Specification Compliance and Calibration Data Book Volume I

for

Solar Backscatter Ultraviolet
Spectral Radiometer Mod 2
(SBUV/2 Flight One)

Document No. B6802-71
Revision A
February 25, 1985

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Goddard Space Flight Center
Greenbelt, Maryland 20771

in accordance with
Contract NAS 5-26400, Item 40C

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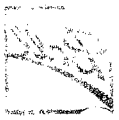

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☐ PRELIMINARY	NO.	DATE 2/25/85
☒ FINAL		SUPERSEDING -

TITLE OF CHANGE:
Revision A

CONTRACTUAL AUTHORITY:
N/A

DOCUMENT TITLE:
Specification Compliance and Calibration Data Book for SBUV/2 Vol. I

DOCUMENT NO.:	REV:	DATE OF DOCUMENT:
B6802-71	A	

CONTRACT NO:	ECP NO:
NAS 5-26400, Item 40C	N/A

INSTRUCTIONS:	CCN:

Replace Pages: 9-1, 9-2, 9-3, 9-4, 9-5, 9-6, 9-7, 9-8, 9-20, 9-21

Replace Front Covers and Spines

APPROVED _____

CHECKED T Russo 85-2-22

REVISION RECORD

NOTE: Changed data is identified with a vertical black line on the right margin.

REV	DATE	PAGES AFFECTED
—	1/23/85	Initial Release
A	2/25/85	Pages Affected: 9-1, 9-3, 9-4, 9-5, 9-6, 9-7, 9-20 Replace Front Covers and Spines.

0865-029, 12-80

Section 9
GONIOMETRIC CALIBRATION
(Reference Test Procedure 68034)

Goniometric calibration was performed using the fixture illustrated in Figure 9-1. This fixture locates the center of the instrument diffuser at the intersection of the horizontal and vertical axes of rotation. A target (FEL Lamp) placed 3 meters from the Sensor Module provides it with nearly parallel, uniform illumination.

Data was taken over an angular field which covers the expected angles of illumination during orbit. Scans were made in increments of 2 degrees in elevation and 5 degrees in azimuth. Two SERs (SBUV-GC-83-386 and SBUV-GC-83-390) cover the use of the data with respect to the spacecraft position.

Included here are the raw data in instrument counts (Table 9-1a, b, c, d), and the Angular Correction Factors (Table 9-2a, b, c, d). Plots of the center wavelength at each azimuth angle are shown in Figures 9-2 thru 9-11. Figures 9-11 thru 9-14 are plots of raw data (Table 9-1e) for the zero position of the instrument (34° Azimuth, 0° elevation). These plots show a very stable measurement. Wavelengths 300, 350, and 400nm all have measurements repeating to better than 1%. The worst case at 250nm where the signal is very low is ± 2.2% about a mean value. The mean value was used in determination of the angular correction factors.

$$F_{\alpha,\ \varepsilon,\ \lambda} = \frac{C_{\alpha,\ \varepsilon,\ \lambda} - 64}{\overline{C}_{34,\ 0,\ \lambda} - 64}$$

where:

α	azimuth angular position
ε	elevation angular position
λ	wavelength
C	counts

Table 9-3 shows the zero reference at the beginning of each angular scan.

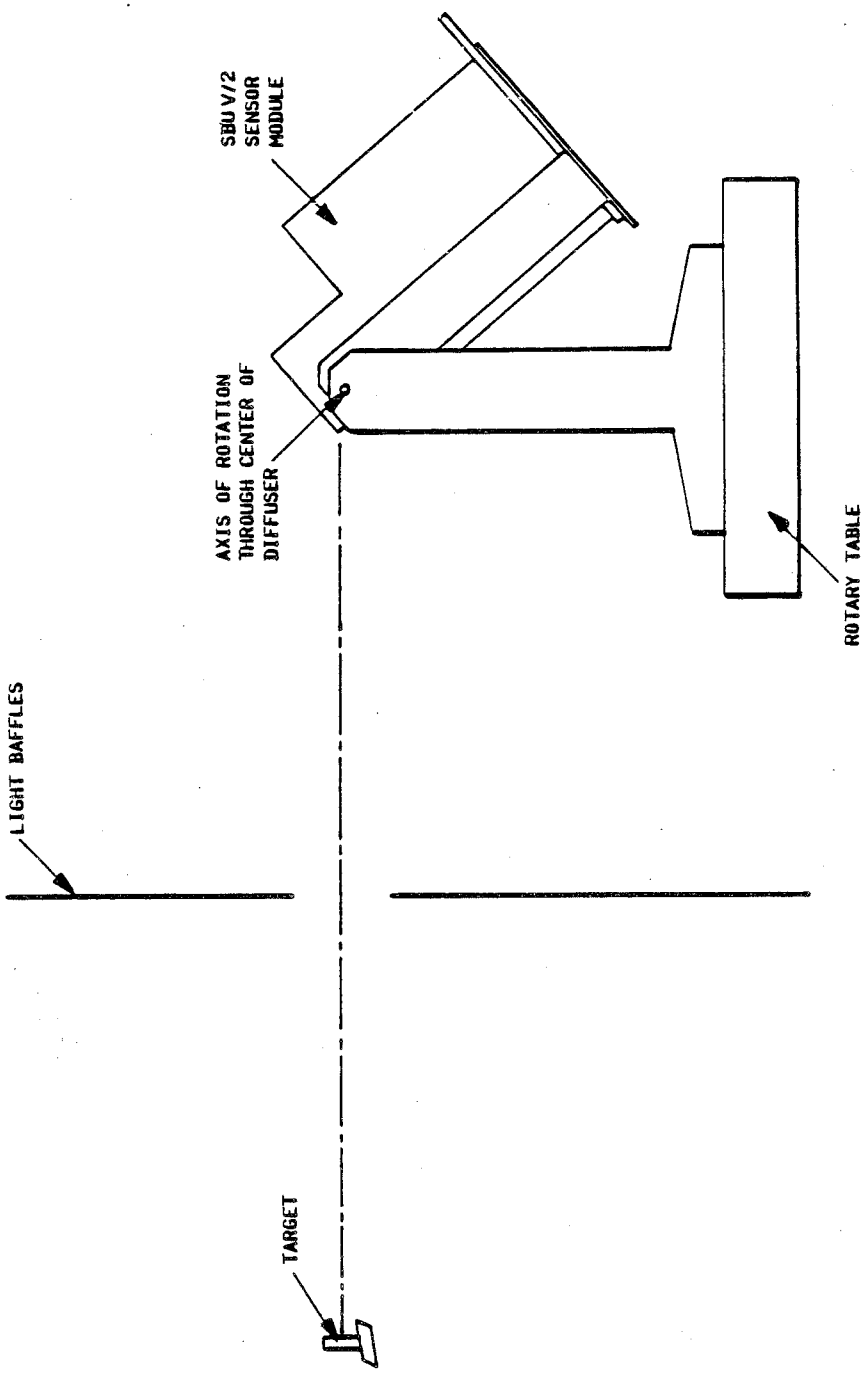


Figure 9-1 Goniometric Calibration Test Fixture

Table 9-1a

Goniometric Data at Wavelength 250nm.

Elevation	AZIMUTH								
	30	34	35	40	45	50	55	60	65
0	322	325	319	323	306	303	290	272	251
2	306	305	309	297	300	288	276	254	238
4	294	292	295	295	284	266	257	245	225
6	269	272	273	269	269	253	244	230	214
8	251	292	258	253	247	243	237	216	205
10	238	232	237	234	233	220	220	184	194
12	219	223	222	224	219	207	197	187	170
14	196	206	199	198	198	186	187	175	165
16	181	178	182	193	182	174	166	156	147
18	163	164	166	164	164	154	150	142	134
20	143	146	148	143	146	142	137	128	120

Table 9-1b

Goniometric Data at Wavelength 300nm.

Elevation	AZIMUTH								
	30	34	35	40	45	50	55	60	65
0	3548	3567	3569	3514	3407	3240	3035	2811	2573
2	3312	3339	3353	3293	3179	3039	2859	2632	2408
4	3092	3095	3096	3063	2969	2825	2654	2464	2232
6	2846	2870	2863	2825	2745	2611	2450	2280	2072
8	2622	2639	2637	2592	2517	2405	2247	2081	1911
10	2369	2389	2384	2347	2285	2170	2045	1891	1732
12	2136	2147	2135	2120	2048	1950	1827	1694	1542
14	1893	1900	1885	1864	1821	1715	1608	1483	1356
16	1632	1640	1649	1623	1561	1502	1398	1298	1174
18	1380	1392	1393	1367	1320	1256	1176	1084	996
20	1119	1133	1125	1114	1067	1029	951	878	796

Table 9-1c

Goniometric Data at Wavelength 350nm

Elevation	AZIMUTH								
	30	34	35	40	45	50	55	60	65
0	19591	19657	19648	19368	18711	17818	16679	15416	14031
2	18273	18338	18363	18047	17481	16634	15586	14388	13098
4	17924	17927	17035	16803	16264	16263	14469	13344	12156
6	15630	15718	15718	15487	14965	14263	13367	12320	11223
8	14305	14364	14379	14148	13700	13020	12206	11271	10260
10	12945	12996	13727	12807	12397	11804	11055	10186	9792
12	11577	11617	11613	11471	11083	10532	9874	9109	8263
14	10194	10256	10229	10588	9742	9269	8675	7997	7252
16	8787	8824	8874	9254	8443	7993	7471	6867	6214
18	7372	7403	7397	7273	7032	6659	6226	5712	5154
20	5922	5940	5923	6174	5636	5336	4977	4537	4103

Table 9-1d

Goniometric Data at Wavelength 400nm

Elevation	AZIMUTH								
	30	34	35	40	45	50	55	60	65
0	49222	49405	49381	48609	47032	44693	41808	38625	35116
2	45808	46118	46119	45358	43886	41738	39078	36045	32820
4	45703	45793	42765	42134	40721	41401	36252	33431	30446
6	39198	39400	39417	38798	37587	35710	33458	30844	28068
8	35833	36041	36009	35465	34336	32630	30544	28177	25632
10	32419	32561	35070	32092	31050	29485	27606	25423	24881
12	28917	29127	29099	28717	27729	26362	24632	22672	20587
14	25473	25604	25586	26807	24341	23138	21622	19931	18063
16	21915	21999	22132	23633	20993	19908	18634	17062	15460
18	18337	18466	18434	18124	17487	16587	15459	14157	12824
20	14698	14777	14767	15717	13985	13240	12296	11269	10155

ANGULAR CORRECTION FACTOR

Table 9-2a

Data at 250nm

ELEVATION	AZIMUTH							
	30	35	40	45	50	55	60	65
0	.9895	.9779	.9933	.9281	.9166	.8667	.7977	.7172
2	.9281	.9396	.8936	.9051	.8591	.8130	.7287	.6673
4	.8821	.8859	.8859	.8437	.7747	.7402	.6942	.6174
6	.7862	.8015	.7862	.7862	.7248	.6903	.6366	.5753
8	.7172	.7440	.7248	.7018	.6865	.6635	.5829	.5407
10	.6673	.6635	.6520	.6481	.5983	.5983	.4602	.4986
12	.5944	.6059	.6136	.5944	.5484	.5101	.4717	.4065
14	.5062	.5177	.5139	.5139	.4679	.4717	.4257	.3873
16	.4487	.4525	.4947	.4525	.4219	.3912	.3528	.3183
18	.3797	.3912	.3835	.3835	.3452	.3298	.2991	.2685
20	.3030	.3221	.3030	.3145	.2991	.2800	.2454	.2148

Table 9-2b

Data at 300nm

ELEVATION	AZIMUTH							
	30	35	40	45	50	55	60	65
0	.9900	.9959	.9803	.9499	.9025	.8442	.7806	.7129
2	.9229	.9346	.9175	.8851	.8453	.7942	.7297	.6660
4	.8604	.8615	8522	.8254	.7845	.7359	.6820	.6160
6	.7905	.7953	.7845	.7618	.7237	.6780	.6297	.5706
8	.7268	.7311	.7183	.6970	.6652	.6203	.5731	.5248
10	.6550	.6592	.6487	.6311	.5984	.5629	.5191	.4740
12	.5888	.5885	.5842	.5637	.5359	.5010	.4632	.4200
14	.5197	.5174	.5115	.4992	.4691	.4387	.4032	.3671
16	.4455	.4504	.4430	.4254	.4086	.3791	.3506	.3154
18	.3739	.3776	.3702	.3569	.3387	.3160	.2898	.2648
20	.2998	.3015	.2984	.2850	.2742	.2520	.2313	.2080

Table 9-2c

Data at 350nm

ELEVATION	AZIMUTH							
	30	35	40	45	50	55	60	65
0	.9933	.9962	.9820	.9485	.9031	.8452	.7809	.7105
2	.9263	.9308	.9148	.8860	.8429	.7896	.7286	.6630
4	.9085	.8633	.8515	.8241	.8240	.7328	.6755	.6151
6	.7918	.7963	.7845	.7580	.7223	.6767	.6234	.5676
8	.7244	.7282	.7164	.6936	.6590	.6176	.5701	.5187
10	.6552	.6950	.6482	.6274	.5972	.5591	.5149	.4948
12	.5856	.5875	.5803	.5605	.5325	.4990	.4601	.4171
14	.5153	.5171	.5353	.4923	.4682	.4380	.4035	.3656
16	.4437	.4481	.4675	.4262	.4033	.3768	.3461	.3128
18	.3717	.3730	.3667	.3544	.3355	.3134	.2873	.2589
20	.2980	.2980	.3108	.2834	.2682	.2499	.2275	.2055

Table 9-2d

Data at 400nm

ELEVATION	AZIMUTH							
	30	35	40	45	50	55	60	65
0	.9932	.9964	.9808	.9490	.9017	.8434	.7791	.7082
2	.9242	.9305	.9152	.8854	.8420	.7883	.7270	.6618
4	.9221	.8628	.8500	.8215	.8352	.7312	.6742	.6139
6	.7907	.7951	.7826	.7581	.7202	.6747	.6219	.5658
8	.7227	.7263	.7153	.6925	.6580	.6158	.5680	.5166
10	.6537	.7073	.6471	.6261	.5944	.5565	.5124	.5014
12	.5830	.5866	.5789	.5590	.5313	.4964	.4568	.4147
14	.5134	.5157	.5403	.4905	.4662	.4356	.4014	.3637
16	.4415	.4459	.4762	.4229	.4009	.3752	.3434	.3111
18	.3692	.3712	.3649	.3520	.3338	.3111	.2848	.2578
20	.2957	.2971	.3163	.2813	.2662	.2471	.2264	.2039

Zero Reference at Begining of Each Angular Scan

Table 9-3

$C_{34,\,0,\,\lambda}$ DURING	$C_{34,\,0,\,\lambda}$			
	250 nm	300 nm	350 nm	400 nm
ε = 0	327	3567	19634	49436
ε = -2	322	3563	19654	49451
ε = -4	326	3564	19676	49446
ε = -6	323	3563	19717	49495
ε = -8	327	3576	19713	49539
ε = -10	323	3579	19696	49539
ε = -12	325	3597	19764	49644
ε = -14	317	3591	19733	49565
ε = -16	327	3597	19736	49633
ε = -18	324	3603	19764	49610
ε = -20	331	3603	19749	49627
END OF TEST	325	3597	19836	49704
MEAN $\bar{C}_{34,\,0,\,\lambda} = \frac{\Sigma\, C_{34,\,0,\,\lambda}}{12}$	324.75	3583.3	19722.7	49557.4

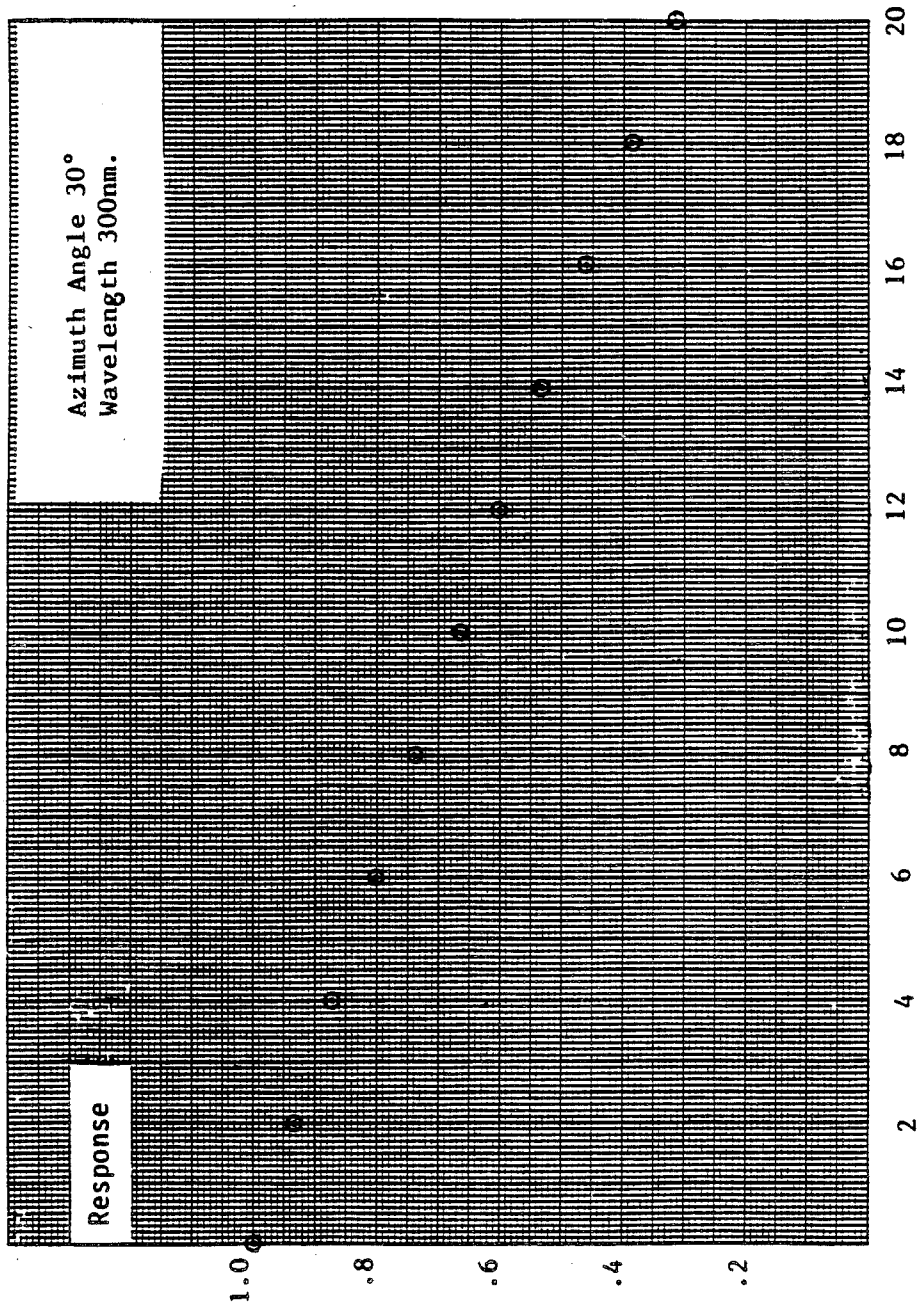
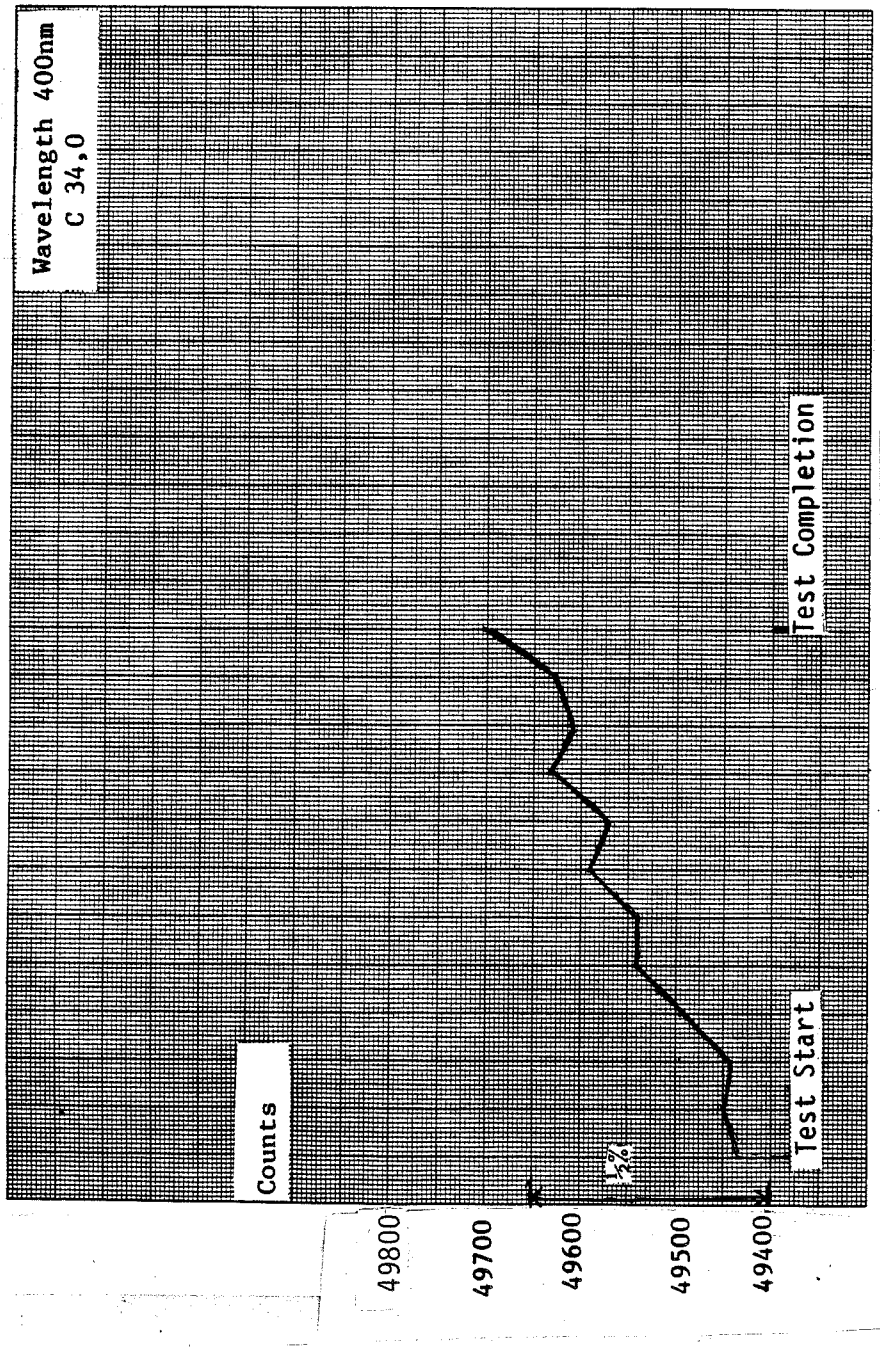


Figure 9-2 Goniometric Response vs Elevation Angle



Signal Stability Over Test at 34°, 0° position.

Figure 9-14

Ball Aerospace Systems Division

System Engineering Report

REPORT NO. SBUV-GC-83-386 DATE 3-19-83

PROJECT SBUV/2

TITLE Use of The Goniometric Test Fixture: Determination of the True Angles of Azimuth and Elevation

PREPARED BY	DATE	APPROVED BY	DATE
F. Gary Cunningham T.O. SBUV/2	8-19-83		

SCOPE/TEXT:(ATTACH ADDITIONAL SHEETS AS REQUIRED)

The goniometric properties of the on-board diffuser are measured by use of the goniometric test fixture, which is designed to simulate the motion of the sun (source) by rotating the instrument about the center of the diffuser while keeping the source fixed. Because of the geometry of the situation, the azimuth and elevation angles of measurement, α_s and ϵ_s respectively, are not the true angles α and ϵ, and are referred to herein as psuedo-angles.

When deployed in the solar viewing position, the plane of the on-board diffuser makes an angle of 28° with the instrument/spacecraft Y-Z plane, and the projection of the diffuser normal onto the Y-Z plane is offset 34 degrees from the +Z axis, in the +Y direction, to accommodate the wide variation in orbital γ angle..

In this exercise the Y-Z plane is represented by a parellel plane passing through the center of the diffuser. The azimuth angle is measured in this plane relative to the +Z axis and the elevation angle is the angle between the source and the Y-Z plane.

Figure 1 depicts the problem which can be outlined as follows:

1) The projection $\overline{OL}$ of diffuser normal $\bar{n}$ onto the Y-Z plane is offset from the Z-axis by +34°.
2) Goniometric calibration is made by azimuthal rotation φ about the line $\overline{OX'}$ ($\overline{OX}$ when the elevation ϵ is zero).

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