e-CALLISTO Solar Radio Spectrometer Network

Software Tools
& System Demonstration

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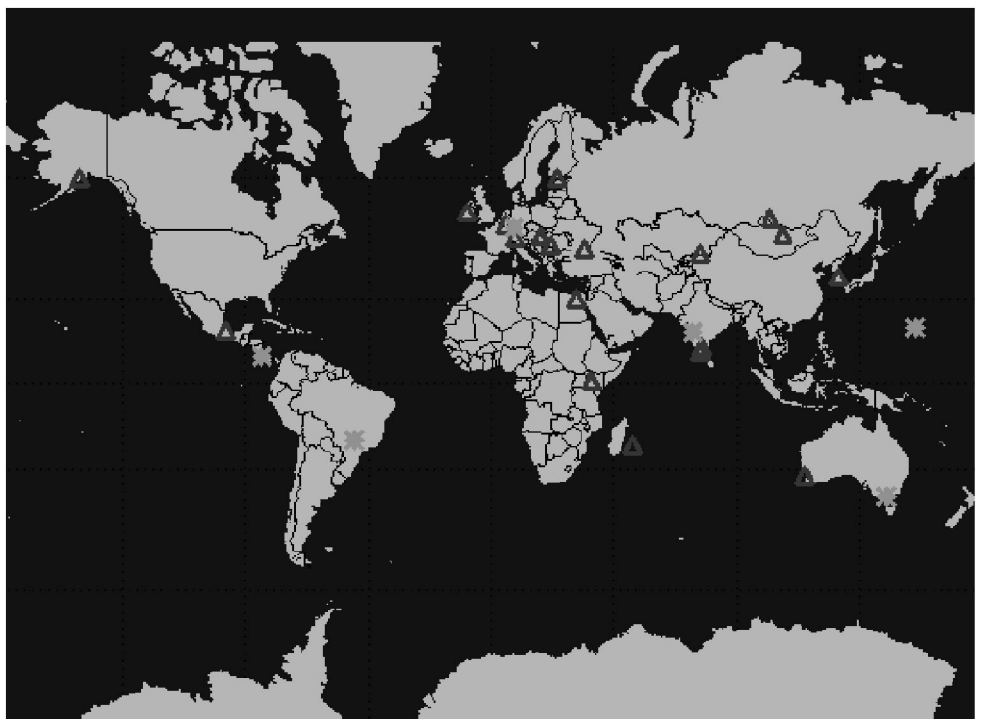
Contents

- e-CALLISTO Solar Spectrometer Network
- e-CALLISTO Software Tools
- Conclusions

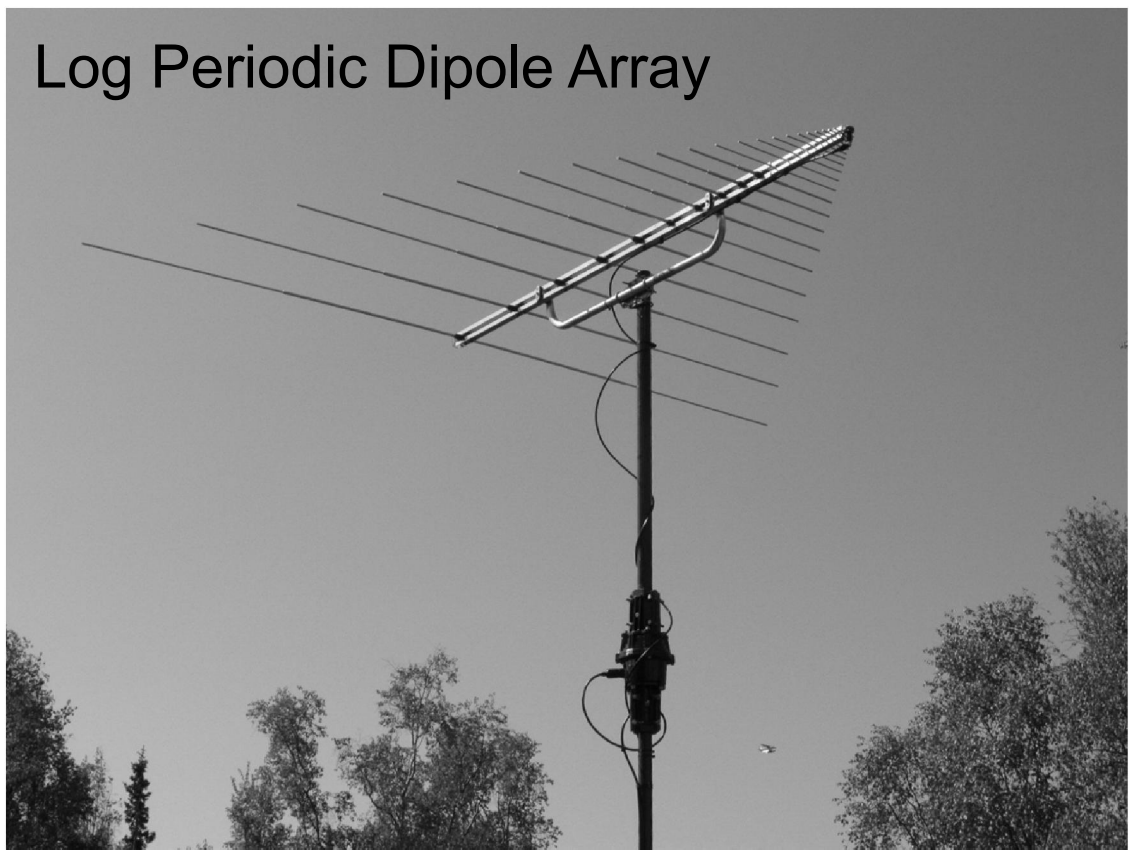
e-CALLISTO

- **e-CALLISTO** Solar Spectrometer Network:
- ***e***xtended-***C***ompound ***A***stronomical ***L***ow-cost ***L***ow-frequency ***I***nstrument for ***S***pectroscopy and ***T***ransportable ***O***bservatory



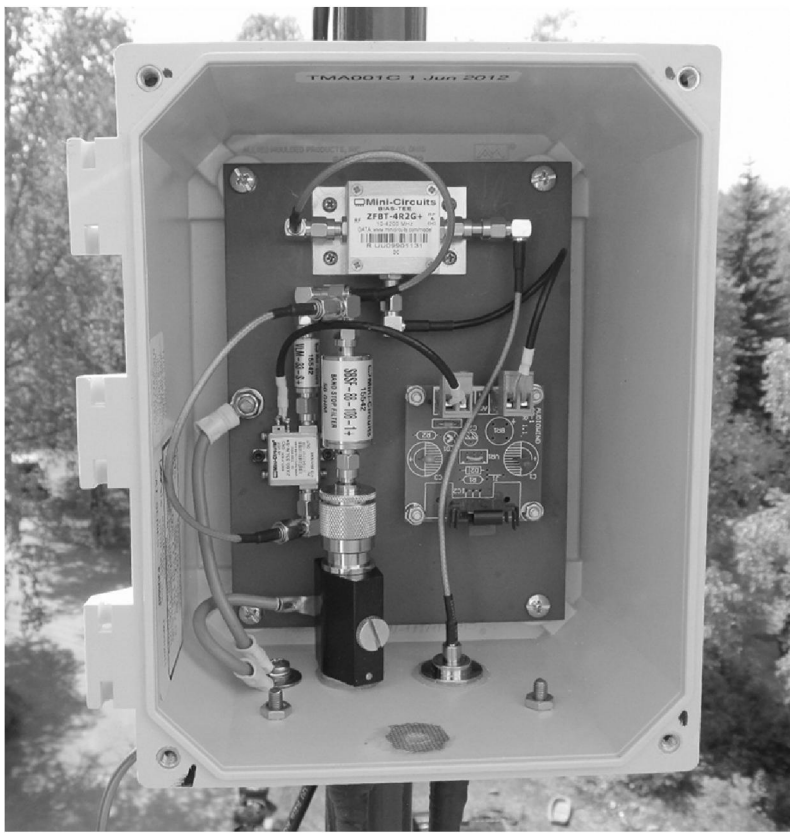
e-CALLISTO

Log Periodic Dipole Array



e-CALLISTO

Tower-Mounted Low Noise Amplifier



e-CALLISTO

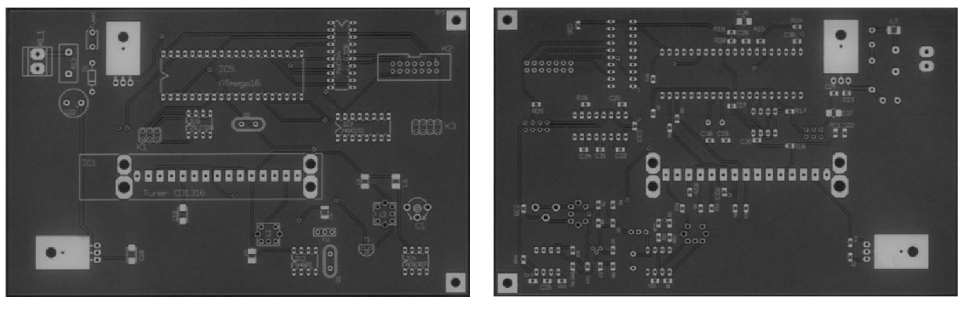
Receiver

e-CALLISTO

- Windows PC
  - 2000
  - XP
  - Vista
  - 7
- Internet access
- Serial or USB port

e-CALLISTO

- e-CALLISTO Receivers available for shipment anywhere worldwide
- Order Information: http://www.reeve.com/Solar/e-CALLISTO/e-callistoOrderInfo.htm
- Full Kit, Partially-Built Kit, Ready-Built Kit
  - US$325 ~ US$475

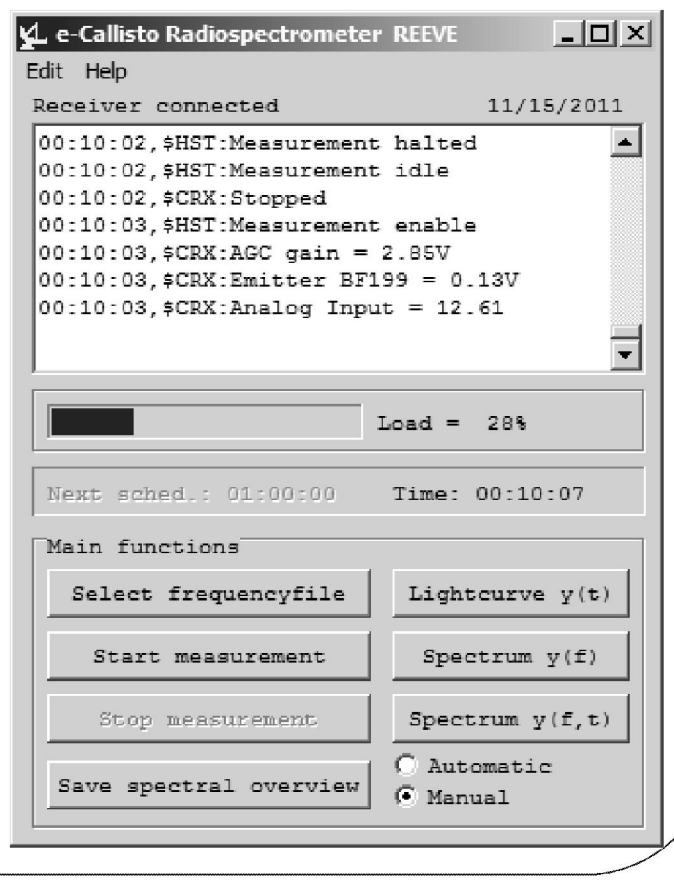


e-CALLISTO Software Tools

Application program	Developer	Remarks
Primary		
Callisto	C. Monstein	Receiver control, data collection, data processing
Operation Support		
Frequency Genie	C. Monstein	Produce frequency list based on local spectrum and RFI
Scheduler Genie	C. Monstein	Produce observation schedule based on observatory location
Web Genie	C. Monstein	Produce solar radio lightcurve for posting on website
Data upload		
FTP-WatchDog	Tools&More	Controls data upload to a website or data server
FITS viewer		
RAPP Java FITS Viewer	P. Messmer	Local viewing of FITS files as spectrograms
Interactive Data Language – IDL	Exelis	Customization of plots through the use of scripts as well as data analysis. Expensive
Time-keeping		
SymmTime	Symmetricom	Periodically update PC time-of-day clock using NTP
NISTime32	NIST	Alternate to SymmTime
MasterSync	MasterClock	Alternate to SymmTime
Receiver test		
Simple 1	C. Monstein	IF transformer tuning aid
Simple 2	C. Monstein	Alternate to Simple 1 that logs measurements
FC-Noise Test Tool	C. Monstein	Control wiring test, noise figure and log detector slope measurements
Noise Figure	C. Monstein	Alternate to FC-Noise Test application for noise figure measurement only
AlaVar	Alamath	Receiver time stability characteristic measurement

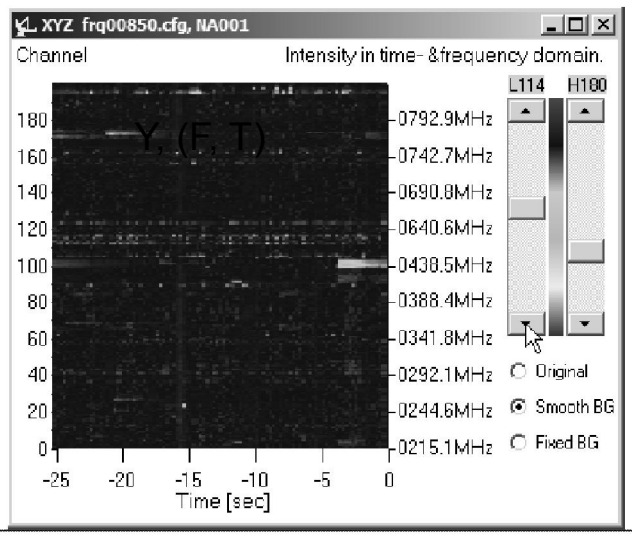
e-CALLISTO Software Tools

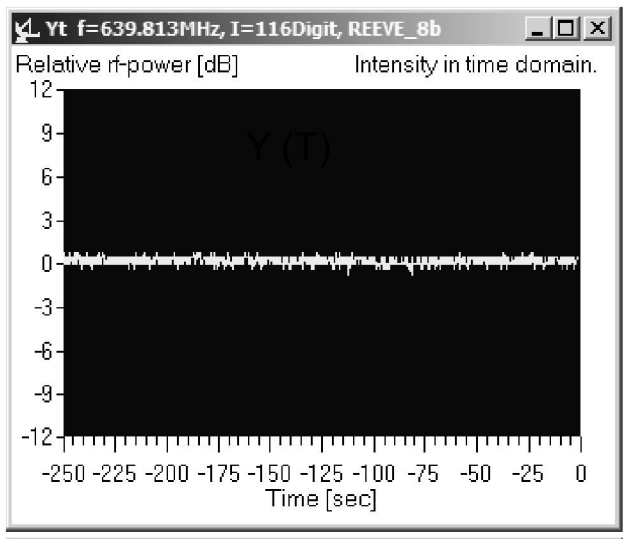
- Callisto Application
  - Controls receiver
  - Automatic or Manual modes
  - Display real-time plots
    - Y (T), Y (F), Y (F, T)
  - Select frequency list
  - Save Spectral Overview
  - Communication status window

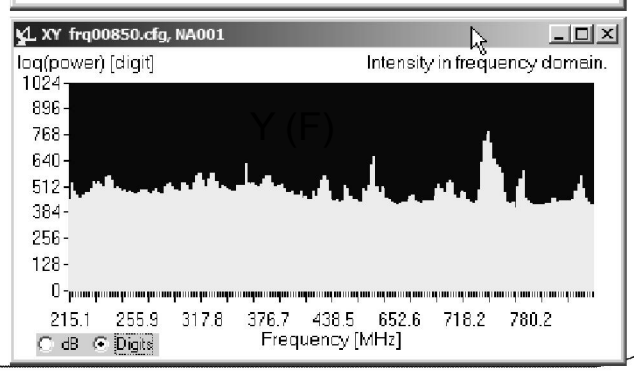


e-CALLISTO Software Tools

- Callisto Application
  - Y (T) – Lightcurve
  - Y (F) – Spectral plot
  - Y, (F, T) – Spectrum plot







e-CALLISTO Software Tools

- Callisto Application ~ Configuration File

callisto.cfg - Notepad

File Edit Format View Help

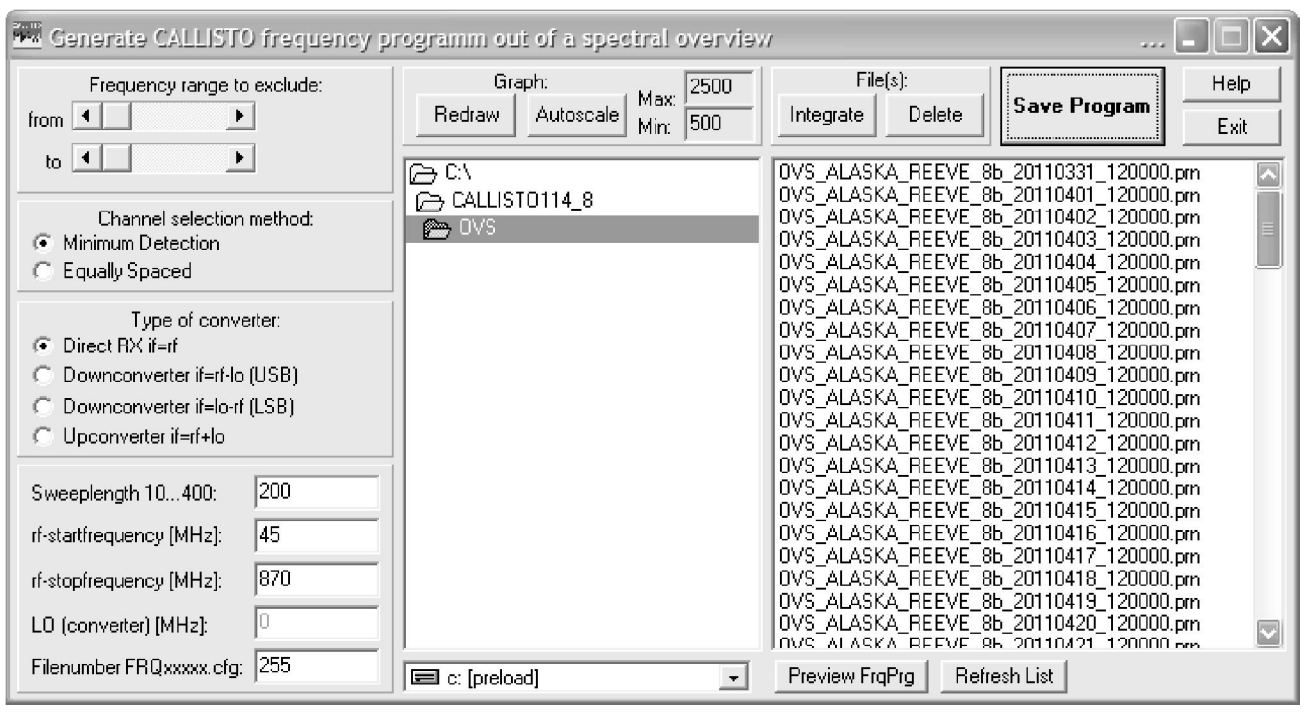
```
//
// Installed on Lightning by: W.Reeve 03 June 2011
// Updated for NA001 by: W.Reeve 09 December 2011
//
// RCU, receiver control unit
[rxcomport]=COM7              // COM1 .... COM18
[observatory]=12              // CALLISTO=12, fixed
[instrument]=ALASKA           // instrument code -> filename_
[titlecomment]=NA001          // Title of API
[origin]=Anchorage_AK_USA     // Place of instrument ETH_Zurich_Switzerland, ...
[longitude]=W,149.9565        // default geographical longitude in decimal degree
[latitude]=N,61.1993          // default geographical latitude in decimal degree
[height]=20.0                 // default altitude [m] above sealevel
[clocksource]=1               // RISC-level: 0=software, 1=internal, 2=external, default 1
[filetime]=900                // time periode for one single FIT-file (in seconds)
[frqfile]=frq00850.cfg        // default frequency program
[focuscode]=59                // default focuscode
[mmode]=3                     // default continuous recording 2=calibrated, 3=raw data
[fitsenable]=1                // 0=no FITSfile, 1=FITS write On
[datapath]=C:\CALLISTO\Data\  // default datafile path (*.fit)
[logpath]=C:\CALLISTO\Log\    // default logfile path (LOG*.txt)
[lcpath]=C:\CALLISTO\LC\      // default light curve path (LC*.txt)
[ovspath]=C:\CALLISTO\OVS\    // default spectral overview path (OVS*.prn)
[chargepump]=1                // charge pump: 0=false=off, 1=true=on, default 1
[agclevel]=110                // PWM level for tuner AGC 50...255, default 120
[detector_sens]=25.4          // detector sensitivity mV/dB, default 25.4
[db_scale]=5                  // dB per division in XY-plot, default 6
[autostart]=0                 // autostart: 0=false, 1=true
```

e-CALLISTO Software Tools

- Frequency Genie
  - Determines frequency list
    - User specified exclude frequency band
    - User specified include frequency band
  - Source data
    - Spectral Overview
    - Equal spaced frequencies for RFI surveys
  - Accommodates up/down converters
  - View Spectral Overview data as spectrograph Y(F)

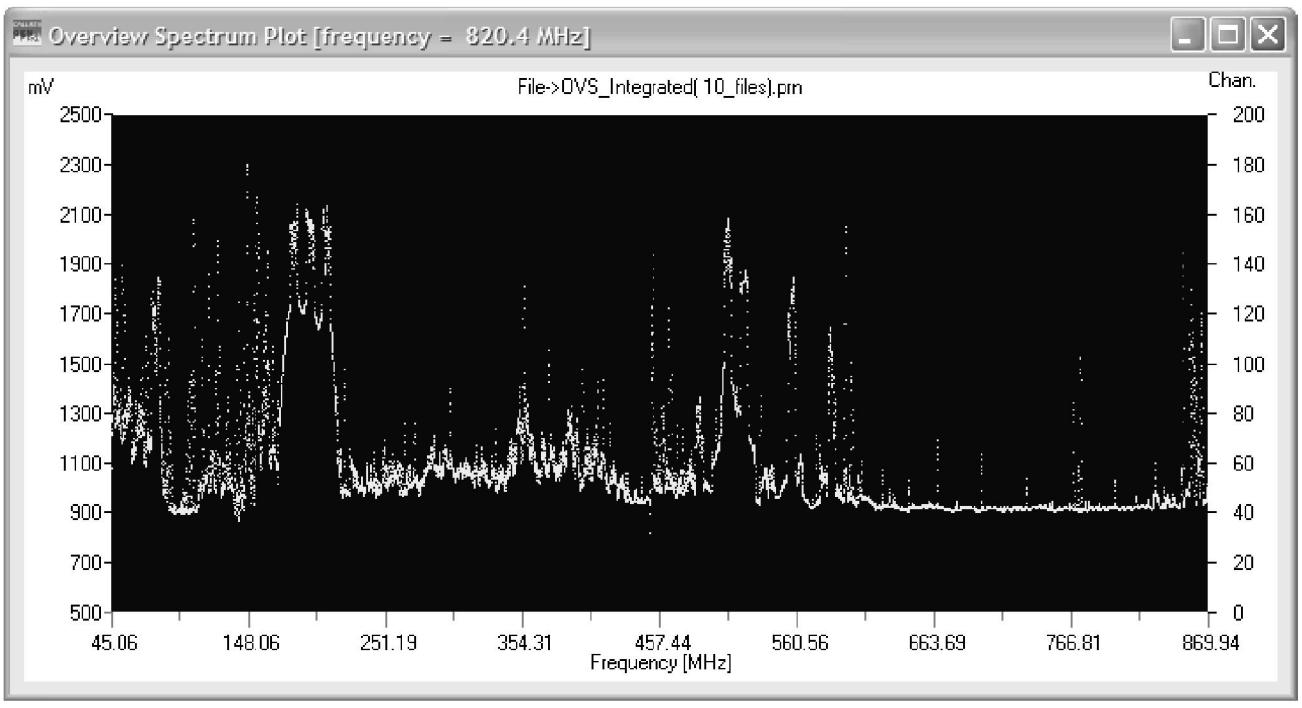
e-CALLISTO Software Tools

- Frequency Genie – User Interface



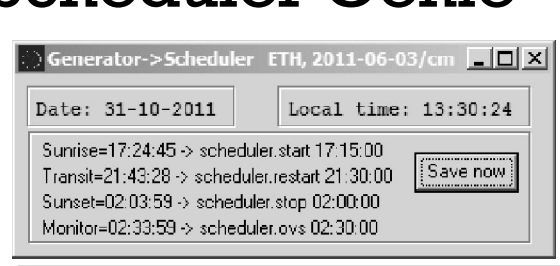
e-CALLISTO Software Tools

- Frequency Genie – Spectrum Plot

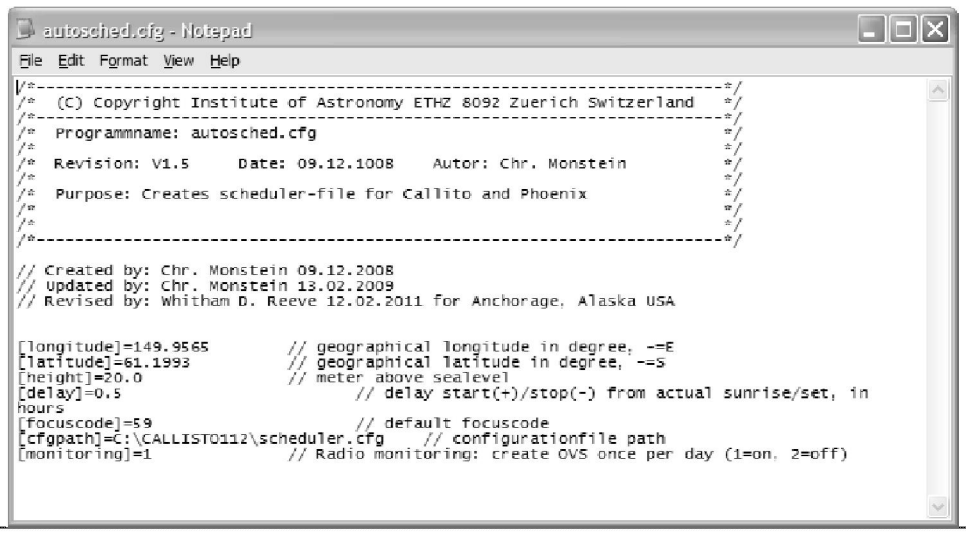


e-CALLISTO Software Tools

- Scheduler Genie



User Interface &
Configuration file

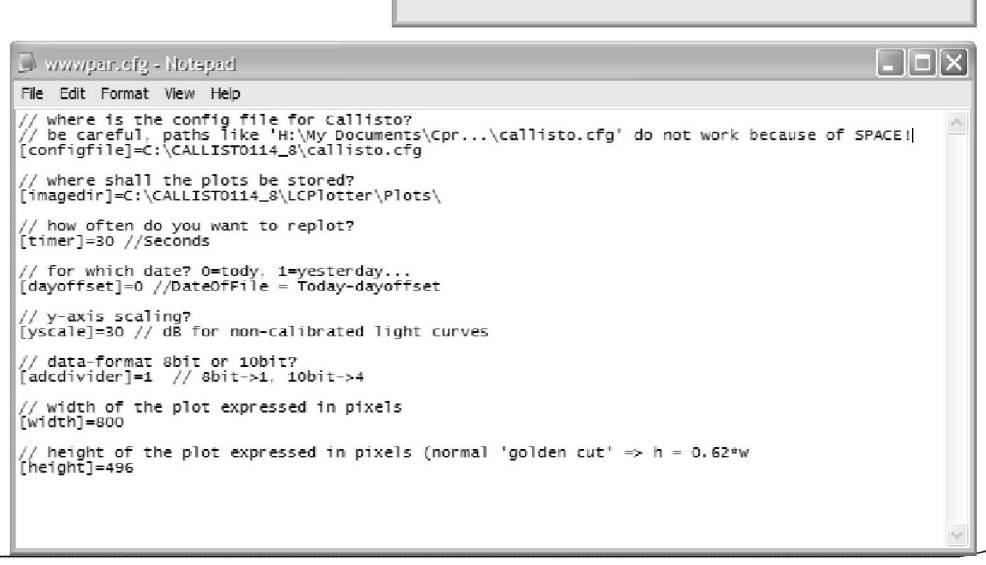


e-CALLISTO Software Tools

- WWW Ge

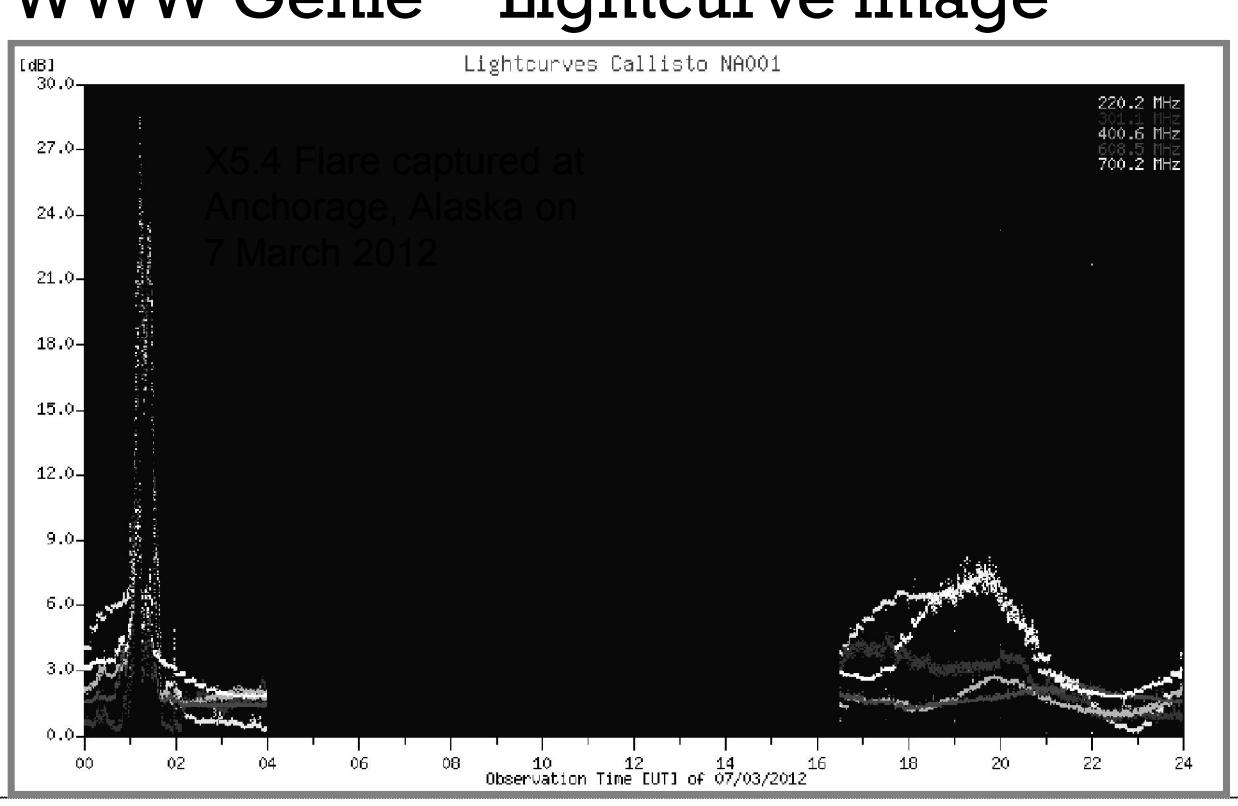
User Interface &
Configuration file

- Produces Light-curve image



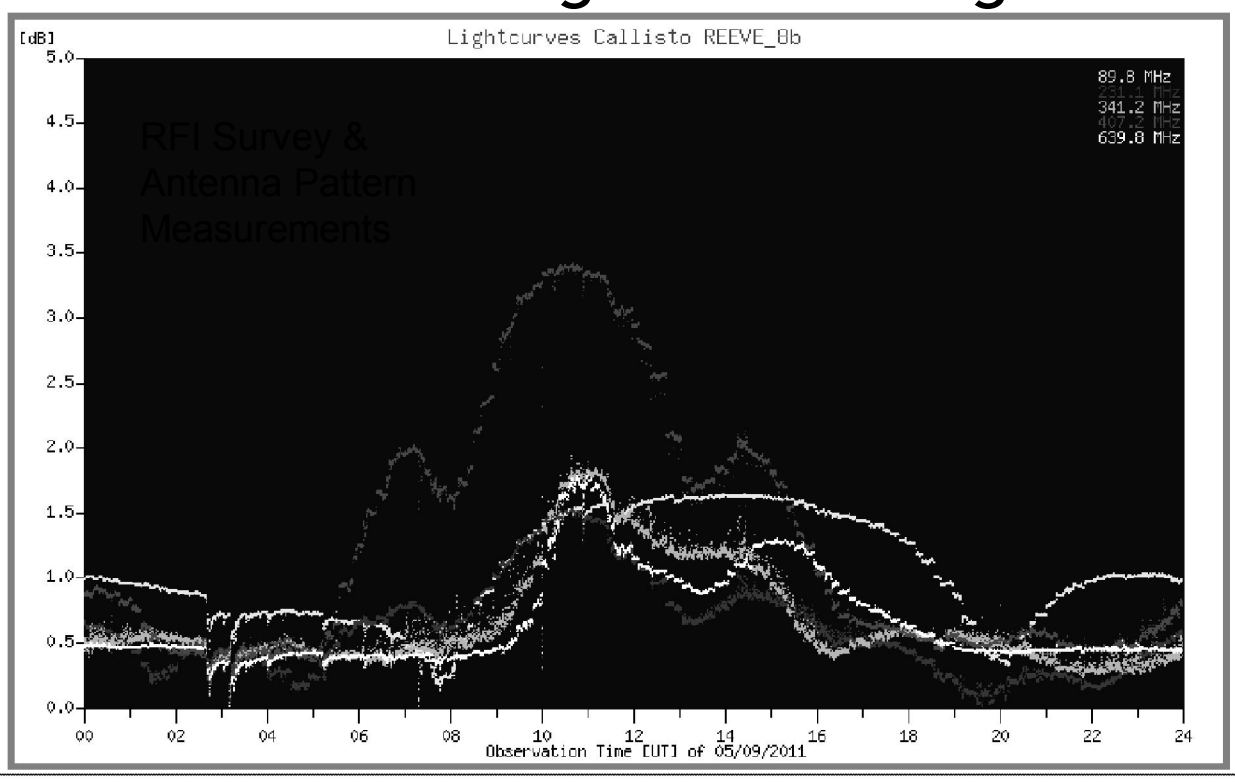
e-CALLISTO Software Tools

- WWW Genie ~ Lightcurve image



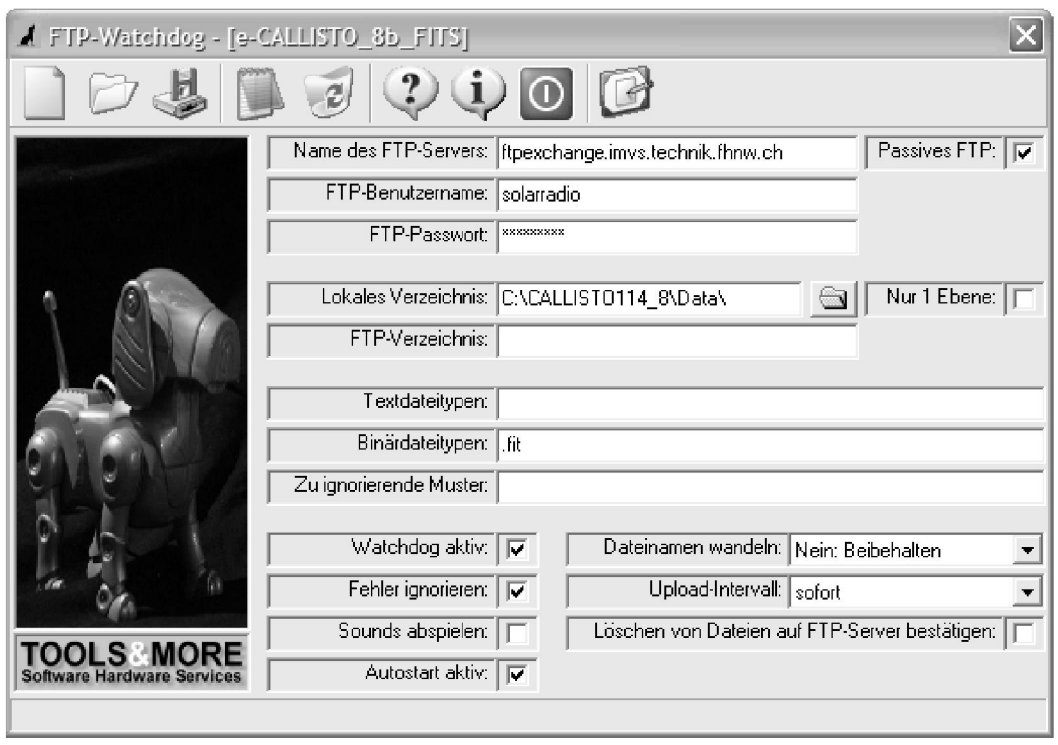
e-CALLISTO Software Tools

- WWW Genie ~ Lightcurve image



e-CALLISTO Software Tools

- FTP-WatchDog



e-CALLISTO Software Tools

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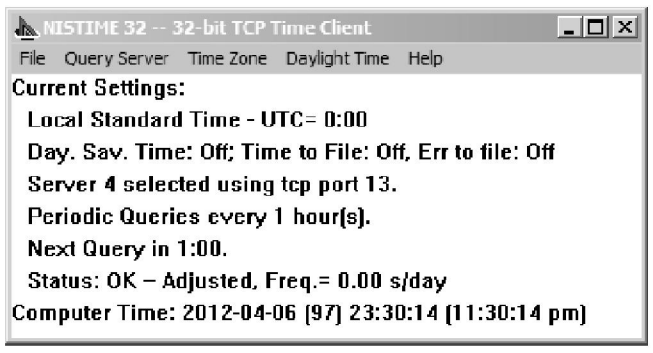
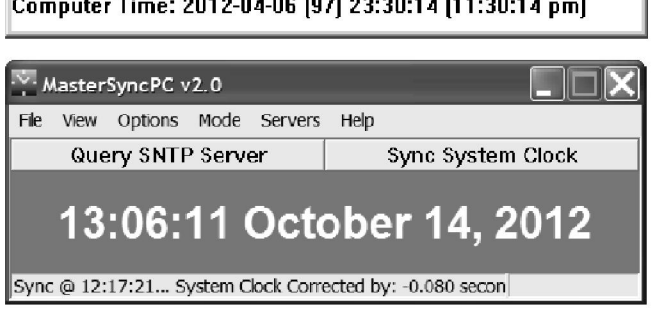
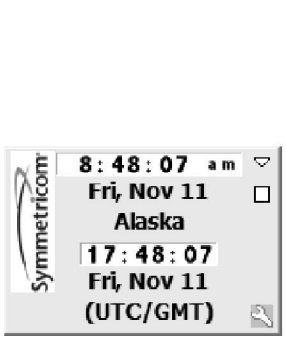


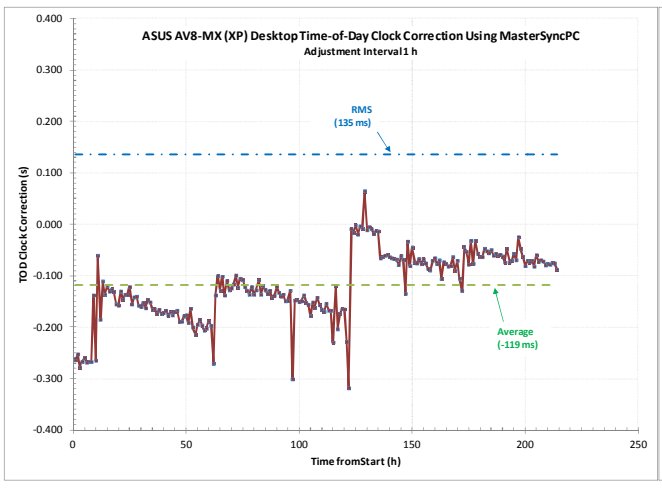




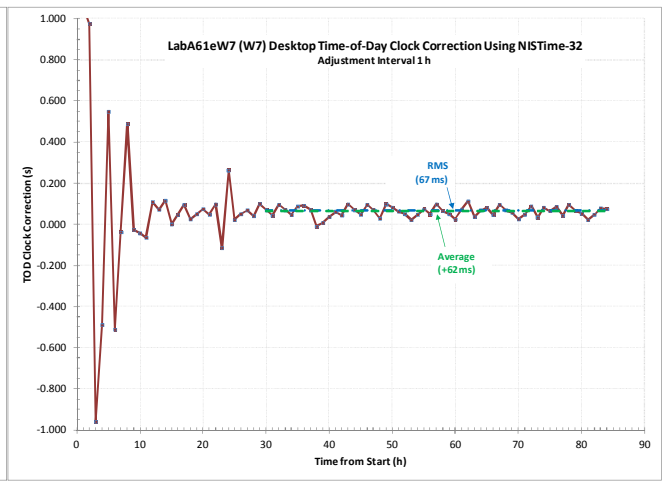
e-CALLISTO Software Tools

- Time-Keeping Applications
  - ☼ PC Time-of-Day clock corrections over time (~4 days)

MasterSync

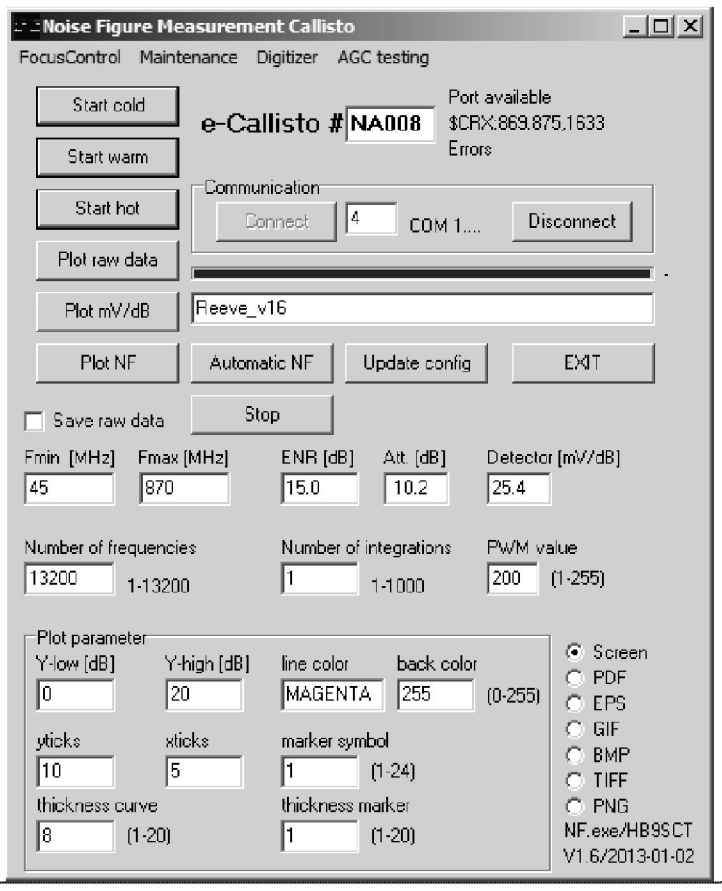


NISTime32



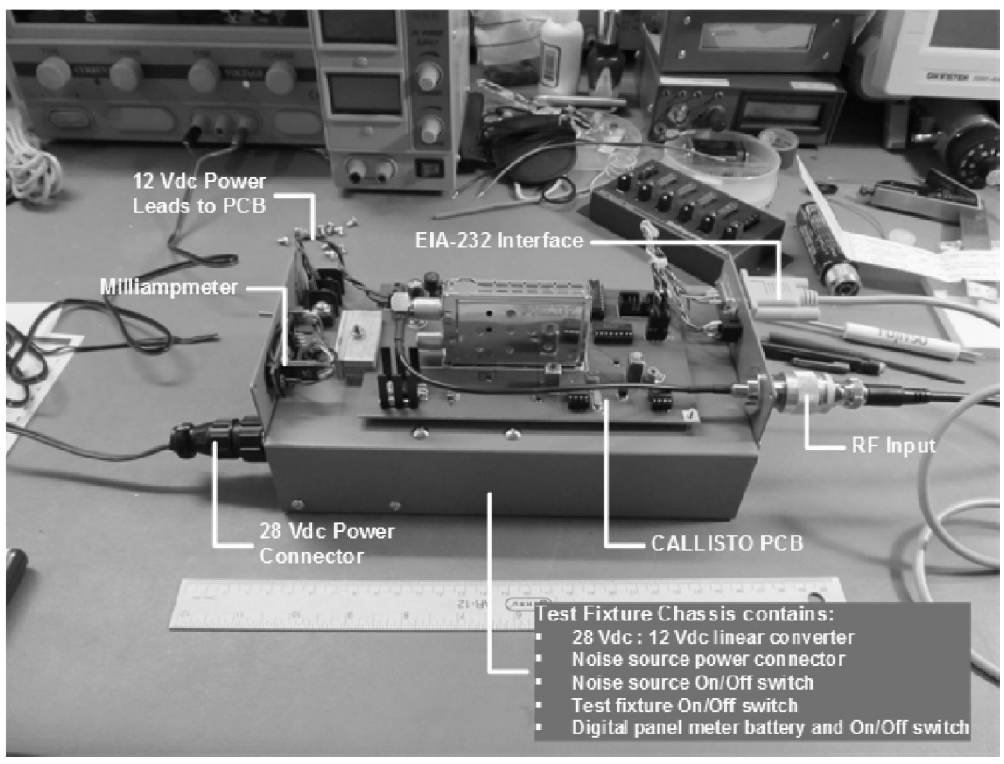
e-CALLISTO Software Tools

- Receiver Test Tool
  - Alignment aid
  - Gain control test
  - Focus Control test
  - Noise figure measurements



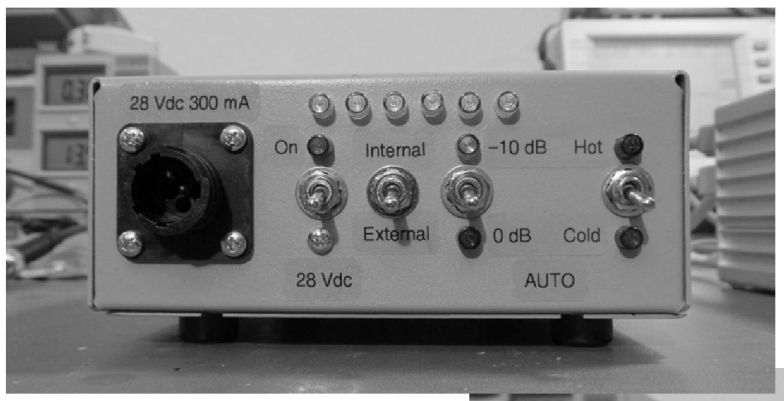
e-CALLISTO Software Tools

- Test & Measurement ~ PCB Test Fixture

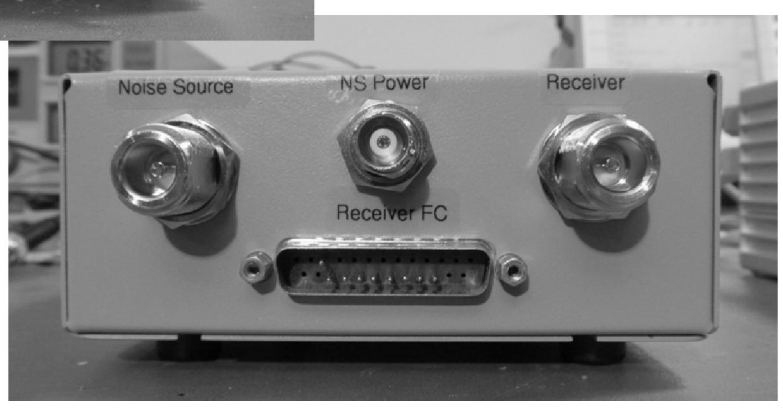


e-CALLISTO Software Tools

- Test & Measurement ~ Receiver Test Fixture



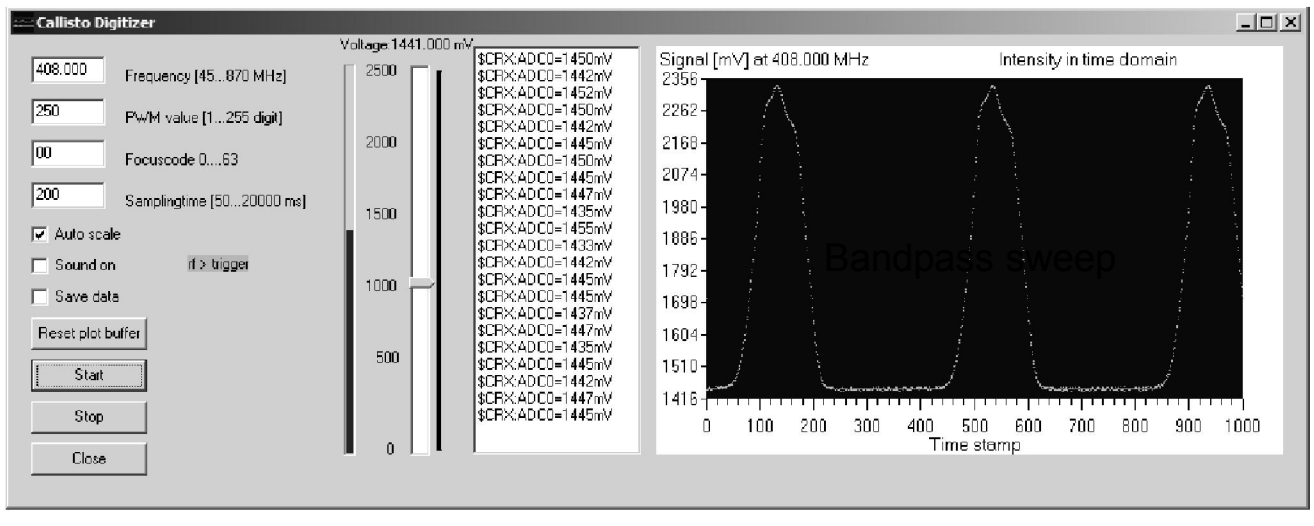
Front



Rear

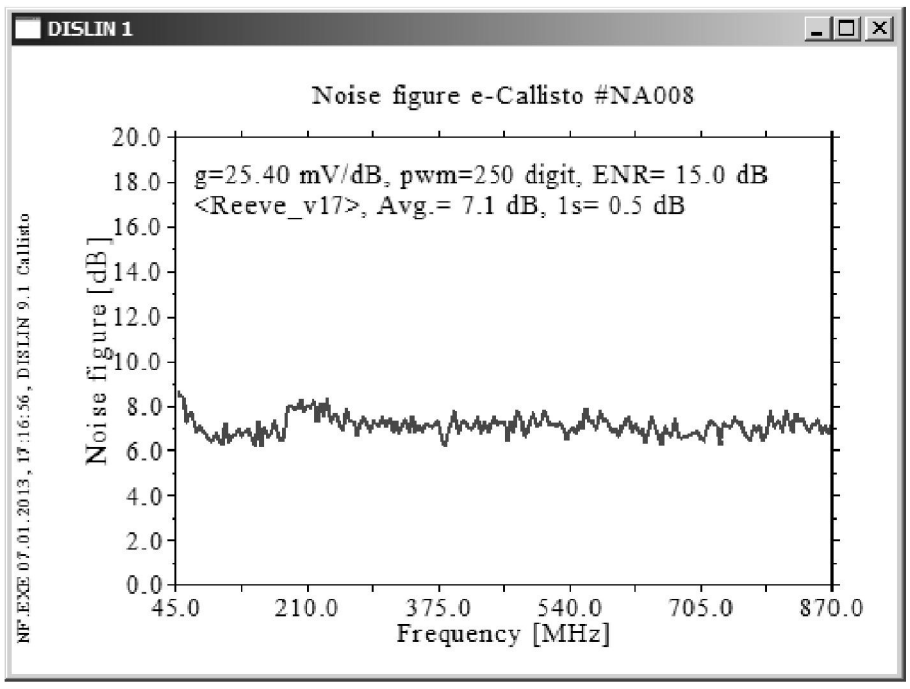
e-CALLISTO Software Tools

- Receiver Test & Measurement
  - Digitizer – Alignment aid
    - For 2nd IF Transformers in receiver
    - Uses receiver background noise or external source



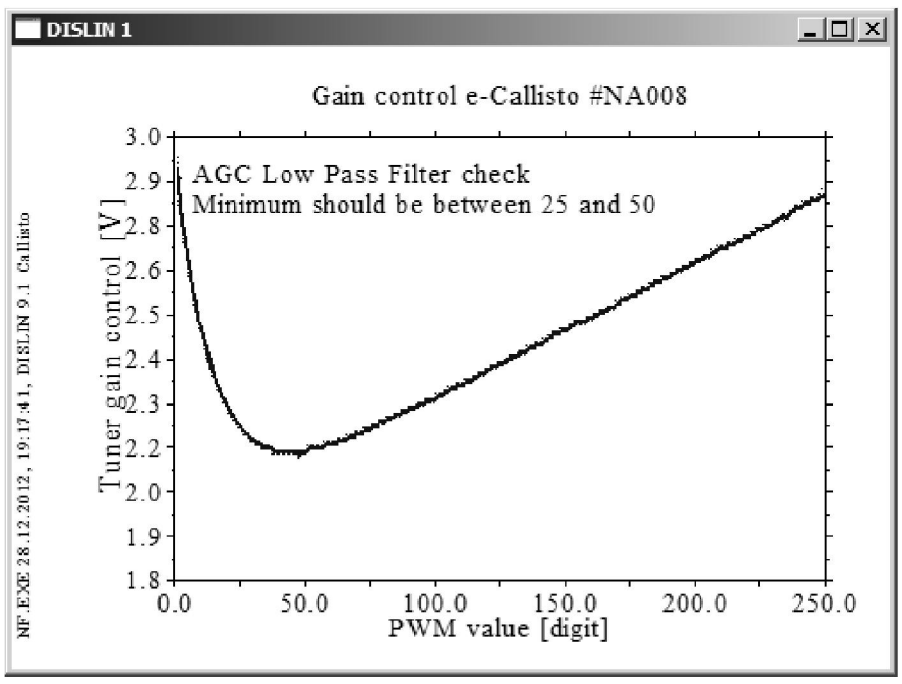
e-CALLISTO Software Tools

- Receiver Test & Measurement
  - Noise figure measurements



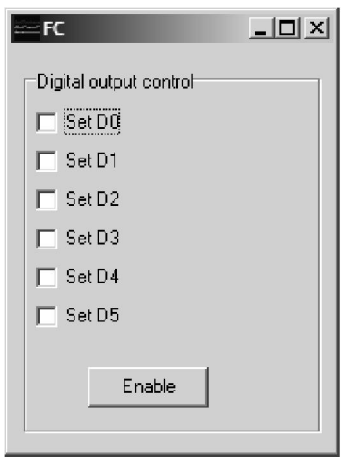
e-CALLISTO Software Tools

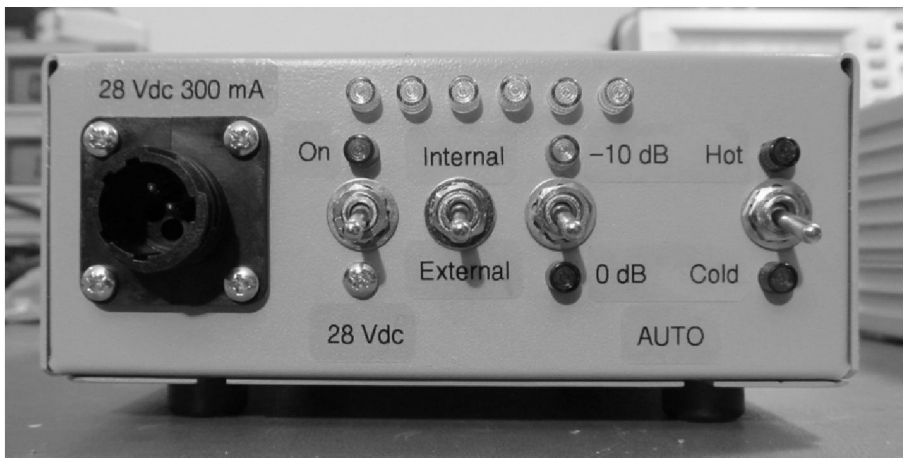
- Receiver Test & Measurement
  - Gain control tests



e-CALLISTO Software Tools

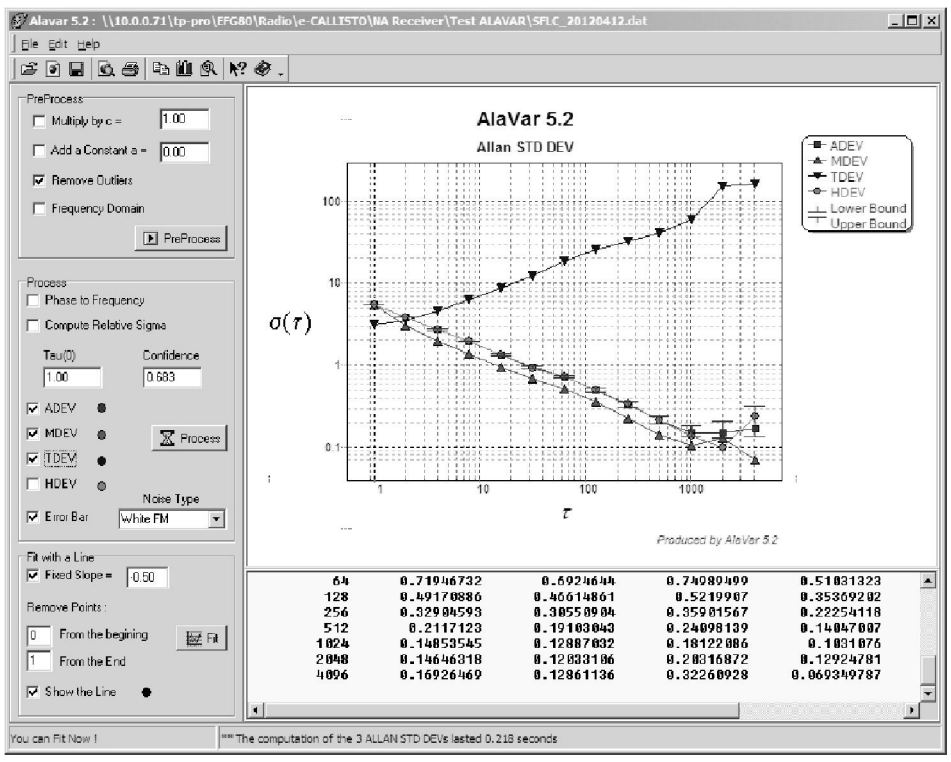
- Receiver Test & Measurement
  - Focal Plane Unit Control test





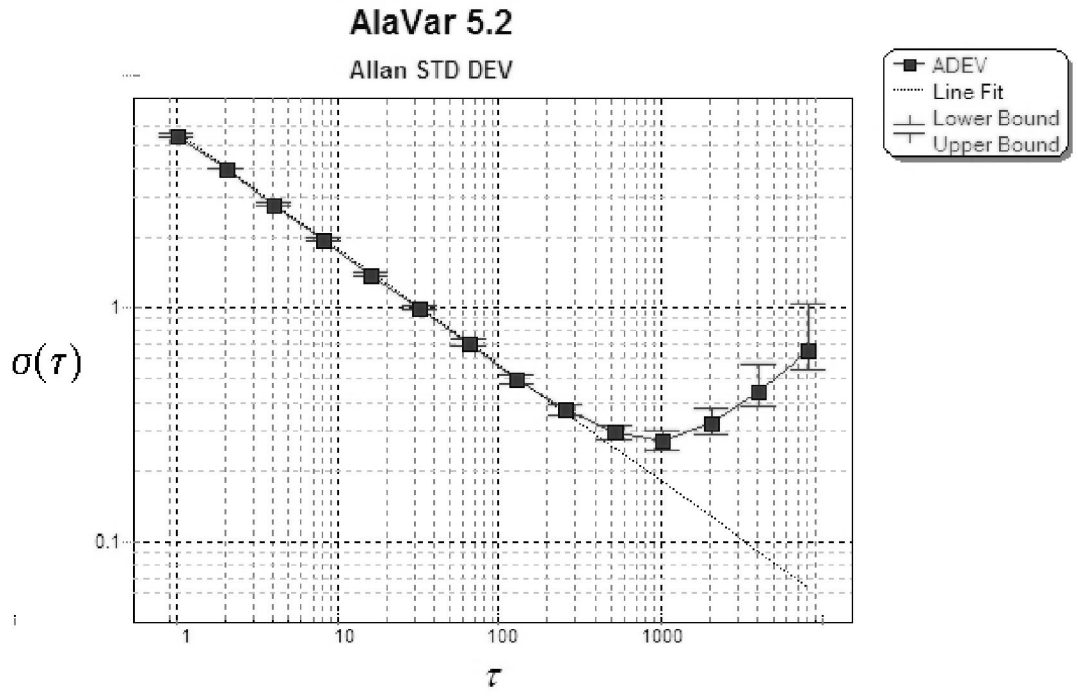
e-CALLISTO Software Tools

- Receiver Stability Analysis – AlaVar
- Allan Variance of a time series
- Connect 50 ohm term. to Receiver



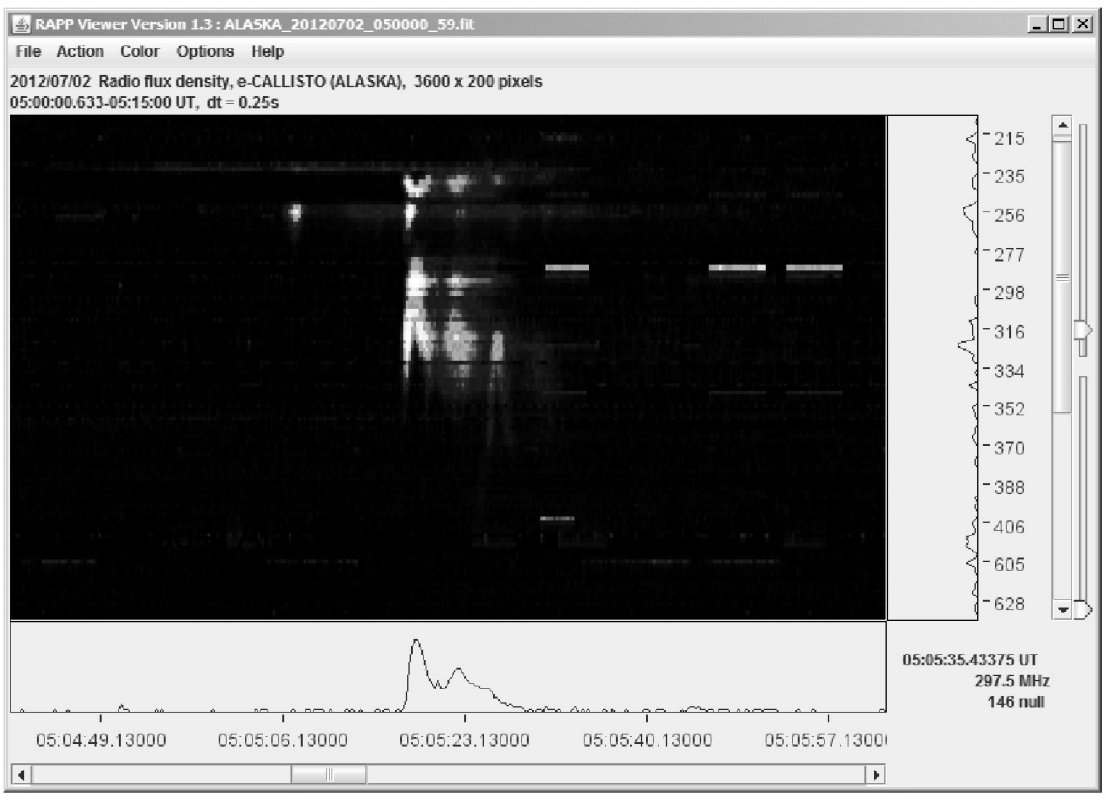
e-CALLISTO Software Tools

- Typical Results for e-CALLISTO Receiver



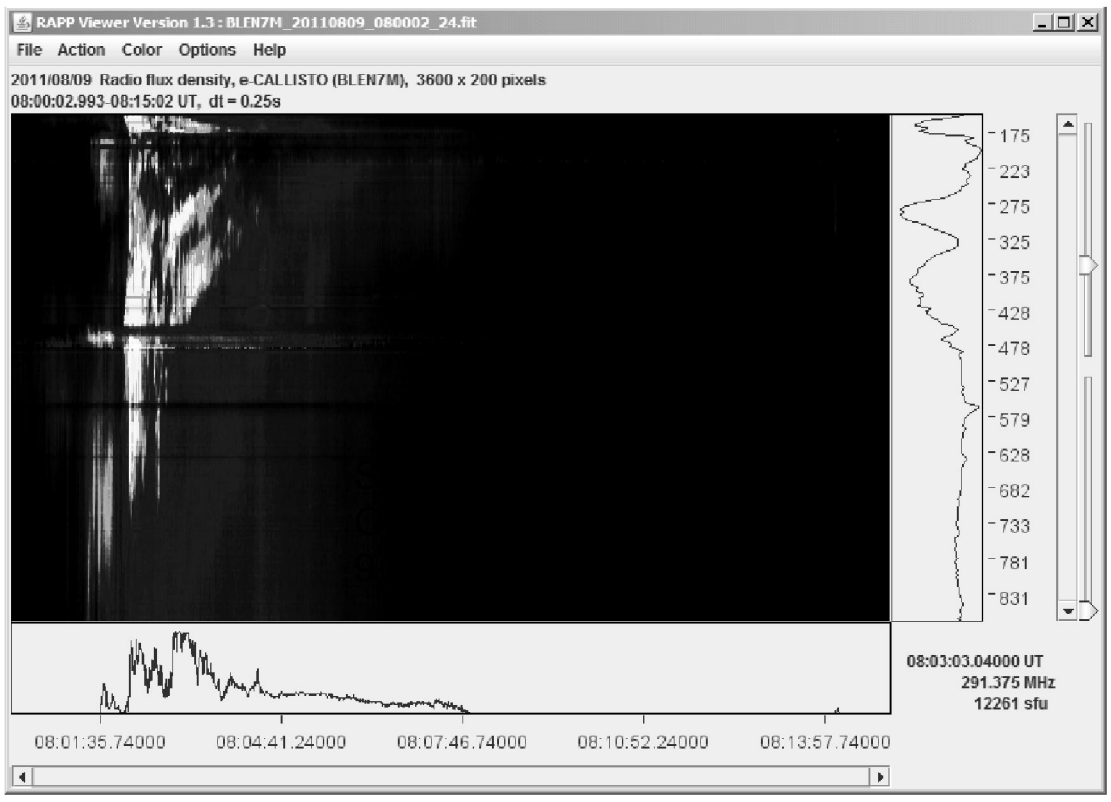
e-CALLISTO Software Tools

- Java FITS Viewer
- Quick and easy to use



e-CALLISTO Software Tools

- Java FITS Viewer
- Data under mouse cursor



e-CALLISTO Software Tools

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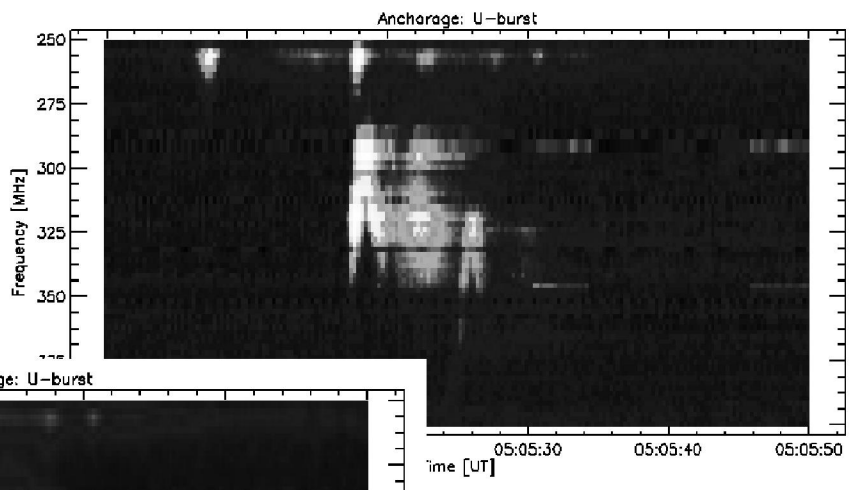
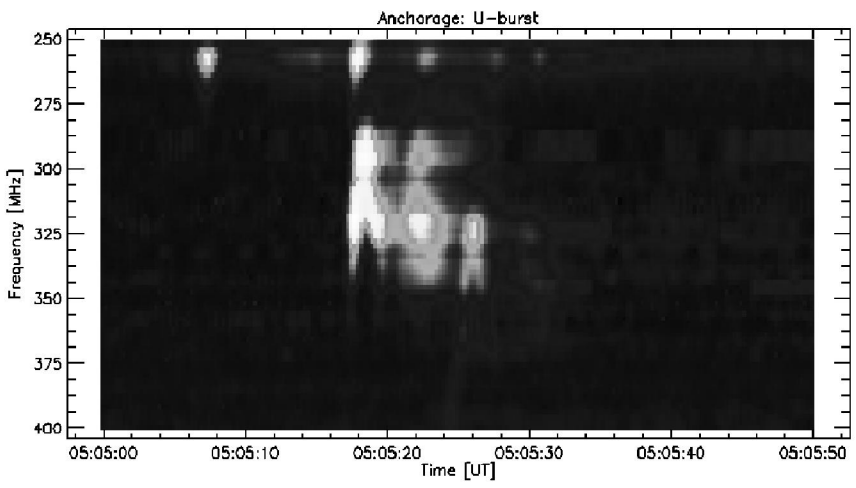
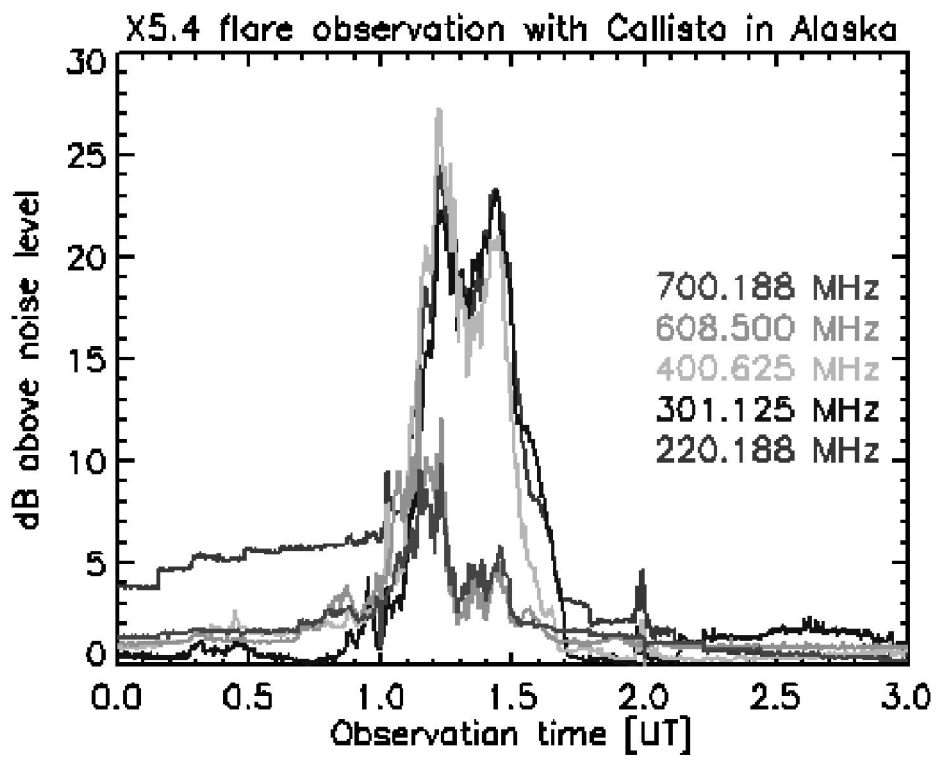




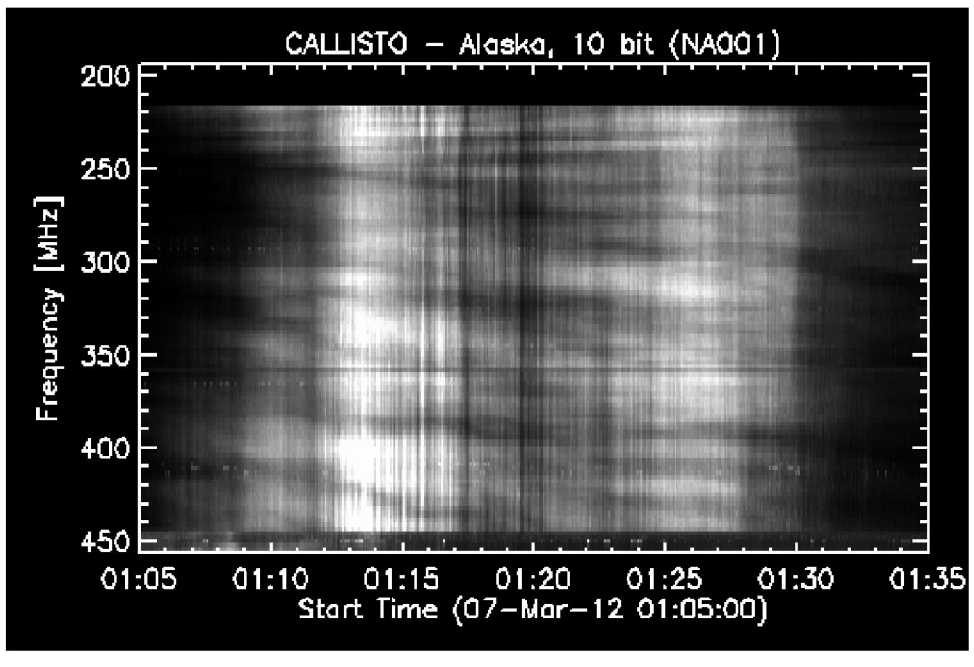
e-CALLISTO Software Tools

- Interactive Data Language IDL
- SolarSoft library



e-CALLISTO Software Tools

- Interactive Data Language – IDL
  - ☼ Much better control over plot details



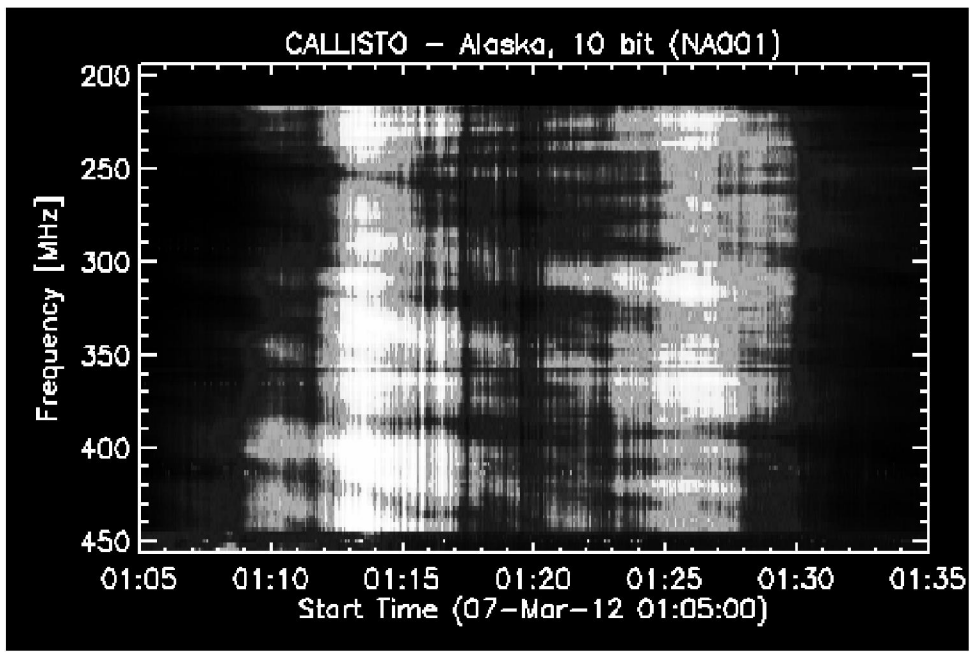
Span multiple time periods

This example spans three 15 minute periods

Black-White color table

e-CALLISTO Software Tools

- Interactive Data Language – IDL

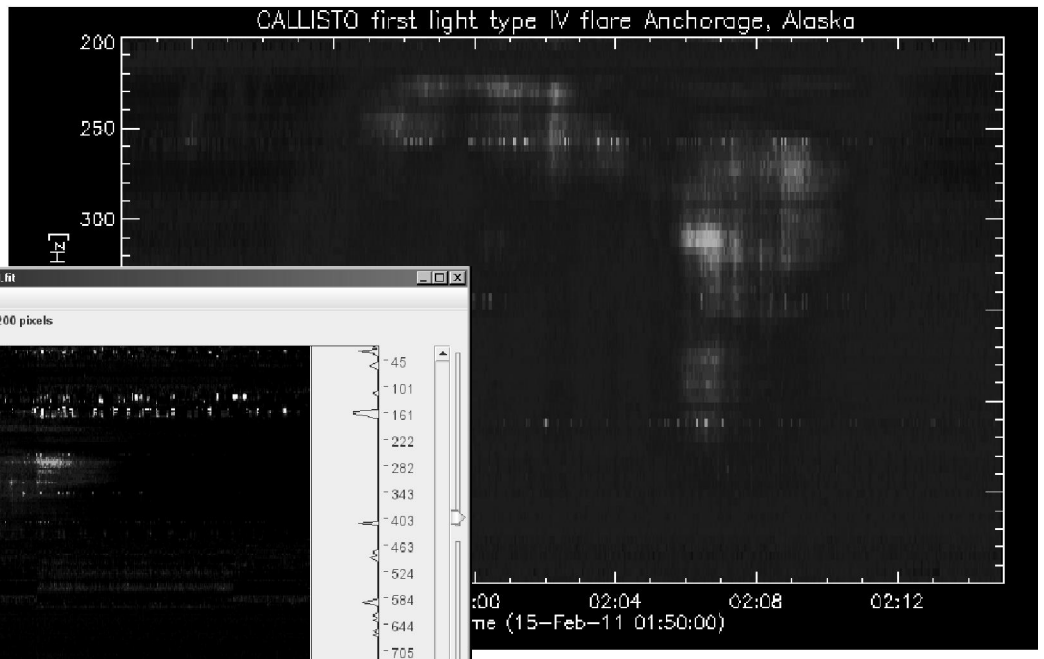


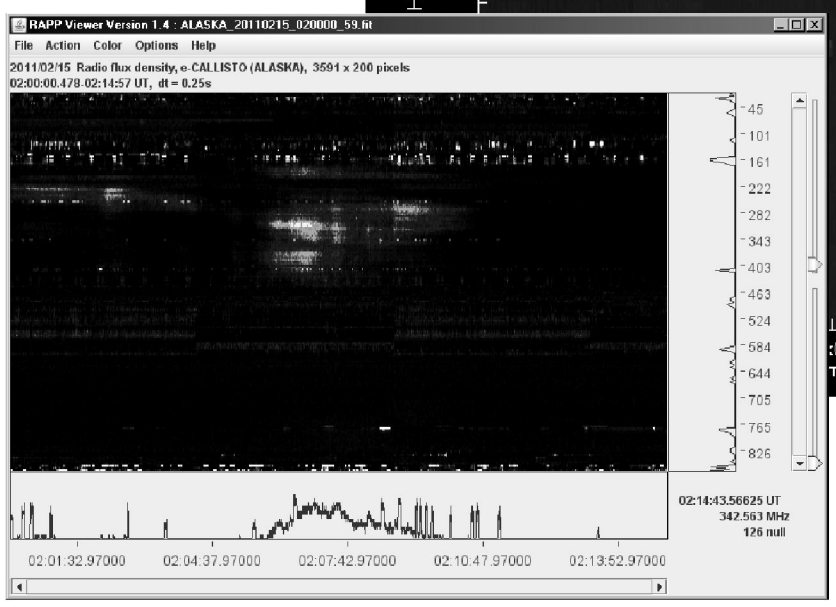
Same event as previous

This example uses the STD-GAMMA-II color table

e-CALLISTO Software Tools

X2.2 Flare → on 15 February 2011 resulted in Type IV emission





← FIRST LIGHT ~
Flare occurred less than 24 hours after commissioning the CALLISTO Receiver

Conclusions

- e-CALLISTO consists of
  - Worldwide network of CALLISTO Receivers, antenna systems and data collection PCs
- Software tools aid receiver construction and operation
- CALLISTO Receiver available in kit form, partially-built or ready-built versions