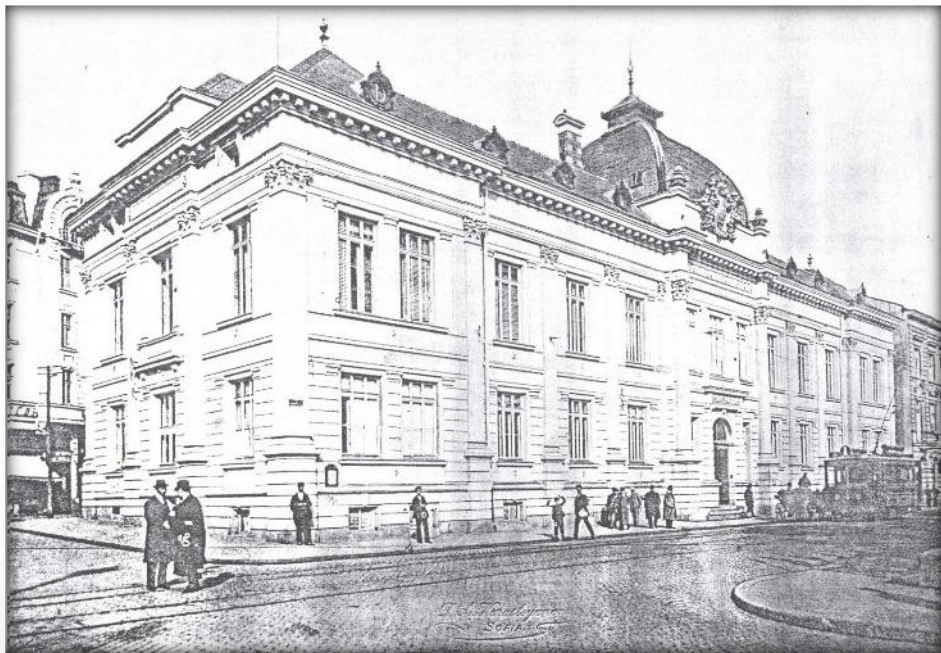




Cash Flow-at-Risk and Earnings-at-Risk

Dr. Anatoliy Antonov

Eurorisk Systems Ltd.
31, General Kiselov Str.
9002 Varna, Bulgaria
Tel. +359 52 612 367
Fax +359 52 612 371
E-mail: info@eurorisksystems.com
Web: www.eurorisksystems.com

⇒ Workshop Part I

1. Introduction

- Definition of Cash flow-at-Risk (CfaR) and Earnings-at-Risk (EaR)

2. Presentation of project – Cash flow in balance sheet structures

- Project balance sheet, Production balance sheet, Bank balance sheet
- Business plans, Budgeting models, Risk horizon

3. Market rates as risk drivers for uncertain cash flows

- Commodities, exchange rates, interest rates, economic indicators
- Description of corporate-specific equations for balance sheet positions and future periods, "pro forma statements"
- linear and non-linear correlations

4. Forecasting of performances

- Evaluation of volatilities and expected cash flows
- Calculation of historical volatilities and correlation
- Forecasts based on historical and implicit market data
- User-defined scenarios

⇒ Workshop Part II

5. Evaluation by means of a multi-dimensional Monte Carlo simulation
 - CfaR/EaR Framework, Level I and Level II Simulation, Volatility-Bridge
 - Simulation of unsteady cash flows for balance sheet positions and future periods using corporate-specific equations
 - Aggregation of cash flows along the balance sheet structure
6. Calculation of Cash Flow-at-Risk (CfaR), Earnings-at-Risk (EaR)
 - Evaluation of CfaR distributions according to balance sheet positions, forecasted periods and total balance sheet
 - Calculation of Expected Loss regarding budget requirements
 - Calculation of CfaR and EaR for different confidence intervals
7. Aspects of the implementation
 - Implementation as a separate application with Microsoft.Net and C#
 - Integrating the application for liquidity planning
 - Reports for balance sheet-, periodical- and aggregation results

Cash Flow-at-Risk (CfaR) and Earnings-at-Risk (EaR)

⇒ Definition of Cash Flow-at-Risk (CFaR) and Earning-at-Risk (EaR)

- **Cash Flow-at-Risk (CfaR):**

The maximum shortfall of net cash generated, relative to the net project income (budget income), that could be experienced due to the impact of market risk on a specified set of exposures, for a specified reporting period and confidence level.

Cash flow is defined as the net change in cash balances.

- **Earnings-at-Risk (EaR):**

The maximum shortfall of earnings, relative to the project income (budget income), that could be experienced due to the impact of market risk on a specified set of exposures, for a specified reporting period and confidence level.

Literary sources: (from www.riskmetrics.com)

- CorporateMetricsTechDoc.pdf – Framework specification
- LongRunTechDoc.pdf – Specification of long-term forecasting and Volatility Bridge.

Cash Flow-at-Risk (CfaR) and Earnings-at-Risk (EaR)

⇒ Calculation methods for CfaR and EaR

⇒ Framework

1. Presentation of volatile and operational cash flows for Corporates and Banks for medium- to long-term risk horizons (3, 12, 24 months)
2. Impact of market rates on individual cash flows (commodity prices, FX, interest rates, indices)
3. Definition of corporate-specific equations for cash flows or prices
4. Periodic representation (daily, weekly, monthly, quarterly) of the project Cash flows in business plans, budgeting models or "pro forma statements"
5. Structuring of In/Out-Cash flows in balance sheet structures

Cash Flow-at-Risk (CfaR) and Earnings-at-Risk (EaR)

⇒ Calculation methods for CfaR and EaR

⇒ Simulation

1. Long-term forecasting of performances and volatilities of market prices and rates (Long Run), definition of daily prices using the Volatility Bridge
2. Multi-dimensional Monte Carlo simulation of corporate-specific equations
3. Cash flow aggregation of each future time period along the balance sheet structure
4. Definition of cash flow distribution according to balance sheet positions and according to future time periods
5. Identifying multi-dimensional CfaR and EaR from distributions according to periods, to balance sheet positions, as well as to the total balance for the given confidence intervals.

Cash Flow-at-Risk (CfaR) and Earnings-at-Risk (EaR)

⇒ Application of CfaR and EaR in businesses and corporations

- **Application:** Business-, Management-, and Supervision-level

- **Increased transparency of risks and risk limitation**

The formalized quantification of the impact of market rate volatility on a company's financial results should significantly improve the clarity of risk awareness within the organization, as well as lead to the establishment of risk limitation systems CfaR and EaR.

- **Communication and standardization of risk measures**

The using of CfaR and EaR as risk measures improves the communication not only between senior management and the business units that assume risk, but also between senior management, the board of directors, shareholders, ratings agencies, and regulatory bodies.

- **Hedging, capital allocation and performance evaluation**

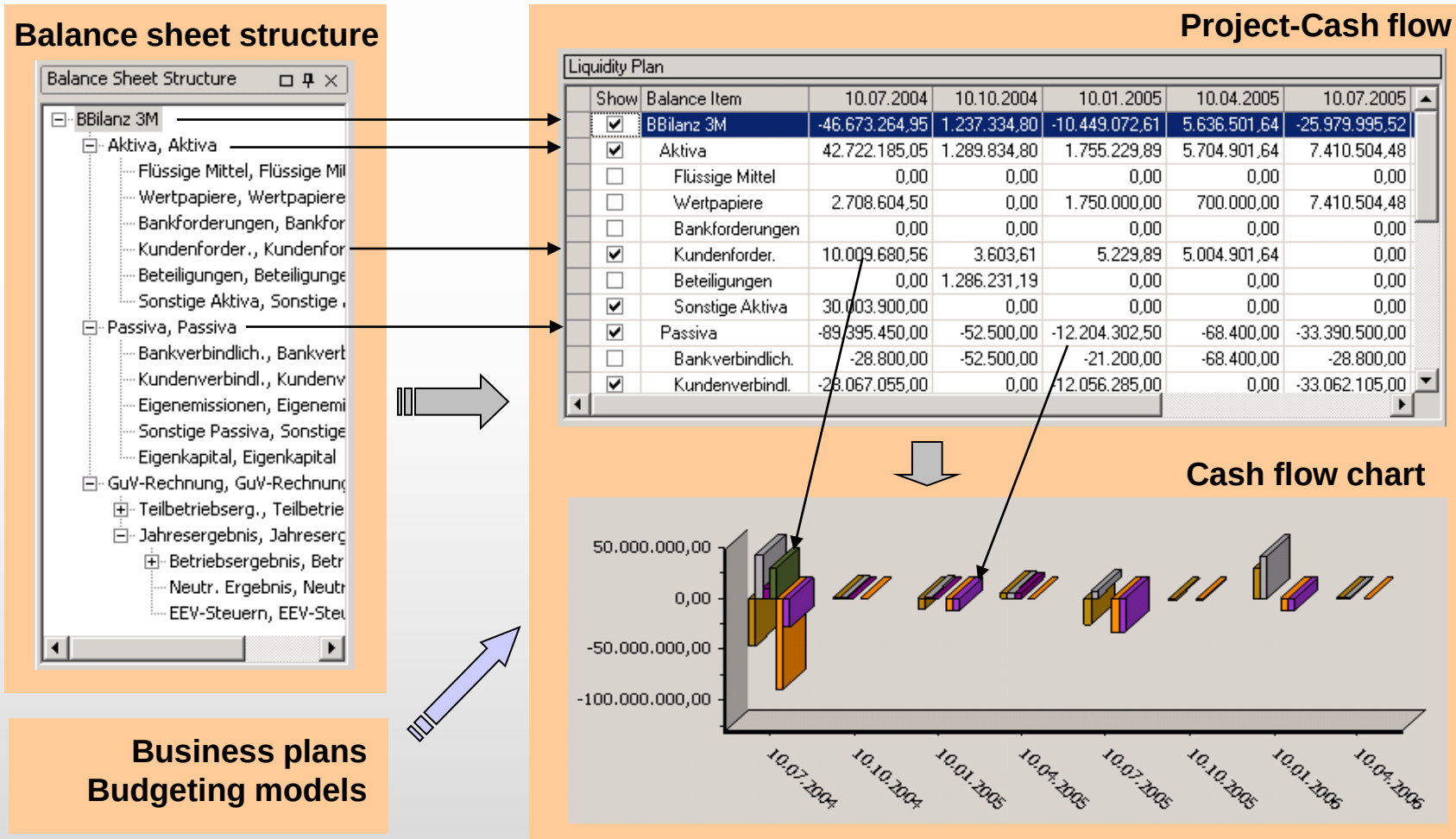
The integration of risk and income analysis leads to the establishment of effective hedging strategies, capital allocation and the optimization of risk performance.

Comparison between market risk and Cash flow-at-Risk (CfaR)

Parameter	Market risk	CfaR and EaR
Area	Financial	Corporate
Framework	RiskMetrics	CorporateMetrics
Accounting treatment	Fair Value (market to market)	Income, cash flows (accounting approach)
Horizon	daily, monthly	monthly, quarterly, annually
Period	for one period	for several periods
Confidence interval	1%	5%
Benchmark	Risk grid points (market index, currency rates, yield curves)	Value developments (business plans, budgeting models, forwards, forecasts)
Aggregation	Portfolio	Balance sheet structure

2. Project – Cash Flows

Demonstration of the Project - Cash flow in balance sheet structures



Demonstration of a liquidity plan in Liquidity Manager

LiPlan 001, Liquiditätsplanung Bilanz, [17.10.2004], P TU801, 10.11.2004, Plan Tochter 801

Balance Sheet Structure

- P TU801
 - K, FINANZENDSTATUS (C+J)
 - C, FINANZSTATUS (A+B)
 - A, FINANZAKTIVA (A1+A2+A3)
 - A1, Guthaben bei Banken (kurzfristig)
 - A2, Guthaben Konzern
 - A3, Sonstige Guthaben
 - B, FINANZPASSIVA (B1+B2)
 - B1, Verbindlichkeiten bei Banken (kurzfristig)
 - B2, Verbindlichkeiten Konzern
 - J, GESAMTE ÜBER-/UNTERDECKUNG (F+I)
 - F, OPERATIVE ÜBER-/UNTERDECKUNG
 - I, NICHT-OPERATIVE ÜBER-/UNTERDECKUNG
 - L, FINANZMASSNAHMEN (L1+L2+L3+L4+L5)
 - M, VERFÜGBARE LIQUIDITÄTSRESERVE (M1+M2+M3)
 - M1, Nicht verfügbare Finanzaktiva
 - M2, Verfügbare Kreditlinien gesamt
 - M3, Aktuelle Ausnützung der Kreditlinien
 - N, VERFÜGBARE LIQUIDITÄT GESAMT (A-L1-L2-L3-L4-L5-M1-M2-M3)

Liquidity Source: ALM-BW-S, 31.10.2002, Szen 1, EUR

Start Date: 01.07.2004
End Date: 31.03.2005
Period: Month

Display: ☒ CashFlow, ☐ Difference, ☐ Cumulative, ☐ Relative

☒ Budget Value, ☐ Expected Value, ☐ Confidence Value, ☐ Expected Loss, ☐ Expected Loss[%]

CFaR / EaR
Calculate

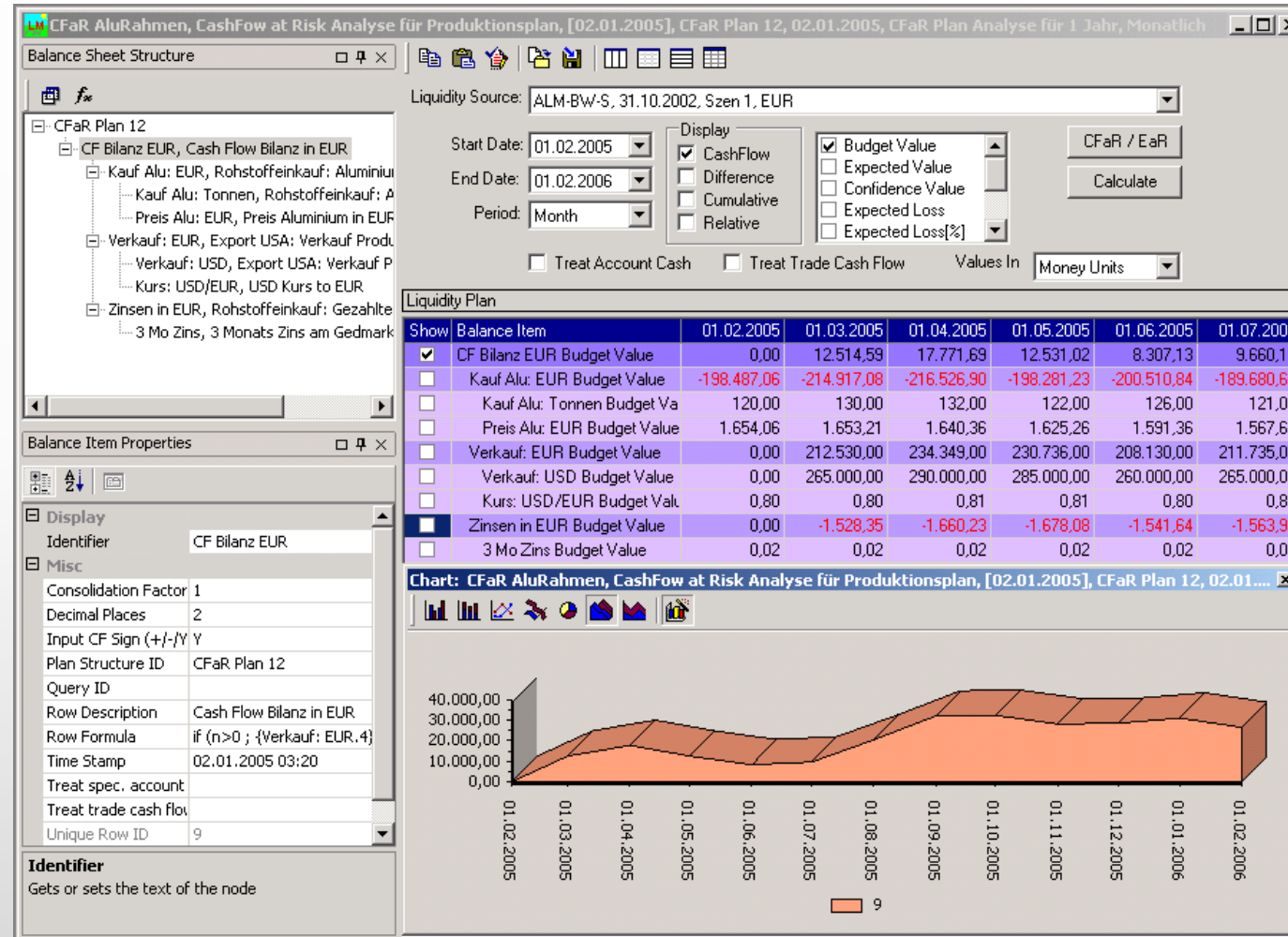
☐ Treat Account Cash ☐ Treat Trade Cash Flow Values In: Money Units

Liquidity Plan

Show	Balance Item	01.08.2004	01.09.2004	01.10.2004	01.11.2004	01.12.2004	01.01.2005
☐	K Budget Value	-46.000,00	74.000,00	124.000,00	34.000,00	-26.000,00	24.000,00
☐	C Budget Value	-135.000,00	-46.000,00	74.000,00	124.000,00	34.000,00	-26.000,00
☐	A Budget Value	125.000,00	170.000,00	190.000,00	220.000,00	160.000,00	110.000,00
☐	A1 Budget Value	100.000,00	130.000,00	140.000,00	160.000,00	110.000,00	70.000,00
☐	A2 Budget Value	20.000,00	30.000,00	40.000,00	50.000,00	50.000,00	30.000,00
☐	A3 Budget Value	5.000,00	10.000,00	10.000,00	10.000,00	0,00	10.000,00
☐	B Budget Value	-260.000,00	-216.000,00	-116.000,00	-96.000,00	-126.000,00	-136.000,00
☐	B1 Budget Value	-250.000,00	-206.000,00	-106.000,00	-96.000,00	-116.000,00	-126.000,00
☐	B2 Budget Value	-10.000,00	-10.000,00	-10.000,00	0,00	-10.000,00	-10.000,00
☐	J Budget Value	89.000,00	120.000,00	50.000,00	-90.000,00	-60.000,00	50.000,00
☐	F Budget Value	50.000,00	120.000,00	50.000,00	-70.000,00	-50.000,00	60.000,00
☐	I Budget Value	39.000,00	0,00	0,00	-20.000,00	-10.000,00	-10.000,00
☐	L Budget Value	-89.000,00	-120.000,00	-50.000,00	90.000,00	60.000,00	-50.000,00
☐	M Budget Value	114.000,00	64.000,00	99.000,00	49.000,00	-1.000,00	-1.000,00
☐	M1 Budget Value	-1.000,00	-1.000,00	-1.000,00	-1.000,00	-1.000,00	-1.000,00
☐	M2 Budget Value	150.000,00	100.000,00	150.000,00	100.000,00	50.000,00	50.000,00
☐	M3 Budget Value	-35.000,00	-35.000,00	-50.000,00	-50.000,00	-50.000,00	-50.000,00
☐	N Budget Value	234.000,00	254.000,00	319.000,00	209.000,00	109.000,00	169.000,00

2. Project – Cash Flows

Demonstration of a production plan in Liquidity Manager



Commodities, market data, economic and industry metrics

National and international time series and statistic

- Examples: Dow Jones Global Industry Indexes, Reuters RIC's, ...
- The calculation of historical volatilities and correlation is possible

⇒ Commodities

- Aluminum, copper, iron, silver ..., wood, ..., plastic, ...
- Wool, cotton, silk, ..., luxury foods, ...

⇒ Energy

- Brent oil, WTI oil, gas, electricity, ...

⇒ Finances

- Interest rates, exchange rates, prices, yields, tax rates

⇒ Industry metrics

- Structured stock indices, industry indices, funds

⇒ Country-specific or overall economy metrics

- Inflation rates, gross domestic product, economic cycle, ...

3. Market Rates as Risk Drivers

Dow Jones Global Industry Historical Indices

Index Selection

Country/Region ISO Code

- WORLD (Excluding: United Kingdom) (W7)
- WORLD (Excluding: United States) (W2)
- WORLD (W1)
-Australia (AU) (Dev)
-Austria (AT) (Dev)
-Belgium (BE) (Dev)
-Brazil (BR) (Eme)
-Canada (CA) (Dev)
-Chile (CL) (Eme)
-Denmark (DK) (Dev)
-Finland (FI) (Dev)
-France (FR) (Dev)
-Germany (DE) (Dev)
-Greece (GR) (Dev)

Market Cap Range Code

- Broad Market
- Large
- Mid
- Small

Industry Sectors

- Consumer, Cyclical
- ..Automobiles
-Auto Parts & Tires
-Auto Parts
-Tires
- ...Automobile Manufacturers

Time Series Period

Begin

July 22 2003

End

July 22 2004

Frequency

Weekly

Currency

- US Dollar
- Local Currency

OK Cancel

Time series for :

Country/Region

X

Market

X

Industry Sector

X

Currency

X

Time Series Period

Exposure Maps: Corporate-specific equations

Example : German Enterprise, risk horizon= 1 year

Purchase of commodities: Aluminium in EUR

Export of the production to the USA

Refinancing: 3-month Libor + 100 BP

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
Aluminium bought (tons)	120	122	118	126	486
Price (tons, EUR)	1,400	1,430	1,460	1,470	
Aluminium bought (EUR)	168,000	174,460	172,280	185,220	699,960
Sale production (USD)	230,000	225,000	236,000	238,000	929,000
USD exchange rate	1.22	1.2	1.18	1.15	
Sale production (EUR)	188,525	187,500	200,000	206,957	782,981
3-month Libor (%)	4.220%	4.180%	4.130%	4.280%	
Pay interest	2,192	2,259	2,209	2,445	9,106
Cash flow	18,332	10,781	25,511	19,292	73,915

Description of the cash flow using equation:

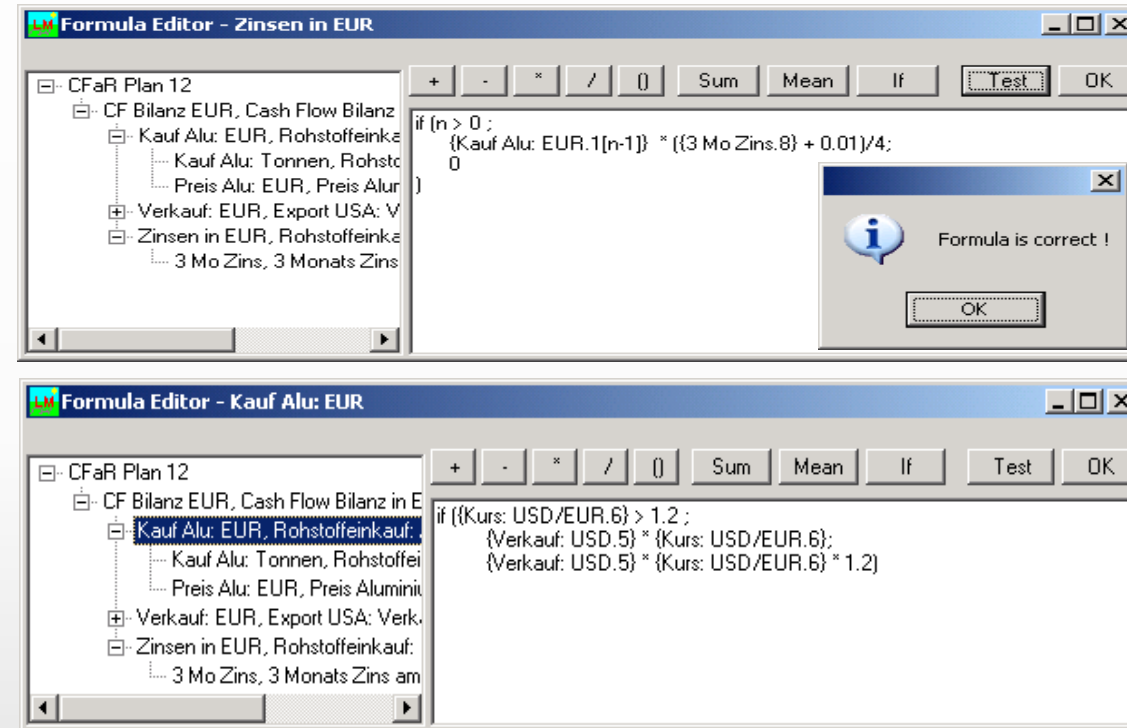
Cashflow = - AluBough*AluPrice*(1+(Libor+100BP)/4) + Prod/USD ExRate

For the second quarter:

Cash flow = - 122*AluPrice*(1+(Libor+100BP)/4) + 225.000/USD ExRate

3. Market Rates as Risk Drivers

Formula-editor in Liquidity Manager



Examples for corporate-specific equations:

Condition along the timeline: Interest payment starting from the 2nd date

Option for the exposure: US sales depend on the USD rate

Exposure Maps: Corporate-specific "pro forma statements"

ABC-USA: Pro Forma Income Statement					
Consolidated (\$000s)	4Q 1998	1Q 1998	2Q 1999	3Q 1999	Total 4 Qtrs
Revenue					
Revenue US	14,000	14,035	14,035	13,965	56,035
Revenue Japan, ¥000s	200,000	199,800	199,800	200,200	
Budget rate, (¥ per \$)	140	142	145	150	
Revenue Japan	1,429	1,407	1,378	1,335	5,548
Total Revenue	15,429	15,442	15,413	15,299	61,583
Expenses					
Gold purchase, Troy oz.	5,000	5,004	5,004	4,979	
Budget rate, USD per oz.	(300)	(300)	(300)	(300)	
Gold expense	(1,500)	(1,501)	(1,501)	(1,494)	(5,996)
General expense	(10,000)	(10,000)	(10,000)	(9,900)	(39,900)
Transaction gain/loss	(41)	(20)	(29)	(46)	(136)
Interest expense	(731)	(731)	(731)	(731)	(2,925)
Depreciation	(500)	(500)	(500)	(500)	(2,000)
Total expenses	(12,772)	(12,753)	(12,762)	(12,671)	(50,957)

Exposure Maps: linear and non-linear relationships

⇒ Presentation of exposure maps through exposure formulas

1. Linear formulas: Risk assessment through VaR/CoVaR

Example: One period (purchase of commodities, selling abroad)

Simulation rates are: **Price_Cmmodity**, **FX_ExchangeRate**

$$\begin{aligned}\text{Cash flow} &= - \text{Volume_Commodity} * \text{Price_Commodity} \\ &\quad + \text{Volume_Products} * \text{FX_ExchangeRate}\end{aligned}$$

2. Non-linear formulas: Risk assessment through Monte Carlo simulation

Example: Multiple periods with price elasticity (foreign sales)

Simulation rates represent exchange rates: **FX_{i-2}**, **FX_{i-1}**, **FX_i**

The price for each subsequent period is adjusted by 70% to the exchange rate change from the previous period:

$$\begin{aligned}\text{Price}_i &= \text{Price}_{i-1} * [1 + 0,7 * (\text{FX}_{i-1} / \text{FX}_{i-2} - 1)] \\ \text{Cash flow}_i &= \text{Price}_i * \text{Volume} * \text{FX}_i\end{aligned}$$

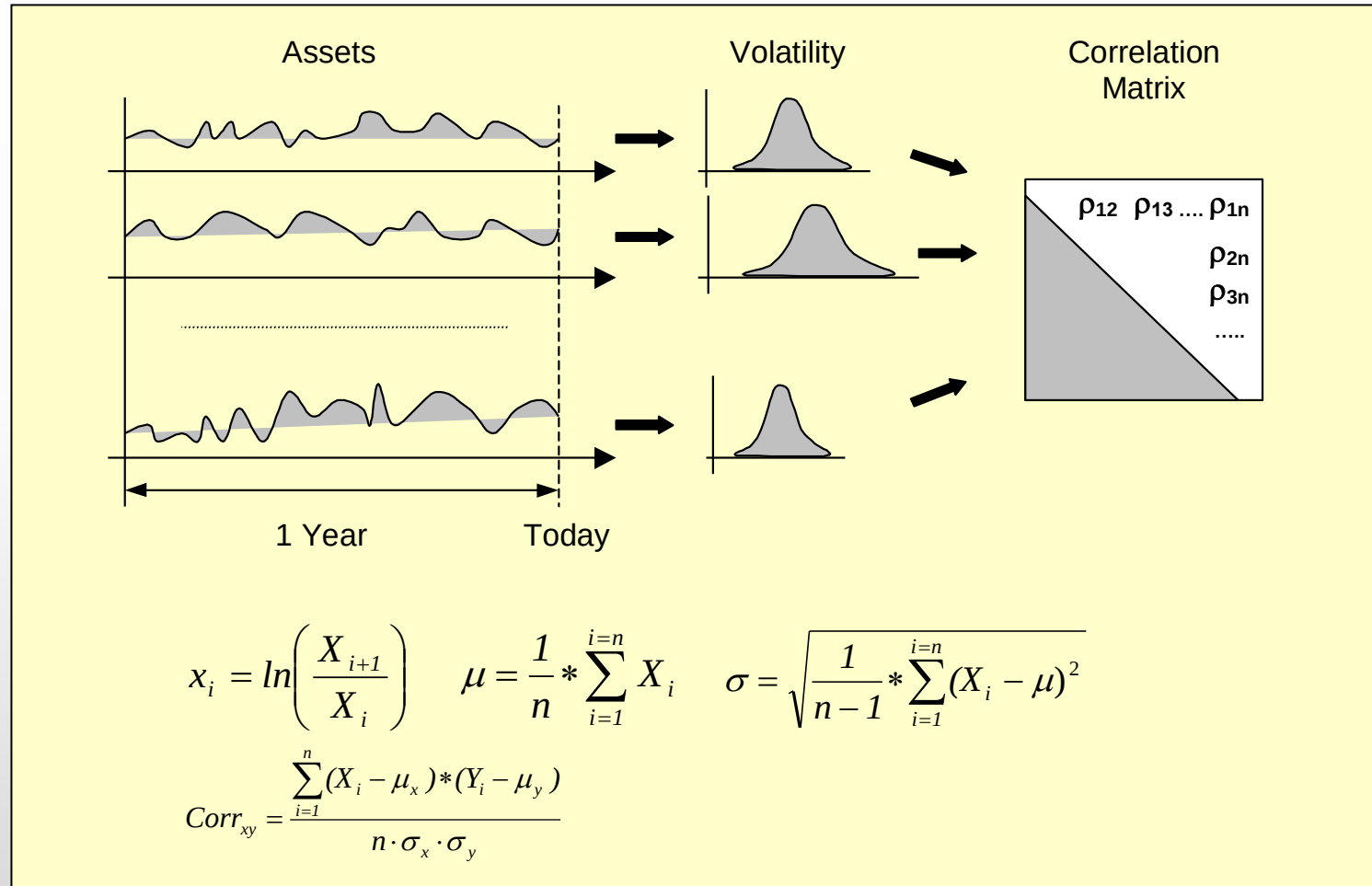
Estimation of volatilities and expected cash flows

⇒ **Estimation of volatilities and expected cash flows according to the market size and forecasted period** (Source: LongRun Technical Document)

- **Forecasts based on historical data**
 - Time series of prices, indices, exchange rates
- **Forecasts based on market prices**
 - Forecasts using Futures and Forwards
 - Forecasts using Options and Swaptions, Term Structure of implied Volatility, „Volatility smile“ for Options
- **Forecasts based on econometric models** (parametric models, non-parametric models)
 - Difference VAR (DVAR), Vector ECM (VECM)
 - Adaptive ECM (AECM)
- **User-defined scenarios**
 - Application of historical data, economic cycle
 - Specification of scenarios for volatilities and expected cash flows

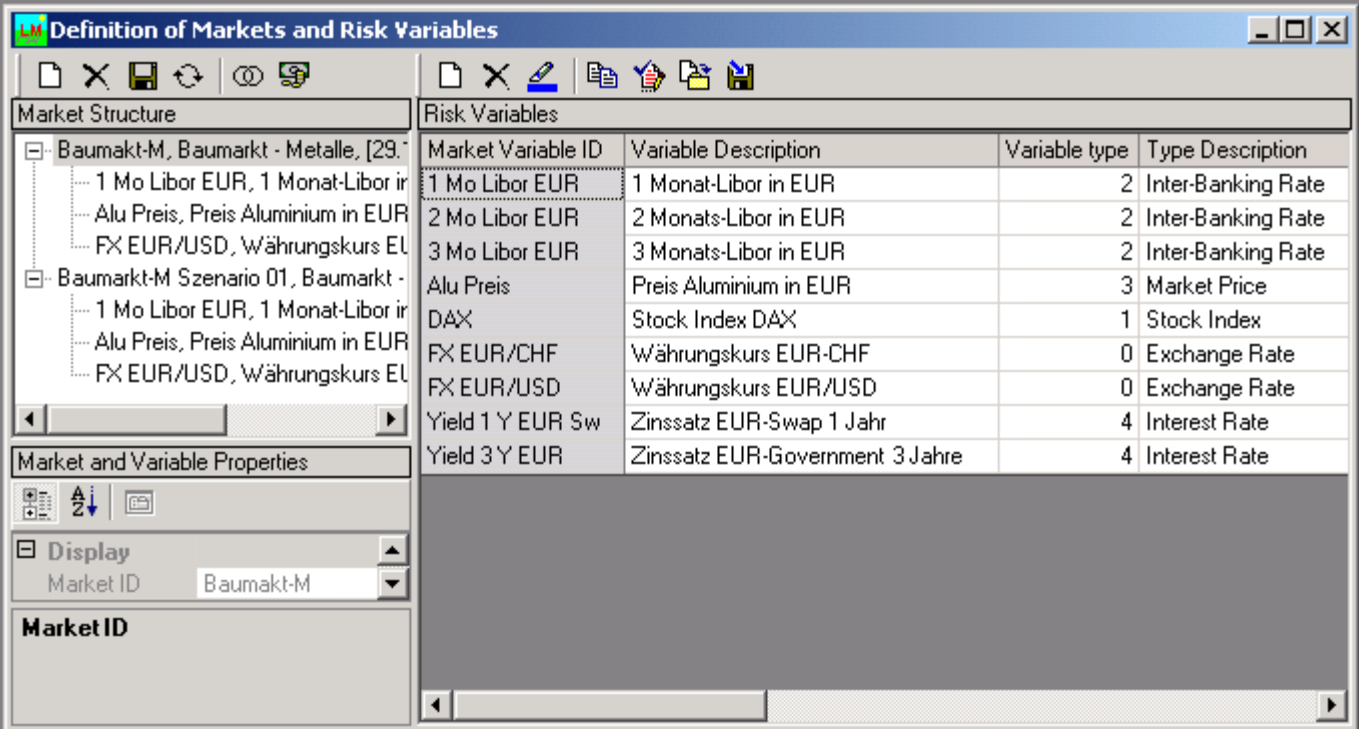
4. Forecasting of Performances

Calculation of historical performances, volatilities and correlation



4. Forecasting of Performances

Definition of markets and risk factors in CFaR/EaR



Market Variable ID	Variable Description	Variable type	Type Description
1 Mo Libor EUR	1 Monat-Libor in EUR	2	Inter-Banking Rate
2 Mo Libor EUR	2 Monats-Libor in EUR	2	Inter-Banking Rate
3 Mo Libor EUR	3 Monats-Libor in EUR	2	Inter-Banking Rate
Alu Preis	Preis Aluminium in EUR	3	Market Price
DAX	Stock Index DAX	1	Stock Index
FX EUR/CHF	Währungskurs EUR-CHF	0	Exchange Rate
FX EUR/USD	Währungskurs EUR/USD	0	Exchange Rate
Yield 1 Y EUR Sw	Zinssatz EUR-Swap 1 Jahr	4	Interest Rate
Yield 3 Y EUR	Zinssatz EUR-Government 3 Jahre	4	Interest Rate

4. Forecasting of Performances

Allocation of data to risk factors in the CFaR/EaR analysis

Variable Definition

Variable:

Description:

VarType:

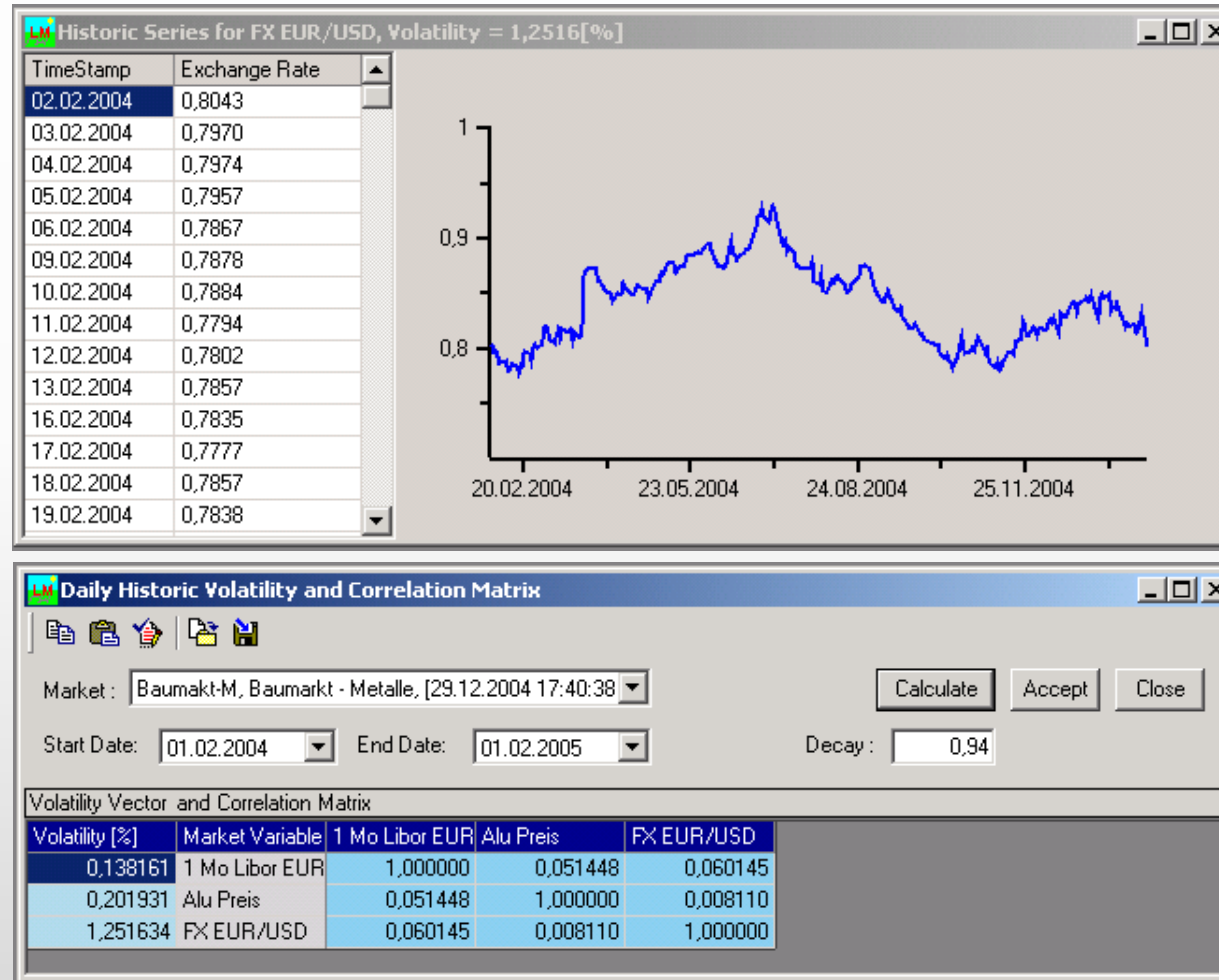
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Risk Variable Type Parameters

SerialNu	Curre	Sour	BidM	Rate Pr	WPKN	SER_NUM	INSTR_T	NAME	ISSUER_ID	MATURITY
ALU Price	EUR	EDF	BID	STDITF						
CH000123	CHF	EDF	ASK	STDITF	CH00012363	CH0001236345	Bond	4 3/8 % CREDIT S	CREDIT SUI	05.01.2006
CH000123	CHF	EDF	BID	STDITF	CH00012363	CH0001236345	Bond	4 3/8 % CREDIT S	CREDIT SUI	05.01.2006
CH000259	CHF	EDF	ASK	STDITF	CH00025945	CH0002594593	Structured	5 3/8 % PBZCHKB	PBZCHKB	16.09.2006
CH000259	CHF	EDF	BID	STDITF	CH00025945	CH0002594593	Structured	5 3/8 % PBZCHKB	PBZCHKB	16.09.2006
CH000880	CHF	EDF	ASK	STDITF	CH00088050	CH0008805068	Structured	5 1/2 % WORLD B	WORLD BAN	19.03.1913
CH000880	CHF	EDF	BID	STDITF	CH00088050	CH0008805068	Structured	5 1/2 % WORLD B	WORLD BAN	19.03.1913
CH001233	CHF	EDF	ASK	STDITF	CH00123303	CH0012330392	Bond	3 1/2 % ZUERCHE	ZKB	29.05.2006
CH001233	CHF	EDF	BID	STDITF	CH00123303	CH0012330392	Bond	3 1/2 % ZUERCHE	ZKB	29.05.2006
CH001283	CHF	EDF	ASK	STDITF	CH00128333	CH0012833312	Bond	3 1/2 % KANTON	KANTON WA	25.02.2009
CH001283	CHF	EDF	BID	STDITF	CH00128333	CH0012833312	Bond	3 1/2 % KANTON	KANTON WA	25.02.2009

4. Forecasting of Performances

Calculation of historical volatility and correlation in CFaR/EaR



4. Forecasting of Performances

Forecasts based on implicit swaption volatilities

Reuters



Volatility of Swap Rates Start (Years)	Interval(Years)				
	1	2	3	4	5
1	17,10%	16,50%	15,20%	14,40%	13,70%
2	18,00%	16,30%	14,90%	13,60%	12,90%
3	17,80%	15,60%	14,00%	12,70%	12,00%
4	16,80%	14,60%	13,00%	11,90%	11,20%
5	15,80%	13,70%	12,20%	11,30%	10,70%

Reuters



Implied 1 Year Swap Rates Period	Swap Rates
starting year 1 and ending year 2.	5,090%
starting year 2 and ending year 3.	5,395%
starting year 3 and ending year 4.	5,603%
starting year 4 and ending year 5.	5,896%
starting year 5 and ending year 6.	6,062%

Variance/Covariance Algebra

$$V_Z = \frac{1}{Z} \sqrt{(xV_X)^2 + (yV_Y)^2 \pm 2 * Cov_{XY}}$$

$$Cov_{XY} = (xV_X) * (yV_Y) * \rho_{XY}$$

$$Cov_{XY} = Cov_{XY_1} \pm Cov_{XY_2}$$

Market

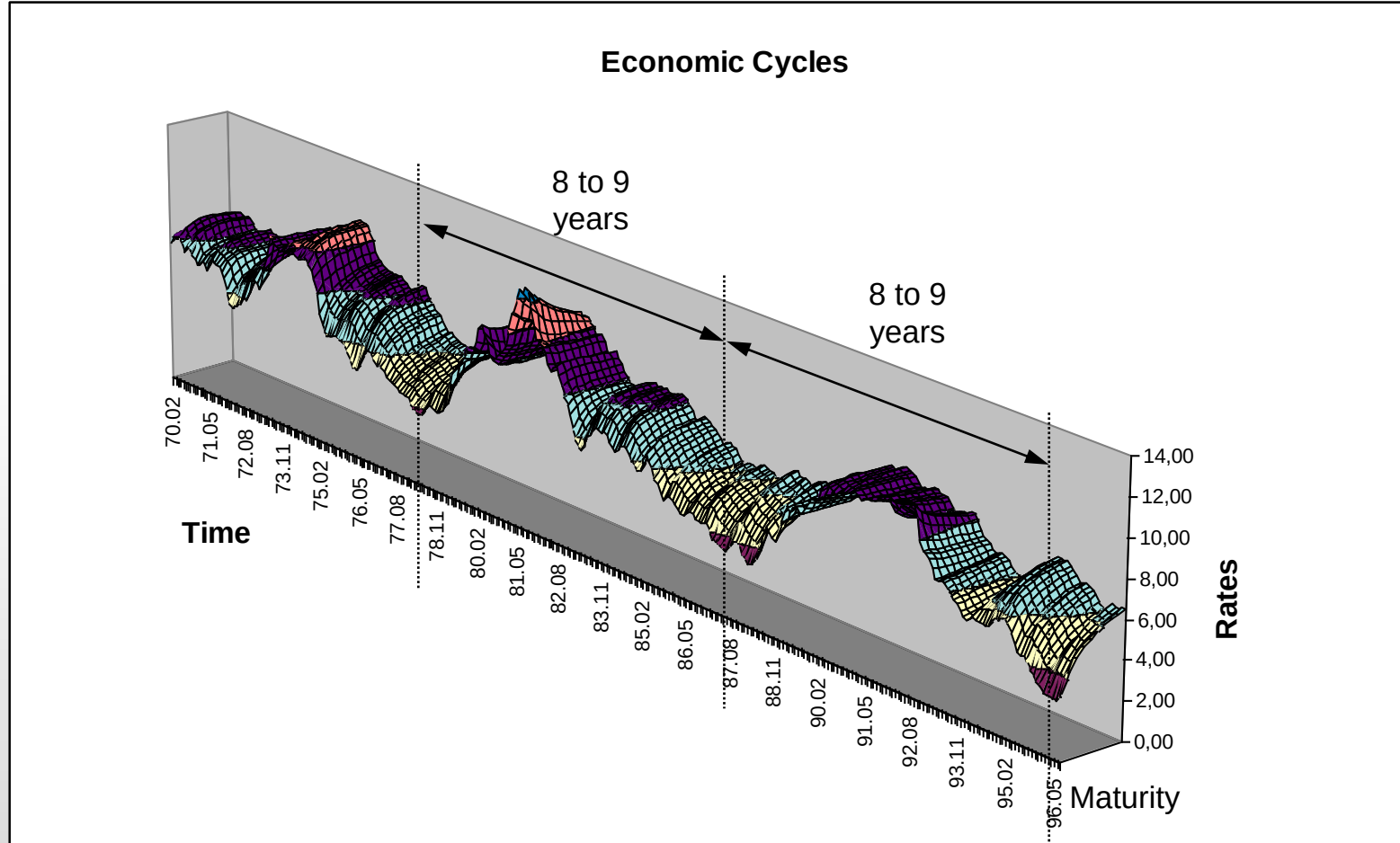
Market



Correlation of Swap Rates	1	2	3	4	5
1	1,000	0,770	0,418	0,542	0,787
2	0,770	1,000	0,660	0,466	0,302
3	0,418	0,660	1,000	0,628	0,391
4	0,542	0,466	0,628	1,000	0,603
5	0,787	0,302	0,391	0,603	1,000

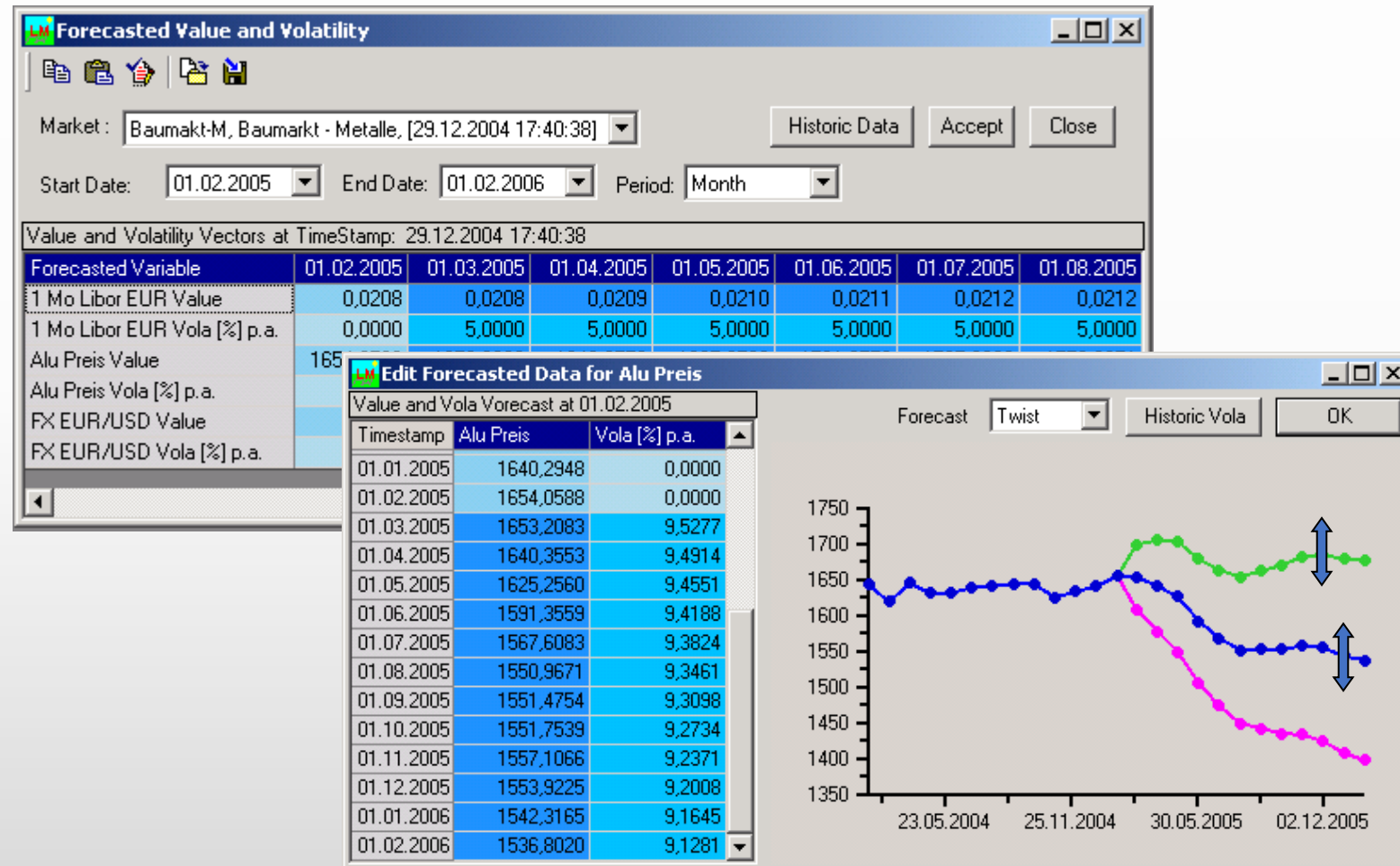
4. Forecasting of Performances

User-defined scenarios for economic cycles



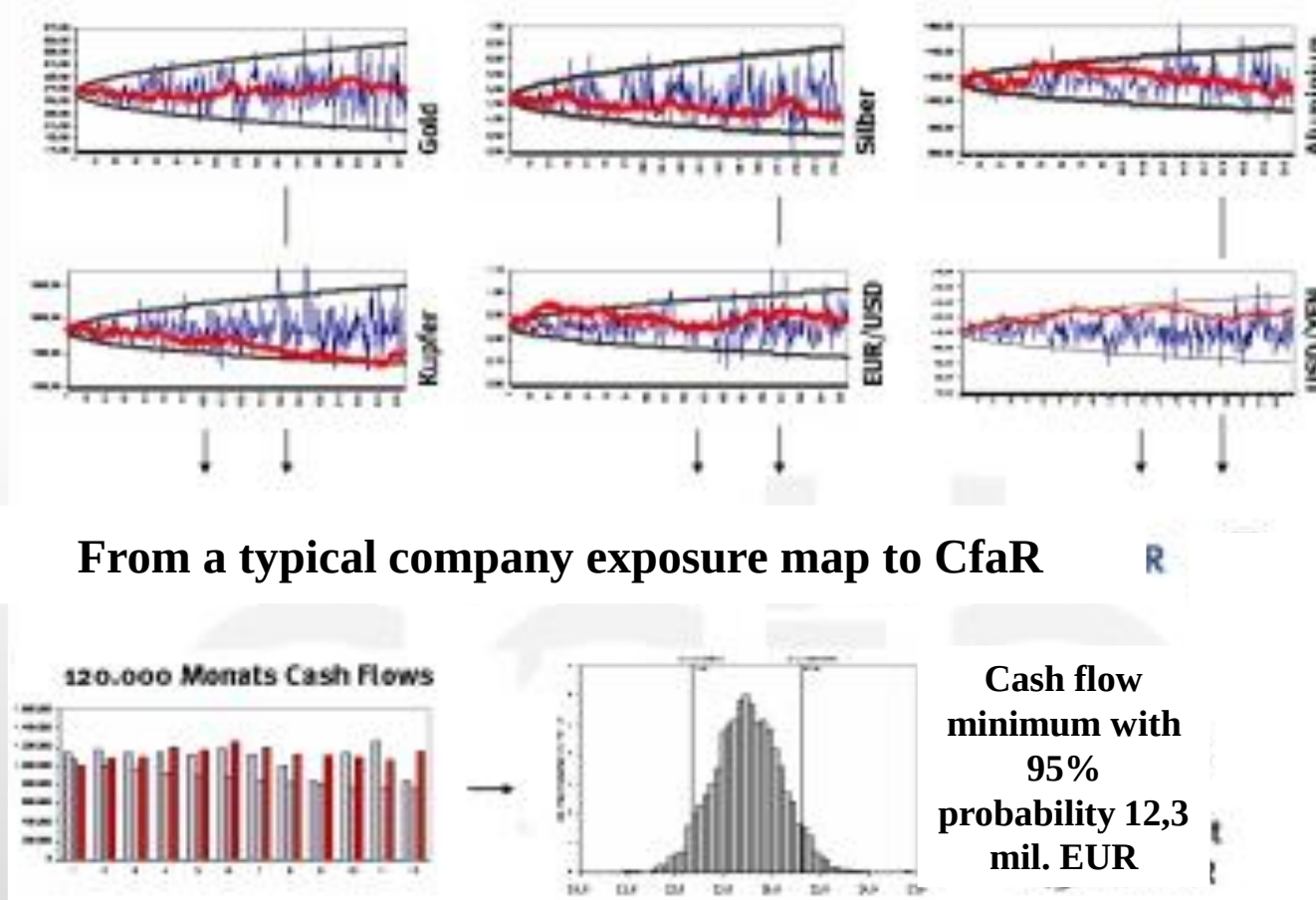
4. Forecasting of Performances

User-defined scenarios for volatility and performance



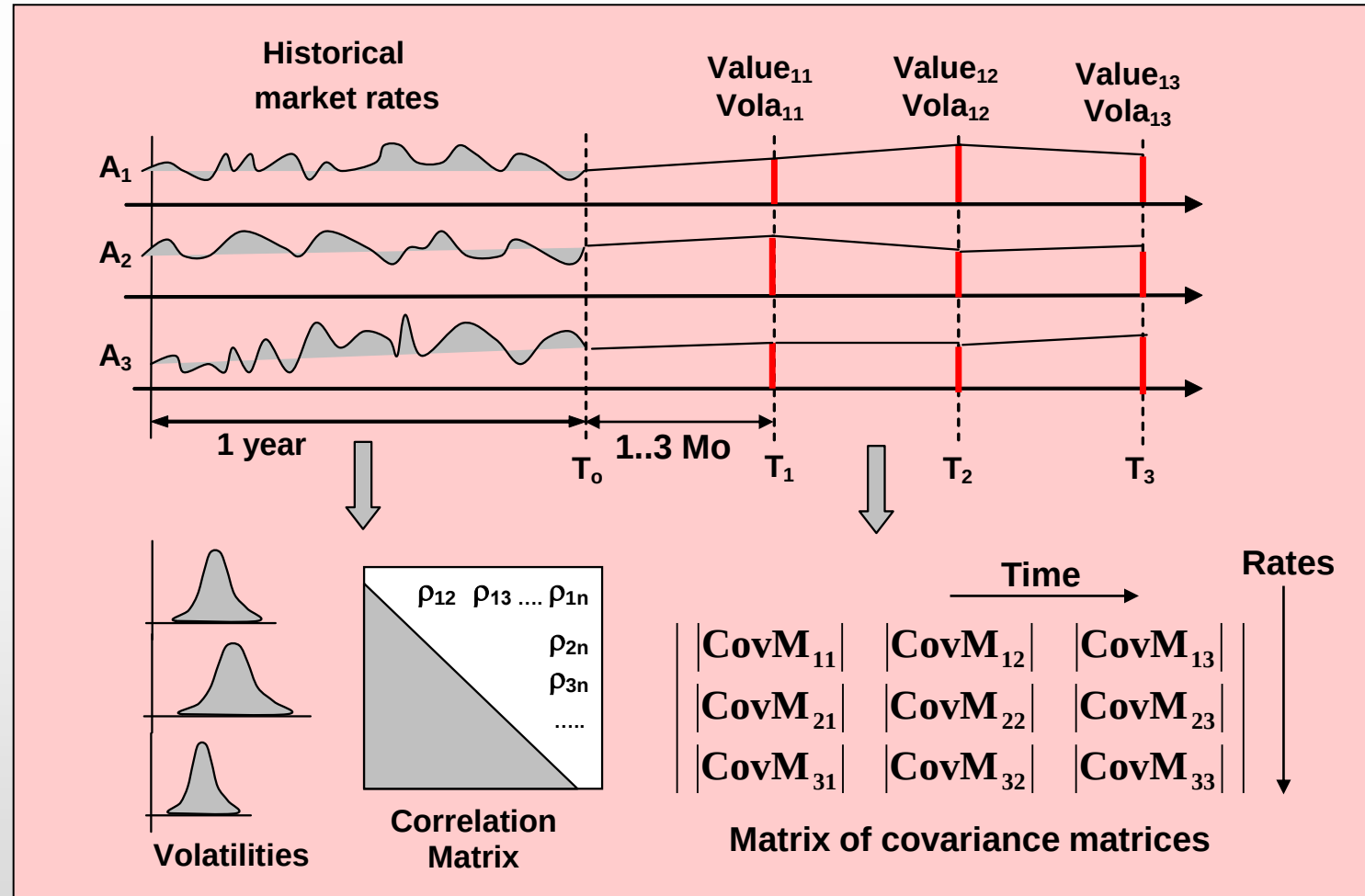
5. Evaluation using Monte Carlo Simulation

CfaR and EaR Framework - Overview



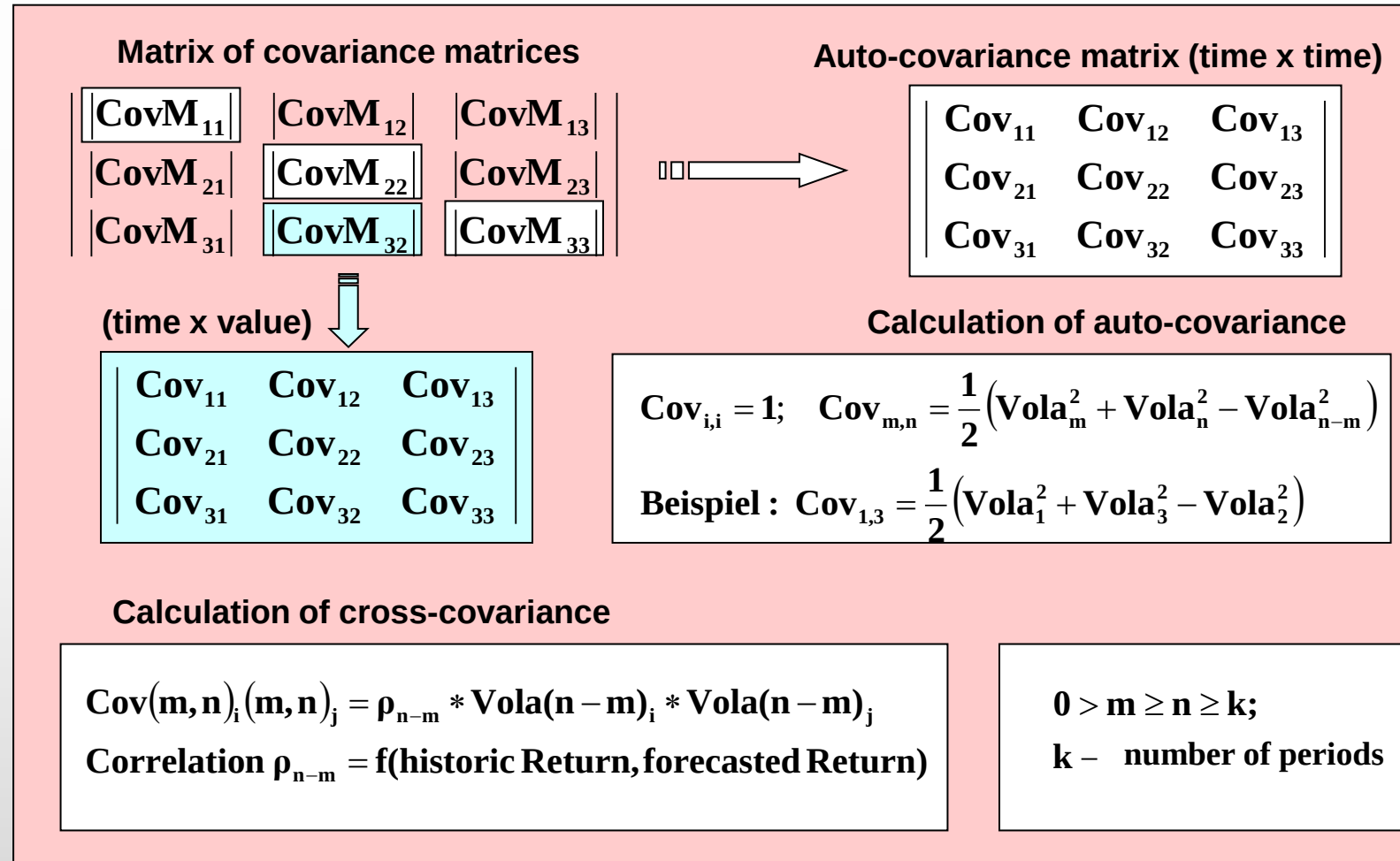
5. Evaluation using Monte Carlo Simulation

CfaR and EaR Framework – Calculation of the simulated data



5. Evaluation using Monte Carlo Simulation

CfaR and EaR Framework, Level I Simulation



5. Evaluation using Monte Carlo Simulation

Level I Simulation: risk factors, risk factors x time - correlation

Cash Flow/Earning at Risk Simulation

Market: Baumakt-M, Baumarkt - Metalle, [29.12.2004 17:40:38] CFaR/EaR Simulation

Monte Carlo Runs: 10000 Market Variables: 3 Asset Correlation

Histogram Intervals: 100 Forecasted Values: 12 Asset-Time Correlation

Confidence Level [%]: 95 Simulated Values: 36

Asset-Time Correlation Matrix

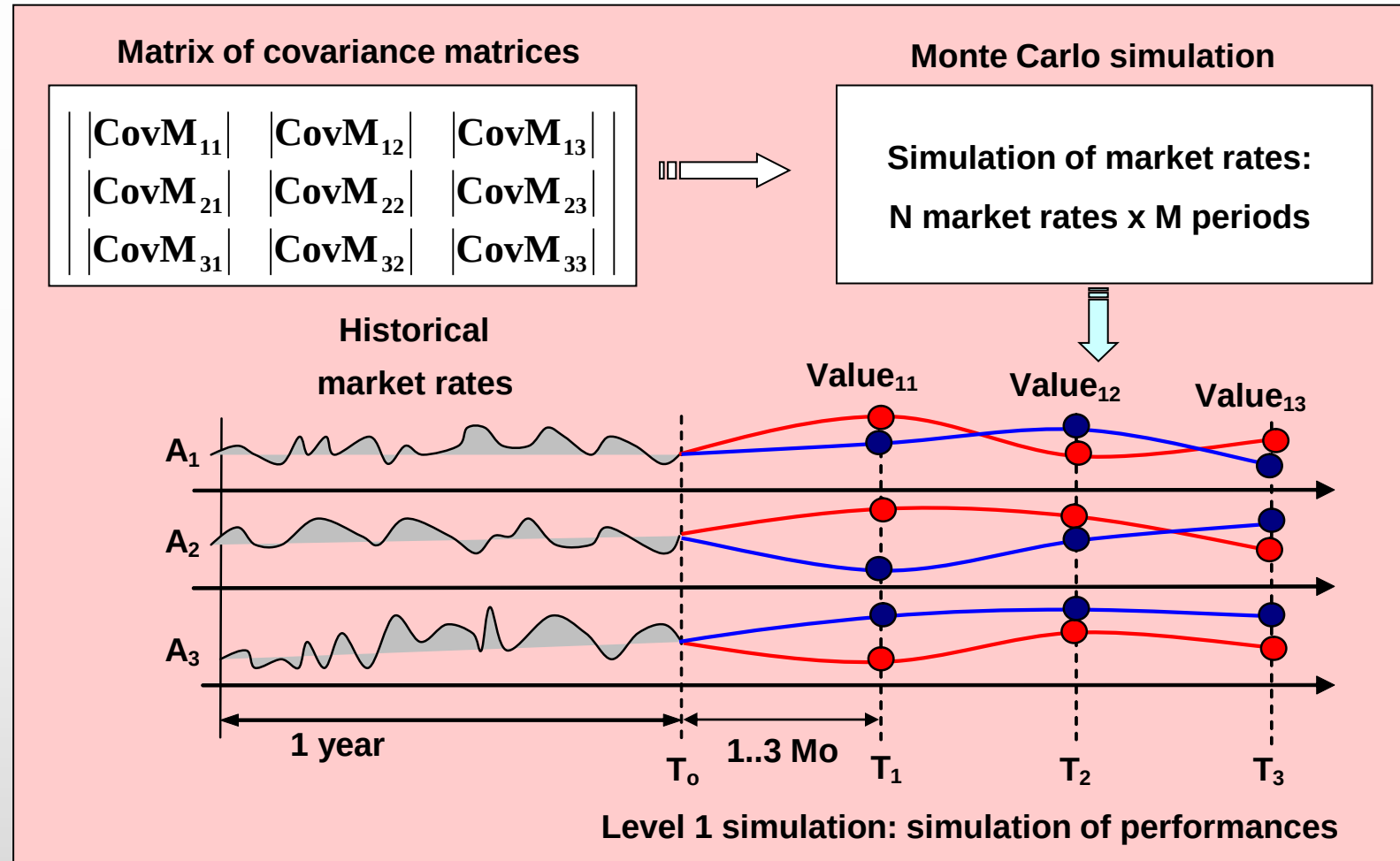
Volatility [%]	Market Variable	(1) 1 Mo Libor E	(2) 1 Mo Libor E	(3) 1 Mo Libor E	(4) 1 Mo Libor E	(5) 1 Mo Libor E
10,0000	(9) Alu Preis	-0,121851	-0,121851	-0,121851	-0,121851	-0,121851
10,0000	(10) Alu Preis	-0,121851	-0,121851	-0,121851	-0,121851	-0,121851
10,0000	(11) Alu Preis	-0,121851	-0,121851	-0,121851	-0,121851	-0,121851
10,0000	(12) Alu Preis	-0,121851	-0,121851	-0,121851	-0,121851	-0,121851
12,0000	(1) FX EUR/USD	-0,296280	-0,148140	-0,148140	-0,148140	-0,148140
12,0000	(2) FX EUR/USD	-0,148140	-0,296280	-0,148140	-0,148140	-0,148140
12,0000	(3) FX EUR/USD	-0,148140	-0,148140	-0,296280	-0,148140	-0,148140
12,0000	(4) FX EUR/USD	-0,148140	-0,148140	-0,148140	-0,296280	-0,148140
12,0000	(5) FX EUR/USD	-0,148140	-0,148140	-0,148140	-0,148140	-0,296280
12,0000	(6) FX EUR/USD	-0,148140	-0,148140	-0,148140	-0,148140	-0,148140
12,0000	(7) FX EUR/USD	-0,148140	-0,148140	-0,148140	-0,148140	-0,148140
12,0000	(8) FX EUR/USD	-0,148140	-0,148140	-0,148140	-0,148140	-0,148140
12,0000	(9) FX EUR/USD	-0,148140	-0,148140	-0,148140	-0,148140	-0,148140

Asset Correlation Matrix

Market Variable	1 Mo Libor EUR	Alu Preis	FX EUR/USD
1 Mo Libor EUR	1,000000	-0,243701	-0,296280
Alu Preis	-0,243701	1,000000	0,267229
FX EUR/USD	-0,296280	0,267229	1,000000

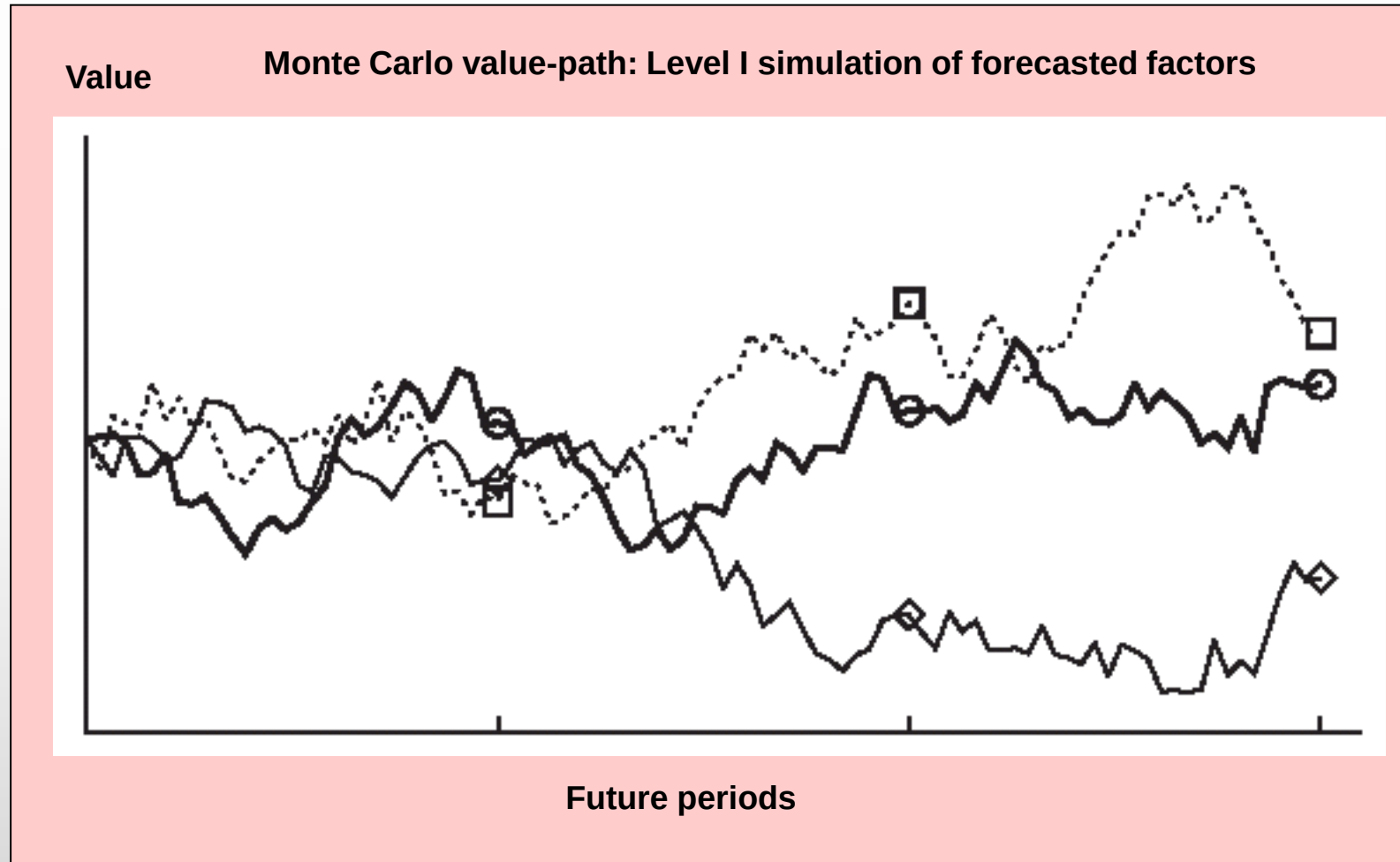
5. Evaluation using Monte Carlo Simulation

CfaR and EaR Framework, Level I Simulation



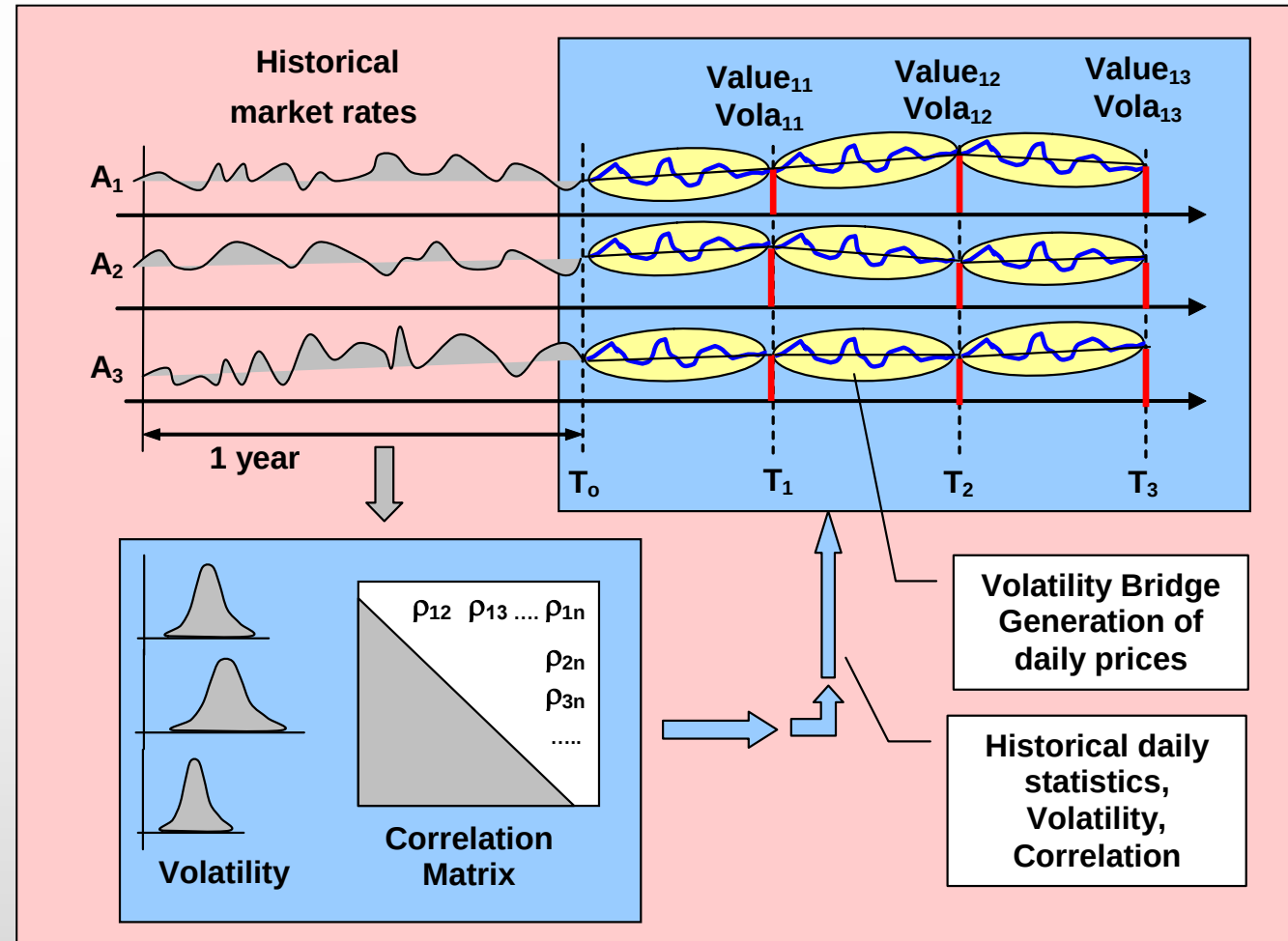
5. Evaluation using Monte Carlo simulation

CfaR und EaR Framework, Level I Simulation



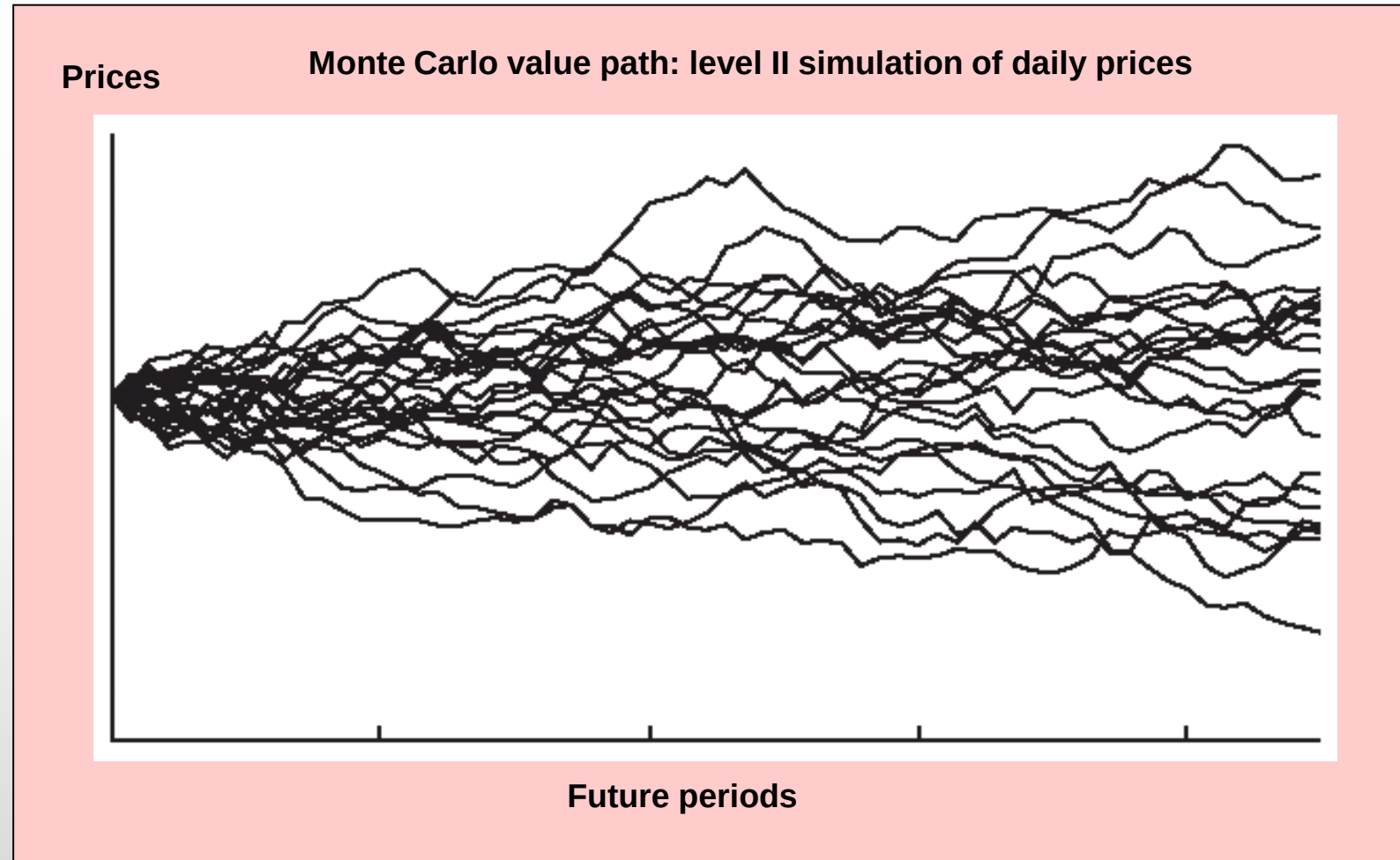
5. Evaluation using Monte Carlo Simulation

CfaR und EaR Framework, Level II Simulation (Volatility-Bridge)



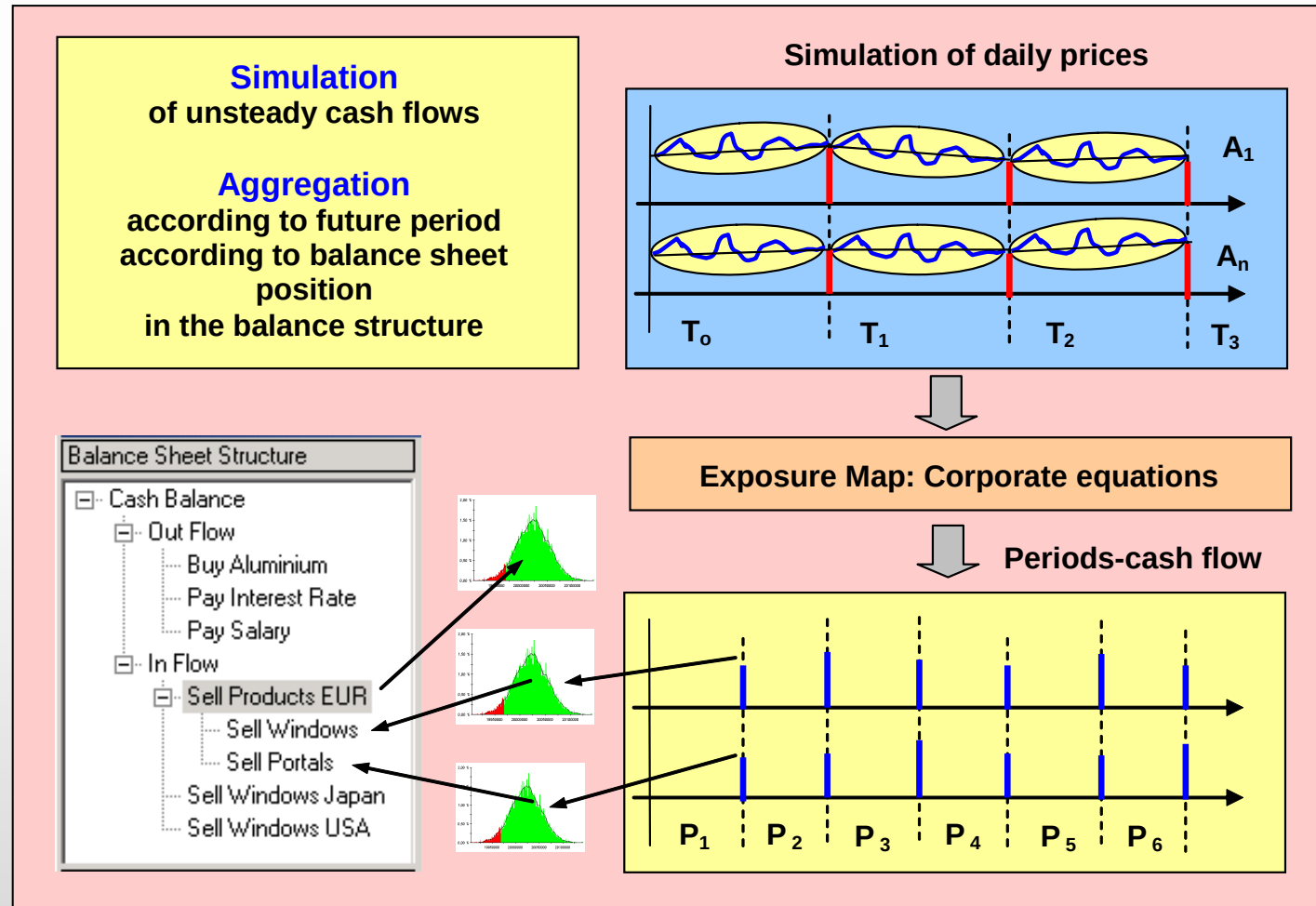
5. Evaluation using Monte Carlo Simulation

CfaR and EaR Framework, Level II Simulation (Volatility-Bridge)



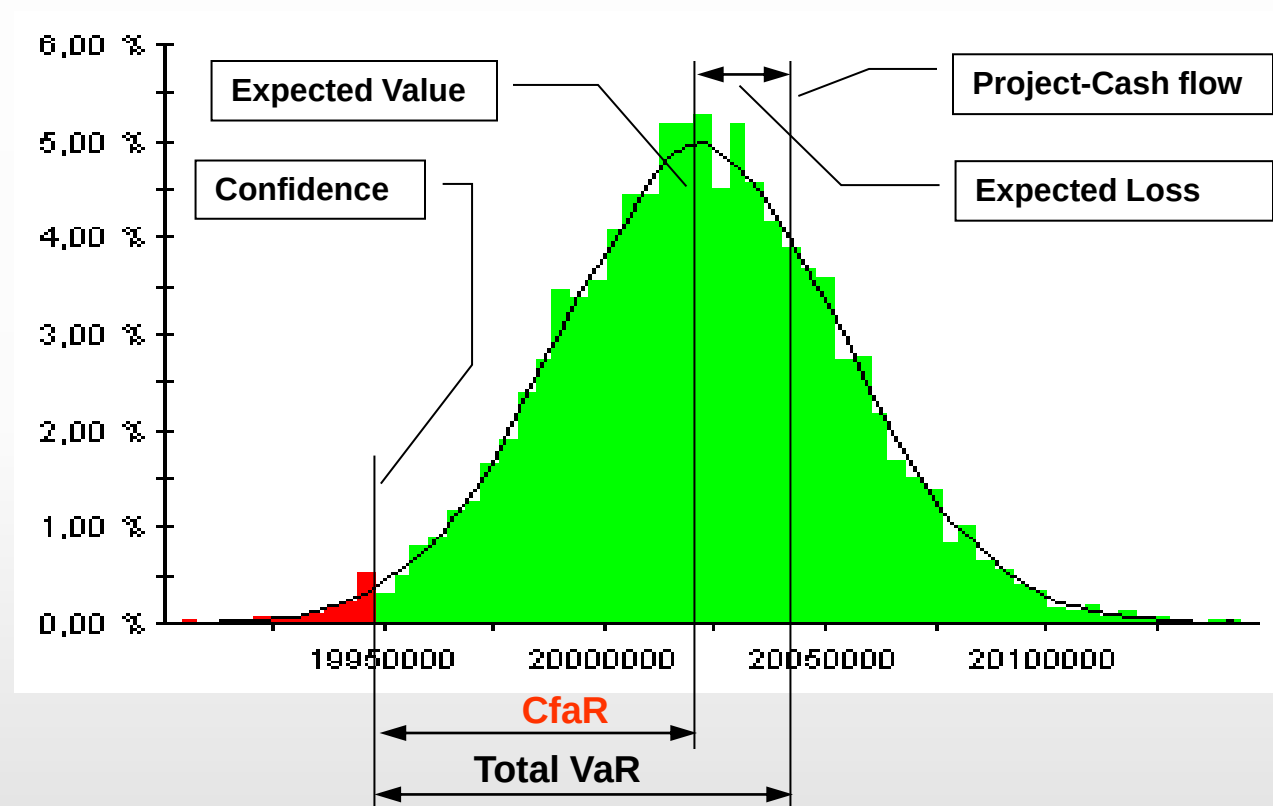
5. Evaluation using Monte Carlo Simulation

Simulation of unsteady cash flows within the balance sheet structure



6. Calculation of CfaR and EaR

Calculation of Expected Loss in the Project-Cash flow



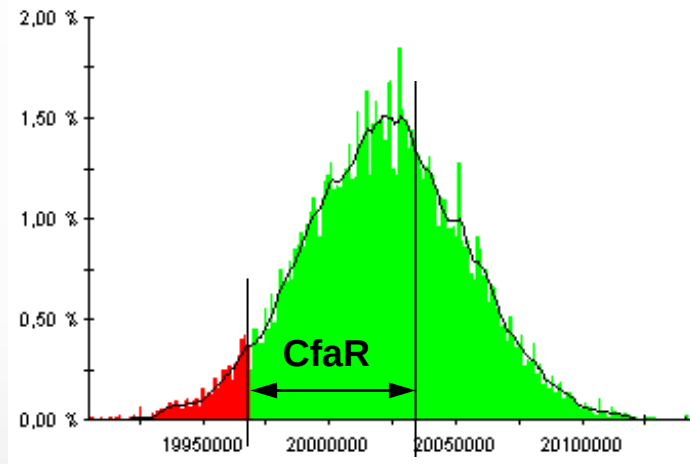
Expected Loss = Project-Cash flow – Expected value

CfaR = Expected value – Confidence value

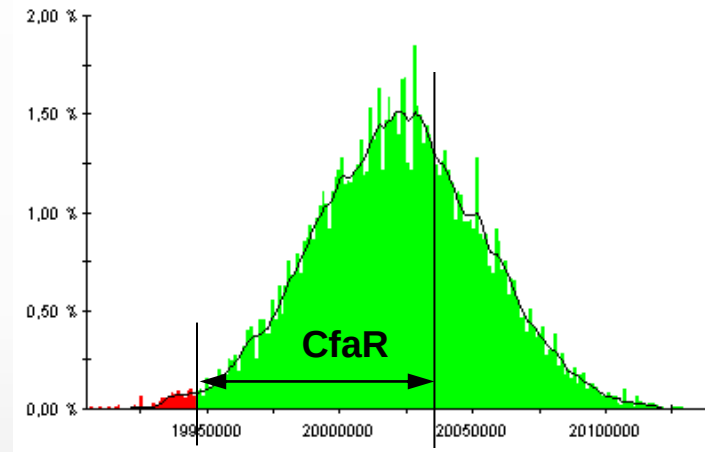
Total VaR = Project-Cash flow – Confidence value

Calculation of CfaR and EaR for different confidence intervals

Confidence interval = 5%



Confidence interval = 1%



The CfaR calculation is derived from the obtained loss distribution:

- Monte Carlo simulation results are arranged in ascending order
- $i = \text{confidence interval} * \text{number of simulation steps}$ (e.g. $= 5\% * 10.000 = 500$)
- The i -th result represents the confidence value
- **Total VaR = Project-Cash flow – confidence value**

6. Calculation of CFaR and EaR

Tabular representation of confidence values and CFaR-EaR

CFaR AluRahmen, CashFlow at Risk Analyse für Produktionsplan, [02.01.2005], CFaR Plan 12, 02.01.2005, CFaR Plan Analyse f...

Balance Sheet Structure            

 **CFaR Plan 12**

- CF Bilanz EUR, Cash Flow
- Kauf Alu: EUR, Roh
- Kauf Alu: Tonne
- Preis Alu: EUR,
- Verkauf: EUR, Exp
- Verkauf: USD, E
- Kurs: USD/EUR,
- Zinsen in EUR, Roh

Balance Item Properties            

Display

Identifier: CF Bilanz EUR

Misc

Consolidation: 1

Decimal Place: 2

Input CF Sign: Y

Plan Structure: CFaR Plan 12

Query ID:

Row Description: Cash Flow Bilanz

Identifier
Gets or sets the text of the node

Liquidity Source: ALM-BW-S, 31.10.2002, Szen 1, EUR

Start Date: 01.02.2005

End Date: 01.02.2006

Period: Month

Display

- ☒ CashFlow
- ☐ Difference
- ☐ Cumulative
- ☐ Relative

☐ Treat Account Cash ☐ Treat Trade Cash Flow

Values In: Money Units

CFaR / EaR

Calculate

☒ Confidence Value

☐ Expected Loss

☐ Expected Loss[%]

☒ CFaR/EaR

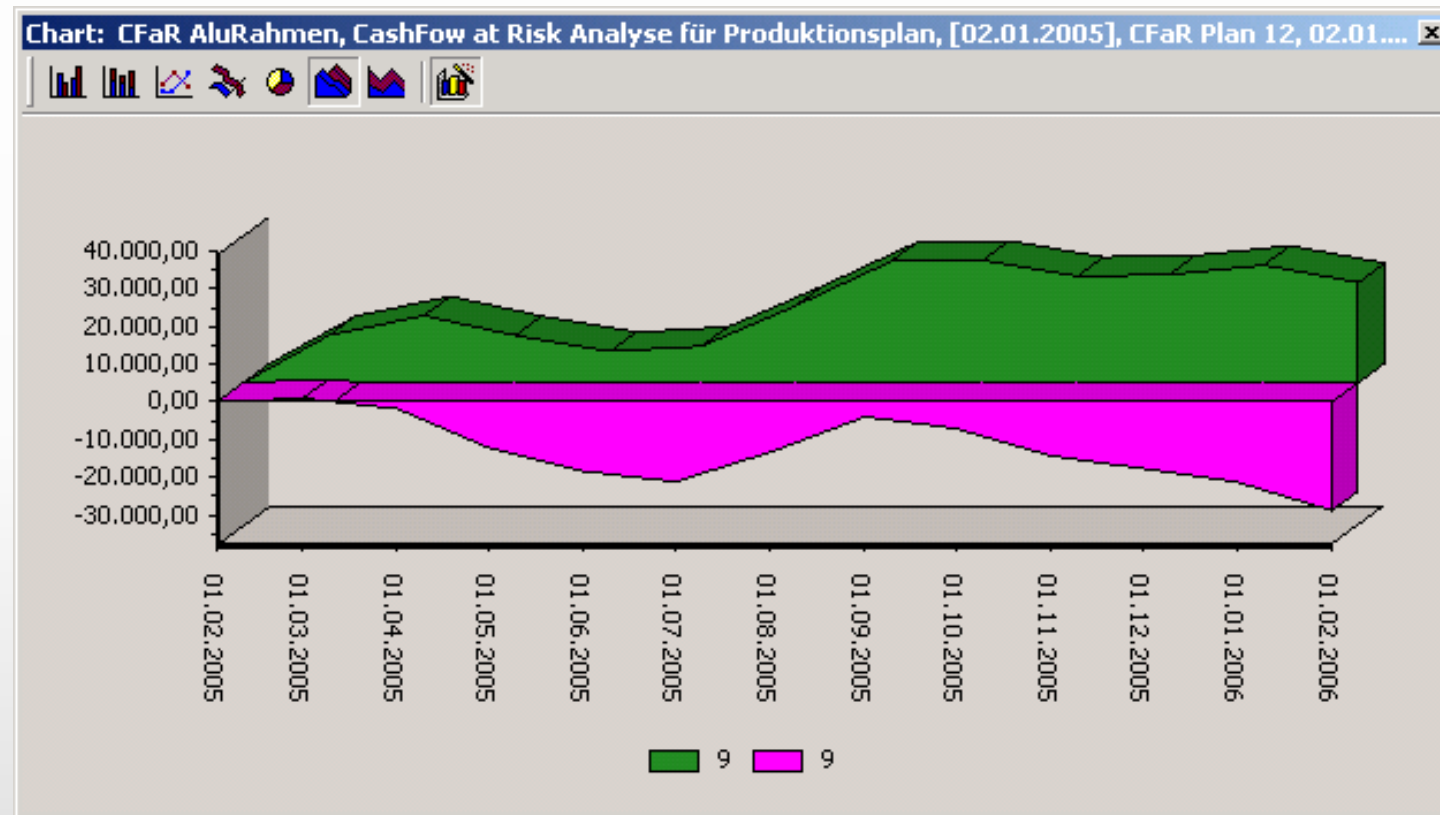
☐ CFaR/EaR [%]

Liquidity Plan

Show	Balance Item	01.02.2005	01.03.2005	01.04.2005	01.05.2005	01.06.2005
☒	CF Bilanz EUR Budget Value	0,00	12.514,59	17.771,69	12.531,02	8.307,13
☒	CF Bilanz EUR Confidence Value	0,00	902,55	-1.812,49	-12.194,39	-18.402,96
☒	CF Bilanz EUR CFaR/EaR	0,00	11.618,26	19.591,81	24.739,65	26.713,93
☐	Kauf Alu: EUR Budget Value	-198.487,06	-214.917,08	-216.526,90	-198.281,23	-200.510,84
☐	Kauf Alu: EUR Confidence Value	-198.487,05	-224.710,32	-230.961,47	-214.666,69	-220.160,95
☐	Kauf Alu: EUR CFaR/EaR	0,00	9.793,23	14.434,56	16.385,46	19.650,11
☐	Kauf Alu: Tonnen Budget Value	120,00	130,00	132,00	122,00	126,00
☐	Kauf Alu: Tonnen Confidence Value	120,00	130,00	132,00	122,00	126,00
☐	Kauf Alu: Tonnen CFaR/EaR	0,00	0,00	0,00	0,00	0,00
☐	Preis Alu: EUR Budget Value	1.654,06	1.653,21	1.640,36	1.625,26	1.591,36
☐	Preis Alu: EUR Confidence Value	1.654,06	1.577,88	1.531,00	1.490,95	1.435,40
☐	Preis Alu: EUR CFaR/EaR	0,00	75,33	109,35	134,31	155,95
☐	Verkauf: EUR Budget Value	0,00	212.530,00	234.349,00	230.736,00	208.130,00
☐	Verkauf: EUR Confidence Value	0,00	200.930,30	215.915,87	208.491,89	184.555,02
☐	Verkauf: EUR CFaR/EaR	0,00	11.607,77	18.439,45	22.256,85	23.576,96

6. Calculation of CfaR and EaR

Graphical illustration of budget and confidence values

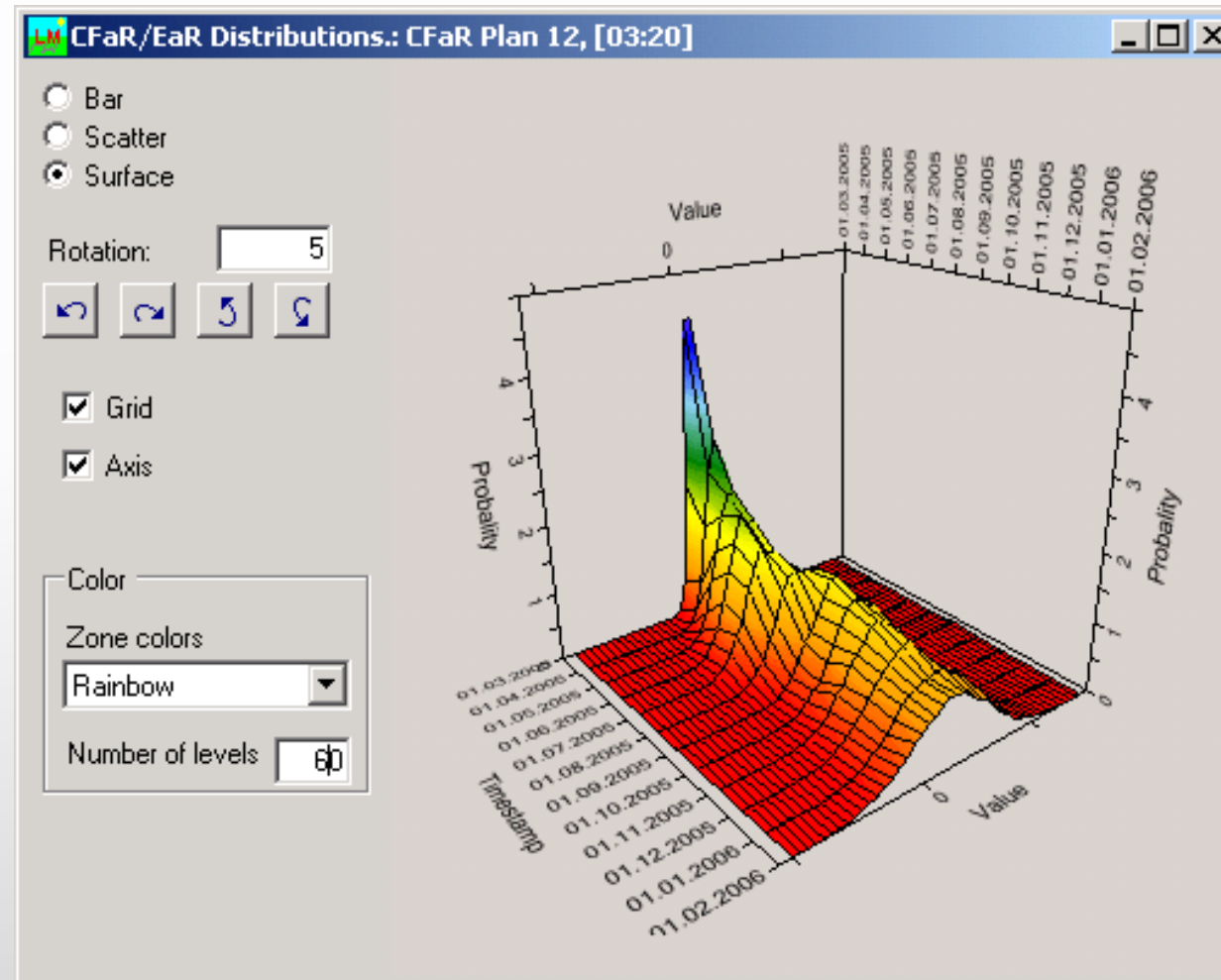


The growth trend for the budget value (green) is positive

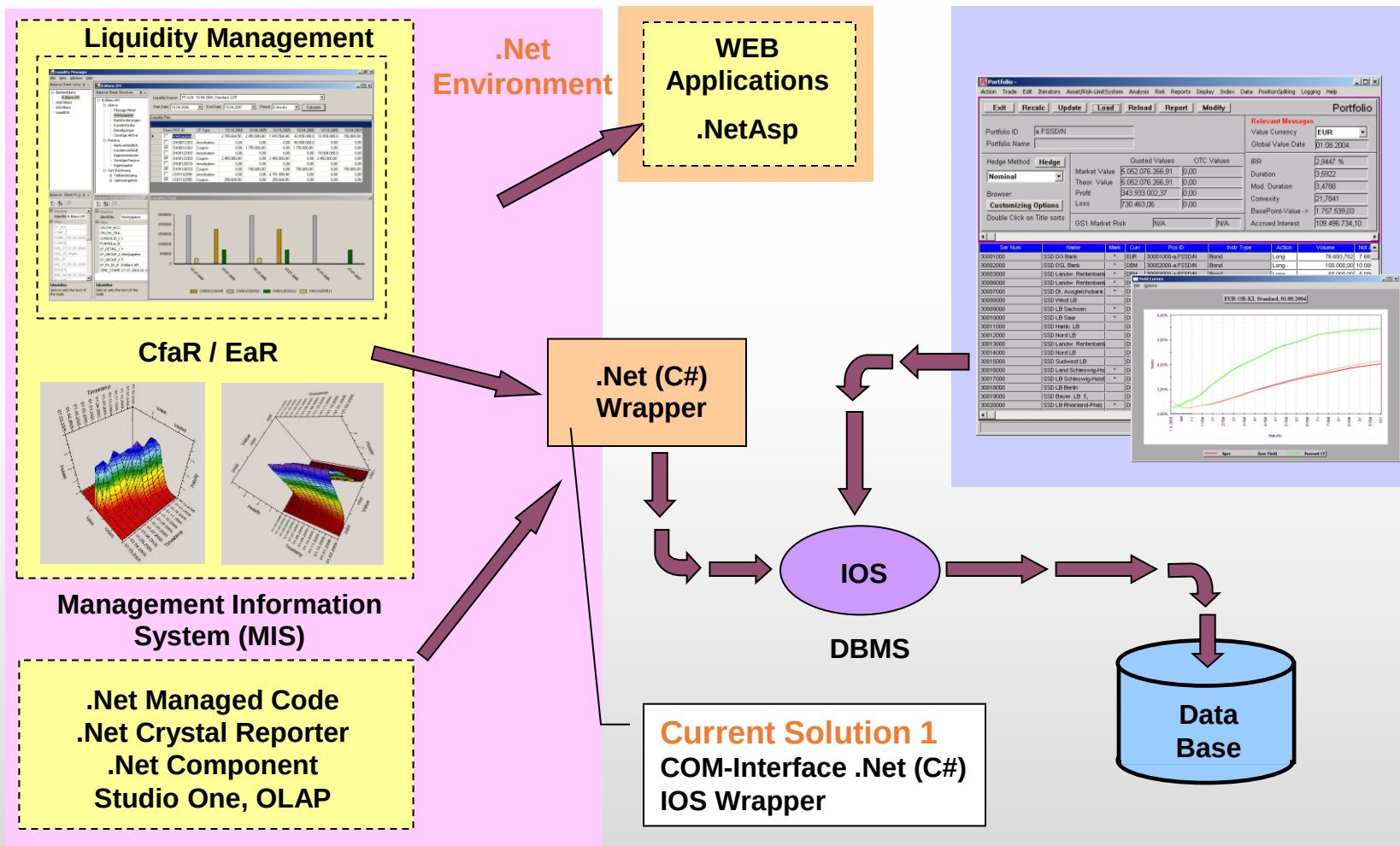
The growth trend for the confidence value (purple) at 95% is negative

6. Calculation of CfaR and EaR

3D distribution graph of expected values for the balance sheet and for aluminum prices

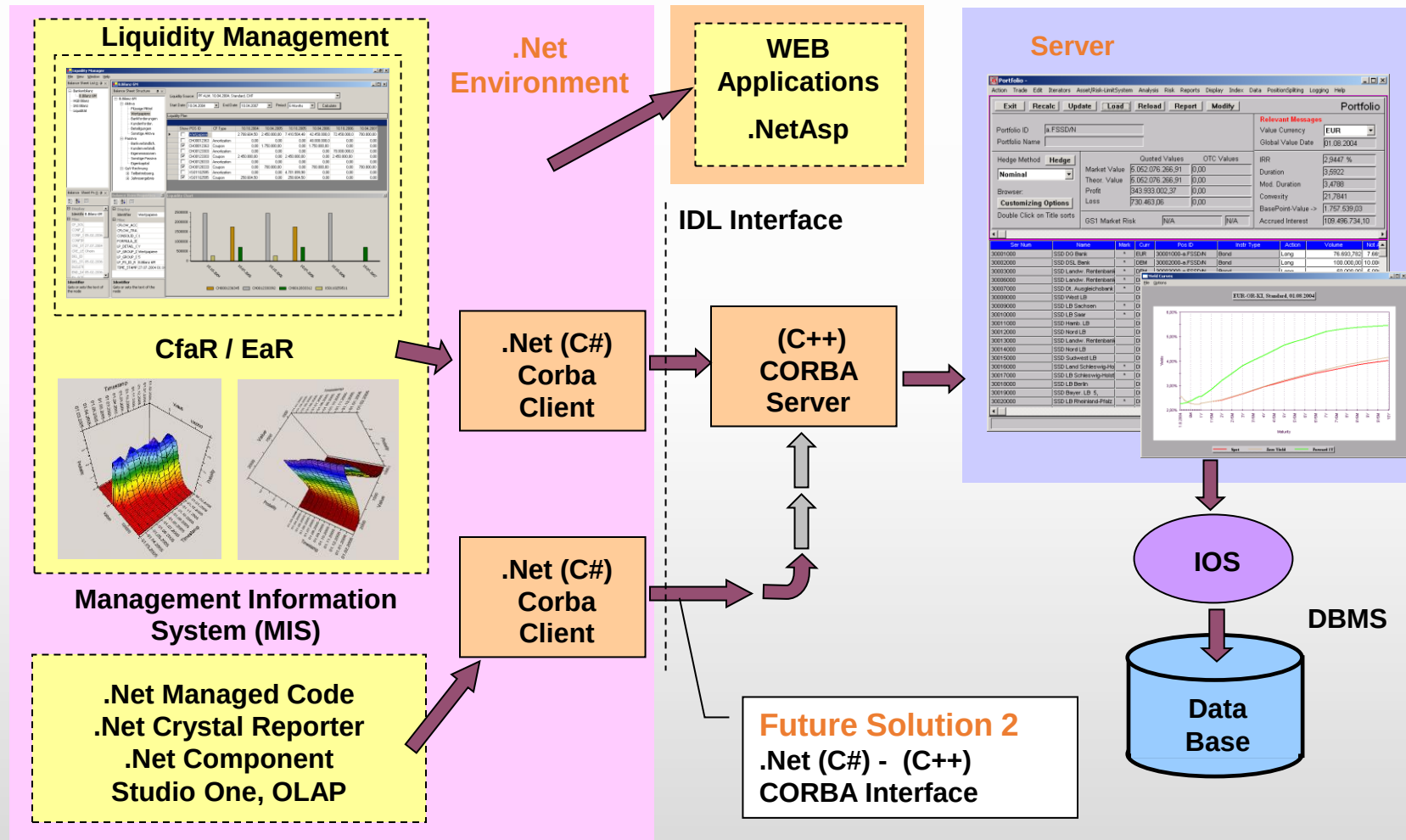


Implementation as a seperate application with Microsoft .Net (C#)



7. Implementation Aspects

Implementation as a separate application with Microsoft .Net (C#)



7. Implementation Aspects

Integration of the application: Liquidity planning

Liquidity Manager - [CFaR AluRahmen, CashFlow at Risk Analyse für Produktionsplan, [02.01.2005], CFaR Plan 12, 02.01.2005, CFaR Plan Analyse für 1 Jahr, M...

File CFaR/EaR Markets View Reporting Window Help

Balance Sheet List Balance Sheet Structure

Balance Sheet List

- Bank Blz, Bankenbilanz, [27.07.2004]
 - BB Plan 001, Plan 001 3 Mo, [17.
 - BB Plan 002, Plan 002 1 Mo, [17.
 - BB Plan 003, Plan 003 3 Mo, [19.
- CFaR AluRahmen, CashFlow at Risk f
 - CFaR Plan, CFaR Plan Analyse f
 - CFaR Plan 12, CFaR Plan Analyse
- Einfache Blz, Einfache Bilanz mit Kenn
- Test Plan, Test Plan aus Einfache
- LiPlan 001, Liquiditätsplanung Bilanz,
 - Diff TU801/802, Differenz Tochter
 - P TU801, Plan Tochter 801, [10.
 - P TU802, Plan Tochter 802, [25.
 - Plan Konzern, Plan Konzern (Toch

Balance Sheet Structure

- CFaR Plan 12
 - CF Bilanz EUR, Cash Flow t
 - Kauf Alu: EUR, Rohsto
 - Kauf Alu: Tonnen,
 - Preis Alu: EUR, Pre
 - Verkauf: EUR, Export U
 - Verkauf: USD, Exp
 - Kurs: USD/EUR, US
 - Zinsen in EUR, Rohstof
 - 3 Mo Zins, 3 Monat

Balance Sheet Properties

Identifier: CFaR Plan 12

Misc

CashFlow Source: ALM-BW-VAR

CF Source Stamp: 31.10.2002

Company ID:

Confirm Time Sta: 01.01.1900

Confirm User ID:

Confirmed:

Create Time Stan: 02.01.2005 01:50

Create User ID: Oheim

Balance Item Properties

Decimal Plar 2

Input CF Si Y

Plan Struct: CFaR Plan 12

Query ID:

Row Descri: Cash Flow Bilanz

Row Formu if (n>0 ; {Verkauf

Time Stamp 02.01.2005 03:2

Treat spec:

Treat trade:

Liquidity Source: ALM-BW-S, 31.10.2002, Szen 1, EUR

Start Date: 01.02.2005

End Date: 01.02.2006

Period: Month

Display

- ☒ CashFlow
- ☐ Difference
- ☐ Cumulative
- ☐ Relative

☒ Confidence Value

☐ Expected Loss

☐ Expected Loss[%]

☒ CFaR/EaR

☐ CFaR/EaR [%]

CFaR / EaR

Calculate

☐ Treat Account Cash

☐ Treat Trade Cash Flow

Values In: Money Units

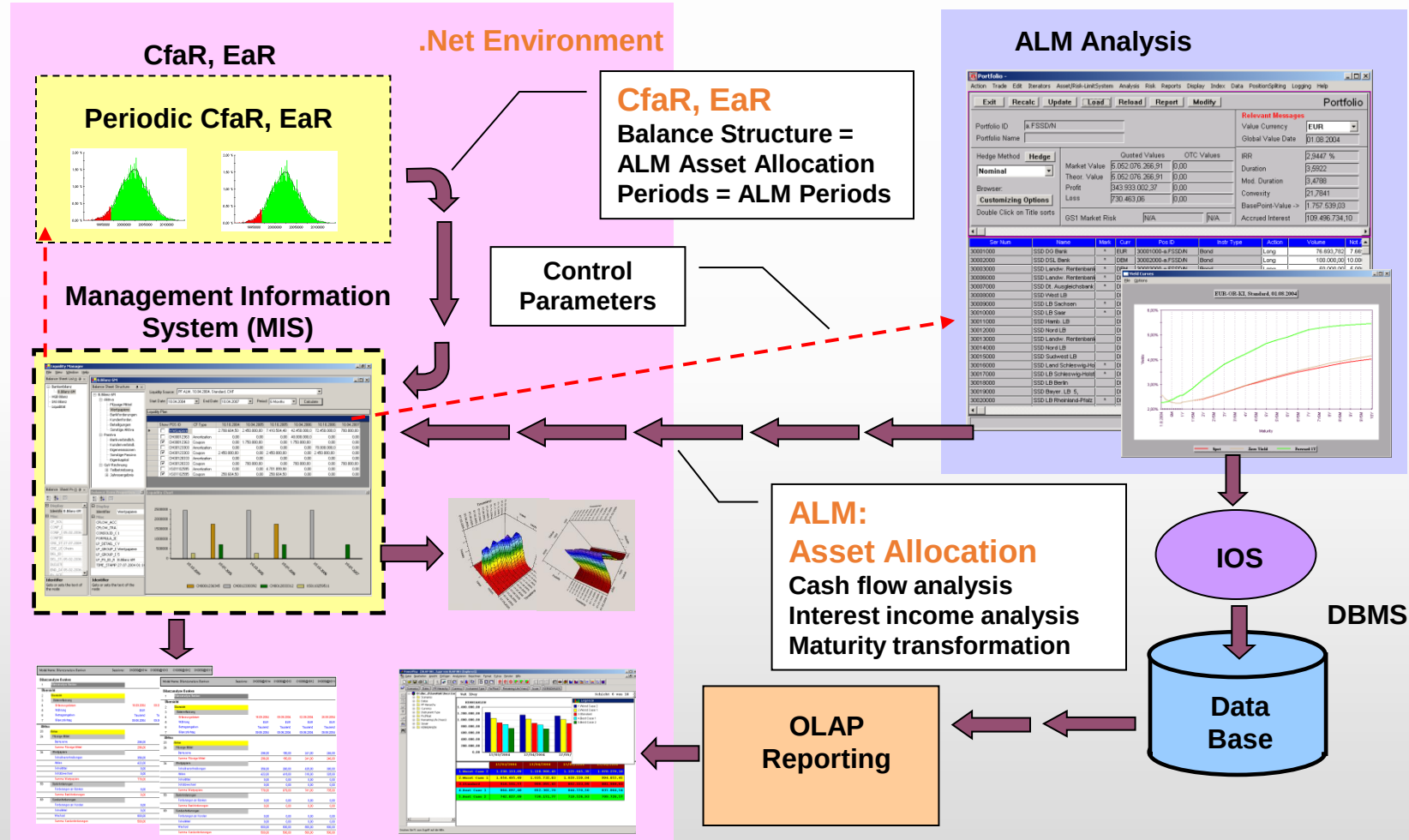
Liquidity Plan

Show	Balance Item	01.02.2005	01.03.2005	01.04.2005	01.05.2005	01.06.2005
☒	CF Bilanz EUR Budget Value	0,00	12.514,59	17.771,69	12.531,02	12.531,02
☒	CF Bilanz EUR Confidence Value	0,00	902,55	-1.812,49	-12.194,39	-12.194,39
☐	CF Bilanz EUR CFaR/EaR	0,00	11.618,26	19.591,81	24.739,65	24.739,65
☐	Kauf Alu: EUR Budget Value	-198.487,06	-214.917,08	-216.526,90	-198.281,23	-200.000,00
☐	Kauf Alu: EUR Confidence Value	-198.487,05	-224.710,32	-230.961,47	-214.666,69	-214.666,69
☐	Kauf Alu: EUR CFaR/EaR	0,00	9.793,23	14.434,56	16.385,46	16.385,46
☐	Kauf Alu: Tonnen Budget Value	120,00	130,00	132,00	122,00	122,00
☐	Kauf Alu: Tonnen Confidence Value	120,00	130,00	132,00	122,00	122,00
☐	Kauf Alu: Tonnen CFaR/EaR	0,00	0,00	0,00	0,00	0,00
☐	Preis Alu: EUR Budget Value	1.654,06	1.653,21	1.640,36	1.625,26	1.625,26
☐	Preis Alu: EUR Confidence Value	1.654,06	1.577,88	1.531,00	1.490,95	1.490,95
☐	Preis Alu: EUR CFaR/EaR	0,00	75,33	109,35	134,31	134,31
☐	Verkauf: EUR Budget Value	0,00	212.530,00	234.349,00	230.736,00	230.736,00
☐	Verkauf: EUR Confidence Value	0,00	200.930,30	215.915,87	208.491,89	208.491,89
☐	Verkauf: EUR CFaR/EaR	0,00	11.607,77	18.439,45	22.256,85	22.256,85
☐	Verkauf: USD Budget Value	0,00	265.000,00	290.000,00	285.000,00	285.000,00
☐	Verkauf: USD Confidence Value	0,00	265.000,00	290.000,00	285.000,00	285.000,00
☐	Verkauf: USD CFaR/EaR	0,00	0,00	0,00	0,00	0,00
☐	Kurs: USD/EUR Budget Value	0,80	0,80	0,81	0,81	0,81
☐	Kurs: USD/EUR Confidence Value	0,80	0,76	0,74	0,73	0,73
☐	Kurs: USD/EUR CFaR/EaR	0,00	0,04	0,06	0,08	0,08

1:58:56

7. Implementation Aspects

Integration of the application: Management Information System (MIS)



7. Implementation Aspects

Reports for balance sheet-, periodical- and aggregation results

Liquidity Manager - [ReportForm]

File CFaR/EaR Markets View Reporting Window Help

Balance Sheet List

- Bank Blz, Bankenbilanz, [27
- CFaR AluRahmen, CashFov
- CFaR Plan, CFaR Plan /
- CFaR Plan 12, CFaR Pl
- Einfache Blz, Einfache Bilan
- LIPlan 001, Liquiditätsplanu
- Simple Bilanz, Simple Bilanz

Balance Sheet Proper

Identifier CFaR Plan 12

Misc

CashFlow: ALM-BW-VAR

CF Source: 31.10.2002

Company ID

Confirm Tim: 01.01.1900

Confirm Us

Confirmed

Create Tim: 02.01.2005 0

Create User: Oheim

Delete Tim: 01.01.1900

Delete User

Deleted

Identifier Gets or sets the text of the node

Current Page No.: 1 Total Page No.: 2 Zoom Factor: 100%

Done!

7:56:42

Cash Flow/ Earning at Risk between 01.02.2005 and 01.07.2005

Plan ID CFaR Plan 12 Timestamp 02.01.2005 Cash Flow Source ALM-BW-VAR

Plan Name CFaR Plan Analyse für 1 Jahr, Monatlich

Plan Title 1 CashFow at Risk Plan Analyse für Festl-Hohenfels GmbH

Plan Title 2 Risikofaktoren: Preis Aluminium pro Tonne, Währungskurs zu USD, 3 Monatszins

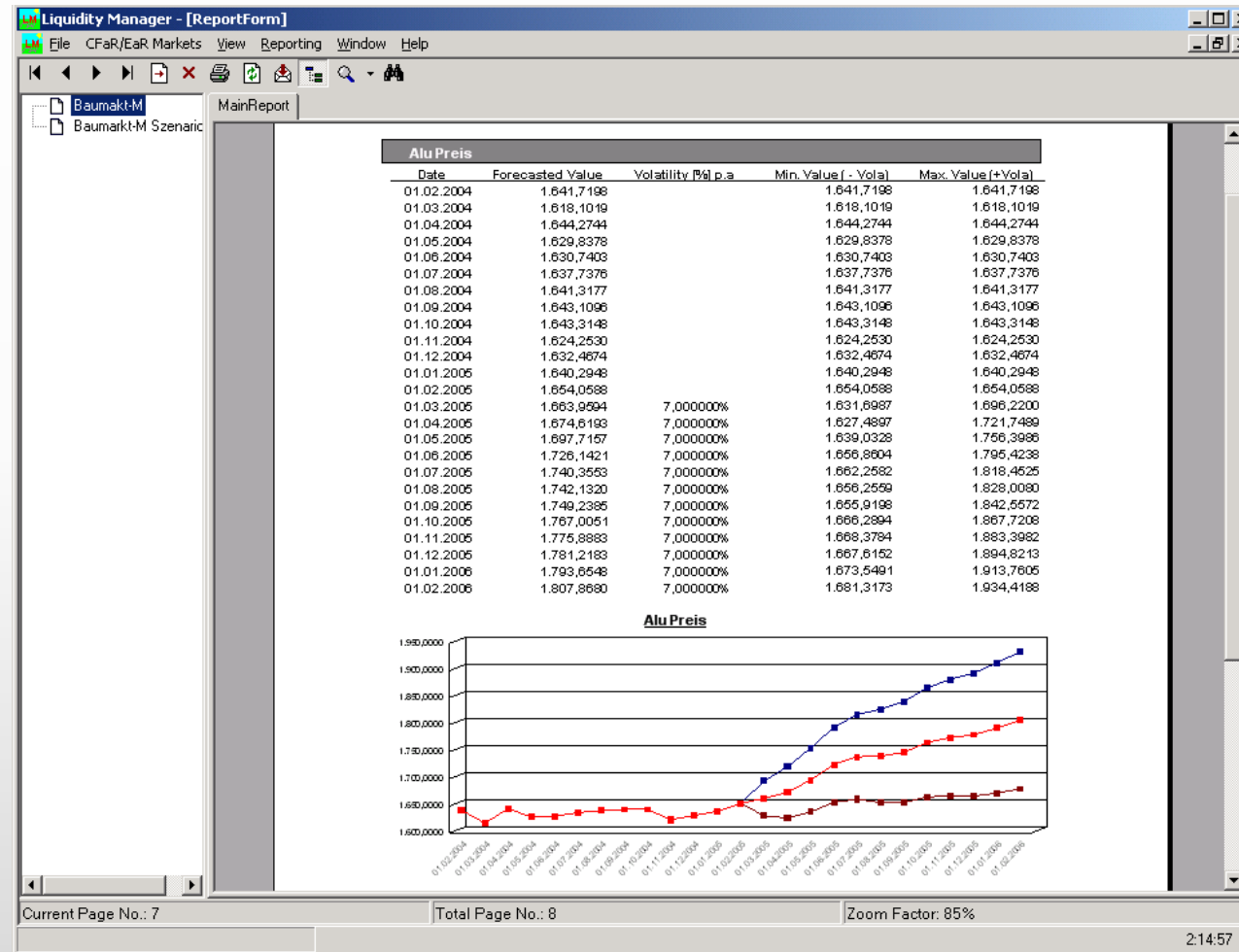
Balance ID CFaR AluRahmen

Company ID 122066 Festl-Hohenfels

Period From To	01.02.05 01.02.05	01.02.05 01.03.05	01.03.05 01.04.05	01.04.05 01.05.05	01.05.05 01.06.05	01.06.05 01.07.05	01.07.05 01.08.05
CF Bilanz EUR, Cash Flow Bilanz in EUR							
Budget Value	0,00	12.514,59	17.771,69	12.531,02	8.307,13	9.660,17	20.505,00
Confidence Value	0,00	902,55	-1.812,49	-12.194,39	-18.402,96	-21.190,15	-13.381,00
Cash Flow at Risk	0,00	11.618,26	19.591,61	24.739,65	26.713,93	30.847,90	33.886,00
Kauf Alu: EUR, Rohstoffeinkauf: Aluminium in EUR							
Budget Value	-198.487,06	-214.917,08	-216.526,90	-198.281,23	-200.510,84	-189.680,60	-183.014,00
Confidence Value	-198.487,05	-224.710,32	-230.961,47	-214.666,69	-220.160,95	-210.778,28	-205.614,00
Cash Flow at Risk	0,00	9.793,23	14.434,56	16.385,46	19.650,11	21.097,68	22.600,00
Kauf Alu: Tonnen, Rohstoffeinkauf: Aluminium in Tonnen							
Budget Value	120,00	130,00	132,00	122,00	126,00	121,00	118,00
Confidence Value	120,00	130,00	132,00	122,00	126,00	121,00	118,00
Cash Flow at Risk	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Preis Alu: EUR, Preis Aluminium in EUR pro Tonne							
Budget Value	1.654,0588	1.653,2083	1.640,3553	1.625,2560	1.591,3559	1.567,6083	1.550,9600
Confidence Value	1.654,0588	1.577,8758	1.531,0026	1.490,9490	1.435,4027	1.393,2473	1.359,4300
Cash Flow at Risk	0,0000	75,3326	109,3528	134,3070	155,9532	174,3610	191,5300
Verkauf: EUR, Export USA: Verkauf Produktion in EUR							
Budget Value	0,00	212.530,00	234.349,00	230.736,00	208.130,00	211.735,00	211.666,00

7. Implementation Aspects

Market simulation report: Forecasting aluminium prices



Thank you for you attention!