



ALMA Observatory



NINS



# The ALMA Software and Release Management

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Joint ALMA Observatory



# Agenda

1. ALMA Software Components (Structure and Division)
2. Software Delivery Process (History, Present and Evolution)



# 1. ALMA Software Components



# ALMA Software Components

- ALMA software components cover end to end system to operate the observatory.
  - From the cradle...
    - Proposal Preparation
    - Proposal Review
  - through infancy to adulthood ...
    - Program Preparation
    - Dynamic Scheduling of Programs
    - Observation
    - Calibration & Imaging
    - Data Delivery & Archiving
  - up to afterlife:
    - Archival Research & VO Compliance



# ALMA Software Components

- ALMA software components are classified as part of **ONLINE** or **OFFLINE** subsystems by depending of their functionality.



# Data flow



# Offline Software

- Proposal submission, project rating and preparation, projects lifecycle and general observatory interfaces are considered part of the OFFLINE software.
- Several web tools have been created for different purposes. They are basically:
  - Based in Java Servlet technology (and ZK platform).
  - Using Apache tomcat as servlet container.
  - Using https protocol for data security.
- Some examples of offline tools are..



# Offline Tools

- **ALMA-OT: Proposal submission and observation preparation**

**Contextual Help**

Retrieve your science proposal from the ALMA server by either:

- Selecting *File > Open Project > From ALMA Archive*
- Or clicking on this [link](#)

**Phase II: Observing Program**

```

    graph LR
      A[Retrieve Science Proposal] --> B[Configure System Setup]
      B --> C[Validate Observing Program]
      C --> D[Submit Observing Program]
  
```

Click on the overview steps to view the contextual help

[Importing And Exporting](#)
[Template Library](#)
[Need More Help?](#)
[View Phase 1 Steps](#)



# Offline Tools

- Project Tracker: Tracking project lifecycle

The screenshot displays the ALMA Project Tracker interface. At the top, a navigation bar includes search and utility options. Below is a table listing various projects with columns for Project Code, PI User ID, Executives, Project Name, Progress, State, Time Co, Grade, Rank, Version, Time of Creation, Timed Out, and Project UID.

Project Code	PI User ID	Executives	Project Name	Progress	State	Time Co	Grade	Rank	Version	Time of Creation	Timed Out	Project UID
CL			R8.0.3 Standard Interferometry v0.0	0 %	CSVReady			D	0.0	2011-09-22 01:48:41		
CL			Doppler Testing topo v0.2	0 %	CSVReady			D	0.2	2011-11-17 01:59:12		
CL			Doppler Testing lsrk v0.2	0 %	CSVReady			D	0.2	2011-11-17 01:49:24		
NA			Resolving FU Ori v2	70 %	Completed			B	134	2012-11-28 12:45:36	2013-04-11	
CL			Short 30Dor for Line positioning Test	0 %	CSVReady			D	0.1	2012-05-09 20:35:31		
CL			R8.1 Standard Interferometry 2.8	0 %	CSVReady			D	2.8	2011-10-23 20:53:28		
			Serpens Mosaic	0 %	PartiallyObserved			D	1	2010-08-15 23:34:23		
			Saturn-psuedo ES - v6.1	0 %	CSVReady			D	6.1	2012-09-28 01:04:27		
			Saturn-psuedo ES - v6.1	0 %	CSVReady			D	6.1	2012-09-28 01:04:27		

The detailed view for project '2011.0.00548.S - Resolving FU Ori v2' shows the following information:

- Entity:** 2011.0.00548.S (Completed)
- Proposal:** [ ]
- ObsUnitSet:**
  - FU Ori-SI (Delivered)
  - FU Ori\_B7 (FullyObserved)
  - FU Ori-SI (ObservingTimedOut)
  - FU Ori\_B9\_DO\_NOT\_RUN (Suspended)
- Project Details:**
  - Code: 2011.0.00548.S
  - PI: Stuartt Corder (scorder)
  - Creation date: 2012-11-28 12:45:36
  - Executives: NA
  - Ph1m Priority Flag
  - Rank: 134
  - Project completion: 70.7%
  - P2G
  - Contact Scientist
  - State: Completed
- Comments and Attachments:**
  - Cycle: 2011.0
  - Version: v2
  - Project UID: uid://A002/X55a0dc/Xd
  - Grade: B
  - Score: 3.829
  - Project Report (PDF, HTML)
  - Project Status UID: uid://A002/X55a0dc/X16
- Status change history timeline:** A timeline showing the project's status changes from April 9 to April 12, with markers for 'Completed' and 'ObservingTimedOut'.

# Offline Tools

- Phase 1 Manager (ph1m): Project rating

ALMA Proposal Handling Team (login: prodtest)

Cycle 2012.1 | Participants | ARP | APRC | **Proposals** | Admin | Reports | Email templates

no \* \* \* \* search clear export list Show 10

row	code	title	canceled	arp	sci cat	pi	pi exec	triage	feasible	exec dist	key1	key2	student p	arp prog	arp avg	arp scoi	arp rank	n.arp score	n.arp rank	aprc prog	aprc rank	aprc fla	dc flag	proj status	su
1			no	ARP2C	20		A	Yes	NA	20a	20c	false	Voting comple	3.949843	3.97142	15	4.037536	15.151515151	Not seen	162	B	B	InProgress	20	
2			no	ARP5	50		A	NotRequire	EU	50c		false	Voting comple	4.742099	4.75	68	6.578089	57.14285714	Not seen	620	U	U	Approved	20	
3			no	ARP1A	10		A	Yes	EU	10c	10d	false	Voting comple	4.01827	3.65	21	4.623532	18.58407079	Not seen	200	C	C	Approved	20	
4			no	ARP1A	10		A	No	EU	10e		true	Voting comple	3.28703	2.45714	7	3.247792	6.194690265	Seen	66	B	I	Rejected	20	
5			no	ARP2B	20		T	NotRequire	NA	20l		false	Not seen	5.225222		75	999999.0		Not seen	999999	U	U	Approved	20	
6			no	ARP1A	10		A	NotRequire	NA	10d		false	Voting comple	4.850629	5.82857	73	7.13611	64.601769911	Not seen	702	U	U	Approved	20	
7			no	ARP1B	10		A	Yes	NA	10b		false	Voting comple	3.561948	3.31428	14	3.65595	12.068965517	Not seen	125	B	B	Ready	20	
8			no	ARP1B	10		T	NotRequire	EU	10c	10e	false	Seen	5.807055		106	999999.0		Not seen	999999	U	U	Approved	20	
9			no	ARP3B	31		T	NotRequire	EU	31d	31e	false	Not seen	5.104941		62	999999.0		Not seen	999999	U	U	Approved	20	
10			no	ARP3B	31		T	NotRequire	EU	31b	31e	false	Not seen	5.129016		63	999999.0		Not seen	999999	U	U	Approved	20	

1 / 114

[ 1 - 10 / 1131 ]

Select all Selected: 0 Triage Un-triage Cancel Un-cancel New sci cat New ARP ARP prog APRC prog Feasible save

# Offline Tools

- **Shift Log (Web):** Tracking observatory operations

ALMA WebShiflog Tool x Ruben

https://asa.alma.cl/webshiflog/

Web Shiflog Tool

Search Refresh Do report About Search... Alma Portal Log out

Entries Story line

[ 1 - 25 / 107 ]

Type	Timestamp	Location	Project code	SchedBlock	ExecBlock	Status	QA0	Subject	Author
MMEX	2015-03-25T21:14:48 - 2015-03-25T21:14:48	OSF-AOS		AOS-MSB8.1.0	uid://A002/X9cb317/X117	RUNNING		DelayCal.py -b 3 -jira ICT3972 -i	system
MMEX	2015-03-25T21:07:28 - 2015-03-25T21:13:31	OSF-AOS		AOS-MSB8.1.0	uid://A002/X9cb317/Xcc	SUCCESS		DelayCal.py -b 3 -jira ICT3972 -i	system
MMEX	2015-03-25T21:08:40 - 2015-03-25T21:12:53	OSF-AOS		AOS-MSB8.1.0	uid://A002/X9cb317/Xce	SUCCESS		DelayCal.py -b 3 -jira ICT3972 -i	system
MMEX	2015-03-25T21:08:40 - 2015-03-25T21:12:47	OSF-AOS		AOS-MSB8.1.0	uid://A002/X9cb317/Xcd	SUCCESS		DelayCal.py -b 3 -jira ICT3972 -i	system
WEATI	2015-03-25T21:11:42	OSF-AOS							system
WEATI	2015-03-25T21:09:35	OSF-TFIN							system
MMEX	2015-03-25T21:01:25 - 2015-03-25T21:06:48	OSF-AOS		AOS-MSB8.1.0	uid://A002/X9cb317/X9a	SUCCESS		DelayCal.py -b 3 -jira ICT3972 -i	system
MMEX	2015-03-25T21:02:30 - 2015-03-25T21:05:59	OSF-AOS		AOS-MSB8.1.0	uid://A002/X9cb317/X9b	SUCCESS		DelayCal.py -b 3 -jira ICT3972 -i	system
MMEX	2015-03-25T20:54:22 - 2015-03-25T21:00:44	OSF-AOS		AOS-MSB8.1.0	uid://A002/X9cb317/X69	SUCCESS		DelayCal.py -b 3 -jira ICT3972 -i	system

Found 107 entries in 0.041 seconds



# Online Software

- The purpose of the online software is to monitor and control the ALMA telescope and to execute scheduling blocks from approved scientific observing projects.
- Online software (applications) are implemented:
  - Over distributed framework based on CORBA and developed for ALMA Observatory: ALMA Common Software (ACS).
  - ACS provides component communication, error and exception handling, alarm system, etc.
  - Applications are programmed on C++, Java and Python languages
  - Hardware response is managed by real time operating system (RTAI).

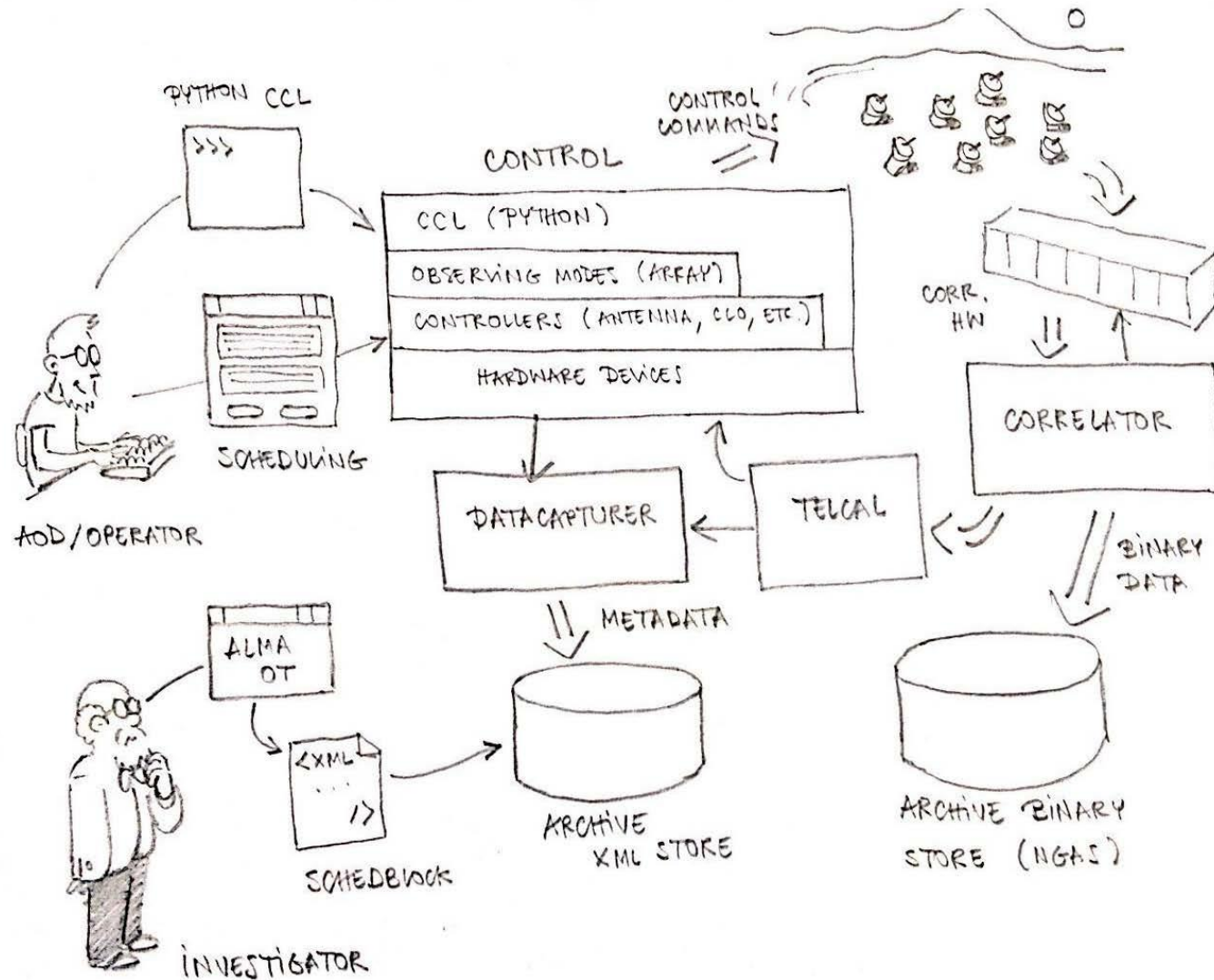


# Online Software

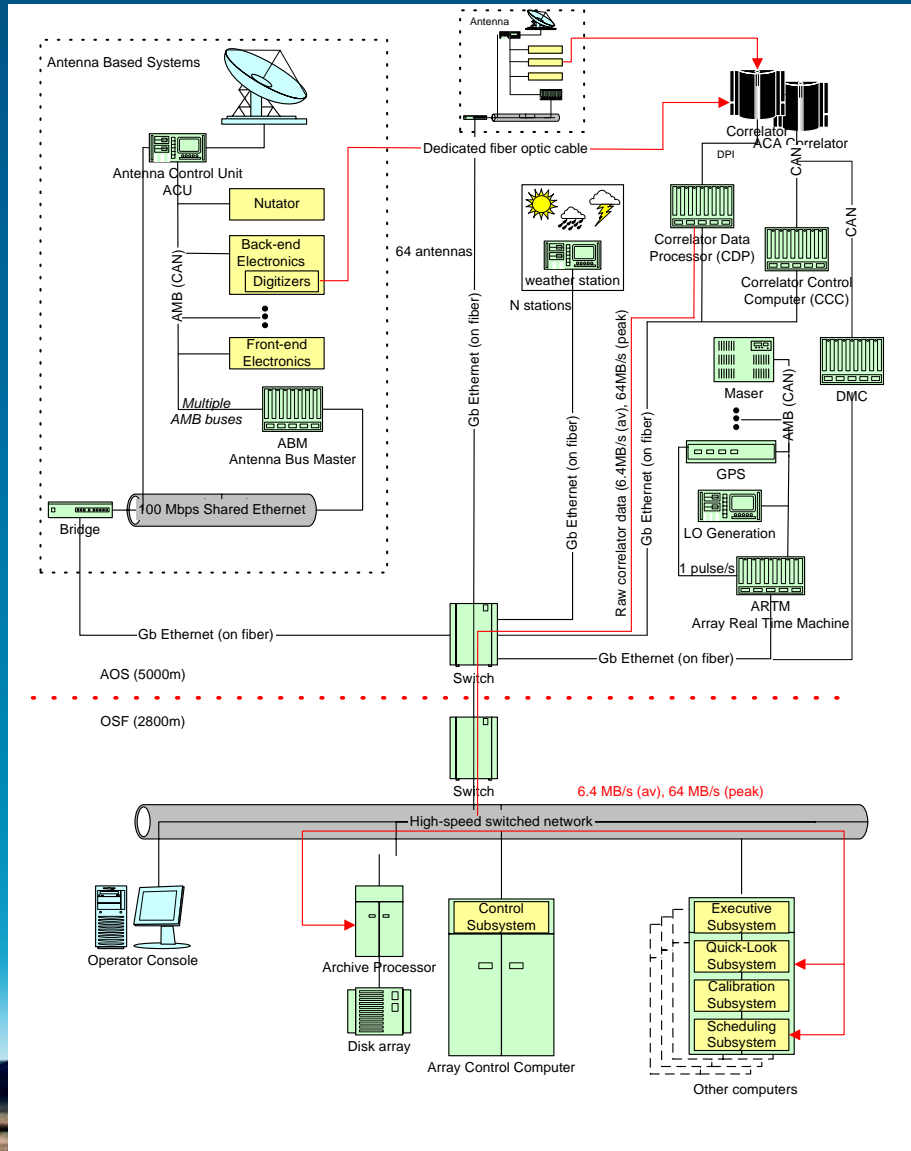
- Online software consider the following subsystems: ACS, CONTROL, BL CORR, ACA CORR, TELCAL, SCHEDULING and PIPELINE Infrastructure.
- PIPELINE heuristics and data reduction software (CASA) are not considered as part of ALMA Software



# ... In More Detail



# Online Software Architecture (physical)





# The ALMA Development and Operations Centers





## 2. Software Delivery Process



# Beginning of ALMA

- Software releases were delivered every 6 months, each one contained lots of new functionality at ONLINE and OFFLINE sides.
- Testing was executed at the developer centers and integration was done at the operational site.
- Testing was focused only at the core functionality (regression tests) but not at the new one added. New functionality verification was delegated to science groups.



# Beginning of ALMA

- Simulation was not mature to isolate a significant number of integration problems! -> Several errors were found when using production hardware (i.e. array elements!) increasing the cost of correcting them.
- Too many changes were introduced while integrating, adding instability to a already fragile system.
- Release stabilization took months before being ready for science commissioning.



# Introducing Changes

- **Increase delivery frequency**
  - Originally from every six months to bi-monthly schema (including testing and integration)
- **Reduce scope per release**
  - Features must be ordered according to observatory milestones (proposal submission, project rating, start cycle observations, etc).
- **Define clear software delivery phases adding a formal handover between each phase**
  - Introduce two (new) roles: Release Manager and Acceptance Manager



# Introducing Changes

- Define clear software delivery phases adding a formal handover between each phase
  - Phase A: Implementations and developer tests
  - Phase B: Verification by Integration & Testing Team (Computing)
  - Phase C: Validation by commissioning team (Science)
- Formalize negotiation about release contents, deadline and software acceptances
  - Introduce two roles: Release Manager (Computing) and Acceptance Manager (Science)





# Example of Release Content

[2015.1-features] Issue No: x

ictjira.alma.cl/issues/?filter=10714

Your computer's time zone does not appear to match your JIRA time zone preference of (GMT-03:00) Stanley. You can update your JIRA preference or hide this message.

**ALMA** Dashboards ▾ Projects ▾ Issues ▾ Agile ▾ Create Search 🔍 ? ⚙️ 👤 ▾

**FILTERS** << 2015.1-features Save as Details ★ Share Export Tools ▾

Find filters

My Open Issues

Reported by Me

Recently Viewed

All Issues

FAVORITE FILTERS

2014.5-bugs

2014.5-features

2014.6-bugs

2014.6-features

2014.6-pending

2014.6-verification-pe...

2015.1-bugs

2015.1-features

2015.1-pending

2015.2-bugs

2015.2-features

2015.2-offline-features

2015.2-online-pending

2015.3-bugs

2015.3-features

2015.4-bugs

2015.4-features

2015.5-bugs

2015.5-features

2015.6-bugs

2015.6-features

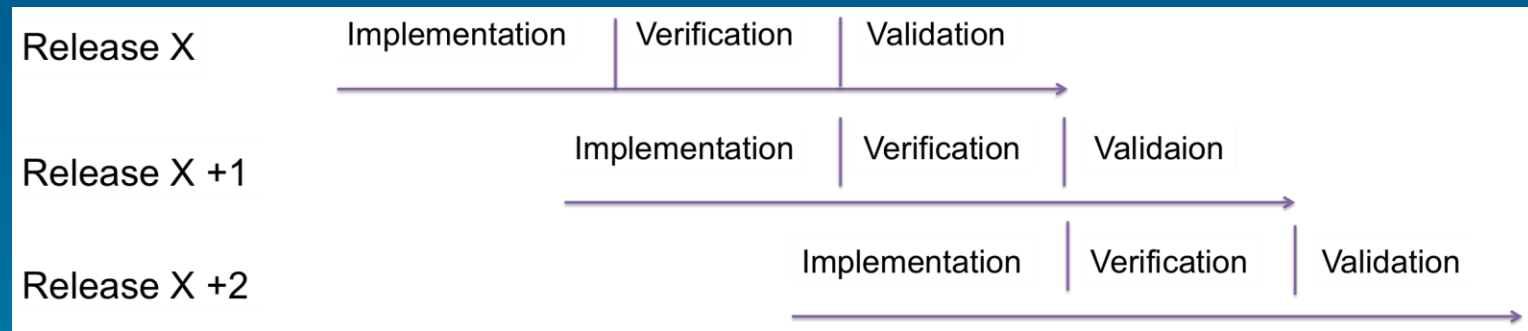
201503-CYCLE3-OFF...

1-50 of 69 Columns ▾

project = "Integrated Computing Team" AND (issuetype = Improvement OR issuetype = "New Feature" OR issuetype = Sub-feature) AND fixVersion = 2015.1 AND resolution in (Fixed, Unresolved, Validated, Verified) ORDER BY component ASC, key ASC

Components	Key	Summary	Assignee	Phase A tests	Phase B tests	Phase C tests	Status	Resolution	Updated	P
02-02 Oracle	ICT-4494	ALMA 2015.1 updates	Mauricio Zambrano	Passed	Passed	Not applicable	CLOSED	Verified	2015-03-11	🟡
02-03 Harvester	ICT-1451	Harvester: import ESO's telbib information into the ASA	Alisdair Manning	Passed	Passed	Not applicable	CLOSED	Verified	2015-02-20	🟡
02-03 Harvester	ICT-2366	Harvester: add APDM abstracts to the asa_project table	Christophe Moins	Passed	Passed	Passed	CLOSED	Verified	2015-03-05	🟡
02-04 ASA Query Interface	ICT-3801	AQ: clean up APIs and make a single entry point	Felix Stoehr	Passed	Passed	Passed	CLOSED	Verified	2015-03-03	🟡
02-04 ASA Query Interface	ICT-3956	AQ: clean up APIs	Felix Stoehr	Passed	Failed	Passed	CLOSED	Fixed	2015-03-04	🟡
02-04 ASA Query Interface	ICT-4004	AQ: refinement of release date calendar tooltip	Felix Stoehr	Passed	Passed	Passed	CLOSED	Fixed	2015-03-03	🟡
02-04 ASA Query Interface	ICT-4716	ASA: the band selection box is missing ALMA bands which are now available	Alisdair Manning	Passed	Not done	Passed	CLOSED	Fixed	2015-03-20	🔥
02-05 Data Packer	ICT-3662	DataTracker: change email text again and put it to a DB field	Christophe Moins	Passed	Passed	Not applicable	CLOSED	Verified	2015-02-27	🟡
02-05 Data Packer	ICT-4140	DataTracker: logging changes	Christophe Moins	Passed	Passed	Not applicable	CLOSED	Verified	2015-02-27	🟢
02-05 Data Packer	ICT-4141	DataTracker: don't bundle up servlet-api.jar	Christophe Moins	Passed	Passed	Not applicable	CLOSED	Verified	2015-02-27	🟢
02-05 Data Packer	ICT-4164	DataTracker: allow the sending to an additional email address also for the 1-month notification	Christophe Moins	Passed	Passed	Not applicable	CLOSED	Verified	2015-02-27	🔴
02-05 Data Packer	ICT-4165	DataTracker: don't send duplicate emails to PIs on application restart	Christophe Moins	Passed	Passed	Not applicable	CLOSED	Verified	2015-02-27	🟡
02-05 Data Packer	ICT-4276	DataTracker: improved logging	Christophe Moins	Passed	Passed	Not applicable	CLOSED	Verified	2015-02-27	🟢
02-08 RequestHandler	ICT-2233	RH: improve Download Manager progress resolution	Felix Stoehr	Passed	Passed	Passed	CLOSED	Verified	2015-03-03	🟢
02-08 RequestHandler	ICT-3276	Add version information for Request Handler	Felix Stoehr	Passed	Passed	Passed	CLOSED	Verified	2015-03-03	🟡
02-08 RequestHandler	ICT-3938	RH: rework the download section of the RH	Felix Stoehr	Passed	Passed	Passed	CLOSED	Verified	2015-03-16	🟡
02-08 RequestHandler	ICT-4031	RH: asdm-tar files are different for each download	Felix Stoehr	Passed	Passed	Passed	CLOSED	Verified	2015-03-03	🟡
06-02 Observing Tool	ICT-508	The OT should provide a 64-bit version of the tarball version with built-in Java	Andy Biggs	Passed	Passed	Passed	CLOSED	Validated	2015-03-10	🟡

# Incremental Release Process (Today)



- Incremental process allowed also optimizing tests resources, including developers, testers, and client testers
- Release Manager is responsible of incremental release calendar and negotiate release contents with acceptance manager



# Software Acceptances

- Incremental releases are accepted for science milestones (cycle-X proposal, project rating, start cycle-X observing) :
  - According to observatory's milestones
  - Incremental releases have passed verification and validation phases
  - Acceptances tests have been successfully carried on.
- **Acceptance Process has the following steps:**
  - Test Report Review
  - Acceptance Testing
  - Acceptance Meeting
  - Software deployment on production environment (JAO and ARCs)





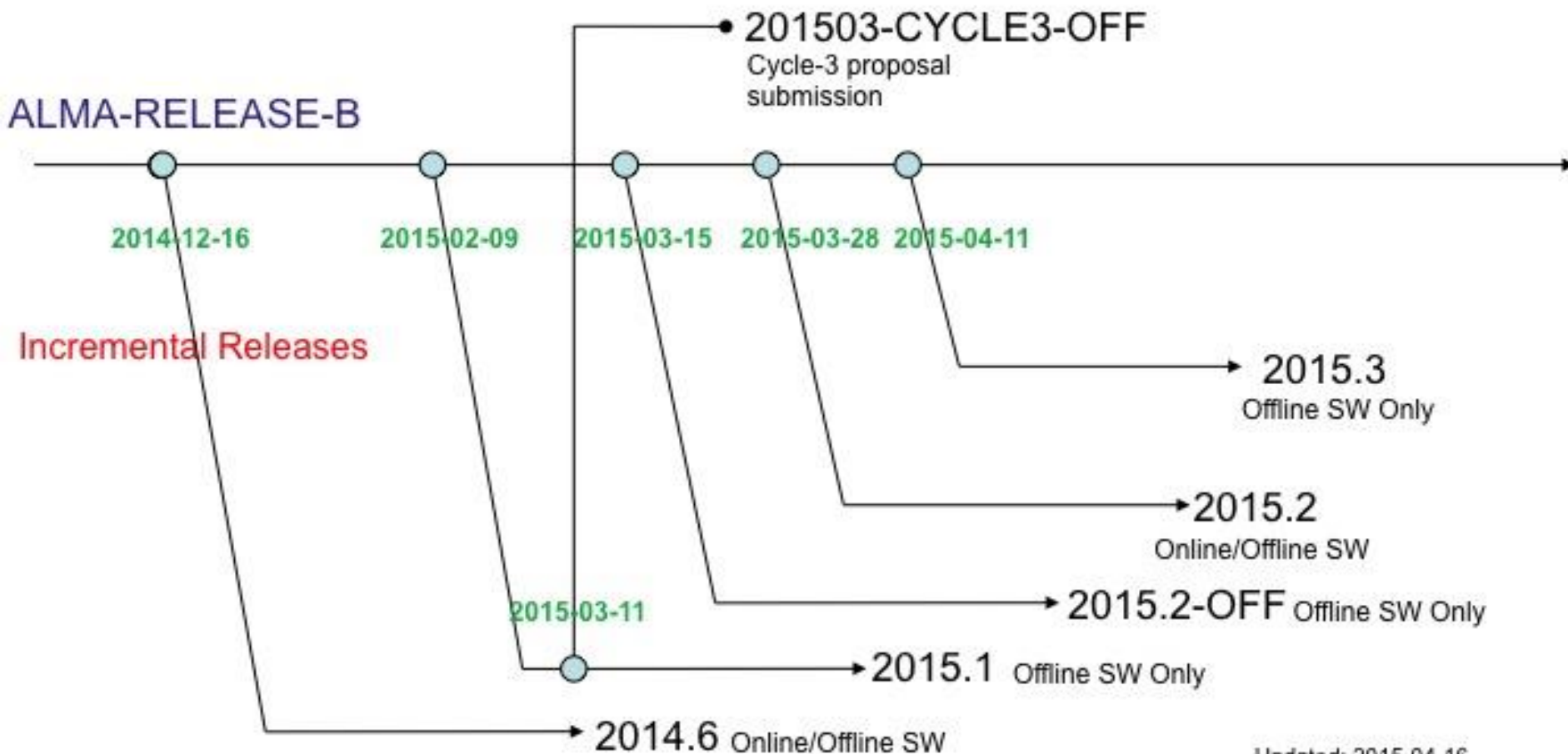
# Software Acceptances

- Acceptance Manager is responsible for creating acceptance calendar according to observatory milestones.

	A	B	C	D	E	F	G	H	I	J
		Month	Observatory Milestone	Incremental Releases (planning details on the link)	Deadline for Requirements	Phase C start/end	Acceptance Branch	Applications to be accepted	TRR/Acceptance Date	Notes
1		2015								
2		Jan								
3										
4							01501-CYCLE2-ON	R10.6	2015/4/15? - 2015/4/20?	Cycle 2 online software update?
5				2015.1-Off	2015.1-Deadlines	2015/03/02-2015/03/09				
6		Feb		2015.2-Off	2015.2-Deadlines	2015/04/13 (Internal)				
7										
8										
9		March					01503-CYCLE3-OFF	2014.5-2015.1-Off-OT, Ph1m, APRC, UserReg/UserRegistration, Harvester, NGAS, PIPELINE Infrastructure	2015/3/11-2015/3/16	Dates for acceptance testing: 2015/03/12 to 2015/03/15. Dates for the official deployment: 2015/03/18
10										
11										
12		April		2015.3-Off	2015.3-Deadlines	2015/05/13				
13										
14										
15							01508-CYCLE3-ON	R10.6(?), R10.8, 2014.2, 2014.4, 2014.6. Online	2015/4/30- no acceptance	Cycle 3 online software, Phase C complete
16		May		2015.4-Off	2015.4-Deadlines	2015/06/25-2015/07/24				
17				2015.4-On	2015.4-Deadlines	2015/07/08				
18										
19		Jun								
20							01506-CYCLE3-OFF	2015.2-3-Off-OT, SPT	2015/6/1-2015/6/15	
21			APRC							
22				2015.5-Off	2015.5-Deadlines	2015/08/05-2015/08/21				
23		July								
24										
25										
26		Aug	P2G Bootcamp							
27										
28				2015.6-Off		2015/10/07 (Internal)	01508-CYCLE3-ON	R10.6(?), R10.8, 2014.2, 2014.4, 2014.6. Online	2015/7/30-2015/8/30	Cycle 3 online software delta acceptance. Start Cycle 3
29				2015.6-On				2015.4-5-Off-OT?, AQUA, SLT, CATALOG, PT, Archive, UserReg/UserRegi		

# Incremental and Accepted Release Schedule

## Accepted Releases



# Software Requests

- Once a release is accepted for science observations all changes are controlled.
  - Software Configuration Control Board (SCCB) is responsible for approving or rejecting software requests.
  - SCCB is compound by science, engineering and computing representatives
  - SCCB meets once per week for resolving software requests.
- **Software requests involves:**
  - Database persistent model changes.
  - Software patches
  - Service releases (whole application updates)
  - Change requests (changes at the software tools)



# The Future

- **ALMA is transitioning from construction to operations:**
  - Less access (technical time) to the operational HW (testing).
  - Continuous operation will require software robustness instead of new functionality.
  - Software should be more stable.
- **Operational model will impact SW delivery process:**
  - Less testing time with access to operational HW.
  - Simulation capabilities should be improved.
  - Number of features will decrease per release.
  - A more agile paradigm can be implemented.



# Transition to Agile Approach

- **Continuous integration model:**
  - There is a stable (“accepted”) branch used for science observations.
  - Developers commit new features in their local repository (or branches) as a software patch compatible with integration branch.
  - Patch is scheduled to be verified by Integration & Testing team during a time slot of a technical time.
  - If feature passed verification; it is committed into the integration branch. Otherwise, patch is rejected to be integrated and scheduled for a new technical time.

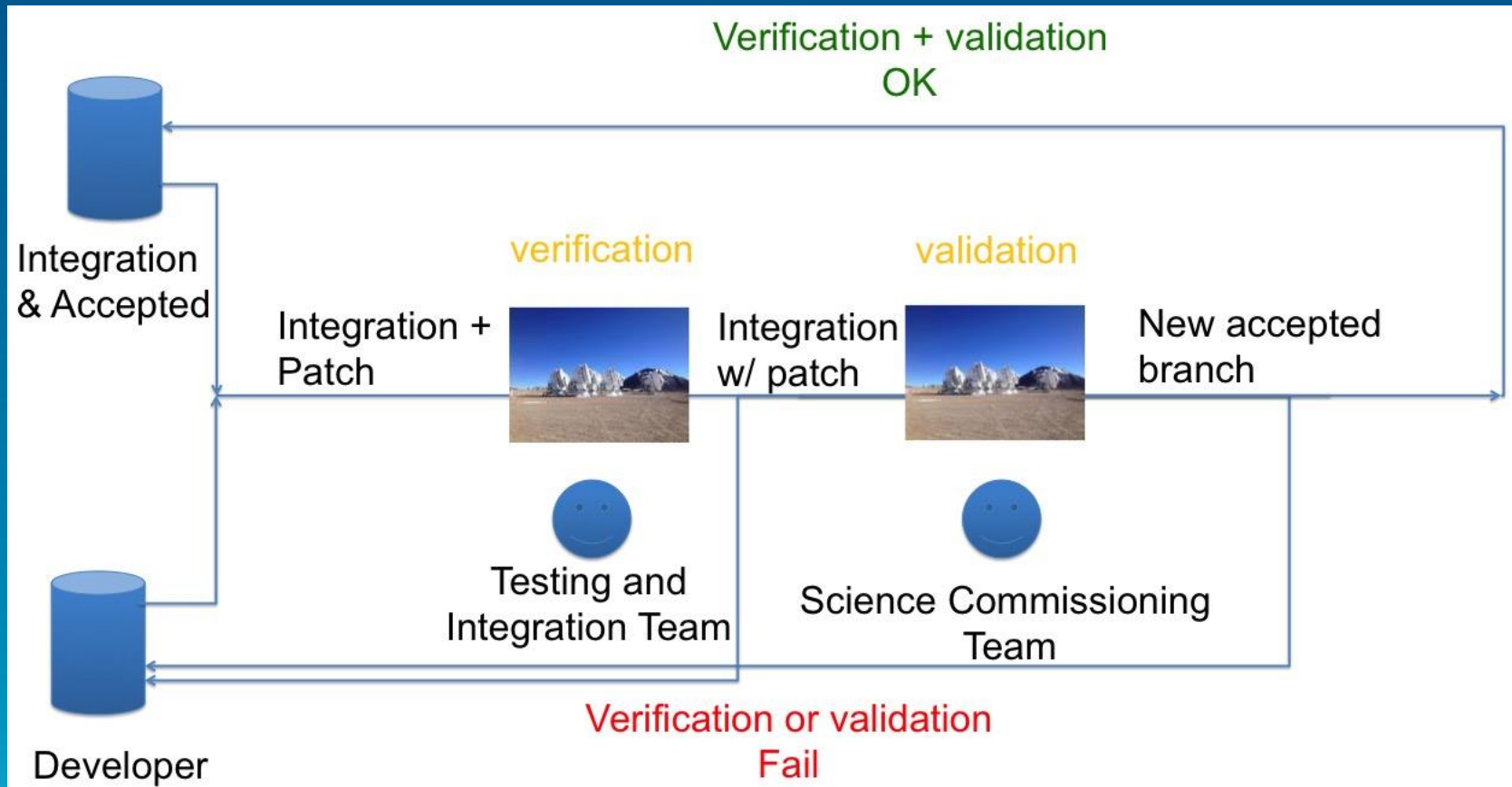


# Transition to Agile Approach

- **Continuous integration model:**
  - After verification, feature must be validated by Science group from integration branch.
  - If validation success, a new accepted branch is created from the integration branch and used for science observations.
  - Otherwise, accepted branch remains the same until fix problems with the new features.
  - Note this model does not require acceptance process but...



# Agile Approach Workflow



# Considerations

- This model will require more discipline from developers, testers and science commissioning team.
  - Developers must schedule the features according to Observatory milestone well in advance (specially big or difficult ones)
  - Verification phase start early in order to get the features working fine for validation.
  - High (and quick) interaction between tester and developers is expected
  - Scientists must be available for complete validation and get the new software ready for science observations.





# Considerations

- A verification phase under simulated environment can be added preliminary to the operational HW testing (online system).
- Online system validation usually takes many time before be declared as success, so it will require special validation period (less “agile”).
- Offline software still produced big number of features improvements.





Thanks! Questions?

Further information:

<http://www.almaobservatory.org>

Contact point: [rsoto@alma.cl](mailto:rsoto@alma.cl)

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and in East Asia by the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Academia Sinica (AS) in Taiwan. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI) and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.