Solution Guide

OPTIMIZATION USE CASE COMPENDIUM

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HIGHLIGHTS

Aladdin's proprietary optimizer, blkops, can now be widely accessed across three main Aladdin applications: Portfolio Construction (PfC), Explore and PortfolioRiskTools (PRT). This use case compendium details the list of common use cases which the client community leverages optimization on Aladdin for, and describes how to implement them across the relevant applications. The goal of this compendium is to act as a starting point for users who are new to Aladdin Optimization, or are looking to expand their usage of optimization for more investment workflows.

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Introduction

Aladdin's proprietary optimizer, blkops, can be accessed across three main Aladdin applications: Portfolio Construction (PfC), Explore, and PortfolioRiskTools (PRT). Each of these applications serves a different purpose and offers unique advantages in the optimization process.

To help users better understand Aladdin's optimization capabilities across these applications, this compendium serves as a compilation of common optimization use cases adopted by the Aladdin client community. This compendium provides users with an understanding of how they can leverage Aladdin's optimization capabilities. Once a user has identified a use case that they wish to integrate into their workflow, they can reference the respective application's user guide for more detailed steps on case setup and results validation.

Overview of Aladdin applications

Explore: Aladdin's portfolio analysis tool, using historical data (T-1 and before) for portfolio modeling, analysis, and reporting. Users can build reports showing exposures, analytics, and attribution in a single view, then generate an analysis through tabular and graphical formats. *Explore optimization is commonly used by active portfolio managers or risk and performance analysts* who conduct research on the factors affecting risk and return on their portfolios. This is because the nature of static data in Explore allows the tool to be nimble and offer a higher degree of customization (e.g., custom sectoring and custom calculated columns), and risk analytics as well as stress testing capabilities are more advanced compared to PfC.

Portfolio Construction (PfC): An intraday portfolio modelling tool, allowing users to view their portfolio's latest up-to-date exposures, layering on intraday activity like orders, trades, and new cash onto the start-of-day portfolio data. *PfC optimization is commonly used by index tracking portfolio managers, wealth managers, and active portfolio managers.* The key benefit of PfC lies in its ability to incorporate intraday data and its integration with the order execution process. Users can integrate information like portfolio substitutions, restrictions, corporate action impact, and tax lot data into the optimization process. They can also combine optimization with other investment workflows like equitization, FX hedging, etc. Proposed orders then run compliance before being posted to the dealing desk directly. PfC appeals to users who are more execution focused, with the intention to immediately implement the orders proposed by the optimizer.

Portfolio Risk Tools (PRT): An interactive tool for measuring portfolio risk and return based on a forwardlooking parametric model for Tracking Error, Stress Testing, Analytic VaR, and Historical VaR. PRT allows users to do more advanced risk and return analysis compared to in Explore. It is also the only tool on Aladdin that allows users to run both mean-variance and Black-Litterman optimization, although it uses an earlier version of the Aladdin optimizer. **PRT optimization is typically used by multi-asset managers or asset allocators** due to its unique capabilities for asset allocation workflows. A detailed description can be found in the 'Asset Allocation' section of this guide.

Key feature differentiators across the applications

	PfC	Explore	PRT
Returns and stress P&L in objective function		~	✓
Minimizing portfolio risk (on top of active risk)		✓	✓
Tax optimization	✓		
Upload alpha scores on the fly	✓		
Integration of custom scores/ research lists	✓	~	
Custom calculated columns		\checkmark	
Set soft constraints and relaxation controls	✓		✓
Asset allocation & Black-Litterman method			✓
Efficient frontier visualizations		\checkmark	✓
Posting orders proposed by optimizer	~		



Use Case Catalogue

Minimize Active Risk

Minimizing active risk is one of the most common objectives in optimization. This is particularly popular amongst managers who track an index and have a mandate to reduce tracking error against the benchmark. In Aladdin's optimization capabilities, overall active risk can be minimized via reduction of idiosyncratic risk, systematic risk, or a combination of both. Systematic risk is risk that is prevalent throughout the market, while idiosyncratic risk is the volatility component of a security which cannot be explained by systematic factors.

When choosing risk minimization as part of the objective, users can define a risk aversion constant for each of the risk variables they have selected. This is indicated in the respective objective function variable columns in PfC, and in the 'Weight' column in Explore. This value is measured against the values for other objective function variables and drives how much the optimizer should seek to minimize risk compared to the other variables. For example, if Systematic Risk & Idiosyncratic Risk are set to 1 and Transaction Cost (TCost) is set to 0.5, the user is seeking to reduce Systematic Risk and Idiosyncratic risk twice as much as they want to reduce TCost.

PfC Optimization Module – Details Tab

D	etails	General Bounds	Issuer Threshold	Factor	Bounds	Tax Lots	Subs
	€ €	ξ Q < → Objec	ctive Function Varial	oles	- ¢	▼ 1 Items	;
		Case Systematic Risk	Case Idiosy	ncratic Risk	Ca	ase Transa Cost Pe	ction nalty
		1.00		1.00			0.50

Explore Optimization Module – Objectives Tab



After the optimization algorithm returns results, users can compare the active risk of the portfolio with the initial value. This can be viewed in PfC's Portfolio Summary View, and in the Risk and Exposure widget in Explore. Note that users need to utilize the 'Compare' feature in order to compare the before and after risk values side-by-side in Explore.

Portfolio Summary View							
፱ ල ල < → ⊠ መ ጭ 🗘 ▼ 1 ltems							
Portfolio	NAV	Active Risk	New Active Risk				
BRS-EQ-JP1	JPY 28,696,237,740,485	1,371	537				

Risk and exposure	⊞⊥C¢⊀>			
	%		Active Risk Contribution	
Security Description	PKTEST	What-if PKTEST 4	PKTEST	What-if PKTEST 4
✓ Compare	100.0%	100.0%	1,270	496
V Fixed Income	50.0%	100.0%	691	0
V Tixed meonie	50.0%	100.0%	071	U
1MDB GLOBAL INVESTMENTS LTD	50.0%	0.2%	2	0

Alpha Maximization

Alpha in Aladdin Optimization is very flexibly defined. It can be viewed as a variable (other than risk and TCost) that users want to maximize (or minimize) as part of the optimization process. Some common examples are maximizing portfolio yield in fixed income portfolios or maximizing a projected profitability score calculated from fundamental equity data for equity portfolios. Alpha maximization is typically used in conjunction with other objective function variables like risk and TCost in the optimization process.

Users can define the alpha term by choosing an existing metric in the tool, maintaining a list of alpha scores in Aladdin, or uploading / calculating alpha scores on the fly. Below is a summary of the alpha related features in PfC vs. Explore:

Tool	Use existing metric as Alpha	Use existing list values as Alpha	Load Alpha scores with Excel	Custom calculate Alpha score using existing metrics
PfC	✓	\checkmark	\checkmark	
Explore	✓	\checkmark		\checkmark

PfC Optimization Module – Details Tab

Details General Bounds Issuer Threshold Factor Bounds Tax Lots Subscriptions Output Reports

€ Q < > Object	ive Function Variables	🕶 🌣 🕶 1 Items	
Case Alpha Multiplier	Case Alpha Source Type	Case Alpha Source Name	Case Alpha Units
1.00	DHV Columns 🔹 👻	Yld	Bps
	DHV Columns Score Cards		

There are 4 main columns in PfC related to setting the Alpha for optimization:

- 1. **Alpha Multiplier**: Represents the coefficient of the Alpha variable and drives how much importance the optimizer places on maximizing Alpha compared to other variables (risk and TCost). To minimize alpha, use a negative integer value instead.
- 2. Alpha Source Type: Select 'DHV Columns' if the alpha is one of the existing PfC columns in Detailed Holdings View; select 'Score Cards' if the alpha will be a custom list that the user has loaded in Aladdin

Note that users intending to use custom lists need to load the list values in PfC prior to running the optimization. This can be done by clicking on the Retrieve Score Cards Data icon in the top toolbar:



- 3. Alpha Source Name: Returns the list of columns / list names available depending on the user's selection of the source type
- 4. Alpha Units: Set as bps by default, allows users to scale alpha values by the appropriate unit

Explore Optimization Module – Objectives Tab

Investment Universe	Objectives	Constraints		
Objective Function Expo	osure 🔿 Absol	ute 💿 Active		
Weight	(bjective		
☑ 1		Maximize Alpha Score	•	+ Add Column

Maximize Alpha Score Measures

Search	Q			Reorder 🔨 🗸	Cus	stom Calculation options Load	Save Cu
> Position			Custom Calculation	×	`	 Calculate expression/script 	
> Security						Measures	Add Measures
> Risk						No measures selected	
> Company Fundamentals		>				Formula 🕐	Clear Formula
> ESG						+ - x / equals	
> Research						comment if/else x ceiling	floor
Custom Calculation						Tound max min x-y	
						a+b	

In Explore, users can select 'Maximize Alpha Score' as an objective then click on 'Add Column' to choose the relevant metric. Custom lists can be selected from the 'Research' section of the set of available measures. Users can also select 'Custom calculation', which allows them to calculate a new metric using other existing columns in Explore.

Maximizing Alpha within allowable risk ceiling

Rather than maximizing alpha while minimizing risk as an optimization objective, some active portfolio managers prefer using optimization to maximize alpha within certain risk limits / budgets instead. This will involve setting the objective to only maximize alpha and setting a constraint on the active risk of the portfolio.

Required configurations in PfC

Coefficients for alpha will be 1.0 and 0 for everything else in the objective function

De	etails	General Bounds	Issuer Threshold	Factor Bound	ds Tax Lots	Subscriptions	Output Reports	
	⊕ Q < → Objective Function Variables ▼							
		Case Systematic Risk	Case Idiosy	ncratic Risk	Case Transa Cost Pe	action enalty	Case Alpha Multiplier	
		0.00)	0.00		0.00	1.00	

Max active risk target created in PfC's target set-up module and subscribed to the portfolio. Note that the risk ceiling is specified in the Upper Tolerance column

🕂 — 🕼 🕼 🌣 🕶 1 Items			Tar					
Target Category	▲Target	Measure	Value Type	Target Value	Lower Tolerance	Upper To <mark>lerance</mark>	Tolerance Type	Currency
PORTFOLIO	Total	Active Risk	Absolute	0.000	0.000	150.000	Absolute	

Case Use Max Active Risk set to 'Yes' in General Bounds tab, max active risk value will automatically populate in the optimization run window based on the target value set.

D	etails	General Bounds	Issuer Threshold	Factor Bounds	Tax Lots	1
	€	Q < > 🗘 🔫	1 Items			
	Case Active	Use Max e Risk	Pf Max Activ Ris	ve Case Enforce k ABS Upper	Issuer	
	Yes		150.0	00		

Required configurations in Explore

Only the maximize alpha objective is added to the objective function

Objec	ctive Function Exposure O Abs	solute 💿 Active			
	Weight	Objective			
~	1	Maximize Alpha Score	•	+	Yield to Maturity

Max active idiosyncratic risk / systematic risk / total risk constraint can be set in the Portfolio Constraints section of the Constraints tab

Investment Universe	Objectives Constr	raints									
Portfolio Constraints	Security Constraints	Sector Constra	aints	Factor Constrain	S						
Constraint measures		Cor	nstraint	Value		Unit		Lower Bound	Upper Bound	Relaxation	
Search	Q	Allo	ow Short sitions	No							
✓ Risk		Ma Tot	ximum A al Risk	ctive 150		bps					×
Beta vs Beno Maximum A	chmark ctive Idio Risk	Constraint o	otions								
Maximum A	ctive Systematic Risk	Constrain	t Maxim	um Active Total Ri	sk						
Maximum A	ctive Total Risk	Value									
> Long/Short		150			?						
> Trade											
> Positions		Unit	Unit								
		bps			•						
•	•										

TCost Minimization

Including transaction cost minimization as part of the objective function allows users to incorporate liquidity costs and considerations into their optimization process. This is typically used in conjunction with other objective function variables like risk and alpha, although users can also use TCost minimization with exposure constraints to replicate a benchmark / model portfolio's exposures with minimal trading costs.

The total TCost in Aladdin is calculated using the below formula, where FC = Fixed Cost; MI = Market Impact; BAS = Bid-Ask Spread. Full Trip T-Cost is converted to Half Trip T-Cost by multiplying by 0.5. γ is 0.5, while κ_1 and κ_2 are regression coefficients and varies across assets.¹

 $Econometric \ T-Cost = FC + MI = \kappa_1 * BAS + \kappa_2 * Risk * \left(\frac{Trade \ Notional}{Average \ Daily \ Volume} \ / \ Horizon\right)^{\gamma}$

¹ To find out more about liquidity analytics and Aladdin's transaction cost models, check out the 'Solution for Liquidity Risk' guidebook, as well as the transaction cost model white paper for various asset classes in the Aladdin literature library

PfC Optimization Module – Details Tab

D	etails	General Bou	unds	Issuer Threshold	Factor Bound	s Tax Lots	Subscriptions	Output Rep	0
	€	(Q < →	Objec	tive Function Varial	oles 🔻	🗘 🔻 1 Items	1		
		Case Transa Cost P	action enalty	Case TCost from PfC		Case Defau TCost (bps	lt Ca	ase Default ADV	
			1.00	Yes					

There are 4 main columns in PfC related to using TCost for optimization:

- 1. **Transaction Cost Penalty:** Represents the coefficient of the TCost variable and drives how much importance the optimizer places on minimizing TCost compared to other variables (risk and alpha).
- 2. **TCost from PfC**²: Instruct PfC to use the TCost data in the 'Standalone Fixed Cost' (bps) column for optimization. This column can be populated by clicking on the 'TC' icon in Detailed Holdings View to retrieve TCost data calculated by the BlackRock TCost model. Users can also manually override the values in this column, or bulk upload the values via Excel.



- 3. Default TCost specify a default TCost value for securities that do not have TCost data
- 4. Default ADV specify a default ADV value for securities that do not have ADV data

Explore Optimization Module - Objectives Tab

Investment Universe	Objectives	Constraints			
Objective Function Expo	osure 🔿 Abso	lute 💿 Active			
Weight	(Objective			
✓ 1		Minimize T-cost		•	×

Spend/Raise Cash

A common motivation for running optimization is to allocate subscriptions or choose an optimal set of securities to sell to raise cash for redemptions. This is typically implemented through specifying a budget which drives how much cash will be spent or raised through the optimization process. A negative budget will raise cash (for outflows) and a positive budget will spend cash (for inflows).

Required configurations in PfC

Optimization budget can only be set in the Run window, under the Budget column. Users can manually type in the budget amount before running the optimization. The budget can also be automatically populated in the below 3 scenarios:

- 1. If a user selects "Spend Equity Budget" in Portfolio Summary View or Cash Detail View, they will see a pre-calculated budget based on the fund's Spendable Cash target.
- 2. If a user models cash or have a new cash inflow/outflow and specifies All Assets as the core asset definition, the cash amount will be used as the optimization budget.

² Note that while this parameter only influences the Standalone Fixed Cost column, when running an optimization problem with TC ost, PfC sends standalone fixed cost, ADV and market impact coefficient to the optimizer to calculate linear Tcost and market impact Tcost.

3. If a user runs optimization from the Trade Flow window, the value in the 'Amount' column will be used as the optimization budget.

By default, PfC Optimization will propose trades in line with budget direction. This means that if a positive budget was specified, only buy trades will be proposed to spend the budget, vice versa for negative budget. If users would like to have both buy and sell trades (i.e. run a rebalance), they can change this behavior in the Case Transactions Allowed column. The budget constraint will then apply to the net cash impact of these transactions.

D	etails	General B	ounds Issu	uer Threshold Fact	or Bounds Tax Lots	Ou	tput Reports		🗸 Unse	ent (89) 🖡	Existing (0
	⊕ स	$\Theta \leftrightarrow$				F	Proposed	Orders	● \$ ○ %		
		~~~~					D(		Orders	Warnings 🕛	Complia < 💙
	Case Name	9	Portfolio	Budget	Case Transactions Allowed		Pr Currency		> ASSE > AC EN	ET WORLD CORF	P PCL ATION CORP
	BD EQ	Demo	AP_EQAPC1	1,000,000.00		-	USD		> ADAR	O ENERGY TBK	
					BUDGET_DIRECTIC BUY_AND_SELL_OI BUY_ONLY SELL_ONLY	)N NLY			ALIBA     ALIBA     Cash Impa     AP_EQ	ABA GROUP HOL act(USD) (APC1 : <mark>-1,000,00</mark>	DING LTD S S N N S S S S S S S S S S S S S

#### **Required configurations in Explore**

In the Portfolio Constraints section users can use the upper and lower bounds to define the optimization budget, as well as the unit of these values (\$ or %). The impact of the budget constraint will appear on the base currency's riskless cash CUSIPs. For example, the scenario below raises 2 million on the riskless USD cash CUSIP, increasing the cash position from 9,756 to 11,756 million.

#### **Portfolio Constraints**

Constraint	Value		Unit		Lower	Bound	Uppe	r Bound	Re	laxation
Allow Short Positions	No								fal	se
Budget			\$		-20000	00	-2000	0000	fal	se
				Market Value (m)				Market Value %		
			•			Optimized GLB-A	CTFI			
Security Description		CUSIP		GLB-A	CTFI (m)	(m)		GLB-AC	TFI	Optimized GLB-ACTFI
✓ Compare					200,795	2	00,795	100.0000	0%	100.00000%
V CASH					15,329		12,134	7.6340	1%	6.04275%
USD CASH(Alpl	ha Committed)	USD_CCA	SH		9,756		11,756	4.8587	0%	5.85475%

The optimizer can propose both buy and sell trades regardless of the budget – the budget simply sets a constraint on the *net cash impact* of all the proposed trades. If users would like to raise either only buy or sell trades, they can utilize the Buy Only or Sell Only constraints under the Portfolio Constraints section.

Edit

# **Optimization with Adjusted Universe**

All portfolio and benchmark holdings loaded into the given Aladdin application form part of the optimization universe by default. There are many cases, however, where users want to add more securities, remove securities, or set trading restrictions on some of the securities in their default universe. The sections below describe how these can be done.

#### **Expanding optimization universe**

Users may want to add non portfolio or benchmark securities into the optimization universe for various reasons such as including new high-conviction names into their portfolio or trading new bond issues / IPO securities.

#### **Required configurations in PfC**

New securities can be loaded into PfC via the Smartcut function, or by loading a trade list. The Smartcut is typically only used if there are very few securities to be added, or the user does not know the security identifier and needs to search for it via the Smartcut. Otherwise, users typically upload the list of securities via the Trade List function in PfC, which automatically loads the securities into the PfC session. All securities loaded into the PfC session will be included into the optimization universe by default.

✓ Ccy AUD ✓ Actions N	lone 🔻 🔡 Ro	und To	1.0 ▼ <b>G</b>	LT ESG	a ø ø sc ⊞	Trans Direction
Custom Actions - None						×
Select Assets	Securities Securit	ies/Positions				
<ul> <li>Trade List</li> </ul>	Add S 50	) (°	ex xe	* + -	A Search	Stop
Portfolio Positions		. 0				Stop
Benchmark Positions	Search Security	Asset Name	Asset Id	Sedol	Isin	Sec Type
Overweights	037833100	APPLE INC	037833100	2046251	US0378331005	EQUITY
	88160R101	TESLA INC	88160R101	B616C79	US88160R1014	EQUITY
Onderweights	02079K305	ALPHADET INC	020/98305	DIVISGU	USU20/9K3059	EQUITY

#### **Required configurations in Explore**

The optimization universe in Explore can be expanded in 2 ways:

1. Adding cash or securities to the What-if portfolio in the What-if Position Modeling screen. A single security or a list of securities which have already been set up in the environment can be added to the portfolio.

**Expert Tip:** users cannot run risk on the fly in Explore, so they need to add securities that already have risk data/ ran through overnight production in order to use them in optimization.

What-if Position Mo	deling					\$
View Details   Add	Cash Add Securities Optimiz	ze Model			C Reset C	omposition
		Notional Market	Value %	Market Value %		
Securities	Description	Original	Modified	Original	Modified	
✓ PKTEST		100.000	100.000	100.000	100.000	

2. Adding securities in the investment universe section of the optimization module in Explore. Users can add securities from a portfolio or upload a list of securities. Filters can also be leveraged to choose only a subset of securities from the added portfolio to be included in the universe.

Invest	tment Universe Objective	s Constraints			
					+ Add to Universe
	Туре	Universe	Filter	Label	
<b>~</b>	Portfolio	PKTEST	Filter Name	Portfolio	
			Z Edit Filter		
<b>~</b>	Benchmark	JACI_INX	Filter Name	Benchmark	
			Z Edit Filter		
<b>~</b>	Portfolio 🔹	Search Q	Filter Name	Portfolio 1	×
	Portfolio				
	Security		Z Edit Filter		

#### Reducing optimization universe

In some cases, users might want to exclude a set of securities from the optimization universe because they manage the portfolio in slices. For example, a portfolio manager who is managing only the equity portion of a multi-asset fund would want to exclude all non-equity securities from the optimization process.

#### Required configurations in PfC

There are two ways to exclude securities from the optimization universe in PfC: setting a core asset definition or using filters in the workspace.

1. **Core Asset definition** – This allows users to directly define the set of securities that should form the optimization universe. For example, if "Equity" is selected as the Core Asset definition, then the optimizer can invest only in equities and NAV will be equal to sum of market value of the equity assets + any optimization cash budget indicated by the user. Also, the risk which the optimizer is minimizing is the Core Asset active risk, which is displayed as Equity Active Risk in PfC's Detailed Holdings View.

Note that when using a Core Asset Definition, the "Use Core Asset MV as NAV" option should also be checked. This will recalculate all % columns in PfC using the Core Asset NAV and ensure alignment with the optimizer's calculations. The rules driving core asset definition are also not accessible by default but can be customized by clients. Clients must reach out to the Aladdin Client Engagement team to set up a new core asset definition to be used in PfC.

Use Core	Asset MV as NAV	Allow Selection of FX Import W	Vorksheet
Core Assets	All Assets 👻 F	tollup By Issuer	•
	Exclude CONSAR VaR Derivat.		
KRD Bucketing	All Assets		Inflation KRD Bucketing
KKD Bucketing	Exclude Cash & Deriv		innation KKD Bucketing
3M 1	Exclude Cash	5Y 20Y 25Y 30Y	3M 1Y 2Y 3Y
Sh	Equity Excl Warrant Fixed Income	Long	Short
Risk Display	Equity Excl ETF Equity		
💿 Default (			

2. **Workspace filters** – This approach filters out a defined set of securities to be loaded the PfC session. When workspace filters are applied, PfC refreshes and only loads a subset of the portfolio. As mentioned above, all securities loaded into the PfC session will be included into the optimization universe by default. In the same way, all securities *not loaded* into PfC will therefore automatically be excluded from optimization.

If users would like to filter securities by security group / type, they can leverage the Coverage section in View Options > Search Criteria tab. Any security type that is unchecked in this section will be filtered out from the portfolio.



Alternatively, if users have more complex filter requirements, they can leverage the filter feature on the PfC toolbar. Note that the filter option must first be added to the toolbar in View Options > Toolbars. Users can check out the PfC User Guide for more details on using this feature.

		Por	t/Bench Options	Order Manageme	nt Warnings	Aggregation	Look Through	Regulatory	Colors	Toolbars
			Available Option	is T	op Row Option	IS				
Filter	Issuer (family)  Issuer (immed) Security (family)	LT	Bench Level Sell for Gain/I Trade Impact	oss	Port Groups Bench Date					
w Qty ing Pf	Security Multi (family) Security (immed) Security Multi (immed) Strategy Currency Sector				Action Rounding Filter LT ESG Score Card					
	Ult. LEH Industry LEH Industry				Transx Direct Hedging	ion				

#### **Required configurations in Explore**

Within the investment universe section of the optimization module in Explore, users can apply filters to reduce the universe to a specified subset of securities in the portfolio or benchmark.

Inves	tment Universe	Objectives	Constraints	
	Туре		Universe	Filter
<b>~</b>	Portfolio		PKTEST	Filter Name
				▲ Edit Filter
<b>~</b>	Benchmark		JACI_INX	Filter Name
				<b></b> Edit Filter

#### **Restricting optimization's trading universe**

Users may want all the portfolio and benchmark positions to form part of the optimization universe, but do not want to trade some of them. For example, when optimizing against a benchmark, users may not want to trade any tobacco securities which are present in the benchmark because that is against their ESG mandate. Note that this is different from removing securities from the optimization universe, as securities which are removed will have their exposures completely ignored in the optimization process and the final output.

#### Required configurations in PfC

Users can restrict trading in 2 ways:

1. Locking restricted securities – Users can utilize the lock function in PfC views to lock individual securities or an entire sector of securities. A locked security or sector can be identified by the blue lock next to the security or sector name. All locked securities will automatically be included in a no-trade list to the optimizer.

	Pivot View				ti 🤉 🗆	Sector View (GICS Sector)				
QQOAR06009 <b>#\$</b>	•					Q Q O A A & & a a e T a	ICS	▼ GICS Sector		
							🔂 AP_E	QAPC1, MSACAX	JPU	
	Asset ID	ISIN	licker	Coupon	Legal Mat	Sort Pivot	New MV Active	New %MV Active	Active Contrib	
<ul> <li>Cash &amp; FX</li> <li>Cash &amp; Cash Equivalents</li> </ul>						✓ Cash & FX	8,998	0.03%		
APOLLO TYRES	S61689022	INE438A01	APOLLOTY			> Cash & Cash Equivalents	8.998	0.03%		
Ĝ ASCENDAS REAL ESTATE INVESTMEN	S65638751	SG1M7790	A17U			> Energy	396.747	1 21%		
BAIDU ADS REPTG INC CLASS A ADR	056752108	US0567521	BIDU			<ul> <li>Metaololo</li> </ul>	330,747	1.21%		
BANK OF THE PHILIPPINE ISLANDS	S60749686	PHY0967S	BPI			> Materials	-1,418,202	-4.32%		
BANK RAKYAT INDONESIA (PERSERO)	S67090993	D10001182	BBRI			Industrials	2,202,796	6.71%	i i i i i i i i i i i i i i i i i i i	
BEIJING CAPITAL INTERNATIONAL AIRP H	S62084223	CNE100000	694			> 🔒 Consumer Discretionary	-657.550	-2.00%		
BEIJING ENTERPRISES HOLDINGS LTD	S60816907	HK0392006	392			<ul> <li>Consumers Steplan</li> </ul>	0(0.077	0.000		
CASTROL INDIA LTD	SBKS8B795	INE172A01	CASTROLIND			> Consumer Staples	263,377	0.80%		
CHINA LIFE INSURANCE LTD H H	B0A0JPWY3	CNE100000	2628			Health Care	-902,919	-2.75%		
CHINA MOBILE LTD	S60735560	HK0941009	941			> Financials	1.068.493	3.26%		

2. **Portfolio restrictions** – Using the restriction setup in PfC, users can create restrictions on a security or a list of securities and apply it to the portfolio. Restrictions can be one-sided (no buy / no sell) or two-sided (no trade). These restrictions will be subsequently respected in the optimization. Note that restrictions must first be enabled via the View Settings > Search Criteria > Show Restrictions option.

#### **Required configurations in Explore**

Trading restrictions in Explore are applied through security constraints. Users will need to first specify the security or list of securities as a separate list in the investment universe section, **even if the securities are already part of the portfolio / benchmark.** They can then select this list when applying the no buy/sell/trade constraints.

Investr	ment Universe	Objectives	Constrain	ts						
										+ Add to Universe
	Туре		Universe		Filte	r		Labe	el.	
<b>~</b>	Portfolio		PKTEST		Filte	r Name		Port	folio	
					_					
					_	Edit Filter				
<b>~</b>	Benchmark		JACI_INX		Filte	r Name		Bend	hmark	
					_	Edit Eiltor				
_										
<b>~</b>	Portfolio	•	1 Securitie	s Add/Upload Secur	ities			S	ecurity list 1	×
Portfol	lio Constraints	Security Cons	traints	Sector Constraints	Factor Constraints					
Constr	aint measures			Constraint	Value	Unit	Lower Bour	d Upper Bound	Associated List	Relaxation
Se	earch		Q	Do Not Buy					Security list 1	×
~	Trade			Constraint options						
	Do Not Buy			Constraint Do Not	t Buy					
	Do Not Sell			Security list						
	Do Not Trade	e		Security list 1		•				
	Maximum Tr	rade Size - Buy		Portfolio						
	Maximum Ti	rade Size - Sell		Benchmark						
	Minimum Tr	ade Size - Buy		Security list 1						

# **Tax Optimization**

Tax optimization is commonly used by portfolio managers who want to incorporate tax liability considerations into their portfolio management process. Aladdin's tax optimization features allow managers to avoid or harvest tax gains/losses, incorporating their desired accounting method and other constraints on tax liability realized from trading the proposed orders. Note that to run tax optimization in Aladdin, clients need to load external lot data into the system. This functionality is only available in PfC as other tools currently do not support viewing of lot information. For the full list of tax parameters available, please refer to the appendix of the PfC Optimization User Guide.

**For Your Info:** to load external lot data into Aladdin, users simply need to send the relevant book information through the Interface File 335. This includes information like book type, book value, book date, book price, book yield and book FX rate. Once the book information is loaded into Aladdin, users are able to access them immediately in Portfolio Construction. For more information on loading book data, please refer to the section on Interface File 335 in the 'Aladdin Standard Loaders' document.

The parameters related to tax optimization are found in the Tax Lots tab of PfC's optimization module. Incorporating tax considerations into the optimization problem involves adding two additional independent variables into the objective function: TaxGain and TaxLosses

#### - $\alpha$ * TaxGain + $\beta$ * TaxLosses

^ v-											
Detail	General Bounds	Issuer Threshold	Factor Bounds	Tax Lots	Output Reports	SCR	Relaxation Control	Asset Bounds			
₽	@@< > <b>\$</b> -	1 Items					Pa	rams			
Pf Me	Accounting	Gains Type	Losses Type			Gains	s Factor I Weight	osses Factor Weight	Short Term Tax Rate	Long Term Tax Rate	Long Term Tax Rate (Month)
Hig	hest Book Price	Avoid	Harvest				1.00	1.00	43.00	20.00	12

The Gains/Losses type determine the impact of TaxGain and TaxLosses on the overall utility. If the user wants to harvest losses for reduced tax liability, setting losses type as 'Harvest' will allow TaxLosses to contribute positively (have a '+' sign in the equation) to the overall utility, hence the optimizer will favor orders that maximize tax loss. Gains/Losses factor weights determine the coefficient of the respective variables. A higher value indicates that more importance should be placed on minimizing or maximizing that variable.

Users can indicate their preferred accounting method which drives the priority of lots that the optimizer is allowed to trade. They can also set the short-term and long-term tax rates, as well as the definition of a long term lot in the parameter set. The values typically depend on the tax regulations of the portfolio's jurisdiction. Tax rates are used to calculate the final tax liability that will be realized from trading the proposed orders. Users can therefore set limits on the Max/Min Tax Gain/Loss or Gain/Loss liabilities:

D	etails	General Bounds	Issuer Threshold	Factor Bounds	Tax Lots	Output Reports	SCR Re	laxation Control	Asset Bounds				
	⊡ Q Q < → Q < Iltems     Params												
	Max Tax Min Tax Min Tax Gain Loss Gain					Min Tax Loss		Max Tax Gain Liab	1	Max Tax Loss Liab	Min Tax Gain Liab	Min Tax Loss Liab	Max Short Term Tax Gain

After optimization, users can view a series of tax reports to get more transparency into the results of the optimization. The tax reports available are:

- **Portfolio Tax Summary:** Shows users a summary of all the tax related metrics at the portfolio level post optimization. This includes metrics like overall tax gain/loss and gain/loss liabilities.
- Asset Tax: Shows users gain/loss information at the CUSIP level for every asset in the optimization universe. Realized gain/loss columns will reflect the gain/loss amounts that will be realized if the proposed orders were executed by the user.
- **Tax-lot Sell Report:** Shows the tax lot information for every lot where an order was proposed by the optimizer.

## **ESG Integration**

Sustainability is a focal theme, with many portfolio managers starting to incorporate ESG data into their portfolio management process. Aladdin Optimization can be used to propose a set of orders that maximizes or minimizes³ the overall portfolio's ESG score or incorporate ESG constraints in order generation so users can set limits on certain metrics like carbon emissions.

#### ESG Data in Aladdin

There are currently 4 different sources of ESG data in Aladdin: MSCI, Sustainalytics, Refinitiv, and a user's custom ESG scores. Vendor-provided data require various levels of licensing before they can be accessed on Aladdin, although certain Sustainalytics and Refinitiv data is available to all users as part of the ESG starter pack. Users can also load their own ESG scores into a list in Aladdin and use them in the optimization process.

Please reach out to your Aladdin Client Engagement team for more details on ESG data licensing and custom data load.

additional cost. There are currently 11 Sustainalytics and 16 Refinitiv metrics available to clients. Sustainalytics metrics include ESG Risk Ratings, Product Involvement, Corporate Governance Scores, Controversies, and Carbon Emissions. Refinitiv metrics include headline ESG scores, pillar scores and key issue scores for each pillar. It also offers Scope 1 + 2 emissions intensity data (measured in metric tonnes divided by company revenues).

For Your Info: ESG Starter Pack offers Aladdin

clients access to a set of headline ESG metrics at no

#### **ESG in Objective Function**

Users can define ESG metrics as an alpha that they want to maximize or minimize in the optimization process.

#### PfC Optimization Module - Details Tab



To use vendor-provided ESG scores, first select 'DHV Columns' from the Alpha Source Type column, then select the relevant metric in column 'Alpha Source Name'. To use custom ESG scores, first select 'Score Cards' from the Alpha Source Type column, then select the relevant custom list in column 'Alpha Source Name'.

Note that users should load ESG or custom list values in PfC prior to running the optimization. This can be done by clicking on the ESG icon or the Retrieve Score Cards Data icon in the top toolbar:



The alpha multiplier represents the coefficient of the Alpha variable and drives how much importance the optimizer places on maximizing ESG Score. To minimize the portfolio ESG score, use a negative integer (e.g. -1) as a multiplier instead.

³ Some data providers like Sustainalytics use lower ESG scores to represent better ESG

#### Explore Optimization Module - Objectives Tab

Objec	Objective Function Exposure ( Absolute  Active									
	Weight	Objective								
<b>~</b>	1	Maximize Alpha Score 🔹	+ ESG Score (Adjusted)							

To use vendor-provided or custom ESG scores as the alpha, select 'Maximize Alpha Score' as an objective, then click on 'Add column' in the blue box next to it to select the relevant columns. Note that vendor scores are available for selection in the 'ESG' section while custom lists are in the 'Research' section.

- > ESG
- > Research

The weight column represents the coefficient of the Alpha variable and drives how much importance the optimizer places on maximizing ESG Score. To minimize the portfolio ESG score, use a negative integer (e.g. -1) as the weight instead.

#### ESG as constraints

#### PfC Optimization Module – Factor Bounds Tab

D	etails	General Bounds	Issuer Threshold	Factor Bounds	Tax Lots	Output Reports	SCR	Relaxation Control	Overrides	A
	€	Q <> + -	🗘 🔻 2 Items				Choo	se DHV Column		×
	Case Name	e	Category	Factor Name	Field Type	-	Columr	Name: [car]		
	USER	GUIDE	Asset Selection	All Assets		-	Carb	on-Tot. Emissions		1
	USER	GUIDE	View Sector	United States	% Exp		Equit Equit	y and Future excl. Ca y and Future excl. Ca	sh Idio MC sh MCAR	•

To set ESG metrics as constraints in PfC, navigate to the 'Field Type' column and scroll to the '...' option in the dropdown window to launch the DHV column chooser. Here, users can search for the ESG metric of their choice. The constraint can either be set at the overall portfolio level, or on a specific sector level. Using a combination of 'Asset Selection' and 'All Assets' sets this constraint on the portfolio level, while setting it on a specific sector involves choosing the relevant sector view and sector name in the 'Category' and 'Factor Name' columns respectively.

#### Explore Optimization Module – Constraints Tab

Portfolio Constraints	Security Constraints	Sector Constraints Fa	ctor Constraints					
Constraint measures		Constraint	Value	Name	Lower Bound	Upper Bound	Relaxation	
Search	Q	Carbon int. of for fuel reserves (MtC02/mmboe	essil All Sectors					×
<ul><li>&gt; Position</li><li>&gt; Security</li></ul>		Constraint options						
> Risk		Constrain Carbon int.	of fossil fuel reserve	s (MtCO2/mmboe)				
> Company Fundar	mentals	<ul> <li>For all sectors</li> </ul>						
> ESG		<ul> <li>For one sector</li> </ul>						
> Research		Lower bound			Upper bound			
Custom Calculati	ion							
		Breakdown						

To add an ESG constraint in Explore, users can choose the ESG metric of their choice in the constraint measures chooser on the left. Double-clicking on the metric adds it as a constraint to the main panel on the right. Users can choose to apply it to all sectors (to set it at the portfolio level), or for just one sector. The sector universe can be defined in the 'Breakdown' section further down the right panel.

#### Trade restrictions in certain securities or sectors

In some scenarios, portfolio managers would like to restrict trading securities or sectors like Tobacco which are considered controversial. This can be easily done in PfC by locking the sector before running the optimization, or setting a factor bound with 0% exposure as the absolute upper and lower bounds. The same bounds can be set in Explore to achieve the same effect.

	Sect	or Vie	w (GIO	CS_ALL Level 3	3)	
Q Q O A A & 0 6 6 9 4 (G	ICS_ALL) (	SICS S	🔻	GICS_ALL Le	evel 3	
Sort Pivot	🔒 New	MV	Bench	MV	Active	New MV
Food Products	AUD	86,830	AUD	96,578	AUD	-9,749
> 🔒 Tobacco			AUD	37,157	AUD	-37,157
Household Products	AUD	62,549	AUD	64,804	AUD	-2,255
> Personal Products	AUD	35,839	AUD	42,360	AUD	-6,520
> Energy Equip & Services	AUD	9,477	AUD	9,453	AUD	25

### **Futures Replication of Benchmark**

Futures can be a cost-efficient way to replicate a benchmark's risk and exposures. Users can choose not to trade the physical assets in their portfolio and have the optimizer use only orders on futures to adjust for risk or exposure deviations from the benchmark. Alternatively, they can also use optimization to create a synthetic portfolio that uses only futures to replicate the benchmark.

**Expert Tip:** Optimization on Aladdin requires equity securities to have exposure to the BFRE factor model. Index futures will only have exposures to the STORM model and as a result will have their risk ignored in the optimization if clients do not have constituent access to the underlying index. Users can reach out to the Aladdin support team to set up risk proxies for these futures, proxying the risk to a similar portfolio or index which will have exposures to BFRE factors.

#### **Required configurations in PfC**

Users can instruct the optimizer to only raise orders on futures by locking all other assets in their portfolio before running optimization. Please refer to above section on "Restricting optimization's trading universe" for more information. When optimizing with futures, users can enable lookthrough in PfC to decompose an index future's exposure into its underlying assets. The assets can then be bucketed in their respective sectors and optimization constraints on these securities / sectors will be respected (i.e. when proposing orders on the futures, the optimizer will adjust the order size accordingly such that the change in the future's underlying exposures will not violate these sector constraints).

Search								
Search Criteria	View Options	Sectors	Prices	Port/Bench Options	Order Management	Warnings	Aggregation	Look Throug
Enable			Fune	d / ETF				
Enable Portfolio Look Through			A	ailable Proxies			Selected Prox	ies
<ul> <li>Portfolio Look Through</li> <li>Benchmark Look Through</li> </ul>			Lookthrough Proxy Primary Benchmark		Fund / Proxy			
Apply				CDX Proxy				
Fund	/ ETF							
Index	Futures							

Please note that PfC currently does not support futures optimization with budget constraints. As there is no cash impact when buying or selling futures, any budget indicated in the optimization process will be irrelevant since that budget field measures the change to the base currency cash in the fund. Specifying the total exposures of futures to be bought or sold in an optimization will require the use of a notional budget constraint which is not available in PfC yet.

Other settings to note when optimizing with futures in PfC includes:

- **Case Include Notional Prices**: Set to Yes. This is required for the optimizer to recognize the notional exposures from futures
- Maximum Long Position: Set to a value >100%. By default, the max long position allowed for the optimized fund is 100%. With futures (or derivatives in general), total %Exp can become >100% since overall exposure is more than NAV which is used as the denominator when calculating %Exp.

#### Required configurations in Explore

Users can instruct the optimizer to only raise orders on futures by adding all other assets in their portfolio into the Do Not Trade list. Please refer to above section on "Restricting optimization's trading universe" for more information. Similar to PfC, when lookthrough on index futures is enabled in Explore, the exposures from underlying assets will be taken into account when the optimizer evaluates security/sector constraints.

Portfolio Sett	ings Portfolio	Label What-if GL	.B-ACTFI 1	
Split Positions	Look-Through	Portfolio Filter	Risk Settings	Performance Settings
Enable look-th	rough	Security type/prox	ies Lo	ok-through inheritance
Portfolio		Funds		Portfolio and strategy name
Benchmar	ĸ	ETFs		
		Index futures		

#### Spending a notional budget

In Explore, users can define a notional budget that targets the notional market value of the fund. This constraint can be set up in the Portfolio Constraints section, and enables users to specify the total exposures of futures that should be raised in an optimization – a helpful feature for use cases like:

- Creating/seeding a synthetic portfolio
- Optimally equitizing cash balances in the fund

As an example, the case below starts from an empty portfolio and replicates the benchmark with a set of futures. When the Notional Budget bounds are both set to 100%, we would expect the portfolio to be fully invested and 100% of the notional budget to be spent. Under this fully invested scenario users would see a Notional Market Value % of 200% and a Market Value of 100%.

-		
	Edia	
	EQL	

Notional Budget		PERCENTAGE	100	100	false
Allow Short Positions	No				false
Constraint	Value	Unit	Lower Bound	Upper Bound	Relaxation

		Notional Market Value %	
Security Description	CUSIP	CASH ONLY	Replication with Futures
V Compare		100.0%	200.0%
V CASH		100.0%	100.0%
NO_BENCH SECURITY	BRS0VYSN1	100.0%	100.0%
USD CASH(Committed)	USD_CCASH		0.0%
V FUTURE			100.0%
EMINI ENERGY SELECT SECT	IXPU12027		1.6%
EMINI FINANCIAL SELECT SE	IXAU12023		17.2%
NASDAQ 100 E-MINI SEP 21	NQU120217		54.4%
S&P MID 400 EMINI SEP 21	FAU120211		26.8%

# **Efficient Frontier Analysis**

The efficient frontier is made up of optimal portfolios that offer the highest expected return for various levels of risk or the lowest risk for given levels of expected return. Portfolios below the efficient frontier are suboptimal because they earn insufficient return for the level of risk. In Aladdin Optimization, we extend the efficient frontier analysis to calculate the highest achievable alpha for defined levels of risk, where the definition of alpha can be flexibly defined by the user.

#### **Required configurations in PfC**

Users can leverage the Scenario Analysis feature in PfC to conduct an efficient frontier analysis. Scenario analysis is a feature that allows users to create multiple iterations of an existing base case, tweaking various parameters in each iteration. All the iterations can then be run simultaneously, allowing users to easily compare changes in optimization results due to the tweaked parameters. In the below example, multiple versions of the original case "BD EQ Demo" is created, where each version has a different alpha multiplier. Running this set of iterations then allows the user to see how the optimization result changes as more and more emphasis is placed on maximizing ESG scores.

•••••••	C 🗸	Retrieve Sci	enarios	9 <del>1</del> 1	3 Items				
Case Name		Case Type		Risk Model		Parent Case	Modified By	Scena	rio
BD EQ Demo		Pahalan		Default	Risk M				
BD EQ Demo_Alpha 2		New Scena	rio	Default	Risk M	BD EQ Demo			<b>~</b>
BD EQ Demo_Alpha 3		Reparance	ce	Default	Risk M	BD EQ Demo			<b>~</b>
Details General Bounds	Issuer	Threshold	Factor	Bounds	Tax Lot	s Subscriptions	Output Reports	SCR	Relaxa
ד פ פ < → Obje	ctive Fun	ction Variab	les	- 0	▼ 2 Iten	ns			
₽ ়	ctive Fun Ca	ction Variab ase Systema	les atic (	▼ ♥ Case Idios	▼ 2 Iten syncratic	ns Case Alph	a Case Alpha		
E Q Q < → Obje Case Name	ctive Fun Ca	ction Variab ase Systema R	iles atic ( isk	▼ ♥ Case Idios	<ul> <li>2 Iten</li> <li>syncratic</li> <li>Risk</li> </ul>	ns Case Alph Multipli	a Case Alpha er Source Name		
E Q Q < → Obje Case Name BD EQ Demo	ctive Fun Ca	ction Variab ase Systema R 1	atic (tisk 1.00	▼ ✿ Case Idios	<ul> <li>2 Iten</li> <li>syncratic</li> <li>Risk</li> <li>1.00</li> </ul>	ns Case Alph Multipli 1.0	a Case Alpha er Source Name 00 ESG Score (W	eighted	Average

Note that the scenario analysis feature allows users to change any parameter in the scenarios, so this frontier analysis can be extended to any two parameters beyond risk and alpha.



#### **Required configurations in Explore**

The efficient frontier in Explore allows users to set a range for the portfolio's Max Total Risk which the optimizer must solve for based on the additional objectives defined within the optimization problem. In the below example, we are analyzing the trade-off between yield and tracking error, for a tracking error range between 50 to 350bps.

Portfolio Constraints	Security Constraints	Sector Constraints	Factor Constraints				
Constraint measures		Constrain	t Value	Unit	Lower Bound	Upper Bound	Relaxation
Search	Q	Allow Sho Positions	ort No				
Risk		Maximun Total Risk	Active 50:350	BPS			×
Objective Function	on Exposure	Absolute 🧿 A	ctive				
Weight		Objective					
✓ 1		Maximize	Alpha Score				ield to Maturity

By default, the analysis will create ten iterations on the frontier, which means ten optimization problems are solved for to find the efficient portfolios. Users can change the default setting in 'Optimization Settings' where the Frontier Iterations option will be made available after the Maximum Active Total Risk constraint has been added to the optimization parameters. The minimum number of iterations is 2 and maximum is 20.

Post optimization, users can find the summary of the optimization results in the 'View Details' section, together with the efficient frontier chart. The result of each iteration will be saved as a 'What-if Portfolio' for users to do further analysis in Explore.

What-if Position Modeling				₽ 12				
View Details   Add Cash   Add Securities   Optimize Model			C'Reset (	Composition				
Notional Mar	ket Value %	Market Value %						
Securities Description Origina	al Modified	Original	Modified					
✓ AP_FIAPC1 100.00	100.000	100.000	100.000					
Efficient Frontier Y-axis		Select	Portfolio	Returns (Absolute) - Alpha	Risk (Absolute)	Transaction Cost	Turnover	System: Risk (Act
Returns (Absolute) - Alpha Score 🛛 🔻			110-2016	Score				
4300.0000			AP_FIAPC1 1_1	3656.0290	99.9613	99.0403	99.0403	69.986
4200.0000	• •	•	What-if AP_FIAPC1 1_2	3787.3750	127.7468	99.0596	99.0596	99.328
8 4100.0000			What-if AP_FIAPC1 1_3	3895.6020	155.5298	99.0514	99.0514	129.20
Alpha			What-if AP_FIAPC1 1_4	3990.3690	183.3112	99.0430	99.0430	158.70
What-If AP_FIAPC1 1_3 Returns (Absolute) - Alpha Score: 3895.6020			What-if AP_FIAPC1 1_5	4076.8160	211.0917	99.0340	99.0340	187.073
4 0 0000000 1 1 1 1 1 1 1 1 1 1 1 1 1 1			What-if AP_FIAPC1 1_6	4137.1850	238.8738	98.9635	98.9635	199.54
2 3700 0000			What-if AP_FIAPC1 1_7	4167.6450	266.6548	98.9066	98.9066	210.34
2600 0000			What-if AP_FIAPC1 1_8	4191.8590	294.4349	98.8638	98.8638	223.93
100 127.7778 155.5556 183.3334 211.1112 238.889 266.6668 294 Risk (Absolute)	1.4446 322.2224 3	50	What-if AP_FIAPC1 1_9	4213.3480	322.2143	98.8268	98.8268	239.015

## **Asset Allocation**

Asset Allocators or Multi-Asset fund managers can determine their strategic asset allocation by using optimization to derive optimal weights for asset classes or sectors in their portfolios. They can do this topdown allocation process through mean-variance optimization where users upload their own return expectations or utilize P&L from stress scenarios as part of the optimization objective. Alternatively, they can leverage the Black-Litterman method to optimize using market equilibrium returns and user expectations.

#### **Mean-Variance Optimization**

Users can leverage PRT to conduct Mean-Variance Optimization (MVO) at the asset class or sector level. PRT provides the ability to aggregate portfolio exposures by a user-defined breakdown, then treating each sector in the breakdown as a single asset during the optimization process. This is aligned to the top-down approach adopted by asset allocators, where we solve for asset classes or sectors rather than individual securities. This means that the result of the optimization problem is going to be the asset class or sector allocation.

Once a portfolio has been loaded in the tool, users would be able to view their portfolio securities and set constraints accordingly. If users would like to group securities into sectors for optimization (e.g. group them by asset class), they should first navigate to the Composition panel and select a breakdown in the 'Break down as...' dropdown, before enabling 'Optimization Controls' to expose the optimization related fields.

<ul> <li>Composition ⑦</li> </ul>					
Cash In/Outflow: USD	✓ Include FX Risk	Optimization Controls	User Expectations	🜔 🖌 Auto Calc	ulate
				% of Portfo	lio NAV 🗸 🗸
Edited Only Show Errors Find:		t		Unit	🔻 Amount
BRS-PENP		Break down as	ctors		
Add Items by Shortcut/CUSIP	<b>▼</b> ⑦	+ I Mul Portfolio Group	o or Composite Benchmark		St
		Level 2			Original:
		Portfolio Secur	ities		New:

Users can define their objective function and constraints, then optimize by filling in appropriate values in the 'Optimize' field as directed. The new asset class allocations will populate in the 'New Hldg' columns.

Objective Function Co	mponents: Choose Objective Ty	pe to Add 🗸 🕜				Weig	ht	Initial	Realized
SYSTEMATIC RISK					[		1 2,9	33.39 bps	2,099.28 bps
IDIOSYNCRATIC RISK					[		1 1	03.77 bps	99.07 bps
- 🖌 WEIGHTED RETURN	IS FROM SCENARIOS 🕂				[		1 -2	70.61 bps	-214.74 bps
— 🗹 Scenario Name:	Fed Interest Rate Regimes - Fed S	Stays the Course 🗸			[	0.	5 -5	41.22 bps	-429.48 bps
Constraints: Choose C	Constraint Type to Add 🗸	0		Lov	ver Bound	Upper Bour	nd	Initial	Realized
- 🖌 NOTIONAL BUDGET					0		0	0.00%	-0.00%
EXPOSURE IR		2			4	5.	5		
— 🖌 MAXIMUM TURNOVE	ER					3	0	0.00%	30.00%
- FLEXIBLE LINEAR	Equity				45	5	0	54.10%	45.00%
- FLEXIBLE LINEAR	Fixed Income				30	4	5	32.05%	45.00%
- FLEXIBLE LINEAR	Alternatives				10	1	5	13.85%	10.00%
BRS-PENP: Portfolio	Group or Composite Benchmark	k (Level 2) 🔿 Collapse	% 0	f Portfolio	NAV		$\sim$	Select C	olumns 🗐
Edited Only Find:	Invert		Unit	🔻 Hldg.	New Hldg	j. 🗸 Optii	nize ၇	-Orio	New
PENP-EQ-AP - Asia Pacif	fic Equity		%	0.67	1	1.29 To op	timize for '?'. Const	minimum ris rain amount	sk, enter
PENP-EQ-EU - Europe E	quity		%	27.52		7.80 enteri	ng option	al bounds.	-, b
PENP-EQ-NA - US Equity	/		%	25.91	2	5.91 Uncor	<i>oles</i> istrained:	2	þ
PENP-GLEMG - Global E	merging Markets		%	0.46		0.46 Lower	bound:	?>5	þ
PENP-GLFI - Global Fixe	PENP-GLFI - Global Fixed Income			5.41	1	8.36 Upper	bound:	?<10 0	þ
PENP-GLILB - Global Inf	lation Linked		%	2.15		2.15		0	Close
PENP-HDGF - Hedge Fur	nds		%	2.96		2.96 ?>0.00		1.53%	2.13%
PENP-PRVEQ - Private E	quity		%	4.04		0.00 ?>0.00		8.42%	0.00%
PENP-RLASS - Real Asse	ets		%	0.61		7.04 ?>0.00		0.30%	5.02%
PENP-RLEST - Real Esta	te		%	6.24		0.00 ?>0.00		8.98%	0.00%

The asset class constraints in the above screenshot are 'Flexible Linear' constraints. This allows users to set allocation bounds in a particular asset class or a group of asset classes. For example, if the user wants to specify a max allocation to equities, flexible linear allows combining different assets to limit their holding.

Note that this is different from the MVO available in PfC and Explore where even though security exposures are aggregated at the sector level, optimization runs at a single-security level. However, in PRT optimization runs at an asset-class level and the result of the problem is asset class allocations. PfC and Explore users typically conduct asset allocation optimization on a model portfolio, where each asset class is represented / proxied by a single asset (e.g. SNP500 ETF to proxy US Equities), and the final weight of that asset post optimization will represent the optimal weight of the corresponding asset class in the actual portfolio. These model portfolios are then frequently used as the benchmark for actual portfolios.

#### **Black-Litterman Optimization**

The Black-Litterman method, also known as reverse optimization, derives returns from combined market equilibrium implied returns and user expected returns. This framework makes the optimization analysis more tailored to personal investment beliefs and styles without having to specify return assumptions for every asset in the investment universe. It also helps to overcome the commonly observed problems of plain mean-variance optimization such as input-sensitivity and unintuitive or concentrated optimal portfolios.

Black-Litterman optimization is currently <u>only available in the PRT application</u>. To run this in PRT, users will first have to load a portfolio then enable 'Optimization Controls' and 'User Expectations'. They can also choose to assign a breakdown to group their securities via the 'Break down as...' dropdown.

<ul> <li>Composition (2)</li> </ul>					
Cash In/Outflow: USD	☑ Include FX Risk	Optimization Controls	User Expectations	🜔 🔽 Auto Cal	culate
				% of Portf	olio NAV 🗸 🗸
Edited Only Show Errors Find:		ert		Unit	🔻 Amount
BRS-CORE1			Break down as 💊	•	

Users also need to add Expected Return as one of the objectives of the optimization. "Expected return" objective term is only used to solve for Black Litterman optimization problems.

<ul> <li>Composition (2)</li> </ul>							
Cash In/Outflow: AUD Include FX Risk	Optimization Controls	<ul> <li>User Expectations</li> </ul>	🜔 🗹 Auto Calculate				
Risk Decomposition: <ul> <li>CAR </li> <li>CER</li> </ul>							
Constraint Builder 🗌 Show Upload Controls Quick Action 🗸							
Objective Function Components: Choose Objective Type to Ad	Initial	Realized					
SYSTEMATIC RISK			10				
IDIOSYNCRATIC RISK							
- Z EXPECTED RETURN			1				

Users can subsequently define the market portfolio and risk version in the User Expectations section. By specifying a **market portfolio**, one assumes that the asset allocation in this market portfolio is efficient – the market is in equilibrium and hence the weights in the portfolio are optimal. The market implied PnL is then derived from the asset weights in the market portfolio⁴. **Risk aversion** is a concept derived from the utility theory that investors demand return compensation for every additional unit of risk. A more risk averse investor will have a higher risk aversion factor as they demand more returns for every unit of additional risk. When setting the risk aversion factor, users should review the weights of systematic and idiosyncratic risk in the objective function as well. Typically, these are set to half of the risk aversion factor.

Add User Expectations: + (	Market Portfolio:	JACI_INX	Risk Aversion:	20	
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⁴ To learn more about how market implied PnL is derived, please refer to the PRT Optimization guide.

Expert tip: Why should we set weights of systematic and idiosyncratic risks to half of the risk aversion factor?

From the objective function:

$$w^{sys} \times \sigma_{sys}^2 + w^{idio} \times \sigma_{idio}^2 - 1000 \times w^{ret} \times exp.return = 0$$

We assume  $w^{ret}$  to be 1. In addition, 1000 *  $w^{ret}$  is done to adjust return to the proper units of the optimization equation. To simplify the return portion, we assume  $1000 \times w^{ret} \times exp.return = exp.return^*$ . We also assume  $w^{sys} = w^{idio}$ . Therefore,

$$w^{risk} \times (\sigma_{sys}^2 + \sigma_{idio}^2) - exp.return^* = 0$$

By Utility theory, *return* =  $0.5 \times risk \ aversion \times \sigma^2$ . Hence,

 $w^{risk} \times (VaR)^2 = 0.5 \times risk \ aversion \times \sigma^2$ 

 $w^{risk} = 0.5 \times risk \ aversion$ 

$$\frac{w^{risk}}{isk \ aversion} = 0.5$$

Note: Utility Theory is an economic theory defined by public research, users can read up more about this on their own accord to better understand its significance.

On top of specifying the market portfolio, users can also layer on their own relative and absolute performance assumptions for assets

- Relative: Take a stance on whether one asset will underperform, outperform or match performance of another asset.
- **Absolute**: Users input the exact % an asset will return

Users can also specify the confidence level for their return expectations, which dictates how much the user expected return is leveraged in the optimization. There are 4 choices available: low (35%), medium (65%), high (95%) and certain (100%). Confidence level dictates how much the user expected return is leveraged in the optimization. The higher the confidence, the more the optimization leverages user expected return.

Add User Expectations: 🕂 🥝	Market Portfolio:	JACI_INX Risk Aversion	n: 20		
Item 1		Stance	Item 2	By Amount	Confidence
- 🖌 Corporate Debt		Underperforms: 🗸	Government Debt	2 %	Medium (65%) 🗸
- 🗸 Cash	2	Returns: 🗸		0.1 %	High (95%) 🗸

When running the optimizer with the Black Litterman method, we recommend changing the columns from the default Original Risk and New Risk columns to Market Implied PnL and Expected PnL columns. This allows users to see the full impact from return expectations they have layered on. Mkt Imp PnL is calculated by only Market portfolio. Exp PnL is calculated by layering user expectation on returns from Mkt Imp PnL.

Item 1	Stance	Item 2		Ву А	mount	Confidence		
- RS1000 - RUSSELL 1000 INDEX	Outperforms: 🗸	MS_EU - MSCI Europe	2		3 %	Medium (65%		
BAR30RUS15: Portfolio Group or Composite Benchr	nark (Level 1) 🜔 Collapse	% 0	of Portfolio	NAV	$\checkmark$	Select Colu	ımns 🗏	
Edited Only Find:		Unit	🔫 Hldg.	New Hidg. 🗸	Optimize ၇	AMKT Imp PnL	<ul> <li>Exp</li> <li>PnL</li> </ul>	
LIBOR_3MO - LIBOR 3 Month Index		%	0.50	0.18	?>0.00	0 bps	0 bps	~
LEH_AGG - Barclays U.S. Aggregate Index		%	35.00	40.64	?>0.00	35 bps	24 bps	
LGA_INX - Barclays Global Aggregate Index		%	7.50	3.78	?>0.00	90 bps	47 bps	
BCLYGLBLIL - Barclays Global Inflation Linked Bond Index		%	5.00	3.97	?>0.00	202 bps	156 bps	
SPGSCOMM - S&P/GSCI Commodity Spot Index		%	0.50	0.00	?>0.00	428 bps	371 bps	
JPMGBI-EM - JPM Morgan GBI-EM Index		%	7.50	7.59	?>0.00	617 bps	554 bps	
MS_PAC - MSCI Pacific		%	5.00	3.10	?>0.00	846 bps	817 bps	
MS_EU - MSCI Europe		%	10.00	0.00	?>0.00	1126 bps	984 bps	
WIL5000RE - Dow Jones (DJ) Wilshire Real Estate Index		%	5.00	5.17	?>0.00	915 bps	970 bps	
RS1000 - RUSSELL 1000 INDEX		%	15.00	15.39	?>0.00	1077 bps	1162 bps	~
Cash		%	0.00	0.00		0 bps	0 bps	

# **DOCUMENT HISTORY**

Date	Version	Updates
March 2022	1.0	Creation of the Optimization Use Case Guide

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