,A}}$ + C_{poor} - V_{poor}

if $A_{\mathrm{good,A}} + C_{\mathrm{good}} + r \geq V_{\mathrm{good}}$ **then**

- r_{good} = $A_{\mathrm{good,A}}$ + C_{good} + r_{poor} - V_{good}

- $A_{\text{good,A}} = V_{\text{good}} - C_{\text{good}}$
- $A_{\text{excellent,A}} = A_{\text{excellent,A}} + r_{\text{good}}$

else

$A_{\text{good,A}} = A_{\text{good}} - r$

end if

end if

7 Use Cases

Now we flesh out the above rules with some specific use cases.

7.1 Use Case 1: Binning LSTs

Table 1: Binning LSTs Examples

Case	Min LST	Max LST	Bins
1	00:00	01:00	0
2	00:00	10:00	0,1,2,3,4,5,6,7,8,9 ([0,9])
3	00:30	01:30	0
4	10:00	10:59	10
5	00:30	10:59	[0-9]
6	22:30	08:59	22,23,[0-7]

Table 1 shows examples of how Min. and Max. LSTs are translated into LST bins for pressure calculatations.

7.2 Night Time Flags and Pressures

Here we describe examples of how the various night time flag weights are calculated. In order to fit all 24 LST bins in the same table, the columns are: Day from August 1, 2012, Sun Rise (UTC), Sun Set (UTC), Sun Rise (LST), Sun Set (LST), followed by the 24 LST hours. The last two dates are Jan 29 and Jan 30, 2013.

7.2.1 Use Case 2: Optical Night Flag

Table 2: Optical Night Flag

Day	Rise	Set	R-LST	S-LST	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
0	10:21:31	00:30:12	1.73	15.91	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
1	10:22:24	00:29:12	1.81	15.96	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
2	10:23:16	00:28:10	1.89	16.01	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
181	12:26:38	22:38:52	15.72	1.95	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
182	12:25:49	22:40:00	15.77	2.03	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0

Table 7.2.1 is an example of how the Optical Night Flag (Sec. 4.3) weights should be calcualted.

7.2.2 Use Case 3: Thermal Night Flag

Table 7.2.2 is an example of how the Thermal Night Flag (Sec. 4.3)weights should be calcualted.

7.2.3 Use Case 4: RFI Night Flag

Table 7.2.3 is an example of how the RFI Night Flag (Sec. 4.3) weights should be calcualted.

Table 3: Thermal Night Flag Examples

Date	Rise	Set	R-LST	S-LST	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
0	10:21:31	03:30:12	1.73	18.92	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
1	10:22:24	03:29:12	1.81	18.97	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
2	10:23:16	03:28:10	1.89	19.02	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
181	12:26:38	01:38:52	15.72	4.96	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
182	12:25:49	01:40:00	15.77	5.04	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0

Table 4: RFI Night Flag Examples

Date	Rise	Set	R-LST	S-LST	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
0	12:00:00	00:00:00	3.38	15.41	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
1	12:00:00	00:00:00	3.44	15.48	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
2	12:00:00	00:00:00	3.51	15.54	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
181	13:00:00	01:00:00	16.27	4.31	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
182	13:00:00	01:00:00	16.34	4.37	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0

7.3 Use Case 5: Overfilled Weather Bin Use Cases

Since the rules for what happens with overfilled weather bins is independent of LST, the following use cases just focus on a generic LST bin.

7.3.1 Use Case 5.1 Simplest Case

Table 5: Use Case 5.1: Simplest Case

Weather Type	Availability	Carryover	Grade A
Poor	90.5	22.0	28.0
Good	45.25	N/A	35.0
Excellent	45.25	N/A	25.0

Table 5 shows our simplest case, where no hours are redistributed: not too much Grade A, Poor Weather time, $A_{\mathrm{poor,A}}$. This is because 22 + 28 = 50, which is less then 90.5, so nothing needs to get redistributed.

7.3.2 Use Case 5.2 A little too much Grade A (Poor Weather)

Table 6 shows a situation where there is a little too much Grade A, Poor Weather time, $A_{\mathrm{poor,A}}$.

- 45 + 59.5 = 104.5 is greater then 90.5, so
- r_{poor} = 45 + 59.5 - 90.5 = 14
- $A_{\mathrm{poor,A}}$ = 90.5 - 45 = 45.5

How much do we need to add to Grade A (Good Weather)?

- 15 + 10 + 14 = 39 is less then 45.25, so
- $A_{\mathrm{good,A}}$ = 15 + 14 = 29

Table 7 shows the final result after the distribution has been made. In summary, 14 hours got taken off Grade A (Poor Weather), $A_{\mathrm{poor,A}}$, and put into Grade A (Good Weather), $A_{\mathrm{good,A}}$

Table 6: Use Case 5.2: Before

Weather Type	Availability	Carryover	Grade A
Poor	90.5	45.0	59.5
Good	45.25	10.0	15.0
Excellent	45.25	0.0	25.0

Table 7: Use Case 5.2: After

Weather Type	Availability	Carryover	Grade A
Poor	90.5	45.0	45.5
Good	45.25	10.0	29.0
Excellent	45.25	0.0	25.0

7.3.3 Use Case 5.3: Simply too much Grade A (Poor Weather)

Table 8 shows a situation where there is way too much Grade A, Poor Weather time, $A_{\mathrm{poor,A}}$.

- 45 + 79.5 = 124.5 less then 90.5, so
- r_{poor} = 45 + 79.5 - 90.5 = 34
- $A_{\mathrm{poor,A}}$ = 90.5 - 45 = 45.5
- How much do we need to add to Grade A (Good Weather)?
- 10 + 15 + 34 = 59 greater than 45.25, so
- r_{good} = 10 + 15 + 34 - 45.25 = 13.75
- $A_{\mathrm{good,A}}$ = 45.25 - 10.0 = 35.25
- Now add this remainder to the excellent weather:
- $A_{\mathrm{excellent,A}}$ = 25 + 13.75 = 38.75

Table 9 shows the final times after the redistribution has been made.

In summary, 34 hours were taken from Grade A (Poor), $A_{\mathrm{poor,A}}$, with 20.25 added to Grade A (Good), $A_{\mathrm{good,A}}$, and 13.75 added to Grade A (Excellent), $A_{\mathrm{excellent,A}}$.

Table 8: Use Case 5.3: Before

Weather Type	Availability	Carryover	Grade A
Poor	90.5	45.0	79.5
Good	45.25	10.0	15.0
Excellent	45.25	0.0	25.0

Table 9: Use Case 5.3: After

Weather Type	Availability	Carryover	Grade A
Poor	90.5	45.0	45.5
Good	45.25	10.0	35.25
Excellent	45.25	0.0	38.75

7.4 Use Case 6: Pressures from Periods

Table 10: Use Case 6: Pressures from Periods

StartDate	Duration	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
2012-04-05T12:00:0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.38	1	1	.63	0
2012-04-05T12:00:0	12	1	1	1	1	1	1	1	.66	0	0	0	0	0	0	0	0	0	0	0	.38	1	1	1	1

Table 10 shows the results of pressures being calculated for different periods. Note how the sum of LST weights should equal the period duration. Also note how all weights are 1 or 0, except endpoints, that added together should equal one.

7.5 Use Case 7: Binning Pressures by Weather Use Cases

The following tables, Table 11, Table 12, and Table 13, show how sessions of different types get their pressures distributed across weather types. The total row is the original pressure as calculated by Equation 6

Table 11: Use Case 7.1: Fixed Session

WeatherType	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
Total	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Poor	0	0	0	0	0	0	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	0	0	0	0	0	0
Good	0	0	0	0	0	0	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	0	0	0	0	0	0
Excellent	0	0	0	0	0	0	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	0	0	0	0	0	0

Table 12: Use Case 7.2: Windowed Session (window size = 2 days)

WeatherType	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
Total	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Poor	0	0	0	0	0	0	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	0	0	0	0	0	0
Good	0	0	0	0	0	0	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	0	0	0	0	0	0
Excellent	0	0	0	0	0	0	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	0	0	0	0	0	0

7.6 Use Case 8: LST Exclusion

Table 14 shows how taking into account an LST exclusion range modifies that session's coefficients (w-i's).

In our example, the pressure is 1.0 across all LST's; we see the affects of adding an exclusion range of '4.5-7.2,21.2-23.0'.

Table 13: Use Case 7.3: Windowed Session (window size = 20 days)

WeatherType	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**1**	**2**	**3**
Total	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Poor	0	0	0	0	0	0	.75	.75	.75	.75	.75	.75	.75	.75	.75	.75	.75	.75	0	0	0	0	0	0
Good	0	0	0	0	0	0	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	0	0	0	0	0	0
Excellent	0	0	0	0	0	0	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	0	0	0	0	0	0

Table 14: Use Case 8: LST Exclusion

When	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**1**	**2**	**3**
Before	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
After	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1

7.7 Use Case 9: Proposal Life Cycles

Here's a rather big use case that tries to examine how pressure categories change over multiple semesters.

7.7.1 The First Semester

The first time we used the PHT and tried to calculate pressures was during 12A; our new proposals were for 12B. At first, all we had were these fresh 12B proposals, none of which had been assigned a grade or allocated time, and they all were for the 12B semester. Therefore, all our sessions fell into the same category: requested.

Then we had to start figuring out the carryover, so we pulled over from the DSS only those projects and sessions that were not complete and made corresponding legacy PHT proposals and sessions. These all fell into the carryover category, and we used time remaining for computing their pressure.

Table 15: Use Case 9.1: Beginning of first semester

Category	Hours	Composition
requested	150.0	the new proposals for 12B
carryover	110.0	legacy projects from 12A and earlier

Table 15 shows the total times at the very beginning of the semester.

Then we started editing these 12B proposals: some get assigned a passing grade and time, other's get a failing grade and no time, and a few exceptional sessions get assigned a semester past 12B.

Table 16: Use Case 9.2: Editing first semester

Category	Hours	Composition
requested	100.0	the new proposals for 12B
allocated	40.0	the new proposal for 12B that will become DSS projects
ignored	10.0	right now, all that's contributing to this are the 'future' sessions
carryover	110.0	legacy projects from 12A and earlier

Table 16 shows the times after we start editing these new sessions.

As we get closer to the TAC meeting, and the actual start of the 12B semester, we want the carryover to actually reflect what time is left at the start of 12B, not the current time remaining. So, a DSS lookahead simulation is run, and this is used to enter in next semester values for each carryover session (some are actually marked off as completed).

Table 17: Use Case 9.3: Use Lookahead, first semester

Category	Hours	Composition
requested	100.0	the new proposals for 12B
allocated	40.0	the new proposal for 12B that will become DSS projects
ignored	10.0	right now, all that's contributing to this are the 'future' sessions
carryover	75.0	legacy projects from 12A and earlier

Table 17 shows the times after we apply the results of the lookahead simulation, and start using the next semester fields.

The editing process continues, and the TAC meeting is held. The final decisions for these new proposals are finally made.

Table 18 shows the times after the TAC makes its final decisions.

Finally, 12B is about to start, so all the allocated sessions need to have equivalent sessions in the DSS. These are created, and it has no affect on our table above at all.

Table 18: Use Case 9.4: TAC meeting, first semester

Category	**Hours**	**Composition**
requested	50.0	the new proposals for 12B that won't become DSS projects
allocated	85.0	the new proposal for 12B that will become DSS projects
ignored	15.0	right now, all that's contributing to this are the 'future' sessions
carryover	110.0	legacy projects from 12A and earlier

7.7.2 The Second Semester

The first day of 12B arrives, but we have not yet imported any new proposals for 13A into the PHT. Our allocated category now moves into carryover, and the proposals in requested get moved to ignored, because the term 'current semester' has moved from 12B to 13A (see Note 1).

Table 19: Use Case 9.5: Beginning of second semester

Category	Hours	Composition
ignored	65.0	Sessions for 12B with failing grade, and 'future' sessions (see Note 2)
carryover	195.0	legacy projects from 12B and earlier

Table 19 shows the times at the very beginning of this second semester.

Now we import new proposals for 13A (on the second day of 12B). This introduces requested time into the system.

Table 20: Use Case 9.6: New proposals, second semester

Category	Hours	Composition
requested	100.0	the new proposals for 13A
ignored	65.0	Sessions for 12B with failing grade, and 'future' sessions (see Note 2)
carryover	195.0	legacy projects from 12B and earlier

Table 20 shows the times right after importing new requests for this second semester.

Then we start editing these 13A proposals: some get assigned a passing grade and time, other's get a failing grade and no time, and a few exceptional sessions get assigned a semester past 13A.

Table 21: Use Case 9.7: Editing, second semester

Category	Hours	Composition
requested	50.0	the new proposals for 13A
allocated	45.0	the new 13A proposals that will get scheduled.
ignored	70.0	Sessions for 12B with failing grade, and 'future' sessions (see Note 2)
carryover	195.0	legacy projects from 12B and earlier

Table 21 shows the times after editing the new requests for this second semester.

As we get closer to the TAC meeting, and the actual start of the 13A semester, we want the carryover to actually reflect what time is left at the start of 13A, not the current time remaining. So, a DSS lookahead simulation is run, and this is used to enter in next semester values for each carryover session (some are actually marked off as completed).

Table 22: Use Case 9.8: Using Lookhead, second semester

Category	Hours	Composition
requested	50.0	the new proposals for 13A
allocated	45.0	the new 13A proposals that will get scheduled.
ignored	70.0	Sessions for 12B with failing grade, and 'future' sessions
carryover	150.0	legacy projects from 12B and earlier

Table 22 shows the times after running the lookahead simulations and using the next semester fields.

The editing process continues, and the TAC meeting is held. The final decisions for these new proposals are finally made. Here's what our numbers look like now:

Table 23: Use Case 9.9: TAC meeting, second semester

Category	Hours	Composition
requested	30.0	the new proposals for 13A
allocated	65.0	the new 13A proposals that will get scheduled.
ignored	70.0	Sessions for 12B with failing grade, and 'future' sessions
carryover	150.0	legacy projects from 12B and earlier

Table 23 shows the times after the TAC meeting.

Note 1 - there are two sources of time for carryover sessions: either the time remaining from it's associated DSS session, or the PHT session's very own next semester time field. At the begining of the 12B semester, the 'old' carryover is still using the next semester field, but what will the 'new' carryover, that is the 12B sessions be using? If they were to be using the time remaining field, then this would reflect the numbers we have in the first table of 3.7.1. But we currently don't support two sources of time for carryover. We should figure this out. One option is for the source to be chosen by the user - in which case at the beginning of 12B they can choose to use time remaining.

Note 2 - this depends on what future sessions are specified. In this example assume they semesters WAY in the future ... need to discuss this further.

7.7.3 Fleshing out the example with more carryover

Adding more carryover, and taking into account Maintenance and Testing Sessions, here's how our example could be fleshed out:

- Maintenance Session from 12A - with a period in each week of semester 13A (that's about 200 hours)
- Testing Session for 13A - allocated 16 hours (observing type == 'commissioning')
- Additional Carryover - allocated lots of time, but labeled as 'complete' in the DSS, so does not contribute anything to the pressure

Carryover, C: 150.0 + 200.54 + 16.0 = 366.54

Table 24: Use Case 9.10: Final Example

Category	Hours	Composition
requested	30.0	the new proposals for 13A
allocated	65.0	the new 13A proposals that will get scheduled.
ignored	70.0	Sessions for 12B with failing grade, and 'future' sessions
carryover	366.54	legacy projects from 12B and earlier, plus maintenance and testing

Table 24 shows all the times after these new sources of carryover have been added.

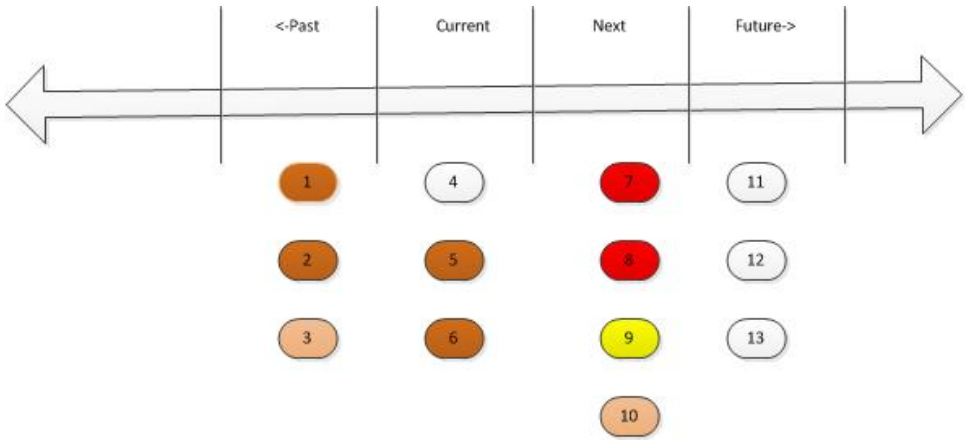

Figure 1: Lst Pressures Timeline

Figure 1 gives a visual example of how the sessions in the PHT and DSS produce an LST Pressure plot. The timeline above has been generalized such that a specific semester is not specified. Instead, 'now' is sometime in the Current Semester.

Each colored oval above represents a PHT session. Its position in the timeline represents its semester, and its color represents what category it falls into. This color is meant to be close the color of the category in the plot (Figure 2). For simplicity, all sessions have an LST range between 10 and 20 Hours, are grade A, and have Poor weather.

Table 25: Session Legend

Session	Semester	Category	Hours	Notes
1	12A	carryover	75	allocated two cycles ago, astronomy with 75 hrs left
2	12A	carryover	0	allocated two cycles ago, but complete, so 0.0 hrs left
3	12A	carryover	200	maintenance (pre-assigned), 200 hrs from periods in Next Semester
4	12B	ignored	0	received failing grade during last cycle; never got scheduled
5	12B	carryover	45	astronomy allocated last cycle, with 45 hrs left
6	12B	carryover	40	allocated last cycle astronomy with 40 hrs left
7	13A	allocated	45	this cycle, 45 hrs
8	13A	allocated	20	this cycle, 20 hrs
9	13A	requested	0	requested this cycle, wont get scheduled (ignored next cycle), 30 hrs
10	13A	carryover	16	testing (pre-assigned this cycle), 16 hrs
11	13B	future	5	allocated last cycle to future semester, 5 hrs
12	13B	future	10	allocated last cycle to future semester, 10 hrs
13	13B	future	5	allocated this cycle to future semester, 5 hrs

Table 25 we briefly explain the category and time that each session contributes to the pressure.

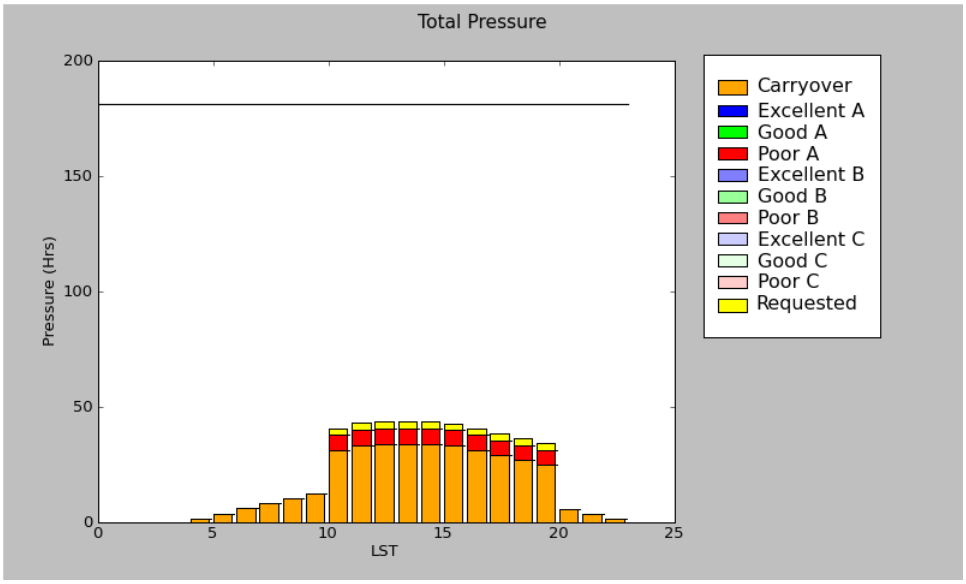

Figure 2: Lst Pressures Plot

Figure 2 shows the resulting pressure plot. Some notes on this:

- The three colors shown are from carryover (both types), allocated (Poor A specificially), and requested.
- All sessions have an LST range of 10 to 20 Hours. Thus the spread of all sessions' time across those 10 LST bins. The exception to this is the pressure from maintenance that is derived off the actual periods.
- Note that 'ignored' and 'future' sessions do not appear in the plot.

References

[Marganian(2012)] Marganian, Paul, 2012, “PHT Time Accounting” PH/PN001.0

[Marganian(2010)] Marganian, Paul, 2010, “DSS Time Accounting” DS/PN011.0