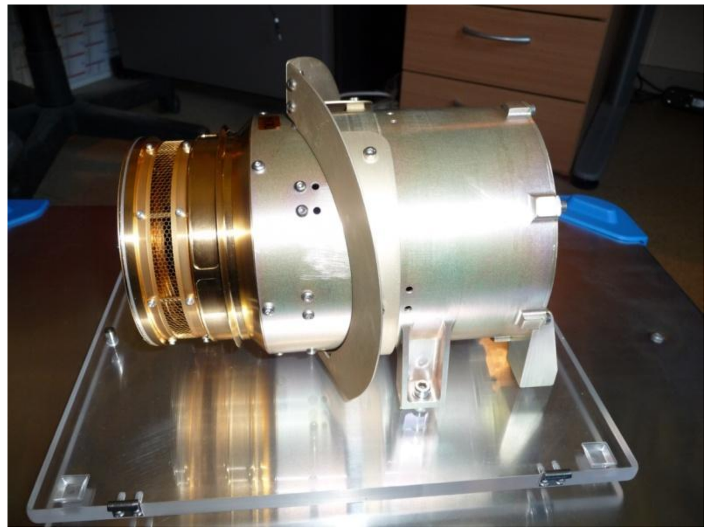
MERCURY ELECTRON ANALYZER – MMO

Meeting 14, 15, 16 July 2010



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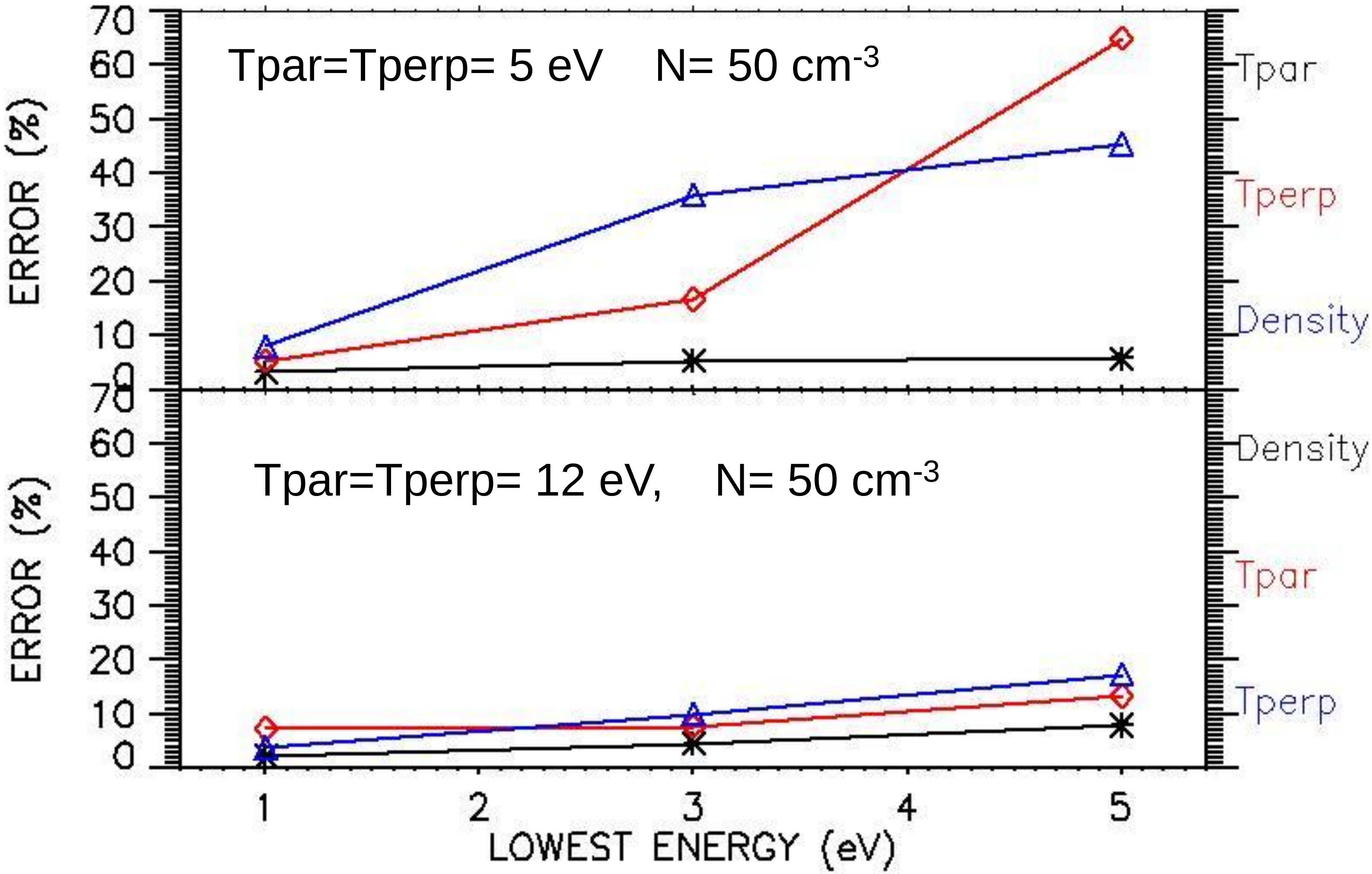
Interplanetary conditions

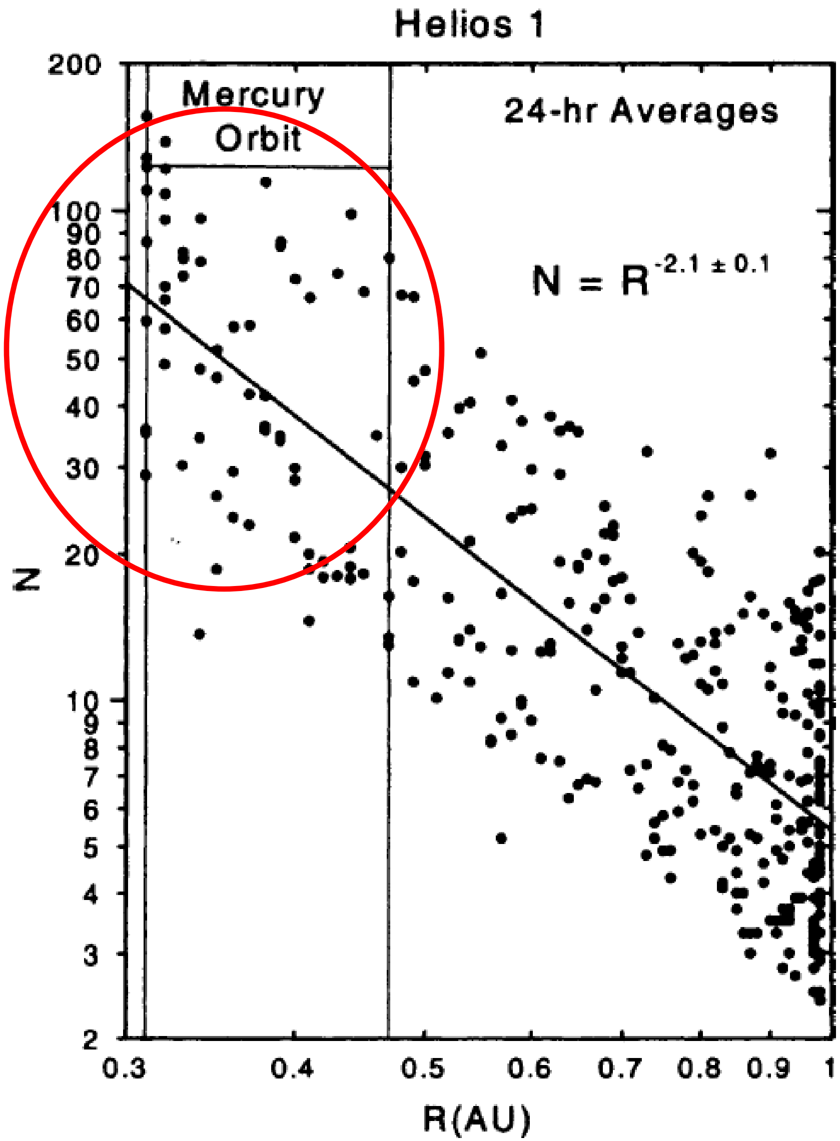
	Mercury	Earth	Jupiter	Neptun
Distance to the Sun (AU)	0,3 - 0,47	1,0	5,2	30,2
SW Density	73 - 32	7	0,3	0,008
Temp	17 - 13	8	2,7	0,8
B_{IMF} (nT)	46 - 21	6	3,4	0,14
E_{IMF} (mV/m)	18 - 8	2,4	1,3	0,05

ρV^3 VB^2

ERROR ON THE TEMPERATURE FOR VARIOUS Emin

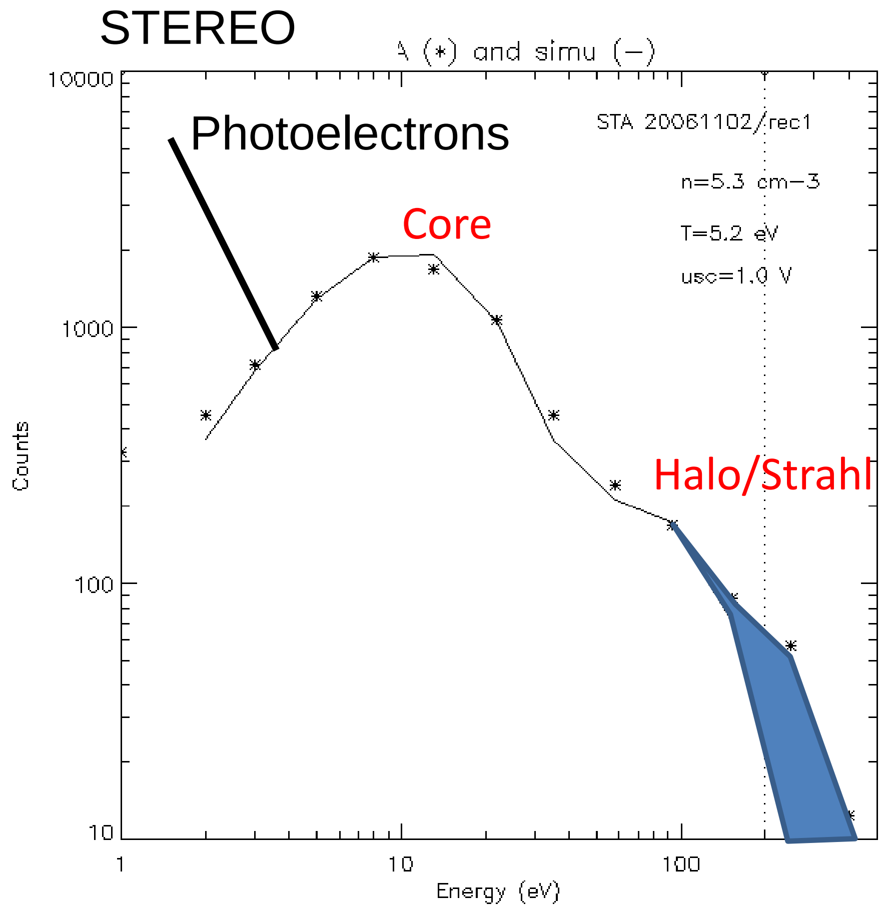


DEPENDANCE OF THE SOLAR WIND DENSITY WITH RADIAL DISTANCE



Burlaga, 2001

THE SOLAR WIND AT 1 AU



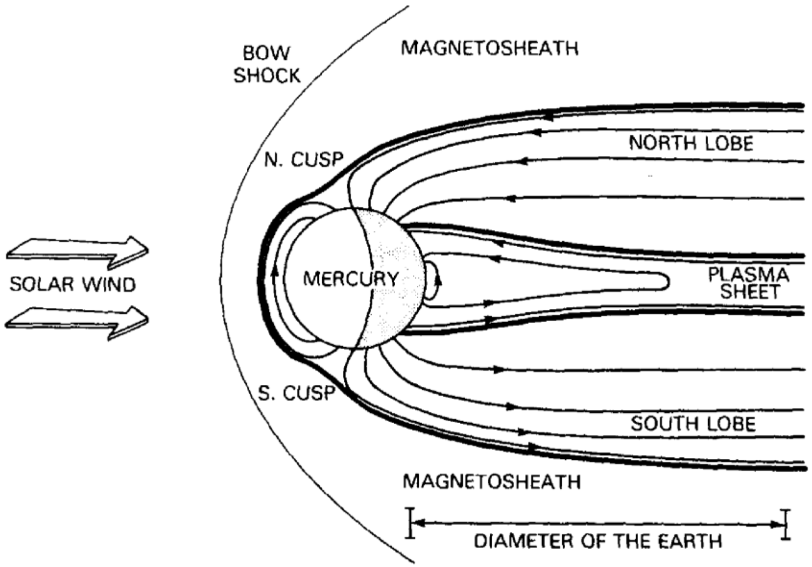
AT 0.3 AU:

The peak will be displaced around 20-30 eV at Mercury orbit

Mercury: Density x10

Note the measurements are made down to 2 eV

MERCURY, THE MAGNETOSPHERE



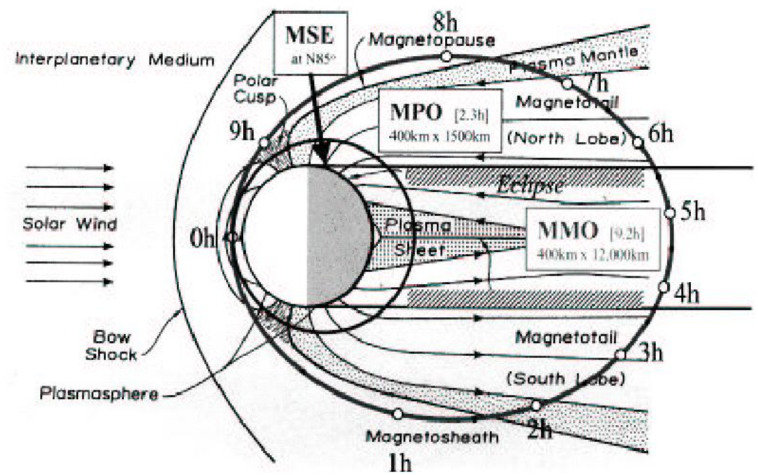
Magnetic field = 900 nT

No ionosphere

Exosphere = $H^{(+)}$, $He^{(+)}$, $Na^{(+)}$

Bepi-Colombo MMO

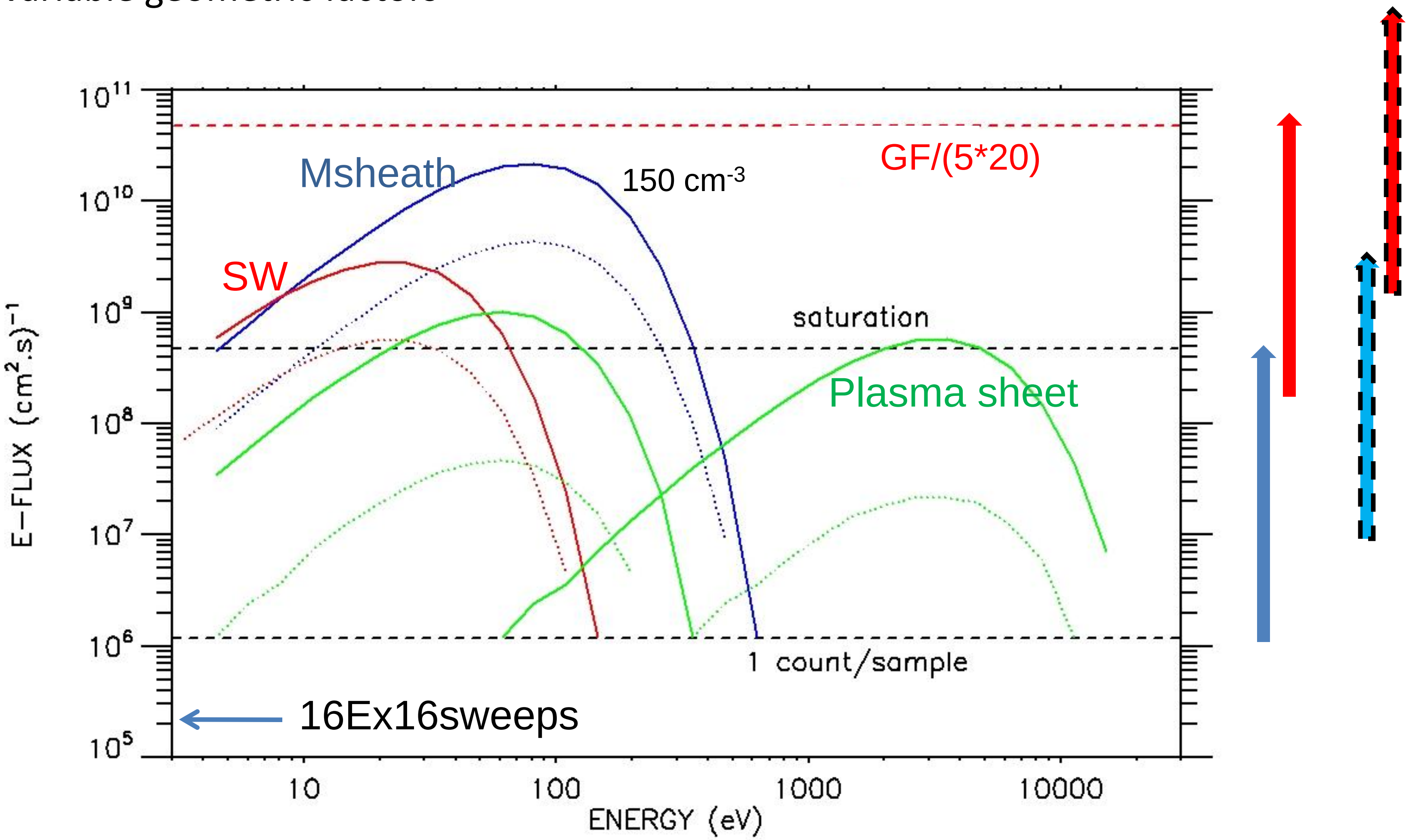
Orbit : polar- 9.2 h



Max time in magnetosphere : 6 h

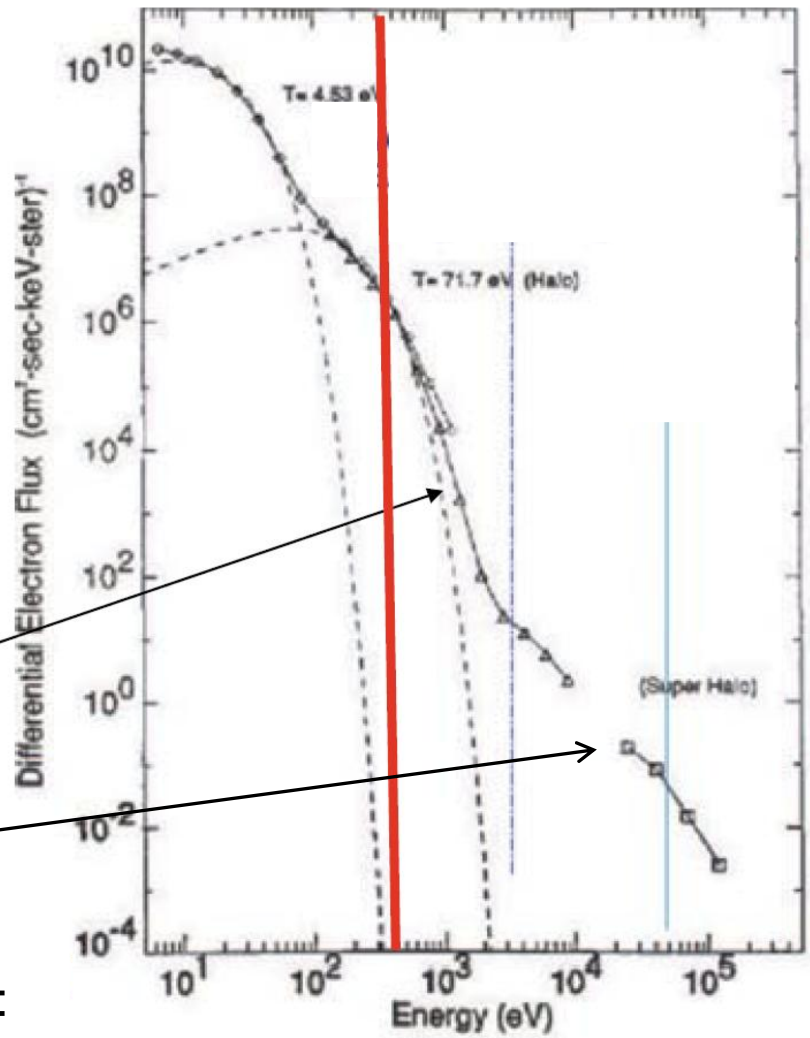
Scientific requirements

To measure a very large range of electron fluxes: from the almost empty magnetospheric lobe up to the dense solar: 2 sensor heads with different and variable geometric factors



‘High energy electron measurements’

WIND

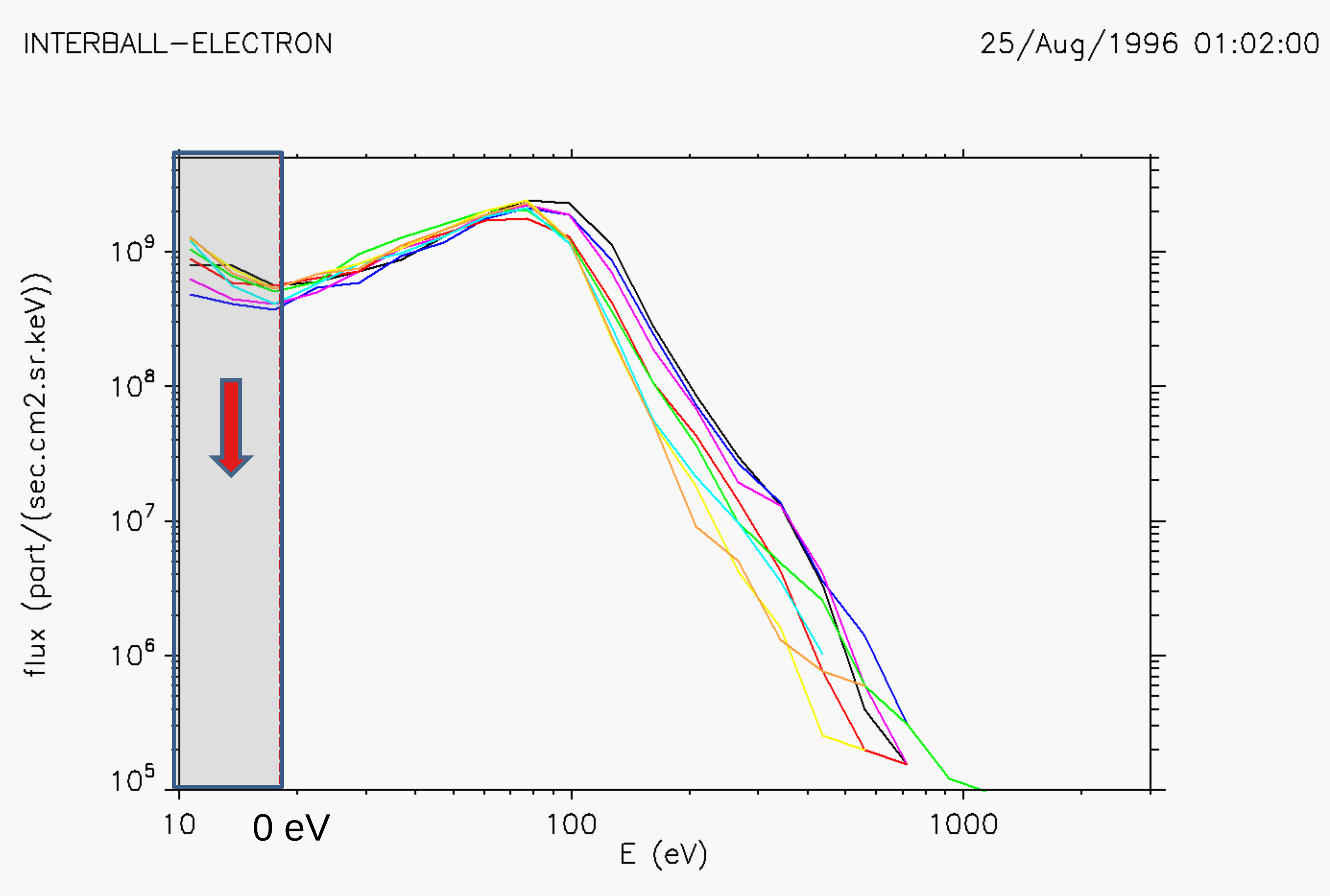


Halo

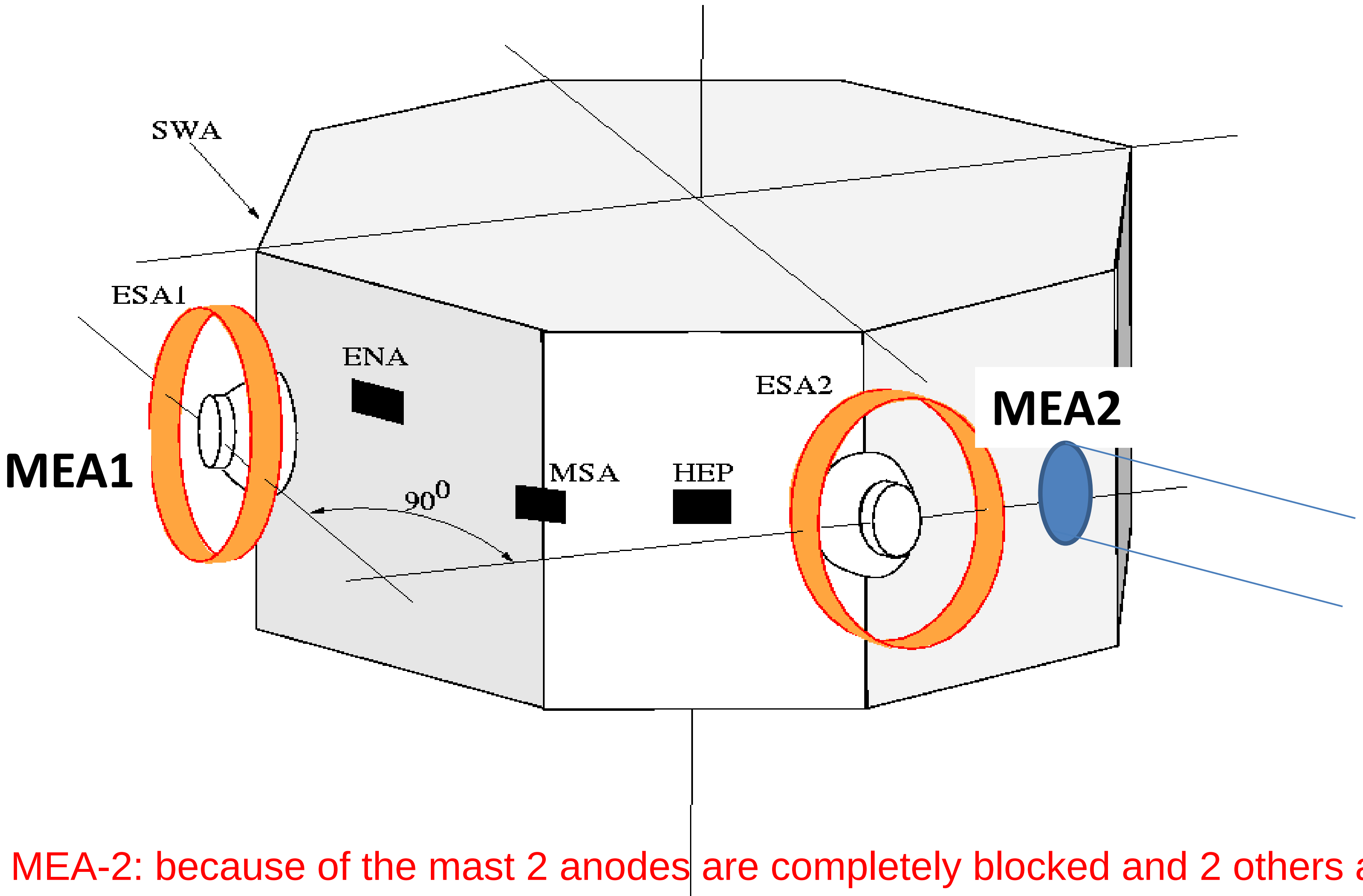
Super Halo

Measurable using 10-30 spins:
accumulation time: 40 s -120 s

CORRECTIONS FOR THE S/C POTENTIAL



MEA locations on MMO

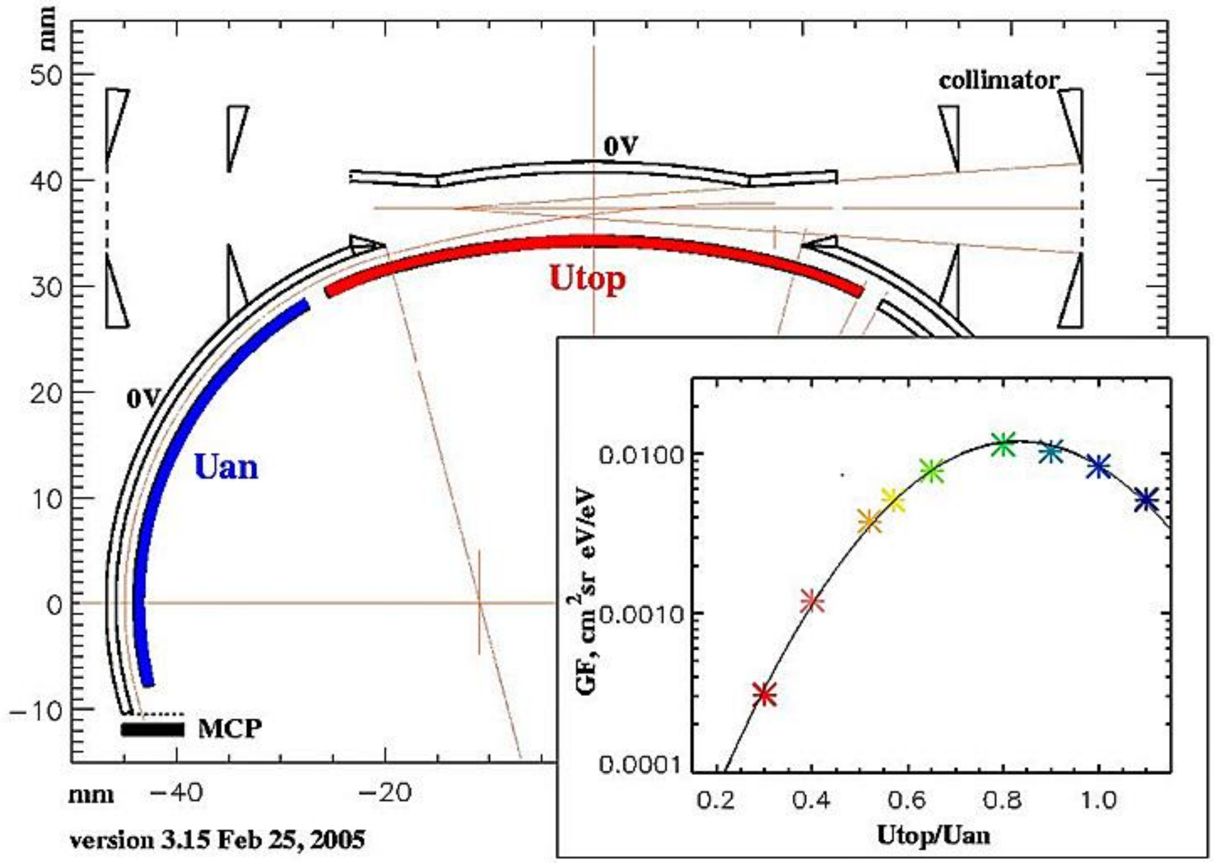


MEA-2: because of the mast 2 anodes are completely blocked and 2 others are partially obscured

VARIABLE TRANSMISSION

Inner sphere divided in 2 parts with different voltages

⟶ attenuation coefficient up to 100



Solution equivalent to make 'out of tune' 2 serial analyzers

LOWEST ENERGIES

- The lowest energy should be selectable in order to avoid unnecessary data (very high count rates)
- Either using the S/C potential provided by MEFISTO or by telecommand.
- The sweep will thus have a flat low voltage part
- The corresponding counts are set to zero

MEA 1 (Full geometrical factor)

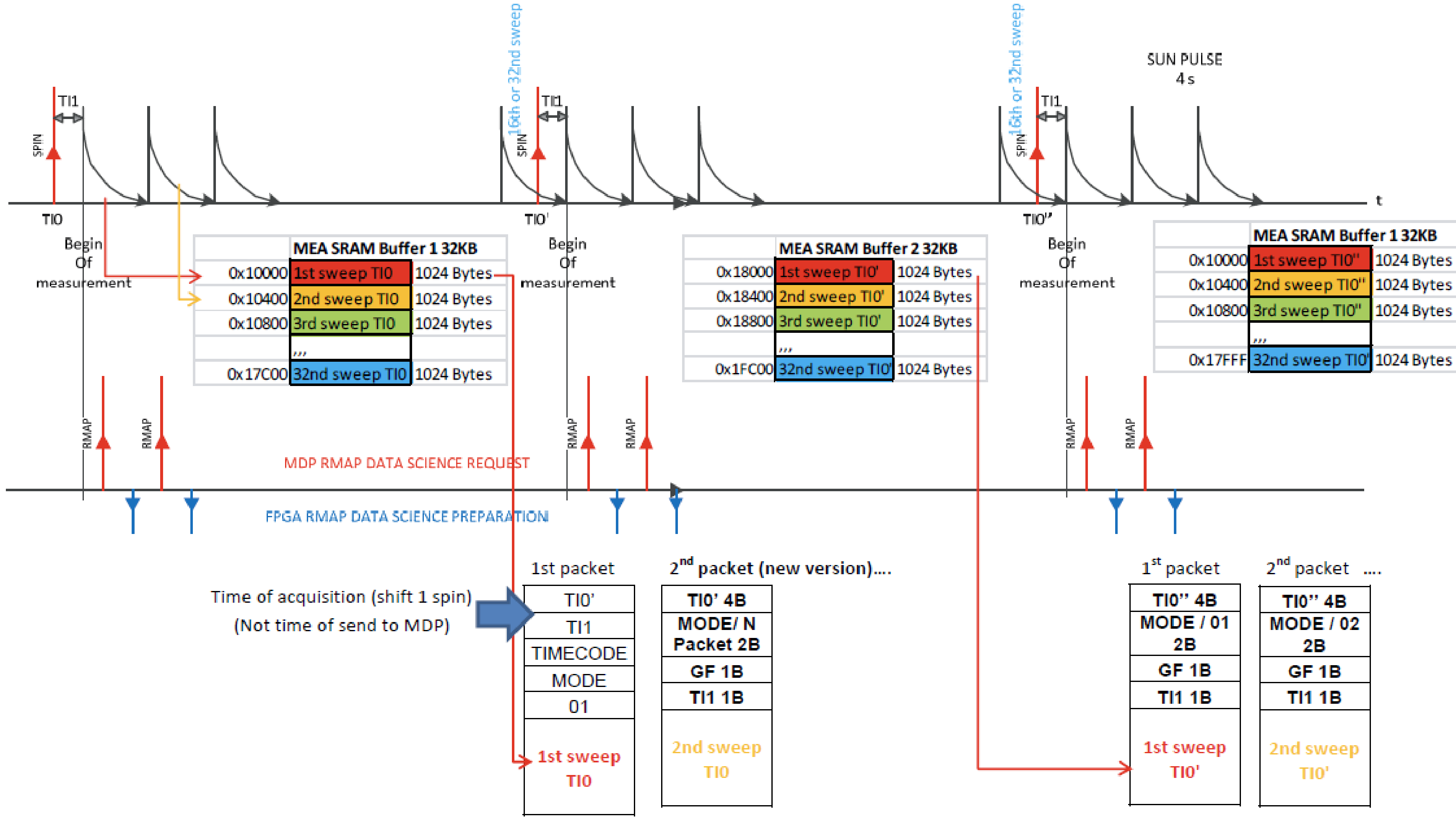
U_{TOP}/U_{Analyz}	0.8	0.42	0.34	0.27
$GF\ cm^2 sr\ eV/eV$	$4 \cdot 10^{-3}$	$6.7 \cdot 10^{-4}$	$2.0 \cdot 10^{-4}$	$6.7 \cdot 10^{-5}$
GF_0/GF	1	6	20	60
$\Theta\ deg$	1.8	7.0	8.2	9.0
$\Delta\Theta\ deg$	5.9	4.5	3.0	3.6
K	8.67	8.48	8.57	8.51
$\Delta E/E$	0.11	0.16	0.11	0.09

MEA-2

U_{TOP}/U_{Analyz}	0.8	0.52	0.37	0.28
$GF\ cm^2 sr\ eV/eV$	$2 \cdot 10^{-4}$	$6.7 \cdot 10^{-5}$	$1.6 \cdot 10^{-5}$	$4 \cdot 10^{-6}$
GF_0/GF	20	60	250	1000
$\Theta\ deg$	1.8	6.3	7.5	9.0
$\Delta\Theta\ deg$	5.9	5.0	3.0	3.5
K	8.67	8.62	8.57	8.51
$\Delta E/E$	0.11	0.13	0.11	0.08

Entrance grid

New packet header: Modification to have a time increment in the firet 6 bytes, the mode and the geometrical factor in the header



Time of acquisition (shift 1 spin) = TI0' + TI1 + (n° packet – 1) x Tspin / 32 or (Tspin /16)

Tspin / 32 = sweep time in mode with 32 sweeps; Tspin /16 = sweep time in mode with 16 sweeps;

TI0' (4B) = Time index from MDP (RMAP), time of spin when packet are send to the MDP, 4Bytes; **TI1 (1B)** ="spin phase" defined by TC, timing between sun pulse and begin of measure. **GF** = Geometry factor (0 ⇔ 1 | 1 ⇔ factor 1 | 2 ⇔ factor 2 …). **MODE** = 0⇔ 16 en/16swp | 1⇔ 16 en/32swp…

NECESSARY HK INFORMATIONS

HK : pass to ground every several minutes= Temperature, currents, MCP bias and currents. Important HK have to be passed by the scientific data.

Energy table: to be added by MDP to to the scientific packet

Geometry factor : inside the packet header

Mode: way to compute Pitch-angle, High?, Medium?, Low?, Engineering?, 8 bits

How to decide when to stop the sweep? Information about the step number will come from MDP: 1 (high energy)-32 , to be also added to the scientific data by MDP

How to decide the way to construct pitch-angle distributions From a TC sent from the ground

Table: N_{ion}, T_{ion}, spacecraft potential to be constructed onboard and used by MDP to fix the step where to stop the sweep.

CONTROL OF THE GEOMETRICAL FACTOR AND OF THE ENERGY SWEEP
ENGINEERING MEDIUM RATE MODE

Elementary step counter : 8 b
HV top part of the analyzer: 12 b
HV of the low part of the analyzer: 12 b

32 b/4= 8b/s

Time to have a full control of the 128 double steps: 128 spins= 512 seconds

CORRECTION FOR SPACECRAFT POTENTIAL

The spacecraft potential Φ_{sc} will be estimated with the following equation:

$$\Phi_{sc} = -A(\Phi_{sensor} + \Phi_{offset})$$

Where Φ_{sensor} is the average Langmuir sensor to spacecraft potential, A is scale factor taking into account the perturbation of the "local" plasma environment by the spacecraft, the antennas and their photoelectrons,

Φ_{offset} is the potential difference between the Langmuir sensor and the plasma which can vary from near zero in high density plasmas to about two volts in low density plasmas.

The values of A and of Φ_{offset} will be determined in flight calibration effort by comparing the calculated electron densities and density deduced from wave measurements.

25200.0001
23469.3281
21857.5161
20356.3981
18958.3731
17656.3591
16443.7681
15314.4511
14262.6931
13283.1691
12370.9151
11521.3121
10730.0581
9993.1451
9306.8421
8667.6721
8072.3981
7518.0061
7001.6881
6520.8311
6072.9971

5655.9191
5267.4851
4905.7281
4568.8151
4255.0411
3962.8151
3690.6591
3437.1941
3201.1361
2981.2911
2776.5431
2585.8571
2408.2671
2242.8741
2088.8391
1945.3831
1811.7791
1687.3511
1571.4681
1463.5431
1363.0311

1269.4221
1182.2411
1101.0481
1025.4301
955.0071
889.4191
828.3361
771.4481
718.4671
669.1251
623.1711
580.3731
540.5151
503.3931
468.8221
436.6241
406.6381
378.7111
352.7021
328.4791
305.9201

284.9111
265.3441
247.1201
230.1491
214.3431
199.6221
185.9131
173.1451
161.2541
150.1791
139.8651
130.2601
121.3141
112.9821
105.2231
97.9961
91.2661
84.9981
79.1611
73.7241
68.6611

63.9461
59.5541
55.4641
51.6551
48.1071
44.8031
41.7261
38.8611
36.1921
33.7061
31.3921
29.2361
27.2281
25.3581
23.6161
21.9941
20.4841
19.0771
17.7671
16.5471
15.4101

14.3521
13.3661
12.4481
11.5931
10.7971
10.0561
9.3651
8.7221
8.1231
7.5651
7.0461
6.5621
6.1111
5.6911
5.3001
4.9361
4.5971
4.2821
3.9881
3.7141
3.4591
3.2211
3.0000

Back

32 ‘steps’
2776.5- 3.22 eV

2776.5431
2585.8571
2408.2671
2242.8741
2088.8391
1945.3831
1811.7791
1687.3511
1571.4681
1463.5431
1363.0311

1269.4221
1182.2411
1101.0481
1025.4301
955.0071
889.4191
828.3361
771.4481
718.4671
669.1251
623.1711
580.3731
540.5151
503.3931
468.8221
436.6241
406.6381
378.7111
352.7021
328.4791
305.9201

284.9111
265.3441
247.1201
230.1491
214.3431
199.6221
185.9131
173.1451
161.2541
150.1791
139.8651
130.2601
121.3141
112.9821
105.2231
97.9961
91.2661
84.9981
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31.3921
29.2361
27.2281
25.3581
23.6161
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20.4841
19.0771
17.7671
16.5471
15.4101

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12.4481
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10.7971
10.0561
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8.1231
7.5651
7.0461
6.5621
6.1111
5.6911
5.3001
4.9361
4.5971
4.2821
3.9881
3.7141
3.4591
3.2211
back

25200.0001	5655.9191
23469.3281	5267.4851
21857.5161	4905.7281
20356.3981	4568.8151
18958.3731	4255.0411
17656.3591	3962.8151
16443.7681	3690.6591
15314.4511	3437.1941
14262.6931	3201.1361
13283.1691	2981.2911
12370.9151	2776.5431
11521.3121	
10730.0581	
9993.1451	
9306.8421	
8667.6721	
8072.3981	
7518.0061	
7001.6881	
6520.8311	
6072.9971	

Back

64 ‘steps’

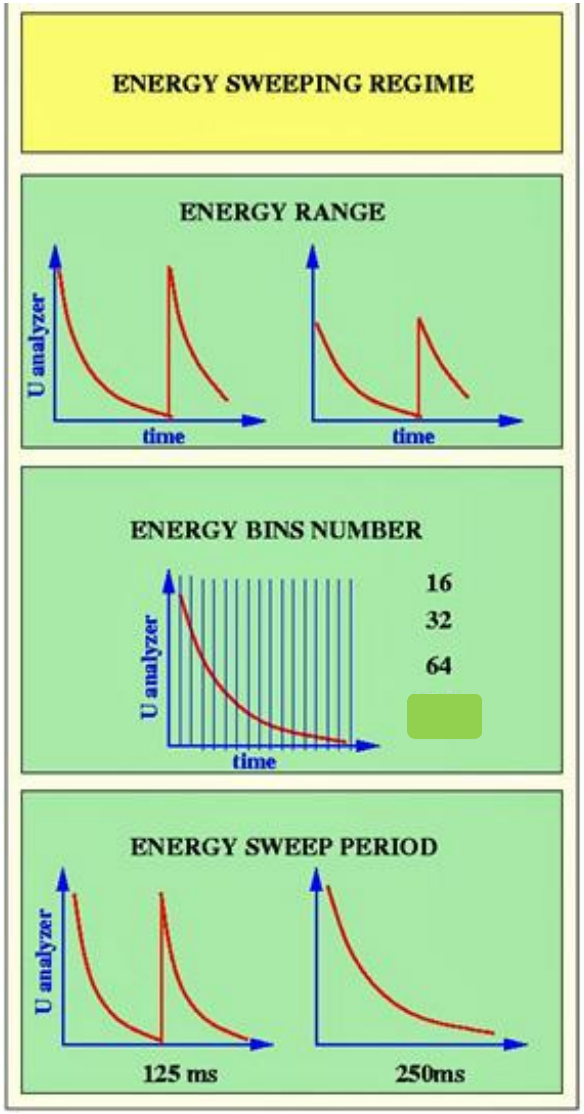
284.9- 3.22 eV

“Photo-electrons”

284.9111	63.9461	14.3521
265.3441	59.5541	13.3661
247.1201	55.4641	12.4481
230.1491	51.6551	11.5931
214.3431	48.1071	10.7971
199.6221	44.8031	10.0561
185.9131	41.7261	9.3651
173.1451	38.8611	8.7221
161.2541	36.1921	8.1231
150.1791	33.7061	7.5651
139.8651	31.3921	7.0461
130.2601	29.2361	6.5621
121.3141	27.2281	6.1111
112.9821	25.3581	5.6911
105.2231	23.6161	5.3001
97.9961	21.9941	4.9361
91.2661	20.4841	4.5971
84.9981	19.0771	4.2821
79.1611	17.7671	3.9881
73.7241	16.5471	3.7141
68.6611	15.4101	3.4591
		3.2211

Back

OPERATING MODES



32 or 64energy spectra per spin

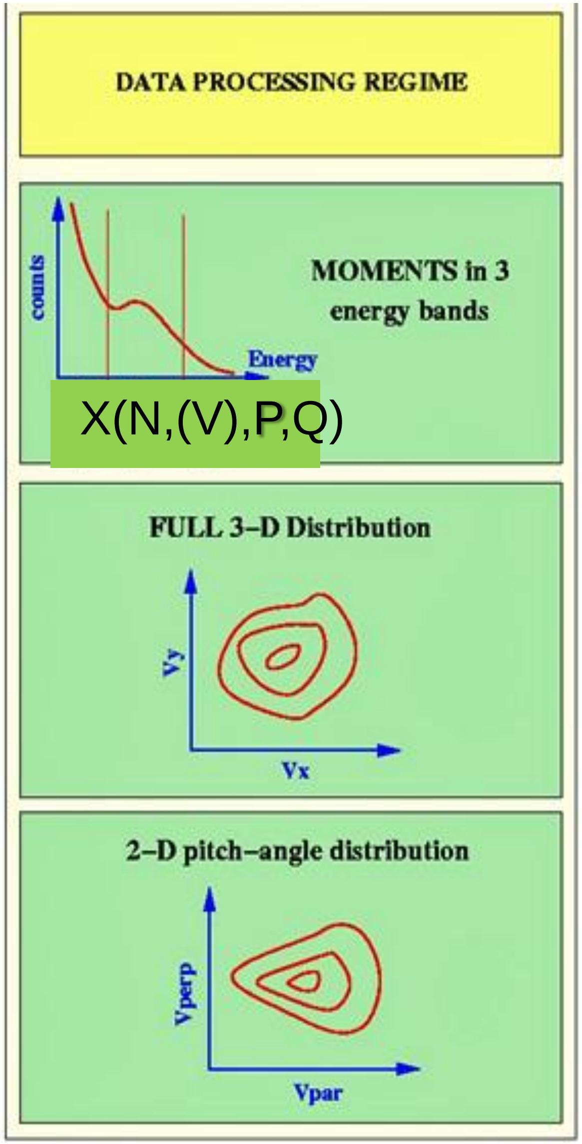
4 energy sweep possibilities:

-3-300 (Photo-electrons)
-3-3000 (Solar wind)
-3-25,200 (Magnetosphere)
-3000-25,200 (Super strahl and accelerated e^-)

2 different numbers of energies, 32 for moment computation, 64 for photo-electrons without moments

The sweep is stopped at photoelectron boundary, determined from S/C potential or after flight calibration

OPERATING MODES



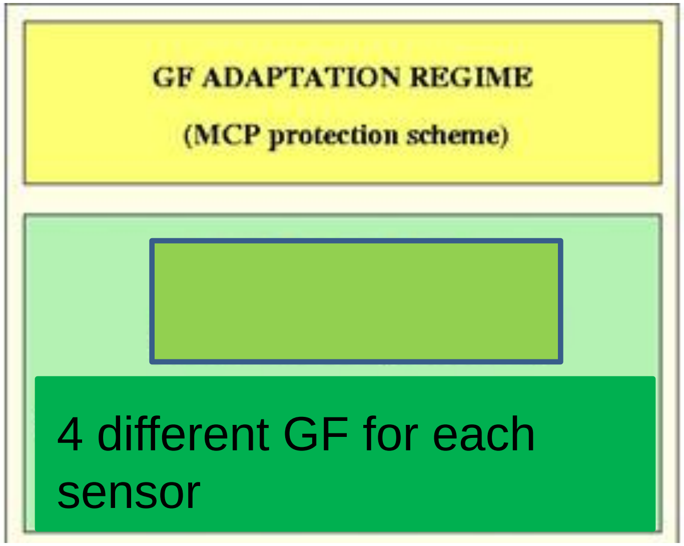
Moments corrected from the spacecraft potential

3D distributions:

Pitch-angle: from the onboard B field or from the partial pressure tensor (2sec and 4 sec)

+ Omni-directionnal energy spectrum, ODES

OPERATING MODES



Choice made from previous spins or change can be inhibited by TC

HOW TO SUPPRESS HIGH COUNT RATE DUE TO PHOTO-ELECTRONS AND TAKE INTO ACCOUNT THE SATELLITE POTENTIAL

1) Direct method

Density $\iiint (C_a/((K_a {v_a}^4)).v_a\sqrt{1 + q\frac{v_\Phi^2}{v_a^2}}\,.(v_a dv_a).\cos\theta.\,d\theta.\,d\varphi$

Velocity $1 + q\frac{v_\Phi^2}{v_a^2}$

Pressure tensor $1 + q\frac{v_\Phi^2}{v_a^2})^{3/2}$

Heat flux $1 + q\frac{v_\Phi^2}{v_a^2})^{3/2}$

Spacecraft potential : Vsc= $-A(\Phi_{sensor} + \Phi_{offset})$

Difficult to determine in-flight

HOW TO SUPPRESS HIGH COUNT RATE DUE TO PHOTO-ELECTRONS AND TAKE INTO ACCOUNT THE SATELLITE SPACECRAFT

2) Indirect method

-Compute the moments from the highest energy down to the energy which is guessed to equal two times the satellite potential. (hypothesis: potential=0 in the computations)

-Pass partial moments for each energy lower than 2 times the guessed potential (hypothesis: potential=0)

-The value of the potential is changed according to the orbit

Ex: For a solar wind potential of 10 volts, moments are computed from 2776 eV to 27.22 eV and 5 partial moments for lower energies are transmitted.

Spacecraft potential : Vsc= $-A(\Phi_{sensor} + \Phi_{offset})$ found on ground and partial moments are corrected.

HOW TO CHANGE THE GEOMETRICAL FACTOR IN-FLIGHT

-Based on saturation

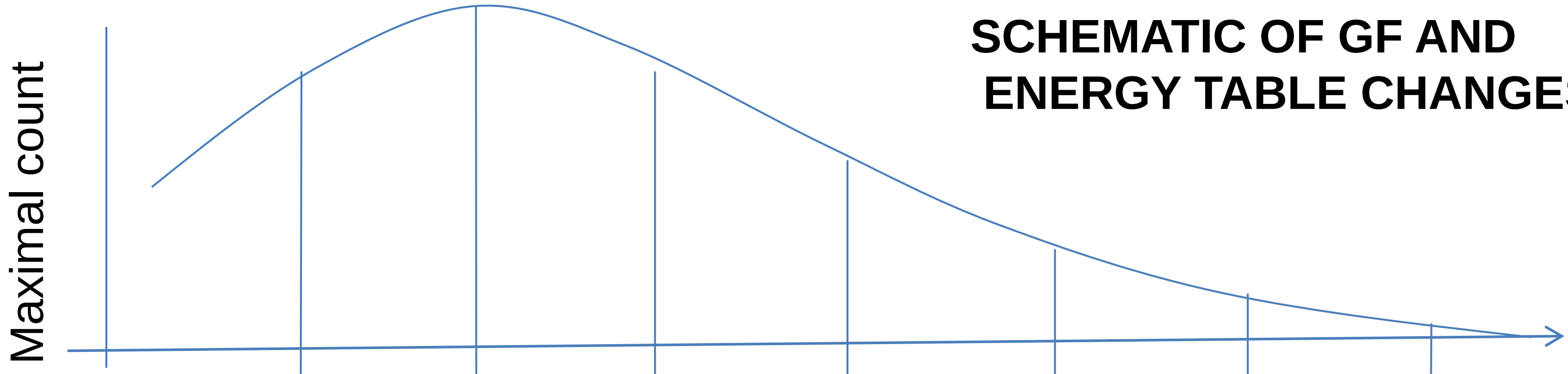
Solar wind/Sheath: if the count rate averaged over X spins at an energy of 25 eV or 100eV are higher than 1x 10^5/(sec.anode) (1/2x10^6x0.2 cm^2)

Mercury magnetosphere: if the counts at 40 eV or 200 eV or 2000 eV are higher than 1x 10^5/(sec.anode) (1/2x10^6x0.2 cm^2)

Finally: cimpute the sum of the counts at 25, 40, 100 and 200 eV and if one of these counts exceed the threshold: increase the geometrical factor

-Based on too few events:

Solar wind, Sheath, Magnetosphere: If the average total number of counts/spin is lower than 1000 during X spins



SCHEMATIC OF GF AND ENERGY TABLE CHANGES

MEA-1 GF factor	60	250	1000	250	60	20	20	20
MEA-2 GF factor	60	1	1	1	60	20	6	1
MEA-2 ETable	T1	T3	T3	T3	T1	T1	T1	T1
MEA-1 ETable	T2	T2	T2	T2	T2	T2	T2	T2
Sensor deciding	MEA-2	MEA-2	MEA-2	MEA-2	MEA-2	MEA-2	MEA-1	MEA-1

T1: 3eV – 25 keV
T2: 3eV - 3 keV
T3: 3keV – 25 keV

OMNIDIRECTIONNAL ENERGY SPECTRA

$$ODES_i = \Sigma_{j,k}[C_{i,k}/\varepsilon_k]<\cos(\theta)>$$

i: energy
k:anodes (polar angle)
j: azimuth – rotation

ε_k allows to take into account the variations of the transmission of the analyzer with azimuth

ODES will be corrected on ground from the satellite potential which modify the geometrical factor and the energy transmission

PITCH-ANGLE DISTRIBUTION

-Correspond to the sweep when the magnetic field is inside the plane of measurements - once per spin

-16 anodes are transmitted

-N energies are transmitted

The direction time when B will be in the measurement plane is computed

-either from the magnetometer data, once the offsets are corrected (by whom?)

-or from the symmetry direction of the partial pressure tensor for E between 150 and 300 eV

MINIMUM INFORMATION REQUIRED LOW BIT RATE

(1) Moments are computed taking into account the satellite potential from MEFISTO

Each sensor: 218 b/s; 436 b/s for both sensors (146 b/s compressed)

Moments every spin from 1 sensor = 52 b/s (1) 13x16/4

Omnidirectionnal energy spectrum every spin (16Ex16b)/4 = 64 b/s

Pitch angle distributions at 4 energies every 4 spins: 4Ex16anodesx16b/16 = 64 b/s

Option: 3D every 150 spins (600 seconds): 16Ex88Ωx16b/600 = 38 b/s

MINIMUM INFORMATION REQUIRED   LOW BIT RATE

(2) Without potential correction

Each sensor: 206 b/s;   412 b/s for both sensors (138 b/s)

Moments every 4 spin from 1 sensor = 78 b/s (2)   6E(13x16b/16)

Omnidirectionnal energy spectrum every spin (16Ex16b)/4 = 64 b/s

Pitch angle distributions at 4 energies every 4 spins: 4Ex16anodesx16b/20 = 64 b/s

+3D every 150 spins (600 seconds): 16Ex88Ωx16b/600 = **38 b/s**

MEA energy tables:

Name	Description	Energy Range	Step Number	Comment
T0	Photoelectrons	3 - 300eV	64	32(?) TBD
T1	Full Range	3eV - 25keV	32	
T2	Low Energies	3eV - 3keV	32	
T3	High Energies	3keV – 25 keV	32	

MCP calibration procedure:

Definitions:

UMCP Tolal MCP voltage, V, (that is MCP bias + 400V)

UMCP_D Digital reference (0 -> x0FFX, 4 LSB are not used) 13V step.

WUMCP The working point, Total voltage, V

WUMCP_D Digital reference of the working point

Description:

8 successive values with a step 65V (x0050 in digital reference), around the WUMCP_D. Thus the values are:

UMCP = WUMCP + [-234.0, -169.0, -104.0, -39.0, 26.0, 91.0, 156.0, 221.000]

UMVP_D = WUMCP_D + [-288, -208, -128, -48, 32, 112, 192, 272]

Thus we need 8 telecomands during any MR mode with time step 30s.

After this sequence a telecomand to return to WUMCP previous point should be done.

MEDIUM BIT RATE ENGINEERING MODE

(1) Moments are computed taking into account the satellite potential from MEFISTO

MEA-1: 1384 b/s

Moments every 1/2 spin from MEA-1= 104 b/s (1) 1Ex13x16/2

Omnidirectionnal energy spectrum every1/2 spin (32Ex16b)/2 = 256 b/s

Pitch angle distributions at 8 energies every 1/2 spin: 8Ex16anodesx16b/2 = 1024 b/s

MEA-2: 692 b/s

Moments every 1spin from MEA-1= 52 b/s (1) 1Ex13x16/4

Omnidirectionnal energy spectrum every1 spin (32Ex16b)/4 = 128 b/s

Pitch angle distributions at 8 energies every 1 spin: 8Ex16anodesx16b/4 = 512 b/s

3D: 16Ex88Ωx16b/4= 5632 b/s

TOTAL MEA-1+MEA-2: 7708 (2570) b/s

MEDIUM BIT RATE ENGINEERING MODE

(2) Moments are computed with zero potential

MEA-1: 1264 b/s

Moments every 1/2 spin from MEA-1= 624 b/s (2) 6Ex13x16/2

Omnidirectionnal energy spectrum every1/2 spin (32Ex16b)/2 = 128 b/s

Pitch angle distributions at 4 energies every 1/2 spin: 4Ex16anodesx16b/2 = 512 b/s

MEA-2: 632b/s

Moments every 1spin from MEA-2= 312 b/s (1) 6Ex13x16/4

Omnidirectionnal energy spectrum every1 spin (32Ex16b)/4 = 64 b/s

Pitch angle distributions at 4 energies every 1 spin: 4Ex16anodesx16b/4 = 256 b/s

3D-1 spin, 1 detector: 16Ex88Ωx16b/4= 5632 b/s

TOTAL MEA-1+MEA-2: 7528 (2743) b/s

MEDIUM BIT RATE ENGINEERING PHOTOELECTRON MODE

MEA-1: 1152 b/s 64 steps starting at 280 eV

Omnidirectionnal energy spectrum every1/2 spin (64Ex16b)/2 = 128 b/s

Pitch angle distributions at 8* energies every 1/2 spin: 4Ex16anodesx16b/2 = 1024 b/s

* Changed by telecommand and made of 3 elementary steps

MEA-2: 632b/s Normal E sweep

Moments every 1spin from MEA-2= 312 b/s (1) 6Ex13x16/4

Omnidirectionnal energy spectrum every1 spin (32Ex16b)/4 = 64 b/s

Pitch angle distributions at 4 energies every 1 spin: 4Ex16anodesx16b/4 = 256 b/s

3D-1 spin, 1 detector: 16Ex88Ωx16b/4= 5632 b/s

TOTAL MEA-1+MEA-2: 7528 (2743) b/s

MEDIUM BIT RATE SCIENCE MODE

(1) Moments are computed taking into account the satellite potential from MEFISTO

MEA-1: 1128 b/s

Moments every 1/2 spin from MEA-1= 104 b/s (1) 1Ex13x16/2

Omnidirectionnal energy spectrum every1/2 spin (32Ex16b)/2 = 256 b/s

Pitch angle distributions at 6 energies every 1/2 spin: 6Ex16anodesx16b/2 = 768 b/s

MEA-2: 692 b/s

Moments every 1spin from MEA-1= 52 b/s (1) 1Ex13x16/4

Omnidirectionnal energy spectrum every1 spin (32Ex16b)/4 = 128 b/s

Pitch angle distributions at 8 energies every 1 spin: 8Ex16anodesx16b/4 = 512 b/s

3D-2 spins: 16Ex88Ωx16b/8= 2816 b/s

TOTAL MEA-1+MEA-2: 4636 b/s (1546)

MEDIUM BIT RATE SCIENCE MODE

(2) Moments are computed with Vs/c = 0

MEA-1: 1392 b/s

Moments every 1/2 spin from MEA-1= 624 b/s (1) 6Ex13x16/2

Omnidirectionnal energy spectrum every1/2 spin (32Ex16b)/2 = 256 b/s

Pitch angle distributions at 4 energies every 1/2 spin: 4Ex16anodesx16b/2 = 512 b/s

MEA-2: 696 b/s

Moments every 1spin from MEA-1= 312 b/s (1) 6Ex13x16/4

Omnidirectionnal energy spectrum every1 spin (32Ex16b)/4 = 128 b/s

Pitch angle distributions at 4 energies every 1 spin: 4Ex16anodesx16b/4 = 256 b/s

3D-2 spins: 16Ex88Ωx16b/8= 2816 b/s

TOTAL MEA-1+MEA-2: 4904 b/s (1635)

REDUCED MEDIUM BIT RATE SCIENCE MODE

(1) Moments are computed taking into account the satellite potential from MEFISTO

Either: 2076 b/s (692):

MEA-1: 1384 b/s

Moments every 1/2 spin from MEA-1= 104 b/s (1) 1Ex13x16/2

Omnidirectionnal energy spectrum every1/2 spin (32Ex16b)/2 = 256 b/s

Pitch angle distributions at 8 energies every 1/2 spin: 8Ex16anodesx16b/2 = 1024 b/s

MEA-2: 692 b/s

Moments every 1spin from MEA-1= 52 b/s (1) 1Ex13x16/4

Omnidirectionnal energy spectrum every1 spin (32Ex16b)/4 = 128 b/s

Pitch angle distributions at 8 energies every 1 spin: 8Ex16anodesx16b/4 = 512 b/s

Or: 2816 b/s (939)

3D-2 spins: 16Ex88Ωx16b/8= **2816 b/s (939)**

REDUCED MEDIUM BIT RATE SCIENCE MODE

(2) Moments are computed with Vsc = 0

Either: 2088 b/s (696):

MEA-1: 1392 b/s

Moments every 1/2 spin from MEA-1= 624 b/s (1) 6Ex13x16/2

Omnidirectionnal energy spectrum every1/2 spin (32Ex16b)/2 = 256 b/s

Pitch angle distributions at 4 energies every 1/2 spin: 8Ex16anodesx16b/4 = 512 b/s

MEA-2: 696 b/s

Moments every 1spin from MEA-1 = 312b/s (2) 6Ex13x16/4

Omnidirectionnal energy spectrum every1 spin (32Ex16b)/4 = 128 b/s

Pitch angle distributions at 4 energies every 1 spin: 4Ex16anodesx16b/4 = 256 b/s

Or: 2048 b/s (470)

3D-2 spins: 16Ex88Ωx16b/8= 2048 b/s

HIGH BIT RATE SCIENCE MODE

Total: 33792 (11264)

MEA-1 3D-1/2 spin: 32 Ex88Ωx16b/2= 22528 b/s

MEA-2 3D – 1 spin: 32Ex88 Ω16b/4 = 11264 b/s

MEA MODES

LBRWI=	M, ODES, PA	146 bps	32E 32 sweeps
LBRWO=	M, ODES, PA	138	“
MBReWI =	M, ODES, PA, 3D	2570	“
MBReWO=	M, ODES, PA, 3D	2743	“
MBResmph=	M, ODES, PA, 3D	2743	64E 32 sweeps
MBRsmWI=	M, ODES, PA, 3D	1546	32E 32 sweeps
MBRsmWO=	M, ODES, PA, 3D	1635	“
MBRredWI1 =	M, ODES, PA	692	“
MBRredWI2=	3D	939	“
MBRredWO1 =	M, ODES, PA	696	“
MBRredWO2 =	3D	470	“
HBR =	3D	11264	“

LBRWI : **L**ow **b**it **r**ate **wi**th the satellite potential from MEFISTO
MBReWO: **M**edium **B**it **R**ate **e**ngineering **w**ith**o**ut the MEFISTO potential

INFORMATIONS NEEDED ONBOARD

-Spin pulse

-Magnetic field with offset removed or

-True phase angle of the plane containing the magnetic field

-Spacecraft potential (in fact Φ_{sensor} : Vsc= $-A(\Phi_{sensor} + \Phi_{offset})$

-Information transmitted between MEA-1 and MEA-2: symmetry direction of the electron distribution function ? Or computed from each sensor?

Burst mode, to MDP

16phi x 16cells x 64E x 16b x 2sensors/4s = 131072 bps

32phi x 16cells x 32E x 16b x 2sensors/4s = 131072 bps

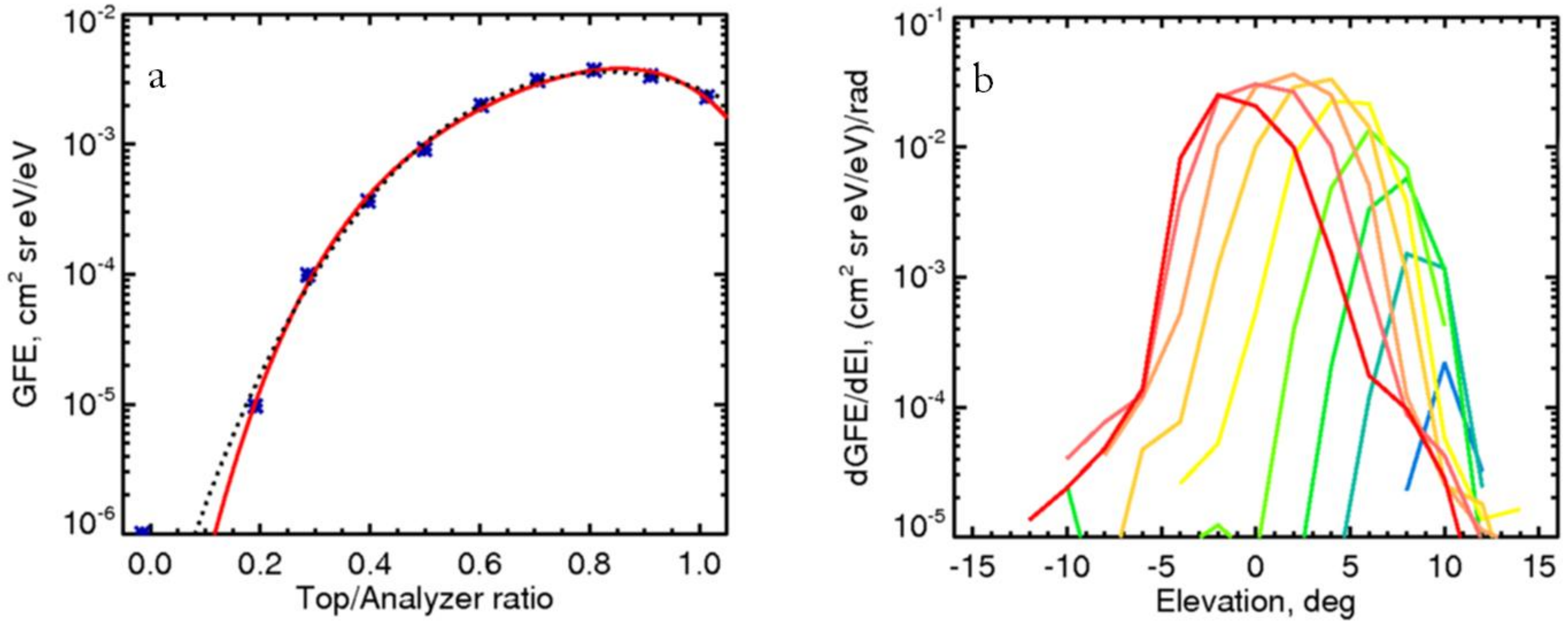
16phi x 16cells 16E x 16b x 2sensors/4s = 32768 bps

From MEA-1 and MEA-2 to MDP: 32768 bytes x 2 every 4 seconds
= 131072 bps

MEA

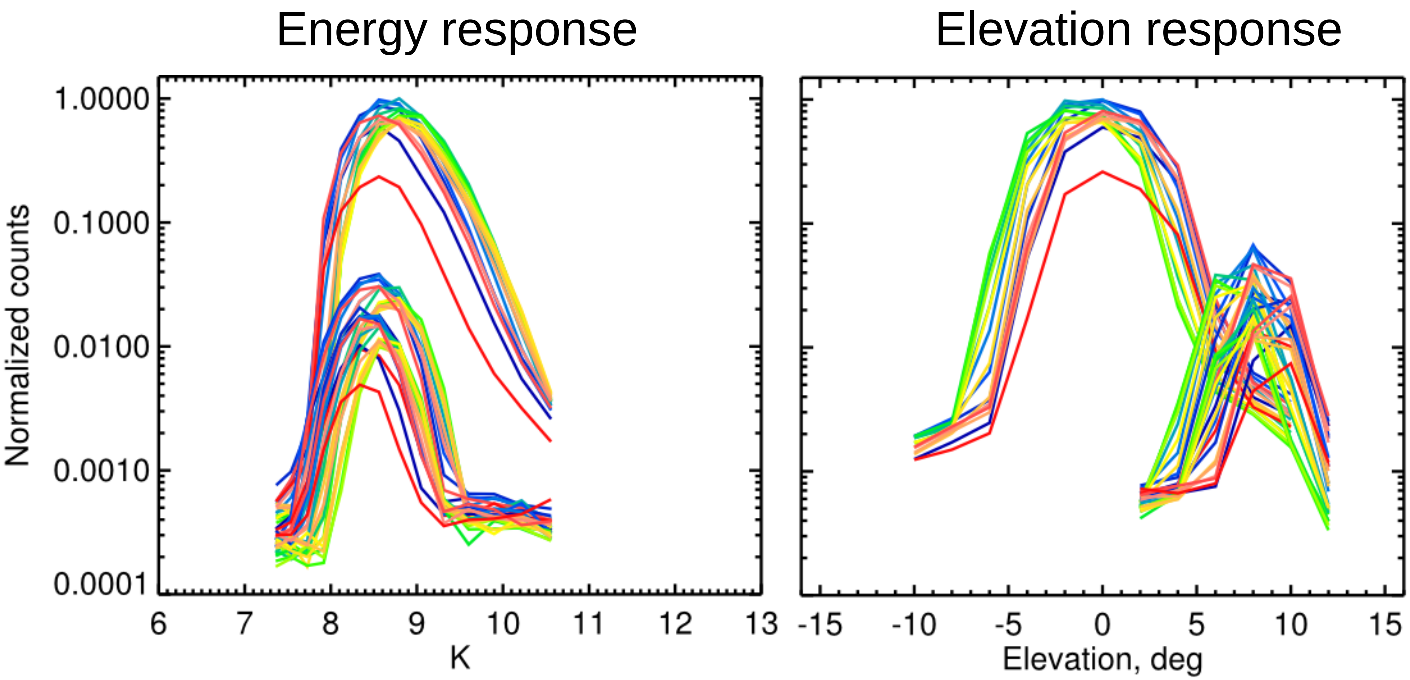
GENERAL PROPERTIES

MEA EQM
General properties for different GF values



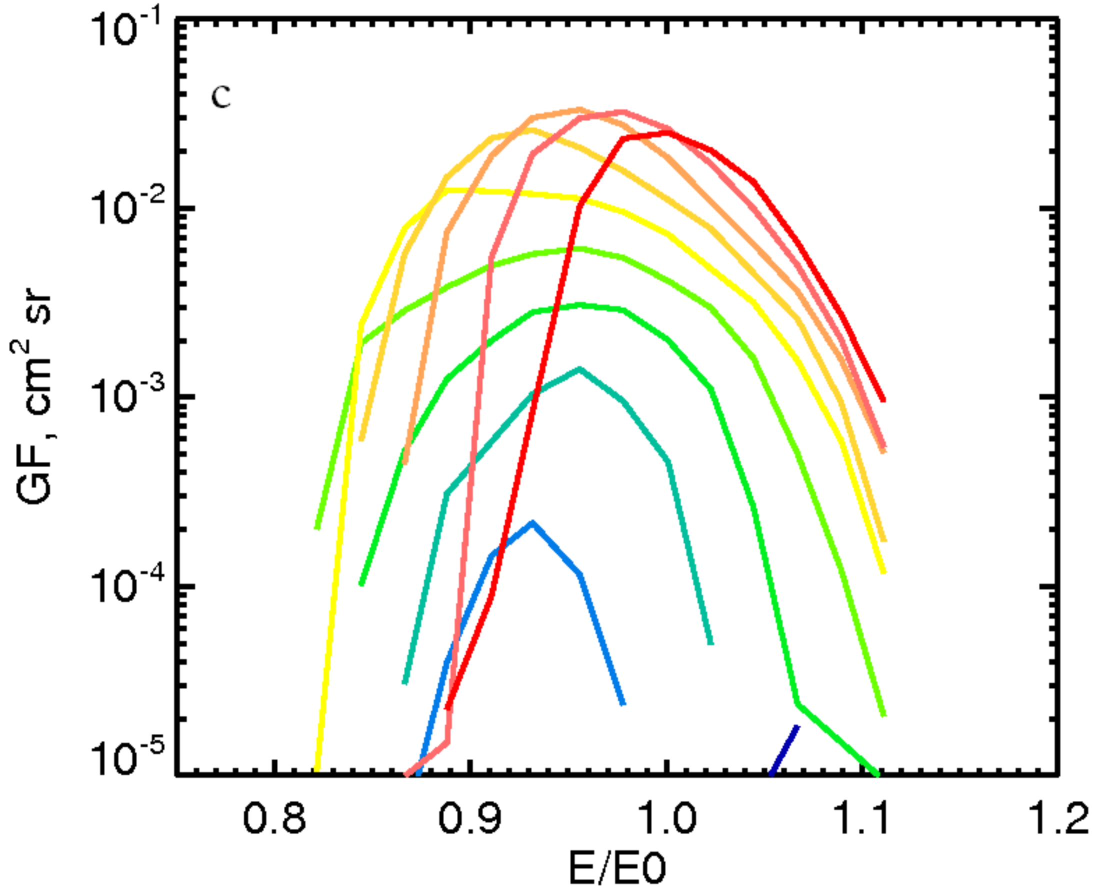
E/V=k varies with the geometrical factor

MEA EQM
General properties for different GF values

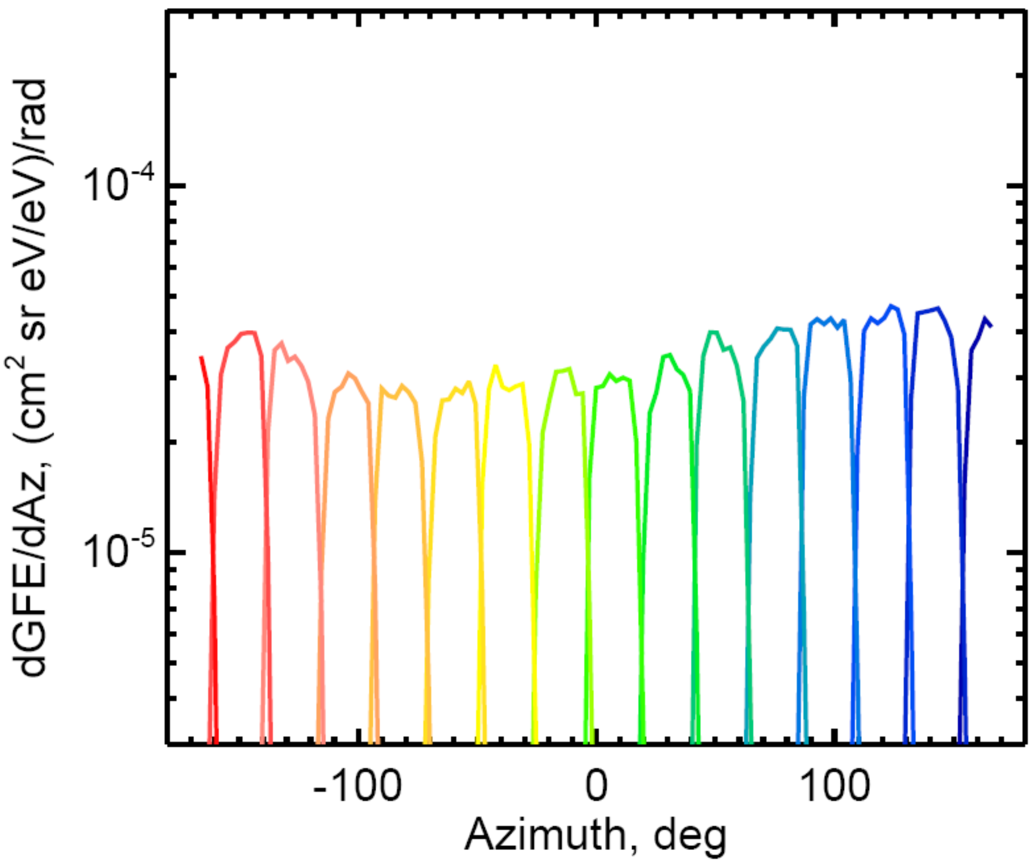


GF attenuation	K0 (Energy/Uanalyzer)	ΔE/E	Elevation,deg	Δ Elevation, deg
1	8.7	9.2%	0	5
34	8.4	8.3%	8	3
78	8.3	8.0%	8.5	2

MEA EQM
General properties for different GF values

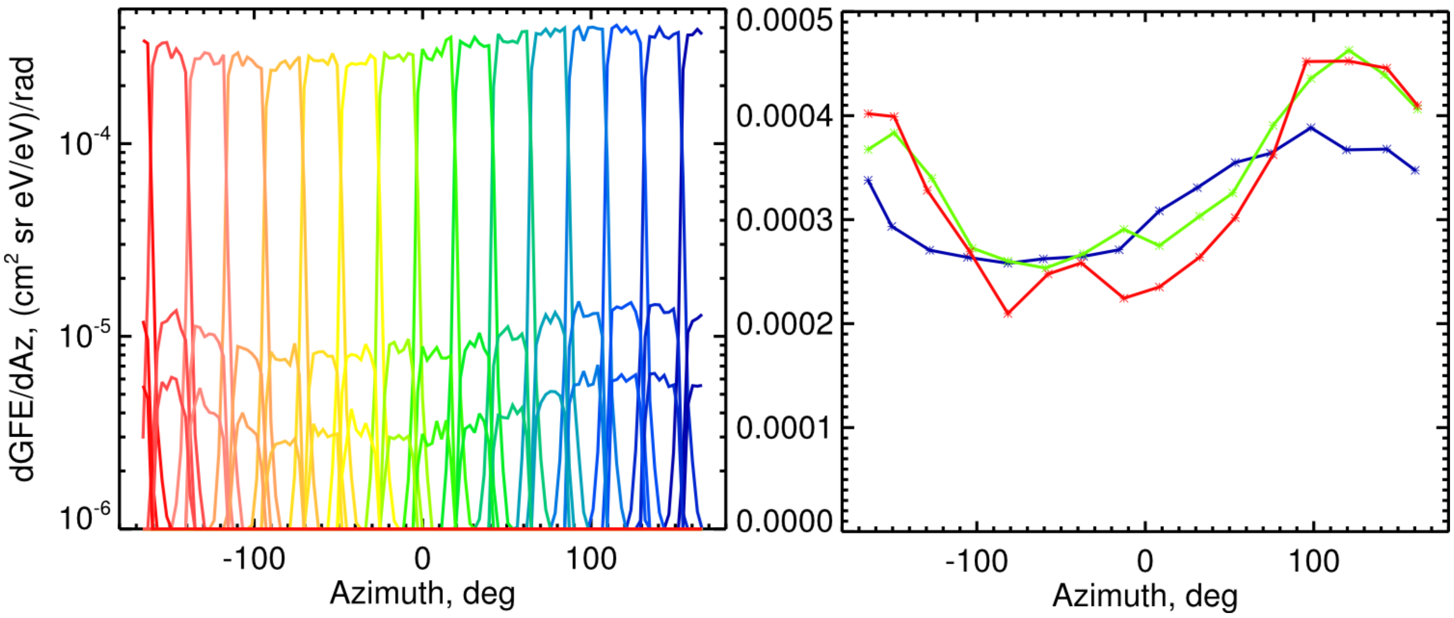


MEA EQM
General properties for different GF values



For a given GF, transmission varies with azimuth

MEA EQM
Azimuthal variation of the geometrical factor



Left: Azimuth response of the 16 anodes for 3 values of the geometrical factor
Right: GF in linear scale versus azimuth. The blue, green and red curve respectively correspond to Utop/Uan=0.85, 0.3 and 0.25. GF values are normalized to the maximal GF.

MEA EQM
Variable geometric factor