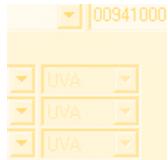
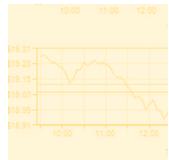




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May	26.25	UVA
May	27.50	UVA
May	30.00	UVA
May	32.50	UVA



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## Goldman Sachs' Liquidity Strategy: **Seek, Route, Cross**

The size and depth of our liquidity pool, as well as our ability to aggregate liquidity from displayed and non-displayed sources, help our clients achieve optimal results. Through our GSAT liquidity-seeking algorithms, our SIGMA smart router, and our SIGMA X crossing network, we offer the opportunity to achieve price improvement with minimal market impact. The three features of Seek, Route, and Cross form the pillars of our liquidity strategy.

### Seek liquidity using our suite of GSAT Algorithms



Our sophisticated suite of multi-asset GSAT algorithms are designed to provide superior execution quality. Specifically, our Sonar algorithm seeks liquidity by searching multiple sources of displayed and non-displayed liquidity, executing orders using optimal order types. Furthermore, we have enhanced our algorithms to expose portions of orders in SIGMA X on the way to the public market.

### Route to all destinations using our SIGMA Smart Router



Our SIGMA smart routing engine routes to various pools of displayed liquidity and interacts with SIGMA X non-displayed liquidity before accessing the public markets. Every day over 225mm shares pass through our smart router.

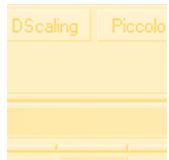
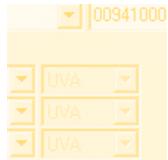
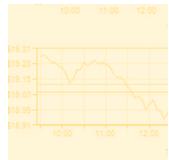
### Cross your order with non-displayed liquidity in SIGMA X



SIGMA X started out by bringing together a host of complementary external liquidity providers (XLP's) to create a virtual pool of private liquidity. The next generation of SIGMA X provides a safe destination for customer orders, allowing users access to an unrivaled pool of non-displayed liquidity. This allows customers to not only take liquidity from non-displayed sources but also benefit from the 450+mm shares of streaming liquidity that flow through our infrastructure every day.



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## Access Points for **SIGMA X**

**1. GSAT:** All of our equity algorithmic orders take advantage of SIGMA X.

**2. SIGMA:** By routing orders to our SIGMA smart order router you automatically have the opportunity to interact with SIGMA X.

**3. REDIPlus:** Firm orders may be sent directly to SIGMA X via REDIPlus. These orders can be sent by any of our execution tools including Portfolio Trader for baskets of names. REDIPlus tickets users may also passively post tickets to SIGMA X, allowing customers to rest shares that can automatically be removed and sent to the public market at their convenience.

**4. FIX:** Route orders to GSAT, SIGMA, or SIGMA X out of your Order Management System, or from another provider's EMS.

### SIGMA X Firm Orders and Tickets Posting:

- Allow your order to take advantage of pass-through liquidity and block-level matches within SIGMA X, until you route shares directly to the marketplace.

#### How it works:

- SIGMA X allows users to post orders at explicit or relative prices
- Liquidity providers are given full-spread price improvement as their eligible orders interact with the system's 225+ mm shares of daily pass-through flow

#### Parameters:

- Minimum Quantity (MXQ):** this parameter allows users to create their own anti-gaming thresholds. A low MXQ allows users to take full advantage of all streaming liquidity, while a high one assures you will participate in block-level matches only
- Minimum Discretion Quantity (MDQ):** this offers the opportunity to create posted orders that are willing to pay up (or sell down) to another price level if a certain number of shares can be guaranteed. For example, you may choose to peg to the NBBO bid for any execution size, but are also willing to pay up to the mid if your entire order can be executed.

#### Order Types:

**Peg** order type lets you peg your order to a relative price (Bid, Mid, or Ask) within the SIGMA X ATS.

**Limit** order type posts your order within the SIGMA X ATS at an explicit price.

**Ping** order type allows you to hit the SIGMA X ATS, in an IOC fashion, for your given execution parameters.

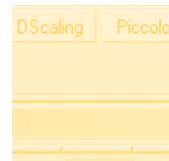
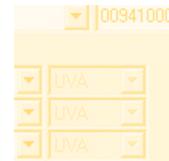
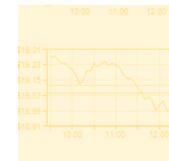
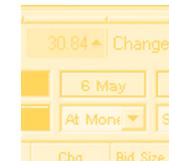
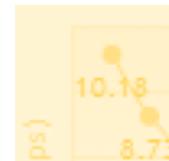
#### Order Matching Priority (provided minimum volume thresholds are met):

- Price
- Time

\*We always adhere to the Reg NMS interpretation of the NBBO with respect to slow and fast markets



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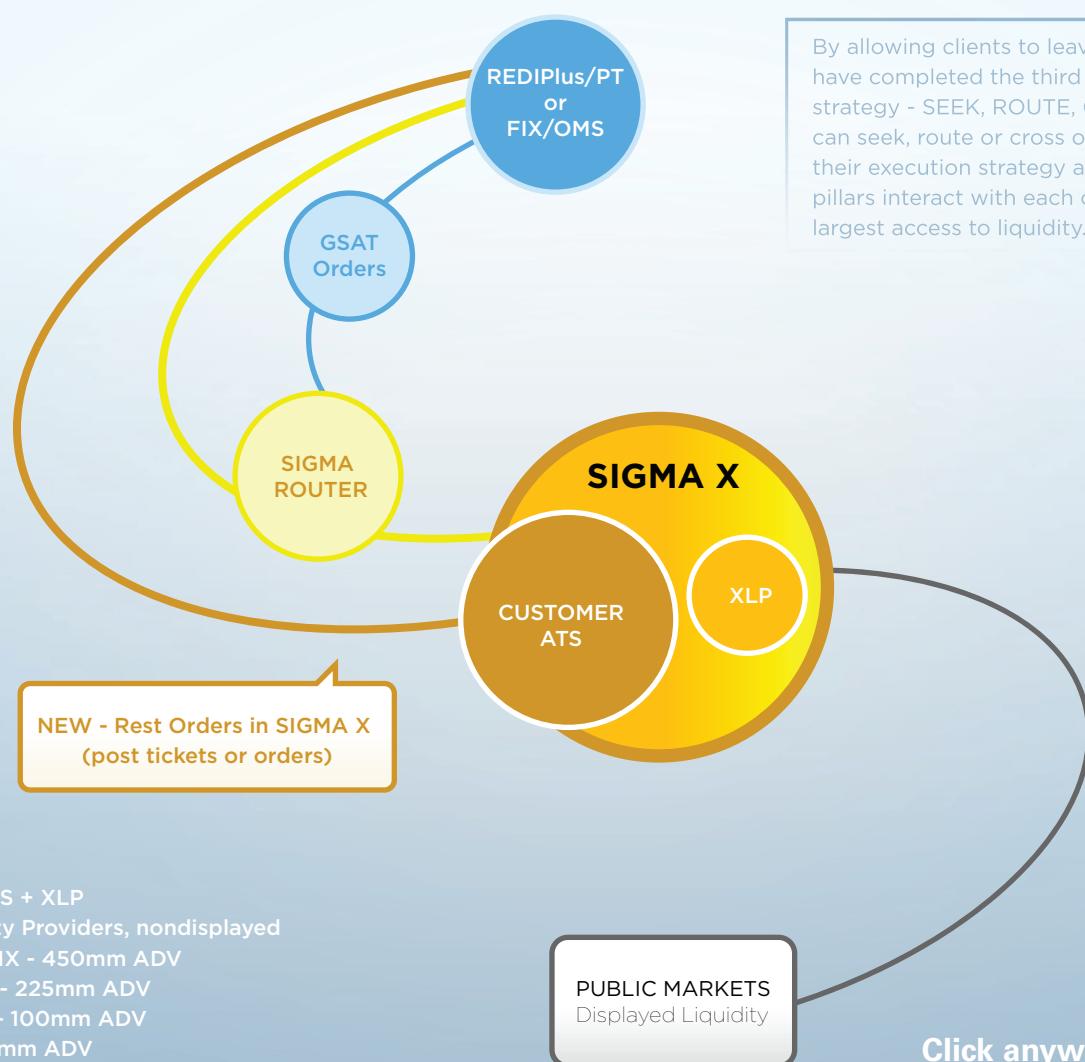
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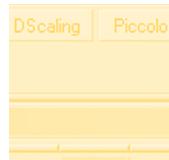
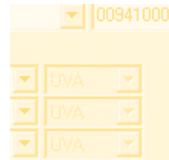
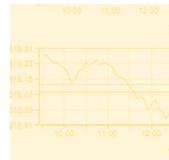
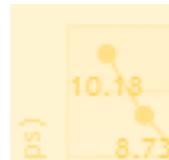
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By allowing clients to leave resting orders, we have completed the third pillar of our liquidity strategy - SEEK, ROUTE, CROSS whereby clients can seek, route or cross orders depending on their execution strategy and objective. All 3 pillars interact with each other to ensure the largest access to liquidity.



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## SIGMA X: The Numbers

Average daily volume of GSEC electronic trading (REDIPlus & FIX): 450 mm shares

Average daily volume of our SIGMA router: 225 mm shares

Average daily volume of GSAT orders: 100 mm shares

Average daily crossing volume in SIGMA X: 40 mm shares

Percent large cap names: 53%

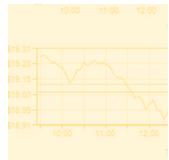
Percent small and mid cap names: 47%

Average daily number of unique symbols with executions: 2,837

SIGMA X Customer ATS Latency: less than 1 millisecond



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## Frequently Asked Questions

Why should I use SIGMA X when there are so many other alternative trading systems out there?

- As the #1 broker by volume on the NYSE and NASDAQ, Goldman Sachs offers our clients more access to liquidity than any other provider. SIGMA X offers clients the ability to interact with streaming liquidity, external liquidity providers (XLPs), and block-level customer flow, providing the opportunity maximize price improvement while minimizing market impact.
- SIGMA X is fully integrated with our SIGMA smart router and our GSAT algorithms, allowing you the benefits of non-displayed liquidity access without having to change your workflow. With the addition of SIGMA X ticket posting, you can leave resting orders in SIGMA X while you continue to work your order in the public markets.
- Unique order parameters like minimum discretion quantity and relative discretion make SIGMA X posting a sophisticated way to reach non-displayed liquidity.
- We also offer clients real time and post trade analytics, allowing you to thoroughly evaluate translation cost analysis.

How do I know my order won't be "gamed" in SIGMA X?

- SIGMA X is a completely anonymous pool, so there is no way to know who is on the other side of a trade. All orders placed in SIGMA X are firm orders, so users can't back away from an order. Additionally, with the ability to specify a minimum fill quantity, customers have the ability to interact only with block level flow.
- Goldman Sachs further separates electronic customer flow from "upstairs" flow by maintaining two separate broker dealers. All SIGMA X flow is executed under our electronic agency-only broker dealer, Goldman Sachs Execution and Clearing LP, while "upstairs" trading takes place at Goldman Sachs & Co.

Who are the External Liquidity Providers in SIGMA X?

- SIGMA X liquidity is comprised of customer flow, electronic market makers, and other alternative trading systems. We think of it this way: SIGMA X = ATS (customer orders) + XLP (external liquidity providers)
- External Liquidity Providers include ATD, Knight, Liquidnet H2O, NYFIX Millennium, and Goldman Sachs. We are actively pursuing relationships with additional XLPs as well.

Where can I go for additional information?

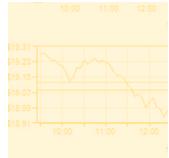
- Please contact your electronic trading sales or coverage rep. Additionally, you can refer to our website at [www.gs.com/electronictrading](http://www.gs.com/electronictrading) or email us at [gsecnews@gs.com](mailto:gsecnews@gs.com).



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May	32.50	UVA



30.84	▲ Change
6 May	
At Month	▼ Share
Chg	Bid Size



00941000	▼
UVA	▼
UVA	▼

DScaling	Piccolo
UVA	▼

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