EVLA Software - Overview

Bryan Butler
NRAO

History of EVLA Computing (1)

- EVLA computing consists of three parts:
  1. Monitor & Control
     - Array and antenna control, monitor, alarms/messaging, raw data collection
  2. Scientific Support Systems (SSS)
     - Proposal preparation, observation preparation, scheduling, archiving, image pipeline
  3. Post-processing (AIPS, CASA)
- The term e2e has been used for several combinations of 1, 2, and 3.
- All three parts are in the *scope* of the EVLA phase 1 proposal
  - Of these three, only M&C was *budgeted* in proposal
  - SSS and post-processing were not budgeted in proposal; instead were assigned to Data Management, a separate division of NRAO with deliverables to all telescopes and projects

History of EVLA Computing (2)

- Data Management was dissolved in 2003
- Post-processing became part of Interferometry Software Division (ISD), jointly managed and funded by EVLA and ALMA
- Scientific Support Systems split between ISD (with observatory-wide focus) and the EVLA project, for EVLA-specific deliverables
  - EVLA specific activities funded out of EVLA contingency
  - Other activities funded out of VLA/VLBA operations
- Current EVLA Computing Division (ECD) staff responsibilities:
  - EVLA M&C
  - Basic VLA and VLBA operational support
  - Scientific Support Systems
  - Oversight of Post-processing
- ISD role being taken over by the e2e Operations Division
  - Focus on User Support

EVLA Software Requirements

The software design and implementation is driven by a number of requirements documents:

- e2e Science Software Requirements
- Engineering Software Requirements
- Real-time System Software Requirements
- Operations Software Requirements
- Post-processing Requirements

These do not have *everything* in them (for instance Proposal Handling and User Database, which are covered in separate [less formal] documents), but are fairly complete)

EVLA Software Requirements

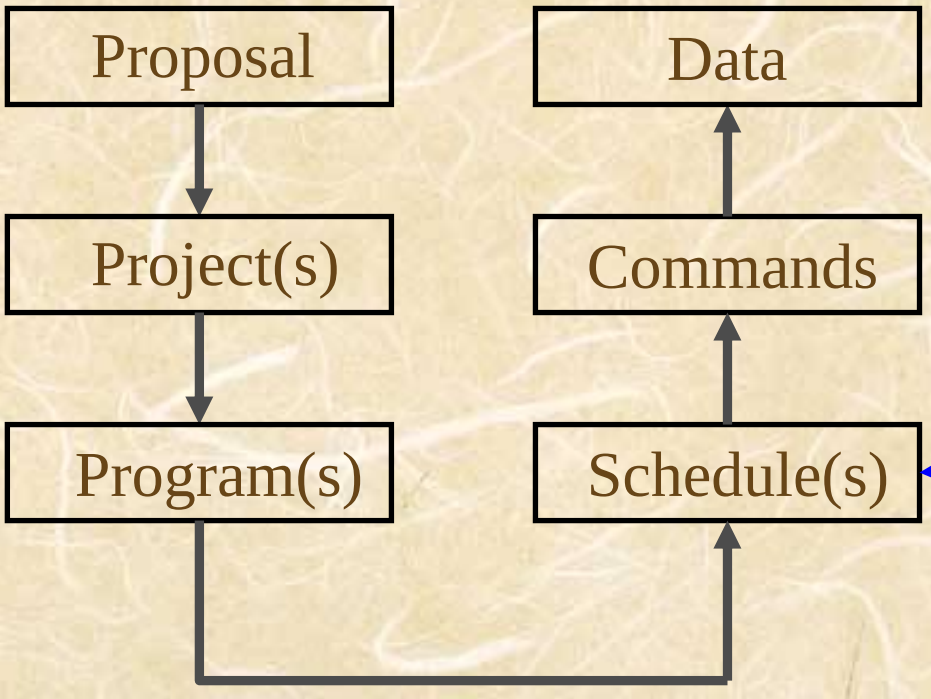
- Each requirement is assigned a priority (1, 2, 3):
  1. Essential - must be present and work with high efficiency
  2. Important - should be present but may have to be delayed
  3. Desirable - considered for development during operations
- Each requirement is also assigned a timescale (A-E):
  A. Arrival of prototype correlator (Q3 2007)
  B. Arrival of production correlator (Q2 2008)
  C. Science commissioning (Q1 2009)
  D. Shared risk observing (Q2 2010)
  E. Full science operations (Q2 2012)

EVLA High Level Design, ca. 2004

- Undertaken in spring of 2004
- "Team" created (Morgan, Ryan, Sowinski, Waters, plus several advisors)
- Completed high level design reviewed and accepted by NRAO e2e Oversight Committee in June 2004.
- Extensive modification in the past two years.

Major Elements ("Models")

The main flow of information (and processes; the "workflow" or "dataflow") is:

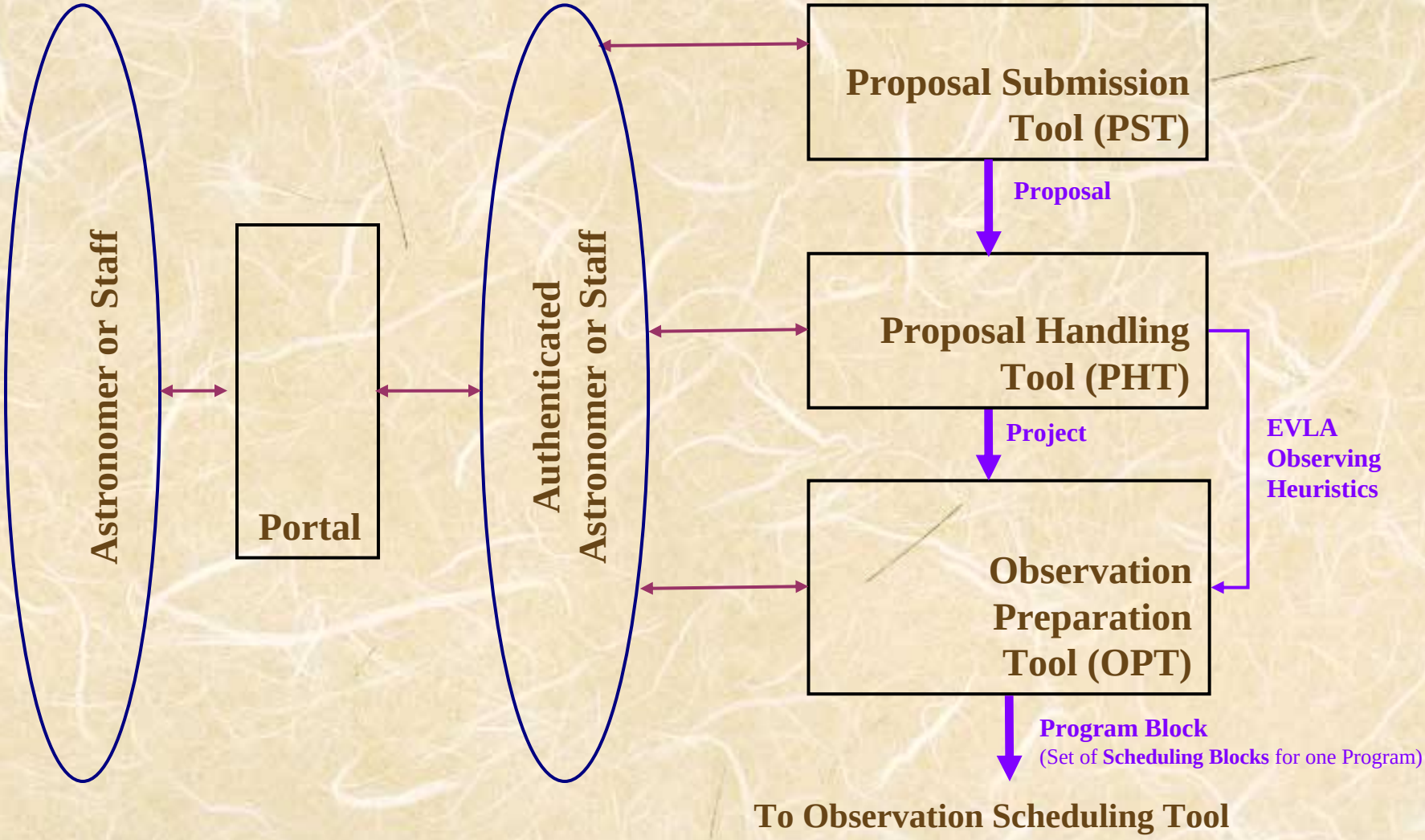


A Scheduling Block (SB) is an atomic unit of observing. It is made up of a sequence of *scans*; a scan is made up of *source(s)*, *resource(s)* (hardware definition - both Front End and Back End), *timing* information, and a *"mode"*. The *mode* defines the *subscan(s)*, which are comprised of a single *source*, *resource*, and *timing* information.

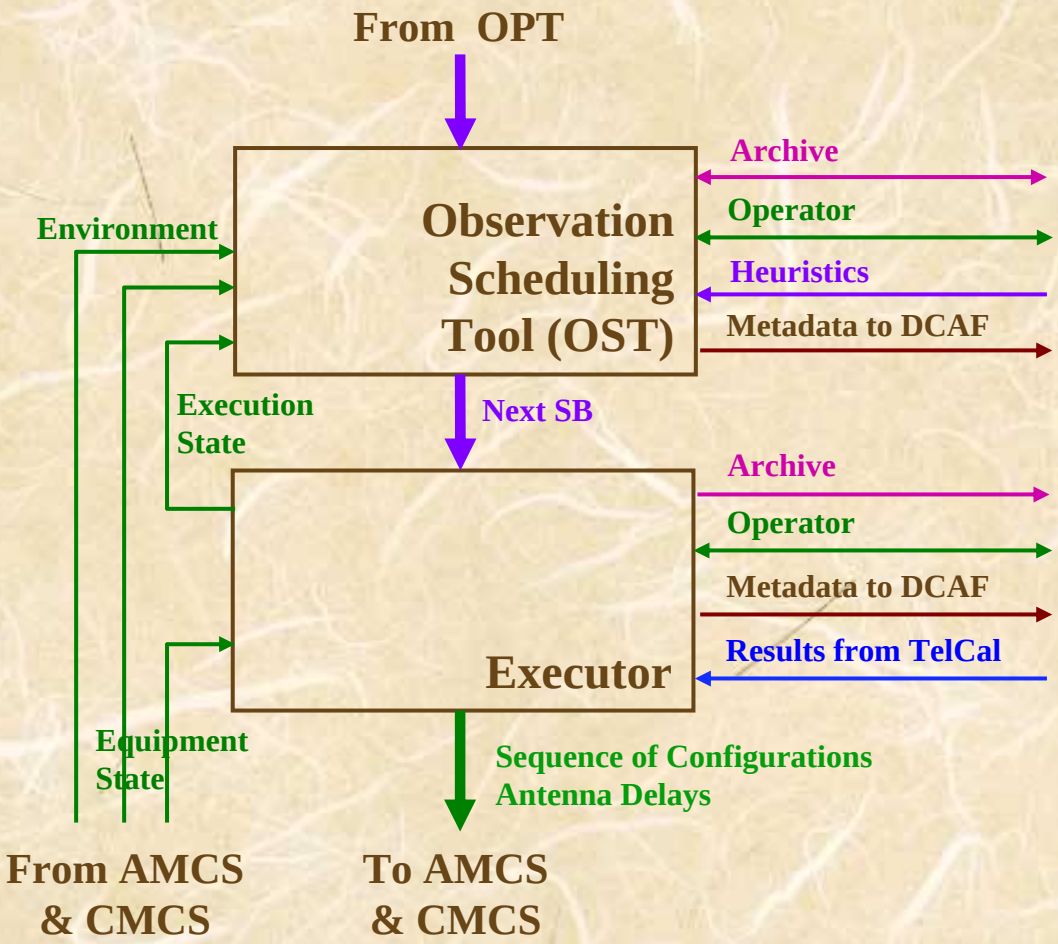
EVLA High Level Design

- Most major subsystems have a direct counterpart in current VLA software
- We have a significant amount of experience in what is needed for those subsystems
- Electronic storage and passage of information between subsystems, and therefore the ability to do much of this automatically, is the new part
- Subsystems are loosely coupled; information (the models) is stored in databases and accessed independently by the subsystems

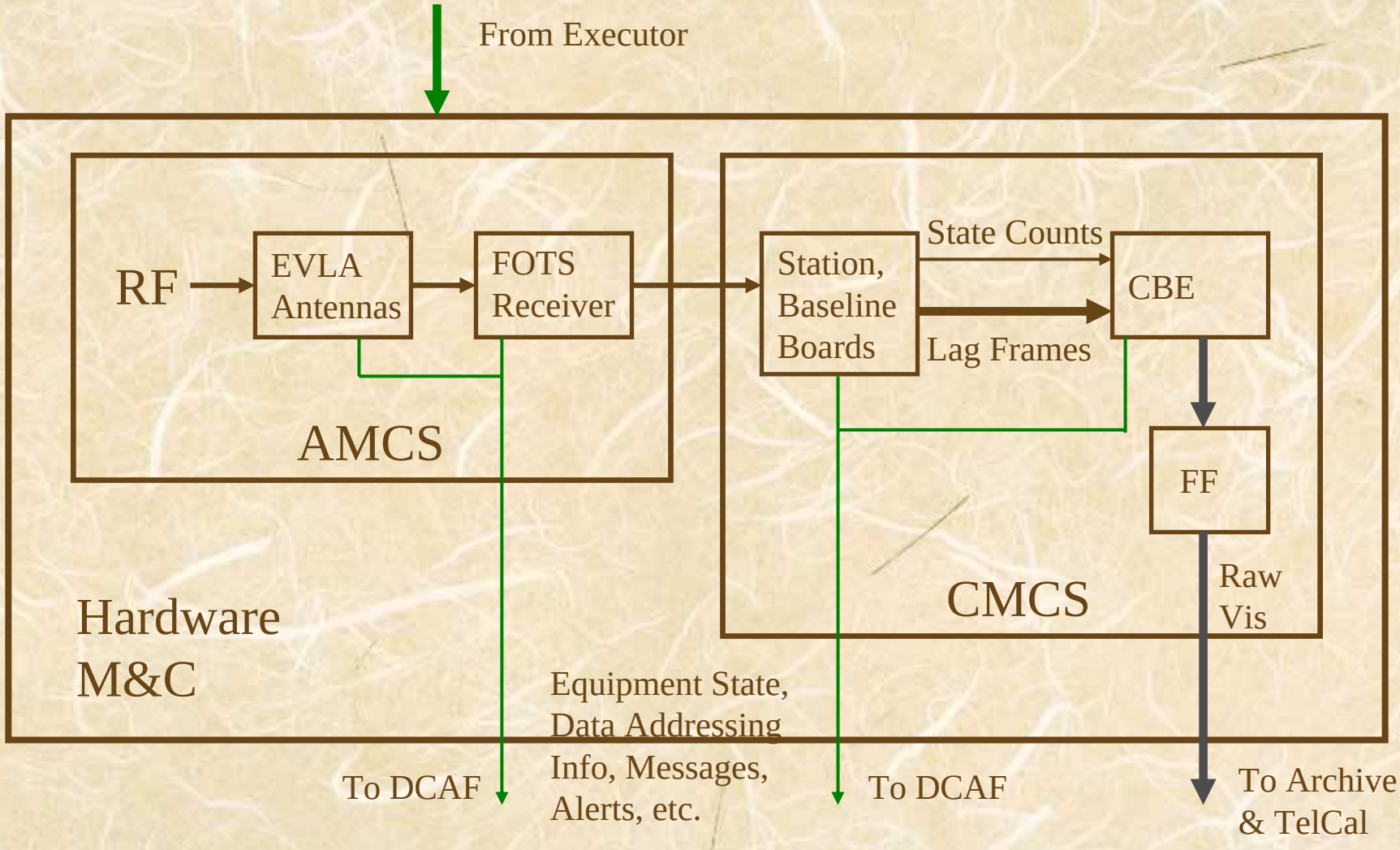
EVLA High Level Design (1)



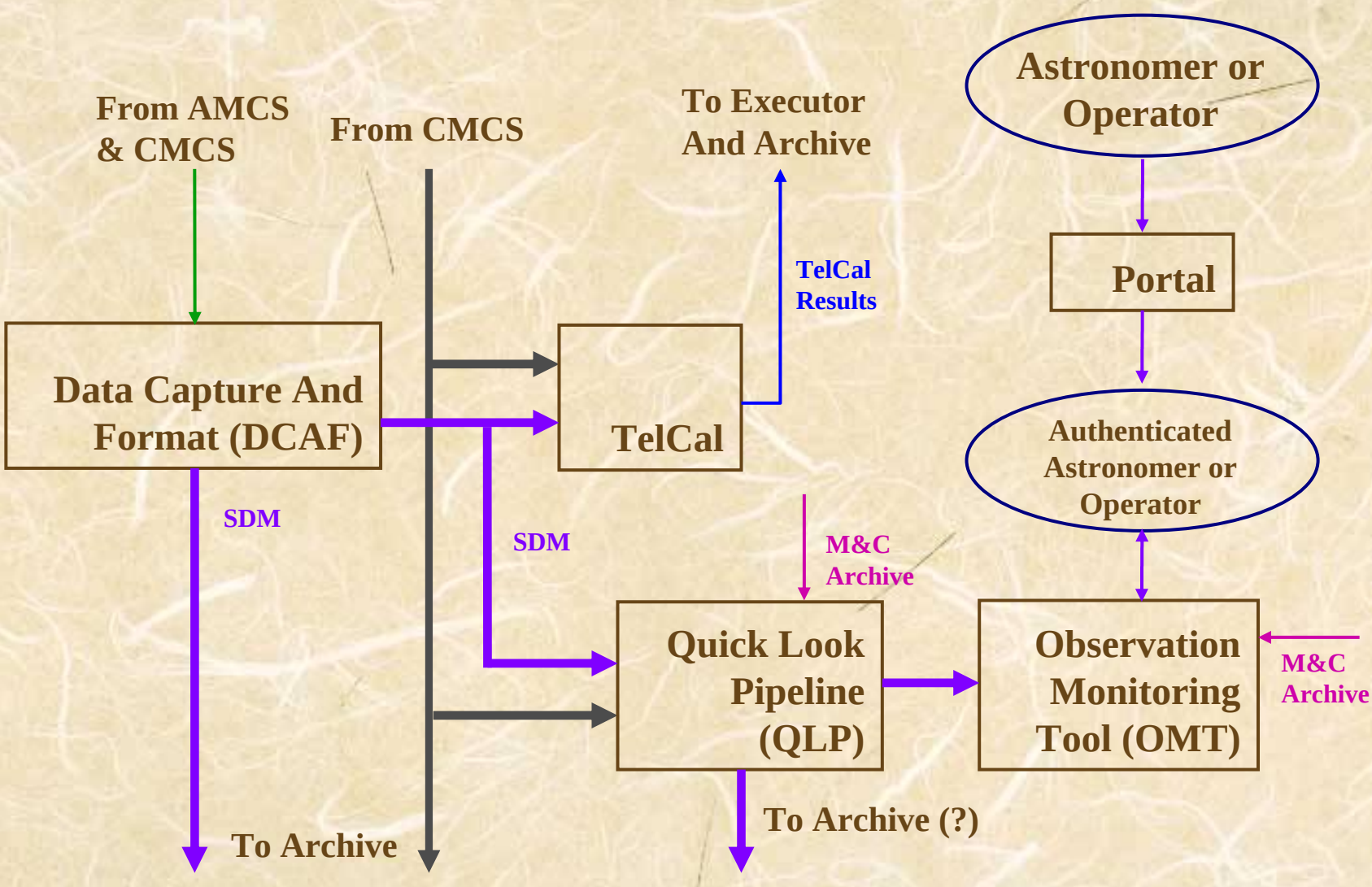
EVLA High Level Design (2)



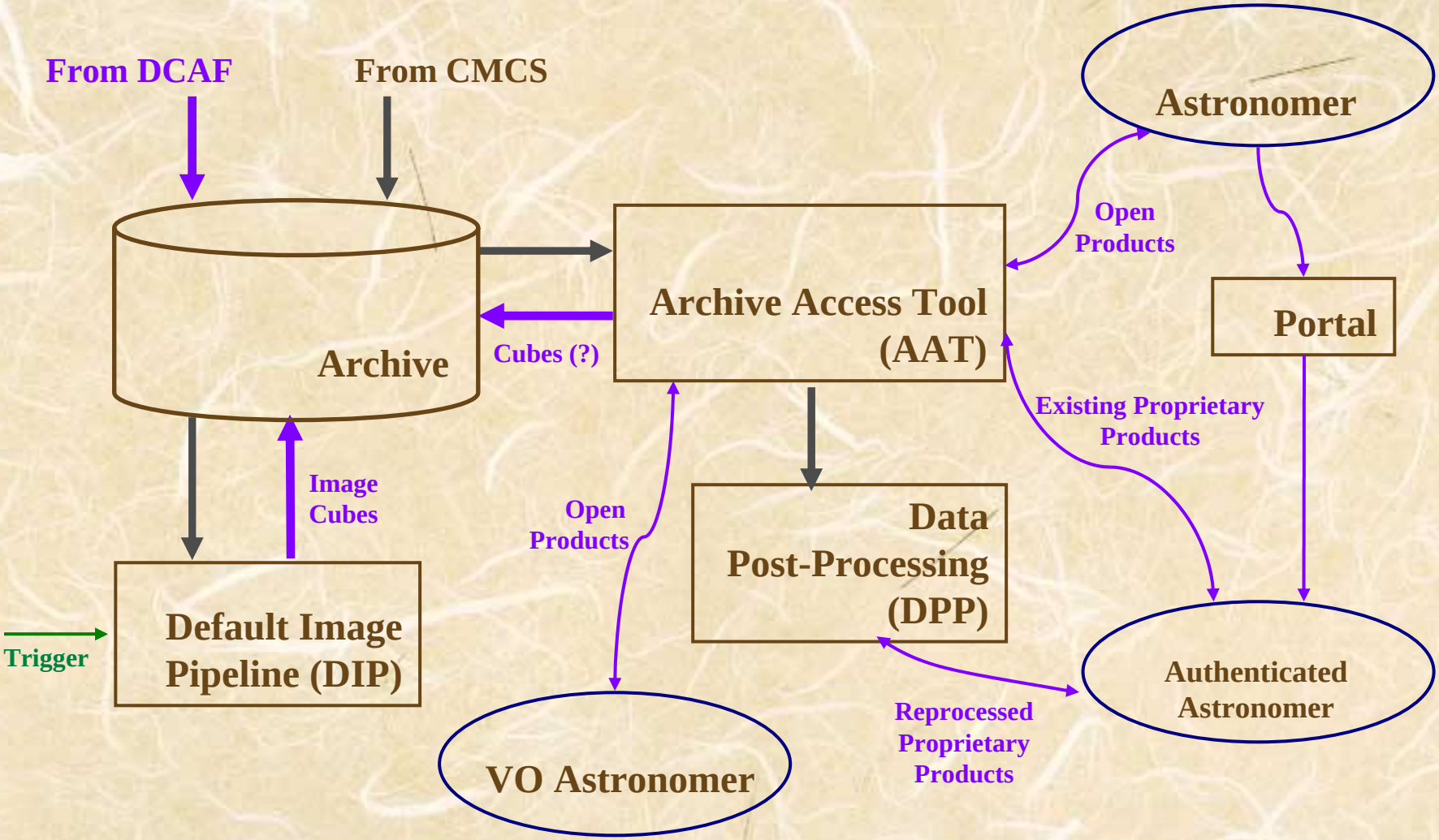
EVLA High Level Design (3)



EVLA High Level Design (4)



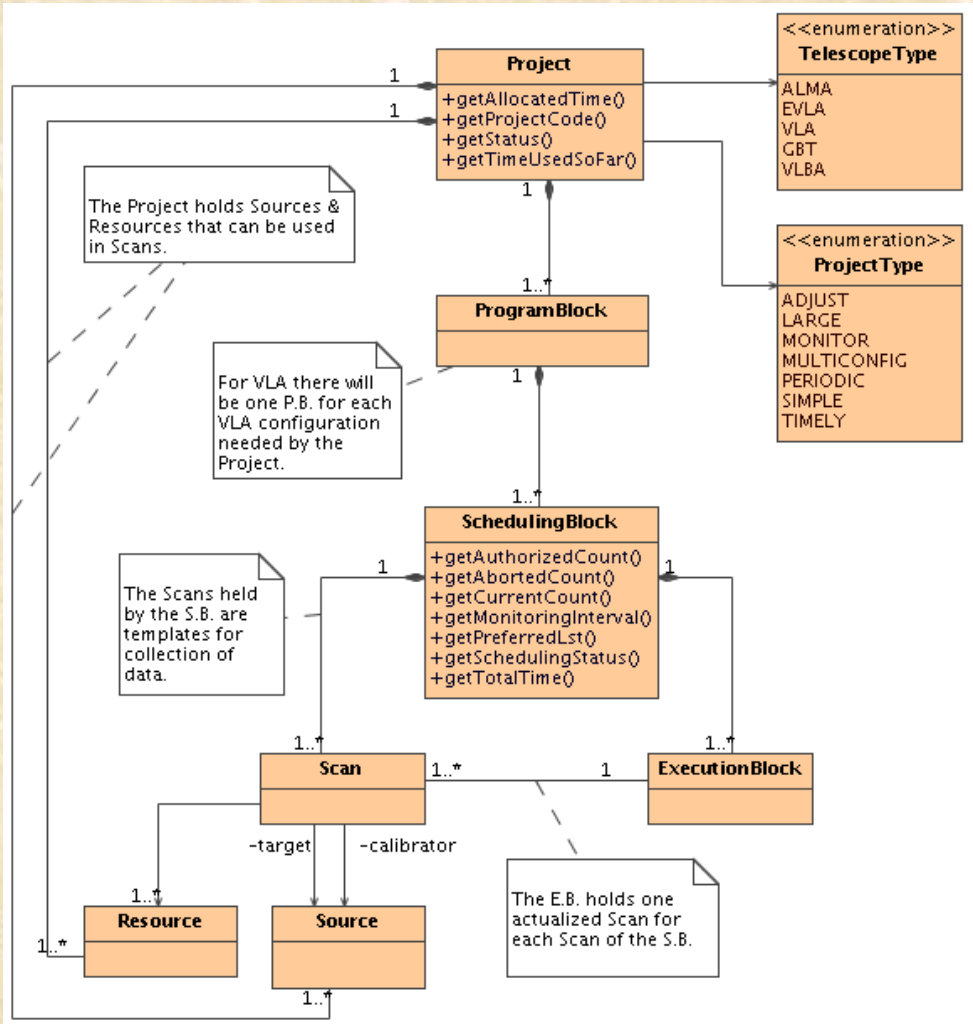
EVLA High Level Design (5)



Developing Models

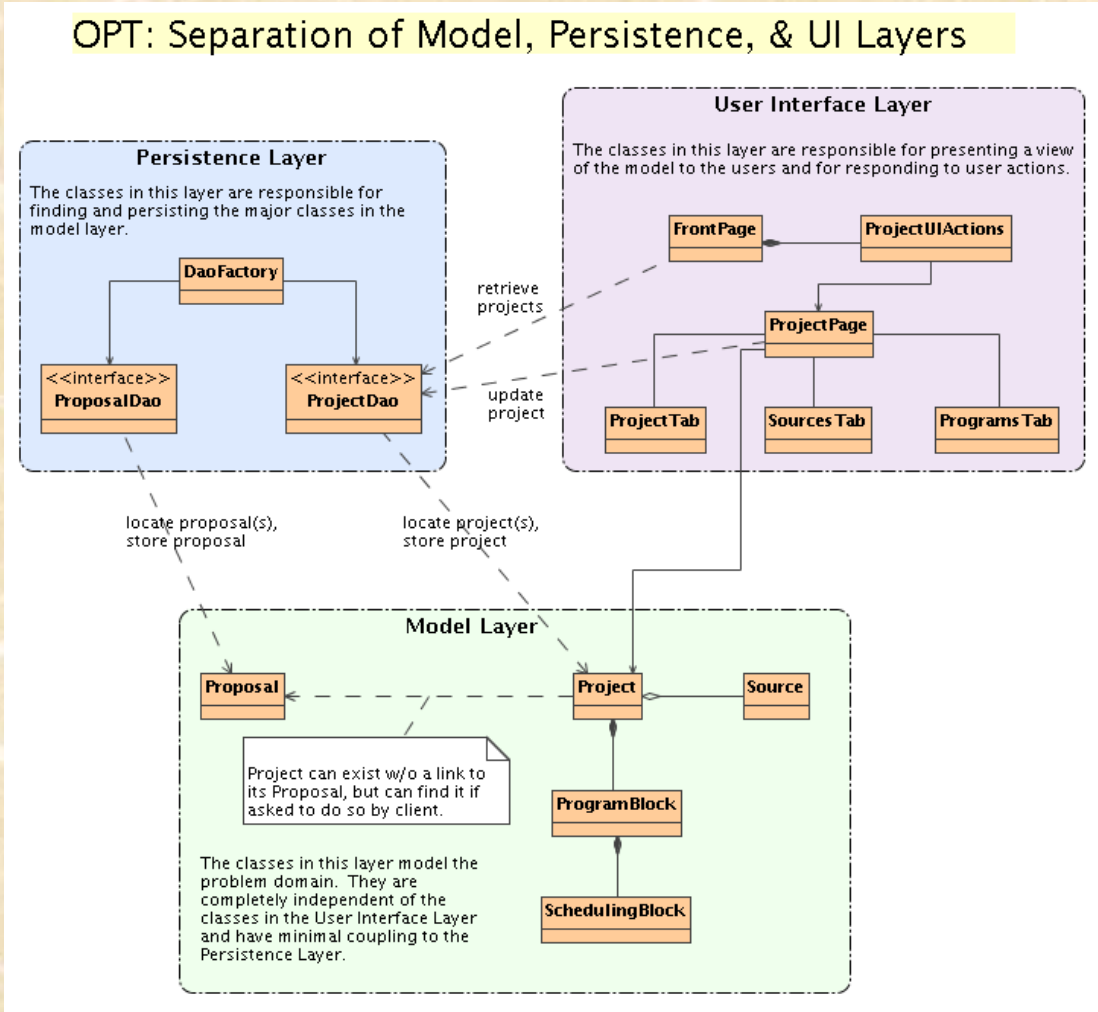
- Domain expert develops an XML model, based on requirements, and other information (for instance, information gained from dynamic scheduling tests on the VLA)
- XML is turned over to the developers, who then turn it into classes
- Classes are iterated with domain expert, which feeds back into the XML model

Project/PB/SB Model

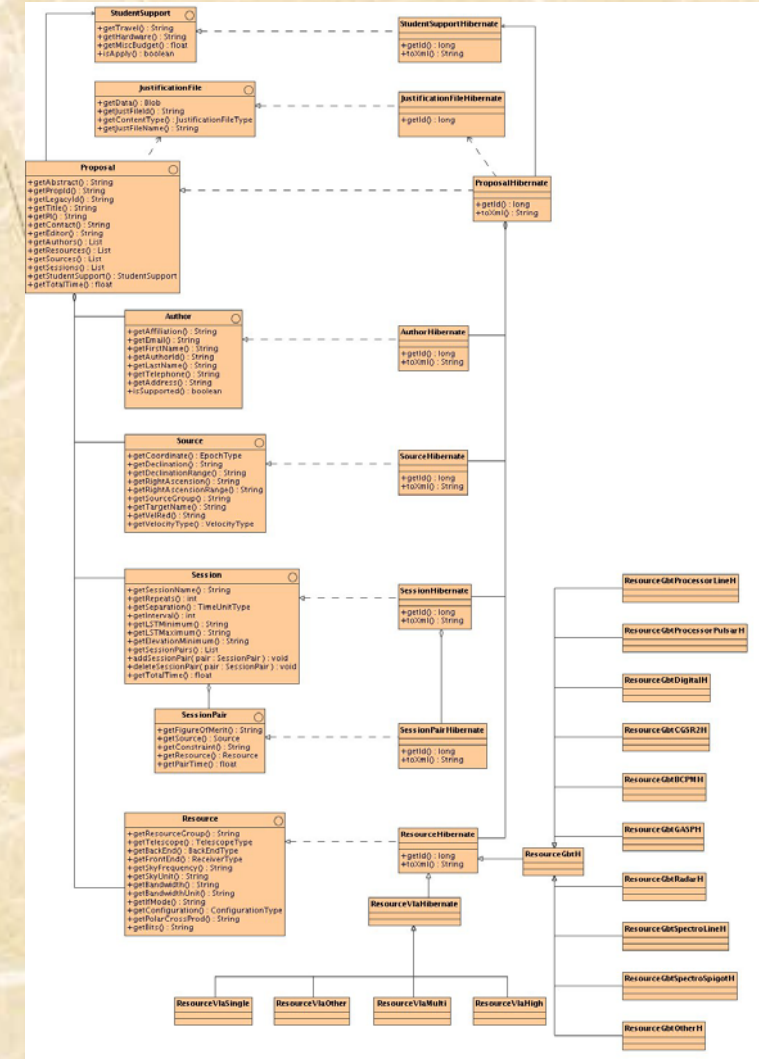


A Program Block (PB) is the internal representation of a Program. It is the same as the ALMA ObsUnitSet, with the exception that ALMA allows infinite nesting of OUS's.

Design - Separation of Primary Components



Detailed Design Example - PST



Subsystem Designs & Prototypes

- Subsystems with a very advanced prototype: Portal, PST, Executor, OMT
- Subsystems with an early prototype: PHT, OPT, OST, AAT, TelCal
- Subsystem with only a roughed out prototype: DCAF
- Subsystems with only block diagrams: QLP, DIP. Note that effort for these pipeline subsystems is not funded or staffed currently.

Portal

- Accesses "User Database" - storehouse of information on users
- Authenticates users
- Controls access to the various tools
- Generates unique token used to verify user login status within the other tools.

Portal

Accomplishments and current status:

- Fully functional - extensively tested in 3 proposal deadlines
- 578 users, 381 institutions currently in User Database
- Integrated with PST and OPT
- Hooks in for integration with VLA/VLBA AAT.
- Code conforms to our new architecture

Portal

Remaining work:

- Continued user support
- Other support (adding a user group to facilitate the PHT referee process, for example)
- Coordination with ALMA on possible common authentication scheme (possibly even application)
- Keeping an eye on VO developments (single sign on for access to all VO sites, e.g.)
- Integration into current VLA/VLBA AAT

Proposal Submission Tool (PST)

- Used to collect form data (web browser)
- Mostly telescope independent, with "resources" the exception, and also some policies (student support, for instance)
- Implemented to support GBT and VLA first so that EVLA can benefit from early user feedback.

PST

Accomplishments and current status:

- Fully functional - tested in 3 proposal deadlines for GBT, 1 for VLA
- Last deadline, VLA PST use was optional - ~2/3 chose to use it over the old LaTeX forms
- Integrated with Portal and User Database
- No server problems at last deadline (110 proposals submitted via PST, all but 3 in last week, 73 in last day, 43 in last 3 hours)
- New code base, with improvements to interface and conforming to our new architecture, to be used for June deadline

PST

Remaining work:

- Continued user support
- Updates based on feedback from use for GBT and VLA deadlines
- New functionality (search old proposals, for example)
- Coordination with ALMA on potential of common PST and underlying model
- Used for EVLA in 2010 (means only addition of EVLA Resource tab page)

Proposal Handling Tool (PHT)

- Allows editing and adding of data to the proposal
- Supports assigning of referees to proposals
- Makes proposals available to referees online
- Supports scheduling committee functions

PHT

Current status:

- Requirements are in hand, but not in the form of detailed requirements like the other areas, but rather as a "user story" (converted to formal Use Cases by our developers)
- Minimal functionality incorporated within the PST:
  - editing and adding data
  - viewing and printing (to send to referees and scheduling committee)
- Other functions still handled by VLA and GBT staff

PHT

Remaining work:

- Assignment of referees
- Online referee access to proposals and ability to put in reviews online
- Handling of referee reviews
- Scheduling committee functions
- To be implemented before October deadline, except for more complicated scheduling committee functions
- Full EVLA support Q2 2012

Observation Preparation Tool (OPT)

- Converts Project into Program Blocks (PB is a collection of Scheduling Blocks)
- Needs detailed telescope knowledge
- Needs to support 3 "levels" of user:
  - Novice (automatic generation of PBs for "standard modes")
  - Intermediate (graphical setting of observing parameters)
  - Expert (allow for script level editing)

OPT

Accomplishments and current status:

- Detailed design in place, core classes designed for reuse in the rest of the system
- Early prototype of the web application in place
- Duplicates look-and-feel of the PST
- Integrated with Portal
- Simple navigation and input and output functions supported
- Old Calibrator Selection Tool available as guide to look-and-feel for that component

OPT

Remaining work:

- Calibrator selection component using NRAO-wide calibrator database (Q3 2006)
- Spectral setup component (for VLA; Q1 2007)
- Full VLA support (Q2 2007)
- Prototype WIDAR fully supported (Q3 2007)
- Full EVLA support (Q2 2012)

Observation Scheduling Tool (OST)

- Takes pool of available Scheduling Blocks and chooses what should be observed next on the telescope
- Must take into account scientific priority, current observing conditions, and other priority modifiers (project completion pressure, for example)
- Must be able to run autonomously, eventually

OST

Accomplishments and current status:

- Prototype system successfully used during several VLA reconfigurations - it works!
- All command line utilities at this point

OST

Remaining work:

VLA prototype:

- Over the next 6 months, a system is being phased in that will support the dynamic scheduling of all "filler" and "monitor" observing at the VLA.
- Make it possible for all VLA observing to be dynamically scheduled by mid-2007.

EVLA:

- Assigning effort beginning late summer 2006 to support the incorporation of the knowledge gained during prototype implementation into a tool which is integrated with the rest of the EVLA software system (conforms to the new HLA).
- Full EVLA support by Q2 2012.

Archive Access Tool (AAT)

- Searches and retrieves data from the disk archive
- Raw data and processed products made available
- Should support Virtual Observatory (VO) access, at least on the processed products
- If EVLA has common SDM and archive storage software and hardware (NGAS) with ALMA, then tool can be common

AAT

Accomplishments and current status:

- Prototype exists which makes raw VLA and VLBA data available
- Used extensively for several years now - extremely successful!
- Authentication code there, not exercised yet (because we haven't had VLA data come out for projects which used the online VLA PST yet)
- NGAS hardware and software beginning to be implemented at AOC for use by current tool

AAT

Remaining work:

- Complete NGAS evaluation (Q4 2006)
- Test authentication (Q4 2006)
- Collaboration with ALMA to impart our "lessons learned" and to evaluate possibility of using their archive access tool
- Minimal EVLA support (Q2 2007)
- Full EVLA support (Q2 2012)

Antenna Checkout Software

- ECD responsible for delivering software to make it possible for the VLA Operations Group to test and accept antennas into normal VLA operations
- List of needed software in place, developed in cooperation with the VLA Operations Group
- Most software in place; remainder being developed given two milestones:
  - initial (command line) version deliverable by the time antenna 18 is outfitted (end of May 2006)
  - final (GUI) version deliverable by the time antenna 24 is outfitted (end of July 2006)

Collaboration with ALMA

- **Proposal and Observation Preparation**: See next slide
- **Observation Monitoring:** EVLA has currently functioning tool which been demonstrated to ALMA; ALMA looking seriously at adopting it.
- **Visibility data archive + DCAF**: sharing will require agreement on common science data model, which EVLA and ALMA are actively working on (documentation on shortfalls of ASDM for EVLA; EVLA supplied VLBA data to ALMA to see if it can be supported in SDM)
- **Post-processing** – both ALMA and EVLA have adopted CASA as their default data post-processing system
- **Pipeline** – Not among priority 1 items for EVLA; e2e Operations Division will facilitate efforts to adopt ALMA pipeline infrastructure

Collaboration with ALMA - PST & OPT

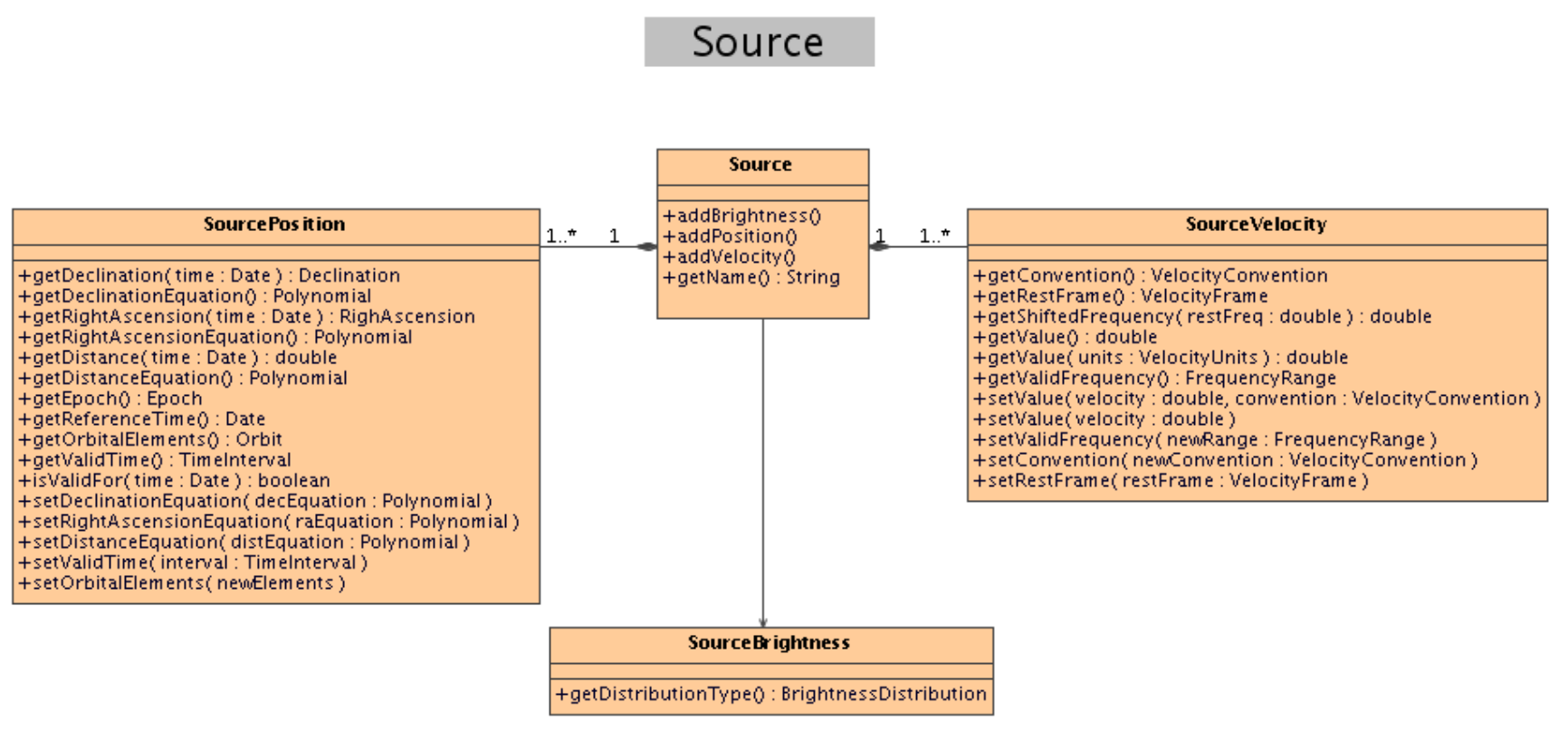
We just spent a week in in Edinburgh having a joint meeting with ALMA and GBT to determine what pieces of the PST and OPT software could be shared. Such items include:

- Proposal Model (ALMA's Science View of Project Data Model)
- Validation infrastructure
- Help system
- Astronomical tools (coordinates, time, etc.)
- Calibrator selection subcomponent (ALMA reuses EVLA)
- Spectral setup subcomponent (EVLA reuses ALMA)
- Development tools (Eclipse, MagicDraw, Hibernate)

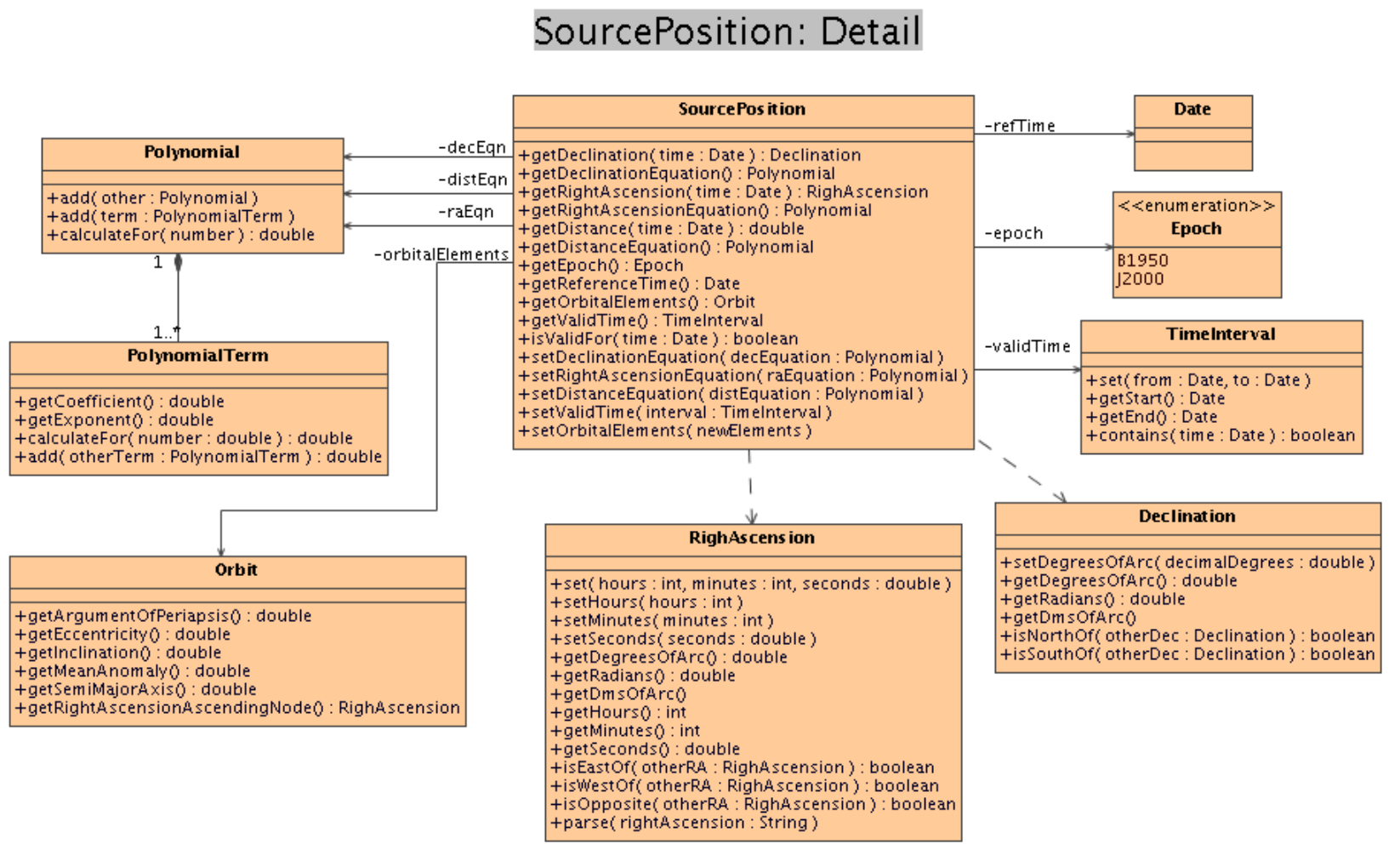
A detailed report is being prepared (first draft complete).

Backup Slides

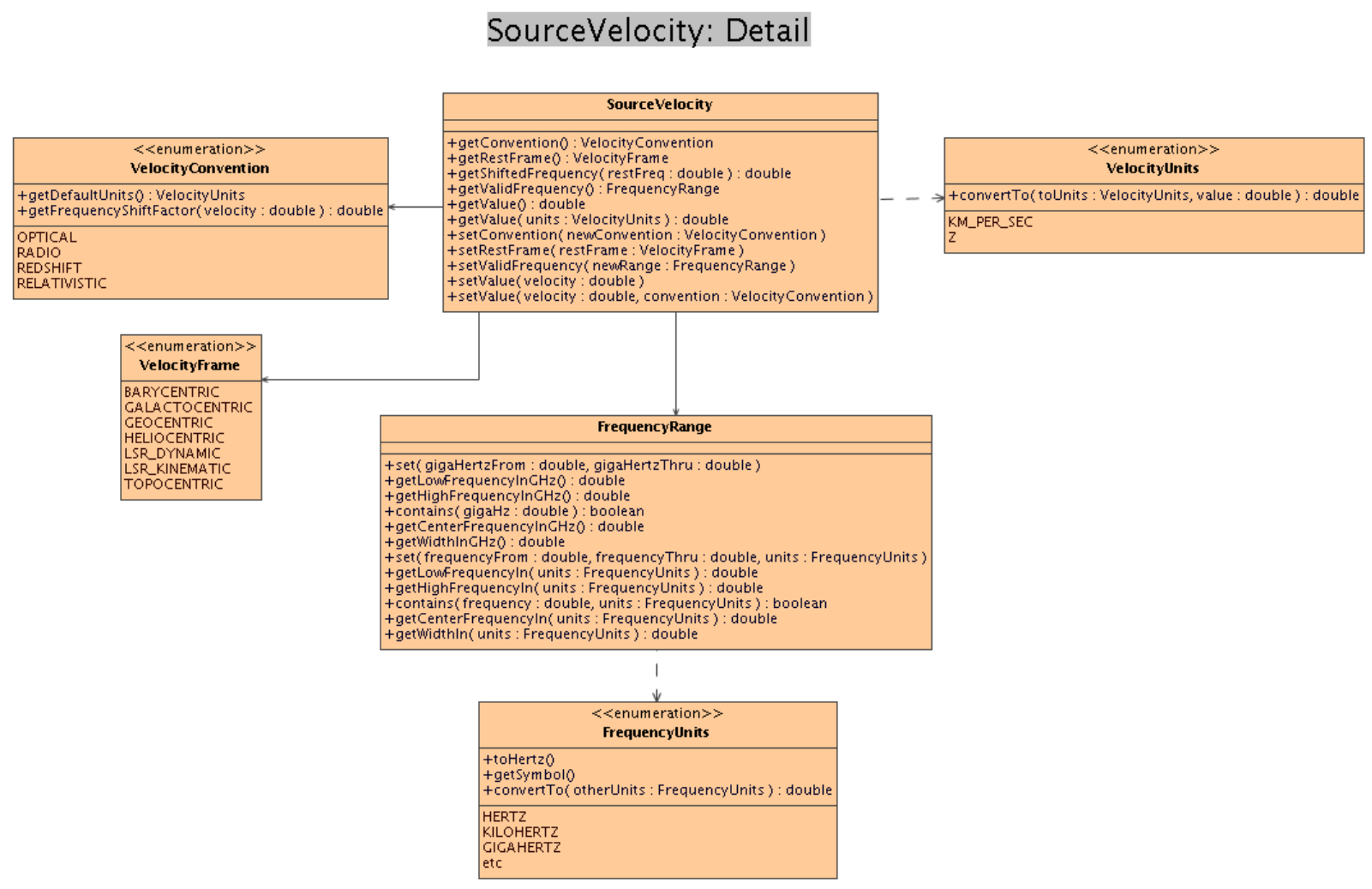
Source Model



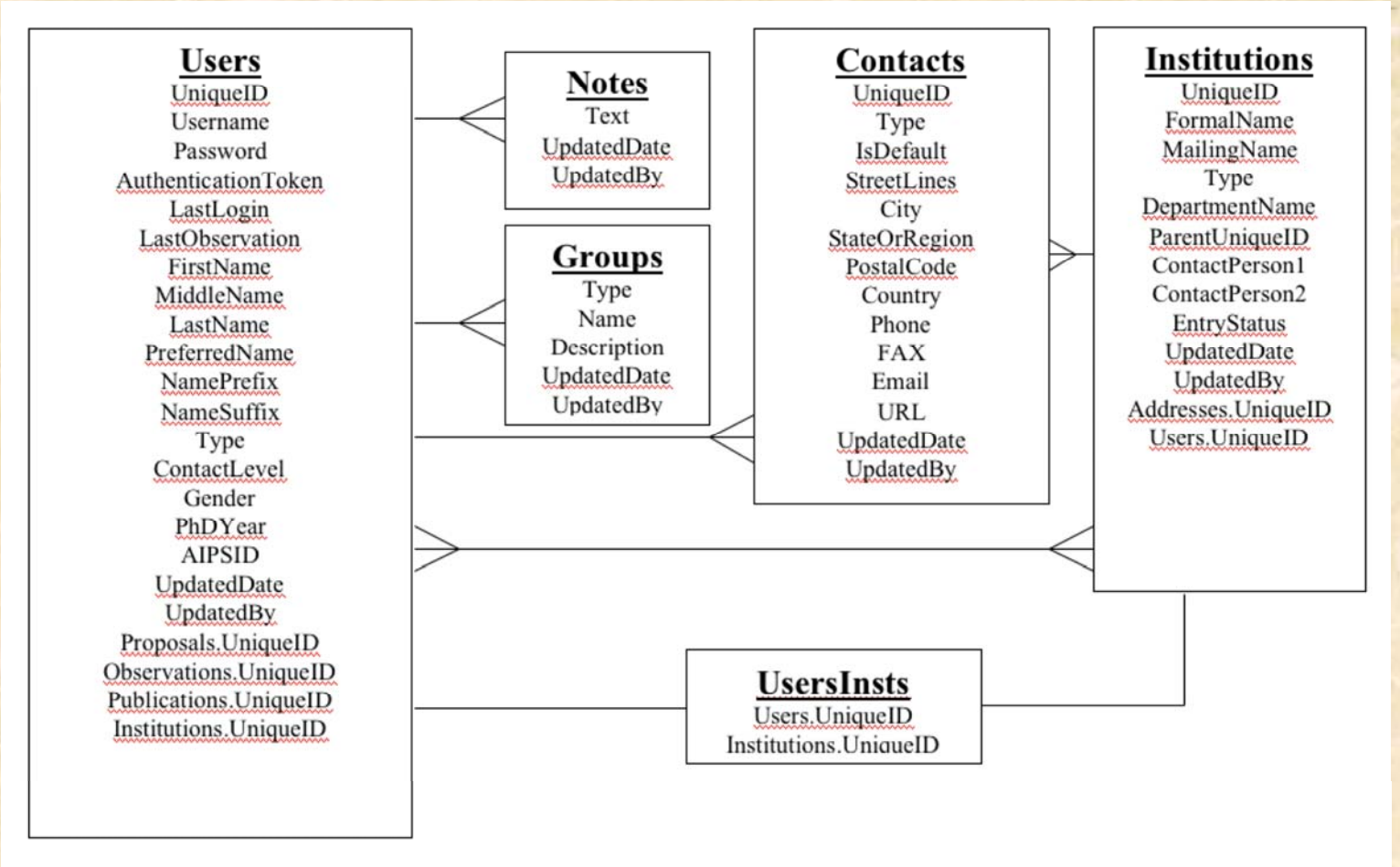
SourcePosition Detail



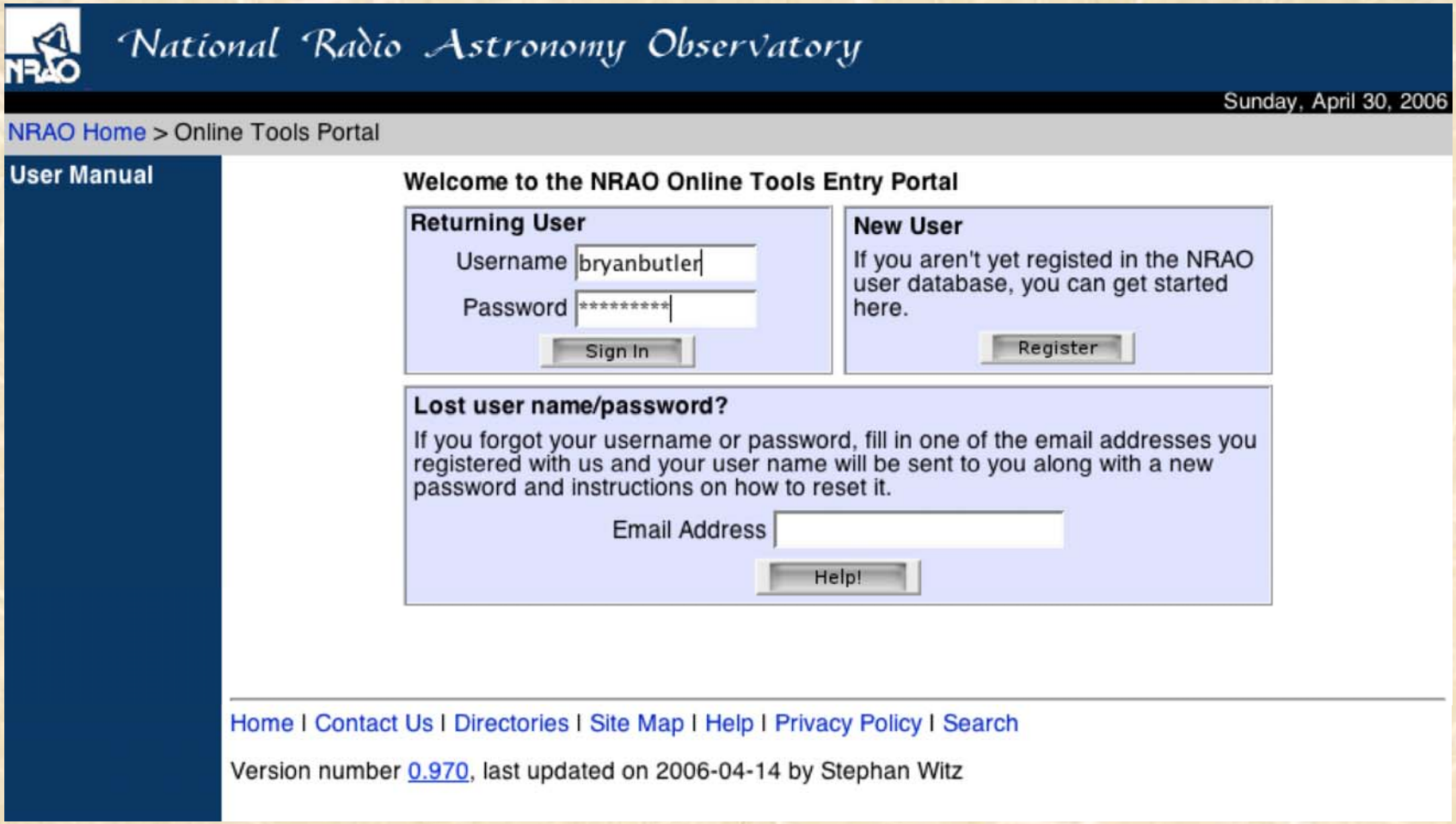
SourceVelocity Detail



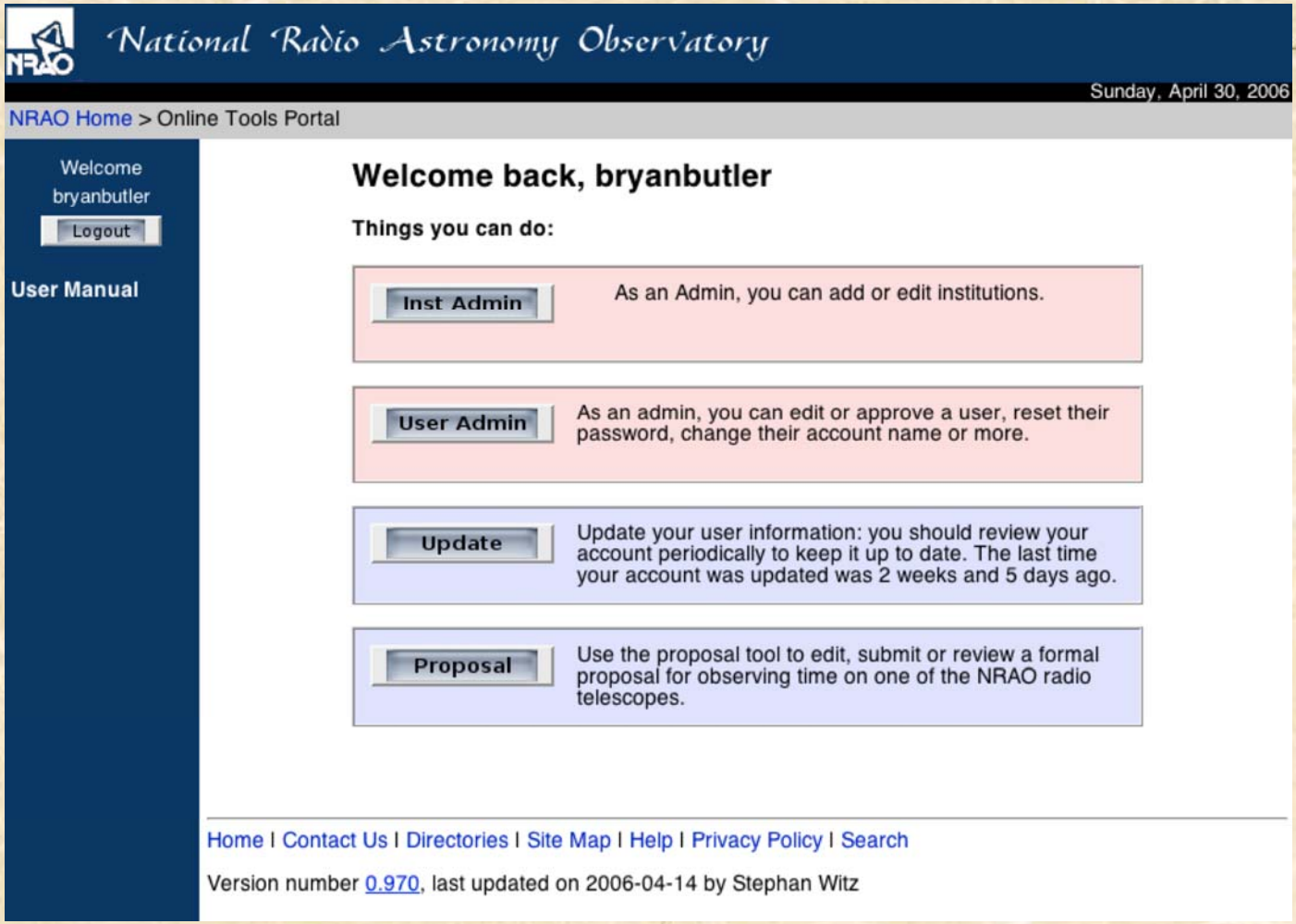
User Database



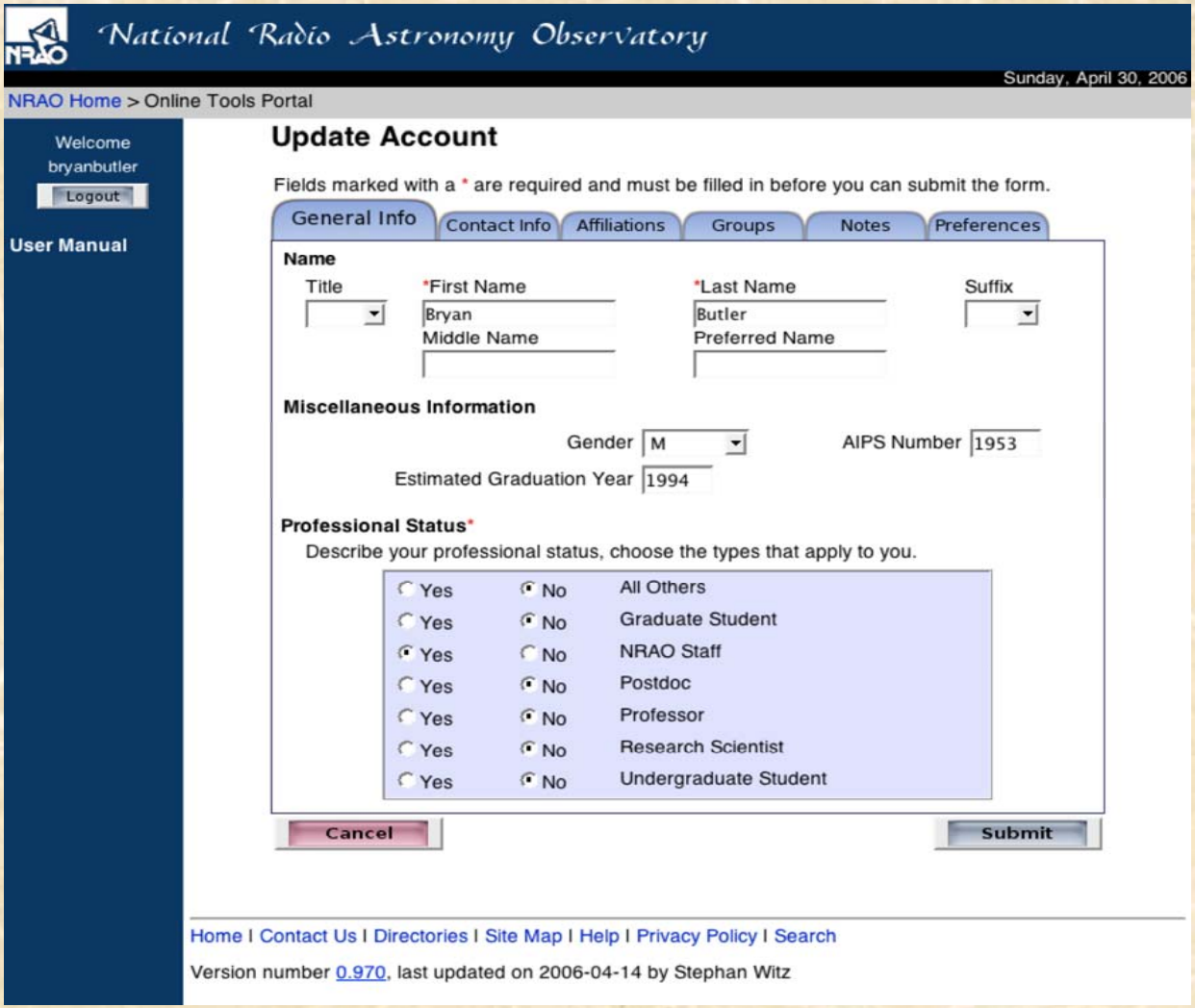
Portal


National Radio Astronomy Observatory
Sunday, April 30, 2006
NRAO Home > Online Tools Portal
User Manual
Welcome to the NRAO Online Tools Entry Portal
Returning User
Username bryanbutler
Password *********
Sign In
New User
If you aren't yet registed in the NRAO user database, you can get started here.
Register
Lost user name/password?
If you forgot your username or password, fill in one of the email addresses you registered with us and your user name will be sent to you along with a new password and instructions on how to reset it.
Email Address
Help!
Home | Contact Us | Directories | Site Map | Help | Privacy Policy | Search
Version number 0.970, last updated on 2006-04-14 by Stephan Witz

Portal


National Radio Astronomy Observatory
Sunday, April 30, 2006
NRAO Home > Online Tools Portal
Welcome
bryanbutler
Logout
User Manual
Welcome back, bryanbutler
Things you can do:
Inst Admin
As an Admin, you can add or edit institutions.
User Admin
As an admin, you can edit or approve a user, reset their password, change their account name or more.
Update
Update your user information: you should review your account periodically to keep it up to date. The last time your account was updated was 2 weeks and 5 days ago.
Proposal
Use the proposal tool to edit, submit or review a formal proposal for observing time on one of the NRAO radio telescopes.
Home | Contact Us | Directories | Site Map | Help | Privacy Policy | Search
Version number 0.970, last updated on 2006-04-14 by Stephan Witz

Portal


National Radio Astronomy Observatory
Sunday, April 30, 2006
NRAO Home > Online Tools Portal
Welcome
bryanbutler
Logout
User Manual
Update Account
Fields marked with a * are required and must be filled in before you can submit the form.
General Info
Contact Info
Affiliations
Groups
Notes
Preferences
Name
Title
*First Name
Bryan
Middle Name
*Last Name
Butler
Preferred Name
Suffix
Miscellaneous Information
Gender M
AIPS Number 1953
Estimated Graduation Year 1994
Professional Status*
Describe your professional status, choose the types that apply to you.
Yes No All Others
Yes No Graduate Student
Yes No NRAO Staff
Yes No Postdoc
Yes No Professor
Yes No Research Scientist
Yes No Undergraduate Student
Cancel
Submit
Home | Contact Us | Directories | Site Map | Help | Privacy Policy | Search
Version number 0.970, last updated on 2006-04-14 by Stephan Witz

PST - Main Components

- Model - retrieve and write data to database
- Controller - business logic to map user input (from browser) into objects which are then written to database
- View - the look-and-feel of the interface (done in browser)
- Validation of various fields - an important and significant part of the tool
- Help system

PST - Model

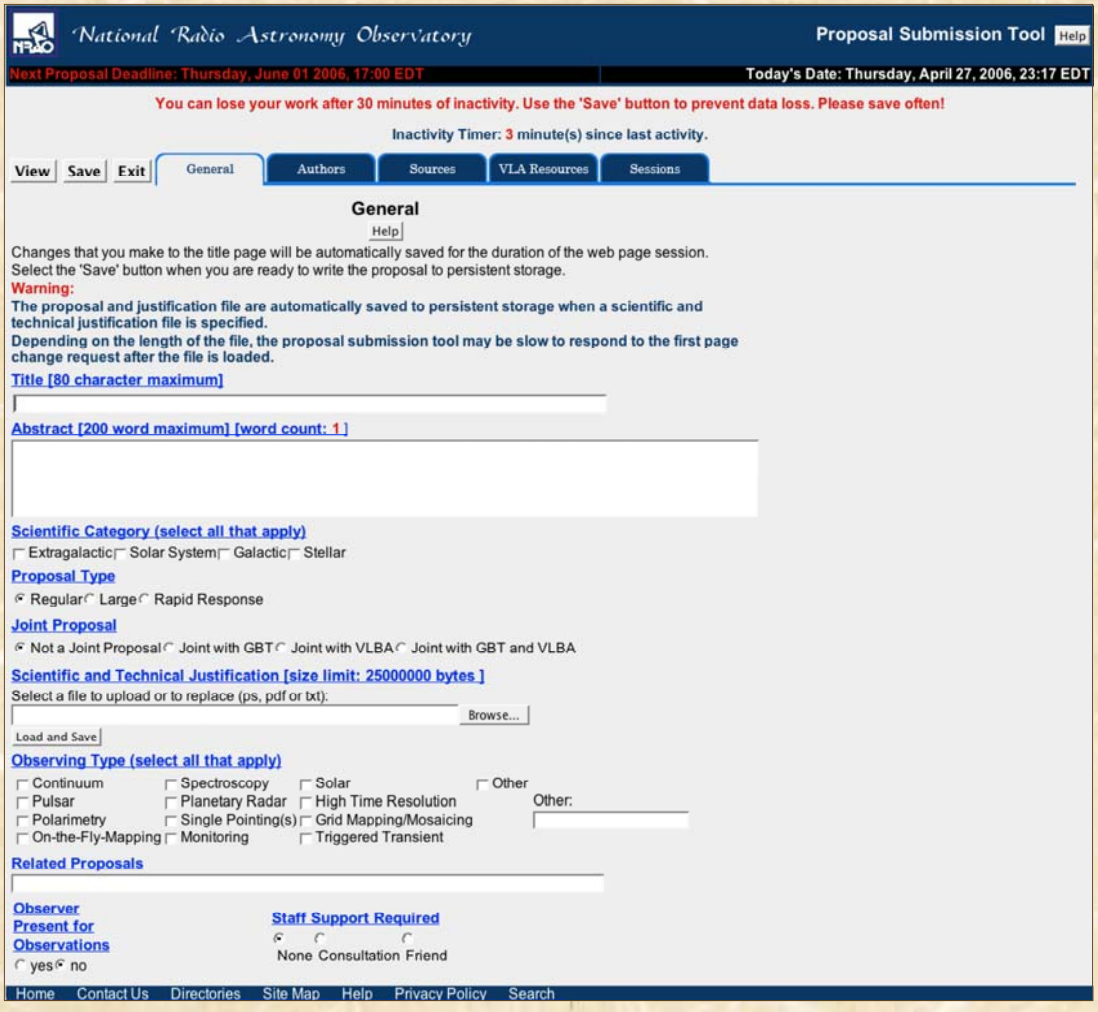
The Model drives everything, and contains:

- science information - title, category, "mode", abstract, scientific justification, and some misc. info.
- Authors, including which is the PI and "contact author"
- Sources
- Resources (telescope hardware setup)
- "Sessions" (a guide to SB setup)
- Student Support

This is all the information that is necessary to:

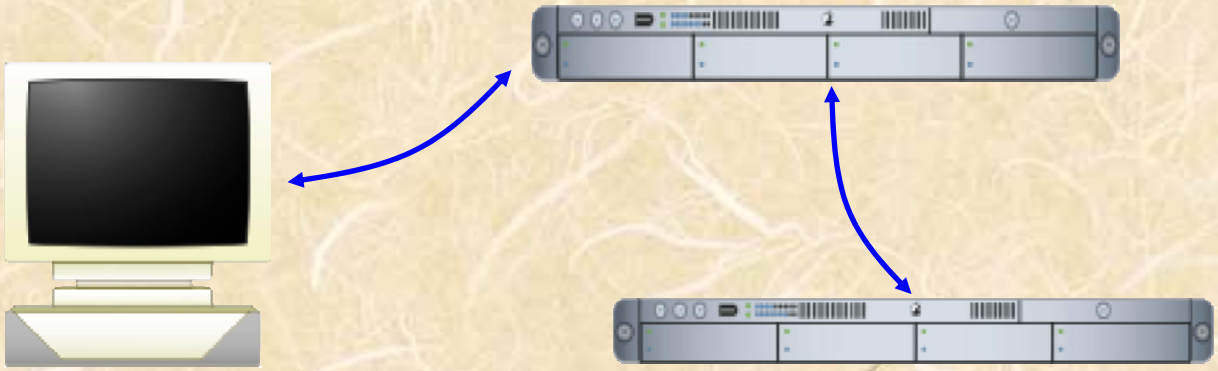
- Referee the proposal
- Assign telescope time (and money)
- Automatically generate SBs (mostly for novice users, but experienced users will use this too!)

PST - View


National Radio Astronomy Observatory
Proposal Submission Tool
Help
Next Proposal Deadline: Thursday, June 01 2006, 17:00 EDT
Today's Date: Thursday, April 27, 2006, 23:17 EDT
You can lose your work after 30 minutes of inactivity. Use the 'Save' button to prevent data loss. Please save often!
Inactivity Timer: 3 minute(s) since last activity.
View
Save
Exit
General
Authors
Sources
VLA Resources
Sessions
General
Help
Changes that you make to the title page will be automatically saved for the duration of the web page session.
Select the 'Save' button when you are ready to write the proposal to persistent storage.
Warning:
The proposal and justification file are automatically saved to persistent storage when a scientific and technical justification file is specified.
Depending on the length of the file, the proposal submission tool may be slow to respond to the first page change request after the file is loaded.
Title [80 character maximum]
Abstract [200 word maximum] [word count: 1]
Scientific Category (select all that apply)
Extragalactic Solar System Galactic Stellar
Proposal Type
Regular Large Rapid Response
Joint Proposal
Not a Joint Proposal Joint with GBT Joint with VLBA Joint with GBT and VLBA
Scientific and Technical Justification [size limit: 25000000 bytes]
Select a file to upload or to replace (ps, pdf or txt):
Browse...
Load and Save
Observing Type (select all that apply)
Continuum Spectroscopy Solar Other
Pulsar Planetary Radar High Time Resolution
Polarimetry Single Pointing(s) Grid Mapping/Mosaicing
On-the-Fly-Mapping Monitoring Triggered Transient
Other:
Related Proposals
Observer Present for Observations
yes no
Staff Support Required
None Consultation Friend
Home
Contact Us
Directories
Site Map
Help
Privacy Policy
Search

PST - Deployment

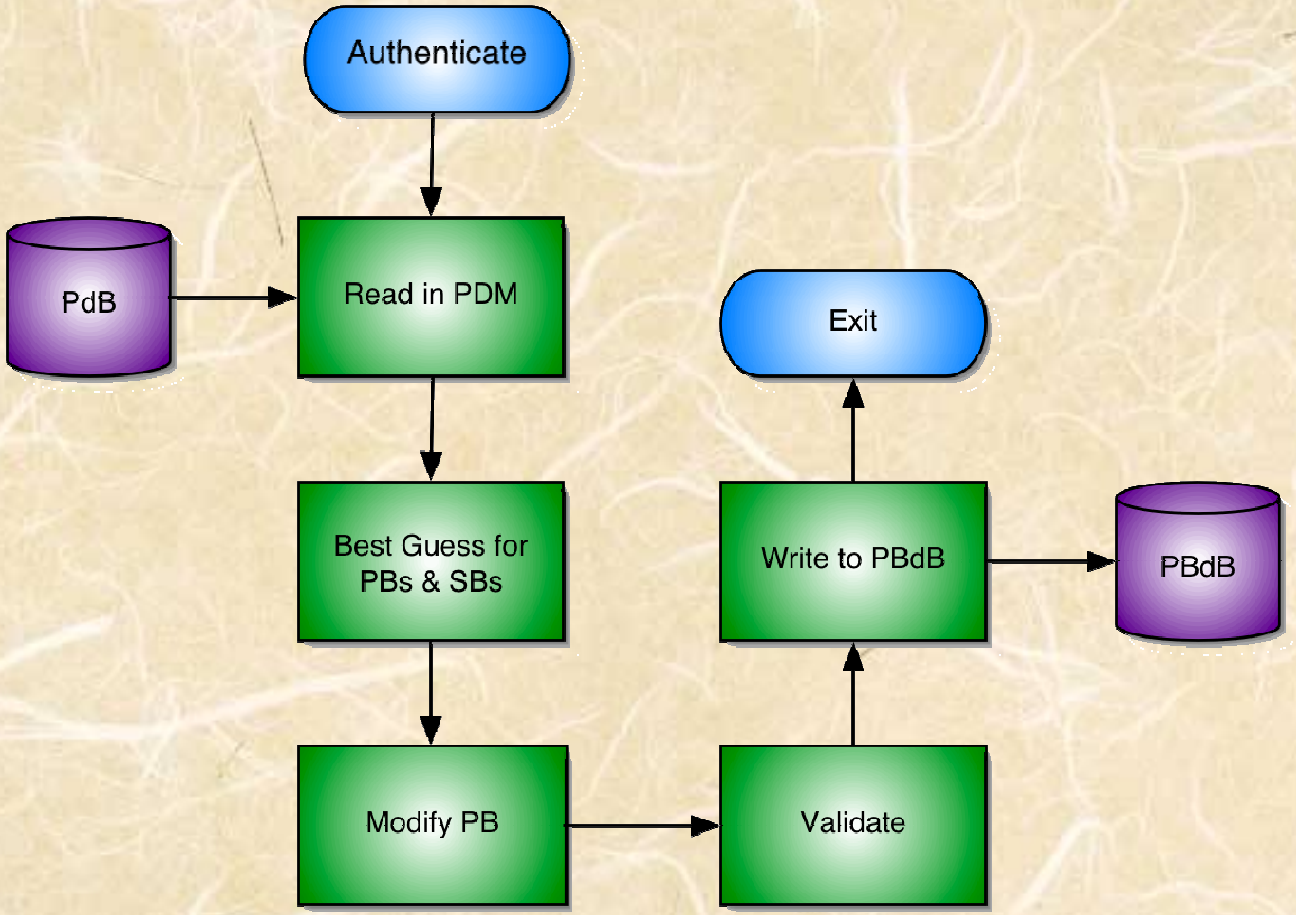
smrti.aoc.nrao.edu
running Apache &
Tomcat



Client machine
running web
browser

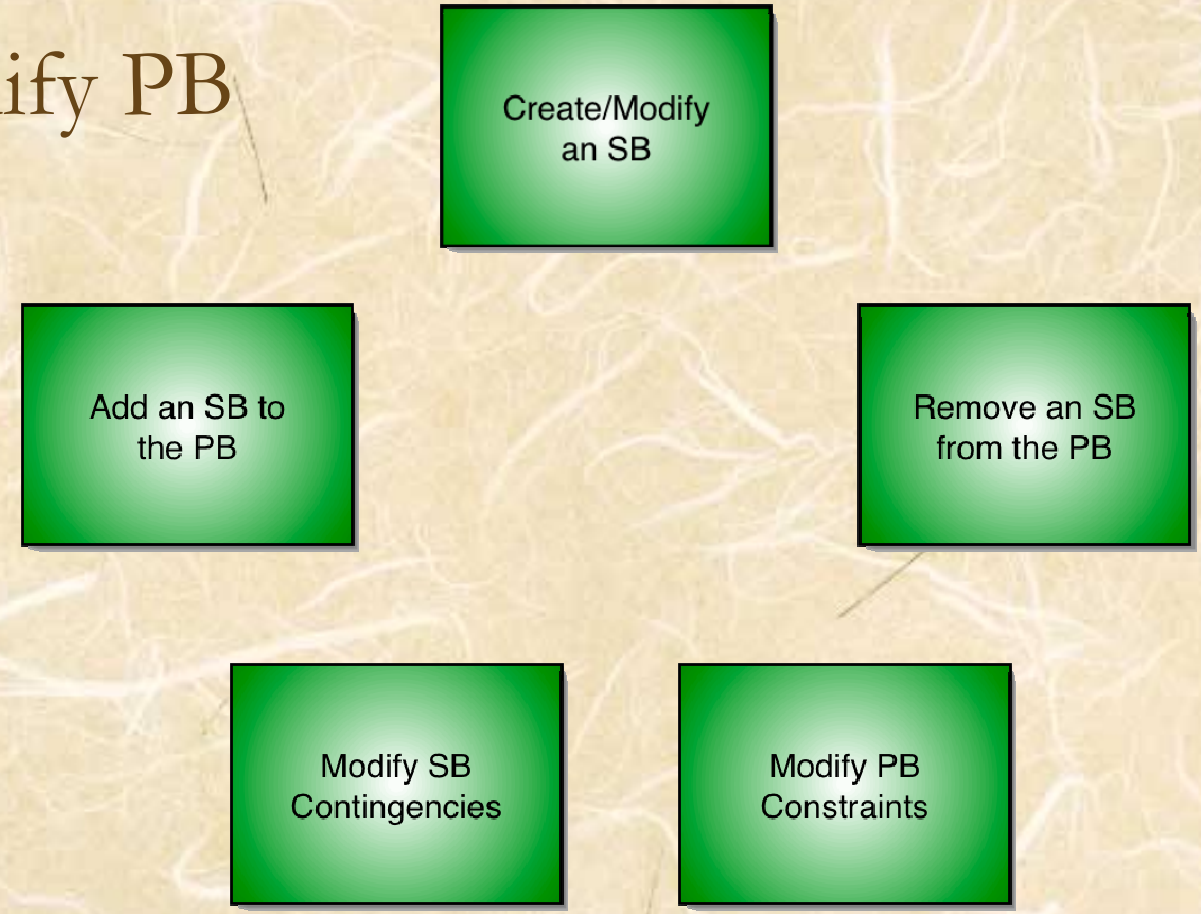
chewbacca.aoc.nrao.edu
running Oracle

OPT - Components



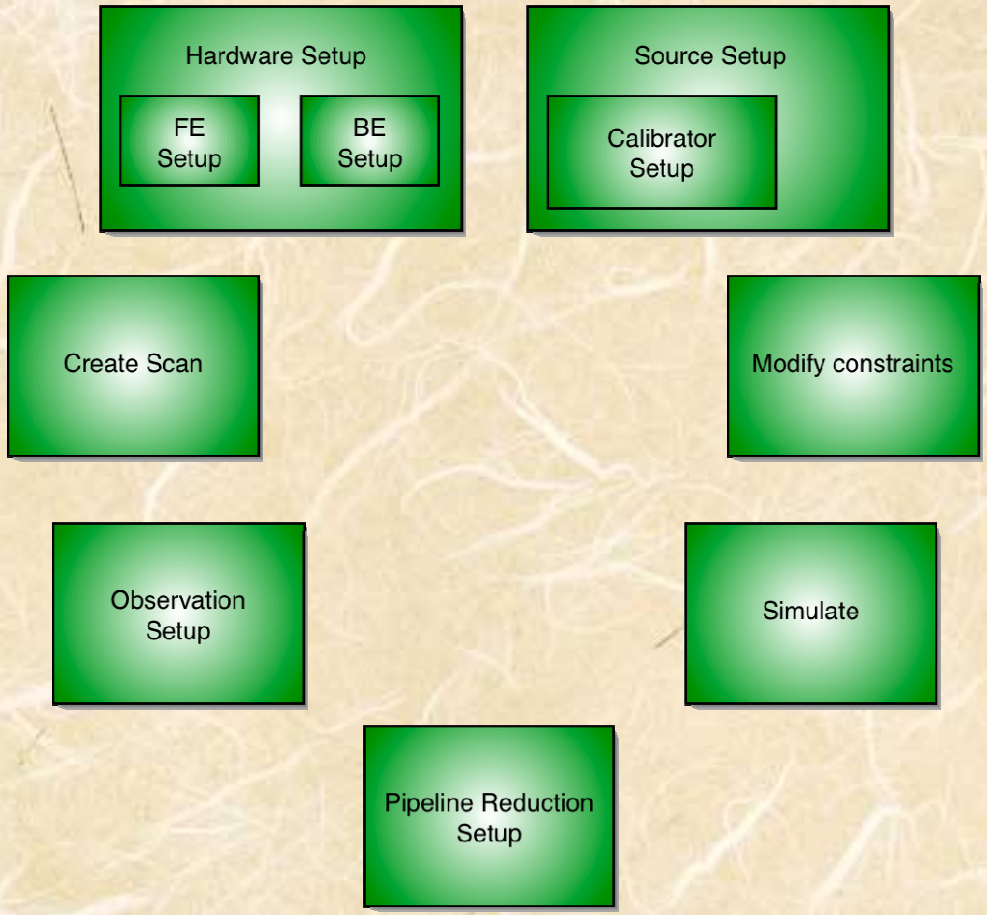
OPT - Components

Modify PB



OPT - Components

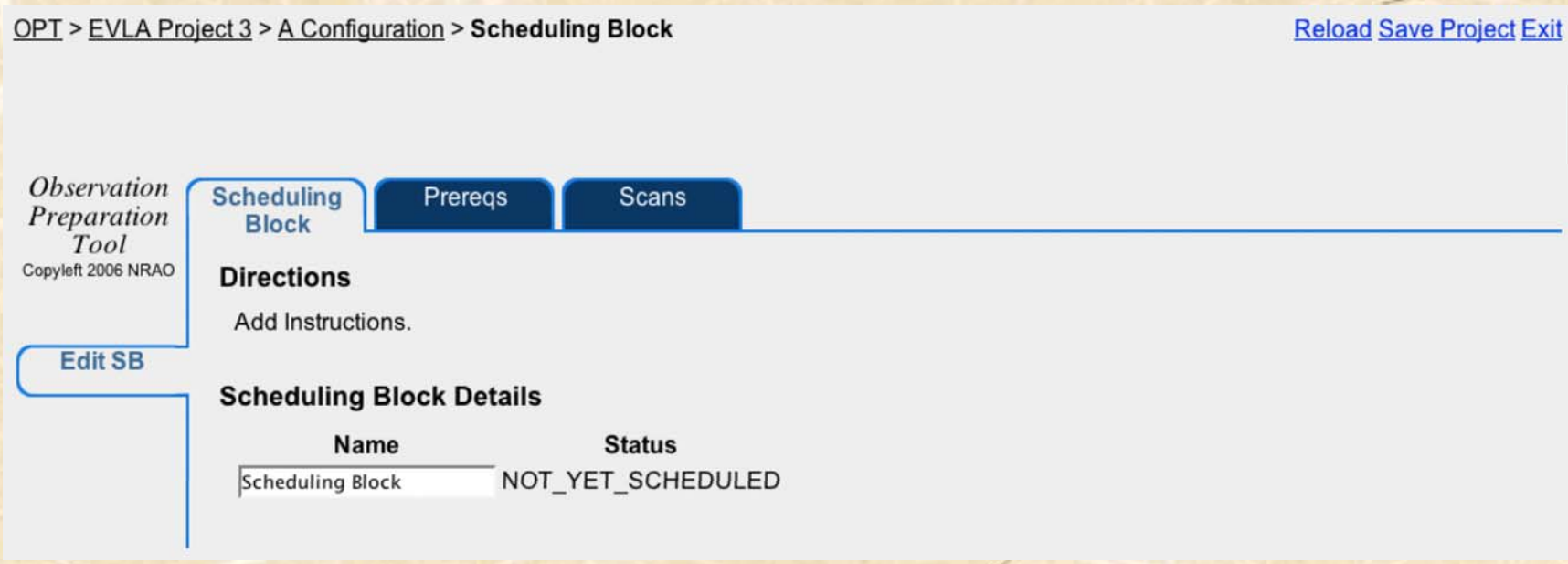
Modify SB



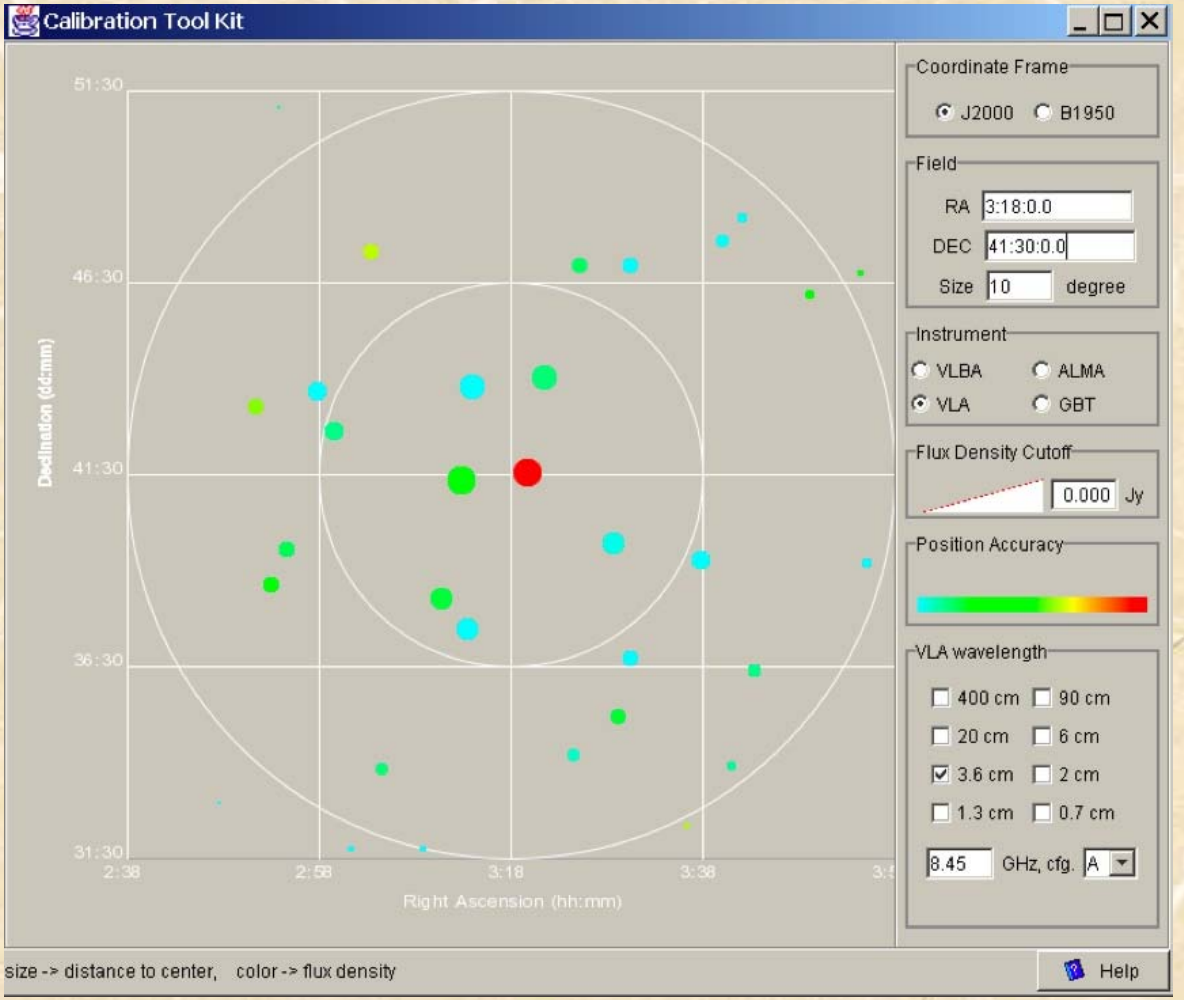
OPT

OPT > EVLA Project 3 > Program > Scheduling Block
Reload Save Project Exit
Observation Preparation Tool
Copyleft 2006 NRAO
EVLA Project 3
Programs
Sources
Resources
Pairs
Edit Project
Directions
Need to fill in some directions here still.
Project Details
Proposal Code
Project Code
Title
Type
Telescope
Status
Priority
Allocated Time
Time Used
two
brandnew
EVLA Project 3
UNKNOWN
UNKNOWN
NOT_STARTED
2147483647
0.0
0.0

OPT


OPT > EVLA Project 3 > A Configuration > Scheduling Block
Reload Save Project Exit
Observation Preparation Tool
Copyleft 2006 NRAO
Scheduling Block
Prereqs
Scans
Directions
Add Instructions.
Edit SB
Scheduling Block Details
Name
Status
Scheduling Block
NOT_YET_SCHEDULED

OPT - Calibrator Selection

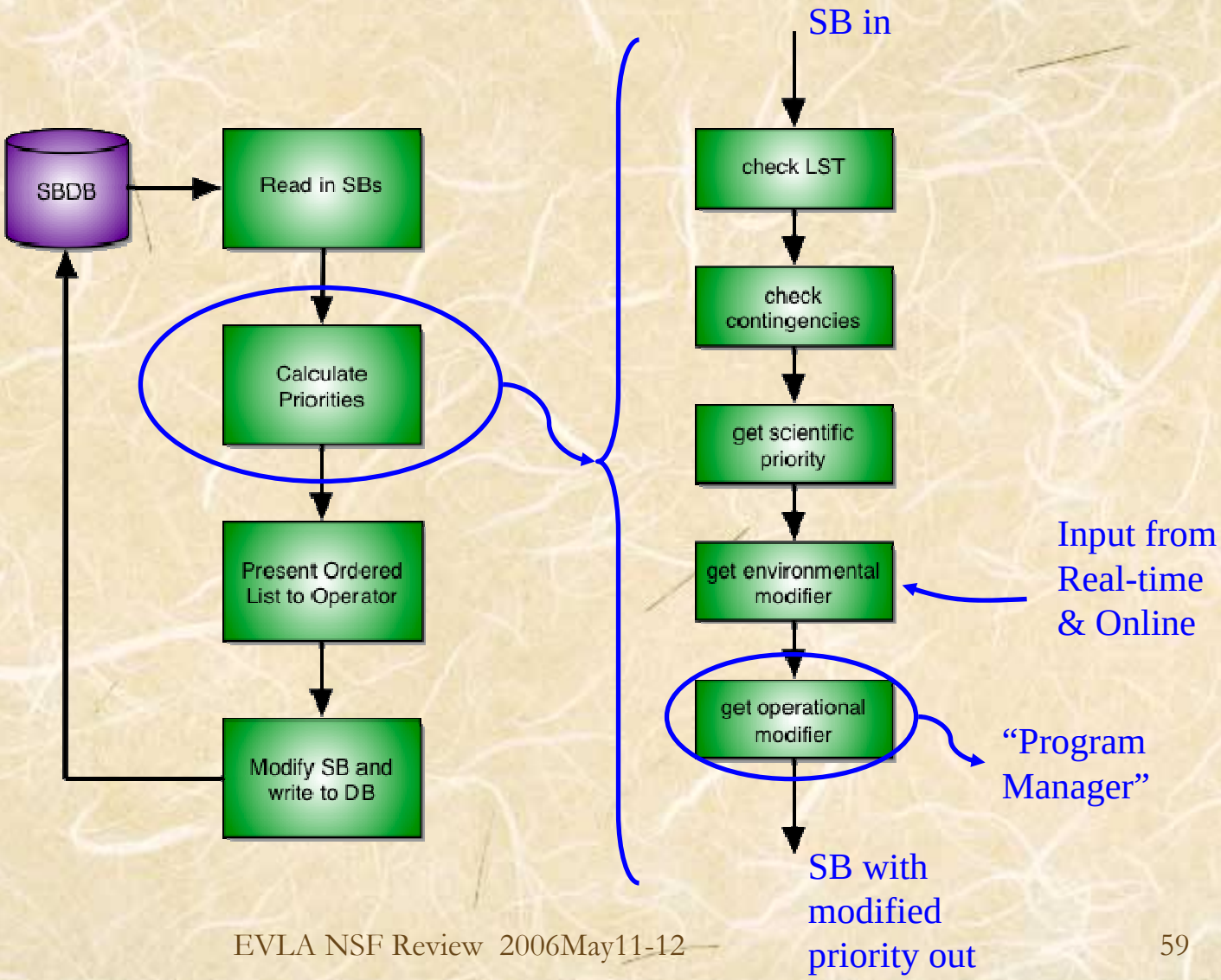


- Calibrator Selection Tool developed as part of DM effort in 2002
- Code reuse unlikely
- Lots of scientific staff input on layout and interface, so can be used as a guide for look-and-feel

OST - Tests on VLA

- Prototype system tested on the VLA during all reconfigurations since July 2005
- Modification of OST used successfully for VLBA for several years
- Observers send in modified OBSERVE files (extra "header" information included in comments at the top)
- OBSERVE files wrangled by NRAO staff
- Prototype OST system presents operator with prioritized list of what to observe next
- Providing us with invaluable information on the practical aspects of dynamic scheduling of a many-element radio interferometer.

OST Prototype - Components



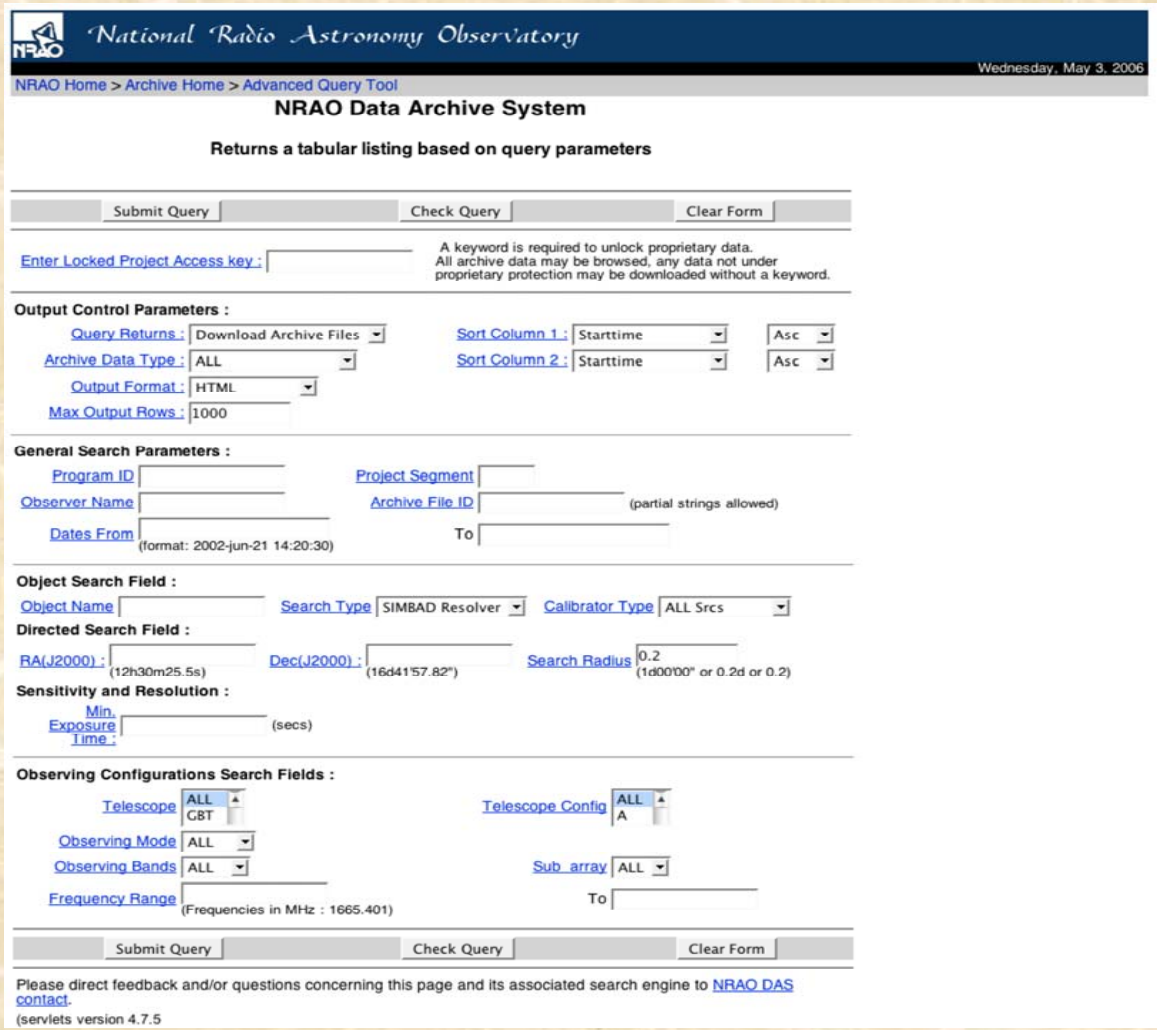
OST VLA Tests - Lessons Learned

- It works! Fundamentally, the VLA can be dynamically scheduled, with Scheduling Blocks drawn from a pool and subsequently observed.
- The system is inordinately fond of short SBs - it works well for them, but medium to long length SBs (>~ 2 hours) have not been well tested.
- Popular LSTs are efficiently used - those LSTs that are not so oversubscribed are not so efficiently used.
- Currently effort-intensive (but getting better)

AAT - VLA/VLBA Prototype

- VLA and VLBA raw data currently accessible via web application
- Extensively tested; available since October 2003
- Non-proprietary data openly available
- Proprietary data made available via observatory-supplied "key"
- Both simple (Project ID, for example), and complex (akin to VO cone search) searches supported
- More data downloaded via this mechanism than is taken real-time at the VLA (~3 GB/day)

AAT - VLA/VLBA Prototype



National Radio Astronomy Observatory

Wednesday, May 3, 2006

NRAO Home > Archive Home > Advanced Query Tool

NRAO Data Archive System

Returns a tabular listing based on query parameters

Submit Query | Check Query | Clear Form

Enter Locked Project Access key :

A keyword is required to unlock proprietary data.
All archive data may be browsed, any data not under proprietary protection may be downloaded without a keyword.

Output Control Parameters :

Query Returns : Download Archive Files
Archive Data Type : ALL
Output Format : HTML
Max Output Rows : 1000
Sort Column 1 : Starttime Asc
Sort Column 2 : Starttime Asc

General Search Parameters :

Program ID
Project Segment
Observer Name
Archive File ID (partial strings allowed)
Dates From (format: 2002-jun-21 14:20:30)
To

Object Search Field :

Object Name
Search Type : SIMBAD Resolver
Calibrator Type : ALL Srcs

Directed Search Field :

RA(J2000) : (12h30m25.5s)
Dec(J2000) : (16d41'57.82")
Search Radius : 0.2 (1d00'00" or 0.2d or 0.2)

Sensitivity and Resolution :

Min. Exposure Time : (secs)

Observing Configurations Search Fields :

Telescope : ALL, GBT
Telescope Config : ALL, A
Observing Mode : ALL
Observing Bands : ALL
Sub_array : ALL
Frequency Range (Frequencies in MHz : 1665.401)
To

Submit Query | Check Query | Clear Form

Please direct feedback and/or questions concerning this page and its associated search engine to NRAO DAS contact.

(servlets version 4.7.5