The impact of the field-aligned distribution of nanoflare heating on loop diagnostics

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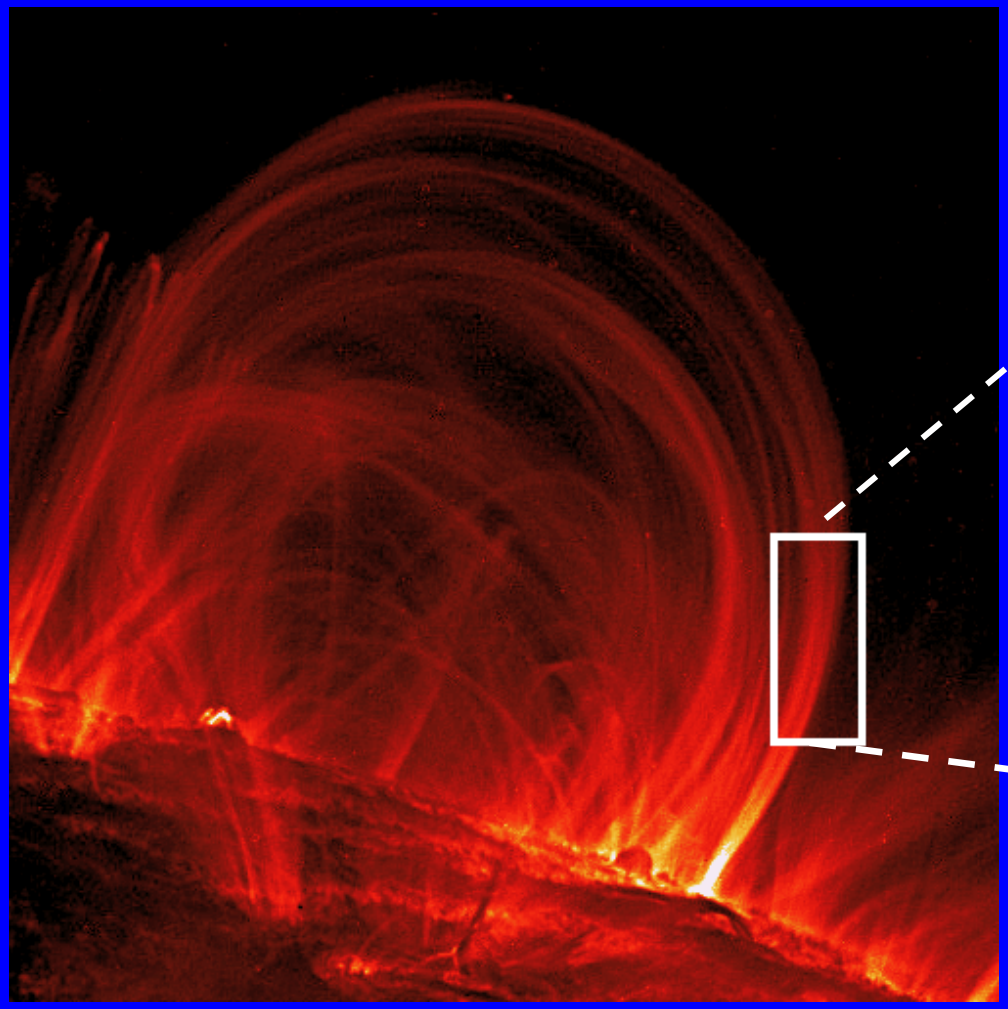
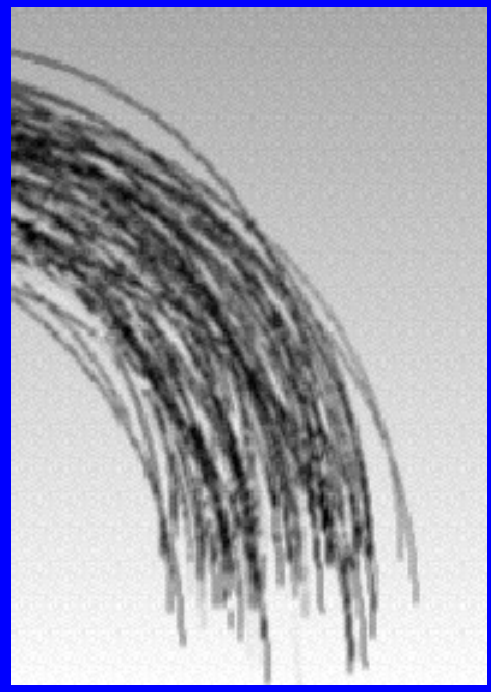
Research supported by NASA and ONR

Nanoflares and filamentation



Multi-stranded loop



700 Km

Nanoflares at **sub-resolution strands** are repeated every several 1000 s

Hydrodynamic simulations of nanoflares

Model a strand with L = 300 Mm

20 nanoflares with different E

Repetition time ~ 4000 s

Spatial distribution of the nanoflare heating:

- uniform
- loop top 1000 km
- random 1000 and 5000 km
- footpoints 10000 km
- one footpoint 10000 km

SAME TOTAL HEATING

Construction of diagnostics

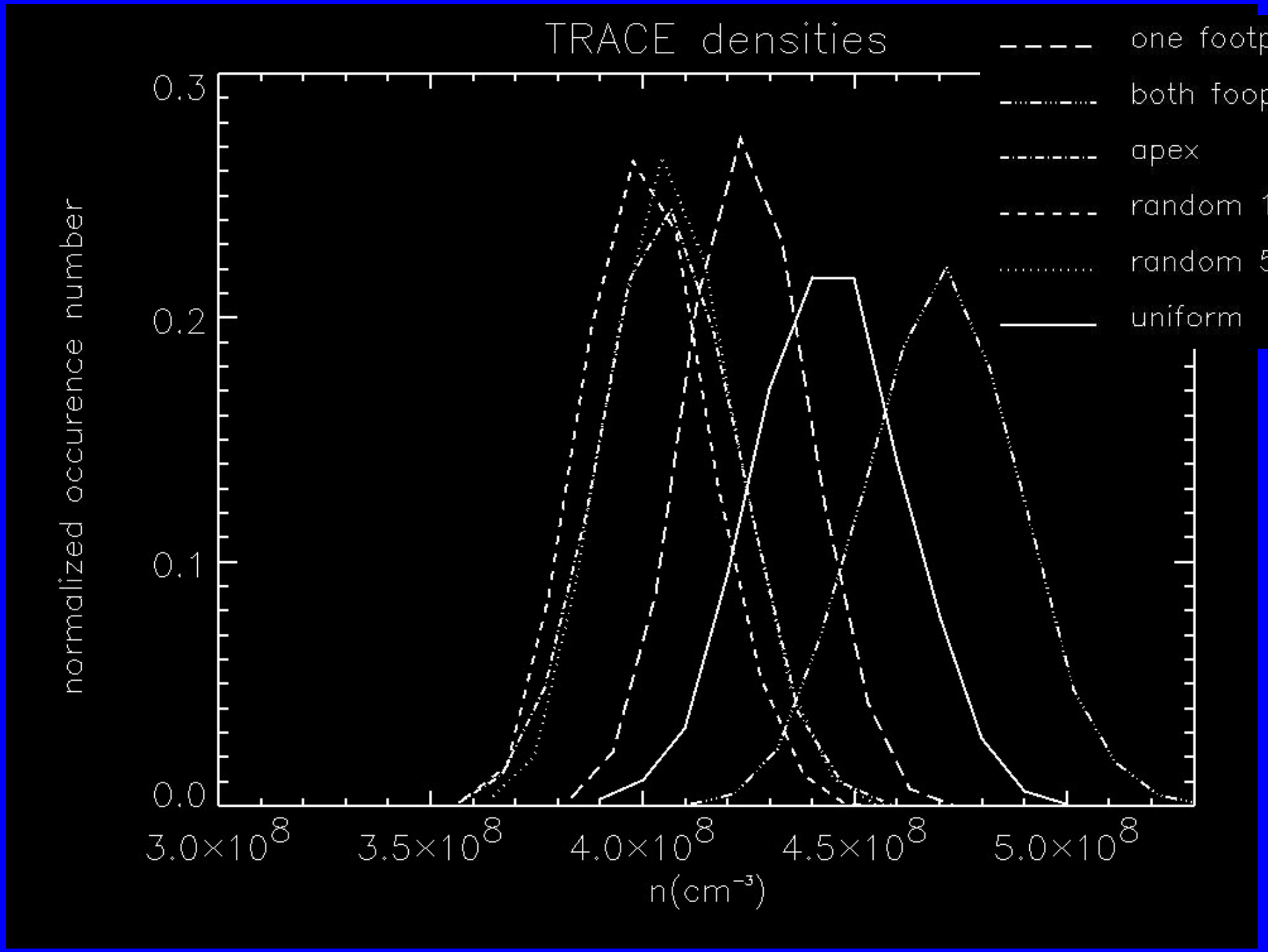
Average intensities for a number of randomnly selected moments in the simulation

equivalent

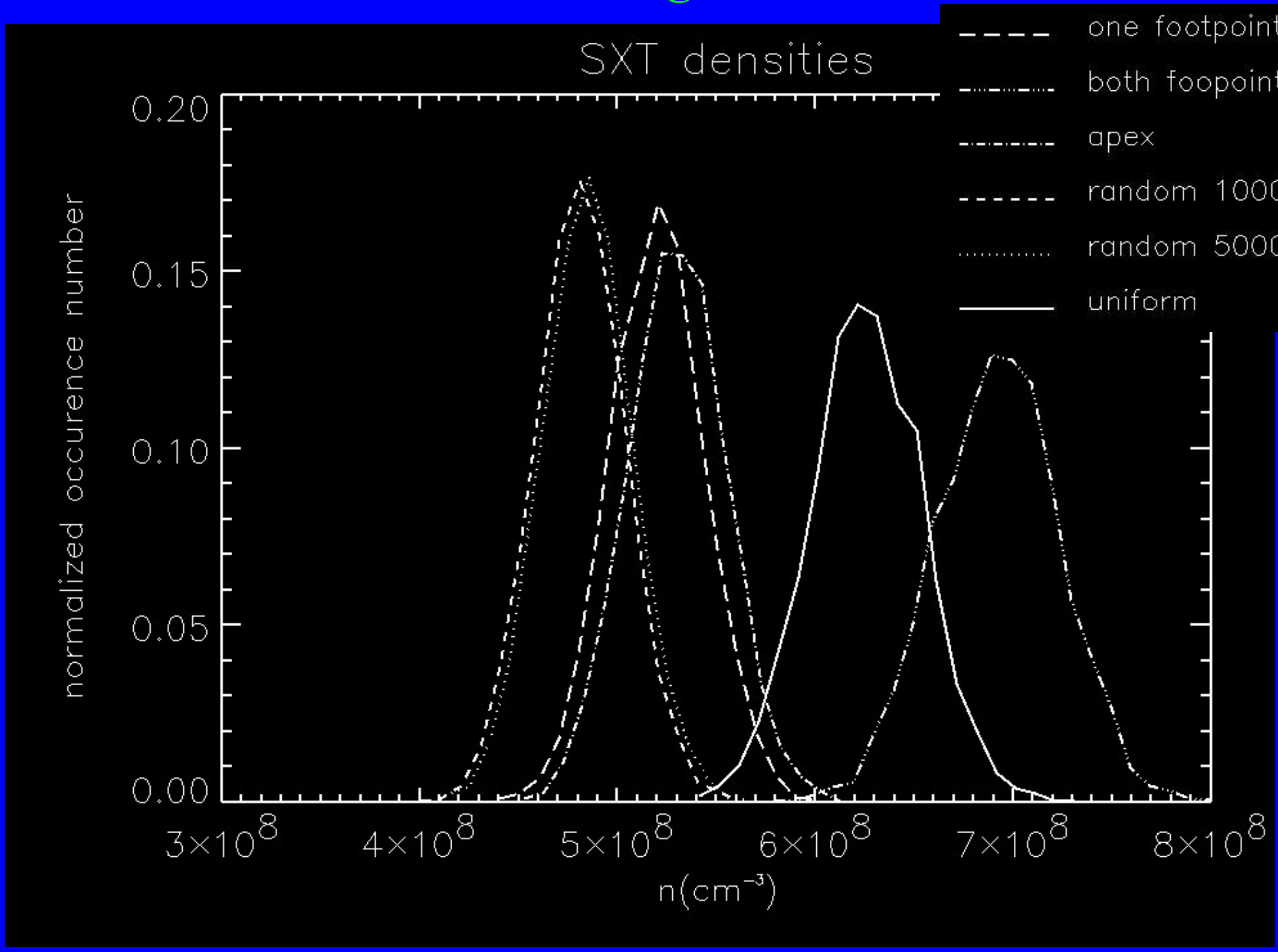
Snapshot of a multi-stranded loop

Use filter-ratio method to infer densities that would have been deduced by TRACE and SXT

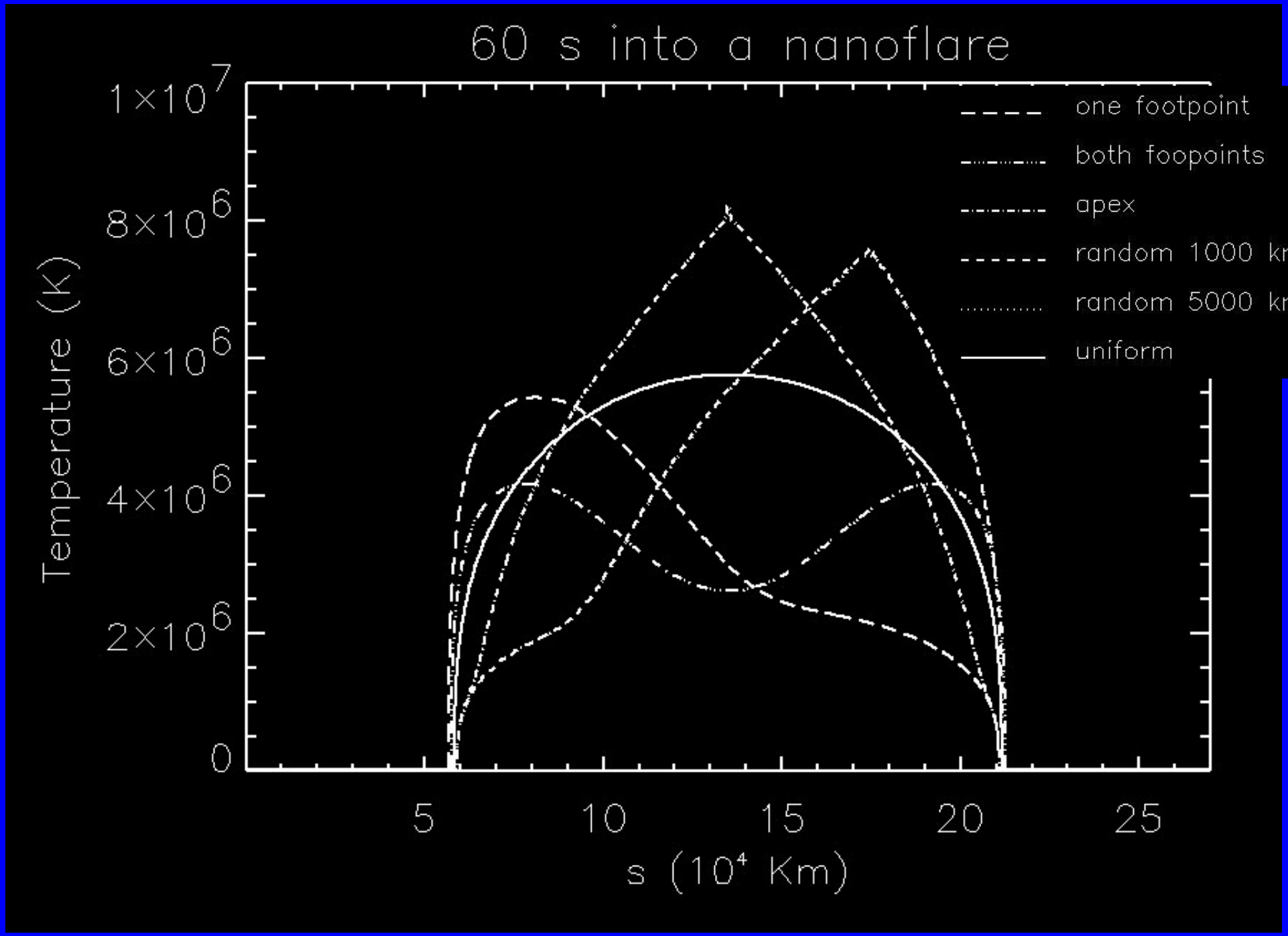
TRACE diagnostics



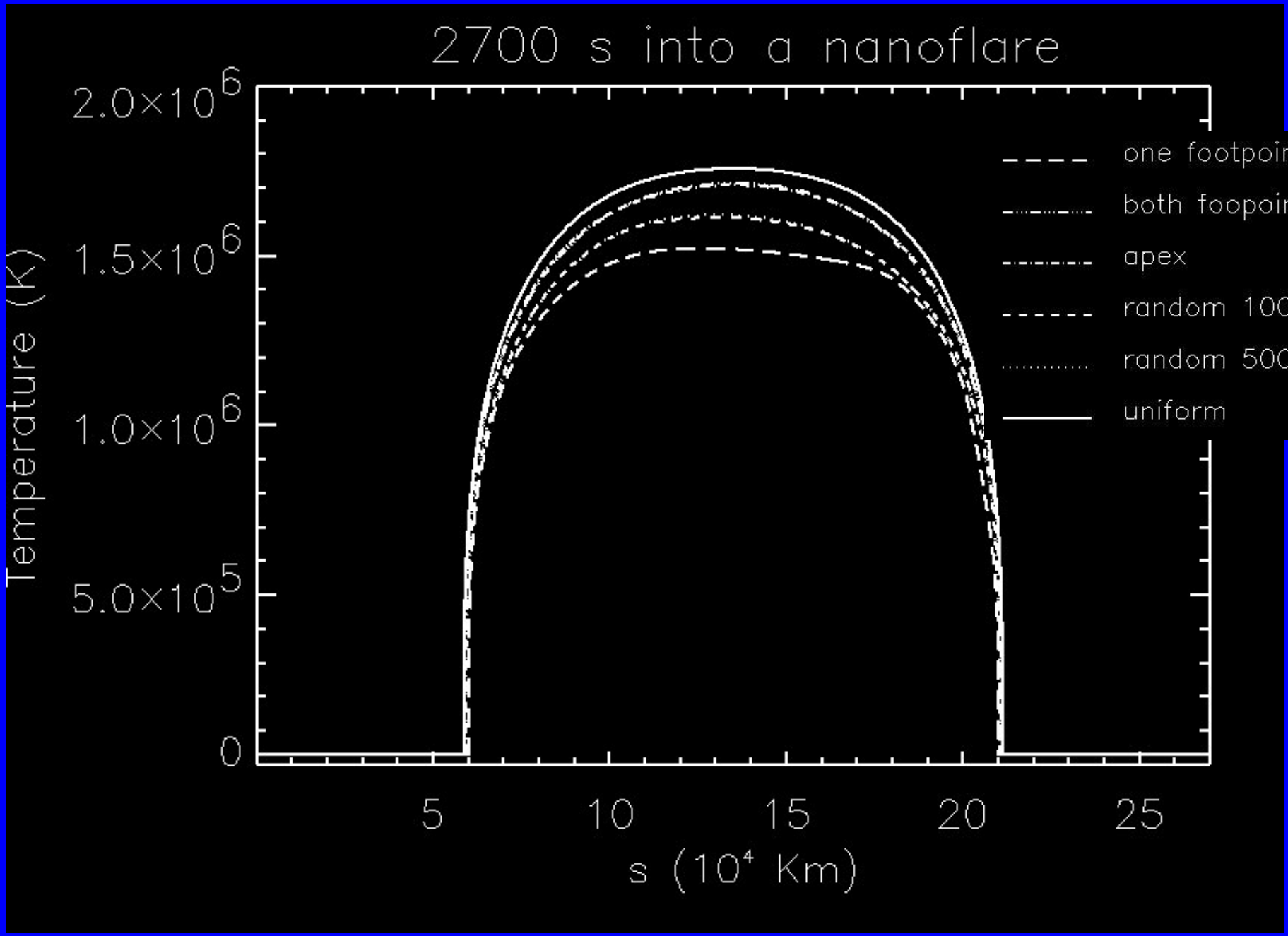
SXT diagnostics



T distributions during the heating phase



T distributions in the cooling phase



Conclusions

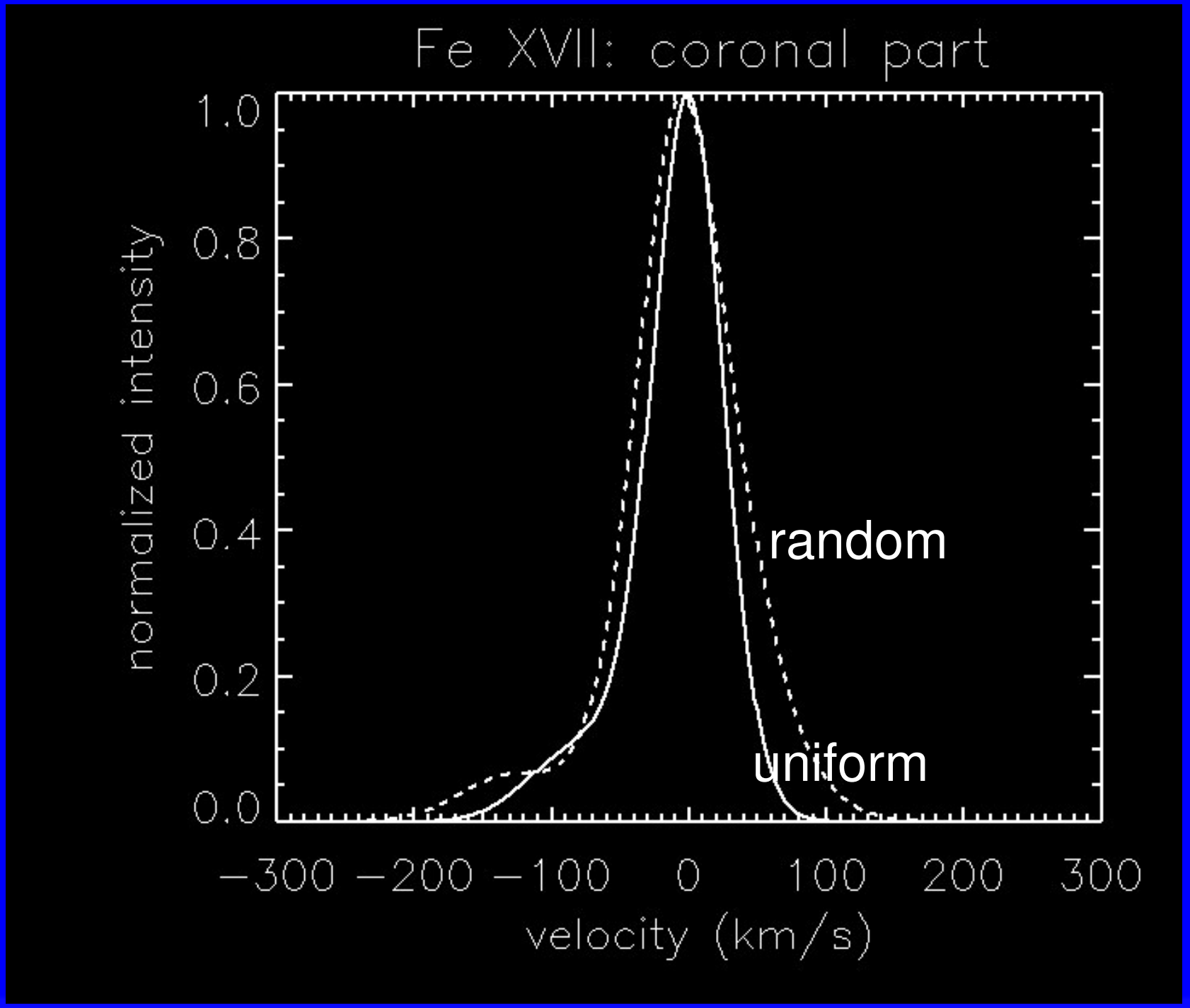
Diagnostics in TRACE/SXT temperatures cannot reveal the spatial distribution of nanoflare heating along the magnetic field:

BOTH

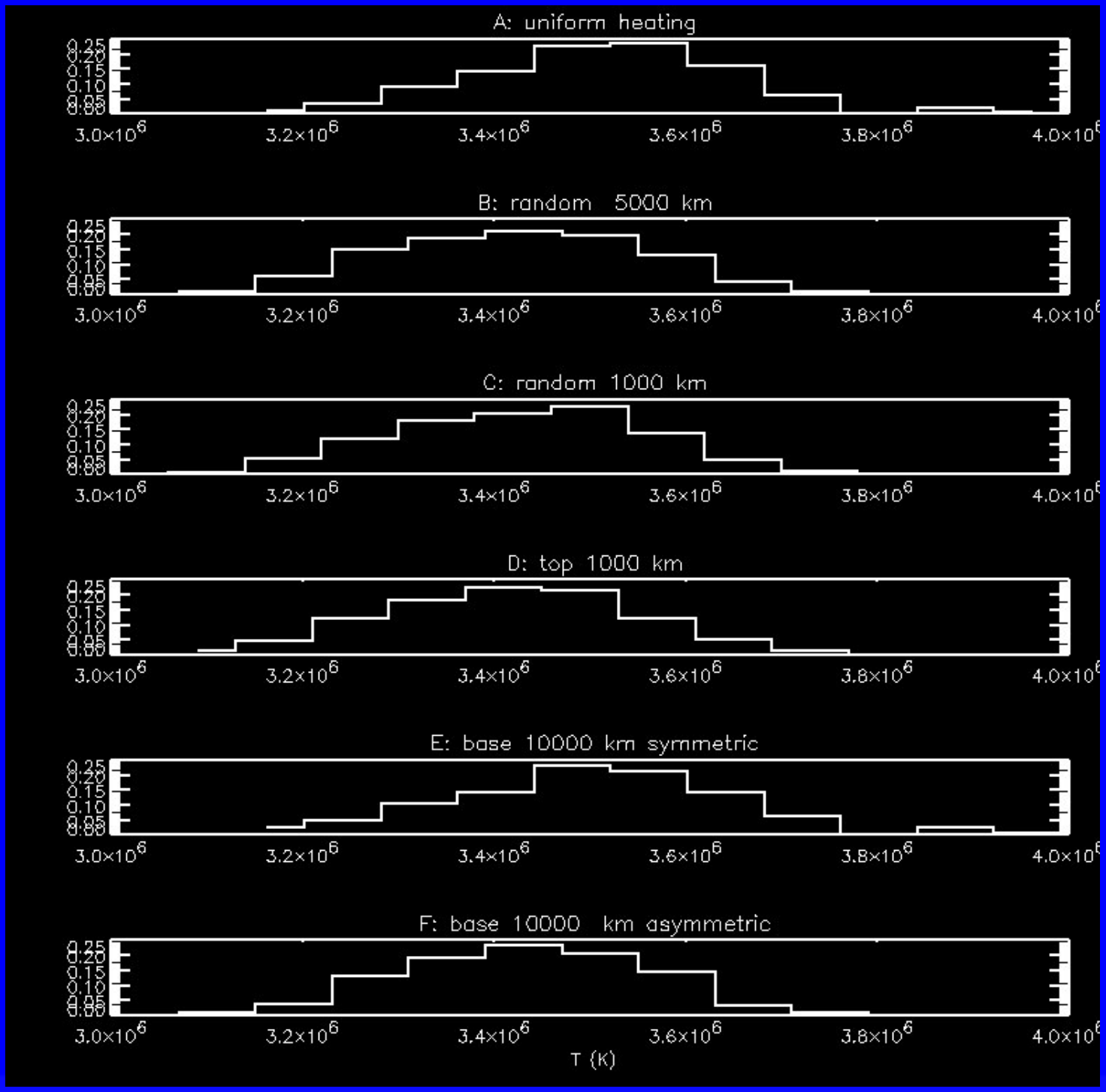
Late in cooling (conduction & mass flows)
Averaging over large number of strands

Way out ?

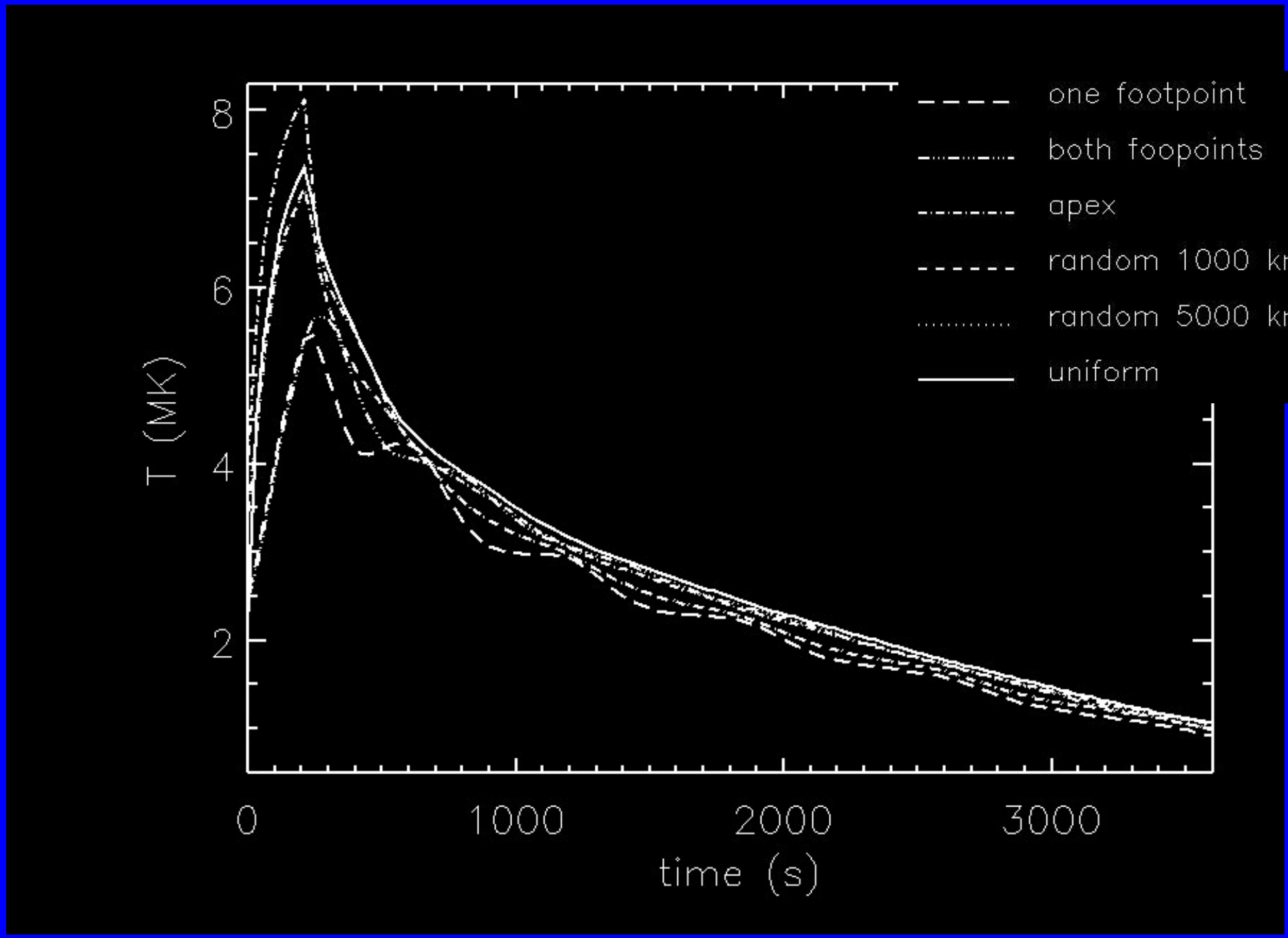
High temperature spectroscopic diagnostics



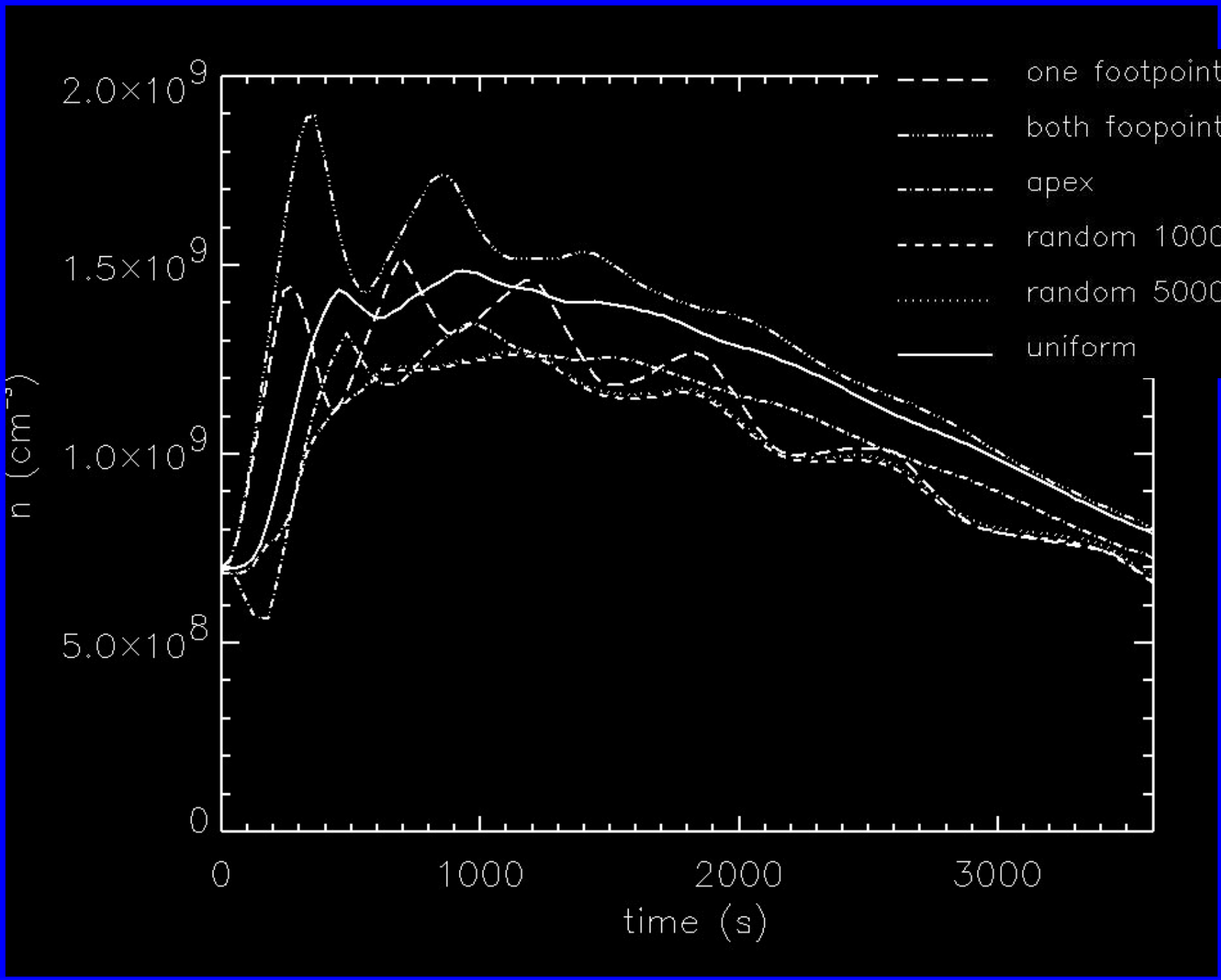
SXT temperatures



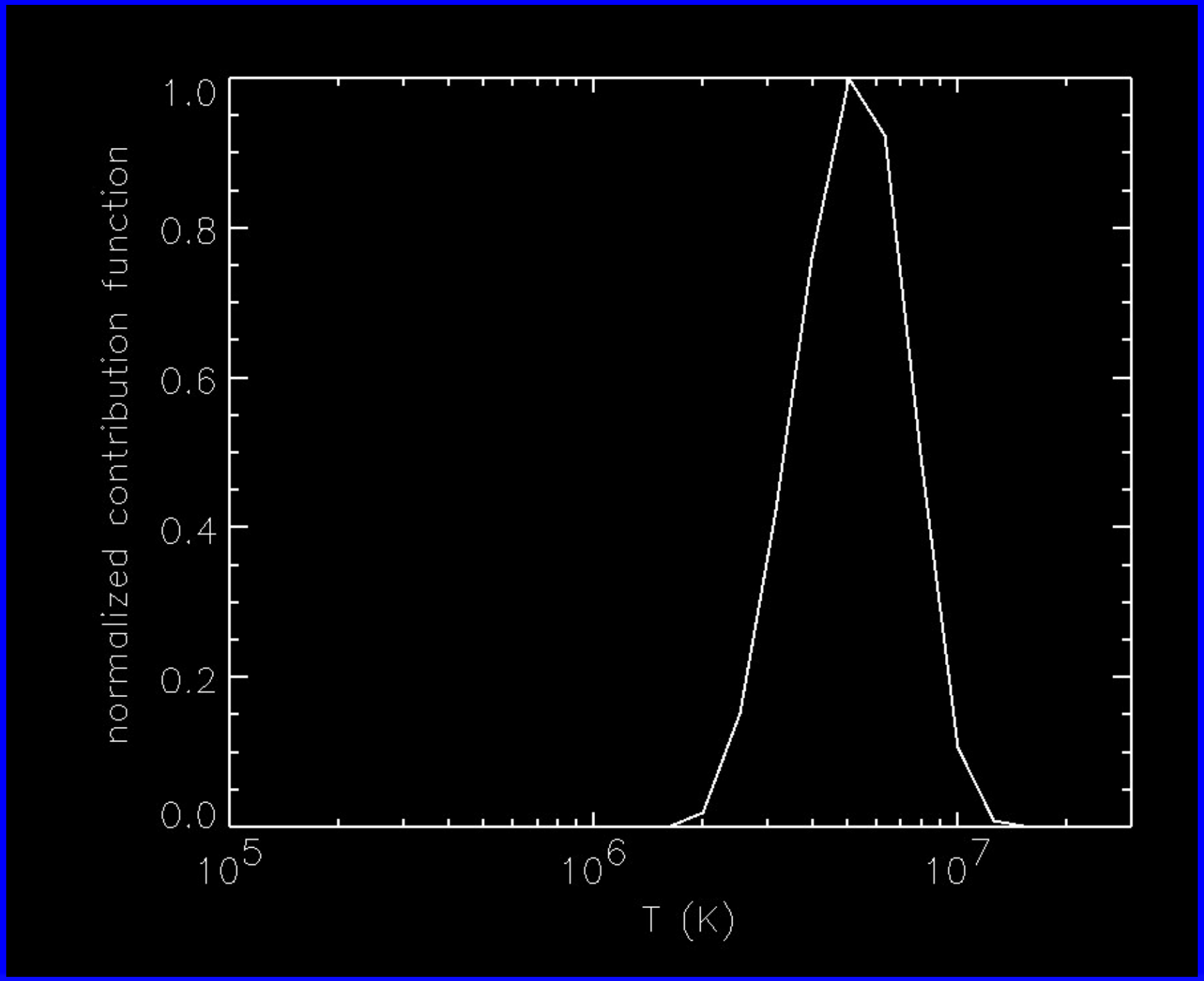
Temperature evolution for a sample nanoflare



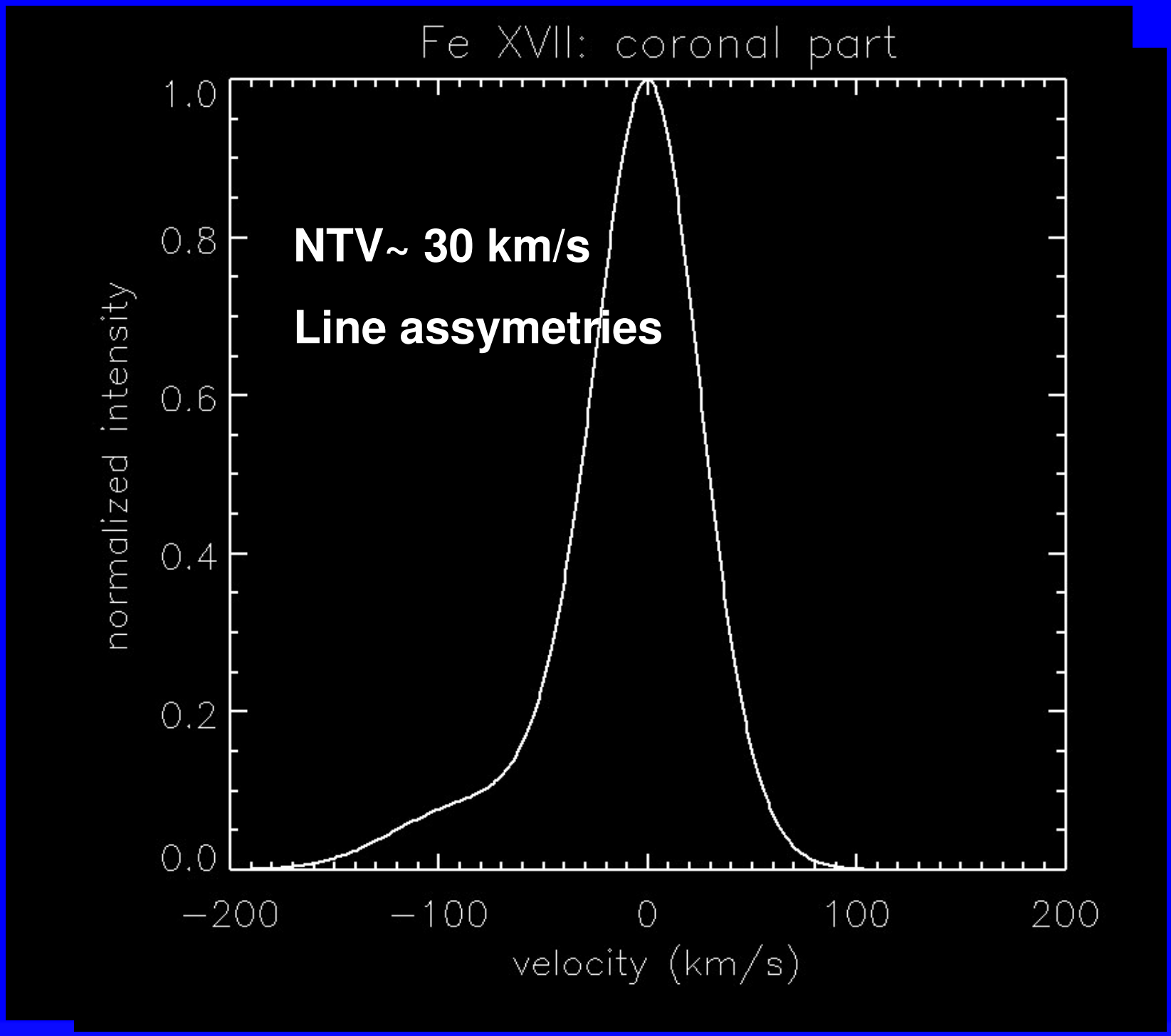
Density evolution for a sample nanoflare



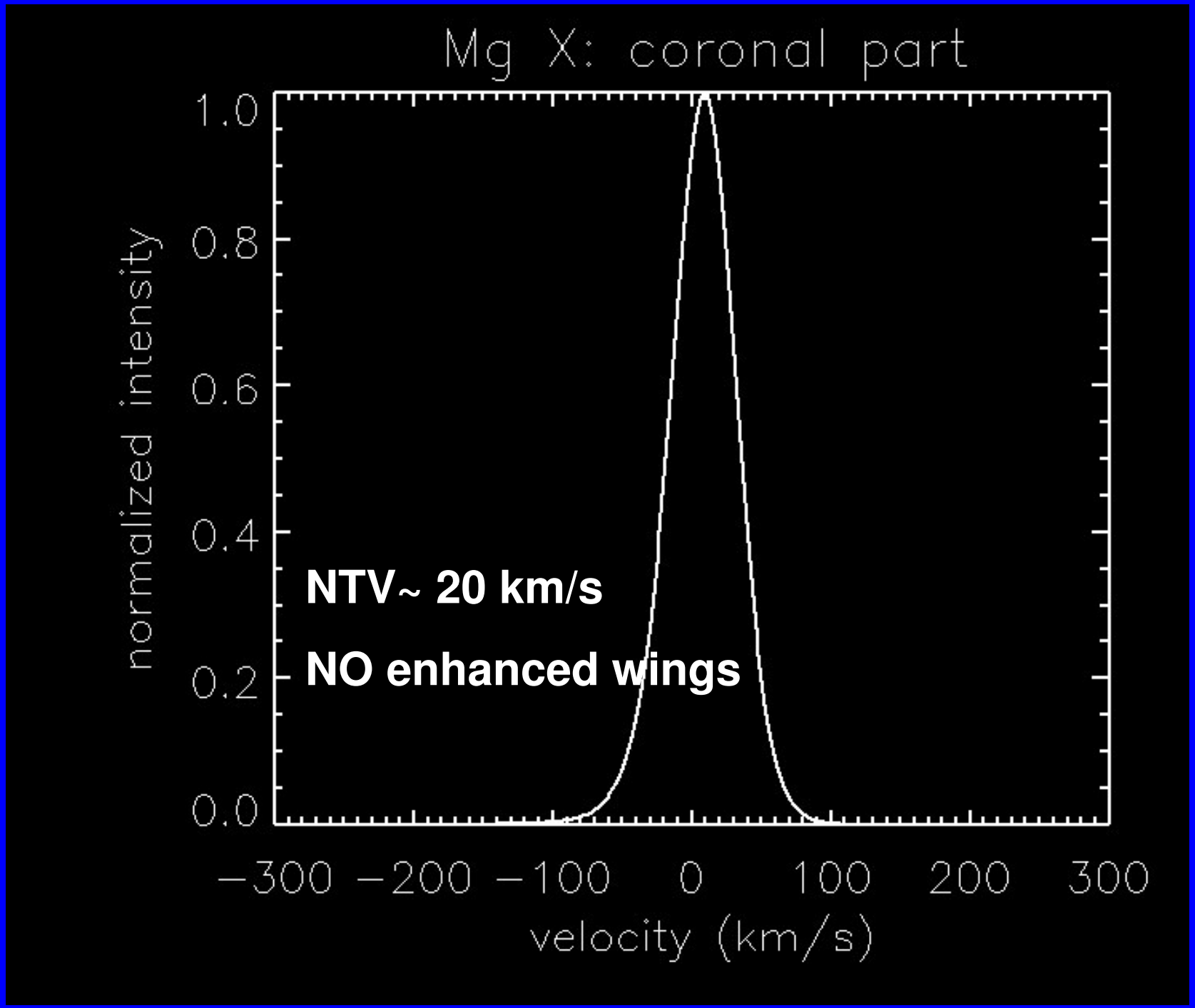
A sample hot line: Fe XVII @ 1153 A



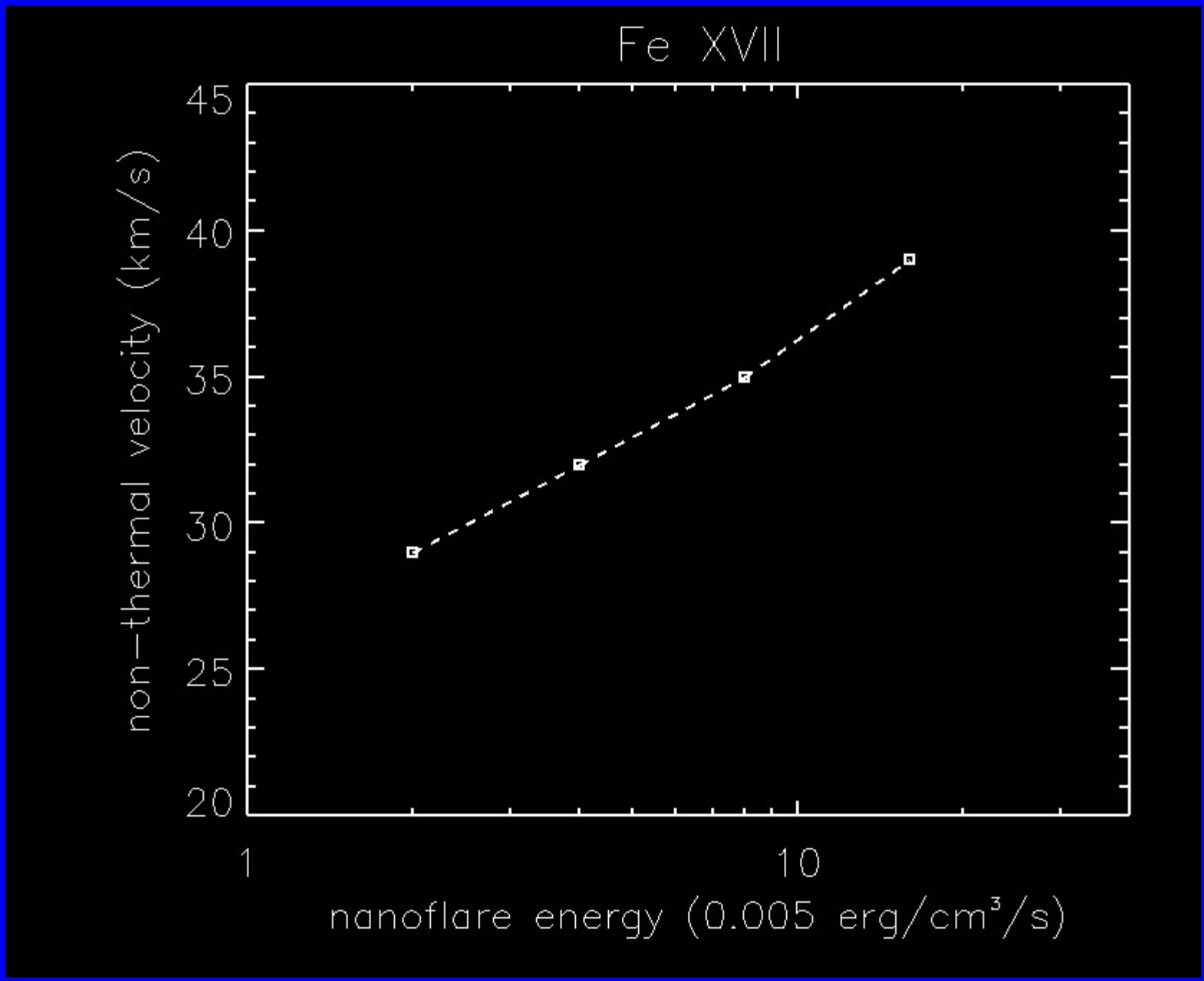
Fe XVII profile for the coronal part of the loop



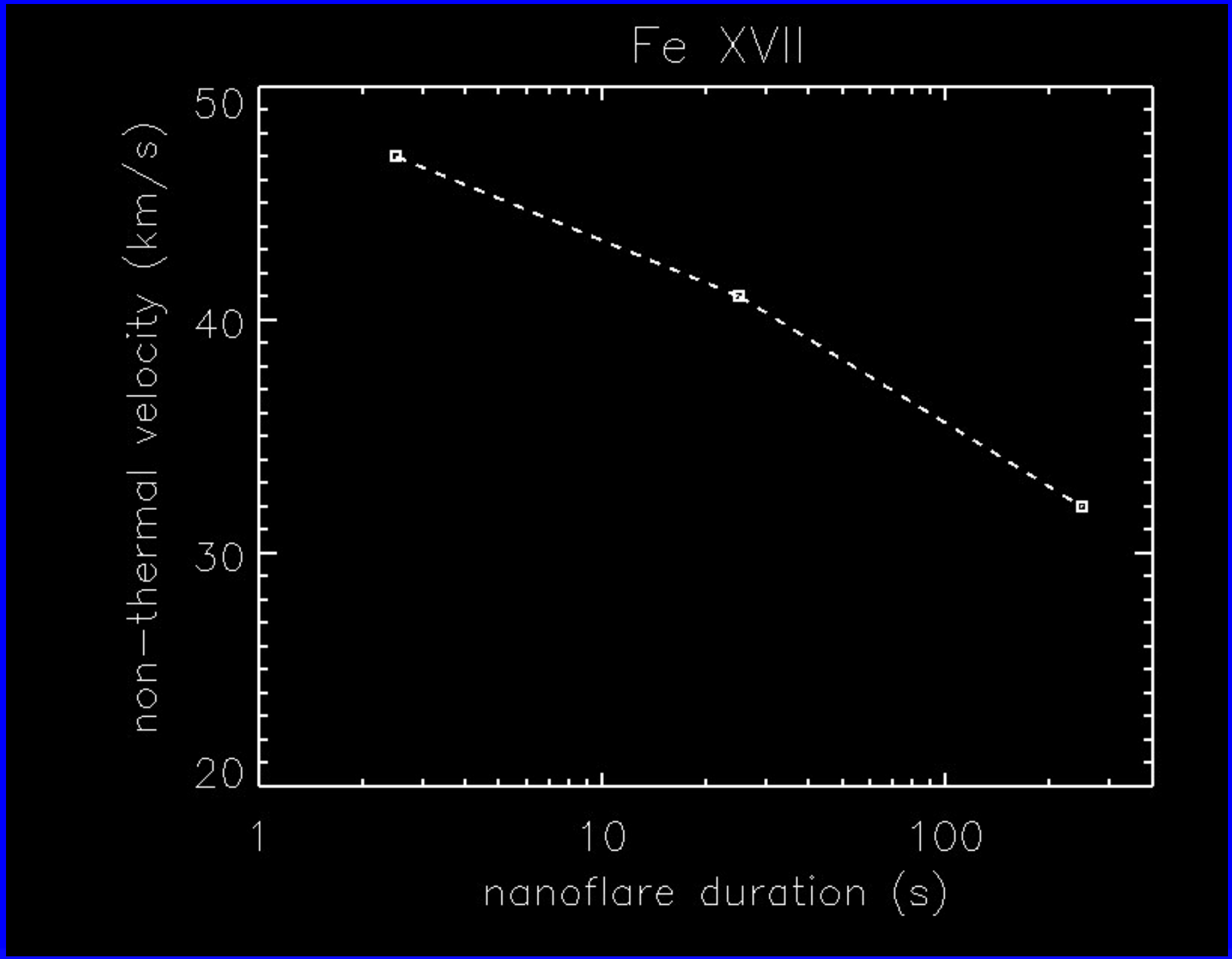
Mg X profile


Mg X: coronal part
normalized intensity
1.0
0.8
0.6
0.4
0.2
0.0
NTV~ 20 km/s
NO enhanced wings
−300
−200
−100
0
100
200
300
velocity (km/s)

Dependence of ntv on nanoflare energy



Dependence of ntv on nanoflare duration



Fe XVII profile at footpoints