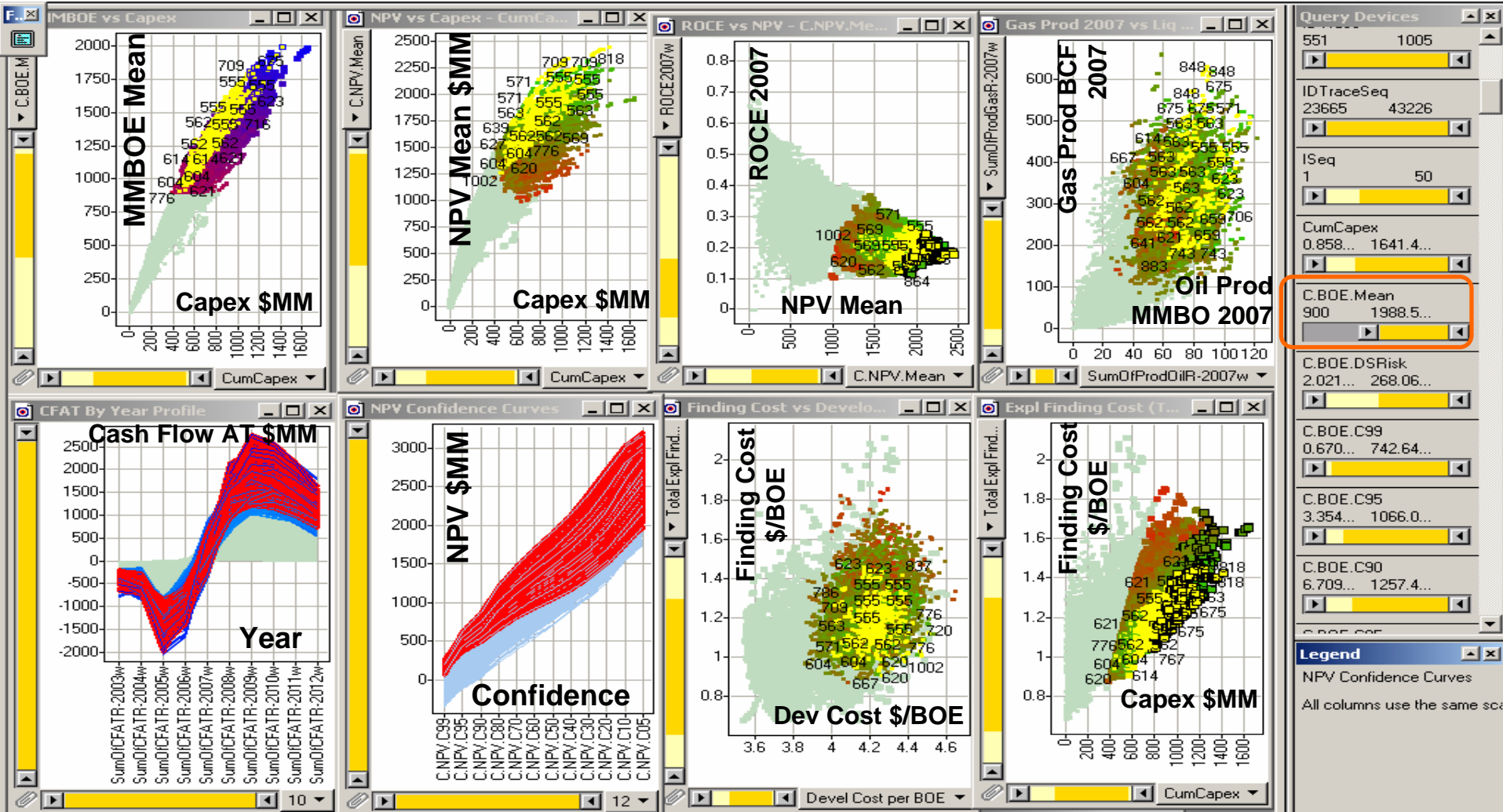


# Portfolio Analysis Decision Making With Spotfire® and BlitzPort™

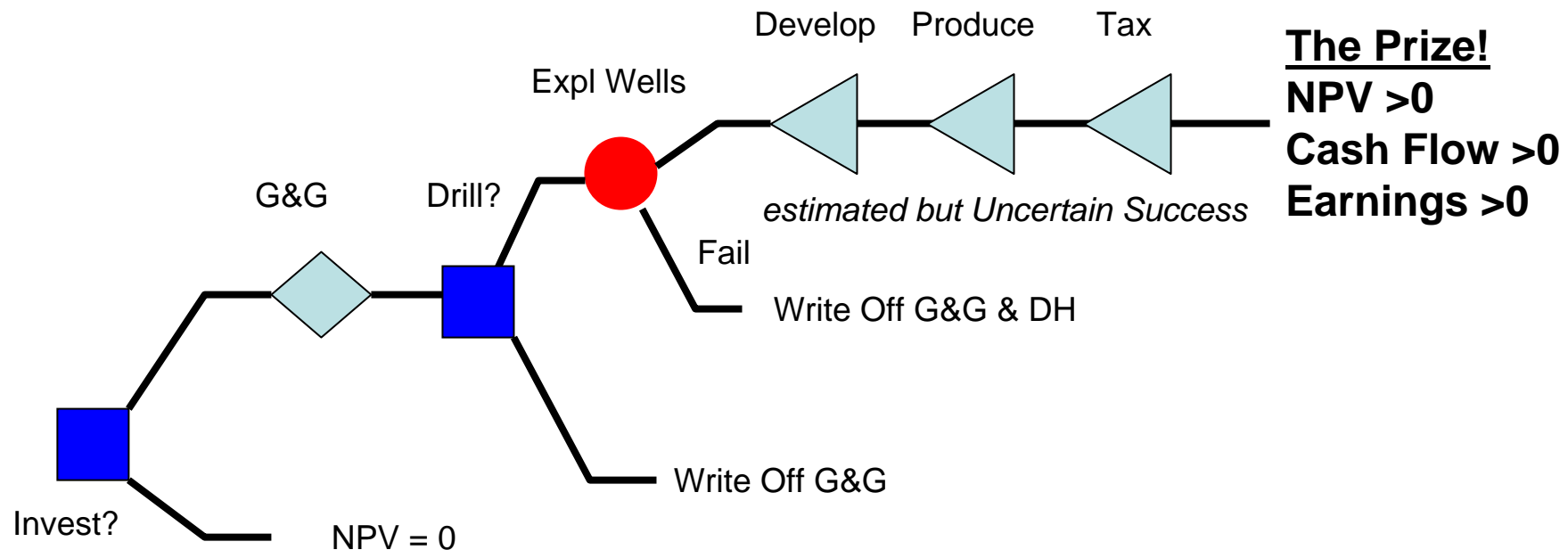
Dr. Stephen M. Rasey, Director and CFO, WiserWays, LLC

February 10, 2004 – Spotfire Energy Forum – Houston, TX



# Investment Opportunities

- Projects where you have an opportunity to invest capital with estimated, but uncertain, profitable returns in the future.
- Example here: Exploration Projects



## Decisions in the Portfolio Management Process

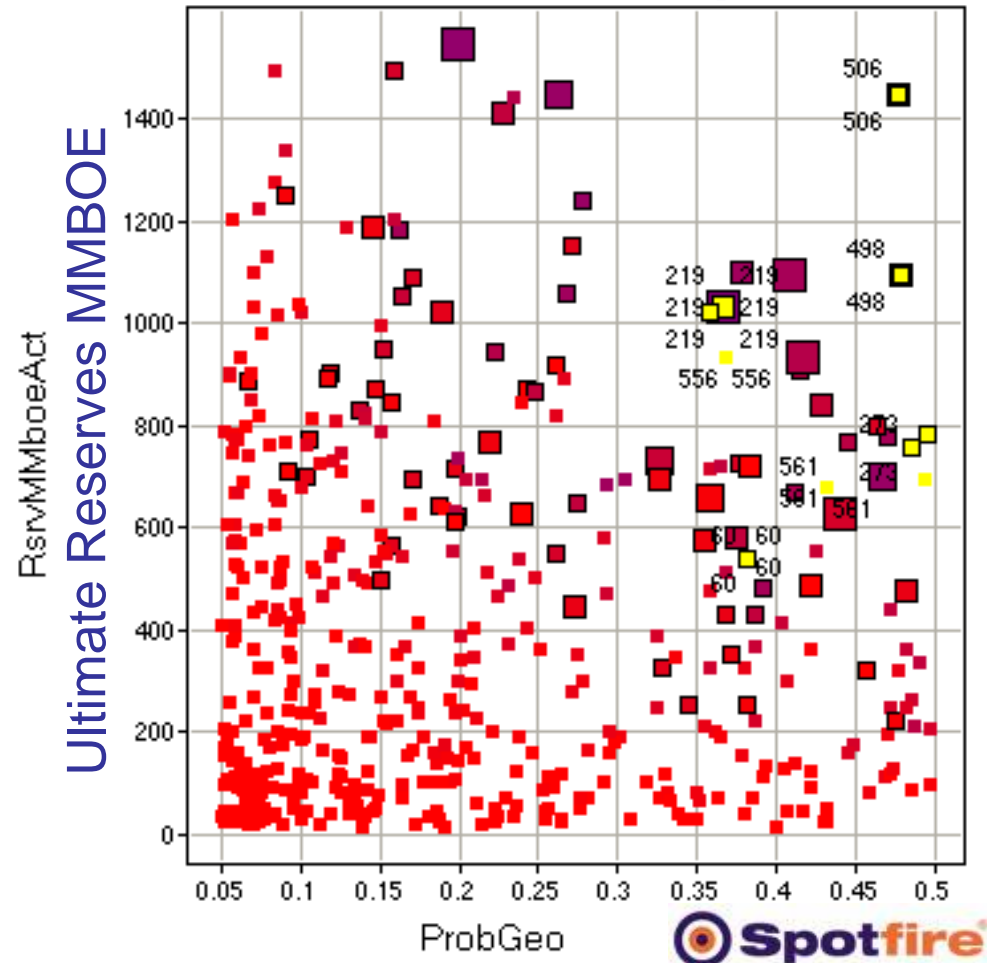
- What Projects should we consider for investment?

→ **A Prospect Inventory**

- Which Projects have data good enough to trust building Portfolios?

→ **Data Quality Control**

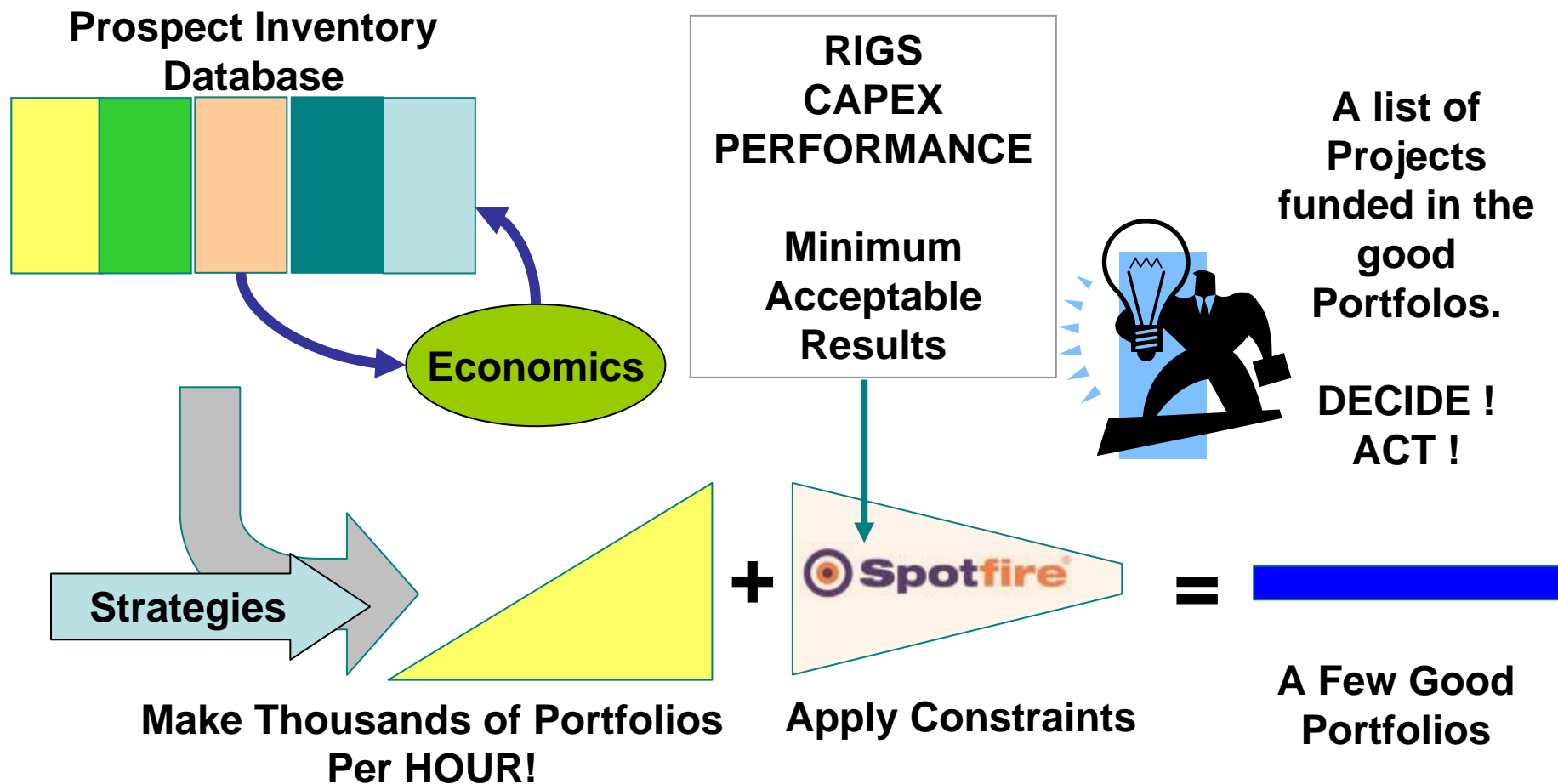
### Available Prospects



# WiserWays BlitzPort™ Process for Portfolio Analysis

What **Strategies** create Portfolios that deliver the best results measured by

- Short Term Requirements – Long Term Goals – **High Confidence** Results

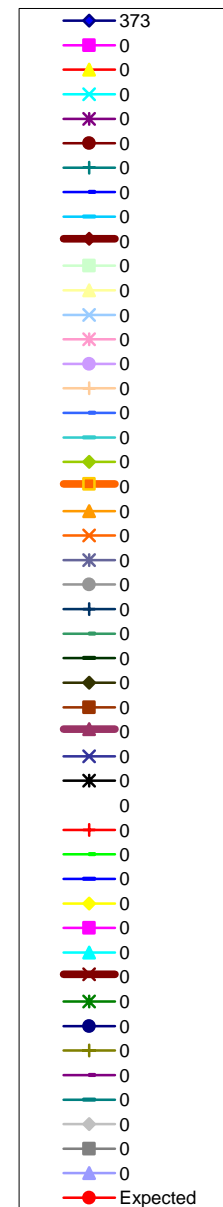


## Building a Candidate Portfolio

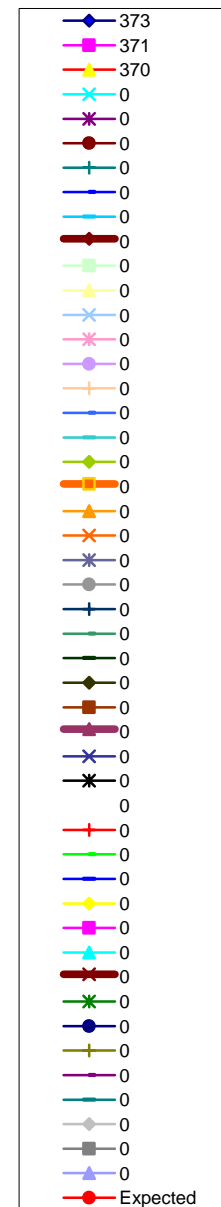
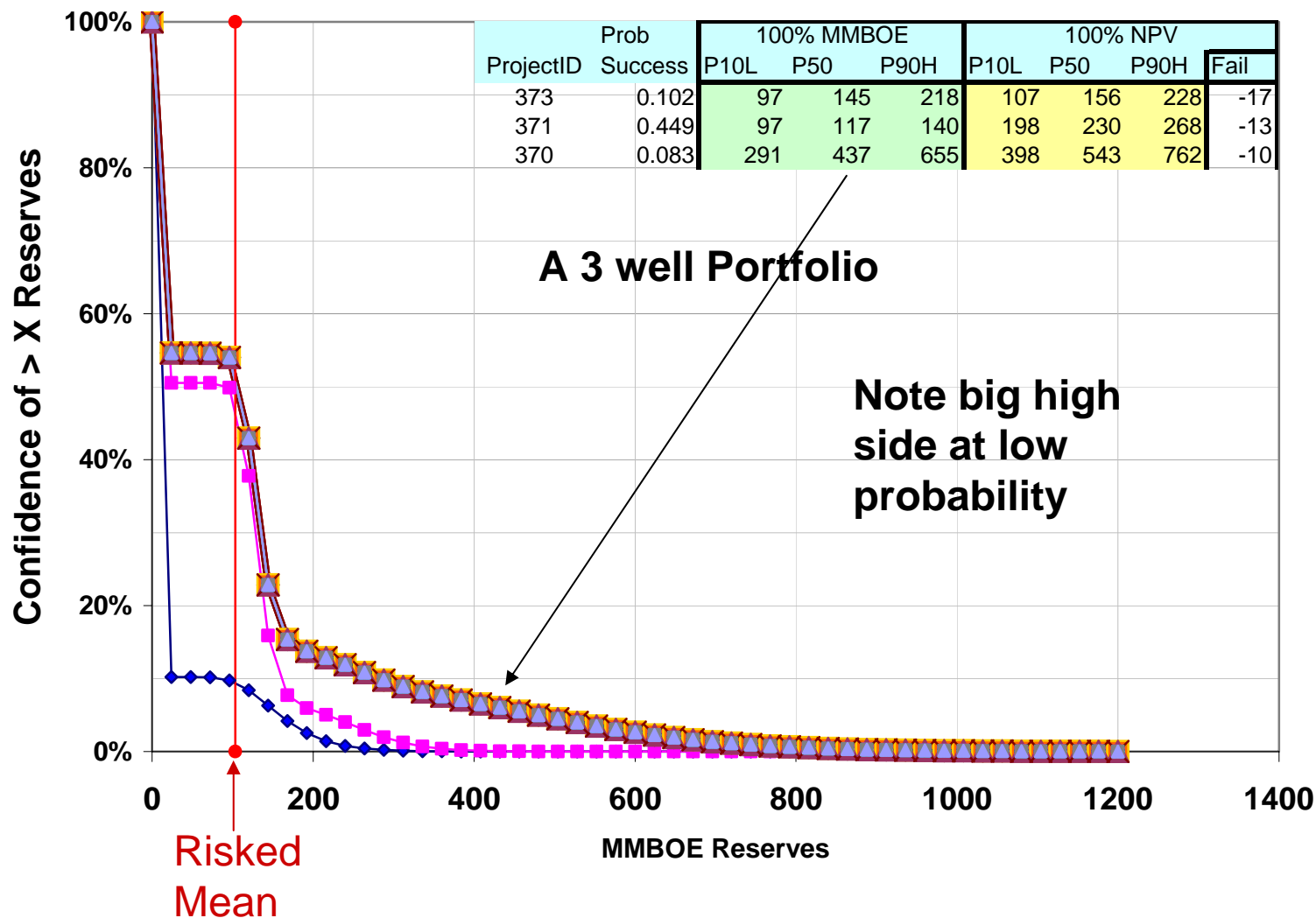
ProjectID	Prob Acquire	Prob Success	100% MMBOE			100% NPV			
			P10L	P50	P90H	P10L	P50	P90H	Fail
359	1	0.102	97	145	218	107	156	228	-17
360	1	0.449	97	117	140	198	230	268	-13
361	1	0.083	291	437	655	398	543	762	-10
362	1	0.457	107	128	154	42	63	89	-45
364	1	0.475	75	90	108	70	85	103	-48
365	1	0.220	237	308	401	261	332	424	-67
366	1	0.056	335	586	1026	160	411	851	-9
368	1	0.125	249	374	561	644	829	1105	-21
369	1	0.209	205	266	346	187	249	329	-36
370	1	0.327	244	293	351	383	444	518	-94
371	1	0.126	76	114	171	110	148	205	-4
373	1	0.200	227	295	383	596	725	892	-21

More  
↓

ProjectID	Prob Success	100% MMBOE			100% NPV			
		P10L	P50	P90H	P10L	P50	P90H	Fail
373	0.102	97	145	218	107	156	228	-17

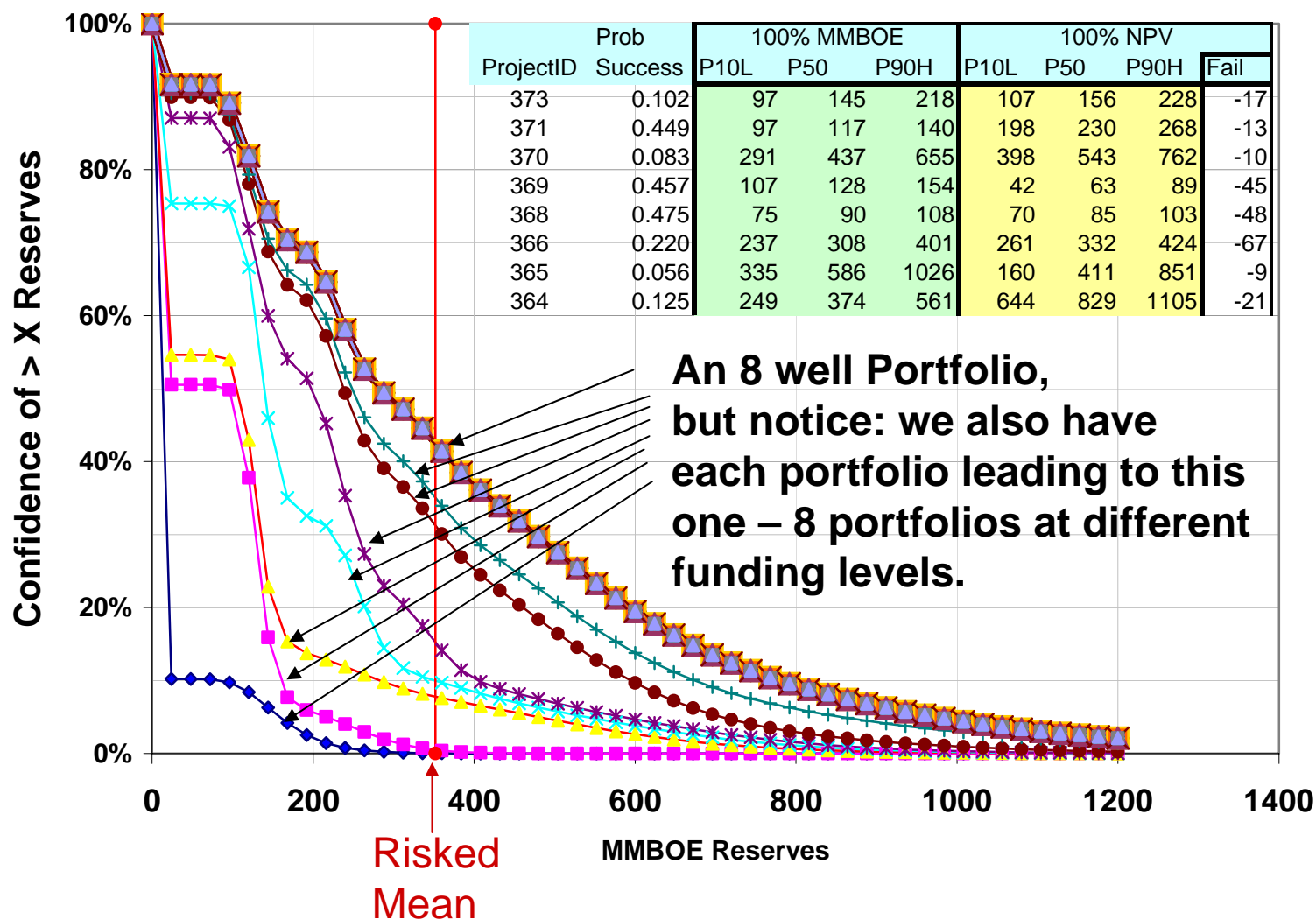


# Confidence of At Least X Reserves



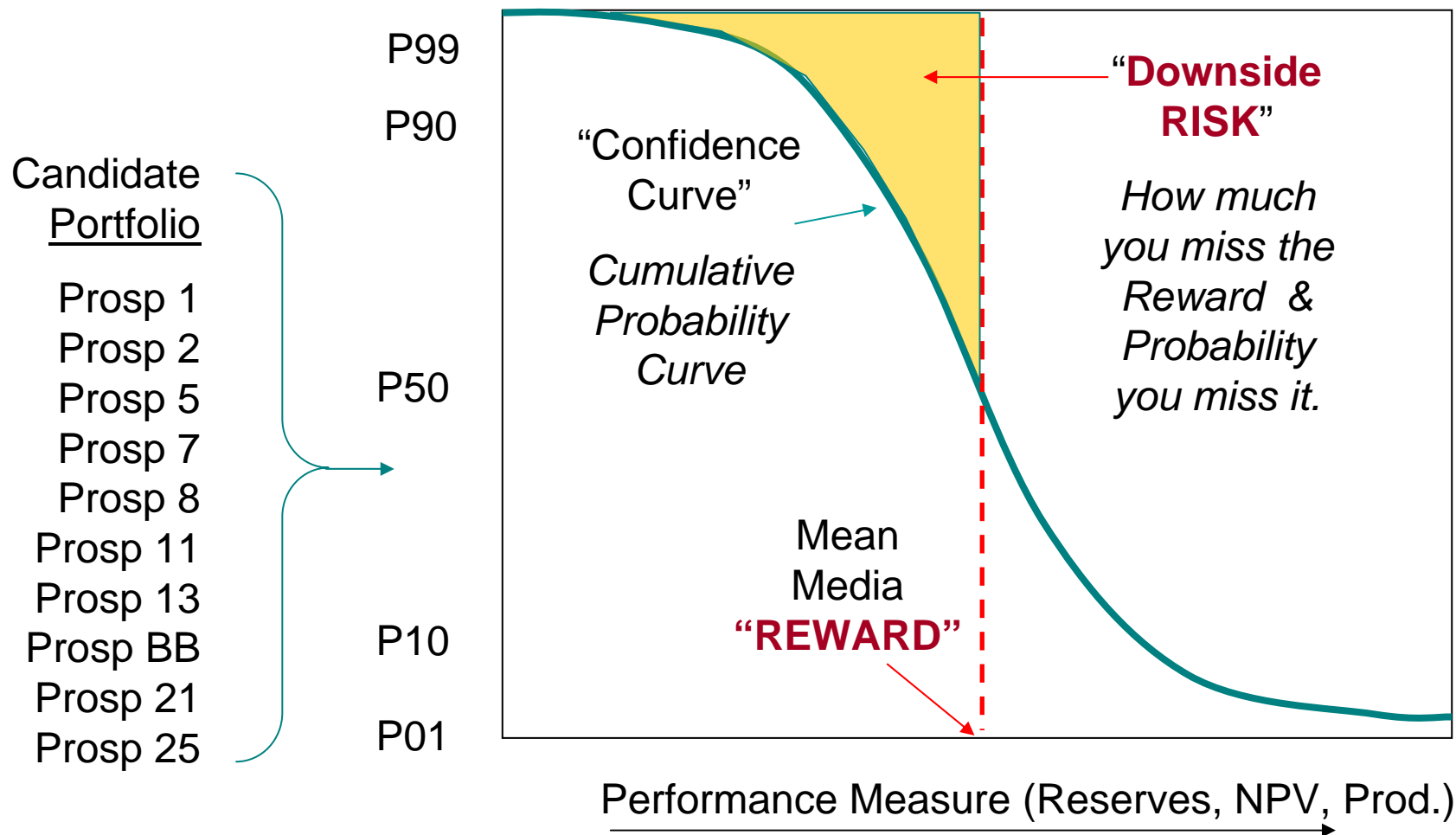


# Confidence of At Least X Reserves



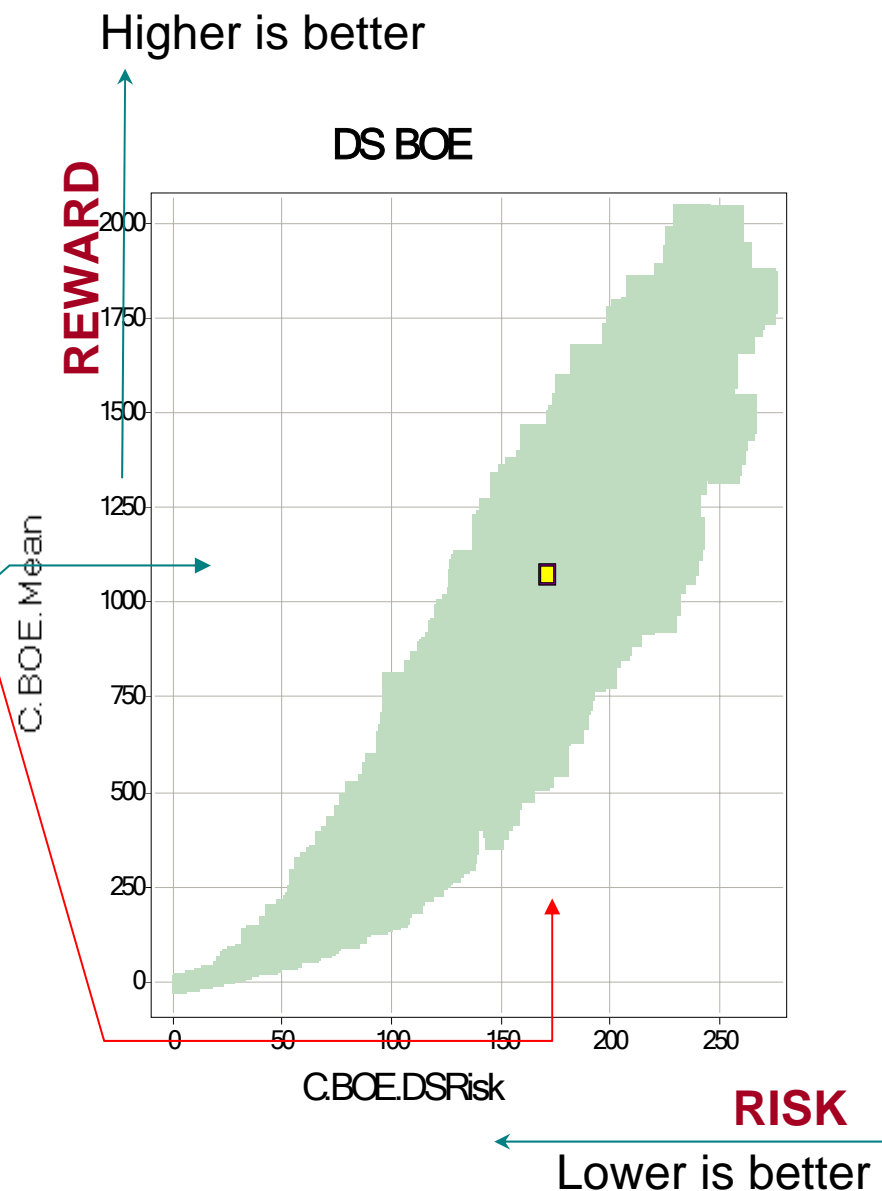
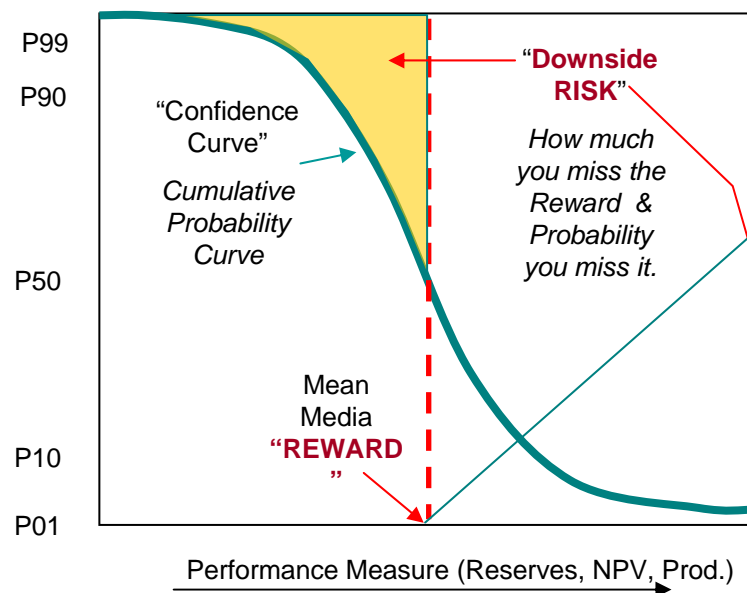


# Portfolio Risk and Reward



# We Plot the Portfolio as ONE POINT

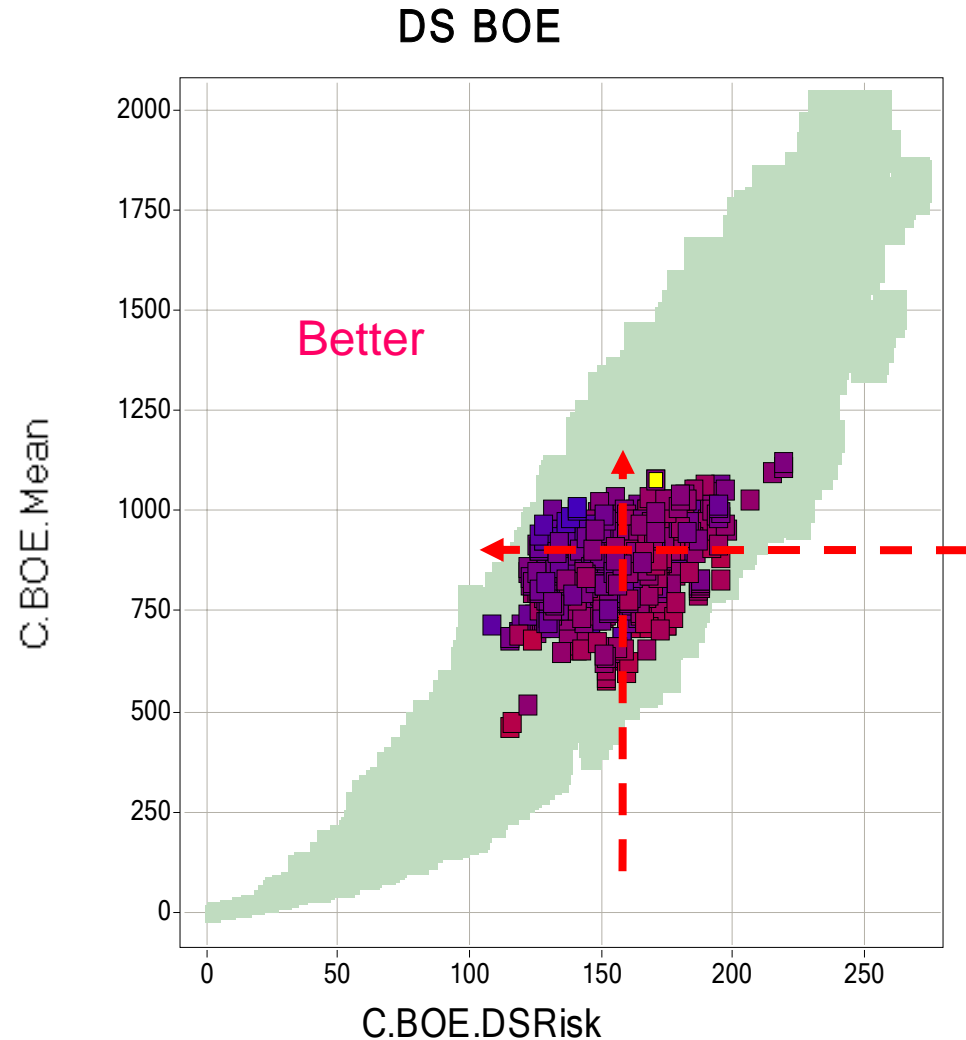
## (Risk, Reward)



## Definitions

- Efficient Portfolio: A portfolio that provides the greatest expected return for a given level of risk.
- Which is Lowest Risk for a given expected return.

(Source: <http://www.investorwords.com>)



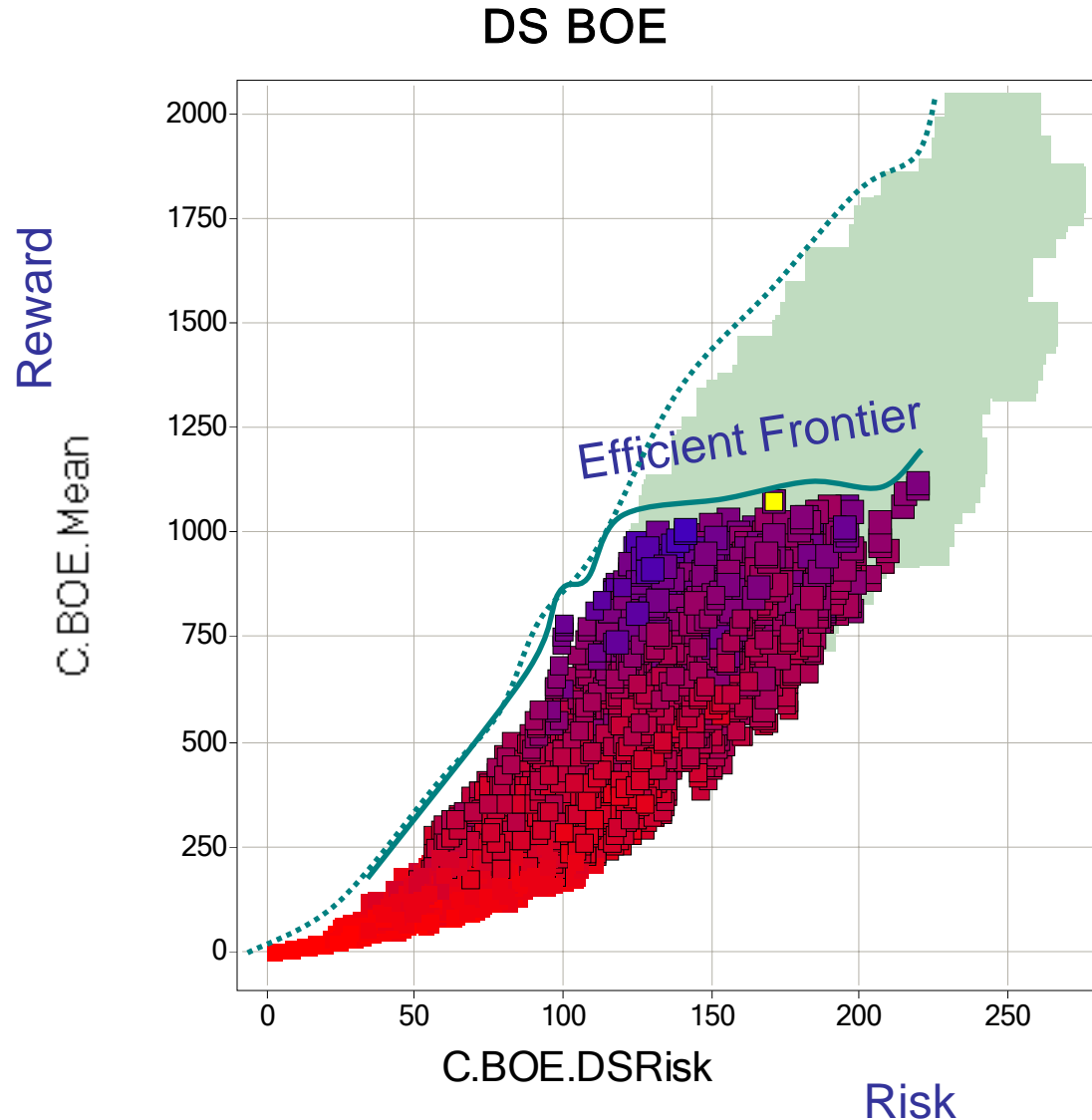
## Definitions

- Efficient Frontier:  
The line on a risk-reward graph comprised of all efficient portfolios.

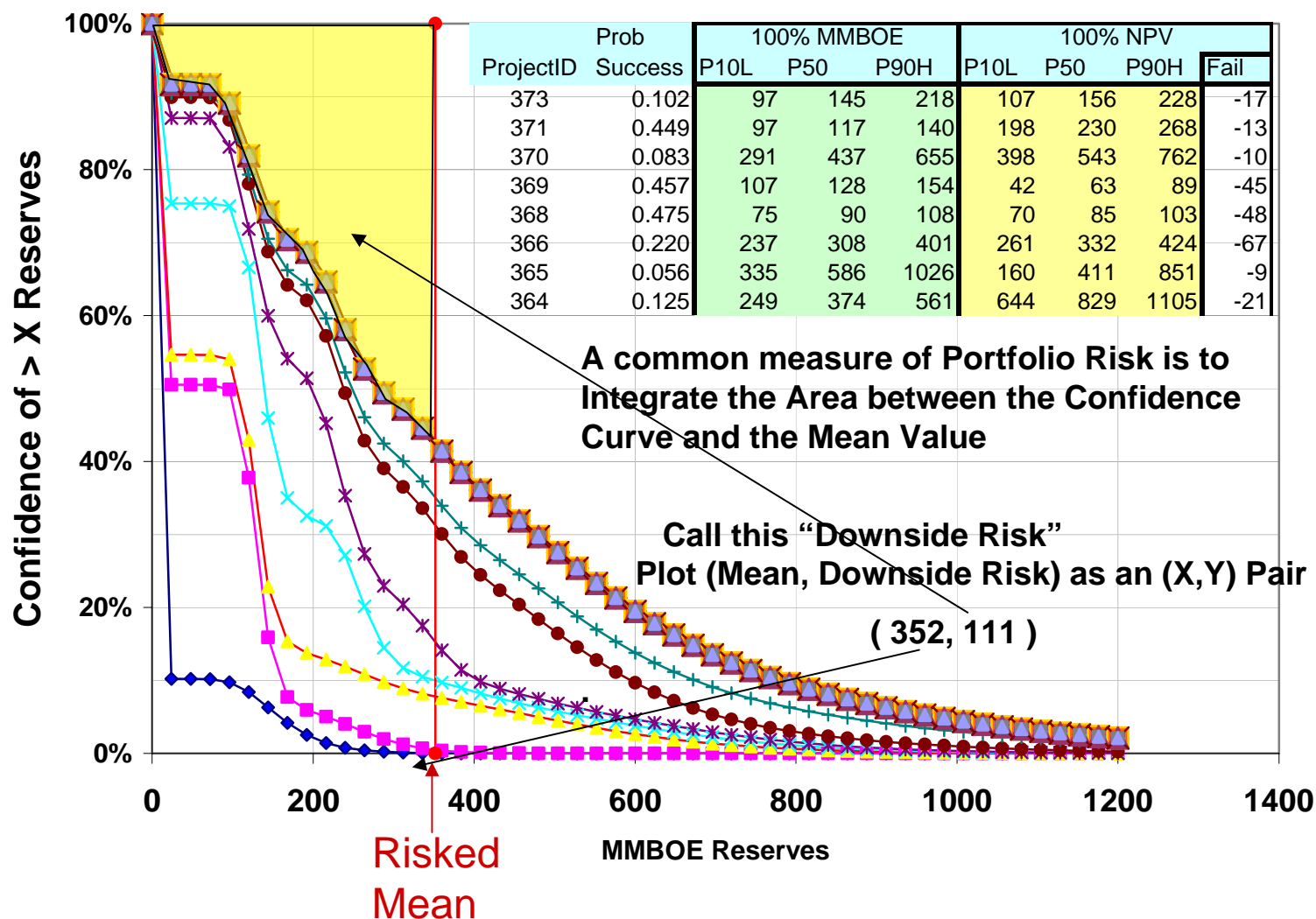
This is the Frontier for all portfolios with Capex limited to under 500 MMUSD.

So the Frontier is dependent on Budget and Goals

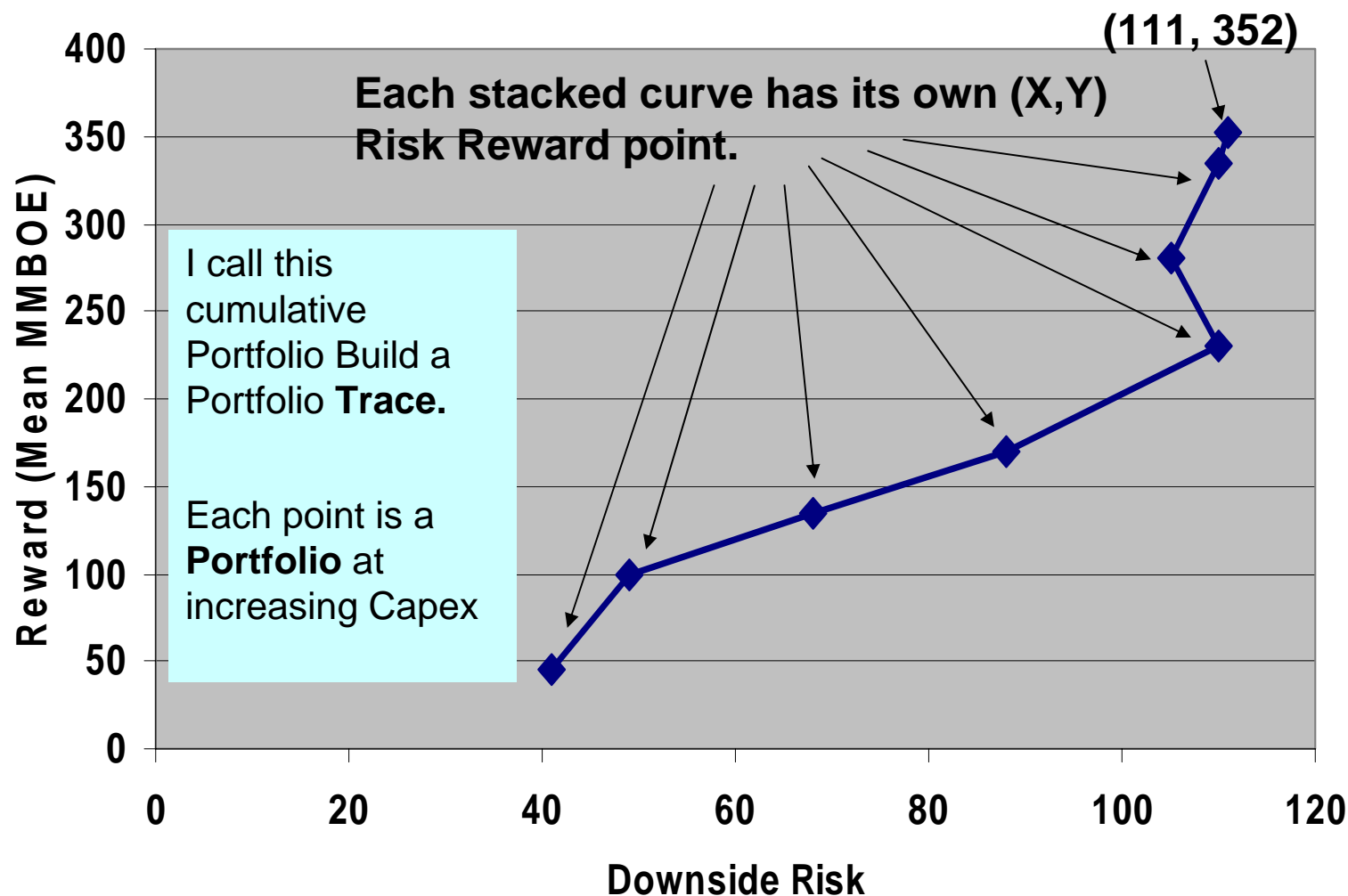
(Source: <http://www.investorwords.com>)



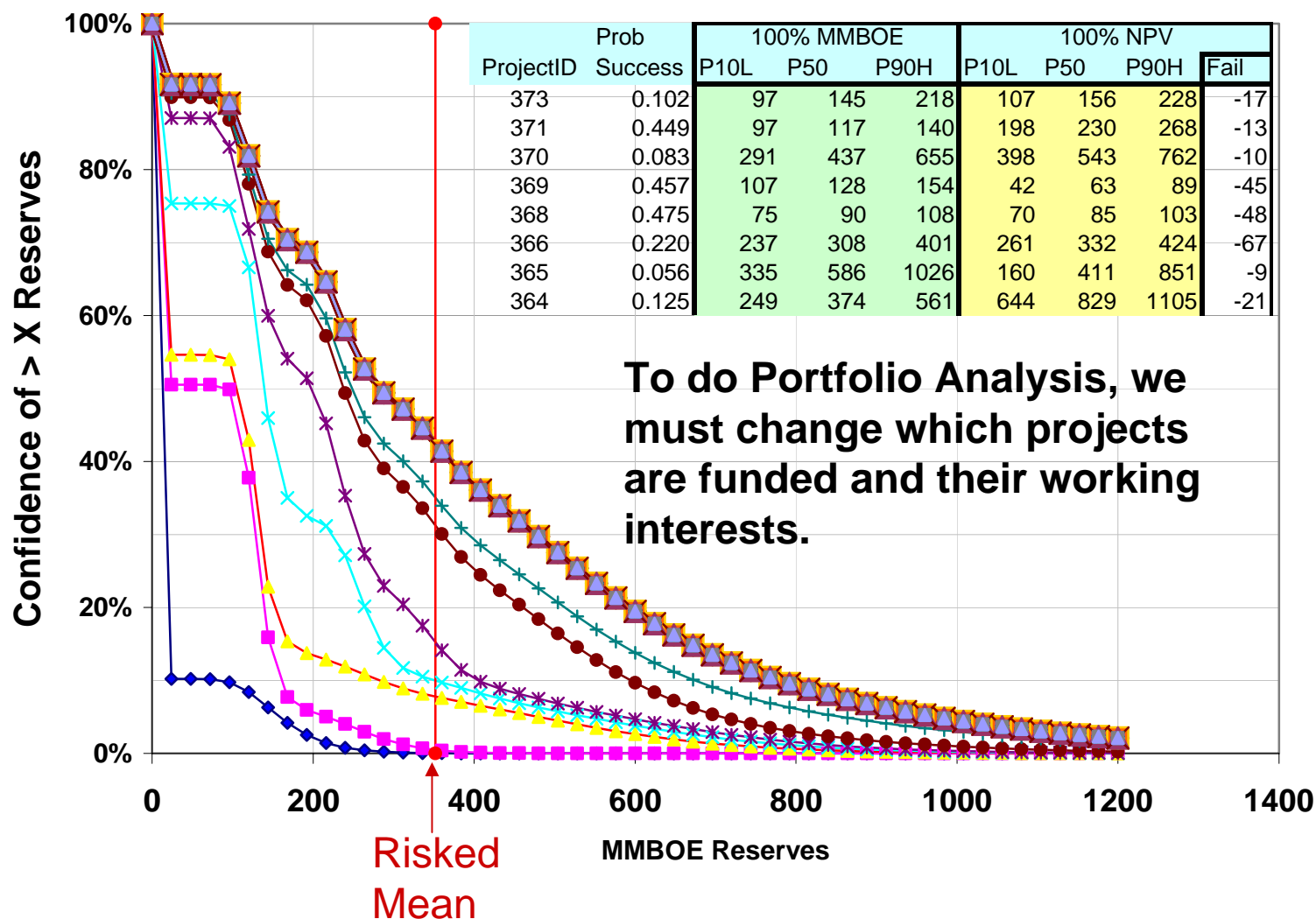
# Confidence of At Least X Reserves



## Risk Reward Plot for an 8 well Portfolio Trace

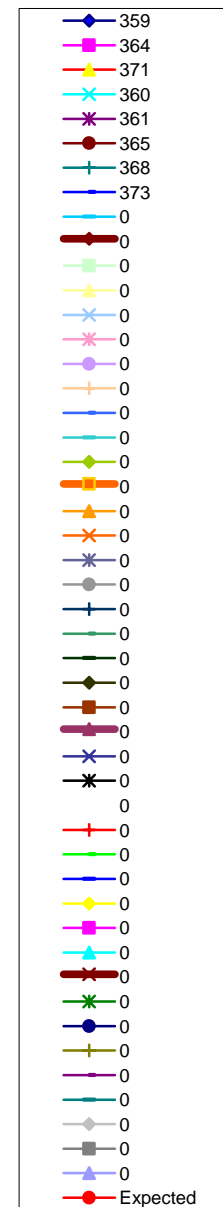
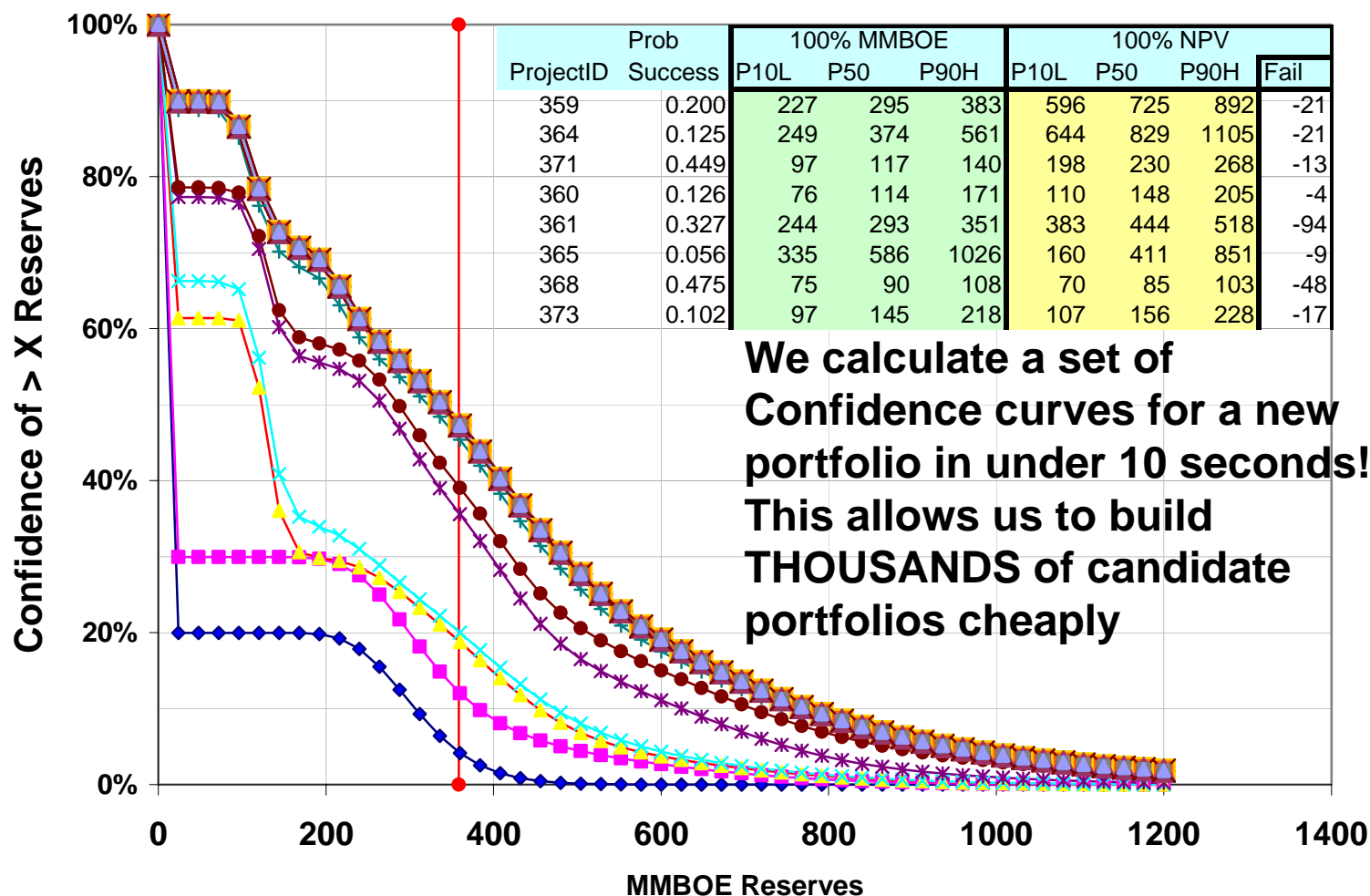


# Confidence of At Least X Reserves





# Confidence of At Least X Reserves



## WiserWays BlitzPort™ Confidence Curve Calculator

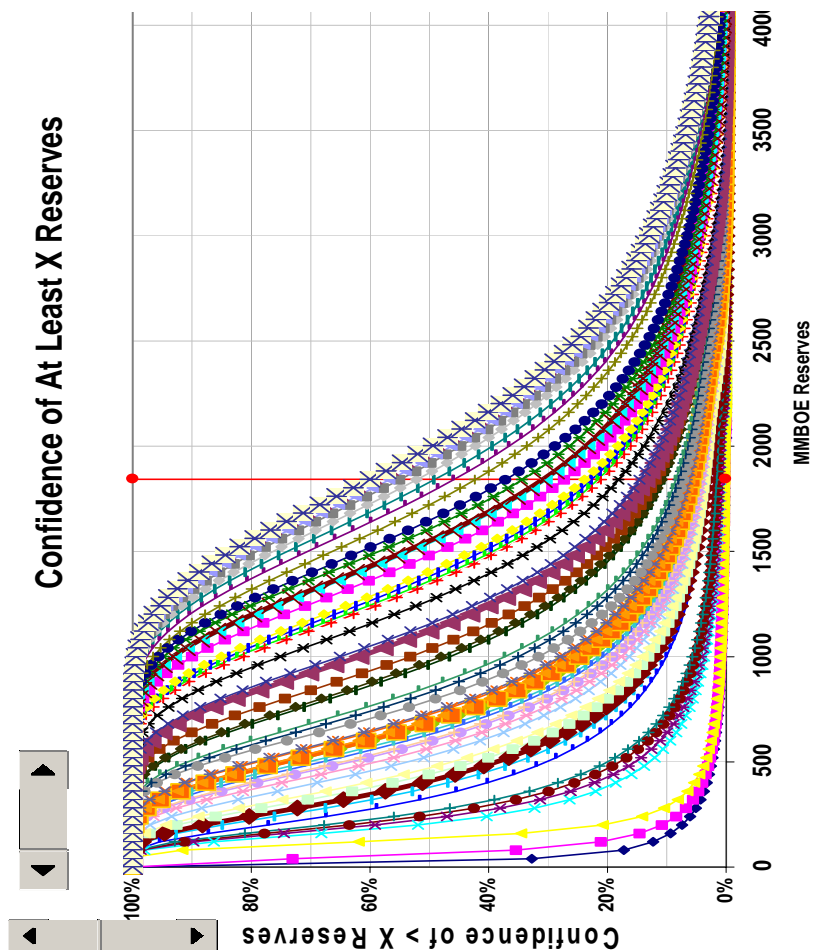
- The largest version can handle
  - a 5000 Project inventory,
  - Up to 150 funded at any one portfolio
  - Up to 3 discrete working interest per project
  - “Rank and Cut” driven by customizable strategies and goals.
- Each trace calculates has up to 150 Portfolio points.
- Each Portfolio point has FIVE confidence curves at isotiles (every 5%) written to the database.
- Process time: 15 seconds per trace including writing to the Database. -- 10 Portfolios per second. (2.4Ghz Pentium IV)
- Confidence Curves calculated directly without simulation
- Available for sale from WiserWays.

## WiserWays MultiField Confidence Curve Calculator Superior to Monte Carlo Simulation

- **Calculation speed is 20 seconds.** Monte Carlo simulation could take 200 to 2000 seconds.
- **Repeatable.** No random numbers used.
- Output of Monte Carlo simulation always have a statistical uncertainty in the result.  
MultiField has **no such error.**
- MultiField automatically writes results to a database.  
Most Monte Carlo applications use manual processes to write to separate spreadsheets.
- Input Distributions are not limited to Log-Normal assumptions.

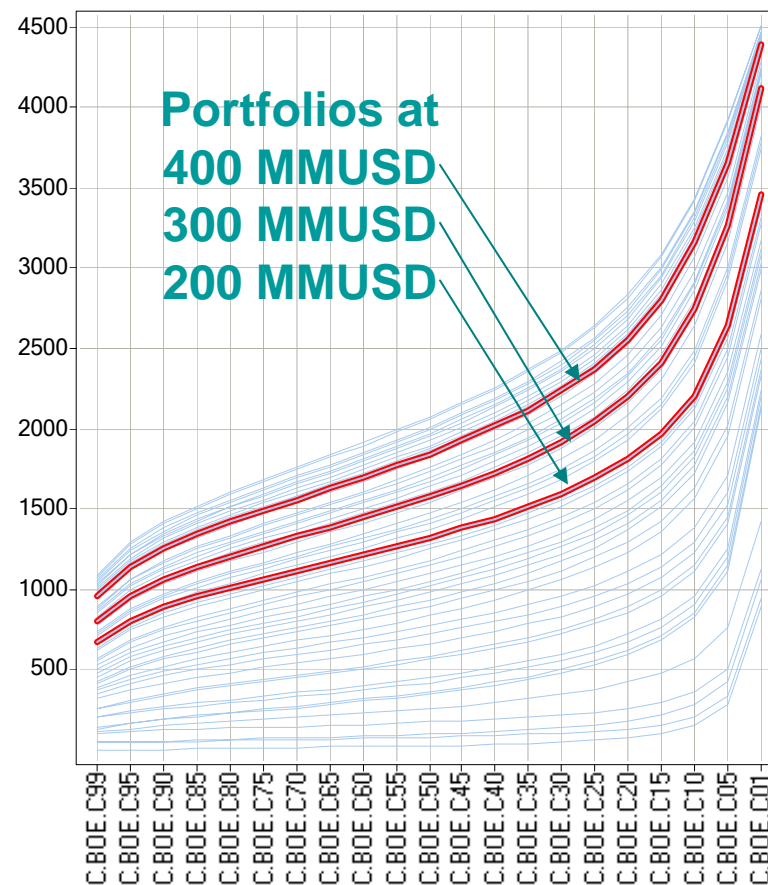
# Confidence Curves in Excel and Spotfire

## Excel (rotated)



## Spotfire Profile Chart

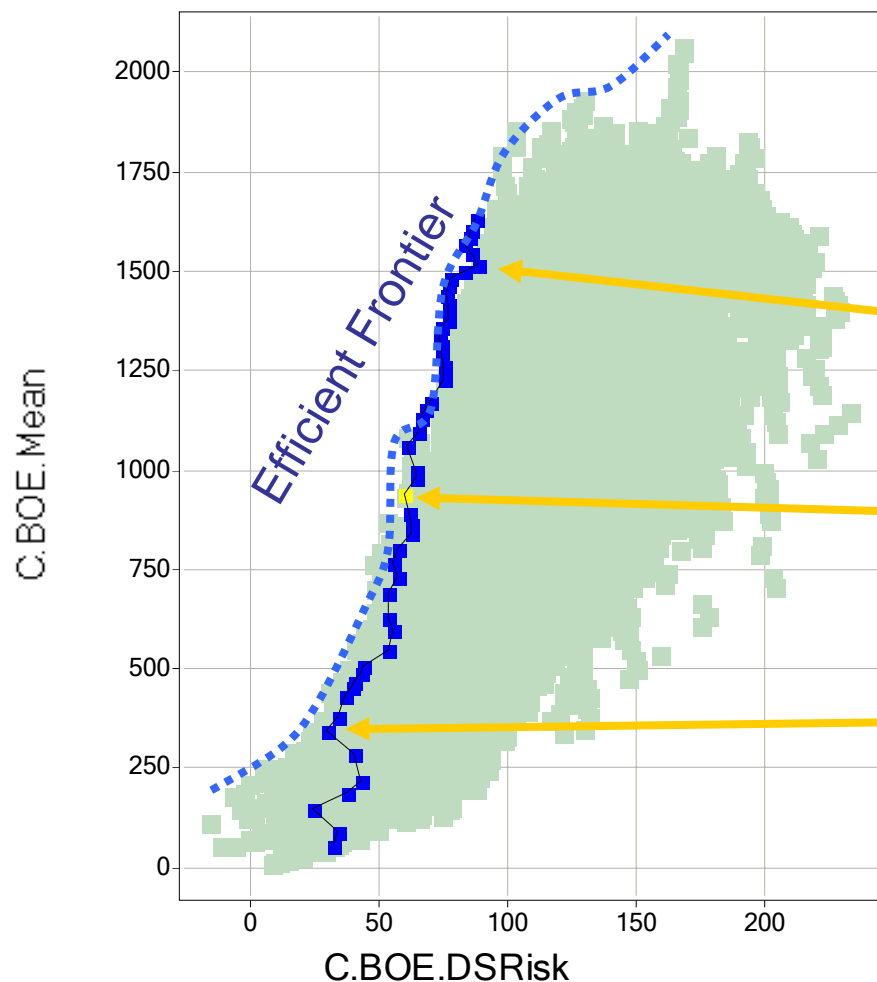
### MMBOE Conf



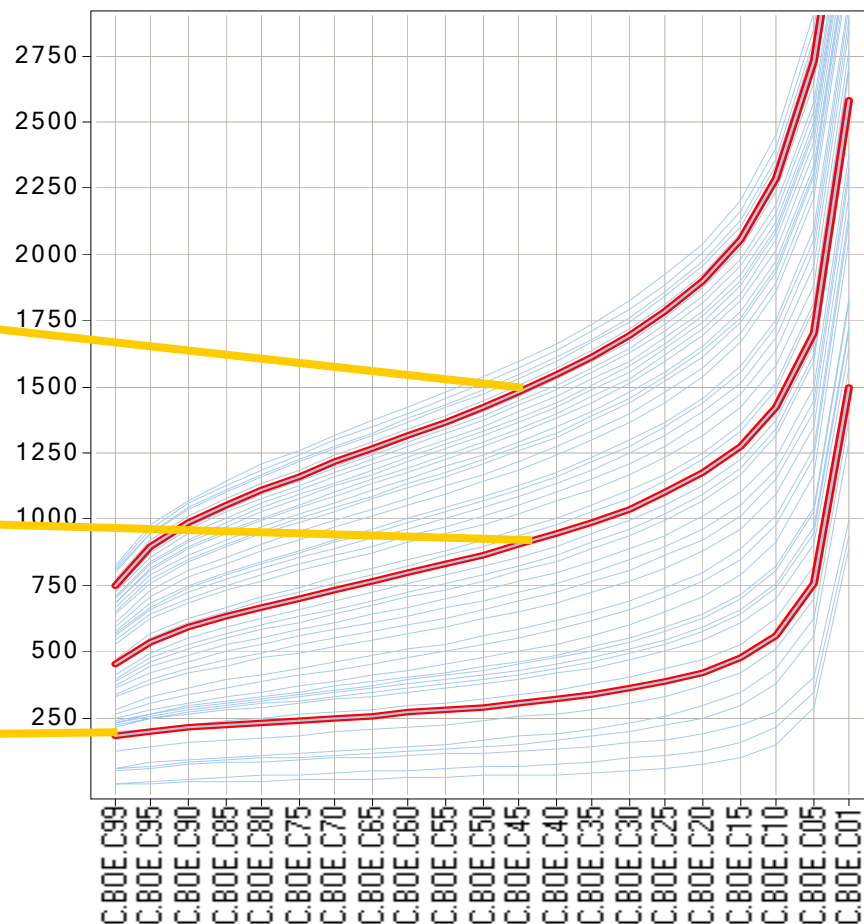
# MMBOE Risk Reward Trace 1007

Each Portfolio Point on the Risk Reward Plot  
Maps to a Confidence curve

BOE DSRisk

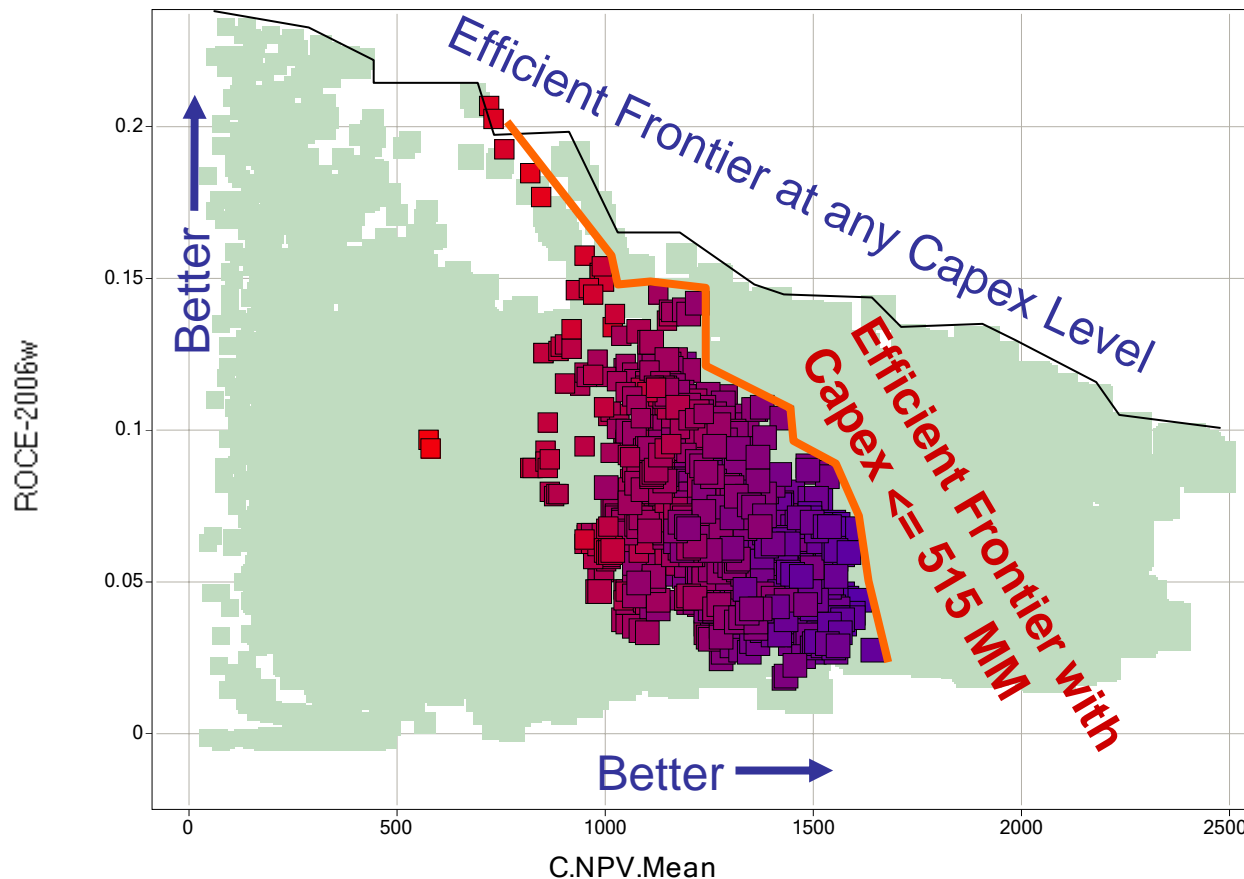


MMBOE Conf



# Efficient Frontiers can also compare trade-offs between conflicting goals

ROCE vs NPV - C.NPV.Mean vs. ROCE-2006w



Here we compare Return on Capital Employed in 2006 vs Portfolio NPV (in 2003)

The selected points (red-blue) are constrained by CumCapex between 450 and 515 \$MM

Are there any Companies using this Portfolio System?

¡Sí!



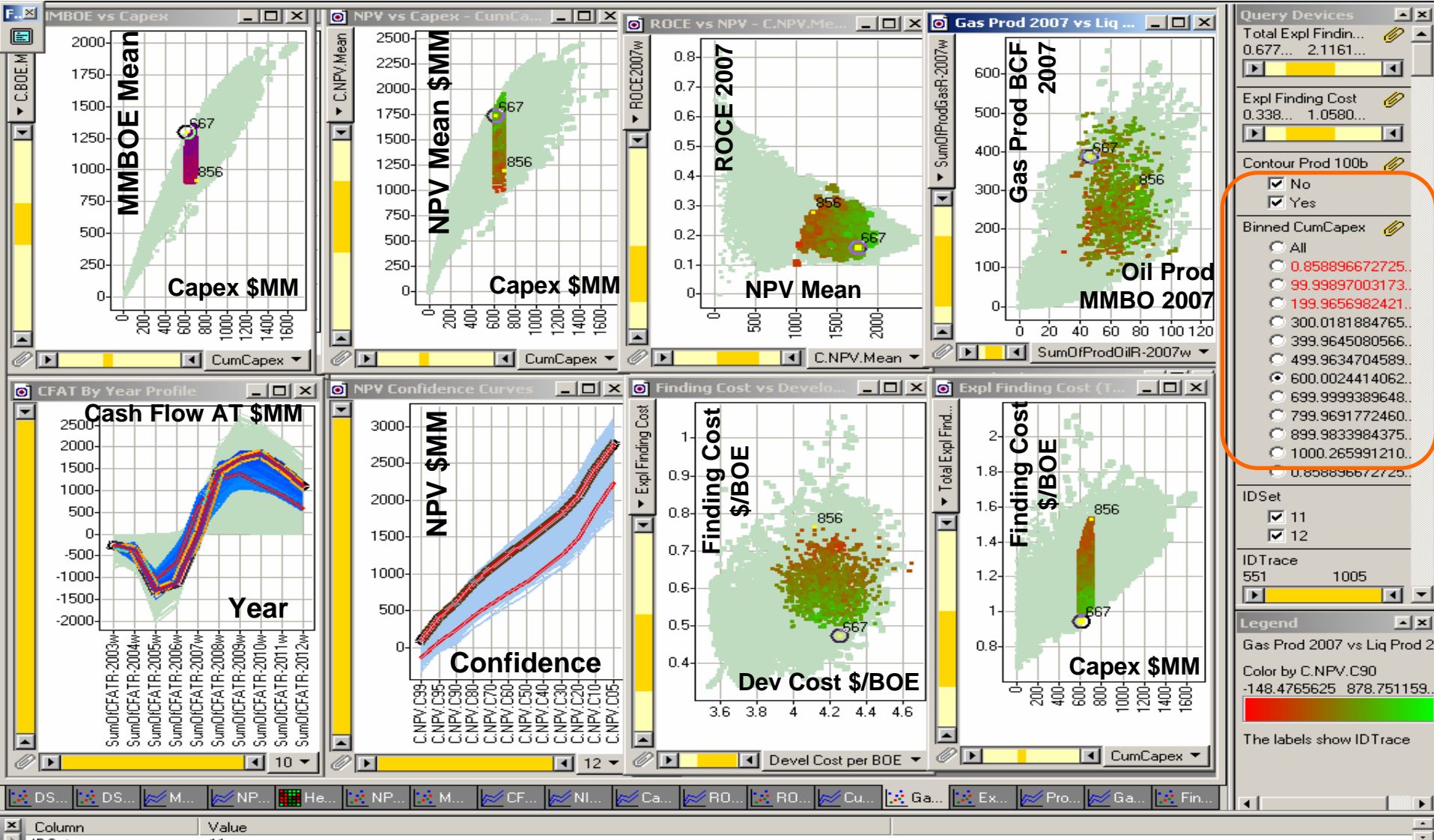
At the April 2002 AAPG Convention, Pemex presented their processes for Risk Analysis and outlines of their Prospect Inventory. They reported they had over 1000 prospects.

Brett Edwards of Custer Resources saw a version of this Portfolio Analysis presentation from the May 2003 London Spotfire User's Conference. We made a proposal to Pemex Exploration Executive Management on July 20. We got an immediate go-ahead.

By October 8 we generated over 1,500,000 portfolios.



# Case Study: Select 2003 Exploration Portfolios based upon Reserves, Finding Cost, Development Capex and Production.



# Out of Millions of Portfolios in the database, Find 2000-60000 Portfolios to analyze

Microsoft Access - [T2A1frmNamePortfolioSets : Form]

File Edit View Insert Format Records Tools Window Help

Type a question for help

Tahoma 8 B I U

**Create Sets of Portfolios (T2A1)**

**Limits in Portfolio Retrievals**

	Min	Max	Count
Expl Capex	500	800	
MMBOE			
IDTrace			
Active Traces:	20911	22050	1141
IDSet	4480	4700	
Active Sets:	4483	5509	1028

Name this Set: 1203a

**Set Description:**  
Capex 500 to 800, IDSets 4480-4700, about 10 seconds

**Number of Portfolios Selected**  
2,406

Status

**Count Portfolios**

**Save Set using this name**

**Delete this Named Set**

T3A4: Active Study Edit

T3B: Save Active A1Sets

--> Goto T2S1 Send Portfolios to Spotfire

T2H7frmActiveWtsUserid

**Use Wts:**  
NPV, MMBOE, GasR, OilProd, GasProd

	Use	Wts
<input checked="" type="checkbox"/>		0.75, 0, 0.25, 0, 0
<input checked="" type="checkbox"/>		0.5, 0.5, 0, 0, 0
<input checked="" type="checkbox"/>		0, 0.5, 0.5, 0, 0
<input checked="" type="checkbox"/>		0, 0.75, 0.25, 0, 0
<input checked="" type="checkbox"/>		0.75, 0.25, 0, 0, 0
<input type="checkbox"/>		0.15, 0.15, 0.4, 0.15, 0.15
<input type="checkbox"/>		0, 0, 0.5, 0, 0.5
<input type="checkbox"/>		0, 0, 0.5, 0.5, 0
<input type="checkbox"/>		0, 0.25, 0, 0, 0.75
<input type="checkbox"/>		0, 0.25, 0, 0.75, 0
<input type="checkbox"/>		0, 0.25, 0.75, 0, 0

Record: 1 of 26

**Query String**

```
SELECT Count(5.IDTraceSeq) AS NumPorts FROM (T2ActiveWts INNER JOIN T2H4qnuSetDesc ON T2ActiveWts.Wts = T2H4qnuSetDesc.Wts)
INNER JOIN (((T2ActiveSets AS A INNER JOIN TTrace AS T ON A.IDSet = T.IDSet) INNER JOIN TTraceSeq AS S ON T.IDTrace = S.IDTrace)
INNER JOIN TConfCurve AS C ON S.IDTraceSeq = C.IDTraceSeq) ON T2H4qnuSetDesc.IDSet = A.IDSet WHERE ((T2ActiveWts.userid='raseysm')
AND (T2ActiveWts.bActive)=True) AND (A.userid='raseysm' AND C.Measure = 'MMBOE' AND s.cumcapex >=500 AND s.cumcapex <=800 AND
t.IDSet >=4480 AND t.IDSet <=4700)
```

Form View

## T2S1: 1. Select a Named Set of Portfolios to send to Spotfire

Microsoft Access - [T2S1frmPortfolioToSpotfire : Form]

File Edit View Insert Format Records Tools Window Help

Type a question for help

Tahoma 8 B I U

### Send Portfolio Data to Spotfire (T2S1)

**Project Queries Available**

T1J6	Portfolio: Weights, 5 ConfCurves, 4 Profiles	T2J6qnuConfCurveFlows
T2C5	Portfolio: 5 Conf Curves, Projects Funded (140 m	T2C5qnuColsConfCurveProj
T2C6	testing: Weights, 5 Conf Curves, Projects Fundec	T2C6qnuWtsConfProj

**Spotfire Templates Available**

T2C6	030929 case	spot\T2C6.sfs
T2C6	030929 case	spot\T2C5.sfs
T2J6	030929 case	spot\T2J6.sfs

Portfolio Set Name to Run:  # of Portfolios:

Portfolio Set Description

PortSetNam	NumPorts	NumAtSave	Description
1201a	11700	11700	amemo
1203a	2406	2406	Capex 500 to 800, IDSets 4480-4700, about 10
test1	13780		
test2	2273		
Test29a	3940		
Test29b	26849		
test3	42651		

Connection and Query String

Form View

# T2S1 – Step2: Choose Canned Queries to send to Spotfire

Microsoft Access - [T2S1frmPortfolioToSpotfire : Form]

File Edit View Insert Format Records Tools Window Help

Type a question for help

Tahoma 10 B I U

**Send Portfolio Data to Spotfire (T2S1)**

**Project Queries Available**

T1J6	Portfolio: Weights, 5 ConfCurves, 4 Profiles	T2J6qnuConfCurveFlows
T2C5	Portfolio: 5 Conf Curves, Projects Funded (140 m	T2C5qnuColsConfCurveProj
T2C6	testing: Weights, 5 Conf Curves, Projects Fundec	T2C6qnuWtsConfProj

**Spotfire Templates Available**

T1J6	030929 case	spot\T1J6.sft
T1J6	030929 case	spot\T1J6.sfs

Portfolio Set Name to Run: **1203a** # of Portfolios: **2406** Create New Spotfire Window

Portfolio Set Description  
Capex 500 to 800, IDSets 4480-4700, about 10 seconds

--> Send to Spotfire

Connection and Query String sent to Spotfire:

```
Select f.ItemIID2, F.ItemDescription, F.ItemIID3 From B1A2qryBPortfolioSFTemplates as F WHERE ItemIID2 = 'T1J6';
```

Choose the Query

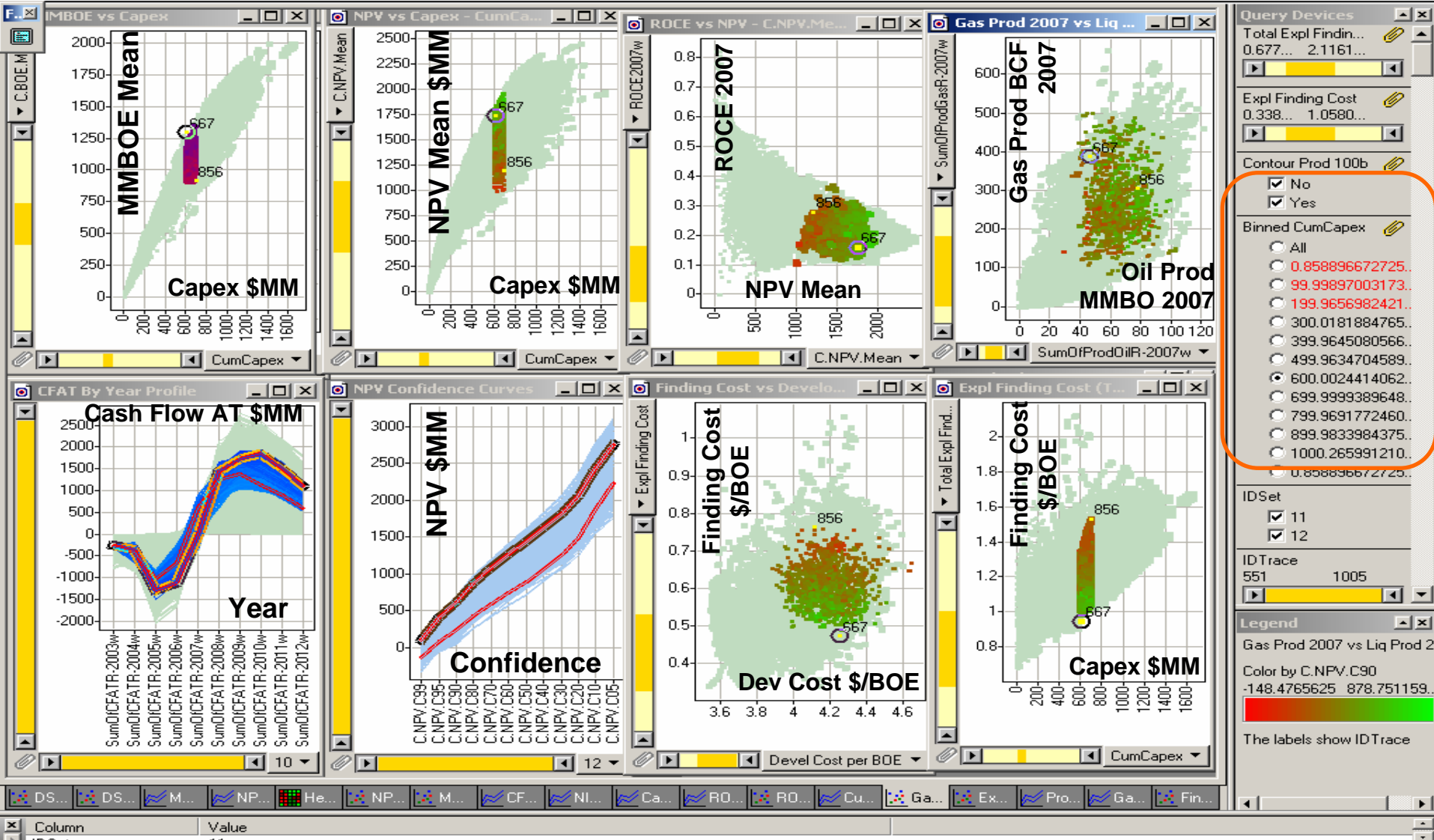
Choose a Spotfire Template that is compatible with the query

Launch the Query

Use an existing instance of Spotfire or create a new one

Choose the Set of Portfolios to Plot

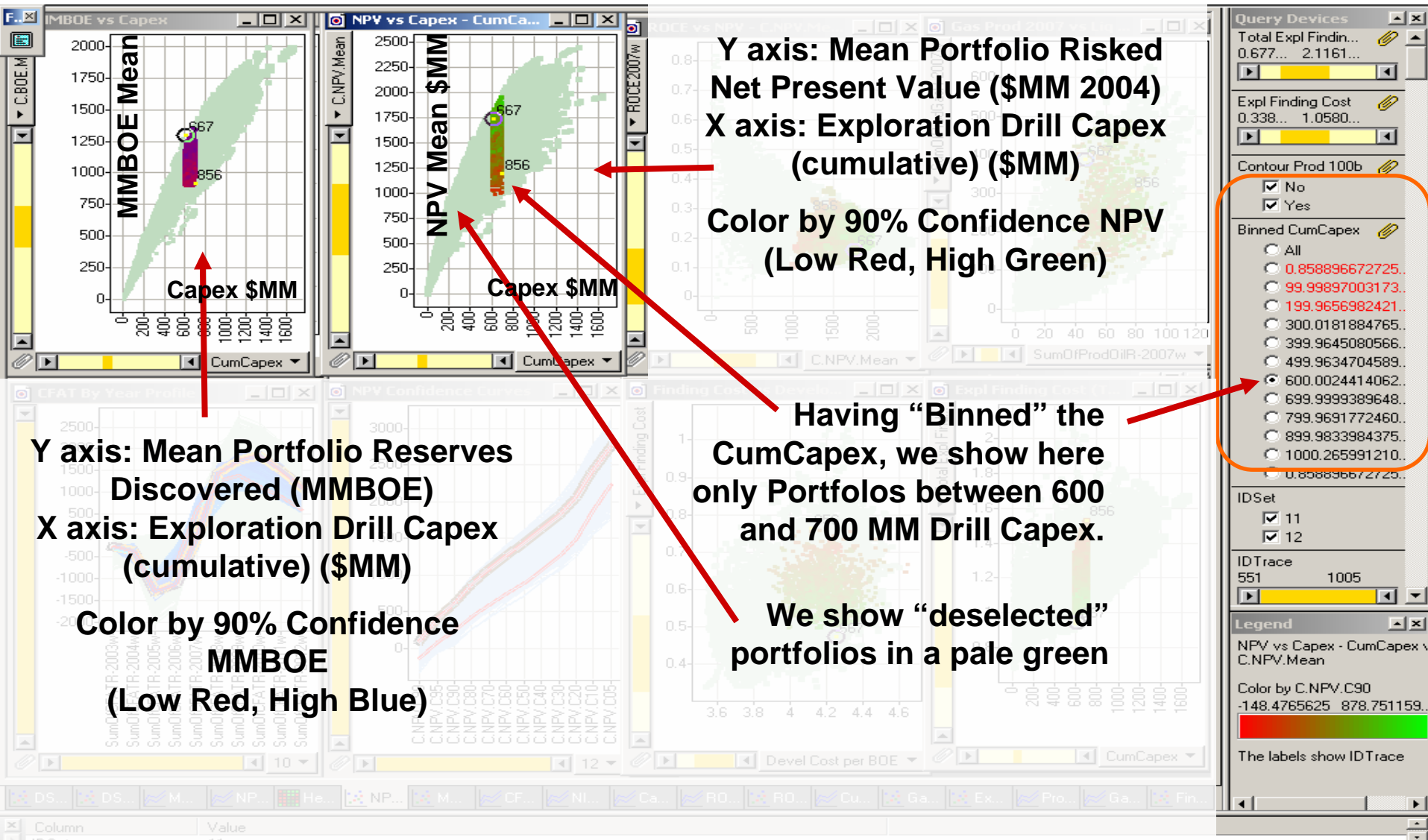
# Case Study: Select 2003 Exploration Portfolios based upon Reserves, Finding Cost, Development Capex and Production.





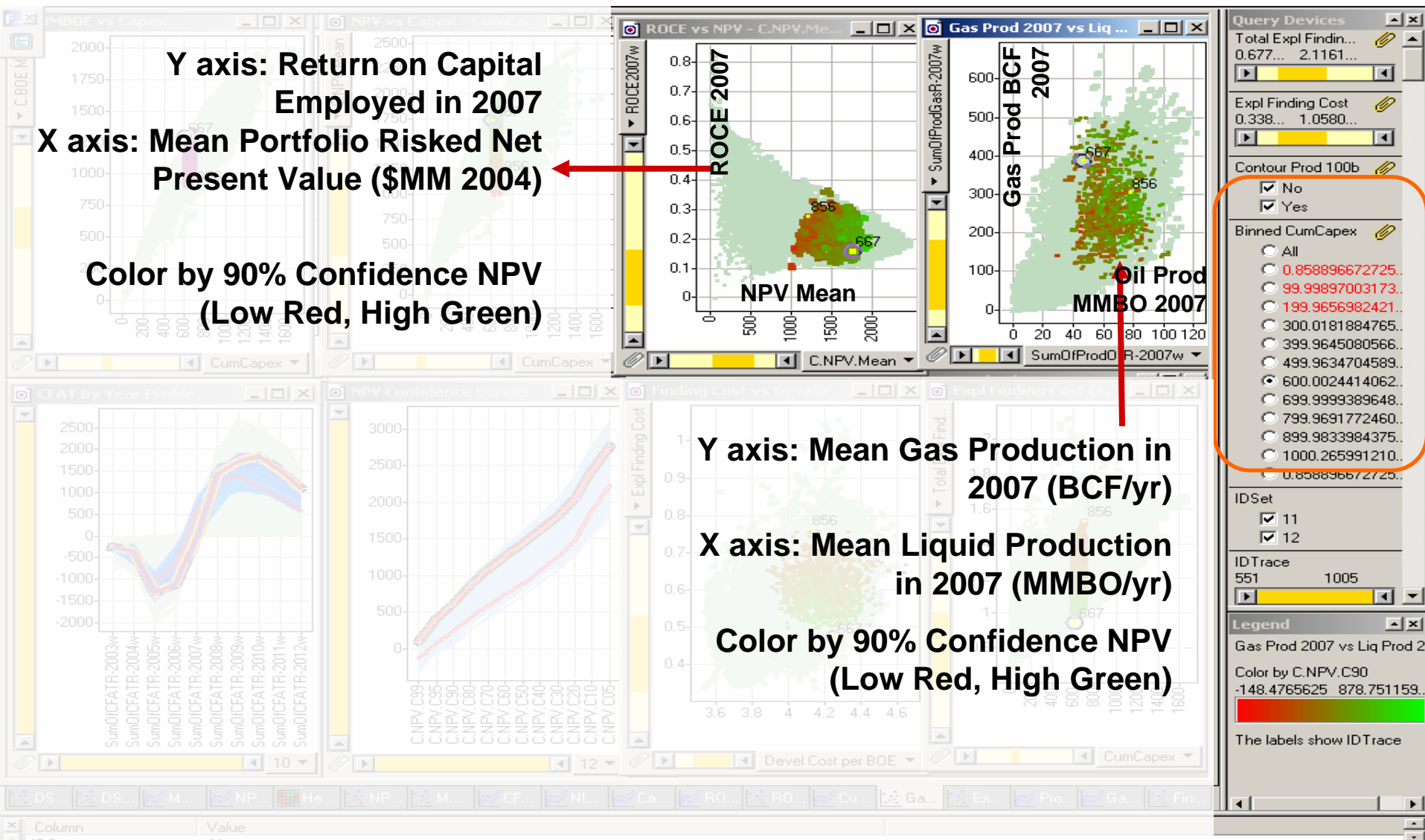
# Orientation: What are the Plots in the Display?

## MMBOE and NPV vs Cumulative Capex



# Orientation: What are the Plots in the Display?

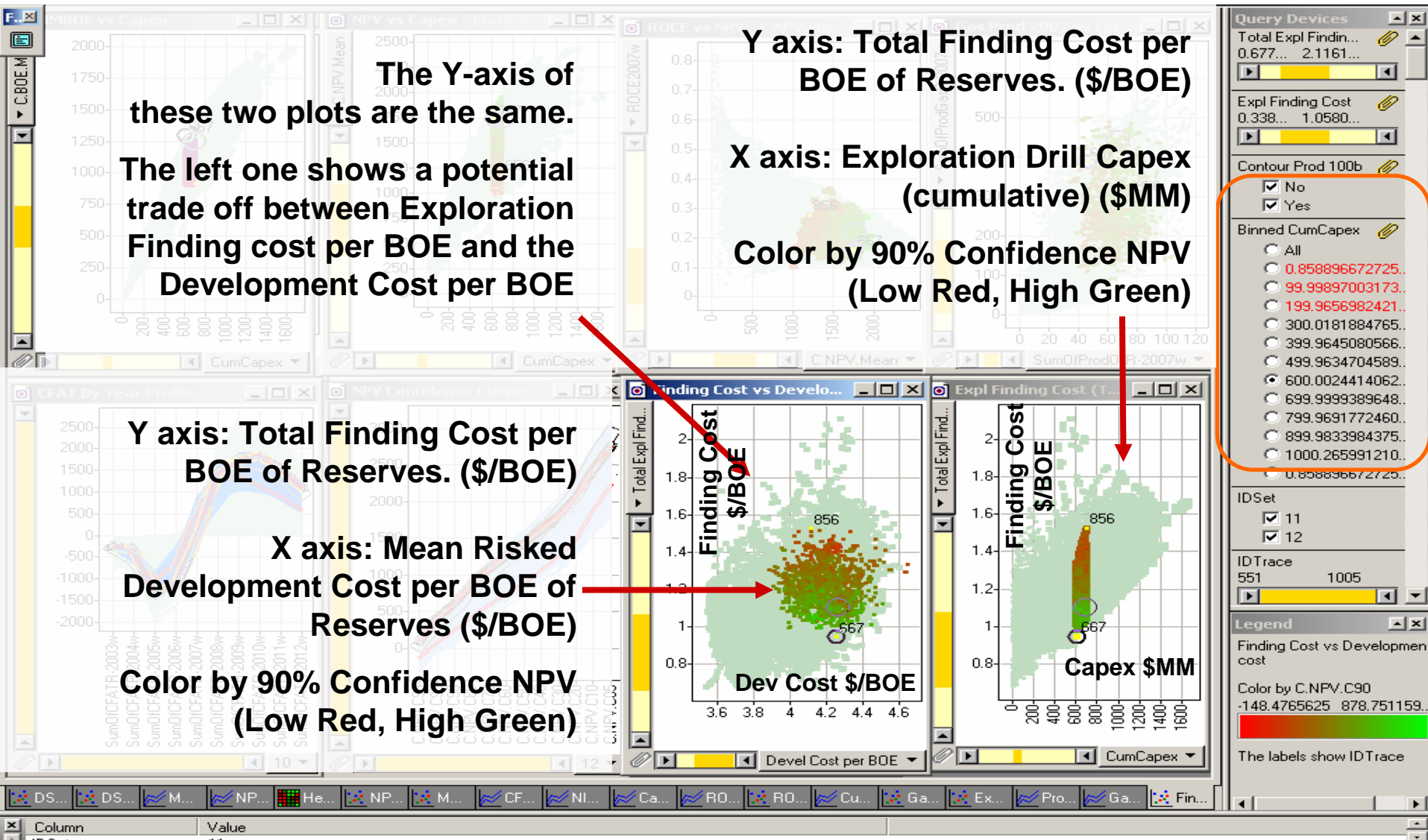
ROCE-2007 vs NPV; 2007 Gas Production vs Oil Production





# Orientation: What are the Plots in the Display?

## Finding Cost vs Capex; Finding Cost vs Development Cost



# Orientation: What are the Plots in the Display?

## Cash Flow by Year; NPV Confidence

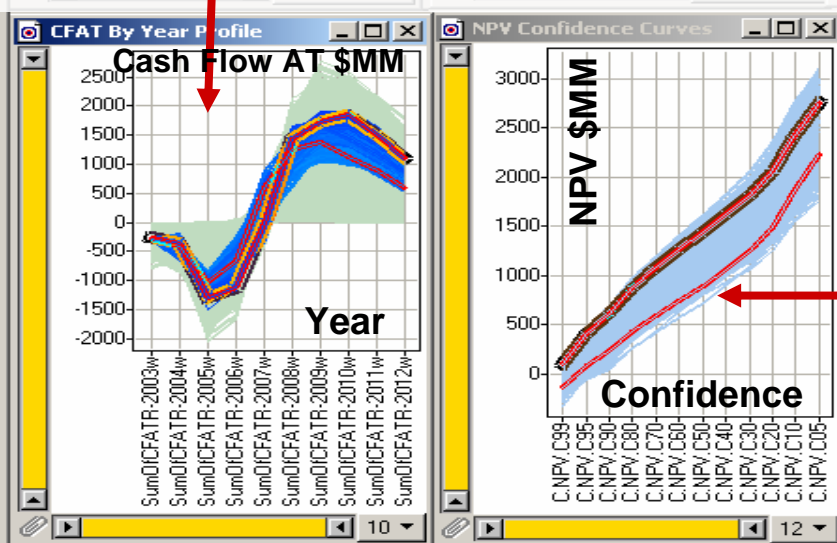
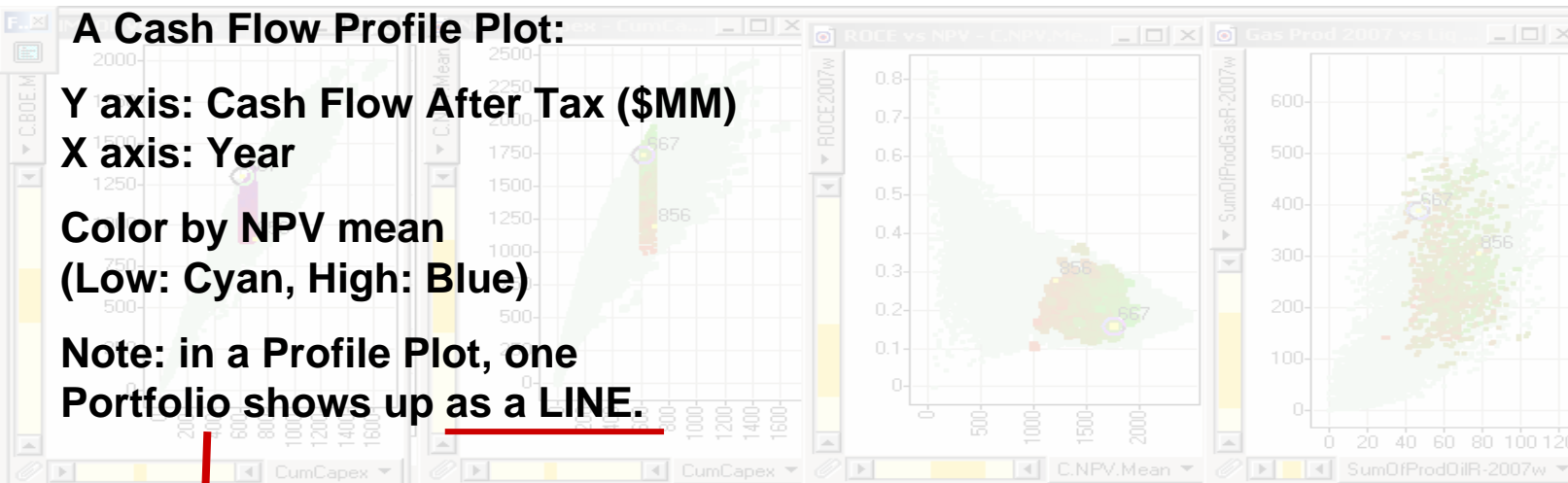
### A Cash Flow Profile Plot:

**Y axis: Cash Flow After Tax (\$MM)**

**X axis: Year**

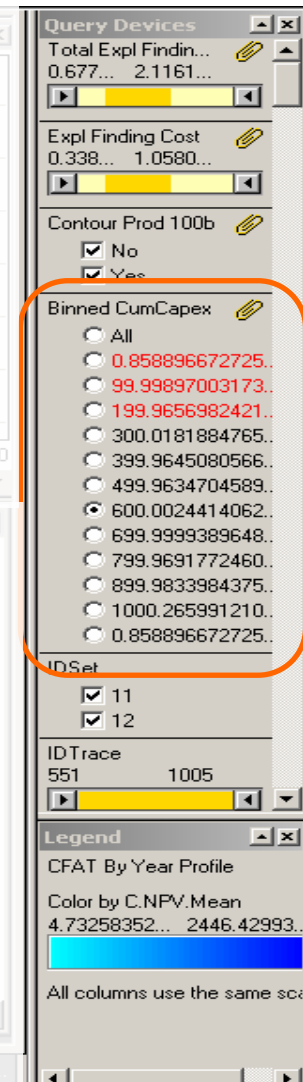
**Color by NPV mean  
(Low: Cyan, High: Blue)**

**Note: in a Profile Plot, one  
Portfolio shows up as a LINE.**

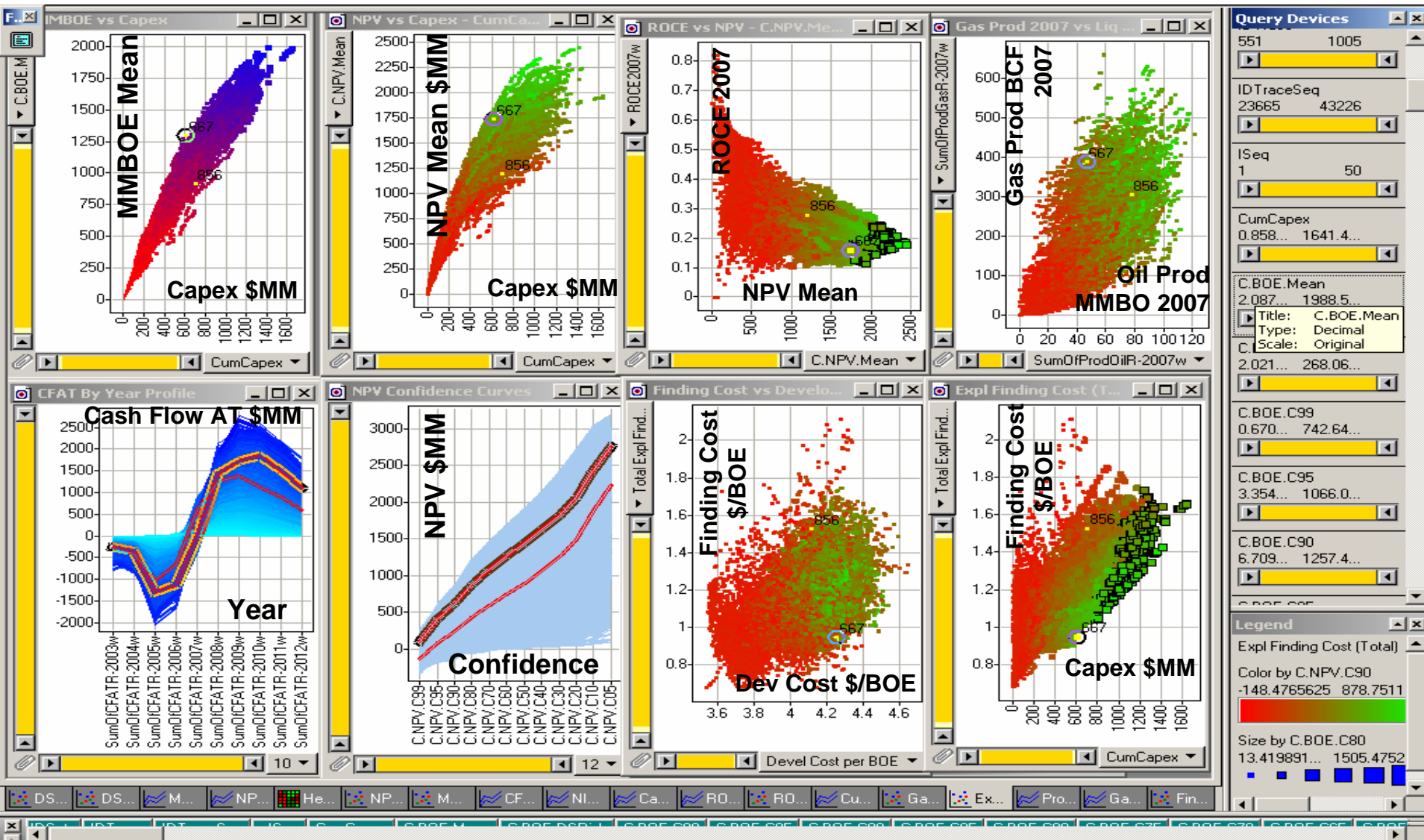


**The NPV Confidence Curve**  
**Y axis: Risked NPV (\$MM 2004)**  
**X axis: The Confidence level that  
we will exceed the Y value.**

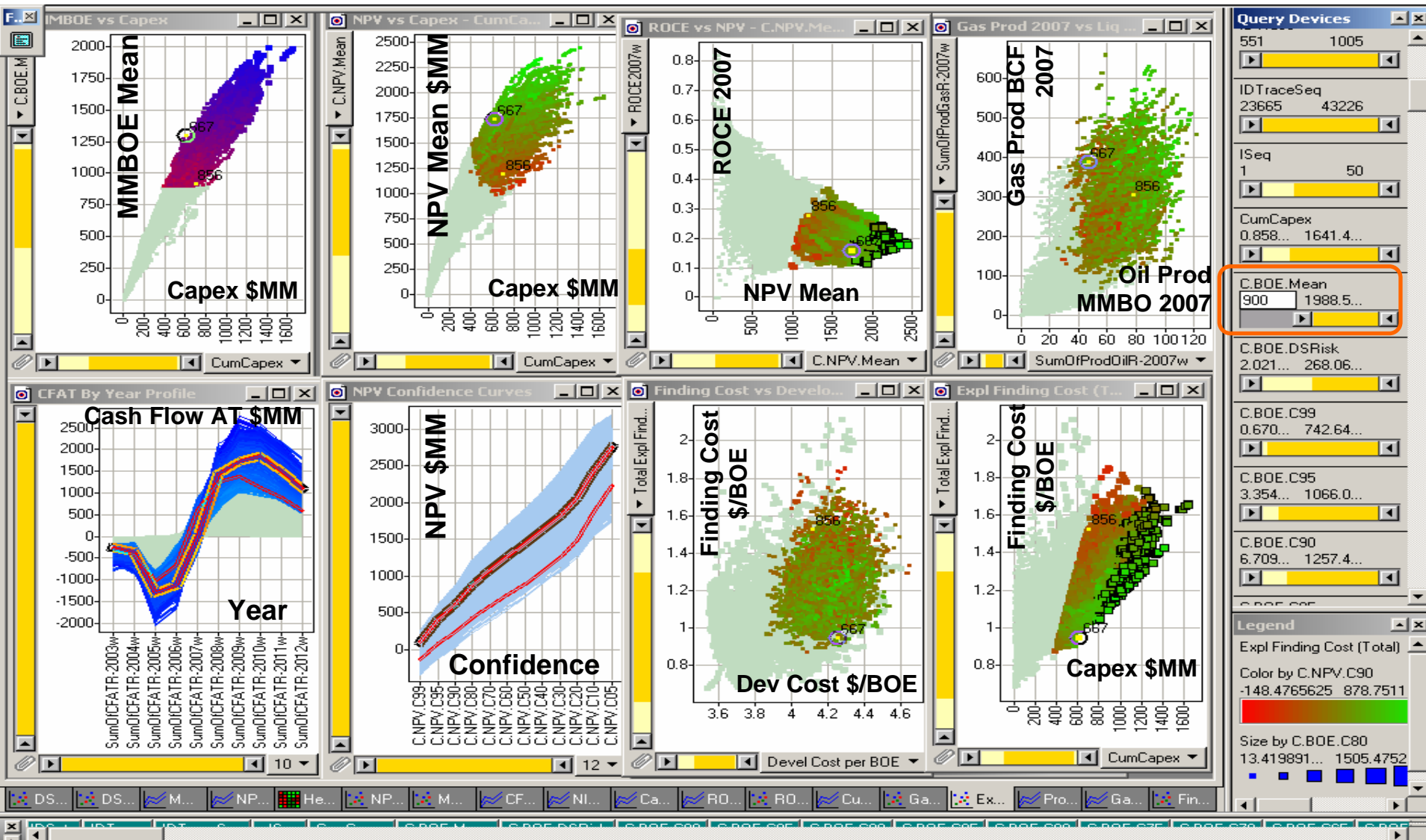
**Color is constant pale blue.  
Deselected portfolios are NOT  
shown**



# Step 1: Display all the available Portfolios. (Ctrl-R)

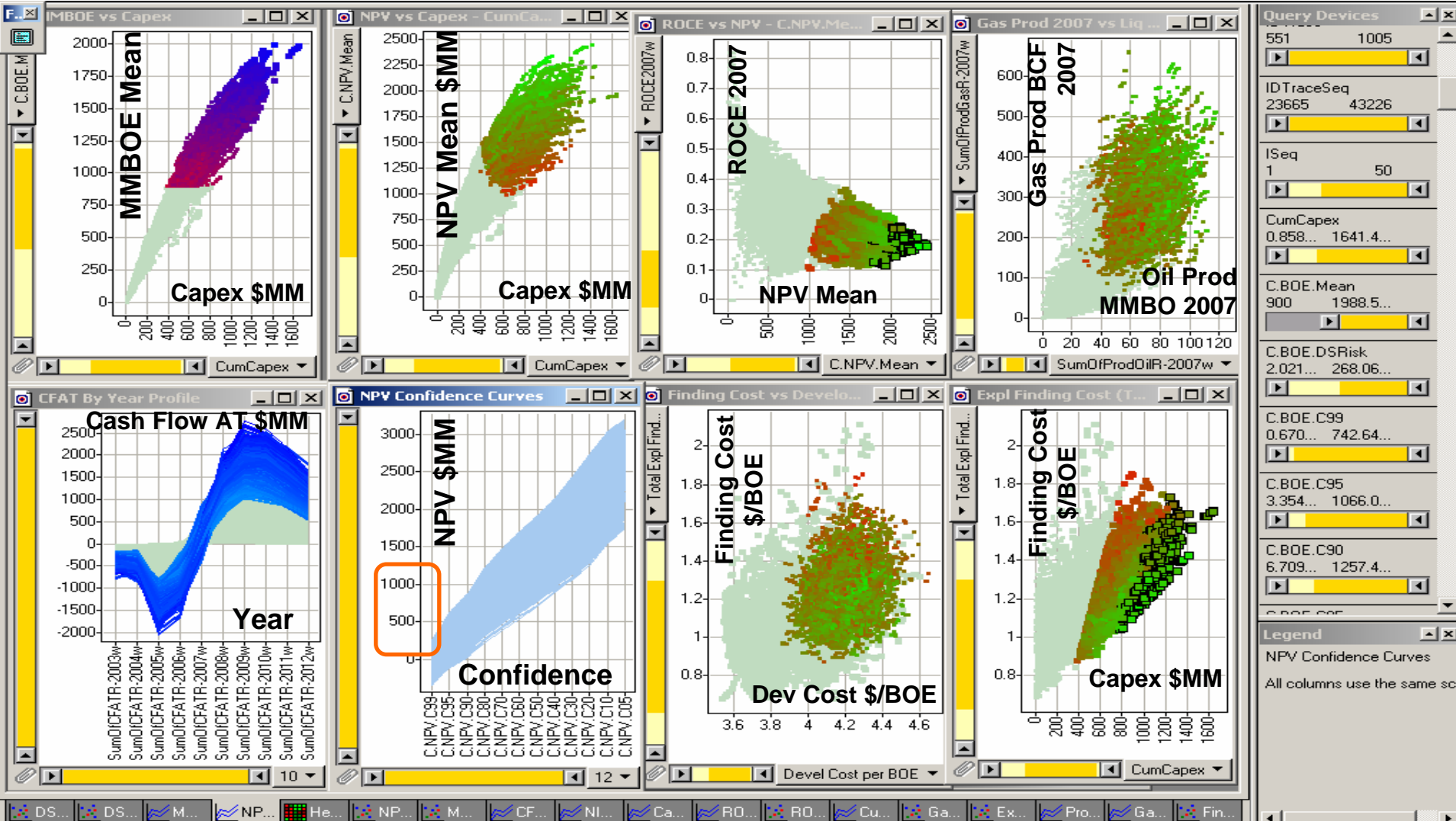


## Step 2: Apply a minimum Mean Reserves Required.

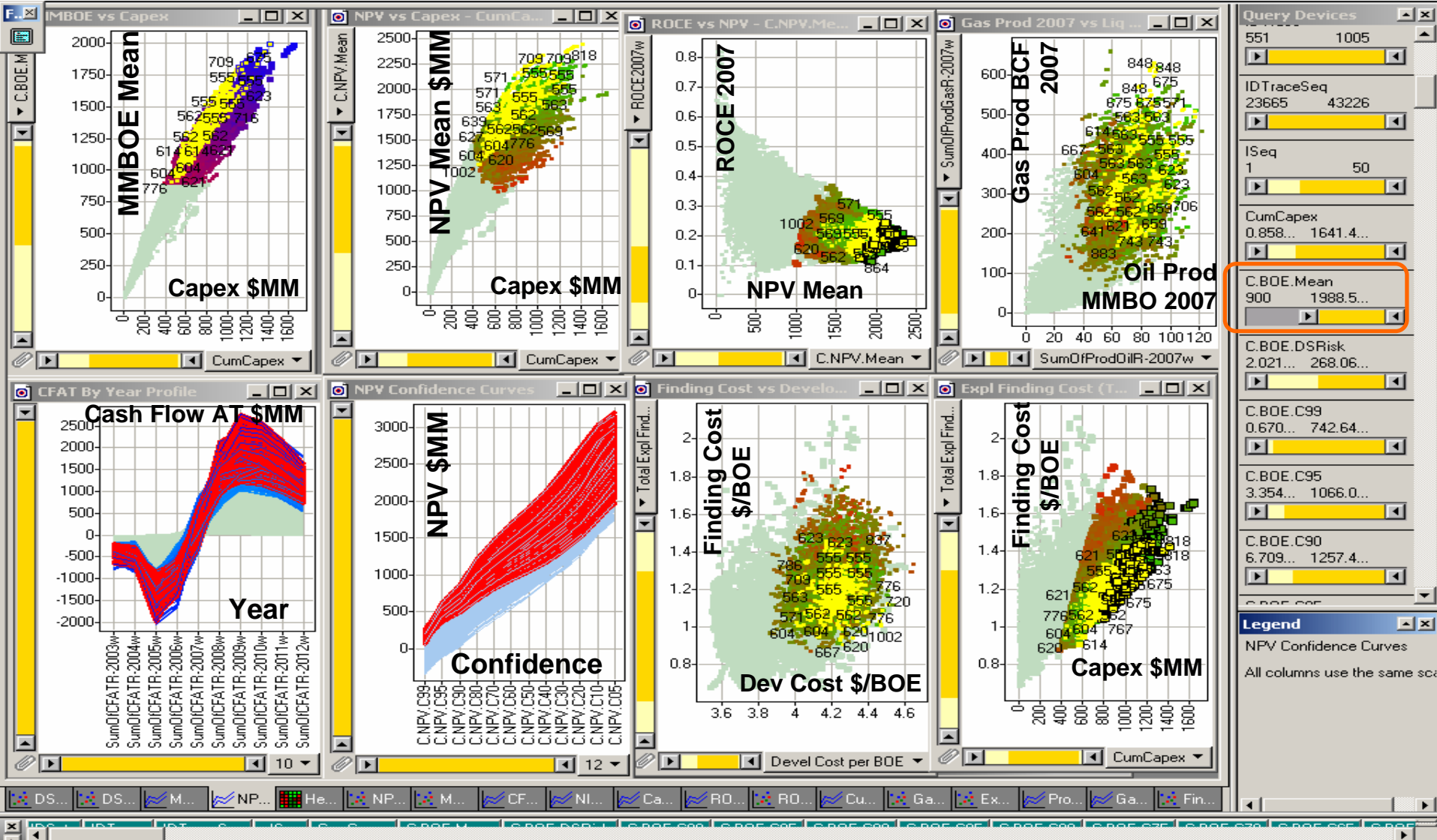




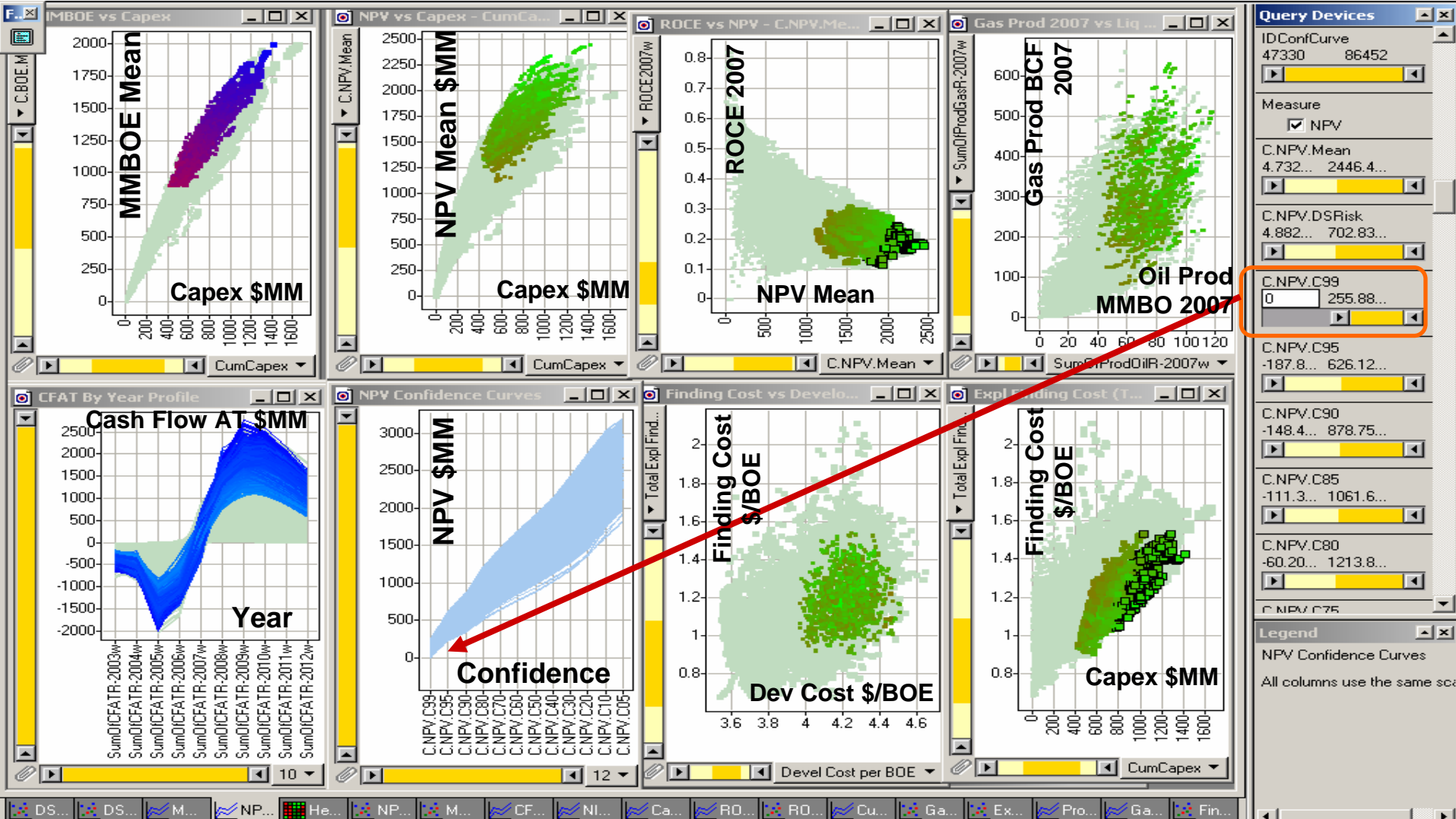
Step 3: If we require portfolios with a 99% Confidence of >0 NPV, are there good portfolios?



Step 3: If we require portfolios with a  
99% Confidence of >0 NPV, are there good portfolios? YES.

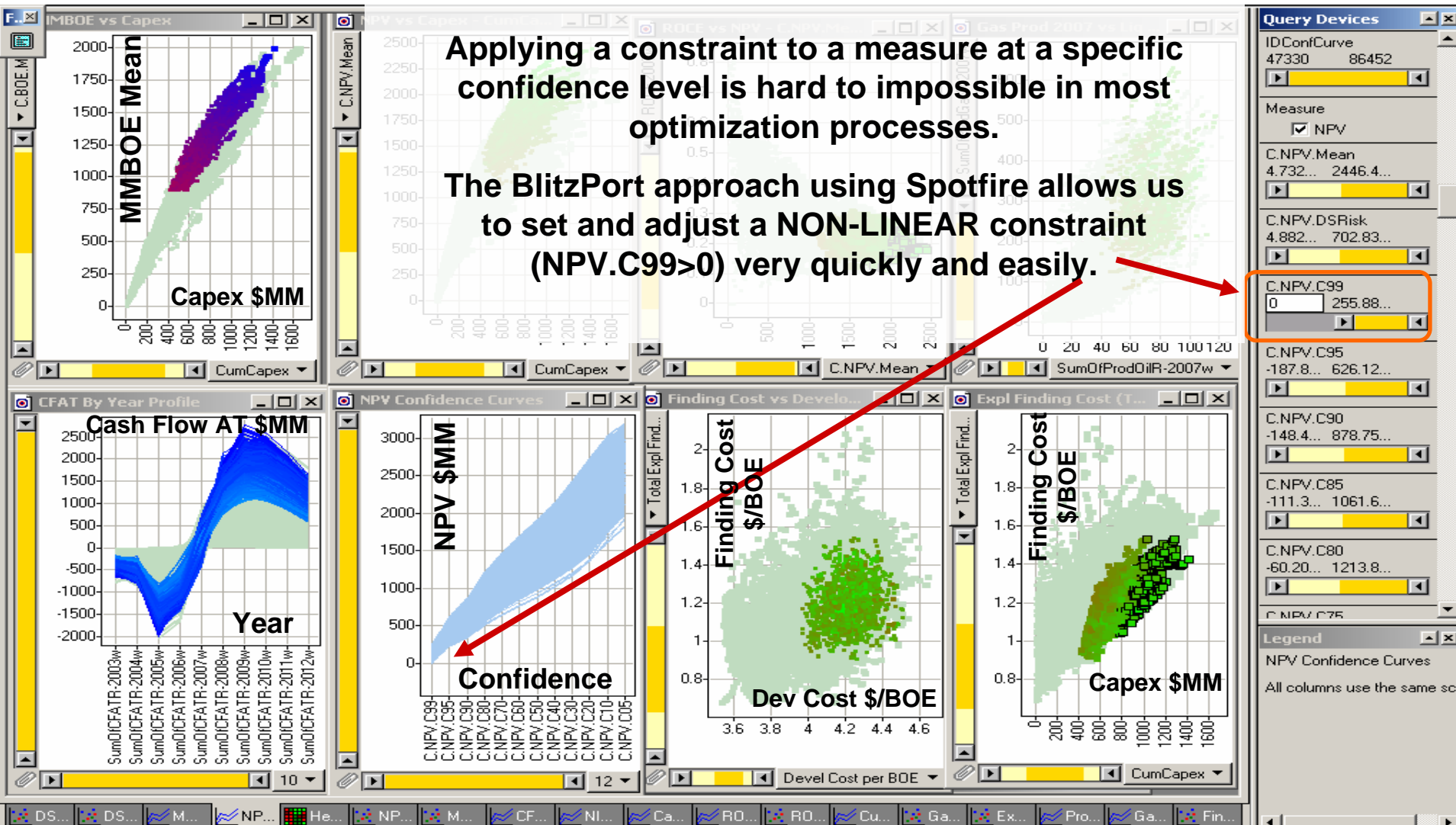


# Step 4: Require that 99% Confidence of NPV > 0

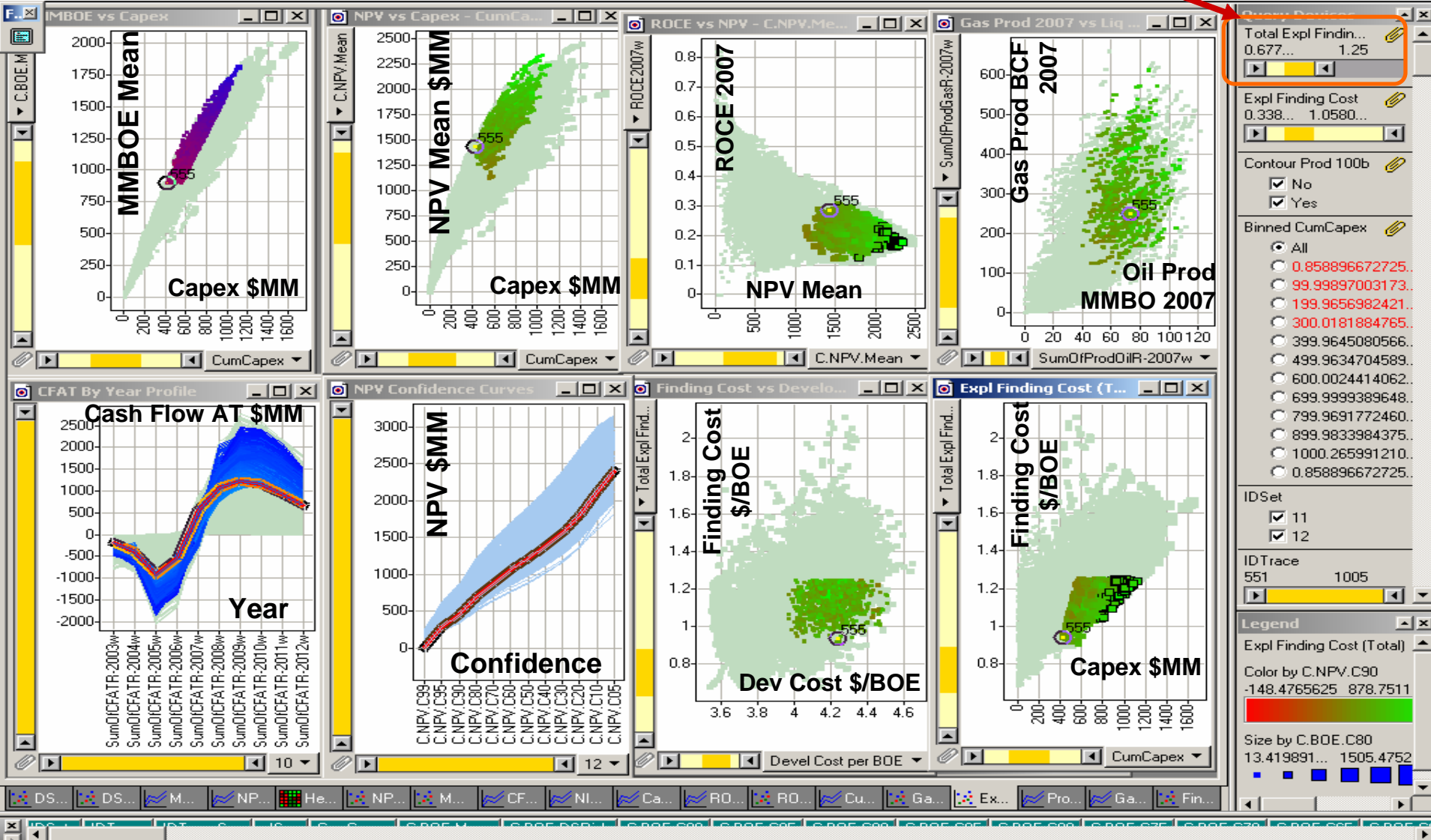




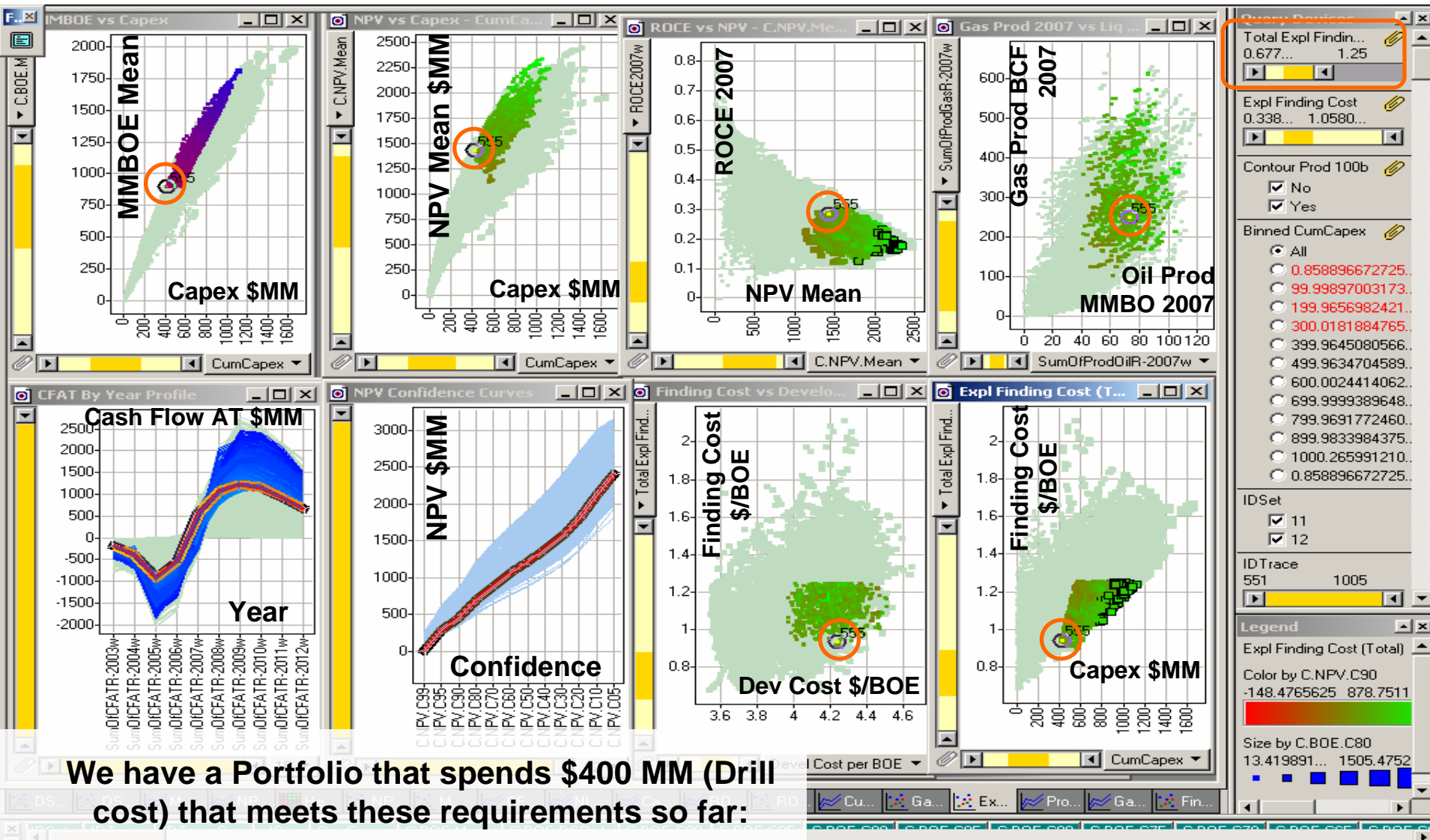
## Step 4: Require that 99% Confidence of NPV > 0



# Step 5: Top quartile performance means Exploration Finding Cost must be $\leq 1.25$



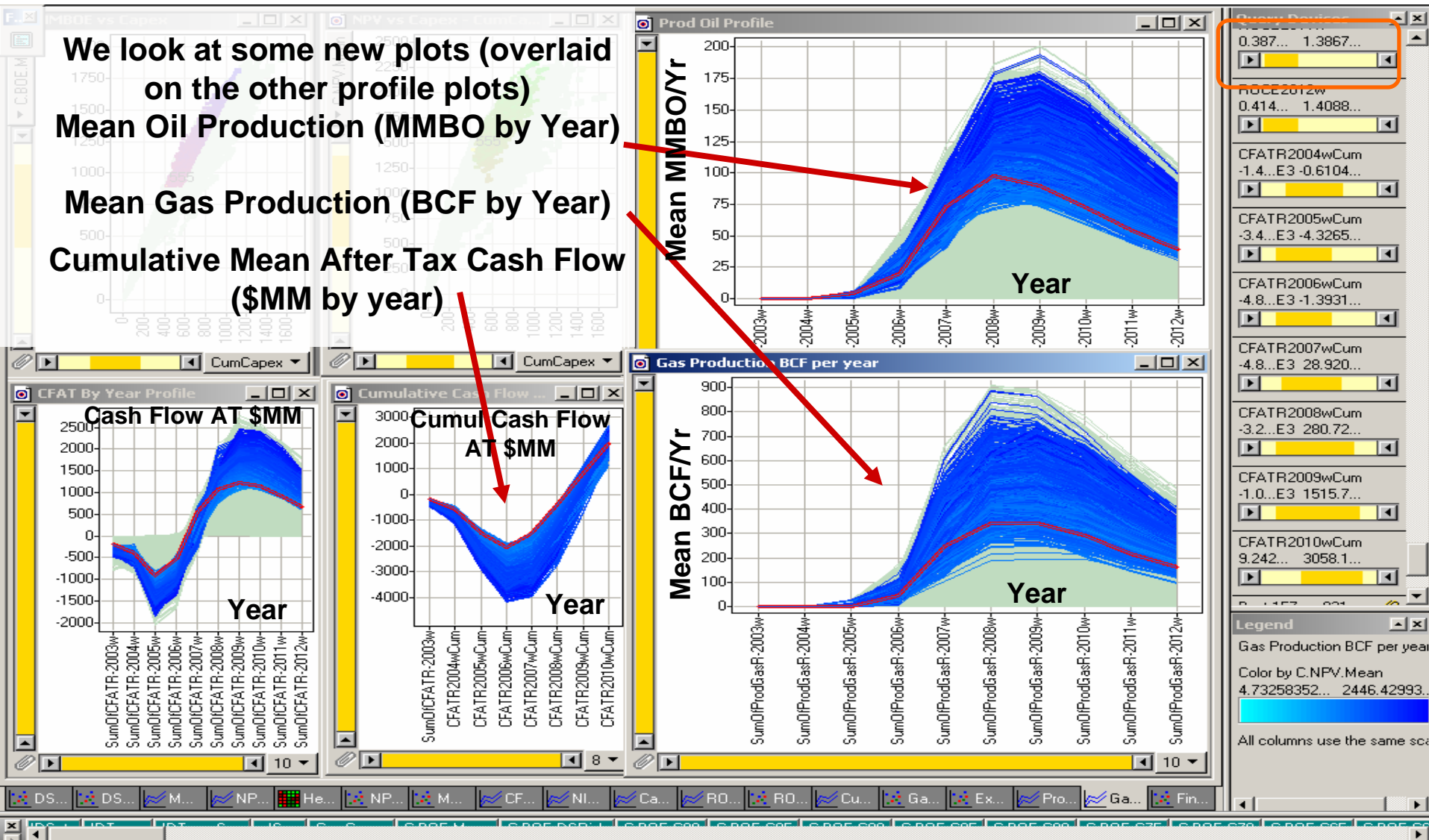
# Step 5: Top quartile performance means Exploration Finding Cost must be $\leq 1.25$



We have a Portfolio that spends \$400 MM (Drill cost) that meets these requirements so far:

# Step 6: Place Limits on Total Negative Cash Flow

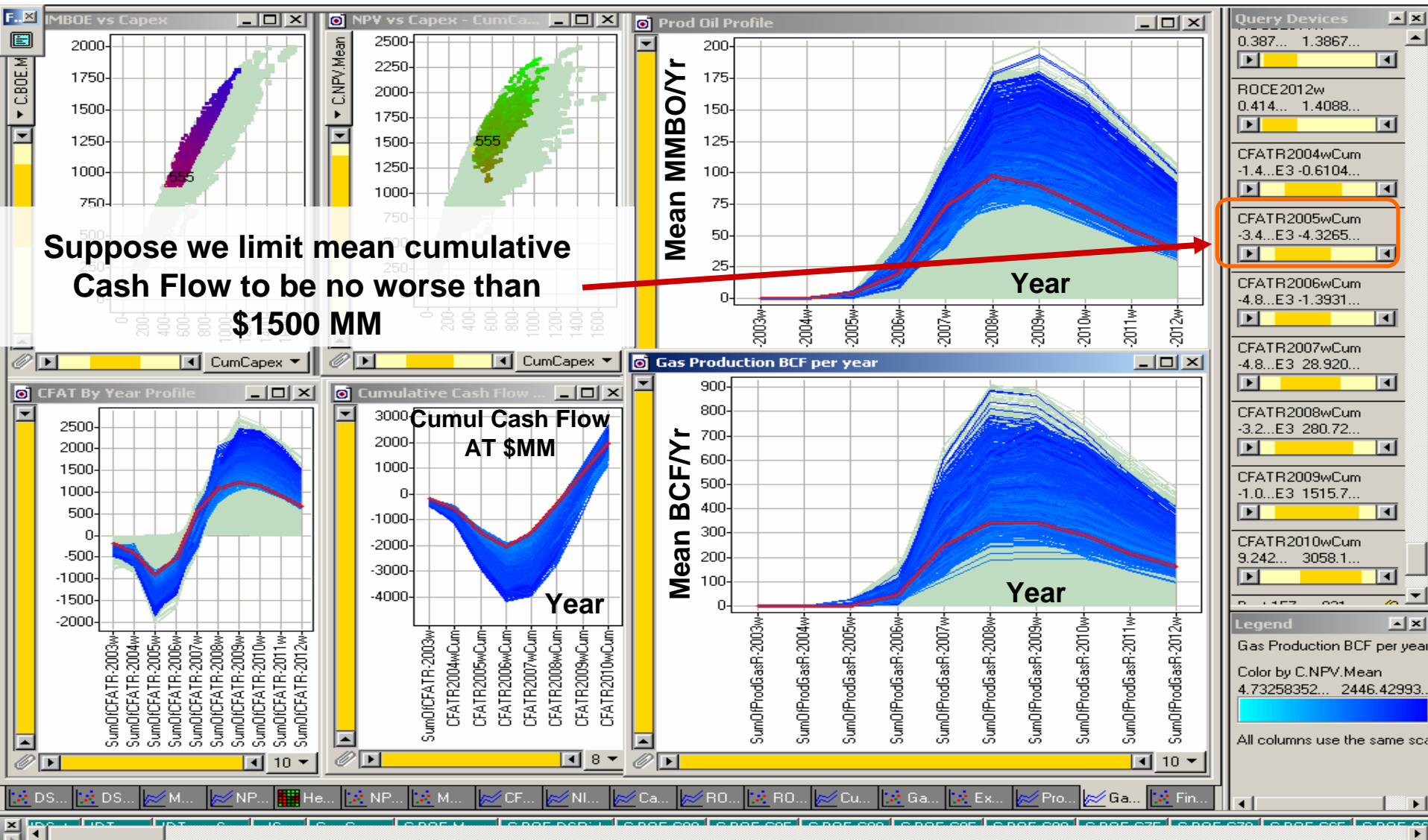
We look at some new plots (overlaid on the other profile plots)  
 Mean Oil Production (MMBO by Year)  
 Mean Gas Production (BCF by Year)  
 Cumulative Mean After Tax Cash Flow (\$MM by year)



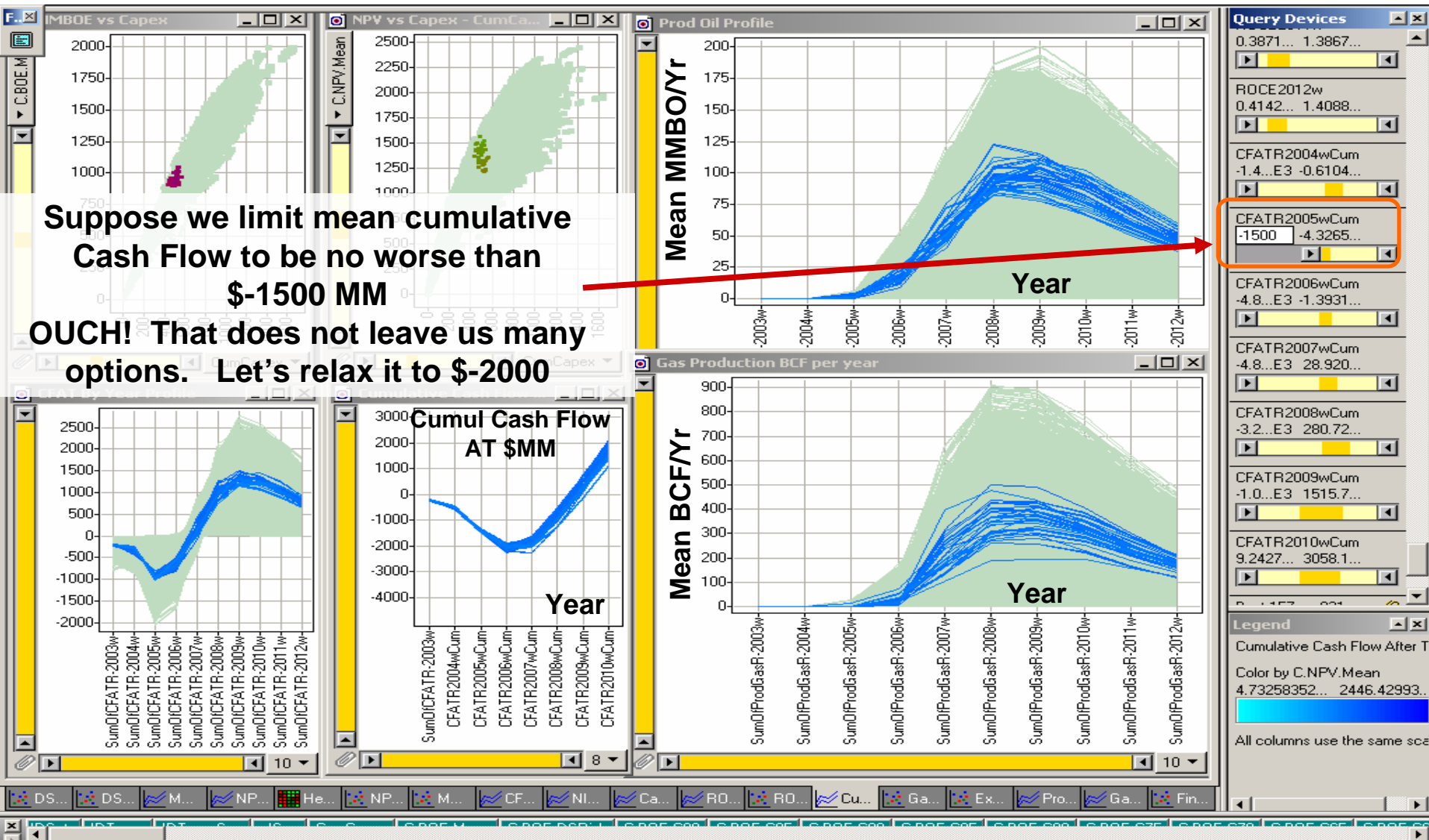


## Step 6: Place Limits on Total Negative Cash Flow

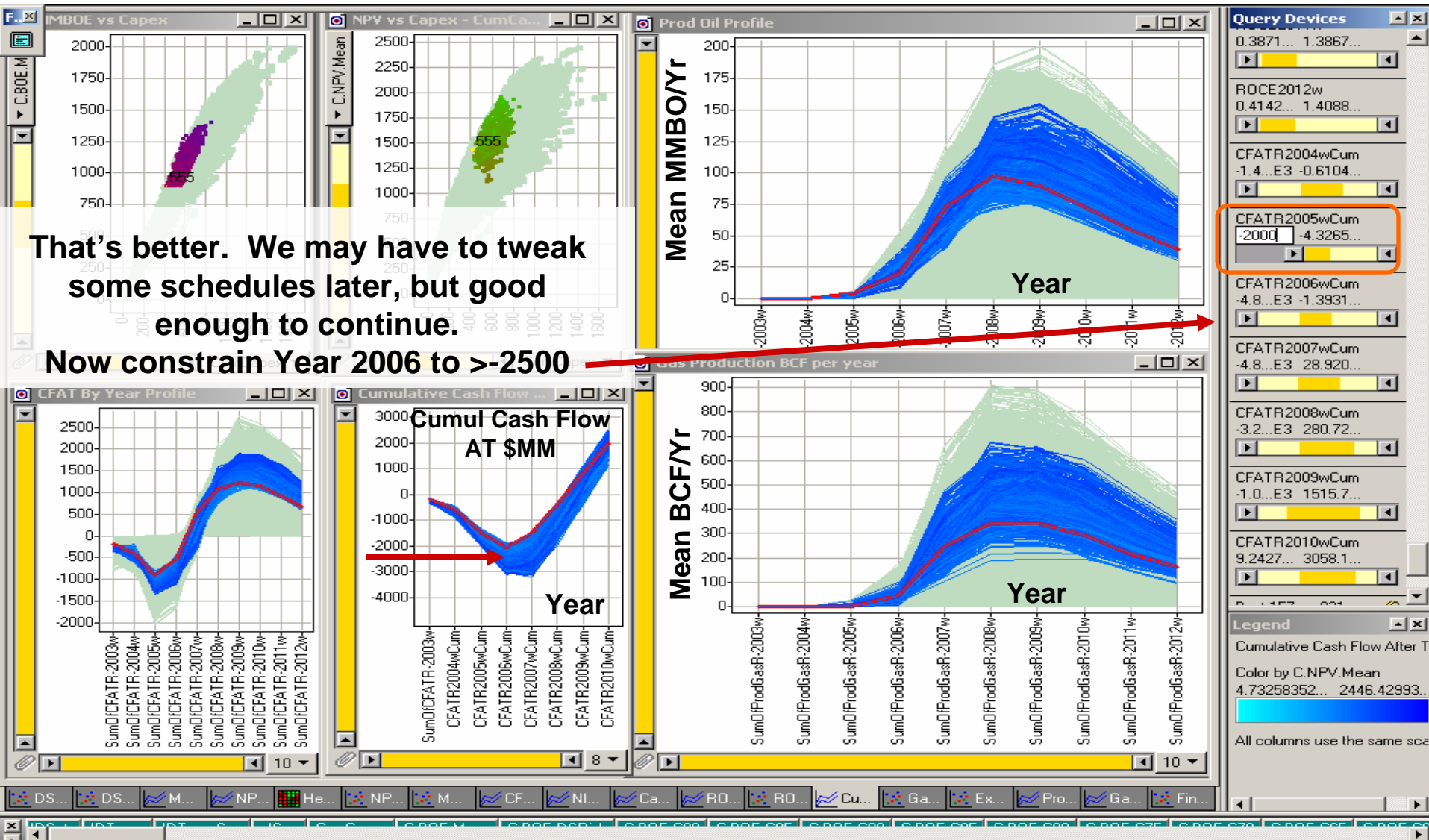
Suppose we limit mean cumulative Cash Flow to be no worse than \$1500 MM



# Step 6: Place Limits on Total Negative Cash Flow

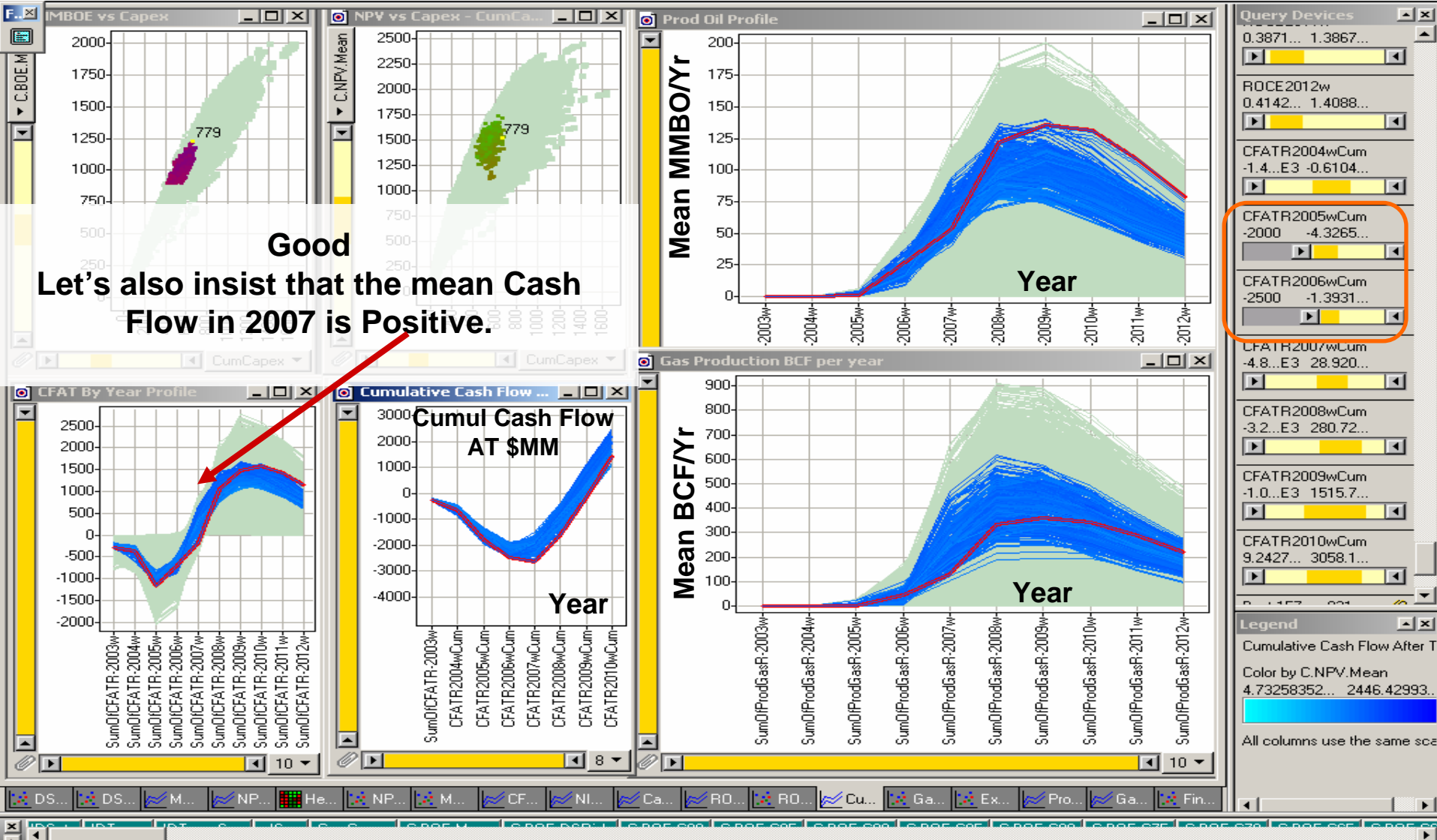


## Step 6: Place Limits on Total Negative Cash Flow

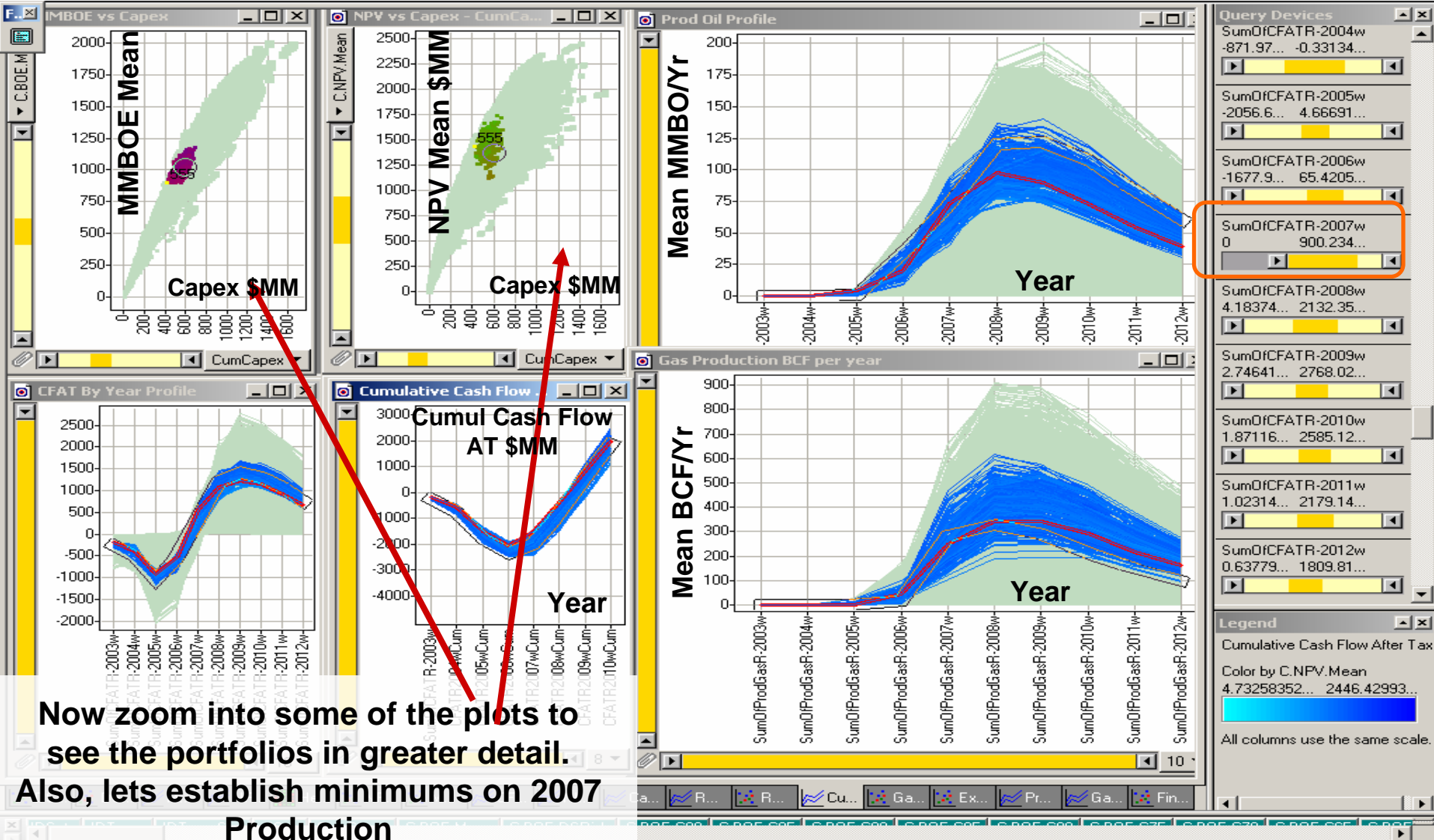




# Step 6: Place Limits on Total Negative Cash Flow



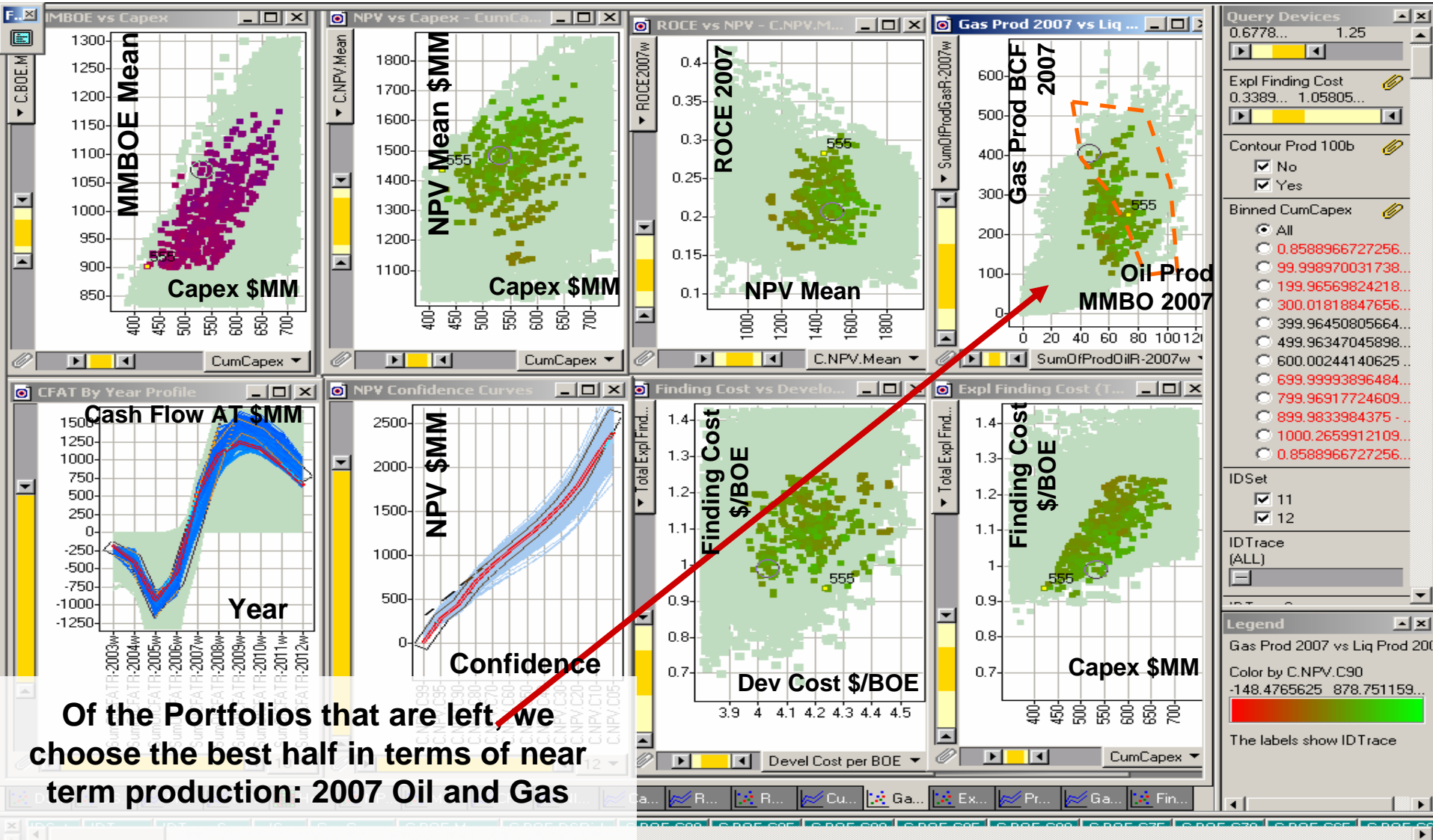
## Step 6: Place Limits on Total Negative Cash Flow



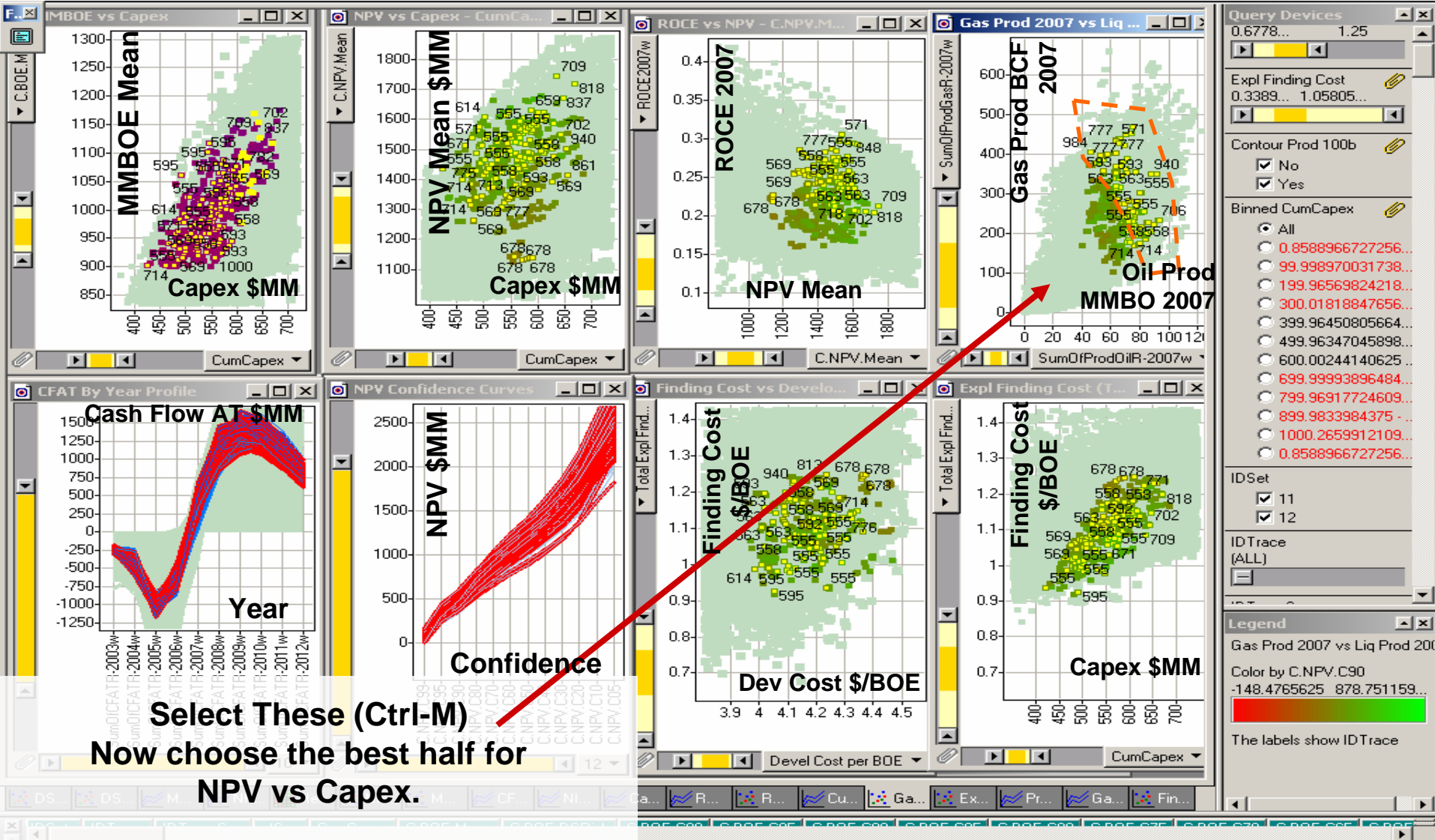
Now zoom into some of the plots to see the portfolios in greater detail.

Also, let's establish minimums on 2007 Production

# Step 7: Zoomed in. Choose Best 2007 Production requirements



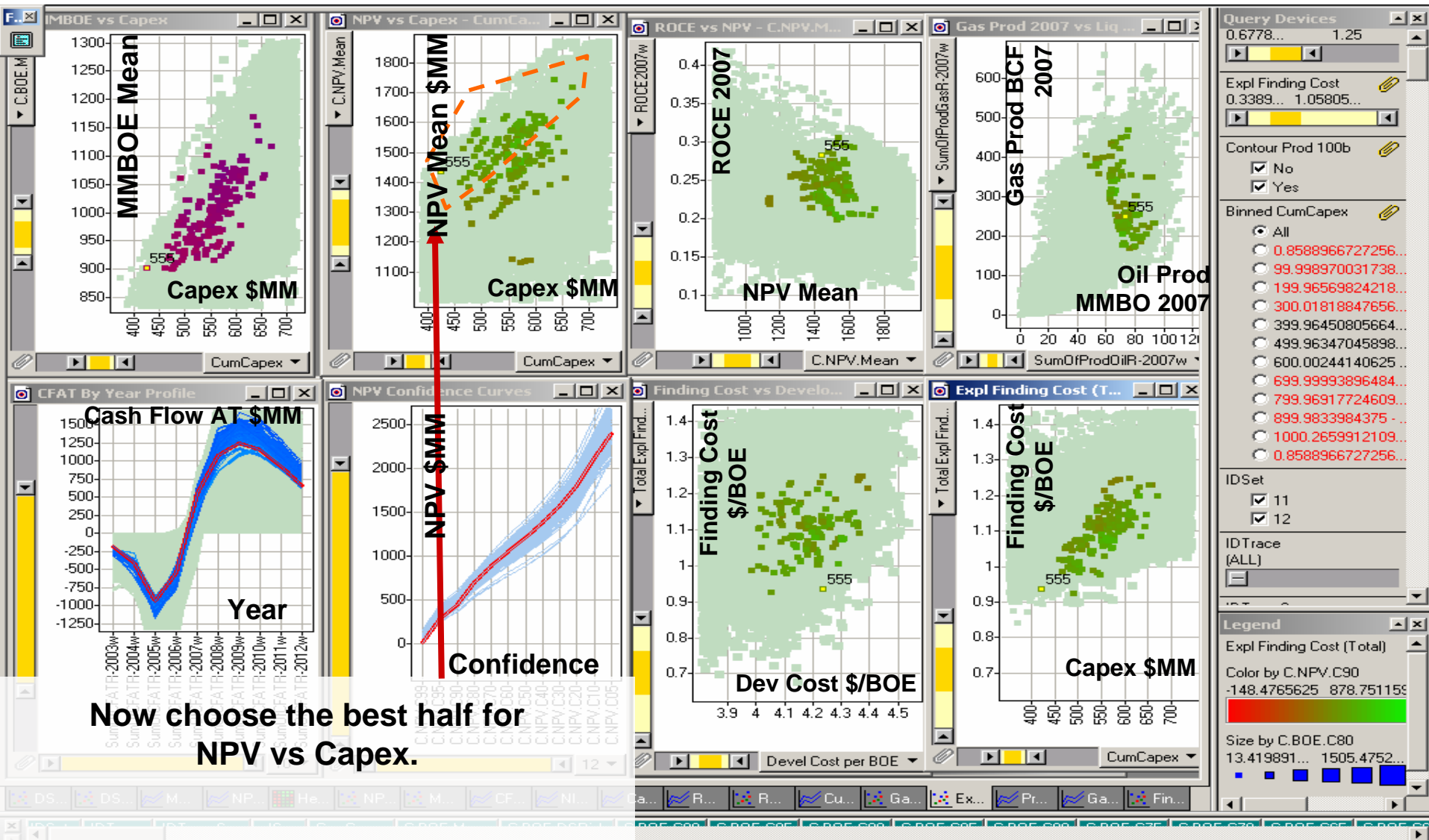
# Step 7: Zoomed in. Choose Best 2007 Production requirements



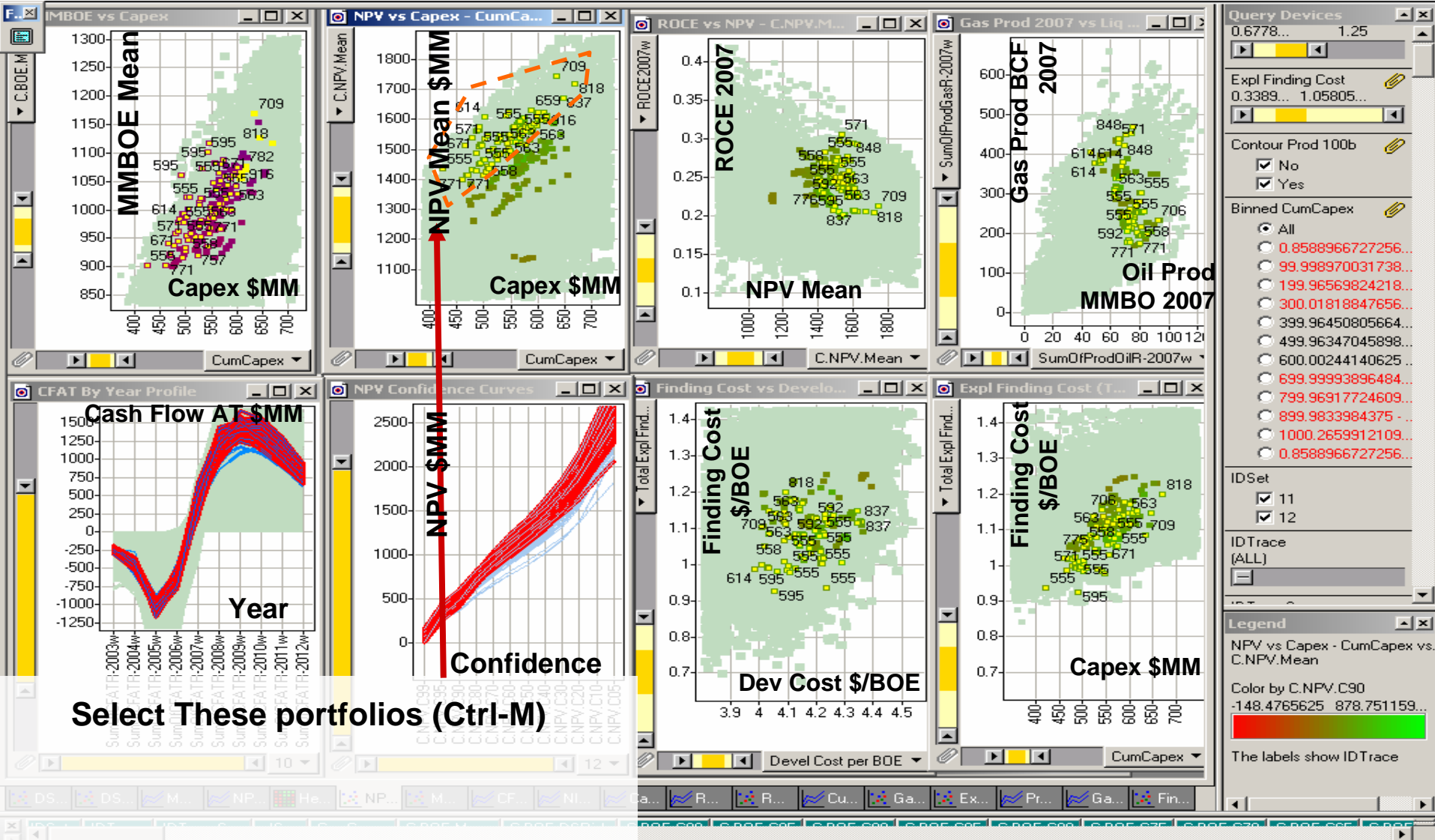
Select These (Ctrl-M)  
Now choose the best half for  
NPV vs Capex.



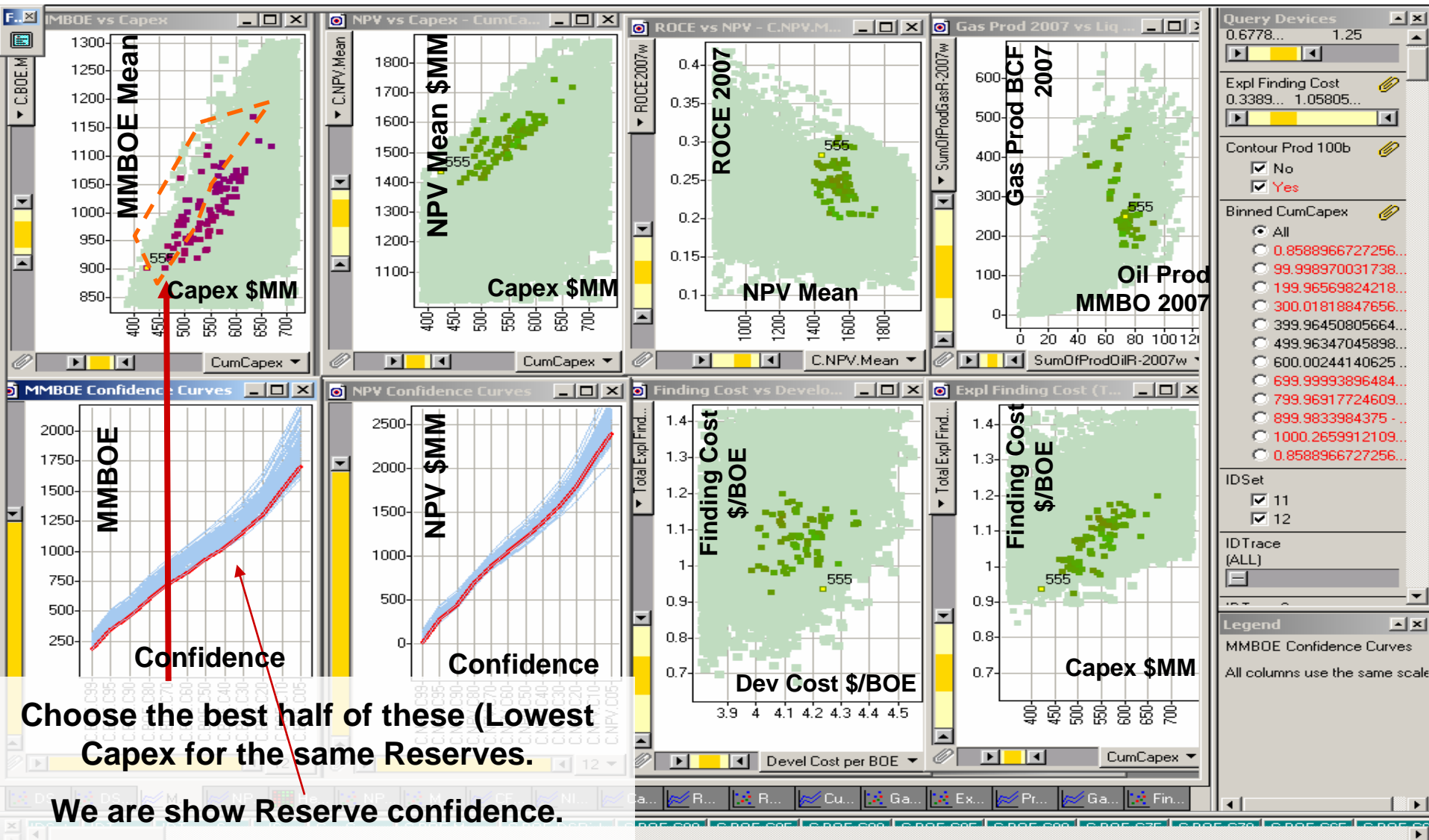
# Step 8: Zoomed in. Choose Best half of NPV vs Capex



# Step 8: Zoomed in. Choose Best half of NPV vs Capex

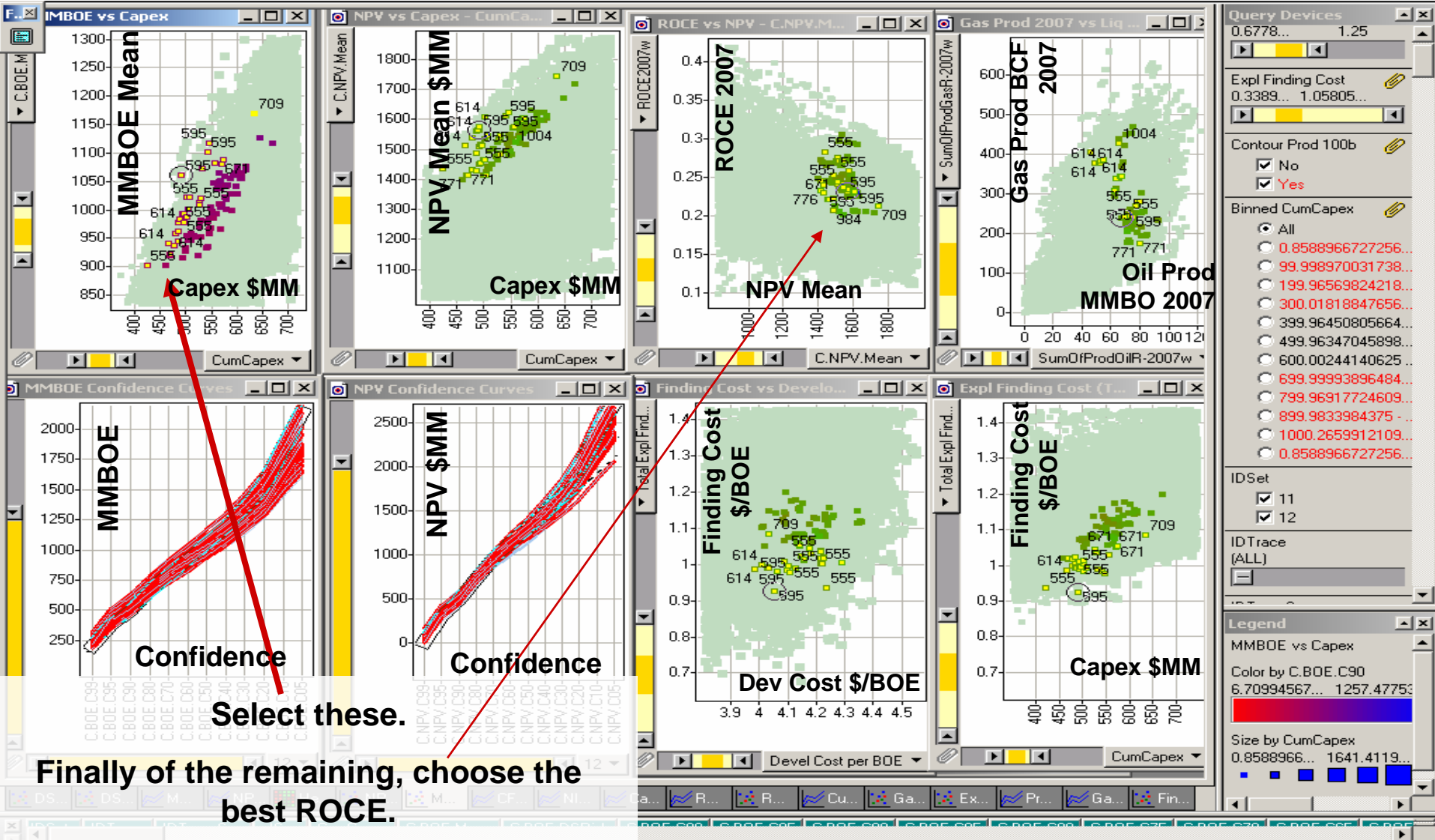


# Step 9: Zoomed in. Choose Best half of Reserves vs Capex

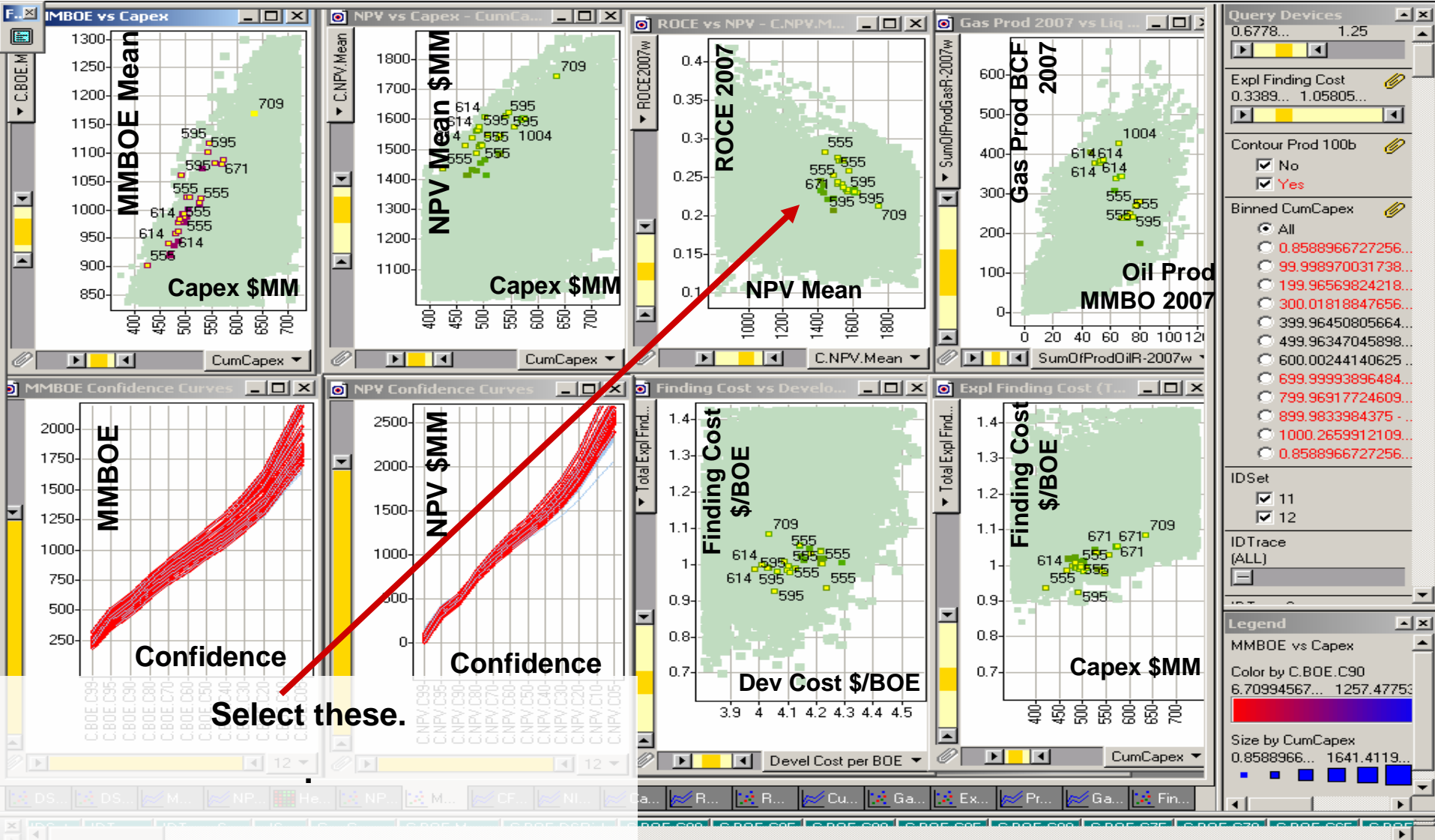




# Step 9: Zoomed in. Choose Best half of Reserves vs Capex

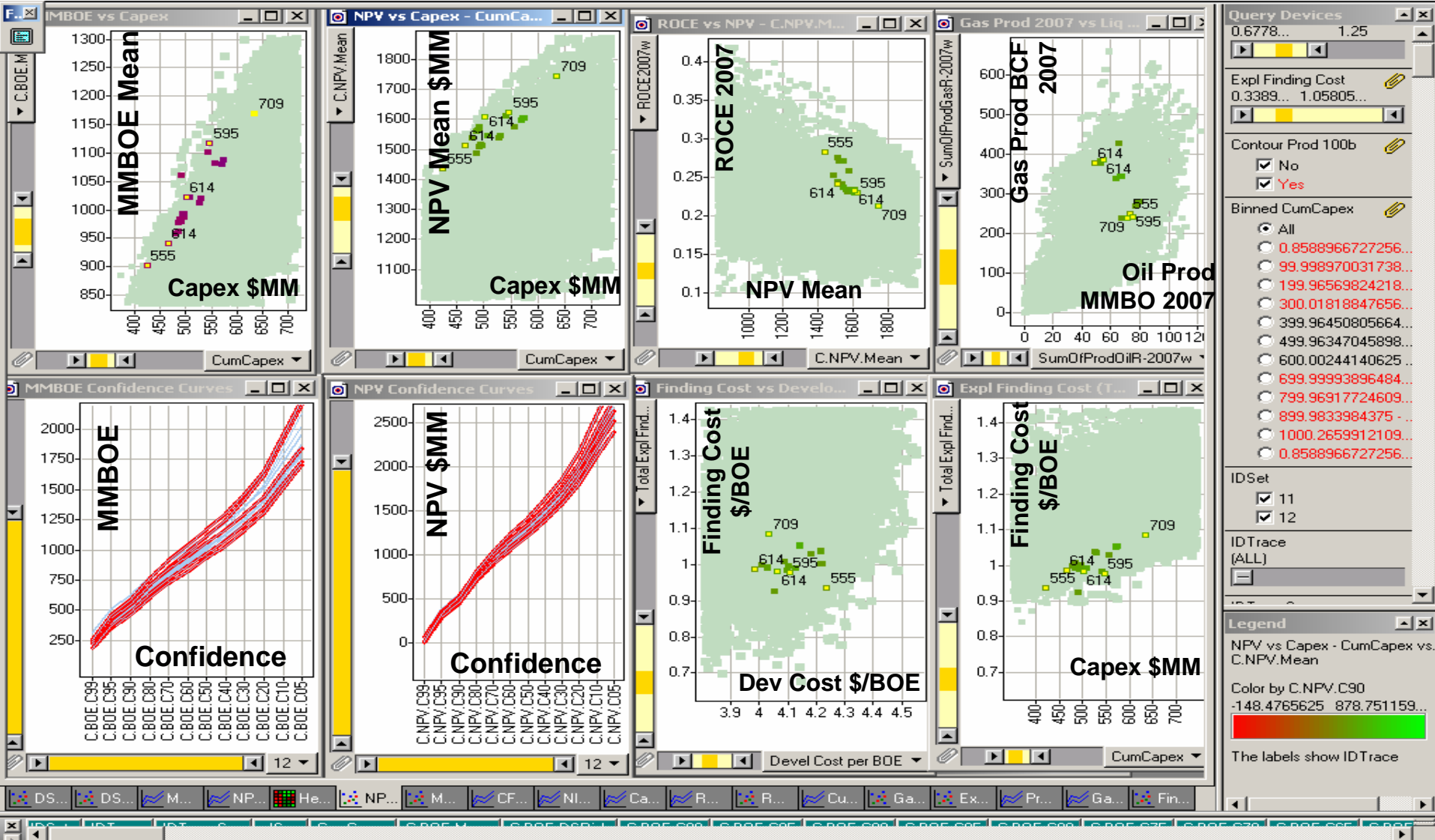


# Step 10: Zoomed in. Choose Best half of ROCE vs NPV



# Step 11: Zoomed in.

## Choose the Best Portfolios at different capex levels



# Step 12: Use the Project Census tool find which Projects are funded in the selected portfolios.

Expl. Capex where Opportunity was funded  
By Portfolio Trace

Capex:			635	547	501	465	423
Order Desc	C.NPV.Mean		1745	1624	1610	1514	1435
Oport Clave	Oportunidad	Count	709	595	614	614	555
578	Jackson	4	8	5	5	5	8
561	Williams	4	47	65	65	65	67
498	Gehrig	4	269	129	174	174	153
422	Rickey	4	293	200	298	298	156
564	Chance	3	9	6			9
541	Appling	3	27		45	45	74
440	Johnson	3	145	173	111	111	
446	Yount	3	292	198	220	220	
590	Clemens	3	331		212	212	224
556	Aaron	3	283		287	287	199
512	Clemente	3	394	360			286
429	Hornsby	3	486	349			302
490	Palmer	3	623	454			576
436	Marichal	2	54	77			
557	Griffey, Jr.	2	58				98
563	Bench	2		88	97	97	
546	Smith	2		215	245	245	
492	Hubbell	2		300			241
520	Alexander	2		222	407	407	
479	Cobb	2		250	387	387	
582	Robinson	2	415		319	319	
412	DiMaggio	2		388			351
464	Kaline	2			445	445	323
508	Reggie	2	461	400			
475	Fingers	2			501	501	365
569	Heilmann	2		547	572	572	
481	Young	2		569			620
601	Waner	1					231
500	Waner	1					231

By Portfolio Trace

Capex:			635	547	501	465	423
Order Desc	C.NPV.Mean		1745	1624	1610	1514	1435
Oport Clave	Oportunidad	Count	709	595	614	614	555
518	Lajoie	1			330	330	
517	Terry	1					355
528	Collins	1					395
600	Brock	1					423
585	Simmons	1		426			
480	Schmidt	1			438	438	
411	Cochrane	1	450				
567	Boggs	1			462	462	
530	Berra	1			479	479	
410	Seaver	1		480			
598	Ripken, Jr.	1			485	485	
419	Mize	1		491			
455	Baker	1			492	492	
607	Wagner	1					491
510	Plank	1					495
602	Faber	1			525	525	
448	Ryan	1					526
504	Stargell	1					530
478	Eckersley	1		542			
418	Ford	1	542				
507	Campanella	1					567
499	Yastrzemski	1	568				
606	Gibson	1			568	568	
608	Foxx	1	596				
450	Ott	1		611			
548	Paige	1		623			
570	Gwynn	1	635				
		0					
		0					

We will zoom into this part of the table to describe it in detail.

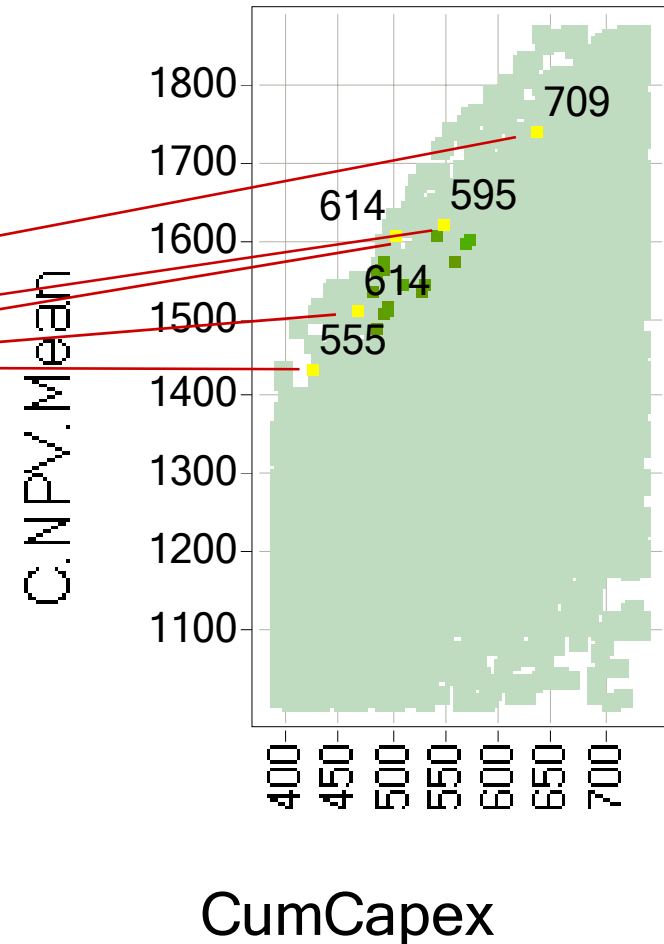
# What the Project Census Drill down tells us....

The Census is an Excel workbook with VBA subroutines that reads which records are marked in Spotfire.

It then creates an SQL query to retrieve the funded projects for those portfolios, organizes and formats the report.

## NPV vs Capex -

			Expl. Capex where Opportunity was funded By Portfolio Trace				
Capex:			635	547	501	465	423
Order Desc		C.NPV.Mean	1745	1624	1610	1514	1435
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436	Marichal	2	54	77			
557	Griffey, Jr.	2	58				98
563	Bench	2		88	97	97	
546	Smith	2		215	245	245	





# What the Project Census Drill down tells us....

Portfolios (by Trace Number and Capex)

Ordered by NPV decending left to right

Expl. Capex where Opportunity was funded  
By Portfolio Trace

Capex:			635	547	501	465	423
Order Desc	C.NPV.Mean		1745	1624	1610	1514	1435
Oport Clave	Oportunidad	Count	709	595	614	614	555
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557	Griffey, Jr.	2	58				98
563	Bench	2		88	97	97	
546	Smith	2		215	245	245	

Portfolio Capex

NPV of Portfolio

Trace Number.

The 5 Portfolio points  
come from 4 Portfolio  
Traces.

Trace 614 was picked  
at two Portfolios with  
different Capex Levels.



# What the Project Census Drill down tells us....

Portfolios (by Trace Number and Capex)

Ordered by NPV decending left to right

Expl. Capex where Opportunity was funded  
By Portfolio Trace

Capex:			635	547	501	465	423
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563	Bench	2		88	97	97	
546	Smith	2		215	245	245	

Projects are in Rows

The cells show the  
Capex level where that  
Project is funded in  
that Portfolio.

The Lower the number,  
the stronger the  
project.

The Higher up in the list,  
the better the project helps meat your goals....

Portfolios (by Trace Number and Capex)

Ordered by NPV decending left to right

Expl. Capex where Opportunity was funded  
By Portfolio Trace

Capex:			635	547	501	465	423	
Order Desc			C.NPV.Mean	1745	1624	1610	1514	1435
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436	Marichal	2	54	77				
557	Griffey, Jr.	2	58				98	
563	Bench	2		88	97	97		
546	Smith	2		215	245	245		

The Projects are  
sorted first by the  
Number of Traces that  
Fund the project.

Next by the average  
Capex level that  
funded the project.

These 4 projects were  
funded in all four  
Traces.

These 9 Projects were  
funded in 3 of 4 traces.

The Higher up in the list,  
the better the project helps meat your goals....

Portfolios (by Trace Number and Capex)

Different Capex Levels.

Expl. Capex where Opportunity was funded  
By Portfolio Trace

Capex:			635	547	501	465	423
Order Desc	C.NPV.Mean		1745	1624	1610	1514	1435
Oport Clave	Oportunidad	Count	709	595	614	614	555
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436	Marichal	2	54	77			
557	Griffey, Jr.	2	58				98
563	Bench	2		88	97	97	
546	Smith	2		215	245	245	

A Grey number means  
that the project was  
funded in a Trace  
higher than the Capex  
for that selected  
portfolio

It is useful when  
comparing portfolios  
of different capex  
levels.

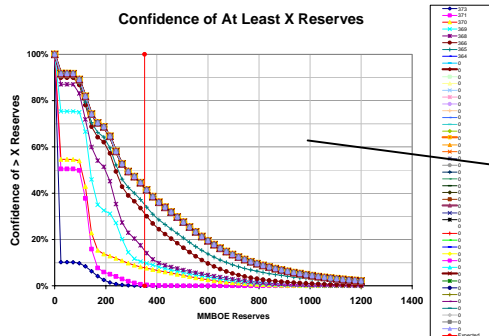
## Spotfire Sheds Light on a Complicated Problem

- Woolsey's 1<sup>st</sup> Law
  - “A Manager would rather live with a problem he cannot solve than accept a solution he does not understand.”
- Woolsey's 2<sup>nd</sup> Law
  - “A Manager does not want, and will not pay for, an OPTIMUM solution. He wants to be better off now, as quickly and as cheaply as possible.

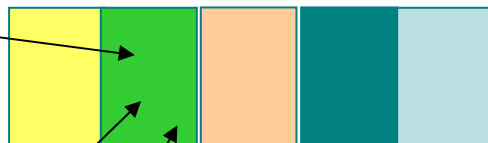
\*Dr. R. E. D. Woolsey, Professor of OR/MS, Colorado School of Mines  
Woolsey & Swanson, Operations Research for Immediate Applications, Harper & Row, 1974.

# Spotfire Communicates Portfolio Decisions. How and where the Portfolios are built matters not.

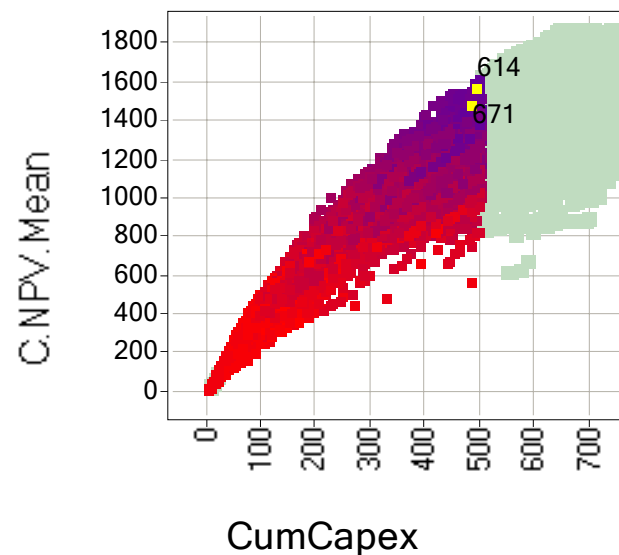
## BlitzPort MultiField



## Prospect and Portfolio Database



## NPV vs Capex - CumCapex



**Management  
Created Portfolios**

**Integer/Linear  
Programing Portfolio  
Optimizer**

**Once the Portfolios are stored in the  
database, Spotfire can compare them all**

## WiserWays-Spotfire Portfolio Analysis Process

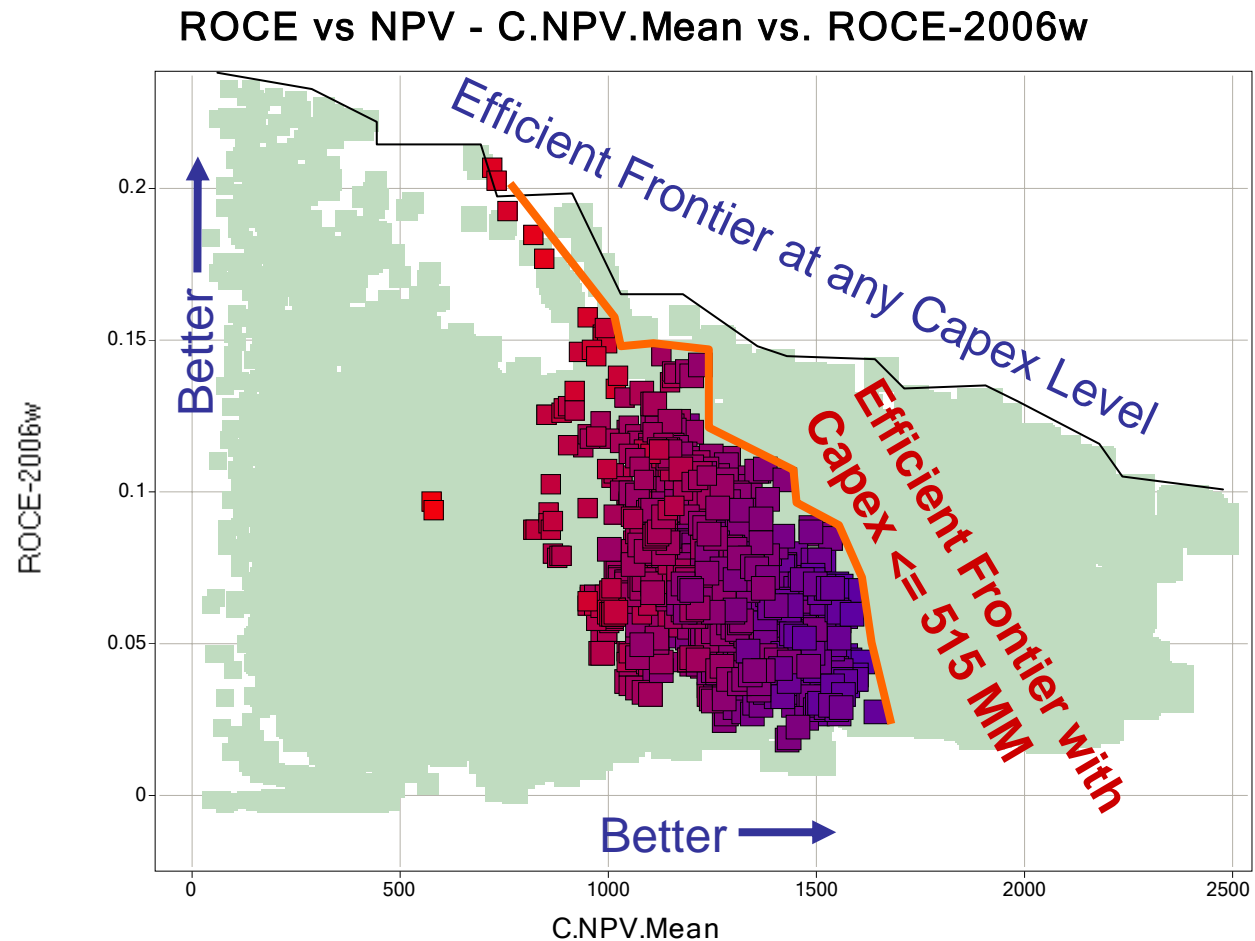
- Define the population of potential Projects to fund
  - Define a set of Strategies for funding candidate portfolios.
  - Use an automated process to generate thousands of candidate portfolios according to the different strategies.
  - Load the candidate Portfolios into Spotfire
  - Apply/change constraints by sliding Spotfire query devices.
  - Select many good portfolios that are close to the Efficient Frontiers of many different measures.
  - Find the projects most often funded in these good portfolios.
- If happy with plan, Fund these projects, Execute Plan
- Change and Negotiate Goals.
  - Refine Strategies.



# Goals for Improving the Portfolio Management process

- To know which portfolios are superior to other in the Performance measures that matter.

To “trade-off” one goal with another

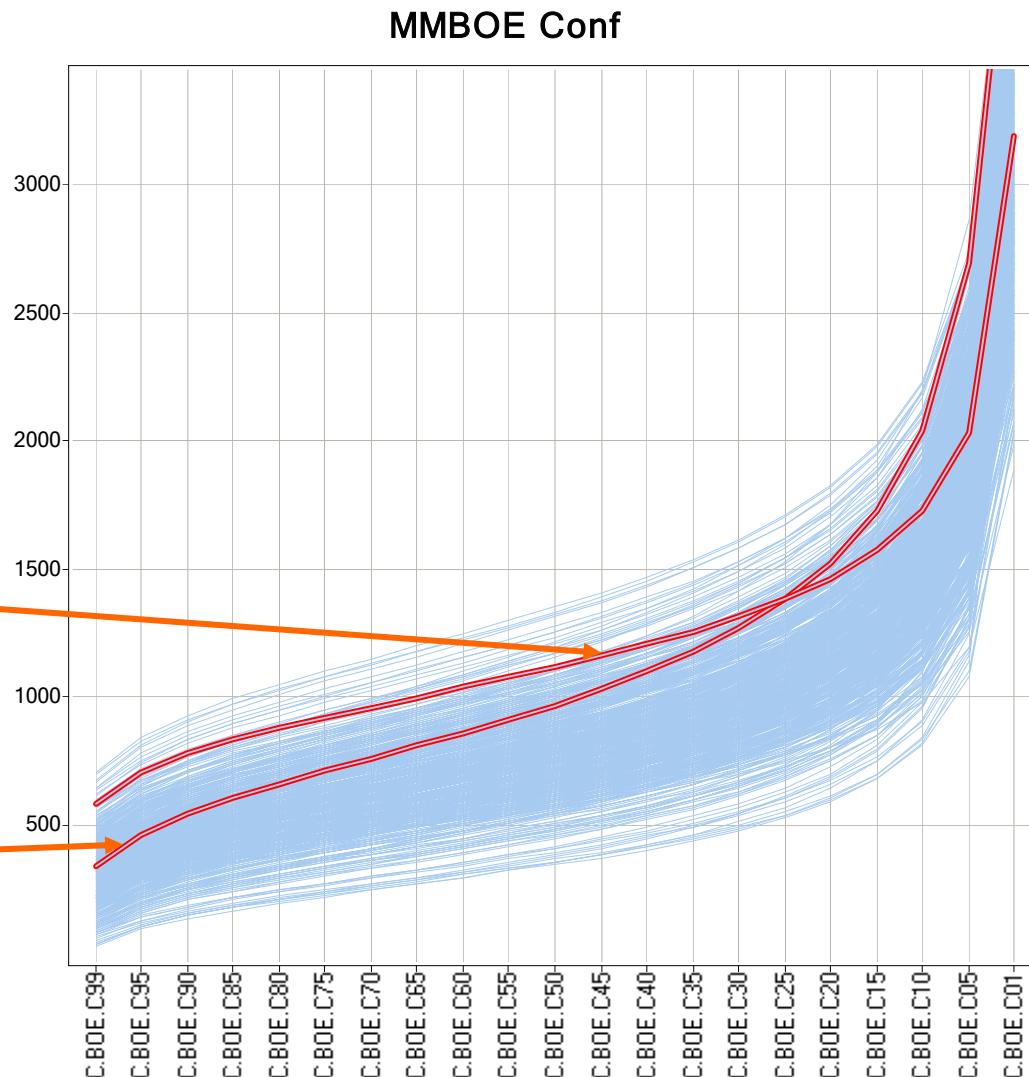


# Goals for Improving the Portfolio Management process

- To Understand, Predict, and communicate the range of possible outcomes of any funded Portfolio

This Portfolio has a  
 5% Probability for > 2000 MMBOE  
 65% Probability for > 1000 MMBOE  
 90% Probability for > 750 MMBOE

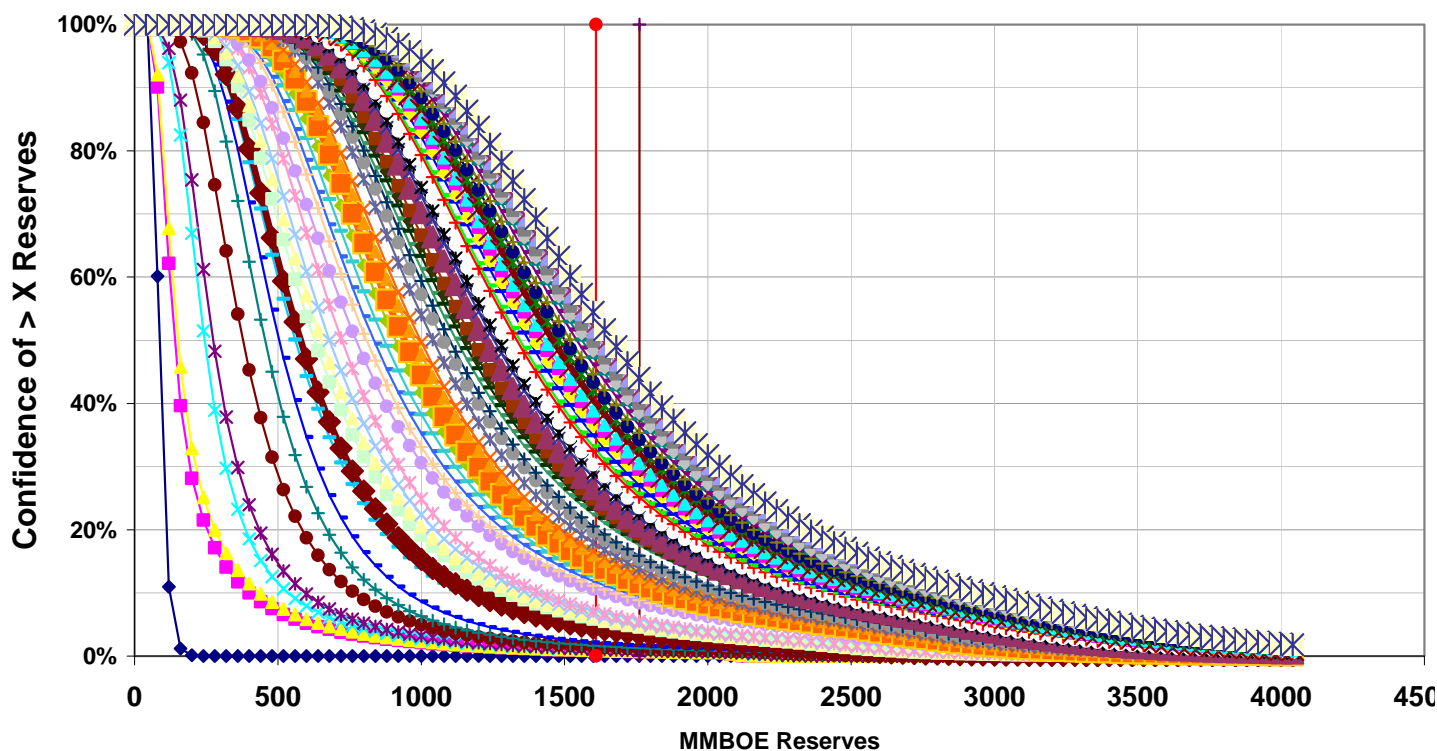
A different Portfolio has a  
 10% Probability for > 2000 MMBOE  
 45% Probability for > 1000 MMBOE  
 65% Probability for > 750 MMBOE



## How the proposed project meets these goals

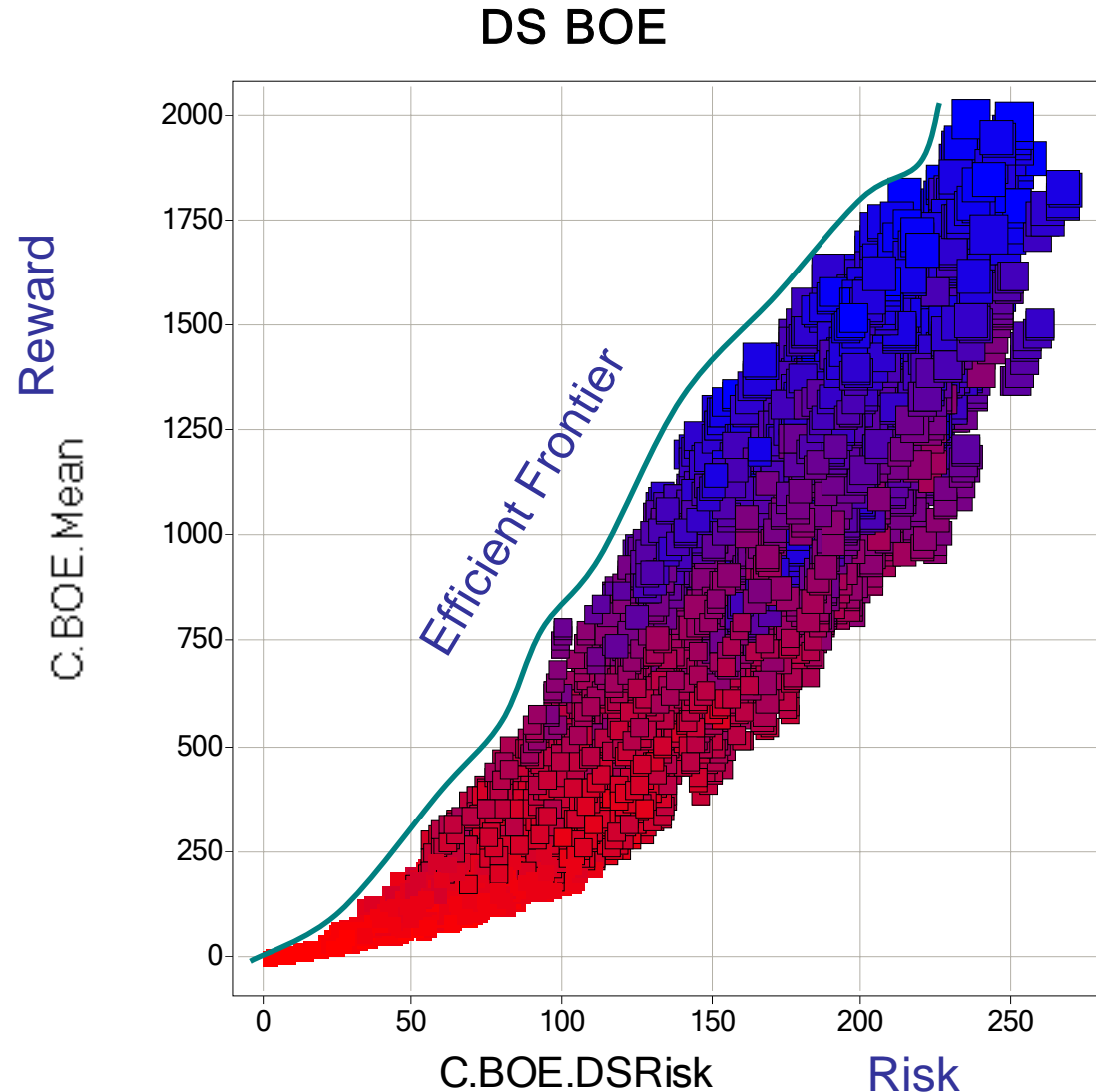
- The MultiField Portfolio Confidence Curve Calculator can quickly generate the range of results for candidate portfolios quickly.

Confidence of At Least X Reserves



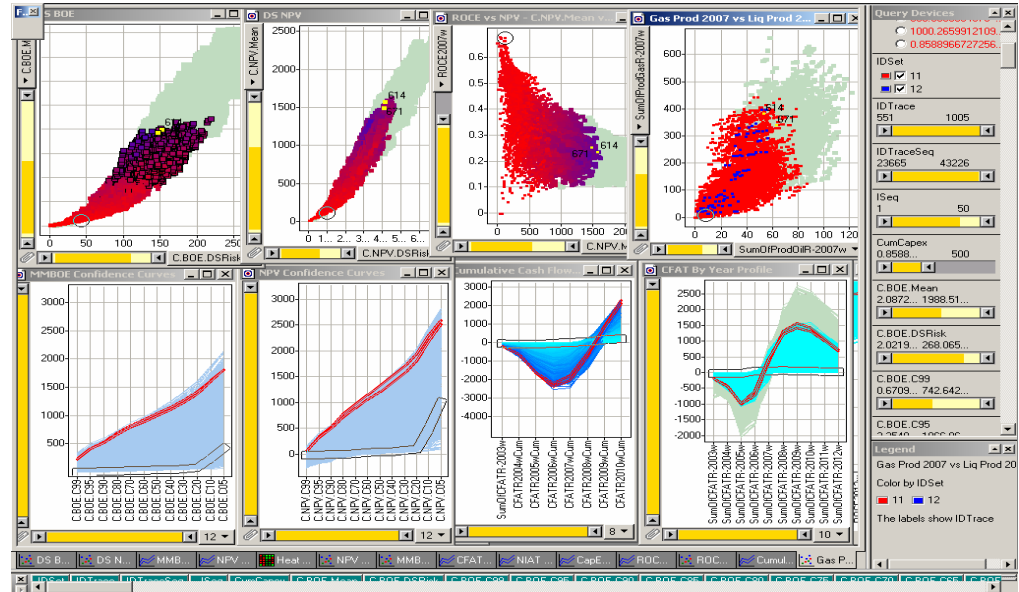
# Goals for Improving the Portfolio Management process

- To Reduce the time to assemble, calculate and analyze the candidate portfolios
- To increase the number of candidate portfolios that can be considered within a given amount of time, thereby exploring more options.



## BlitzPort and Spotfire

- By making VISIBLE the potential funding opportunities, **DECISION MAKERS** can see available alternatives and the degree of difference (or equivalence) between them.



- You can **change your constraints** in the conference room for real-time turnaround.
- Understandable. Quick. Easy. Inexpensive.

Thanks to

- Spotfire
  - For the opportunity to speak here and for the work we have done together since 2001.
- Adán Oviedo Pérez, Subdirector, Exploración Vicepresident, Pemex
- Brett Edwards, President, Custer Resources



And Thank You for your attention.

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