This manuscript presents a statistical analysis of turbulence data obtained in the Swarthmore Spheromak Experiment (SSX) in an attempt to diagnose dissipation physics. Specifically, the authors examine the kurtosis, permutation entropy, and statistical complexity of temporal magnetic field increments. The authors claim to find that all of the statistical diagnostics are correlated with the steepening of the energy spectrum and indicate the presence of dissipation. The work is interesting and worthy of publication, but the work suffers from a few major and minor weaknesses detailed below.

We thank the referee for a thorough reading of our manuscript and are pleased that the work is viewed as interesting and worthy of publication. We have attempted to address each weakness and believe that the manuscript is now more clear in its assertions and intended conclusions.

Major

1) The observed steepening of the magnetic energy spectrum is attributed solely to dissipation physics; however, there are many examples in the literature suggesting that the steepening of the magnetic energy spectrum at kinetic scales could be a signature of dispersion and/or intermittency, see, e.g., Schekochihin et al ApJS 2009 and Boldyrev and Perez ApJL 2012. Is there any evidence that the observed signatures in SSX are of dissipation and not dispersion or intermittency?

The way in which we intended to use the term dissipation was in a broad sense of energy leaving the inertial range. In plasmas, this dissipation can take the form of actual dissipation (in the sense of thermalization through viscous or resistive collisionality) or of other means as described in the opening paragraph (coupling between wave fluctuations) of which dispersion is a generalization of this idea, and of intermittency (the formation of current sheets and reconnection layers). Perhaps a better term should be coined for this mechanism describing the energy transition from inertial to dissipation scales, but it is common in the literature for dissipation to mean this general idea. We thank the referee for pointing out this potential ambiguity in terminology and we have attempted to be clearer in our meaning throughout the manuscript.

In SSX, we do have evidence that our "dissipation" occurs due to intermittency channels through the formation of current sheets (Schaffner PRL 2014). Our plasma is also fairly collisional with an ion-ion mean free path on the order of the gyroscale. Thus, resistive effects may also be in play. The emphasis on this paper was meant to be less on evidence for a particular type of "dissipation" mechanism and more an examination of metrics at scales associated with the transition between inertial and dissipation range turbulence. Modifications to the introduction and concluding sections have been made to clarify this point.

2) Due to the limited measurement time, all of the statistical diagnostics begin at ~ 1 microsecond; however, this lag corresponds to the approximate break frequency of the energy spectrum. Therefore, the overarching claim that the statistical diagnostics correlate to the spectrum and indicate the presence of dissipation is not well supported. Further, that the entropy decreases with the lag seems counter-intuitive for fully developed turbulence, unless the system is either collisional or not fully developed. Is it possible to address any of these concerns? For instance, what is the collision frequency of the system? What is the Alfvenic crossing time? Is it possible to obtain reliable statistical data that extends into the inertial range? Without answers to these questions, it is not possible to accurately asses the conclusions of the manuscript.

It is true that the timescales at which the flatness and entropy/complexity metrics are explored begin at about the spectra break. However, the conclusions of this paper were not intended to be that these results necessarily supported the observation of dissipation, but instead to examine the behavior of these metrics *assuming* **that dissipation is occurring at these scales within the plasma. Support for the these temporal scales being within the dissipation regime come from prior work, particularly Schaffner ApJ 2014 which explored the case for dissipation in detail using temporal and spatial spectra as well as through the anisotropy of perpendicular versus parallel fluctuations. The manuscript has been modified to clarify this view of the authors.**

Ideally, as the referee indicates, the analysis techniques should be extended into the inertial range through examination of longer time periods. Unfortunately, generation of such longer stationary turbulent time periods is not yet possible on the current experimental device, SSX. As mentioned toward the end of the manuscript, longer pulses are being pursued on an upgraded version of this

device at Bryn Mawr College. With longer periods of stationary turbulence, the behavior of these metrics at inertial range scales can be explored. This initial work helps to set a baseline for these future experimental endeavors.

Regarding the trend in entropy, the authors are not entirely clear on whether the referee is referring to the decreasing entropy with respect to increasing time scale (to the right) or with decreasing time scale (to the left). The authors attempt to address both:

Decreasing entropy to the left:

It is potentially counter-intuitive to observe a decreasing entropy with decreasing time scale, however it should be emphasized that the entropy decreasing is the permutation entropy, rather than the normal entropy associated with degrees of freedom. As the time scale is reduced, a reduced permutation entropy basically indicates that the possible patterns observed in the data are decreasing. Though the reason for this has not been fully explored, one possible explanation lies in the connection to increasing flatness which corresponds to increasing intermittency. In other words, the metric may only be seeing the sharp upward or downward trends of large intermittent signals which manifest as a reduced number of observed ordinal patterns. It should also be noted that this analysis has been run on true fully-developed conventional fluid turbulence. The results are not fully analyzed or published yet, but initial results suggest a similar trend of decreasing permutation entropy is observed with decreasing time scale.

Decreasing entropy to the right:

The entropy begins to decrease beyond a scale of about 1us. As noted in the manuscript, the time restrains of this analysis limit the effectiveness of this metric to about 1us. Thus, entropy results at time lags above this value are suspect and the decrease is likely due to decreasing statistics rather than any physical reasoning.

Finally, values such as collision frequency and Alfven times are indicated in a table added. The mean free path of the system is roughly on the order of the ion gyroscale so the plasma can certainly be considered collisional to an extent and certainly more so than astrophysical plasmas.

Minor

1) A couple of statements are made in the introduction that are poorly defined: 1) "Plasma turbulence in the literature typically refers to the relatively large fluctuations of plasma parameters" and 2) "nor important non-local effects." I am unsure what relatively large fluctuations means, as turbulence amplitudes can indeed be quite small compared to, for instance, the background magnetic field. Similarly, non-local effects is very broad and could refer to myriad phenomena, some of which are of debatable import.

The phrase "relatively large fluctuations of plasma parameters" has been more modified to "a broadband spectrum of spatial or temporal fluctuations of plasma parameters"

A clarifying clause has been added to better define the phrase "nor important non-local effects": "specifically the direct transfer of energy from a large scale to a small scale without passage through an intermediate scale. A citation of Moser and Bellan 2012 has also been added as an explicit example of an observed non-local effect of this kind in an experiment.

2) It would be useful to include an indication of the location of important plasma frequencies in Figure 2. For instance, where are the cyclotron frequencies? Also, the spectra are constructed by averaging over fifty shots. Are these shots completely consistent and repeatable? If not, the inclusion of error bars representing a standard deviation may be informative.

A table has been added providing relevant plasma parameters for this dataset in both time and frequency space. The shots are fairly repeatable with a statistical spread on each metric on the order of 10%.

3) Taylor's hypothesis is mentioned a few times in the manuscript, yet the authors claim that it is not applicable *in SSX. If the authors choose to discuss Taylor's hypothesis, the manuscript would be well served with a quantitative approximation of the validity (or lack thereof) of the hypothesis, especially since violation of Taylor's hypothesis will alter the energy spectrum.*

A line has been added giving some qualitative justification for not applying the Taylor Hypothesis for this dataset.

4) Practically no plasma parameters are supplied in the manuscript. It would be very helpful to know, for instance, what the plasma beta, RMS delta B/ , Mach number, cyclotron frequency, etc are.

A table of relevant parameters has been added.

5) Some of the definitions in section IV C are unclear. The permutation entropy, S, is defined as a quantity normalized from 0 to 1, but H is later defined as the normalized permutation entropy. How is H normalized, and how does it differ from S

This was an error and has been fixed. S is the unnormalized permutation entropy and H is the normalized permutation entropy.

? N is defined as N = n!, so is N+1 = n!+1 or (n+1)!? C is stated to be normalized, but to what is it normalized? I was unable to find any reference to a Shannon-Jenson complexity in the literature. Is it Shannon-Jenson or Shannon-Jensen complexity? Which brings me to my final point regarding this section: despite introducing rather complex statistical measures, it is devoid of references.

N=n! so N+1 = n!+1. The Jensen-Shannon statistical complexity is constructed to be normalized. The normalization factor happens to have the form of 2/(denominator) in Eq. 4. This is the quantity needed to normalize the sum of Shannon entropies in the numerator. The most important references for this technique have been added.

6) Finally, the manuscript is unusually afflicted with typos and would benefit greatly from a thorough proofread.

A thorough proof-read has been conducted.