



BIAS Team

Solar Orbiter / RPW

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ROC/BIAS Management

- Andris Vaivads (IRF) – Lead Co-I (overall responsibility)
- Erik Johansson (IRF) – Lead software engineer
- Yuri Khotyaintsev (IRF) – Lead archiving scientist

SUPPORT:

- Daniel Graham (IRF) – Consultant, AC calibration
 - Anders Eriksson (IRF) – Consultant, DC calibration
 - Thomas Nilsson (IRF) – SPIS simulations
 - Thomas Karlsson (KTH) – KTH coordination
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- Footnote: Lennart Åhlén (IRF) – Hardware engineer (BIAS design, testing) – Retired in ~April 2017



BIAS Calibrations Software (BICAS)

- Software version control (internal): git
- Implementation:
 - MATLAB 2016a (+ NASA CDF patch)
 - Internally uses official datasets (CDFs) plus "internal datasets", all related through a web of modular one-way dependencies. Output datasets are derived recursively, indirectly from the input datasets. Design should make the dataset processing flexible w.r.t. e.g. multiple dataset versions and changing dataset relationships.
- Intended to be extended to be used on both pipelines: ROC-SGSE (ground calibration ; current design), and RODP (mission)



Current status, issues

- There is a submitted RCS User Manual (RUM) draft
- There is no Software Requirements Specification (SRS)
- ~ICD compliant (not latest ICD; if ignoring CDF contents).
- Does read, process, and produce subset of datasets. Supported output CDFs “decent”.
 - Handles LFR WF datasets; incomplete implementation for TDS-LFM WF.
 - Simplistic calibration: multiplication (no transfer functions, no offsets)
 - Processes dataset levels according to old scheme L2R → L2S (not L1R→L2S)
 - No sweeps and bias currents (awaiting design decisions with ROC; only RODP pipeline anyway)
- No official BIAS calibration table skeleton yet: non-trivial
- (+Partial internal tool for exploring/working with BIAS standalone calibration data.)



BIAS Datasets

- **BICAS input datasets:**
 - Can read – All LFR, V01/V02
 - ROC-SGSE_L2R_RPW-LFR-SBM1-CWF
 - ROC-SGSE_L2R_RPW-LFR-SBM2-CWF
 - ROC-SGSE_L2R_RPW-LFR-SURV-CWF
 - ROC-SGSE_L2R_RPW-LFR-SURV-SWF
 - ROC-SGSE_HK_RPW-BIA
 - Can read (processing incomplete)
 - ROC-SGSE_L2R_RPW-TDS-LFM-RSWF
 - ROC-SGSE_L2R_RPW-TDS-LFM-CWF
 - Will also eventually need to read more datasets (RODP pipeline). Awaiting design decisions.
 - SOLO_L1_RPW-BIA-SWEEP (Sweeps)
 - Bias currents
- **BICAS output datasets:**
 - Can output; skeletons are well defined (V02)
 - ROC-SGSE_L2S_RPW-LFR-SBM1-CWF-E
 - ROC-SGSE_L2S_RPW-LFR-SBM2-CWF-E
 - ROC-SGSE_L2S_RPW-LFR-SURV-CWF-E
 - ROC-SGSE_L2S_RPW-LFR-SURV-SWF-E
 - Partially implemented; Skeletons are well defined
 - ROC-SGSE_L2S_RPW-TDS-LFM-RSWF-E
 - ROC-SGSE_L2S_RPW-TDS-LFM-CWF-E
 - Will also eventually need to read more datasets (RODP pipeline). Awaiting design decisions.
 - Sweeps
 - (Preliminary L3 datasets (no L4); no impl.)
 - E x B drift
 - True satellite potential
 - 3D electric field ($E \cdot B = 0$)



Past confusion on BIAS standalone calibration (1/2)

There has been some confusion and misunderstanding on:

- which of two BIAS standalone calibration data (which test) to actually use
- which h/w was actually used for the same two BIAS standalone calibrations

This should now be resolved.



Past confusion on BIAS standalone calibration (2/2)

Conclusions: There are **two** relevant BIAS standalone calibration tests, but **none** with only flight-h/w:

- **Test performed 2016-06-21 to 22**
 - Hardware:
 - Non-flight BIAS board (FS0)
 - **Flight harness**
 - **Flight preamps**
 - One ("MEB") temperature
 - Already archived at ROC?
 - **Should be used for:** Transfer functions (frequency response), absolute DC offset (+gain). /L.Åhlén
- **Test performed 2016-07-23 to 24**
 - Hardware:
 - **Flight BIAS board (PFM)**
 - IRFU's "flight-like" harness
 - IRFU's "flight-like" preamps
 - Multiple ("MEB") temperatures
 - Should also be archived at ROC?
 - **Should be used for:** DC offset (+gain) *temperature dependence* (not absolute values) /L.Åhlén

Flight = Physical h/w that is planned to actually fly; not just identical design.



Some BIAS questions (mostly for XB)

- BIAS calibration tables
 - Difference ROC-SGSE & RODP calibration tables? Not the same?
 - ~Convention for how to encode transfer functions (frequency response) in official calibration tables?
 - No complex numbers in CDFs? Real+imaginary part (TDS)? Abs.value+phase? (dB+phase ?!!)
 - Interpolate transfer functions for arbitrary resistance? How?
 - ~DECIDED: Calibration table contains time series of calibration data (timestamped). Handles changes in resistance/stimuli & temperature, results of in-flight internal calibrations(?)
 - ~DECIDED: Store transfer functions as fits/coefficients.
 - ~DECIDED: Somehow interpolate to produce calibration data for current resistance/stimuli (in calibration table?)
 - Note: For every point in time there is at least: 3 DC single offsets + 3 DC diff offsets + 4 transfer functions (+3 PA/bias offset+gain?)
 - Note: Transfer functions need to be read by others: LFR (more?)
- ~Plan for the "odd" BIAS RCS input data?
 - RCS input for sweep data, incl. sweep bias currents.
 - RCS input for fix-bias current data to combine with WF data (*not* sweeps)
 - Difference ROC-SGSE and RODP pipelines for above data?



Some BIAS questions (mostly for XB)

- Add gattrs. "CALIBRATION_TABLE", "CALIBRATION_VERSION" to BIAS L2 datasets too?
- (XB should be waiting for BIAS L2 dataset quicklooks (ROCDATPRO-31).)