Market Data and High Frequency Trading

by

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Telvent DTN Overview

- DTN was started in 1984 to provide time sensitive information, market data, to help people make profitable decisions.
  - Over 120,000 customers in financial, agriculture, energy and weather markets
  - Acquired by Telvent in 2008 for $445,000,000
  - Schneider Electric acquired Telvent in 2011 $1.4B
- Market Data products
  - IQ Feed- integrated with several 3rd party software applications
  - ProphetX- institutional commodity traders
  - NxCore- full broadcast data feed
  - Web Services- XML delivered data for web sites, risk mgmt
  - Text Files- efficient way to receive data for large # of symbols

Telvent DTN & Nanex

- Nanex is a software provider, started in 2000
  - Licenses advanced software to process, analyze, and transmit market data to trading systems.
  - Looked at multiple data providers and selected to partner with DTN
- Launched NxCore in 2005.
  - DTN data with NxCore software
  - Only product able to deliver full broadcast feed via Internet
  - Compress data over 90% and process over 2M msg/second
  - Customers include advanced individual traders, algorithmic traders, quant traders, hedge funds, and online brokers
  - Real Time, end of day, and historical tick data back to 2004
  - Using NxCore data and API, users can develop systems to analyze the markets for trading opportunities

Comparison of IQ Feed & NxCore

	IQ Feed	NxCore
Symbol limit	500 – 1200	No limit 500,000+
Timestamp resolution	1 second	25 millisecond
Equity regional quotes	By request	all exchanges included
Historical Data	Included	Add'l fee, data back to 2004
News	Included	Not included
API	Socket based ASCII strings	Callback with dll

Markets are Interconnected

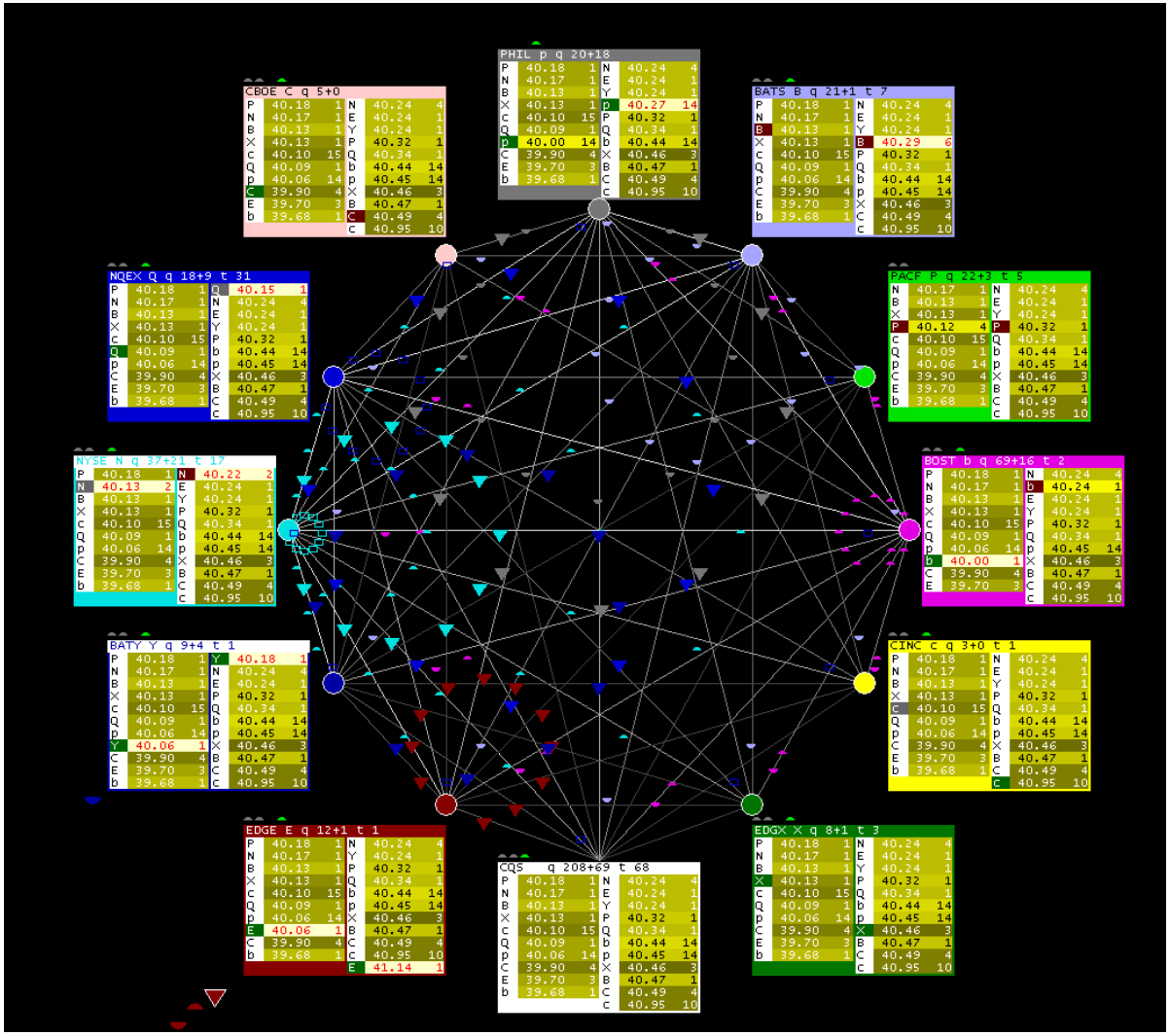
- Order can be from institutional firm or retail traders

- 12 Equity exchanges
- ECN/ATS
- Dark Liquidity Pools

- ETF, 3X Leveraged
- Options- OPRA
  - 10 Option Exchanges
- Futures- eMini S&P, Dow
- Basket Trading

Multiple Market Centers

Multiple Market Centers



Flash Crash
May 6, 2010

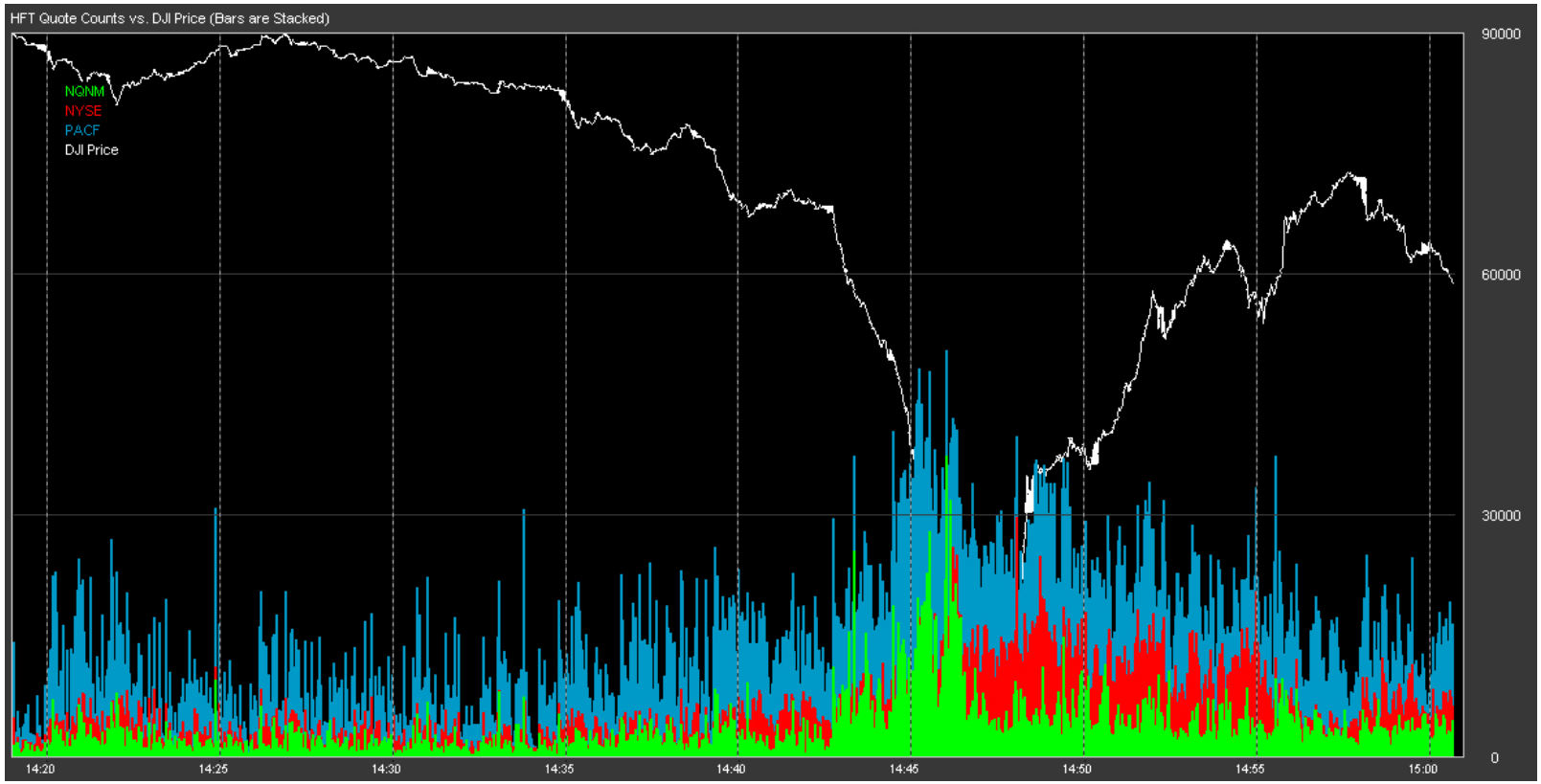
- The Dow Jones Industrial Average
  - At 14:30 DJIA was down 261 points
  - At 14:42 DJIA was down 413 points
  - At 14:48 DJIA was down 998 points, largest intraday point loss, 9.2%
  - At 14:50 DJIA was down 666 points
  - At 15:00 DJIA was down 453 points
  - DJIA closed down 347, 3.2%
- NASDAQ & BX declared “Self Help” against NYSE Arca (PACF) at 14:37 & 14:38 respectively.

Nanex Analysis

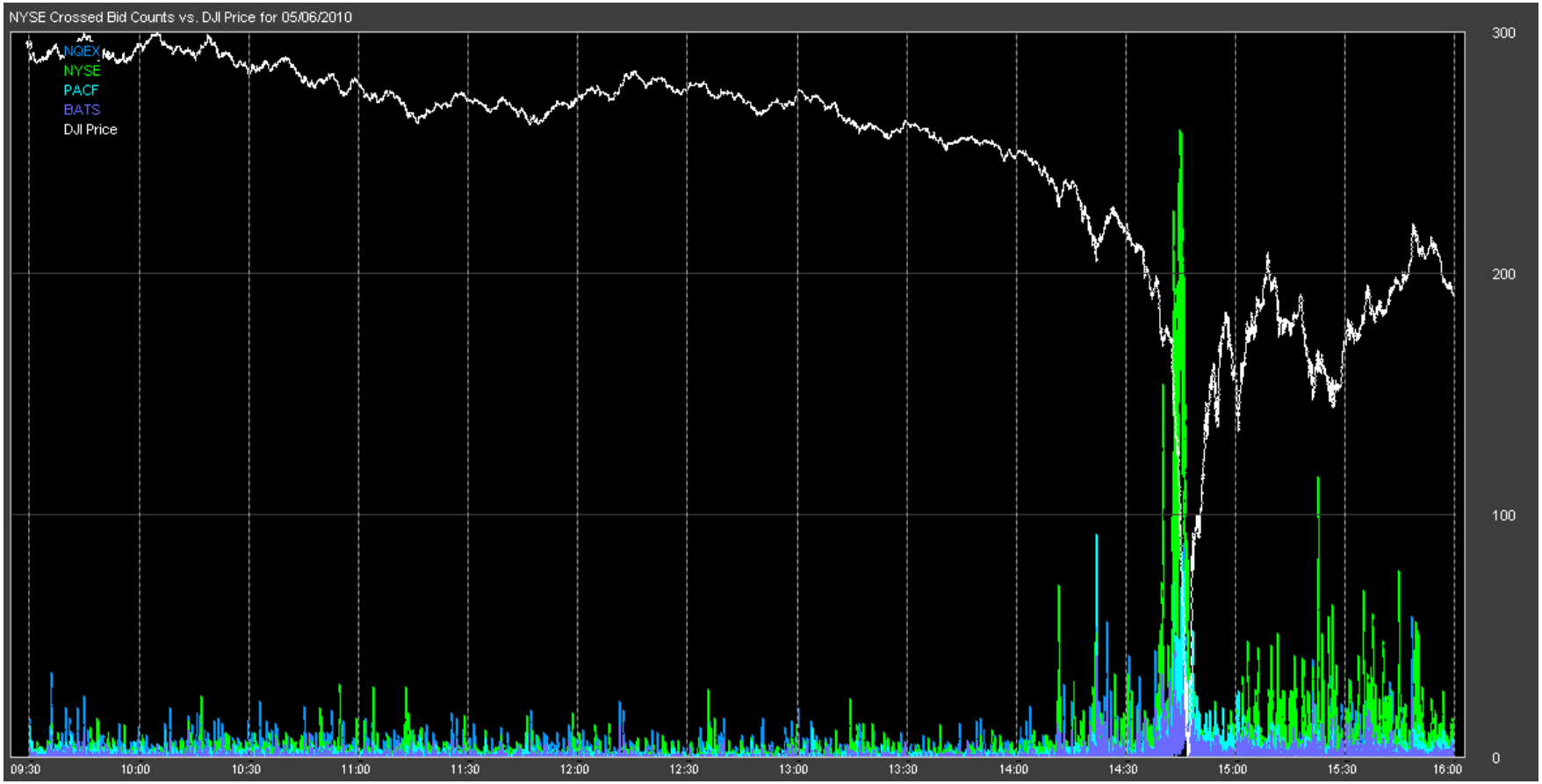
- Analyzed over 7,000,000,000 trades and quotes
  - At 14:42:46 NYSE Bids started crossing Best Ask prices on over 100 stocks increased to over 250 NYSE listed stocks within 2 minutes
- NYSE Quotes started lagging other market center quotes,
- NYSE Bid's were not dropping as fast as other exchanges Offer prices
- HFT's sent buy orders on one exchange and sent sell orders to NYSE, more selling pressure on NYSE
- Many HFT's pulled out of the market reducing liquidity

Quote Bursts by Exchange

- **Burst of 150 or more quotes in a single second, for a single issue by the same exchange**

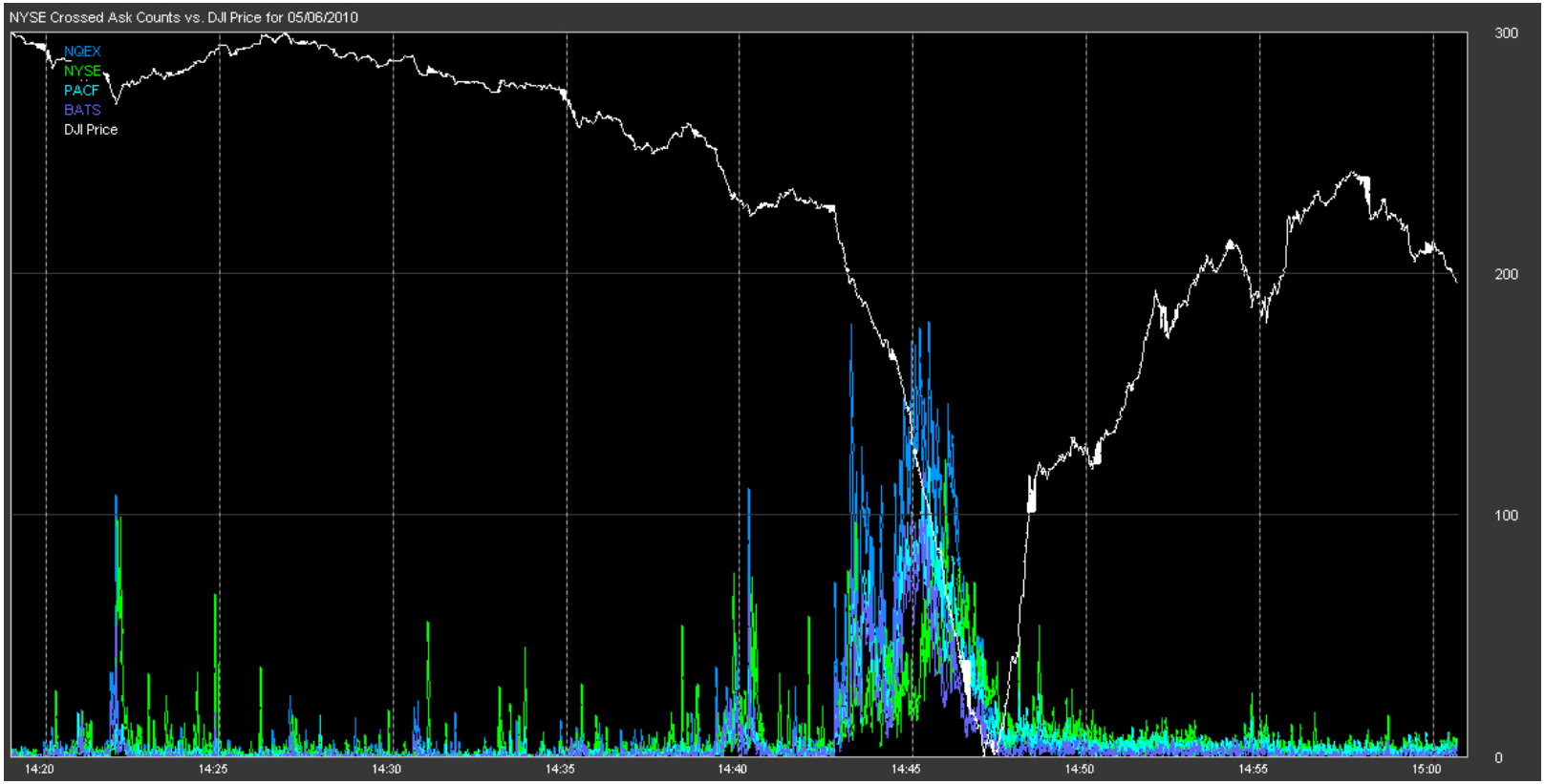


NYSE Bid > National Best Ask



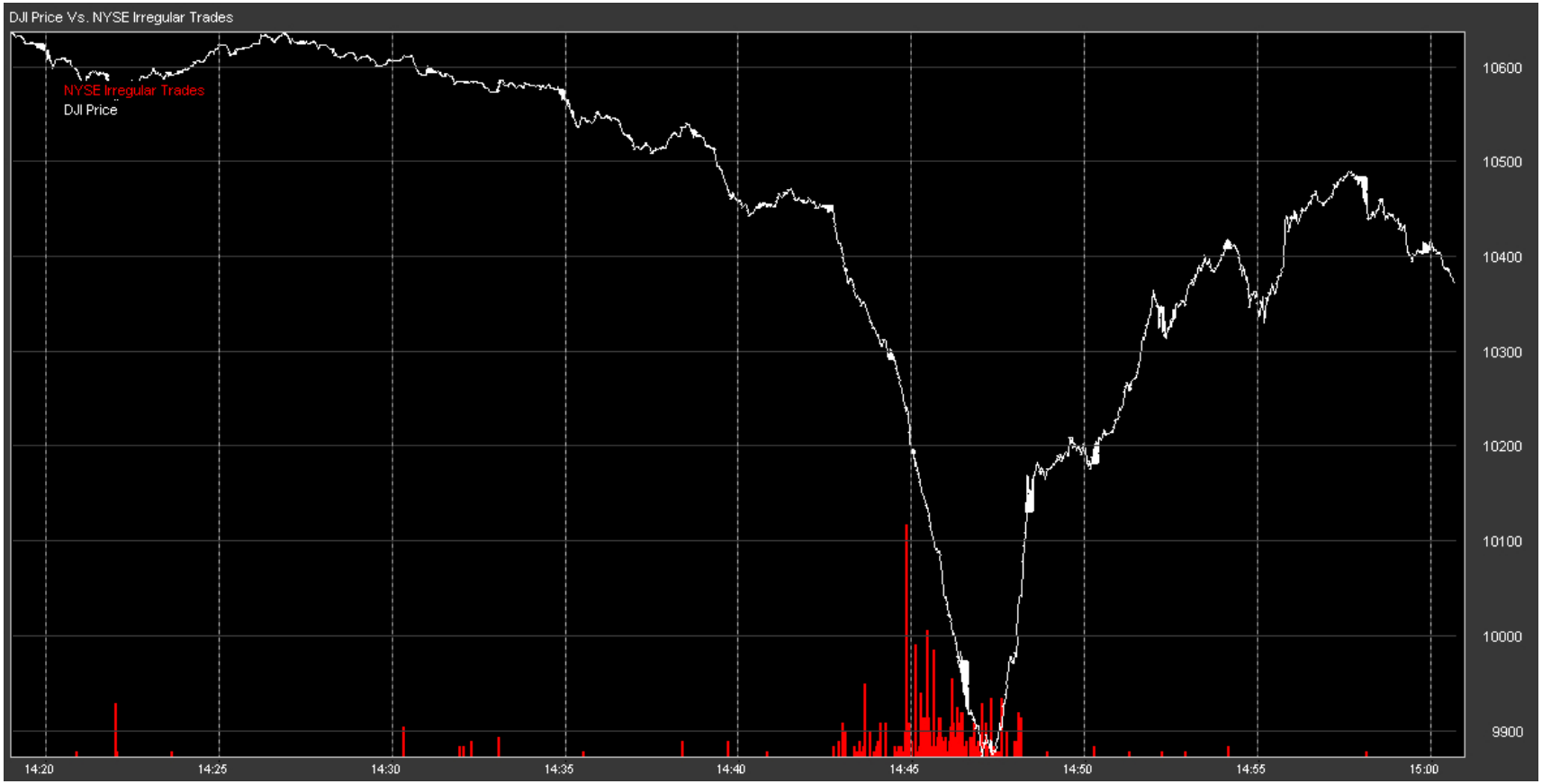
Ask below Best Bid

- **Total Number of NYSE listed stocks where the Exchange's Ask price is below the Best bid price.**



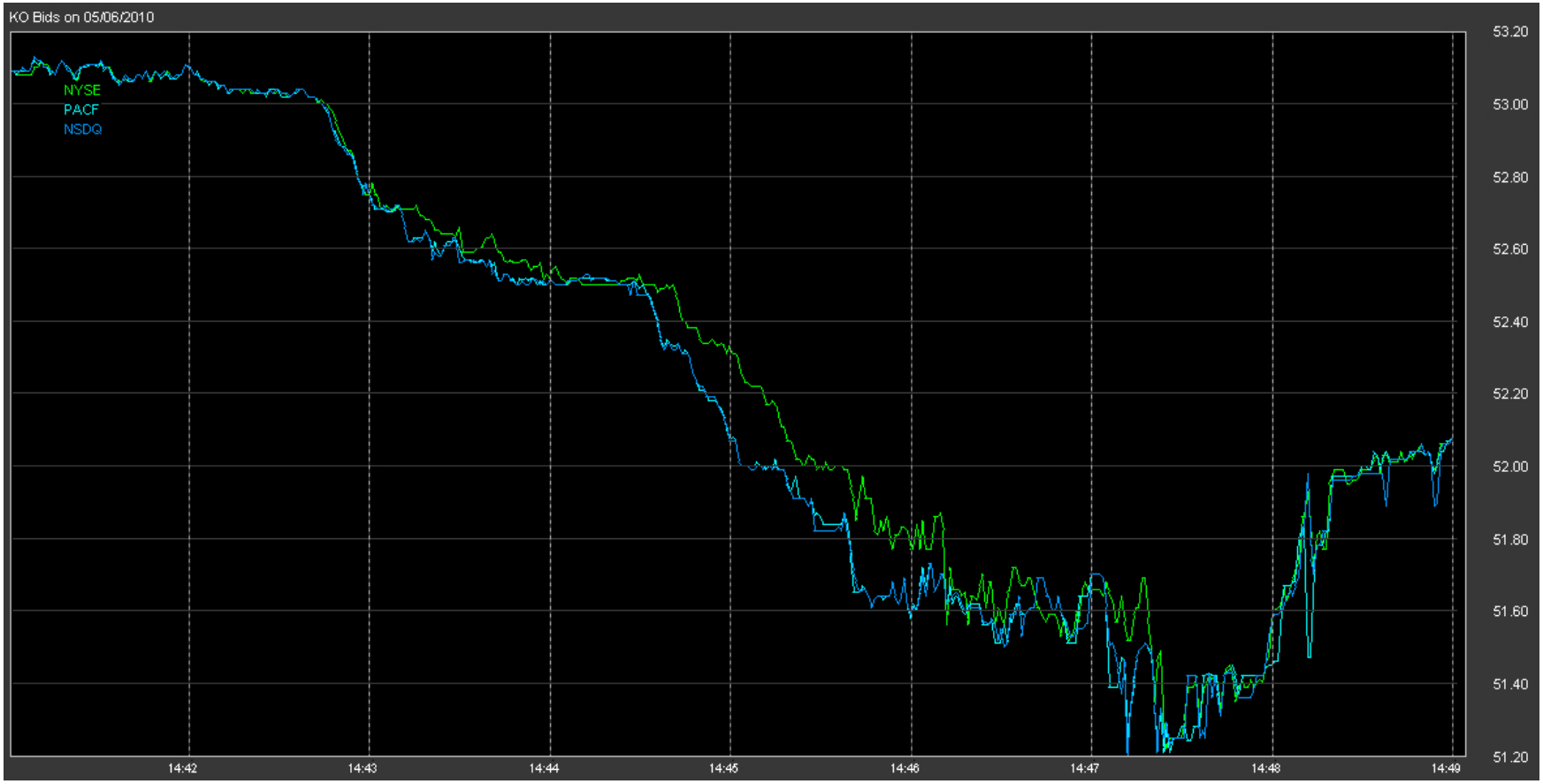
NYSE reports Trades below NBB

consecutive NYSE trades under the Best Bid

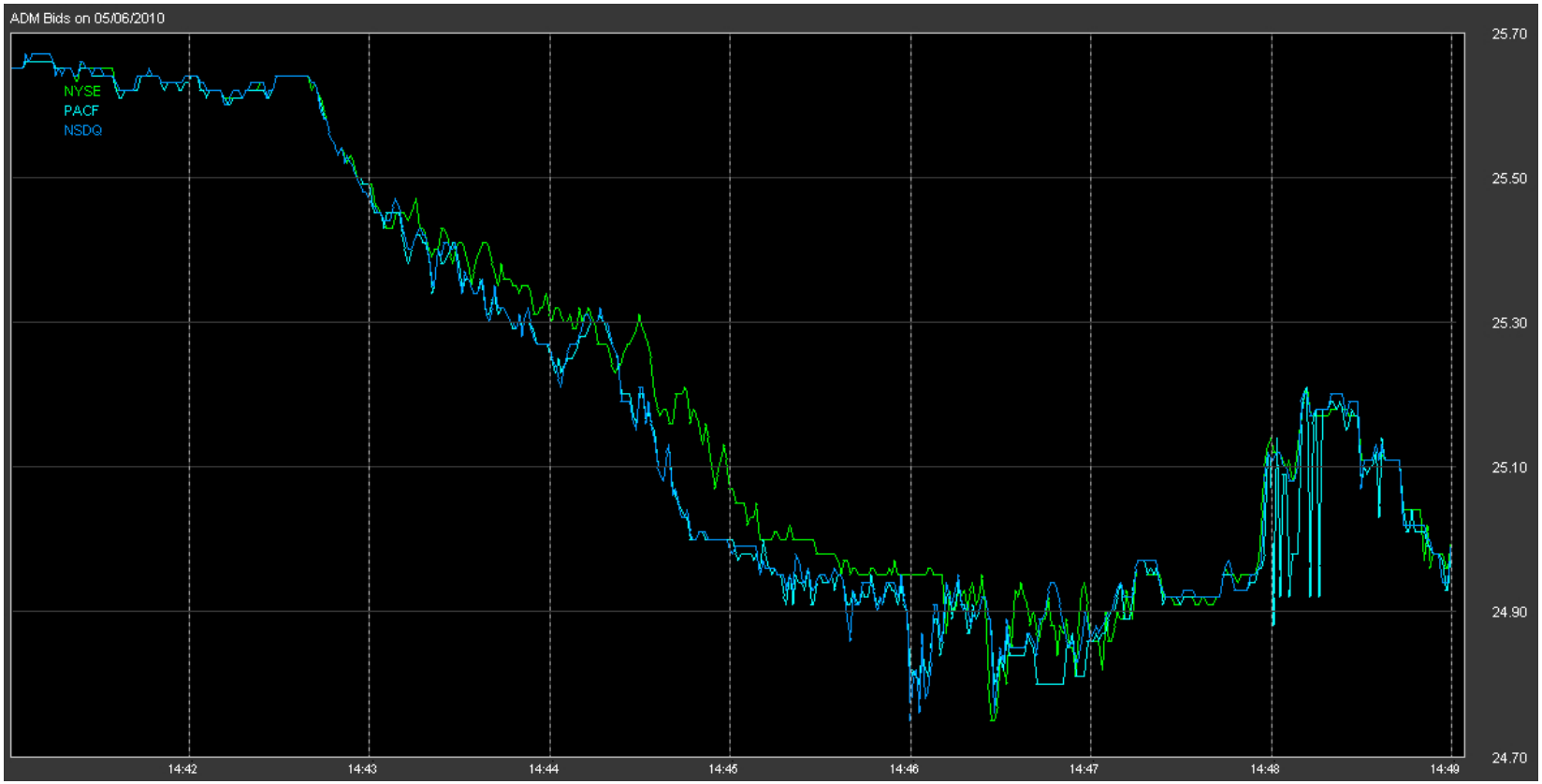


NYSE Quotes Delayed

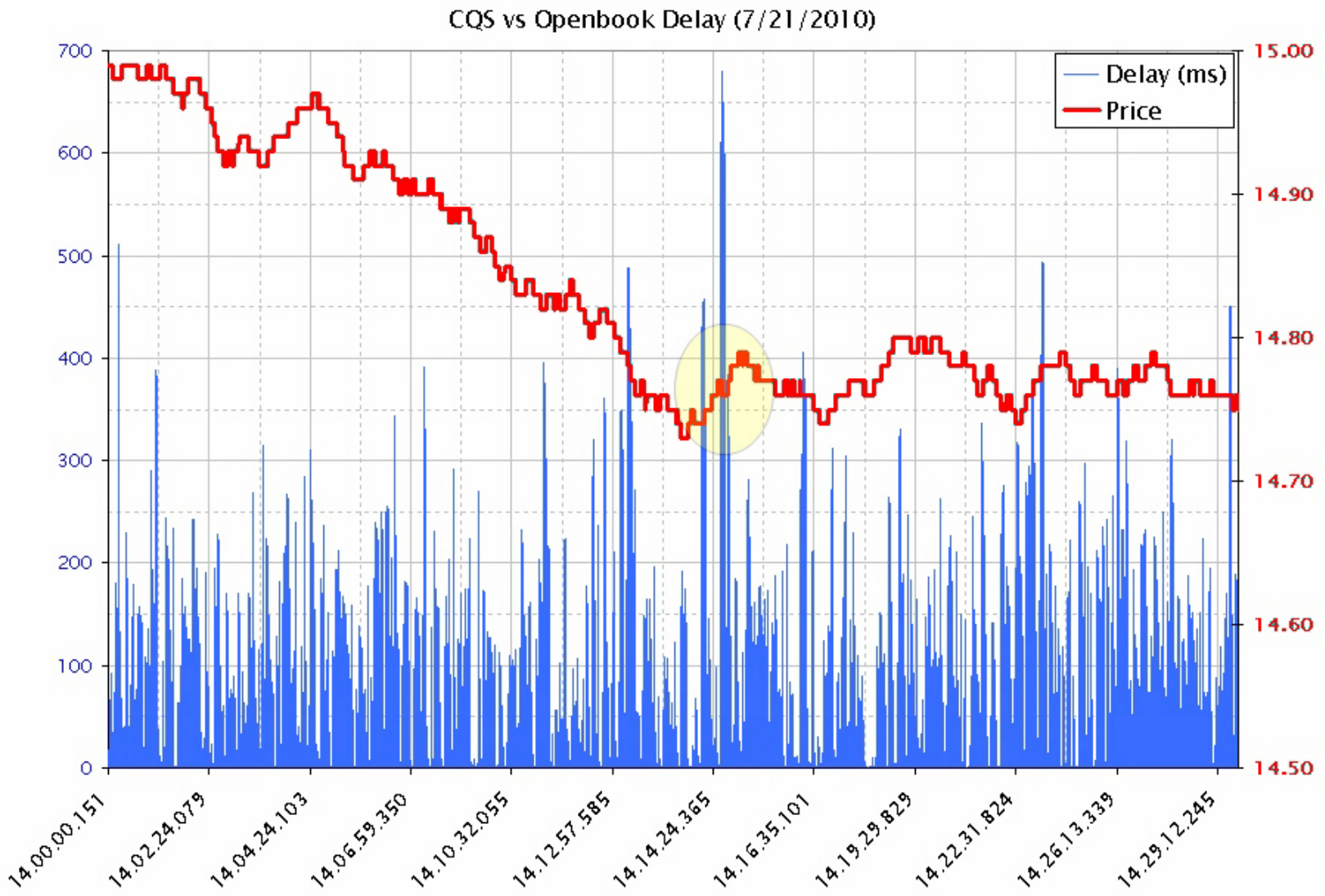
- Notice lag between NYSE and NASDAQ & PACF (ARCA)



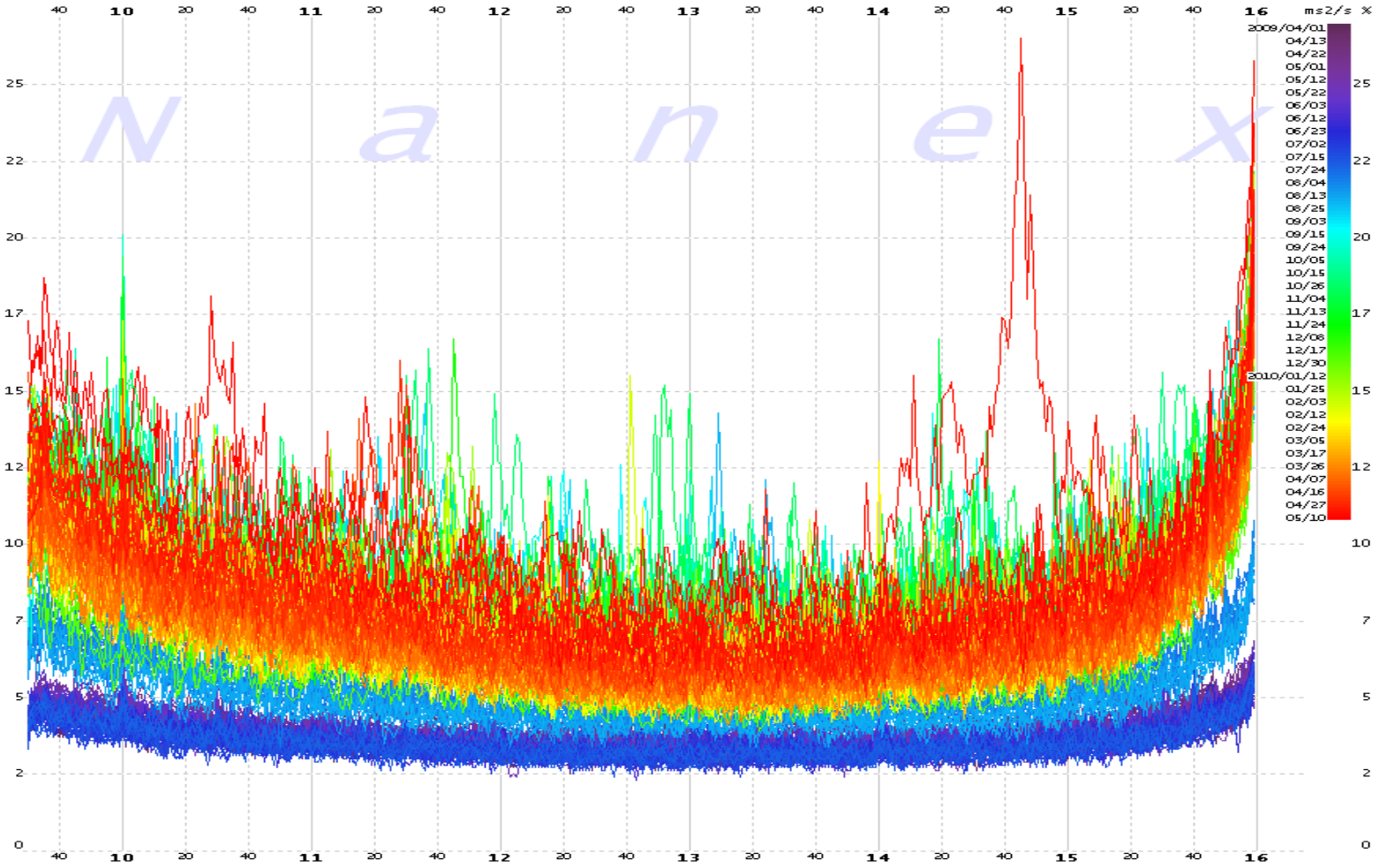
ADM's NYSE Quotes Lag



CQS vs NYSE Openbook Delay



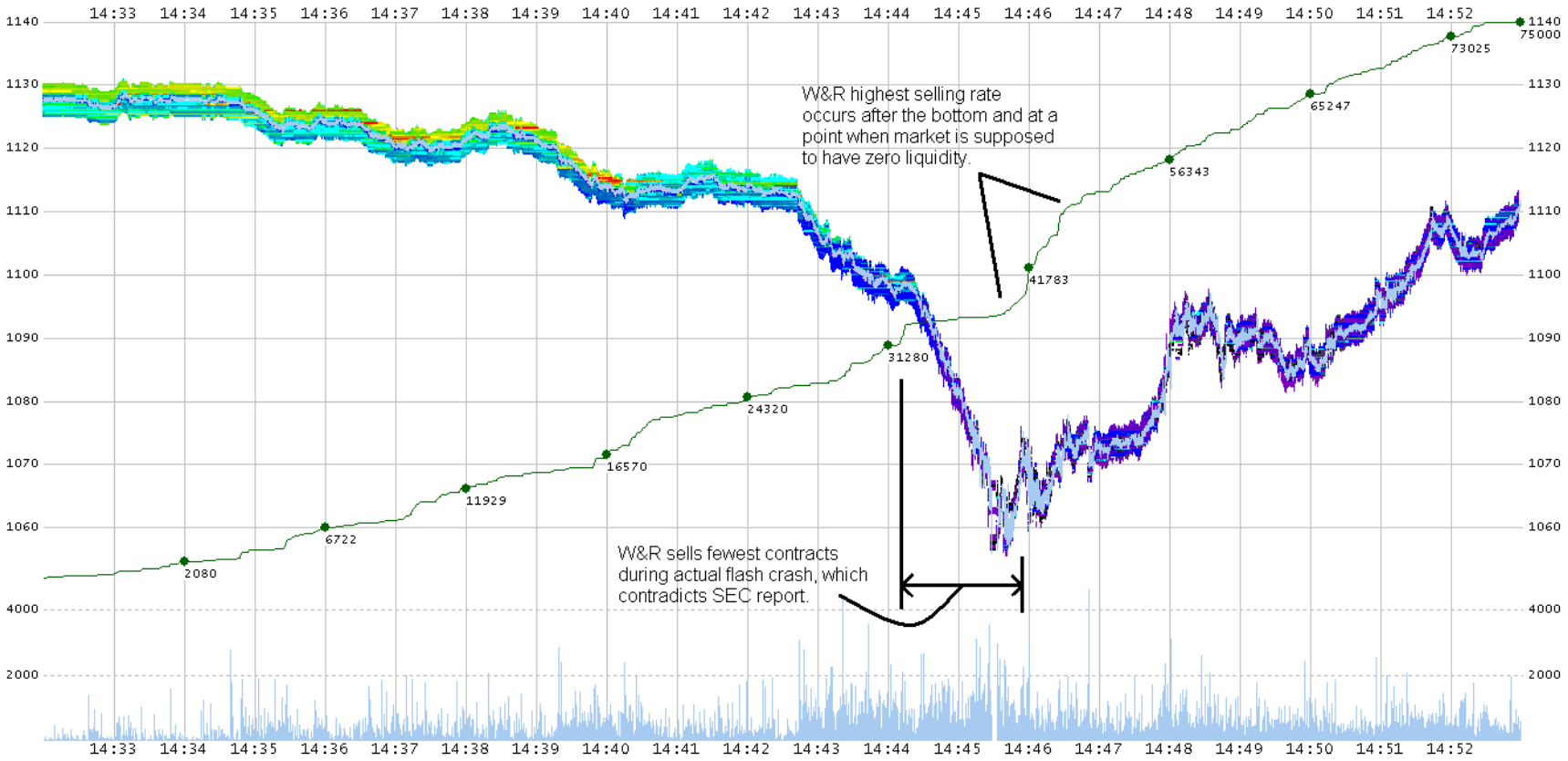
Nanex Feed Saturation Ratio



SEC: Cause was e-Mini sell Algorithm

- SEC report indicated the root cause was “fundamental trader” algorithm sent order to sell 75,000 eMini contracts.
- We received the trades from the “fundamental trader” and compared to the market.

Order Executions



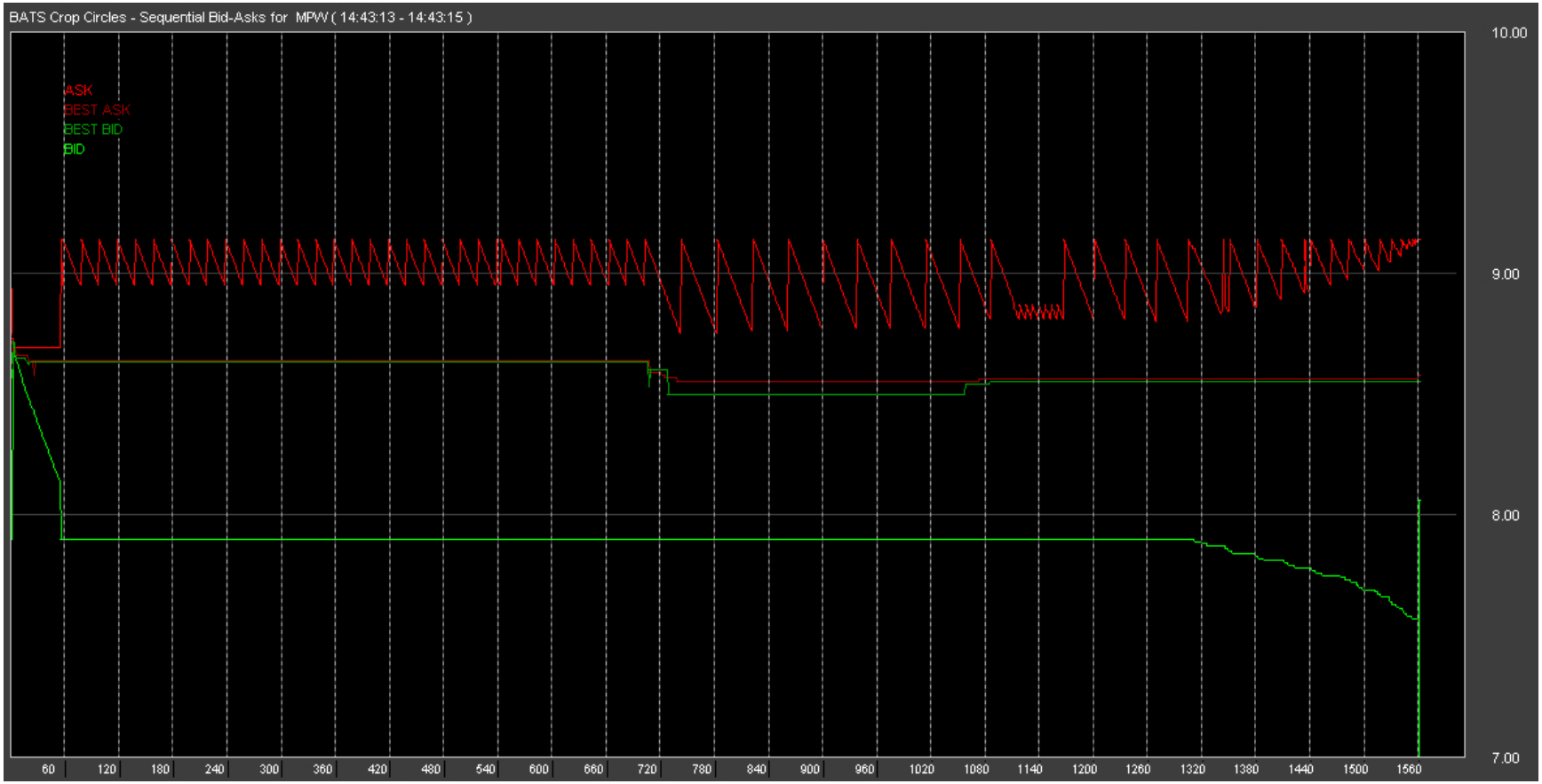
Does an increase in quotes add value?

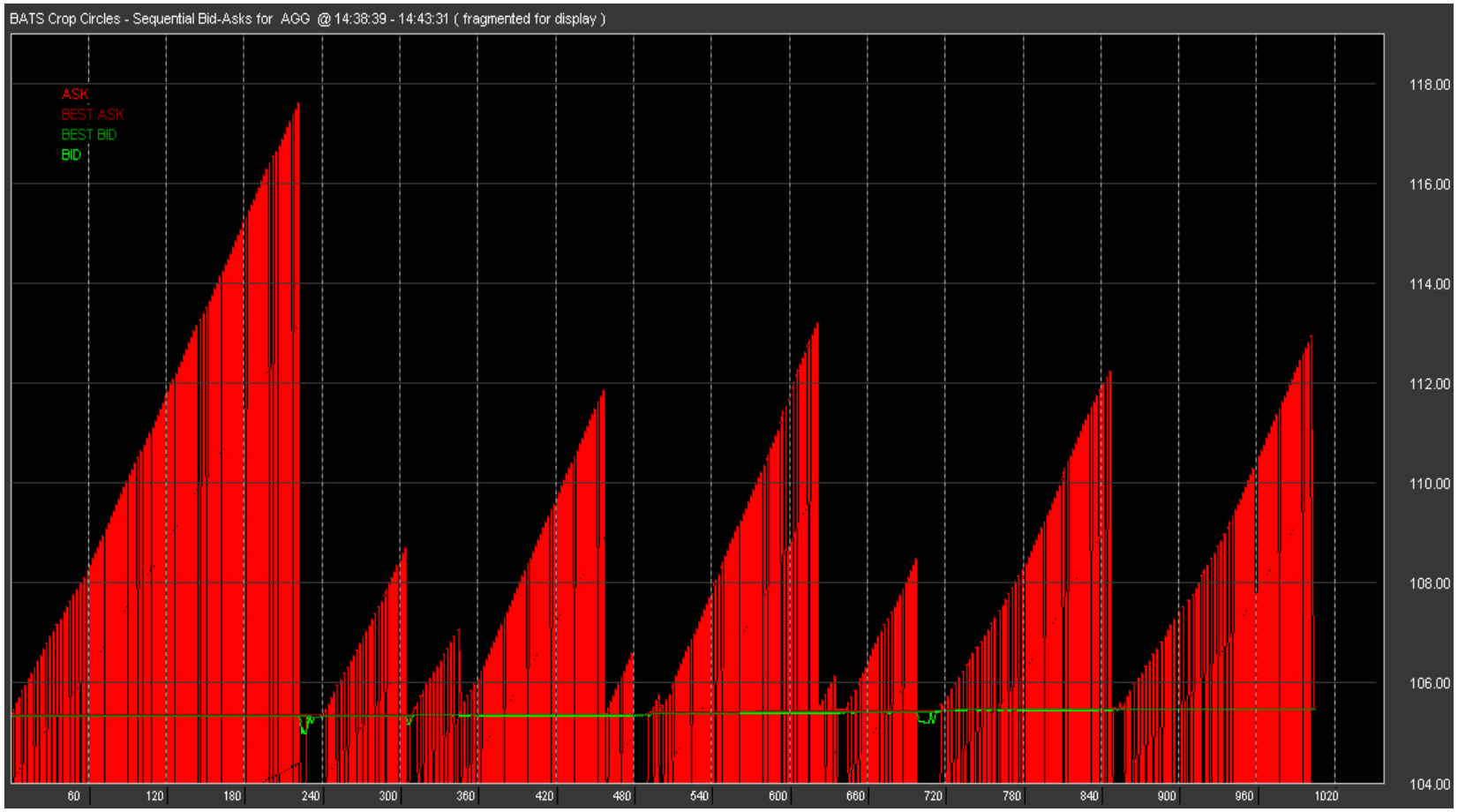
- Exchanges were transmitting hundred even thousands of quotes in one second for one stock
- The exact same quote price and size was repeated multiple times in a row from same exchange.
- Often times the quotes were outside the BBO
- No value added to the trading community, only “noise”
- We refer to this practice as “Quote Stuffing”

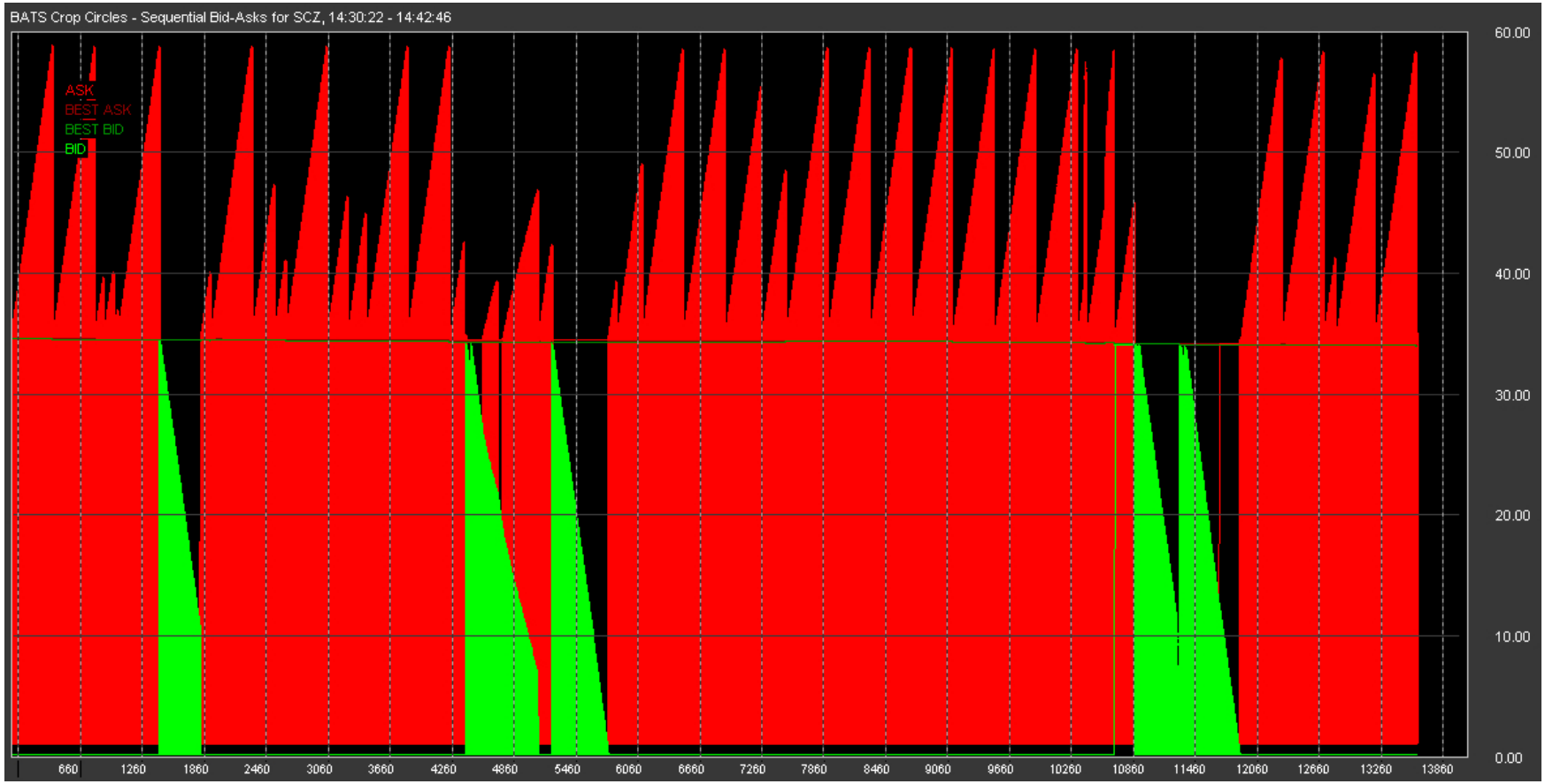
Why Quote Stuff?

- Cause more dislocation (arbitrage) events.
- Confuse or fool other algorithms.
- Confuse smart order routers.
- Update your table of exchange gateway latencies.
- Increase the odds that an order routed to multiple exchanges simultaneously will be detected early enough to withdraw orders at other exchanges.
- Make the audit trail significantly more difficult to follow.
- Destroy "match at midpoint" type orders.
- Quote stuffing in one symbol affects latency for all other symbols processed by the same CPU or network.
- An internalizer can use it to create time so they can trade at real-time prices but fill orders at the delayed prices if favorable.
- Drive up costs for everyone outside the colocation circle.

Quote Stuffing Examples




BATS Crop Circles - Sequential Bid-Asks for AGG @ 14:38:39 - 14:43:31 (fragmented for display)
ASK
BEST ASK
BEST BID
BID
118.00
116.00
114.00
112.00
110.00
108.00
106.00
104.00
60
120
180
240
300
360
420
480
540
600
660
720
780
840
900
960
1020


BATS Crop Circles - Sequential Bid-Asks for SCZ, 14:30:22 - 14:42:46
ASK
BEST ASK
BEST BID
BID
60.00
50.00
40.00
30.00
20.00
10.00
0.00
660
1260
1860
2460
3060
3660
4260
4860
5460
6060
6660
7260
7860
8460
9060
9660
10260
10860
11460
12060
12660
13260
13860

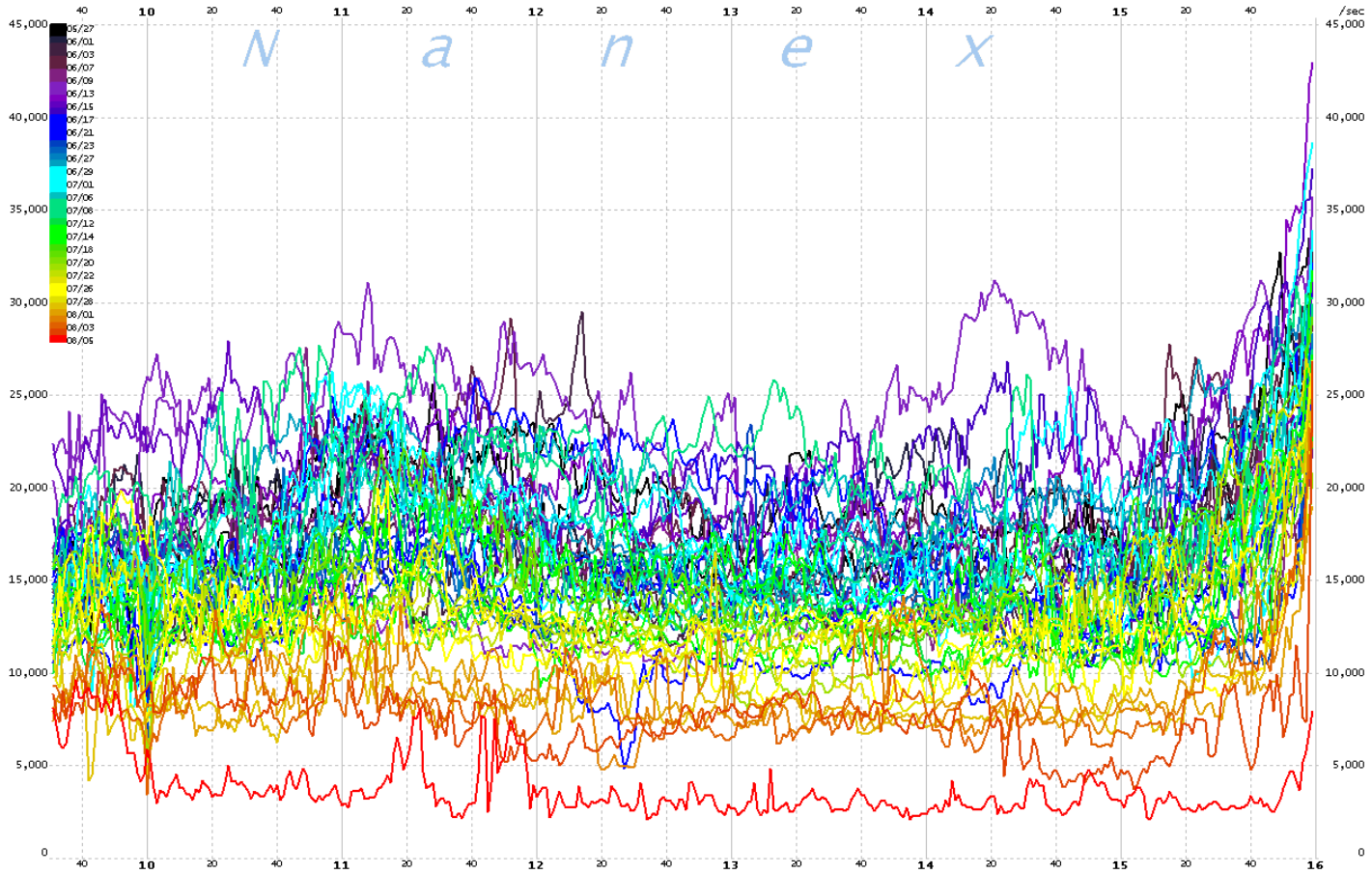
High Frequency Trading

- What is HFT?
  - A computerized trading strategy used to exploit market inefficiencies. Trading can be in a wide range of assets: equities, options, ETF's, futures, and currencies. Trade positions are held for ultra short periods of time, often milliseconds.
- Arbitrage:
  - Between equity/options exchanges
  - Between underlying securities and ETF or futures (eMini)
- Latency:
  - Minimize transport, processing, decision making, order routing time

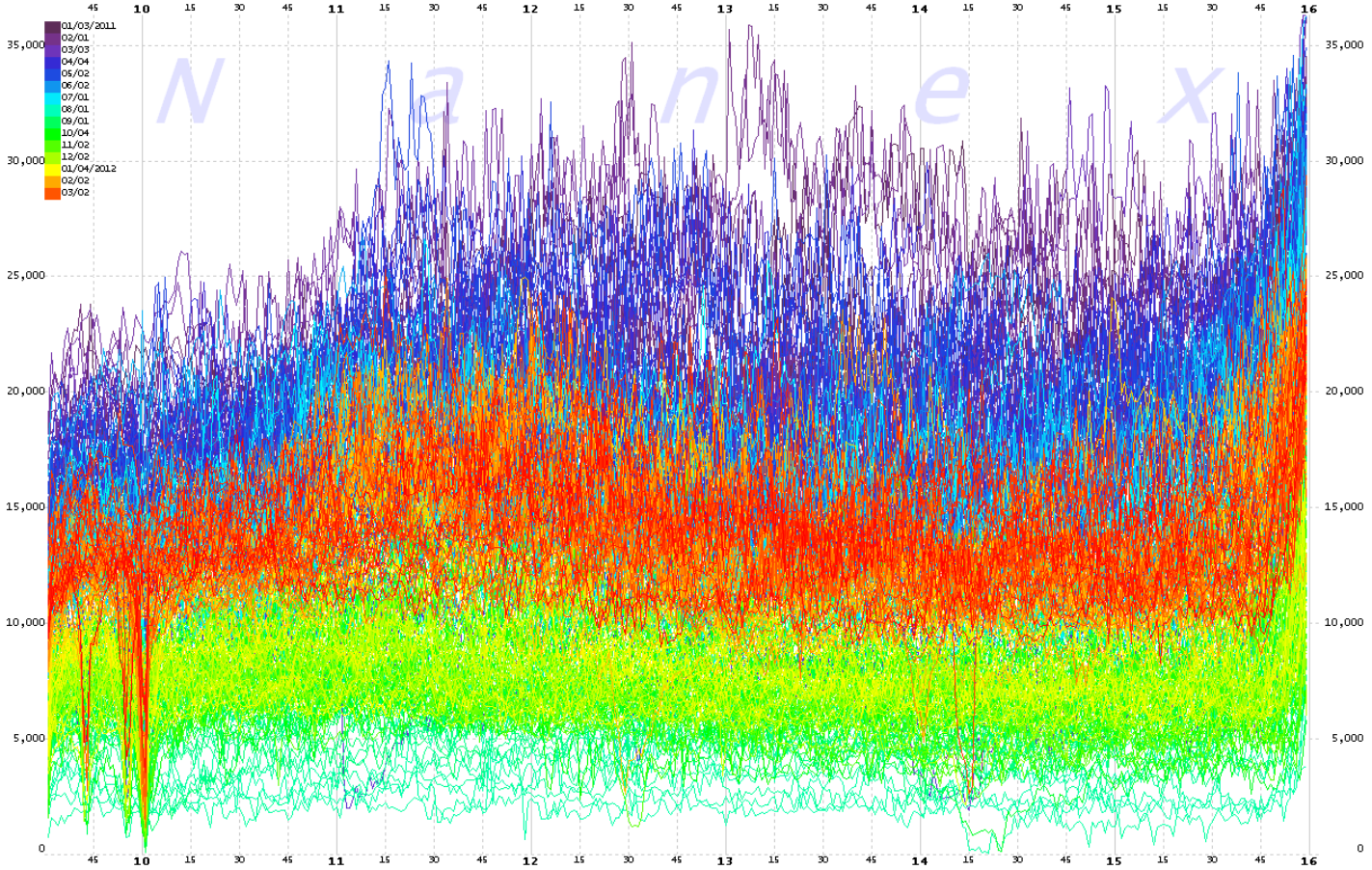
Effects of HFT

- Quote Stuffing:
  - Transmit large number of quotes that do not improve the BBO.
  - Increase latency for other traders
    - Reach capacity for individual exchange channels
    - Requires other firms to process taking resources
- Increase in fragmentation of market
  - NYSE and NASDAQ executions decrease as more trading done in dark pools and internal matching systems.
- Decrease in eMini depth
  - Often times less than 10000 contracts to clear book
  - Reduce value of resting orders
  - More difficult to quickly fill larger orders without moving the market

E-Mini Depth 2011



E-Mini Depth


01/03/2011
02/01
03/03
04/04
05/02
06/02
07/01
08/01
09/01
10/04
11/02
12/02
01/04/2012
02/02
03/02
35,000
30,000
25,000
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15,000
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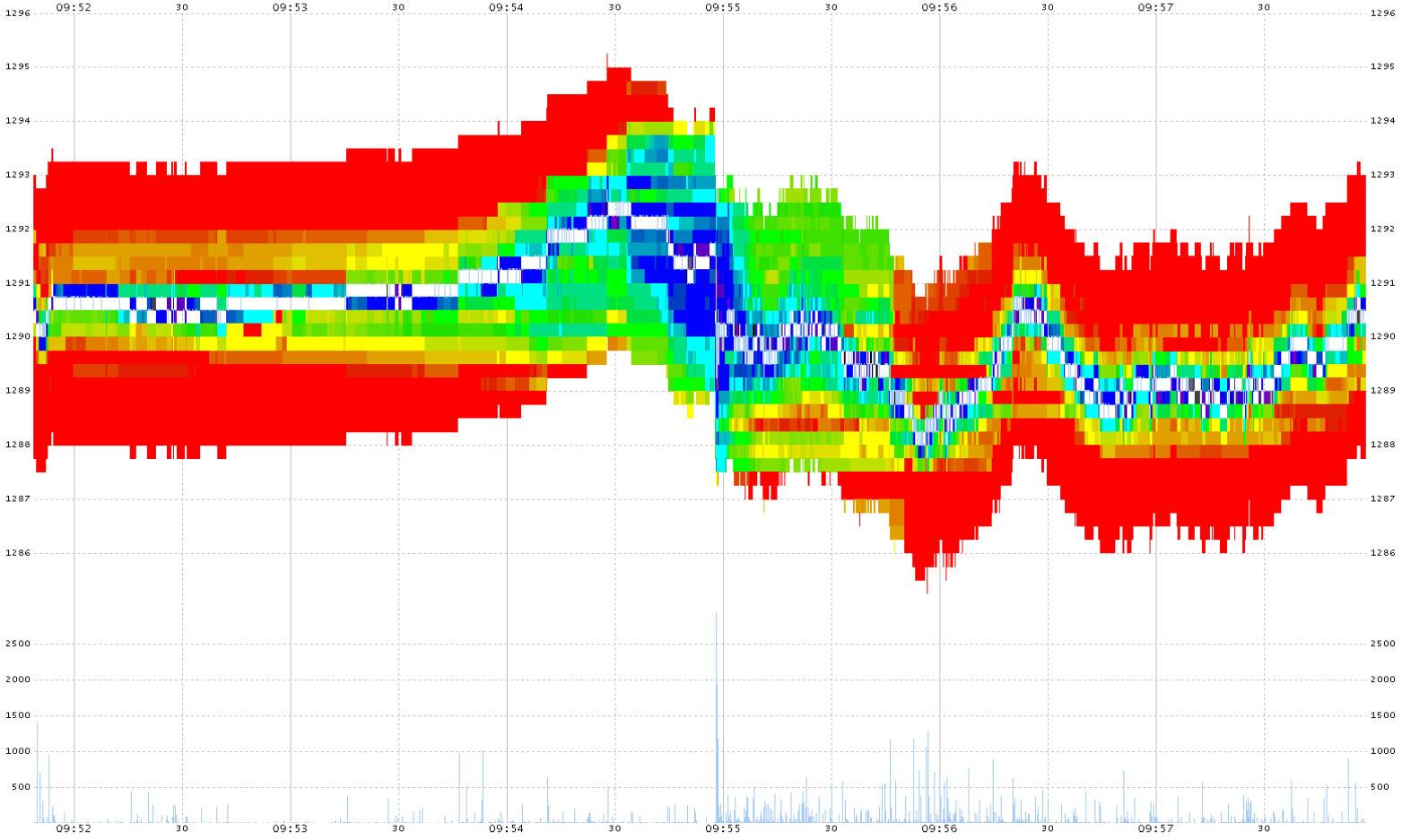
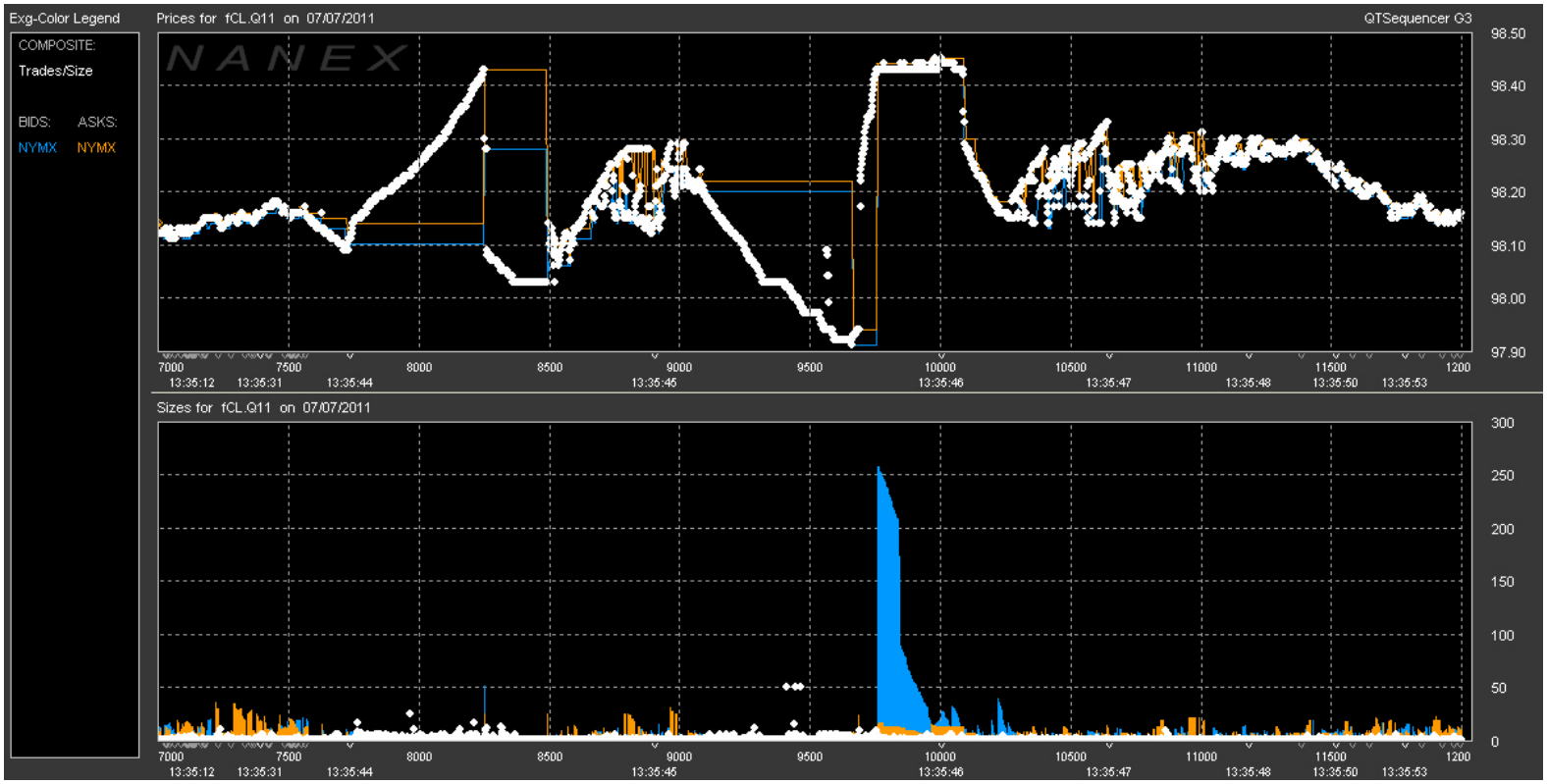
10
11
12
13
14
15
16

E-Mini Depth


09:52
30
09:53
30
09:54
30
09:55
30
09:56
30
09:57
30
1296
1295
1294
1293
1292
1291
1290
1289
1288
1287
1286
2500
2000
1500
1000
500

Crude Oil Algo

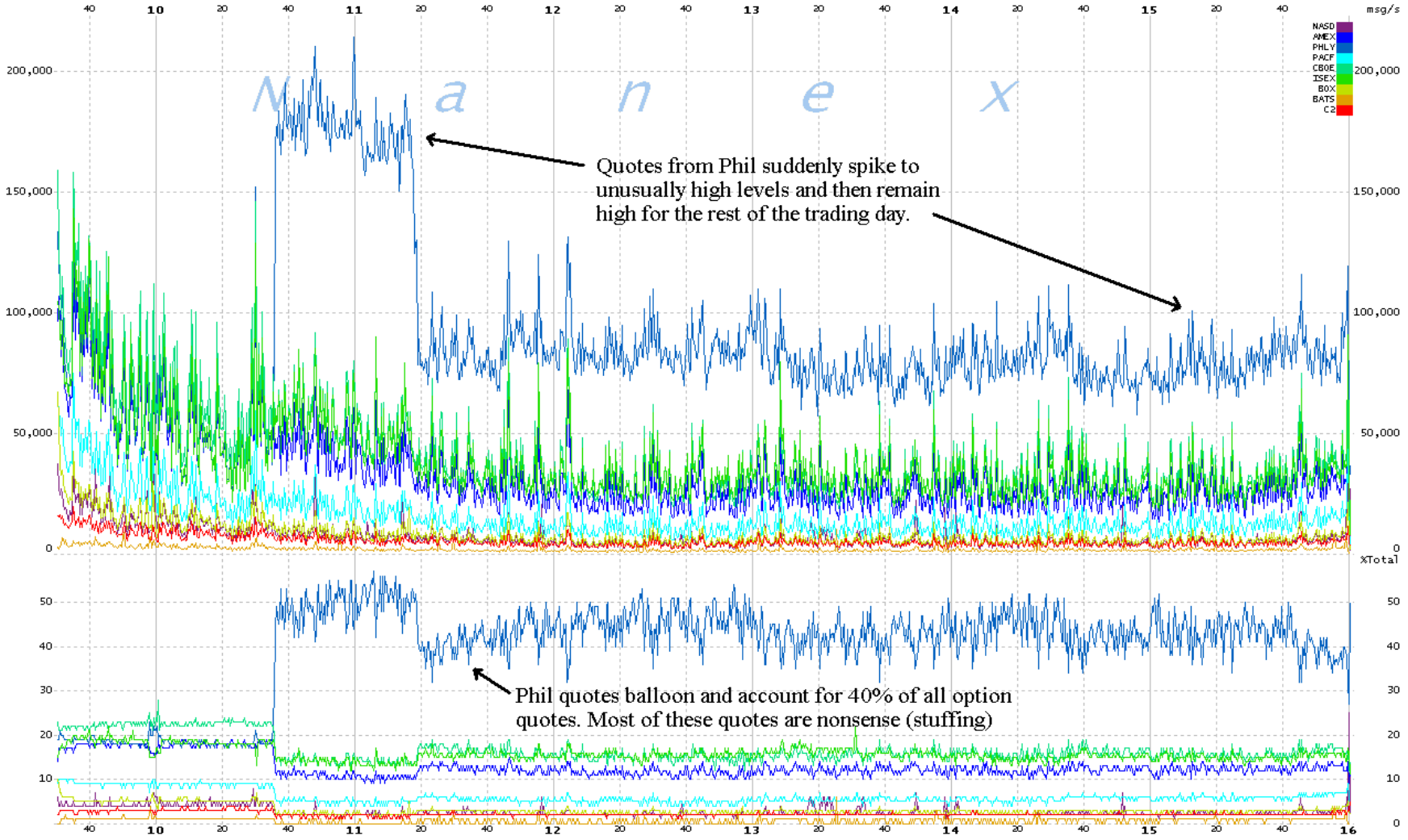
- July 7, 2011 the August futures (CLQ11) cleared out both sides of the depth of book 4 times in 5 seconds and moving ETF's USO, UCO, and SCO



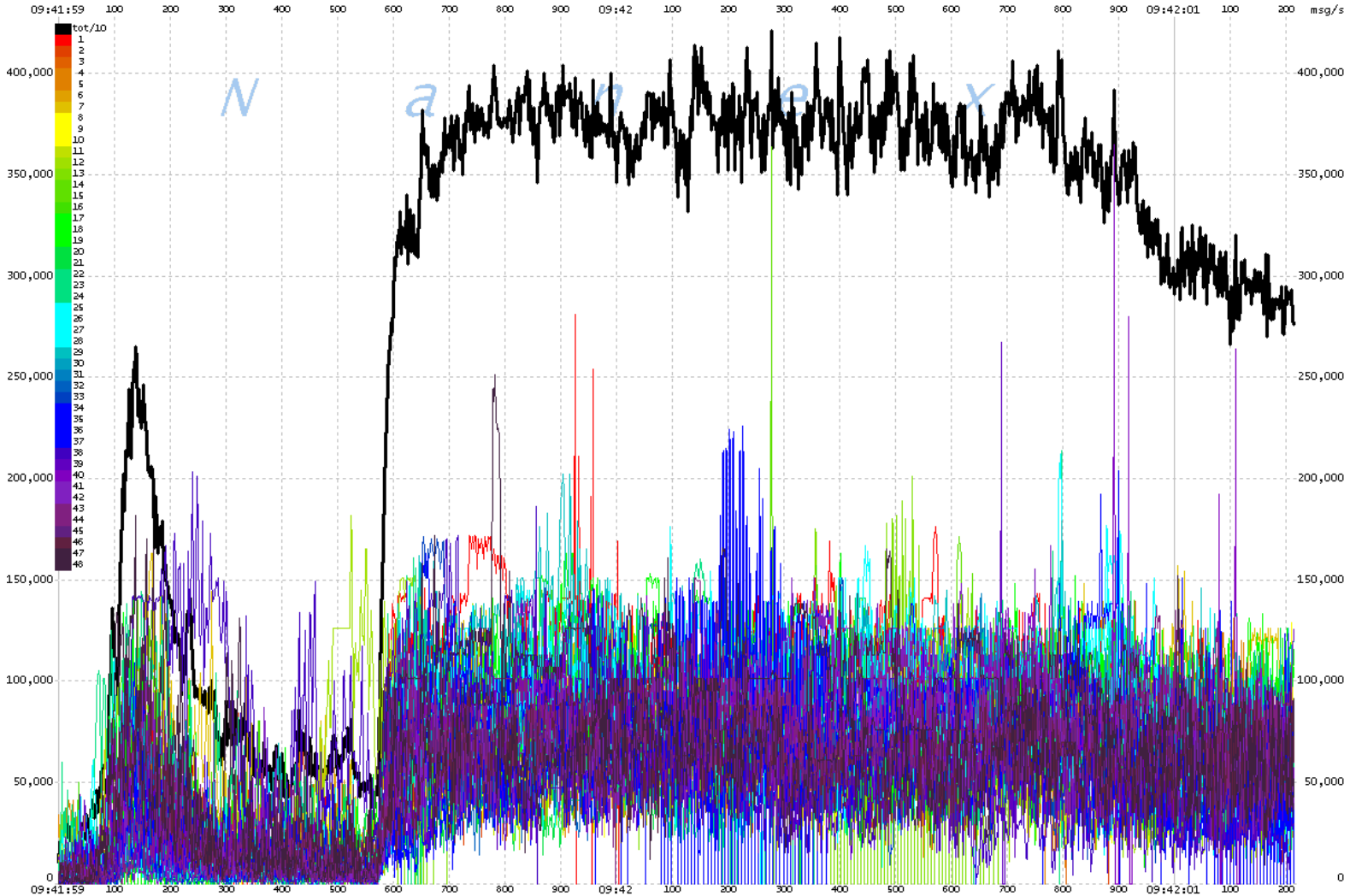
OPRA Quote Stuffing

- There are 9 options Exchanges that quote over 500,000 contracts each providing a bid/ask price and size.
- OPRA forecast are for up to 10,000,000 msg/second 2.4 Gps in telco to receive the data.
- Data is transmitted by OPRA over 48 multicast channels
- Every day there are contracts that have over 100 quotes in a second that don't improve the BBO
- Many quotes are sent to add latency to other contracts that are transmitted in the same multicast channel.
- Example: June 8th, PCLN June 620 call had 597 quotes in a second.

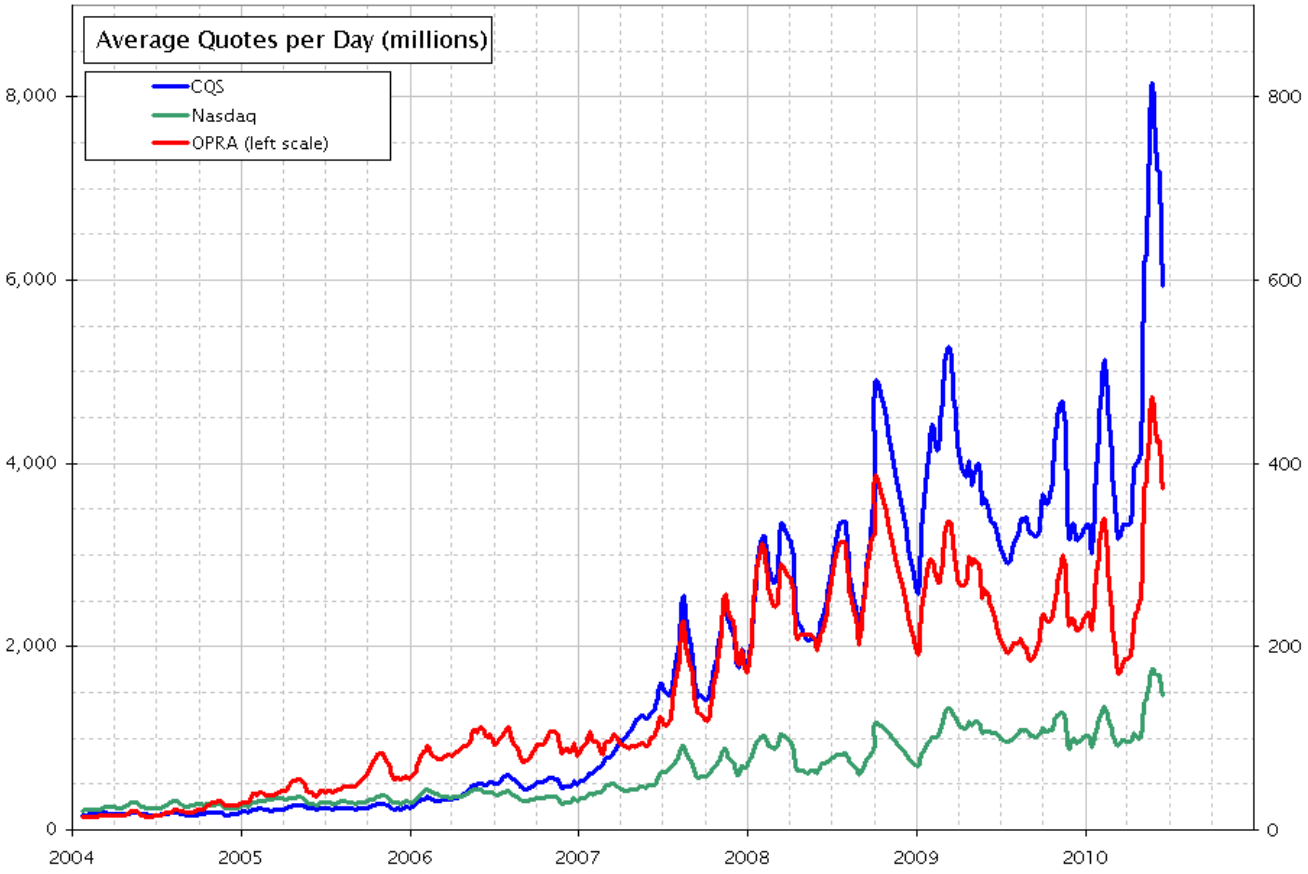
PHLX high quote rates



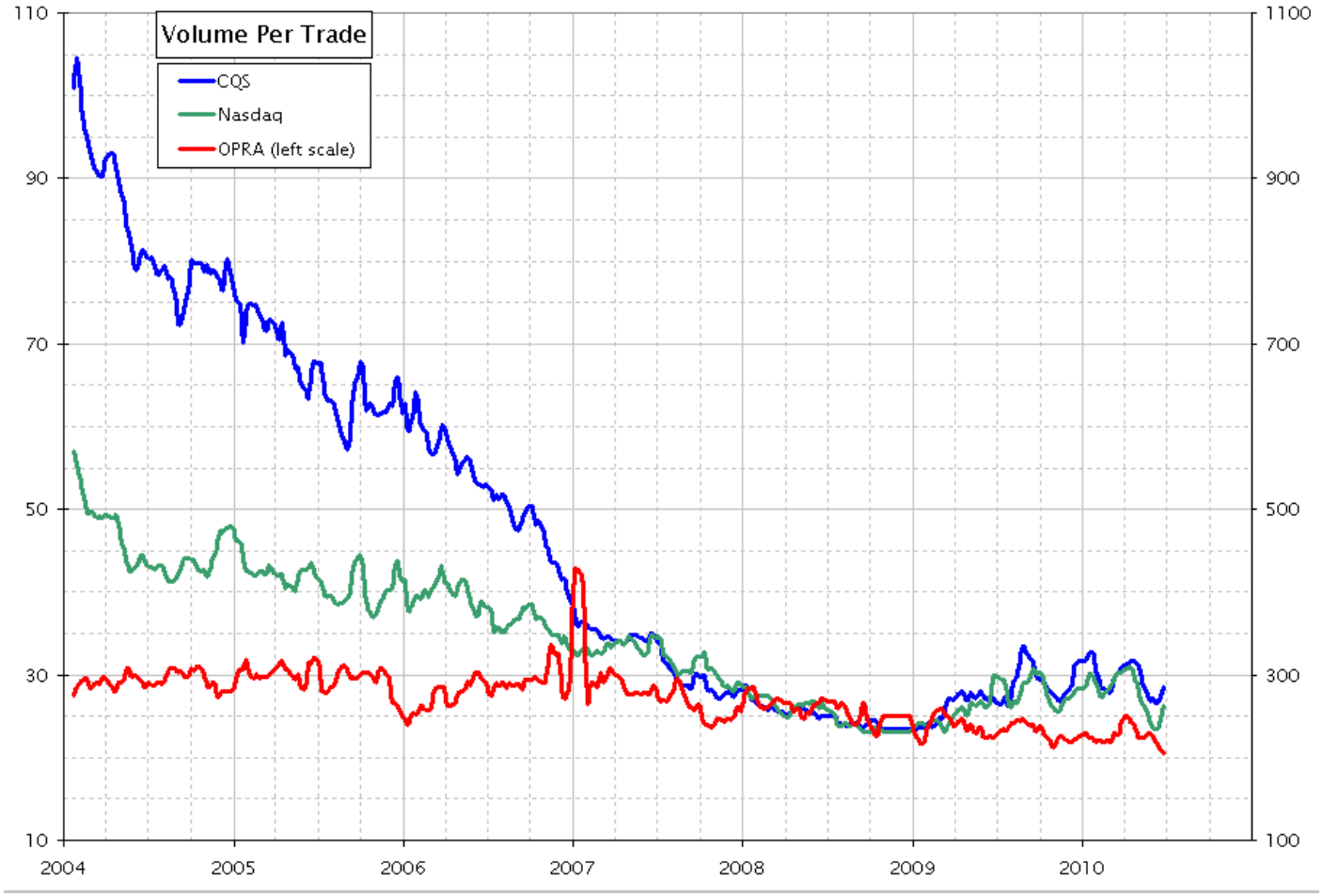
OPRA Saturated



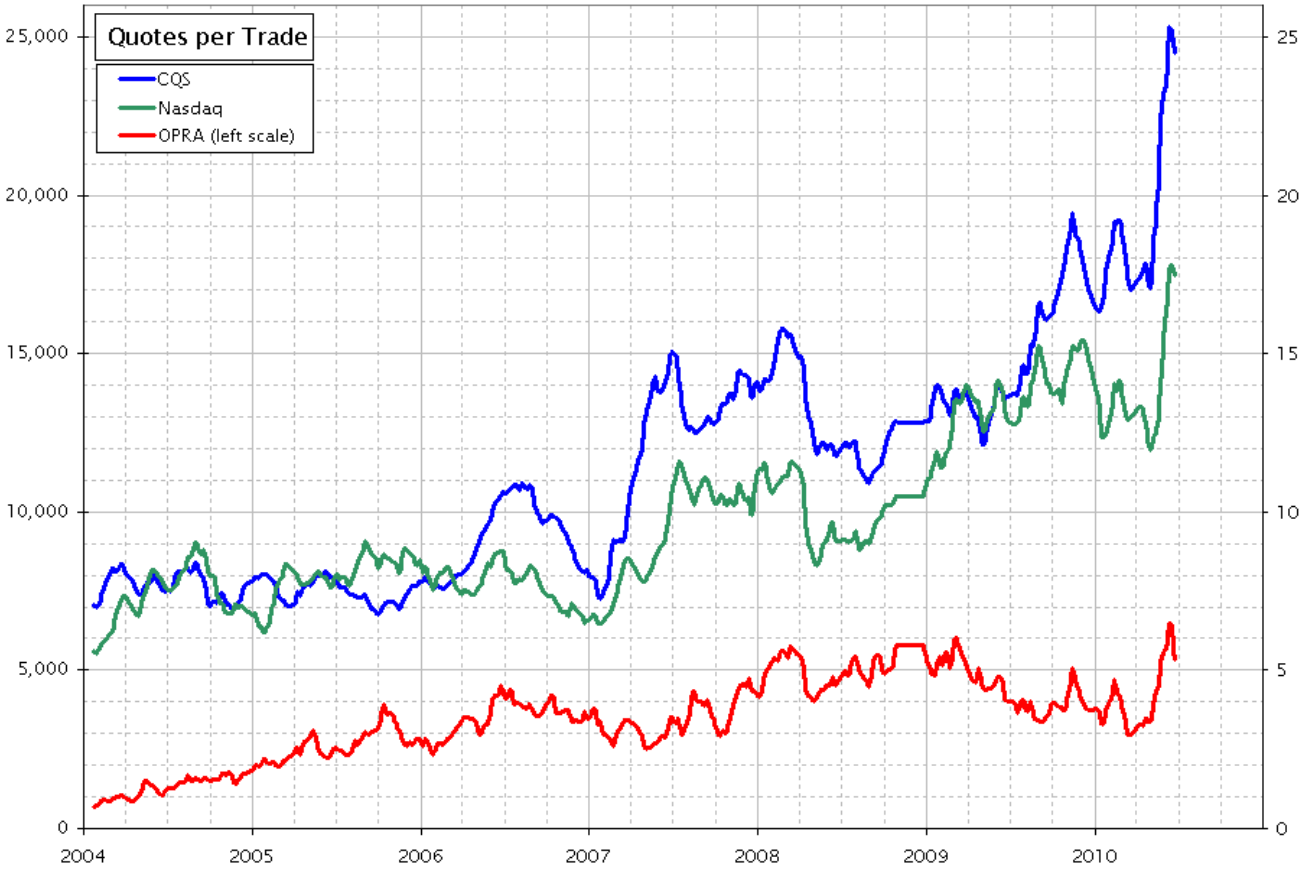
Quotes Per Day



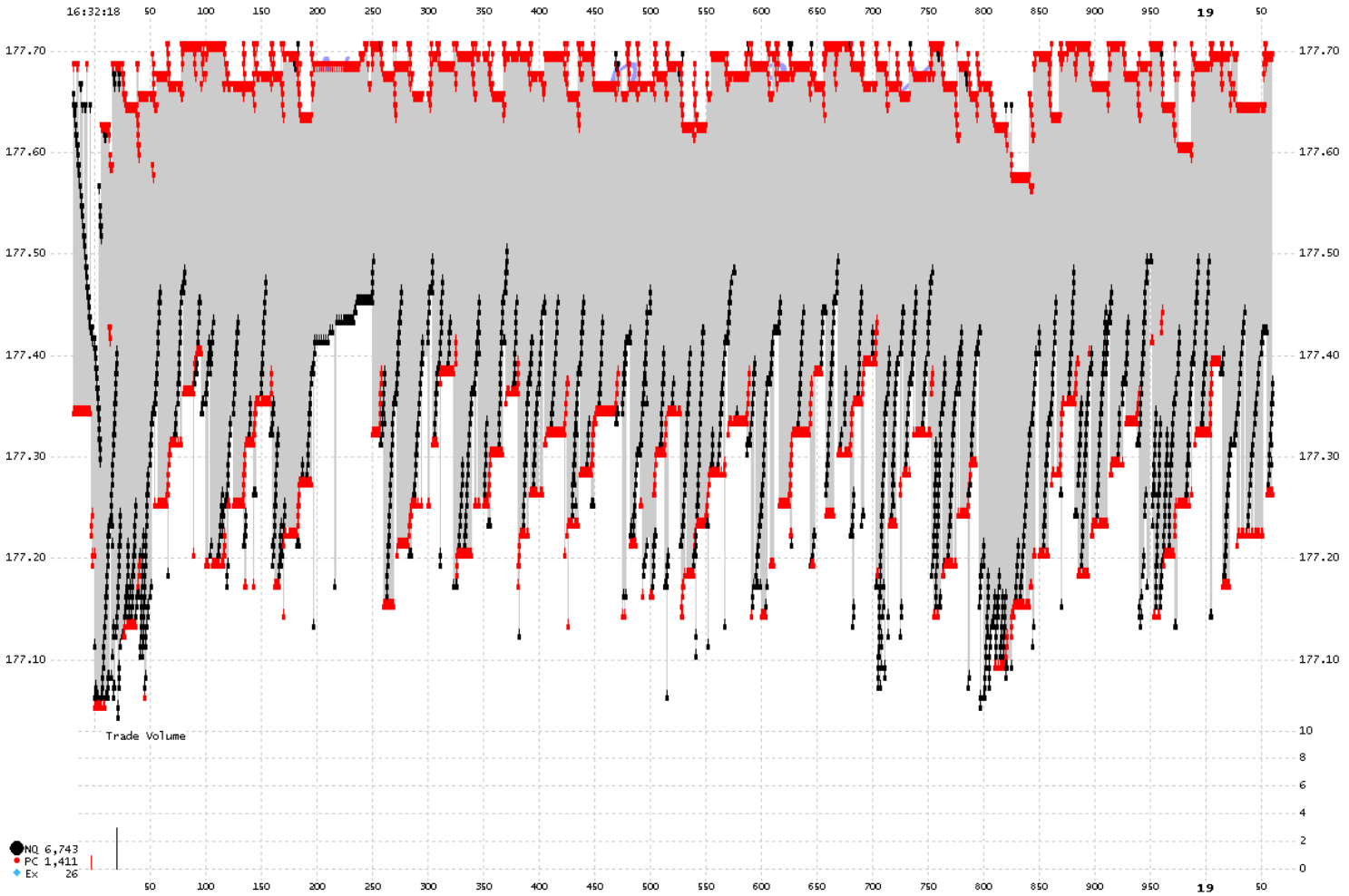
Average Trade Size



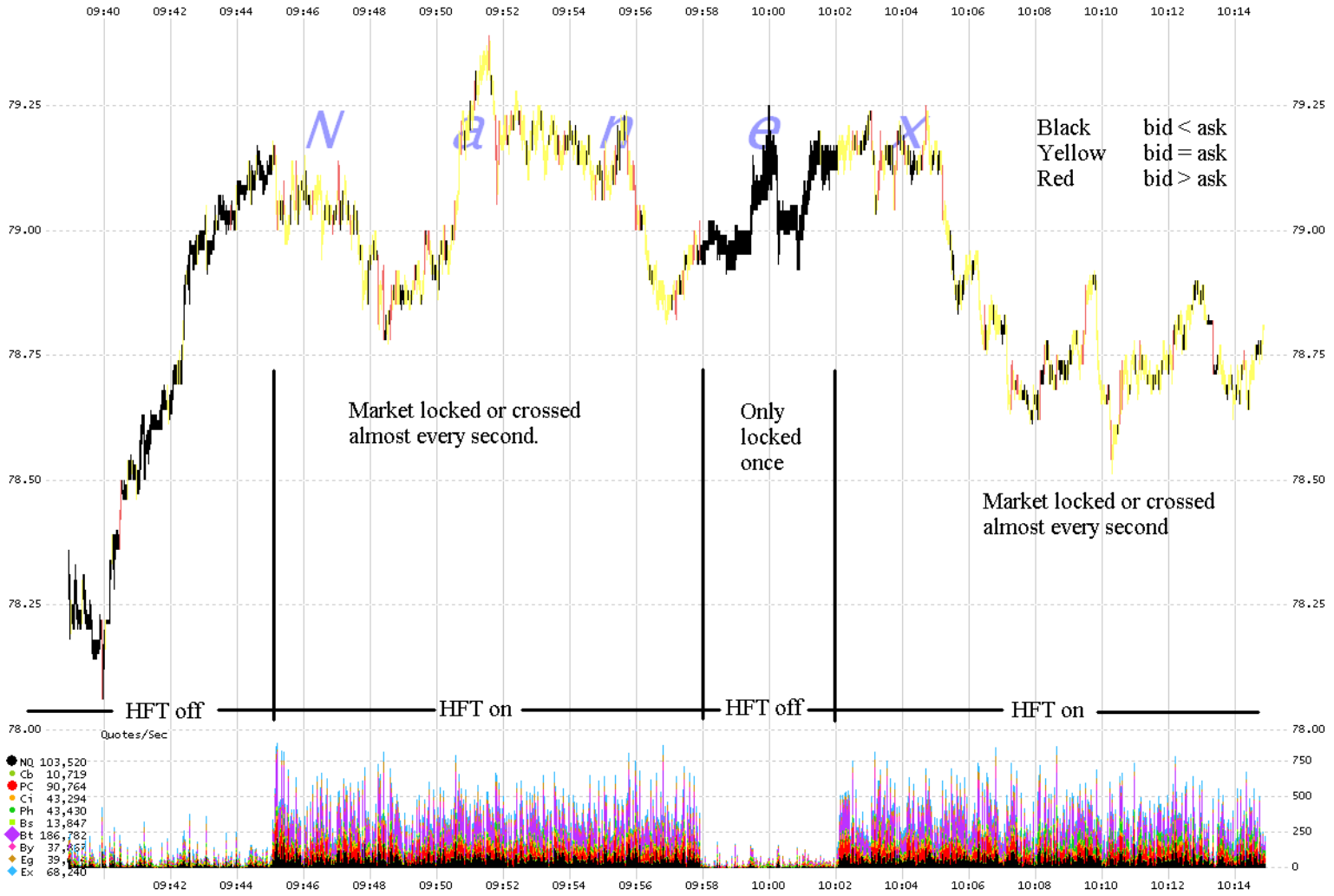
Quote/Trade Ratio



AMZN Jan 31, 2012



Algo locking markets



Level playing field? No

- Retail traders and small firms do not have resources of large Wall Street firms
  - Proximity hosting next to exchange matching engines, $10k/mo
  - High end hardware, 40 GB networks, FPGA
  - Direct Exchange feeds, CME, ARCA, BATS, EDGE, NASDAQ BASIC faster than CQS/CTS, OPRA
  - Team of developers to develop and refine Algo systems,
- Location- firms outside of New York and Chicago big disadvantage, especially West Coast traders.

Regulatory Changes

- Volcker Rule:
  - Wall Street firms are closing prop trading groups
  - Traders are starting up smaller firms to use HFT strategies
- Removed Naked Access: 15c3-5
  - Required risk mgmt checks before orders can be routed
- ICE: Weighted Volume Ratio
- NASDAQ: Weighted Order to Trade Ratio starting July 2nd
- FINRA 5210: “prohibits the publication of manipulative or deceptive quotations or transactions “

HFT Profits

- Tabb Group estimated HFT equity trading profits
  - 2009: $7.2 billion
  - 2012: $1.8 billion in 2012
- Increase in costs
  - Networking and hardware
  - Compliance costs estimated to be 26% of revenue
  - Updating algorithms- additional software developers

Questions?

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Thank you