Atacama Large Millimeter Array

ALMA Software

Template Software Development Plan

For (e.g.) Pipeline Subsystem

Software Plan

GRaffi
ESO

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Author Signature: G.Raffi	Date: 2002-03-12
Approved by: B.Glendenning	Signature:
Institute:	Date:
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Change Record

REVISION	DATE	AUTHOR	SECTIONS/PAGES AFFECTED
		REMARKS	
0.1	2001-07-23	G. Raffi	Draft Example of Development Plan
0.2	2002-01-14	G. Raffi	6 monthly releases, Readiness Review …
1.0	2002-03-12	G. Raffi	Changes after review, IEEE layout

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Introduction
*This document is to be filled in by the person responsible for each ALMA Software Subsystem project. **Italic font is used for instructions to the author and should normally be deleted**, unless some parts are re-used. Edited text should in no case be left in italic.*

Anything that is in normal font is intended to be an example that might be written in this Subsystem agreement and might be incomplete and incorrect.

This document should be seen as an integral part of the ALMA Computing Plan for Phase 2 [Plan], which is applicable to the Subsystem development work. For sections in which the subsystem requires no changes to [Plan], write the phrase "As in [Plan]" to make it clear that the section was not accidentally omitted.

Note that [Plan] is currently being revised. Because of this additional instruction is provided in italics to aid authors before the revised [Plan] is available.

1   Project Overview

1.1   Purpose and Scope
This part should extend the start-up definition given in [Plan]. It should deal with the Subsystem definition in terms of purpose and scope. The amount of text to be written should be between 1 and 2 pages. The Subsystem design should be described later in short under Design.

Describe the Subsystem parts that are included/excluded and the relationship to other Subsystems that have a direct interface, including integration with them if required.

The start-up definition for the Purpose and Scope of the Pipeline is:

- Calibration Pipeline for all possible calibration modes (7)

- Science Pipeline for the standard observing modes (6)

- Quick Look

- Infrastructure (including comparison among different ones)

- Pipeline decision paths

- Basic level of quality checks on data to be archived

In general it is intended that this work should consist of scripts on top of already existing Components

1.2   Assumptions and Constraints
All the standards and products defined in the Computing Plan for Phase 2 [Plan] and [Practices] are fully applicable. List possible exceptions to the use of standard products if any, as these require approval by the Computing group.

Subsystems shall be developed based on a middle layer of software called ALMA Common Software (ACS) (described in [ACS]). It is planned to extend the ALMA Common Software [ACS] with frameworks appropriate for Subsystems. List any extension to ACS over its current functionality that you expect will be required (or would be useful).

List any external (to ALMA) commercial or non-commercial packages, products or platforms that you expect to also use.

1.3   Deliverables

List here only additions to what described in [Plan] for the various groups of categories, namely Software, Documentation, Computer equipment, Support time, considering also aspects like delivery dates and locations.

1.4   Schedule and Budget Summary

The estimates of effort and material costs for every Subsystem are given in [Plan] and are fixed. In particular resources and final deadlines are fixed. Resources are summarized below.

- *The **total duration** of the project is normally **5 years** from T0, including 6 months for maintenance support. Should T0 happen after 1/06/02 still the contract will end on T1=30/5/2007. Therefore development time will have to be reduced (resulting in increased effort to accomplish the foreseen number of FTEs).*

- *The **total effort** is taken from [Plan] and repeated here. More details are given under Roles and Responsibilities and under Staffing in Chapter 3.*

The **total effort** allocated for development of the Pipeline software is 11.5 FTE-years for the 5 year project described here. This has been divided into 4 FTE-years for Pipeline- Heuristics and 7.5 FTE-years for the Pipeline – Infrastructure.

- *The **material construction costs** is taken from [Plan] and repeated here. More details are given in Chpater 4 under Infrastructure.*

The **material construction costs** estimated for the Pipeline comprise 250 K$ for a prototype Beowulf cluster .The final clusters in Chile and at the two regional centers are meant to be acquired later and are therefore outside the scope of this agreement.

1.5   Document Scope

A version of this document exists for each Global Activity and each Subsystem. Where multiple institutes are involved in the Subsystem, representative of the other institutes must be consulted by the Subsystem responsible on any version. Possible disagreements must be noted and shall then be resolved in consultation with the Computing Group.

Financial agreements, when applicable, are separate, but all the deliverables and responsibilities must be clear in this document, even when there are no financial implications.

This Plan represents the terms of a technical agreement between ALMA Computing and the ALMA Development Group (SDG) responsible for the Pipeline Subsystem. It is subject to configuration control as soon as reviewed. Changes are subject to approval by the Software Problem Report Control Board of the Computing group management.

1.6   Document Evolution

The structure of this document is in compliance with the recommendations of IEEE Std 1058-1998.

Further editing of this document should be in Word and maintain this layout based on the ALMA software document template [Doc]. In particular all sections in this skeleton document must be maintained, even if empty. Additional sub-sections may be added.

This Plan shall be produced as Version 1 for time T0 (see later). It will then be upgraded at PDR (Version 2) and yearly at CDRs 1-3 (Versions 3-5).

Version 1.0 and 2.0 should aim at covering all features of the Subsystem, in particular all user requirements, coming from [SSR],[Offline] and [Architecture] and giving a general plan for their implementation. Versions 3-5 should be very specific about features to be implemented in the next Release, associating them with some key requirements.

1.7   Glossary

Acronyms and terms peculiar to this Subsystem can be added here. First check if they are not already in the ALMA software glossary at:

http://www.alma.nrao.edu/development/computing/docs/joint/draft/Glossary.htm

A number of key terms, although contained in [Plan] are also retained here for reading clarity.

```
SDG         Software Development Group, responsible for a
            Subsystem

CDR 1-3     (Incremental) Critical Design Review 1 to 3.

FTE         Full Time Equivalent (staff-year)

ICD         Interface Control Document

Package     Major component of Subsystem

PAR         Preliminary Acceptance Review

PDR         Preliminary Design Review

RR          Readiness Review

R0-5        (major) Release of software (and its number)

Subsystem   Subsystem of the ALMA Software System
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1.8   Applicable documents

The documents referenced are the result of ALMA Phase 1 work and are **fully applicable** to the Computing Activities and Subsystems. *In general all the reviewed documents of Phase 1 are collected on the Web in the ALMA Computing Documents and are applicable, for the part that is relevant to the various Subsystems:*

http://www.alma.nrao.edu/development/computing/docs/index.html

1. [Plan] ALMA-SW-Draft, ALMA Computing Plan for Phase 2, G.Raffi, B.Glendenning

2. [SSR] ALMA Reviewed Document 11, 2001-MAY-03, ALMA Science Software Requirements and Use Cases, Robert Lucas et al.

3. [Offline] ALMA-SW-Draft, ALMA Offline Data Processing Requirements, S.Meyers et al.

4. [Analysis] ALMA-SW-Draft, Initial Software Analysis, J.Schwarz et al.

5. [Architecture] Software Architecture & High-Level Design, J.Schwarz et al. (draft)

6. [Practices] ALMA-SW-Draft, ALMA Software Engineering Practices, M.Zamparelli

7. [ACS] ALMA Reviewed Document 16, 2001-SEPT-09, ALMA Common Software Architecture, G.Chiozzi et al. Subsystem References

1.9   References
List all Subsystem related documents, evolving with project. This shall include design documents, interface control documents, user and maintenance manuals, test procedures, plans etc., according to what specified in [Practices].

2   Project Organization

2.1   Organization Interfaces
A Subsystem has to be seen as fully integrated in the whole ALMA software with complementary work done by other groups within ALMA Computing , like High Level Analysis and Design, Common Software, Software Engineering , Integration/Test and other Subsystem groups. List in general terms any assumptions about functions that you expect to be performed by other ALMA Computing groups for later discussion and agreement. Specific software interfaces will be described later in this document.

Clarify organization aspects, describing the relation between the project organization described below (as internal to this Subsystem) and the parent groups/division organization at the various Institutes.

2.2   Group Organization
Figure 2 shows the organization of the software development group for the Pipeline Subsystem. The Contact Person and the Subsystem Scientist for the Pipeline Subsystem are NN1 and NN2.
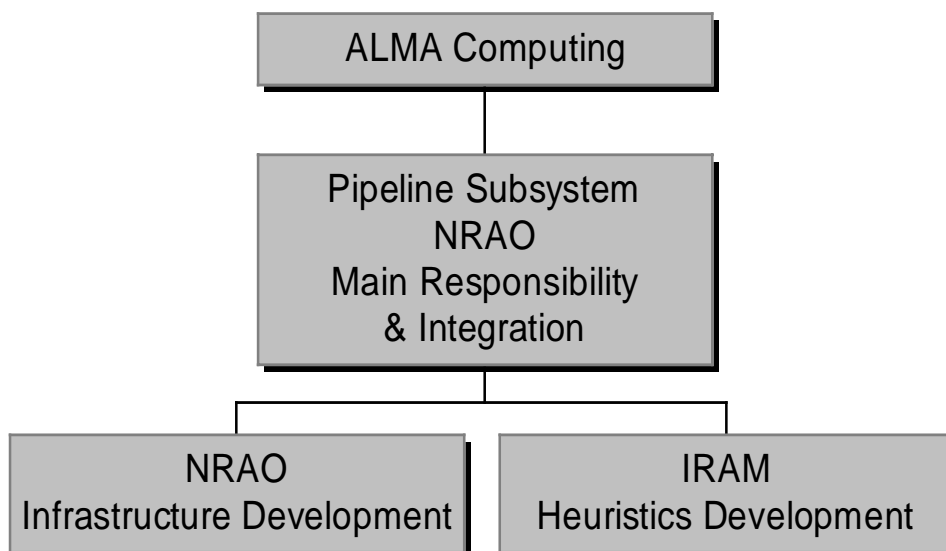

Fig.2 : Organization overview of the Pipeline Software Subsystem

2.3   Roles and Responsibilities

The SDG organization should be described in terms of staffing, time commitments and responsibility for Packages (see example below). Each major work activity should be identified and defined. It is acceptable that a sub-division in precise Packages is done only for PDR.

Project main responsible: NN (at 40%), NRAO, Group /Division
Development staff at NRAO for Pipeline Infrastructure (total 7.5 FTEs=1.5 FTE/year): NN1 at 50%, NN2 at 100%.
Responsibility of NRAO for Pipeline Infrastructure involves the following Packages: TBD
Project responsible at IRAM: NN (at 30%), IRAM (ADACE), Group/Division
Development staff at IRAM (ADACE) for Pipeline Heuristics (total 4 FTEs=08.FTE/year): NN1 at 80%.
Responsibility of IRAM (ADACE) for Pipeline Heuristics involves the following Packages: TBD

3   Managerial Process Plans

This part specifies the project management processes for the Subsystem, for what is additional or different for this Subsystem with respect to [Plan].

3.1   Start-up Plan

3.1.1   Estimates
All Global activities and Subsystems have been estimated by the Computing group to assess the cost of Phase 2. Therefore they are fixed in terms of both effort and material cost. The Main Milestones are derived from the ALMA Phase 2 planning. Any different estimates should be indicated here along with the method used and the confidence level, for later discussion.

3.1.2   Staffing
This section should add staffing considerations to what explained before under Roles and Responsibilities, like staffing profile over time, possible aggregations with other projects, potential priority conflicts.

Specify the sources of staff personnel (e.g.: internal transfer to ALMA Computing, allocation of time within existing group/division, new hire, contracted, etc.).

Possible in-kind staff contributions should also be given here together with their role.

3.1.3   Staff Training
This section should indicate planned visits, exchanges and time lengths along with formal managerial or technical training if required.

ACS training for all development staff should be foreseen before or immediately after PDR.

3.2   Work Plan

3.2.1   Work Breakdown Structure

Define the various work activities in terms of Packages as described later in the Technical Process Plan.

Specify the following factors for each Package:

Necessary resources, Estimated duration (it might be less than the total one), Features corresponding to Requirements.

3.2.2   Schedule Allocation

Specify, compatibly with the Release Milestones explained under Development Model, the time-sequencing constraints and concurrent activities.

Identify the critical path in the schedule.

Indicate any constraints on the scheduling due to external factors.

3.3   Project Tracking Plan

Subsystem project control shall be organized as explained below.

3.3.1   Requirements Management

*User requirements are attributed in [Plan] to the various Subsystems. The features described in this document (in the various versions) should be tracked back to requirements via a Requirements Compliance table, to be given in **Attachment** 7.3.*

Proposed new requirements and changes to existing requirements should be indicated together with their impact. Change requests not affecting science requirements should use the Software Problem Reporting system (see [Practices] for more information).

3.3.2   Progress Control

Progress control is based on tracking the implementation of key requirements as defined in the Requirements Compliance table(see   7.5). In particular at the yearly CDRs one should:

- *Track the features and corresponding key requirements implemented in the previous Release, with a 3-level scheme: not implemented, partially implemented and completed.*

- *Prepare a revised list of features and corresponding key requirements for the next Release. Corrective actions (e.g. in case of delays) should be discussed in the Review Minutes.*

3.3.3   Quality Control

The ALMA Computing rules for Software Quality are defined in [Practices]. All software should be delivered complete with (incremental) Documentation and Package/Subsystem test scripts, as described before under Deliverables. Reviews and reports by the Software Engineering Group and by the Integration Group for a given Release will be the basis for an objective assessment.

Specify here any additional quality related aspects for this Subsystem.

3.3.4   Communication and Reporting

*Consultation and collaboration among the Institutes of the SDG should be at the basis for Subsystem development work, as explained in [Plan]. This foresees: **Monthly Status reports**, **Monthly meetings** (including the Contact Person and the Subsystem Scientist) with **minutes** (with*

*sections about Issues, Decisions and Actions). Serious **problems** or foreseen delays should be immediately discussed with the Contact Person, indicating the proposed recovery actions.*

Specify here anything that is additional or special in this respect for this Subsystem.

3.4   Risk Management Plan

Identify and describe the applicable impact of any of the following risk factors: (to be prepared for T0 and to be kept up-to-date later):

Schedule risk, Personnel risk, Delays of Hardware/Computing equipment, Estimates of effort risk, Design and technology risk, User acceptance risk.

Specify measures to mitigate identified risks, including a contingency planning.

In case the Test Interferometer is used as a test bed or when activities go on in parallel for the test interferometer, implications should be indicated here. Other hardware constraints that might have an impact on releases should be indicated and discussed before the situation occurs.

3.5   Project Termination Plan

Conditions concerning Intellectual property, Termination of project, Upgrade Project and Disputes are applicable as described in [Plan].

Specify here measures that are special to this Subsystem if any.

4   Technical Process Plans

4.1   Development Model

*The software development model for Subsystems is incremental and based on a 6 month Release cycle. It should be noted that this incremental model will work only if the various SDG groups respect strictly the deadlines for Releases. Given that this model is described in [Plan] only the Milestone names are given below and the due. The general Phase 2 Planning model given in **Attachment 7.1** should make it easier to visualize these Milestones.*

Comments and notes specific to this Subsystem should be added to the parts in Italics in the table below.

Subsystem Start *(T0)*
Note that the date T1 is fixed under the assumption that T0 will not be after 1/06/02. Should T0 be delayed, T1 should still be considered as a fixed date and this will reduce the available development time. Assuming the T0 delay is small, extra effort can be planned within the available time. Subsystem Kick-off meetings to prepare for T0 are planned for April 22-26, 2002.
Preliminary Design Review (PDR) *(T0+6 months)*
The preliminary design has to be based on a proposal agreed among the various institutes involved. Possible alternatives should be reported so that they can be discussed at PDR.
(Incremental) Critical Design Reviews (CDR1,3) *(T0+11 months and yearly afterwards)*
They should present the detailed design of the new features of the next main release, the results of testing the previous release and possible changes to be discussed.

(Incremental) Release (R0,5) (T0+10 months and yearly afterwards up to T1)
The delivery of a Release (major and minor) to the Integration group shall include delivery of test procedures and (incremental) documentation. Features to be implemented at the various Releases have to be described here.
Readiness Review (RR) (T1-12 months = 30/5/2006)
The RR normally happens at the site of the Institute having the main development responsibility, before shipment to Chile of the relevant computing and controlled hardware.
Preliminary Acceptance Review (PAR) (T1-6 months = 31/11/2006)
SDG staff shall be available in Chile to perform commissioning tests, with the support of the ALMA site operations group. SDG will be responsible for acquiring and shipping on time all the computing equipment needed in Chile.
Support Completion (T1=30/5/2007, normally T0+5 years)
This Phase normally overlaps with the Subsystem Upgrade (4 years). The latter is not covered by this document and will imply a new Development Plan and a new Agreement.

4.2   Methods and Tools
The recommended development methodologies and the applicable programming languages are defined in [Practices]. List here the languages and tools that are proposed for this Subsystem.

List any other standards (e.g. process related) that you propose to follow.

4.3   Infrastructure
The dates of foreseen specialized computer purchases should be indicated (not the PCs).

Specify any other considerations to establish and maintain the development environment (hardware, operating system, network and software).

4.4   Acceptance Plan
A set of specific tests and procedures for acceptance should be indicated here, in addition to the general integration criteria indicated above (for PDR).

Specify any technical processes, methods, or tools required for deliverable acceptance, such as testing, demonstration, analysis and inspection.

5   Supporting Process Plans

5.1   Configuration Management
The process described in [Practices] is applicable.

5.2   Validation
Describe here or in a separate Test Plan how this Subsystem can be integrated and tested with other Subsystems. A reference to separate Test Procedures document should be given.

Features and limitations deriving from the need to test software on a computer model, without having the appropriate hardware should be described here as well. In particular some parts of the Subsystem might need simulation for the purpose of integration testing (for PDR).

5.3   Documentation
The incremental documentation plan is to be found in [Practices].

Specify here explicitly the documents to be produced for this Subsystem and their upgrade plans, so that this will be discussed and agreed.

5.4   Quality Assurance
List here whatever might be specific and different for this Subsystem with respect to what defined in [Practices].

5.5   Reviews
List here if you see the need for other specific reviews with respect to the ones at the PDR and CDRs that are foreseen under the Development Model.

5.6   Problem Resolution
The ALMA software has a software problem reporting system (based on Action Remedy and Problem Report Board meetings)(see [Practices] for more details).

5.7   Process Improvement
Identify processes that can be improved, for discussion at the next review meeting.

6   Software Description

This chapter provides a summary of parts that have to be described and should at latest by PDR be replaced by an external document referenced here, provided this has at least the contents listed below.

6.1   Software External interfaces
This section should define the Interfaces to other Subsystems, taking [Architecture] as the starting point. It should be agreed by the Computing group. A first definition is required at T0 and should be of general nature (see example below), to become more precise at PDR when Interface Control Documents are requested.

Example of interfaces to be listed:

- ACS interfaces and services: Error, Logging, Alarm, Time, Command, Sampling, GUI widgets & tools, Process/Distributed Object life-cycle management

- Archive interfaces: Search for next observing block, retrieve raw data, archive image

- Control software: Observing sequence completed

6.2   Software Design
The result of Phase 1 work in terms of High Level Analysis and Architecture is given respectively in [Analysis] and [Architecture]. This is applicable to Subsystems and represents the start point for the Subsystem design activity.

The Subsystem Concept (what comes before an architecture and preliminary design) should preferably be described in a separate document or otherwise be given in an Appendix (1-3 pages). From PDR onwards a reference to the Subsystem Design Documentation should also be given.

6.3   Packages

The Subsystem software should be split into Packages that are lower level software entities. While a precise split into Packages might not be possible before PDR, a subdivision of the Subsystem should be indicated at T0 (see later section on Subsystem responsibilities). Institutes should be responsible for a number of entire Packages, not for fractions of a Package.
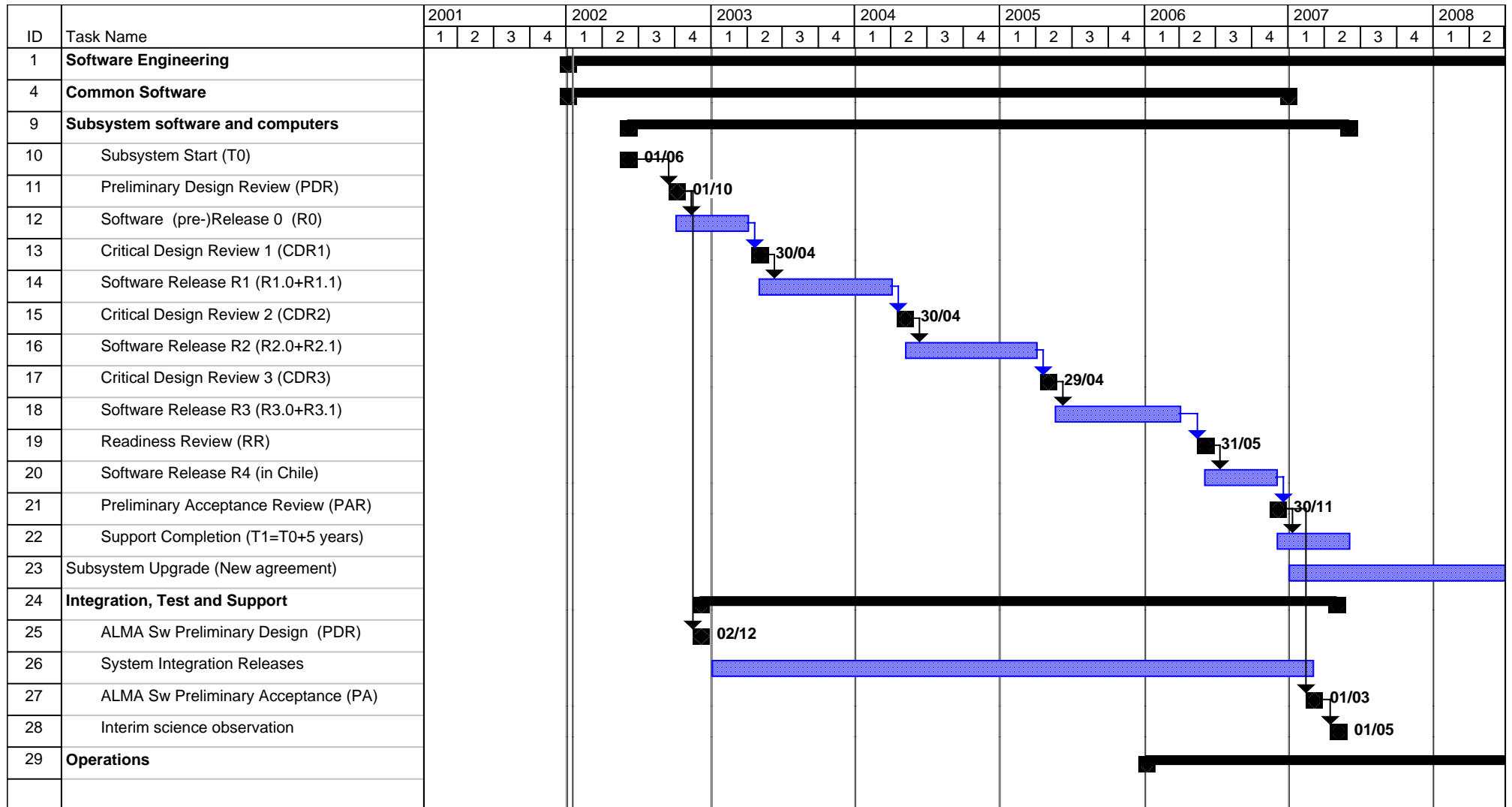
6.4   Interfaces between Packages

Interfaces between Packages should be described in a document indicated here (for PDR).

6.5   Integration of Packages

Procedures to integrate Packages into a Subsystem, including logistic aspects should be described (for PDR).

7   Attachments

7.1   General Phase 2 Planning Model

ID	Task Name	2001				2002				2003				2004				2005				2006				2007				2008	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
1	**Software Engineering**																														
4	**Common Software**																														
9	**Subsystem software and computers**																														
10	Subsystem Start (T0)					01/06																									
11	Preliminary Design Review (PDR)						01/10																								
12	Software (pre-)Release 0 (R0)																														
13	Critical Design Review 1 (CDR1)										30/04																				
14	Software Release R1 (R1.0+R1.1)																														
15	Critical Design Review 2 (CDR2)														30/04																
16	Software Release R2 (R2.0+R2.1)																														
17	Critical Design Review 3 (CDR3)																		29/04												
18	Software Release R3 (R3.0+R3.1)																														
19	Readiness Review (RR)																					31/05									
20	Software Release R4 (in Chile)																														
21	Preliminary Acceptance Review (PAR)																									30/11					
22	Support Completion (T1=T0+5 years)																														
23	Subsystem Upgrade (New agreement)																														
24	**Integration, Test and Support**																														
25	ALMA Sw Preliminary Design (PDR)						02/12																								
26	System Integration Releases																														
27	ALMA Sw Preliminary Acceptance (PA)																									01/03					
28	Interim science observation																										01/05				
29	**Operations**																														

7.2   Detailed Planning

This has to be compatible with the general phase 2 planning model for all Subsystems given in Attachment 7.1. I it has to detail the planning at the Package and the milestones for the various partners of the SDG (to be ready for PDR).

This has to be included and kept up-to-date at least for every review. After Release 0 there should always be some contingency for problems to be fixed and for support, while development of the next Release is proceeding.

7.3   Requirements Compliance Table

Releases should be planned in terms of features, which should be traceable back to key requirements. This part should be updated with the Versions of this document and is essential for Project tracking. It should contain a list of:

• *Features split by Release (to be filled out already for T0) (Release R1.0-3.0 planned for complete implementation of a feature)*

• *Association between features and key requirements(the numbered ones in [SSR]and [Offline]).*

• *a 3-level feature implementation scheme: not implemented (N), partially implemented (P) and completed (C) + Release Version(planned Release for completion).*

Package	Feature name	Short description	SSR requirement Numbers	To be completed at Release (R1.0-3.0)	Status at Milestone T0 (N,P,C)
Quick Look Display	Graphic Tool	Takes any two axes and displays data with continuity as they get calculated or statically from an existing table	6.2R2	R1.0 Priority 0 items R2.0 Priority 1 items Pr.2 out of scope	N N _