GRAVITY INVESTMENTS

PORTFOLIO RE-OPTIMIZATION

GSPHERE PRODUCT TOUR

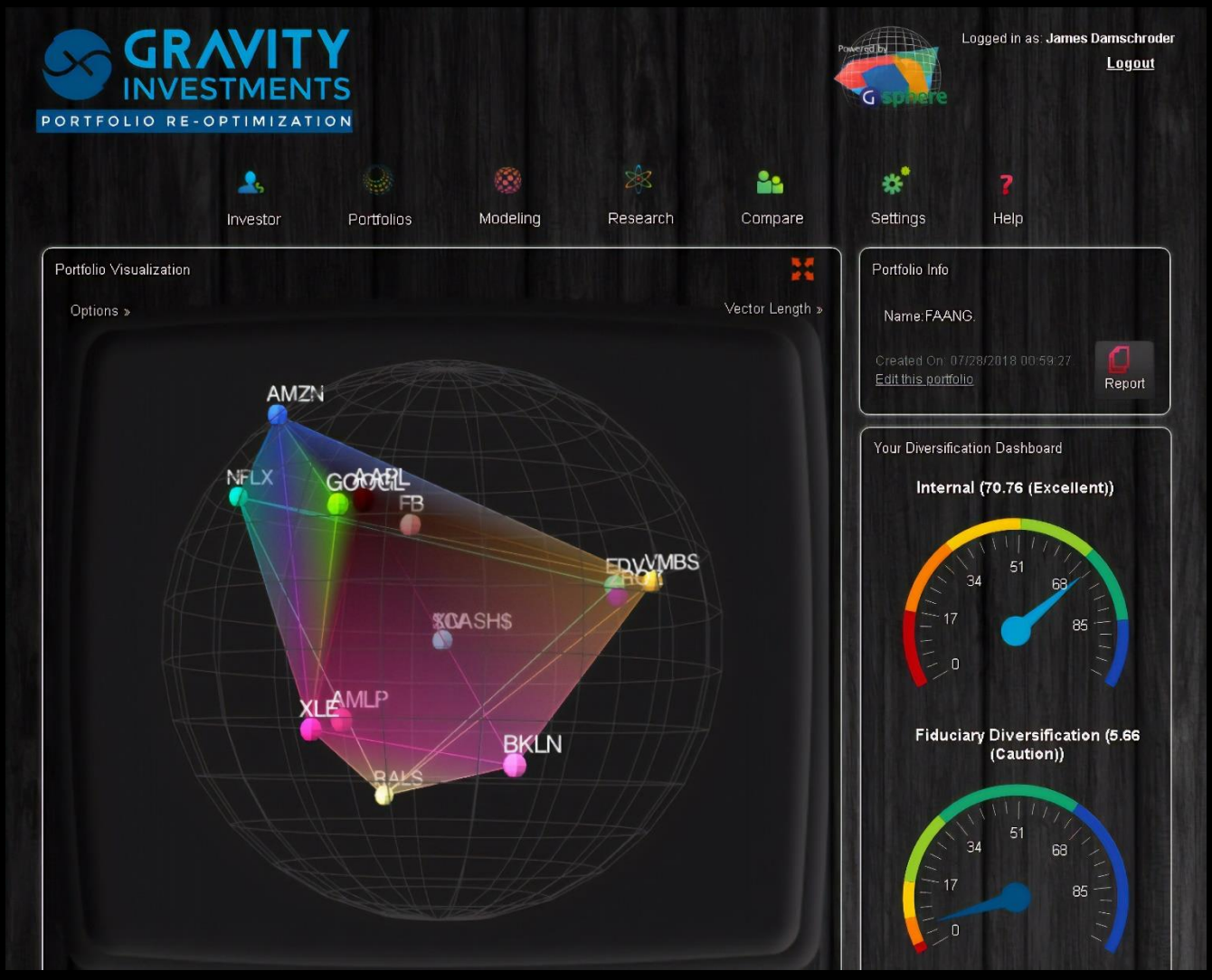
Contents

VIEW PAGE

Welcome to the Gsphere Product Tour

Gsphere is a Portfolio Re-Optimization system featuring visualizations and patented diversification measurements

In this guide we will show many of the system features. Note that not all user types have access to all the features described in this guide



DIVERSIFICATION DASHBOARD

Internal Diversification (59.65 (Good))

The Internal Diversification is the Gini Co-Efficient of the KL expansion (AKA energy spectrum or Eigenvalues) of a weighted correlation matrix

It gives a percentage values from 0 to 100 which may be interpreted such as: this 8-asset portfolio is 70% diversified. A score of 100% means that there is no observable systemic commonalities inside the portfolio.

Fiduciary Diversification (7.75 (Caution))

Fiduciary Diversification is measured by the portfolios intrinsic dimension multiplied by the Gini-Co-efficient

Because the Fiduciary diversification fully accounts for both the quantity and commonality of investments it is the best singular measure for diversification and thus the best evaluator for the fiduciary obligations to diversify for U.S investors.

Systemic Diversification is measured as the Intra Portfolio Correlation or IPC. This is a weighted average intra portfolio correlation which then scales the range of the correlation spectrum to a percentage scale. Note that good values start around 40%. Seldom do any portfolio achieve a value greater than 70% since all values greater than 50% provide that the average correlation is negative.

Systematic Diversification (49.02 (Good))

Idiosyncratic Diversification (11.94 (Adequate))

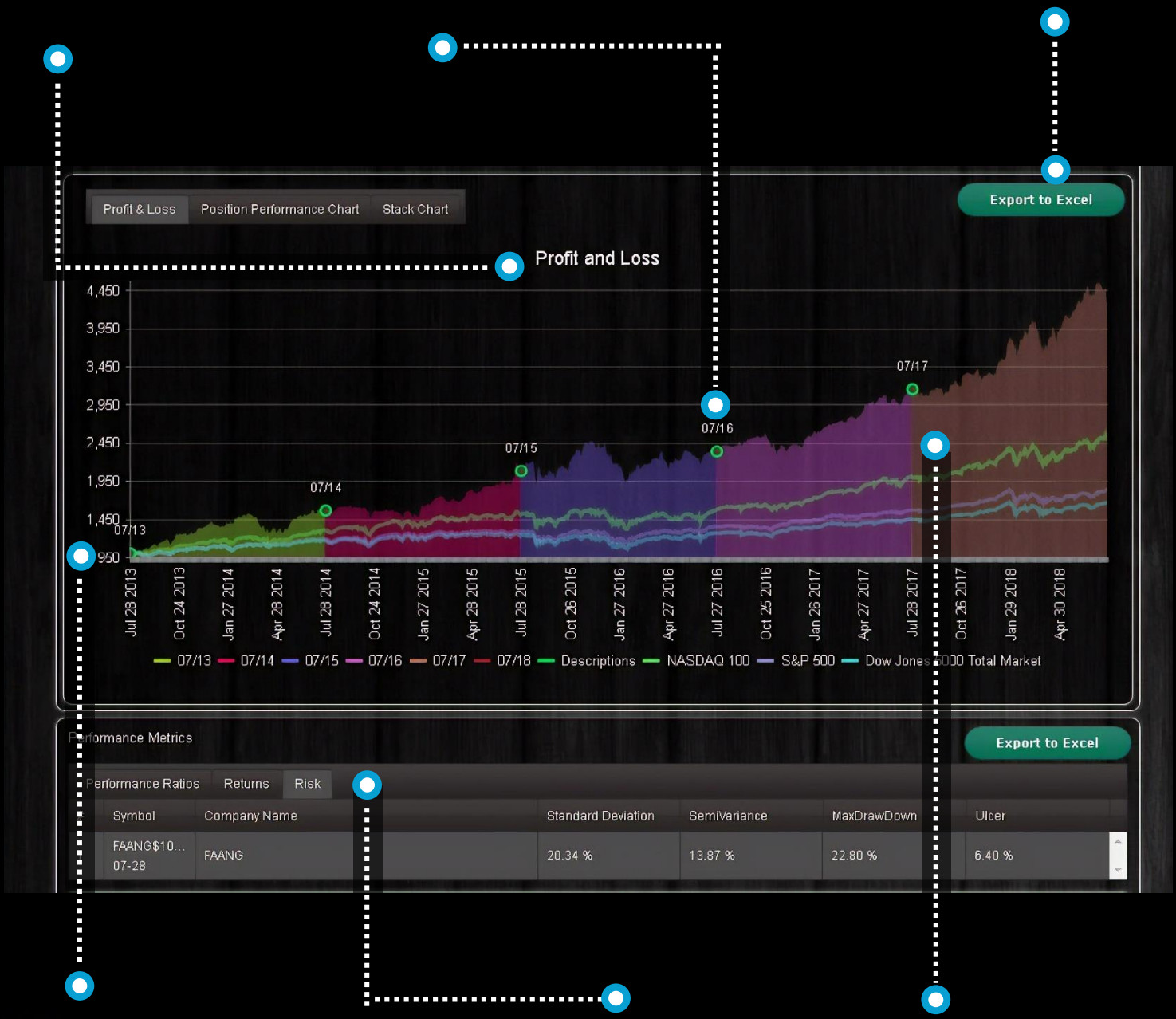
The Idiosyncratic diversification is the portfolio's intrinsic dimensionality. This value is like the portfolios Concentration Co-efficient (CC), but further subtracts any perfect redundancy. More Simply it is the number of asset in the portfolio adapted for the weighting scheme. This value is generally equivalent to the holding quantity for equally weighted portfolios.

DETAILED P&L

P&L history chart is created anytime a strategy includes multiperiod Re-Optimizations in the backtest.

Can display when rebalancing actions and stop loss protection

Export the P&L chart data to Excel for other projects



Always based on a $1000 invested, dividends are reinvested

Portfolio metrics for your designated period appear here in the three tabs

Profit and Loss details shows historical events, each color segment is a different Re-Optimization segment

ROLLING ALLOCATION CHART

The Rolling allocation chart (stack chart) shows how allocations vary over time

This is especially interesting to see how the optimization and rules engine combine to produce different portfolio allocations across market conditions

This chart is produced automatically for optimized backtests

A nice way to illustrate added value to investors

Often you can see how in Diversification Optimization disfavored investments grow in allocation

HISTORICAL ALLOCATIONS

Control to activate display options for portfolio history when available

Navigate the date tabs to see the corresponding allocation and risk return chart

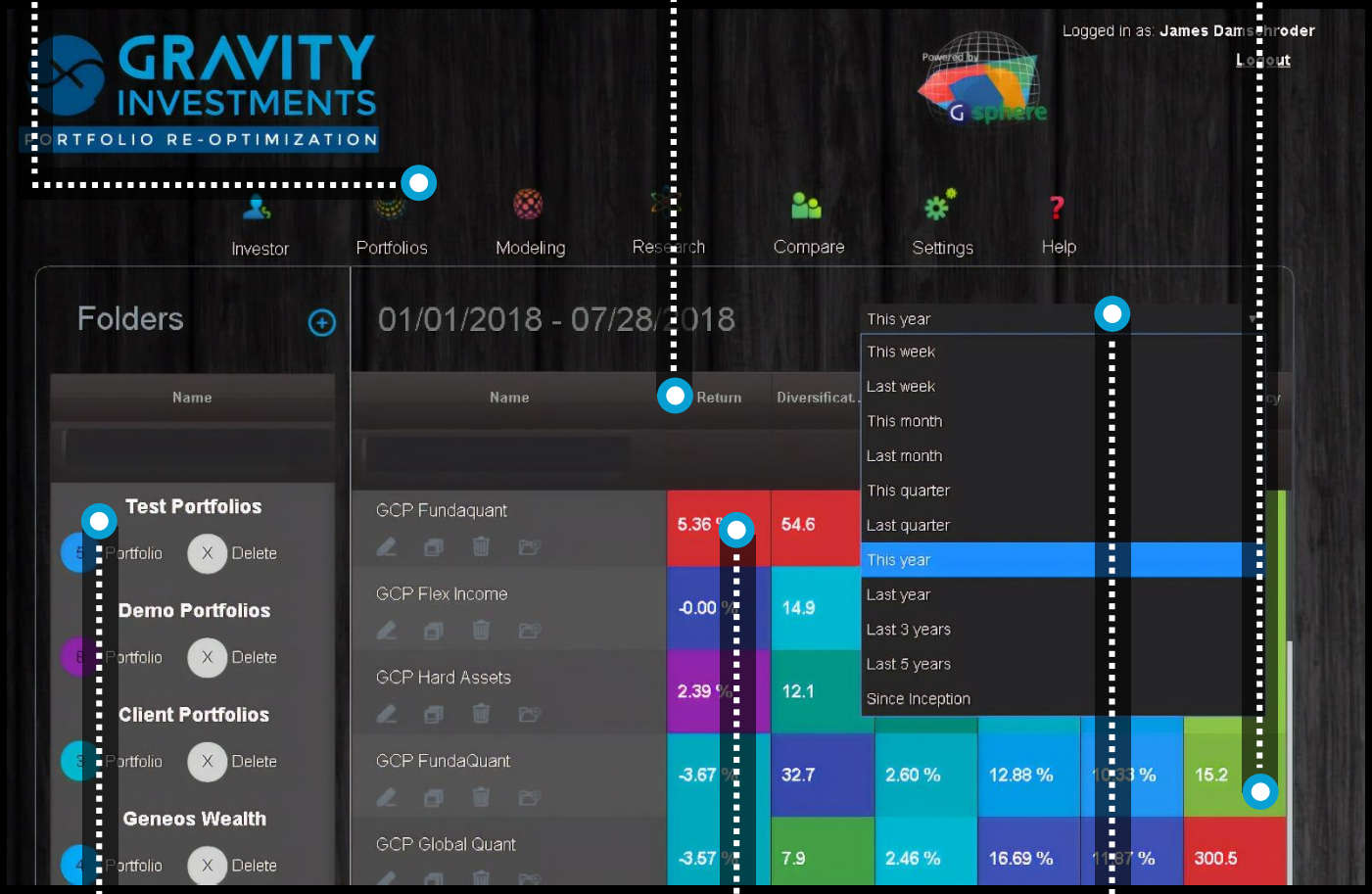
Light, interactive HTML5 charts render great on any screen or device

PORTFOLIO MONITOR

This page lives here on the portfolio page

Measures for Return, Diversification, Income, Risk, Capital, Preservation and Consistency

Color coded for issue spotting



Organize portfolios into folder

See portfolio performance

Update to any desired period

BENCHMARKS

Add any benchmarks you would like to see with the portfolio

Set as many as would like

Graph the portfolio vs benchmark

Mark a benchmark as default for it to always show with the portfolio

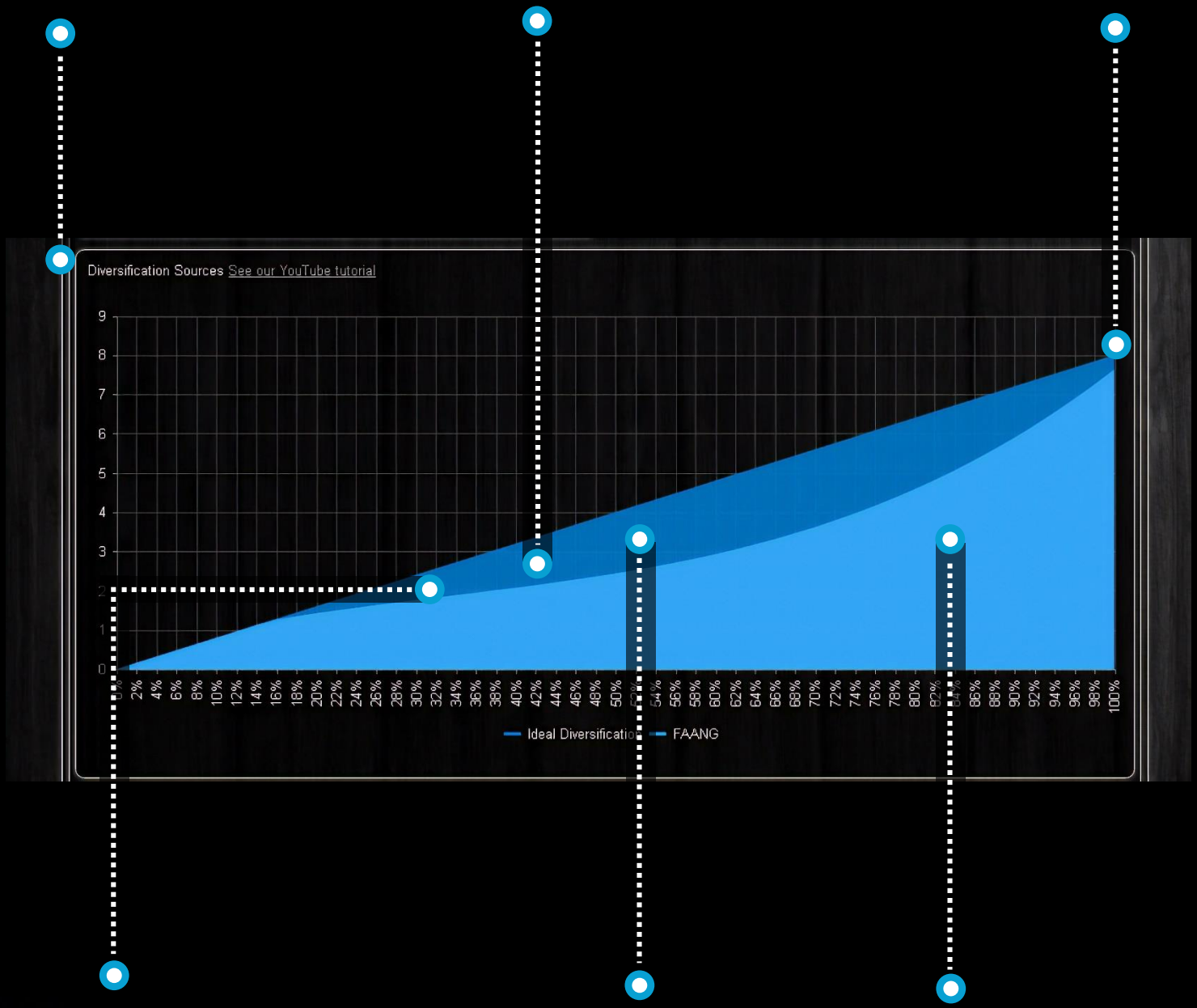
Analyze MPT and relative performance stats

DIVERSIFICATION SOURCE CHART

This chart shows how much diversification may be in any portfolio.

The extent to which the portfolio fills the space under the diagonal line provides for how much diversification the portfolio has for a given number of investments.

The peak value shows how many dimensions it takes to span the portfolio with 100% of the information included. More dimension = more diversification. If the top value is less than the diagonal, then there is some amount of complete redundancy in the portfolio. This is often greater in larger portfolio especially index strategies



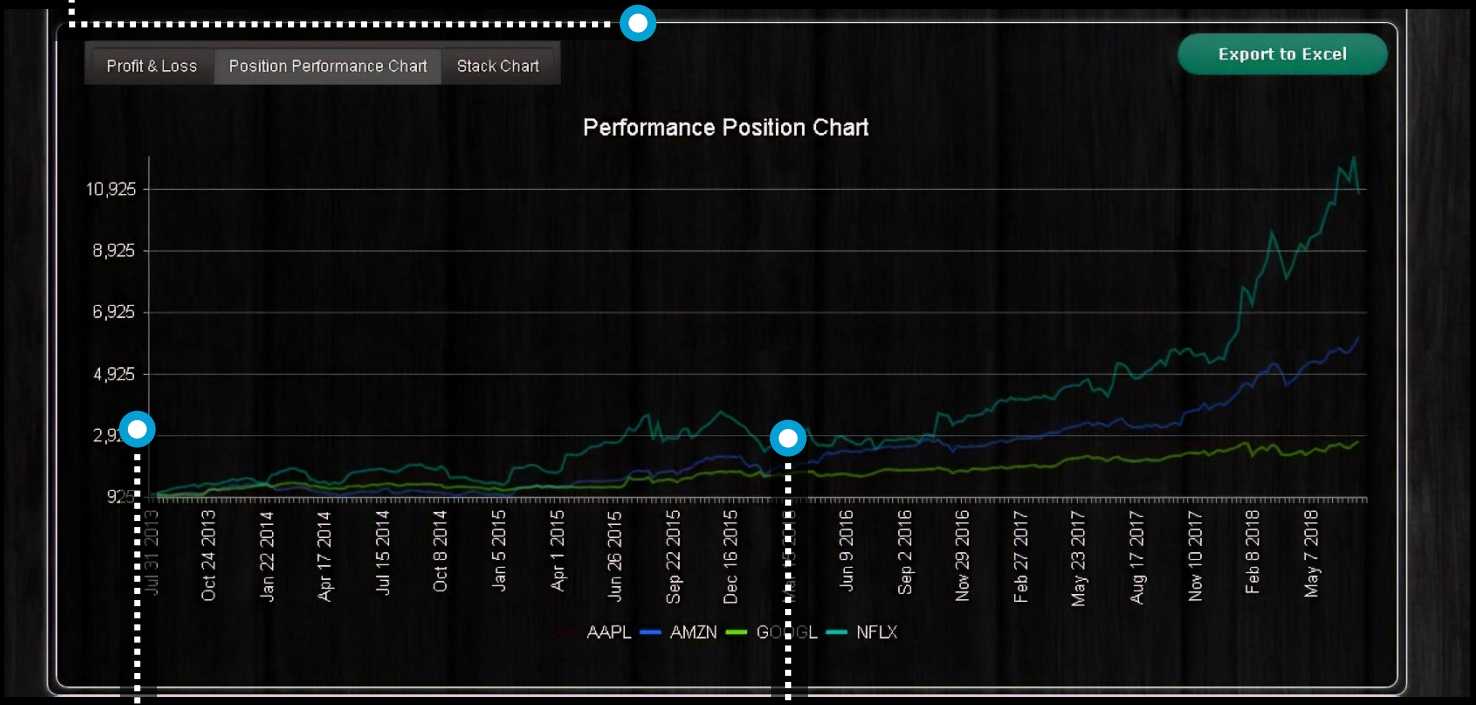
The graph would fill the diagonal exactly if all of the assets were uncorrelated and equally weighted. As systemic and weighting concentrations pervade the strategy the graph will dip

The extent which the graphs fills the diagonal is called the Gini Co-efficient. This is the % used in the internal diversification gauge.

The chart integrates idiosyncratic (asset specific) diversification (AKA holding quantity) with the systemic commonality of the positions (the Gini Co-efficient)

POSITION PERFORMANCE

See the individual performance of each asset



All assets are normalized for an initial 1000$ invested

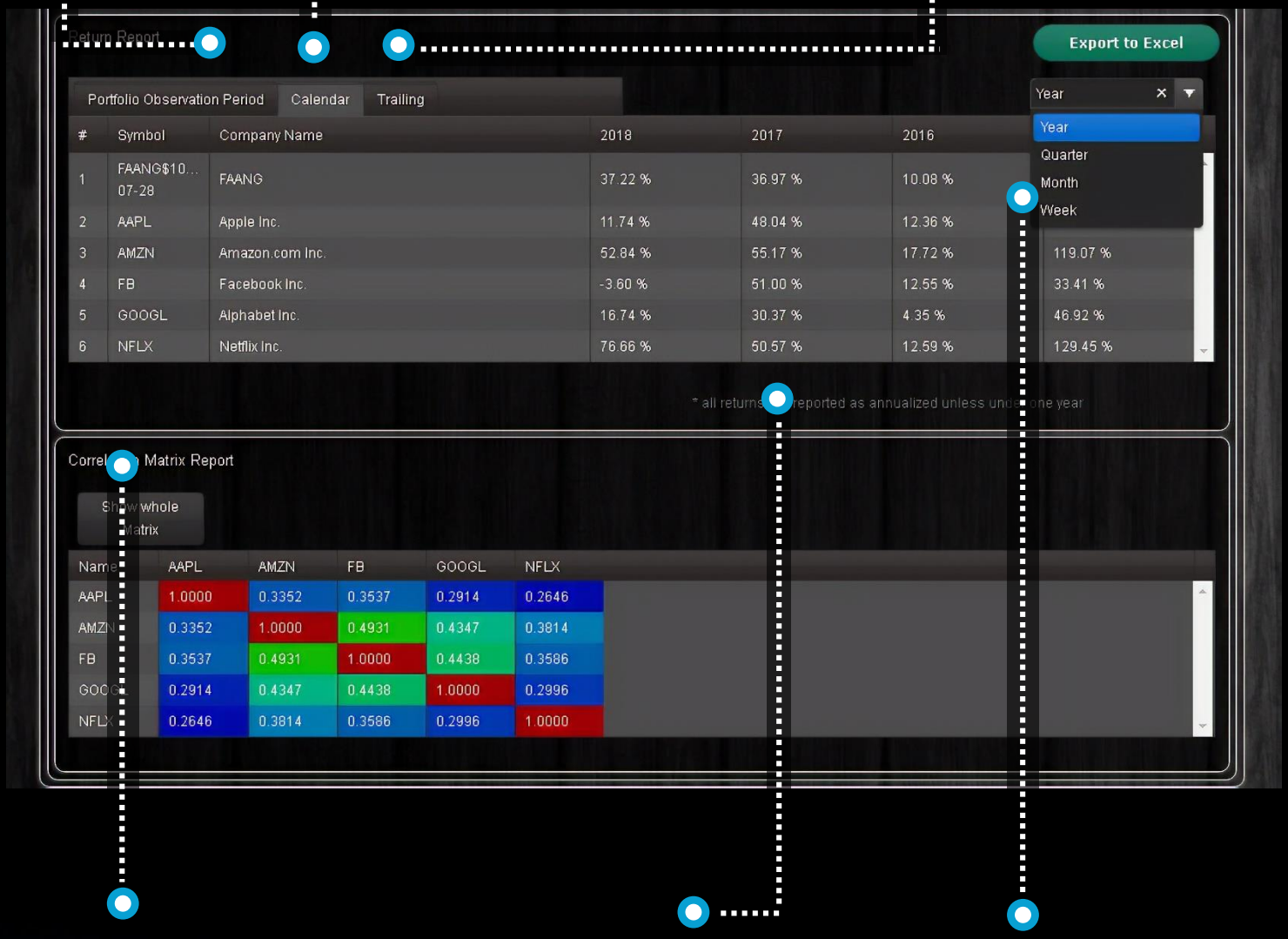
Mouseover the graph to see dates and prices

RETURNS AND CMATRIX

The return report gives portfolio and position returns including in cell charts

Calendar returns available here on this tab

Trailing returns available here on this tab



See the correlation matrix color coded to spot opportunities and risks

Sort any of the rows to spot issues

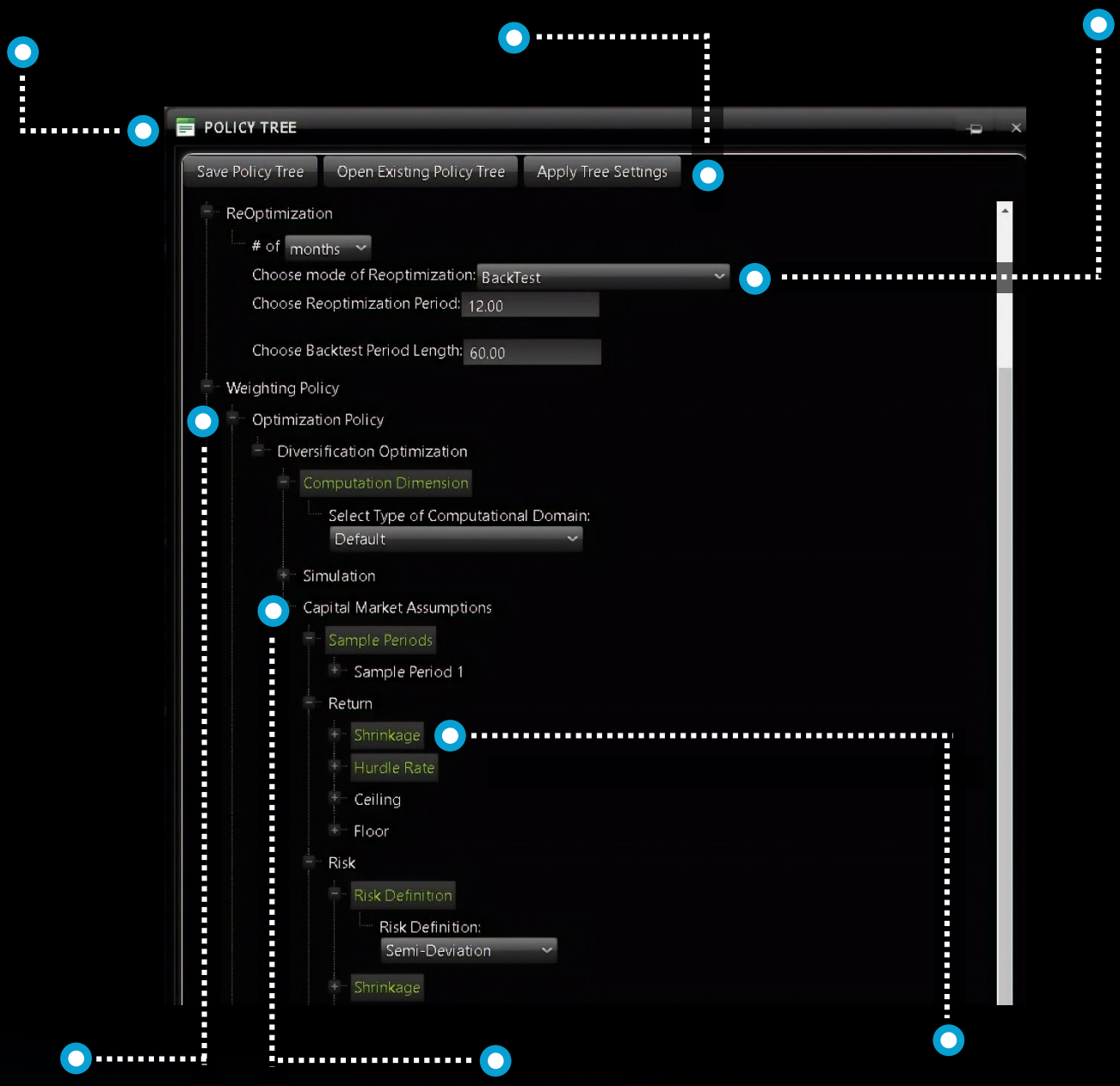
Set your own timescale

POLICY TREE

The policy tree is the rule set that govern how any strategy is optimized, backtested and automated

Polices can be saved and shared

Govern not just the rebalancings, but the Re-Optimization so that the portfolio adapts with the market.



Set the method for how to optimize the portfolio

Set the rules to govern how to set the capital market assumptions and sample data. Add and weight multiples samples following our best practice guidelines for best performance

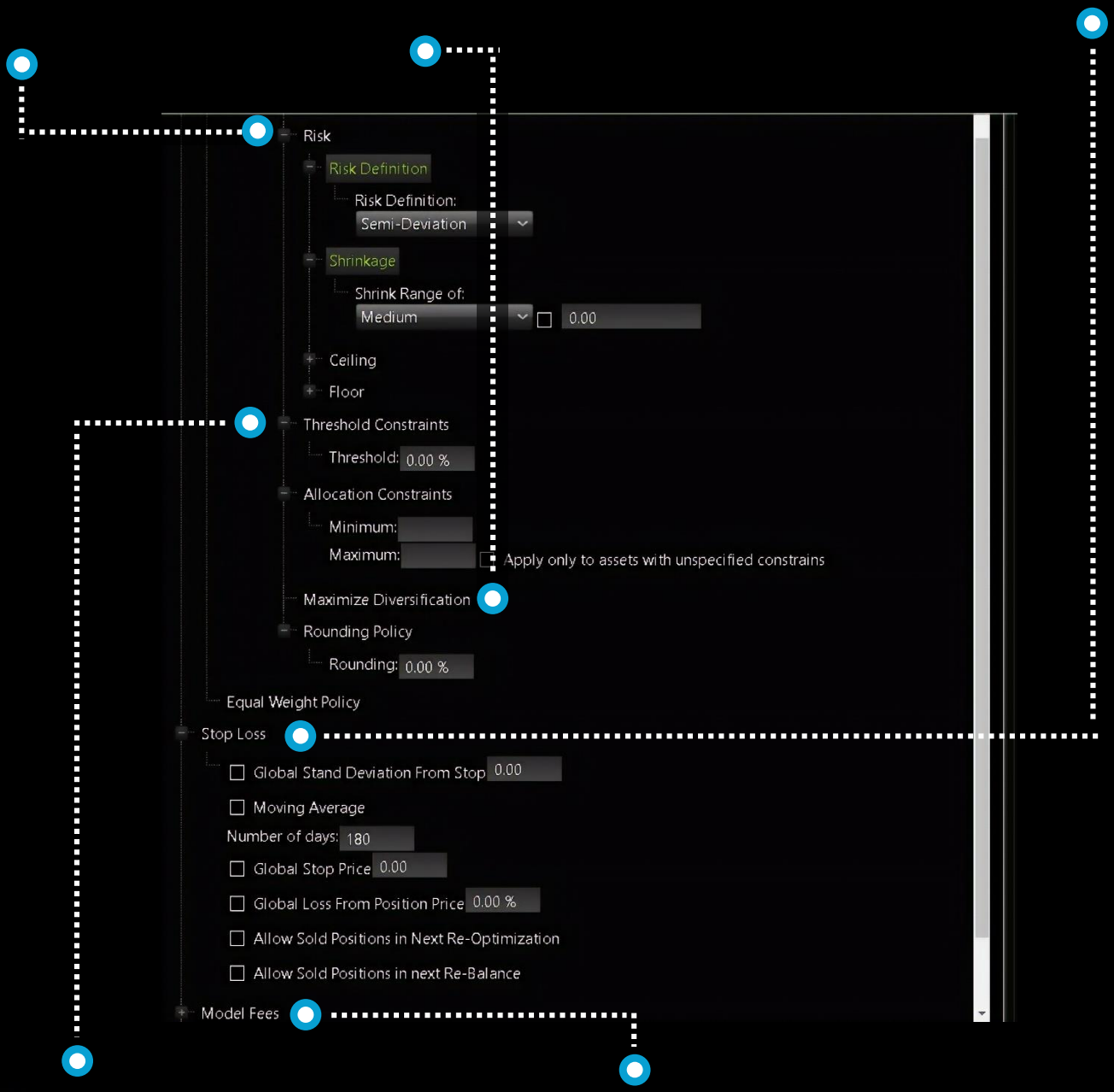
Control the risk, return and diversification. Throttle up or back the importance of each variable to the strategy.

POLICY TREE 2

Policies to define and control risk estimation

Maximum diversification policy not only works well, but ensures investor or advisor stays on the tracks

Stop Loss polices to govern in position risk management. Never let a loss become a bad story



Constraint policies applied to entire portfolio

Add any fee to display performance net fees

POLICY GUIDELINES

DIVERSIFICATION MANAGEMENT

Threshold Constraint	The Threshold Policy is applied to both a portfolio an any recommendation report built including that portfolio. The purpose of the threshold is to remove very small allocation weights that are so small as to be a nuisance due to the transaction costs outweighing the portfolio benifit given the value of a portfolio. The value is expressed as a percentage and any allocation given to any assets less than the designated percentage will be reset to zero and the captial reallcated to the remaining assets.
Constraint Policy	This policy when activated incorpoates the global minimum and maximun constraints as part of the policy tree
Rounding Policy	rounds any optimized postions to desired integer or decimal
Computation Dimension	The compuational Dimension relates to the number of assets being optimized. Generally the more assets being optimized the higher to computations dimension. A rule of thumb is the square root of the number of assets. Three is the minimum value, whiel there is no formal maximum, the computational demands grows exponentially with every added dimension so we generally cap the values at 10. The computational dimension is also used as a concentration control function, the smaller the computations dimension the more gsphere will "cherry pick" a smaller subset of the most effeceint and optimal assets.

SIMULATION

Simulation	The Simulation is used to generate a "SuperPostion" this represents the average allocation produced by each simulated iteration. The simulation works effectively as a blender and generally normalizes the allocations in the direction of equal weight while maintaining the principal tenents of Diversification Optmization. The simulation policy is prefered to using constraints to ensure a pragmatic, diversification portfolio that balances both systematic and non-sustematic risks. The simualtion is a Monte Carlo method which means simualted values are drawn from a porbability distribution. The helps the simualtion maintain a realistic posture.
Simulation Count	The greater the simulation count the greater the blending. Values should generally be set in the range 0-100. Simualtions counts greater than 100 will have only a marginal effect and will take more time to compute.

Simulation ND	ND simulations combines the monte carlo simulation method with Gsphere own genetic algorythm. The resulting combination produces the same superposition allocation but one that is a little less randomley fluctuated and more in tune with the optimization inputs. Generally speaking it is the prefered simulation option.
Allow Existing Assets to Vary	An existing postion refers to an allocation, share of value that has been defined to the system. This postions will not vary in its portfolio weight unless checked

WEIGHTING

Equal Weight	An equal weight policy distributed the portfolio evenly
Equal Vector	An equal vector policy overrides any risk or return assumption because it assumes equal utility among all the assets. The resulting portfolio is a diversification maximizing portfolio. This policy will result in all assets receiving some allocation weight with the possible exception of cash. This is a very simple, yet effective policy, especially for those seeking greater diversification and not having any preferences for one security versus another.
ReOptimization	The Reoptimization unit and interval is set and applies to a backtested portfolio or automated portfolio throught the robo advisory service.
ReBalancing	The Rebalancing unit and interval is set and applies to a backtested portfolio or automated portfolio throught the robo advisory service.

SAMPLING

Sample Period	Gsphere supports any number of sample peroids. The portfolio manager is free to set any sample peroid(s) of their choice. The decision to
Sample Period is Trailing	IF the sample peroid is marked as trailing then the sample will roll forward in any future reoptimization, both in a backtest or with automation.
Correlation Type	The correlation type is a property unique to any sample peroid.
Sample Weight	The weight assigned to any sample puts the risk, return and correlation forecasts produced by that sample in the designated porportion to the values produced by other samples. It is the relative weights that matter and it is irreleevant if there is only one sample peroid created. Weights to sampl peroids should generally be in porportion to the portfolio managers belief in the perdictive efficacy of that sample.

OBSERVATION

Observation Period	The observation peroid is the peroid of time that the results of the optimization will be reviewed. If running a backtest, we strongly recommend that the observation peroid be fully distinct from the sample peroid as as not to introduce any biases. For portfolios built to be put traded on now the observation peroid shows how that strategy would of done in the past.
Walk Forward	By selecting the walk forward option the portfolio manager is build a backtest. The observation peroid will walk forward from the latest data in any of the sample peroids and follow therules set by the reoptimization and rebalacning policies.
Auto-Update	When active this policy gives that the portfolio will always open with latest performance data
Observation Period is Relative	If the observation peroid is relative then as time passes the observed peroid will advance with time.

CAPTIAL MARKET ASSUMPTIONS

Return Shrinkage	Return shrinkage is a normalization tehnique that helps to clean up outliers in the data. Shrinakge preserves the rank of the data (so that your lowest return position will remain you lowest return postion etc) but it decreased the dispersion of return values amoung your portfolio positions. In the end, we want to produce estimated return values that are a fair yardstick of how much we value that assets, typically the actual range of finanical data is much greater than the range of prefernce that investors would ascribe. Shrinkage is based on an algo rythm called James Stein Estimation. It is demonstrated that using any level of shrinkage will produce more accruate estimates. the relative Shrinkage used between the risk and return variables is also used to make the portfolio more aggresive or conservative. For example shrinking risk values to the average would effectively eliminate the risk stastic from impacting the asset allocation, accordingly the portfolio tips in the direction of returns and favors greater returning assets without regard to the risk involved, becoming more aggressive. Generally some minimum level of shrinkage is recomended as more shrinakge allows diverisification to take a more promient role in portfolio construction.
Return Floor	The return floor will evelate any return value to the set floor. The floor is applied before shrikage. It is used to correct historical anomolies.
Return Ceiling	The return ceiling will lower any return value to the set ceiling. The ceiling is applied before shrinkage. It is used to correct historical anomolies. Generally we apply return ceilings in the range of 20-35 %

Return Shrinkage

Rather than shrinking the dispersion of positions returns estiamtions to the population mean you can override that value. Generally, a return shrinkage target would be set to a long term portfolio level return and the use of the target is more appropriate if the sample peroid provides useful return rank data but may be of an inapprorporate magnitude.

Hurdle Rate

The hurdle rate is the minimum rate at which any risky investment must be expected to make. Hurdle rates can be higher in more aggressive portfolios and lower in conservative portfolios. Gsphere will exclude from the optimization any asset failing to outperform the hurdle rate. Hurdle rates can also be negative which is oftern used to enable assets with negative hisotical performance to be inlcuded to the optimization. The hurdle rate can be a return on a money market fund, or treasury bill or it can be the margin rate for a leveraged portfolio or it can be the rate of expected inflation.

Risk Definition

Changes to the risk defintion change the risk metric that is associated to each asset. Gravity has developed significant best practices with the risk definition. Recall that any risk metric is a surrogate for the probability and magnitude of futures losses. The standard deviation from "modern Portfolio theory" is easily improved on with metrics that better correspond to what risk actually is and that have a more predictive quality.

Risk Shrinkage

Risk shrinkage is a normalization tehnique that helps to clean up outliers in the data. Shrinakge preserves the rank of the data (so that your lowest risk position will remain you lowest risk postion etc) but it decreased the dispersion of risk values in your portfolio positions. In the end we want to produce estimated risk values that are a fair yardstick of how much we value that assets, typically the actual range of finanical data is much greater than the range of prefernce that investors would ascribe. Shrinkage is based on an algo rythm called James Stein Estimation. It is demonstrated that usintg any level of shrinkage will produce more accruate estimates. the relative Shrinkage used between the risk and return variables is also used to make the portfolio more aggresive or conservative. For example shrinking risk values to the average would effectively eliminate the risk stastic from impacting the asseta llocation, accordingly the portfolio tips in the direction of returns and favors greater returning assets without regard to the risk involved. Generally some minimum level of shrinkage is recomended as more shrinakge allows diverisification to take a more promient role in portfolio construction.

Risk Floor

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Risk Ceiling

The risk ceiling will lower any risk value to the set ceiling. The ceiling is applied before shrinkage. It is used to correct historical anomolies.

Risk Shrinkage Target

Rather than shrinking the dispersion of positions risk estiamtions to the population mean you can override that value. Generally, a risk shrinkage target would be set to a long term portfolio level risk metric and the use of the target is more appropriate if the sample peroid provides useful return rank data but may be of an inapprorporate magnitude.

RISK MANAGEMENT

Global Stop from Positions Price	This stop loss policy sells off any postion at an absoute price threshold.
Global Stop %	The Stop loss policy will sell off any postion in a given optimization interval that has a daily closing value sufficient to attain a loss in the position greater than the threshold specified. Stop loss policy can be used for tax loss harvesting. Stop loss is a traders tehnique in accordance with the philosophy "let your winners run and cut your profits short." Additionally it can prevent pychologically damaging losses to impact the portfolio manager or investor psyche.
Global Stop # of Standard Deviations	The Stop loss policy will sell off any postion in a given optimization interval that has a daily closing value sufficient to attain a loss in the position greater than the threshold specified by calculating the assets standard deviation and entering the some multiplier of that standard deviation. For example, if a position has an annualized standard deviation of 20% and the portfolio manager enters a value of 1.5 then 1.5 * 20 = 30% and when that postion losses 30% a stop loss order is triggered. This applies to backtests and portfolio automation.
Allow Stopped Positions to Reinvest in next Re-Optimization	After a postion has been sold because a stop loss sale rule, this contingent policy governs if that postion will be allowed in a subsequent reoptimization.
Allow Stopped Positions to Reinvest in Next Rebalance	After a postion has been sold because a stop loss sale rule, this contingent policy governs if that postion will be allowed in a subsequent rebalancing

UPCOMING POLICIES

Volume Weighting	It is often regarded that price movements assocated with greater volume have greater predictive merit. Volume weighting any sample catpures this belief.
Profit Taking	rules to govern how postions can lock in gains.
Sample Inversion	Inverting a sample is a technique that a portfolio manager applies when she believes that the sample peroid offers material negative predictive efficacy.
Stambaugh Extrapolation	Stambaugh Extrapolation uses the relationship information for assets with shorter histories to interpolate a longer history than better enables an apples to apples estimation with other assets
Rip Cord Policy	The Rip Cord Policy when triggers sells the entirity of the portfolio and goes to cash.

FEE POLICY

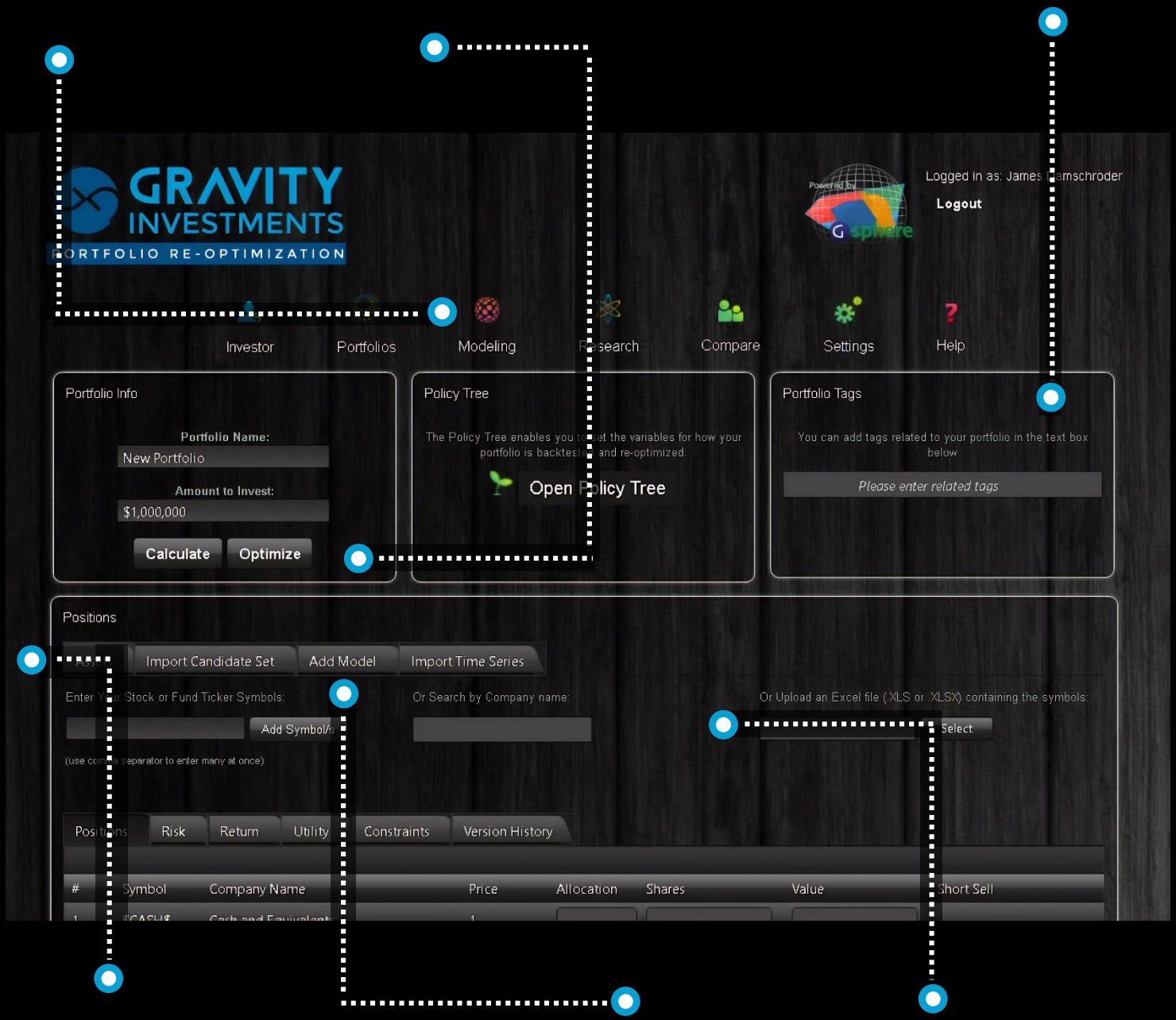
Fee Policy	Sets a fee that will be subtracted from all illustrated performance metrics and charts

PORTFOLIO EDIT

This page lives here on the modeling link

Use this page to optimize a portfolio with unallocated capital or just calculate an existing portfolio

Tags support portfolio display, sharing, automation and performance options



This row of tabs supports the methods to enter assets or lists into the system

The model tab allows for already created portfolios to be included to a strategy. This supports a model-of-models approach

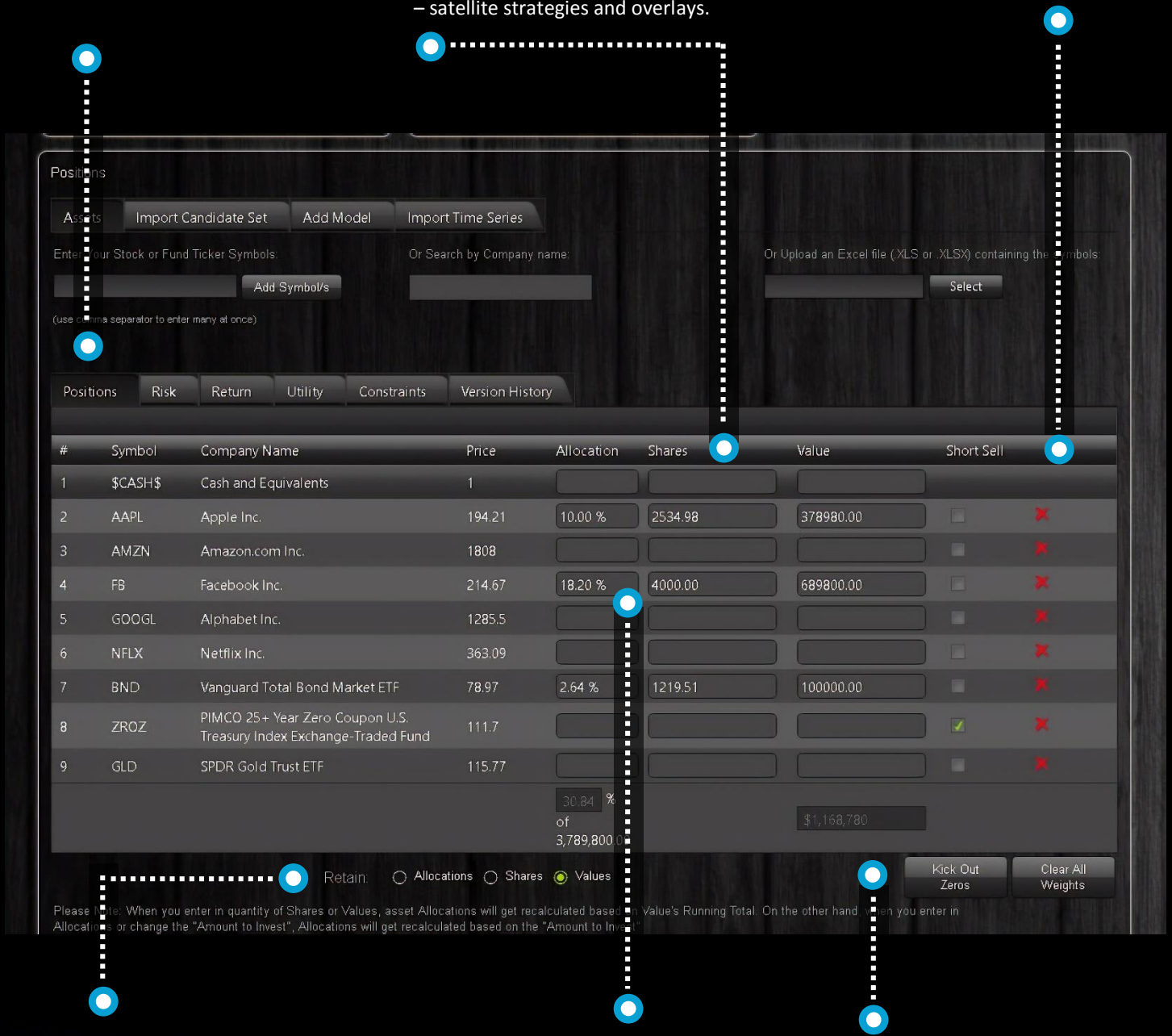
Enter tickers, or enters names of companies or funds, or import from outside sources

POSITION GRID

This is the position grid which the user can declare any known or fixed weighting to any position

If the user declares no positions then the optimization runs ‘naked’, if the gird is filled in, gsphere is just a calculator. But partial optimizations support complex client scenarios, core – satellite strategies and overlays.

Take a short position in any desired asset by checking the box, forecasted inputs will invert



Retaining previously optimized results, then adding additional capital to the model supports a contextual optimization of the investors existing, optimized or held away accounts.

Enter an allocation, share or value and the value entered will persist through optimizations, edits and future events

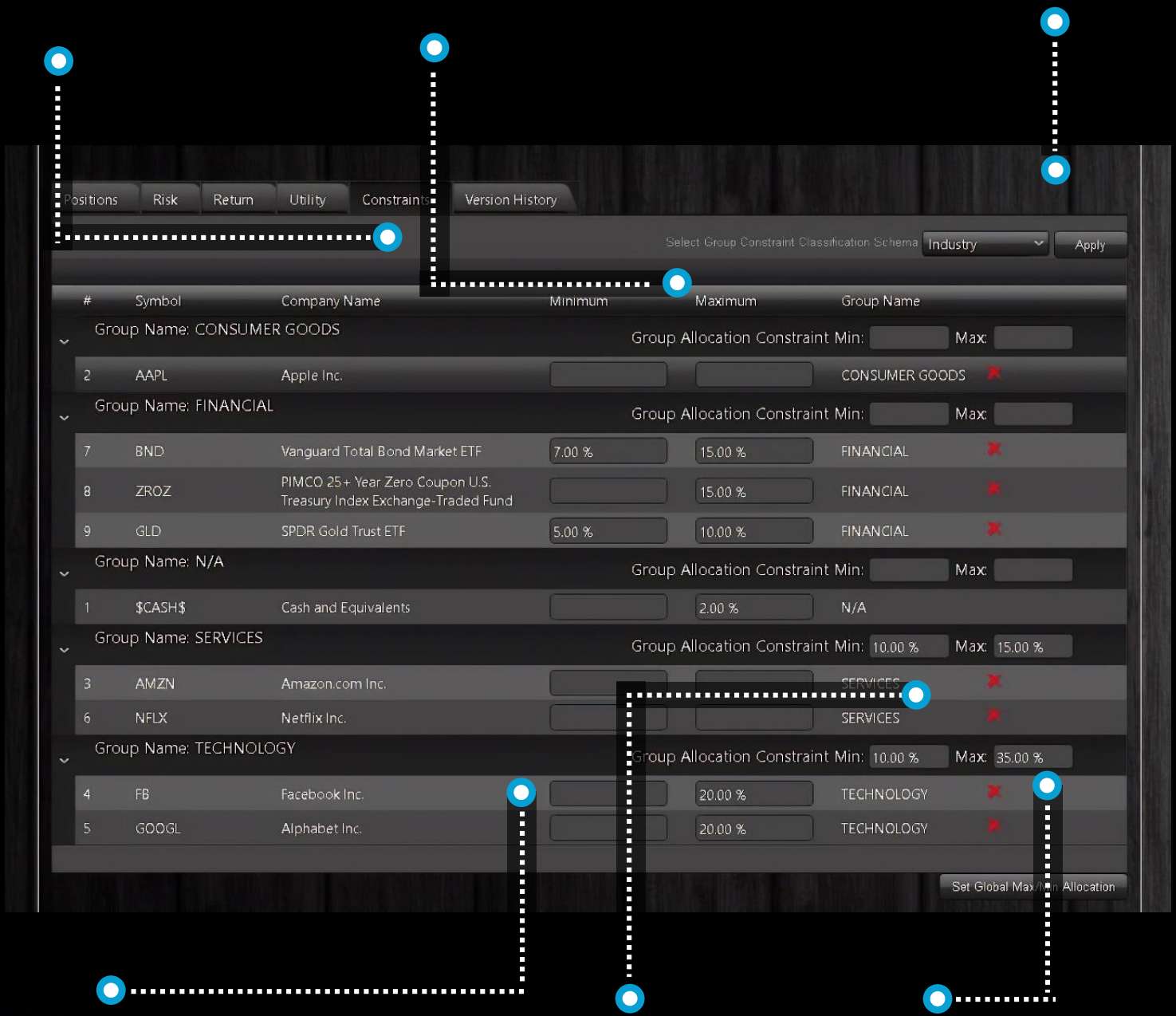
Removing unallocated positions and clearing all assigned or derived weights support various workflows

CONSTRAINT TAB

Constraints can be set globally from the policy tree or individually in this tab

Create any combination of position and group min and max constraint

You can apply a group schema here to use as a category constraint



Set individual asset minimum and maximum constraints

Use the groupings here or click-in to make up your own groups

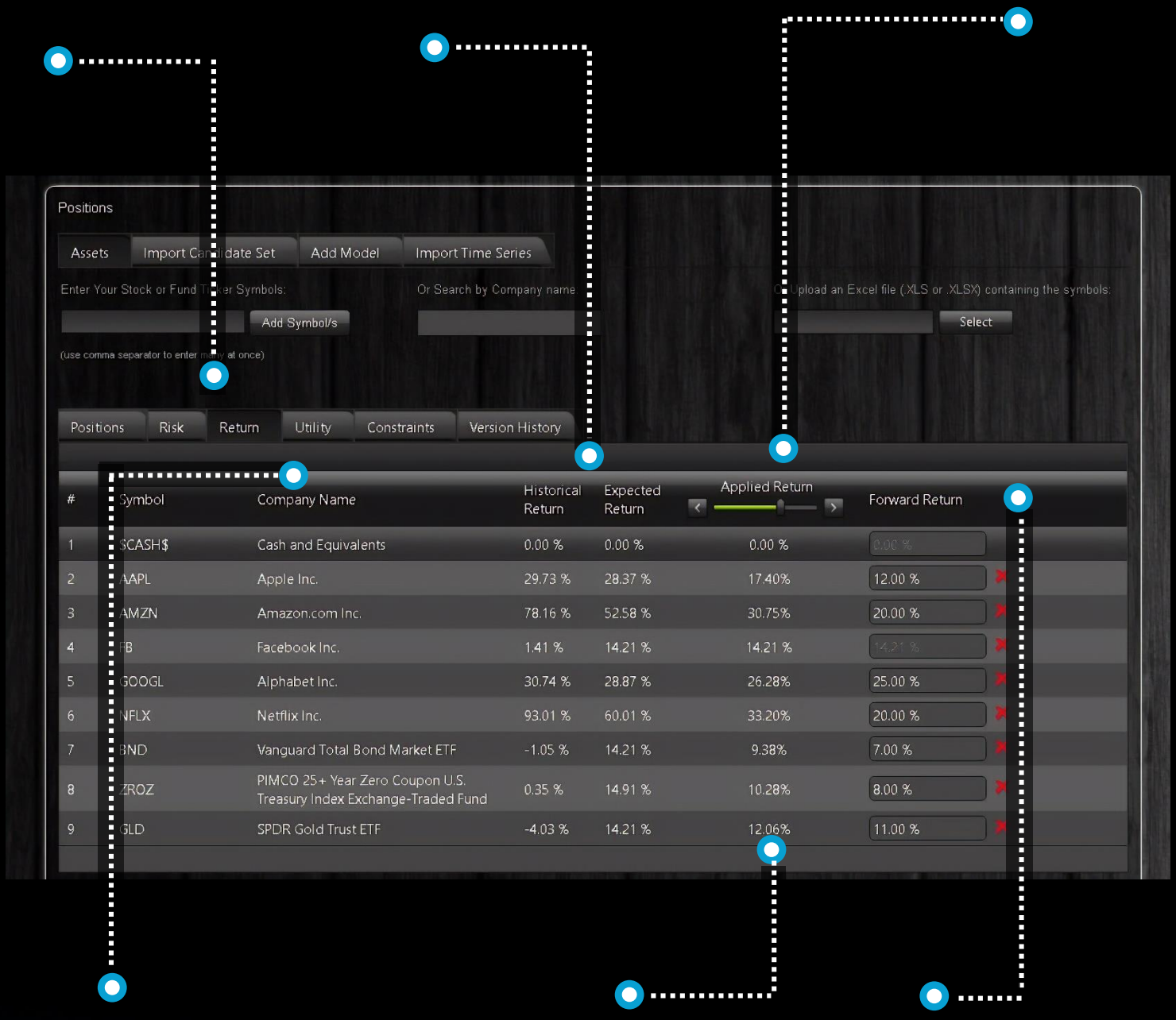
Set group min and max constraints

RETURN ESTIMATION GRID

Inspect and manage your risk and return estimations

Track the return estimations as they go from historical to projected

Applied returns are what is fed to the optimizer



The Utility tab gives the final utility function (numerator and denominator)

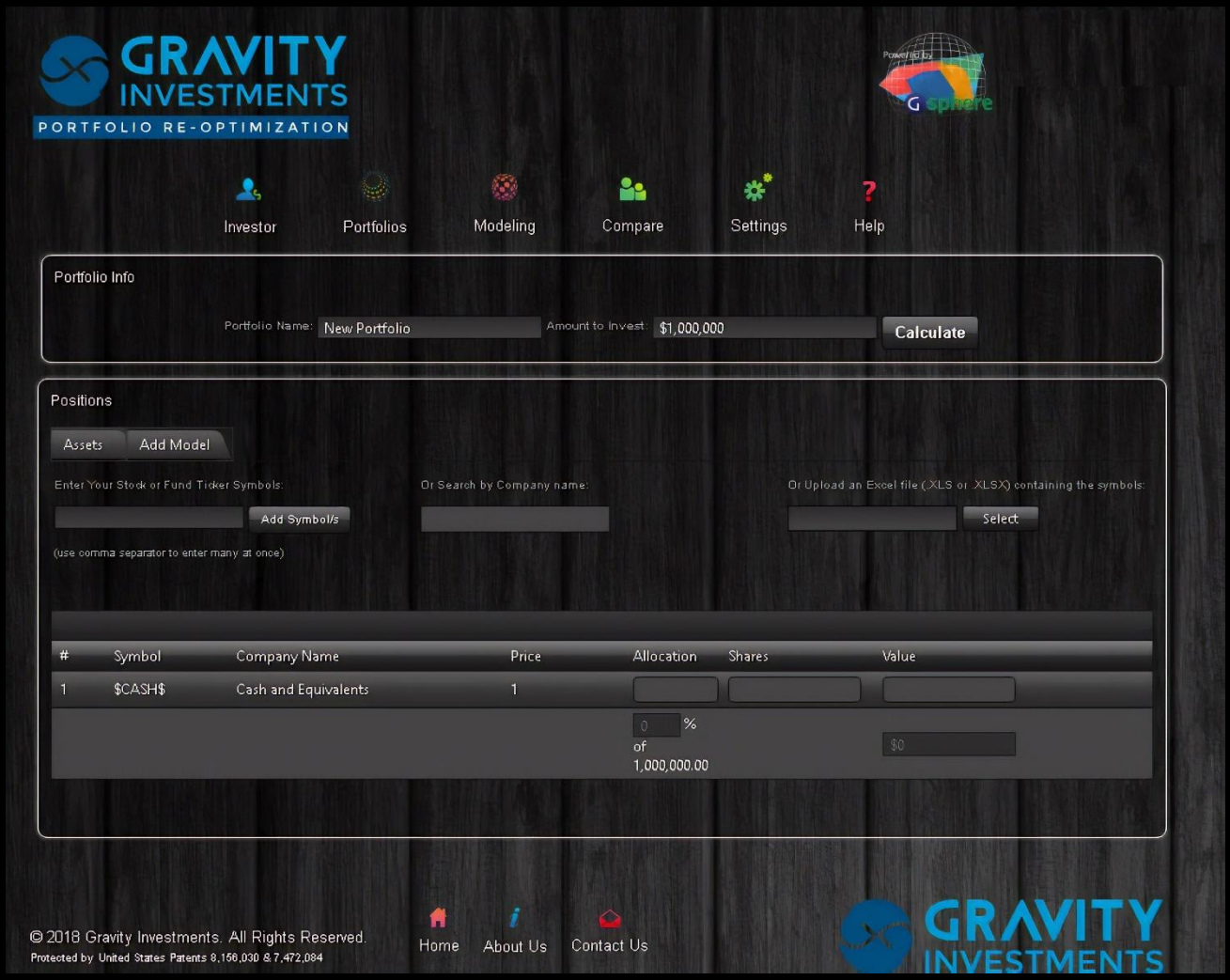
Blend Gravity's quantitative forecasts with a manual or outside source

Forward returns can be manually entered or imported

ADVISOR PAGE

The portfolio edit page for the advisor user type offers a streamline interface

users workflow is to enter portfolio into the system to get portfolio analysis and create the basis for a recommendation

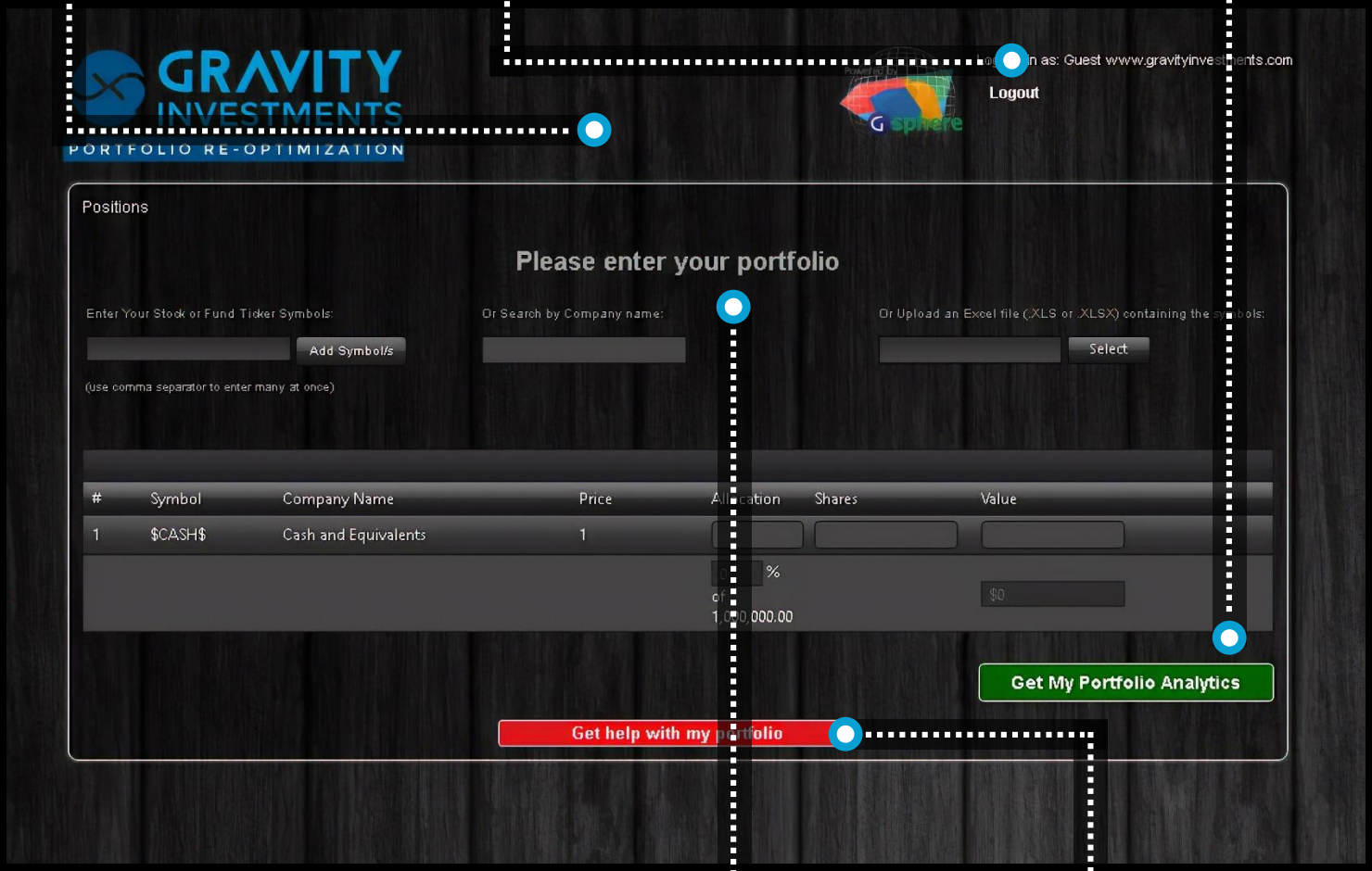


GUEST EDIT

The guest user edit is designed to be custom branded and embedded, usually as part of a free portfolio analysis

Prompt web visitors with a strong call to action that sends them here

Most investors are less diversified than they think they are so this will expose the investors true diversification and can inspire corrective action



the investor enters their portfolio

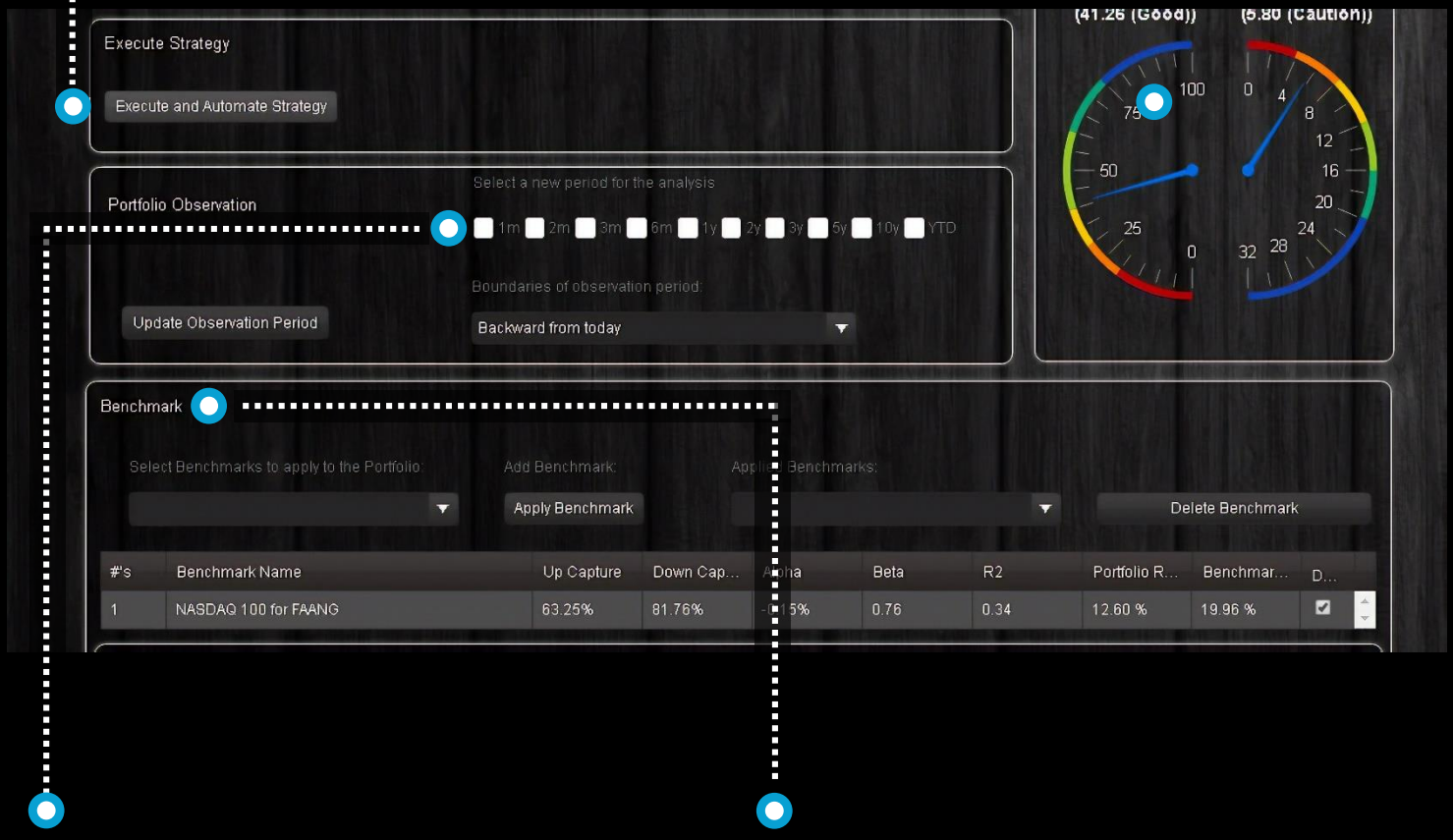
the users is taken to the portfolio view page

VIEW CONTROLS

When the portfolio manager is ready to execute and automate the strategy the portfolio is sent to the trading system with our API

The portfolio is tagged with Automated tag which turns on the portfolio monitor and triggers activated investment policies as they become executable

Updates to the portfolio are pushed to the trading system



User can select any time period to view the portfolio for, and all charts, graphs and analytics update to the reset period.

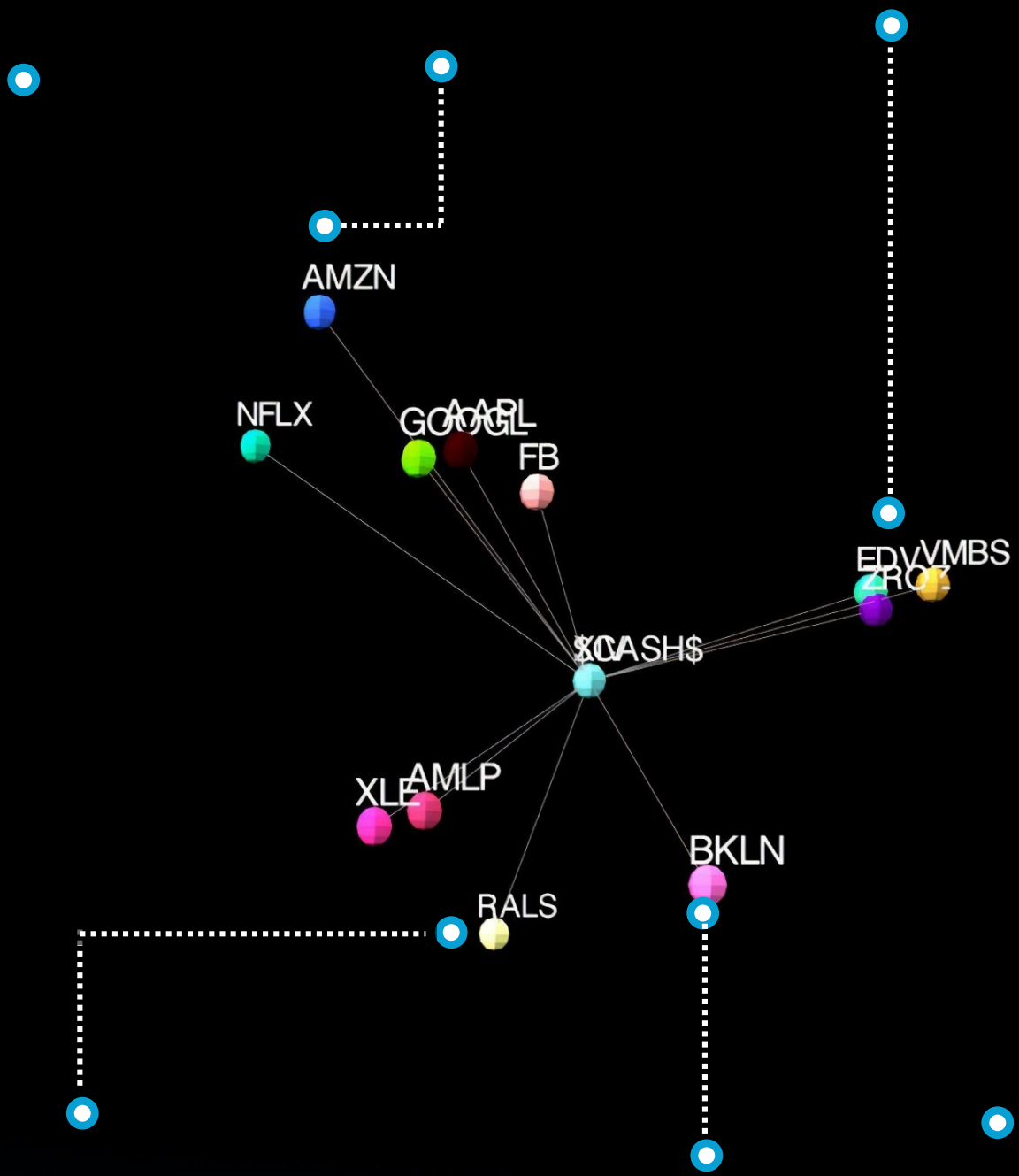
User can set multiple benchmarks for stats and charting

VECTORS

Gsphere maps correlations of assets to angles of separation in the 3D polar chart

Assets with more attractive metrics (greater utility) have longer vectors

Highly correlation assets customer together



Uncorrelated assets are graphed 90 degrees apart

Opposite correlations are graphed opposite apart one another

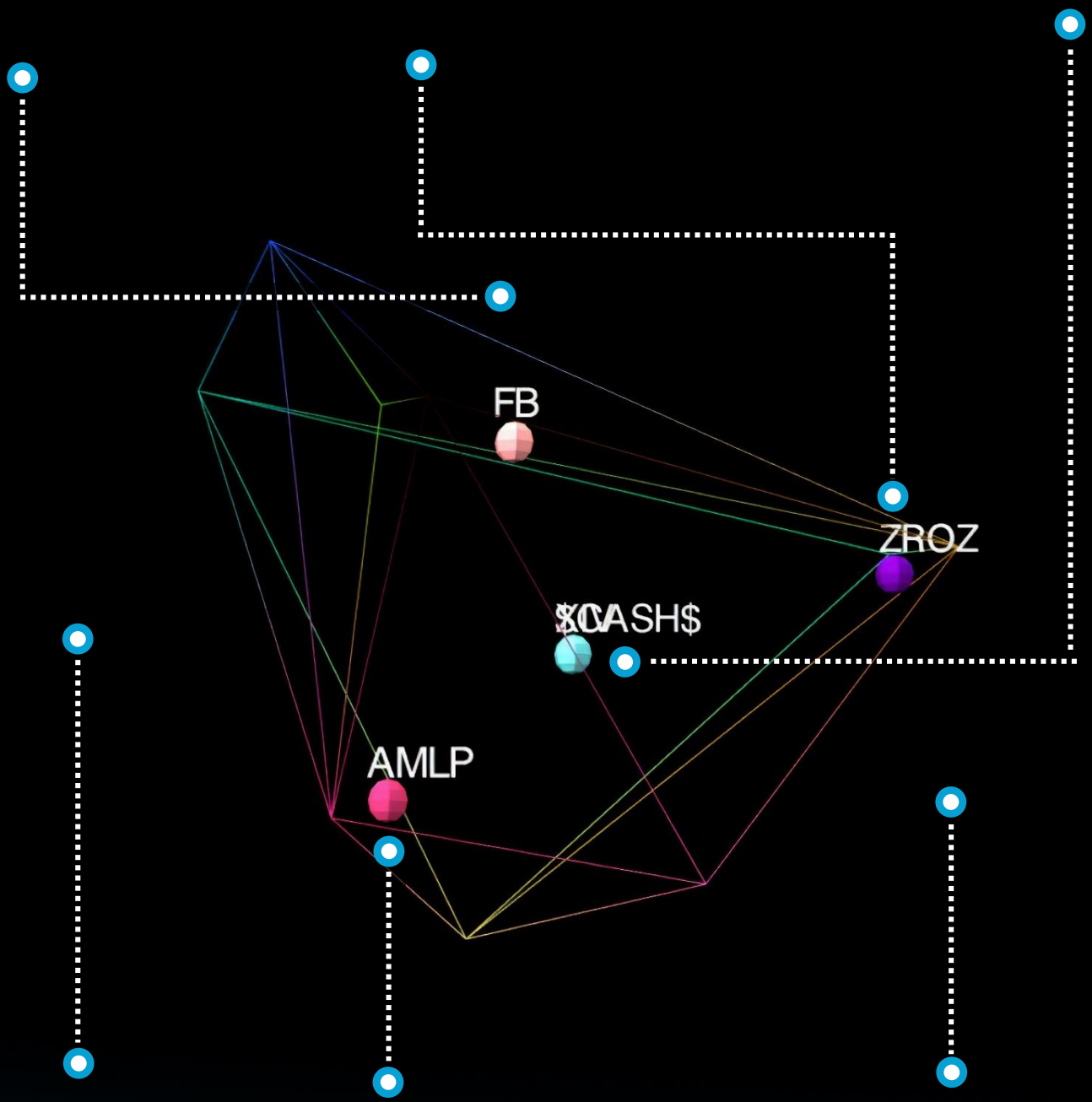
In this way, we translate economic balance to physical balance

FRAME

The frame is the portfolios 3D, holistic efficient frontier

The best investments combine to create the frame

Inefficient assets are trapped inside



Inefficient assets will be outperformed by some combination of other assets for any market direction

We can visualize nearly efficient vs. deeply inefficient assets and be more forgiving for nearly efficient assets with a simulation induced superposition

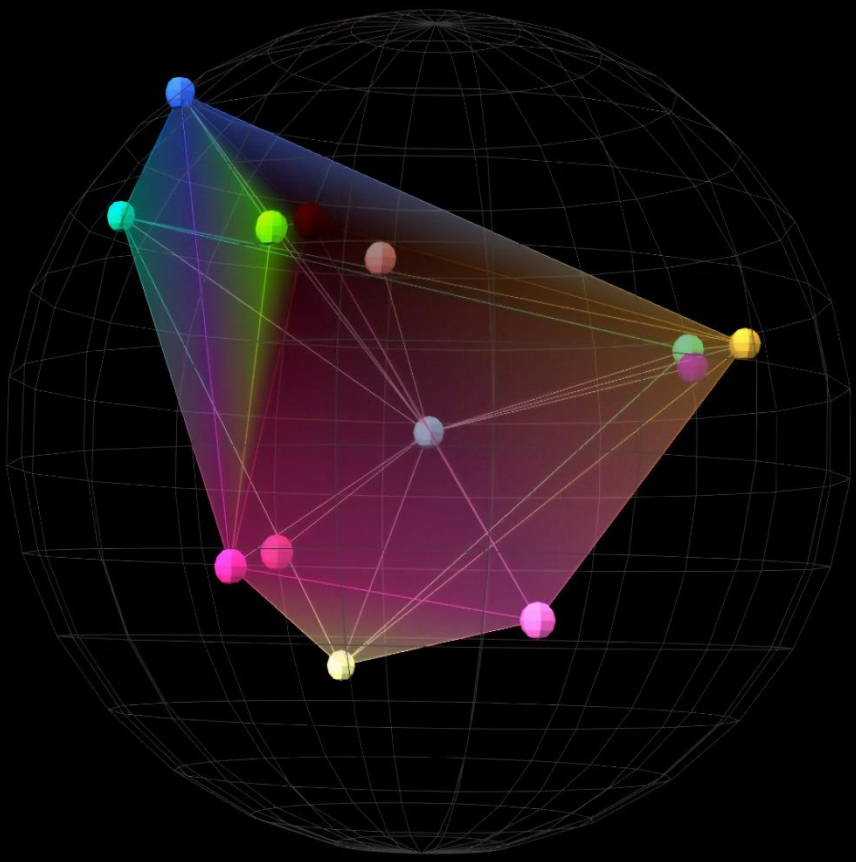
The frame and graphics are always displayed in 3 dimensions, but the mathematics can be set in higher dimensions. The lower the calculation dimension the more discriminating the algorithm

SPHERE

The symmetry of the volume this process induces is the portfolios diversification visualization

this visualization is great to objectively educate clients about diversification

This is the source of many investors “aha moment”



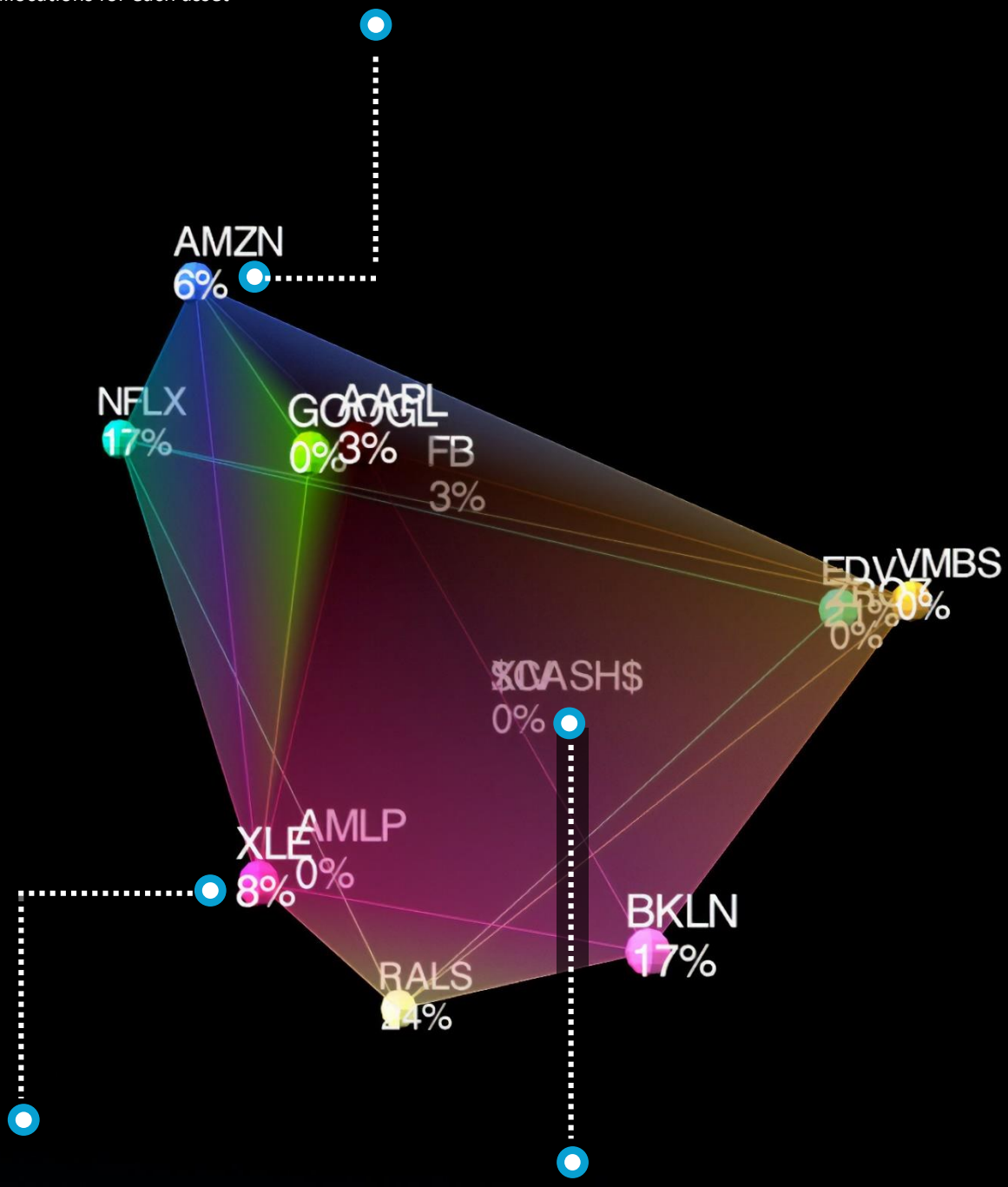
the 3d graphics are interactive: both on the webpage and inside the pdf reports

The sphere is just a visual reference model to depict what perfect symmetry looks like against the portfolio. Portfolios do not need perfect sphericity to have great diversification, but huge risk reduction align with major improvement to symmetry.

ALLOCATIONS

With the portfolio modeled geometrically, we can calculate the optimal allocations for each asset

The weights are equal to the assets' relative volume contribution



It is like a smart pie chart, containing the assets relativity information and the sum of the whole; the very definition of holistic

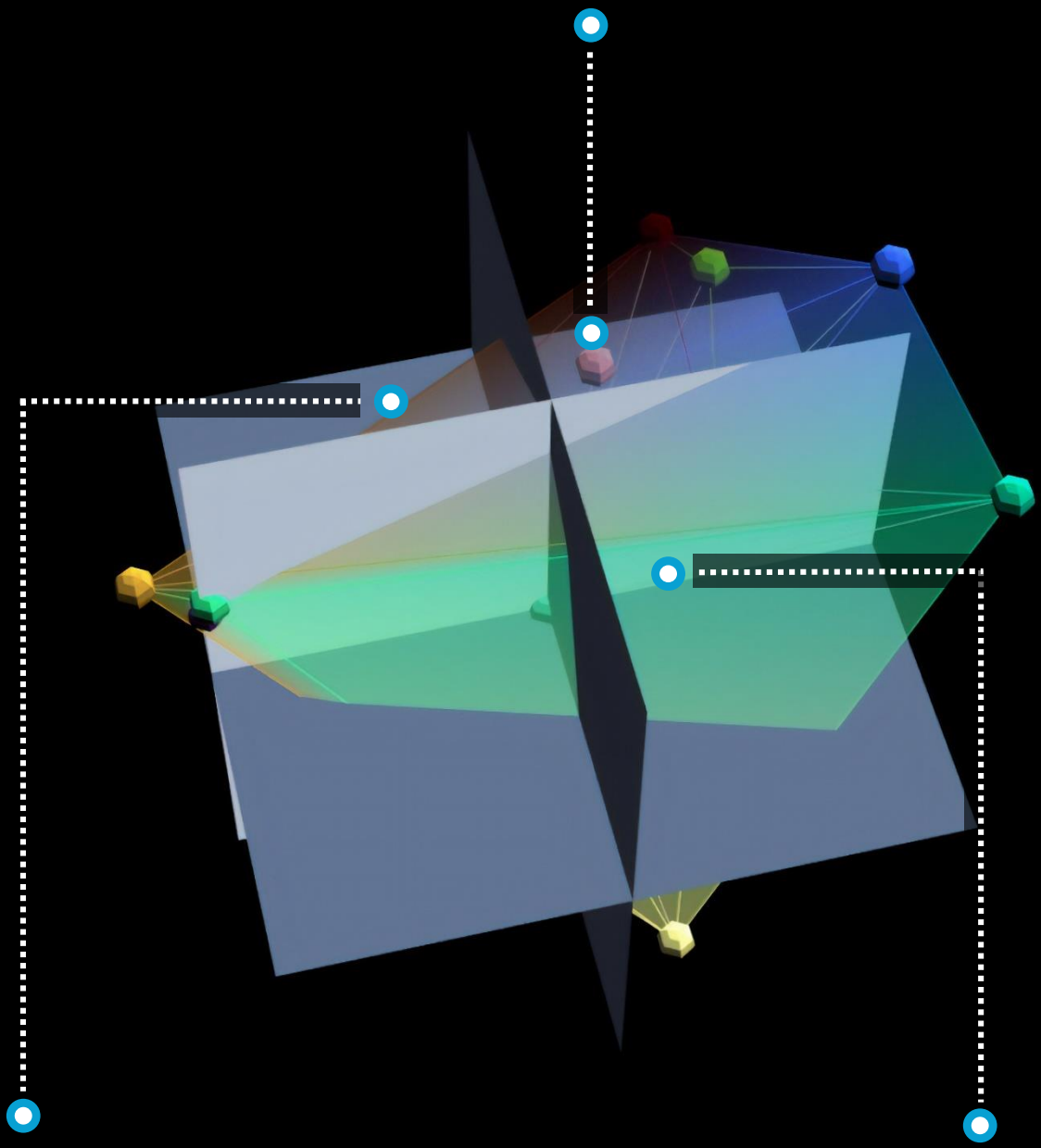
Inefficient assets have zero weight

BOXES

The diversification boxes cut the 3D space into 8 boxes

Each box represents diversification potential

Box exposure or lack of it is very tangible and easy to understand



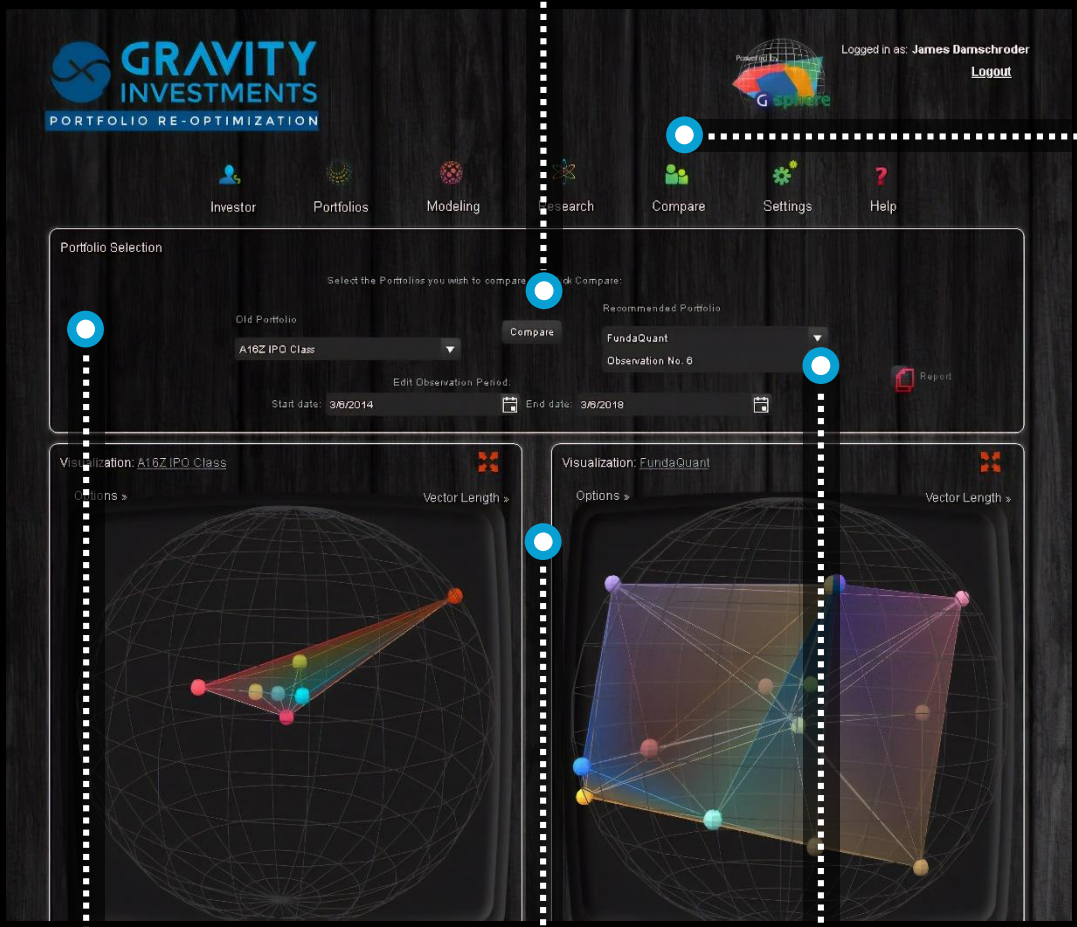
An empty box is an opportunity to obtain better diversification for the investor.

The boxes are another visual reference like the globe

COMPARE

Gsphere offers a full comparison of any two portfolio

The comparison is available in the compare link



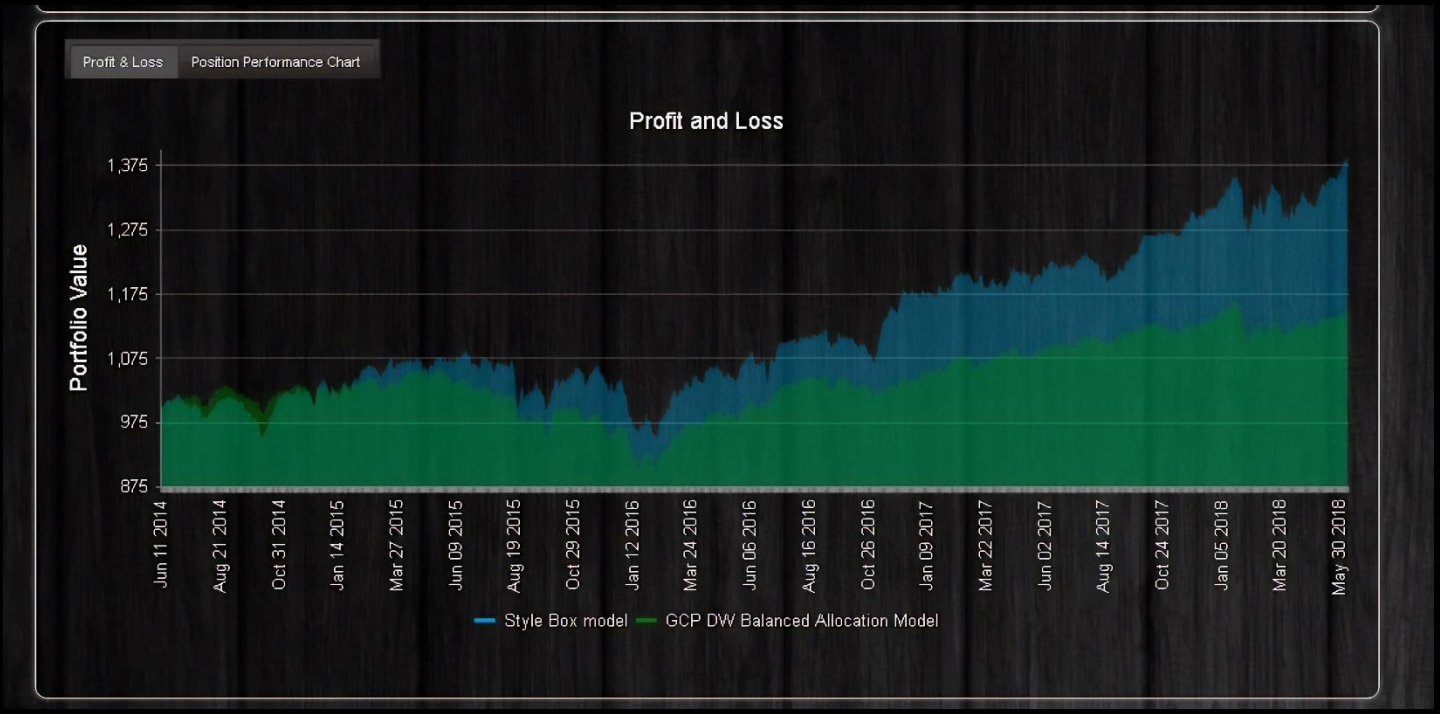
Select the portfolio to compare and adjust the data range if desired

The differences in the 3D views can be striking when investors have poor diversification

Advanced users can compare multiple versions of the same portfolio

COMPARISON PROFIT AND LOSS CHART

The relative profit and loss of the two portfolios is often an important influence in investor acceptance



COMPARISON DIVERSIFICATION GAUGES

Comparative diversification gauges remove any shred of subjectivity in the comparison

Each color code and scale is unique to that measure; red is danger, orange is caution, yellow is adequate, green is good, dark green is excellent and blue is abundant

Fiduciary Diversification is the standard for evaluating fiduciary appropriateness of diversification

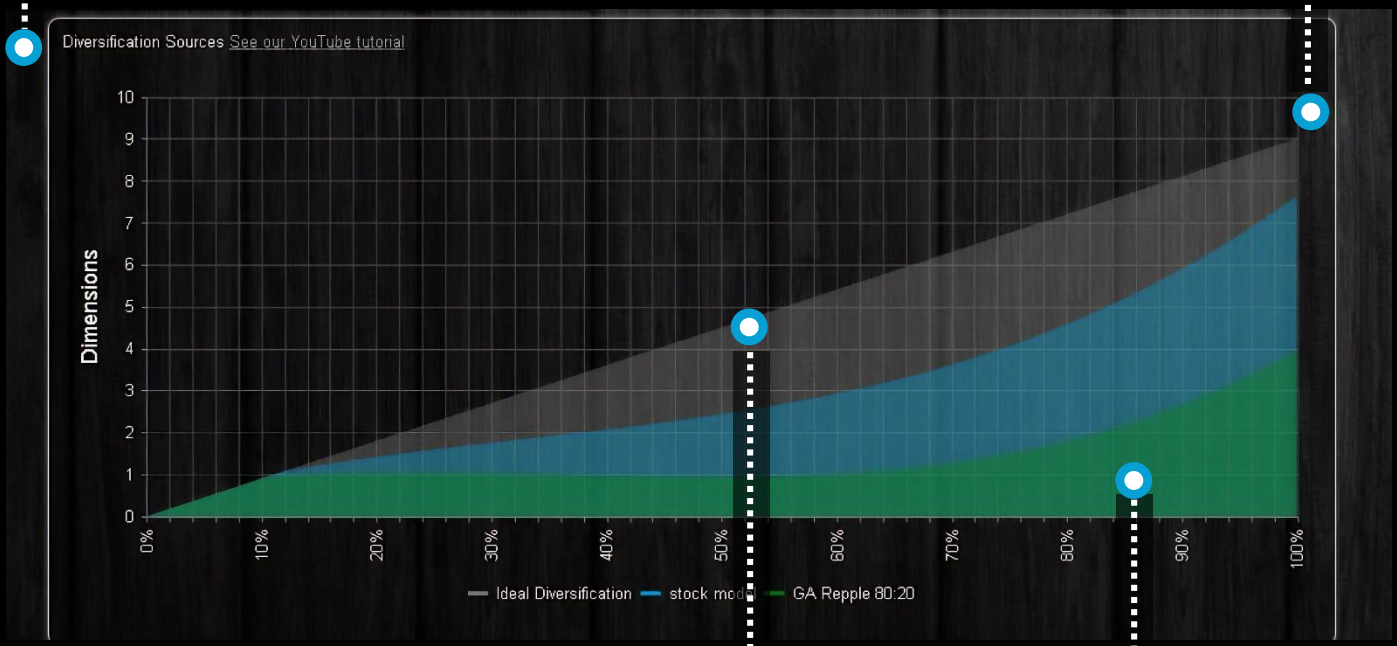
While there is no limit to some diversification values, further increases in values do little to help, but also do not hurt unless it causes other values to retract

Often, we see a trade off in idiosyncratic diversification and systematic diversification. To have strong total fiduciary diversification one needs both.

COMPARISON DIVERSIFICATION SOURCES

This chart illustrates the totals dimensionality for each portfolio

More important that the total dimensionality (the right most value for each graph) is the path it takes to get there. This is the diversification of your diversification

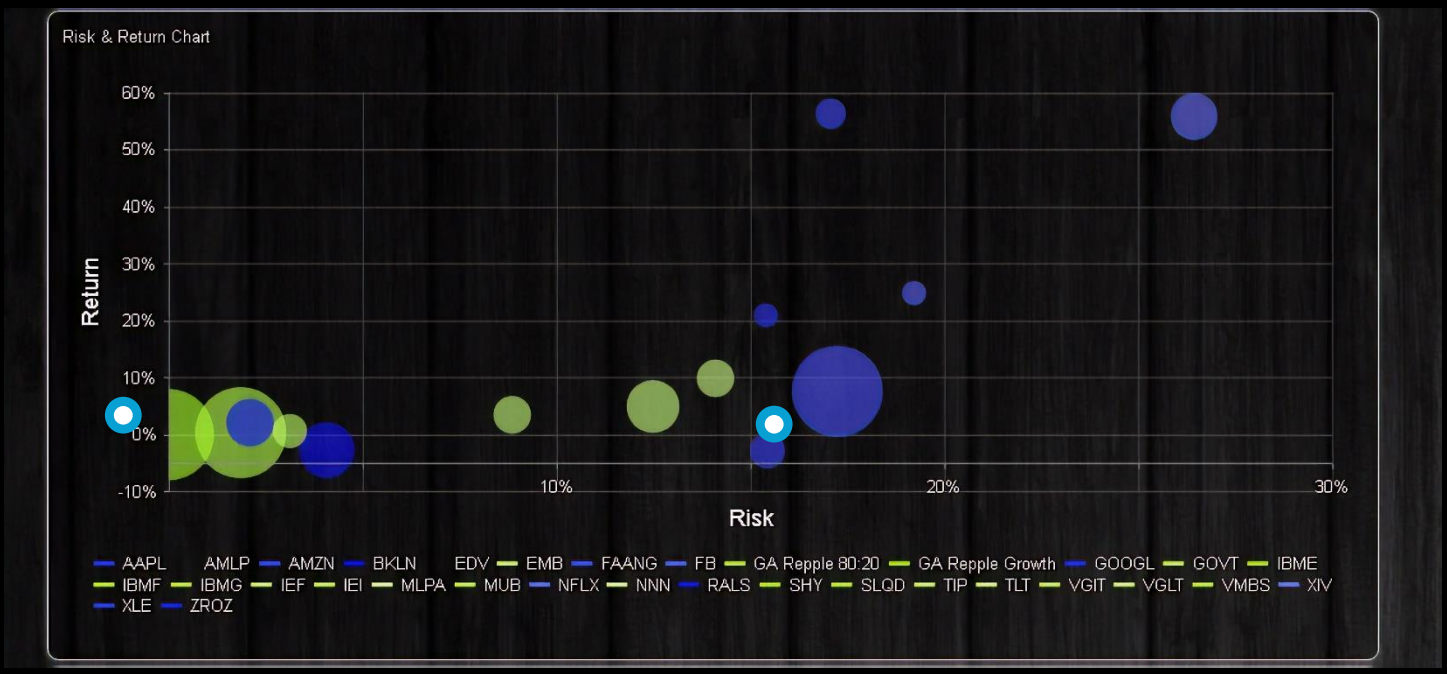


A linear increase is vastly superior to hyperbolic increase

This green graph shows that despite all of the holdings, statistically this portfolio has 70% of its variation governed by one single thing. This is the insidious systemic risk that many investors bare without awareness.

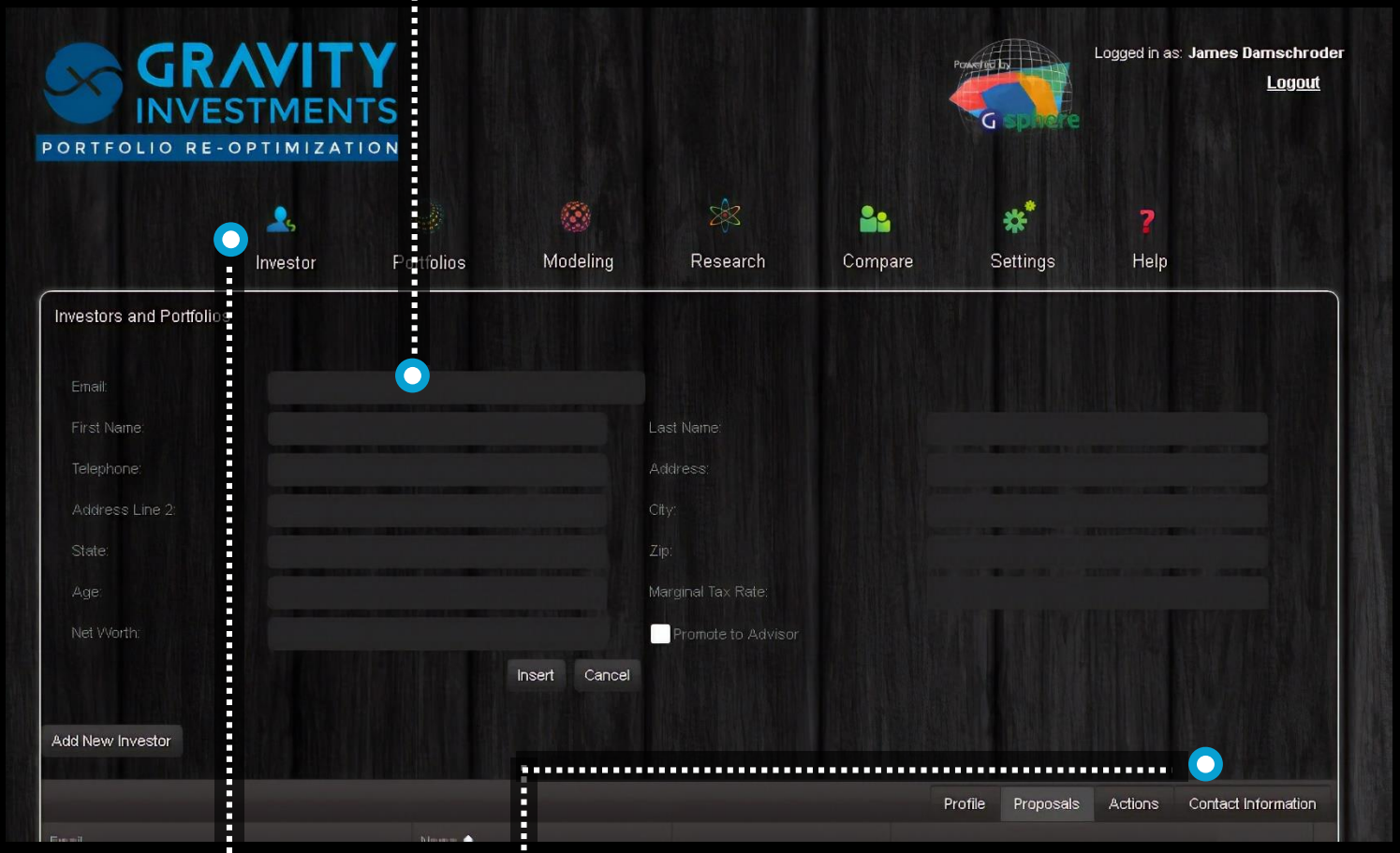
COMPARE RISK & RETURN

Comparative risk and returns illustrates both the portfolios and their components



CONTACT

Enter investor details and KYC / profile data here



Investors and their portfolios are kept separate from your models for privacy

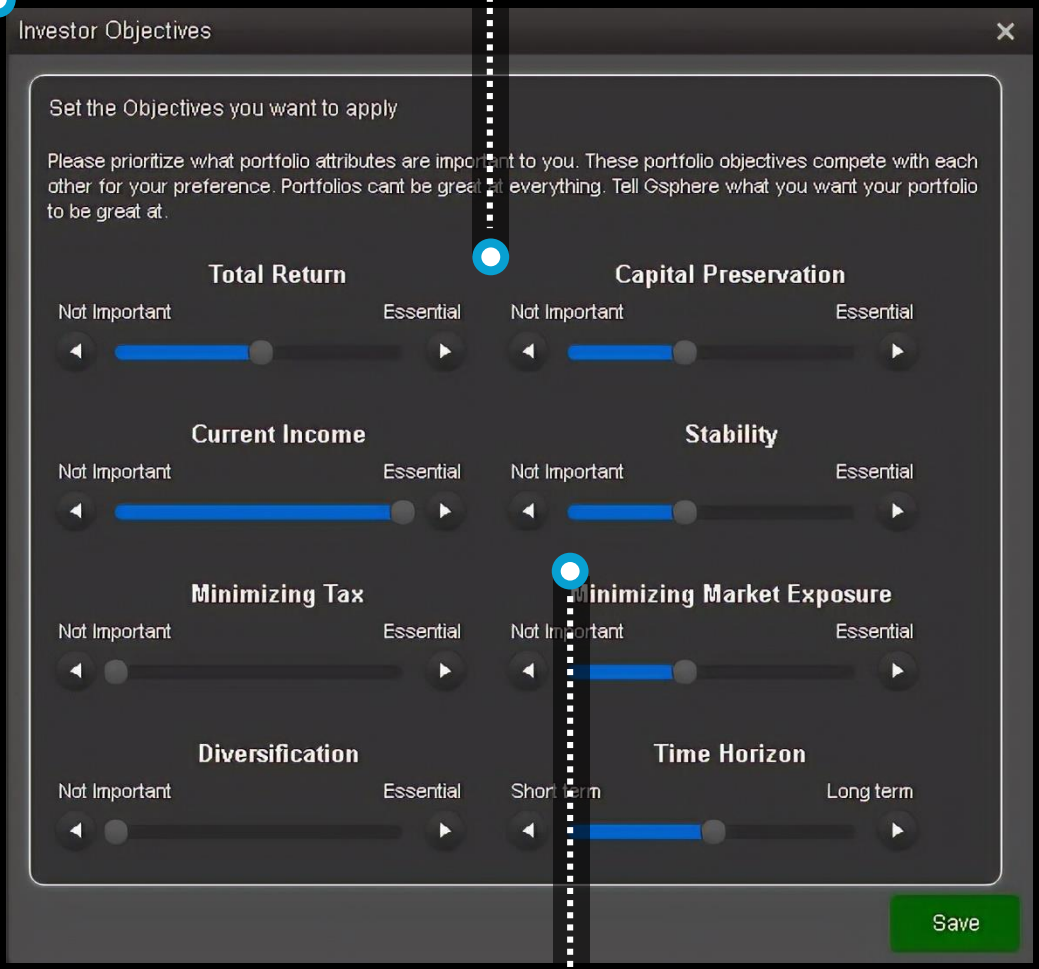
keep investor objective, proposals, contact data and analytics here

OBJECTIVES

These portfolio objectives may be set by the advisor or sent to the investors

The investor must prioritize what is important to her

Each objective is competing with the others for her preference

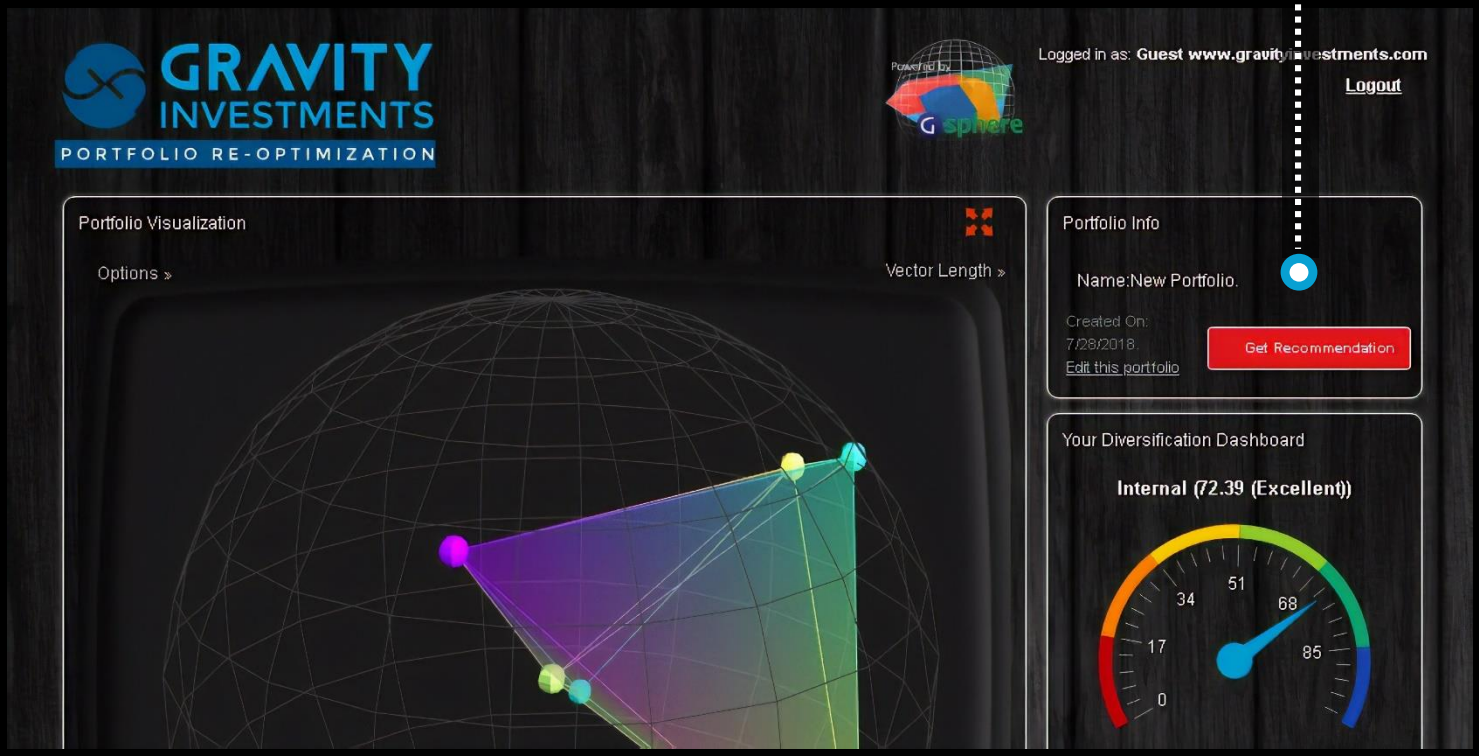


The objectives will be used to either select the model that is the best fit from the firms designated model lineup or are used to reparametrize the utility functions of the investment candidates used in the custom recommendation

Each position is evaluated against each objective and multiplied by the investors preference

RECOMMENDATION

The recommendation button is a major call to action that appears on the portfolio view page after getting her portfolio analytics back



The logic behind the recommendation is set in the brand settings page

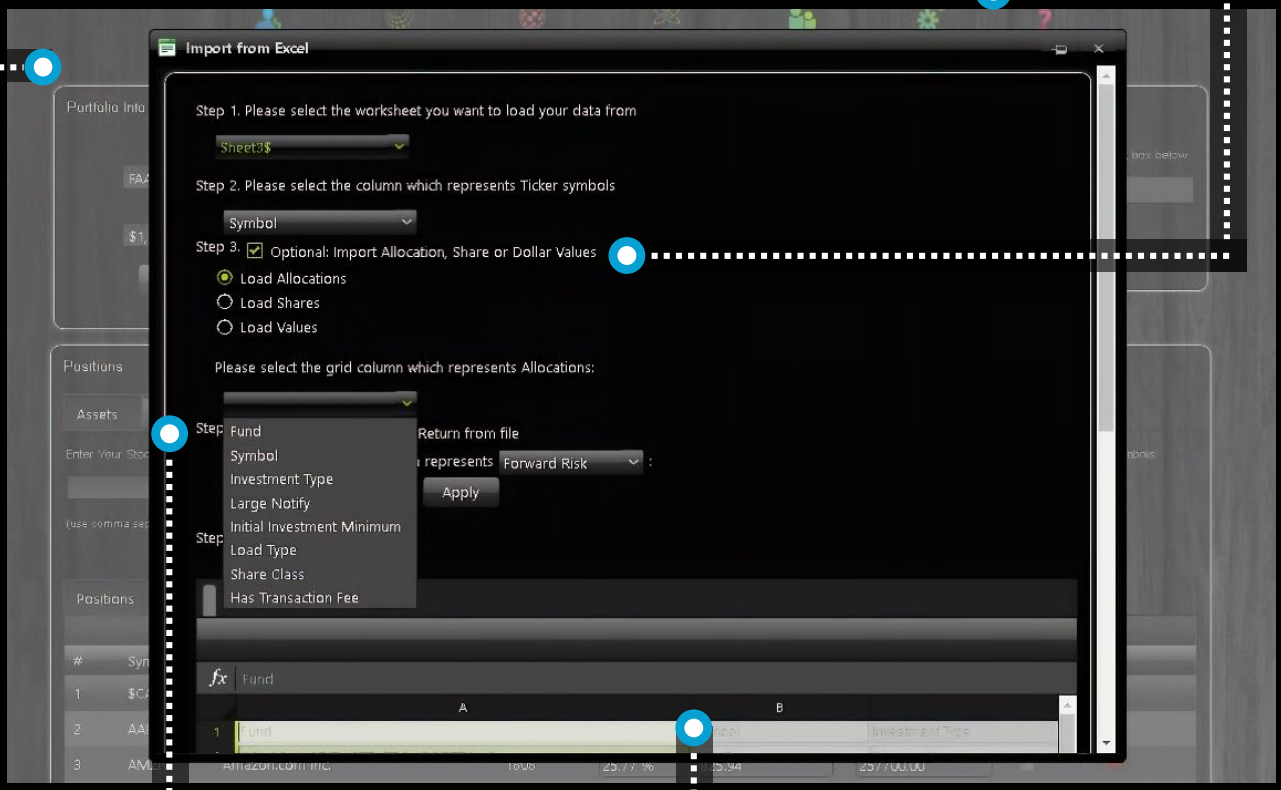
The recommendation may be a selection of a model portfolio, or an optimization of existing holdings, or a custom implementation of the firm's candidate sets and the investors objectives.

EXCEL IMPORT

Import positions for a quick analysis

Flexible formats to minimize excel manipulations

Import allocation, shares or values depending on your workflow and data availability, or just import the positions to optimize



Import risk and / or return assumptions

Preview the import data

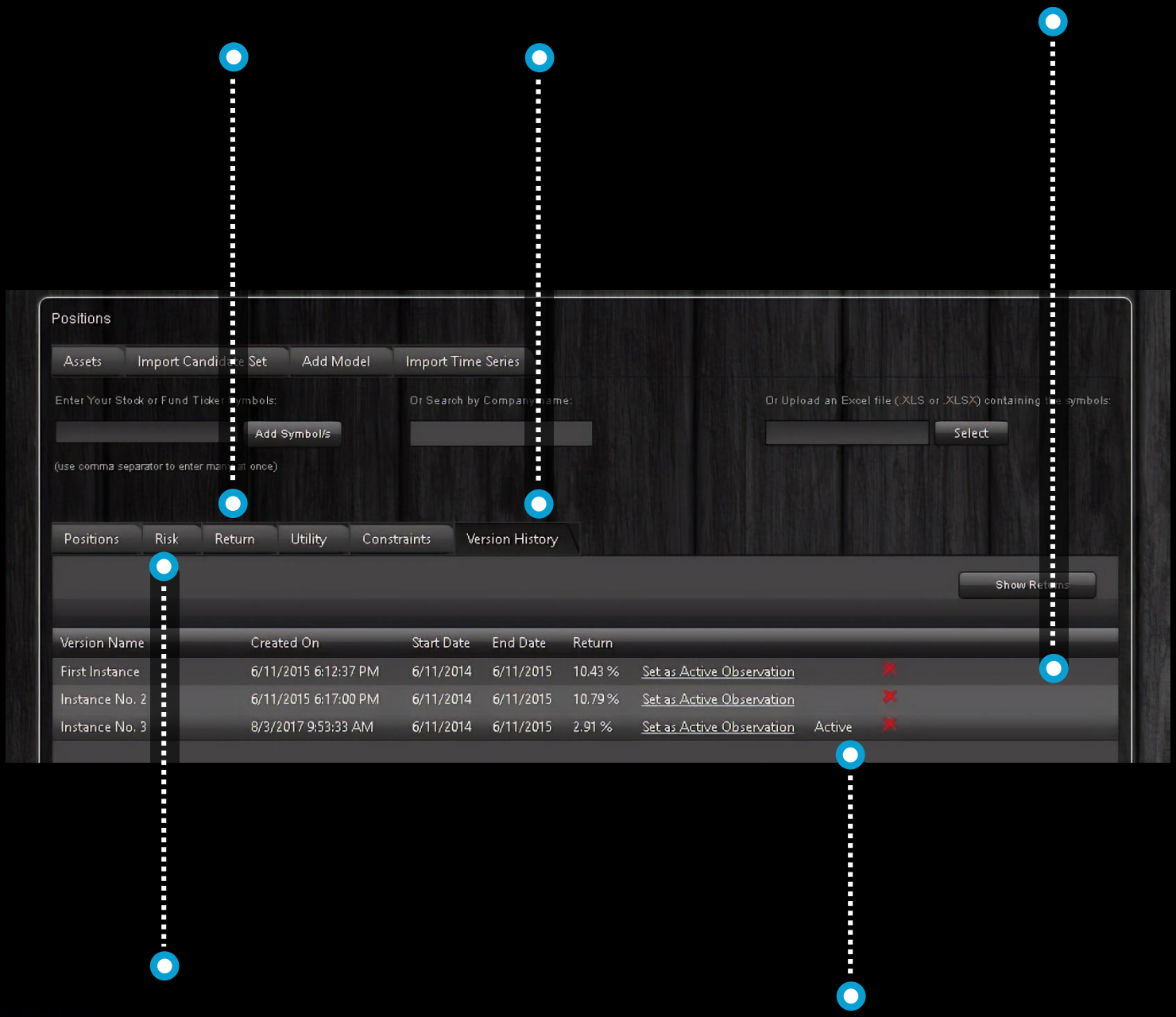
Support for importing outside time series allows inclusion of private assets, hedge funds etc. into model

VERSIONS

Use this to compare returns across various iterations of the strategy

For any strategy you can keep track of the version history

Track the history of the live strategy



Comply with DOL standards to document and manage uncompensated risk

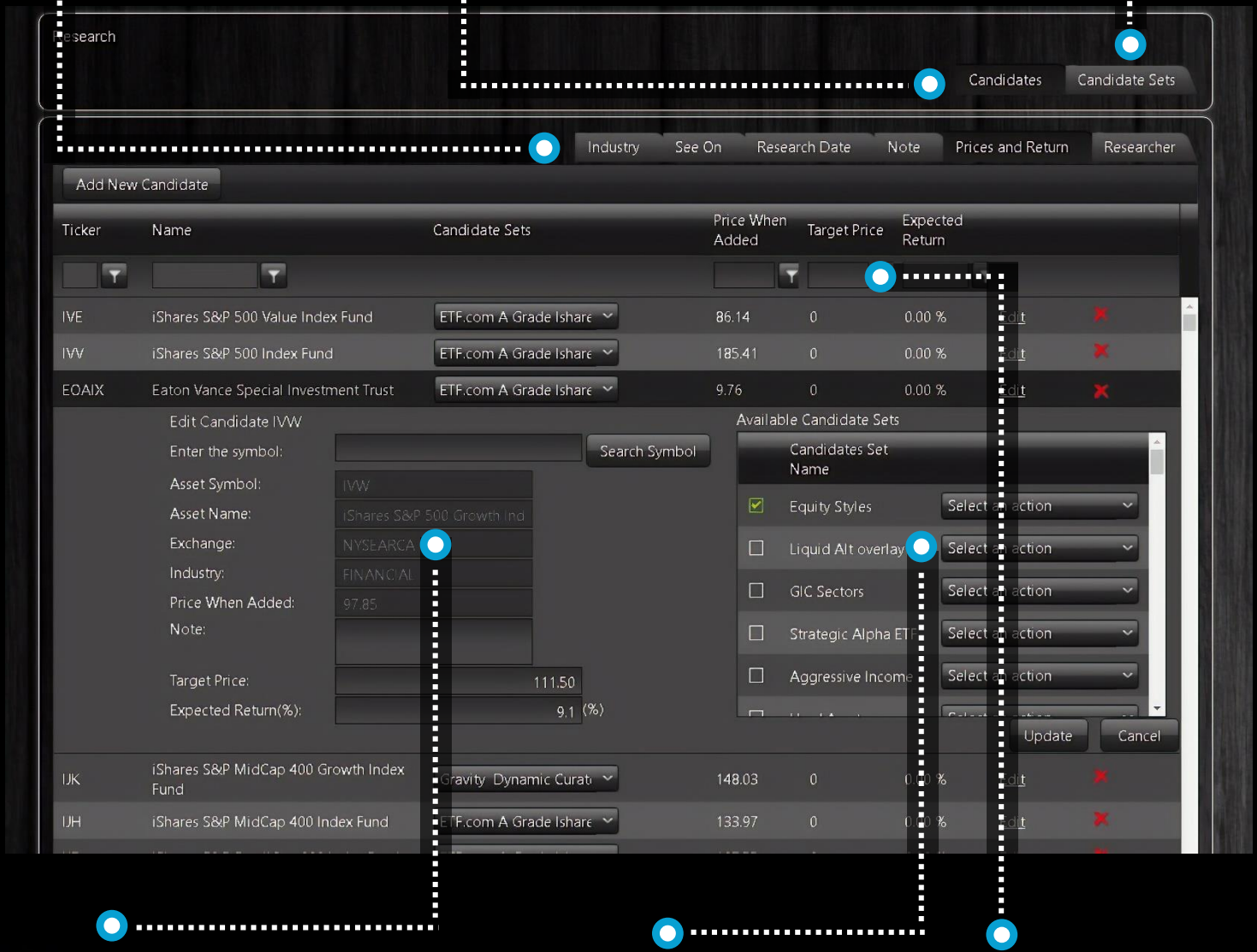
Rollback to any previous version to set that version as the active instance

RESEARCH

Log, audit and track your researched positions

Manage individual positions here, we call investments that are sent to the optimization “candidates”

Candidate sets are groups like a watch list or a buy list that are sent to the optimizer, these are building blocks of your strategies



See position details.

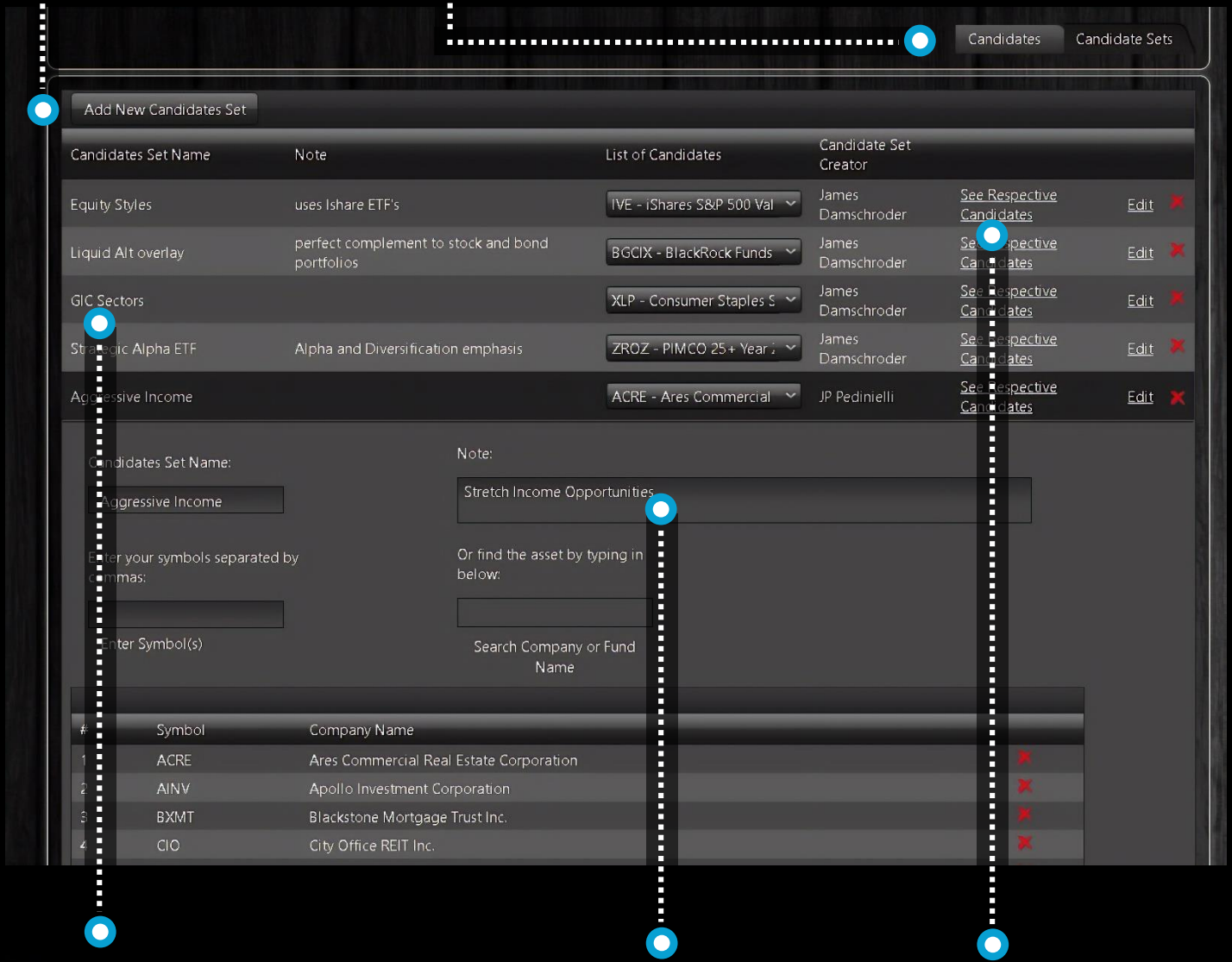
Researches may set the target price or expected return here which will inure as an optimization input

Manage what candidate sets any positions may be included to

RESEARCH 3

The list candidate sets created by or shared to the user

Candidate sets can be centrally managed and shared with advisors or teams



Manage the list of included investments here

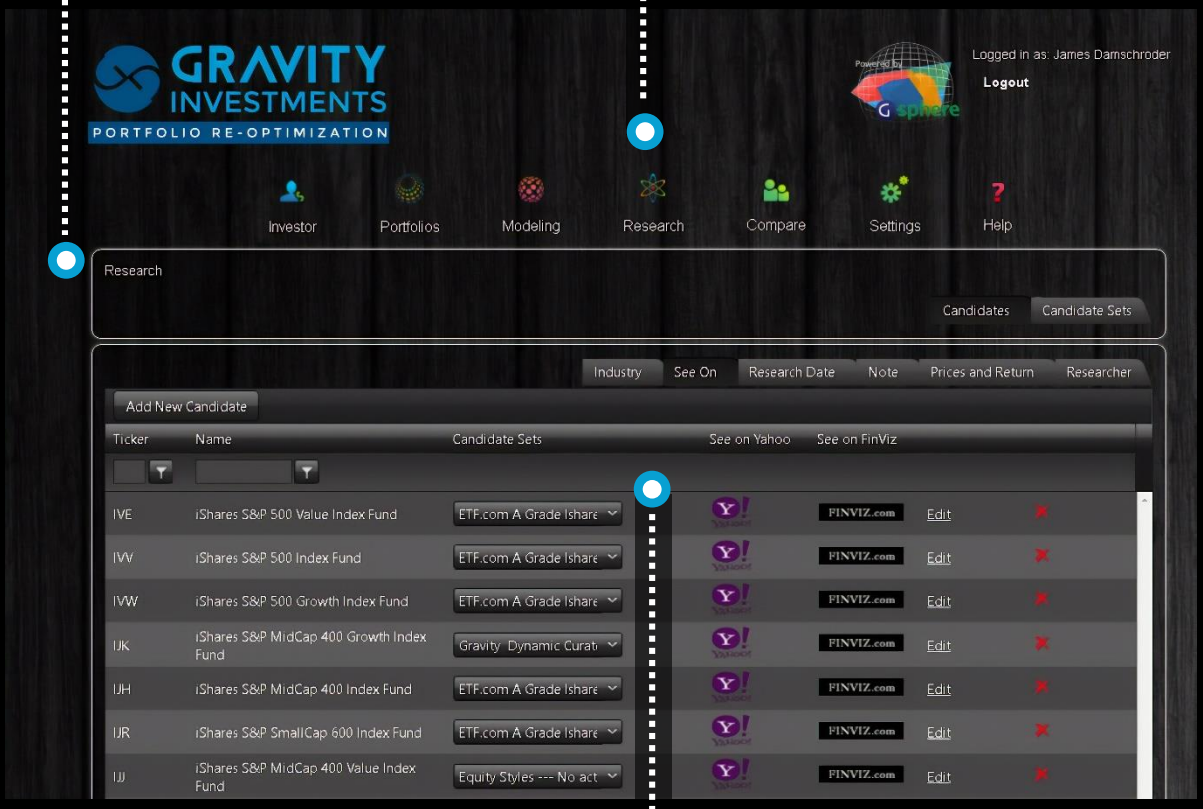
Edits to the candidate set on an existing strategy will be utilized in the following Re-Optimization

Candidate sets are static lists available to all Re-Optimization events if the security had existed in the prior period

RESEARCH

All sets are available in the Research link, available to portfolio managers and admins.

Link to outside research



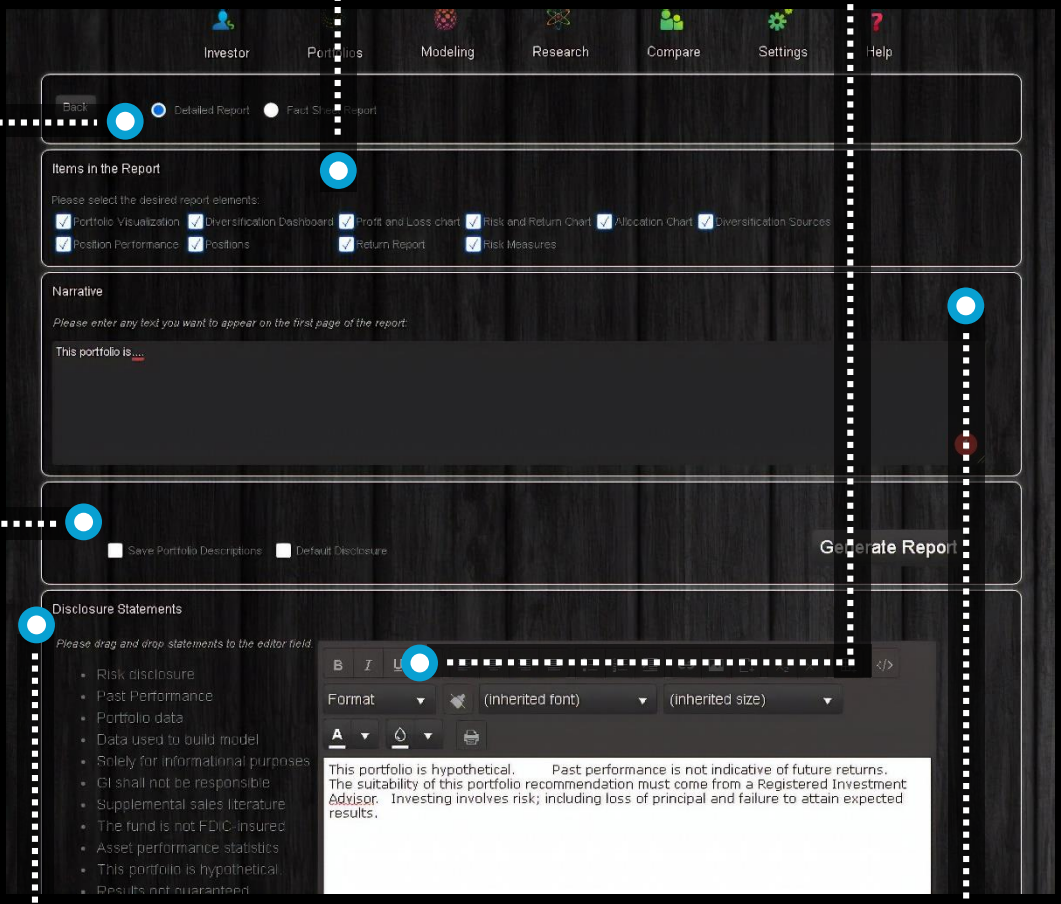
Document whose ideas they are and why they are good investments

REPORT CONFIG

Select the report format: detailed report or factsheet. A comparison report is also offered from the comparison page and generally follows the format of the detailed report

Select the individual elements desired to include in the report. If benchmarks are set on your portfolio view page they will be included in the report.

All reports formants feature interactive 3D content inside the pdf (must be opened by Adobe Acrobat)



Checking these boxes will save the reports elements to the report in the future

Select standard disclosure items or create your own

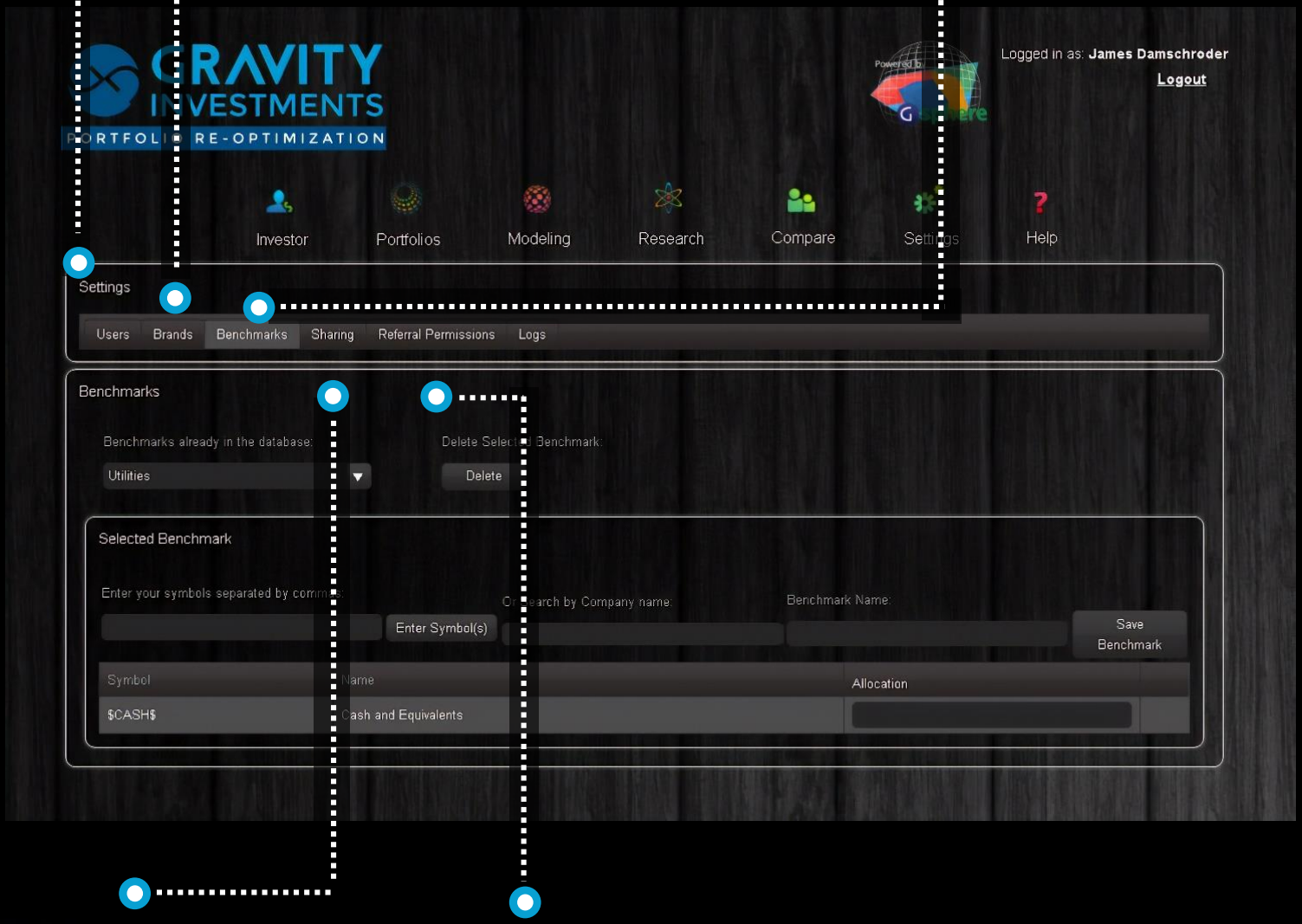
Include a narrative or for the factsheets, include a strategy description and objective and a firm profile and manager profile.

SETTINGS

Admin control user access conditions

Admins and Brand managers configure brand options

Create benchmarks including custom blended benchmarks



Share data features with your brand or other users

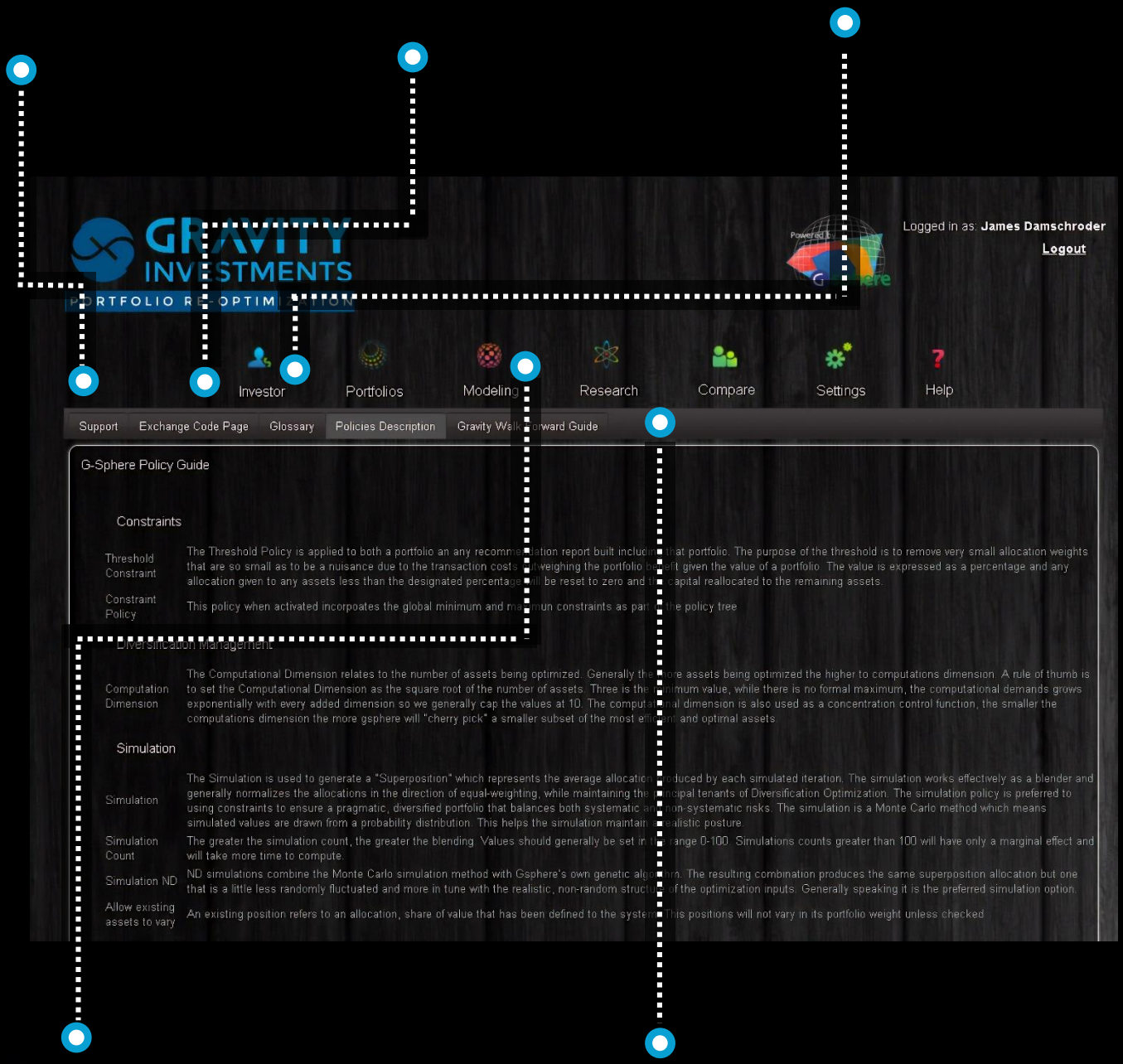
Set the permission links for guest user access to system features including free portfolio analysis and portfolio views

HELP

Contact information for direct support or support tickets

Look up worldwide exchange codes as ticker suffix for global exchange strategies

Glossary with definitions and formulas



Detailed descriptions of investment policies

Guide to walk forward out of sample multiperiod backtesting