



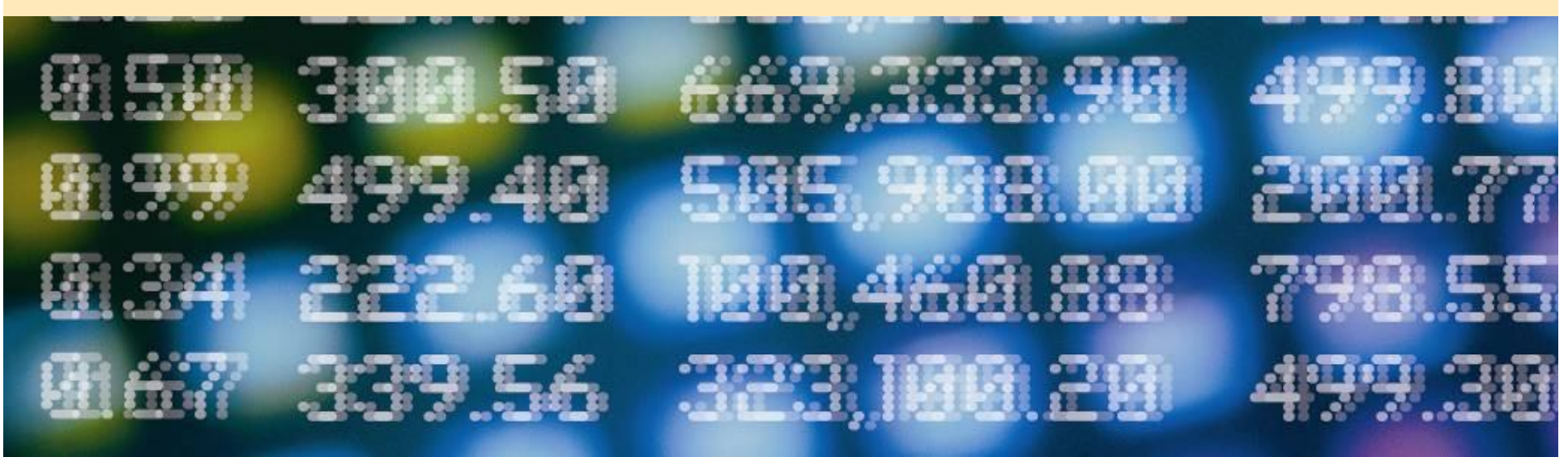
FIXGlobal

FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM



Introduction to Algorithmic Trading

Sep 3, 2009



FIXGlobal

FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

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



FIXGlobal

FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

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
-



FIXGlobal

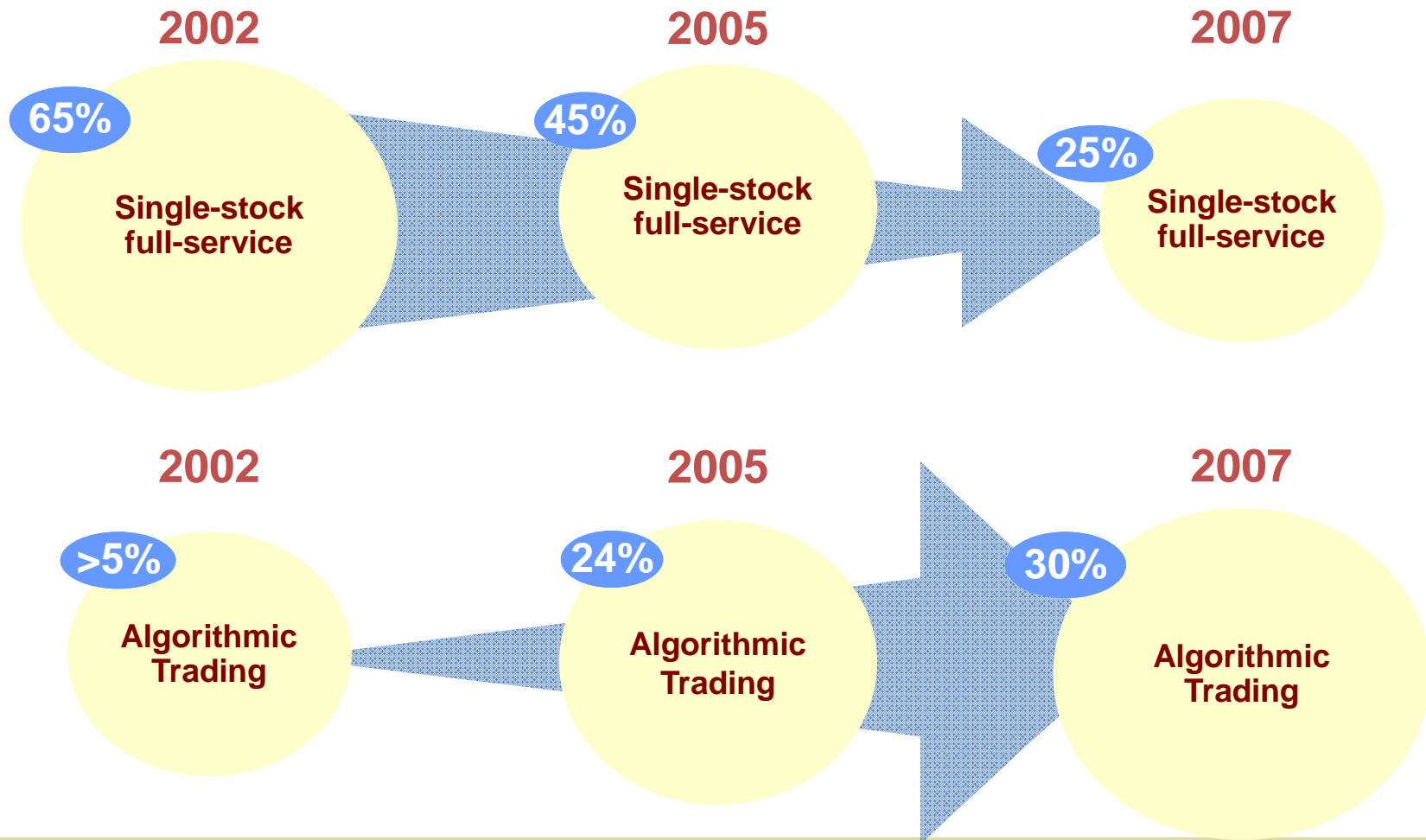
FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

The Changing Equity Market – US Perspective





FIXGlobal

FACE2FACE

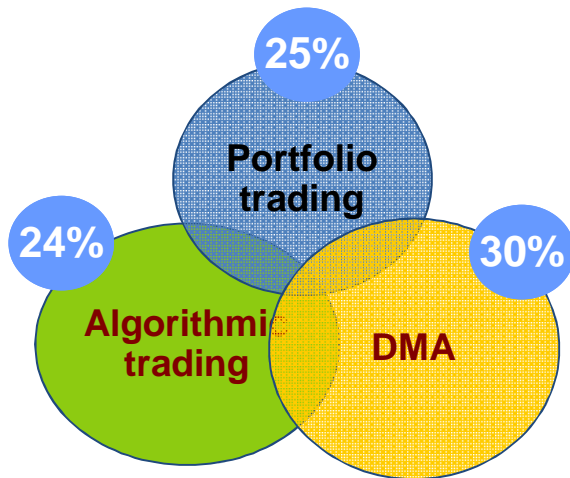
Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

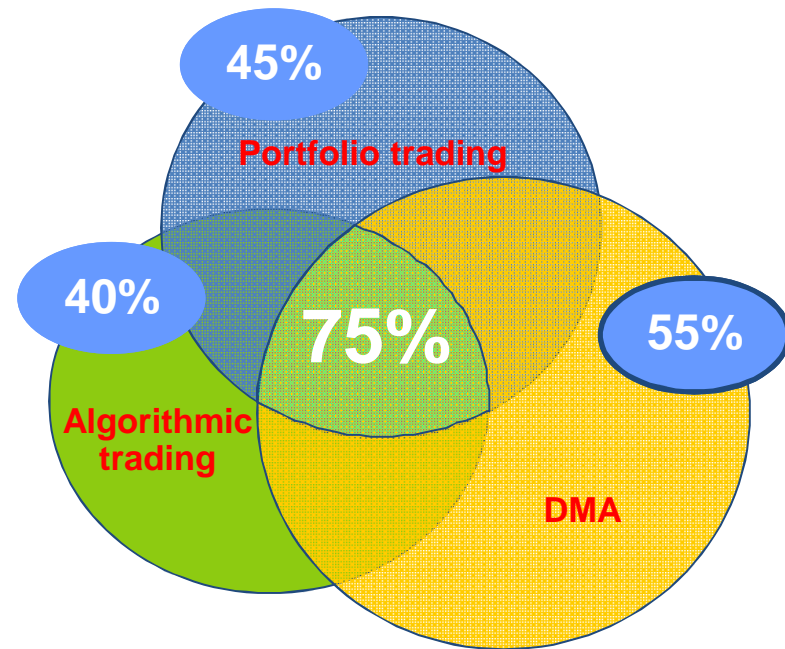
The Changing Equity Market - US Perspective

2005



55%

2007



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.



FIXGlobal

FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

How to Access – use GSAT as example

GS Electronic Trading



Vendor Systems

Direct FIX Connection

Portfolio Trading Desk

GS Sales Trading
Shares Trading Desk





FIXGlobal

FACE2FACE

Forum 2009

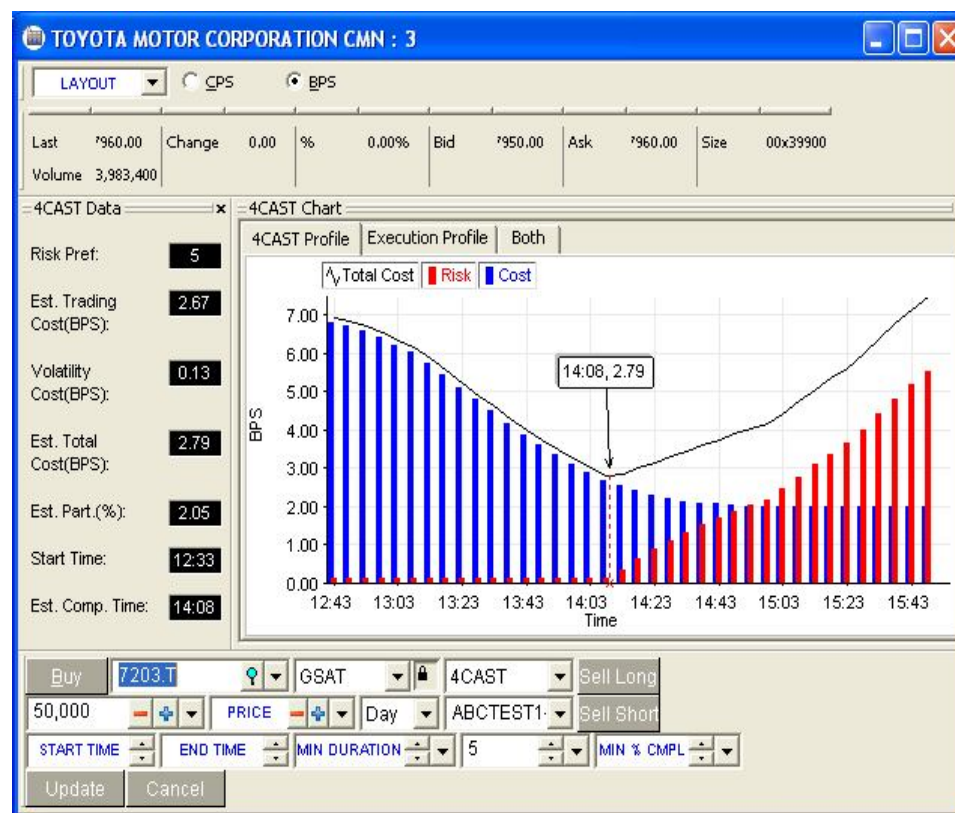
In support of

FIX PROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

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



FIXGlobal

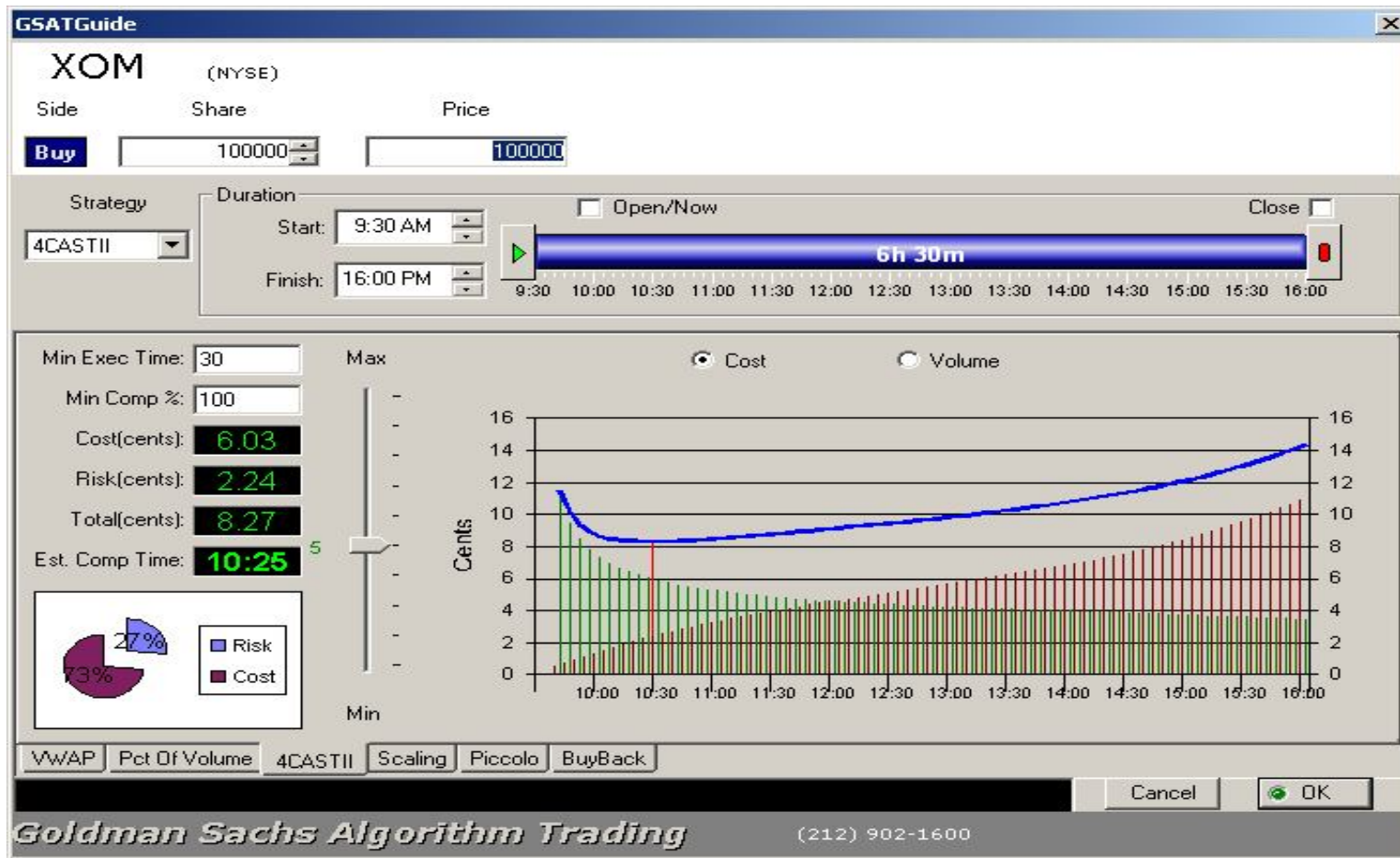
FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

Pre-Trade Analytic Tool: use GSAT as example





FIXGlobal

FACE2FACE

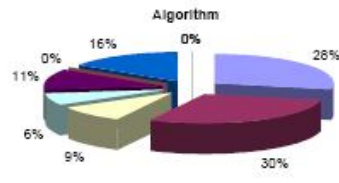
Forum 2009

In support of

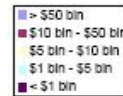
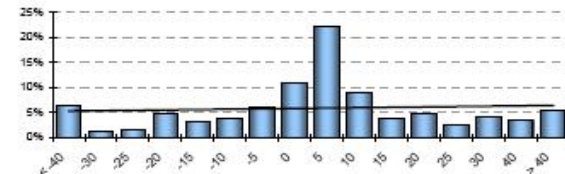
FIX PROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

Post-Trade Analytics Reports

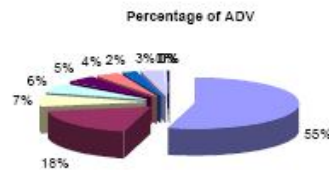
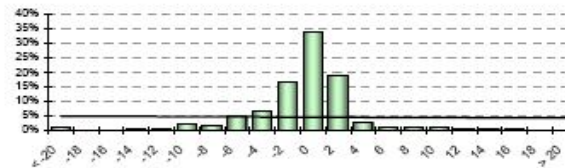
Example



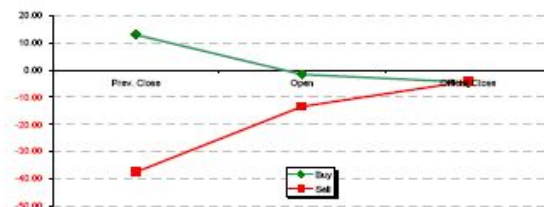
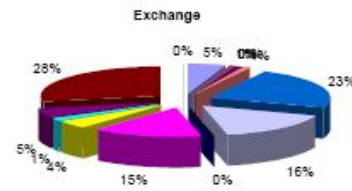
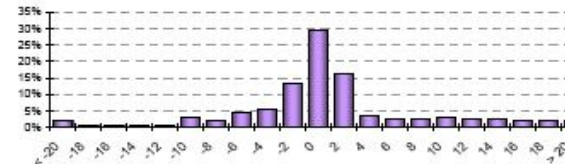
Distribution of Performance vs 'Touch'



Distribution of Performance vs 'VWAP'



Distribution of Performance vs 'Benchmark'



The above chart is for illustrative purpose only



FIXGlobal

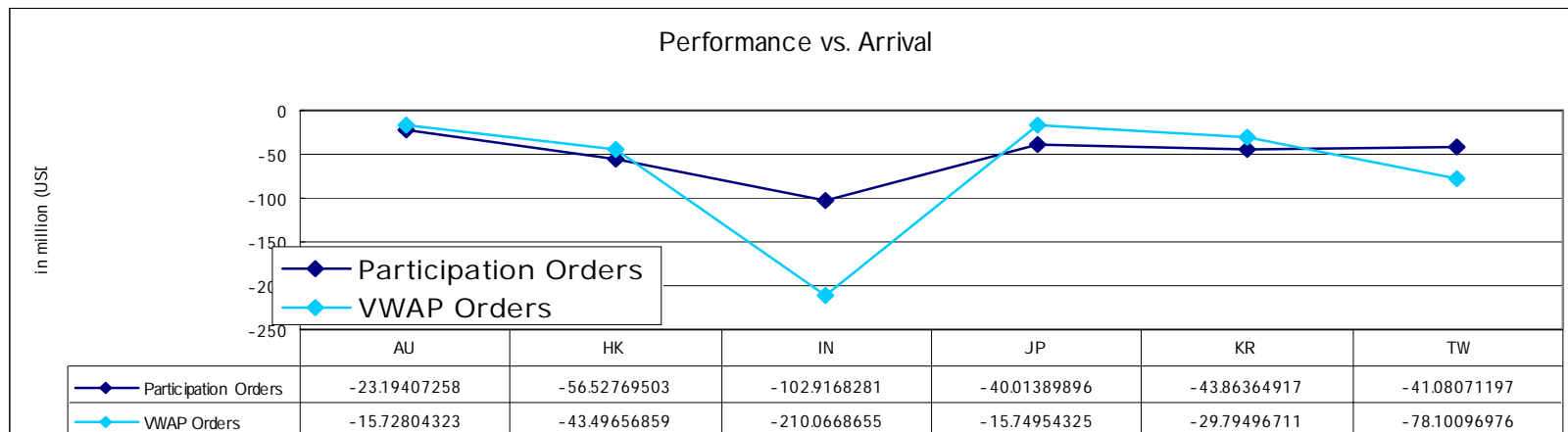
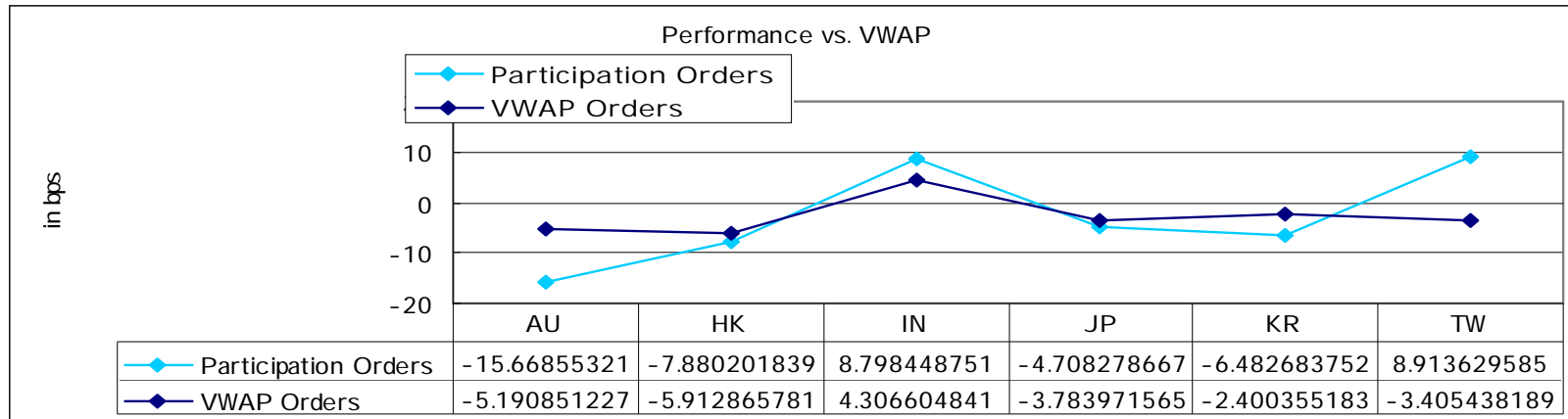
FACE2FACE

Forum 2009

In support of

FIX PROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

Average performance: use GSAT as example





FIXGlobal

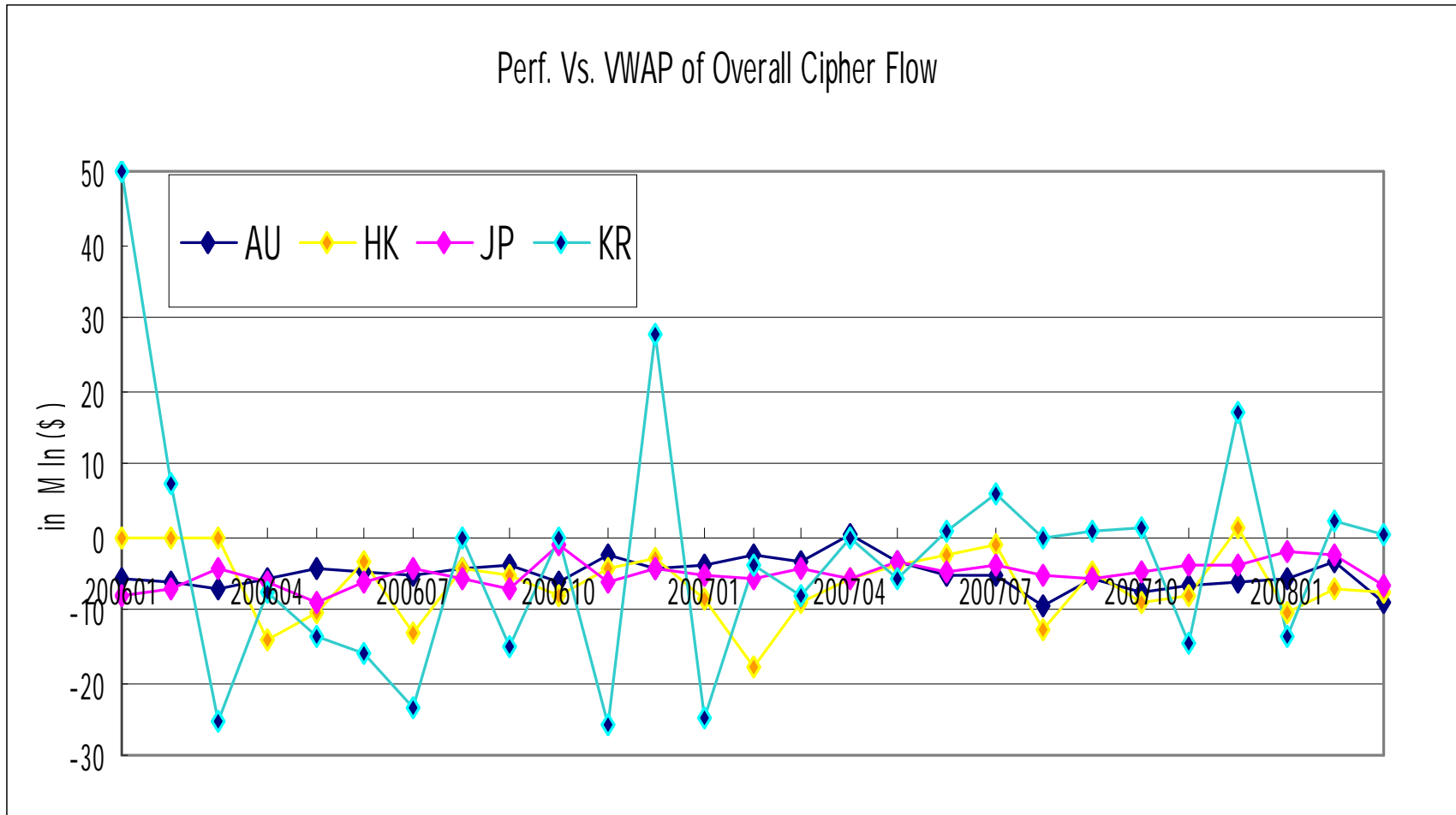
FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

Historical performance pattern: use GSAT as example





FIXGlobal

FACE2FACE

Forum 2009

In support of

FIX PROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

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

231 P324 lmbig EquityEMS

按 1<GO> 递送, 3<GO> 添加至交易记录, 4<GO> 人工递送

证券	买/卖	数量	在处理	已完成	未完成	平均价	种类	最新交易价	状态	经纪人	有效期
Add Order - Strategy Ticket - BANK OF CHINA-H - HKD											
经纪人	买/卖	数量	代码	限价	类型	时效					
GSDA	BY	100000	3988 HK Equity	3.580	LMT	DAY	<input type="checkbox"/> Odd Lots				
帐户	处理说明	执行指令	止损	本人/代理*	GTD						
	DMA	NHLD	0.000								
指令	Settle Date	CFD									
	04/10/08	否									
策略	Start	End	Max % Volume								
VWAP											
*仅限递送											
			递送		人工		添加		关闭		
证券	买/卖	有效期	经纪人	数量	在处理	已完成	状态	Lmtprc			

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.
 07-Apr-2008 13:38:05



FIXGlobal

FACE2FACE

Forum 2009

In support of

FIXPROTOCOL
INDUSTRY-DRIVEN MESSAGING STANDARDSM

Disclaimer

© Copyright 2009, The Goldman Sachs Group Inc. All rights reserved.

This material should not be construed as an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. We are not soliciting any action based on this material. This material is for the general information of clients of Goldman Sachs (Japan) Ltd. It does not take into account the particular investment objectives, financial situations, or needs of individual clients. Before acting on any advice or recommendation in this material, clients should consider whether it is suitable for their particular circumstances and, if necessary, seek professional advice. Certain transactions, including those involving futures, options, and high-yield securities, give rise to substantial risk and are not suitable for all investors. The material is based on information that we consider reliable, but we do not represent that it is accurate or complete, and it should not be relied on as such. Opinions expressed are our current opinions as of the date appearing on this material only. We and our affiliates, officers, managing directors, partners, employees, including persons involved in the preparation or issuance of this material may, from time to time, have long or short positions in, and buy or sell, the securities, or derivatives (including options) thereof, of companies mentioned herein. No part of this material may be (i) copied, photocopied, or duplicated in any form by any means or (ii) redistributed without Goldman Sachs (Japan) Ltd.'s prior written consent. All information herein assumes execution services under normal market conditions and normal system operations. Non-normal market conditions include, but are not limited to: locked and crossed markets, fast or volatile markets, periods of order imbalances, periods of halted trading, periods of unusually wide spreads, and periods of time affected by a communications or systems outage. Goldman Sachs (Japan) Ltd. and its affiliates reserve the right at their sole discretion to reduce, modify, suspend or cancel any of their order handling protocol, including but not limited to, automated price improvement and automatic execution, without notice on a stock by stock or on a client by client basis.

