

SUNGARD ADAPTIV 360

Risk Management
and Operations
Solutions

Facing the Challenge - Industry Demands

Financial institutions trading cash and derivatives instruments face increasing pressure to manage risk and achieve operational efficiency. As trading volumes grow and the variety and complexity of transaction types multiply, it is more difficult to achieve a consolidated view of risk and to process transactions in an automated manner. This leads to an incomplete view on credit and market risk and to greater operational risk and expenses.

The use of multiple front office systems leads to inefficient and incomplete support for front-to-back trade processing and enterprise risk management. This is because many front office systems lack full functionality and are unable to interoperate with other trading systems. Middle and back office activities should be done on a single, consistent and scalable platform to ensure timely, reliable and accurate trade processing and risk measurement.

The challenge is to achieve comprehensive risk management and operations capabilities in a cost-effective manner, independently from the choice of front office system for each asset class. For this financial institutions are demanding:

- **Scalable solutions** which can handle the increases in trading volumes requiring systems to be able to load and process high numbers of transactions, and also to be able to perform computationally intensive simulation based risk calculations within tight time-frames.
- **Extensibility** to adapt to product innovation. The solution must be able to incorporate new trade types into its framework as they appear, not only for valuation and risk purposes but also for trade lifecycle processing.
- **Broadening the scope.** Modern systems must be able to measure and manage a multitude of risks, ranging from VaR and counterparty potential future exposure, to concentration risks, liquidity and Credit VaR.
- **Robust infrastructure.** All of these functions must be housed in a robust infrastructure which manages static and market data, as well as security, auditing and reporting.



THE EVER INCREASING COMPLEXITY OF PATH-DEPENDENT PRODUCTS REQUIRING SIMULATION BASED PRICING POSES A TECHNOLOGY CHALLENGE TO INCORPORATE THESE IN ENTERPRISE RISK CALCULATIONS.

Meeting the Challenge – Adaptiv 360

Financial institutions striving to balance conflicting business, technology and cost considerations are turning to SunGard Adaptiv to meet these challenges.

Today, market sentiment is favourable for a solution that offers middle and back office functionality with comprehensive risk analytics and straight-through processing. Across asset classes for both cash and derivative instruments, Adaptiv 360 is capable of capturing trades, calculating market and credit risk metrics, performing lifecycle processing, managing payments and generating sophisticated accounting and documentation output, all on a single platform.

Adaptiv 360 is underpinned by a robust architecture which provides:

- Trade capture capabilities for a wide range of products from simple vanilla trades to structured derivatives, and includes integrated lifecycle processing functions.
- A single trade representation utilised throughout Adaptiv 360 that delivers an environment designed to centralise and consolidate transaction processing across all asset classes, maximising operational efficiency and minimising operational risks.
- An analytics platform for counterparty credit simulations, sensitivity reporting, market risk simulations and P&L decomposition.
- Modular support for accounting, payments and documentation.

Product Coverage

Adaptiv 360 supports trade capture for derivative and cash instruments in interest rate, equity, commodities, credit, and FX asset

classes. The well-documented extensibility framework ensures that new instruments may be added to the system in a timely and efficient manner. Any deal can be included in the VaR analysis through full re-pricing or approximated based on its Greek sensitivities on a pre-calculated or imported price grid.

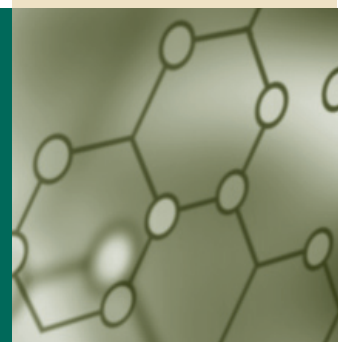
As part of the larger SunGard family Adaptiv 360 have leveraged expertise in other business units to provide components which have already been integrated into the solution suite in the following areas:

- Structured products,
- Convertible bonds, and
- Mortgage backed securities pricing and risk.
- Complete Risk Analytics

Risks can be quantified and controlled using Adaptiv 360's comprehensive Trader Tools, Desk Level Analytics and Basel-II compliant enterprise risk features. Among the benefits are:

- Market Risk measured and managed by providing standard risk factor sensitivities, VaR (parametric, historical and Monte Carlo simulation), scenario analysis and stress testing, hedge recommendations, cash flow forecasting, P&L decomposition and more.
- Counterparty credit risk using add-on or simulated PFE methodologies, and Credit VaR simulations.
- Pricing models that support instrument ageing and an API to add new models.

ADAPTIV 360 IS CAPABLE OF CAPTURING TRADES, CALCULATING MARKET AND CREDIT RISK METRICS, PERFORMING LIFECYCLE PROCESSING, MANAGING PAYMENTS AND GENERATING SOPHISTICATED ACCOUNTING ALL ON A SINGLE PLATFORM.



- Powerful data-mining and drill-down capabilities providing managers with the tools to investigate and isolate sources of risk.
- Limits can be easily set and monitored

Full transparency of calculations and advanced analysis tools

Even today, many risk systems remain black boxes, providing little transparency on what a particular number means and how it was calculated. With Adaptiv 360 all inputs to VaR calculations from the individual risk factor values used in each simulation, to the base (or horizon) portfolio value, to cash returned through ageing and the entire profit and loss distribution at every portfolio aggregation level are output and saved for future analysis.

Factor drill-down can be employed to automatically isolate and independently calculate the risk from individual factor groups. This helps to ensure compliance with the regulatory requirement to report interest rate, foreign exchange, equity and commodity risk separately - without additional calculation steps - as well as providing further granularity for newer risk factors. This provides a better understanding and explanation of correlation effects, marginal and component contributions and specific risk, all within a simulation (both Historical and Monte Carlo) framework.

Technical efficiencies and process improvements

Adaptiv 360 utilises the very latest technologies to deliver performance and process benefits to users. SunGard leverages the flexibility and speed of Microsoft's .NET technologies and the power and performance of 64-bit processing. Adaptiv also leverages

the SunGard infrastructure by sharing and integrating common functionalities that have been developed within the SunGard Financial Services organisation.

Adaptiv 360 supports distributed parallel processing which enables:

- The capability to calculate process intensive market risk calculations, including high numbers of VaR simulations on large and complex portfolios.
- Distributed calculations are delivered in a secure and resilient manner, utilising .NET remoting and Extensible Markup Language (XML) messaging.
- Built-in fail-over, resiliency and the ability to simply and seamlessly add or remove calculation nodes ensures that the maximum benefit is derived from hardware investments.
- Incremental calculation workflow which provides real-time intra-day risk calculations.

Adaptiv 360 provides an unparalleled extensibility framework using version-safe .NET and COM application programming interfaces (APIs). These allow pricing models to be seamlessly replaced by proprietary models, and new instrument classes to be added, including new risk factors if required.

Adaptiv Analytics

Adaptiv 360 is fully integrated with Adaptiv Analytics, SunGard's high-performance, scalable, extensible risk simulation engine. This engine powers many of the complex risk calculations within Adaptiv 360 and is available for deployment on a single server, or across a grid of servers for additional capacity. For further details on Adaptiv Analytics please visit our website at www.sungard.com/adaptiv



ADAPTIV LEVERAGES THE SUNGARD INFRASTRUCTURE BY SHARING AND INTEGRATING COMMON FUNCTIONALITIES THAT HAVE BEEN DEVELOPED WITHIN THE SUNGARD FINANCIAL SERVICES ORGANIZATION.

Adaptiv 360, Managing the Process

Lifecycle Processing

Adaptiv 360's Trade Administration module provides consistent, centralised and audited trade lifecycle processing across asset classes. Trade Administration reduces operational risks by controlling the entry, approval and processing of trades. Adaptiv 360 can be automated to process without manual intervention, thus reducing costs and operational risks, whilst also providing user-defined exception management for specific trades, along with a full transaction audit trail.

Adaptiv's single trade record eliminates the traditional front office/back office reconciliation processes and, because all lifecycle processing updates can be done in real-time, users are assured a common view of all trades at all times.

Lifecycle functions include:

- Trade Management, providing a second review for trader actions.
- Rate Administration, which stores observations, performs resets and includes customised formulas and payoffs.
- Options processing for barrier monitoring, expiries and exercise, with the choice of generating a cash settlement or physical underlying.
- Liquidations, supporting multiple close-out methods for realizing profit and loss.
- Early Terminations processing for ending OTC transactions in full or in part.
- Scripting capabilities to automate processing.

Activity	Outstanding	Rejected	Pending	Total	Update	Update TimeStamp
New Trades	41	2	36	41	✓	8/25/2009 9:14:39 AM
Amended Trades	56	0	56	56	✓	8/25/2009 9:14:39 AM
Rate Observations					✓	
Trade Resets	0			0	✓	
Multi-Resets	0			0	✓	8/25/2009 9:15:59 AM
Exercise Options	0			0	✓	8/25/2009 9:15:59 AM
Expire Options	0			0	✓	8/25/2009 9:15:59 AM
Trade Closures	0			0	✓	8/25/2009 9:15:15 AM
Futures Close at Market Price	0			0	✓	8/25/2009 9:15:12 AM
FX and Money Market	0			0	✓	8/25/2009 9:15:12 AM
OTC Derivatives	10			10	✓	8/25/2009 9:15:12 AM
Securities	2			2	✓	8/25/2009 9:15:12 AM
Terminations	0			0	✓	8/25/2009 9:15:12 AM
Cancellations	0			0	✓	8/25/2009 9:15:12 AM
Other	0			0	✓	8/25/2009 9:15:12 AM
Issue Exercise	0			0	✓	8/25/2009 9:15:12 AM
Rollovers	0			0	✓	8/25/2009 9:15:15 AM

Figure 1: The Activity Monitor displays the current status of processing.

- An Activity Monitor that displays outstanding tasks to be completed. Managerial control is enhanced as users can view the whole operation, keeping an eye on bottlenecks and reducing operational risk. Users can drill down directly into processing functions from the Activity Monitor.
- An Activity Summary, which is an audit trail of completed trade processing and storage of all historic trade versions.
- A suite of tools that can perform audited updates across the book of trades.

Within the Trade Administration Module there are controls that provide security and flexibility as well as the ability to reverse any activity that has been performed.

Adaptiv Settlements

The Adaptiv Settlements module is an automated netting and payment processing module that helps institutions centralise their cashflow management and automatically control multiple payments streams, utilising

ADAPTIV 360 PROVIDES CENTRALISED, CONSOLIDATED PAYMENT PROCESSING ACROSS CASHFLOWS FROM MULTIPLE SYSTEMS AND PRODUCTS.

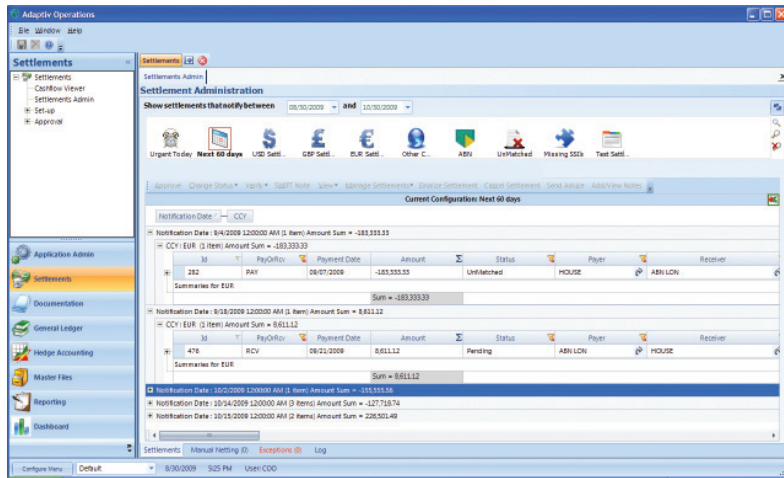


Figure 2: Customisable on-line reporting is exportable to Microsoft Excel.

flexible user-defined netting rules to produce industry standard and customised payment advice.

With comprehensive multi-level authorisation and approvals functionality Adaptiv 360 provides centralised, consolidated payment processing across cashflows from multiple systems and products. This ensures that only authorised payments are released on the due date and that the institution meets the required auditing standards. Full validation, netting management and release controls enable payments to be settled without manual intervention and with reduced settlement risk. This reduces both counterparty credit risk and the number of individual payments and associated costs.

Features:

- Create user-defined payment treatments and business rules to automatically assign the required settlement process to each cashflow.
- User-defined netting rules including cross

product netting, bilateral and multilateral payment netting schemes.

- Flexible, user-defined dynamic approval schedules to control cashflow processing and settlement release procedures.
- Monitor and analyse payment information, history and audit trail, in real-time.
- Full auditing capability.
- S.W.I.F.T. and XML payment advice support.
- Adaptiv Documentation

The Adaptiv Documentation module creates, manages, validates and transmits the various messages required for trade support. It enables straight-through processing of confirmations, payments and other types of messages. The system supports a variety of message types including S.W.I.F.T., free format and XML, and can transmit these messages to many distribution devices and interfaces including printers, S.W.I.F.T., e-mail or fax.

Financial institutions often have multiple trading or payment systems that typically do not have a central message mechanism to receive manage and transmit messages. Adaptiv 360 can be integrated with any trade processing system to provide straight-through message processing based on user-defined business rules. This enables an institution to integrate multiple trading systems for centralised processing, enabling more effective message management and control.

The consolidation and processing enhancements provided by Adaptiv Documentation are fully supported by comprehensive audit trails and message archiving. This simplifies the monitoring and control requirements, and ensures compliance



THE CONSOLIDATION AND PROCESSING ENHANCEMENTS PROVIDED BY ADAPTIV DOCUMENTATION ARE FULLY SUPPORTED BY COMPREHENSIVE AUDIT TRAILS AND MESSAGE ARCHIVING.

with both internal and external auditing mandates.

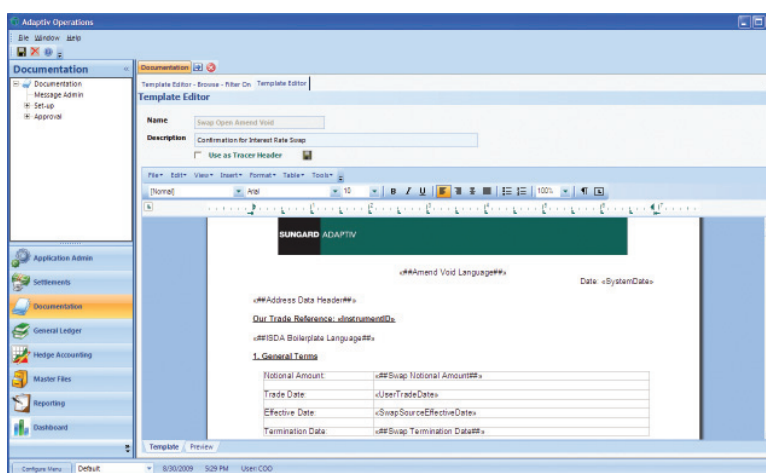
Features:

- Ergonomic, user-friendly Template Designer based on Microsoft Word allows complex document creation with functions such as tables, bitmaps to provide logos for headed paper and electronic signatures.
- Support of if/then logic allows the user to build complex statements to include/exclude text based on trade or static data.
- Extended character sets allow local language confirmations, for example Mandarin, Arabic and Cyrillic script.
- Documents can be produced and stored in a variety of file formats including RTF, DOC, PDF, HTML and XML.
- Available with a library of ISDA standard templates.

Adaptiv General Ledger

The Adaptiv General Ledger module is a sub-ledger application that allows an institution to generate, maintain and consolidate all journal entries for the trading operations of multiple financial organisations. It provides real-time, simultaneous, multi-currency coverage across multiple legal entities and accounting books, using the most widely used accounting methodologies.

Real-time posting to the main ledger(s) of all user-defined trade events, including banks' and customers' settlement accounts, ensures up to the minute accuracy for reporting and enquiries. Adaptiv 360 maintains all general ledger requirements, from multiple sources, within a single environment, thereby reducing



operational costs and errors. Extensive user-definable reporting, including trial balance reporting functionality supported at ledger level through to single trade level. Reports can be easily exported into other applications (for example Microsoft Excel, HTML).

Features:

- Create user-defined accounting treatments and business rules to automatically assign the required accounting process
- Real-time generation of lifecycle accounting events to minimise the traditional end-of-day batch processing overhead
- Flexible structure and design to support multiple international accounting standards, e.g. FAS133/IAS39, plus product/regional specific functions as required
- View accounting entries, history and audit trail, in real-time
- Security and authorisation levels for all general ledger functions
- User configurable screens supporting the analysis and reporting of all accounting data

Figure 3: The Documentation Editor allows easy creation of rules-based document templates.

REAL-TIME POSTING TO THE MAIN LEDGER(S) OF ALL USER DEFINED TRADE EVENTS, INCLUDING BANKS' AND CUSTOMERS' SETTLEMENT ACCOUNTS, ENSURES UP TO THE MINUTE ACCURACY FOR REPORTING AND ENQUIRIES.

Adaptiv 360, Manage the Risk

Figure 4: All analyses are output in a powerful pivot-table "hypercube" allowing drill-down through sub-portfolios to individual transactions and the creation of views, such as interest rate sensitivity by currency, and by product (displayed below). The output can also be represented graphically "on the fly" or in pre-defined and saved screen layouts.

Adaptiv 360 provides organisations with the tools to effectively measure, monitor and manage market and credit risk and the infrastructure to ensure compliance with regulatory requirements for capital adequacy. This is achieved by combining a real-time, robust and distributable enterprise scale portfolio management engine with sophisticated risk analytics.

Adaptiv 360's risk engine supports all the major Value at Risk (VaR) models:

The **variance risk** model provides parametric (variance/covariance) VaR reporting capabilities. All required data and analytic tools are available within Adaptiv 360, e.g. volatilities and correlations are calculated from historical data and may be edited, and a gamma effect may also be included to track

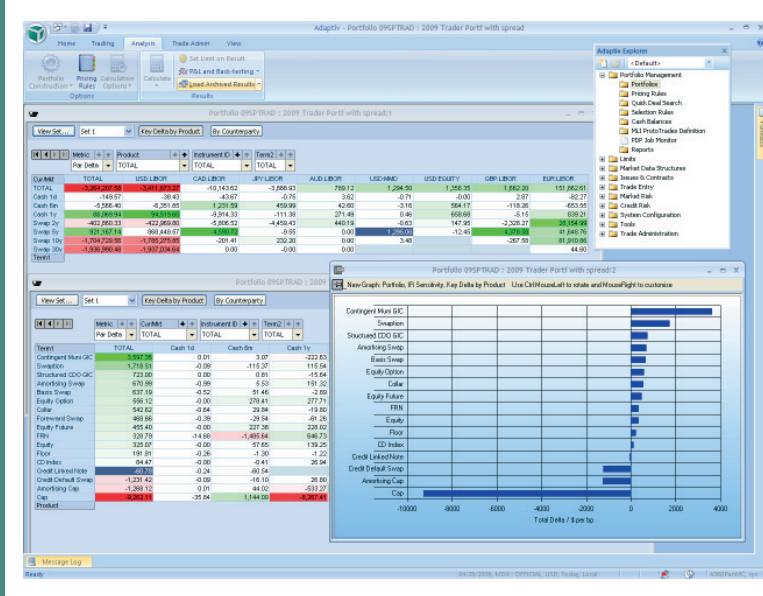
non-linear risk. When initiating the calculation multiple confidence intervals and holding periods may be selected.

Adaptiv 360 provides advanced support for **historical VaR**. This includes a comprehensive deal ageing library, and the full management of the underlying historical data sets. VaR can be calculated under any confidence level for any horizon and with a choice of return method (proportional, absolute, historical and none) and a decay factor to overweight more recent values. Incremental calculations allow effective near real-time results and limit checks.

A high performance **Monte Carlo** based simulation VaR engine is also included. Scenario generation is completely configurable, down to the probability distribution driving the returns of each individual risk factor, and stratified sampling techniques and antithetic variables are employed for variance reduction. Non-parametric, lognormal, non-normal and extreme value distributions of the P&L are generated, giving greater insight into the possible loss distribution.

Multiple generators e.g. Historic Simulation and Monte Carlo as well as multiple horizons can be run simultaneously and the daily results stored and available for comparison purposes, trend analysis and back-testing.

Regardless of the calculation type chosen, Adaptiv 360 provides for rich results navigation and visualisation.



REGARDLESS OF THE CALCULATION TYPE CHOSEN, ADAPTIV 360 PROVIDES FOR RICH RESULTS NAVIGATION AND VISUALIZATION.

A comprehensive reporting structure allows VaR results to be broken down by trader, book, desk, location, counterparty, instrument type and almost any other transaction/position attribute such as sector or industry. Marginal contribution to risk ('Hot Spots' analysis) by risk factor or sub-portfolio is provided, along with decomposition (drill-down) of risk to user-defined Risk Factor groups.

Empirical and analytical sensitivity measures

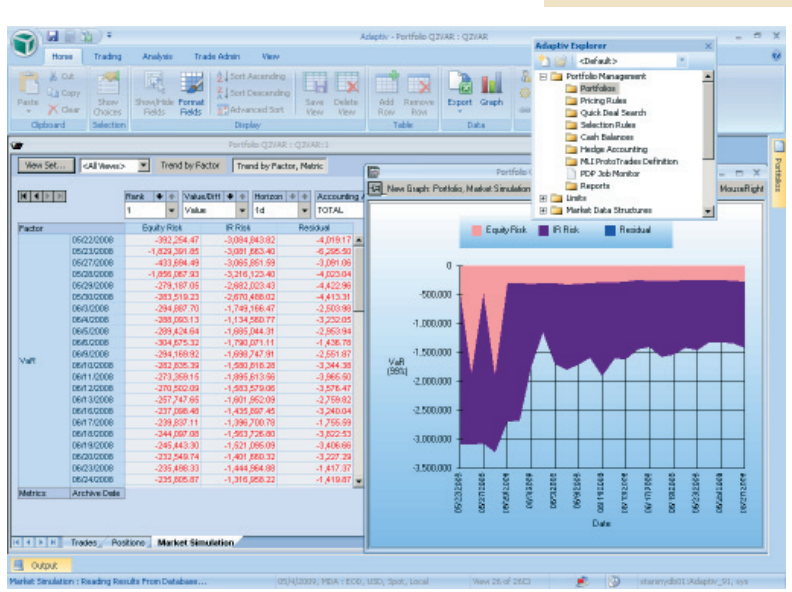
Adaptiv 360 supports both empirical and analytical sensitivity measures. Empirical sensitivity allows users to specify shifts to risk factors in order to calculate portfolio sensitivities. The algorithm shifts one risk factor at a time, keeping all other factors constant and revaluing any trades with a dependency on that risk factor, thus optimising performance. Numerically and analytically generated sensitivities are then combined into a unified exposure view.

This numerical exposure generation technique is used to populate multi-dimensional scenario/PV Grids in order to reduce the number of simulations required for process intensive path-dependant structured products. These grids can also be populated by front office systems.

Back-testing Value at Risk

Adaptiv 360 provides full back-testing of all VaR measures over user specified confidence intervals and holding periods. Back-testing can be applied to both actual P&L and 'no action' P&L and results can be presented as green, amber or red signals based on regulatory rules.

Adaptiv 360 has a standard back-testing functionality which is used to validate the VaR



model used as per Basel Regulations. More complex P&L decomposition is also provided. P&L attribution allows the decomposition of portfolio value changes due to market movement, trade activity and time. Market value changes are attributed to user-defined factor groups. This measure allows the user to gain comprehensive insight into the sources of return driven by portfolio exposures to risk factors, and can be used to validate how well your portfolio sensitivities predicted your P&L.

Stress testing

The Basel Committee on Banking Supervision requires that financial institutions improve their processes for measuring and managing the risk to the organisation from extreme events - "event risk" - those events in the tail of the distribution curve. Adaptiv 360 provides a powerful scenario analysis and stress-testing framework. This framework allows stress scenarios to be applied to any portfolio analysis, from exposure reports through VaR

Figure 5: Stored/archived results can be returned on-screen (or exported from the database) with results over weeks, months or longer reloaded in order to analyse trends. Trends over time, at any aggregation level, such as by factor group (above) can be analysed.

ADAPTIV 360 SUPPORTS BOTH EMPIRICAL AND ANALYTICAL SENSITIVITY MEASURES. EMPIRICAL SENSITIVITY ALLOWS USERS TO SPECIFY SHIFTS TO RISK FACTORS IN ORDER TO CALCULATE PORTFOLIO SENSITIVITIES.

and hedging analysis, allowing risk managers to measure and understand the impact of stress scenarios not only on potential losses, but also potential changes in risk as well as capital requirements.

Stress-tests can be defined at the risk factor level, with the system providing a simple user interface for defining new scenarios. Additionally, historic scenarios that utilise the stored market data time-series from any period in the past can be defined. This powerful feature ensures that these traumatic historic events can be fully captured, including all factor movements and break-downs in correlations, and the impact over a period of weeks or months.

Counterparty Potential Future Exposure (PFE) and Credit Value at Risk (CVaR)

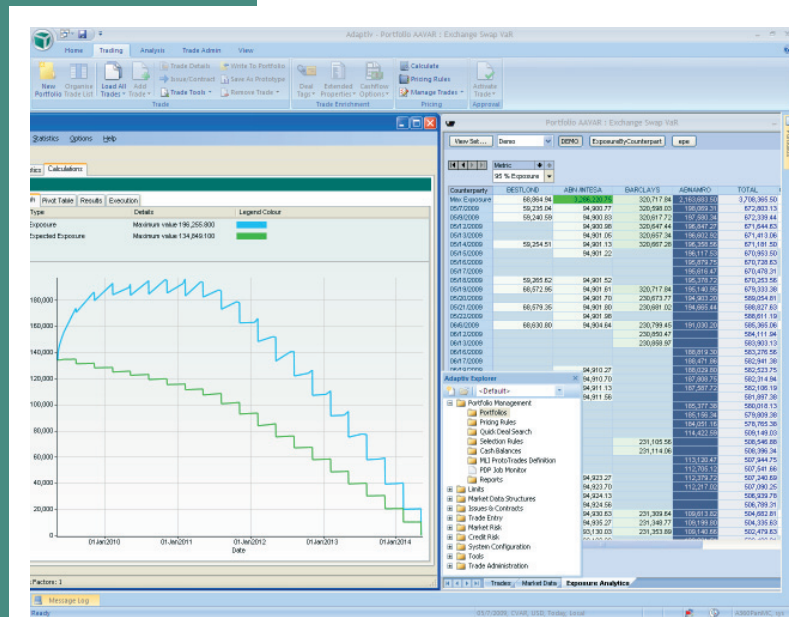
Adaptiv 360 also provides credit risk analysis using the same underlying trade information and market data as is used for market risk. Adaptiv’s credit analytics are specifically designed to handle the unique challenge of simulation based PFE calculations. Calculating potential future exposure using Monte Carlo simulations – the industry standard approach - requires many millions of valuations over hundreds of future time horizons, incorporating “ageing” of deals, requiring suitable stochastic risk factor models to evolve rate and prices through time and taking exposure mitigants such as netting, collateral and guarantees into account.

The solution uses a combination of a globally configured, user-specified base time-grids (of an unlimited number of points) and dynamically generated time grids. The solution analyses each portfolio and dynamically generates an appropriate grid of time points on which to simulate into the future. This approach has several advantages over a constant fixed grid of future points:

- Increased accuracy by ensuring all profile inflection points are captured
- Reduces the number of future points used for smaller and shorter maturity portfolios whilst maintaining accuracy.
- Deals are only revalued on appropriate forward dates ensuring redundant revaluations are not performed.

Basel II requirements for internal model approval for Counterparty Credit Risk are also supported by Adaptiv 360, with the following measures produced:

Figure 6: The full time profile of counterparty potential future exposure can be analysed within Adaptiv 360.



ADAPTIV'S CREDIT ANALYTICS ARE SPECIFICALLY DESIGNED TO HANDLE THE UNIQUE CHALLENGE OF SIMULATION BASED POTENTIAL FUTURE EXPOSURE CALCULATIONS.

- Peak Exposure (PE)
- Expected Exposure (EE)
- Effective Expected Exposure (EEE)
- Expected Positive Exposure (EPE)
- Effective EPE

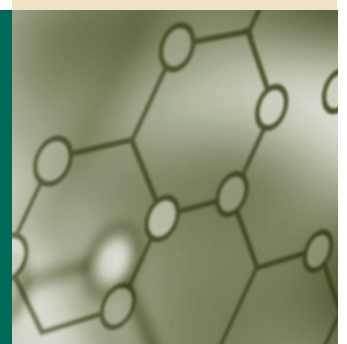
As Value at Risk (VaR) is a widely used framework for market risk exposure, Adaptiv 360 has extended the same proven concept to credit risk. The Credit VaR (CVaR) report combines the expected exposure profiles and simulated credit events and calculates the simulated losses, the value at risk, and the expected shortfall and its risk contributions. These calculations are based on a counterparty and issuer credit rating transition matrix, expected credit risk recovery rates and a highly flexible credit spread curve setup, e.g. based on countries, industries or sectors. In Adaptiv's credit VaR framework, the «unexpected credit loss» is calculated for an extreme loss percentile, e.g., a loss due to counterparty defaults or rating migrations that is estimated to have no more than 1.0% probability of occurring in the next year. This advanced solution takes full advantage of the amalgamation of market and credit risk analysis, leveraging further the award-winning, high performance calculation core of Adaptiv Analytics.

Summary

In a financial services landscape defined by ever increasing volumes and complexity, institutions are being pressed to ensure that risk management practices and operational processes address all risks faced by the organisation. Adaptiv 360's modular design allows organisations of varying size and complexity to deploy best of breed functionality within their own budget, operations and technological parameters. Proven in over 100 client installations, Adaptiv 360 is addressing the needs of today's financial institutions whilst being ready to meet the challenges of tomorrow.

SunGard Adaptiv

SunGard Adaptiv provides enterprise wide risk management and operations solutions for financial services institutions. Adaptiv assists institutions of varying size and complexity to deploy technology to meet both internal and regulatory requirements for risk management and operational control. We help financial services institutions from the banking, hedge fund, asset management, insurance and corporate sectors with our deep understanding of risk management and operational processes.



www.sungard.com/adaptiv

SunGard Adaptiv
25 Canada Square
London
E14 5LQ
United Kingdom
Tel: +44 (0)20 8081 2000

SunGard Adaptiv
560 Lexington Avenue
9th Floor
New York
NY10022
USA
Tel: +1 212 745 9400

SunGard Adaptiv
8 Temasek Boulevard
#39-02/03 Suntec Tower 3
Singapore 038988
Tel: +65 6227 6400

©2009 SunGard

SunGard, SunGard Adaptiv and the SunGard logo are trademarks or registered trademarks of SunGard Data Systems Inc or its subsidiaries in the U.S. and other countries. All other trade names are trademarks or registered trademarks of their respective holders.