

**Magnetospheric Multiscale (MMS)
Fast Plasma Investigation (FPI)
Data Products Guide**



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L2 File and Variable Naming Conventions

File Naming Convention

There are currently two FPI L2 files per species, mode, and observatory: moments and distributions. The L2 file naming convention is

<obs>_fpi_<mode>_l2_<tag>_<YYYYMMDDHHMMSS>_v<x.y.z>.cdf, where:

- <obs> is one of: mms1, mms2, mms3, mms4
- <mode> is one of: brst, fast, slow
- <tag> is one of: des-dist, des-moms, dis-dist, dis-moms
- <YYYYMMDDhhmmss> is the date time tag of the first record in the file
- <x.y.z> is the version of the FPI ground system software used to generate the file

Variable Naming Convention

Moments and distribution variables utilize the convention of

<obs>_<species>_<varname>_<mode>, where:

- <obs> is one of: mms1, mms2, mms3, mms4
- <species> is one of: des, dis
- <varname> is the variable name in the tables below

<mode> is one of: brst, fast, slow

FPI DES/DIS Moments File Structure

Variable	Units	DataType	Dim	Description
errorflags	32-bit error flags	CDF_UINT4	1	Vector of data-quality indicators at epoch start time
compressionloss	0, 1	CDF_UINT1	1	Compression lossless/lossy indicator at survey start time
steptable_parity (burst only)	0, 1	CDF_UINT1	1	Step table parity
startdelphi_count	del-phi counts	CDF_UINT2	1	Del-Phi (obs spin-phase) count at epoch start time
startdelphi_angle (burst only)	deg	CDF_REAL4	1	Del-Phi (obs spin-phase) angle at epoch start time
sector_despinp (burst only)	00-32	CDF_UINT1	1	Sector de-Spin P value
pitchangdist_lowen (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	30 x 1	Electron pitch-angle distribution for "low" energies
pitchangdist_miden (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	30 x 1	Electron pitch-angle distribution for "mid" energies
pitchangdist_highen (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	30 x 1	Electron pitch-angle distribution for "high" energies
energyspectr_px	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" +X in DBCS
energyspectr_mx	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" -X in DBCS
energyspectr_py	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" +Y in DBCS
energyspectr_my	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" -Y in DBCS
energyspectr_pz	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" +Z in DBCS
energyspectr_mz	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" -Z in DBCS
energyspectr_par (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron energy parallel to the magnetic field direction
energyspectr_anti (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron energy anti-parallel to the magnetic field direction
energyspectr_perp (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron energy perpendicular to the magnetic field direction
energyspectr_omni	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Omni-directional electron/ion energy spectrum
numberdensity	cm ⁻³	CDF_REAL4	1	Number density
numberdensity_err	cm ⁻³	CDF_REAL4	1	Number density error
densityextrapolation_low	cm ⁻³	CDF_REAL4	1	Estimated (via extrapolation to 0) contribution to density integral below 10eV
densityextrapolation_high	cm ⁻³	CDF_REAL4	1	Estimated (via extrapolation to infinity) contribution to density integral above 30keV
bulkv_dbcs	km/s	CDF_REAL4	3 x 1	Bulk-velocity vector in DBCS
bulkv_spin_dbcs (fast/burst only)	km/s	CDF_REAL4	3 x 1	Bulk-velocity spintone vector in DBCS
bulkv_gse	km/s	CDF_REAL4	3 x 1	Bulk-velocity vector in GSE
bulkv_spin_gse (fast/burst only)	km/s	CDF_REAL4	3 x 1	Bulk-velocity spintone vector in GSE
bulkv_err	km/s	CDF_REAL4	3 x 1	Bulk-velocity error vector
prestensor_dbcs	nPa	CDF_REAL4	3 x 3	Pressure tensor in DBCS
prestensor_gse	nPa	CDF_REAL4	3 x 3	Pressure tensor in GSE
prestensor_err	nPa	CDF_REAL4	3 x 3	Pressure tensor error
temptensor_dbcs	eV	CDF_REAL4	3 x 3	Temperature tensor in DBCS
temptensor_gse	eV	CDF_REAL4	3 x 3	Temperature tensor in GSE
temptensor_err	eV	CDF_REAL4	3 x 3	Temperature tensor error
heatq_dbcs	mW/m ²	CDF_REAL4	3 x 1	Heat-flux vector in DBCS
heatq_gse	mW/m ²	CDF_REAL4	3 x 1	Heat-flux vector in GSE
heatq_err	mW/m ²	CDF_REAL4	3 x 1	Heat-flux error vector
energy	eV	CDF_REAL4	32 x 1	Sky-map energy bin centers
energy_delta	eV	CDF_REAL4	32 x 1	Sky-map delta energies
temppara	eV	CDF_REAL4	1	Parallel temperature
tempperp	eV	CDF_REAL4	1	Perpendicular temperature

FPI DES/DIS Distributions File Structure

Variable	Units	DataType	Dim	Description
errorflags	32-bit error flags	CDF_UINT4	1	Vector of data-quality indicators at epoch start time
compressionloss	0, 1	CDF_UINT1	1	Compression lossless/lossy indicator at survey start time
steptable_parity	0, 1	CDF_UINT1	1	Step table parity
startdelphi_count	del-phi counts	CDF_UINT2	1	Del-Phi (obs spin-phase) count at epoch start time
startdelphi_angle	deg	CDF_REAL4	1	Del-Phi (obs spin-phase) angle at epoch start time
phi	deg	CDF_REAL4	32 x 1	Sky-map instrument azimuthal angles
dist	s^3/cm^6	CDF_REAL4	32 x 16 x 32	Sky-map instrument distribution
disterr	s^3/cm^6	CDF_REAL4	32 x 16 x 32	Sky-map instrument distribution 1-sigma error
sector_despinp	00-32	CDF_UINT1	1	Sector de-Spin P value
energy	eV	CDF_REAL4	32 x 1	Sky-map energy bin centers
energy_delta	eV	CDF_REAL4	32 x 1	Sky-map delta energies

FPI DES/DIS Quality Flags

For distribution files

Bit	Description
0	Manually flagged interval
1	Overcounting/saturation effects likely present in skymap
2	Compression pipeline error

For moments and quicklook files

Bit	Description
0	Manually flagged interval
1	Overcounting/saturation effects likely present in skymap
2	Reported spacecraft potential above 20V
3	Invalid/unavailable spacecraft potential
4	Significant (>25%) cold plasma (<10eV) component
5	Significant (>25%) hot plasma (>30keV) component
6	High sonic Mach number ($v/v_{th} > 2.5$)
7	Low calculated density ($n < 0.05 \text{ cm}^{-3}$)
8	BentPipe magnetic field used instead of brst l2pre magnetic field
9	Survey l2pre magnetic field used instead of brst l2pre magnetic field (burst only)
10	No internally generated photoelectron correction applied (DES only)
11	Compression pipeline error

FPI DES/DIS Quicklook File Structure

Variable	Units	DataType	Dim	Description
errorflags	32-bit error flags	CDF_UINT4	1	Vector of data-quality indicators at epoch start time
compressionloss	0, 1	CDF_UINT1	1	Compression lossless/lossy indicator at survey start time
steptable_parity (burst only)	0, 1	CDF_UINT1	1	Step table parity
startdelphi_count	del-phi counts	CDF_UINT2	1	Del-Phi (obs spin-phase) count at epoch start time
startdelphi_angle (burst only)	deg	CDF_REAL4	1	Del-Phi (obs spin-phase) angle at epoch start time
sector_despinp (burst only)	00-32	CDF_UINT1	1	Sector de-Spin P value
pitchangdist_lowen (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	30 x 1	Electron pitch-angle distribution for "low" energies
pitchangdist_miden (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	30 x 1	Electron pitch-angle distribution for "mid" energies
pitchangdist_highen (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	30 x 1	Electron pitch-angle distribution for "high" energies
energyspectr_px	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" +X in DBCS
energyspectr_mx	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" -X in DBCS
energyspectr_py	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" +Y in DBCS
energyspectr_my	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" -Y in DBCS
energyspectr_pz	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" +Z in DBCS
energyspectr_mz	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron/Ion energy spectrum "near" -Z in DBCS
energyspectr_par (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron energy parallel to the magnetic field direction
energyspectr_anti (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron energy anti-parallel to the magnetic field direction
energyspectr_perp (DES only)	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Electron energy perpendicular to the magnetic field direction
energyspectr_omni	keV/(cm ² s sr keV)	CDF_REAL4	32 x 1	Omni-directional electron/ion energy spectrum
numberdensity	cm ⁻³	CDF_REAL4	1	Number density
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densityextrapolation_low	cm ⁻³	CDF_REAL4	1	Estimated (via extrapolation to 0) contribution to density integral below 10eV
densityextrapolation_high	cm ⁻³	CDF_REAL4	1	Estimated (via extrapolation to infinity) contribution to density integral above 30keV
bulkv_dbcs	km/s	CDF_REAL4	3 x 1	Bulk-velocity vector in DBCS
bulkv_spin_dbcs (fast/burst only)	km/s	CDF_REAL4	3 x 1	Bulk-velocity spintone vector in DBCS
bulkv_gse	km/s	CDF_REAL4	3 x 1	Bulk-velocity vector in GSE
bulkv_spin_gse (fast/burst only)	km/s	CDF_REAL4	3 x 1	Bulk-velocity spintone vector in GSE
bulkv_err	km/s	CDF_REAL4	3 x 1	Bulk-velocity error vector
prestensor_dbcs	nPa	CDF_REAL4	3 x 3	Pressure tensor in DBCS
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prestensor_err	nPa	CDF_REAL4	3 x 3	Pressure tensor error
temptensor_dbcs	eV	CDF_REAL4	3 x 3	Temperature tensor in DBCS
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temptensor_err	eV	CDF_REAL4	3 x 3	Temperature tensor error
heatq_dbcs	mW/m ²	CDF_REAL4	3 x 1	Heat-flux vector in DBCS
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heatq_err	mW/m ²	CDF_REAL4	3 x 1	Heat-flux error vector
energy	eV	CDF_REAL4	32 x 1	Sky-map energy bin centers
energy_delta	eV	CDF_REAL4	32 x 1	Sky-map delta energies
temppara	eV	CDF_REAL4	1	Parallel temperature
tempperp	eV	CDF_REAL4	1	Perpendicular temperature