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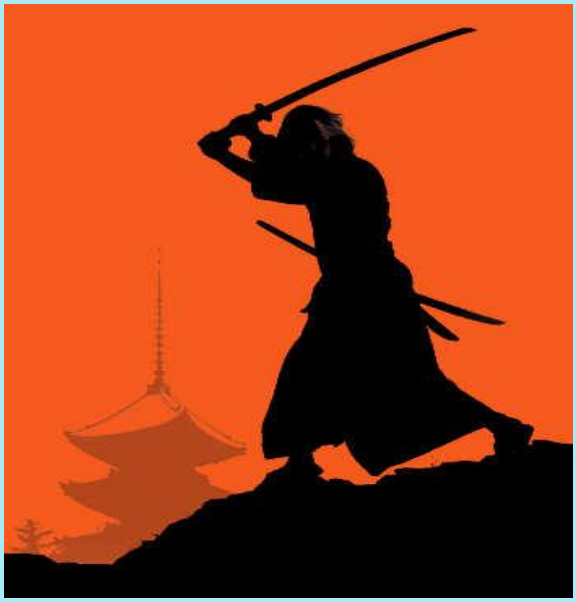
A Guide to Samurai for NinjaTrader®
"Train your Ninja with Samurai"



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The risk of loss in trading commodity futures contracts can be substantial. You should therefore carefully consider whether such trading is suitable for you in light of your financial condition. You may sustain a total loss of the initial margin funds and any additional funds that you deposit with your broker to establish or maintain a position in the commodity futures market. Past performance is not indicative of future results. We recommend that you learn more from the Commodity Futures Trading Commission (CFTC) or the National Futures Association.

Trading Securities:
In considering whether to trade in securities or enter into any such transaction, you should be aware that trading in securities can be extremely risky. You should be prepared to lose all of the funds used for trading in securities. You should not fund your security trading activities with retirement savings, emergency funds or funds set aside for purposes such as education or home ownership. Trading in securities can also lead to large and immediate financial losses. Trading in securities requires knowledge of the securities markets. Trading in securities requires in-depth knowledge of the securities markets and trading techniques and strategies. In attempting to profit through trading in securities, you must compete with professional, licensed traders employed by securities companies. You should have the appropriate experience before engaging in the trading of securities. All losses are your responsibility.

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"Hypothetical performance results have many inherent limitations, some of which are described below. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently achieved by any particular trading program.

One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or to adhere to a particular trading program in spite of trading losses are material points which can also adversely affect actual trading results. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results and all of which can adversely affect actual trading results."

We offer a simple and powerful collection of improved technical indicators inherited from classical oscillators widely used throughout modern technical analysis. These oscillators take advantage of full intra-bar information provided by the NinjaTrader® charting package. They allow for up to four times better precision against their classical counterparts. Samurai indicators also offer a special benefit to high-frequency intraday trading, because they provide far greater accuracy on short period price oscillations.

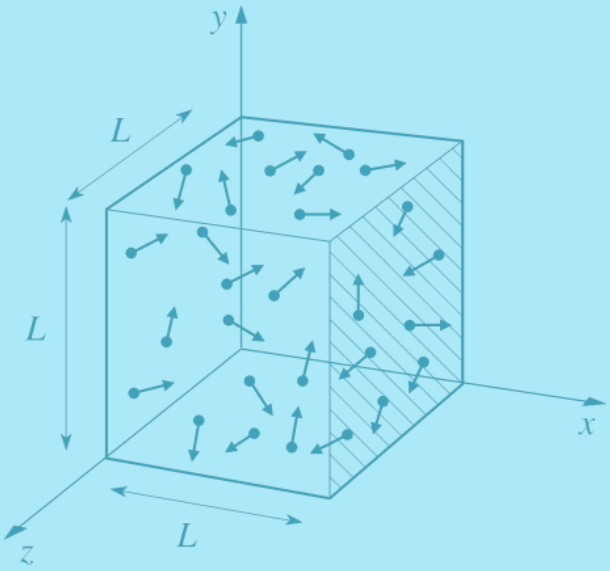
Introduction

Standard price bars on a chart typically have four channels: open, high, low and close. Many technical indicators use only one of these channels for statistical analysis. In figure 1, we illustrate the benefits of using all four channels to improve trade signal precision. This is illustrated in a simple example of the Bollinger Bands indicator listed below.

Figure 1: Probability Channel with Improved Bollinger Band

Figure 1, illustrates a simulated intra-bar probability channel associated with the price components provided on the chart. The blue price gradient depicts the associated probability levels extrapolated from the price sample within each bar. Against this price distribution, we plot Bollinger bands calculated by the standard method against the improved price bar resolution. One can see that the bands using all of the available price information are smoother and more consistent with the price channel. In Samurai, we include the indicators in figure 1, as well as many other indicators using the same improvement principle.

Background (The Mystery of Market Prices)



Samurai is actually based on quantum physics theory. Specifically, the quantum uncertainty principle.

Quantum uncertainty of price is the acknowledgment that uncertainty affects the measurement of market conditions in the same fashion that uncertainty affects quantum systems. This suggests that all known price points should be used to leverage uncertainty. For this reason, Samurai takes advantage of all four price channels simultaneously. A visual representation of this principle is depicted in figure 2. For those that are interested in the details, please read the article, “Unraveling the Mystery of Stock Prices” (Zinchenko, 2010).

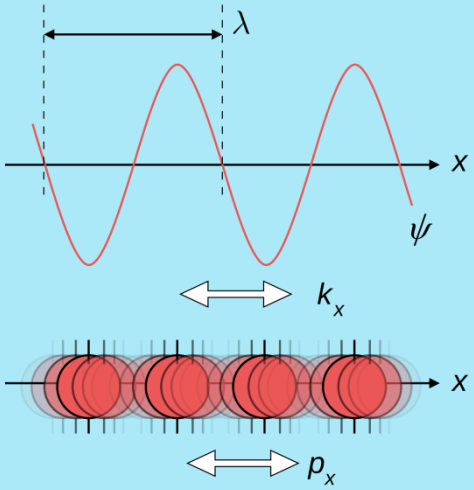


Figure 2: Leverage Uncertainty

Stable Price Aggregates

To decrease the amount of information to deliver, data providers commonly use a sort of price aggregation. The standard aggregation approach has evolved historically. It includes the classical combination of open, high, low, and close prices for a symbol over a given period. Occasionally extra fields such as volume, open interest, and other quantities are also provided.

On a typical time stamp from a data vendor, this aggregate will generally be written into one line as follows:

Date	Open	High	Low	Close
2000.01.01 00:00:00	4.12	5.18	3.14	4.72

It is evident from the first glance that the data is incomplete. All four points are voluntarily assigned to one common time stamp, despite different events and time intervals. A more accurate table would look something like this:

Date	Open	High	Low	Close
2000.01.01 00:00:00	4.12			
2000.01.01 00:00:01			3.14	
2000.01.01 00:00:02		5.18		
2000.01.01 00:00:03				4.72

Therefore, we must come to the conclusion that nearly all financial data (and indicators that use them) is delivered to traders in an arbitrarily tampered and malformed fashion. For a novice, the difference may appear hardly noticeable. However, the impact of this hidden knowledge becomes crucial in real-time analysis. When the exact time of a trade signal can spell the difference winning or losing, you want the most accurate data possible.

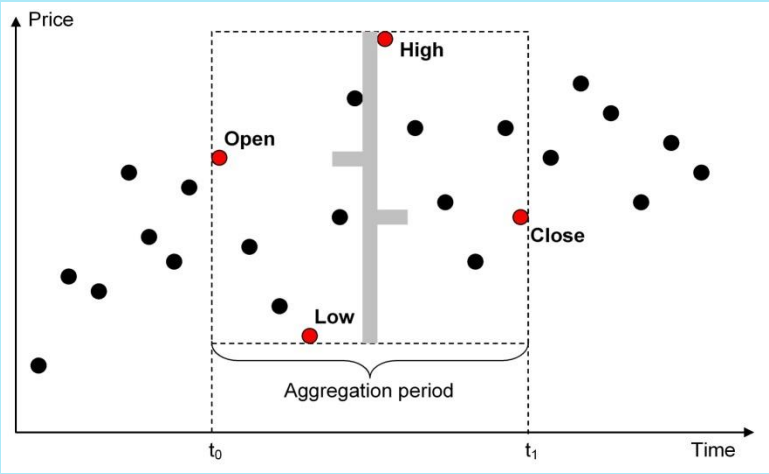


Figure 3: OHLC Price Bar as Scatter Diagram

One can only wonder why such poor data aggregation has been established as the dominant norm of data vendors. Data provided for a given timestamp represents a random set of four

points over a period that does not correspond to the timestamp indicated. As plainly evident in figure 3, a typical trading bar is an attempt to package a scatter diagram of four prices observed over one given period. A continuous chart built on such data offers unstable visual impressions and false trend indicators.

One way to improve precision without acquiring additional data is to use all of the available data from the provider and smooth that data. In Samurai, we take all four data points lumped under one time stamp and sum up the averages over several bars. Not only will you have four times the amount of data, but the relative role of high and low prices in the average will steadily diminish.

Installation

The Samurai indicators are easily installed in a fashion similar to other NinjaTrader® indicators. Here is the installation process:

1. NinjaTrader ships as a 32 and 64 bit version in a single package
2. If you have 64 bit Windows, both **32 and 64 bit** are installed
3. Samurai can only be installed **on 32 or 64 bit**
4. Always run the NinjaTrader bit version **matching** the Samurai version
5. If you already have a previous version of Samurai installed, remove it first: Control Center > File > Utilities > Remove NinjaScript Assembly
6. NinjaTrader package setup:
    - Run proper version of NinjaTrader
    - Save NinjaScript of Samurai in convenient location
      Example of file name: **SamuraiSuite_8_2019_05_09.zip**
    - Import NinjaScript: Control Center > File > Utilities > Import NinjaScript (point to your convenient location)
    - Get NinjaTrader Machine ID: Control Center > Help > About
    - Send activation request mail with NinjaTrader Machine ID to support@quant-trade.com

Indicator Overview

Once installed, you will have a series of new indicators that are preceded by an identifier called, “Precision”. Each indicator is an improved version of its counterpart. In the following table, we briefly describe each indicator as compared to its classic counterpart included in the NinjaTrader platform. We have also included several new indicators that are explained in the “Price Beam” section below.

Indicator	Counterpart	Comment
Precise APZ	Adaptive Price Zone (APZ)	The adaptive price zone (APZ) is a volatility-based indicator that helps investors identify possible market turning points.

Precise Average	Average Price	Average of a series of prices from the chart. Precise Average uses all price channels.
Precise Bollinger Bands	Bollinger Bands	Uses “Precise Standard Deviation” and “Precise Average” for better precision as displayed in figure 1.
Precise DEMA	Double Exponential Moving Average (DEMA)	The (DEMA) uses two exponential moving averages (EMAs) to eliminate lag, as some traders view lag as a problem. The (DEMA) is used in a similar way to traditional moving averages (MA).
Precise DM Index	Directional Movement Index (DMI)	The Directional Movement Index, or (DMI), is an indicator developed by J. Welles Wilder in 1978 that identifies in which direction the price of an asset is moving. The indicator does this by comparing prior highs and lows.
Precise EMA	Exponential Moving Average (EMA)	The (EMA) is a moving average that places a greater weight and significance on the most recent data points.
Precise FOSC	Forecast Oscillator (FOSC)	The Forecast Oscillator is a technical indicator that compares a security closing price to its time series forecast. Uses “Precise Linear Regression” as the forecast base.
Precise HMA	Hull Moving Average (HMA)	The Hull Moving Average (HMA) was developed by Alan Hull for the purpose of reducing lag, increasing responsiveness while at the same time eliminating noise.
Precise Linear Regression	Linear Regression	Extension of the linear regression based indicators. Calculated on all price channels to improve the precision.
Precise Linear Regression Intercept	Linear Regression Intercept	This linear regression intercept indicator plots the intercept for the trendline for each data point. It is calculated on all price channels.
Precise Linear Regression Slope	Linear Regression Slope	This linear regression indicator plots the slope of the trendline value for

		each given data point. It is calculated on all price channels.
Precise MA Envelopes	Moving Average Envelopes (MA Envelopes)	Envelopes are technical indicators that are typically plotted over a price chart with upper and lower bounds. The most common example of an envelope is a moving average envelope.
Precise MACD	Moving Average Convergence/Divergence (MACD)	The (MACD) turns two trend-following indicators, moving averages, into a momentum oscillator by subtracting the longer moving average from the shorter one.
Precise Momentum	Momentum	The Momentum Indicator (MOM) is a leading indicator measuring a security's rate-of-change.
Precise PPO	Percentage Price Oscillator (PPO)	The Percentage Price Oscillator (PPO) is a technical momentum indicator that shows the relationship between two moving averages in percentage terms.
Precise Price Oscillator	Price Oscillator	The Price Oscillator (PO) is a technical momentum indicator that shows the relationship between two moving averages
Precise ROC	Rate-of-Change (ROC)	The Rate of Change Indicator (ROC) is a momentum oscillator, which measures the percentage change between the current price and a given period past price.
Precise RSI	Relative Strength Index (RSI)	The Relative Strength Index (RSI) is a well-versed momentum based oscillator which is used to measure the speed (velocity) as well as the change (magnitude) of directional price movements.
Precise SMA	Standard Moving Average (SMA)	Standard Moving Average (SMA) calculated on all price channels.
Precise Standard Deviation	Standard Deviation	Standard Deviation calculated on all price channels.
Precise Standard Error	Standard Error	Standard Error calculates the error between prices and a linear regression

		line. Uses Precise Linear Regression to calculate with all price channels.
Precise TEMA	Triple Exponential Moving Average (TEMA)	Designed to smooth price fluctuations, thereby making it easier to identify trends without the lag. Uses “Precise Exponential Moving Average”.
Precise TMA	Triangular Moving Average (TMA)	The (TMA) is similar to other moving averages. However, the triangular moving average differs in that it is double smoothed. Calculated on all price channels.
Precise TRIX	Triple Exponential Average (TRIX)	Displays the percentage Rate of Change (ROC) of a triple (EMA) over all of the price channels.
Precise TSF	Time Series Forecast (TSF)	Calculates probable future values for the price by fitting a linear regression line over a given number of price bars and following that line forward into the future. Uses all price channels.
Precise WMA	Weighted Moving Average (WMA)	The average value of a security's price over a period of time with special emphasis on the more recent portions of the time period. Uses all price channels.
Price Beam	No Counterpart	See below for detailed description.
Price Beam Linear	No Counterpart	See below for detailed description.

Price Beam Indicators

The Price Beam is the fundamental indicator that constitutes the core foundation of the other indicators in Samurai. It visually displays the stochastic distribution of the underlying price points in the form of a visual heat map. Higher regions of color intensity reveal a greater concentration of the price probability function, while less color intensity corresponds to less likely price distribution ranges. No color designates an outer field of zero probability for price distribution. Brightly colored regions represent channels of higher probability ranges. Figure 4 is a graphical representation of a price chart with multiple price distribution channels. Each channel has a different associated level of probability. Collectively they have a price distribution range.

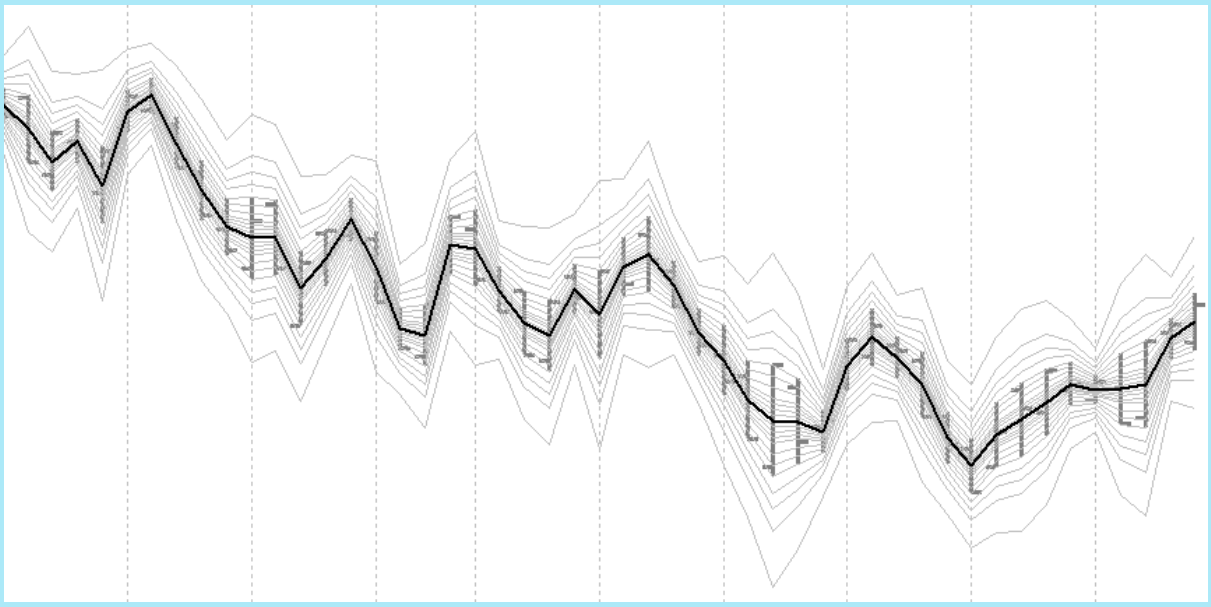


Figure 4. Price Distribution Channels

There are two types of Price Beam indicators. One is simply called the Price Beam and the other is the Price Beam Linear. The Price Beam depicts color intensity according to the Gaussian probability of decay from the median value in the price channel. Essentially this means that the normal Price Beam is more exact, but not as easy to see visually. The Price Beam Linear depicts the same decay, but according to a simple linear decay function. This makes ‘Linear' better for visual perception, but less exact with respect to the true probability level. Specifically, it relates to a rule, which is used for coloring different levels of probability.

An example of how the four prices are distributed across price channels is represented as a Gaussian probability of decay and represented in figure 5. Here you see what looks like a Bell curve with three standard deviations from the mean. Each deviation level is composed of all four prices in each bar. This demonstrates the likelihood of price-concentration and price decay on the chart. The actual calculations in the Price Beam are somewhat more complicated, but this example should give you a general idea of how it works.

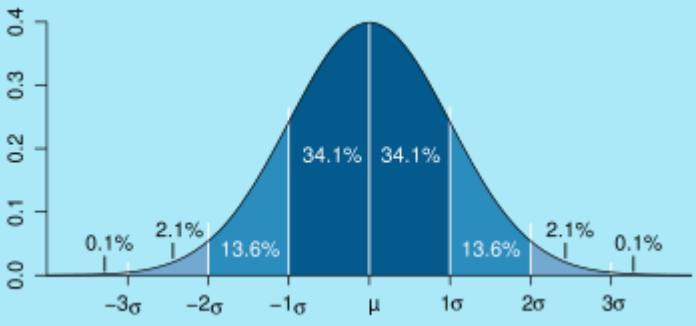


Figure 5: Price Probability Channels

Examples of the Price Beam and the Price Beam Linear are presented in the screenshots below. Both of these indicators can be used to forecast the range of each bar and the likelihood of that range. The brighter areas of the beam correlate with standard deviation and Gaussian probability channels. This suggests that most price activity will fall in the higher intensity areas of the beam.

In figure 6, a Price Beam is added to a chart in NinjaTrader®. You can see the fine resolution of the Price Beam and the highest probability channels.

Figure 6: Price Beam

In figure 7, the Price Beam Linear is placed on the same chart. While the range is not as specific, this view gives you a wider range of possibilities. Used together, the Price Beam and Price Beam Linear can maximize their potential.

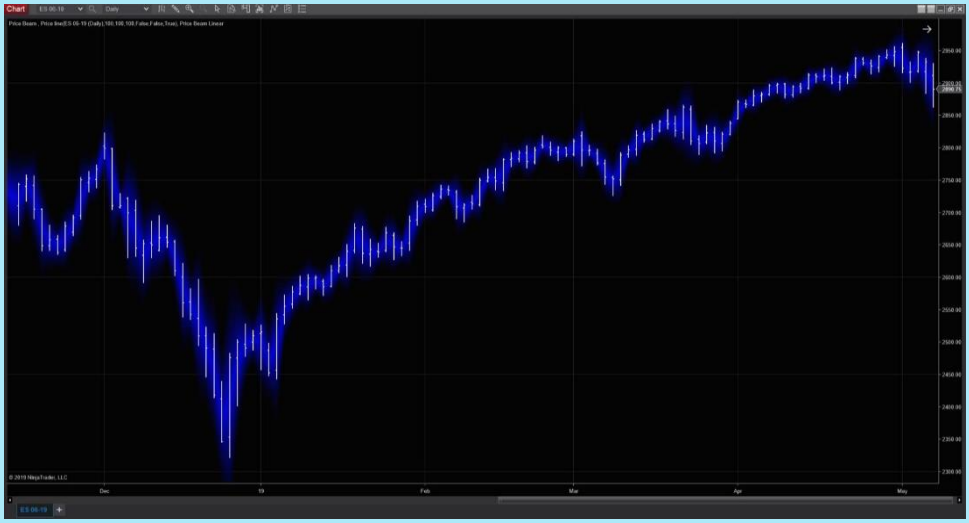


Figure 7: Price Beam Linear

Summary

The data dilemma explained in this guide severely complicates price forecasting. If we only take the open or close price as a forecasting base for a trading strategy, then we rely on a partial portion of statistical information during marginal market periods. This open or close data may not represent the market state inside that period. If, on the other hand, we take the high or low period as a forecasting base, then we have the advantage of the precise value range, but not the time accuracy. Combined together, these factors predetermine forecasting error at least equal to the size of the bar aggregation quadrant depicted in figure 3.

We can decrease the error by using complete price data (OHLC) and forecasting with all four price components. In this case, the associated trading signal precision will increase up to four times against the original. While the real boost can be considerably less due to the time uncertainty of high and low values, it is still a valid improvement. Based on this interpretation, we offer a number of simple chart analysis techniques, which are expected to improve the accuracy of trade signals based on quantum mechanics.

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