

Parker Solar Probe SWEAP-SPC

Data Release Notes

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Release 10: DCP-9b, DCP-10a (orbit 10), levels 2 and 3

April 24, 2022

Overview of Measurements

This release comprises all SPC level 2 and level 3 ion measurements from encounter 10, including the time range from November 12, 2021 through January 24, 2022. As in prior releases, these data have been processed with [version 02](#) of the SPC data analysis pipeline.

Two significant data gaps

Users are advised of the following interruptions in SPC operations.

Table upload error (2021-10-27T04:18Z to 2021-11-05T11:08Z)

An interruption in SPC operations occurred following the instrument turn-off on 2021-10-27 at 04:18 UT. During the commanding period that followed, an erroneous SPAN control table was uploaded that overwrote a portion of the SPC control table. This resulted in invalid (pure noise) measurements by SPC, which are not recoverable, until the table was corrected and normal operation was resumed at 2021-11-05 at 11:08 UT.

SPC over-limit HV current draw (2021-11-18 to 2022-01-27)

Early on 2021-11-18, a safety limit was exceeded while SPC was executing flux angle mode observations in a high-speed solar wind stream. SPC turned off at that time and remained off for the remainder of the encounter. Should this problem recur in future orbits, operations have been modified to periodically attempt restart after a safe amount of time has elapsed.

SPC Encounter 10 remarks

Continued partial loss of non-radial flow measurements

Two segments of the SPC sensor (segments A and D) that govern the measurement of the north-south flow angle were conductively coupled for most of orbit 10, including the entire interplanetary cruise between encounters 9 and 10. As a result, all measurements of the Y_{sc} flow component (usually corresponding to the N_{RTN} component) are set to "fill."

Release 9: DCP-9a, DCP-9b (orbit 9), levels 2 and 3

February 07, 2022

Overview of Measurements

This release comprises all SPC level 2 and level 3 ion measurements from encounter 8, including the time range from July 26, 2021 through November 11, 2021. As in prior releases, these data have been processed with [version 02](#) of the SPC data analysis pipeline.

Modification to cruise operations

Beginning on 2021-09-15, the SPC instrument is run continuously in FULL SCAN mode throughout the cruise phase of the orbit. This mode allows for a modest improvement in signal-to-noise and ensures complete capture of the proton distribution during low-signal conditions. PEAK TRACKING mode will continue to be used in encounters only. During periods where peak tracking mode is suspended, the full scan flag (DQF array element 16) is excluded from the OR sum that determines the GENERAL_FLAG.

SPC Encounter 9 remarks

Once again, several significant events should be noted by data users, all of which are identified in the data quality flag variables and annotated in the [SPC Reduced Data Quality Periods table](#).

Solar wind out of SPC field of view near perihelion

The orbital velocity of Parker Solar Probe is now such that the [primarily radial] flow of the solar wind is strongly aberrated in the spacecraft frame near perihelion, particularly from 2021/08/09 to 2021/08/11. This is a normal condition that the complementary fields of view of the SPC and SPAN-Ai instruments are designed to accommodate. The data sets described here, however, include SPC data only. Please consult the data quality flag (DQF) variable, which marks periods where the solar wind flow is out of the SPC field of view.

Partial loss [and partial correction] of non-radial flow measurements

The segments of the SPC sensor that govern the measurement of the north-south flow angle were conductively coupled for most of Encounter 9. As a result, all measurements of the Y_{sc} flow component (usually corresponding to the N_{RTN} component) are set to "fill."

The segments of the SPC sensor that govern east-west flow angle measurement were partially coupled (at least ~10%) for most of this encounter, and they were strongly or completely coupled for a period of approximately three and a half days, from 2021/08/07 at around 04:30

UT to 2021/08/10 at around 19:00 UT. As noted in the data flags and in the [SPC Reduced Data Quality Periods table](#), this impaired measurements of the X_{SC} flow component (usually corresponding to the T_{RTN} component) completely for extended periods. The affected data quantities have also been set to "fill." For the remainder of the orbit, a [linear] correction has been applied to the SPC sensor differences in order to correct for the coupling and recover the flow vector in the XY plane. The accuracy of $v_{X,SC}$ and $v_{T,RTN}$ remain somewhat diminished.

Consultation with the instrument team is strongly advised for those intending to use these data--particularly for any study that may be sensitive to systematics in the absolute accuracy.

Periodicities associated with survival heater cycling

This phenomenon was present in the outbound cruise phase following encounter 9. As noted in the [SPC Reduced Data Quality Periods table](#) and may be clearly seen in the quicklook spectrograms, there was broadband periodic noise associated with survival heater activity over the outbound segment of the orbit, with increasing magnitude at high energies. During the severe phase, the period is on the order of one hour.

Because this noise typically exceeds the acceptable "high background noise" limit of 6 pA for the SPC data analysis pipeline, the GENERAL_FLAG is set throughout most of 09/2021 and 10/2021. We note, however, that the solar wind energy is often well-separated from the noisy regime. The moment-based estimates of the solar wind parameters (i.e. NP_MOMENT, WP_MOMENT, VP_MOMENT_XXX) are strongly influenced by this noise because it appears in the tails of the phase space distributions, and so they often include periodic contamination on this ~1 hour timescale. The Maxwellian fit-based estimates (i.e. NP_FIT, WP_FIT, VP_FIT_XXX) are more strongly localized to the core of the phase space distribution, and as a result they often show no sign of the contamination. Please refer to the more detailed DQF array included in the L3 data products.

The instrument team is aware that certain quasi-periodic density fluctuations on timescales of ~hours are of scientific interest. Investigators that would use SPC data from this period for such studies are urged to consult with the instrument team.

Release 8: DCP-8a, DCP-8b (orbit 8), levels 2 and 3

October 27, 2021

Overview of Measurements

This release comprises all SPC level 2 and level 3 ion measurements from encounter 8, including the time range from March 18, 2021 through July 25, 2021. As in prior releases, these data have been processed with [version 02](#) of the SPC data analysis pipeline.

SPC Encounter 8 remarks

Once again, several significant events should be noted by data users, all of which are identified in the data quality flag variables and annotated in the [SPC Reduced Data Quality Periods table](#).

Solar wind out of SPC field of view near perihelion

As in encounters 4-7, the orbital velocity of Parker Solar Probe is such that the [primarily radial] flow of the solar wind is strongly aberrated in the spacecraft frame near perihelion. This is a normal condition that the complementary fields of view of the SPC and SPAN-Ai instruments are designed to accommodate. The data sets described here, however, include SPC data only. Please consult the data quality flag (DQF) variable, which marks periods where the solar wind flow is out of the SPC field of view.

Low energy noise

As in encounters 6-7, a strong anomalous signal was observed in all SPC sensors at energies below, but somewhat overlapping with, the solar wind proton energy for a period of approximately two days near perihelion. As noted in the data flags and in the [SPC Reduced Data Quality Periods table](#), this anomaly is most significant from approximately April 28, 2021 at ~02:02 UT to April 30, 2021 at 23:59 UT. The anomalous period is mostly, but not entirely, contained within the above-described orbit segment where the solar wind is not in the SPC field of view.

Partial loss [and partial correction] of non-radial flow measurements

The segments of the SPC sensor that govern the measurement of the north-south flow angle were conductively coupled for the inbound phase and much of the encounter phase of orbit 8. As a result, all measurements of the Y_{SC} flow component (usually corresponding to the N_{RTN} component) are set to "fill."

The segments of the SPC sensor that govern east-west flow angle measurement were partially coupled (at least ~10%) for most of this encounter, and they were strongly or completely coupled for a period of approximately five days. As noted in the data flags and in the [SPC Reduced Data Quality Periods table](#), this impaired measurements of the X_{SC} flow component (usually corresponding to the T_{RTN} component) completely from 2021/04/26 20:04 UT to 2021/05/01 23:59 UT. The affected data quantities have also been set to "fill." For the remainder of the orbit, a [linear] correction has been applied to the SPC sensor differences in order to correct for the coupling and recover the flow vector in the XY plane. The accuracy of $v_{X,SC}$ and $v_{T,RTN}$ remain somewhat diminished.

Consultation with the instrument team is strongly advised for those intending to use these data--particularly for any study that may be sensitive to systematics in the absolute accuracy.

Periodicities associated with survival heater cycling

This phenomenon was stronger in orbit 8 than in prior orbits. As noted in the [SPC Reduced Data Quality Periods table](#) and may be clearly seen in the quicklook spectrograms, there were significant broadband noise bursts associated with survival heater activity over the outbound segment of the orbit, beginning on May 5 and continuing at varying degrees throughout the rest of the orbit. An adaptive filter has been applied to those data in order to mitigate the issue in the level 3 data products, but artifacts may still be present, particularly in measurements of density and temperature. The GENERAL_FLAG variable is frequently set throughout this period as a precaution, however certain quantities like the radial solar wind speed and temperature are often recovered (refer to the more detailed DQF array). In most severe cases, the noise bursts occasionally resulted in poor peak tracking, creating gaps in the L3 data coverage.

The instrument team is aware that certain quasi-periodic density fluctuations on timescales of ~hours are of scientific interest. Investigators that would use SPC data from this period for such studies are urged to consult with the instrument team.

Release 7: DCP-7a, DCP-7b (orbit 7), levels 2 and 3

June 28, 2021

Overview of Measurements

This release comprises all SPC level 2 and level 3 ion measurements from encounter 7, including the time range from January 12, 2021 through March 17, 2021. As in prior releases, these data have been processed with [version 02](#) of the SPC data analysis pipeline.

SPC Encounter 7 remarks

Once again, several significant events should be noted by data users, all of which are identified in the data quality flag variables and annotated in the [SPC Reduced Data Quality Periods table](#).

Solar wind out of SPC field of view near perihelion

As in encounters 4-6, the orbital velocity of Parker Solar Probe is such that the [primarily radial] flow of the solar wind is strongly aberrated in the spacecraft frame near perihelion. This is a normal condition that the complementary fields of view of the SPC and SPAN-Ai instruments are designed to accommodate. The data sets described here, however, include SPC data only. Please consult the data quality flag (DQF) variable, which marks periods where the solar wind flow is out of the SPC field of view.

Low energy noise

As in encounter 6, a strong anomalous signal was observed in all SPC sensors at energies below, but somewhat overlapping with, the solar wind proton energy for a period of approximately two days near perihelion. As noted in the data flags and in the [SPC Reduced Data Quality Periods table](#), this anomaly is most significant from approximately January 16, 2021 at ~15:59 UT to January 18, 2021 at 15:12 UT. The anomalous period is mostly, but not entirely, contained within the above-described orbit segment where the solar wind is not in the SPC field of view. Investigation of the anomaly remains ongoing.

Partial loss [and partial correction] of non-radial flow measurements

The segments of the SPC sensor that govern the measurement of the north-south flow angle were conductively coupled for the duration of this data release. As a result, all measurements of the Y_{SC} flow component (usually corresponding to the N_{RTN} component) are set to "fill."

The segments of the SPC sensor that govern east-west flow angle measurement were partially coupled (at least ~10%) for most of this encounter, and they were strongly or completely coupled for a period of approximately four days. As noted in the data flags and in the [SPC Reduced Data Quality Periods table](#), this impaired measurements of the X_{SC} flow component (usually corresponding to the T_{RTN} component) completely from 2021/01/15 15:37 UT to 2021/01/19 21:10 UT. The affected data quantities have also been set to "fill." For the remainder of the orbit, a [linear] correction has been applied to the SPC sensor differences in order to correct for the coupling and recover the flow vector in the XY plane. The accuracy of $v_{X,SC}$ and $V_{T,RTN}$

Consultation with the instrument team is strongly advised for those intending to use these data--particularly for any study that may be sensitive to systematics in the absolute accuracy.

Periodicities associated with survival heater cycling

This phenomenon was stronger in orbit 7 than in prior orbits. As noted in the [SPC Reduced Data Quality Periods table](#) and may be clearly seen in the quicklook spectrograms, there were significant broadband noise bursts associated with survival heater activity over the outbound segment of the orbit, beginning on January 28 and continuing through February 17. An adaptive filter has been applied to those data in order to mitigate the issue in the level 3 data products, but artifacts may still be present, particularly in measurements of density and temperature. The GENERAL_FLAG variable is frequently set throughout this period as a precaution, however certain quantities like the radial solar wind speed and temperature are often recovered (refer to the more detailed DQF array). In most severe cases, the noise bursts occasionally resulted in poor peak tracking, creating gaps in the L3 data coverage.

The instrument team is aware that certain quasi-periodic density fluctuations on timescales of ~hours are of scientific interest. Investigators that would use SPC data from this period for such studies are urged to consult with the instrument team.

Release 6: DCP-6a, DCP-6b (orbit 6), levels 2 and 3

April 5, 2021

Overview of Measurements

This release comprises all SPC level 2 and level 3 ion measurements from encounter 6, including the time range from August 23, 2020 through January 11, 2021. As in Releases 4 and 5, these data have been processed with [version 02](#) of the SPC data analysis pipeline, and are accordingly labeled with the _v02 suffix. The distinction between the present version and previous versions is described in the “Science data version 02” section below.

SPC Encounter 6 remarks

Several significant events should be noted by data users, all of which are identified in the data quality flag variables and annotated in the [SPC Reduced Data Quality Periods table](#).

Solar wind out of SPC field of view near perihelion

As in encounters 4 and 5, the orbital velocity of Parker Solar Probe is such that the [primarily radial] flow of the solar wind is strongly aberrated in the spacecraft frame near perihelion. This is a normal condition that the complementary fields of view of the SPC and SPAN-Ai instruments are designed to accommodate. The data sets described here, however, include SPC data only. Please consult the data quality flag (DQF) variable, which marks periods where the solar wind flow is out of the SPC field of view.

Low energy noise

For a period from approximately September 15, 2020 at 14:00 UT to September 28, 2020 at 19:00 UT, a strong anomalous signal was observed in all SPC sensors at energies below, but somewhat overlapping with, the solar wind proton energy. A new data quality flag entry has been introduced (DQF index 27) to track this anomalous signal. The general flag (GENERAL_FLAG) has also been applied to observations that are corrupted by the anomaly. The anomalous period is mostly, but not entirely, contained within the above-described orbit segment where the solar wind is not in the SPC field of view. Investigation of the anomaly is ongoing at the time of this release.

Partial loss of flow angle determination

During the inbound phase of encounter 6, certain segments of the SPC sensor became electrically coupled. At different points during the orbit, the differentials required to measure the solar wind flow angles were lost. New data quality flag entries have been introduced in DQF

indices 24, 25, and 26, which respectively correspond to partial or total loss of angular sensitivity in the XZ plane, the XY plane, and both planes simultaneously.

Flow angle measurement is impaired in the spacecraft XY plane (RN_{RTN} , i.e. out of the ecliptic) from at least the beginning of observations on September 15, 2020 through January 11, 2021. Flow angle measurement in the the XZ plane (RT_{RTN} , i.e. in the ecliptic) was impaired from at least the beginning of observations on September 15, 2020 up until September 29, 2020 at 23:11:00, when a distinct decoupling was observed.

This phenomenon is likely related to a known contamination issue, and it is thought to be related to the Release 4 *note on T_{RTN} and Y_{SC} velocity components*, below. Investigation into the cause and characterization of the full effect are ongoing. Diagnostic data are being collected on a continuous basis in order to correct for the effect, where possible, in future orbits.

Release 5: DCP-5a, DCP-5b, DCP-5c (orbit 5), levels 2 and 3

November 16, 2020

The SWEAP team.... May 1, 2020 through August 22, 2020.

Release 4: DCP-3b level 3 (orbit 3), DCP-4 levels 2 and 3 (orbit 4)

September 15, 2020

Overview of Measurements

The SWEAP team is pleased to release SPC level 2 and 3 ion data from encounters 3 and 4. This release comprises the remainder of level 3 measurements from the time range October 13, 2019 to April 30, 2020, and level 2 measurements from January 10, 2020-April 30, 2020. This includes all SPC data transmitted during Data Collection Periods 4a and 4b (DCP-4a, DCP-4b), and the remainder of Data collection period 3b (DCP-3b).

As in previous releases, derived L3 measurements correspond in 1-to-1 fashion with the contemporaneous L2 measurement spectra. Each level 3 file corresponds uniquely to the level 2 file of the same date, and each time point therein to the same time point in the level 2 file.

These data have been processed with [version 02](#) of the SPC data analysis pipeline, and they are accordingly labeled with the _v02 suffix. The distinction between the present version and previous versions is described in the “Science data version 02” section below.

This release comprises all measurements of suitable quality made by the SPC instrument from the end of the Release 3 period through April 30, 2020, including the date of the 2nd Venus encounter (December 26, 2019). No Release 1-3 data have been revised or replaced at this time.

SPC Encounter 4 remarks

Encounter 4 is officially defined as the period from November 15, 2019 at 15:00 UT to April 04, 2020 at 09:00 UT. It includes the fourth perihelion, which occurred on January 29, 2020 at a solar distance of $27.87 R_{\text{sun}}$.

No new issues or exceptions occurred in Encounter 4. The full scan parameterization issue described in the Release 1 notes (see *SPC Encounter 2 remarks*), and the red-limit violation

issue described in the Release 2 notes, have been resolved and verified. Neither apply to this release.

During certain cruise phase periods (beyond 0.3 AU) and during the 2nd Venus encounter, the spacecraft was slewed such that only two or fewer of the SPC sensor's four quadrants were illuminated. Under these circumstances, the flow angle and the absolute solar wind flux cannot be determined. This condition applies for most measurements from October 11, 2019 at 22:00 UT through December 20, 2019 at 09:00 UT, and from February 29, 2020 at 15:00UT through the end of this distribution. The user is referred to the data flags and to the [SPC Reduced Data Quality Periods table](#).

For a period around closest approach, the solar wind flow was outside of the nominal SPC field of view. This is a consequence of the orbital speed of the spacecraft around perihelion, which is comparable to the slow solar wind flow speed. The SWEAP suite is designed such that the SPAN-A ion instrument is fully illuminated under these conditions. The user is again referred to the data flags and to the [SPC Reduced Data Quality Periods table](#).

Note on T_{RTN} and Y_{SC} velocity components (Level 3)

Simultaneous observations by the SPC and SPAN-A Ion instruments during this encounter indicate a significant discrepancy in the Y-component of the plasma flow velocity vector (in the spacecraft frame) under some common encounter conditions. This discrepancy also strongly manifests in the T-component for velocities reported in the RTN frame. The root cause is presently under investigation and the data sets will be revised as appropriate when it is determined.

Science data version 02

This data version differs from prior version in two respects:

1. An error has been corrected in the calculation of spacecraft coordinates and velocities in the Heliocentric Inertial (HCI) frame. The Version 01 data pipeline was erroneously cast in the ECLIPJ2000 frame and labeled as HCI.

This change corrects the "SC_POS_HCI" and "SC_VEL_HCI" ephemeris variables that are provided in the L3 files.

Because the Z-axis of the HCI frame is used to determine the inertial T_{RTN} and N_{RTN} basis vectors, this change also affects the Level 3 vector velocities reported in the RTN frame. The difference is generally small as compared to the velocity component uncertainties: ~1 km/s near closest approach in the N-component and ~0.1 km/s near closest approach in the T-component.

2. Minor updates have been made to the instrument calibration in order to improve on flow angle and effective area determination when the plasma is warm (i.e. when the thermal speed is comparable to the bulk flow speed relative to the spacecraft). These are noted in each data file via the "CALIBRATIONS_USED" global attribute. Specifically, the new calibrations employed are *psp_swp_spc_calfiles_effectiveAreaTable_v1*, and *psp_swp_spc_calfiles_uvphithetalookup_20200417*.

In all other respects, these data are consistent and continuous with prior releases. Prior release remarks apply except where directly addressed above.

Release 3: DCP-3a level 3 and DCP-3b level 2 (orbit 3)

April 14, 2020

Overview of Measurements: DCP-3a level 3

The SWEAP team is pleased to release the SPC level 3 ion data from Encounter 3. The files contain data from the time range July 20, 2019 - October 13, 2019. This includes all SPC data transmitted during Data Collection Period 3a (DCP-3a).

The derived measurements released here correspond in 1-to-1 fashion with the [level 2] measurement spectra that comprise the previous release. Each level 3 file corresponds uniquely to the level 2 file of the same date, and each time point therein to the same time point in the level 2 file.

This release comprises all measurements of suitable quality made by the SPC instrument from the end of the Release 1 period through October 13, 2019. These data have been processed with version 01 of the SPC data analysis pipeline. They are consistent and continuous with Release 1 in all respects, including format and calibration. No Release 1-2 data have been revised or replaced at this time. The Release 1-2 notes in the sections that follow therefore apply to this release as well.

The data are, as before, provided in daily files *psp_swp_spc_l3i_YYYYMMDD_v01.cdf*. Files have only been created for dates where SPC observations were made and transmitted.

Overview of Measurements: DCP-3b level 2

The SWEAP team is pleased to release the SPC level 2 ion data from Encounter 3. The files contain data from the time range December 12, 2019 - January 10, 2020. This includes all SPC data transmitted during Data Collection Period 3b (DCP-3b).

This release comprises all measurements of suitable quality made by the SPC instrument from the end of the Release 2 period through January 14, 2020, excluding the date of the 2nd Venus encounter. These data have been processed with version 01 of the SPC data analysis pipeline. They are consistent and continuous with Release 1 in all respects, including format and calibration. No Release 1 data have been revised or replaced at this time. The Release 1-2 notes in the section that follows therefore apply to this release as well.

The data are, as before, provided in daily files *psp_swp_spc_l2i_YYYYMMDD_v01.cdf*. Files have only been created for dates where SPC observations were made and transmitted.

SPC Encounter 3 remarks

Please refer to the Release 2 remarks, which apply to this release as well.

Release 2: DCP-3a, level 2 (orbit 3)

February 10, 2020

Overview of Measurements

The SWEAP team is pleased to release the SPC level 2 ion data from Encounter 3. The files contain data from the time range July 20, 2019 - October 13, 2019. This includes all SPC data transmitted during Data Collection Period 3a (DCP-3a).

This release comprises all measurements of suitable quality made by the SPC instrument from the end of the Release 1 period through October 13, 2019. These data have been processed with version 01 of the SPC data analysis pipeline. They are consistent and continuous with Release 1 in all respects, including format and calibration. No Release 1 data have been revised or replaced at this time. The Release 1 notes in the section that follows therefore apply to this release as well.

Data have been, as before, provided in daily files *psp_swp_spc_l2i_YYYYMMDD_v01.cdf*. Files have only been created for dates where SPC observations were made and transmitted.

SPC Encounter 3 remarks

Encounter 3 is officially defined as the period from August 27, 2019 at 02:18:40 UT to September 07, 2019 at 09:20:54 UT. It includes the third perihelion, which occurred on September 01, 2019 17:49:47 UT at a solar distance of $35.67 R_{\text{sun}}$.

The SPC instrument was halted on August 30, 2019, at approximately 17:30 UT. This stoppage has been attributed to a “red limit violation”-- an instance where a diagnostic of a component’s electrical current draw exceeded its predetermined safety threshold. It was later determined that the safety threshold itself was set erroneously low, leading to a violation during normal function.

As a result of this halt, no SPC measurements were recorded from August 30, 2019 at 17:30 UT to September 18, 2019 at 23:30 UT. The gap spans more than 70% of Encounter 3, and it includes the perihelion period.

Data quality up to the halt was very good. The full scan parameterization issue described in the Release 1 notes (see *SPC Encounter 2 remarks*) has been resolved and verified. Encounter 3 data are not affected by that issue.

The instrument was restarted on September 18, 2019, and normal function was verified. The incorrect limit was revised. Future encounters will not be affected.

Release 1: Initial Data Release (orbits 1-2)

November 12, 2019

Overview of Measurements

The SWEAP team is pleased to release the data from Encounter 1 and Encounter 2. The files contain data from the time range October 31, 2018 - June 18, 2019.

The prime mission of Parker Solar Probe is to take data when within 0.25AU of the Sun during its orbit. However, there has been some extended campaign measurements outside of this distance. The data are available for those days that are within 0.25AU as well as those days when the instruments were operational outside of 0.25AU.

Each SWEAP data file includes a set of a particular type of measurements over a single observing day. Measurements are provided in [Common Data Format \(CDF\)](#), a self-documenting data framework for which convenient open source tools exist across most scientific computing platforms. Users are strongly encouraged to consult the global metadata in each file, and the metadata that are linked to each variable. The metadata includes comprehensive listings of relevant information, including units, coordinate systems, qualitative descriptions, measurement uncertainties, methodologies, links to further documentation, and so forth.

Level 2 and 3, version 01 release notes

General remarks

Efforts have been made to distill all exceptional conditions that can affect normal data analysis into the “GENERAL_FLAG” variable, which can be found in all of the I3i files. In all data quality flags, a value of 0 signifies “good/no condition present”. In this version, all data are organized as time series such that the set of time points, EPOCH.DAT, is the same in I2i and I3i for a given date.

SPC Level 2 ion data

(“psp_swp_spc_I2i_YYYYMMDD_v01.cdf”)

This data product contains measurements of ion flux as a function of energy, organized into spectra. The SPC instrument measures one-dimensional distributions with a wide field of view. Please refer to the [instrument paper](#) for details.

This data set covers all periods for which the instrument was turned on and taking data in the solar wind in ion mode. This includes maneuvers affecting the spacecraft attitude and orientation.

The `MODE_FLAG` variable contains information about the type of spectrum being measured. “Ion full scan” spectra are marked with `MODE_FLAG.DAT = 1`. These spectra comprise a broad energy range, typically with lower signal-to-noise than the more frequent “ion peak tracking” spectra, which are marked with `MODE_FLAG.DAT = 0`. In the most frequent operating mode, ion full scans are executed once every ~30 seconds or whenever the peak signal from the solar wind is poorly defined.

SPC Level 2 ion data quicklook plots (“psp_swp_spc_l2i_YYYYMMDD_v01.png”)

These are browse-spectrogram plots showing the contents of the corresponding l2i data file. Ion full scan and ion peak tracking spectra are co-plotted, which can manifest as vertical bars or dashed lines.

SPC Level 3 ion data (“psp_swp_spc_l3i_YYYYMMDD_v01.cdf”)

This data product contains derived measurements of ion properties in the solar wind, including density, temperature, velocity vector. These measurements correspond 1-to-1 with spectra in the `psp_swp_spc_l2i` file for the same date. It may be convenient for some applications to cross-reference the two — For example, the corresponding l3i file contains ephemeris and data quality flag information that may be useful for an investigator who is concerned only with l2i type measurements.

Conditions that impact measurement quality are documented in the “DQF” variable, which contains a 32 element flag array for each measurement time. Each element of the array is reserved to signify a specific condition. These conditions are described in the “DQF_FLAGNAMES” variable. In this version, for example, `DQF_FLAGNAMES.DAT[23]` is set to “spacecraft maneuver.” If measurement *i* was made during a spacecraft maneuver, it is thus flagged with `DQF.DAT[23,i] = 1`.

In version 01, measurements are not provided (i.e. variables are set to fill) during spacecraft maneuvers, under conditions of low signal-to-noise, and during certain observed transients. Such conditions are rare during encounters, but increasingly frequent in interplanetary cruise. These are documented in the “DQF” variable. Remarks are also provided in the [SPC Reduced Data Quality Periods table](#).

In version 01, the solar wind alpha particle component is not measured (i.e. variables are set to fill).

SPC Encounter 1 remarks

Data quality is very good for the duration of the encounter. The solar wind flow was within the optimal field of view for the SPC instrument for nearly the entire encounter — See data flags for specific exceptions. As with all encounters, signal-to-noise is higher during approach than egress, which is reflected in the typically smaller uncertainties and less frequent “primary peak low signal” flag events.

SPC Cruise phase remarks

Measurements recorded during cruise phase are not all transmitted to Earth. The typical return is 1 spectrum out of every 32.

SPC Encounter 2 remarks

Due to an erroneous setting in the operating mode for this encounter, ion full scan spectra and certain spectra immediately following ion full scans are of reduced quality. In the affected full scan spectra, the energy steps over an initial portion of the measurement spectra have zero width (i.e. I2i variables `MV_LO.DAT = MV_HI.DAT`), and the corresponding measurements are purely noise. In some cases, this results in a poor determination of the proton “primary peak” energy, inducing additional subsequent full scans that are subject to the same incompleteness. In other cases, the energy range for the subsequent “ion peak tracking mode” scan is not ideal. The affected I3i measurements have been flagged with `DQF.DAT[22] = 1` (“energy ranging/peak tracking error”) and/or set to fill.

The operating mode has been revised such that future encounters will not be so affected.

SWEAP Science Working Group Information

For a further discussion of the scientific uses of the data please join the Parker Solar Probe Working Group which will meet Tuesdays and run for 2 hours starting November 19. Call in information and times will be posted on the SWEAP and FIELDs website prior to the meeting. Announcements will also be made in SPA and Solar newsletters.