

Department of Computer Science

User System of Astrogeology Technologies(USAT)

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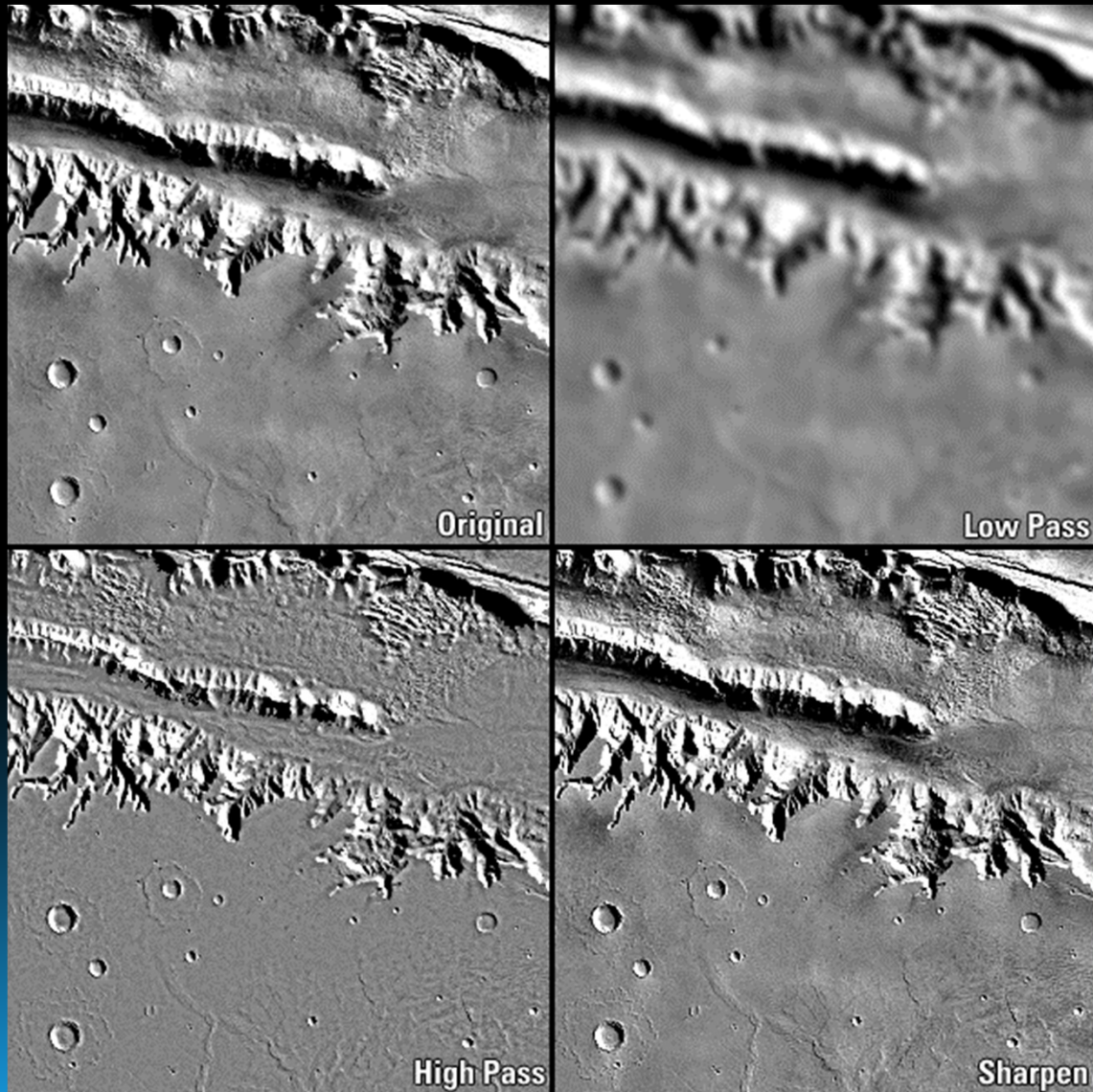


USER SYSTEM OF ASTROGEOLOGY TECHNOLOGIES

# Introduction

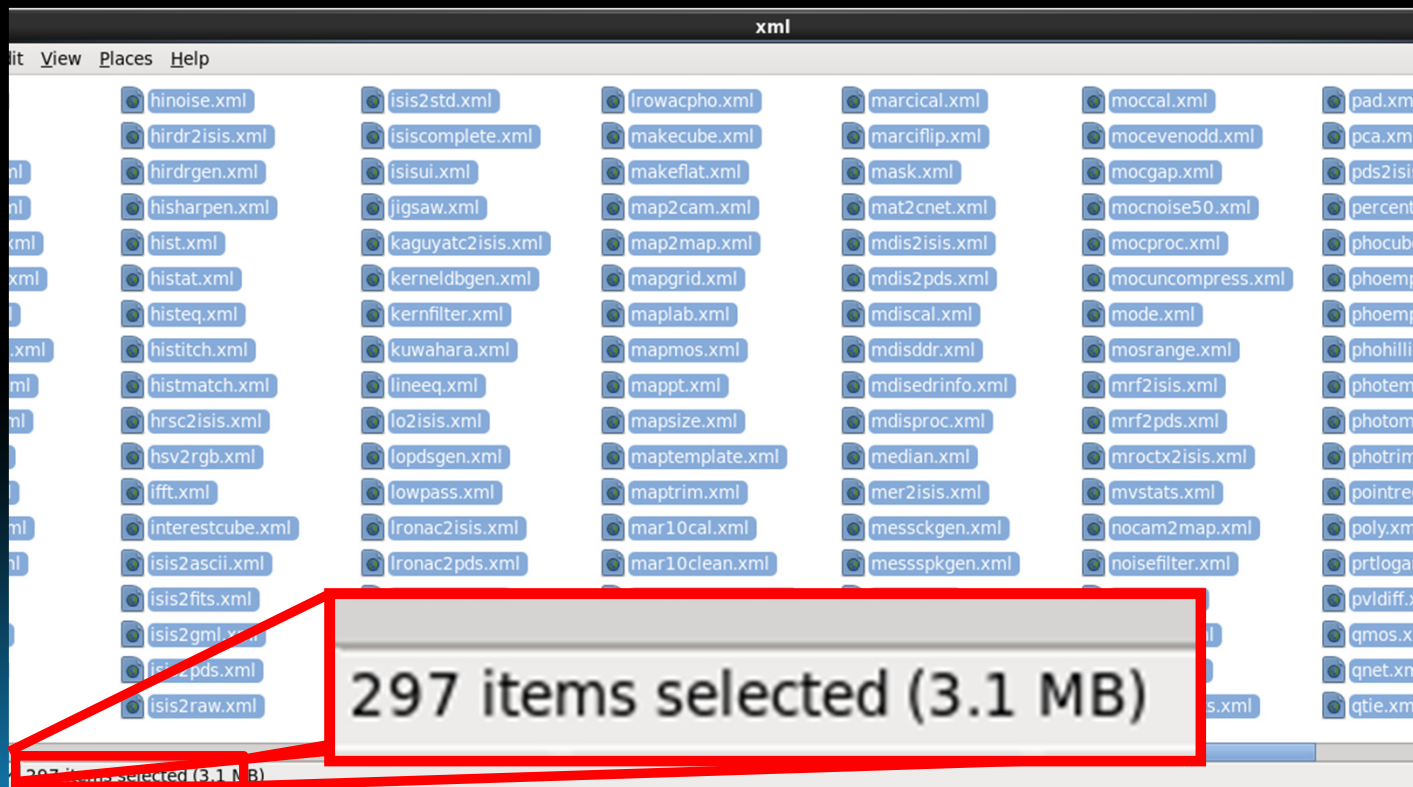
- USGS Astrogeology Research Program
  - Trent Hare and Moses Milazzo
- ISIS (Integrated Software for Imagers & Spectrometers)
  - A tool used in analyzing images from planetary missions

# Example Filters of ISIS3



# Problem

- $\approx 300$  different programs



# Problem Continued

- Command-line interface
- Hand-written scripts

```
if ($#argv != 2) then
    echo "Usage: $0 maptemplate.map[0|1]"
    echo "0 = keep all files as you go"
    echo "1 = delete old files as you go"
    goto done
endif

set map=$1
set del=$2

foreach i ( *.IMG )
    set base = `basename $i .IMG`
    set new = "$base.cub"
    echo mroctx2isis "from=$i to=$new"
    mroctx2isis from=$i to=$new
    if (=e $new && $del) then
        /bin/rm $i
    endif
end

foreach i (*.cub)
    echo spiceinit "from=$i"
    spiceinit from=$i
end
```

# The Task

- Create a centralized GUI
  - Organized and easy to use
  - Workflow creation
- Help Center
  - Documentation within the GUI

# Requirements & Specifications

- Expandability
  - ▣ Integrate new ISIS programs
  - ▣ Adapt to future environments
- Ease of Use
  - ▣ Everything needed to make a workflow at one's fingertips
- Design for Unix/Linux environments



# Solution Overview

The screenshot displays the Galaxy web interface with the following components:

- Navigation Bar:** Galaxy logo, Analyze Data, Workflow, Shared Data, Admin, Help, User.
- Tools Panel (Left):**
  - Options dropdown
  - CORE PROGRAMS
  - Cameras
  - Control Networks
  - Display
  - Filters
    - [deriv](#) Apply horizontal or vertical derivative
    - [divfilter](#) Apply a spatial high pass filter to a cube (divide)
    - [dstrip](#) Remove horizontal or vertical stripes/noise from a cube
    - [gauss](#) Filter a cube through a kernel using Gaussian weight
    - [gradient](#) Apply Sobel or Roberts gradient to a cube
    - [highpass](#) Apply a spatial high pass filter to a cube
    - [interestcube](#) Used to test Interest Operators
- Tool Configuration (Center):**
  - lowpass**
  - Input Cube:** 10: pds2isis on data 1 (dropdown)
  - Select ISIS Cube to apply the filter to.
  - Filter Pixel Types:**
    - Select All (button) Unselect All (button)
    - Filter valid pixels
    - Filter invalid pixels
    - Filter Null pixels
    - Filter LIS pixels
    - Filter LRS pixels
    - Filter HIS pixels
    - Filter HRS pixels
  - Execute (button)
- Tool Description (Bottom):**

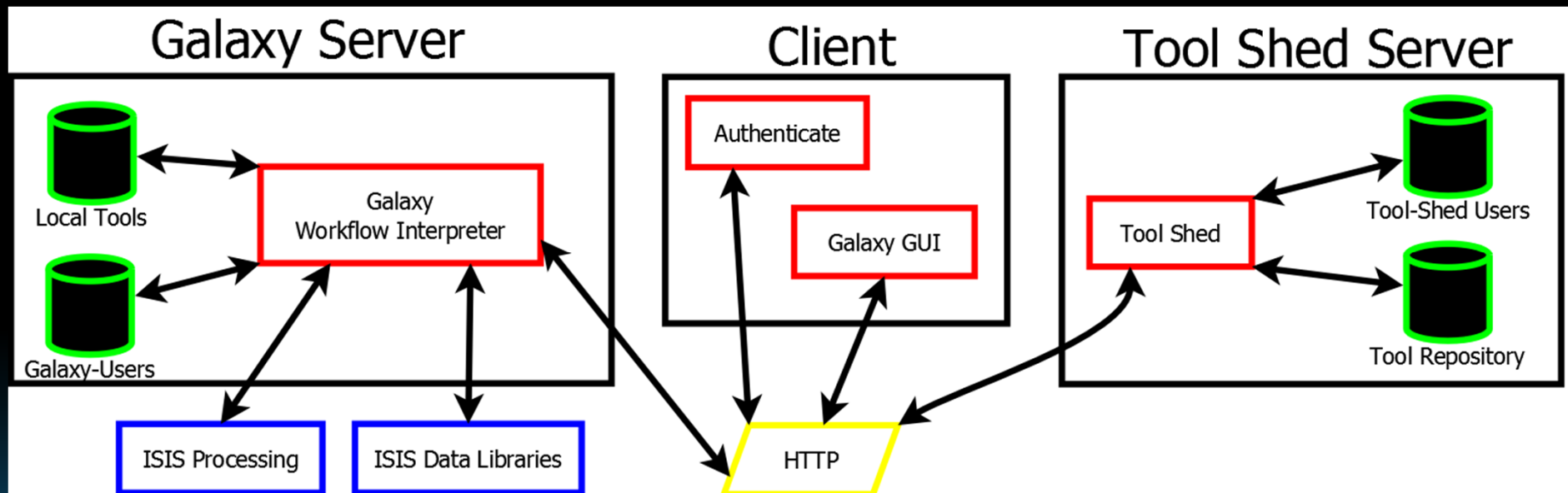
This program applies a lowpass or blurring filter to a cube. An NxM boxcar is moved through the cube and average of the boxcar at each position is computed. This average, which effectively blurs the data, is written to the output cube. The user has the ability to choose which input pixels are filtered including 1) all pixels, 2) pixels within a user specified range, 3) pixels outside a user specified range, and 4) special pixels. In general, the larger the boxcar the more
- History Panel (Right):**
  - Options dropdown
  - Unnamed history (2.0 Mb)
  - 10: pds2isis on data 1 (eye, edit, delete icons)
  - 1: mars\_viking.pds (1.0 Mb, format: pds, database: 2, Info: uploaded None file, eye, edit, delete icons)
  - Image in pds format
- Status Bar:** Done



# Galaxy

- What is it?
  - Open source software
  - Workflow creator
  - Uses XML, Javascript and Python
- Why use it?
  - Preexisting foundation vs. recreating the wheel

# Architecture Overview



# Basic Features

# Galaxy - Tool Shed

- Upload tools
- Keep track of tool versions

## Preview tools and inspect metadata by tool version

**Tools** - click the name to preview the tool and use the pop-up menu to inspect all metadata

name	description	version	requirements
<a href="#">pds2isis</a> ▼	Convert PDS formatted image to a ISIS Cube.	1.0.0	none
<a href="#">minmax</a> ▼	Apply a minimum or maximum filter to a cube	1.0.0	none
<a href="#">median</a> ▼	Set pixels to median of surrounding pixel values	1.0.0	none
<a href="#">kernfilter</a> ▼	Filter a cube through a kernel	1.0.0	none
<a href="#">kuwahara</a> ▼	Filter a cube, smoothing but preserving edges	1.0.0	none
<a href="#">isis2pds</a> ▼	Convert an ISIS Cube to a PDS formatted image.	1.0.0	none
<a href="#">interestcube</a> ▼	Used to test Interest Operators	1.0.0	none
<a href="#">lowpass</a> ▼	Apply lowpass or blurring filter to a cube	1.0.0	none
<a href="#">gauss</a> ▼	Filter a cube through a kernel using Gaussian weight	1.0.0	none
<a href="#">highpass</a> ▼	Apply a spatial high pass filter to a cube	1.0.0	none
<a href="#">deriv</a> ▼	Apply horizontal or vertical derivative	1.0.0	none
<a href="#">gradient</a> ▼	Apply Sobel or Roberts gradient to a cube	1.0.0	none
<a href="#">dstripe</a> ▼	Remove horizontal or vertical stripes/noise from a cube	1.0.0	none
<a href="#">divfilter</a> ▼	Apply a spatial high pass filter to a cube (divide)	1.0.0	none
<a href="#">qview</a> ▼	Open qview and view images	1.0.0	none

[Reset metadata](#)

Inspect the repository and reset the above attributes for the repository tip.

# Galaxy – Tool Administration

- Easy installation from Tool Shed

[Install to local Galaxy](#) [Tool Shed Actions](#) ▼

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**Repository demo\_toolset**

**Revision:**  
0:f99a18926e51

- Tool Management

[Get updates](#)

[Deactivate or uninstall](#)

[Repository Actions](#) ▼

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✔ The cloned tool shed repository named 'demo\_toolset' is current (there are no updates available).

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**Installed tool shed repository 'demo\_toolset'**

**Tool shed:**  
134.114.52.66:9009

**Name:**  
demo\_toolset

# Galaxy – ISIS Image Data

- Link Data:
  - Remote server file Directory
  - Current server history
- Upload from:
  - Website(FTP) URL
  - Local single file
  - Local directory
- Job Queues

Upload files to a data library

**Upload files from filesystem paths**

**Upload option:**  
Upload files from filesystem paths ▼  
Choose upload option (file, directory, filesystem paths, current history).

**File Format:**  
Auto-detect ▼

**Paths to upload**

Upload all files pasted in the box. The (recursive) contents of any pasted dir

**Preserve directory structure?**  
 Yes  
If checked (default), library sub-folders will be used to preserve any subdire  
filesystem will be placed directly in the library folder.

**Copy data into Galaxy?**  
Link to files without copying into Galaxy ▼

# Galaxy – Data Library

- Data link complete

**Data Library "Mars Rover Data"** Add datasets Add folder Library Actions ▾

Pres Data

Name	Message	Data type	Date uploaded	File size
<input type="checkbox"/> <a href="#">calibration</a> ▾	Automatically created by upload tool			
<input type="checkbox"/> <a href="#">marci</a> ▾	Automatically created by upload tool			
<input type="checkbox"/> <a href="#">files.txt</a> ▾		txt	2012-04-24	1.4 Kb
<input type="checkbox"/> <a href="#">marciCoefficients_v001.pvl</a> ▾		txt	2012-04-24	1.7 Kb
<input type="checkbox"/> <a href="#">uvflat_band6_summing8_v001.cub</a> ▾		data	2012-04-24	129.0 Kb
<input type="checkbox"/> <a href="#">uvflat_band6_summing8_v002.cub</a> ▾		data	2012-04-24	129.8 Kb
<input type="checkbox"/> <a href="#">uvflat_band7_summing8_v001.cub</a> ▾		data	2012-04-24	129.0 Kb
<input type="checkbox"/> <a href="#">uvflat_band7_summing8_v002.cub</a> ▾		data	2012-04-24	129.8 Kb
<input type="checkbox"/> <a href="#">visflat_band1_summing1_v001.cub</a> ▾		data	2012-04-24	577.0 Kb
<input type="checkbox"/> <a href="#">visflat_band1_summing1_v002.cub</a> ▾		data	2012-04-24	577.8 Kb
<input type="checkbox"/> <a href="#">visflat_band1_summing2_v001.cub</a> ▾		data	2012-04-24	577.6 Kb

- Public data or restrict permissions to a few

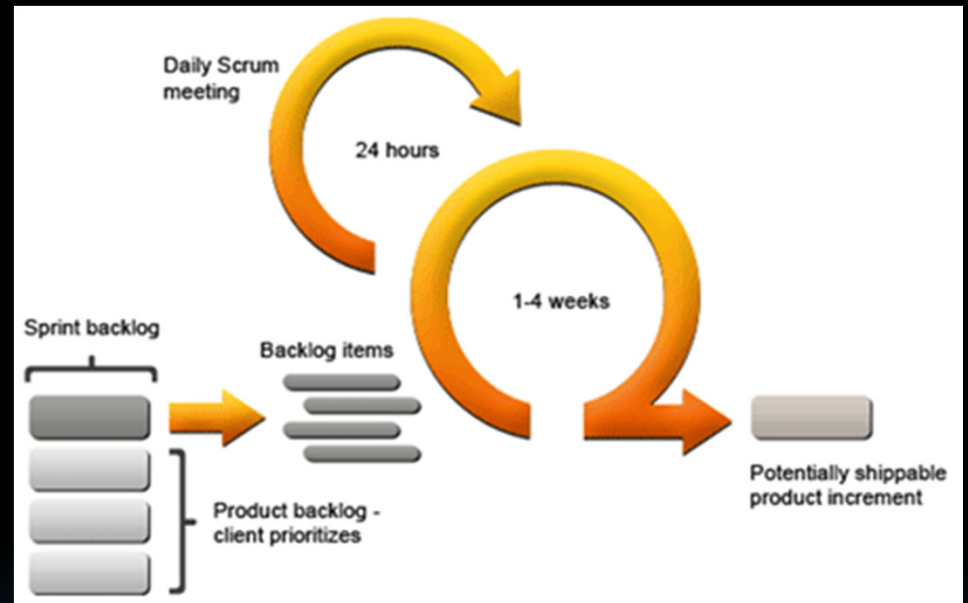
**Make public**

**Edit permissions**



# Design Process

- Initially Waterfall Method
- Scrum
  - Weekly Sprints
  - Rapid Prototyping



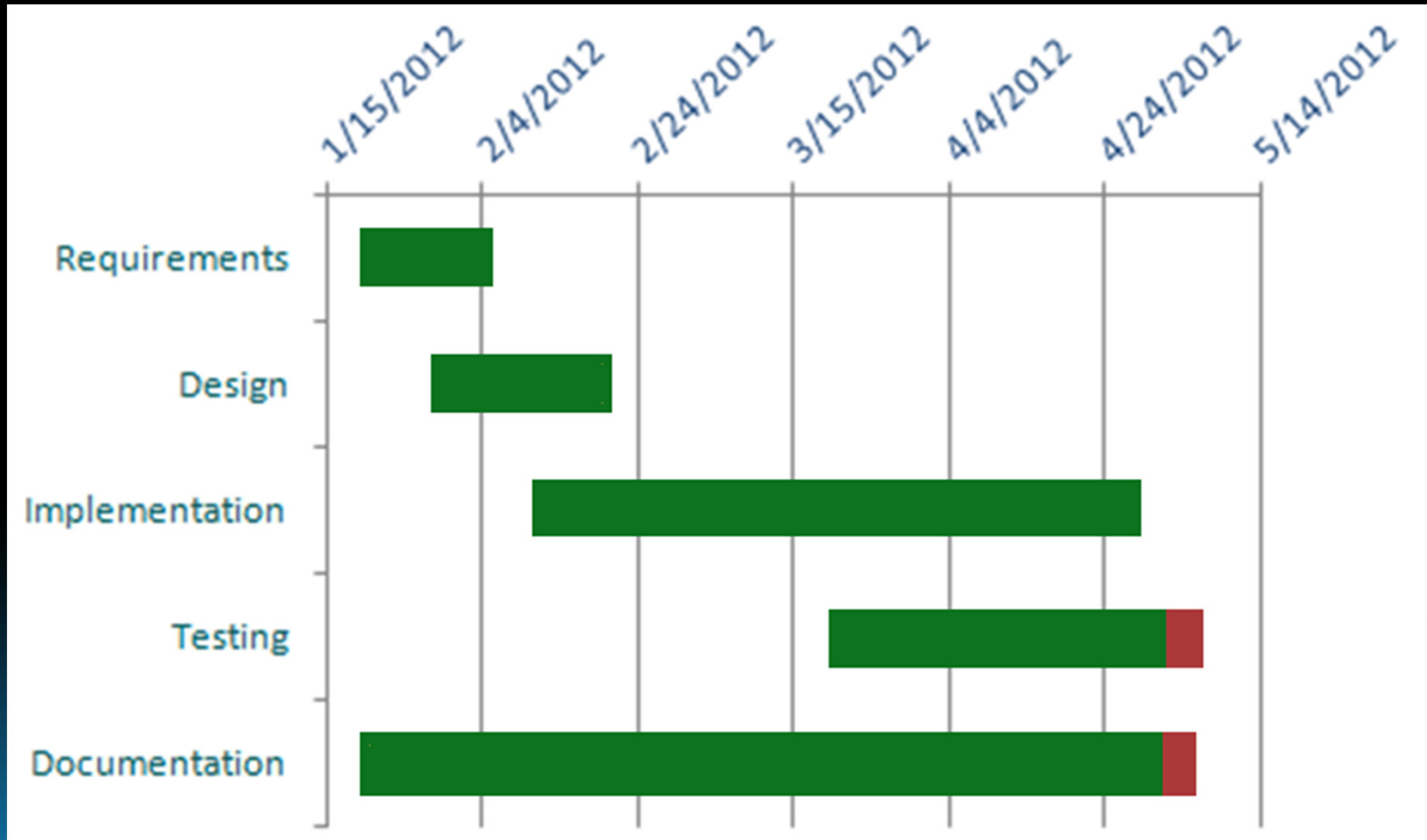
# Difficulties

- Tool Builder
  - ISIS XML to Galaxy XML
- Galaxy
  - Bioinformatics
  - File extensions
  - Tool configuration
- Framework
  - ISIS Data Library

# Successes

- Knowledge of problem
  - A Successful Solution
- Sponsor collaboration
- Estimated Year long project
  - Completed in less than 4 months

# Schedule



# End Result

- Completed project requirements
  - Including many secondary goals
- Ground-work for future development in Astrogeology research
  - Cluster Computing (Amazon Ec2)
  - Web based image viewer
  - Mobile Access
- Expansion of Galaxy into new domains

**POSTER # 235**

**POSTER TIME = 1:30P TO  
3:00P**

**ROOM = IIA-B**

**QUESTIONS?**