

Developing professional-quality applications with MATLAB

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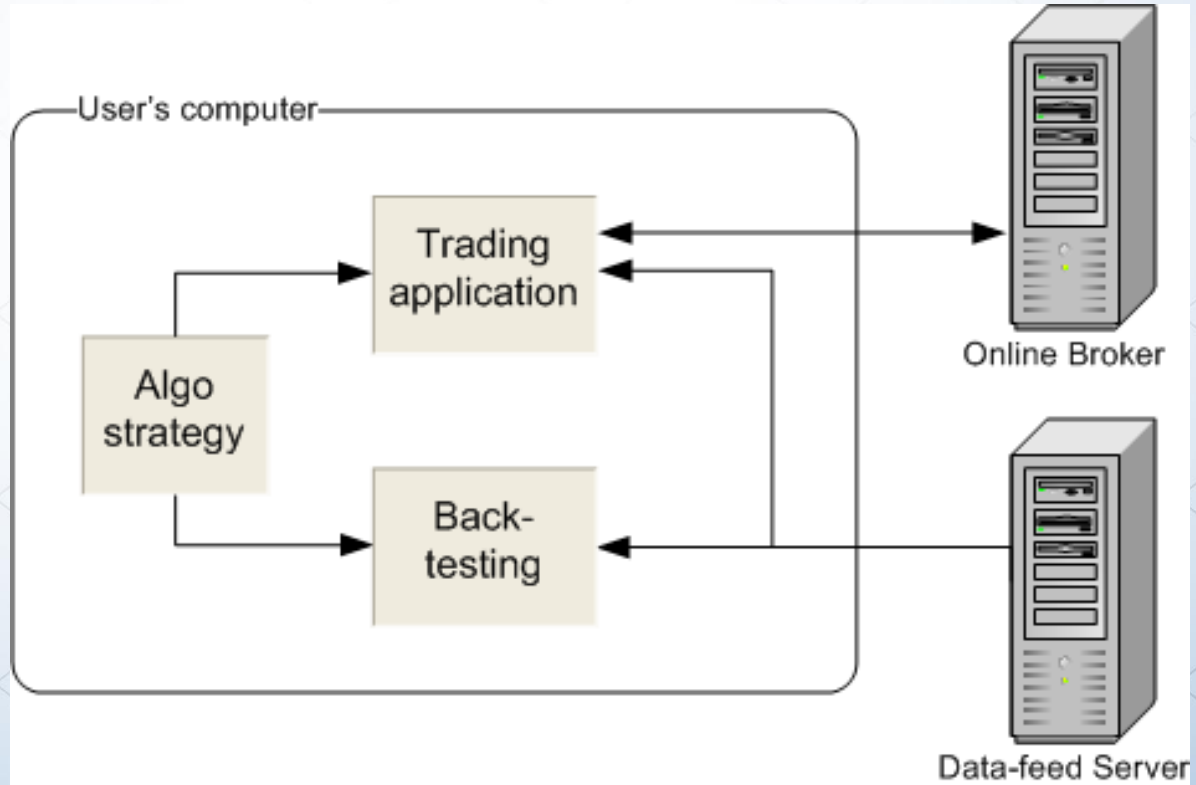
UndocumentedMatlab.com

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Common challenges

- ✓ RAD
- ✓ Functionality
- ✗ Robustness
- ? Usability
- ? Performance

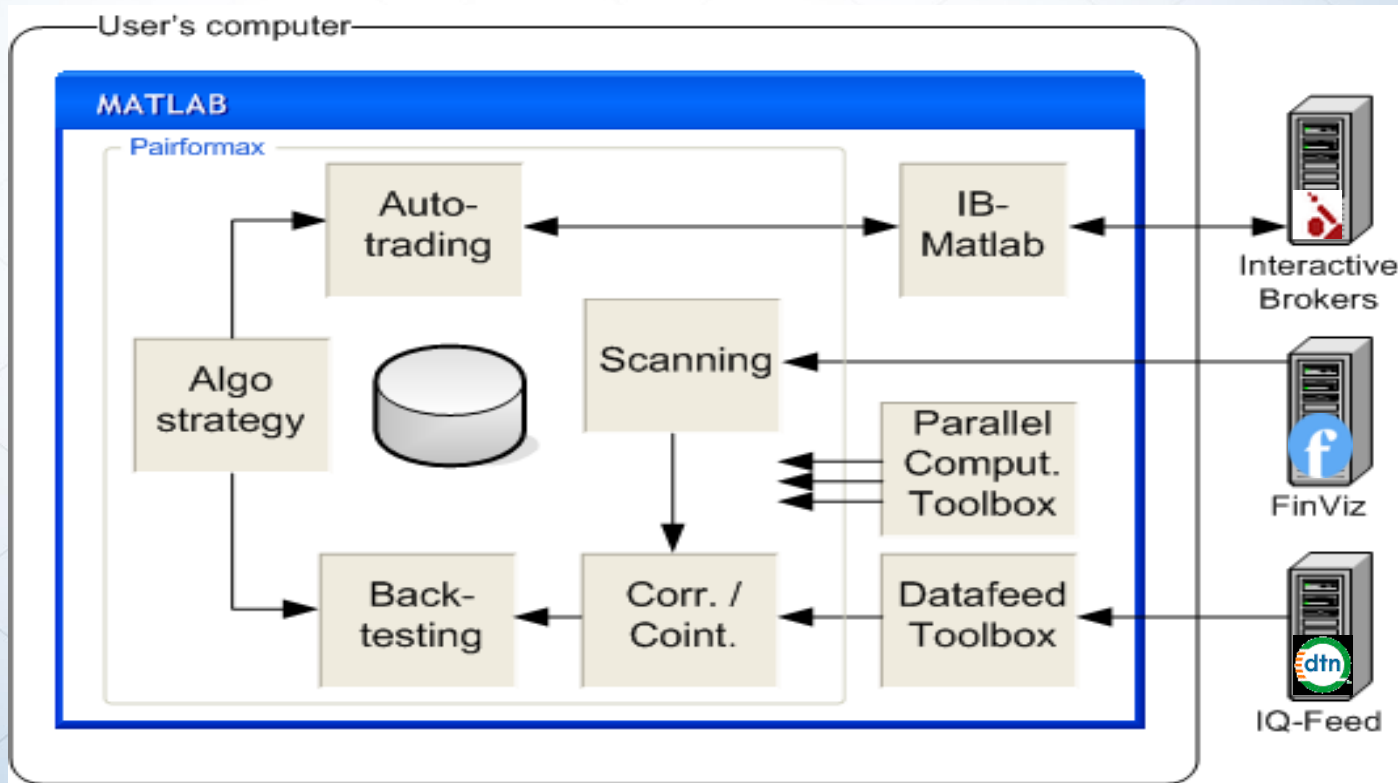
General algo-trading design



Pairformax process flow

1. **Scan** for applicable stocks
2. **Download** historical data
3. **Correlate** – find well-correlated pairs
4. **Backtest** various user-defined strategies
5. **Select** pairs/strategies to trade
6. **Trade** the selected pairs/strategies

Pairformax main components



Data challenges

- Huge amounts of data
 - 3K stocks (2) * 6 data items / bar * 8 bytes (double) / bar * 4K 30-min bars / year * 5 years
 - Multiple backtesting strategies
 - Impractical to process everything in sequence
- Data quality
 - gaps, inaccuracies, misaligned data
- Time constraint
 - Continuous scanning during auto-trading
 - Interactive backtesting design cycles

Improving run-time performance

- Data reduction
 - Several processing steps
 - Tighter config constraints
- Vectorize where possible
- Employ early bail-outs wherever possible
- Increase RAM
- Separate machines for backtest R&D, auto-trading
- Parallel processing
 - Use Parallel Processing Toolbox
 - `parpool(feature('numcores'))`
 - Reduce broadcast data to minimum
 - Especially important for tasks having I/O waits

GUI challenges

- Display large amounts of results data
- Interactivity / reactivity
- Usability

Displaying large amounts of data

- General concepts
 - Combination of tables & charts
 - Sorting, filtering & searching are **extremely** important
 - Ability to detach charts as separate figures also important
- Enable sorting & filtering on data tables
 - Pre-sort data tables by descending value (best at top)
- Provide an integrated search-box
- Use tabs, flex-box panels (*uiextras* on FEX)
- Summarize data in separate tabs, sub-tables

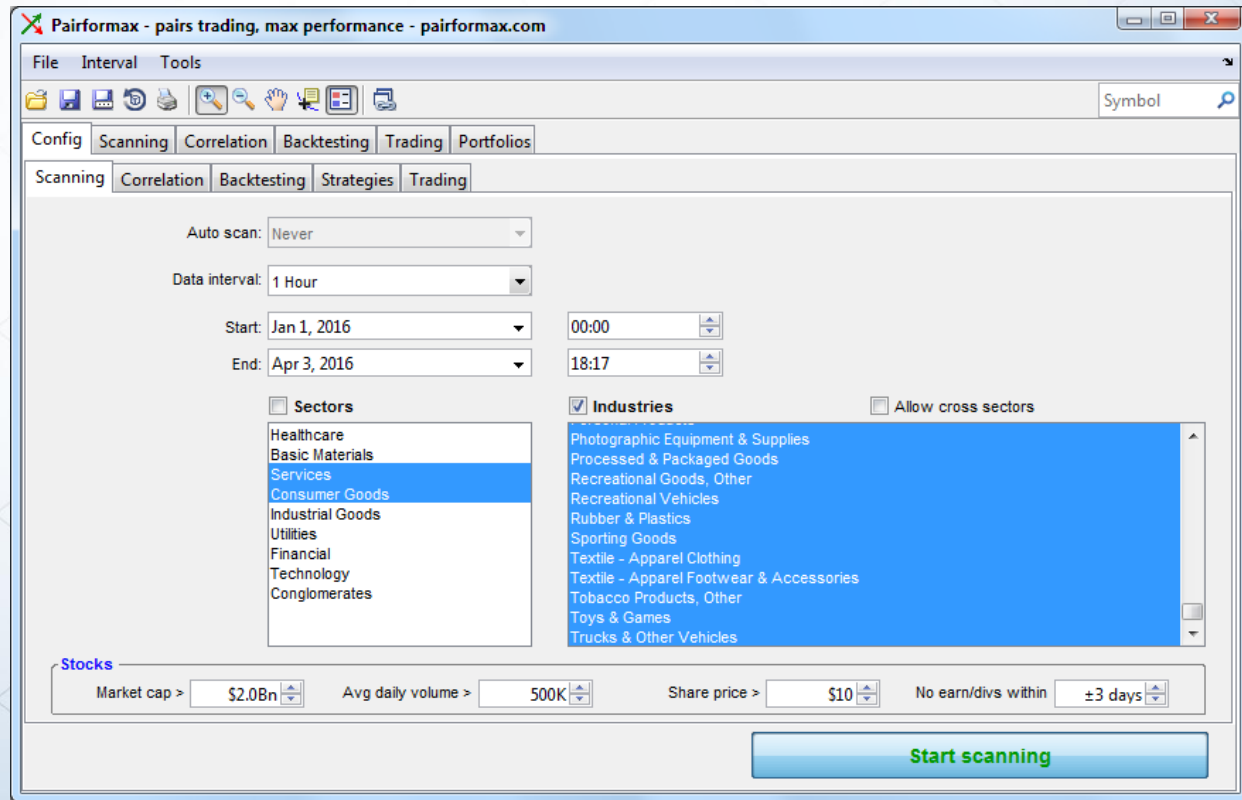
Improving usability

- User should be able to configure as much as possible in GUI
- Remember user preferences (`setpref/getpref`), reload last data
- Intuitive flow (left→right, top→bottom)
- Disable or hide figure/panel/controls during processing tasks
 - `enableDisableFig` (FEX)
 - Ensure you restore in all exit conditions, inc. early bail-outs and exceptions
- Avoid data overload – hide non-critical data
 - Use tooltips, tabs, closed/hidden panels, etc.
 - Remove unnecessary scrollbars, panel/table borders, unused controls
- Use appropriate Java controls (date selector, spinner, tree, searchbox)
- Use colors/fonts consistently
 - Deviate only to emphasize, e.g. backtesting summary sub-table headers (HTML)

Improving GUI performance

- Use `uitable('v0')` or `JTable`, not standard `uitable`
- Use `drawnow` sparingly
 - Not too often, to avoid flicker/slowdowns
 - Not too seldom, to let the user see ongoing progress
- Cache data wherever possible
- Improve the *perceived* performance
 - Intuitive flow
 - Postpone non-visible updates to end of processing
 - Ongoing feedback (console, progress bars, GUI update)

Pairformax screenshots



Pairformax screenshots

The screenshot displays the Pairformax software interface, titled "Pairformax - pairs trading, max performance - pairformax.com". The interface includes a menu bar (File, Interval, Tools), a toolbar, and a main workspace with tabs for Config, Scanning, Correlation, Backtesting, Trading, and Portfolios. The "Trading" tab is active, showing a strategy configuration window for "test strategy".

The strategy configuration window includes a "Name" field set to "test strategy" and a "Symbol" search field. Below the tabs, the "Overview" section is expanded, showing the following criteria:

- Sell X, buy Y: ("A")**
 - Entry criteria**
 - Z score > 0.50 and
 - Spread amount is increasing for 3 bars and
 - RSI is increasing for 1 bar
 - Take-profit criteria**
 - Profit of 2.5% or more
 - Stop-loss criteria**
 - Loss of 1.2% or more trailing
- Buy X, sell Y: ("B")**
 - Entry criteria**
 - Z score < -0.50 and
 - Spread amount is decreasing for 3 bars and
 - RSI is decreasing for 1 bar
 - Take-profit criteria**
 - Profit of 2.5% or more
 - Stop-loss criteria**
 - Loss of 1.2% or more trailing

At the bottom of the window, there are buttons for "New", "Copy", "Del", and a prominent "Rerun backtest" button.

Pairformax screenshots

Pairformax - pairs trading, max performance - pairformax.com

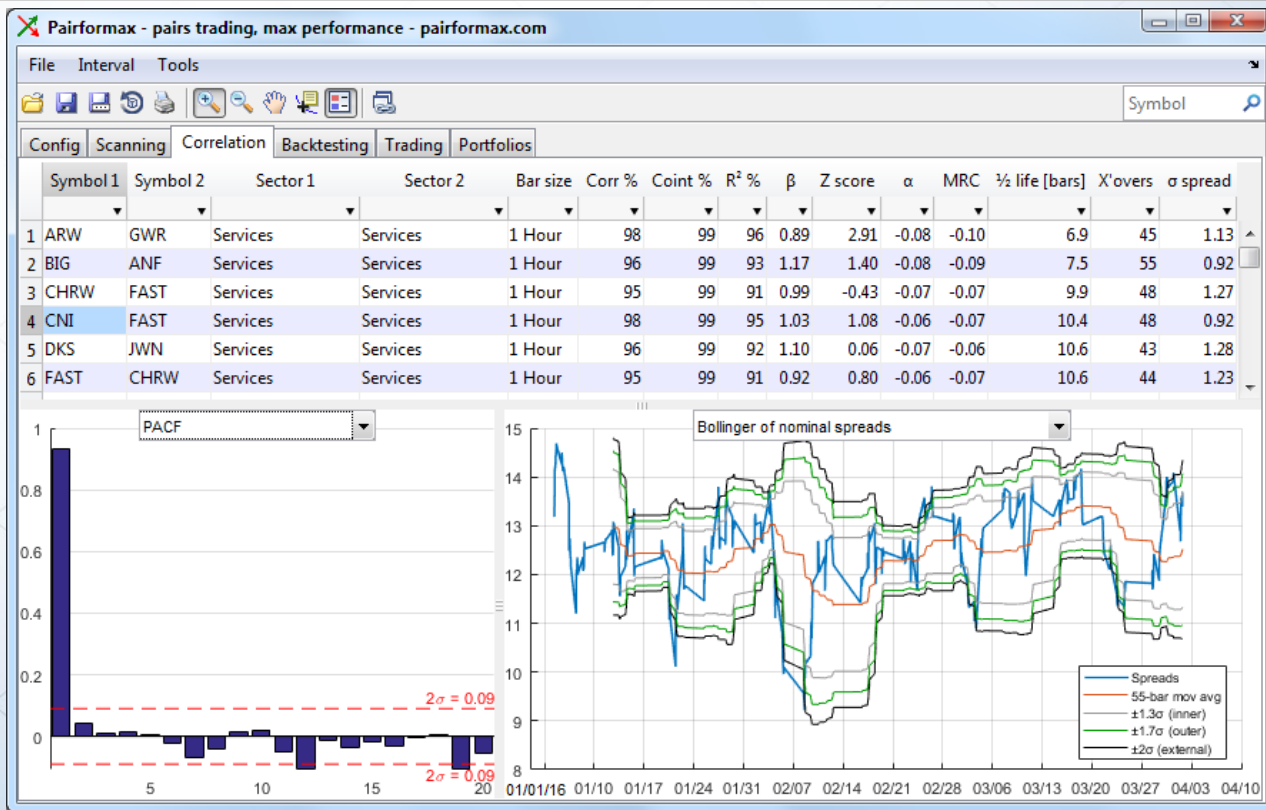
File Interval Tools

Symbol

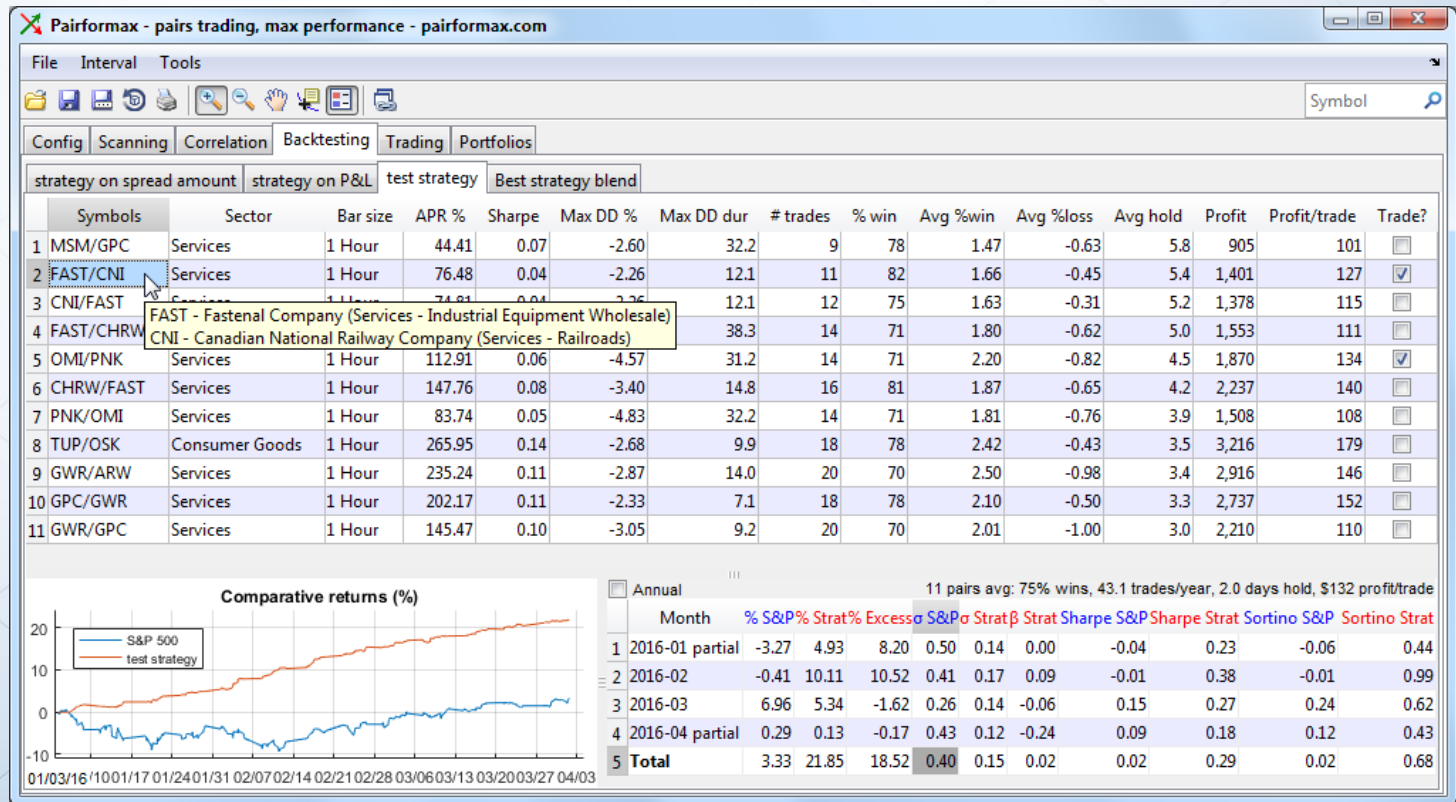
Config Scanning Correlation Backtesting Trading Portfolios

	Symbol	Company	Sector	Industry	Country	Market Cap	P/E	Price	Change	Volume	Next div x date	Next earn date
1	AAPL	Apple Inc.	Consumer Goods	Electronic Equipm...	USA	\$ 609,848 M	11.7	\$ 109.99	0.92%	25,661 K TBA		2016-04-25
2	AMZN	Amazon.com, Inc.	Services	Catalog & Mail Or...	USA	\$ 281,798 M	482.7	\$ 598.50	0.82%	2,914 K TBA		2016-04-28
3	PG	The Procter & Ga...	Consumer Goods	Personal Products	USA	\$ 225,913 M	27.6	\$ 83.53	1.48%	8,027 K TBA		2016-04-26
4	WMT	Wal-Mart Stores I...	Services	Discount, Variety S...	USA	\$ 221,123 M	15.1	\$ 69.06	0.83%	6,602 K TBA	2016-12-07	2016-05-19
5	KO	The Coca-Cola C...	Consumer Goods	Beverages - Soft Dr...	USA	\$ 202,715 M	28.0	\$ 46.83	0.95%	14,922 K TBA		2016-04-20
6	BUD	Anheuser-Busch I...	Consumer Goods	Beverages - Brewers	Belgi...	\$ 200,927 M	25.3	\$ 125.65	0.79%	3,027 K TBA		2016-05-04
7	BABA	Alibaba Group H...	Services	Specialty Retail, Ot...	China	\$ 197,782 M	19.1	\$ 78.73	-0.38%	9,251 K TBA		2016-05-05
8	HD	The Home Depot, ...	Services	Home Improveme...	USA	\$ 168,960 M	24.7	\$ 134.85	1.06%	4,258 K TBA		2016-05-17
9	DIS	The Walt Disney ...	Services	Entertainment - Di...	USA	\$ 161,640 M	18.5	\$ 99.07	-0.24%	5,876 K TBA		2016-05-03
10	PM	Philip Morris Inter...	Consumer Goods	Cigarettes	USA	\$ 154,737 M	22.6	\$ 99.75	1.67%	4,181 K TBA		2016-04-19
11	PEP	Pepsico, Inc.	Consumer Goods	Beverages - Soft Dr...	USA	\$ 151,653 M	28.2	\$ 103.78	1.27%	4,129 K TBA		2016-04-18
12	UL	Unilever PLC	Consumer Goods	Personal Products	Unite...	\$ 133,696 M	23.5	\$ 45.10	-0.18%	945 K TBA		TBA
13	UN	Unilever N.V.	Consumer Goods	Personal Products	Neth...	\$ 133,650 M	23.2	\$ 44.64	-0.09%	1,939 K TBA		TBA
14	MO	Altria Group Inc.	Consumer Goods	Cigarettes	USA	\$ 123,467 M	23.6	\$ 63.06	0.64%	5,833 K TBA		2016-04-28
15	MCD	McDonald's Corp.	Services	Restaurants	USA	\$ 114,523 M	26.4	\$ 127.02	1.07%	5,212 K TBA		2016-04-22
16	NKE	NIKE, Inc.	Consumer Goods	Textile - Apparel F...	USA	\$ 104,897 M	28.5	\$ 61.59	0.20%	7,554 K TBA		TBA
17	KHC	The Kraft Heinz C...	Consumer Goods	Food - Major Diver...	USA	\$ 96,097 M		\$ 79.08	0.66%	3,418 K TBA		2016-04-26
18	UPS	United Parcel Ser...	Services	Air Delivery & Frei...	USA	\$ 92,744 M	19.6	\$ 104.95	-0.49%	2,764 K TBA		2016-04-28
19	SBUX	Starbucks Corpor...	Services	Specialty Eateries	USA	\$ 90,194 M	37.4	\$ 61.02	2.21%	9,393 K TBA		2016-04-21
20	RAI	Reynolds Americ...	Consumer Goods	Cigarettes	USA	\$ 71,880 M	18.6	\$ 50.33	0.04%	4,511 K TBA		2016-04-15

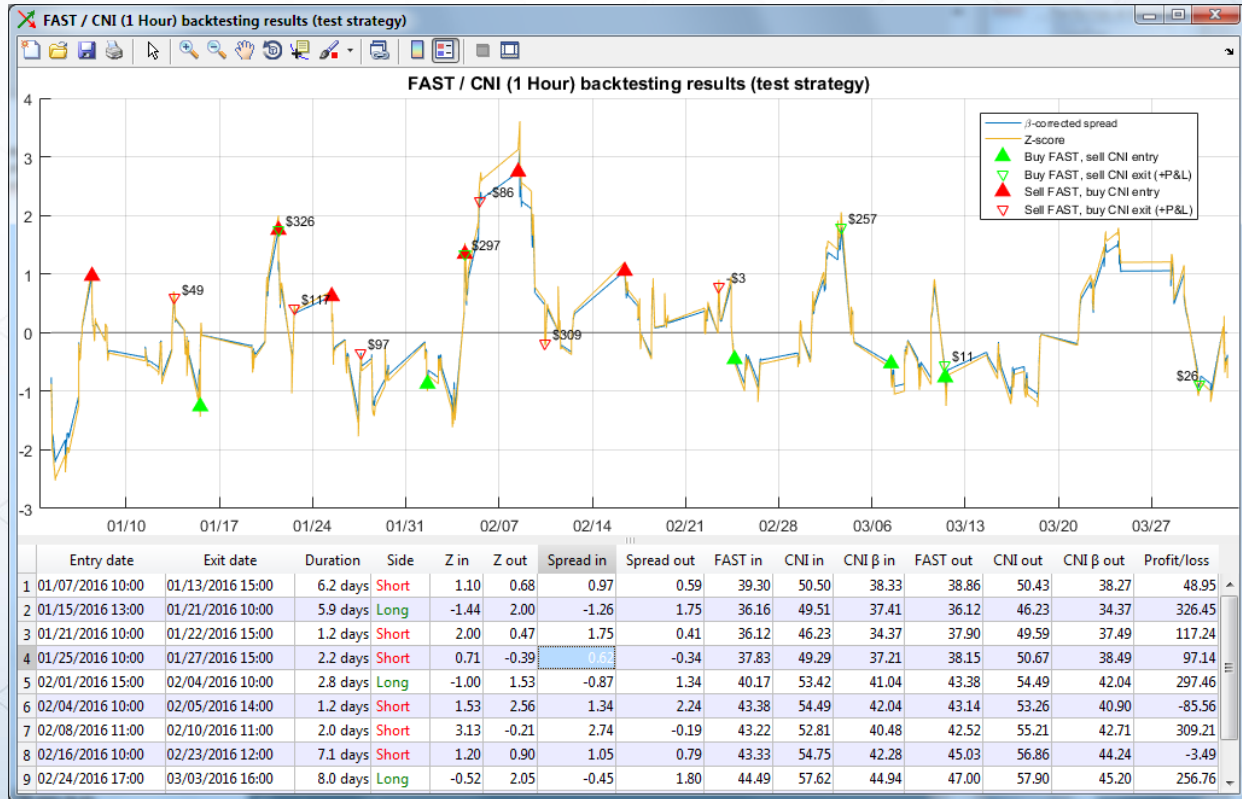
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Pairformax screenshots



Products & services used

- Mathworks
 - MATLAB
 - Datafeed Toolbox
 - Parallel Computing Toolbox
 - Optional: Financial, Database, Optimization Toolbox
- 3rd-party (MATLAB)
 - IB-Matlab Toolbox
 - Spatial Econometrics Toolbox
 - GUI Layout Toolbox
- 3rd-party (other)
 - Interactive Brokers
 - DTN IQ-Feed
 - FinViz.com

Thank you!

[http://UndocumentedMatlab.com/
files/Pairformax-Systematics.pdf](http://UndocumentedMatlab.com/files/Pairformax-Systematics.pdf)

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