

Supplementary Appendix

Bidding in first-price and second-price interdependent values auctions: A laboratory experiment

Theodore L. Turocy and Timothy N. Cason

This version: 4 December 2015

Bid function fits

In the main manuscript we present summary results from fitting bid functions using a logit error model in conjunction with the possibility of cursed beliefs and underweighting (or overweighting) of the opportunity costs of higher bids in FPA. We fit each bidder's function individually, taking the actual behavior of other bidders in the same session as being consistent estimators of their strategies. That is to say, we assume that each bidder has correct beliefs about the empirical play of others in the session, but we do not impose that the others are necessarily playing a strategy that is consistent with one that can be generated by our model.

In this appendix we provide a more detailed view on the results of this exercise. Our intention in fitting individual functions is to summarize and highlight the heterogeneity in individual behavior across all our treatments. In that vein, this appendix contains a rendering of each fitted bid function, using a heatmap of the mixed behavior strategy fitted via the logit model. This visualization is useful in that it allows an inspection of whether the fitted functions are capturing the principal characteristics of each bidder's bidding behavior.

In what follows, each page corresponds to one session. We group sessions by treatment. First-price auction sessions come first, followed by second-price. Each panel corresponds to a single bidder. The red dots are a scatterplot of the bidder's actual bids, with the signal on the horizontal axis and the bid on the vertical. The fitted behavior bidding strategy is presented using a heatmap. This is a greyscale mapping, where a probability of 0 is white and 0.2 is black; therefore, the shading communicates the amount of dispersion in the fitted bidding functions. In addition, for each bidder we plot a dashed line, which connects, for each signal, the bid which is predicted to have the highest probability by the model.

For ease in interpreting these data, each figure contains a plot of the 45 degree line. In addition, for the first-price auction, we provide a dotted line plotting the risk-neutral Nash equilibrium $b(x) = \frac{1}{2}x$ (recall that the 45 degree line is also the Nash equilibrium in the second-price auction). For CV and IV treatments, we additionally plot the fully-cursed equilibrium prediction.

We will not comment in deep detail on these fits, as it is our intention that these plots should speak for themselves as to whether the fitted parameters organize the various bidders' behavior adequately. Beyond again underscoring that participants have substantially different approaches

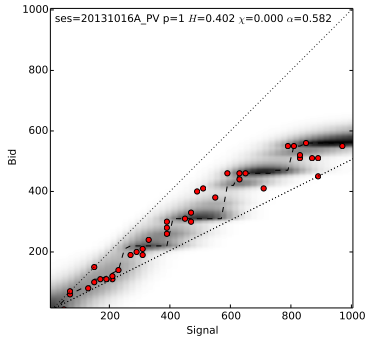
to bidding in these auctions, we note that in general the IV and CV treatments see more bidders whose bids contain a substantial noisy component which cannot be explained as a function solely of the bidder's signal. Nevertheless, this is not universal: bidder 8 in FPA-CV 2013-10-17-A is essentially exactly an equilibrium bidder, whereas bidder 7 in SPA-CV 2013-11-18-A is quite close to being spot-on a cursed equilibrium bidder.

We note two other features which the heatmaps reveal. Although the use of the slider device encouraged the use of the whole bid space rather than just round or otherwise accessible numbers, nevertheless round-number bids are slightly more prevalent overall. This results in jumps in the empirical best response bids, and explains why, although the aforementioned bidder 8 in FPA-CV 2013-10-17-A follows the equilibrium, (s)he actually did not play a best response to the empirical distribution of bids, which explains why the λ fitted to that bid data does not approach infinity. Turning to SPA, and especially to SPA-IV, there is a clear asymmetry in the shading in the heatmap; empirically bids in excess of the best response are less costly than bids below it. This is most visible in sessions in which one or more bidders submits a bid of 1000 (or close to it) rather frequently.

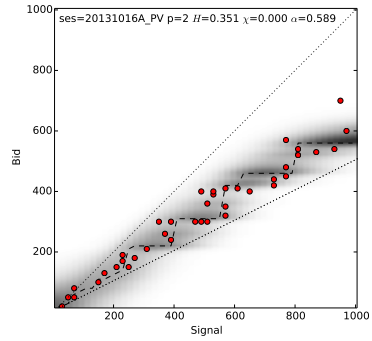
Finally, we note that there are patterns of bidding behavior which the parameterization we have chosen does not capture well. An example is Bidder 8 in FPA-CV 2013-10-17-B. This bidder bids with roughly the equilibrium slope of one-half, but with a nonzero intercept. This particular pattern is not accommodated particularly well by any combination of cursedness and linear re-weighting of opportunity costs.

We provide the data as well as the Python scripts used to generate these fits (and plots) with this supplementary appendix, which can be found at <http://www.gambit-project.org/turocy> (or on request from the authors).

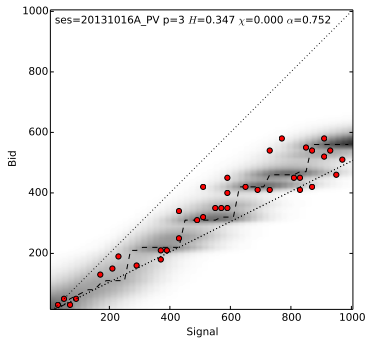
1 FPA-PV sessions



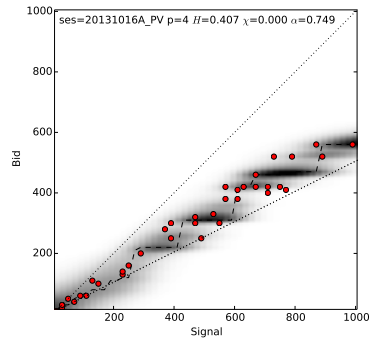
(a) FPA-PV 2013-10-16-A Bidder 1



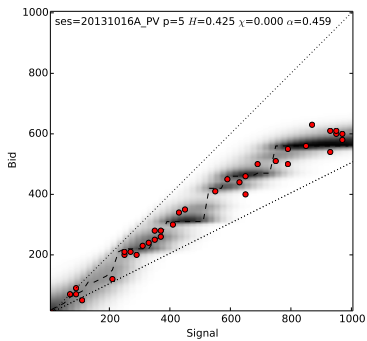
(b) FPA-PV 2013-10-16-A Bidder 2



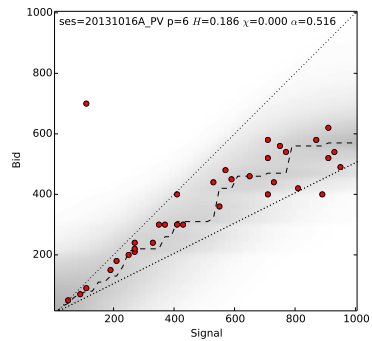
(c) FPA-PV 2013-10-16-A Bidder 3



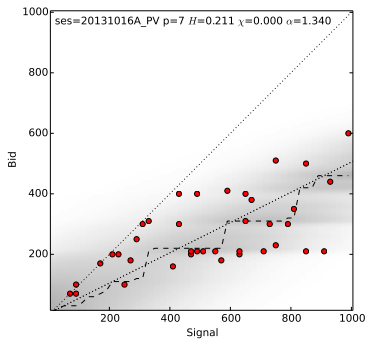
(d) FPA-PV 2013-10-16-A Bidder 4



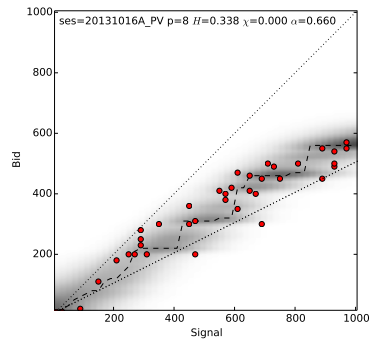
(e) FPA-PV 2013-10-16-A Bidder 5



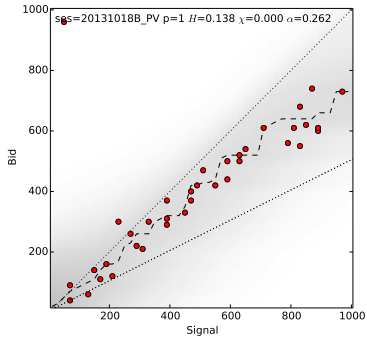
(f) FPA-PV 2013-10-16-A Bidder 6



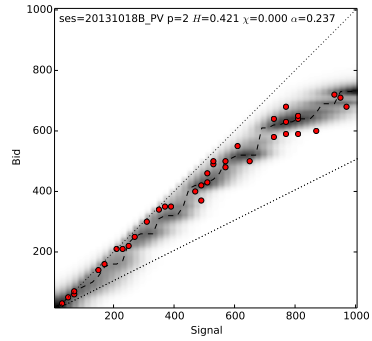
(g) FPA-PV 2013-10-16-A Bidder 7



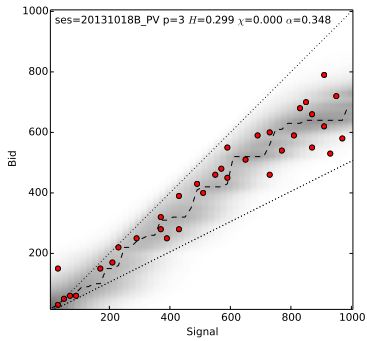
(h) FPA-PV 2013-10-16-A Bidder 8



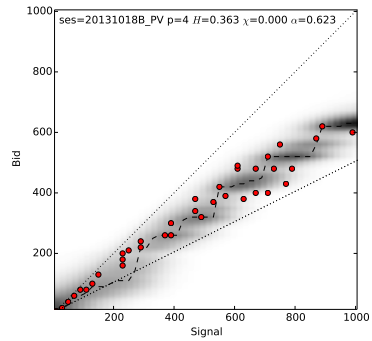
(a) FPA-PV 2013-10-18-B Bidder 1



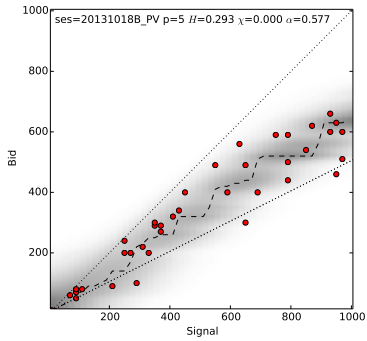
(b) FPA-PV 2013-10-18-B Bidder 2



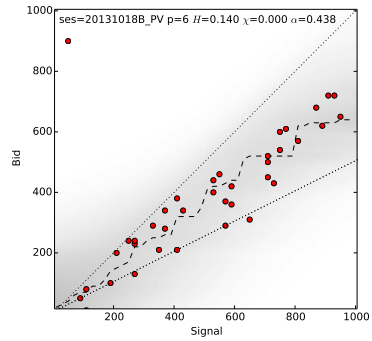
(c) FPA-PV 2013-10-18-B Bidder 3



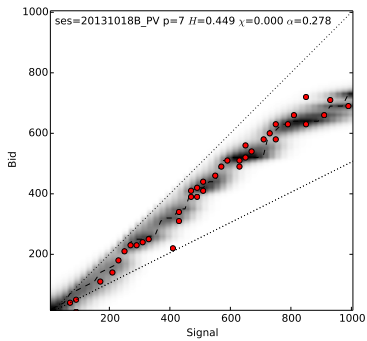
(d) FPA-PV 2013-10-18-B Bidder 4



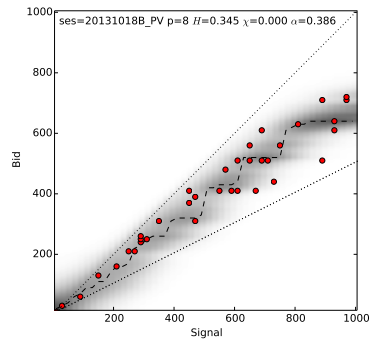
(e) FPA-PV 2013-10-18-B Bidder 5



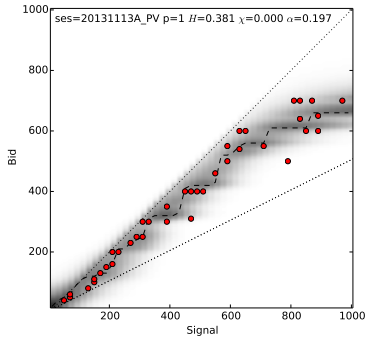
(f) FPA-PV 2013-10-18-B Bidder 6



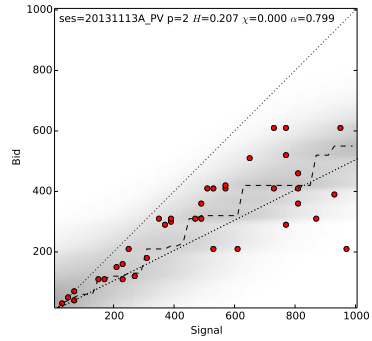
(g) FPA-PV 2013-10-18-B Bidder 7



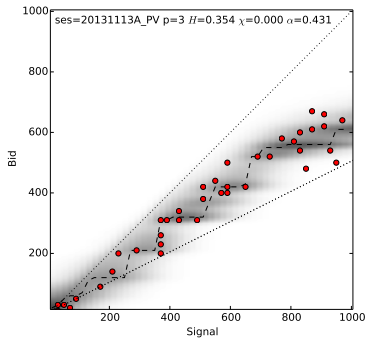
(h) FPA-PV 2013-10-18-B Bidder 8



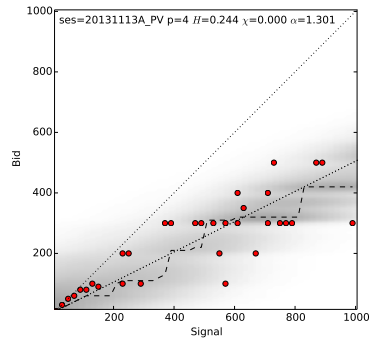
(a) FPA-PV 2013-11-13-A Bidder 1



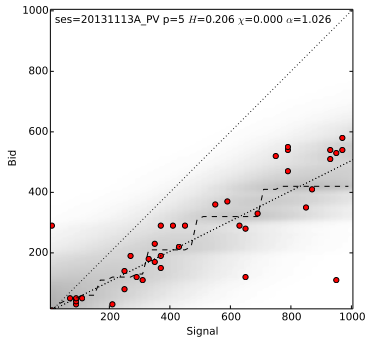
(b) FPA-PV 2013-11-13-A Bidder 2



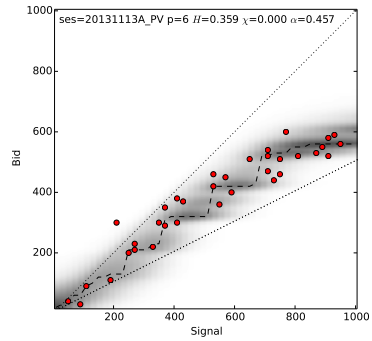
(c) FPA-PV 2013-11-13-A Bidder 3



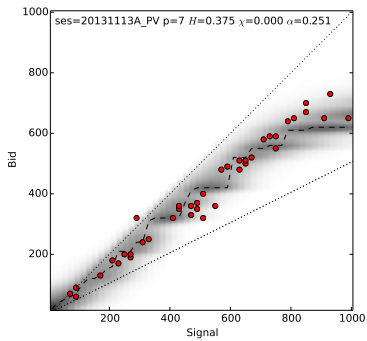
(d) FPA-PV 2013-11-13-A Bidder 4



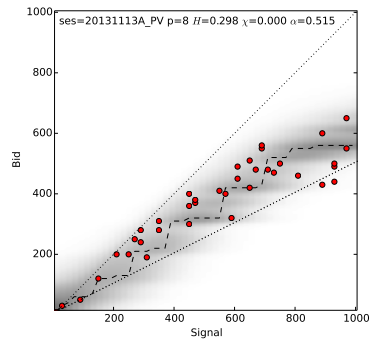
(e) FPA-PV 2013-11-13-A Bidder 5



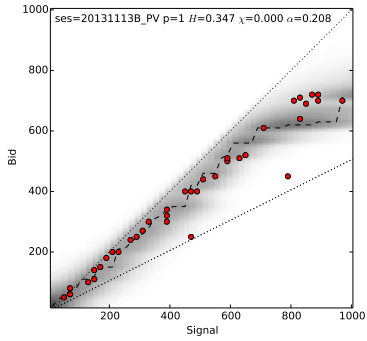
(f) FPA-PV 2013-11-13-A Bidder 6



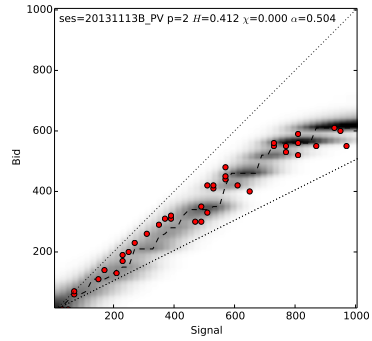
(g) FPA-PV 2013-11-13-A Bidder 7



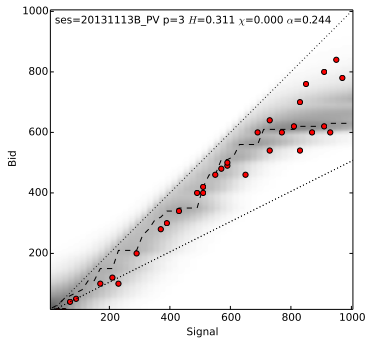
(h) FPA-PV 2013-11-13-A Bidder 8



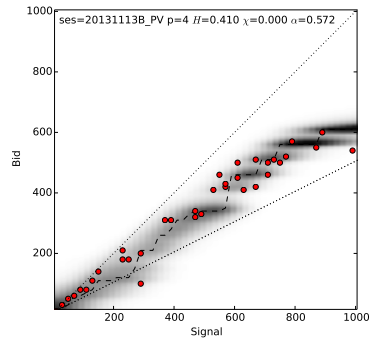
(a) FPA-PV 2013-11-13-B Bidder 1



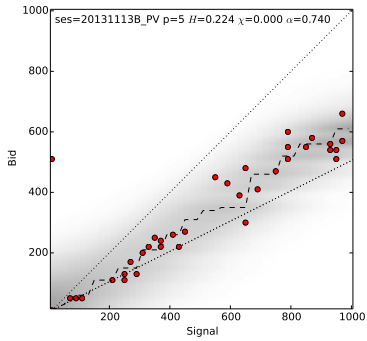
(b) FPA-PV 2013-11-13-B Bidder 2



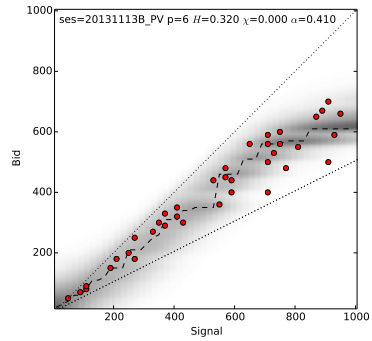
(c) FPA-PV 2013-11-13-B Bidder 3



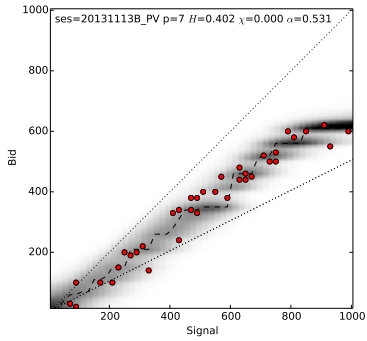
(d) FPA-PV 2013-11-13-B Bidder 4



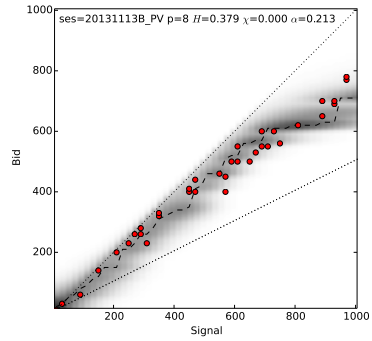
(e) FPA-PV 2013-11-13-B Bidder 5



(f) FPA-PV 2013-11-13-B Bidder 6

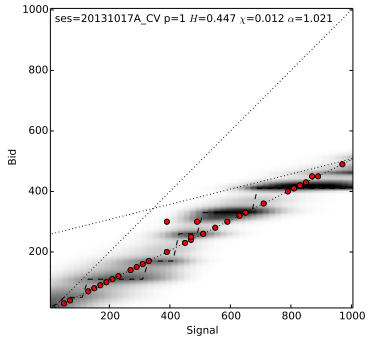


(g) FPA-PV 2013-11-13-B Bidder 7

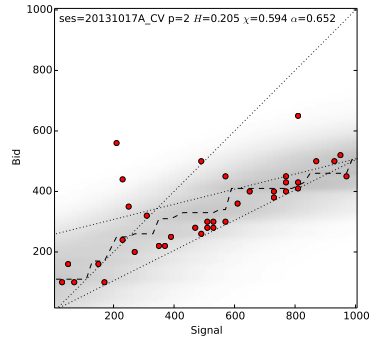


(h) FPA-PV 2013-11-13-B Bidder 8

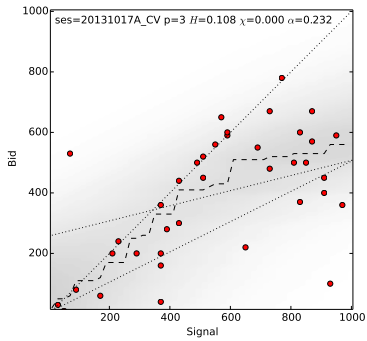
2 FPA-CV sessions



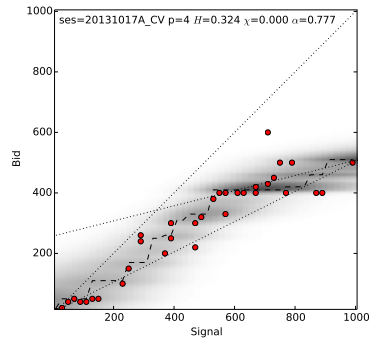
(a) FPA-CV 2013-10-17-A Bidder 1



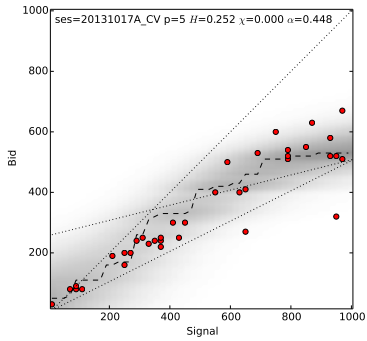
(b) FPA-CV 2013-10-17-A Bidder 2



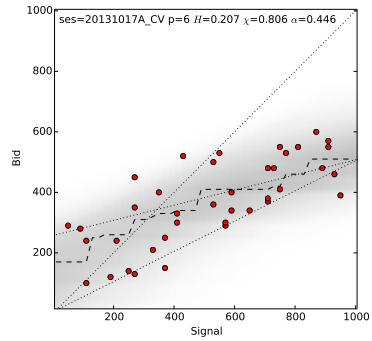
(c) FPA-CV 2013-10-17-A Bidder 3



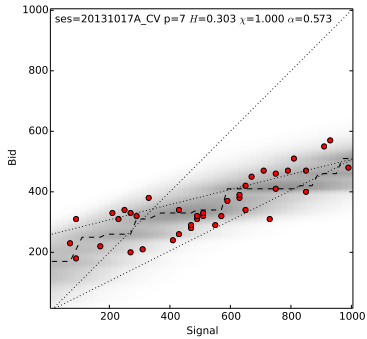
(d) FPA-CV 2013-10-17-A Bidder 4



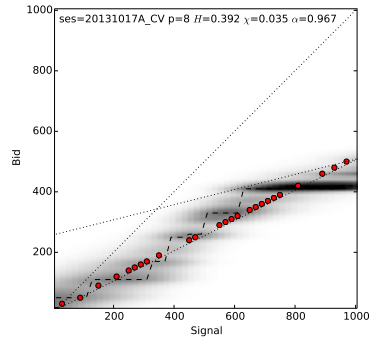
(e) FPA-CV 2013-10-17-A Bidder 5



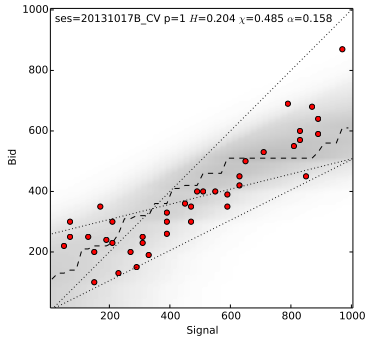
(f) FPA-CV 2013-10-17-A Bidder 6



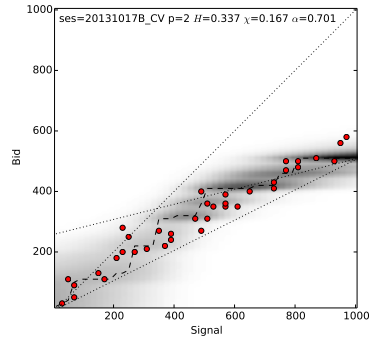
(g) FPA-CV 2013-10-17-A Bidder 7



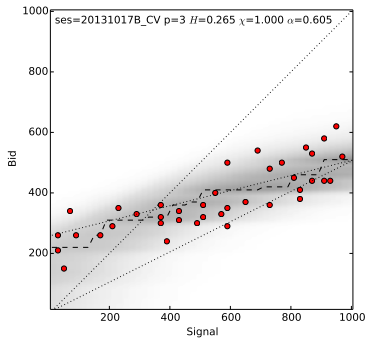
(h) FPA-CV 2013-10-17-A Bidder 8



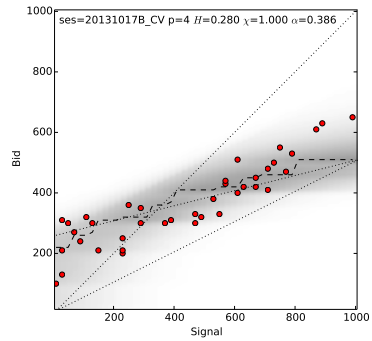
(a) FPA-CV 2013-10-17-B Bidder 1



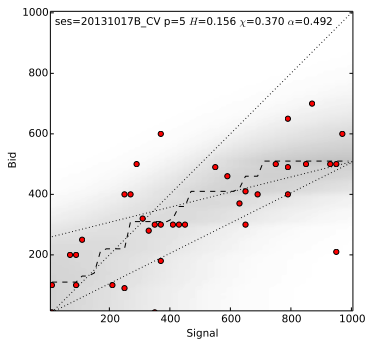
(b) FPA-CV 2013-10-17-B Bidder 2



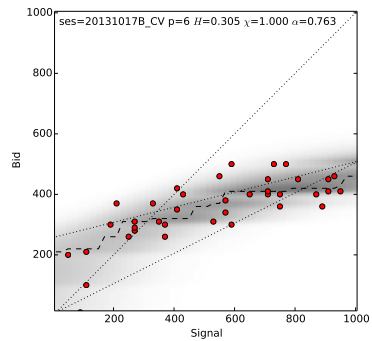
(c) FPA-CV 2013-10-17-B Bidder 3



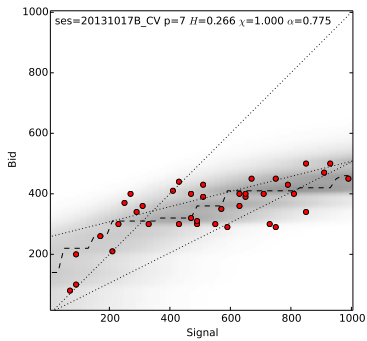
(d) FPA-CV 2013-10-17-B Bidder 4



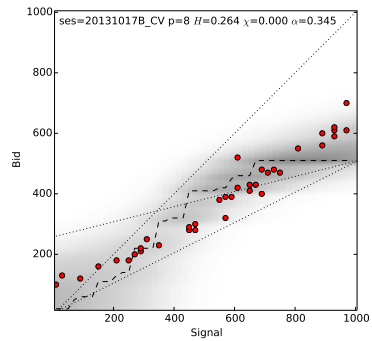
(e) FPA-CV 2013-10-17-B Bidder 5



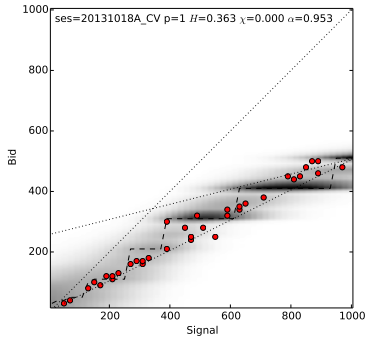
(f) FPA-CV 2013-10-17-B Bidder 6



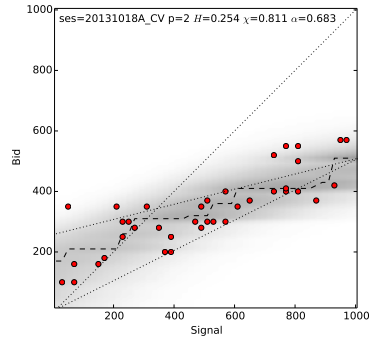
(g) FPA-CV 2013-10-17-B Bidder 7



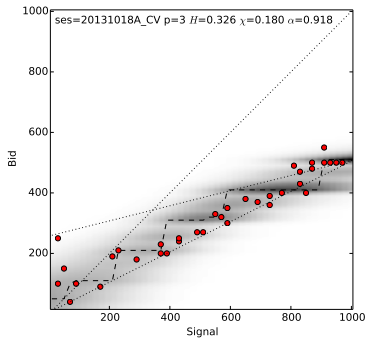
(h) FPA-CV 2013-10-17-B Bidder 8



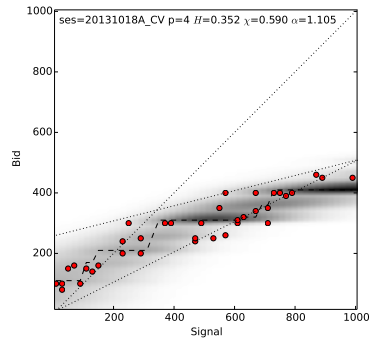
(a) FPA-CV 2013-10-18-A Bidder 1



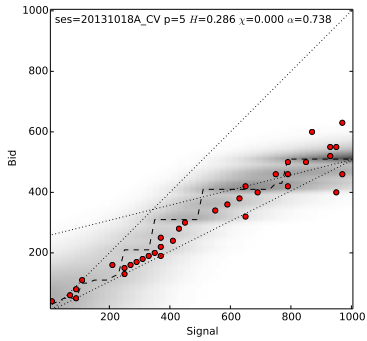
(b) FPA-CV 2013-10-18-A Bidder 2



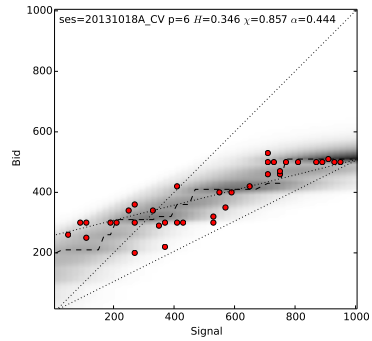
(c) FPA-CV 2013-10-18-A Bidder 3



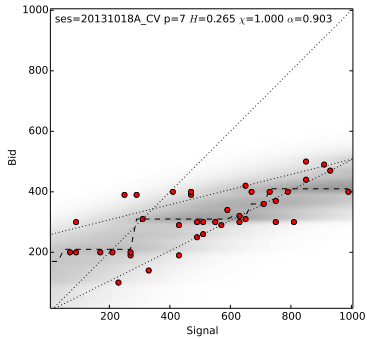
(d) FPA-CV 2013-10-18-A Bidder 4



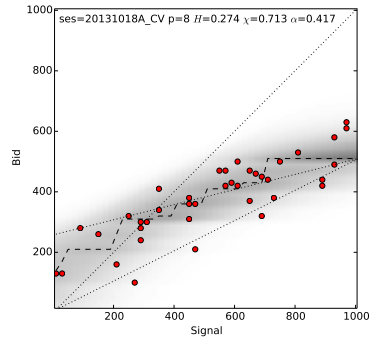
(e) FPA-CV 2013-10-18-A Bidder 5



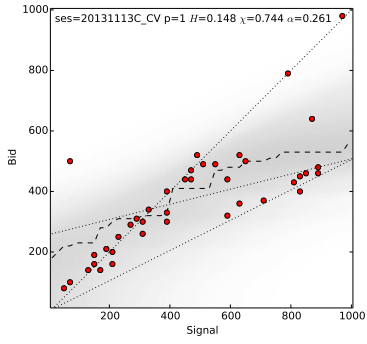
(f) FPA-CV 2013-10-18-A Bidder 6



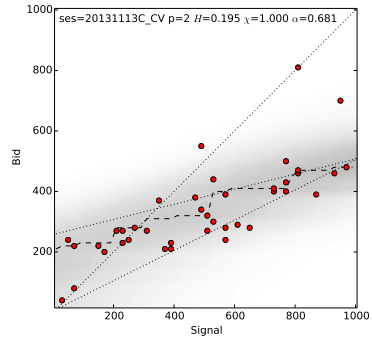
(g) FPA-CV 2013-10-18-A Bidder 7



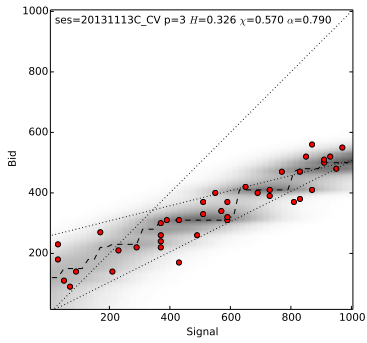
(h) FPA-CV 2013-10-18-A Bidder 8



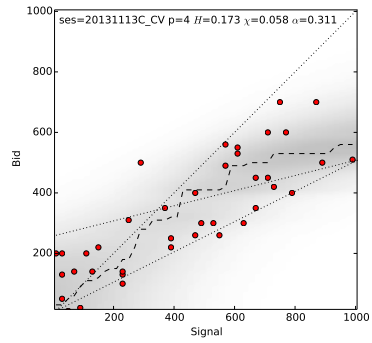
(a) FPA-CV 2013-11-13-C Bidder 1



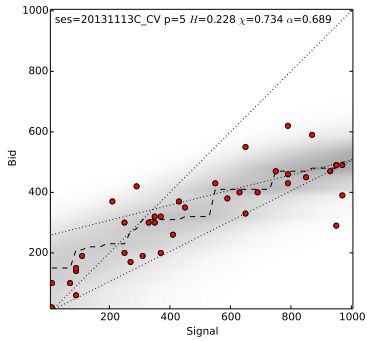
(b) FPA-CV 2013-11-13-C Bidder 2



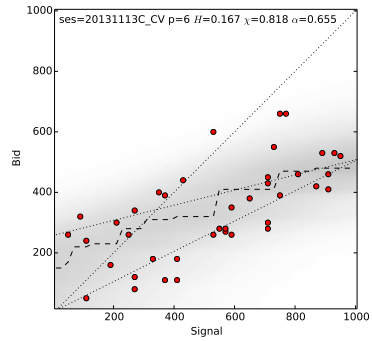
(c) FPA-CV 2013-11-13-C Bidder 3



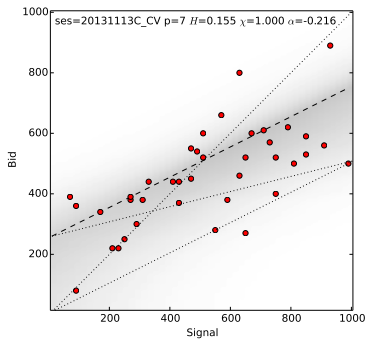
(d) FPA-CV 2013-11-13-C Bidder 4



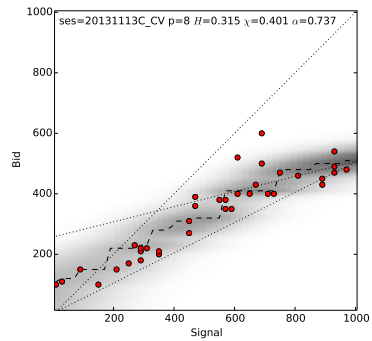
(e) FPA-CV 2013-11-13-C Bidder 5



(f) FPA-CV 2013-11-13-C Bidder 6

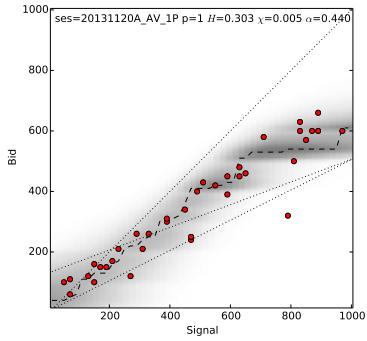


(g) FPA-CV 2013-11-13-C Bidder 7

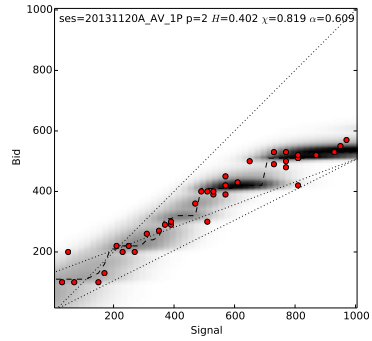


(h) FPA-CV 2013-11-13-C Bidder 8

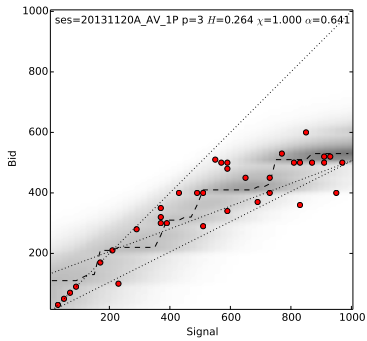
3 FPA-IV sessions



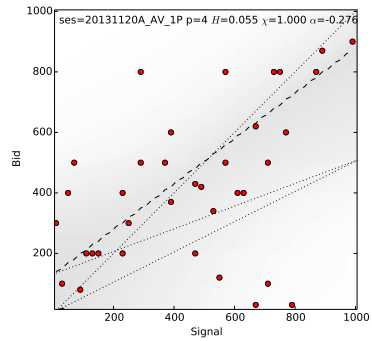
(a) FPA-IV 2013-11-20-A Bidder 1



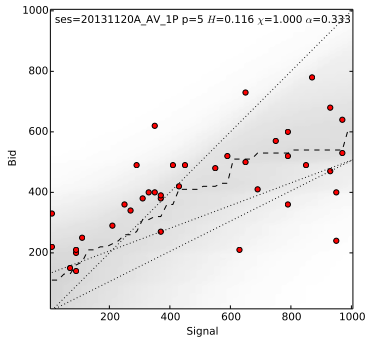
(b) FPA-IV 2013-11-20-A Bidder 2



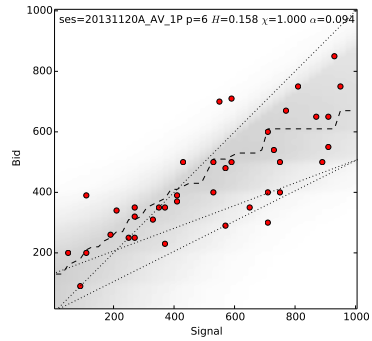
(c) FPA-IV 2013-11-20-A Bidder 3



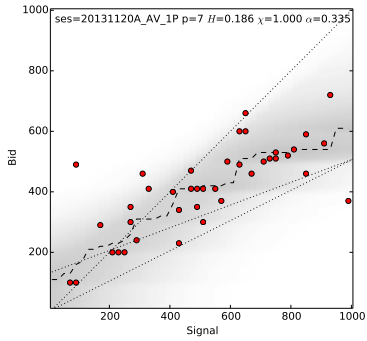
(d) FPA-IV 2013-11-20-A Bidder 4



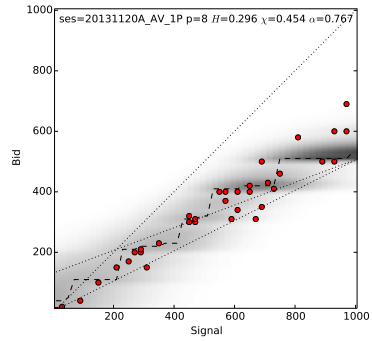
(e) FPA-IV 2013-11-20-A Bidder 5



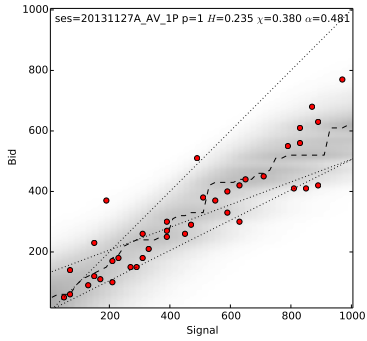
(f) FPA-IV 2013-11-20-A Bidder 6



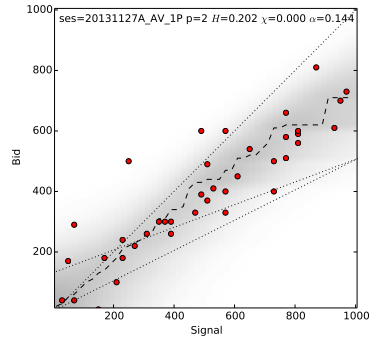
(g) FPA-IV 2013-11-20-A Bidder 7



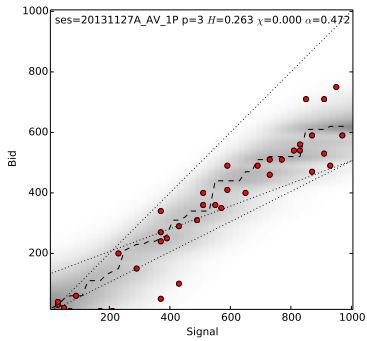
(h) FPA-IV 2013-11-20-A Bidder 8



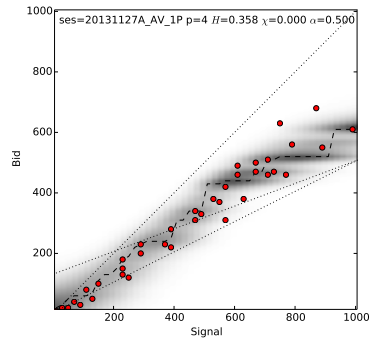
(a) FPA-IV 2013-11-27-A Bidder 1



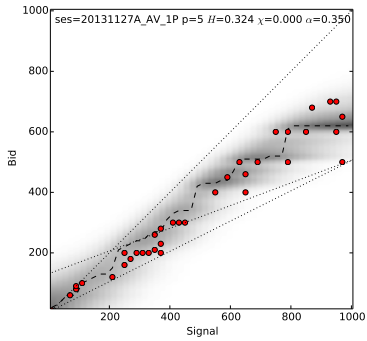
(b) FPA-IV 2013-11-27-A Bidder 2



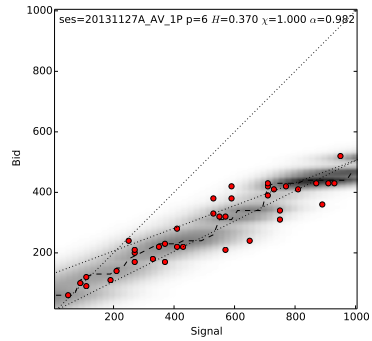
(c) FPA-IV 2013-11-27-A Bidder 3



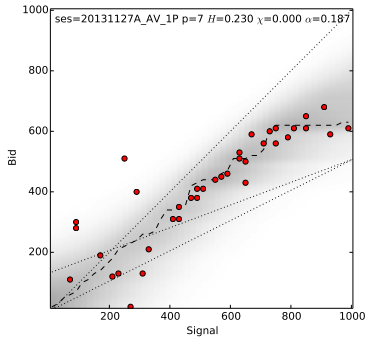
(d) FPA-IV 2013-11-27-A Bidder 4



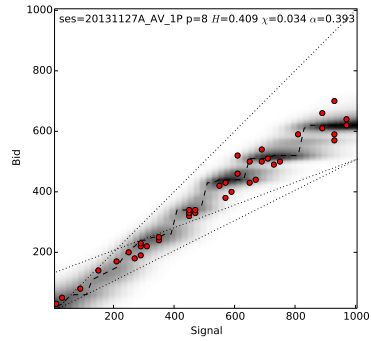
(e) FPA-IV 2013-11-27-A Bidder 5



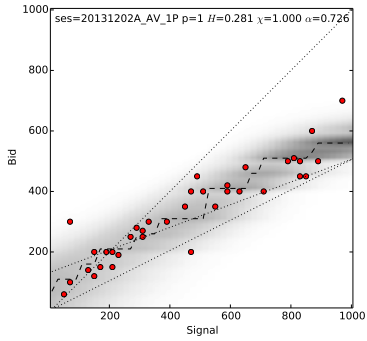
(f) FPA-IV 2013-11-27-A Bidder 6



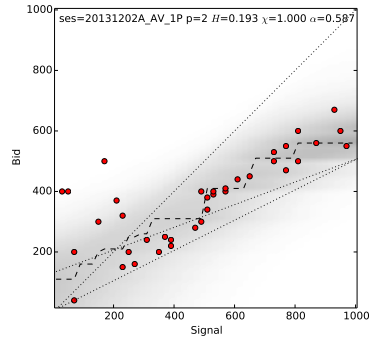
(g) FPA-IV 2013-11-27-A Bidder 7



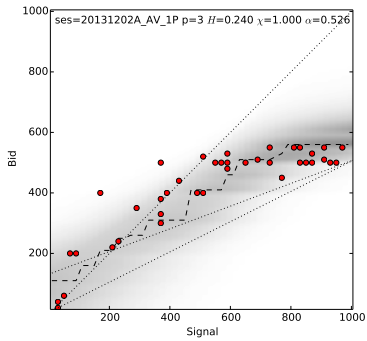
(h) FPA-IV 2013-11-27-A Bidder 8



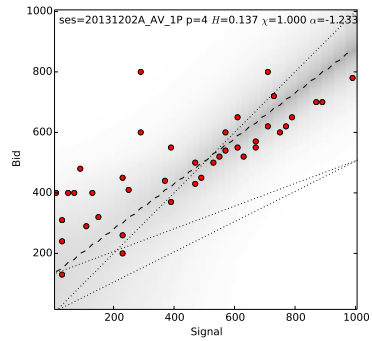
(a) FPA-IV 2013-12-02-A Bidder 1



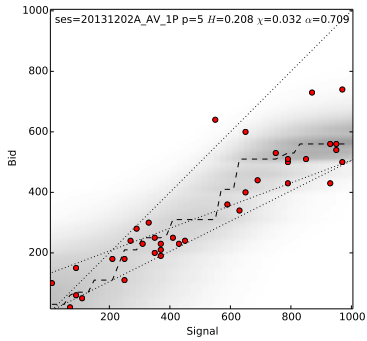
(b) FPA-IV 2013-12-02-A Bidder 2



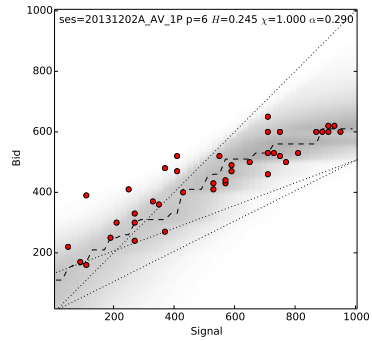
(c) FPA-IV 2013-12-02-A Bidder 3



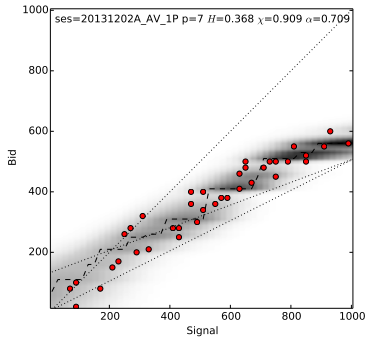
(d) FPA-IV 2013-12-02-A Bidder 4



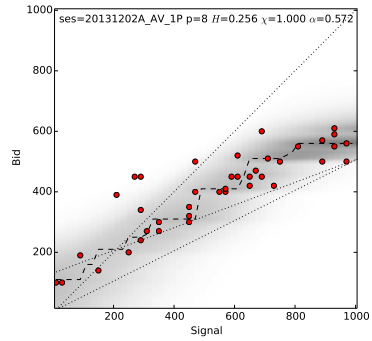
(e) FPA-IV 2013-12-02-A Bidder 5



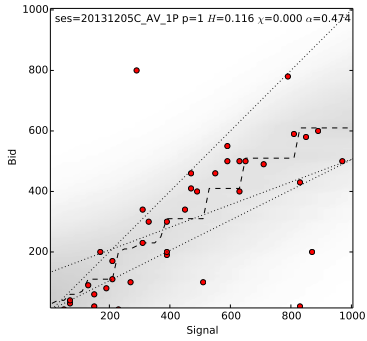
(f) FPA-IV 2013-12-02-A Bidder 6



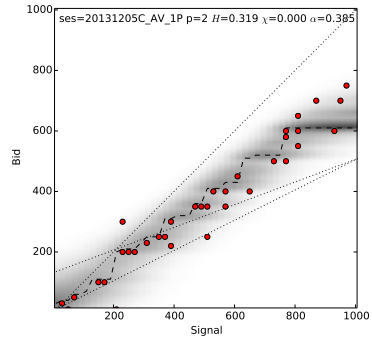
(g) FPA-IV 2013-12-02-A Bidder 7



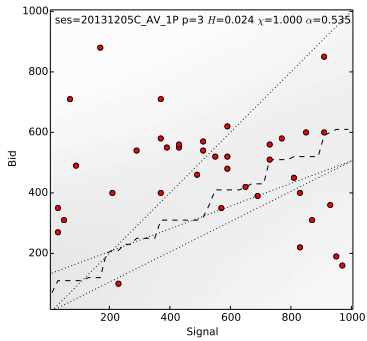
(h) FPA-IV 2013-12-02-A Bidder 8



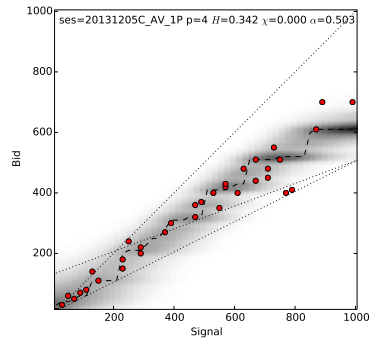
(a) FPA-IV 2013-12-05-C Bidder 1



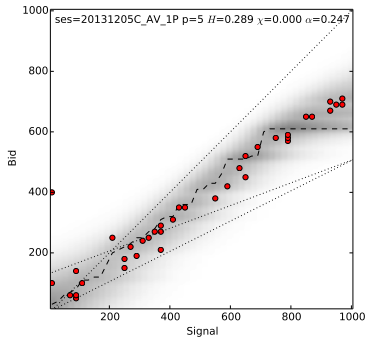
(b) FPA-IV 2013-12-05-C Bidder 2



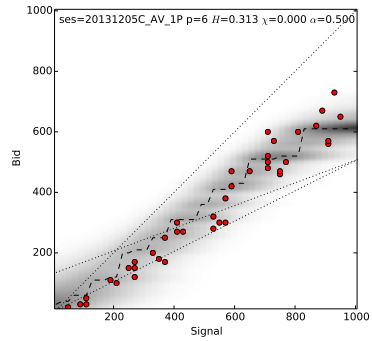
(c) FPA-IV 2013-12-05-C Bidder 3



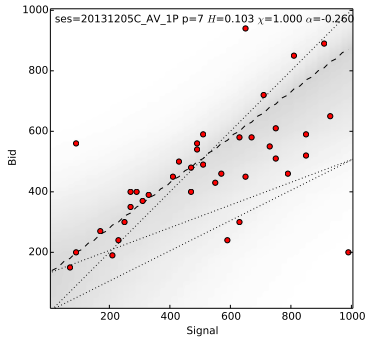
(d) FPA-IV 2013-12-05-C Bidder 4



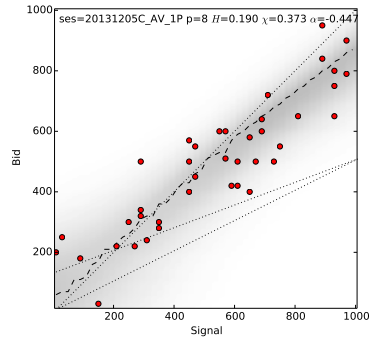
(e) FPA-IV 2013-12-05-C Bidder 5



(f) FPA-IV 2013-12-05-C Bidder 6

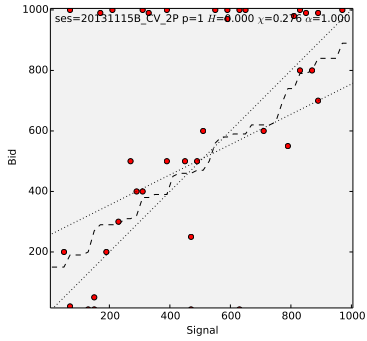


(g) FPA-IV 2013-12-05-C Bidder 7

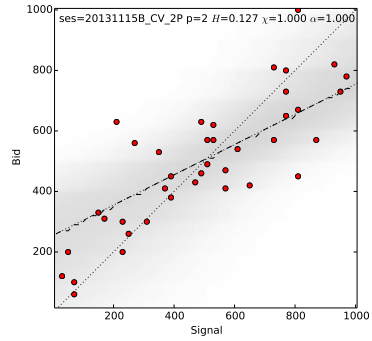


(h) FPA-IV 2013-12-05-C Bidder 8

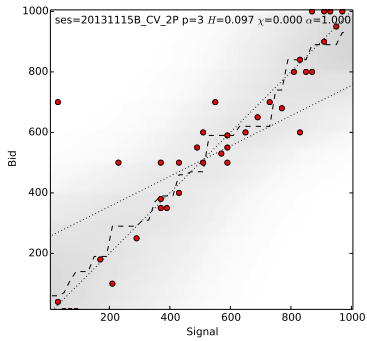
4 SPA-CV sessions



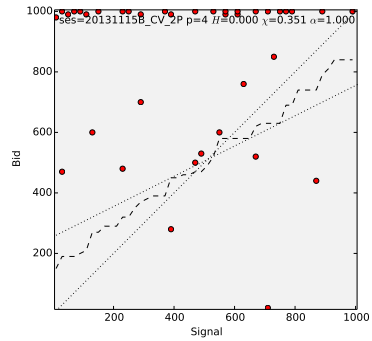
(a) SPA-CV 2013-11-15-B Bidder 1



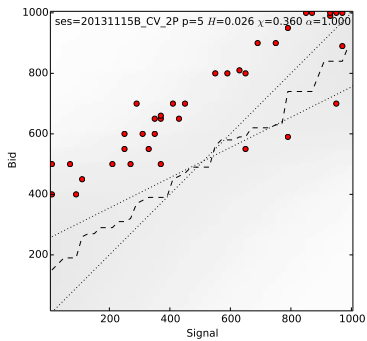
(b) SPA-CV 2013-11-15-B Bidder 2



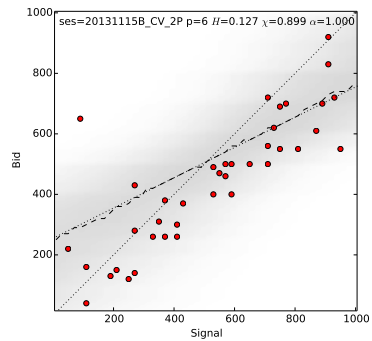
(c) SPA-CV 2013-11-15-B Bidder 3



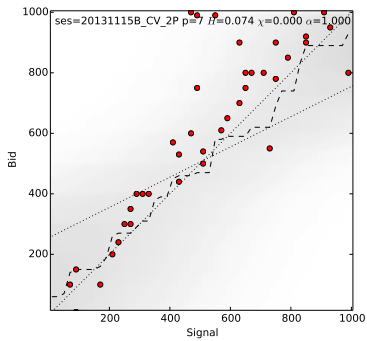
(d) SPA-CV 2013-11-15-B Bidder 4



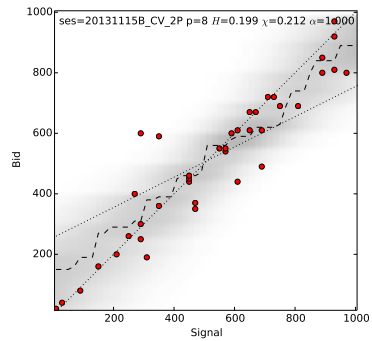
(e) SPA-CV 2013-11-15-B Bidder 5



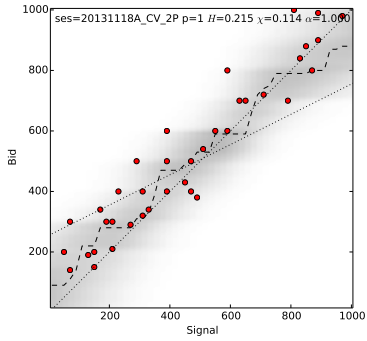
(f) SPA-CV 2013-11-15-B Bidder 6



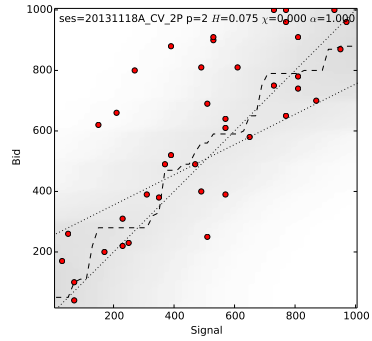
(g) SPA-CV 2013-11-15-B Bidder 7



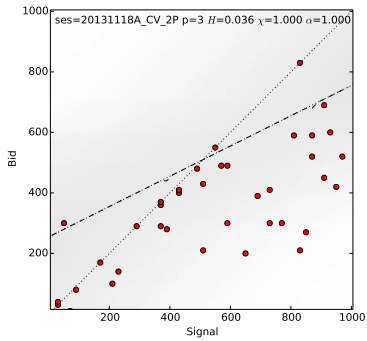
(h) SPA-CV 2013-11-15-B Bidder 8



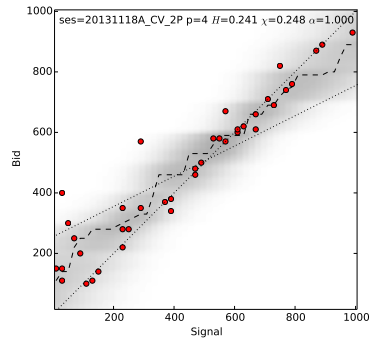
(a) SPA-CV 2013-11-18-A Bidder 1



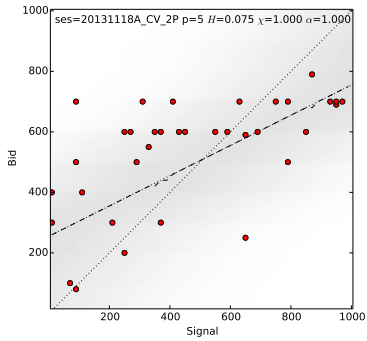
(b) SPA-CV 2013-11-18-A Bidder 2



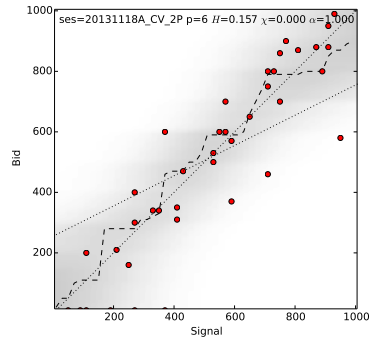
(c) SPA-CV 2013-11-18-A Bidder 3



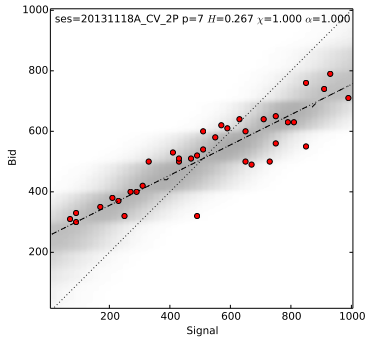
(d) SPA-CV 2013-11-18-A Bidder 4



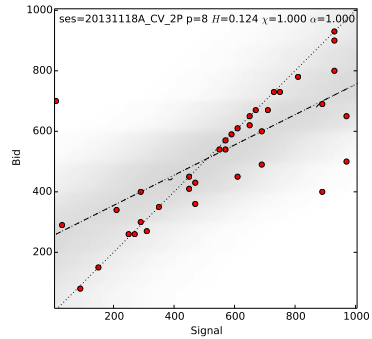
(e) SPA-CV 2013-11-18-A Bidder 5



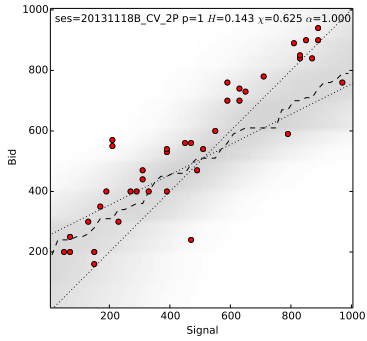
(f) SPA-CV 2013-11-18-A Bidder 6



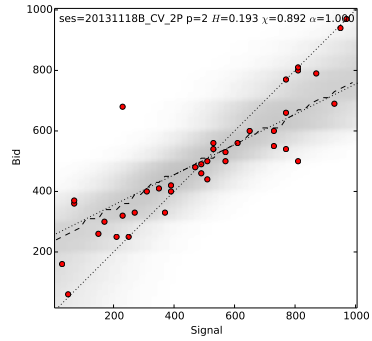
(g) SPA-CV 2013-11-18-A Bidder 7



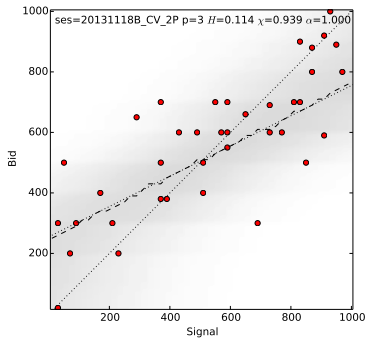
(h) SPA-CV 2013-11-18-A Bidder 8



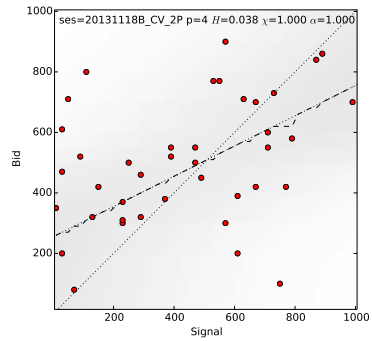
(a) SPA-CV 2013-11-18-B Bidder 1



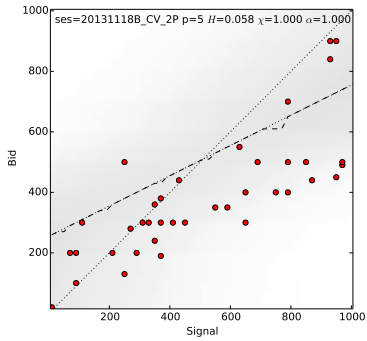
(b) SPA-CV 2013-11-18-B Bidder 2



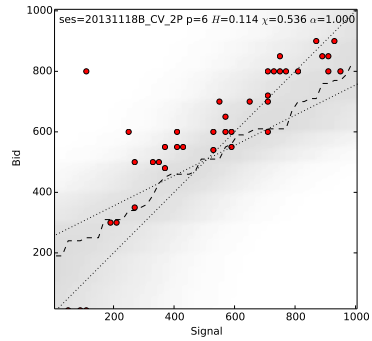
(c) SPA-CV 2013-11-18-B Bidder 3



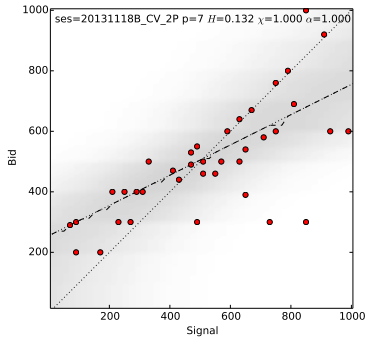
(d) SPA-CV 2013-11-18-B Bidder 4



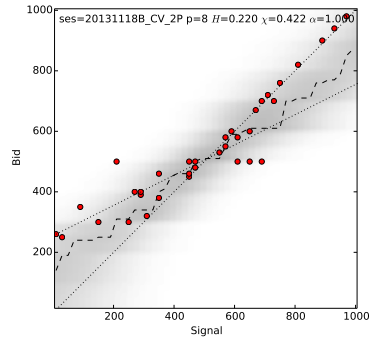
(e) SPA-CV 2013-11-18-B Bidder 5



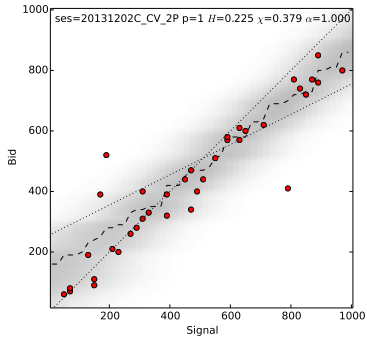
(f) SPA-CV 2013-11-18-B Bidder 6



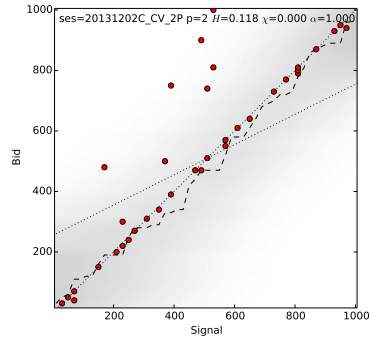
(g) SPA-CV 2013-11-18-B Bidder 7



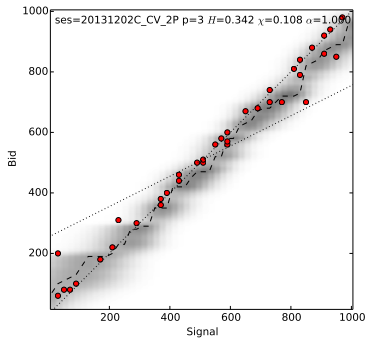
(h) SPA-CV 2013-11-18-B Bidder 8



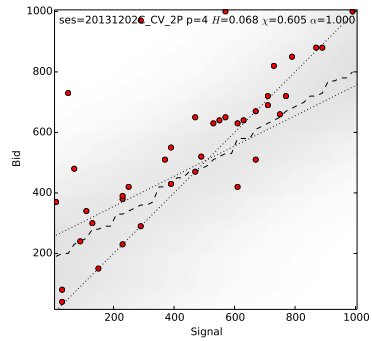
(a) SPA-CV 2013-12-02-C Bidder 1



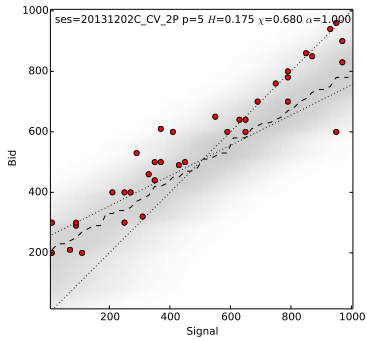
(b) SPA-CV 2013-12-02-C Bidder 2



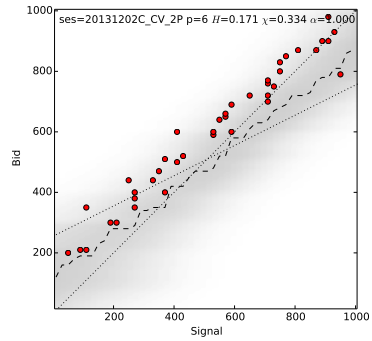
(c) SPA-CV 2013-12-02-C Bidder 3



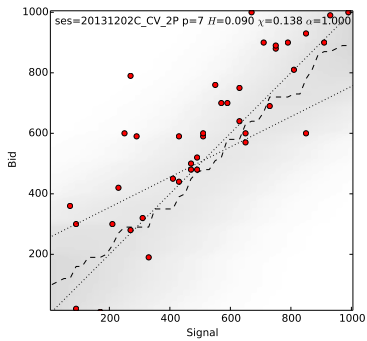
(d) SPA-CV 2013-12-02-C Bidder 4



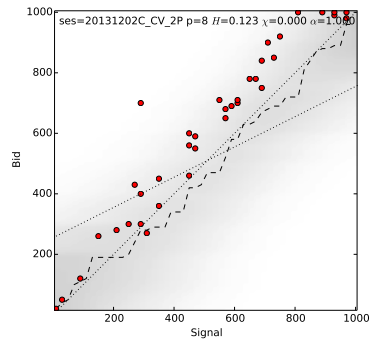
(e) SPA-CV 2013-12-02-C Bidder 5



(f) SPA-CV 2013-12-02-C Bidder 6

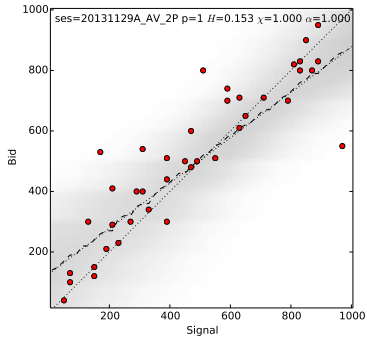


(g) SPA-CV 2013-12-02-C Bidder 7

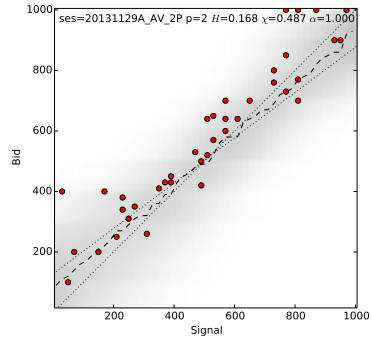


(h) SPA-CV 2013-12-02-C Bidder 8

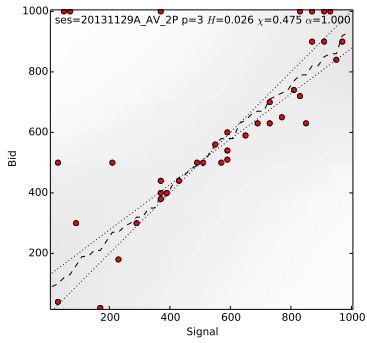
5 SPA-IV sessions



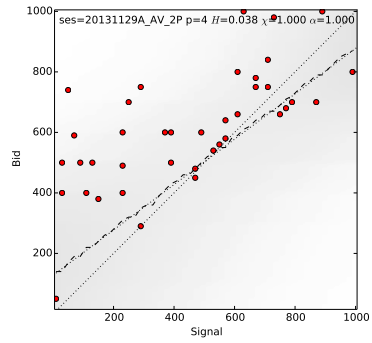
(a) SPA-IV 2013-11-29-A Bidder 1



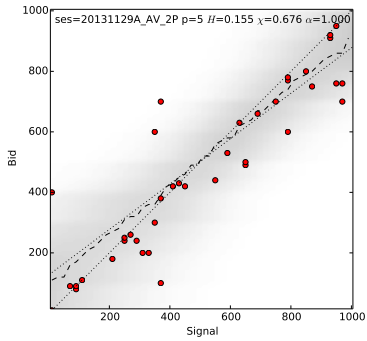
(b) SPA-IV 2013-11-29-A Bidder 2



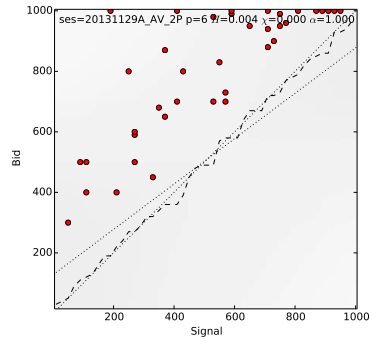
(c) SPA-IV 2013-11-29-A Bidder 3



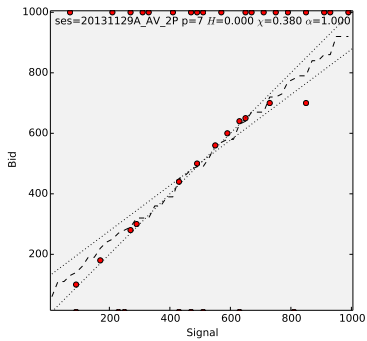
(d) SPA-IV 2013-11-29-A Bidder 4



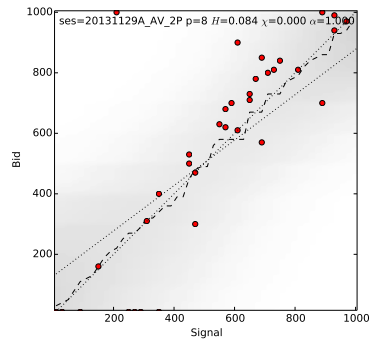
(e) SPA-IV 2013-11-29-A Bidder 5



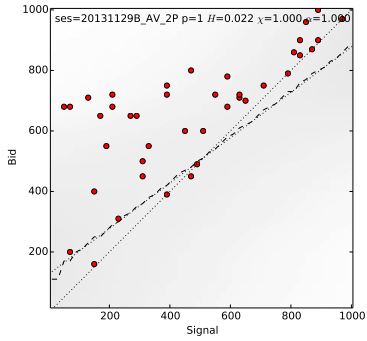
(f) SPA-IV 2013-11-29-A Bidder 6



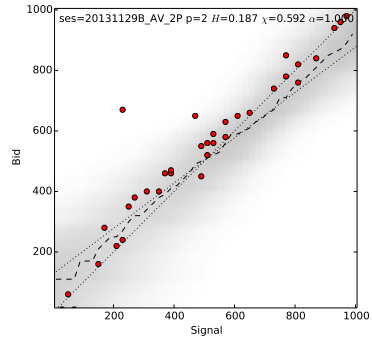
(g) SPA-IV 2013-11-29-A Bidder 7



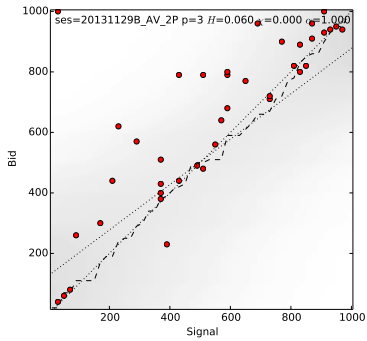
(h) SPA-IV 2013-11-29-A Bidder 8



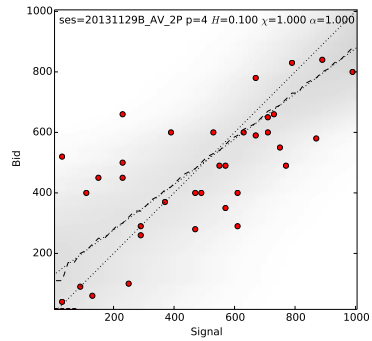
(a) SPA-IV 2013-11-29-B Bidder 1



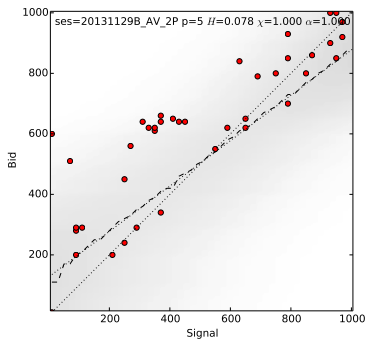
(b) SPA-IV 2013-11-29-B Bidder 2



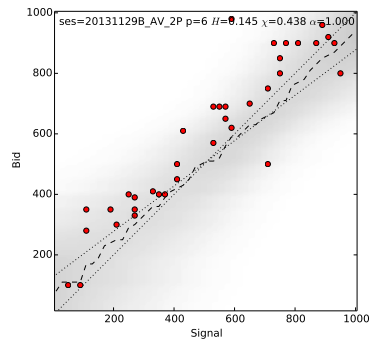
(c) SPA-IV 2013-11-29-B Bidder 3



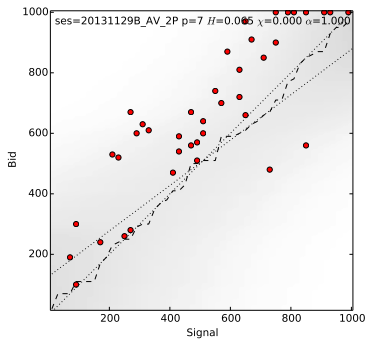
(d) SPA-IV 2013-11-29-B Bidder 4



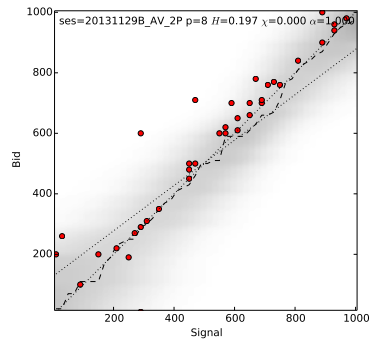
(e) SPA-IV 2013-11-29-B Bidder 5



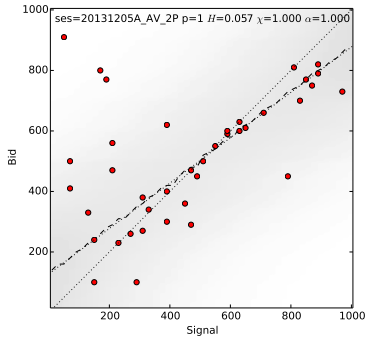
(f) SPA-IV 2013-11-29-B Bidder 6



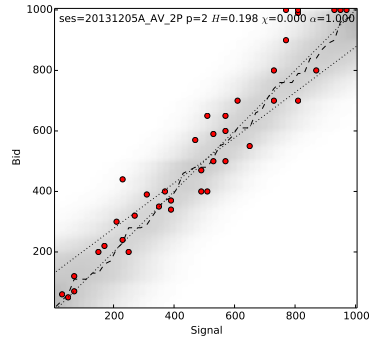
(g) SPA-IV 2013-11-29-B Bidder 7



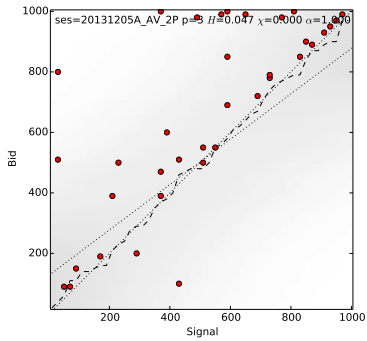
(h) SPA-IV 2013-11-29-B Bidder 8



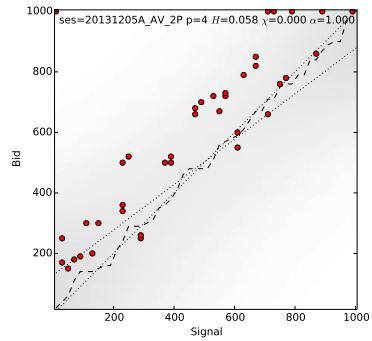
(a) SPA-IV 2013-12-05-A Bidder 1



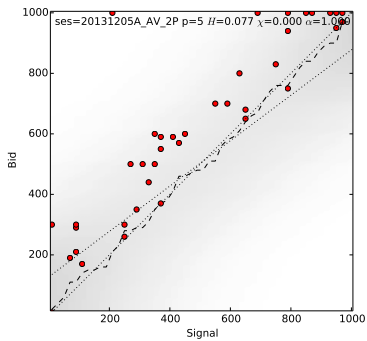
(b) SPA-IV 2013-12-05-A Bidder 2



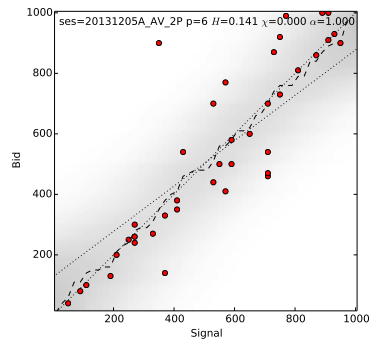
(c) SPA-IV 2013-12-05-A Bidder 3



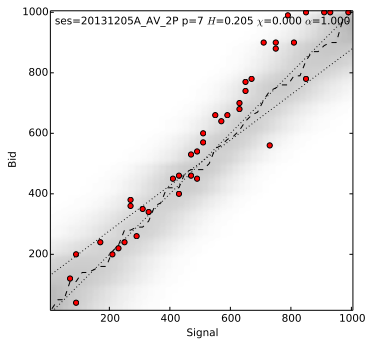
(d) SPA-IV 2013-12-05-A Bidder 4



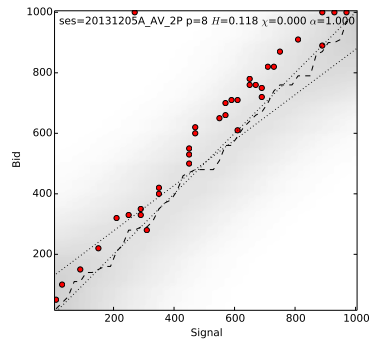
(e) SPA-IV 2013-12-05-A Bidder 5



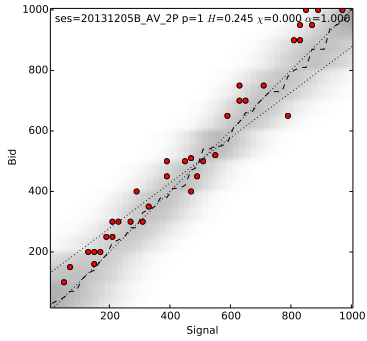
(f) SPA-IV 2013-12-05-A Bidder 6



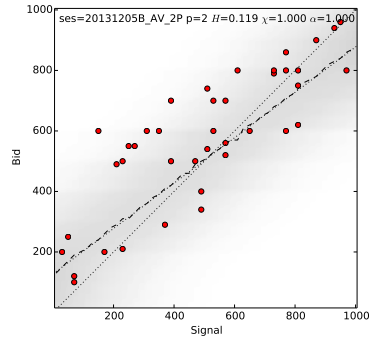
(g) SPA-IV 2013-12-05-A Bidder 7



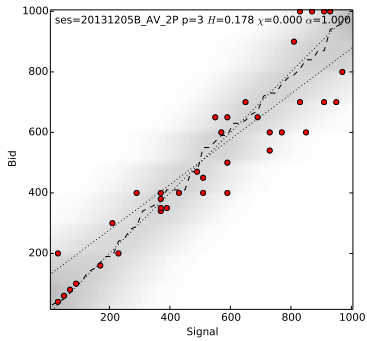
(h) SPA-IV 2013-12-05-A Bidder 8



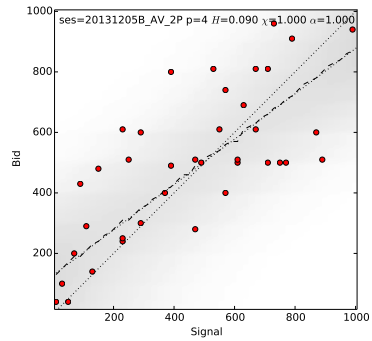
(a) SPA-IV 2013-12-05-B Bidder 1



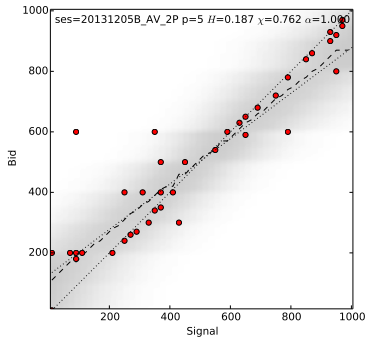
(b) SPA-IV 2013-12-05-B Bidder 2



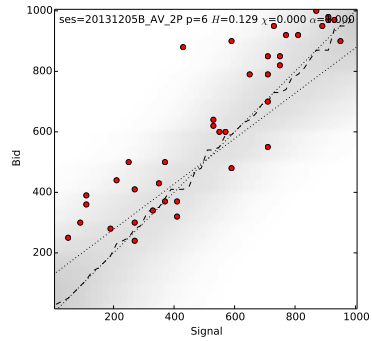
(c) SPA-IV 2013-12-05-B Bidder 3



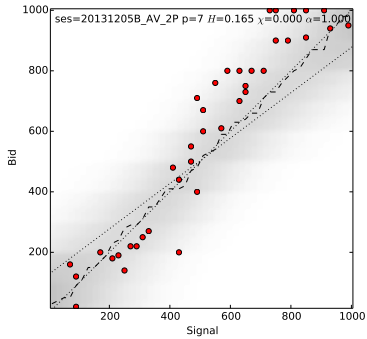
(d) SPA-IV 2013-12-05-B Bidder 4



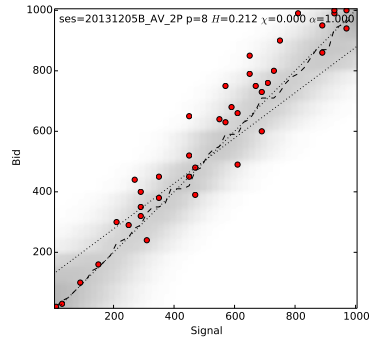
(e) SPA-IV 2013-12-05-B Bidder 5



(f) SPA-IV 2013-12-05-B Bidder 6



(g) SPA-IV 2013-12-05-B Bidder 7



(h) SPA-IV 2013-12-05-B Bidder 8