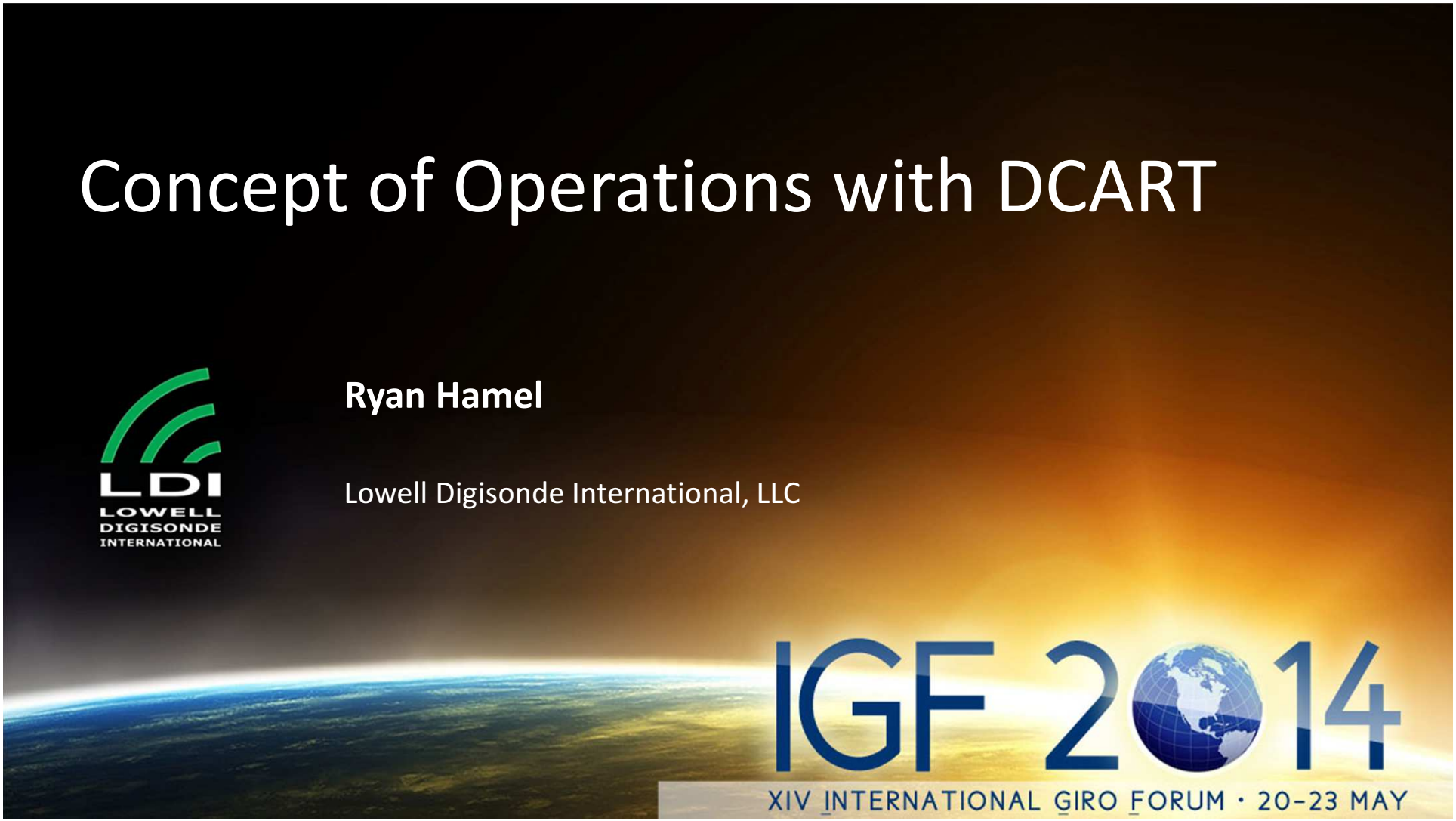
Concept of Operations with DCART

Ryan Hamel

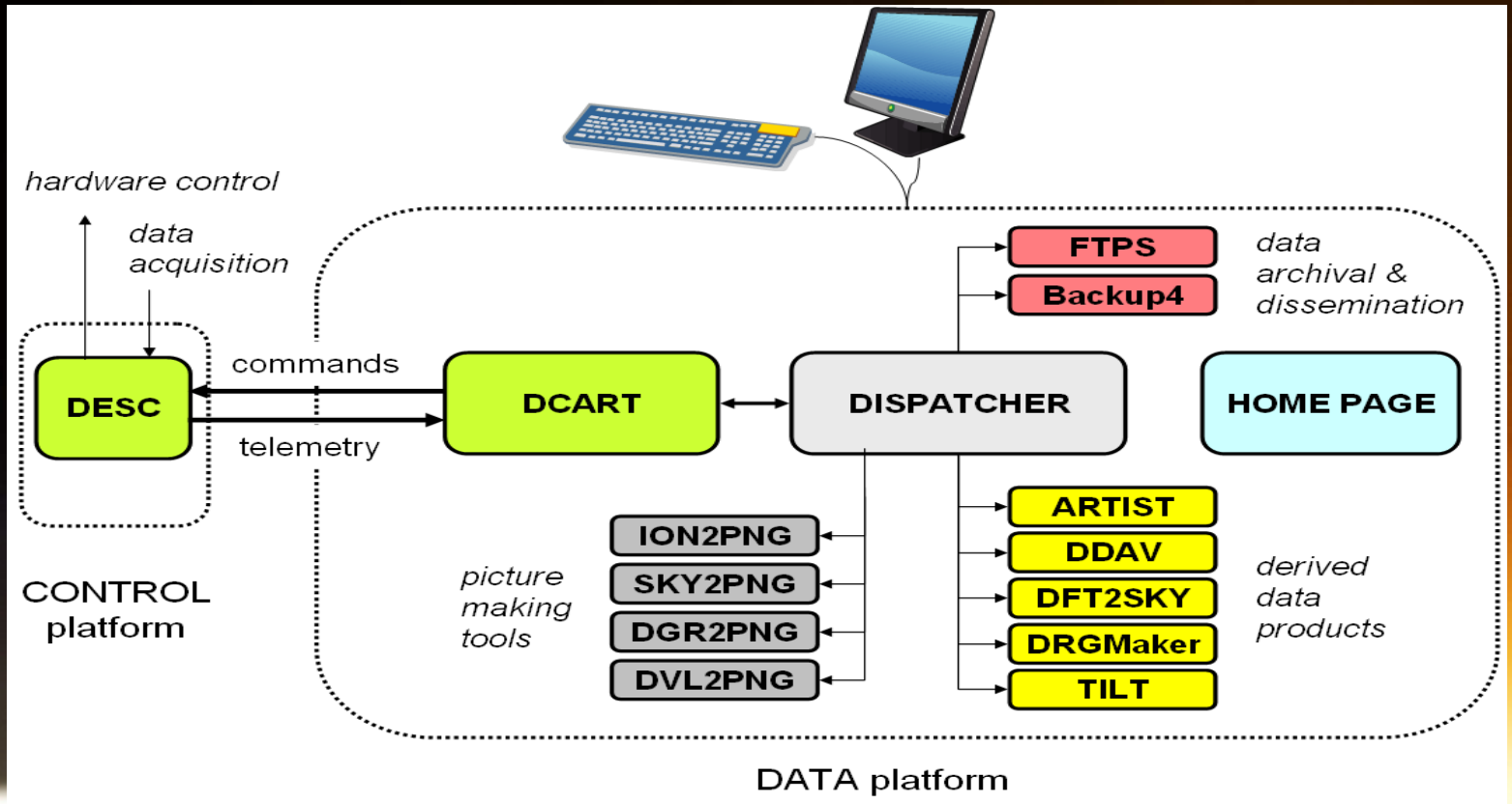
Lowell Digisonde International, LLC



Outline

- Overview of DPS-4D software
- DCART interface basics
- Concepts for digisonde control and experiment planning
- Additional Presentations
  - Common errors in measurement programming Ivan
  - Under the hood (software design) – Alex
  - Working groups – Ivan & Alex

Top Level View of Software



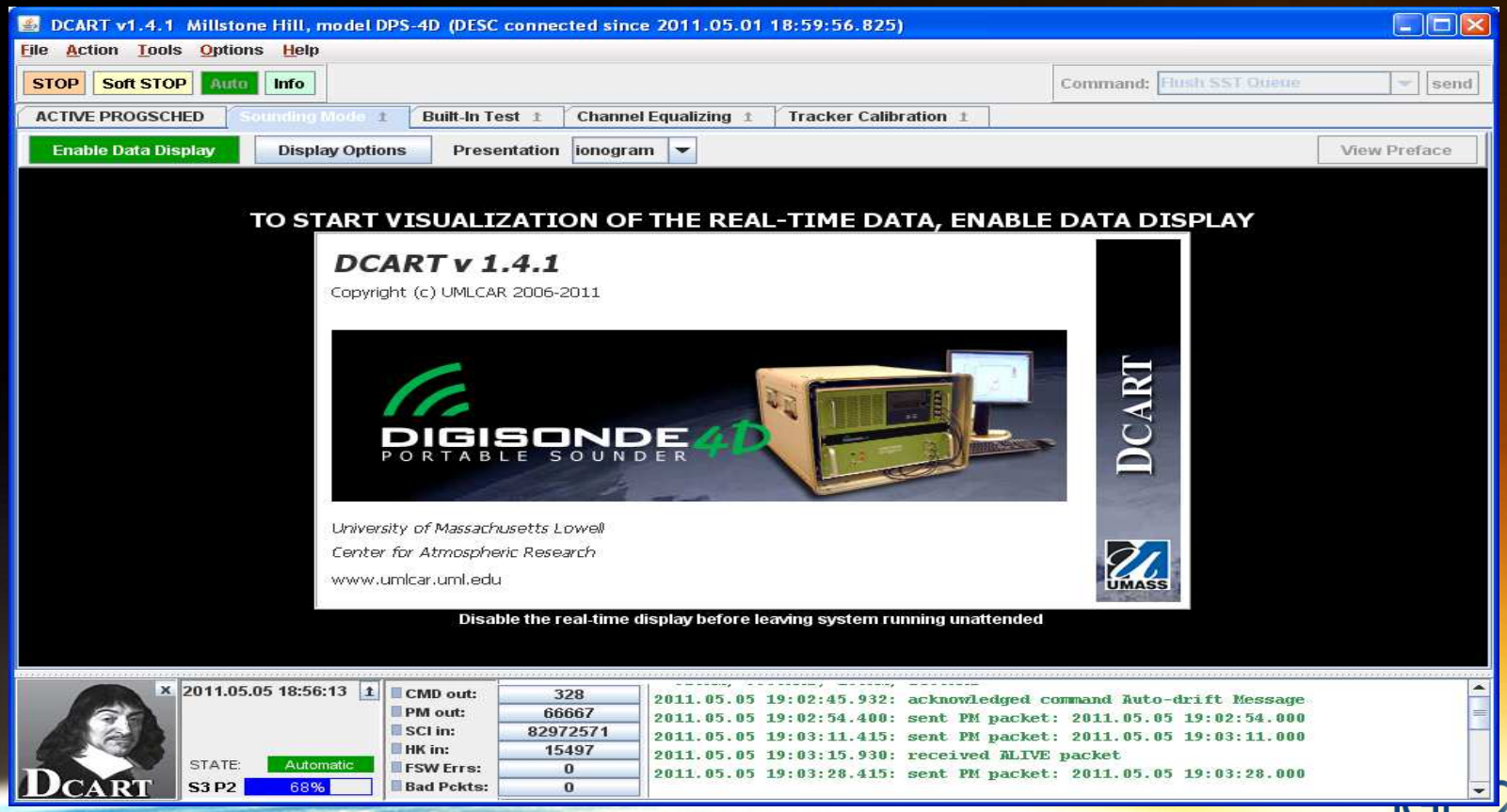
A word on DESC

- Digisonde Embedded System Control
- DESC is the software running in RTEMS on the Control Computer that interface with the hardware.

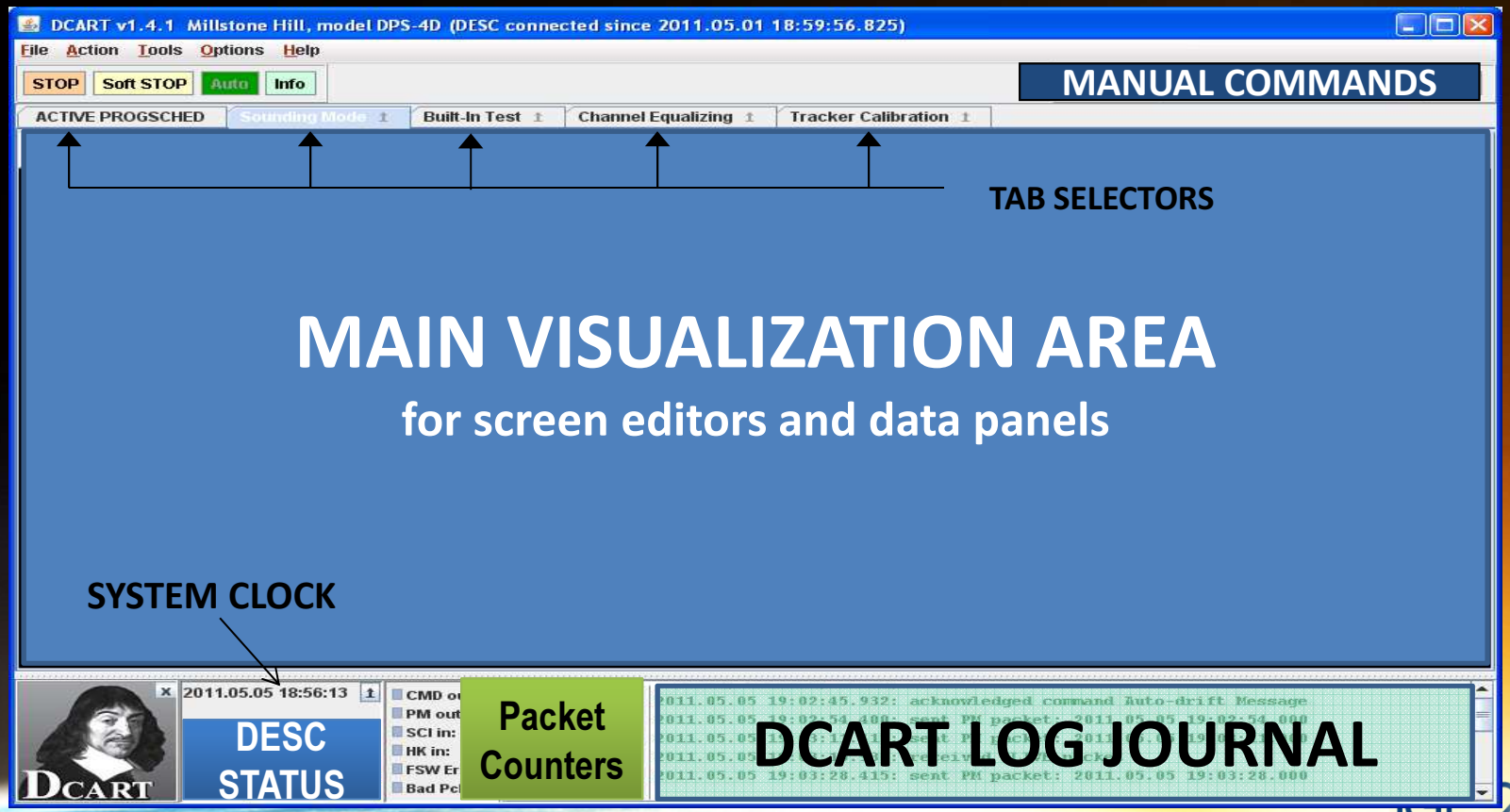
DCART : Main Functions

- PLANNING EXPERIMENTS
  - Program design
  - Schedule design
  - Daily Ops design
  - Campaign design
- MANUAL CONTROL
  - Start and stop
- DATA VISUALIZATION
  - Science data
  - Housekeeping data

Welcome to DCART



DCART Screen Organization



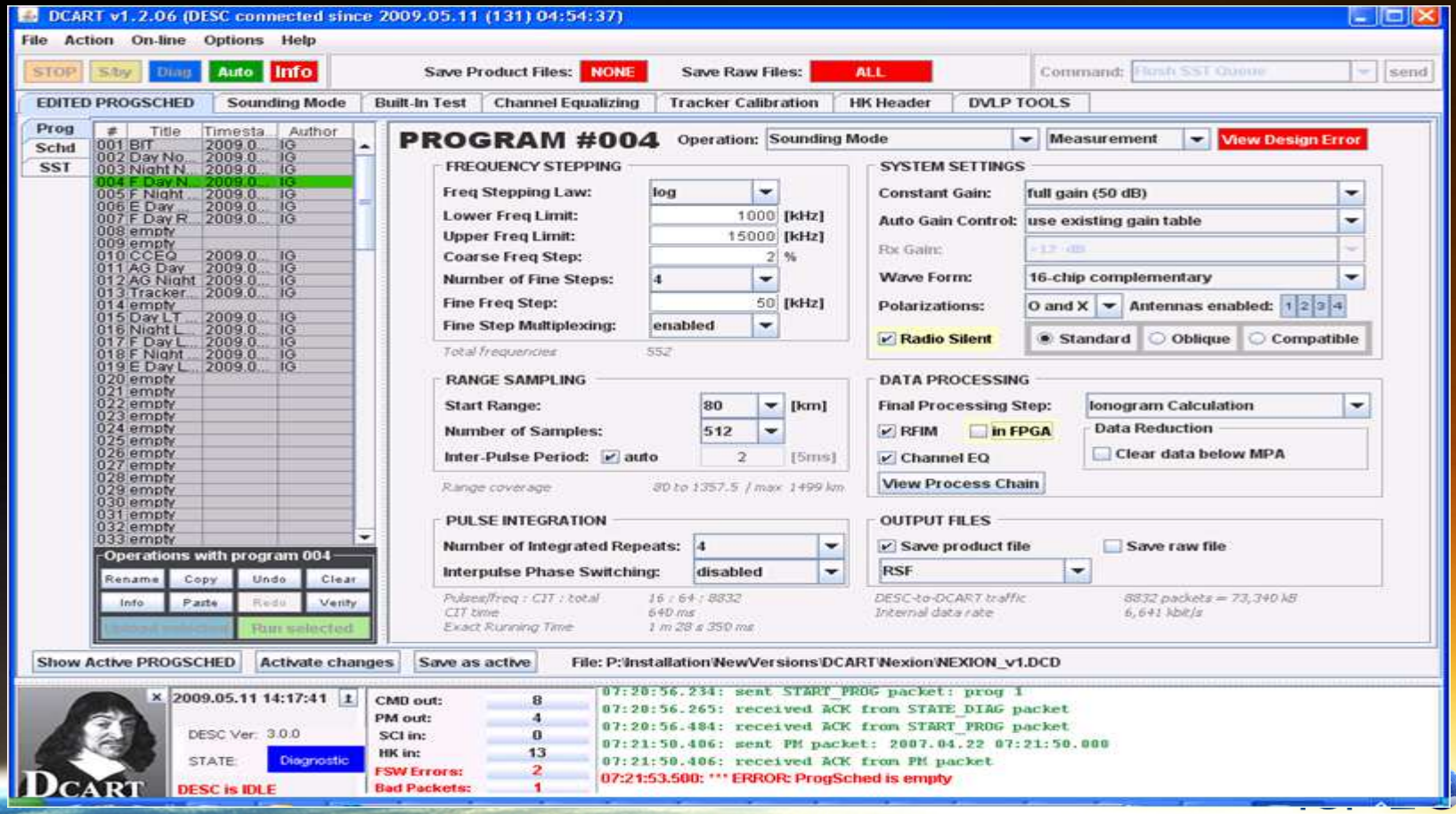
Top Level Color Concept

- **RED** = PROBLEM that requires operator's attention
- **YELLOW** = important option or control
- **ORANGE** = "hazardous" operation that affects quality/amount of collected data
- **GREEN** = working normally
- **BLUE** = information

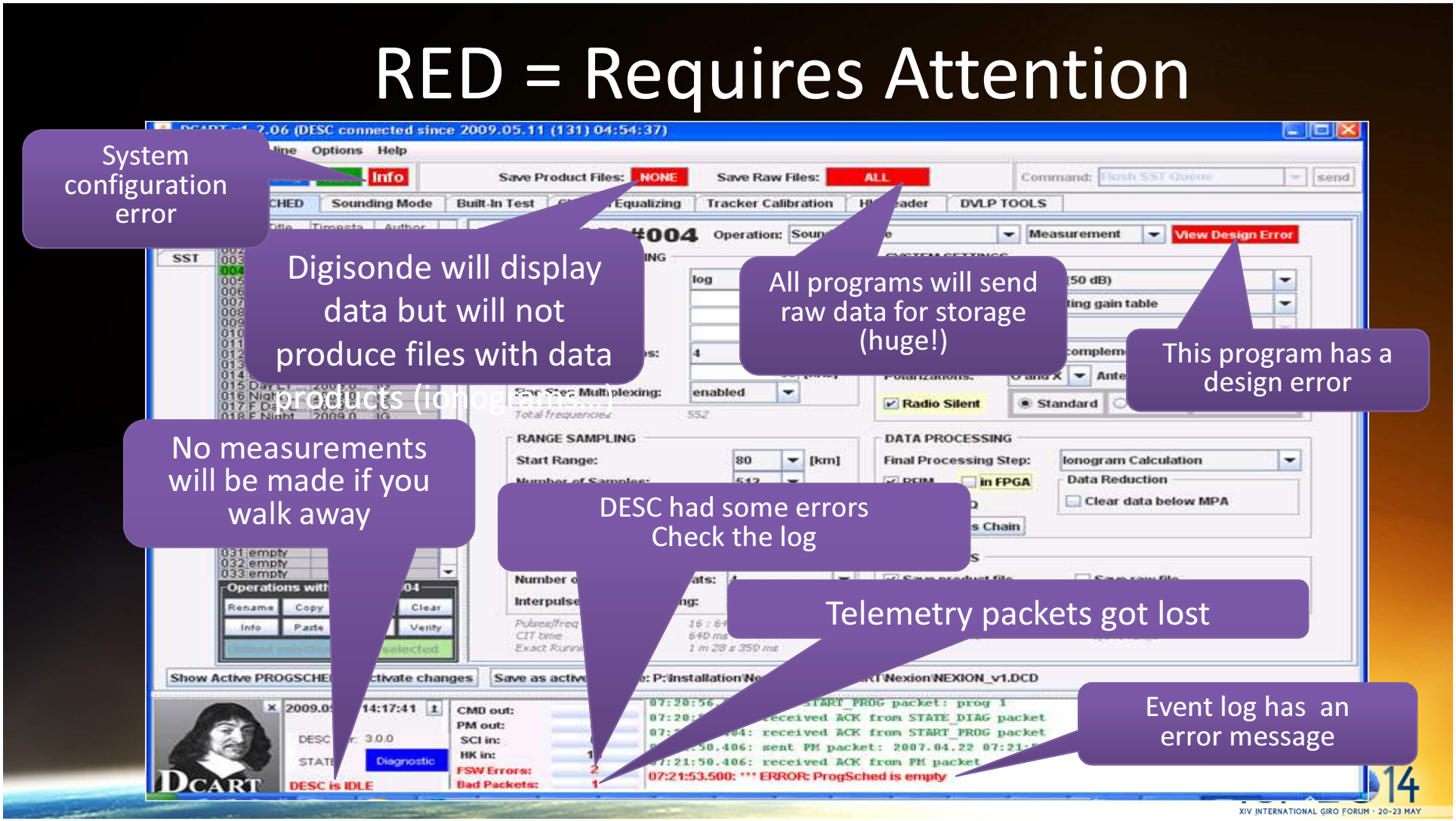
Stop immediately

Finish measurement and stop

RED = Requires Attention



RED = Requires Attention



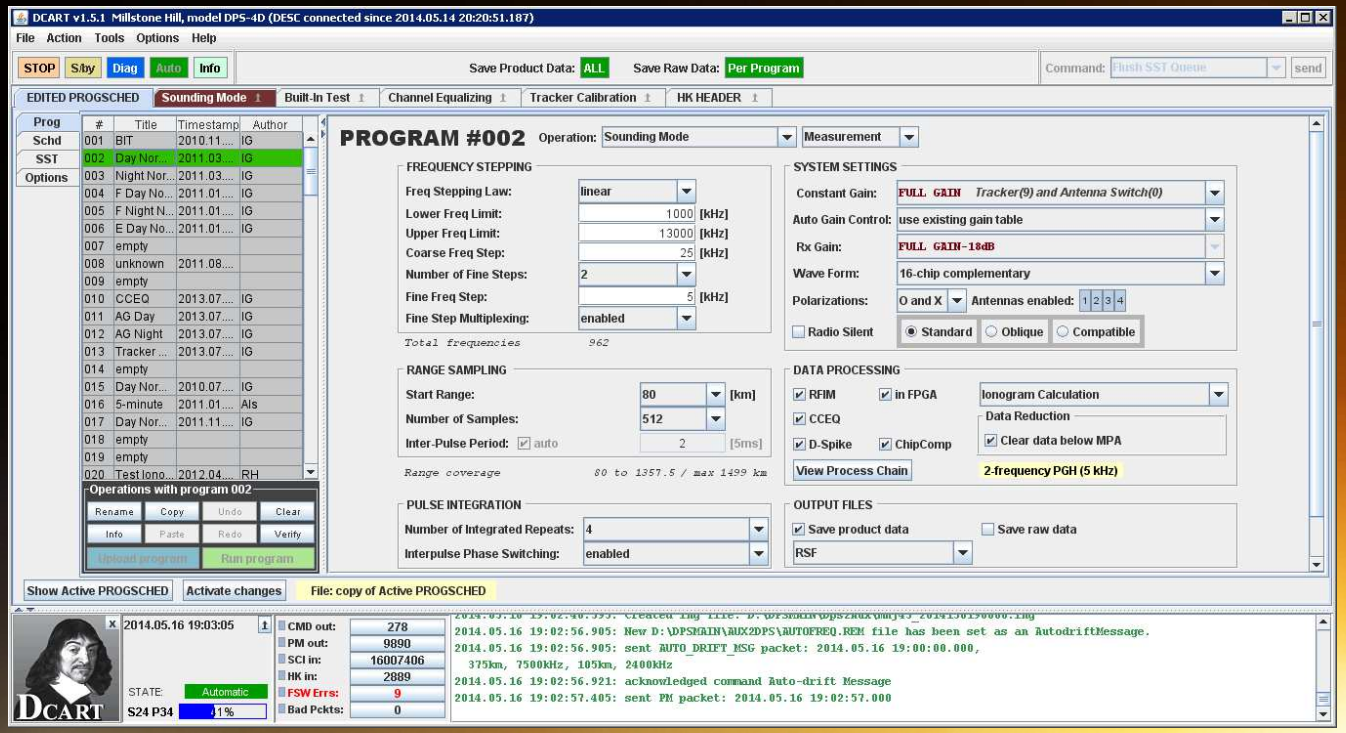
Planning Measurements

- Design of Programs
- Design of Schedules
- Design of Schedule Start Times
- Design of Campaigns

Program

- Programs are *usually* measurements that produce science data: Ionogram, Drift / Skymap
- Program Operation
  - Sounding Mode, Built-In Test, Channel Equalizing, Tracker Calibration, NoOp
  - Measurement, Internal Loopback, HW Test Pattern, SW Test Pattern

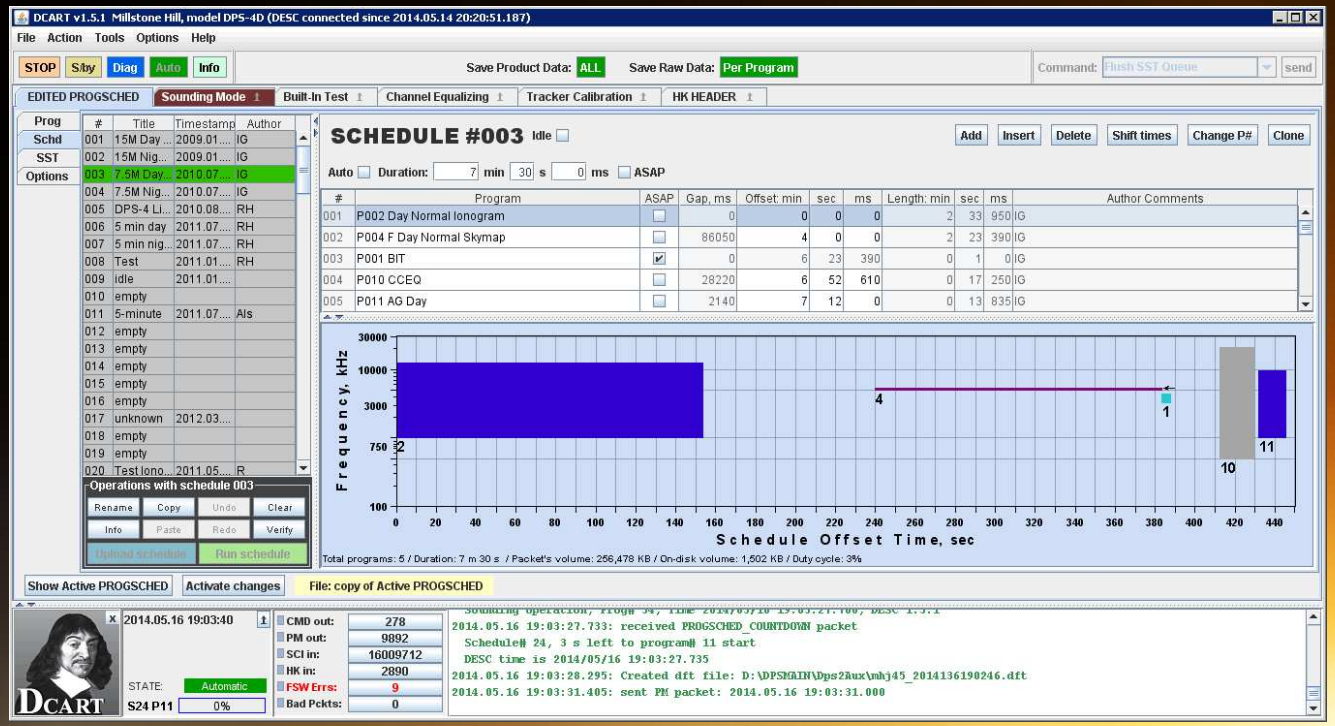
Program Example



Digisonde Schedules

- Digisonde Schedule = repetitive sequence of measurement programs repeated forever
- Concept of “x-ITL”
  - DITL = Day In The Life
  - WITL = Week In The Life
  - 15MITL = 15 Minutes In The Life
  - OITL = Orbit In The Life

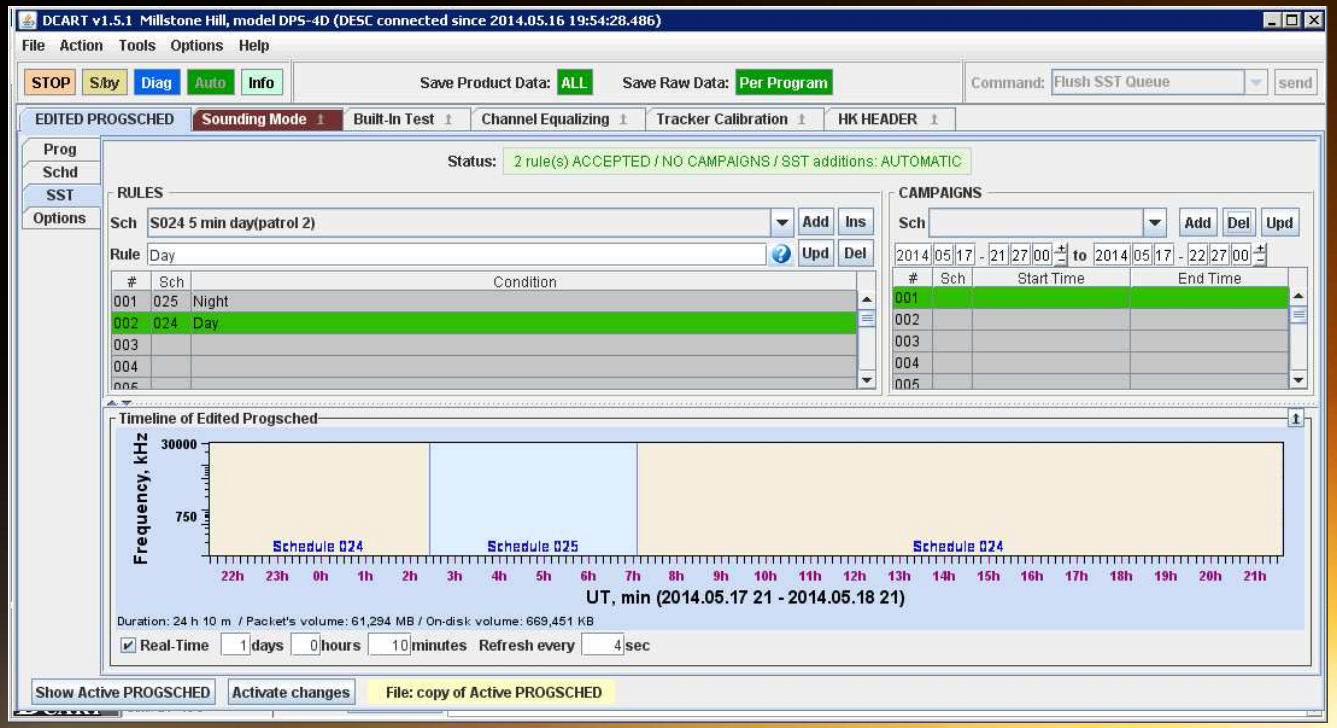
Schedule Example



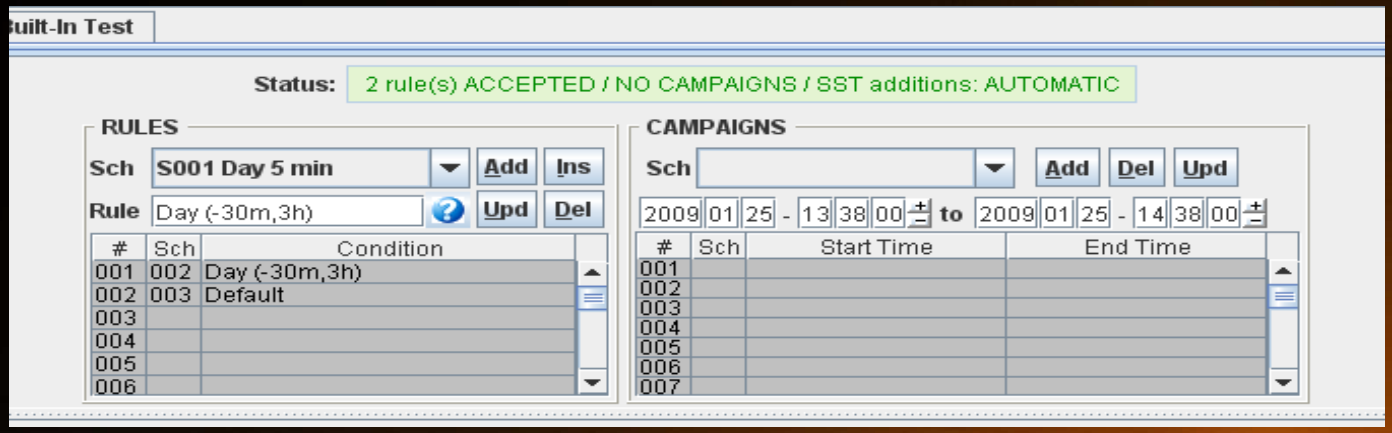
SST and SST Queue

- DCART determines when to start a particular schedule depending on rules set by the user.
- **SCHEDULE START TIME**
  - Time in UT when a certain schedule starts
  - Good for day/night switching
  - Good for campaigns
- **SST Queue**
  - List of SSTs in DESC (control software)
  - When DESC is in the AUTO mode
    - look at the earliest SST in the Queue
    - when the time is right, start the schedule and remove the SST
    - repeat

Schedule Start Time (SST)

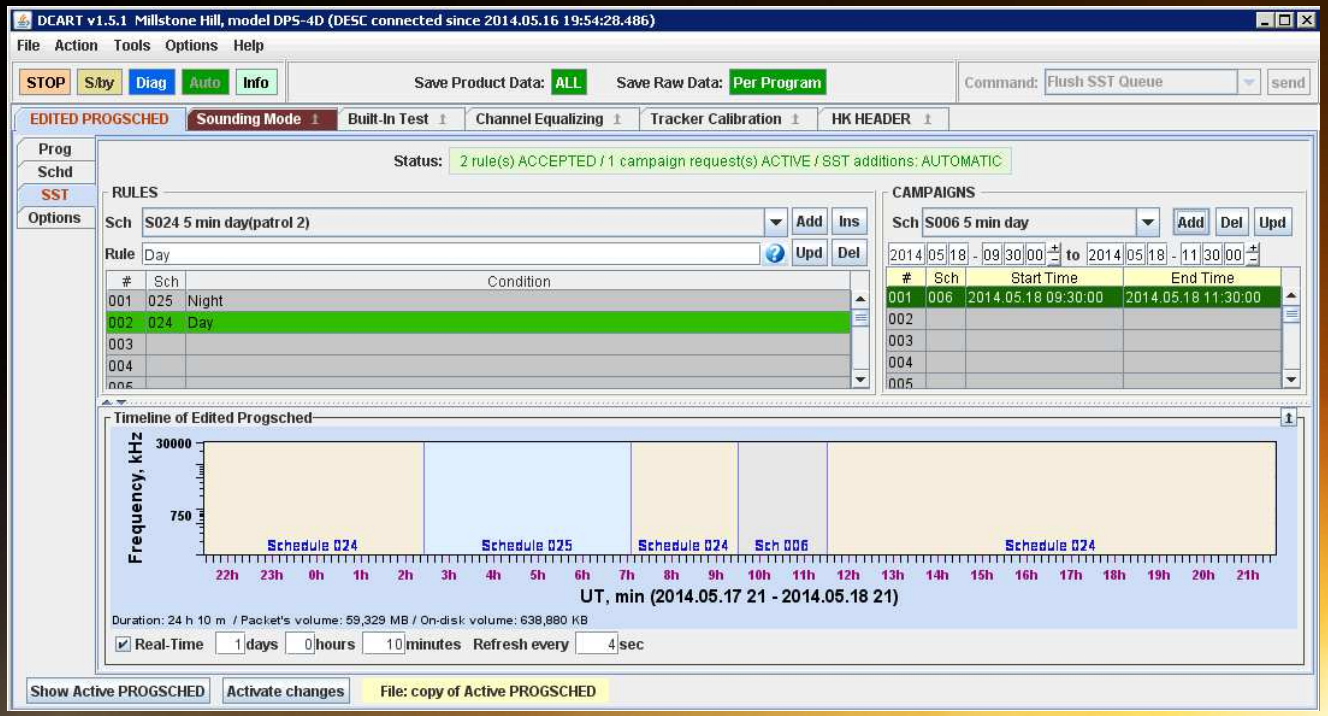


Campaign Mode



- Just add start and stop UT for a particular schedule, the rule-based DITL will be overwritten
- Campaign requests can be sent to DCART over the FTP as plain text files

Campaign Mode Example



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Digisonde Day and Night Schedules

- We recommend different schedules for day and night
- DAY: higher upper frequency, coarser frequency stepping
- NIGHT: lower gain, lower upper frequency, finer stepping, no E-layer drift

EDITED PROGSCHED

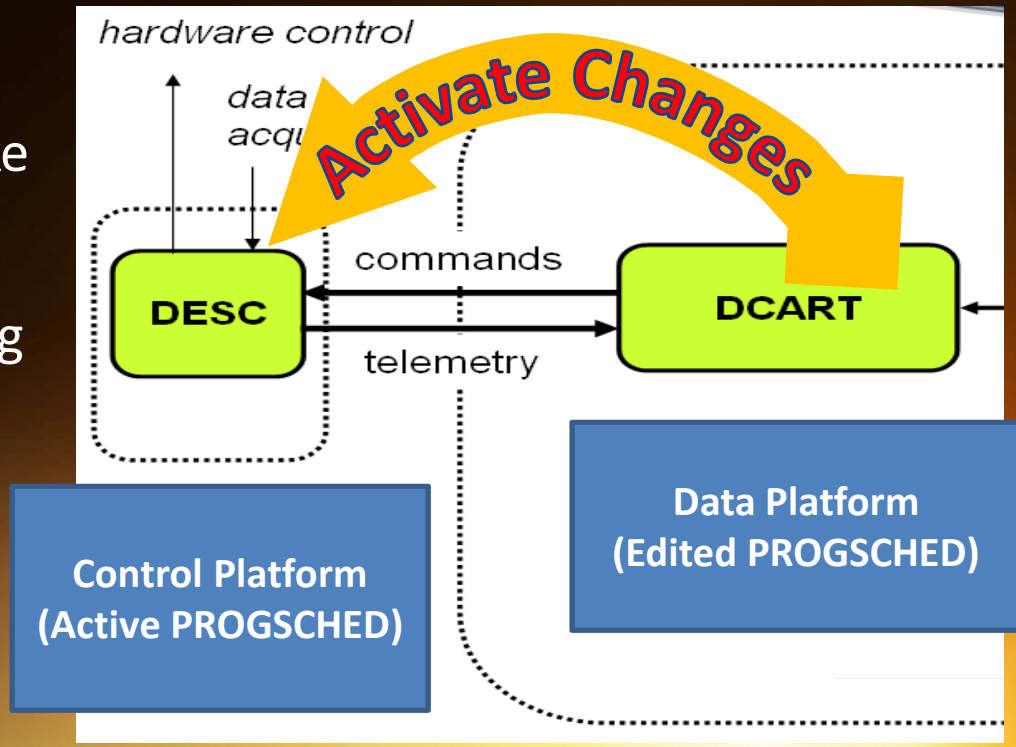
ACTIVE PROGSCHED

Note on Active vs Edited PROGSCHD

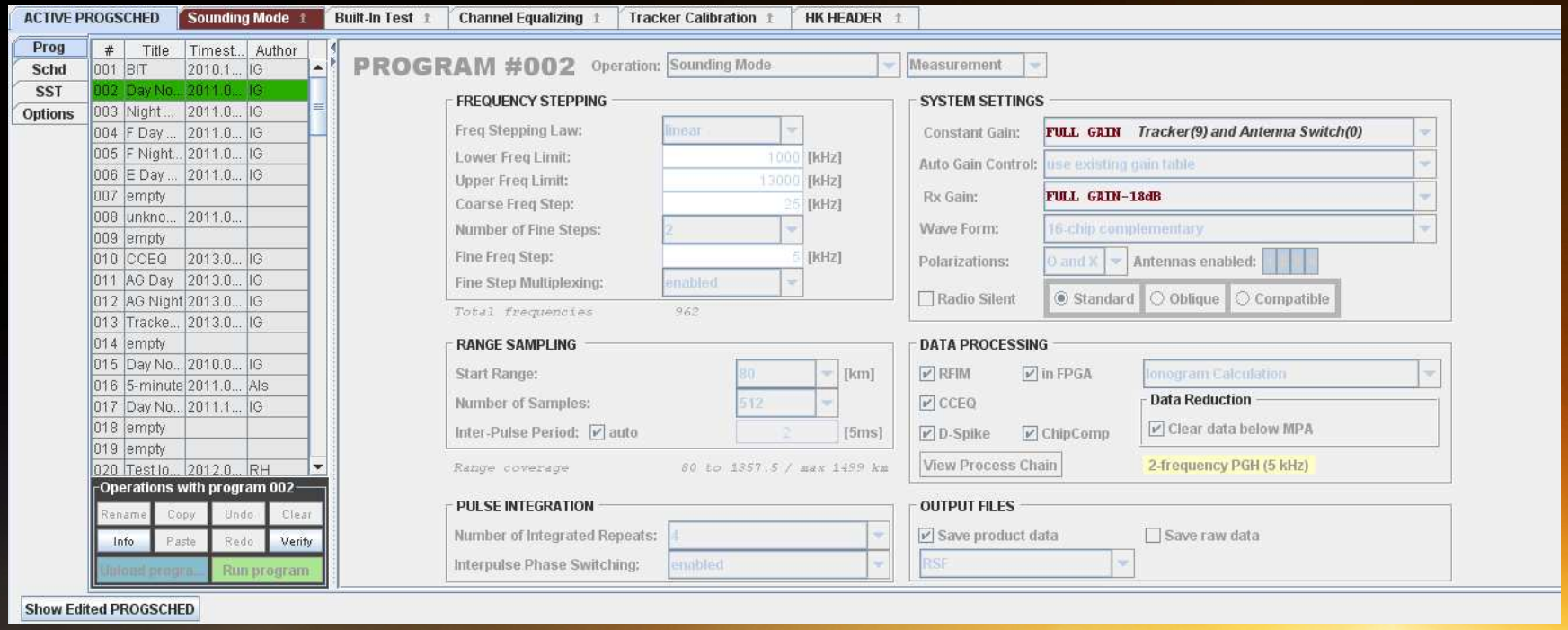
- Progschd contains the descriptions of all programs, schedules, SSTs, and campaigns
- User can make changes to programs, schedules, sst without disrupting system operation
- This is accomplished by having two versions of progsched; one on the Control platform and the other on Data platform

Activating Changes

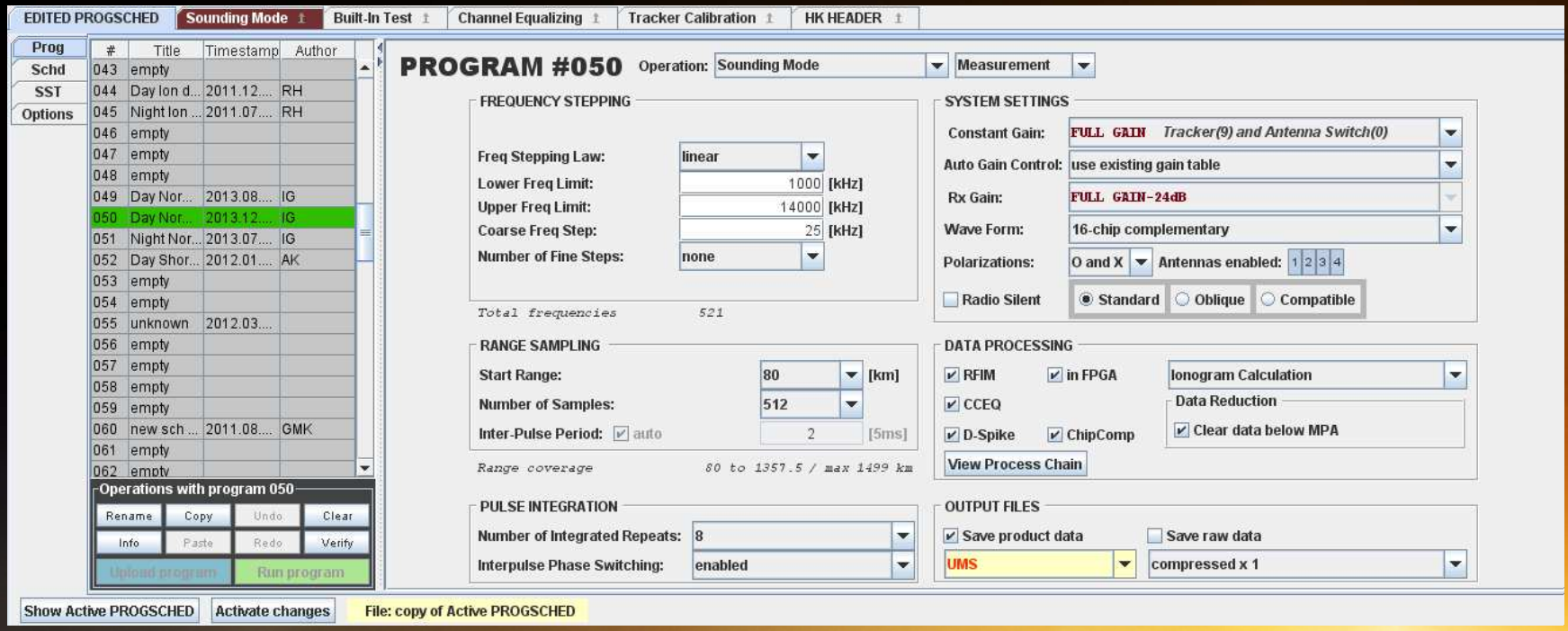
- The user can view the active progsched sent from the Control Platform but not make changes
- When editing programs and schedules the user is changing the edited progsched on the Data Platform
- Once editing of progsched is complete remember to Activate Changes!



Interface showing Active PROGSCHED

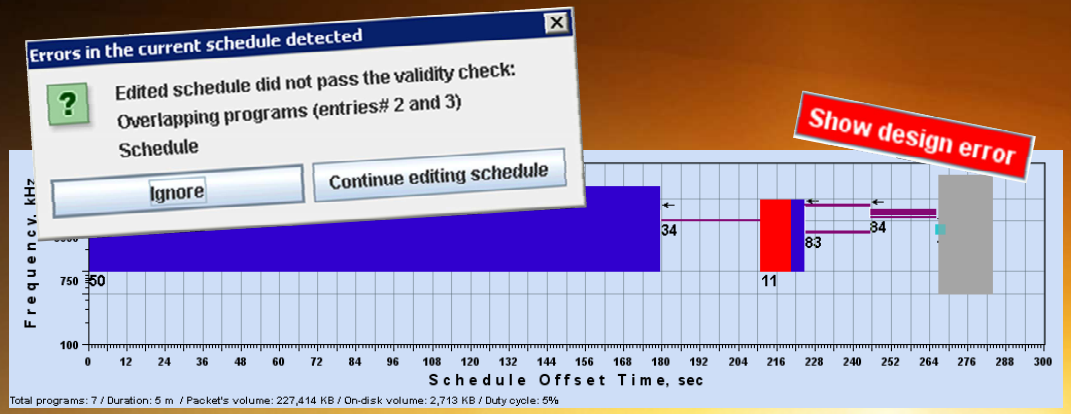


Interface showing Edited PROGSCHED



Additional Tips

- Backup entire program and schedule definition file, D:\Dispatch\Control\progsched ← just copy the file
- Be wary of using a single program in many schedules
- Usually I find it easier to copy a program and use it in one or few schedules



Advanced Interface Features

- Programming and analysis of Cross-Channel Equalizing (CCEQ) data,
- Programming and analysis of Tracking Filter Calibration data,
- Direct hardware commanding,
- Optional production of raw and derived products
- Commanding of DESC into Diagnostic and Standby state for manual uploads, and
- Manual production of SSTs


Dalu
감사합니다
Gracias
Danke
Ευχαριστίες
THANK YOU
Obrigado
Köszönöm
Grazie
Спасибо
Dank
Tack
谢谢
Merci
ありがとう
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BACKUP

From HITL to x-ITL

- Digisonde 256, DPS-4: HITL
  - Hour In The Life (HITL) is one schedule
  - E.g., 4 times a hour
- Digisonde 4D: x-ITL
  - Any-period-of-time In The Life (x-ITL)
  - Inspired by IMAGE RPI mission planning
    - Multiple programs run at irregular intervals
  - E.g., 5MITL is 5 minutes in the life
    - Equivalent to 12 times an hour, only that one copy of 5MITL is sufficient instead of 12 copies to describe for HITL
    - Advantage becomes clearer when 5MITL has more than 2-3 programs

DCART Schedule Editor

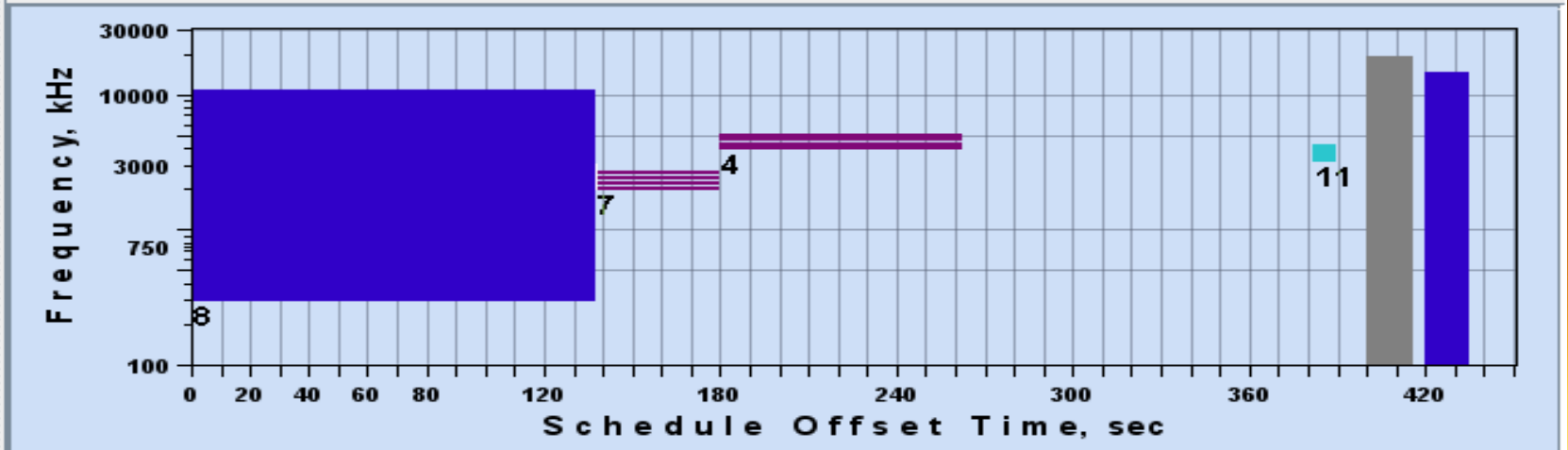
with xITL

7.5MITL

SCHEDULE #002 Idle | Add | Insert | Delete | ClonE

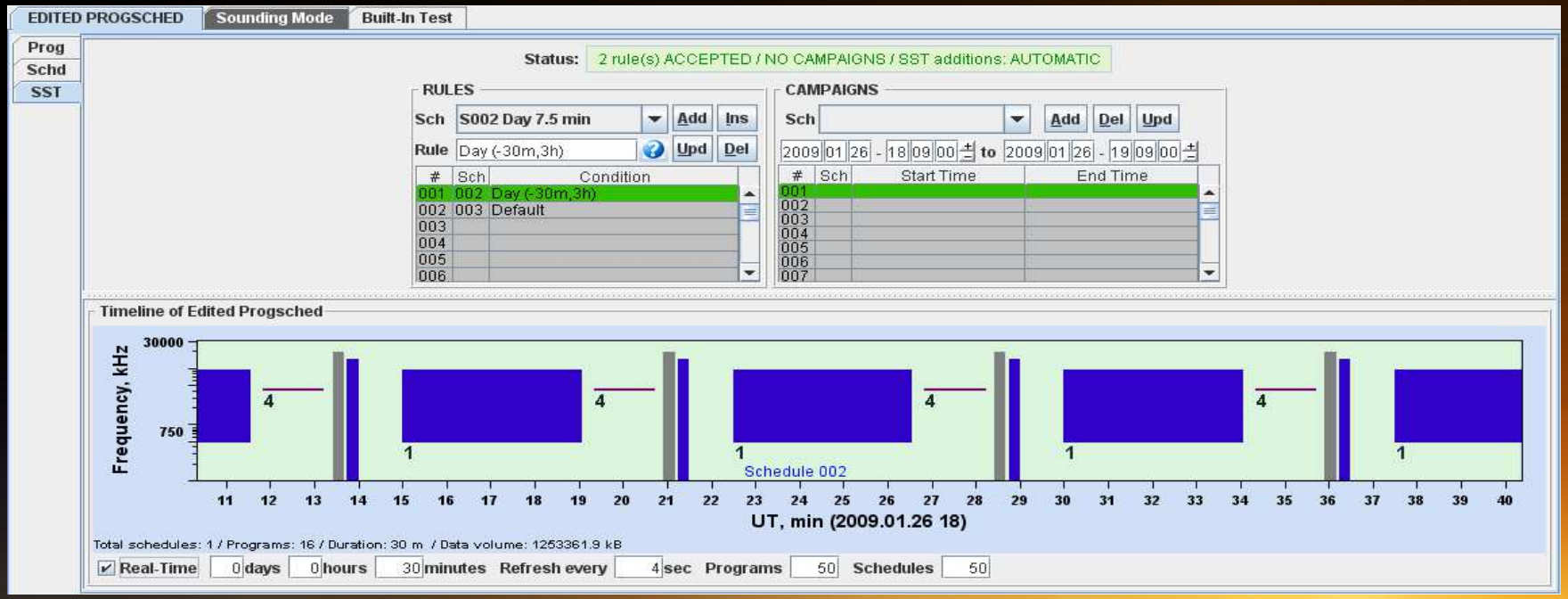
Auto | Duration: 7 min 30 s 0 ms | ASAP

#	Program	ASAP	Gap, ms	Offset: min	sec	ms	Length: min	sec	ms	Author Comments
001	P008 PGH ion day		0	0	0	0	2	17	630	GMK
002	P007 E drift	✔	0	2	17	630	0	40	990	IG
003	P004 F day		1380	3	0	0	1	21	950	GMK
004	P011 BIT		120000	6	21	950	0	1	0	SS
005	P025 CCEQ		17050	6	40	0	0	15	990	GMK
006	P027 AG day		4010	7	0	0	0	15	20	GMK

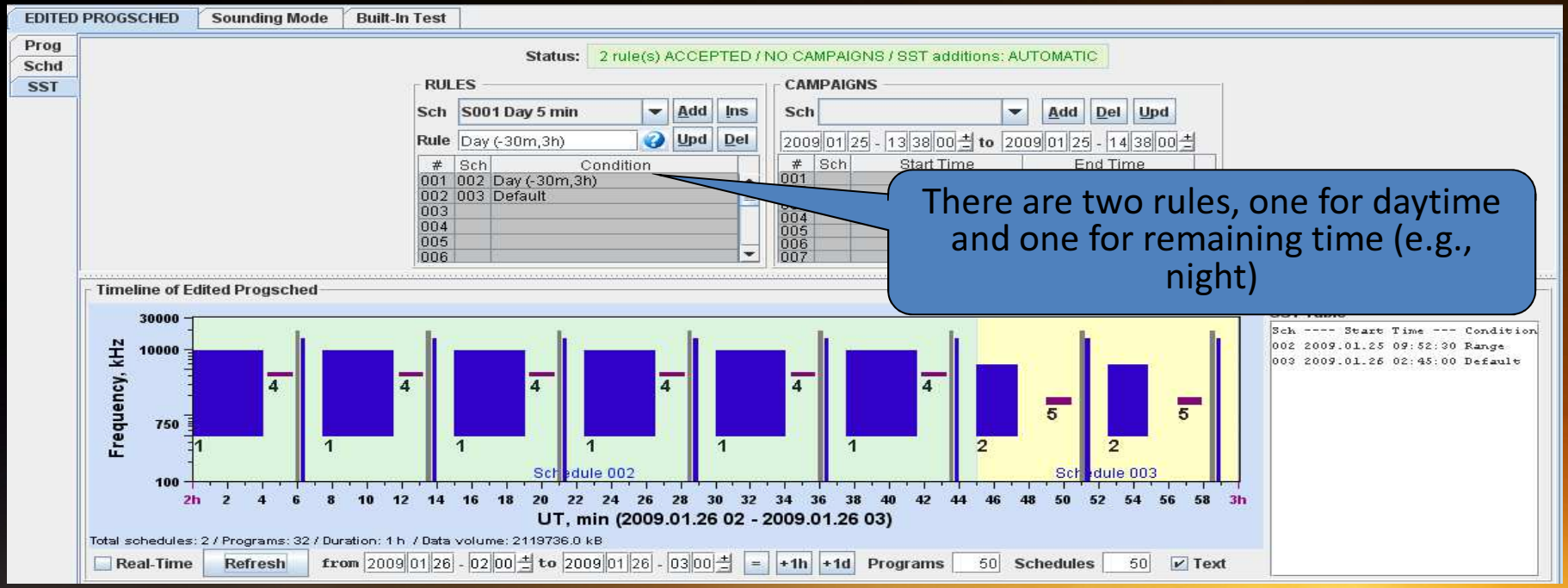


Total programs: 6 / Duration: 7 m 30 s / Data volume: 232066.0 kB

DCART Timeline Display



EASY SST SCENARIO



- DAY = schedule 2
- NIGHT = schedule 3

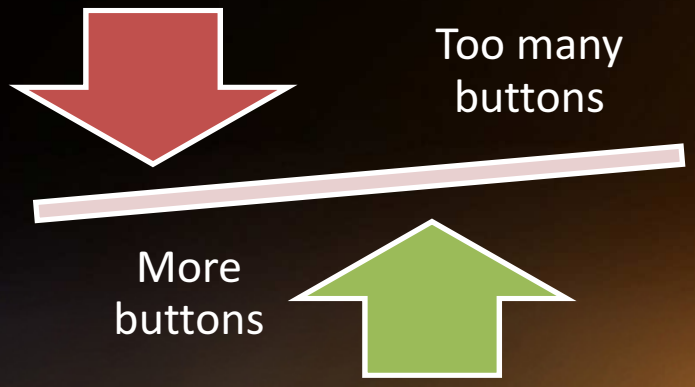
Replenishing SST Queue

- DCART calculates new SSTs
- Two main mechanisms to add SSTs to the Queue:
  - RULE-BASED
    - Define rule(s) for automatic SST generation
      - E.g., day and night schedules
  - CAMPAIGN
    - Specify start and stop UT for a particular schedule

PRIORITY OF CAMPAIGN IS HIGHER

TWO USER MODES OF INTERFACE

(Abbreviated and Advanced)



- Conflict between flexibility and usability
- Two user modes
  - Normal
  - Advanced

Queue Replenishing Modes

- BUILD FOR A TIME PERIOD
  - Enter start UT
  - Enter stop UT
  - Push “Rebuild” button
  - Get list of SSTs
  - Send all SSTs to DESC
  - DESC makes them happen

TYPICAL FOR SPACE MISSIONS

- REPLENISH AUTOMATICALLY
  - No need to type times
  - DCART uses rules and campaign times to prepare SSTs
  - Shortly before the start time, the SST is sent to DESC
  - DESC makes it happen

TYPICAL FOR DIGISONDE OPS

Queue Replenishing Modes (2)

- BUILD FOR A TIME PERIOD
  - Rebuild SSTs
  - Display the timeline
  - Correct rule mistakes manually
  - Send to DESC or save as a script

typical operation

- REPLENISH AUTOMATICALLY
  - Display the timeline
  - No manual correction of generated SSTs possible
  - Adjust rules or campaign times
  - Repeat

MISTAKES CAN BE CORRECTED

RELIABLE RULE ENGINE IS NEEDED