

*Dear Chadi Salem and friends in Kiel,*

*This is now finally my reponse to your questions.*

Dear Rainer, ... we've woken up again! I'm forwarding you an email from Chadi Salem in which he asks several detailed questions about E1 and the E2 data included in the E1 data. Could you please take a look at his questions and see what you can answer?

Thanks. Yours,

Subject: Fwd: Follow up on our Helios discussion (email to Schwenn)

Hi Bob, I remembered we sat with Eckart and Lars in your office and composed this very detailed email with questions to Rainer Schwenn, but I believe I/we never got an answer from him. Cheers, Chadi.

*RS: Sorry, something went wrong.*

From: Chadi Salem Subject: Follow up on our Helios discussion Date: July 16, 2015 at 6:24:31 AM PDT To: rschwenn@gmx.de, Bob Wimmer-Schweingruber Cc: "Marsch Prof., Eckart" , Lars Berger , Jan Steinhagen , Chadi Salem

Dear Rainer, Thank you so much for our great phone discussion earlier today, and thanks again for being willing to help keep the Helios data alive and well. Eckart and I are composing this email with the list of our questions regarding E1 mainly, but with some questions related to E2.

The first of our question was if you have any other documentation or information regarding E1 other than the blue book, that Robert and Eckart have in Kiel. Eckart mentioned an article about the whole experiment or/and the data analysis process that you published in "Raumfahrtforschung". Would have a copy of that paper or a reference if it's published somewhere?

**Title:** The plasma experiment on board Helios /E 1/  
**Authors:** [Schwenn, R.](#); [Rosenbauer, H.](#); [Miggenrieder, H.](#)  
**Affiliation:** AA(Max-Planck-Institut für Physik und Astrophysik, Garching bei München, Germany), AB(Max-Planck-Institut für Physik und Astrophysik, Garching bei München, Germany), AC(Max-Planck-Institut für Physik und Astrophysik, Garching bei München, Germany)  
**Publication:** Raumfahrtforschung, vol. 19, Sept.-Oct. 1975, p. 226-232. In German. Research supported by the Bundesministerium für Forschung und Technologie.  
**Publication Date:** 10/1975  
**Category:** Instrumentation and Photography  
**Origin:** [STI](#)  
**NASA/STI Keywords:** Helios Project, Plasma Probes, Satellite-Borne Instruments, Solar Instruments, Solar Wind, Data Processing, Electron Energy, Heavy Ions, Interplanetary Medium, Solar Protons, Solar Wind Velocity

**Bibliographic Code:** [1975RF.....19..226S](#)

We found the reference, it is: Aufbereitung und Auswertung der Daten des Plasmaexperimentes auf den Helios-Sonnensonden Schwenn, Rainer. - Eggenstein-Leopoldshafen : Fachinformationszentrum Energie, Physik, Mathematik Karlsruhe, 1982

**RS: Yes, I found this book in the UB library, made a copy (in PDF) and sent it to you via e-mail already.**

2- Concerning the E1 data acquisition. We understand that the elevation angles were measured simultaneously and the azimuthal angles were resolved during a spacecraft rotation. But How were the energy channels swept through? How did all of this fit within the 40.5 sec cadence of the ion measurements? We also would like to know the time sequence of the energy sweeping during the count/distribution measurements, in order to study slices of the distribution function (2D) at the highest possible time resolution (1s? corresponding to the spin period of the spacecraft) .

**RS: The elevational channels were measured simultaneously, and the azimuthal angles were resolved during a spacecraft rotation, as you say, The energy channels were swept through one by one, with increasing energy, spin by spin, i.e. in 32 seconds. In NDM, this sweep was always done , although only a number of channels around the chosen peak was transmitted. Note therefore, that for example, if channels 9 to 13 were chosen, the begin of that scan started 9 seconds after the given time tag. In HDM the complete energy sweep was taken and transmitted in groups of 8 each. This is all well described in the first Blue book.**

What about the electron distribution measurements?

3- How were the magnetic field data acquired or averaged for the plasma data files? Is it an 40.5 sec average? or is it as Eckart believes that it was done as an average during a quarter of the full frame (40.5/4 ~10 sec).

**RS: I do not remember. I think, though, that Eckart is not right here.**

4- What is the origin of the moments of the ion or/and electron distributions that are in the header of the E1 data files? The header of these files contains a bunch of information, that they call here at Kiel, "fluid parameters" or "metadata" [density, temperature, velocity, etc. magnetic field, trajectory information, ...].

**RS: I do not have those particular data files at hands here. But I am sure, that those „fluid parameters“ were all derived by our simple 1D method as given in the Mühlhäuser programs. Note that the directional data were derived from the complete 3D data blocks, but also using 1D Maxwellian fits to the appropriately summed up data slices.**

Do you still have the routines that Muehlhaeuser developed in fortran for your old fluid data analysis? If so, perhaps we can work on this to improve the quality of the moments, for example by doing fits to the data or something similar. In particular, we could look again at

the separation between protons and alphas, which would be very useful, in particular for the perihelion passages [in preparation for Solar Orbiter and Solar Probe Plus science].

***RS: The separation between protons and alphas has always been a difficult issue. It is easy, if in the E/C spectrum there is sufficiently deep valley between the proton and the alpha-peaks. But with high ion temperatures (especially near the Sun) this valley is eroded, and a simple separation no longer works. This is the reason why around perihelia the alpha data are often not evaluated. I remember, that Eckart and some students of his tried to work around this problem, but I do not remember the results.***

5- The magnetic field averages over 40.5 sec (?) in the E1 files, when compared to the 4Hz data, show a factor 10: Each components of the 40.5 sec averages are 10 times higher than their 4Hz counterparts. Why is the reason for this “funny” conversion factor?

***RS: No idea. Maybe I do not really understand this question.***

6- The 2D electron distribution functions available in the E1 files in Kiel that Eckart has are “processed” distributions. By that, we mean that the photoelectron populations were cut out, the energies were corrected by some spacecraft potential estimate (that may be or may not be very accurate), etc. Is there a chance that the original distribution functions are still available somewhere? For example, it’d be great to study the shape and evolution of the photoelectron distribution, in order to understand what the photoelectron effect would look like at Solar Orbiter and Solar Probe plus distances by extrapolation.

***RS: Better speak to Eckart. I do not remember how they corrected for the S/C potential. I cannot tell whether and where the original data still exist. Probably...***

***I wish you luck with your project!***

***Beste Grüße,***

***Rainer***