3.12 Production Planning Activities

3.12.1 Routine Production Planning Scenario

The following scenario discusses routine planning for production processing. Related scenarios include those in Section 3.6 which discusses planning of resources, and Section 3.13 which discusses routine production processing. This scenario is intended to describe a 'normal' planning cycle to provide a basis of comparison with the abnormal planning situation that is described in Section 3.12.2, Replanning for Production Processing.

3.12.1.1 Scenario Description

The following scenario is assumed to occur during a given day of the Release A period at the LaRC DAAC. The system at the DAAC is in stable operations. The TRMM instruments, including CERES, the Sensor Data Processing Facility (SDPF), and the ECS Ingest subsystem are all operating normally. The Instrument Team (IT) developed Science Software (SS) as embodied in Product Generation Executives (PGEs) have been integrated into the ECS production processing environment and are operating normally. The present scenario describes the process for the development of plans for production processing at the LaRC DAAC. Three planning time cycles described in this scenario - monthly plan, weekly, and daily plans or schedules. The timeframes identified here indicate a possible scheme for the generation of these plans. It is the intent that the production planning tool be flexible enough in its design to support the particular planning and scheduling cycles of the operations organization of each DAAC.

The scenario also describes the addition of a Production Request into the PDPS Database. This is not a routine activity but is described here for the sake of covering other operator interfaces that have a bearing on the routine production planning activity.

3.12.1.2 Frequency

The production planner prepares a monthly and weekly production plan. He also develops a daily production schedule from the most current weekly plan.

Monthly plans are developed for the coming month and one or two months in advance. The monthly plans are generally produced, reviewed, updated and published/distributed approximately 2 weeks before the beginning of the month. The monthly plan for the coming month is used to establish a baseline against which production targets can be measured. Weekly plans are produced, reviewed, updated and published/distributed approximately 5 days before the beginning of the coming week. The weekly plan is also used to produce a baseline for comparison of planned vs. actual production results. A daily plan or schedule is produced each day for the next processing day. The daily schedule is developed from the current weekly plan, adjusted to reflect the actual processing accomplished and the actual resources available at the time of the daily schedule generation. The LaRC DAAC will be operating on a 16-hour per day processing schedule during the Release A period.

During normal processing when reasonably accurate predictions of the processing time for the PGEs are available, the processing schedule should result in a reasonably accurate prediction of when processing data products will be generated. However, during abnormal situations (e.g., equipment failure, etc.), the plan could depart significantly from what is actually accomplished. In such a situation, the production planner may choose to develop a new plan to reflect the current situation. Such a replanning scenario is presented in Section 3.12.2, Production Replanning.

The scenario here includes the description of an addition of a Production Request (PR) into the PDPS Database. The frequency of this activity is, to some extent, determined by the IT responsible for the science software. A PR is a template request to generate a particular data product and causes the associated IT-provided PGE to be run. The PR is a template in that it specifies a time range over which the data products are to be produced, or the PGEs to be scheduled[1]. The PR might request that the data product be produced for only a single day (or other time increment) of data. Alternatively, a single PR might request that data products be produced for every opportunity of input data for several months, resulting in several hundred jobs being planned and run as the input data becomes available. The ITs may only be comfortable in requesting processing for a short time period (e.g., a week or less) early in the mission when they are gaining an understanding of the on-orbit behavior of the instrument, the resulting data, and the interaction of the science processing software with real data. When this behavior is well understood, they may be satisfied to request processing for months at a time. However, DAAC operations may only want to issue processing requests for a more limited time period for operational reasons. The resulting balance of considerations determines the frequency of the PR entry activity.

In the scenario considered here, the IT for the CERES instrument has a standing agreement with the production planner to input a PR covering a one month period every month. The IT reviews the quality of the products on a monthly basis and provides any changes to the PR - e.g., discontinue PR, change time ranges, modify input parameters - to the planner via E-mail prior to the time that the PR should be updated. For the last several months, there have been no changes to the PR other than to reissue it for continued processing[2].

3.12.1.3 Assumptions

Assumptions underlying this scenario are as follows.

1. The scenario presented here is applicable to the Release A time period.

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[1]The Production Request determines a PGE to be scheduled to generate a particular product type. The PR may specify the product, or the PGE. At Release A there is no automatic "data chaining" that determines that several PGEs have to be scheduled to generate a high level product. The planning software will recognize, and reject a PR when that PR specifies a PGE that requires data from another PGE, and there is no PR for the second PGE.

[2]The ECS is currently evaluating CERES descriptions of products and PGEs in terms of the "data product, data set, data series, instance, version and location" identifiers used within CERES to describe sets of products. These metadata items may be used to uniquely identify a product or PGE within a production request.

3.12.1.4 Components

There are two components involved with this scenario, the Processing Workbench of the PLANG CI and the PRONG CI. Figure 3.12.1.4-1 indicates the interaction of the production planning personnel with the Planning Workbench and the subsequent interaction between the Planning Workbench and the Processing Subsystem.

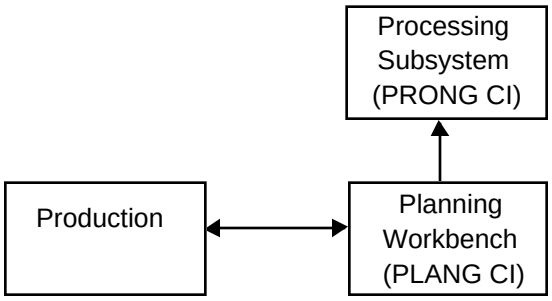

Figure 3.12.1.4-1. Routine Production Planning Scenario Components

3.12.1.5 Preconditions

The following preconditions are assumed for this scenario:

1. It is assumed that at the point at which this scenario is concerned, all resource allocation issues have been resolved with the resource planner, that the list of resources available for use in processing and an allocation profile with time for those resources has been provided to the production planner. See Section 3.6, Resource Planning for additional information on this point.
2. The PDPS database is complete in terms of PRs, DPRs and data availability predictions, etc. and is ready to support the planning activity.
3. Subscriptions have been entered against all data products required for processing.

3.12.1.6 Detailed Steps of Process

Table 3.12.1.6-1 represents the details of the production planning activity, including the entry of a PR. The time values provided are approximate. There is no significant User-Operator interaction during this scenario. The Operator is the production planner who is responsible for the planning of science data processing at the DAAC.

Notes for Figure 3.12.1.6-3

This timeline display here was developed as an early prototype, where ground events were annotated as an outage. The Production Planning Tool will include some user supplied annotation to label these activities. In addition, the names used here to identify PGEs may not conform to the usage of the associated IT.

Table 3.12.1.6-1. Routine Production Planning Process (1 of 7)

Step	Time	User	Operator (production planner)	System	Figure
1	More than 1 week before the target month		The production planner reviews objectives for processing for the coming month. Considerations are: - SS stability - IT input - Project directives The production planner notes that the current PR for a CERES product is due to expire. The IT for CERES has requested that the PR be reissued for the next month.	E-mail from ITs to operations is supported. Depending on local DAAC policy, the lead SCF may also access production request editor directly to enter production requests.	
2	Start of Production Request entry.		The production planner starts the production request editor from the normal operators desktop. The planner selects the option to access the existing PRs. A window is open that provides the collection of fields that constitute a PR.	The production request editor provides several fields to be input by the user.	
3	Production Request entry session < 5 minutes		In the "Instrument" field, the planner selects CERES from a list of options. From the "Processing Level/Description" field, the planner selects "ERBE-like" processing. From the "PGE" field, the planner selects the PGE ID that is the most current for the ERBE-like processing, which is the default. The planner scrolls through the list of user parameters and corresponding values, but makes no changes. The planner scrolls through a list of paired start dates and stop dates for processing that have been previously entered for this configuration of times and user parameters. The planner enters in a new pair of start date & stop date values corresponding to the monthly period requested by the CERES IT. The planner clicks 'Add PR' and exits the Production Request Editor window.	The system uses the production request to generate a series of data processing requests. Each DPR corresponds to the execution of a single PGE. At this point the availability of the data required for each DPR is checked, either from the data server if the data are previously ingested, or from internal predictions if the data are expected to arrive in the future. Also at this point the data to be output from the DPR are calculated to generate predictions of what may be available for subsequent PGEs.	

Step	Time	User	Operator (production planner)	System	Figure
			[NOTE: The terminology used here for the CERES processing may not be consistent with the terminology used by the CERES IT. A new set of attributes to describe a PGE for CERES is being looked into; e.g., PGE, Data Set, Data Series, Instance, Version, Location]		
4	Start of planning session		The production planner now creates a plan for the coming month. The production planner starts the planning workbench. (See Figure 3.12.1.5-1).	The planning workbench is started from the normal operators desktop. Other applications are visible from the desktop.	
5			The planner selects the New Plan option.	Options available to the planner from the planning workbench include: - Prepare New Plan & Save - Open Existing Plan - Update Plan - View Production Requests - Activate Plan - View Plan (timeline) - Baseline Plan -View Plan Activity Log	
6			In the GUI provided, the planner indicates the time period (start date & stop date) for which he wishes to develop a plan.	The planning workbench is configurable for each DAAC to suit their needs.	
7			In a scrollable list, PRs that are applicable to this period are displayed. (See Figure 3.12.1.5-2)	The planning workbench displays PRs that are applicable to the specified planning interval. Each PR is identified by a row in the list which contains information such as the PR name, PGE ID, priority, time period, comments and whether the PR has been scheduled for this plan.	

8			The planner is uncertain concerning the details of one of the PRs displayed and selects to view the details for the PR instead.	The system displays a detail screen for a single PR, identifying all of the information describing the job.	

Step	Time	User	Operator (production planner)	System	Figure
9			The planner reverts to the PR scrollable list display and selects all of the PRs applicable to this period.	The list of all possible PRs are selected for inclusion in the planning activity. Viewing the PRs either via the PR detail GUI or the PR scrolling list, the operator can select or deselect individual PRs and change their priority or toggle them to be scheduled or unscheduled .	
10			The planner has finished selecting the PRs to be run during the planning interval. The planner selects “Schedule” to indicate completion of PR selection.		
11	The development of a single 30 day plan may take of the order of 10 minutes.		The planner clicks on "Timeline" which creates a plan from the selected PRs and presents it as a timeline display. (See Fig. 3.12.1.5-3)	The system uses the selected PRs, information concerning the projected run time of the jobs, system resource projections including ground event activities, and priorities associated with jobs to develop a monthly plan. See "Planning Workbench Detailed Design for the ECS Project" Technical Paper 420-TP-007-001 for detail on the algorithm used for plan generation.	

12	< 5 minutes		The planner considers the resulting plan. He notes that not all of the intended processing objectives are accomplished. This is the result of the large amount of ground event time allocated to production resources during this interval to meet certain test objectives. The planner decides to develop a second candidate plan where the priority of some reprocessing activities are lowered to allow standard processing objectives to be met. The planner is aware that the testing activities will be completed shortly after and that sufficient resources will be available to keep current with standard processing and work off the backlog of reprocessing.		

Step	Time	User	Operator (production planner)	System	Figure
13	< 1 minute		The planner exits from the plan viewing GUI, saves the current plan, and returns to the plan creation activity. He reviews the list of PRs selected previously. He selects a PR corresponding to a reprocessing activity. He modifies the priority level for the PR for the time period and selects “Schedule” to indicate completion of PR modification.	The planning system can save multiple plans during a session that can be retrieved later in the session. The priority can be changed from the PR ID list GUI.	
14	The development of a single 30 day plan may take of the order of 10 minutes.		The planner clicks on "Timeline".	As above.	
15	< 1 minute		The planner considers the second candidate plan created. The expected result of the priority change is achieved. The planner saves this monthly production plan.	As above.	
16	< 1 minute		The planner exits from the plan creation GUIs to the planning workbench. He selects "Baseline Plan" to establish a point of comparison to be used for "Planned vs. Actuals" comparisons.	The planning workbench creates a tabular representation of the information contained in the plan and transfers the resulting document to the Document Data Server (DDS) where it will be available to the public. (A graphical version of this plan accessible via the DDS is TBD).	

Step	Time	User	Operator (production planner)	System	Figure
17	< 1 minute		The production planner now creates a Weekly Plan for the coming week. The underlying information in the planning system database is the same for both the monthly plan and the Weekly plan, but reports generated provide more detailed information. The planner selects the "Open" option to open an existing plan for the week.	(See item 5 above, and Figure 3.12.1.5-1)	
18	< 5 minute		The production planner reviews and updates the selected PRs where required reflecting planning meetings and comments.	As above.	
19	< 3 minutes		The planner clicks on "Timeline" to view the resulting plan for the time period. The planner considers the plan created. The expected result of the priority change is achieved. The planner saves this monthly production plan.	As above.	
20	< 1 minute		The planner exits from the plan creation GUIs to the planning workbench. He selects "Baseline Plan" to establish a point of comparison to be used for "Planned vs. Actuals" comparisons for the weekly plan.	The planning workbench creates a tabular representation of the information contained in the plan and transfers the resulting document to the Document Data Server (DDS) where it will be available to the public. (A graphical version of this plan accessible via the DDS is TBD).	
21			The planner is now ready to review and activate the production schedule for the next day of processing	-	

22	Start of plan activation process.		The planner selects the current weekly plan being used for the activation/schedule seeding operation. Information from this most current weekly plan will be rolled into the processing system COTS scheduler. The planner selects "Activate Plan" from the planning workbench options.	See the options listed under scenario item 5. The plan for the day is updated to reflect any changes in the PDPS Planning database such as the status of DPRs that were previously activated for processing, or changes in the resource allocation timeline for processing.	

Step	Time	User	Operator (production planner)	System	Figure
23			The planner enters the time range of the scheduling period, enters any comments appropriate to the schedule and selects Activate. (See Figure 3.12.1.5-4)	The system creates an ordered list of the activities which are currently active in data processing and integrates with it other activities that may be scheduled within the scheduling window or time period. The planning system processes the list: if the DPR is already active (i.e., in the data processing system), the entry available to the data processing system is updated to insure most current information with possible priority adjustments. If the DPR is not active, it is scheduled into the data processing system.	
24	Steps 22 to this point are ex-pected to take of the order of half an hour total.		The planner reviews the resulting schedule and accepts the results. He returns to the Planning Workbench.	The data processing system will initiate PGE jobs according to the schedule of jobs transferred from the planning system.	

3.12.1.7 Postconditions

At the completion of the above scenario, the planning database contains new and updated entries reflecting the current state of the production plan. The DDS contains the published version of the plan and a timeline view (TBD) of the plan. E-mail messages will have been sent to all affected persons, as determined by the plan insertion or update. The production schedule, as maintained by AutoSys, will have been updated and processing will proceed according to that schedule.

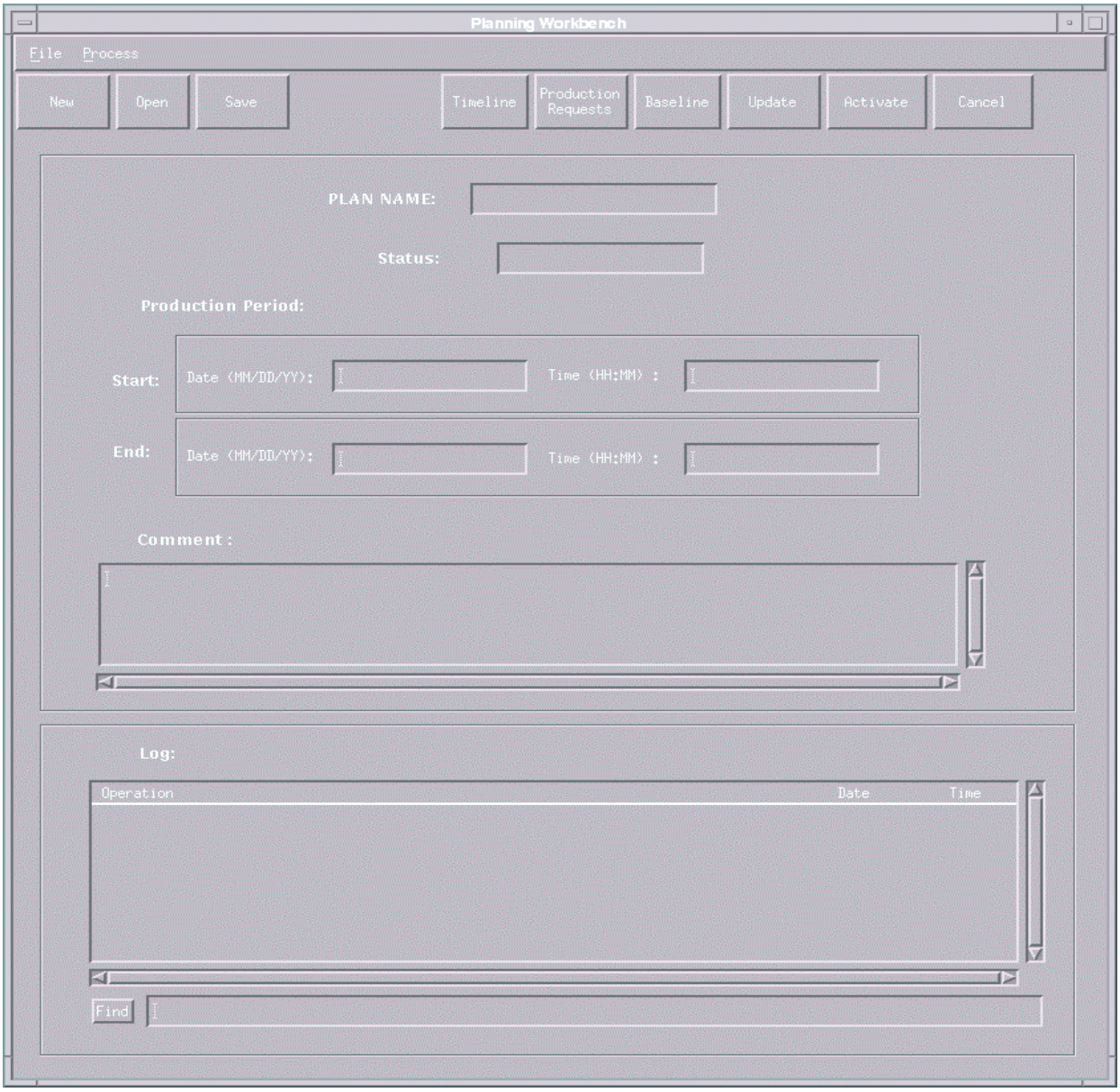

Figure 3.12.1.6-1. Production Planning Workbench GUI

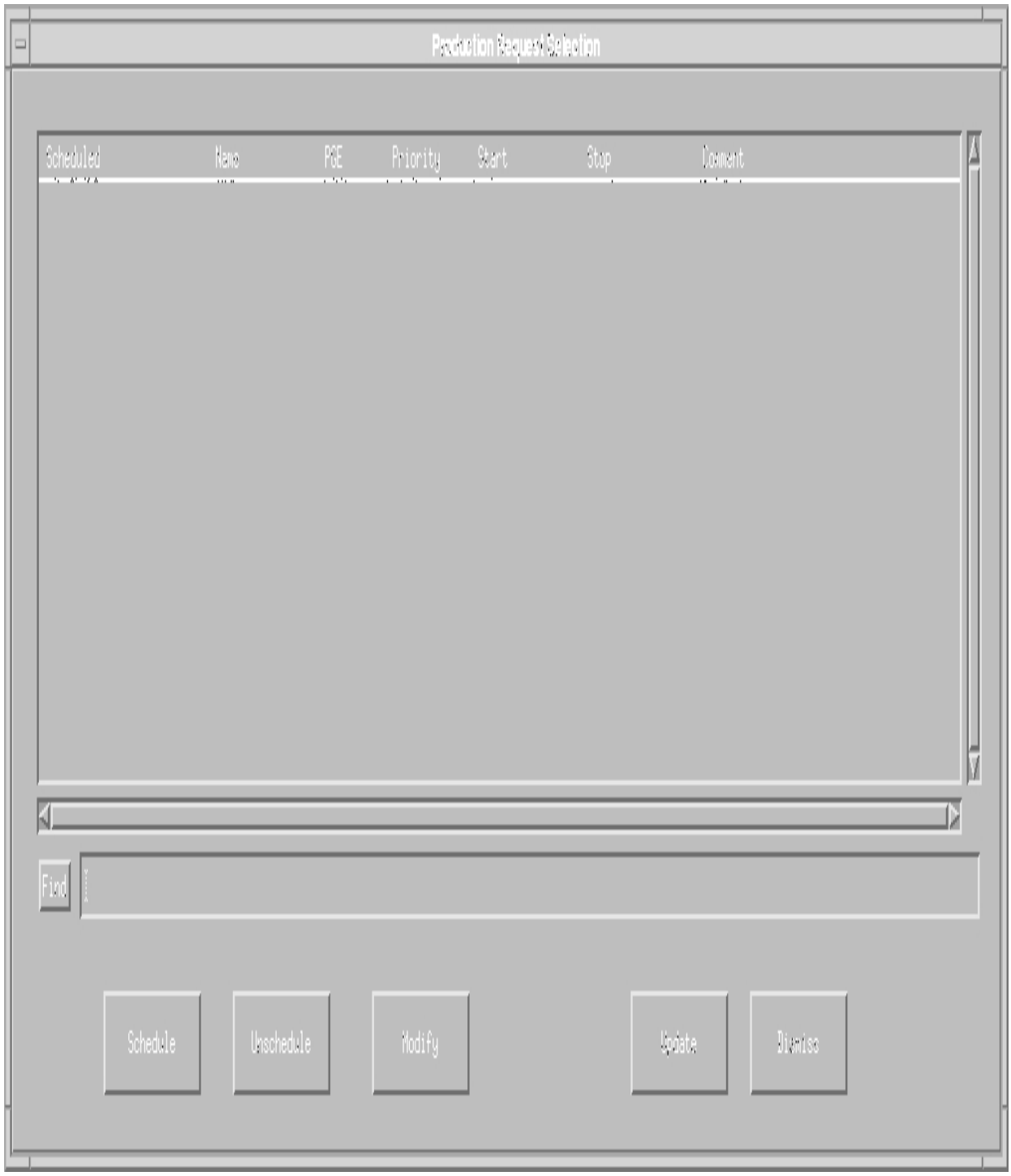

Figure 3.12.1.6-2. Production Request Selection GUI

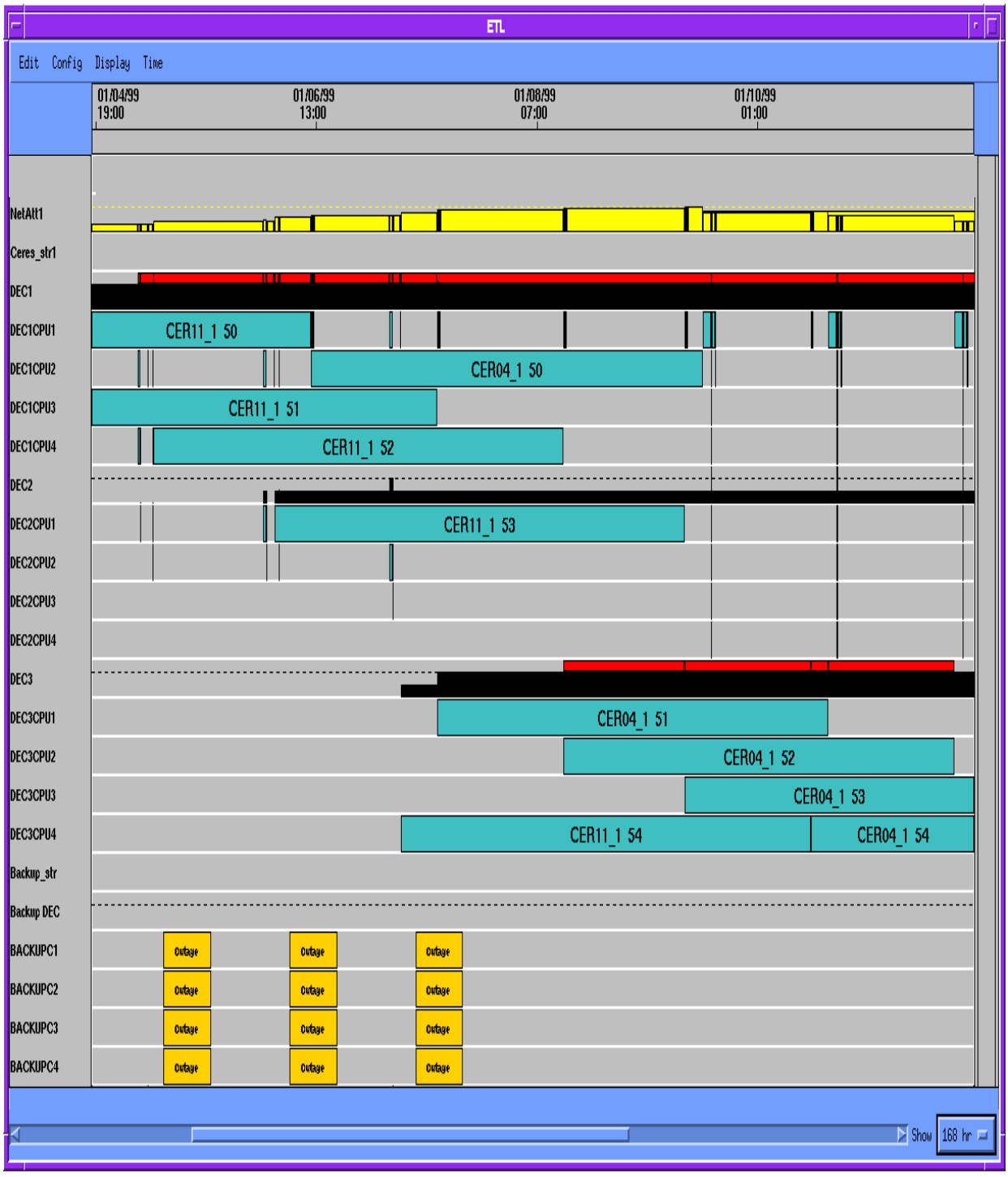

Figure 3.12.1.6-3. Production Timeline View GUI

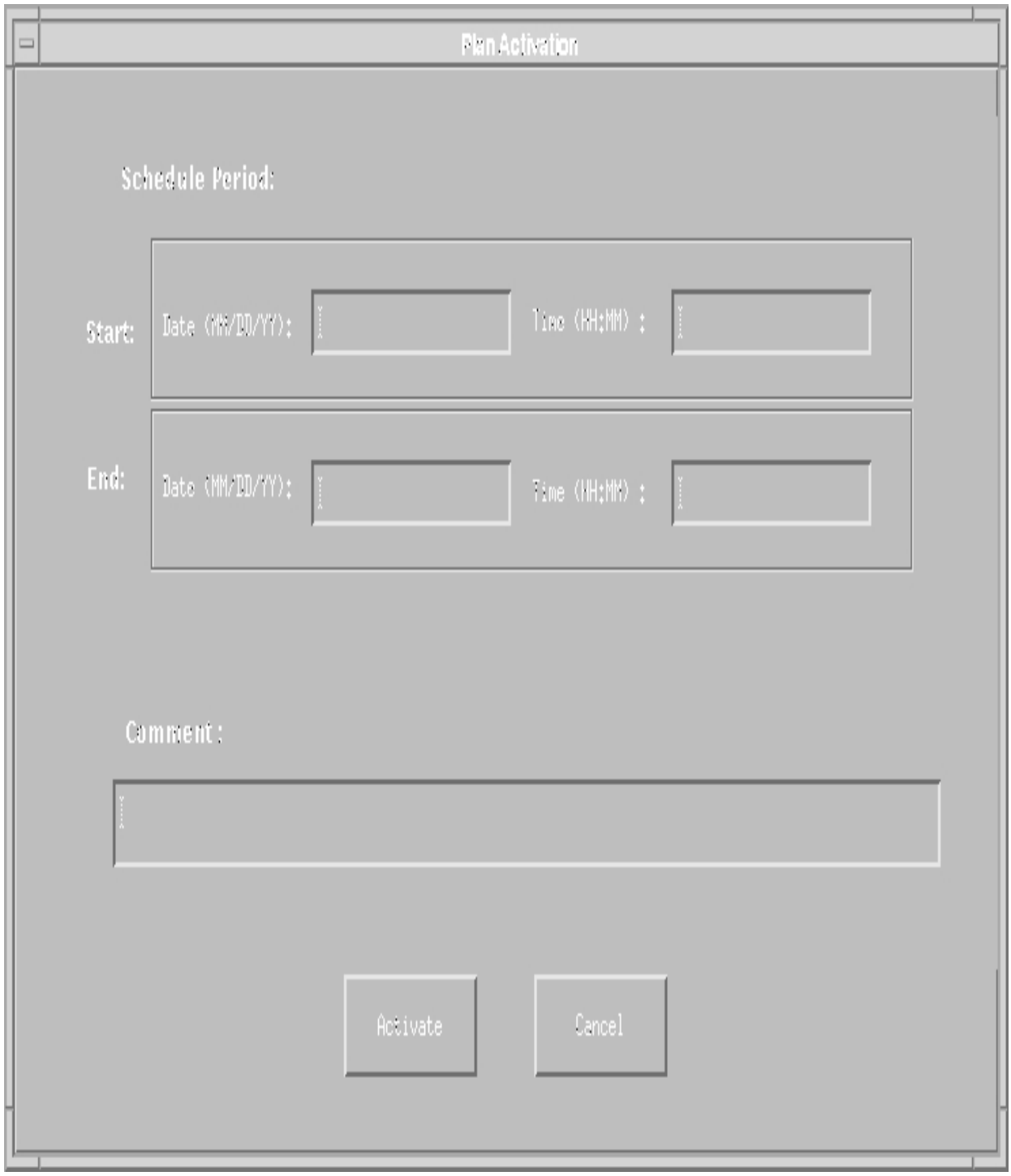

Figure 3.12.1.6-4. Production Plan Activation GUI

3.12.2 Replanning Production Scenario

The following scenario discusses replanning of production processing. Related scenarios include those in Section 3.7 which discusses planning of resources, and Section 3.14 which discusses routine production processing. The scenario presented here is intended to describe an abnormal planning cycle. The normal planning cycle that provides a basis of comparison with the abnormal planning situation is described in Section 3.12.1, Routine Production Planning.

3.12.2.1 Scenario Description

The following scenario is assumed to occur during a given day of the Release A period at the LaRC DAAC. The system at the DAAC is in stable operations. The present scenario describes the process for the development of plans for production processing to replace or supersede plans that have already been established.

3.12.2.2 Frequency

During normal processing when reasonably accurate predictions of the processing time for the PGEs are available, the processing schedule should result in a good prediction of when data products will be generated. However, several difficult-to-predict or unpredictable factors can affect the planning systems ability to produce a plan with accurate predictions. These factors include:

- Equipment failures
- Emergency or high priority processing
- Delayed input data
- PGEs faults
- PGEs with data product dependent components that affect PGE run time (e.g., the PGE runs long or short when clouds are encountered)
- PGEs with geolocation dependent processing
- Unexpectedly high On-Demand processing loads (Release B only)

In these situations, the plan could depart significantly from what is actually accomplished. In such a situation, the production planner may choose to develop a new plan to reflect the current situation. Note however that this is not essential. Production will continue to process the planned jobs, redirecting jobs to other processors should one fail. Also, if a particular job and data product are important, priorities can be adjusted without replanning to speed up the delivery of the product.

In summary, the frequency of occurrence of replanning is difficult to predict. It is assumed that no more than 2 planning sessions per day might occur.

3.12.2.3 Assumptions

Assumptions underlying this scenario are as follows.

1. The scenario presented here is applicable to the Release A time period.

3.12.2.4 Components

There are two components involved with this scenario, the Processing Workbench of the PLANG CI and the PRONG CI. Figure 3.12.2.4-1 indicates the interaction of the production planning personnel with the Planning Workbench and the subsequent interaction between the Planning Workbench and the Processing Subsystem.

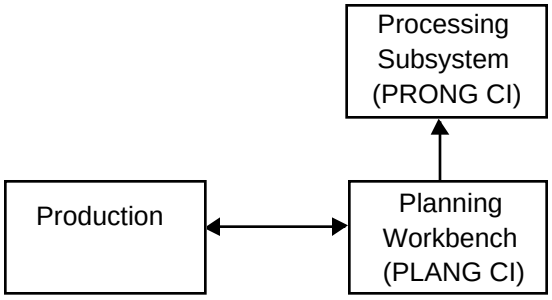

Figure 3.12.2.4-1. Production Replanning Context

3.12.2.5 Preconditions

The following preconditions are assumed for this scenario:

1. A plan for the processing interval has been developed and activated so that the Processing system contains a queue of jobs and has been processing jobs for some time.
2. Because of unexpectedly long run times for some processing jobs, the actual processing accomplished has fallen behind the planned processing.

3.12.2.6 Detailed Steps of Process

Table 3.12.2.6-1 represents the details of the production replanning activity. The time values provided are approximate. The User in this scenario is the Production Monitor who is responsible for overseeing processing. The Operator is the Production Planner who is responsible for the planning of science data processing at the DAAC.

Table 3.12.2.6-1. Production Replanning Process (1 of 2)

Step	Time	User (Production Monitor)	Operator (Production Planner)	System	Figure
1	Middle of a shift	The Production Monitor notices (via the AutoSys TimeScape GUI) (See Figure 3.12.2.5-1) that the planned for objectives of the shift are not being met. Processing has fallen behind schedule. Anticipating questions when products do not appear at the times planned for, he suggests to the planner that replanning may be advisable to get new projections.	The production planner concurs. The production planner starts the planning workbench. (See Figure 3.12.2.5-2).	The AutoSys Job Scheduling COTS used by Processing provides several views of the processing activity, one of them being the timeline view of TimeScape. The planning workbench is the mechanism for planning and replanning of processing. The planning workbench seeds the AutoSys Job Scheduling COTS with processing jobs.	
2	Update of plan		The planner selects and opens the current weekly plan being used for the activation/schedule seeding operation.	Options available to the planner from the planning workbench include: - Prepare New Plan & Save - Open Existing Plan - Update Plan - View Production Requests - Activate Plan - View Plan (timeline) - Baseline Plan - View Plan Activity Log The plan for the day is updated to reflect any changes in the PDPS Planning database such as the status of DPRs that were previously activated for processing, or changes in the resource allocation timeline for processing. The impact of the delayed processing as determined from the DPR status's are reflected here.	

Step	Time	User (Production Monitor)	Operator (Production Planner)	System	Figure
3			The planner reviews the resulting schedule and works to adjust priorities until he accepts the results. The planned completion times are more within expectations.	Workbench tools to update the plan and view the plan in timeline form are used.	
4	Start of plan activation process.		The planner selects "Activate Plan" from the planning workbench options. Information from this updated plan will be rolled into the processing system COTS scheduler. The planner enters the time range of the scheduling period (i.e., current time to end of the shift), enters any comments appropriate to the schedule and selects Activate. (See Figure 3.12.2.5-3)	The system creates an ordered list of the activities which are currently active in data processing and integrates with it other activities that may be scheduled within the scheduling window or time period. The planning system processes the list: if the DPR is already active (i.e., in the data processing system), the entry available to the data processing system is updated to insure most current timing information with possible priority adjustments. If the DPR is not active, it is scheduled into the data processing system.	
5	Steps 2 to this point are expected to take of the order of half an hour total.			The data processing system will initiate PGE jobs according to the schedule of jobs transferred from the planning system.	

3.12.2.7 Postconditions

At the completion of the above scenario, the planning database contains new and updated entries reflecting the current state of the production plan. The Document Data Server contains the published version of the plan and a timeline view (TBD) of the plan. E-mail messages will have been sent to all affected persons, as determined by the plan insertion or update. The production schedule, as maintained by AutoSys, will have been updated and processing will proceed according to that schedule.

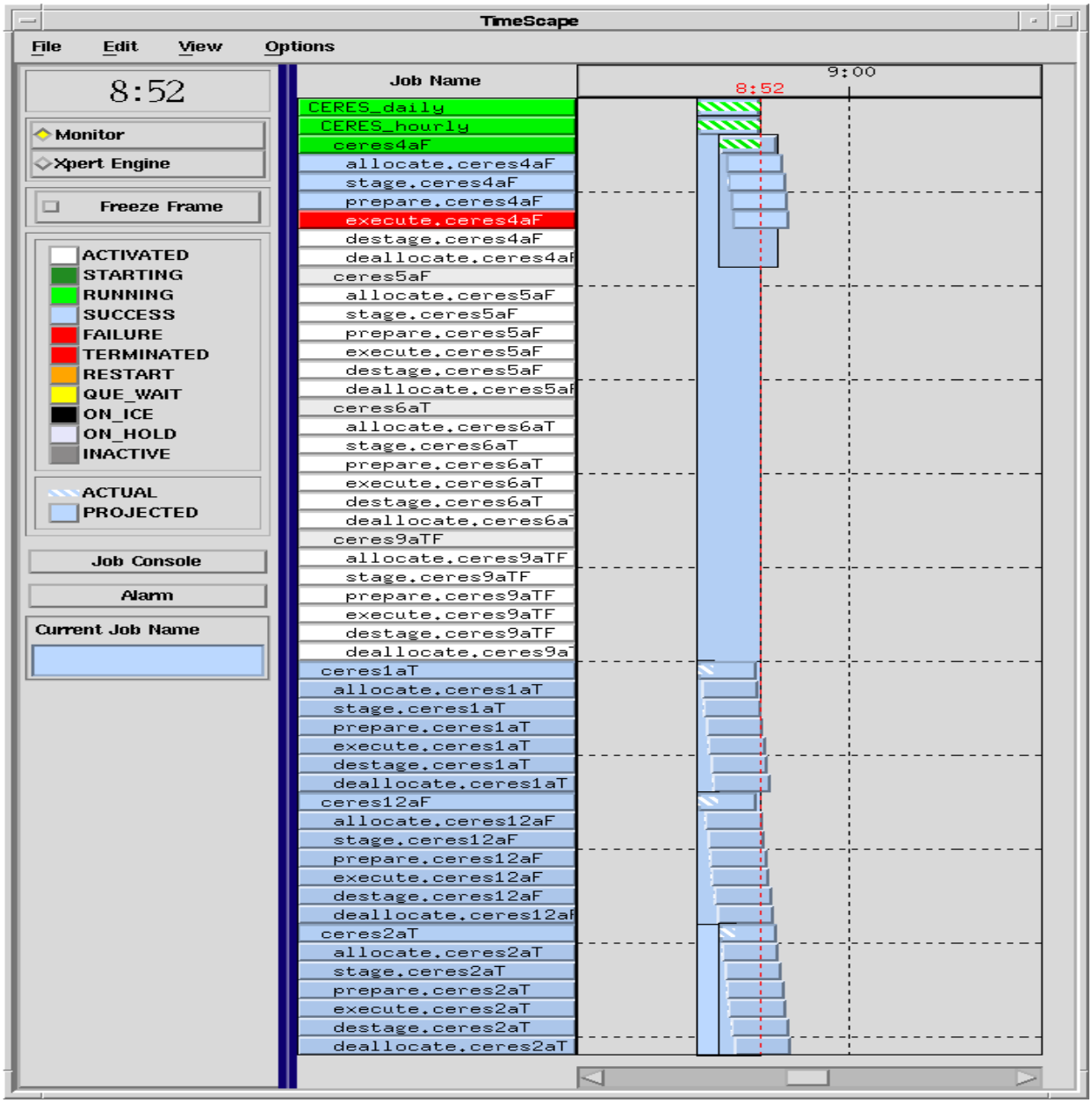

Figure 3.12.2.6-1. AutoSys TimeScape GUI

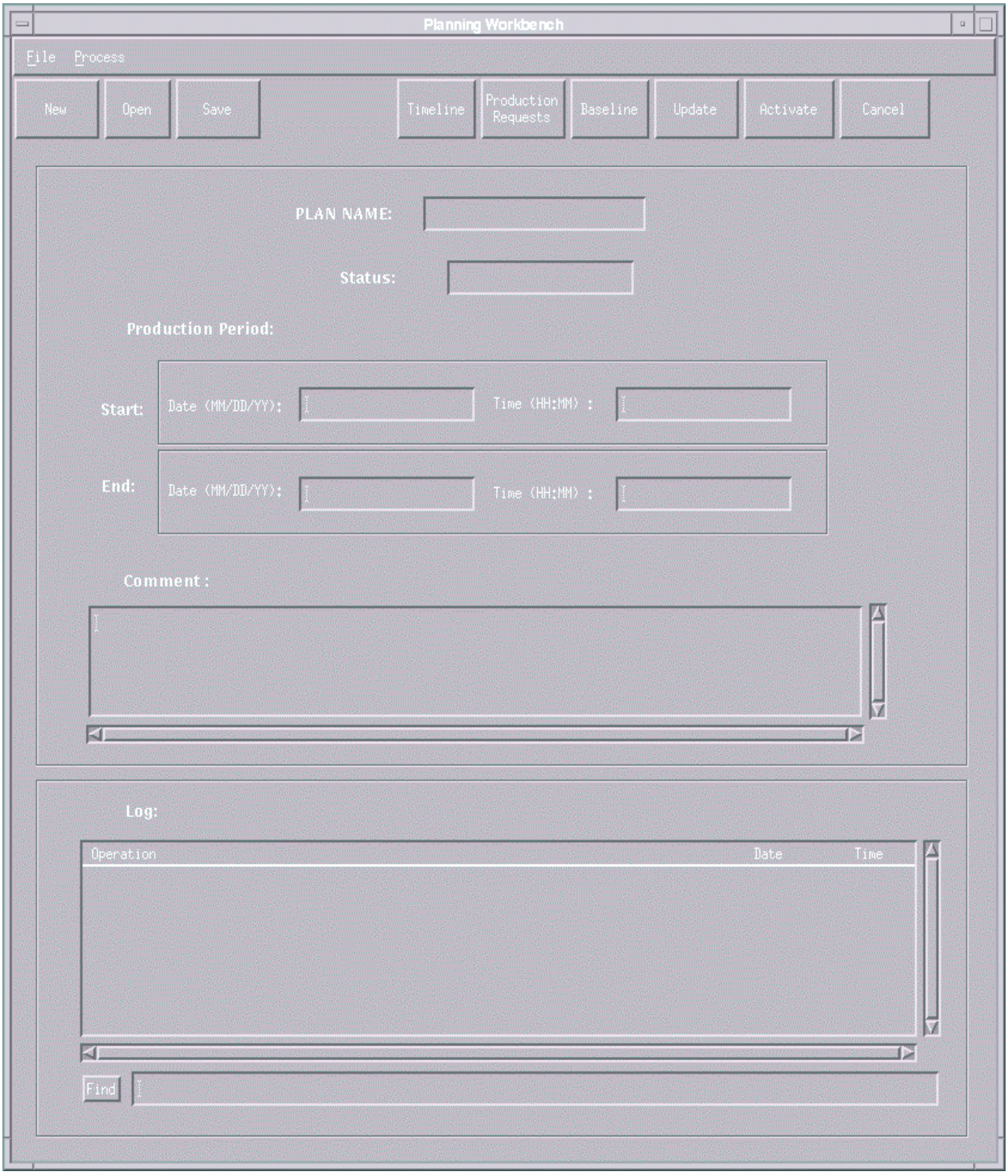

Figure 3.12.2.6-2. Production Planning Workbench GUI

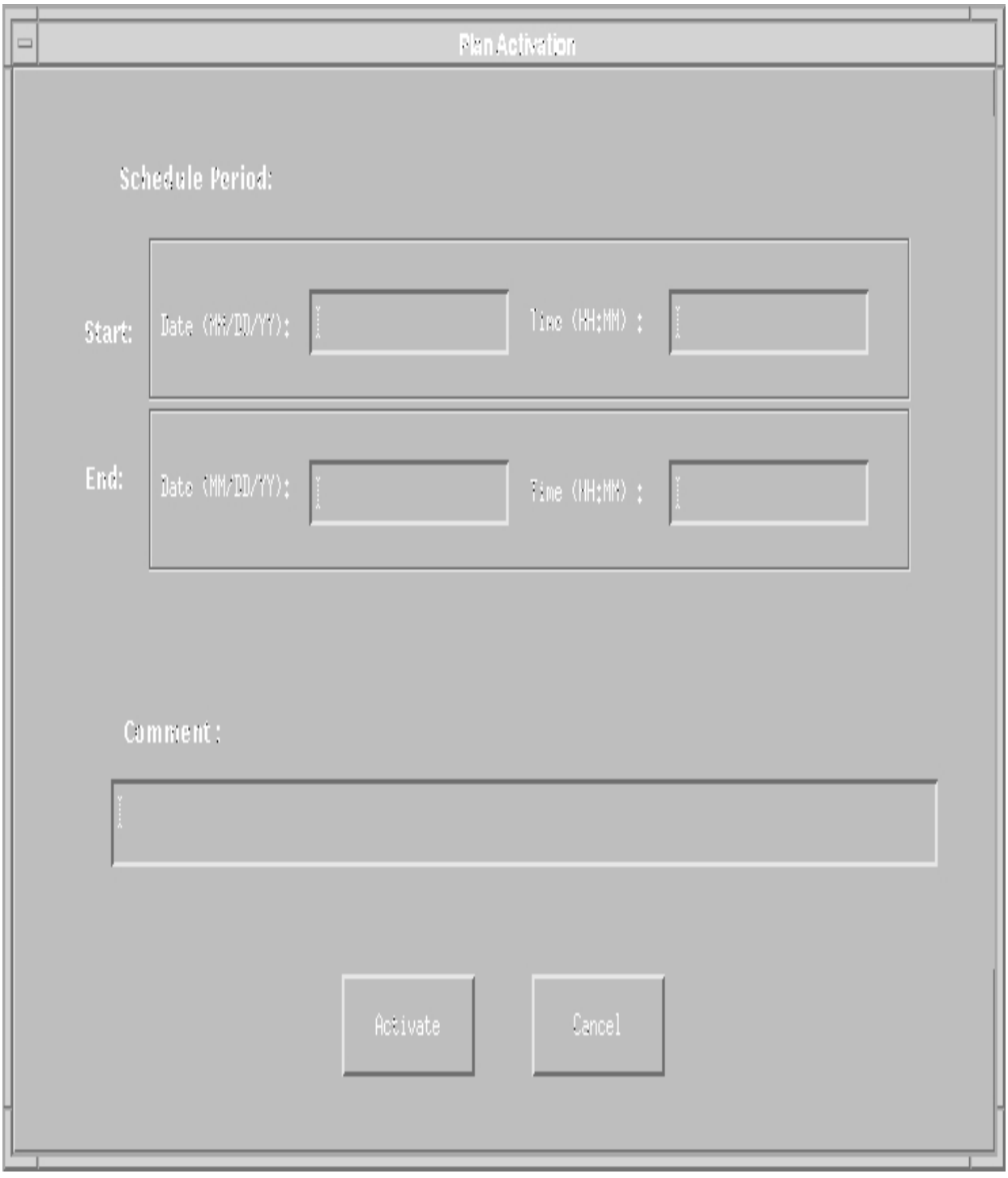

Figure 3.12.2.6-3. Production Plan Activation GUI