

# PERFORMANCE INTEGRITY CONTROLS

Practical Considerations and Uses of Data

North American Performance Measurement Forum

Nashville, TN  
May 26<sup>th</sup> , 27<sup>th</sup> 2022

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1

## Performance Department

Bears Very Important Responsibility

Crucial to the reputation of the firm

- Calculate , Publish & Explain returns of clients' portfolios
- Task:
  - Complex
  - Requires a ton of work
  - Last line of defense before numbers go out to clients
  - No mistake is allowed



2

# What makes the job so difficult ?

- Rely on a sheer volume of data to be
  - accurate, complete and current
- Data that
  - Do not control
  - Produced outside of your department & organization
  - Come from disparate systems
    - Not particularly designed to feed Performance Measurement applications
- Process error prone by nature



3

## A Sea of Data

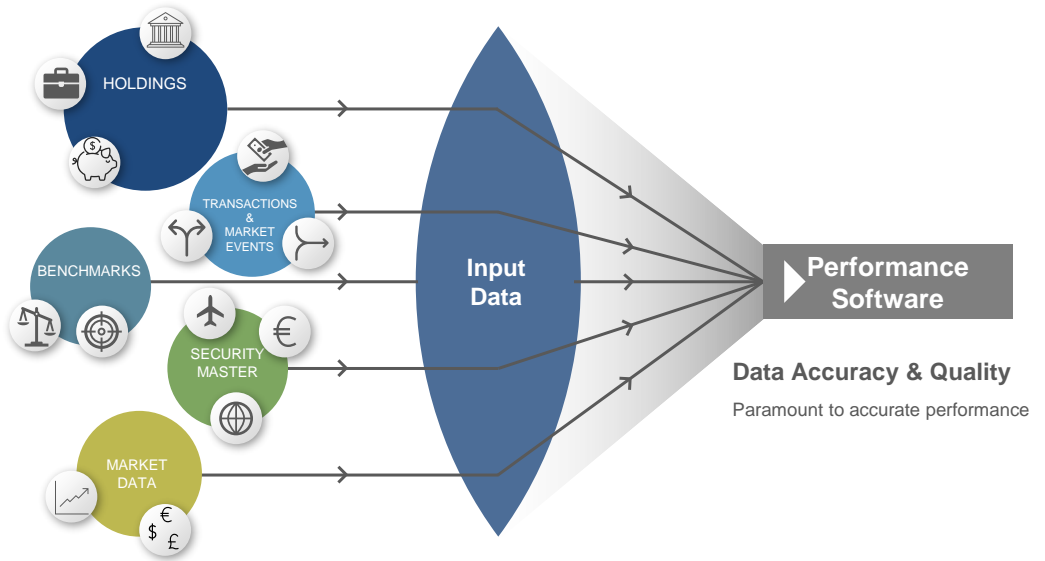


Samuel Taylor Coleridge  
(1772 - 1834)

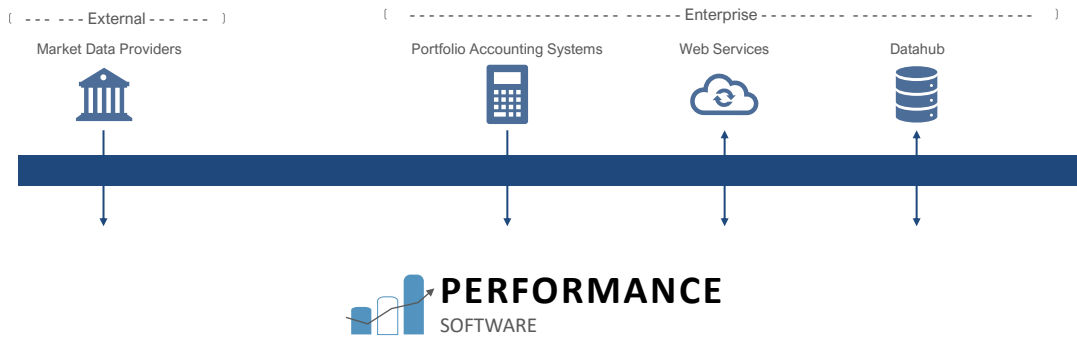


4

# Data, data everywhere



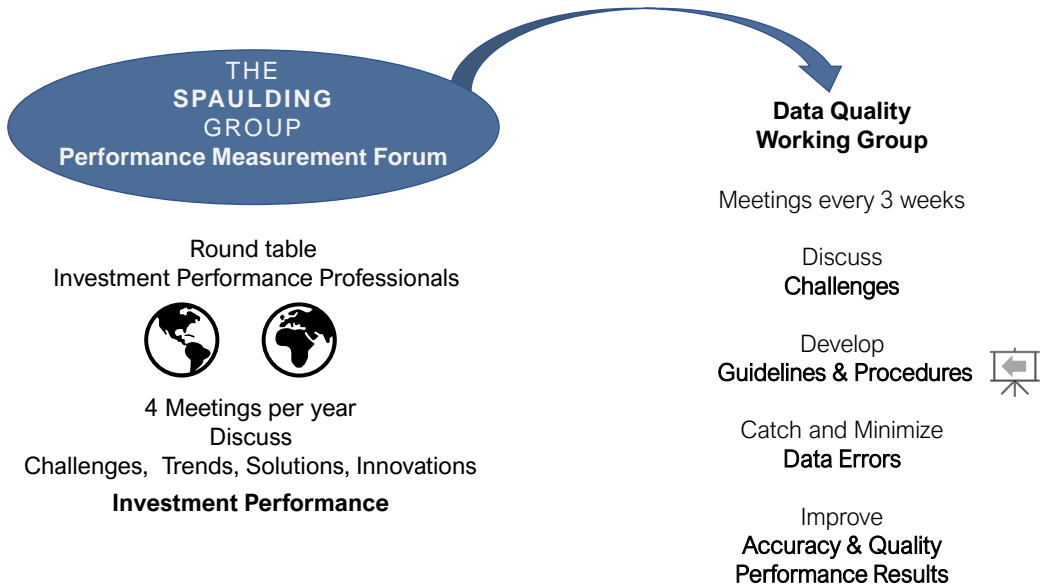
5



- Formats**
- ✓ Flat files : csv, pipe |
  - ✓ Direct Database
  - ✓ <XML>, JSON
  - ✓ Datahub



6



7

# PROPOSE GUIDELINE & PROCEDURES

Survey audience

We' like to get you opinion.

**Ask if propose guideline is..**

**Worth doing ?**

Yes or No

**Reasonably feasible?**

Yes or No



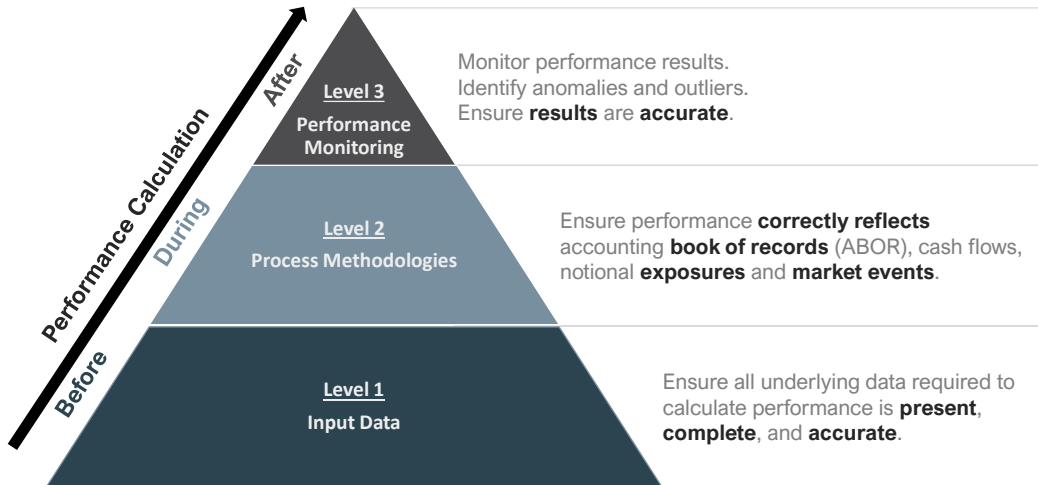
Yes No



8

# DATA VALIDATION

## Process



9

# POSITIONS

## Evaluation days

Ensure	Outcome	How
<ul style="list-style-type: none"> <li>Position files exist for all required days.</li> </ul>	<ul style="list-style-type: none"> <li>Affects day weighting of cash flows and transactions.</li> </ul>	<ul style="list-style-type: none"> <li>Build array-like report highlighting missing periods.</li> </ul>

Count of AT	Column Labels	3-Feb	4-Feb	5-Feb	6-Feb	7-Feb	10-Feb	11-Feb	12-Feb	13-Feb	14-Feb	17-Feb	18-Feb	19-Feb	20-Feb	21-Feb	24-Feb	25-Feb	26-Feb
DEX22006		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26036		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26037		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26038		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26039		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26039-SML		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26041		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26042		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26043		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26044		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26045		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX26183		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29095		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29096		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29097		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29098		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29099		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29100		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29101		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DEX29105		22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
H440		23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
J544H		23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grand Total		486	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22

### Considerations

- ❖ Frequency
- ❖ Weekend
- ❖ Weekend on a month-end
- ❖ Holidays

Is worth doing?  
Seems feasible?



10

# POSITIONS

## Total Portfolio Value vs Security Level Values

Ensure	Outcome	How
<ul style="list-style-type: none"> <li>Market value total portfolio = sum of securities market values</li> </ul>	<ul style="list-style-type: none"> <li>Incorrect evaluations</li> <li>Incorrect Performance</li> <li>Attribution residual</li> </ul>	<ul style="list-style-type: none"> <li>✓ Provide security level positions.</li> <li>✓ Sum up market values.</li> </ul>

### Considerations

- Does performance application expect market values to be provided at the total portfolio level?
- Or does it always sum it from security level positions?



Is worth doing ?  
Seems feasible?



11

# POSITIONS

## Accrued Income

When a bond is sold out, the accrued income of the transaction is calculated up to the settlement date. Some portfolio accounting system shows negative accrued income in their holdings file to represent the interest that has accrued until the settlement date.

Ensure	Outcome	How
<ul style="list-style-type: none"> <li>Accrued income on trade date basis.</li> </ul>	<ul style="list-style-type: none"> <li>GIPS requirement</li> </ul>	<ul style="list-style-type: none"> <li>✓ Distinguish accrued income from market values in input file.</li> </ul>
<ul style="list-style-type: none"> <li>Accrued income on closed positions continues until settlement.</li> </ul>	<ul style="list-style-type: none"> <li>Return not calculable at security level</li> </ul>	<ul style="list-style-type: none"> <li>✓ Calculates contribution and \$ Earned.</li> <li>✓ Return not reported when only income.</li> </ul>

Sec Id	Issuer	Issue	Invested First	Invested Last	Units Begin	Units End	Begin Market Value	End Market Value	Cash Flows	\$ Earned	TW Contribution	Time Weighted Return
063692CC6	BANK OF MONTREAL	3.32 JUN 01 26	1-May-20	1-May-20	35,000,000	20,000,000	35,976,108	20,554,258	-15,420,294	-1,557	-0.00003%	-0.00%
063692CC6	BANK OF MONTREAL	3.32 JUN 01 26	2-May-20	4-May-20	20,000,000	10,000,000	20,554,258	10,277,603	-10,277,305	651	0.00001%	0.00%
063692CC6	BANK OF MONTREAL	3.32 JUN 01 26	5-May-20	5-May-20	10,000,000	10,000,000	10,277,603	10,279,386	-	1,784	0.00004%	0.02%
063692CC6	BANK OF MONTREAL	3.32 JUN 01 26	6-May-20	6-May-20	10,000,000	-	10,279,386	-1,819	-10,284,025	-2,819	0.00006%	-0.03%
063692CC6	BANK OF MONTREAL	3.32 JUN 01 26	7-May-20	7-May-20	-	-	-1,819	-910	-	910	0.00002%	-
063692CC6	BANK OF MONTREAL	3.32 JUN 01 26	8-May-20	8-May-20	-	-	-910	-	-	910	0.00002%	-

Accrued Interest Only

-100%

Is worth doing ?  
Seems feasible?



12

# TRANSACTIONS

## Transaction Code Mapping

Thousands of transaction codes translate to a handful of performance transaction flows. New codes can be introduced anytime.

Ensure	How
<ul style="list-style-type: none"> <li>All transaction codes are correctly mapped.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Monitor and identifying new transactions codes.</li> <li>✓ Soft map transaction codes, so no software modification required.</li> </ul>



Is worth doing ?  
Seems feasible?



13

# TRANSACTIONS

## Reconcile with positions

It's possible that the transactions and positions files be out of sync if extracted from the portfolio accounting system at different times

Ensure	How
<ul style="list-style-type: none"> <li>Holdings positions are in sync with transactions.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Reconcile the positions at end of day against positions of previous day plus transactions during the day.</li> </ul>

$$Share^{Today} = Share^{Yesterday} \pm Transactions$$



Is worth doing ?  
Seems feasible?



14

# TRANSACTIONS

## Reconcile with Cash Positions

Reconciling cash balances is also a good way to ensure positions are in sync with the transactions.

Ensure	How
<ul style="list-style-type: none"> <li>Cash balance positions are in sync with transactions.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Reconcile cash balances (per settlement currencies) at end of day against previous day plus the transactions of the day.</li> </ul>

$$Cash_{USD}^{Today} = Cash_{USD}^{Yesterday} \pm Transactions$$



Is worth doing ?  
Seems feasible?



15

# TRANSACTIONS

## Reconcile Variation Margins of Futures Positions

Reconciling variation margin is a good way to ensure futures positions are in sync with the transactions.

Ensure	How
<ul style="list-style-type: none"> <li>Futures positions and variation margins are in sync P&amp;L that are marked-to-market daily.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Reconcile margin balances at the end of each day = variation margin balances of the previous day +/- the futures P&amp;L of the day</li> </ul>

$$Margin_{USD}^{Today} = Margin_{USD}^{Yesterday} \pm FuturesP\&L$$

Portfolio	Begin Date	End Date	Security Id	Issuer	CHECK	Begin Value	FLOW	Ending Value	Difference
PF1	1/1/2022	1/3/2022	CASHCA	CASH - CA	LocalCashFlow	338,991.44	-	83,507.90	(255,483.54)
PF1	1/1/2022	1/3/2022	880789AD4	TERANET INC	UnitCount	4,476,607.00	-	4,478,211.00	1,604.00
PF1	1/5/2022	1/5/2022	MARGINCA	CASH MARGIN	LocalCashFlow	2,018,641.54	(697,500.00)	1,320,652.12	(489.42)



Is worth doing ?  
Seems feasible?



16



# TRANSACTIONS

## Corrections

Transactions are most likely to be corrected between their trade and settlement dates but can occur later before the month is closed.

Ensure	How
<ul style="list-style-type: none"> <li>All transaction corrections are reflected in the performance results.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Reloading systematically holdings and transactions for the past 3 days.</li> <li>✓ At month end, when the portfolio accounting books are closed, reload holdings and transactions for every day of the month.</li> <li>✓ Then close performance records</li> </ul>
<ul style="list-style-type: none"> <li>Back dated correction are processed across all portfolios</li> </ul>	<ul style="list-style-type: none"> <li>✓ Record of backdated pricing adjustments and their impact on reported performance should be retained in accordance with regulatory requirements so that firms can substantiate all reported performance. This may take the form of an audit trail.</li> </ul>

### Other considerations

- Closed periods
- Transaction correction with effective date

Is worth doing ?  
Seems feasible?



17

# TRANSACTIONS

## External Cash flow timing assumption

Timing of external cash flows have impact on return of portfolio.

External cash flows = exogenous; originating from outside the portfolio. Cash Deposit / Withdrawal

Ensure	How
<ul style="list-style-type: none"> <li>Reflect when the money is available to invest.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Define rules to establish cash flow assumptions.</li> </ul>

	Deposit		Withdrawal	
	Begin	End	Begin	End
MV0	200	200	200	200
CF	100	100	-110	-110
MV1	330	330	110	110
Num	30	30	20	20
Beg/End Day	BOD	EOD	BOD	EOD
F	1	0	1	0
WCF	100	0	-110	0
Denom	300	200	90	200
ROR	10%	15%	22%	10%

Is worth doing ?  
Seems feasible?



18

# TRANSACTIONS

## Internal Cash flow timing assumption

Timing of internal cash flows have impact on return of the securities, sectors and asset classes. E.g. purchase and sales assumed at the begin vs end of day.

Ensure	How
<ul style="list-style-type: none"> <li>Reflect proper timing of transactions.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Purchase BOD, Sale EOD</li> <li>✓ Ensure net weighted flow = 0</li> </ul>

	Purchase		Sale		Purchase		Sale	
	Begin	End	Begin	End	Begin	End	Begin	End
MV0	0	0	100	100	100	100	200	200
CF	100	100	-110	-110	100	100	-220	-220
MV1	110	110	0	0	220	220	0	0
Num	10	10	10	10	20	20	20	20
F	1	0	1	0	1	0	1	0
WCF	100	0	-110	0	100	0	-220	0
Denom	100	0	-10	100	200	100	-20	200
ROR	10%	#DIV/0!	-100%	10%	10%	20%	-100%	10%
Contrib	2.0%	2.0%	2.0%	2.0%	4.0%	4.0%	4.0%	4.0%

Portfolio value = 500

-100%

Is worth doing ?  
Seems feasible?



# EXCHANGE RATES

## Positions & Transactions

Ensure	How
<ul style="list-style-type: none"> <li>Market values of foreign securities converted to home base currency at correct FX rate.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Load local (foreign) and base (home) values</li> <li>✓ Infer implicit FX rates.</li> </ul>
<ul style="list-style-type: none"> <li>FX rates consistent across portfolios.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Compare implicit FX rates across portfolios.</li> </ul>
<ul style="list-style-type: none"> <li>FX rates consistent across securities (within portfolio).</li> </ul>	<ul style="list-style-type: none"> <li>✓ Compare implicit FX rates across securities within portfolios.</li> </ul>
<ul style="list-style-type: none"> <li>FX rates consistent with benchmark</li> </ul>	<ul style="list-style-type: none"> <li>✓ Compare implicit FX rates against benchmark.</li> </ul>

### Considerations

- Multiple FX rate sources.
- Priority ranking
- Internal analysis / attribution

Is worth doing ?  
Seems feasible?



# SECURITY PRICING

## Consistent across portfolios

Ensure security prices	How
<ul style="list-style-type: none"> <li>Exist for all securities.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Inventory securities actively held in portfolios.</li> <li>✓ Validate prices exist for all securities (on any given day)</li> </ul>
<ul style="list-style-type: none"> <li>Exist on all business days</li> </ul>	<ul style="list-style-type: none"> <li>✓ Validate prices exist for all business days.</li> </ul>
<ul style="list-style-type: none"> <li>Reflect current market prices.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Validate security prices changed from day to day.</li> </ul>
<ul style="list-style-type: none"> <li>Consistent across portfolios</li> </ul>	<ul style="list-style-type: none"> <li>✓ Compare securities price across portfolios.</li> </ul>



Is worth doing ?  
Seems feasible?



21

# SECURITY PRICING

## Consistent vs Benchmarks

Ensure	How
<ul style="list-style-type: none"> <li>Security prices are consistent with benchmark</li> </ul>	<ul style="list-style-type: none"> <li>✓ Infer and compare security prices between portfolio and benchmark. Identify acceptable threshold.</li> </ul>
<ul style="list-style-type: none"> <li>Identify impact of different price sources between portfolio vs benchmark</li> </ul>	<ul style="list-style-type: none"> <li>✓ Calculate model portfolio using benchmark prices.</li> </ul>
<ul style="list-style-type: none"> <li>Support for multiple price sources</li> </ul>	<ul style="list-style-type: none"> <li>✓ Implement price sources hierarchy</li> </ul>



Is worth doing ?  
Seems feasible?



22

# PERFORMANCE MONITORING

## Identify Outliers

Comparing returns across accounts and benchmark is a good way to identify anomalies. Returns can be monitored at all levels such as total **portfolio**, **asset classes**, **sectors** and **securities**.

Ensure	How
<ul style="list-style-type: none"> <li>▪ Accounts performance consistent               <ul style="list-style-type: none"> <li>○ Peer accounts</li> <li>○ Benchmark</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>✓ Identify outliers in peer accounts (Composites)</li> <li>✓ Performance attribution against               <ul style="list-style-type: none"> <li>○ Other accounts</li> <li>○ Model account</li> <li>○ Benchmark</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>▪ Securities performance consistent               <ul style="list-style-type: none"> <li>○ Peer accounts</li> <li>○ Benchmark</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>✓ Identify security level return outliers across peer accounts.</li> <li>✓ Security Level Attribution against               <ul style="list-style-type: none"> <li>○ Other accounts</li> <li>○ Model account</li> <li>○ Benchmark</li> </ul> </li> <li>✓ Isolate pricing source difference from security selection.</li> </ul>

**Is worth doing ?**  
**Seems feasible?**



23

## OTHER TOPICS DISCUSSED

Topic	Ensure
<ul style="list-style-type: none"> <li>▪ Data file integrity</li> </ul>	<ul style="list-style-type: none"> <li>✓ Record counts actual versus declared (header/trailer record)</li> <li>✓ Actual date of records versus declared.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Contemporary data.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Verify dates of records are contemporary (recent) unless loading historical data.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Security classification</li> </ul>	<ul style="list-style-type: none"> <li>✓ E.g. sector change. Monitor security classifications</li> </ul>
<ul style="list-style-type: none"> <li>▪ Security master information</li> </ul>	<ul style="list-style-type: none"> <li>✓ Monitor 3<sup>rd</sup> party data metrics</li> </ul>
<ul style="list-style-type: none"> <li>▪ Derivative instruments               <ul style="list-style-type: none"> <li>○ Exchange trader, OTC's</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>✓ Notional exposure, marked-to-market, variation margins</li> <li>✓ Metrics: multiplier, price, delta</li> </ul>
<ul style="list-style-type: none"> <li>▪ Look-through</li> </ul>	<ul style="list-style-type: none"> <li>✓ Disclose exposures pooled funds, ETF, Futures</li> </ul>
<ul style="list-style-type: none"> <li>▪ Illiquid assets</li> </ul>	<ul style="list-style-type: none"> <li>✓ Ensure security prices are reflecting fair market values</li> </ul>
<ul style="list-style-type: none"> <li>▪ Private equities, Real assets</li> </ul>	<ul style="list-style-type: none"> <li>✓ 3 months lag evaluation</li> </ul>



24

THE  
SPAULDING  
GROUP  
Data Quality Working Group

**We're still working on it!**

And we welcome your

**Suggestions and Comments**

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