Intercomparison of Mobility Particle Size Spectrometers

Project No.:	*MPSS-2019-3-7*
Principal Investigator:	Dr. Pasi Aalto
Home Institution:	University of Helsinki
Participant:	-
Candidate:	DMPS Helsinki
Made by:	**Helsinki Homemade**
Counter:	TSI 3010; SN:2438
Location of the quality assurance:	TROPOS Leipzig, Lab 118
Comparison period:	July 04, 2019 – July 09, 2019
Last Intercomparison (with Project No.):	

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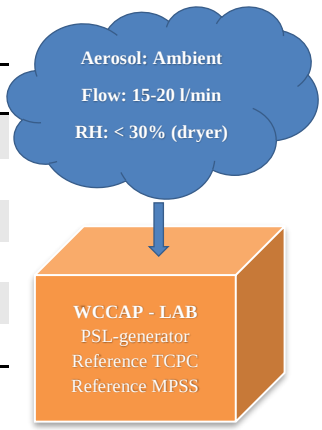
Summary of Intercomparison:

Final-Status:
The final status took place from July 05, 2019 8 PM – July 08, 2019 6 AM. Running the candidate using source Kr.85 from TROPOS, the performance showed a concentration 3% lower than the TROPOS Reference MPSS No.1. The candidate passed the standards of ACTRIS and GAW under the conditions, using the TROPOS Reference MPSS No.1.
Note: Initially, the candidate was running with a 25 m "DMA loss equivalent length" which resulted to overcorrection of smaller particle size range compared to Reference MPSS No.1. After adjusting the DMA equivalent length from 25 m to 15 m, the candidate compared well with the reference instrument. Additionally, the number of size bins were changes from 25 to 40 bins.

Laboratory Setup and Legend

Candidates
DMPS Helsinki



Additional Equipment:
- Bubble flow meter 'Gilibrator', Gilian (Sensidyne)
- Thermo Scientific Nanosphere Size Standard PSL 203nm (±4nm)
- Aerosol nebulizer for PSL (homemade TROPOS)
- Voltcraft multimeter (0-1000V), Keysight Technologies

Legend for plots:
- MC = multiple charge correction
- DL = diffusion loss correction
- CE = CPC efficiency curve
- AL = additional loss corrections

Lab setup:

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PSL Scan: Latex 203 nm +/- 4 nm

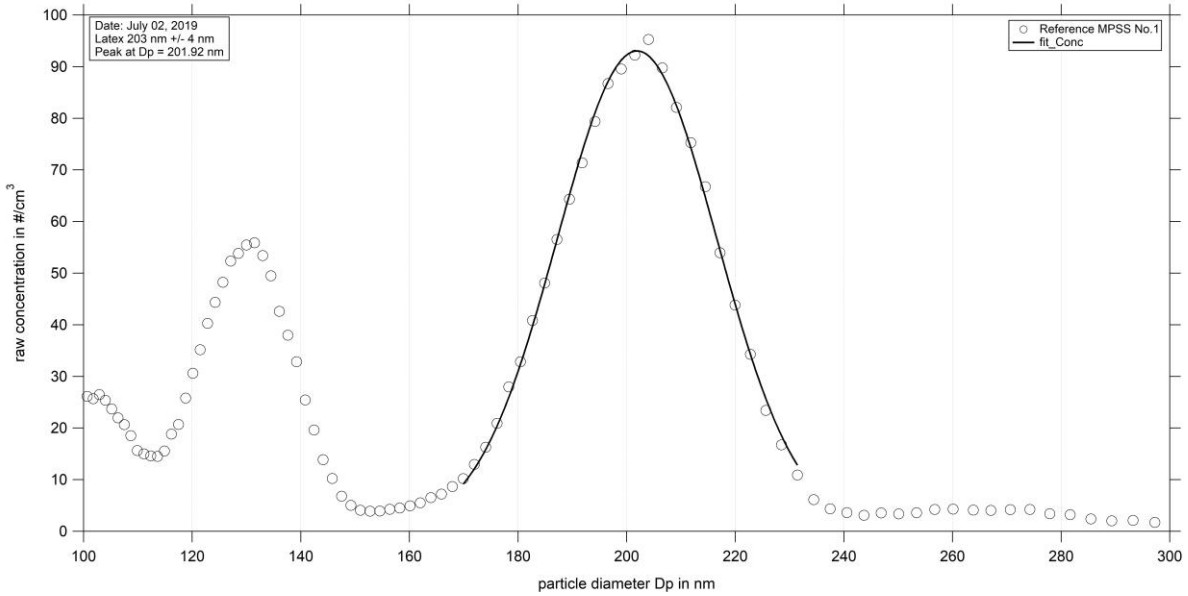

Figure 01: Measurement of latex 203 nm - Reference MPSS No.1: Particle size distribution (raw concentration) for latex 203 nm on July 2nd 2019.

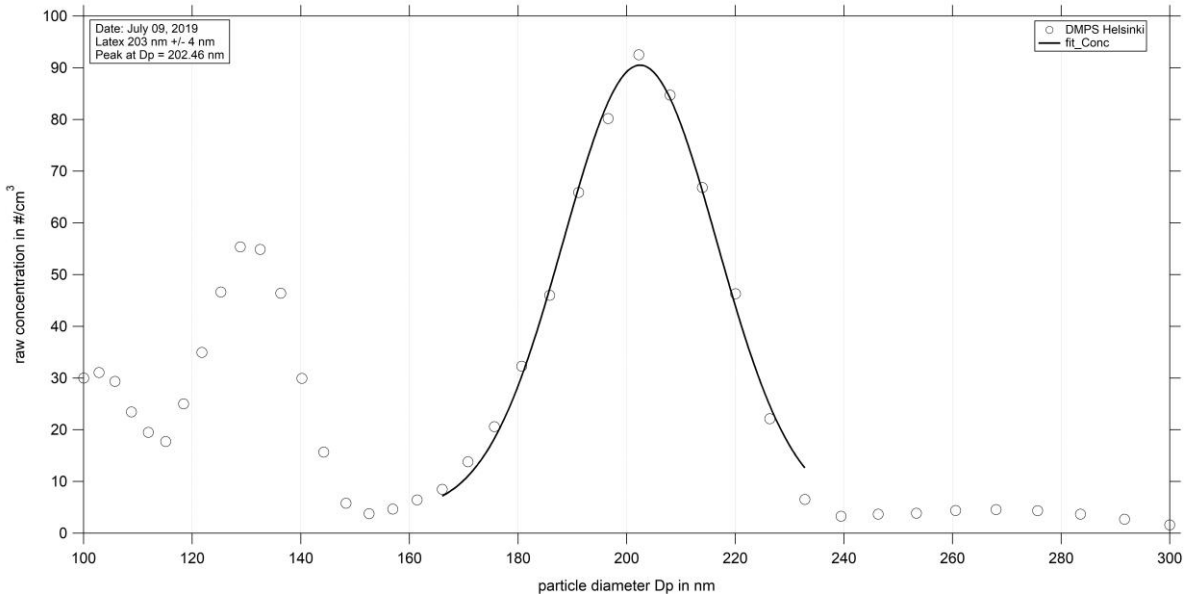

Figure 02: Measurement of latex 203 nm for the candidate DMPS Helsinki: Particle size distribution for latex 203 nm on July 2nd 2019 with a peak at 202.46 nm.

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Time series, Size Distribution and correlations

Info: System running with Kr.85 from TROPOS; The running time is from 05.07.2019, 20:00 PM to 08.07.2019, 06:00 AM. The system is running with 15m DMA loss equivalent length. The system is running with 25 bins.

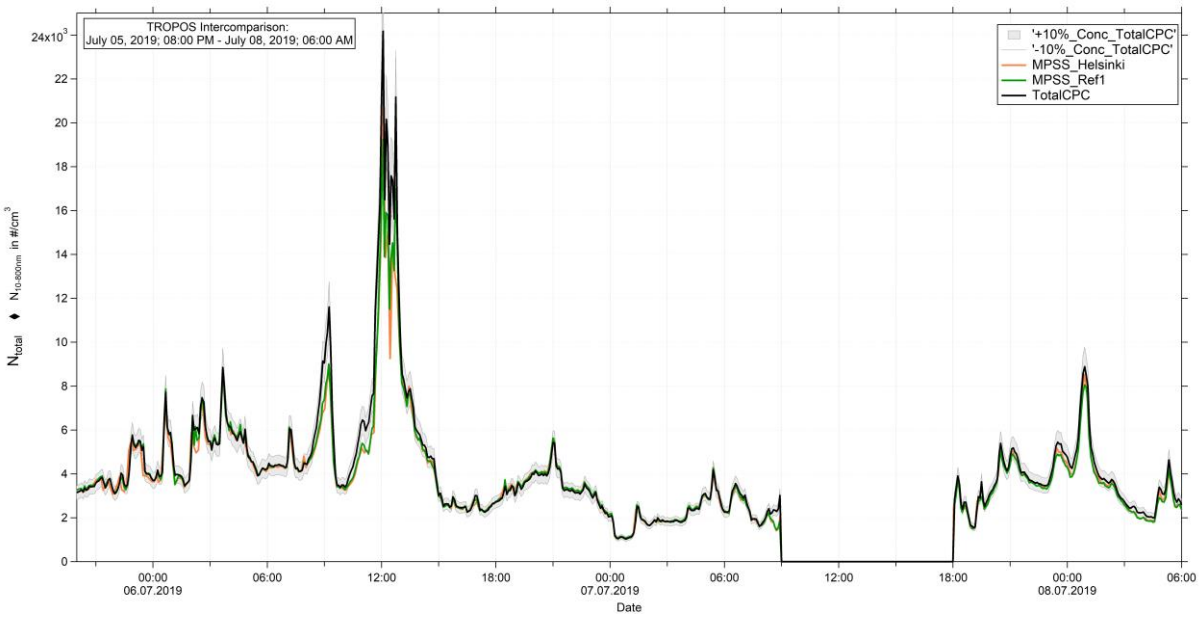

Figure 03: Time series between MPSS Ref1, DMPS Helsinki and TCPC (July 05, 2019 8 PM – July 08, 2019 6 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3772. Multiple charge correction, internal diffusion losses and CPC flow corrections are included. The candidate is running with the Kr.85 source. The system was running with 15m instead of 25m active length on the DMA.

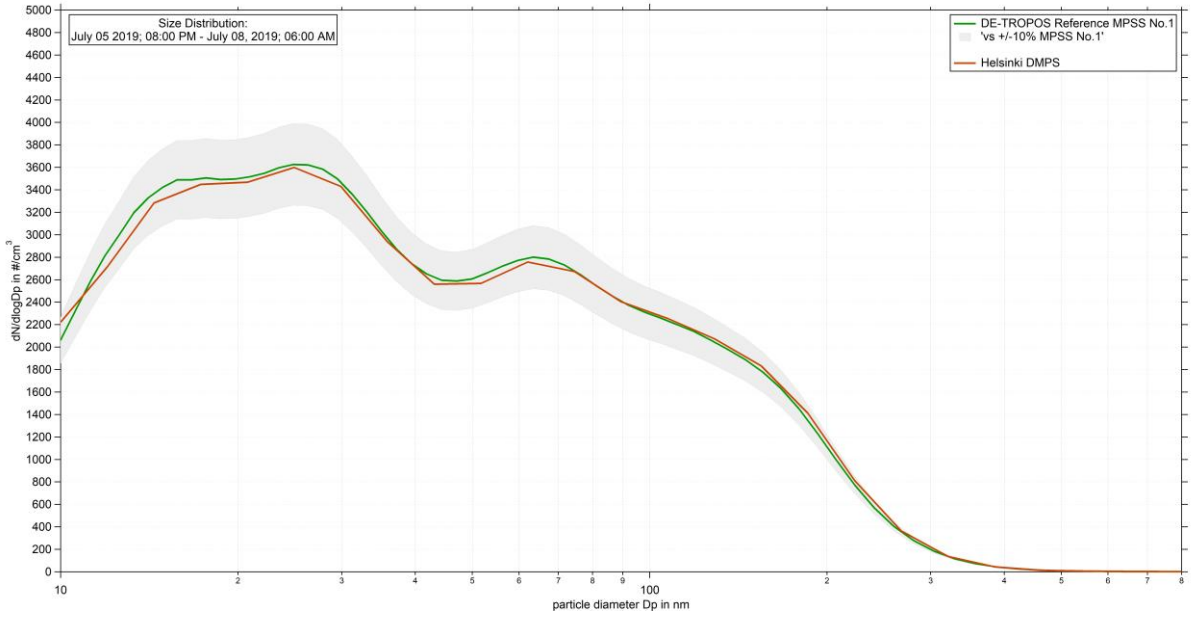

Figure 04: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DMPS Helsinki from July 05, 2019 8 PM – July 08, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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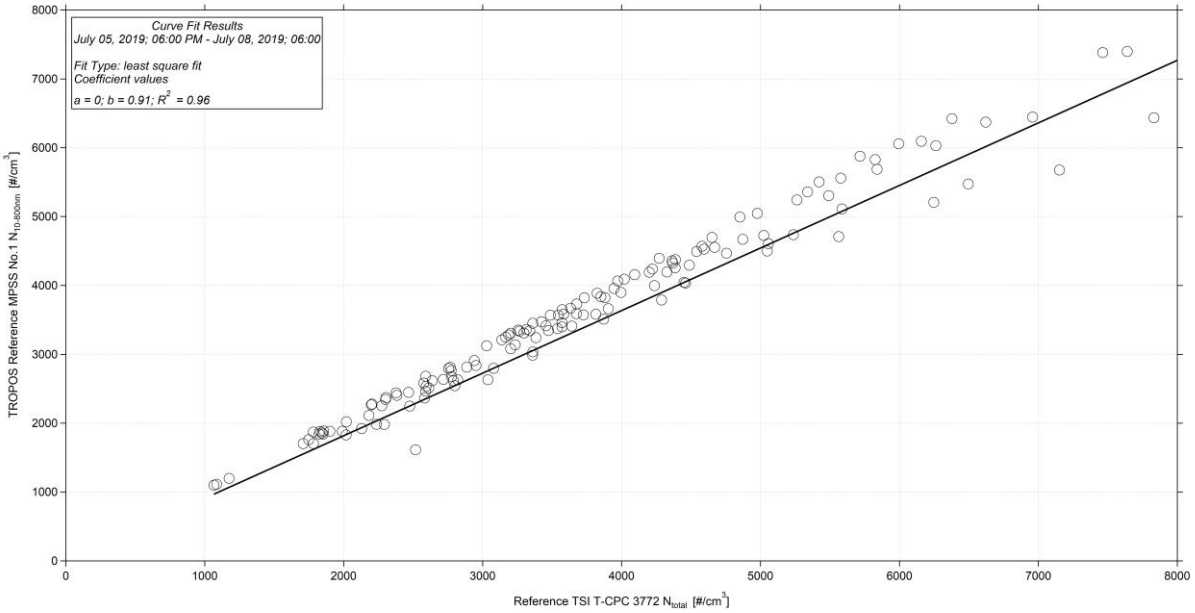

Figure 05: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3772 and TROPOS Reference MPSS No.1. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

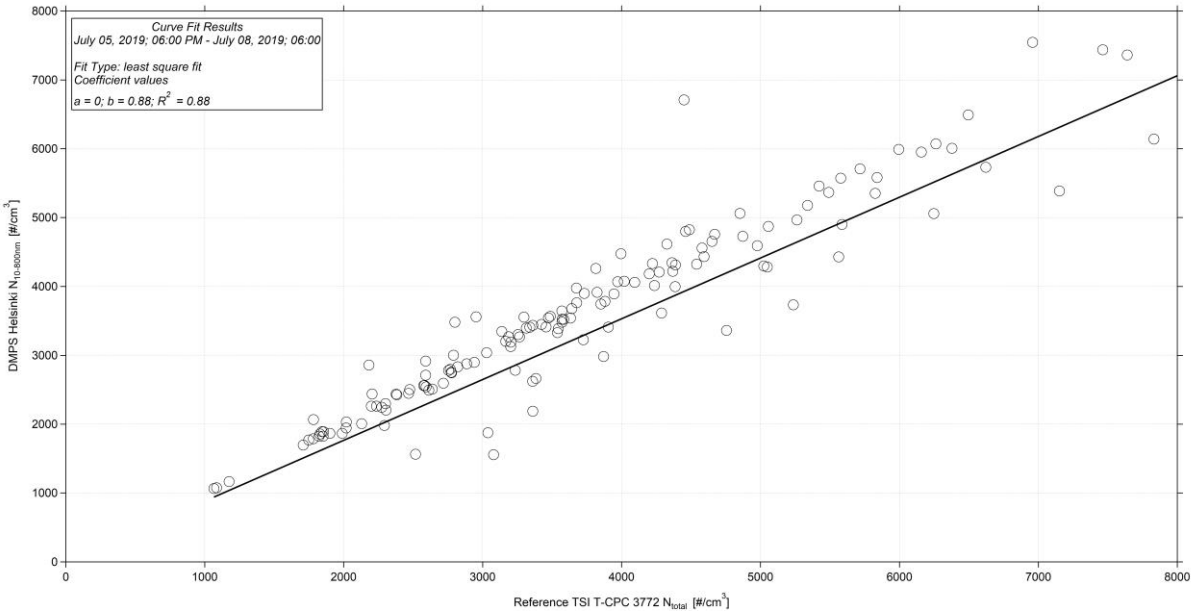

Figure 06: Linear regression between the number concentrations of the TROPOS Reference TSI T-CPC Model 3772 and DMPS Helsinki. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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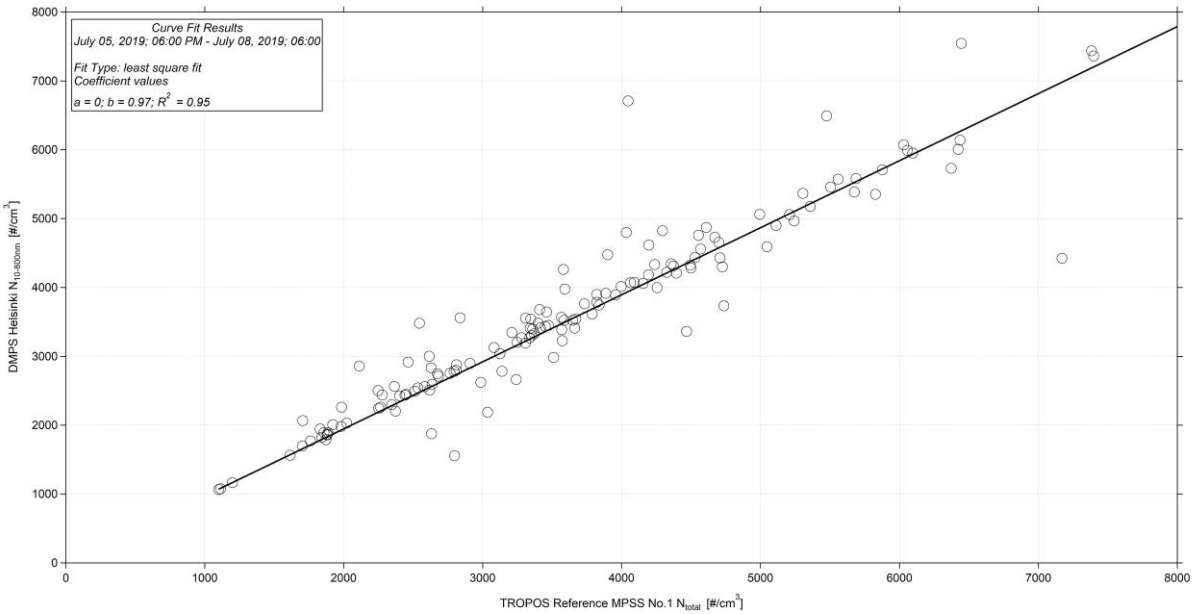

Figure 07: Linear regression between the number concentrations of the TROPOS Reference MPSS No.1 and DMPS Helsinki. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Time series, Size Distribution and correlations

Info: System is running with Kr.85 TROPOS, from 08:00 PM 04.07.2019 to 06:00AM 05.07.2019. The system is running with 25m DMA loss equivalent length. The system is running with 25 bins.

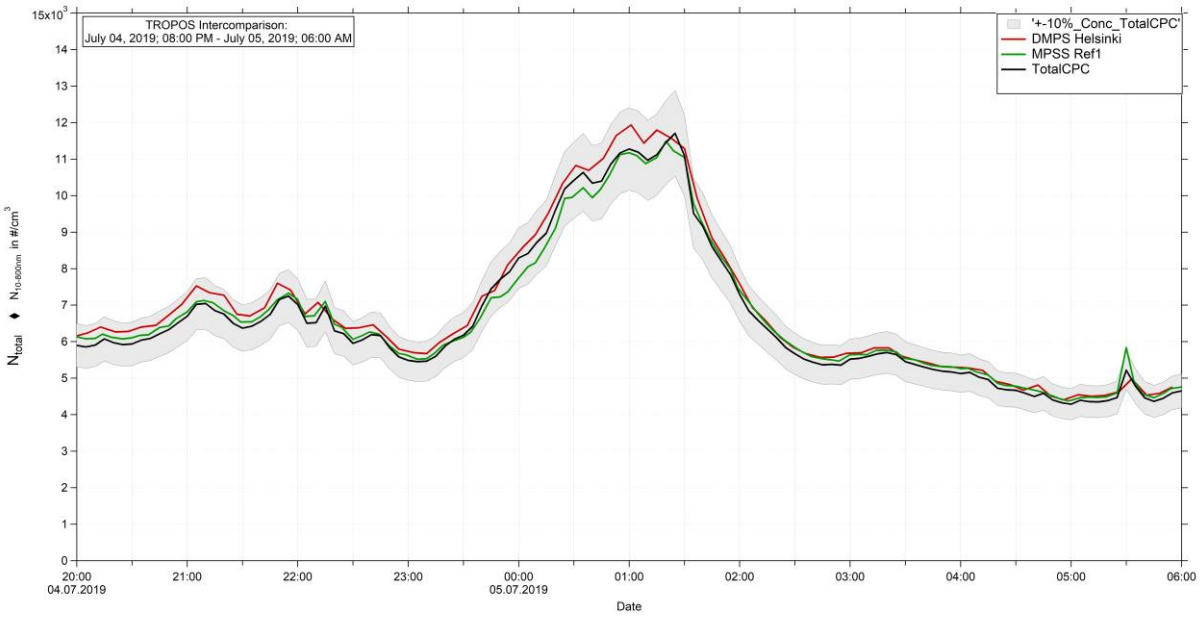

Figure 08: Time series between MPSS Ref1, DMPS Helsinki and TCPC (July 04, 2019 8 PM – July 05, 2019 6 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3772. Multiple charge correction, internal diffusion losses and CPC flow corrections are included. The candidate is running with the Kr.85 source. The system was running with a 25m active length for the DMA Which affects the Diffusion loss correction.

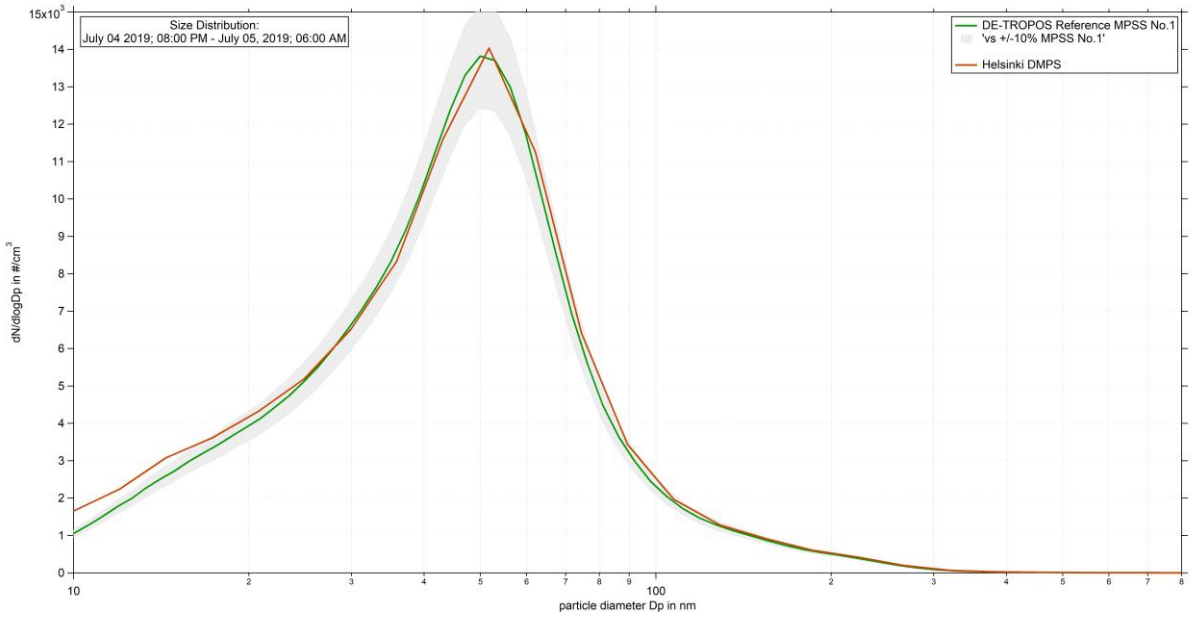

Figure 09: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DMPS Helsinki from July 04, 2019 8 PM – July 05, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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Time series, Size Distribution and correlations

Info: System is running with Kr.85 TROPOS, from 20:00PM 08.07.2019 to 06:00AM 09.07.2019. The system is running with 15m DMA loss equivalent length. The system is running with 40 bins.

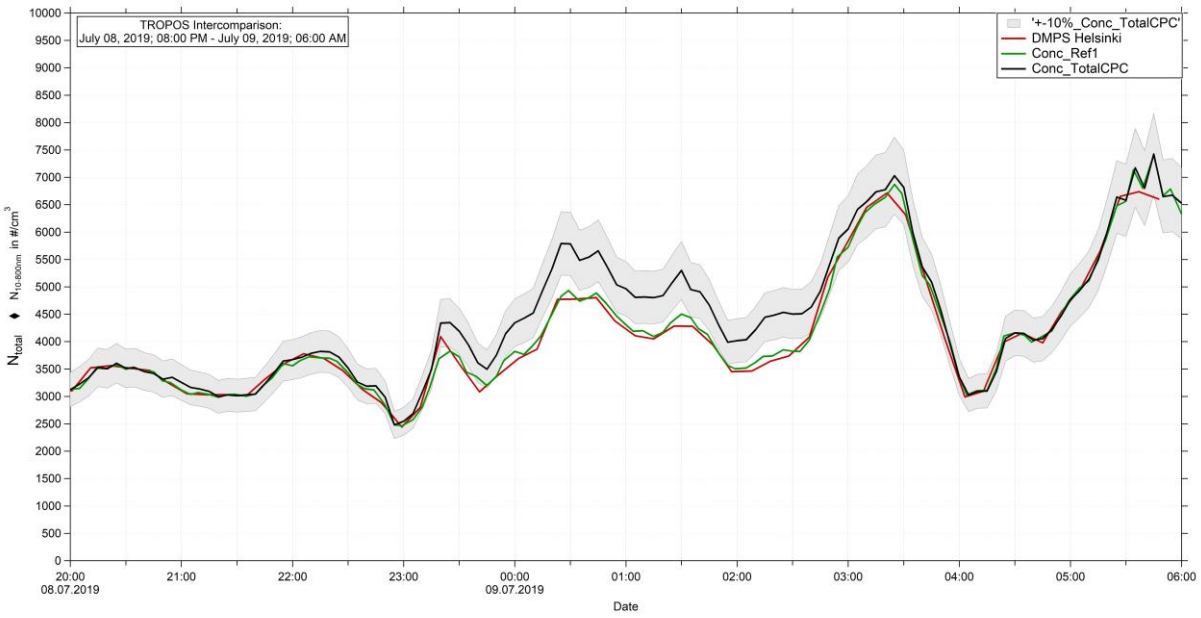

Figure 10: Time series between MPSS Ref1, DMPS Helsinki and TCPC (July 08, 2019 8 PM – July 09, 2019 6 AM) of the integrated particle number concentration ($N_{10\text{-}800nm}$) of the MPSS and total number concentration (N_{total}) of the Reference TSI-CPC Model 3772. Multiple charge correction, internal diffusion losses and CPC flow corrections are included. The candidate is running with the Kr.85 source. The system was running with a 15m active length for the DMA, which affects the diffusion loss correction.

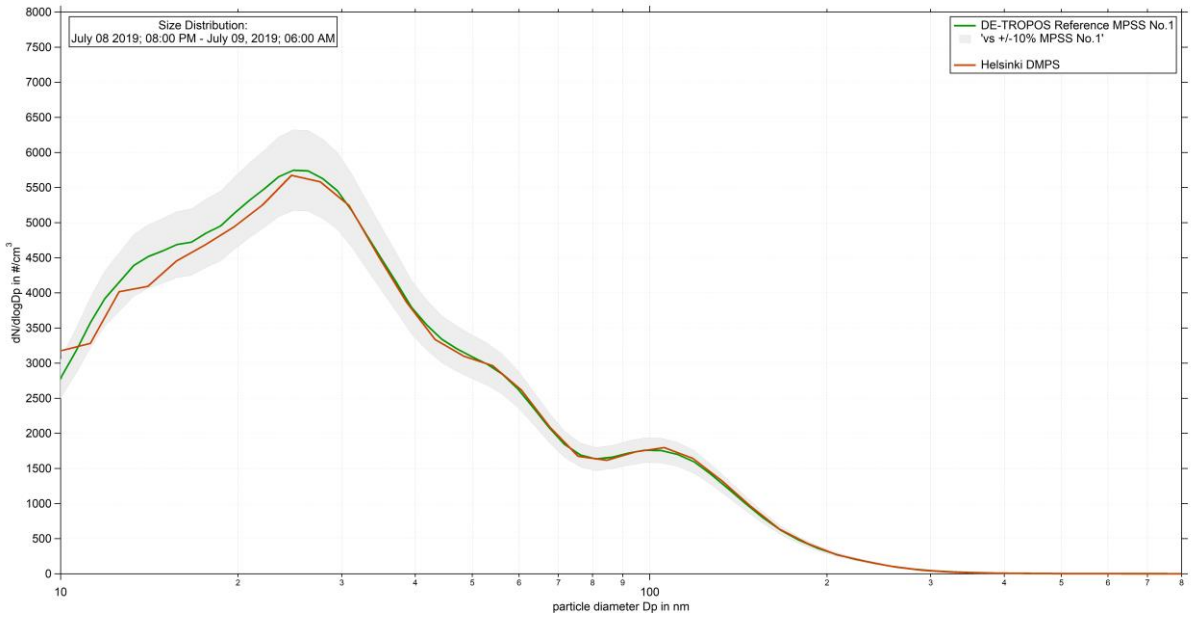

Figure 11: Comparison of mean particle number size distribution of TROPOS Reference MPSS No.1 against DMPS Helsinki from July 08, 2019 8 PM – July 09, 2019 6 AM. Multiple charge correction, internal diffusion losses and CPC efficiency are included.

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