Introduction to Algorithmic Trading

Sep 3, 2009

Algorithmic Trading Basics – use GSAT as example

Algorithmic trading refers to the placing of orders into a quantitative model that automatically executes according to the execution strategy or benchmark specified by the user

Generally (though not necessarily) it involves slicing the order into smaller exchange orders for the purpose of attaining certain timing dictated by the trader, or to reduce market impact

| Algorithm	General Description
VWAP	Designed to minimize shortfall relative to a Volume-Weighted Average Price benchmark.
TWAP	Designed to minimize shortfall relative to a Time-Weighted Average Price benchmark.
Participate	Achieve a user specified percentage of volume while trying to maximize spread capture
4Cast	Minimize the implementation shortfall by optimizing impact cost versus market risk
Piccolo	Short-term spread capture for marketable orders
Sonar	Work order without displaying bids or offers in the market
Dynamic Scaling	Percentage of volume strategy with adaptive participation rate which allows for increase or decrease of execution speed based on changes in price level
Peg	Peg to best bid / offer to work passively and maximize spread capture
Auto Short-Sell	Execute short-sell orders by automatically offering stock at most aggressive offer price given local regulations
Navigator	Determines which of the GSAT algorithms is appropriate to execute an order given its characteristics
Timer Iceberg	Work a portion of the total order on the exchange at a specified time interval until the full order is complete

Algorithmic Trading – Value Proposition

- Improve Execution Quality
    - **Helps attain consistent, predictable results; faster response to market movement**

- Enhanced Productivity
    - **Enables increased focus on difficult orders, improves control**

- Speed & Information Synthesis
    - **Collects vast amount of trading data and looks for trading opportunities**

- Minimize Trade Impact
    - **Sophistication of algorithms reduces trading pattern recognition and information leakage as a result of larger trade size**

- Anonymity from the "Classic" information flow

- Parameters and Customization
    - **Algorithms incorporate trader preferences and risk appetite**

- Algorithmic logic adjust frequently with market dynamics and regulatory changes

The Changing Equity Market – US Perspective

2002

2005

2007

65%

Single-stock full-service

45%

Single-stock full-service

25%

Single-stock full-service

2002

2005

2007

>5%

Algorithmic Trading

24%

Algorithmic Trading

30%
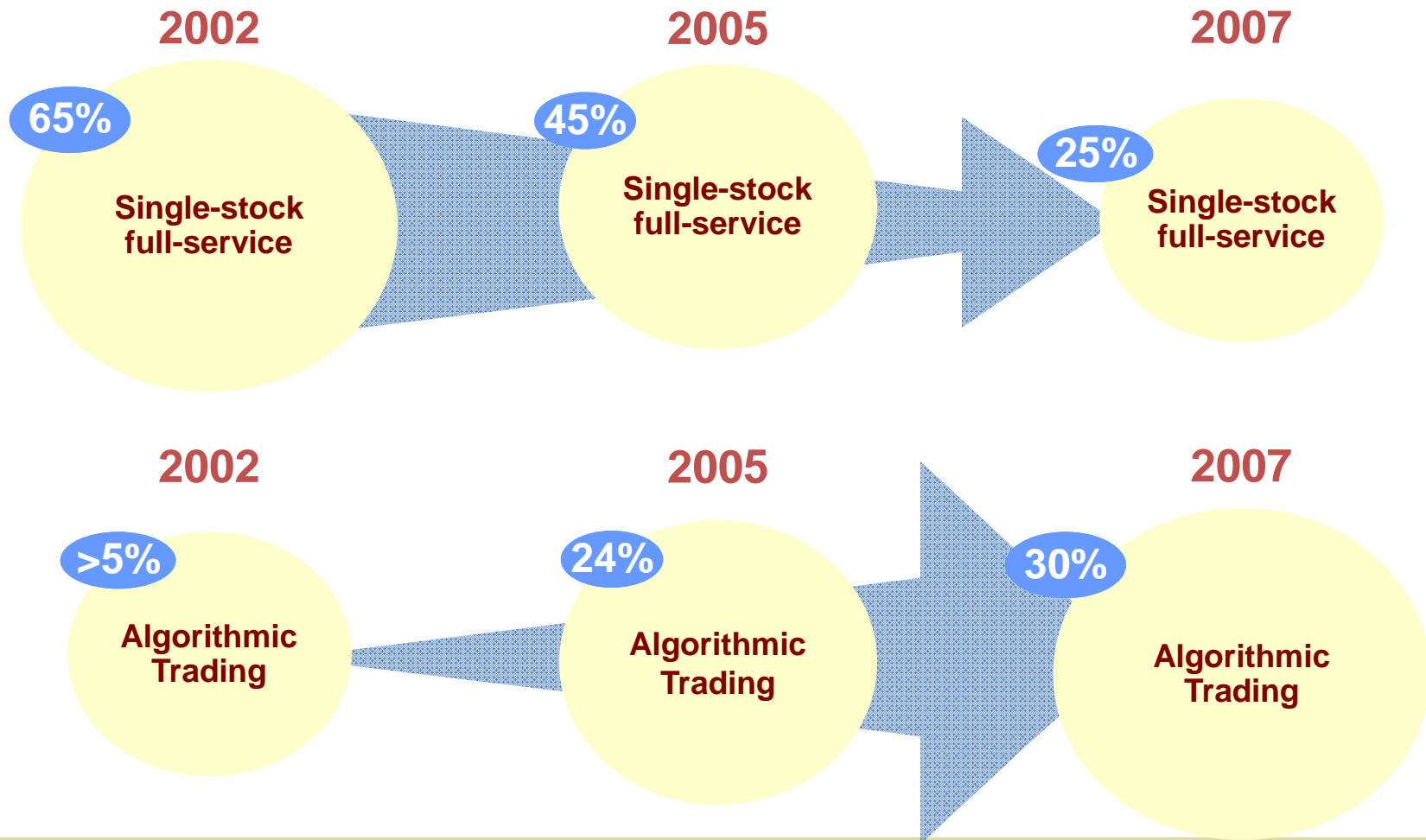
Algorithmic Trading

The Changing Equity Market - US Perspective

2005

2007

25%

Portfolio trading

24%

30%

Algorithmic trading

DMA

45%

Portfolio trading

40%

75%

55%

Algorithmic trading

DMA

55%
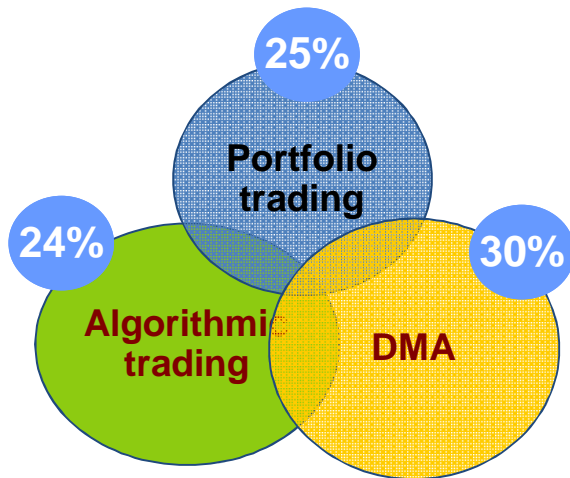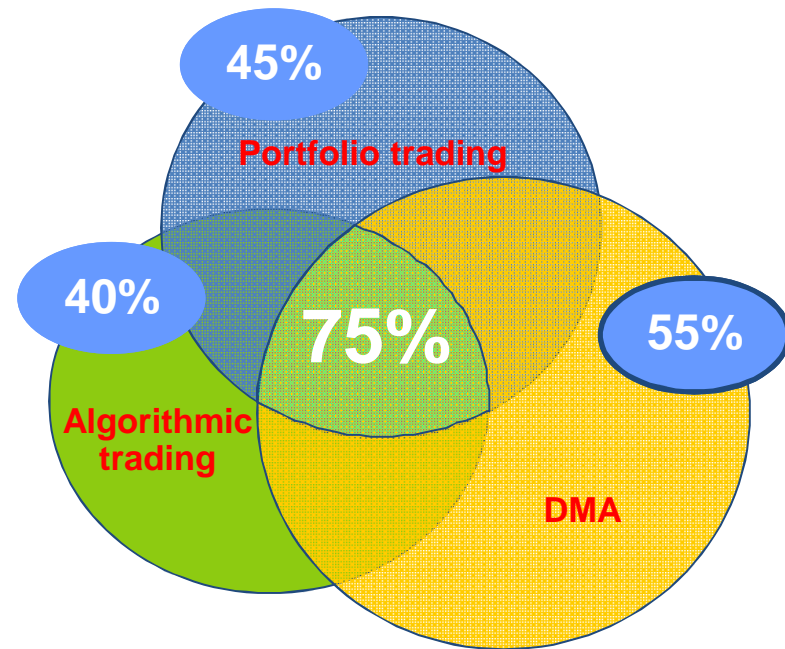
75%

The portfolio trading, algorithmic trading and DMA buckets may overlap: e.g. portfolio trades may execute algorithmically through DMA.
Source of portfolio trading, algorithmic trading and DMA: Greenwich Associates and TowerGroup; Single-stock: Goldman Sachs estimates.

How to Access – use GSAT as example

GS Electronic Trading

Direct FIX Connection

Portfolio Trading Desk

GS Sales Trading

Shares Trading Desk

REDIPlus®

HUNDSUN 恒生

macgregor®

TORA TRADING SERVICES

LINEDATA SERVICES

PORTWARE

GL TRADE

Bloomberg

FLEXTRADE

Vendor Systems

MetaBit

TradingScreen SIMPLIFYING GLOBAL MARKETS®

Charles River

LATENTZERO

Eze Castle Software

ITG INVESTMENT TECHNOLOGY GROUP

REUTERS

Fidessa

GSAT

Pre-Trade Analysis

– **The GUIDE** is an integrated pre-trade analytical tool in REDIPlus exclusively for the 4CAST algorithm. By adjusting your risk preference ('apply view of alpha'), the trader can optimize and view the expected transaction cost and time horizon before submission. The GUIDE offers several fields and graphical representation of the profile.

■ **Risk Aversion:** A representation of the 'strength of alpha' that the client expects to see during the execution horizon. Stronger the expected alpha, higher the RA should be selected.

■ **Estimated Trading cost:** An estimate of the cost of executing the order – based on Goldman Sachs historic estimates, which comprise of both time and impact.

■ **Stock Volatility cost:** A function of the volatility of the stock during the execution period (based on historic estimates for the relevant time of the day) and the Risk Aversion selected by the client.

■ **Estimated Total cost:** A 4cast of the final price (midpoint price + total cost) that the user can expect, given his estimate of volatility (built into the risk aversion).

■ **Optimal Trading Duration and Resulting Participation rate:** Expected rate of participation during the suggested execution horizon (based on ADV and stock specific volume profiles).
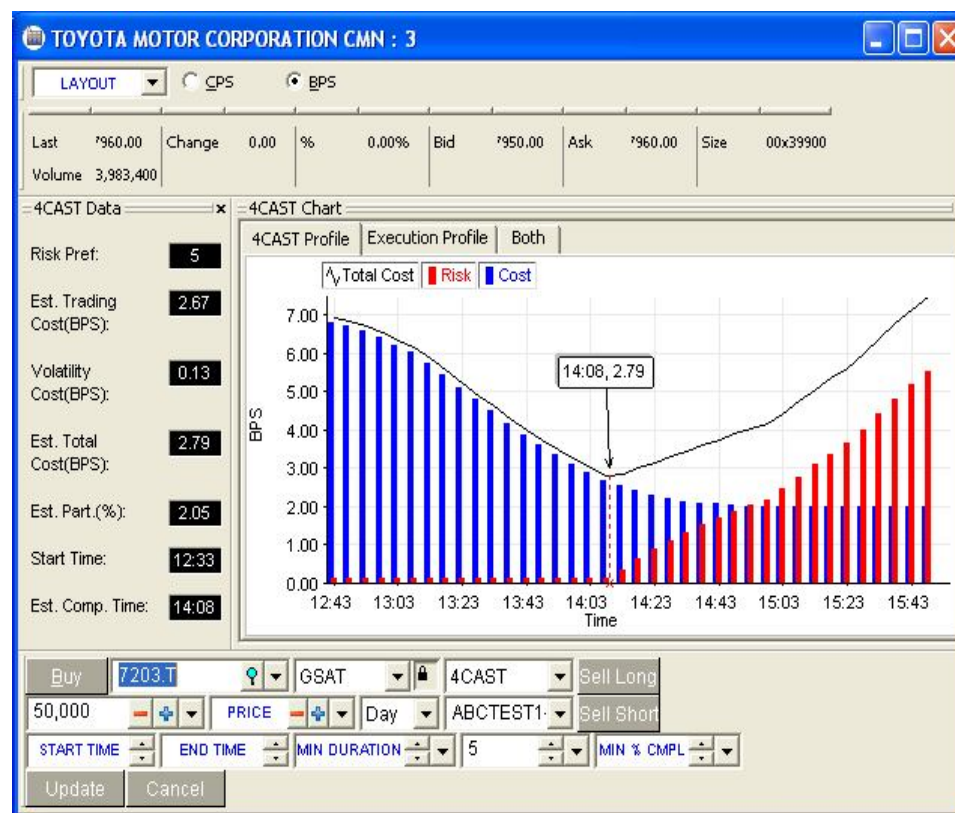
Example

Pre-Trade Analytic Tool: use GSAT as example
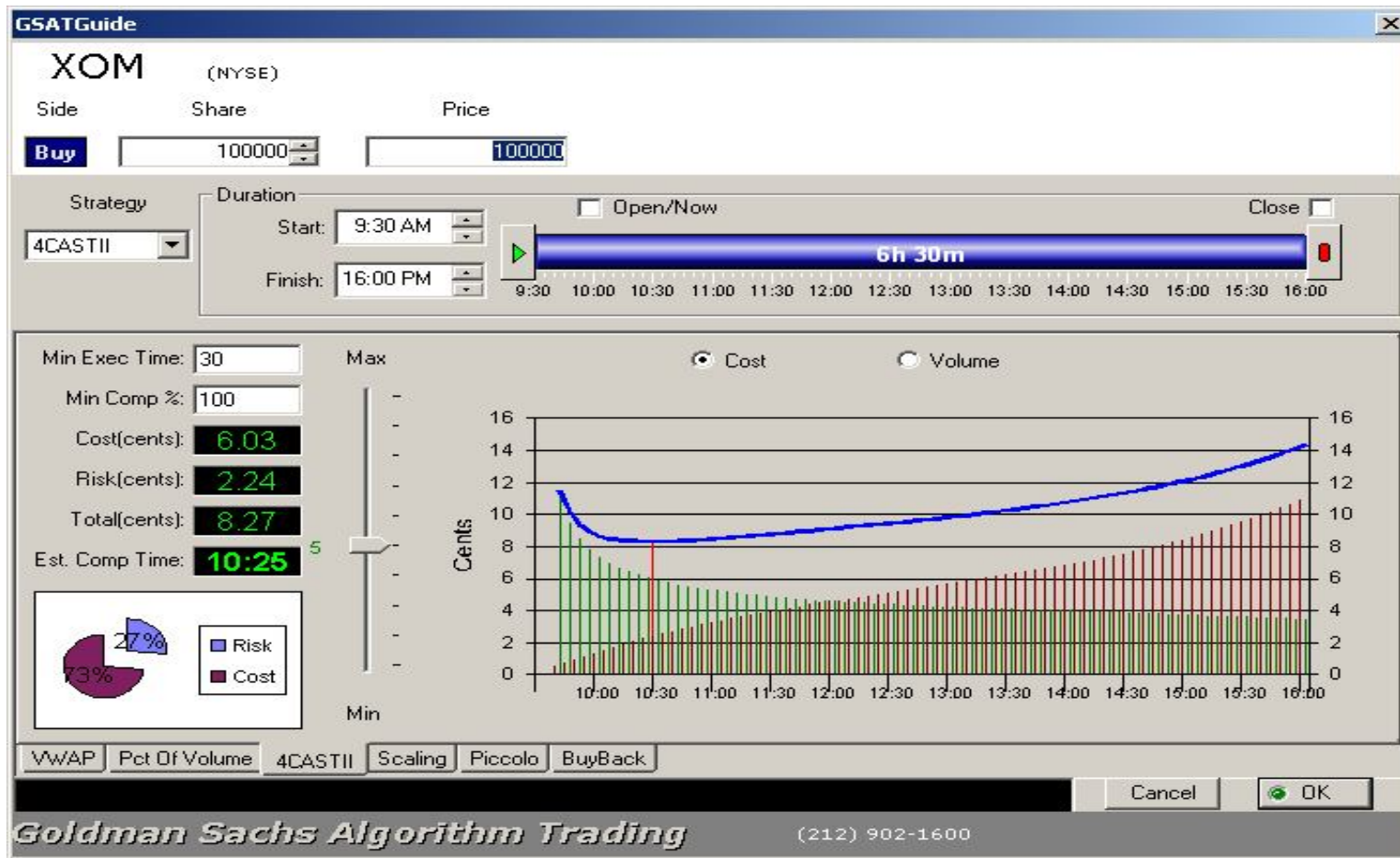
Post-Trade Analytics Reports

Example
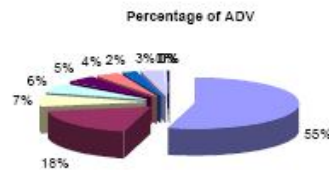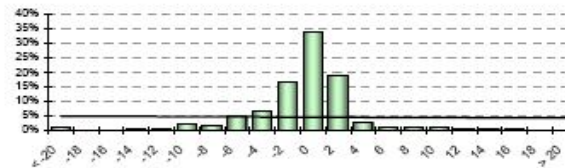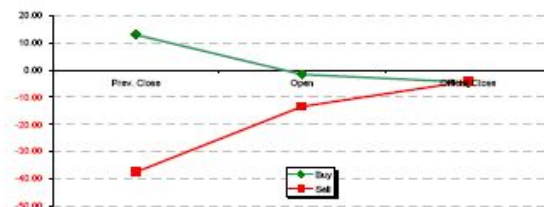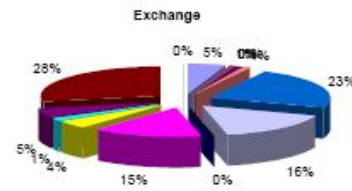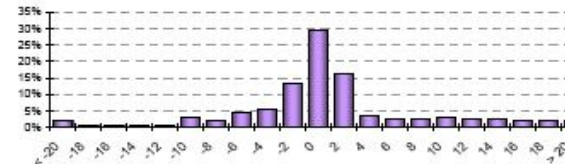
The above chart is for illustrative purpose only

Average performance: use GSAT as example
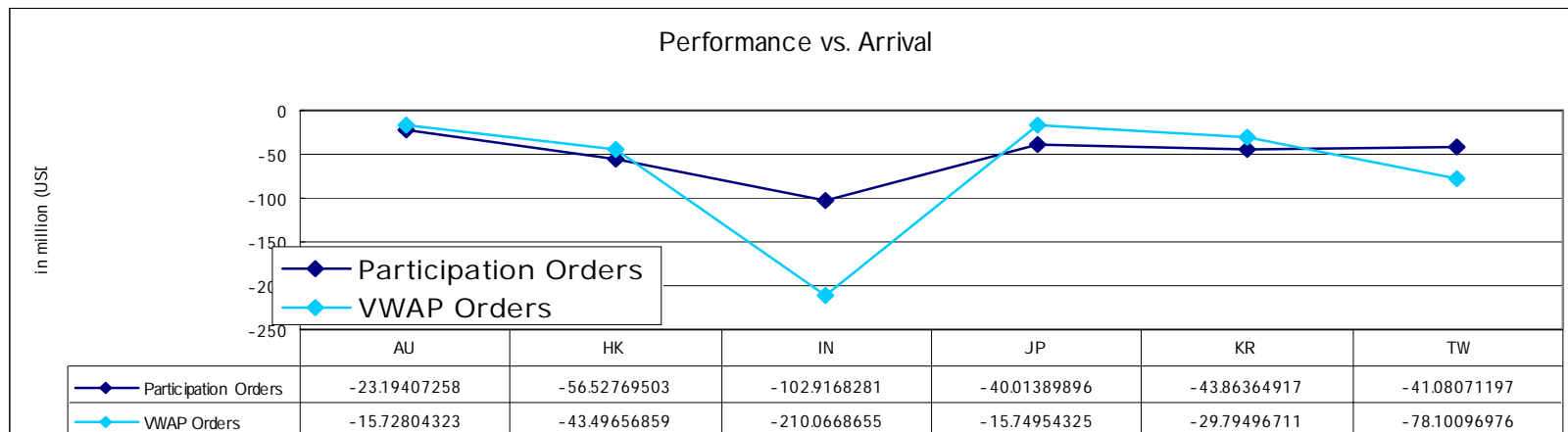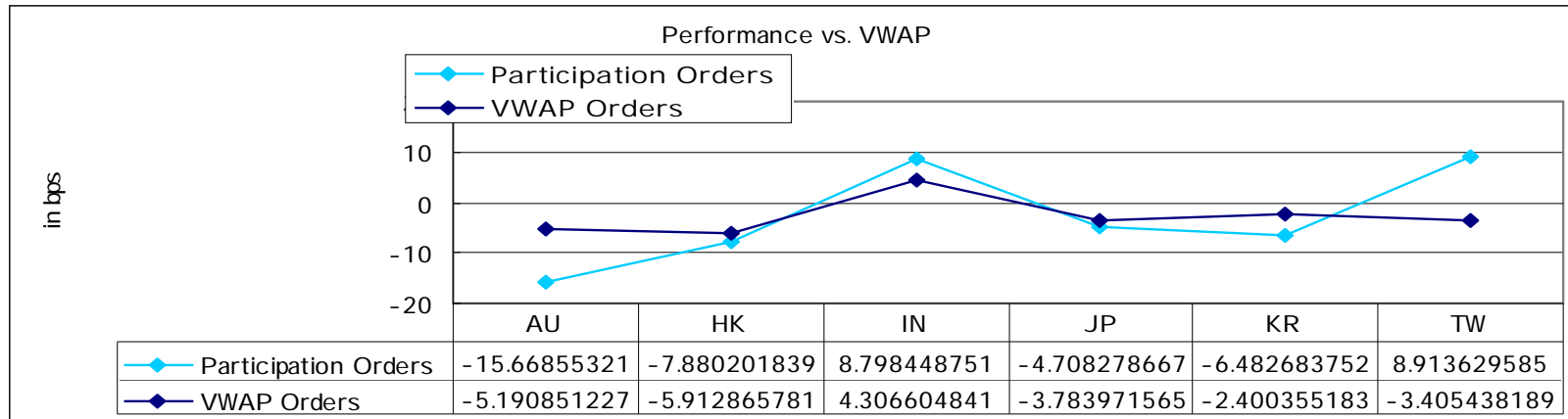
Performance vs. VWAP

in bps

	AU	HK	IN	JP	KR	TW
Participation Orders	−15.66855321	−7.880201839	8.798448751	−4.708278667	−6.482683752	8.913629585
VWAP Orders	−5.190851227	−5.912865781	4.306604841	−3.783971565	−2.400355183	−3.405438189

Performance vs. Arrival

in million (US)

	AU	HK	IN	JP	KR	TW
Participation Orders	−23.19407258	−56.52769503	−102.9168281	−40.01389896	−43.86364917	−41.08071197
VWAP Orders	−15.72804323	−43.49656859	−210.0668655	−15.74954325	−29.79496711	−78.10096976

Historical performance pattern: use GSAT as example
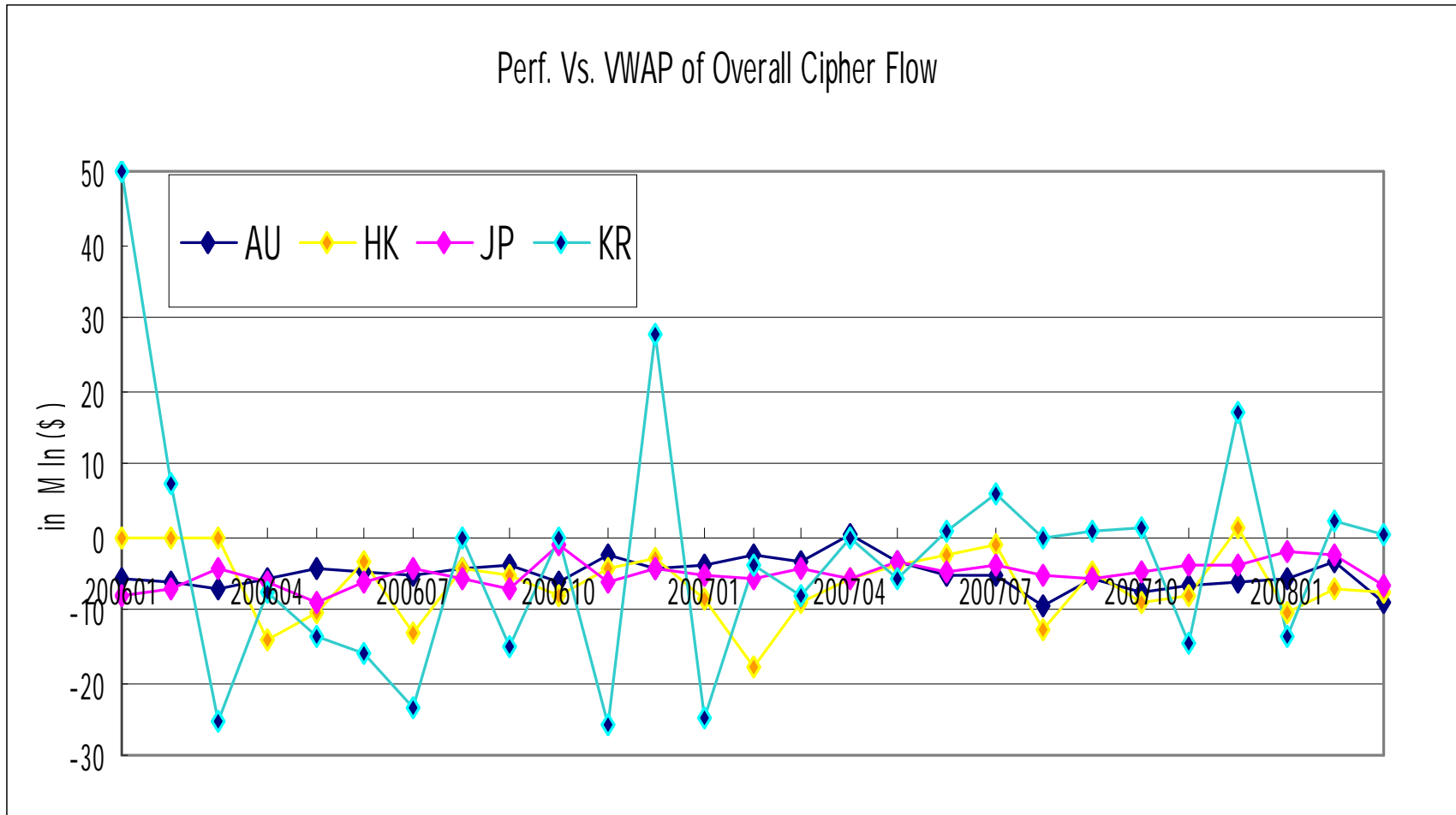
Sample Trading Interface in EMS

经纪人-高盛交易部代号
GS:高接触单股交易
GSPT:高接触组合交易
GSDA:低接触交易（直接和算法交易）

高盛算法交易策略选择
• VWAP
• Participate
• Dynamic Scaling
• Sonar
• AutoShortSell
• 4Cast
• Navigator

Disclaimer