

e-on

Energy
Trading

Technical Analysis applied on Energy Markets

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Bayreuth, November 19th, 2010

We have a large stake in the international energy markets*

Power: 1,240 TWh

Gas: 1,498 TWh

CO2 allowances: 501 million t

Oil: 69 million t

Coal: 223 million t

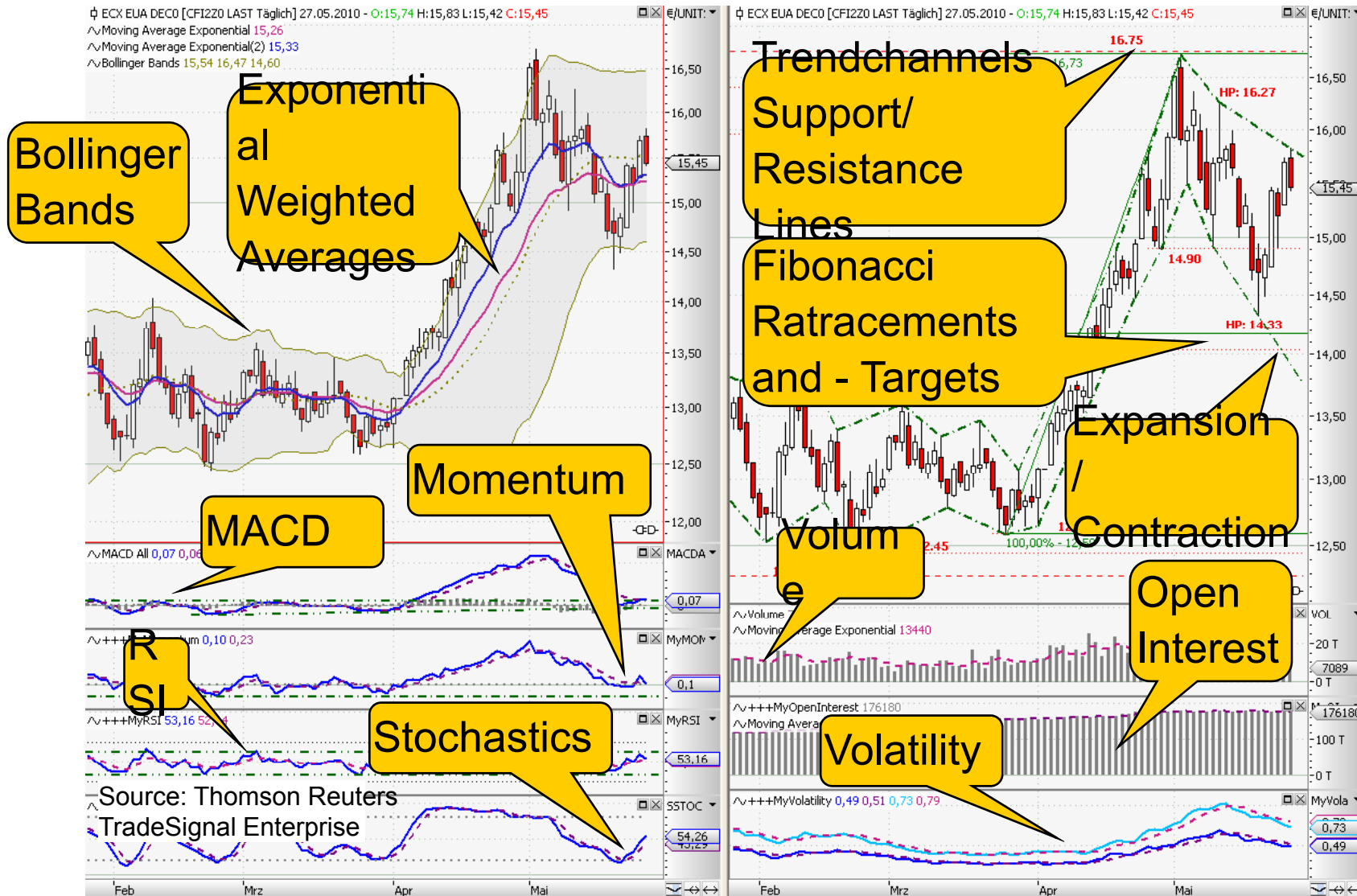
Adjusted EBIT: 949 million €



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Technical Tools applied on the Energy Markets



Technical Tools applied on the Energy Markets

Bollinger Bands

Introduced by: John Bollinger in the early 80s

Category: Envelopes

based on standard deviation around a moving average

used for: evaluating medium term volatility



$$UpperBand_t = MidBand + 2 * \sigma$$

$$LowerBand_t = MidBand - 2 * \sigma$$

Bollinger Bands -> n = 20 (days) / STD -> n = 2

$$\sigma = \sqrt{\frac{1}{n-1} * \sum_{i=1}^n (Price_i - \overline{Price})^2}$$

Technical Tools applied on the Energy Markets

MACD – **M**oving **A**verage **C**onvergence **D**ivergence

Introduced by: Gerald Apple in the 60s

Category: Trend following System

Based on two Exponential Weighted Averages

Oscillator Concept

MACD = Difference between two Exponential Averages

Study of a Study: Signal = Exponential Weighted Average of the MACD Values



Used for: evaluating medium term impulses

$$EWA_t = \alpha * Price_t + (1 - \alpha) * EWA_{t-1}$$

$$\alpha = \frac{2}{n+1}$$

$$MACD_t = EWA_{t,fast} - EWA_{t,slow}$$

$$Signal_t = \alpha * MACD_t + (1 - \alpha) * Signal_{t-1}$$

EWA_{slow} -> n = 20 (days) / EWA_{fast} -> n = 10 (days) / EWA_{Signal} -> n = 5 (days)

Technical Tools applied on the Energy Markets

Momentum / Rate of Change

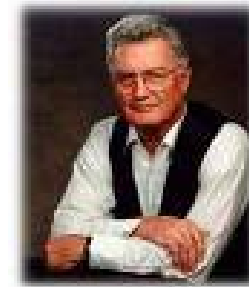
Introduced by: Welles Wilder in 1978 in his book
“New Concepts in Technical Trading Systems”

Category: Trend following System

Based on Difference between two prices

EWA of the Momentum Values to smooth Momentum study

used for: evaluating medium term impulses



$$Momentum_t = Price_t - Price_{t-n+1}$$

$$EWAMomentum_t = \alpha * Momentum_t + (1 - \alpha) * EWAMomentum_{t-1}$$

$$RateOfChange_t = \frac{Price_t}{Price_{t-n+1}}$$

Momentum -> n = 20 (days) / EWAMomentum -> n = 5 (days)

Technical Tools applied on the Energy Markets

RSI

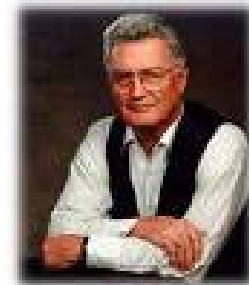
Introduced by: Welles Wilder in 1978 in his book
 “New Concepts in Technical Trading Systems”

Category: Overbought/Oversold System

based on relationship between up- and down
 differences in prices

EWA of the RSI Values to smooth RSI study

used for: evaluating short term impulses



$$RSI_t = 100 - \frac{100}{1 + RS_t}$$

$$Avg(\sum Up)_t = \frac{\sum Up_{t-1} * (n-1)}{n}$$

$$RS = \frac{Avg(\sum Up_n)}{Avg(\sum Down_n)}$$

$$Avg(\sum Down)_t = \frac{\sum Down_{t-1} * (n-1)}{n}$$

RSI -> n = 10 (days) / EWARSI -> n = 5 (days)

Technical Tools applied on the Energy Markets

Stochastics

Introduced by: George Lane in the 50s

Category: Overbought/Oversold System

based on relationship between current close and aggregated high-low range

EWA of the Stochastics Values to smooth Stochastics study

used for: evaluating short term impulses



$$K\% = 100 * \frac{Close_t - LowestLow_n}{HighestHigh_n - LowestLow_n}$$

$$D\% = SMA(K\%)_3$$

$$slowD\% = SMA(D\%)_3$$

Stochastics -> n = 10 (days) / EWARSI -> n = 5 (days)

Technical Tools applied on the Energy Markets

Volatility

- used for: evaluating short term volatility
- ... of statistical trading range of one day
- ... of statistical trading range of two day
(to include gaps)

```
1  Meta:  
2      Synopsis( "The Indicator shows the averaged high/low ranges for a specified period"),  
3      ShortCode( "MyVola" ),  
4      SubChart( True );  
5  
6  Inputs:  
7      HiLoPeriod(10),  
8      HiLoPeriodAvg(5);  
9  
10 Vars:  
11     HiLoBand(close),  
12     HiLoAvg(close),  
13     HiLoBandGap(close),  
14     HiLoBandGapAvg(close);  
15  
16 HiLoBand = Average(High-Low,HiLoPeriod);  
17 HiLoAvg = Average(HiLoBand, HiLoPeriodAvg);  
18  
19 HiLoBandGap = Average(Highest(High,2)-Lowest(Low,2), HiLoPeriod);  
20 HiLoBandGapAvg = Average(HiLoBandGap, HiLoPeriodAvg);  
21  
22 DrawLine( HiLoBand, "HighLowBand", 0, 2);  
23 DrawLine( HiLoAvg, "HighLowAvg", 1, 2);  
24 DrawLine( HiLoBandGap, "InclGap", 0, 2);  
25 DrawLine( HiLoBandGapAvg, "GapAvg", 1, 2);
```

Technical Tools applied on the Energy Markets

Trend channels

based on corrections

high points within a downtrend

low points within an uptrend

Support / Resistance Lines

based important lows and high

importance dependent on cause of appearance

Andrew's Pitchfork Lines

Fibonacci Relationships

based on Fibonacci Row of numbers

(1...1...2...3...5...8...13...21...34...55...89...144...233...∞)

Fibonacci Relationships: $55:89 \approx 0.681$ / $55:144 \approx 0.382$ / $55:233 \approx 0.236$...

$55:34=1.618$ / $55:21 \approx 2.618$ / $55:13 \approx 4.236$...

Used to evaluate retracements and targets

Foundation for Elliott Wave Analysis

Technical Analysis on EURUSD



Technical Analysis on individual Energy products –



Technical Analysis on individual Energy products –



Technical Analysis on individual Energy products –

Carbon



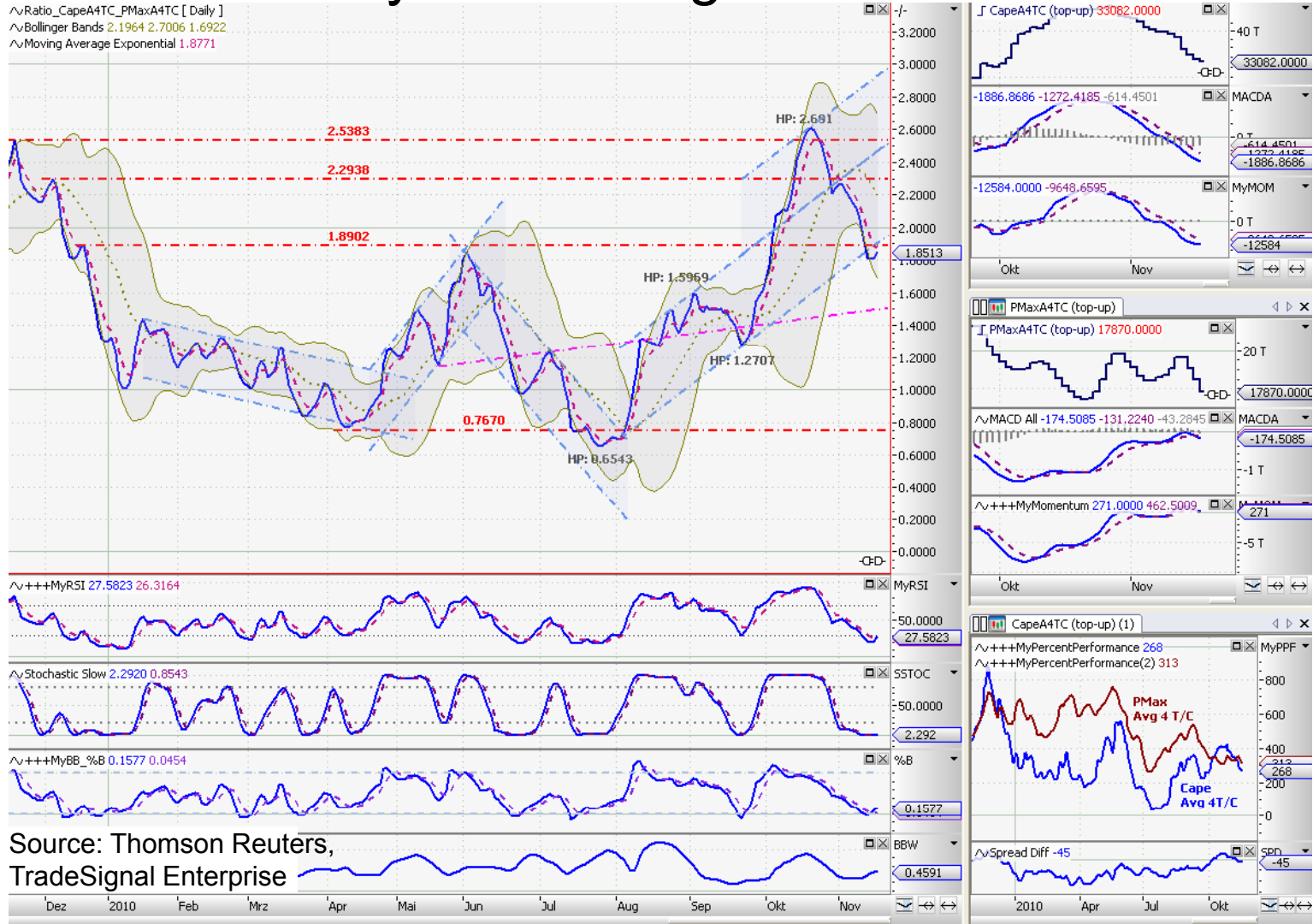
Technical Analysis on individual Energy products –



Technical Analysis on individual Energy products –



Technical Analysis on Freight



Excursion: Coal Logistics Chain – Pit to Power Station – Nov 2010



Cap cost /
profit
maintenance
labour
royalties
explosives
supplies

(AMP \$55)
Mine
(in
Colombia)



Rail \$30



(FAS \$85)
Load
Port \$5

(FOB \$90)



Ship
freight
\$15



Discharg
e Port \$5

Inland
Transport
Rail \$10



Power
Station



(Delivered
Site \$120)



(CIF \$105)

Key Terms:
AMP = At Mine Price
FAS = Free Alongside Ship
FOB = Free On Board
CIF = Cost, Insurance,
Freight

Source: EET-MAC

Technical Analysis on Gas – Fibonacci Retracements &

Targets



Technical Analysis on Power – Fibonacci Retracements & Targets



Technical Analysis on Power – Fibonacci Retracements & Targets

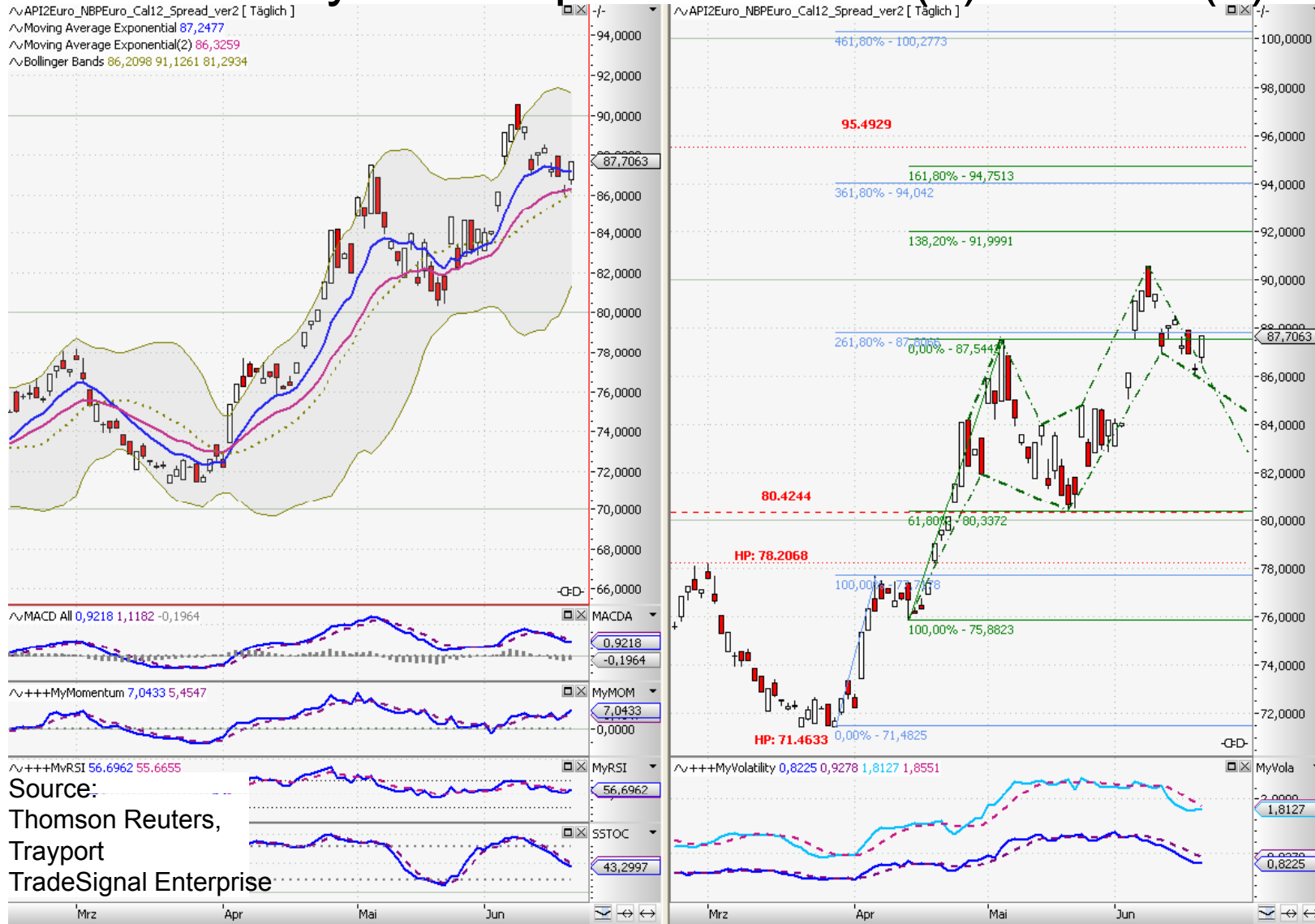


Technical Analysis on Spreads – API2 vs. Oil

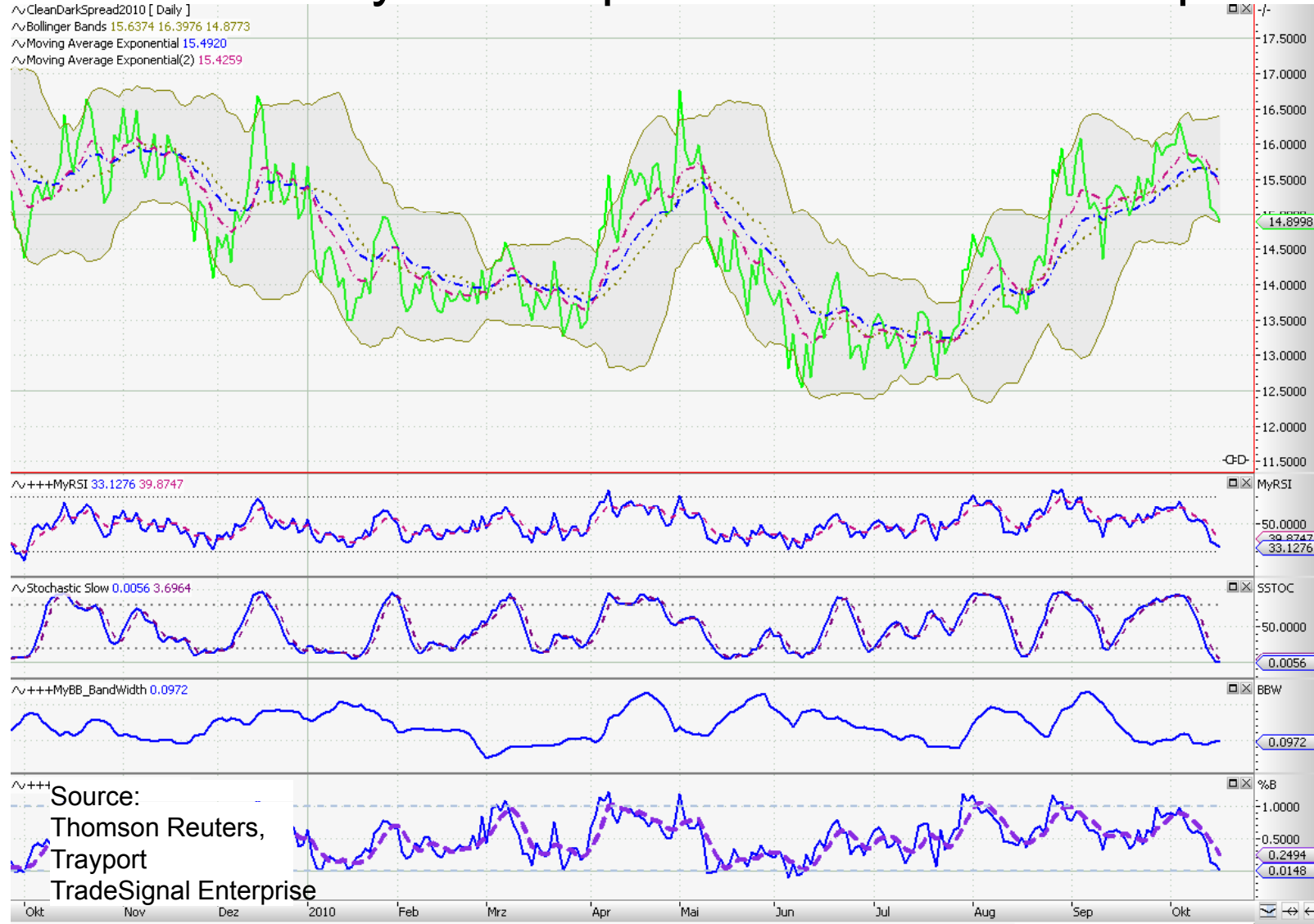


Source:
 Thomson Reuters,
 Trayport
 TradeSignal Enterprise

Technical Analysis on Spreads – API2(€) vs. NBP(€)



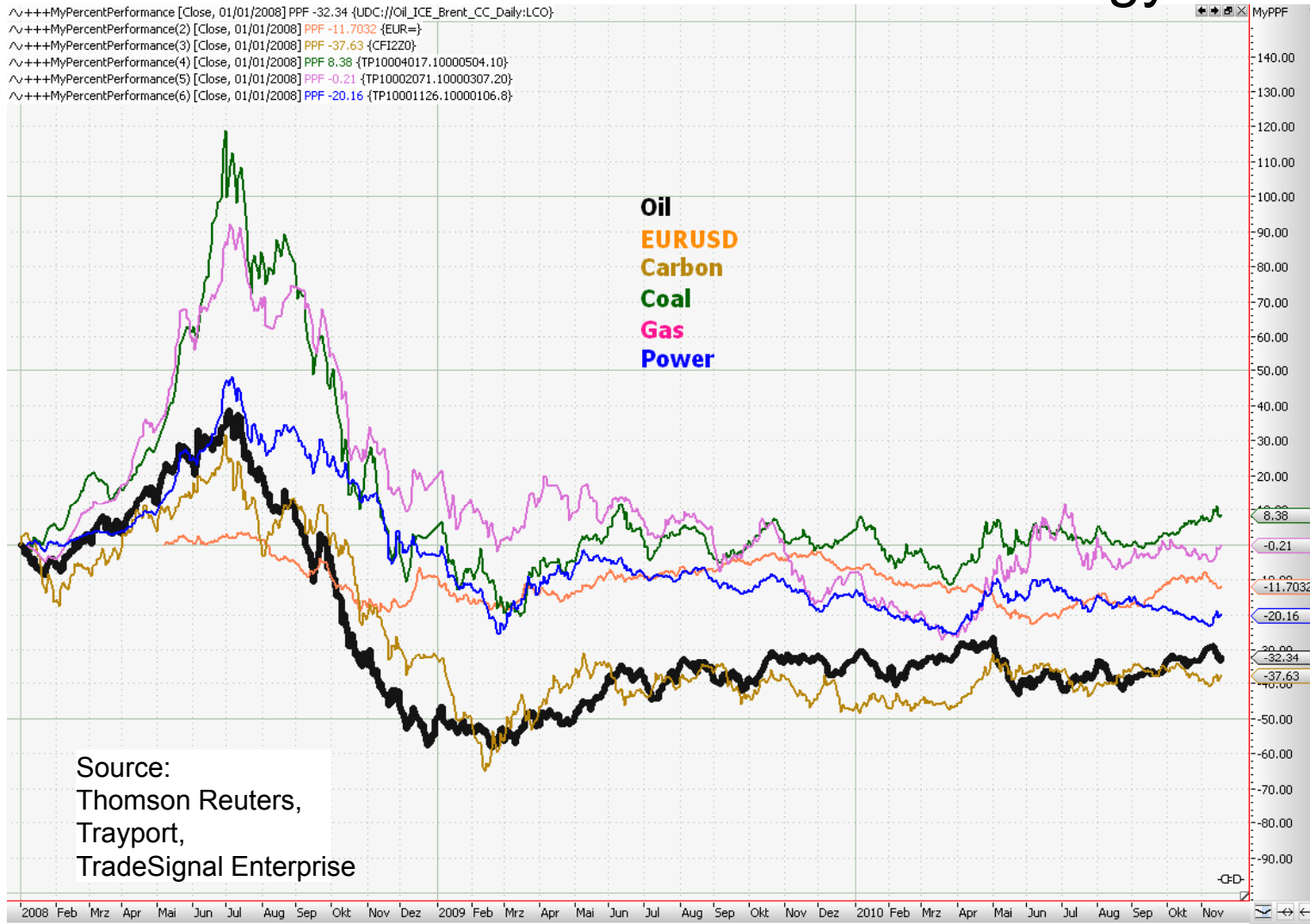
Technical Analysis on Spreads – Clean Dark Spread



Bringing the Energy Markets together – From Individual to Integrated Evaluation

- Indexed Relative Performance Charts
- Volatility Analysis
- Correlation Analysis
- Beta Factor Analysis

Indexed Relative Performance of the Energy Markets



Volatility Analysis in the Energy Markets

What is Volatility ?

A statistical measure of the dispersion of returns for a given security or market index. Volatility can either be measured by using standard deviation or variance between returns from that security or market index. Return can either be calculated as absolute or logarithmic relative.

Standard Deviation

The Standard Deviation is a measure of the variability or dispersion of a data set from its mean.

$$\sigma_{ind} = \sqrt{\frac{1}{n-1} * \sum_{i=1}^n (x_i - \bar{x})^2} \quad \sigma_{dep} = \sqrt{\frac{1}{n-1} * \sum_{i=1}^n (y_i - \bar{y})^2}$$

$$x = \ln\left(\frac{close_{ind}}{close_{ind,t-1}}\right) \quad y = \ln\left(\frac{close_{dep}}{close_{dep,t-1}}\right)$$

Correlation Analysis in the Energy Markets

What is Correlation ?

The Correlation describes the linear relationship between two or more statistical variables. In financial markets, the question which should be answered is whether there is a dependency between two or more time series and if so, how distinctive it is. The mathematical figure which answer that question is the Correlation Coefficient.

Correlation Coefficient

The Correlation Coefficient is the figure to determine the grade of linear relationship. The Correlation Coefficient can accept values between +1 and -1. A Correlation Coefficient of +1 means a complete positive relationship („the more ...the more“), a Correlation Coefficient of -1 means a complete negative relationship („the more...the less“) between two time series. A Correlation Coefficient of 0 means no relationship between two time series.

Correlation Analysis in the Energy Markets

Formula

The Correlation Coefficient r according to Pearson is calculated as follow:

$$r = \frac{\sum_{i=1}^n (x_{ind,i} - \overline{x_{ind}}) * (y_{dep,i} - \overline{y_{dep}})}{\sqrt{\sum_{i=1}^n (x_{ind,i} - \overline{x_{ind}})^2 * \sum_{i=1}^n (y_{dep,i} - \overline{y_{dep}})^2}}$$

Beta Factor Analysis in the Energy Markets

What is Beta Factor ?

The Correlation describes the linear relationship between two or more statistical variables. If the independent market moves up and the dependent market moves also up, the Correlation is +1. If the independent market moves down and the dependent market moves up, the Correlation is -1. If the independent market moves and the dependent market does not, the Correlation is 0. The Beta Factor expands the meaning of the Correlation Factor. It is not only a measure of Correlation it is in addition a measure of risk.

Beta is also referred to as **financial elasticity** or **correlated relative volatility**, and can be referred as a measure of the sensitivity of the return of the dependent market to those of the independent market. It is the non-diversifiable risk, its systematic risk or market risk.

Beta Factor Analysis in the Energy Markets

Variance and Covariance

Variance:

The Variance is closely related to the Standard Deviation. It is simple the square of it. Or, in other words, the Standard Deviation is the Square Root of the Variance.

Covariance:

It is a measure of how much two variables changes together (Variance is a special case of the covariance, when the two variables are identical). If two variable tend to vary together, then the covariance between this two variables is positive. Conversely, if one of them tends to be above its expected value and the other below, then the covariance between this two variables is negative

Beta Factor Analysis in the Energy Markets

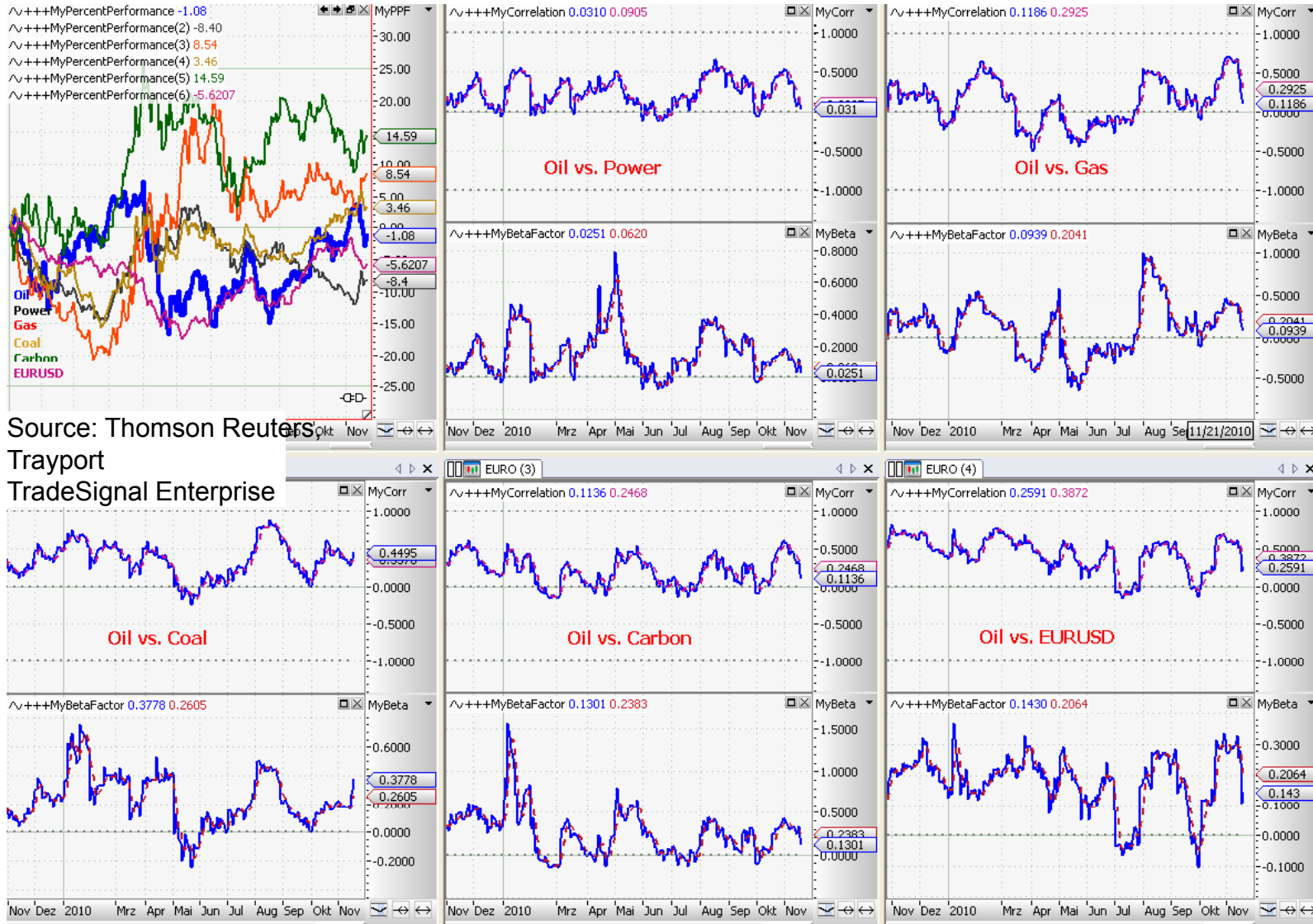
- Formula

The Beta Factor is calculated as follow:

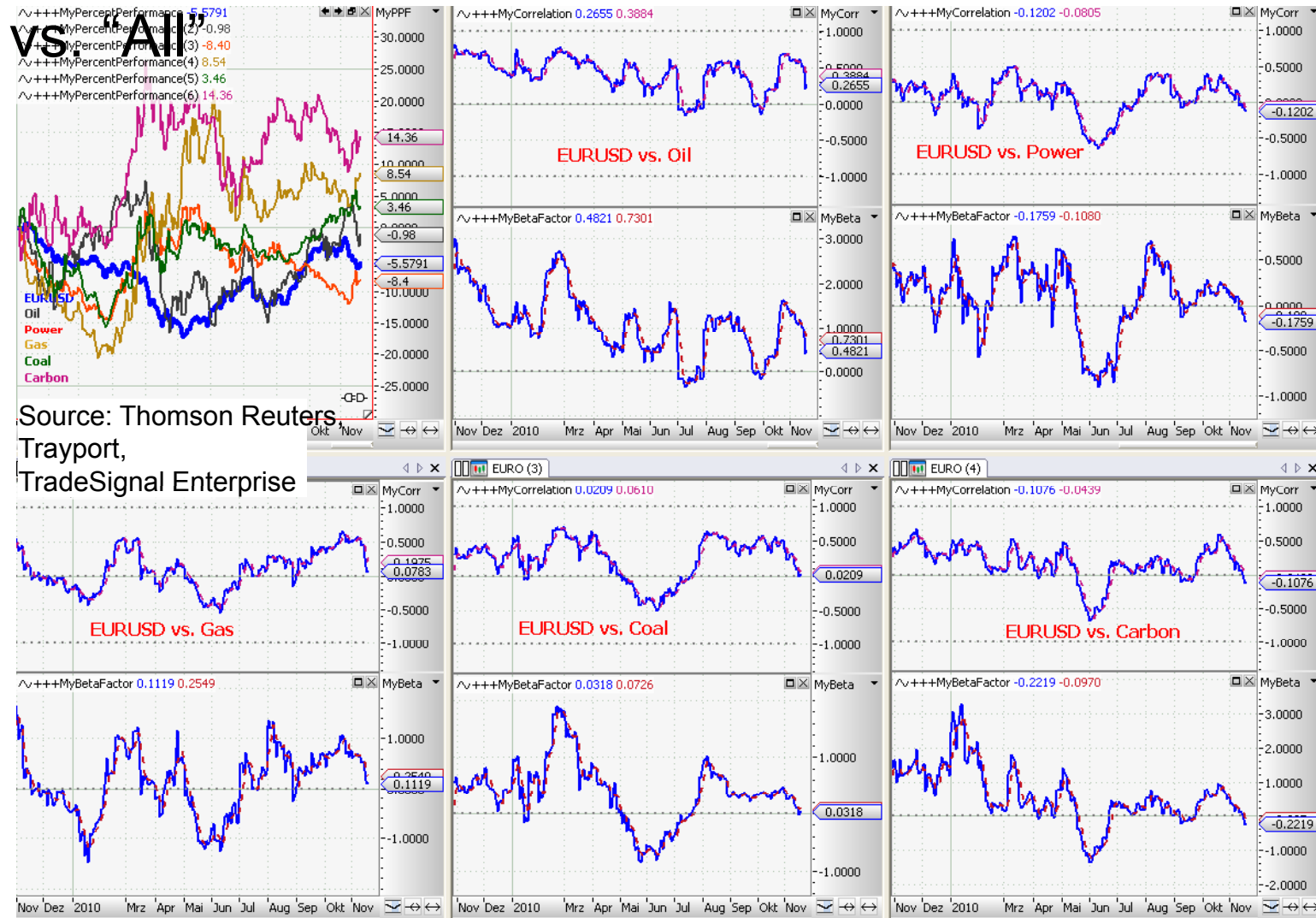
$$\beta = \frac{\text{Cov}(x_{ind}, y_{dep})}{\text{Var}(x_{ind})} = \frac{\text{Cov}(x_{ind}, y_{dep})}{\sigma_{ind}^2}$$

$$\beta = \frac{\sum_{i=1}^n (x_{ind,i} - \overline{x_{ind}}) * (y_{dep,i} - \overline{y_{dep}})}{\sum_{i=1}^n (x_{ind,i} - \overline{x_{ind}})^2}$$

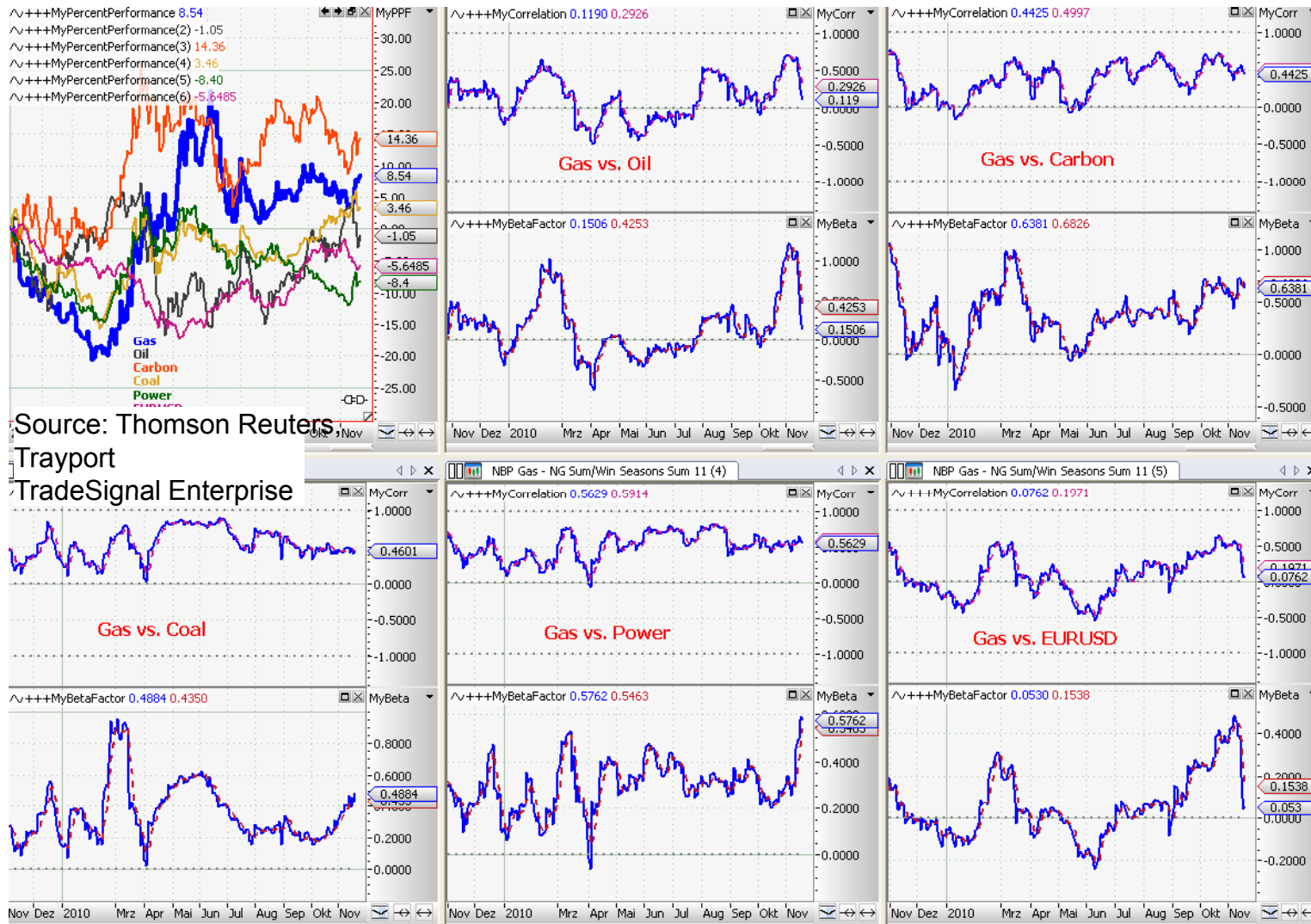
Oil as the Benchmark ? – Oil vs. “All”



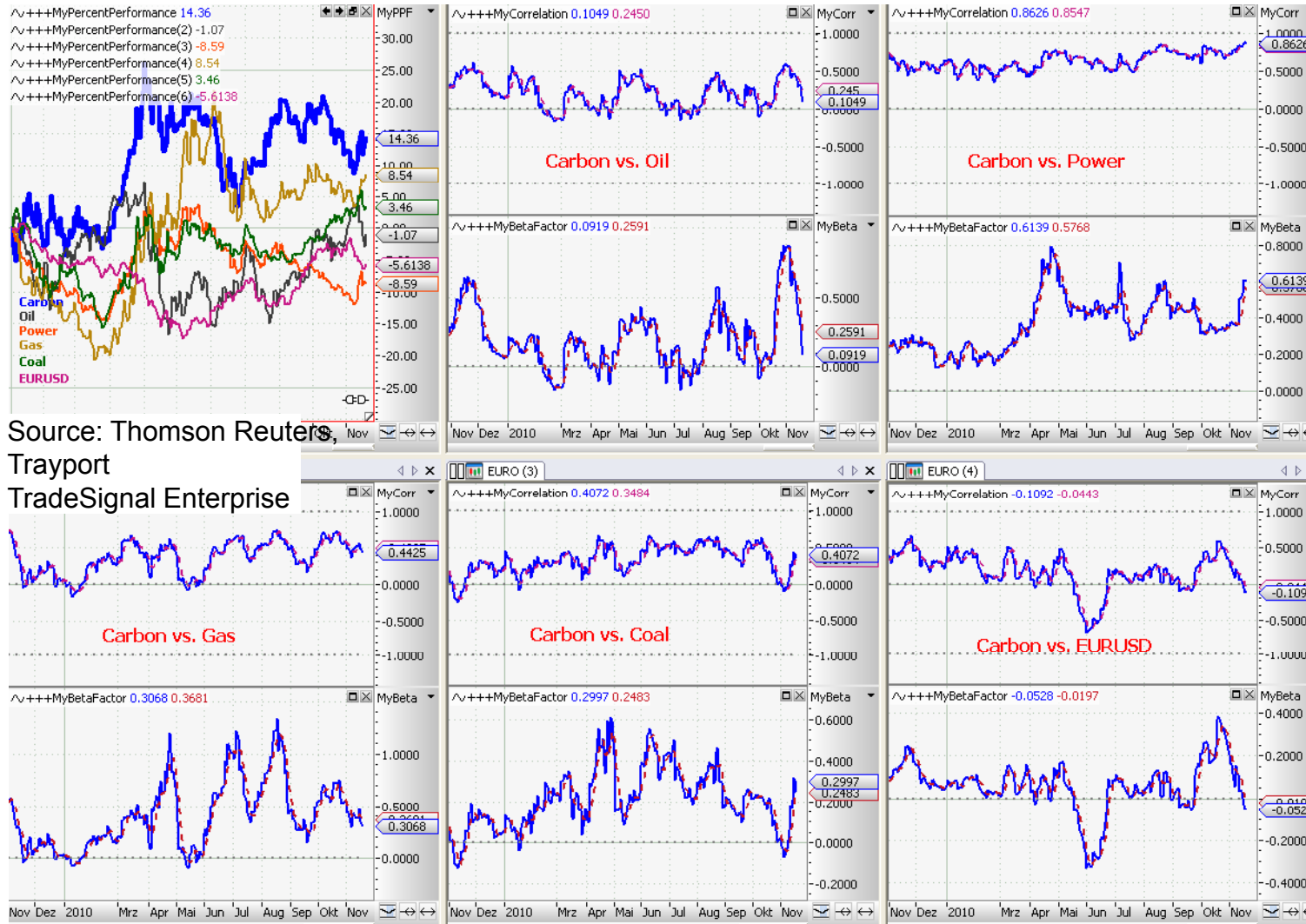
Excursion: EURUSD as the Benchmark ? – EURUSD



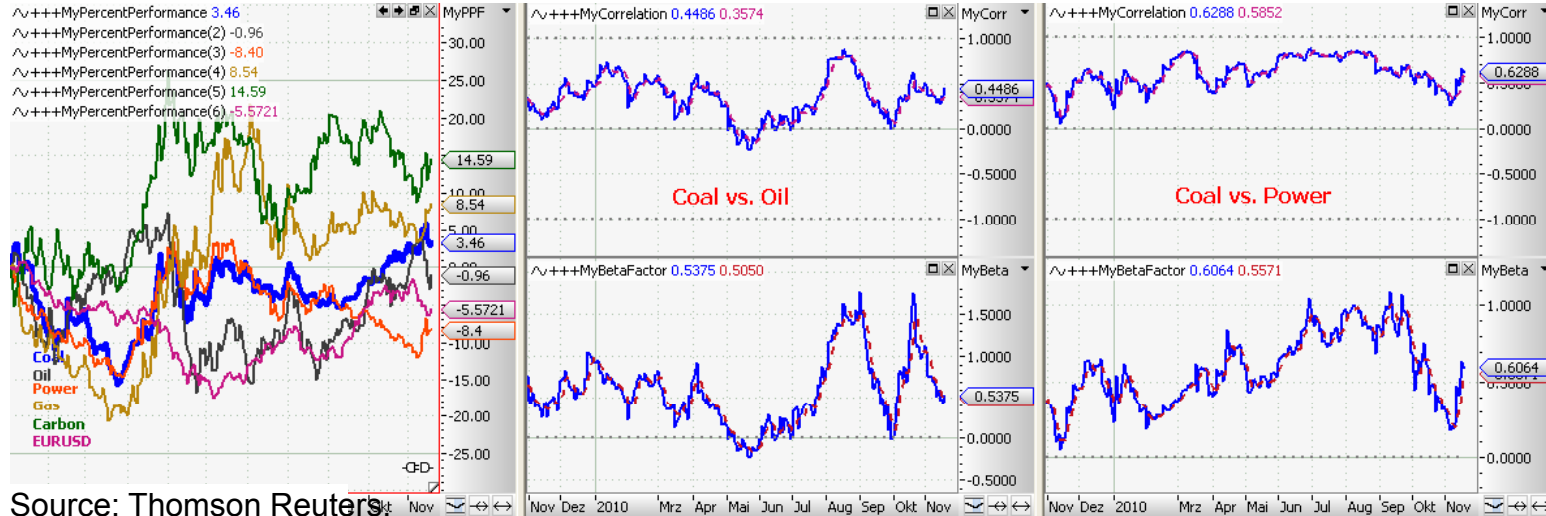
Gas as the Benchmark – Gas vs. “All”



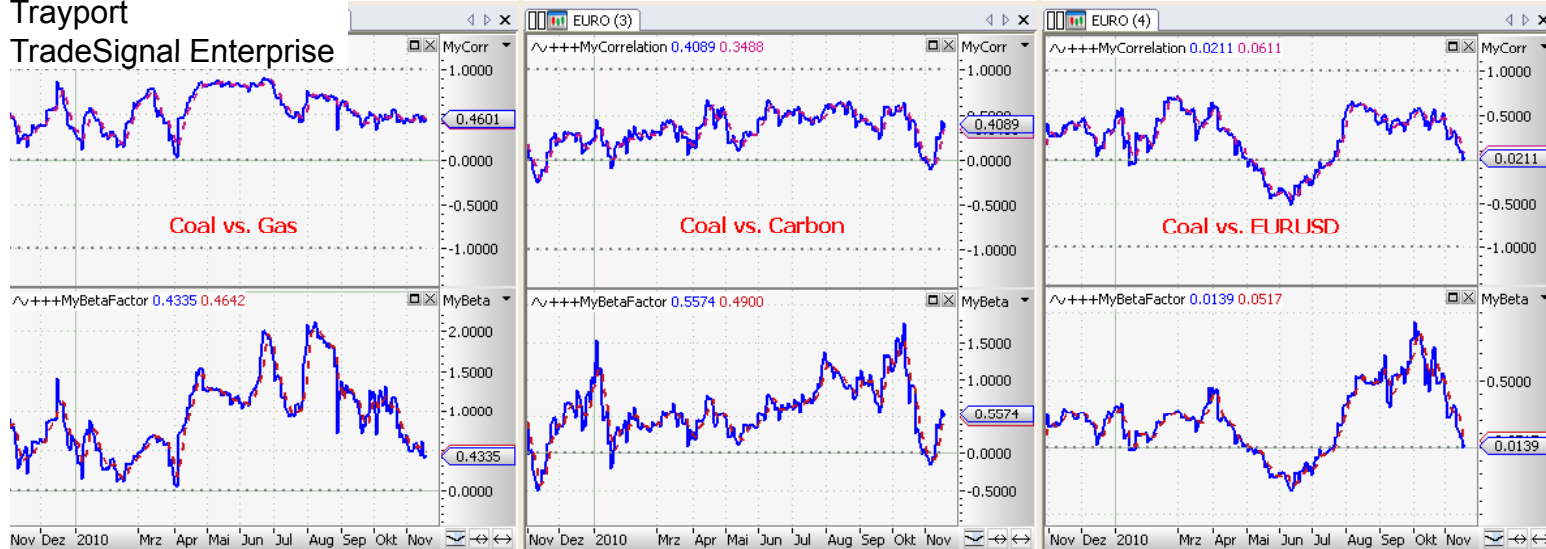
Carbon as the Benchmark – Carbon vs. “All”



Coal as the Benchmark – Coal vs. “All”



Source: Thomson Reuters, Trayport, TradeSignal Enterprise



Power as the Benchmark ? – Power vs. “All”



Conclusion:

At a glance, the energy markets seem to move in the same direction in general

But under the magnifying glass there are distinctive differences

Correlation and Beta Factor can help the trader / analyst to benefit from the interrelated energy market

This knowledge can be useful in particular, if trading cross commodity, for example Spreads

Examples:

In the Power Market: (Clean) Dark Spreads and the (Clean) Spark Spreads

In the Oil Market: Crack Spreads

In the Carbon Market: EUA / CER Spreads

etc.

Our Current Projects:

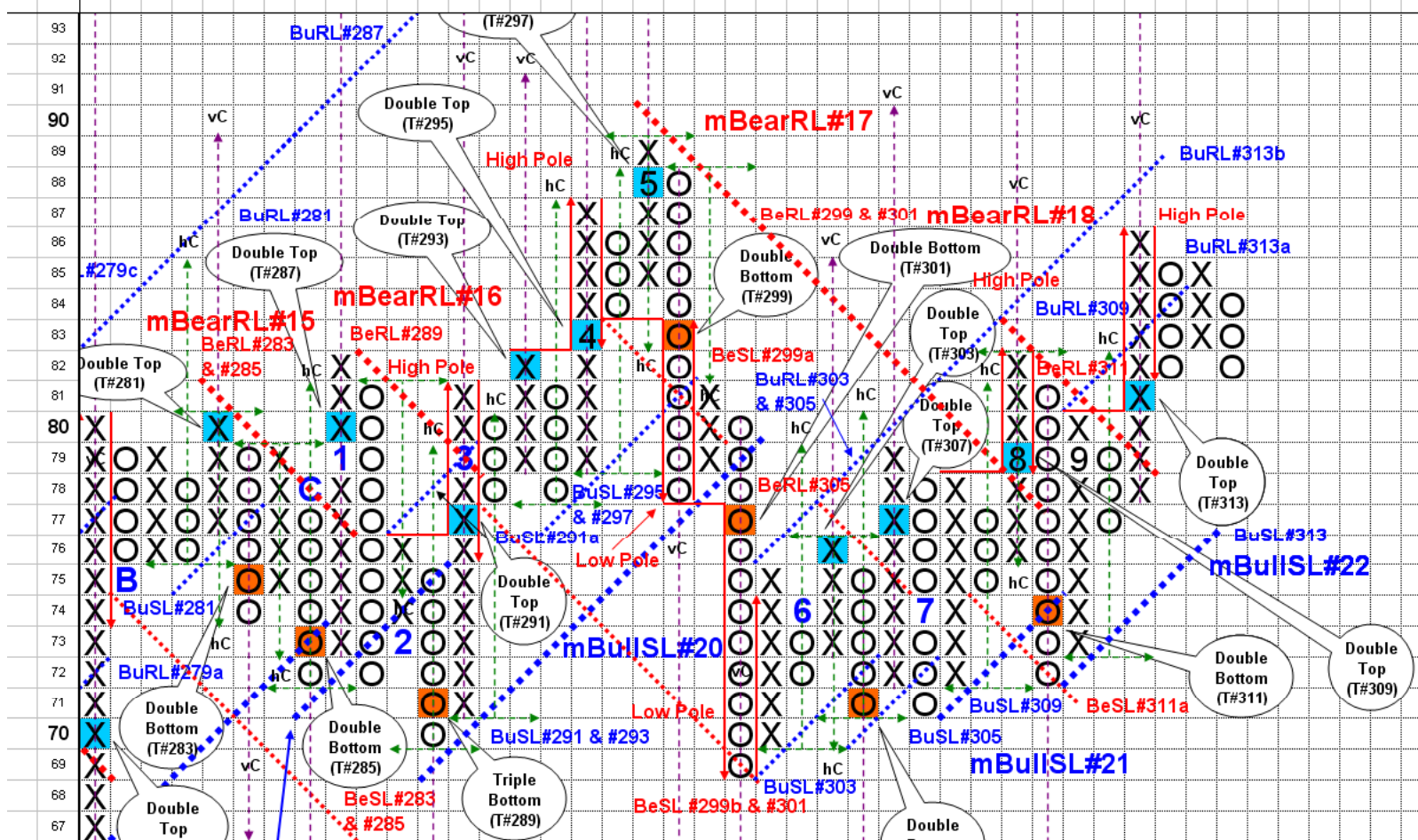
Developing Point & Figure Trader

Development of Technical Trading Systems based on Indicators
and many more...

Point & Figure applied on the Oil Market

Oil (Oil (ICE, Brent Crude Oil, Frontmonth, Continuous Contract, unadjusted)

Box-Size: 5 \$ - 20 \$:	0.50 \$	Reversal: 3-Box-Reversal
Box-Size: 20 \$ - 100 \$:	1.00 \$	
Box-Size: 100 \$ - 200 \$:	2.00 \$	



Point & Figure applied on the Oil Market

Oil (ICE, Brent Crude Oil, Frontmonth, Continuous Contract, unadjusted)

Box-Size: 5 \$ - 20 \$: 0.50 \$ **Reversal: 3-Box-Reversal**
Box-Size: 20 \$ - 100 \$: 1.00 \$
Box-Size: 100 \$ - 200 \$: 2.00 \$

Date	High	Low	C	AP1	AP2	Action	Remarks
09/01/2010	76.76	74.42	X	78.00	74.00	---	
09/02/2010	77.14	75.21	X	78.00	74.00	---	
09/03/2010	77.46	75.33	X	78.00	74.00	---	
09/06/2010	77.18	76.18	X	78.00	74.00	---	
09/07/2010	78.32	75.56	X	78.00	74.00	1 x X	
09/08/2010	78.85	76.78	X	79.00	75.00	---	
09/09/2010	78.82	77.00	X	79.00	75.00	---	
09/10/2010	78.39	77.05	X	79.00	75.00	---	
09/13/2010	79.41	78.13	X	79.00	75.00	1 x X	
09/14/2010	79.90	78.47	X	80.00	76.00	---	
09/15/2010	79.54	78.50	X	80.00	76.00	---	Rollover from the October to the November contract
09/16/2010	79.64	77.87	X	80.00	76.00	---	
09/17/2010	79.47	77.25	X	80.00	76.00	---	
09/20/2010	79.92	77.63	X	80.00	76.00	---	
09/21/2010	80.00	78.00	X	80.00	76.00	1 x X	
09/22/2010	78.84	77.50	X	81.00	77.00	---	
09/23/2010	78.48	76.75	X	81.00	77.00	X ► 0, 3 x 0	
09/24/2010	79.40	77.69	O	76.00	80.00	---	
09/27/2010	79.20	77.60	O	76.00	80.00	---	
09/28/2010	79.53	77.74	O	76.00	80.00	---	
09/29/2010	80.93	78.34	O	76.00	80.00	O ► X, 3 x X	Penetrating Major Bearish Resistance Line #18 - Closing Short Position #311
09/30/2010	82.40	80.41	X	81.00	77.00	2 x X	T#313: Buy @ 81.00 (Double Top) - Closing Short Position #311 - T#314(I): Sell @ 82.00 HorCount Price Target achieved
10/01/2010	83.81	82.21	X	83.00	79.00	1 x X	T#314(II): Sell @ 83.00 (touching Bullish Resistance Line #313a)
10/04/2010	84.41	82.90	X	84.00	80.00	1 x X	High Pole Pattern developed
10/05/2010	84.93	82.93	X	85.00	81.00	---	
10/06/2010	85.88	84.26	X	85.00	81.00	1 x X	
10/07/2010	86.02	82.93	X	86.00	82.00	1 x X	
10/08/2010	84.59	81.86	X	87.00	83.00	X ► 0, 4 x 0	T#314(III): Sell @ 83.00 (High Pole, modified) - T#314(IV): Sell @ 82.00 (High Pole, original)
10/11/2010	84.68	83.30	O	81.00	85.00	---	
10/12/2010	84.00	82.48	O	81.00	85.00	---	
10/13/2010	84.98	83.46	O	81.00	85.00	---	
10/14/2010	85.75	83.72	O	81.00	85.00	O ► X, 3 x X	
10/15/2010	84.50	81.95	X	86.00	82.00	X ► 0, 3 x 0	
10/18/2010			O	81.00	85.00		

Thank you for your attention

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