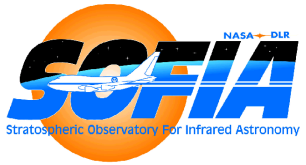


HAWC Software

Instrument Control & Data Processing Subsystems

Ian Gatley (RIT)

HAWC Software Subsystems

- Overarching design considerations:
  - Compatibility with DCS design (e.g., XML-based instrument & pipeline control)
  - Modular components
  - Reliance on widely available, proven, well supported software technologies (e.g., XML, Java, etc.)
  - Continuous improvement of design via rapid prototyping
- Verification plans:
  - Development of high-fidelity instrument simulator to test instrument control & processing pipeline algorithms
  - Regular internal design & code reviews by HAWC software engineers & developers
  - Regular testing by HAWC hardware engineers & scientists

Design Approach

- Well-defined hardware/software interface
  - Dynamic instrument configuration & control
  - GUI-based
  - Data visualization uses GSFC *VisAGE* package
  - Detailed description of state of instrument via markup language (e.g. XML)
  - Platform-independent instrument control & monitoring, facilitating remote usage
- Full compatibility with DCS design

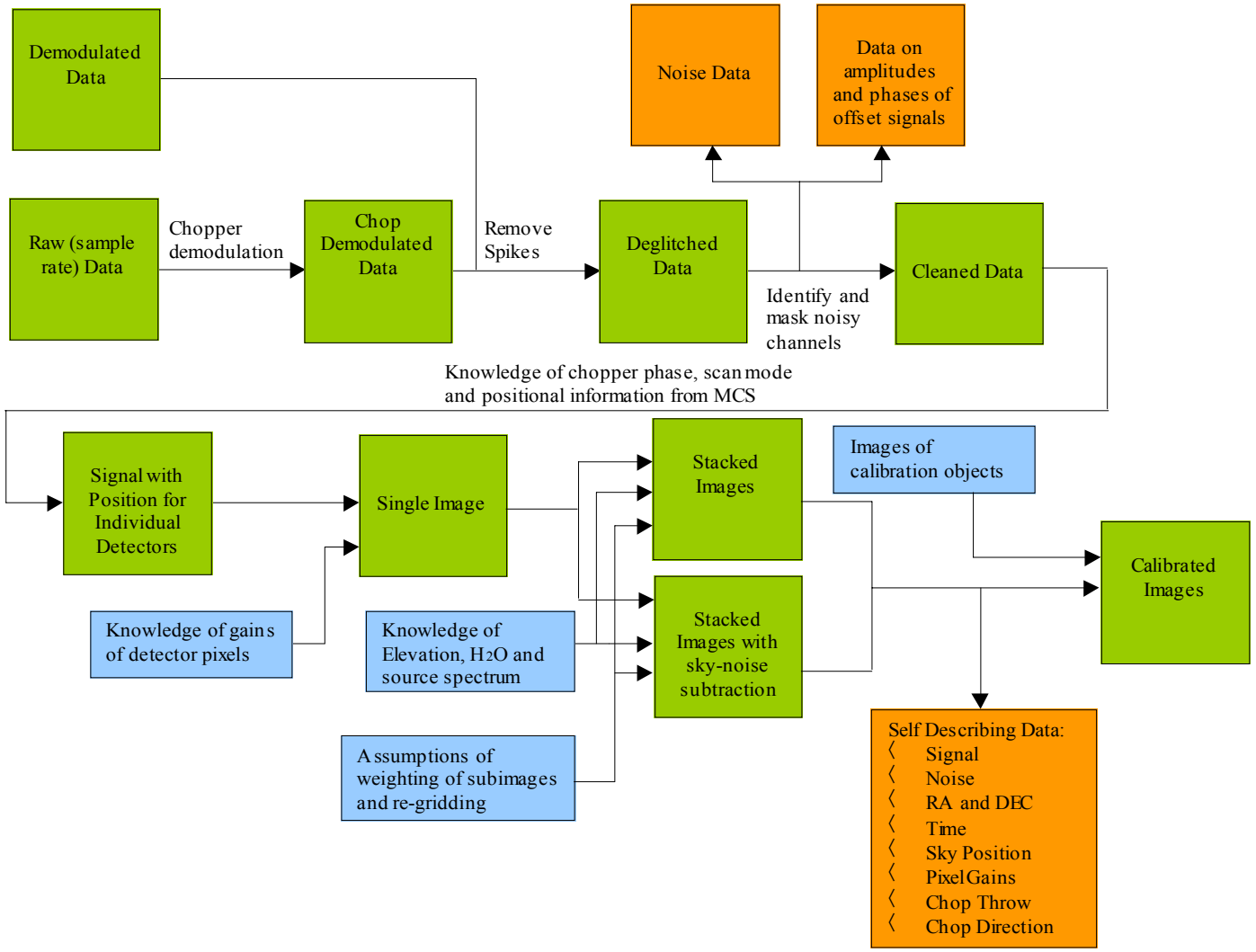
Instrument Control Subsystem: Functional Requirements

- Accept hardware data stream
- GUI-based instrument control
- Monitor system health
- Interface to MCS (e.g., command telescope subsystem)
- Quick-look data processing and visualization

Data Processing Subsystem: Functional Requirements

- Generate *elemental difference images* (chop-rate image data) from demodulated sample-rate (ADC rate) data
- Process individual elemental difference images to assess noise and remove detector artifacts
- Co-add *high-quality* elemental difference images to produce stacked image
- Combine dithered image series
- Calibrate final, combined image intensities & establish image coordinate system
- Merge/correlate image data with contemporaneous ancillary (HK, telescope, observatory) data
- Produce archive-quality products at each major processing step
- Provide quick-look data visualization and manipulation tools

HAWC Data Processing Subsystem: Data Flow



Elemental Difference Images: Processing Steps

- Demodulate sample-rate data
- De-glitch images
- Mask & remove bad pixels
- Characterize & mitigate correlated image noise
- Archive product (demodulated, deglitched, cleaned difference image)

Combined Difference Images: Processing Steps

- Flag low-quality elemental difference images
- Co-add high-quality elemental difference images
- Combine dithered images using TBD interpolation scheme
- Establish image coordinate system
- Flux calibrate, if appropriate
- Archive product (regridded, combined, final dithered image)

HAWC Data Products

** = archived product (TBR)*

- ADC sample-rate pixel (telemetry) stream*
- demodulated, “raw” elemental difference images
- cleaned, deglitched elemental difference images*
- coadded elemental difference images
- merged, “final” dithered image w/ coordinate system attached*
- image calibration files (and other ancillary data files)*
  - bad pixel & glitch mask
  - image noise characterization
  - flat field
  - telescope pointing history
  - global HK data (HAWC, telescope, observatory)