Filtered Historical Simulation 30 years after

www.filteredhistorical.com

The characteristics of FHS

- FHS generates multiple step joint scenarios for the entire range of risk factor, FX, int. rate, liquidity, …
- Maximum likelihood methods build a system of equations to best capture the risk factor dynamics
- Strong forecasting power of risk factor variance
- Generates random residuals, to be used as innovations in the simulation

FHS-the evidence

- Ex-ante tests at 200,000 –actual- daily real portfolios revealed accurate and unbiased risk prediction (See Barone-Adesi et all 2002)
- 100s of independent comparative studies have concluded that FHS tops the list of risk management models currently in use
- Major CCPs use the FHS or a *Quasi* FHS

The FHS calculator

- 15 years of continuous research and testing
- Capable of modeling unlimited number of risk factors
- Millions of Multi period joint scenarios produce efficient risk estimates on the tail extreme
- All portfolios are re-priced until the end of the risk horizon –i.e. handles expiring positions

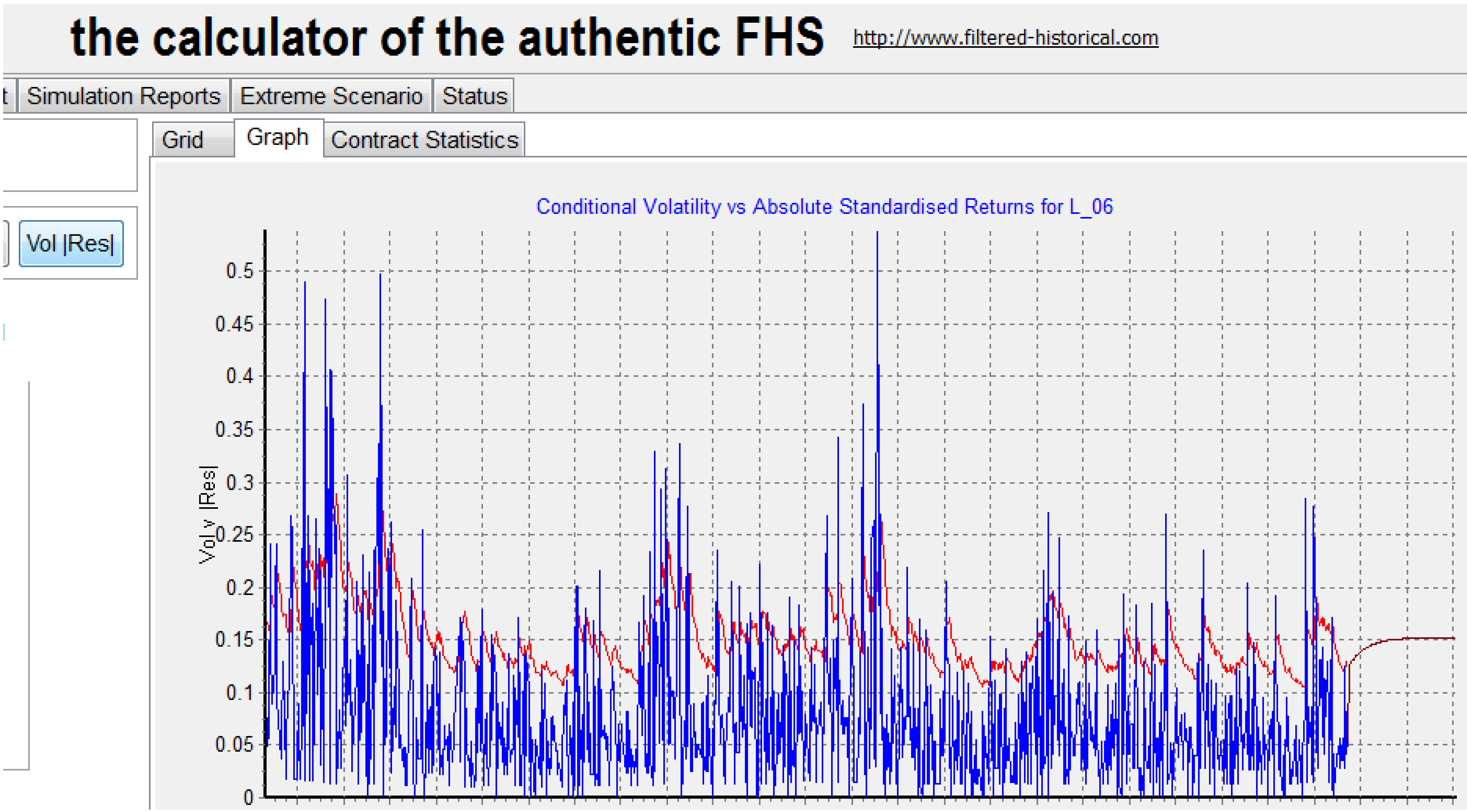
The FHS-calculator

- Sensitivity analysis on the extreme scenarios
- Probabilistic estimation of joint defaults
- Probabilistic estimation of ES (expected shortfall) & confidence intervals by bootstrapping
- Automatic recalibration of the volatility model
- Works with intraday/real time data

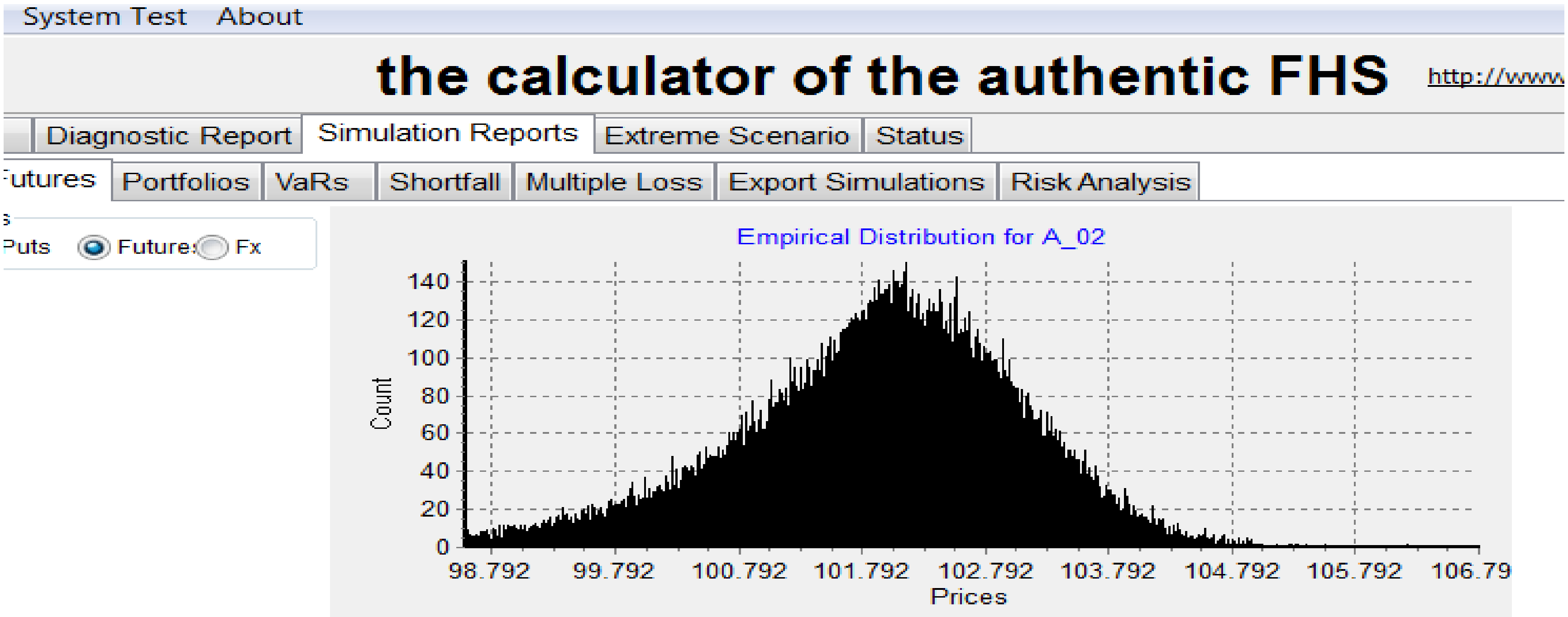
The FHS-calculator

- Millions of feasible Scenarios, mapped with their probability
- Probabilistic separation of *plausible* & *non plausible scenarios*
- Reverse stress: joint default scenarios beyond plausible conditions, mapped with their probability

Powerful volatility forecast



each period Millions of joint scenarios build the distribution of entire set of risk factors



Market Pr.	101.9100
Garch vol.	0.050

	Min(1.0%)	Max(99.0%)	Median	Risk(99.0%)	Actual
+1 Days	101.04241	103.44921	101.91440	0.87199	101.89000
+2 Days	100.60502	104.52311	101.93588	1.33085	101.52000
+3 Days	100.25916	104.94218	101.94713	1.68797	101.82000
+5 Days	99.72318	105.52674	101.96826	2.24508	102.13000
+10 Days	98.57984	106.79226	102.01989	3.44005	102.85000

Millions of pay off scenarios
-for each position -

the calculator of the authentic FHS

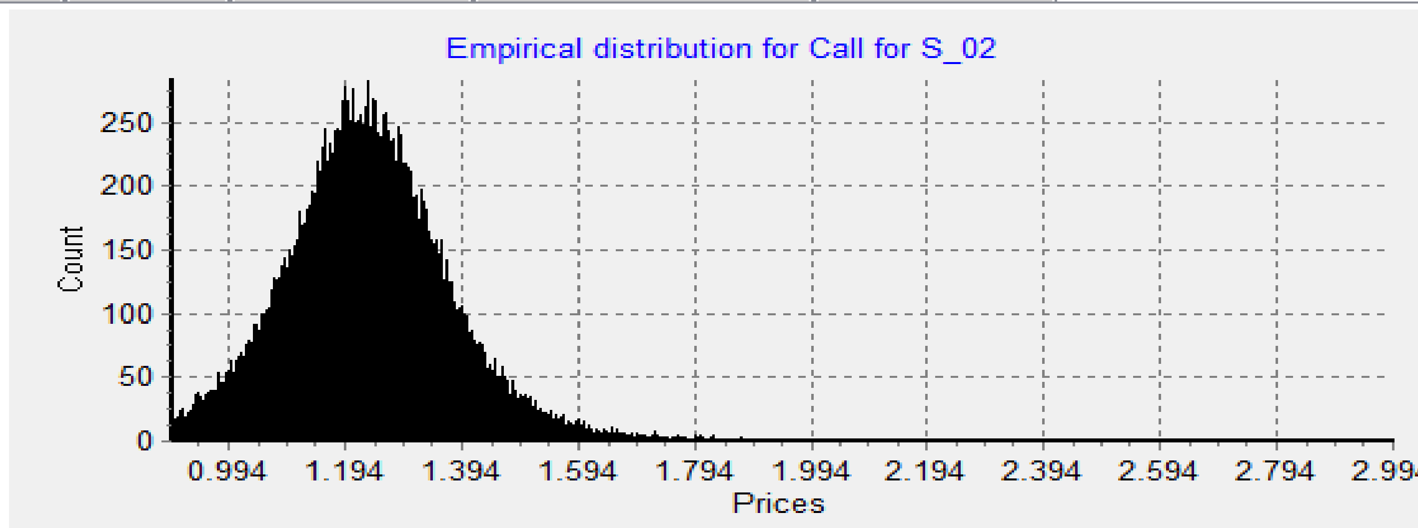
http://www

agnostic Report | Simulation Reports | Extreme Scenario | Status

s | Portfolios | VaRs | Shortfall | Multiple Loss | Export Simulations | Risk Analysis

Future: Fx

0096.50
0096.75
0097.00
0097.25
0097.50
0097.75
0098.00
0098.25
0098.50
0098.75
0099.00
0099.25
0099.50



et Pr.	1.2200
h vol.	0.309
u.a.	97.7100
	0.404

	Min(1.0%)	Max(99.0%)	Median	Risk(99.0%)	Actual
+1 Days	1.09996	1.39048	1.21787	0.11790	1.19000
+2 Days	1.06945	1.62118	1.21661	0.14716	1.22000
+3 Days	1.04431	1.85327	1.21786	0.17355	1.22000
+5 Days	0.99960	2.08188	1.22096	0.22136	1.31000
+10 Days	0.89783	2.99397	1.22630	0.32847	1.39000

At each scenario & period every position is re-priced

the calculator of the authentic FHS http://www.filtered-historical.com

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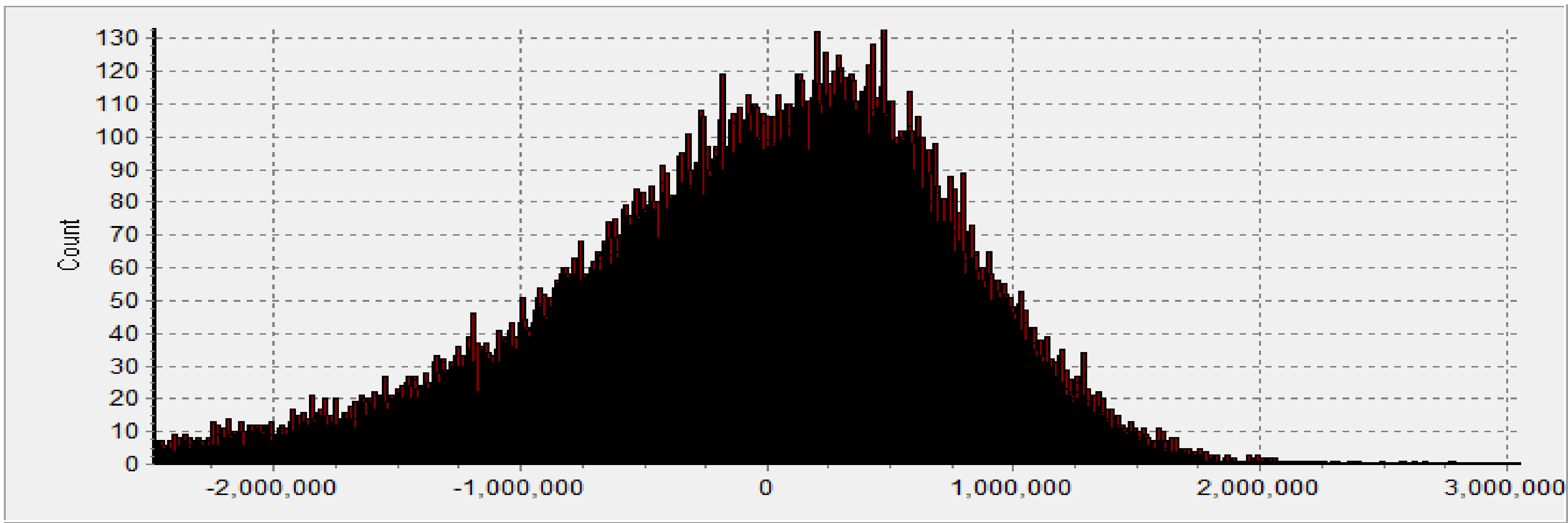
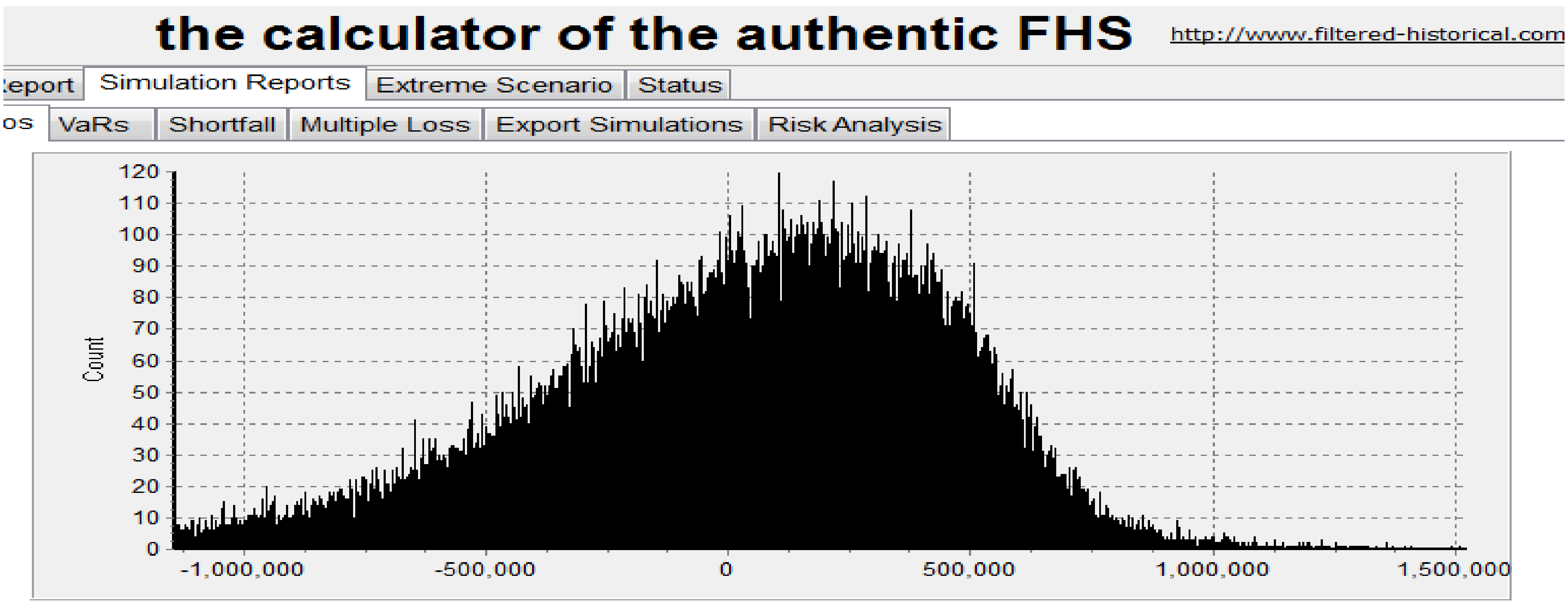
VaRs | Shortfall | Multiple Loss | Export Simulations | Risk Analysis



	Min(1.0%)	Max(99.0%)	Median	Risk(99.0%)	Actual
+1 Days	-692,051	1,031,681	58,448	750,499	61,088
+2 Days	-1,140,881	1,521,977	73,880	1,214,761	-148,919
+3 Days	-1,451,820	1,760,739	53,301	1,505,121	90,204
+5 Days	-1,922,338	2,224,468	32,486	1,954,824	318,364
+10 Days	-2,477,389	3,050,797	19,926	2,497,315	721,205

Non parametric Risk (empirical distribution of portfolio P&L)



	Min(1.0%)	Max(99.0%)	Median	Risk(99.0%)	Actual
+1 Days	-692,051	1,031,681	58,448	750,499	61,088
+2 Days	-1,140,881	1,521,977	73,880	1,214,761	-148,919
+3 Days	-1,451,820	1,760,739	53,301	1,505,121	90,204
+5 Days	-1,922,338	2,224,468	32,486	1,954,824	318,364
+10 Days	-2,477,389	3,050,797	19,926	2,497,315	721,205

Millions of Scenarios for efficient risk estimates on the tails

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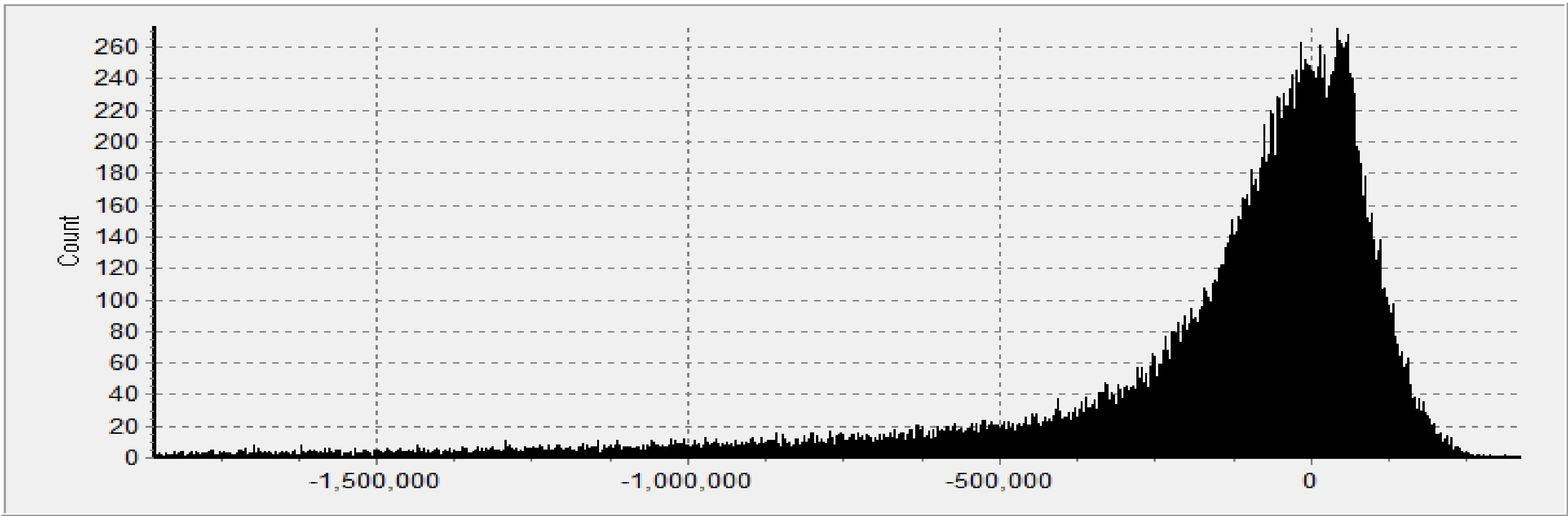
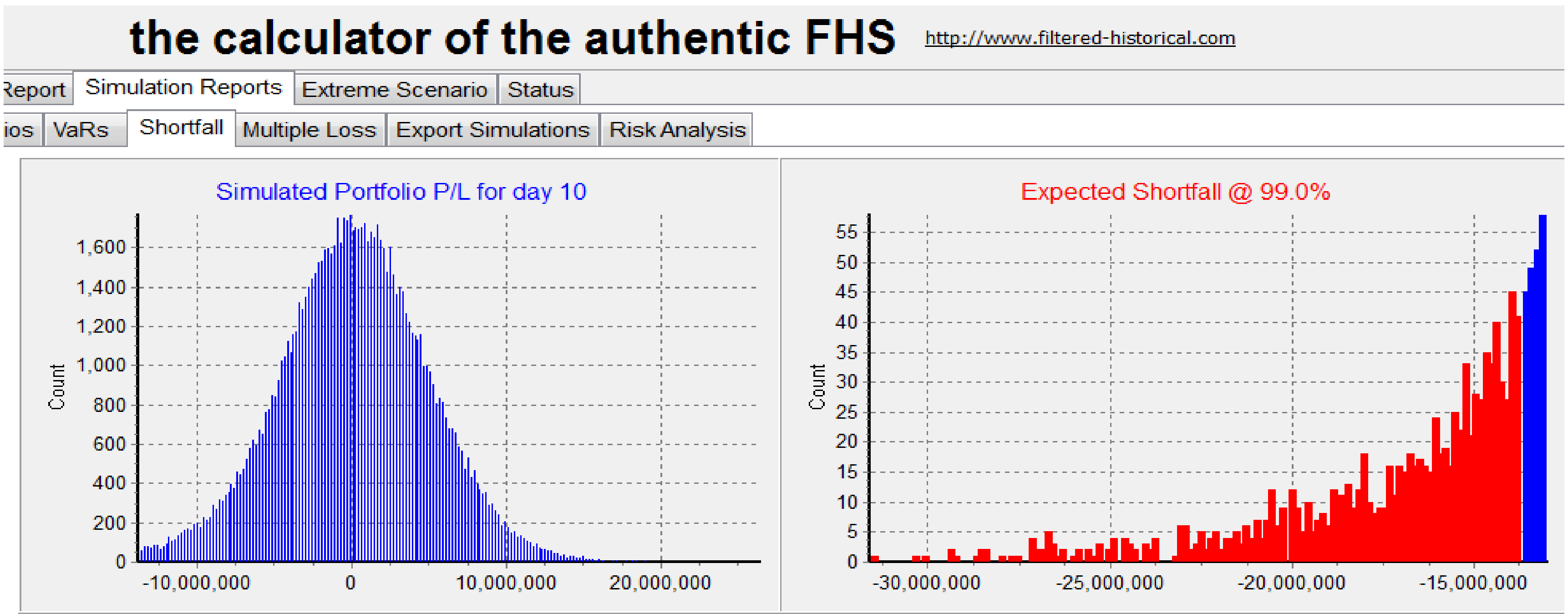
s | VaRs | Shortfall | Multiple Loss | Export Simulations | Risk Analysis



	Min(1.0%)	Max(99.0%)	Median	Risk(99.0%)	Actual
+1 Days	-231,999	104,382	4,176	236,176	-37,300
+2 Days	-852,643	213,003	9,723	862,366	-12,943
+3 Days	-1,104,394	253,250	-5,311	1,099,083	-627
+5 Days	-1,478,319	308,527	-24,949	1,453,371	11,383
+10 Days	-1,853,812	334,536	-53,399	1,800,413	3,070

Expected shortfall (VaR break) & confidence level (by bootstrapping)



	ES	ES_Min	ES_max	VaR
+1 Days	-4,238,590	-4,501,608	-3,975,572	-3,537,071
+2 Days	-8,092,575	-8,625,148	-7,560,003	-6,609,441
+3 Days	-10,061,641	-10,792,054	-9,331,228	-8,015,935
+5 Days	-13,154,104	-14,214,780	-12,093,428	-10,239,948
+10 Days	-17,604,247	-18,936,433	-16,272,060	-13,828,987

Stress testing and joint default, search among millions feasible scenarios

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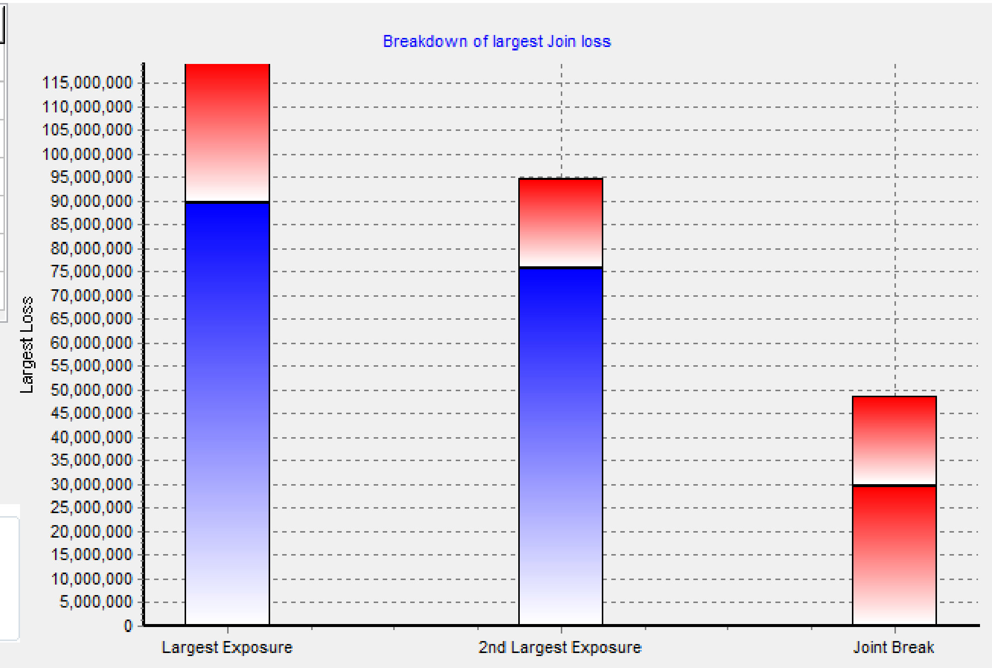
Reverse stress test (extreme market conditions beyond plausible ones)

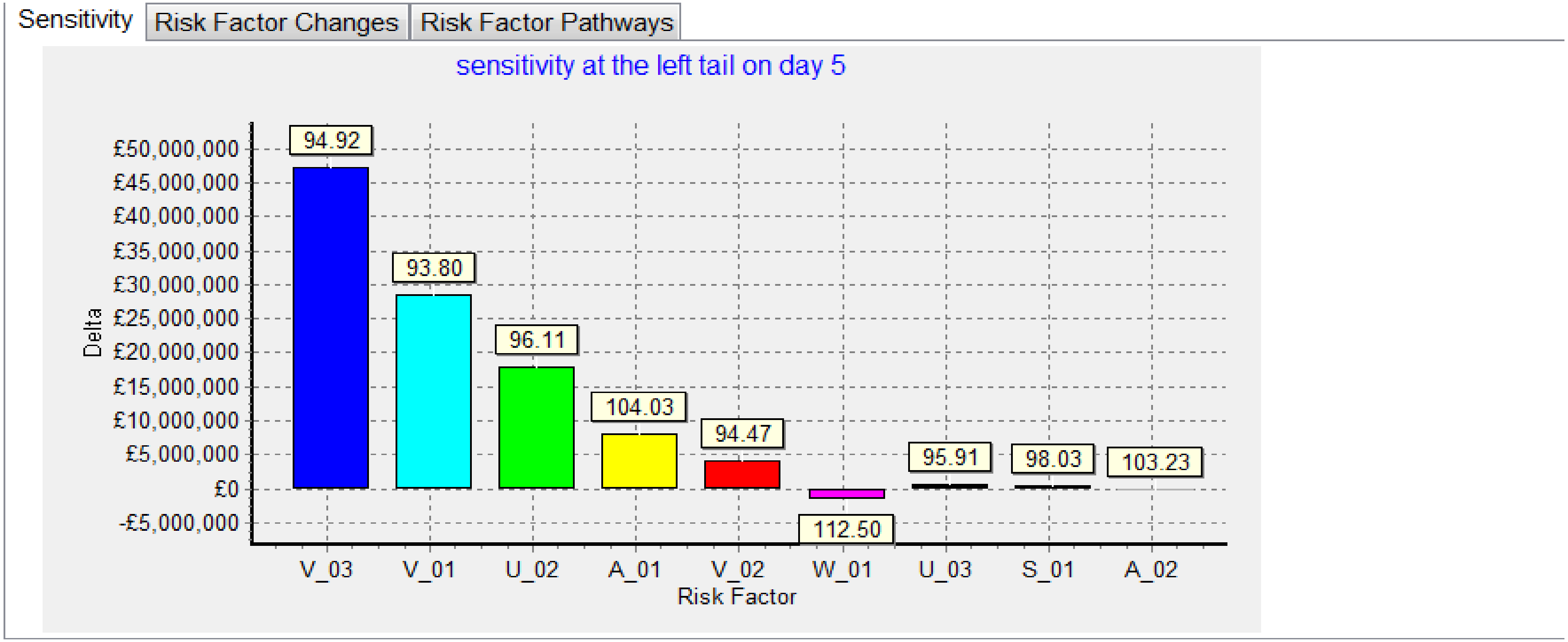
	Portfolio 1	Portfolio 2	Portfolio 1 + 2
Margin (99.5%	89,677,230	75,938,226	165,615,456
Excess Loss	29,675,587	19,058,307	48,733,894
Total Exposure	119,352,817	94,996,533	214,349,350
No. Joint breaks	350		
Prob. Joint break	0.00070		
Portfolio Id.	1136	1423	
# Simulations	500,000		

Currency
- $ Dollars
- £ pounds

Legend
- Margin
- Break



Sensitivity analysis
delta value at extreme scenario



Scenario #	Series	V_03	V_01	U_02	A_01	V_02	W_01	U_03	S_01	A_02
14233	Delta Day 1	81,374,303	24,892,473	-4,837,014	4,163,975	-1,320,613	827,560	315,462	-81,012	-430
26103	Delta Day 2	81,374,303	-24,793,172	22,365,290	4,163,975	-1,316,394	1,281,890	314,521	68,160	761
69978	Delta Day 3	63,048,764	-24,793,172	18,678,182	4,163,975	-1,316,380	673,343	315,462	95,445	761
71401	Delta Day 5	47,226,505	28,555,568	17,891,421	8,124,923	4,163,975	-1,583,833	527,339	314,763	-68,865
29072	Delta Day 10	17,824,148	12,649,089	10,671,951	4,375,741	-571,586	308,538	227,422		

Risk factor changes (COB - 5d) what changes caused extreme scenario

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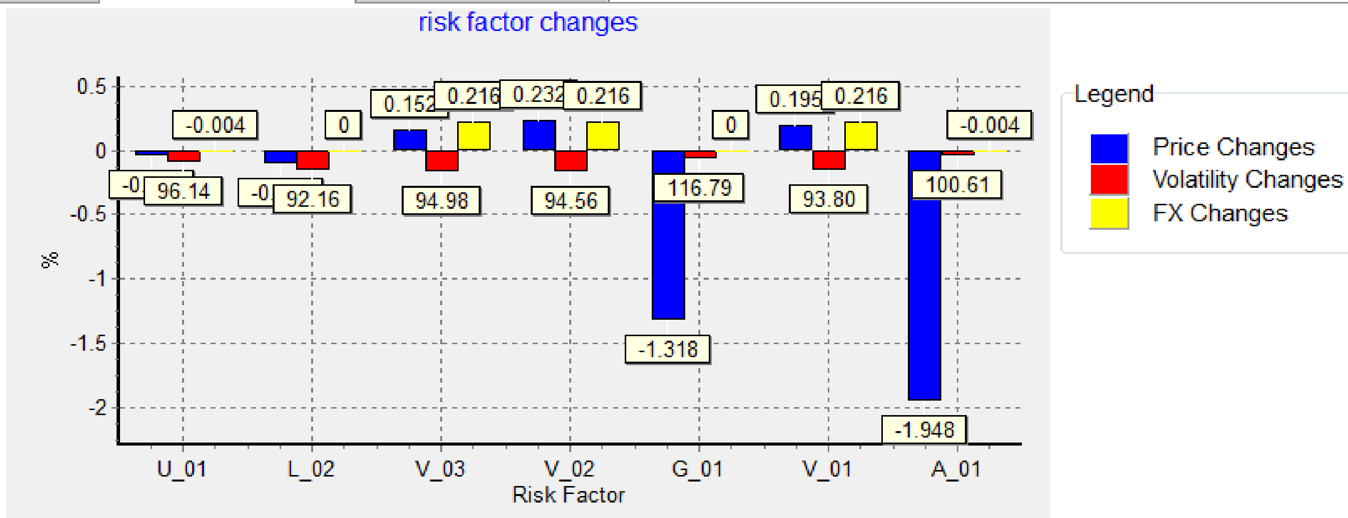
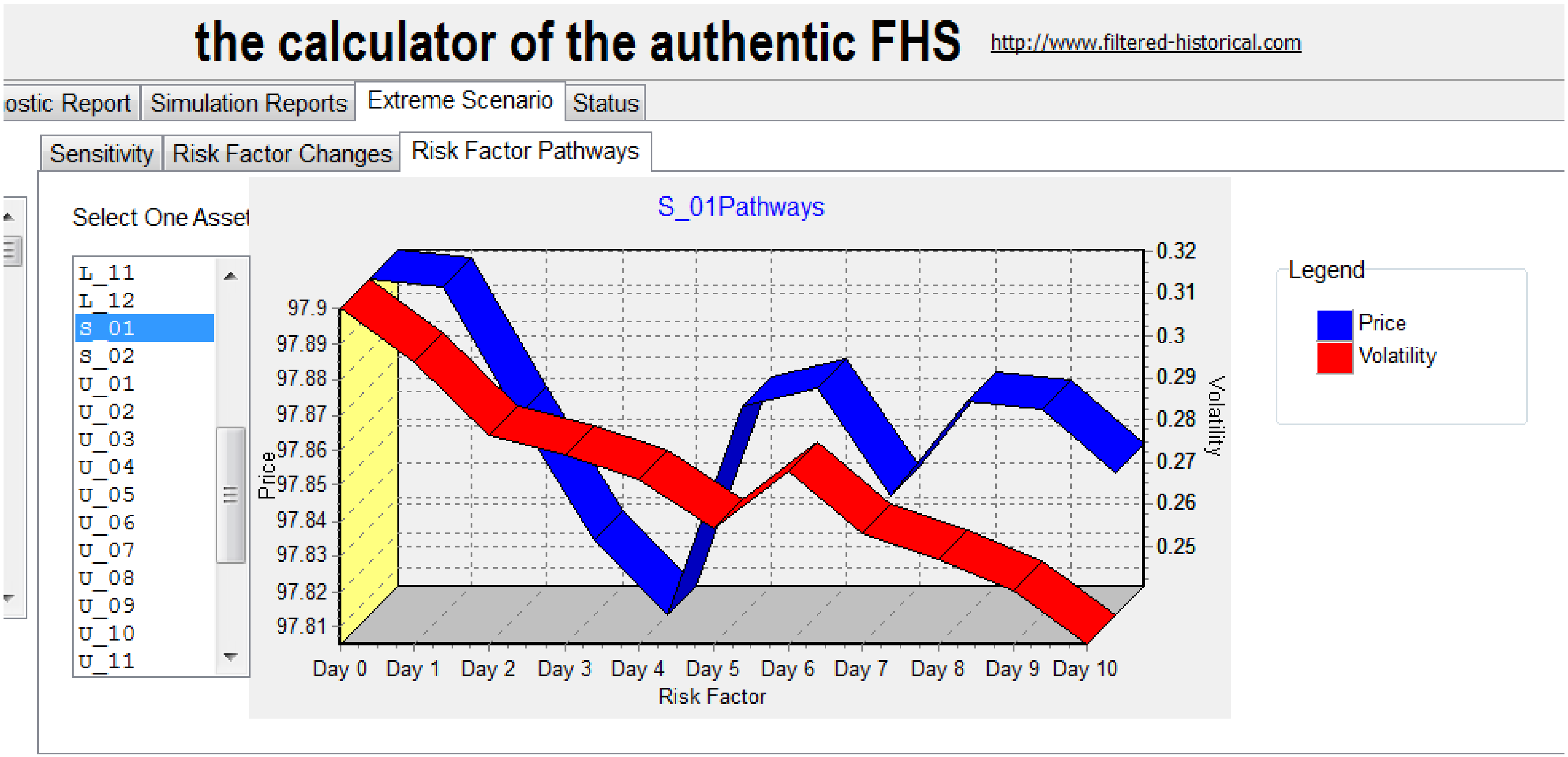
Sensitivity | Risk Factor Changes | Risk Factor Pathways



Changes	U_01	L_02	V_03	V_02	G_01	V_01	A_01	A_02	W_01	G_02	L_04	W_
Price	-00.04	-00.11	00.15	00.23	-01.32	00.19	-01.95	-02.15	00.57	509.68	-00.17	50
Volatility	-00.10	-00.16	-00.16	-00.17	-00.07	-00.15	-00.04	-00.05	-00.07	-00.06	-00.20	-0
FX	00.00	00.00	00.22	00.22	00.00	00.22	00.00	00.00	00.22	00.00	00.00	00

Risk factor behavior on extreme scenario price & volatility pathways



	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
Prices	97.90	97.8978	97.8612	97.8263	97.8052	97.8642	97.8695	97.8391	97.8651	97.8633	97.8455
Volatility	0.320381	0.3076921	0.2902752	0.2853797	0.2797762	0.2683272	0.2819721	0.2669212	0.2610825	0.2535671	0.2408007