solid state detector (SSD) measurement, the TOF < 20 ns data were judged not to be the main TOF-Only product, so they were put in a different priority group so their relatively high count rate wouldn't suppress the more desirable TOF > 20 ns events. Additionally, the N3 PHA data uses a different priority scheme than the N2 PHA data (this may be changed in a future software update, but that hasn't happened as of June, 2016). In the N3 PHA the TOF < 20 ns priority group is only rarely (if ever) the top priority group, but there could be TOF < 20 ns from the rare triple coincidence data or in the TOF-Only data from the rare period when a very low probability event happens to be detected and not overwritten by the priority scheme. In the N2 PHA data the priority groups have rotating priority so that all data groups get representation; not so with the N3 data. Thus there are PHA events both above and below 20 ns in the N2 data, but almost no PHA events below 20 ns in the N3 data.

Values outside stated sensitivity limits

The PHA event data are 'raw' values and some subset of them are noise or other instrumental artifacts, so PHA events with parameters outside the stated instrument sensitivity limits (see SPECIFICATION above) should be ignored, or, at the very least, used with extreme caution.

Bad Time Intervals (BTIs)

Various instrument conditions can make the PEPSSI data difficult or impossible to use for scientific purposes. Powering down, ramping the high voltage power up or down, running in diagnostic mode, etc. will all make the PEPSSI data unusable for standard analysis. The PEPSSI_BTI.TAB file contains a table of 'Bad Time Intervals' which should not be used for science analysis. It should be noted that the entire 'Launch' phase of PEPSSI data is classified as a BTI. While not actually a BTI, the period between 2007 day 144 and day 178 should be treated with caution as well. The PEPSSI Rate Box tables were changed on day 144 and calibration and analysis of this period is still preliminary.

See the SOC Instrument ICD, originally archived with this volume, and McNutt et al. (2008) [MCNUTTETAL2008A] for details.

Measured Parameters

Particle energy information, measured by the SSD, is combined with TOF information to identify the particle's composition. Each particle's direction is determined by the particular 25 degrees sector in which it is detected. Event classification electronics determine incident mass and energy, with 12 channels of energy resolution.

A typical measurement includes 8-point spectra for protons and electrons and reduced resolution energy spectra for heavier ions for all six look

directions.

In calibration, the rate, in counts/s, of each energy and/or TOF bin is converted to flux i.e. differential intensity (1/cm**2-sr-s-keV).

Calibration

The calibration parameters are ideally be determined through a combination of all of the following: ground measurements; analysis of the in-flight calibration alpha-particle source; modeling; intercalibration with known measurements. Currently only the final method has been employed, which has the obvious drawback of not providing an independent determination of the absolute flux. Therefore the fluxes provided in CODMAC Level 3 data should not be used as is to conduct science that is relying on absolute fluxes for scientific interpretation unless the user determines the fluxes independently.

Brief summaries of the flux and PHA calibrations are given here. See McNutt et al. (2008) [MCNUTTETAL2008A] and the SOC Instrument Interface Control Document (distributed with this archive) for details.

Flux Calibration

The calibration quantities are energy pass-band (dE = Ehi - Elo, lower and upper limit of the energies of the particles measured), measurement efficiency (N, the fraction of valid incident particles that are actually measured), the geometry factor (G, the measurement of the physical detector size and solid angle subtended by the field of view). These values are all given and applied with uncertainties in the CODMAC Level 3 files.

The differential intensity, j (1/cm**2-sr-s-keV), is calculated in terms of the counts C, time coverage T (s), geometric factor G (cm**2-sr), upper and lower energy bounds Ehi and Elo (keV), and detection efficiency N:

$$j = (C/T)/(G * dE * N),$$

where dE = Ehi - Elo.

The uncertainty values assume Poisson statistics for C, no error in T, absolute errors in G, Ehi, Elo and relative error in N. I.e., formally the counts are C = C +/- deltaC, the energies are E = E +/- deltaE, the geometry factor is G = G +/- deltaG. The efficiency is N = [N * epsilon or N / epsilon], where epsilon = deltaN/N, to one sigma confidence.

In this initial delivery of the PEPSSI data from the Launch and Jupiter phases of the New Horizons mission these values are supplied to convert the instrument specific data (e.g., count rates) into physical instrument-independent units (e.g., differential intensity), as well as computing the physical quantities themselves. It must be stressed that these are preliminary values that should not be used without significant effort from the user to understand their limitations (see the SOC Instrument ICD, provided with this archive, and McNutt et

al. (2008) [MCNUTTETAL2008A] for a description of the method used to calculate differential intensity, also called flux).

PHA Event Calibration

The following quantities are provided in the calibrated data products. The linear calibration constants are in the data labels; see the SOC Instrument ICD and McNutt et al. (2008) [MCNUTTETAL2008A] for details.

* Calibrated Deposited Energy and/or TOF values

* Speed column from the TOF assuming a 6.0cm flight path.

* The PHA_HIGH_ION calibrated data contain additional quantities, where each value indicates the Incident energy assuming that the event is of that (H, He, O, or S) species:
  - H_Incident_Energy
  - He_Incident_Energy
  - O_Incident_Energy
  - S_Incident_Energy

Events with the multi-hit (cross talk) flag set have been excluded. Quantities of limited usefulness (such as Heavy Ion Discriminator triggers) have been excluded. Because of the difficulty of removing priority scheme biases from non-N2 PHA data, only N2 (APID == 0x692) PHA data is present in the calibrated PHA data.

The Rate_Normalized_Weight quantities have had Priority Group artifacts removed from the PHA data by the procedure described in the SOC Instrument ICD. This column is usually used in making histograms of the High Energy Ion PHA data.

Filters, Optics, Locations, Subsystems
==========

N/A

"

END_OBJECT = INSTRUMENT_INFORMATION

OBJECT = INSTRUMENT_REFERENCE_INFO
REFERENCE_KEY_ID = "MCNUTTETAL2008A"
END_OBJECT = INSTRUMENT_REFERENCE_INFO

OBJECT = INSTRUMENT_REFERENCE_INFO
REFERENCE_KEY_ID = "MCNUTTETAL1996"
END_OBJECT = INSTRUMENT_REFERENCE_INFO

OBJECT = INSTRUMENT_REFERENCE_INFO
REFERENCE_KEY_ID = "ANDREWSETAL1998"
END_OBJECT = INSTRUMENT_REFERENCE_INFO

END_OBJECT = INSTRUMENT