

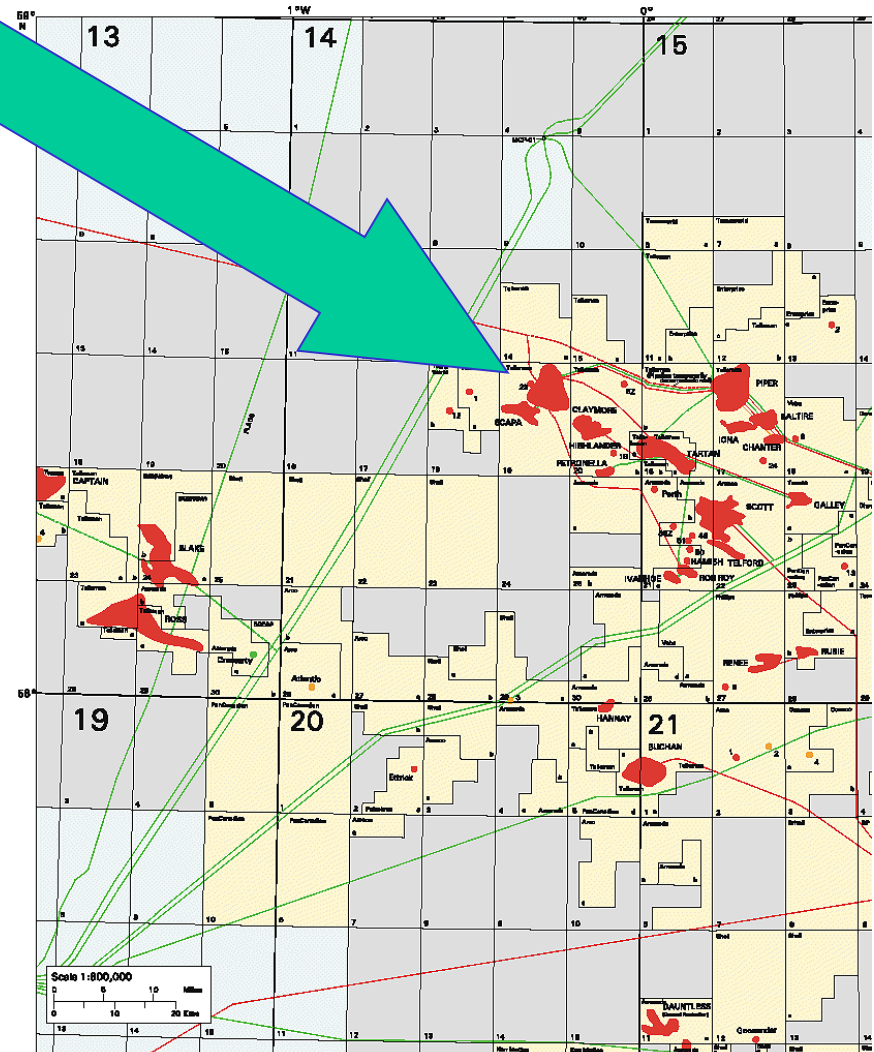


Using Risk Analysis to Optimise Development Drilling Strategy

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Claymore Area Overview

- Central North Sea
- Low GOR, low Pb oil
- First production 1977
- Three main producing reservoirs:
 - 1.8 billion barrels STOIIP
 - 800 MMstb reserves
- Production via:
 - 22 platform producers
 - 6 subsea producers
 - 12 subsea injectors



Claymore Probabilistic Drilling Evaluation - Background

- Claymore team drilled platform ERD exploration/appraisal well in 2001-2
 - Significant drilling problems
 - Five month delay to Claymore development drilling schedule
 - Well results 'disappointing'
 - *"Why didn't we drill the well subsea???"*
- Talisman policy of exploiting near-field opportunities will require additional ERD wells
 - But are subsea well(s) tied back to the Claymore platform the optimum way forward?

- **Reasons to drill ERD platform**

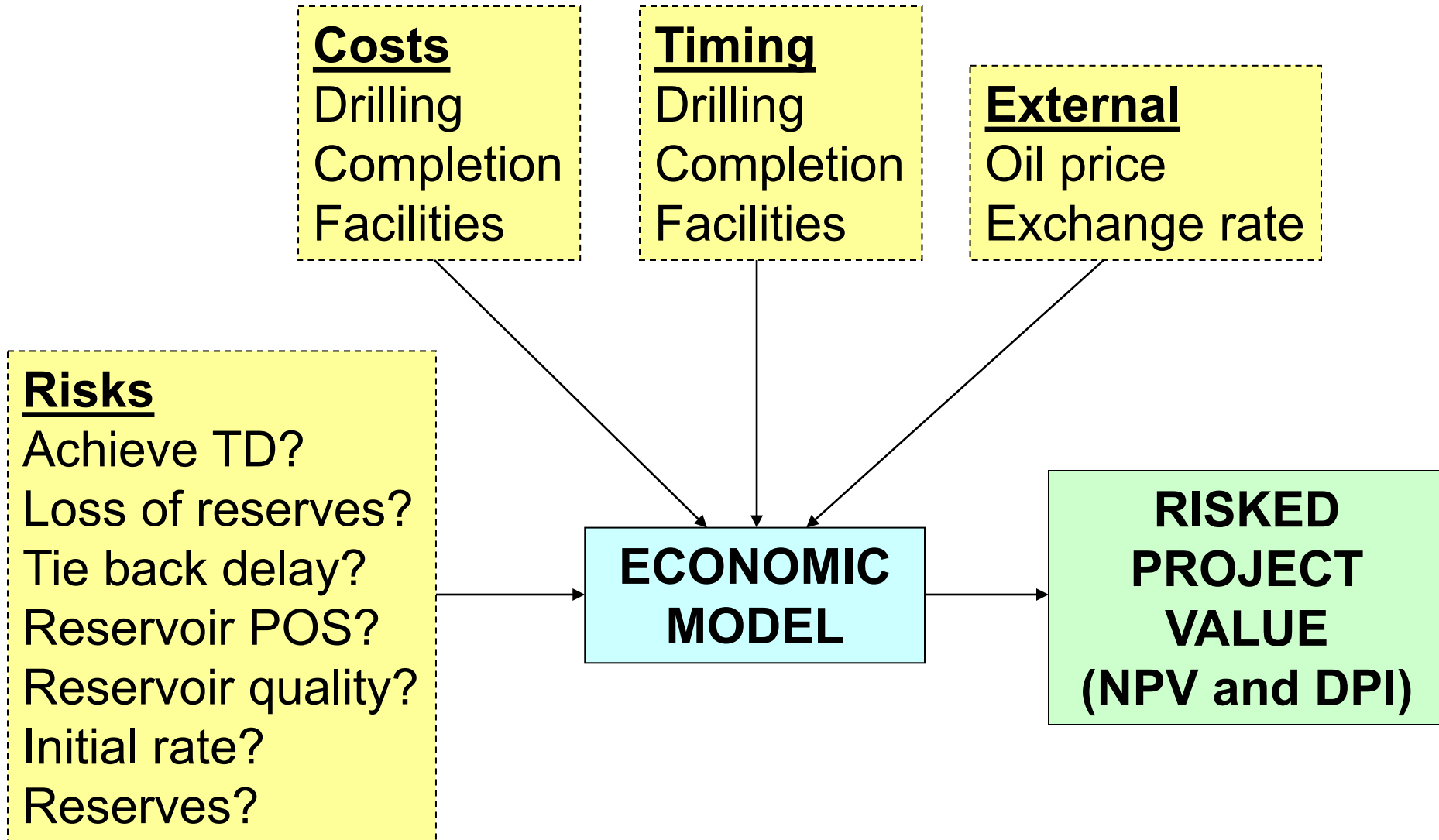
- Simple tie-in
- Immediate production
- Reduced overall cost (success case)
- Higher project value (success case)
- ESP option
- Higher reserves in platform well
 - Lower pressure and pipeline losses reduced
 - 500 psi subsea wellhead pressure and 100 psi platform

- **Reasons to drill subsea**

- Lower capital exposure to failure
- Reduced drilling risk
- Easier sidetrack options

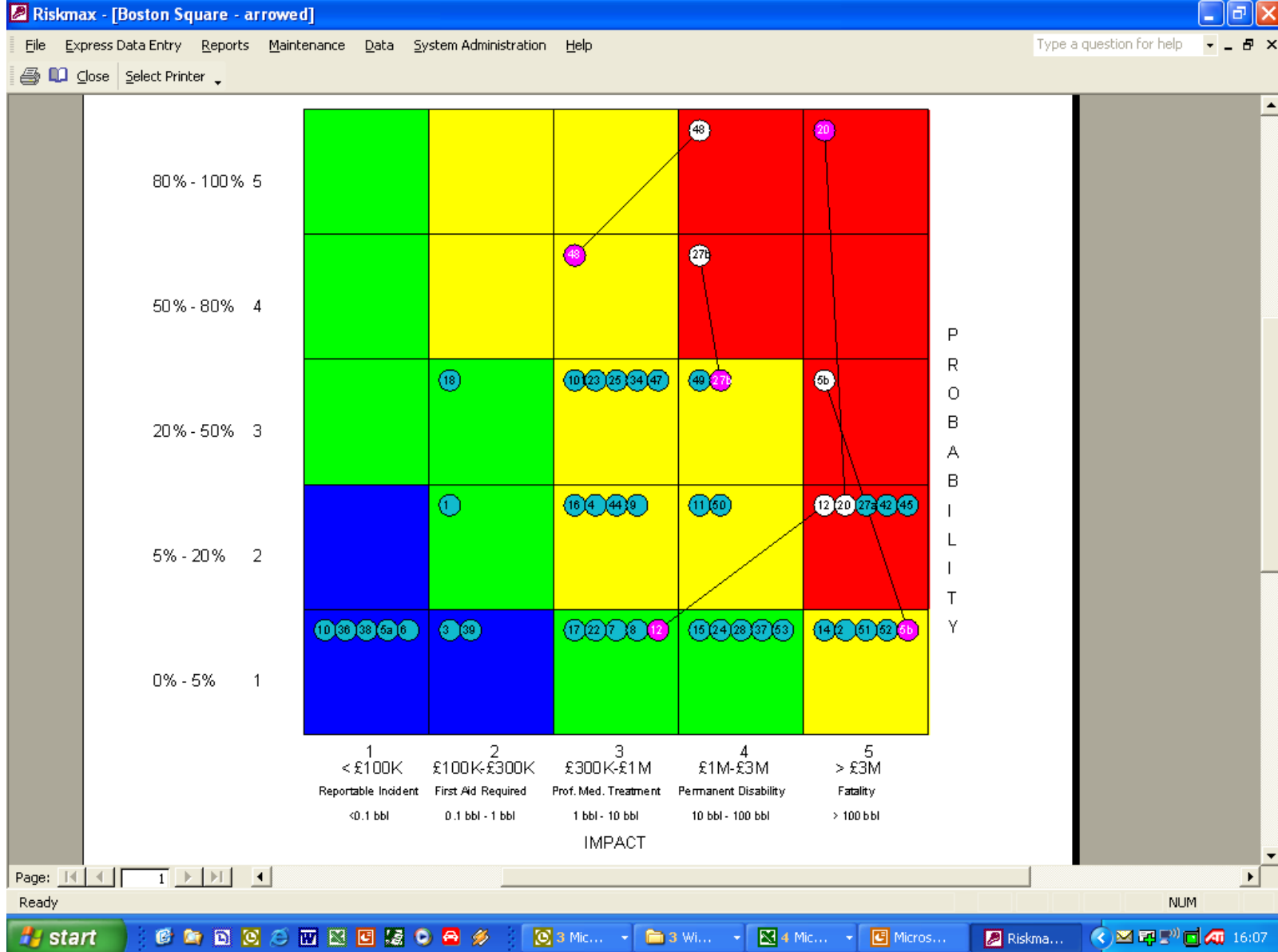
- Key to drilling option is quantifying the project risks!
- Evaluate 2004 step out well probabilistically
 - ERD vs Subsea Tieback

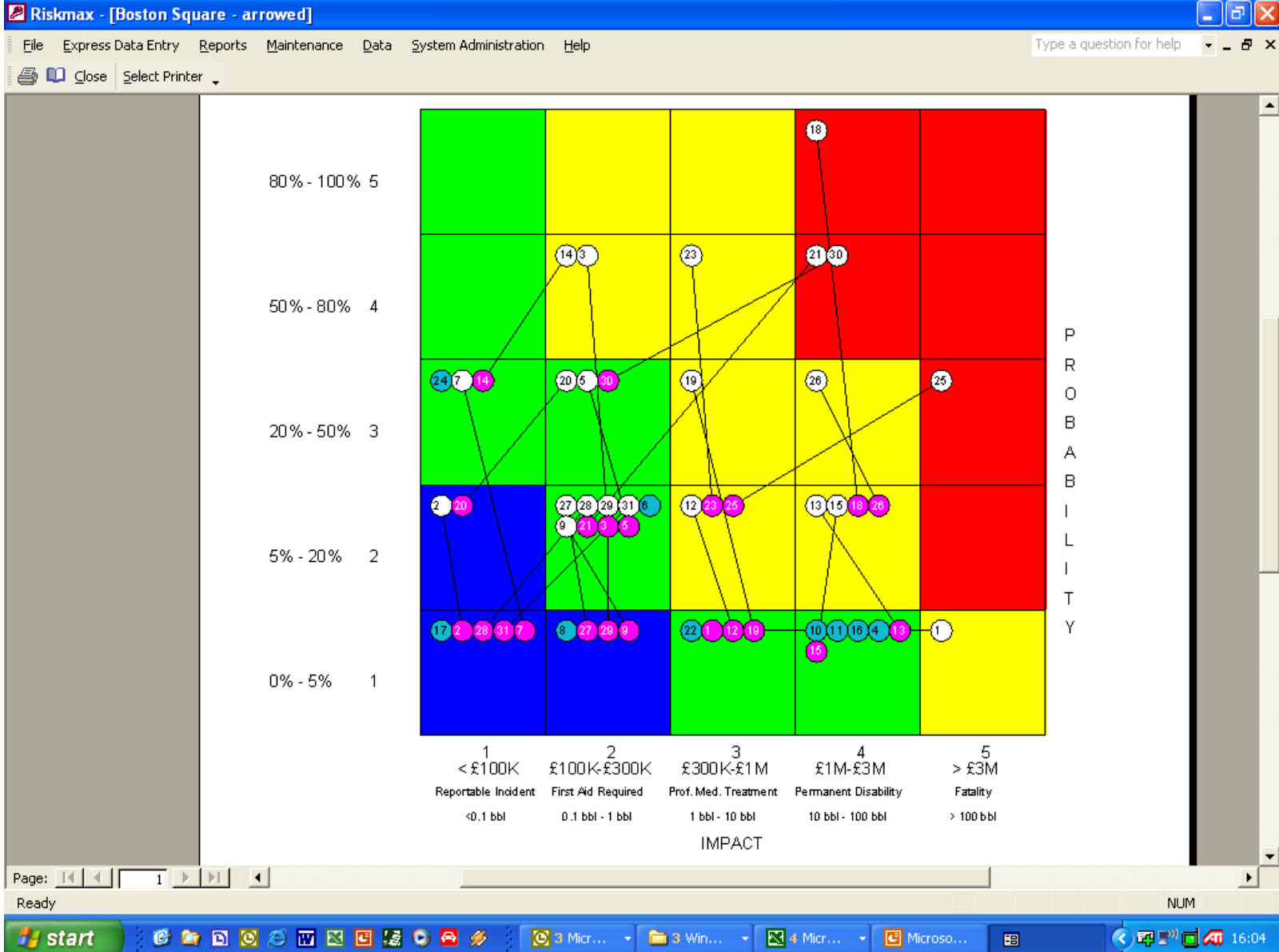
- Screening tool to analyse options capturing:
 - Time/cost risk of drilling activities
 - Time/cost risk of tie-back/hook up
 - Capex phasing
 - Reservoir risk – is there going to be a production well?
 - Uncertainty in production profiles
 - Produce risked project economics
- Excel spreadsheet model using Crystal Ball probabilistic functions, developed in conjunction with Allomax



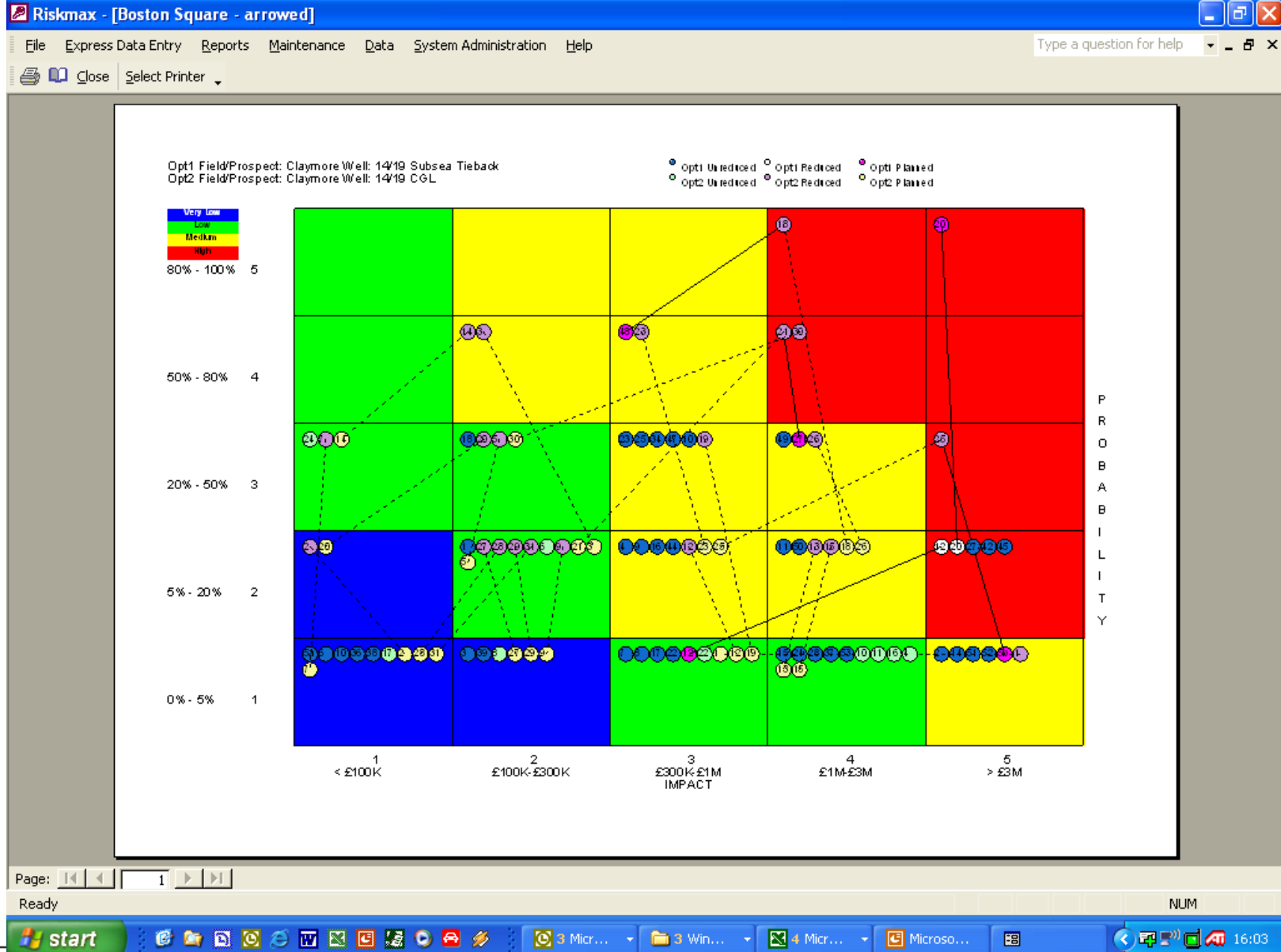
- Key risks identified and quantified in Risk Analysis and Management process
- Entire project team involvement:
 - Drilling
 - Completions
 - Facilities
 - Operations
 - Subsurface
- RAM sessions completed for platform and subsea wells

Subsea Tieback





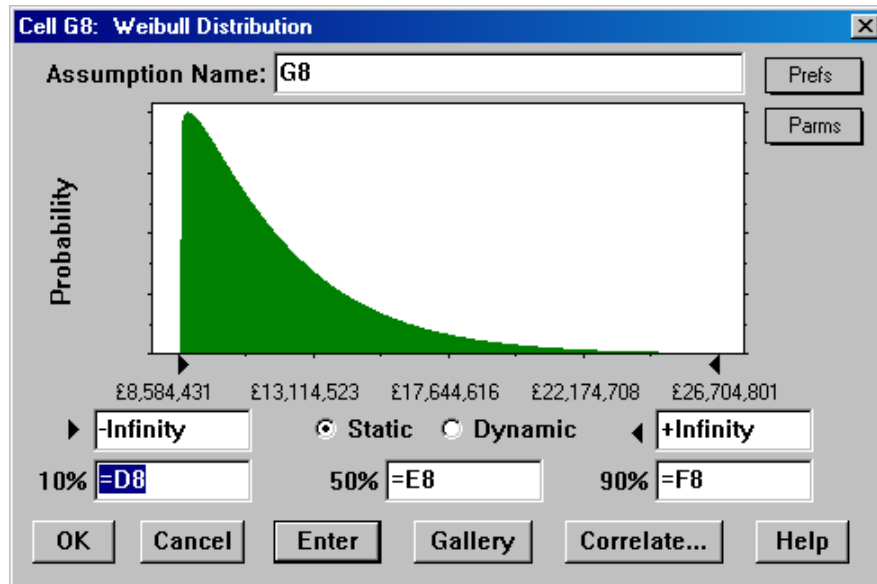
Super-imposed Projects



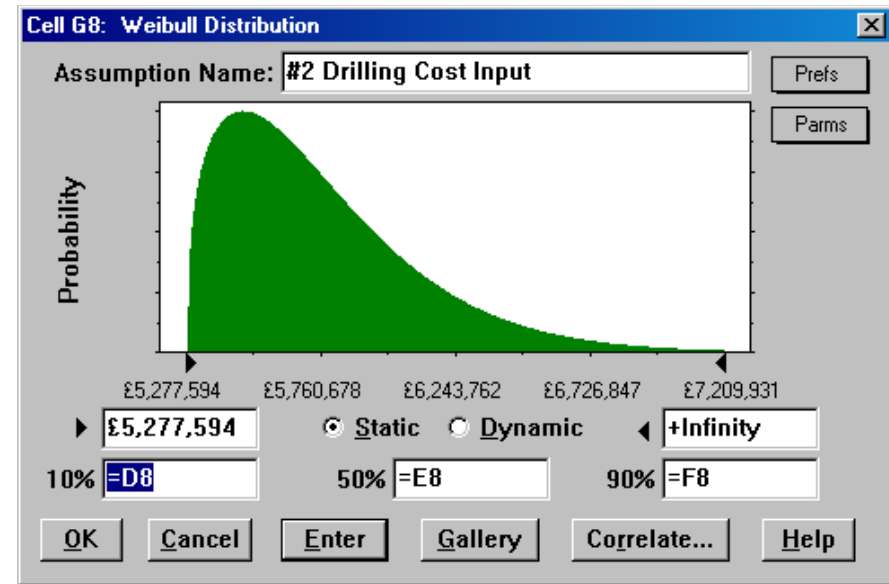
Probabilistic Drilling Evaluation – Risks

- Key risks from RAM session:
 - Ability to achieve TD in ERD well
 - Geological probability of success
 - Schedule delays (tie-back for subsea case and sequential drilling impact on production targets for ERD)
 - Reservoir quality – (East good Claymore, Highlander shaley)
 - Production rate / ultimate recovery
 - Decline model, matched to simulation output (of ESP platform well)
 - Discounted production for gas-lifted subsea well

- Input costs from Drilling, Well Operations and Projects / Facilities teams
- Timing implicitly associated with costs
- Typically skewed distributions



ERD drilling costs distribution



Subsea drilling costs distribution

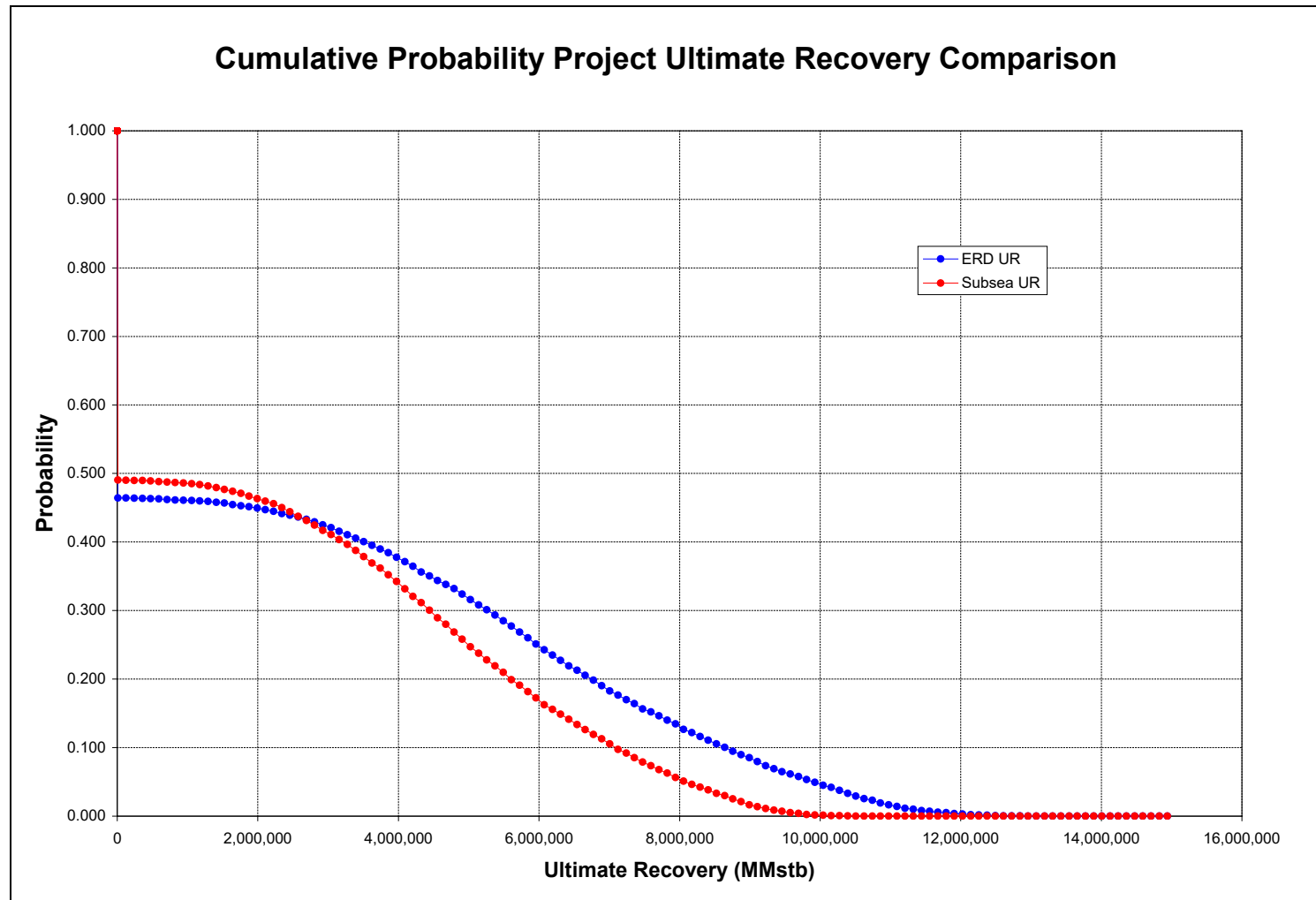
Probabilistic Drilling Evaluation – Costs/Timing Input (ERD)

Option 1 Costs

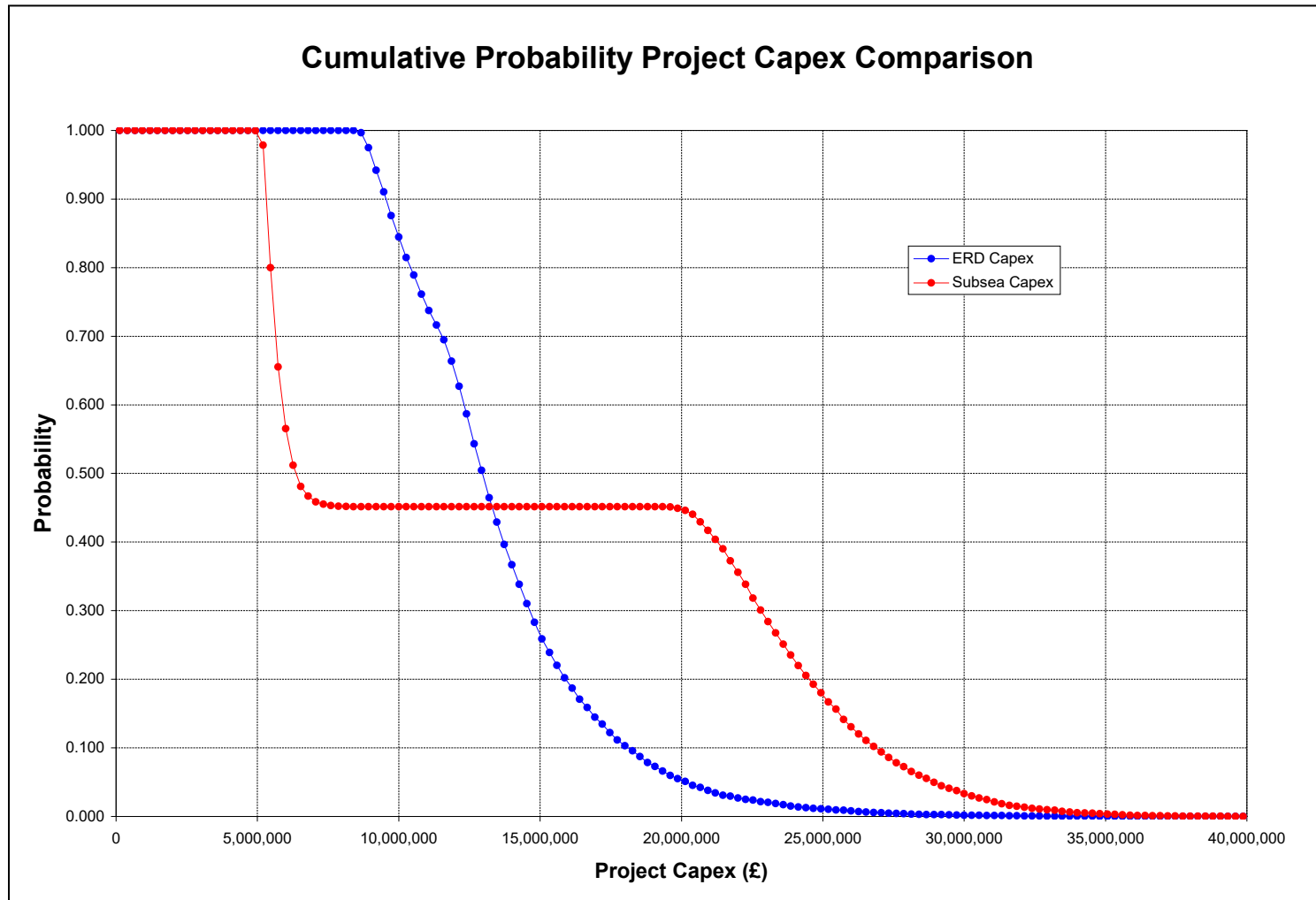
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	P10	P50	P90	Impact	
Costs					
Drilling	£9,000,000	£11,000,000	£16,000,000	£11,000,000	Linked to Drilling costs in Economics
Completion	£2,766,120	£2,953,492	£3,372,995	£2,953,492	Linked to Completion in Economics
Facilities	£60,000	£90,000	£150,000	£90,000	Linked to Facilities in Economics
Total				£14,043,492	

	P10	P50	P90		
Durations					
Drilling	90	120	160	120	Linked to Total Duration below
Completion	21	26	34	26	Linked to Total Duration below
Facilities	1	2	3	2	Linked to Total Duration below
Total				148.00	Linked to Duration in Economics

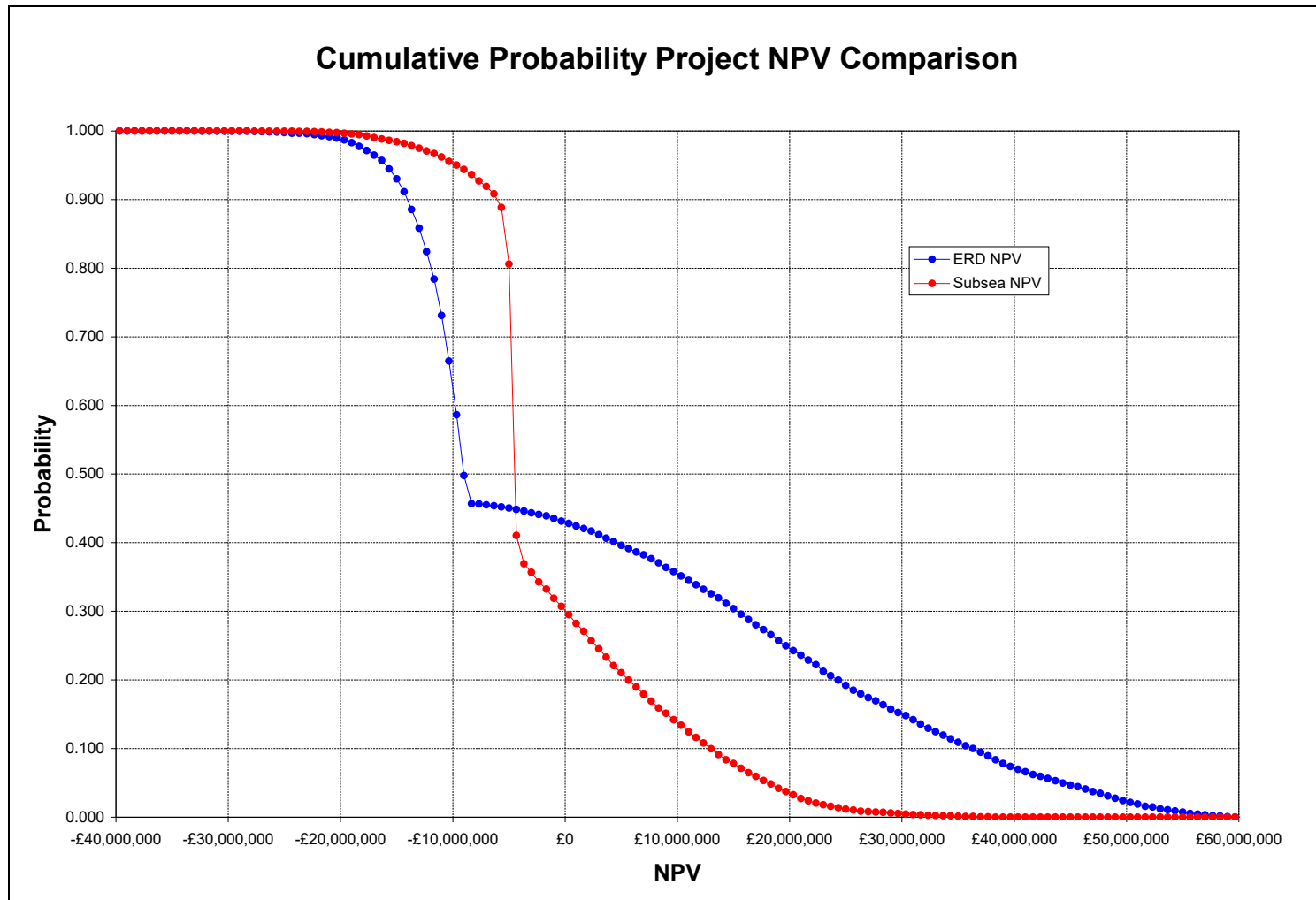


- Assumes reservoir POS = 50 %



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Probabilistic Drilling Evaluation – NPV Cumulative Probability Curve

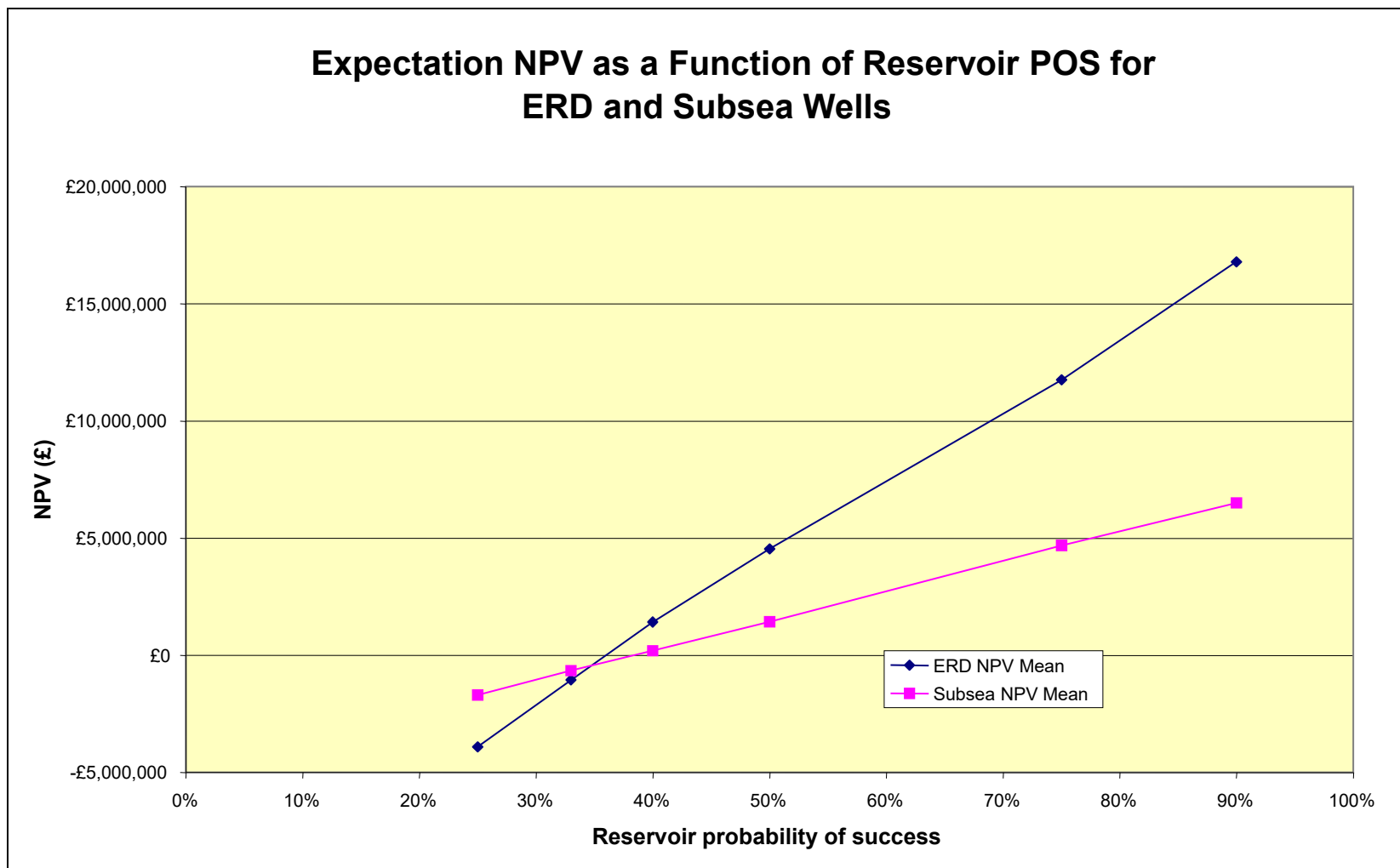


- Assumes reservoir POS = 50 %

	ERD Platform Well	Subsea Well
Drilling capex (£MM)	11.00	5.67
Completion capex (£MM)	2.95	3.50
Tie-back/facilities capex (£MM)	0.09	14.70
Total well capex (£MM)	14.04	23.87
Ultimate recovery (MMstb)	6.6	5.3
NPV (£MM)	22.4	1.4
DPI	1.56	0.06

- Risk not taken into account
- ERD well clearly the preferred option

Expectation NPV as a Function of Reservoir POS for ERD and Subsea Wells



- Intersection of NPV trends occurs at 36 %

Probabilistic Drilling Evaluation – Simplifications/Conclusions

- Probabilistic model is a screening tool but economics are simple
 - No tax calculation
 - Results consistent with full economic model
- Single well project only considered
 - Economics may favour subsea case for a two or three well development
- If 2004 well has greater than 36% POS, ERD well is preferred option
- Useful screening tool that takes account of reservoir risk and cost/timing uncertainties
- Can be used for other probabilistic evaluations
 - Application to Claymore slimhole well evaluation?
- Project took short time