Penetrating Radiation in DIS Data

Manifests as isotropic background count rate that is independent of energy.

DIS Penetrating Radiation Correction Methods

1. Correct Moments using background estimates provided in the DIS moments CDF files:

We average the lowest 5 values (not energies) of differential energy flux in the 'energyspectr_omni' data product to obtain an estimate of the background. This differential energy flux can be used to form a ‘background skymap’ of phase space densities that can be numerically integrated in parallel with the normal processing, providing effective plasma parameters for the background signal.
The validity of this background estimate is broadly applicable, but breaks down in hot magnetosheath intervals where there is at least some valid signal at all energies.
Because the background cannot be reliably estimated for all cases, these estimates are NOT used to automatically correct the L2 moments. Instead, we provide users with the means to correct L2 moments themselves if the background estimate appears to be appropriate for the purpose.
Three variables are provided in the DIS moments CDF:

Variable	Definition / Notes
energyspectr_bg	background differential energy flux measurement
numberdensity_bg	effective number density of the background signal (referred to as n_{bg} below)
pres_bg	effective scalar pressure of the background signal

Note: By definition, the bulk velocities and off-diagonal pressure tensor components of the background signal are zero

FPI DIS Moments can be corrected as follows:

Quantity	Background Correction	
Density		$n_{corr} = n_{L2} - n_{bg}$
Velocity		$V_{i,corr} = n_{L2} V_{i,L2} / n_{corr}$
Pressure Tensor	Definition of pressure tensor component:	$P_{ij} = \text{int} (v_i v_j f d^3\mathbf{v}) - m n V_i V_j$
	For an isotropic background:	$\text{int} (v_i v_j f d^3\mathbf{v}) = P_{bg}$ if i=j, and is 0 otherwise
	Therefore:	$P_{ij,corr} = P_{ij,L2} - \text{int} (v_i v_j f_{bg} d^3\mathbf{v}) + m n_{L2} V_{i,L2} V_{j,L2} – m n_{corr} V_{i,corr} V_{j,corr}$
Temperature Tensor		$T_{ij,corr} = P_{ij,corr} / (n_{corr} k_B)$


Example_DIS_penetrating_radiation.tiff