SOHO Intercalibration Joint Observing Programme 01

INTERCALIBRATION 1

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Progress:

Draft Scheme	February 15 1994
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Distributed to PI Teams	June 22 1994
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Re-Distributed to PI Teams	August 12 1994
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Revisions	February 3, June 21 1995
Revision	February 13, March 13,15 1996
Replaced Fe XII line by N V 1238Åline for SUMER/UVCS	October 1996
Added O V 629 line, change timing of SUMER/CDS phases	August 2, 1999
Revised after TRACE Input	October 14, 1999

Objective: Intensity (and alignment) cross-calibration of CDS-GI, CDS-NI, SUMER, UVCS, EIT, and TRACE

Conditions Necessary to Run: Requires participation of at least two of - CDS, SUMER, EIT, TRACE, and a reasonable quiet-Sun region. [UVCS may not be able to participate as this JOP requires a target on the solar disc].

Scheme: All instruments are directed at the same location on the solar disc and wavelength bands are selected which are appropriate for cross-calibration. The following considerations are taken into account:

- A large co-incident field of view is required to ensure good co-registration and significant spatial overlap - yet it must be small enough to be produced relatively quickly.
- The wavelength overlaps are the following: (1) CDS-GI and CDS-NI = 308-338Å, (2) CDS-NI and SUMER = 513-633Å - specifically the He I 584.33Å and Mg X 609.79Å lines, (3) CDS-GI and SUMER = 656-785Å - specifically the Ne VIII 770.41Å line, (4) CDS-GI and EIT = 171, 195, 284 and 304Å, (5) CDS-NI and UVCS = 521, 610, 625Å, (6) SUMER and UVCS = 1216, 1242, 1032 and 1037Å, (7) EIT and TRACE = 171, 195 and 284 Å, (8) TRACE and CDS-GI = 171, 195, and 284+304 Å.
- Exposure times should be chosen to produce 10% counting statistics or better (counts per pixel or order 100).

• The target area should be quiet Sun.

• CDS cannot perform rasters in GI and NI simultaneously. Therefore, CDS will operate in phases, with phase 1 in NI, phase 2 in GI, with both repeated several times.

• We should minimise the number of wavelength ranges viewed by SUMER, to minimise refocusing operation. Two bands should be sufficient. The SUMER bands are of width ~40Å for first order and 20Å for second order.

Specific Wavelength Selection

CDS-GI = Full wavelength ranges - 151-221Å, 256-338Å, 393-493Å, 656-785Å

CDS-NI = Mg VIII 313.73Å, 315.02Å, 317.01Å, Fe XIII 320.80Å, Fe XV 321.78Å, 327.02Å, Fe XIV, 334.17Å, Fe XVI 335.40Å, Si IX 345.13Å, Si XII 520.67Å, He I 584.33Å, Mg X 609.79Å, Mg X 624.94Å, O V 629.73Å

SUMER = Three bands - 1 centred on He I 584.33Å and Mg X 609.79Å for the SUMER/CDS-NI calibration and Ne VII 770.41Å for the SUMER/CDS-GI calibration. This has been changed (on 2 August 1999) to four bands to include the O V 629.73Å line.

UVCS = H I 1216Å, Fe XII 1242Å, O VI 1032, 1037Å, Si XII 499, 521Å, Mg X 610, 625Å

EIT = All four bands - 171, 195, 284, 304Å

TRACE = The three EUV bands - 171, 195, 284 Å

Frequency: This scheme should be run initially once every two weeks, falling to once per month when it is established that any changes are occurring slowly.

Operating Details:

• **CDS**

Phase 1: Use NIS with 4x240 arcsec slit over 15 locations - total area 1x4 arcmin. Use wavelength selection given above. Exposure time of 80 sec at each of the 15 exposures - total duration 25 min. Data extraction from 13 windows defined by lines above - 15 pixels across each, i.e. 13 x 120 x 15 x 16 bits at 10kb/s over 100 sec - only uses half of standard telemetry rate. No data compression required. CDS Study = ICAL1_N.

Phase 2: Use GIS with 4x4 arcsec slit over 8x8 locations - total area 32x32 arcsec. Use wavelength selection given above. Exposure time of 20 sec at each of the 64 locations - total duration 22 min (first time requires extra 24 min for LUT load). Data extraction - 2048 pixels x 4 bands x 16 bits at 10kb/s over 20 sec. No data compression required. CDS Study = ICAL1_G.

Observation consists of: Phase 1, Phase 2, Phase 1, Phase 1, Phase 1, Phase 2. The timing has been changed on 2 August 1999 to be in phase with the new SUMER sequence to Phase 1, Phase 1, Phase 1, Phase 1, Phase 2, Phase 2.
Total duration = 165 min.

• **SUMER**

Phase 1: Use 1x300 arcsec slit over 79 locations to form 60x300 arcsec image overlying CDS 60x240 arcsec image. Step size = 0.76 arcsec with 16s accumulation at each location. Total duration per raster of 21.7 mins. Wavelength range includes He 584Å. This should co-incide with the CDS phase 1 operation.

Phase 2: Similar to phase 1, but wavelength band including Ne VIII 770Å, and exposure time of 17.5s. This is repeated twice, giving a time of 47.4 min. This should co-incide with the CDS phase 2 operation whose total duration is 22+24 = 46 min.

Phase 3: Similar to phase 1, but wavelength band including Mg X 609 and 625Å and Fe XII 1242Å. 16s exposure, duration of 21.7 min. Should be run with second run of CDS phase 1 operation.

Phase 4: Identical to phase 2.

Observation consists of: Phase 1, 2, 3 and 4. Total duration = 138.2 min.

This sequence has been changed on 2 August 1999 to the following:

Phase 1: unchanged

Phase 2: Identical to phase 1, but centered at the wavelengths of the O V 629.73Å line. This phase will be repeated once to coinside with the second and third run of CDS phase 1.

Phase 3: Similar to phase 1, but wavelength band including Mg X 609 and 625Å and N V 1238Å. 16s exposure, duration of 21.7 min. Should be run with fourth run of CDS phase 1 operation.

Phase 4: Similar to phase 1, but wavelength band including Ne VIII 770Å, and exposure time of 17.5s. This is repeated, giving a time of 47.4 min. This should co-incide with the CDS phase 2 operations whose total duration is 22+24 = 46 min.

Observation consists of: Phase 1, 2, 3 and 4. Total duration = 138.2 min.

- **EIT**

Extract 64 x 96 pixels centred on CDS field of view - i.e. with 2.6 arcsec pixels, a 2.8 x 4.2 arcmin field compared to the CDS 1 x 4 arcmin field. Accumulation time of 20 Sec. Use all four bands. At 5 kb/s, 3072 pixels of 16 bits = 10 sec to extract data, i.e. 30 Sec cadence. Extract series of 120 images co-incident with the CDS/SUMER observations. Total duration - 60 minutes (can be compressed and interspersed with the LASCO programme to match the duration of the other instruments).

- **TRACE**

Extract 768×768 pixels (6.4×6.4 arcsec) centered on the EIT/CDS field of view. Accumulation time of nominally 20 seconds in each EUV channel subject to normal AEC control (TOP1 AEC class, "stable/normal"). Observe in 195, 171, and 284 bands during corresponding EIT accumulation times. Total duration will normally be defined by EIT (or CDS) observing times in each wavelength.

- **UVCS**

Use 7 arcsec slit. Raster over 10 steps of 7 arcsec width. Raster centred on CDS 60 x 240 arcsec field. Expose for 30 sec at each of the 10 locations. Total duration of raster - 300 sec. Perform 3 times with different wavelength selections: Phase 1 - include 1216Å, Phase 2 - include 1238, 1242 (Ly alpha channel), 1032, 1037, 1085Å (O VI channel), Phase 3 - 521, 610, 625Å. Repeat cycle 10 times = 150 min.