Shell Global Solutions

Availability Assurance

Qatar Reliability & Optimisation Forum
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Agenda

- Introduction
- Availability Assurance in Projects
- System for Production Availability and Resource Consumption (SPARC) demonstration
- Availability Assurance in Operations
- Discussion

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…with offices throughout the world

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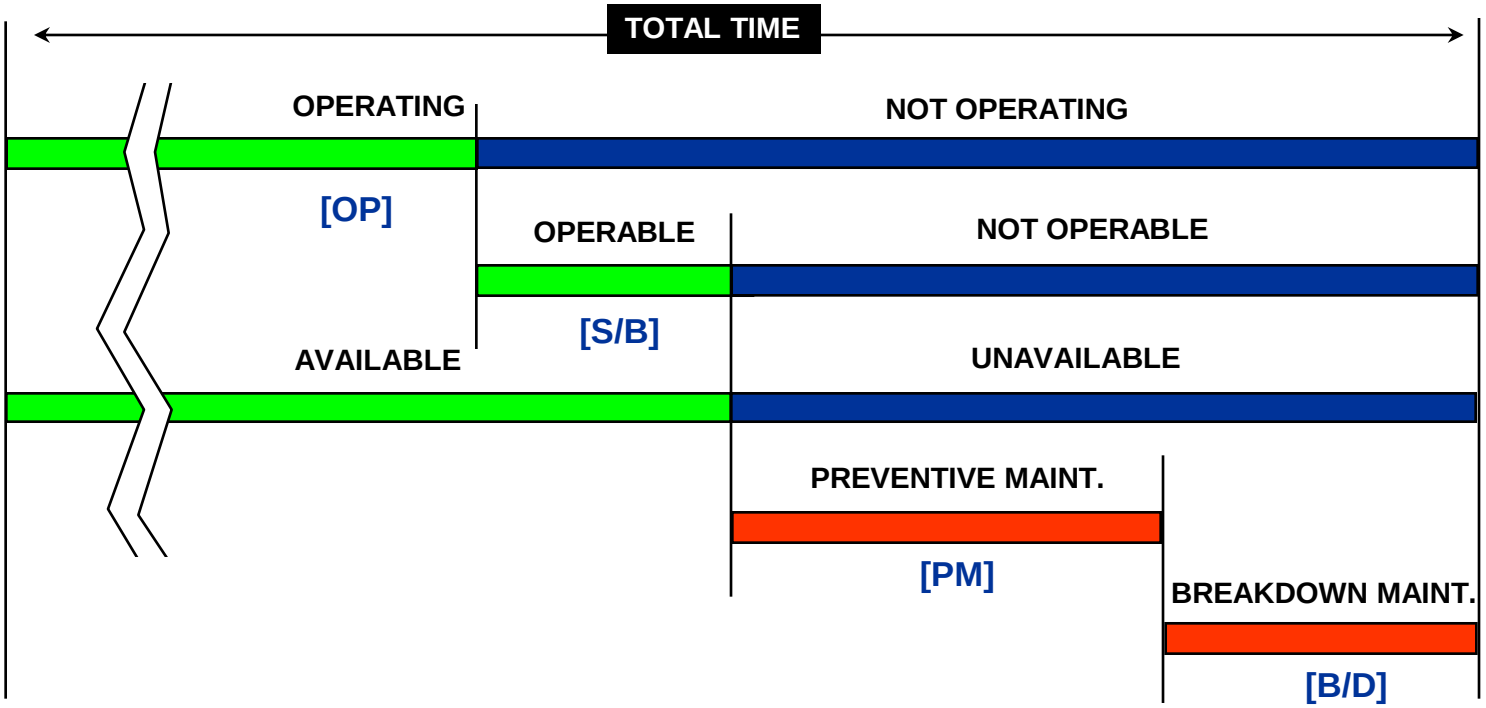
Availability - definitions



$$\text{Availability} = \frac{OP + S/B}{OP + S/B + PM + B/D}$$

Availability Assurance - What

- Provides a framework of activities throughout the project development phases aimed at ensuring that availability targets will be met
- Scope should include all factors that may have a significant impact on production availability:
  - to enable analysis at overall system level and comparison with overall targets
  - consistency of assumptions and failure data across different fields and Operating Units is essential
  - recent SPARC, MAROS, WITNESS, MIRIAM, etc. studies are a convenient starting point

Availability Assurance - Why

- to optimise the design and the economics of the production system, individual project or entire asset
- to ensure long-term supply obligations can be met
- to identify and rank the reliability bottlenecks in the system
- to track actual performance, plant availability is universally accepted as KPI
- to manage market exposure

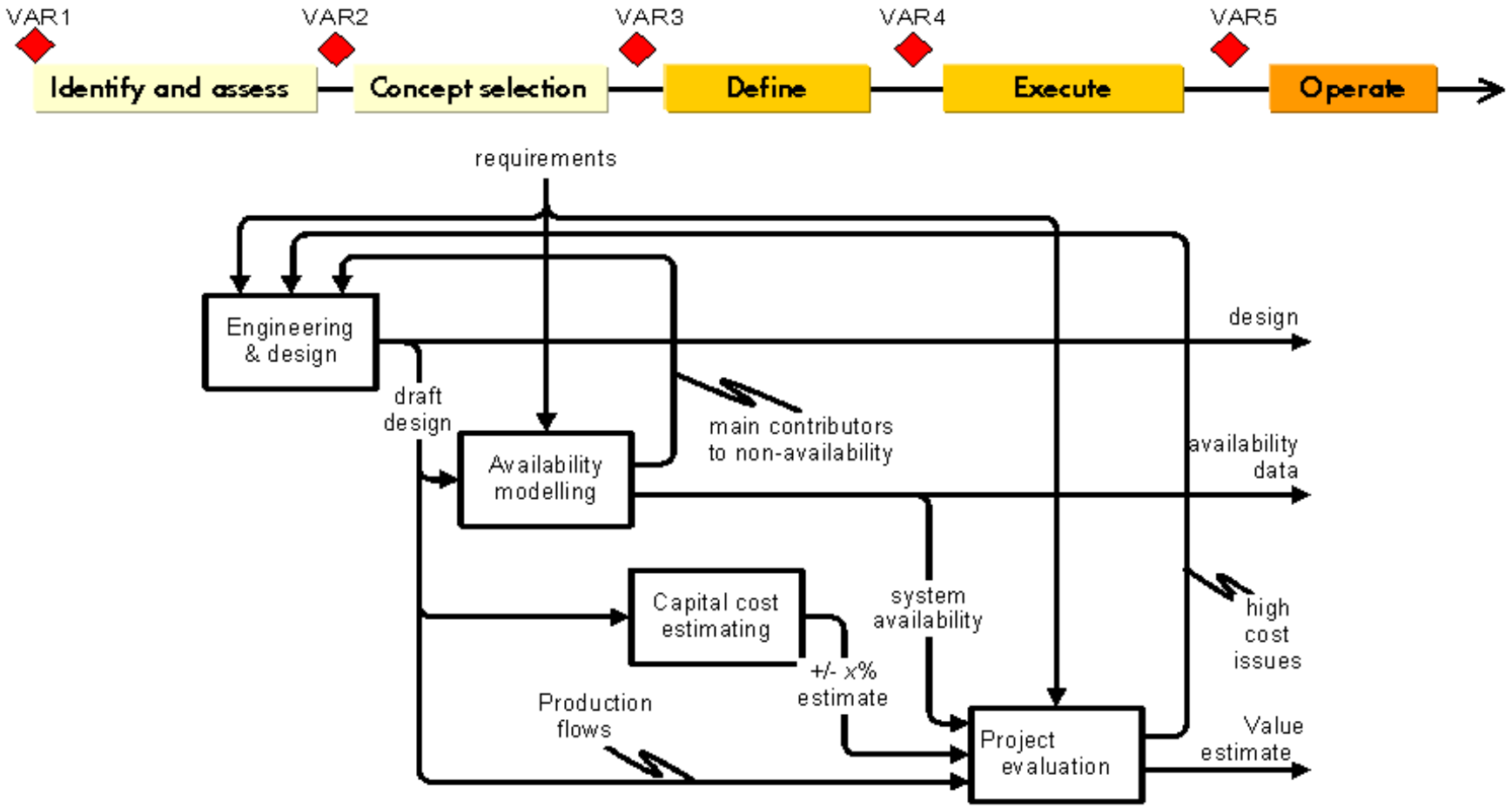
Incidental reliability studies and maintenance improvement initiatives do not provide the same level of control as the dynamic Availability Assurance process.

SPARC Track Record
Integrated Up- and Midstream studies

project	company	first integrated
Groningen Long Term	NAM	2001
ADCO/GASCO	ADCO, GASCO	2003
NLNG train 6 gas supply	NLNG	2004
MLNG gas supply	MLNG, SSB	2005
QG3&4	QG 4	2005
Sakhalin II	SEIC	2006
Ormen Lange	Norske Shell	2007
OKLNG	Shell G&P	2008
ONEcal	NAM	2008
Sunrise Floating LNG	WEL	2008
Prelude Floating LNG	SDA	2008
Middle East LNG	G&P	2008
Gabon LNG		2009
Dubai CO2 EOR		2009
Sakhalin II expansion	SEIC	2009
FLSO	G&P	2009

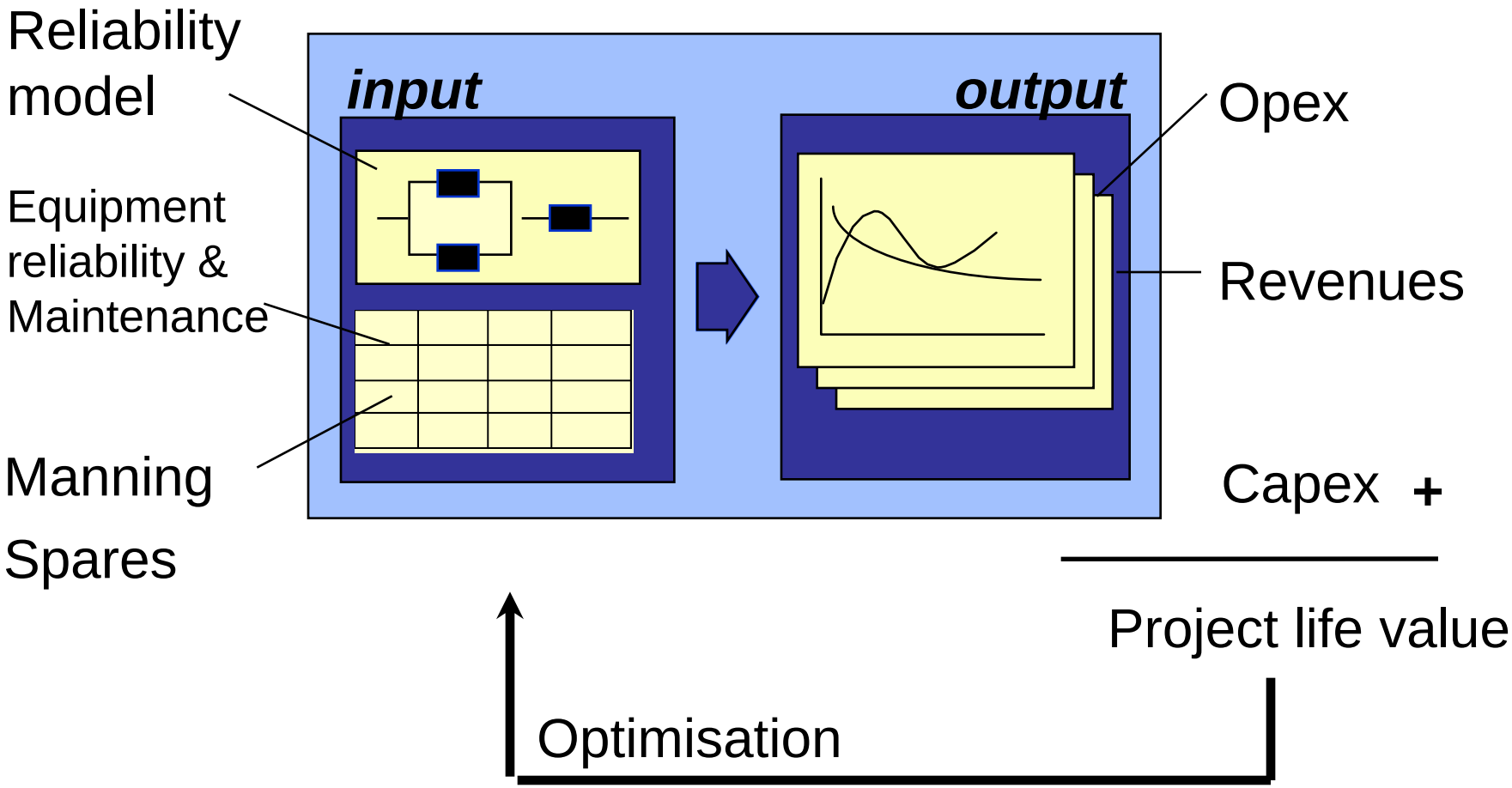
Total number of SPARC studies: 350+

Iterative process of designing for availability

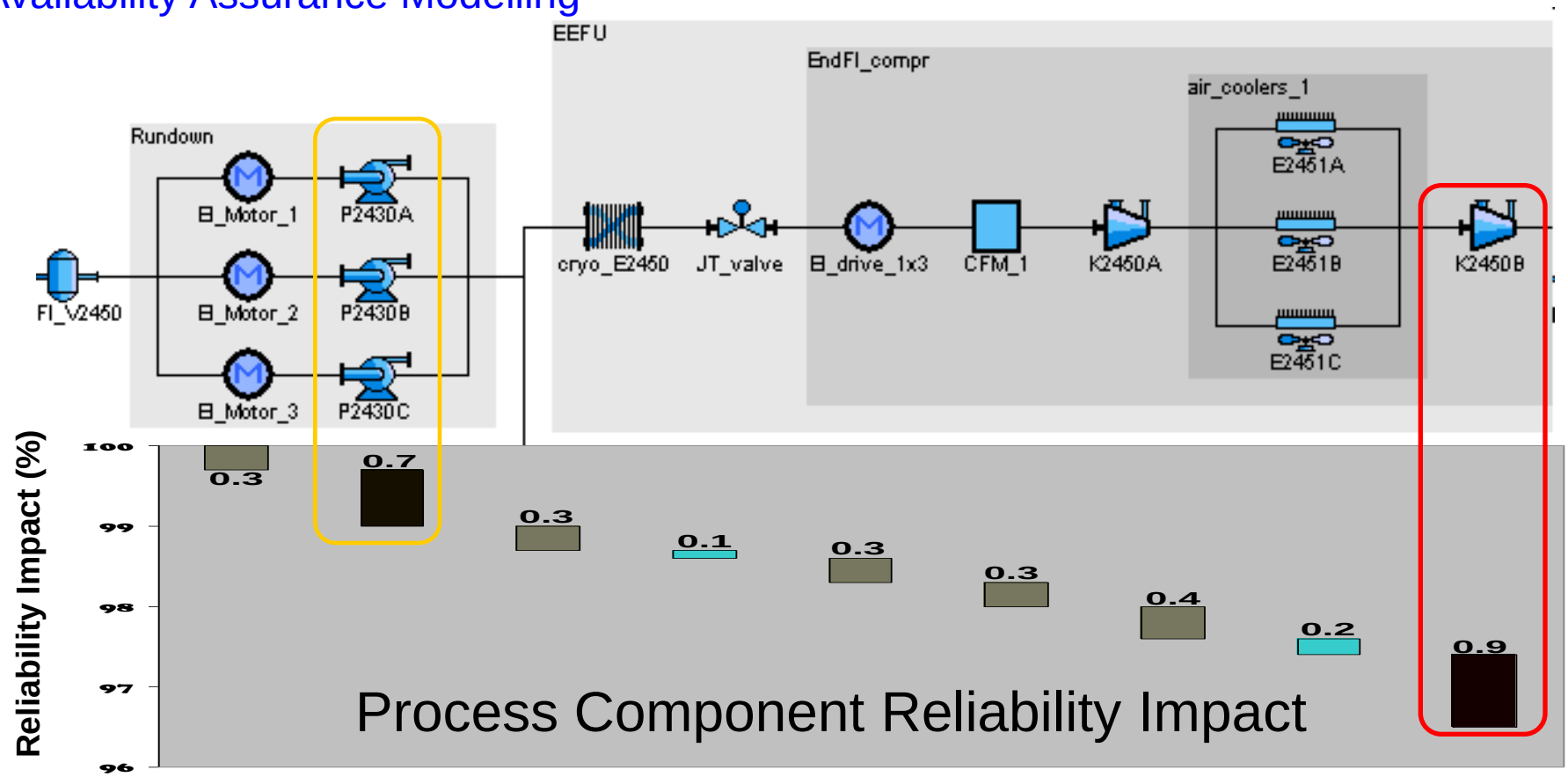


The value optimisation cycle

SPARC



Availability Assurance Modelling



Which parts of our process are the least reliable and the impact this is having on plant through-put.

Manual entry, auto/real-time, leading Reliability calculations

Availability Study step by step

Step 1

Study Basis

1. Agree study outcome, i.e. availability measures
2. Agree scope
3. Gather PFSs and make RBD from it
4. Collect failure data
5. Describe operational flexibility
6. Collect preventive maintenance scheme
7. Make model

Step 2

Model &

Results

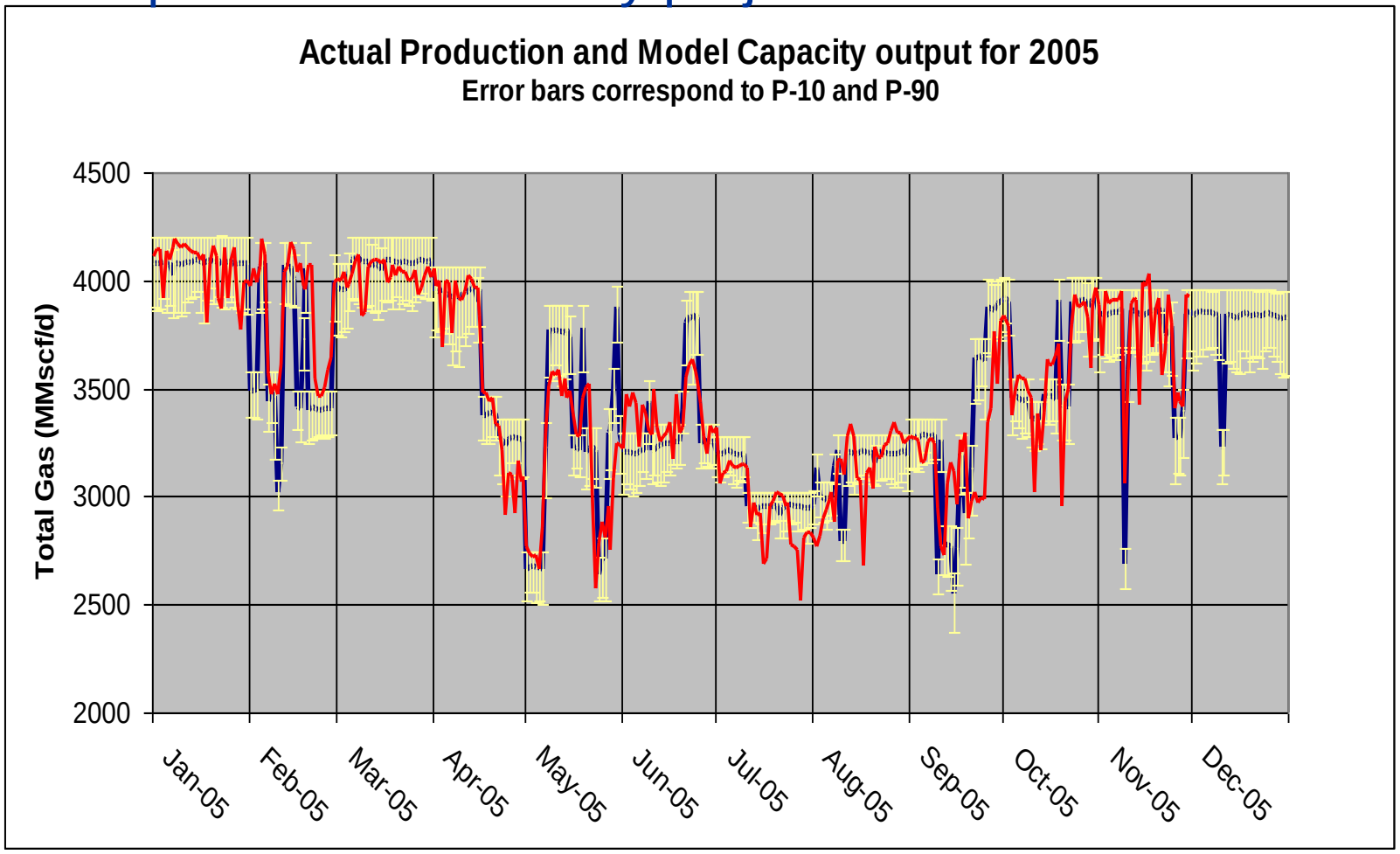
8. Run model to obtain availability measures
9. Report results and explain

Key Assumptions

- Design configuration
  - Integrated P50 Base Case, interfaces with shared facility storage, steam and power, impact of shipping
- Operating envelopes, capacities
  - Well boosting, turn up and turn down, steady state
- Operational flexibility
  - Bypasses and sparing, gas and liquids flaring, grace periods, slow down and start-up
- Sources of failure data
  - Oreda 7.2, IEEE, and OU experience, Benchmarking data, etc.
- Maintenance
  - Planned shutdowns, corrective repairs, mobilisation, sparing

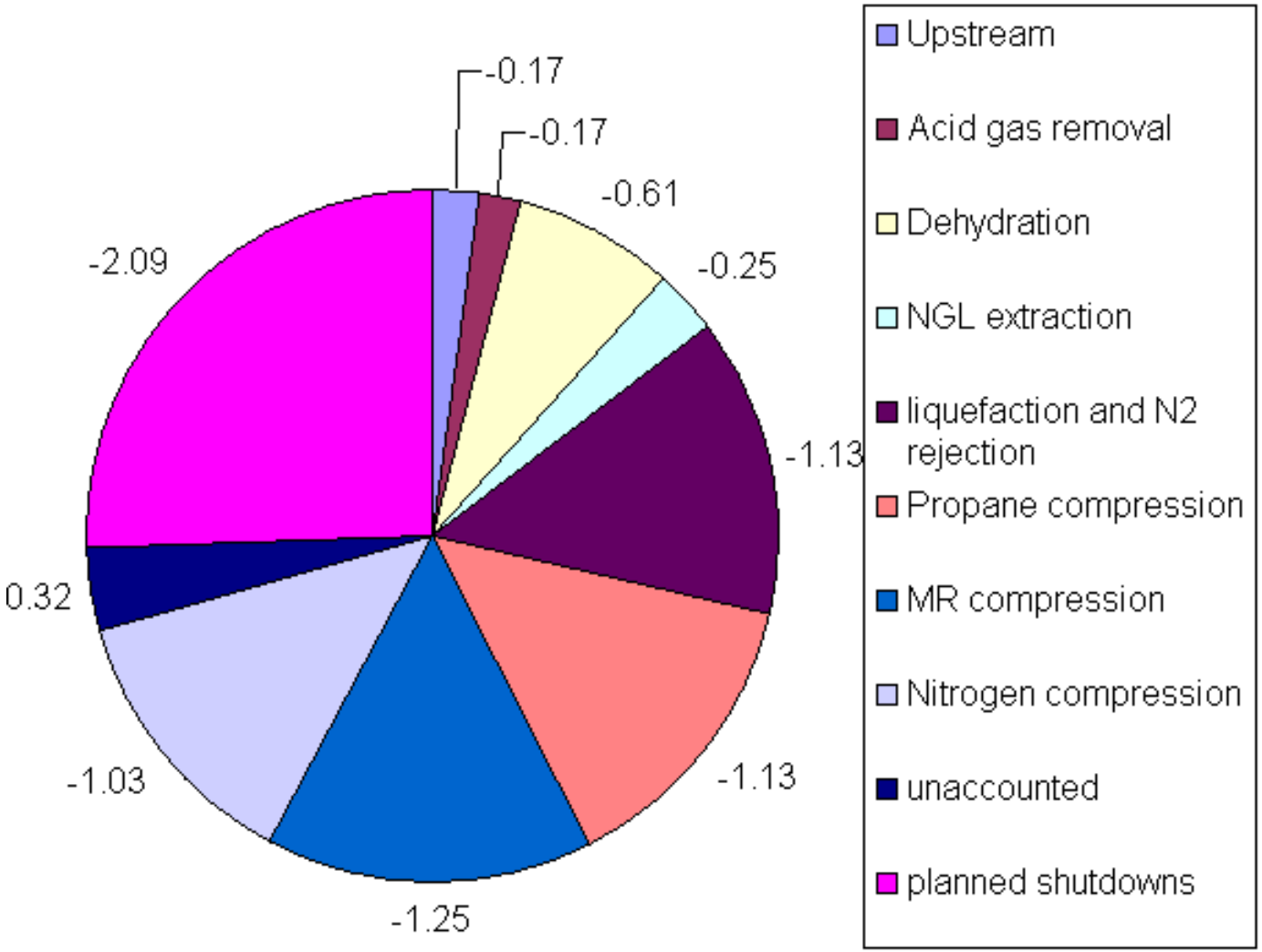
History match

example from an arbitrary project

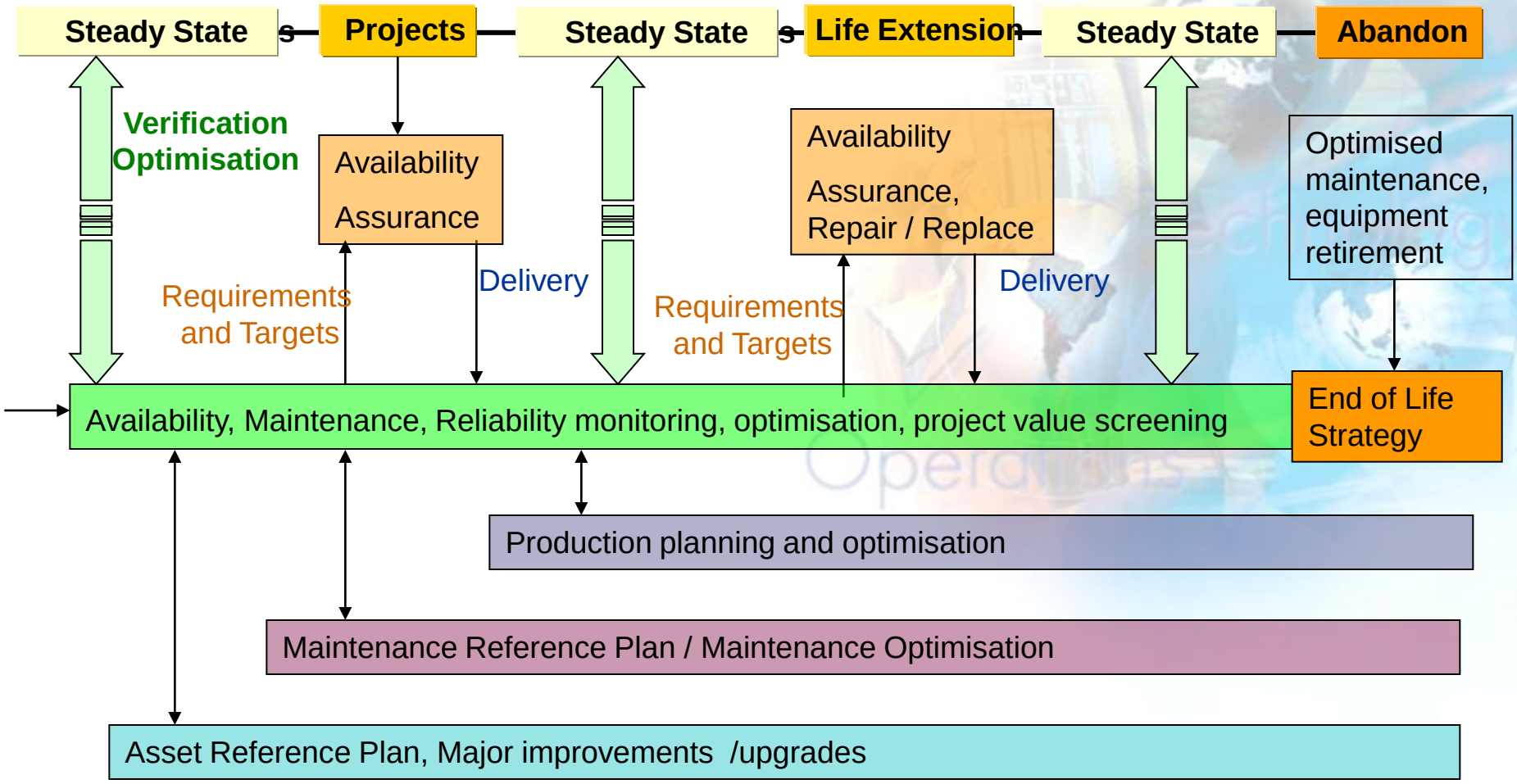


Impact on Effective Capacity (%)

example from an arbitrary project



Availability Assurance in Operations



Life Cycle Availability Assurance

OPTIMUM
DESIGN
CONCEPT

Process Control (DCS)

RCM

Interactive data exchange and system updates

SPARC
On line and Simulation

SPARC model

SPARES

Data Reposi-tory, KPI's

SAP BP

PIMS

SAS

ARP MRP

Design Changes

Information

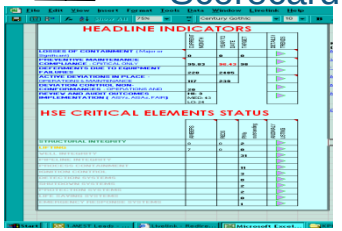
Engineering Database

Maintenance Execution

Information

Reporting

Scorecard



Extracting data from SAP BP and other databases to SPARC field model

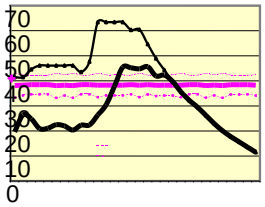
REAL TIME DATA

Data Collection and "Middleware' interface and data conditioning

Reliability
Plant Reliability Information
Plant Defect Index
Failure rate KPI's and characteristics

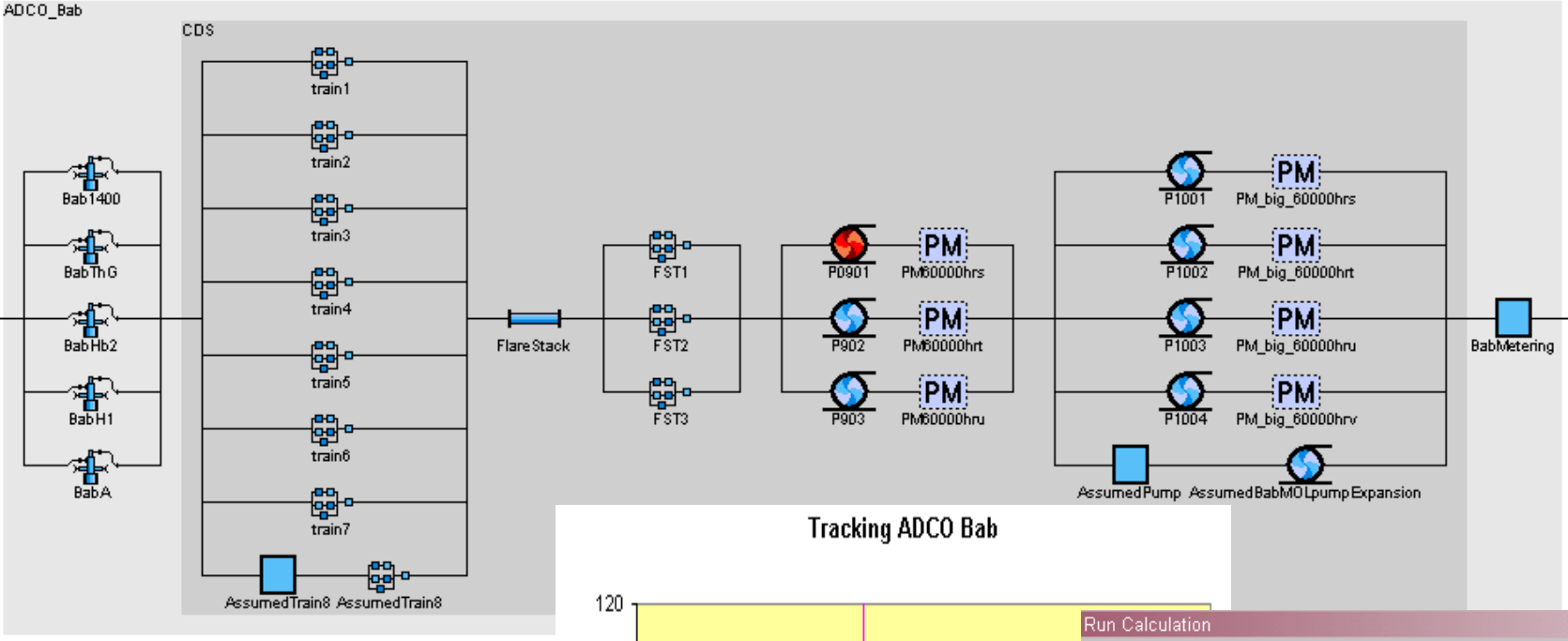
Production
Achievable production availability
Production sensitivity analysis
Production systems reliability

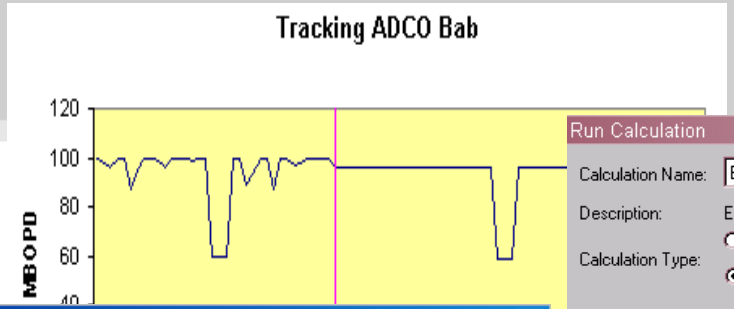
Maintenance
Maintenance effectiveness
Failure Characteristics
Etc

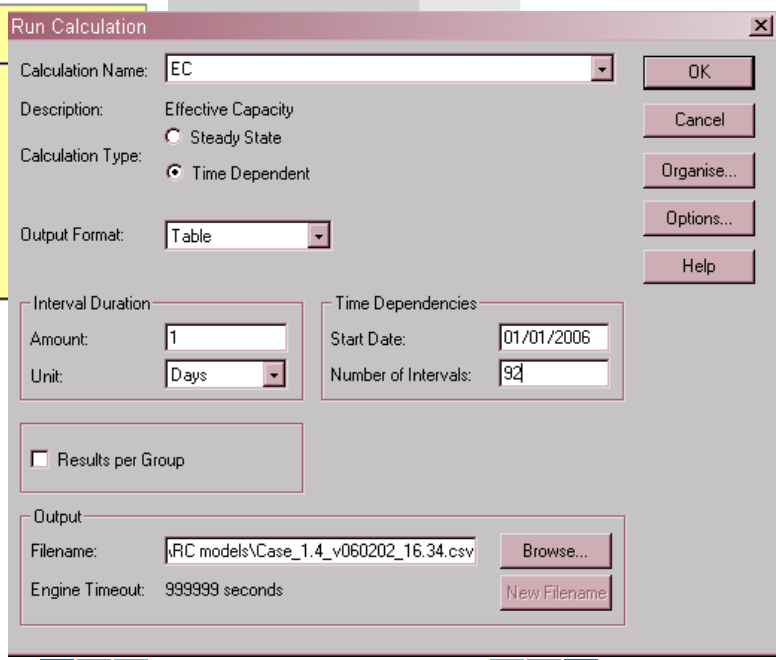


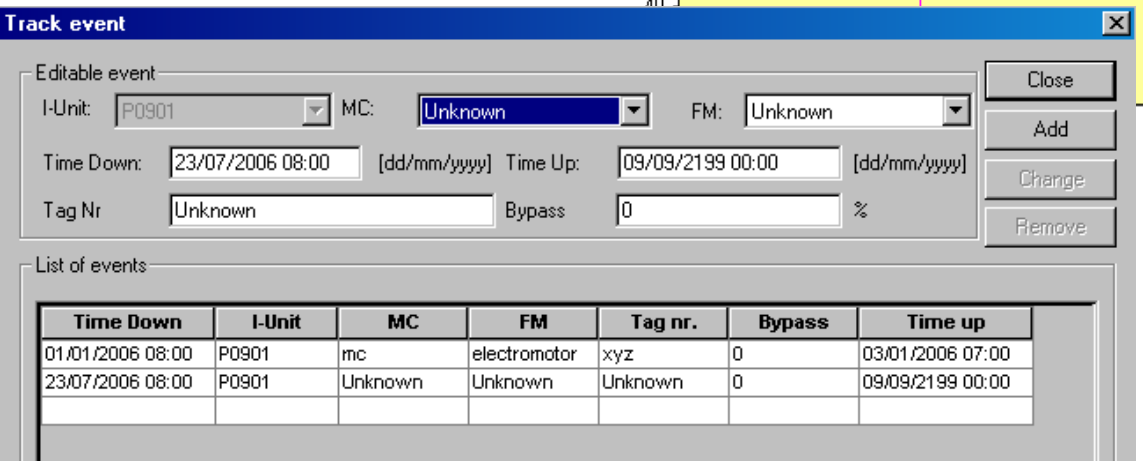
Visual Statistics / results visualisation

Support Models outside SAP
- Online Condition monitoring
- Equipment cost details
- Life Cycle Cost model
- RCM/RBI/SIFPro
- Others

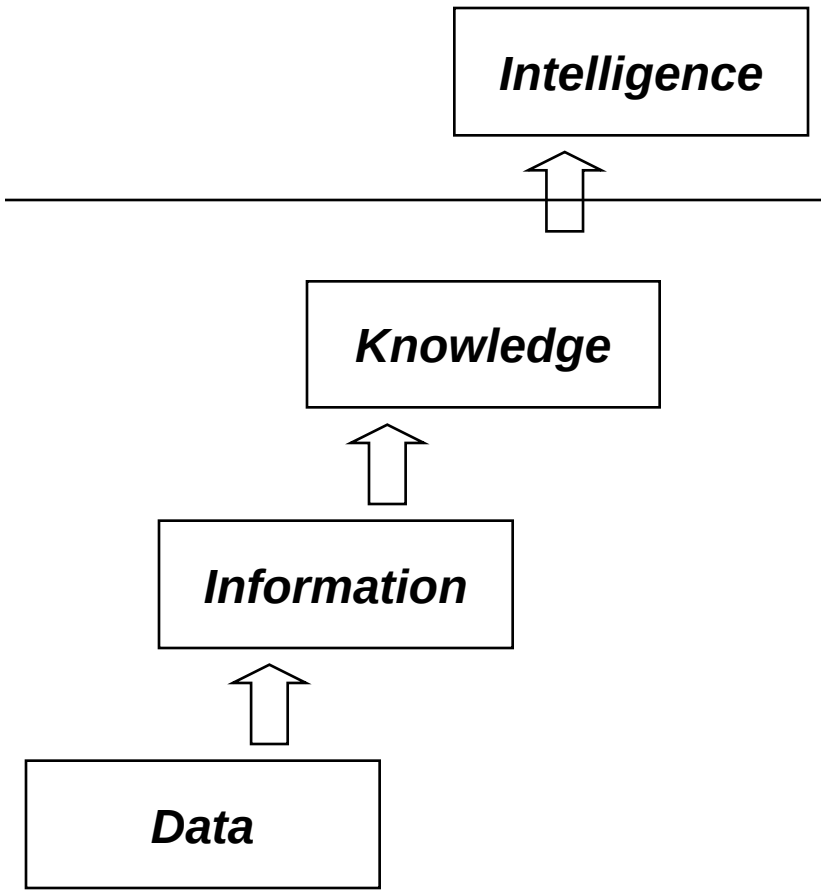

ADCO_Bab
CDS
train1
train2
train3
train4
train5
train6
train7
Bab1400
BabThG
BabHb2
BabH1
BabA
AssumedTrain8
AssumedTrain8
FlareStack
FST1
FST2
FST3
P0901
P902
P903
PM
PM60000hrs
PM60000hrt
PM60000hru
P1001
P1002
P1003
P1004
PM_big_60000hrs
PM_big_60000hrt
PM_big_60000hru
PM_big_60000hrv
AssumedPump
AssumedBabMOLpumpExpansion
BabMetering
GASCO_Bab
GASCO_HabshanOGD1


Tracking ADCO Bab
MBOPD
120
100
80
60


Run Calculation
Calculation Name:
EC
Description:
Effective Capacity
Calculation Type:
Steady State
Time Dependent
Output Format:
Table
OK
Cancel
Organise...
Options...
Help
Interval Duration
Amount:
1
Unit:
Days
Time Dependencies
Start Date:
01/01/2006
Number of Intervals:
92
Results per Group
Output
Filename:
\RC models\Case_1.4_v060202_16.34.csv
Browse...
Engine Timeout:
999999 seconds
New Filename


Track event
Editable event
I-Unit:
P0901
MC:
Unknown
FM:
Unknown
Time Down:
23/07/2006 08:00
[dd/mm/yyyy]
Time Up:
09/09/2199 00:00
[dd/mm/yyyy]
Tag Nr
Unknown
Bypass
0
%
Close
Add
Change
Remove
List of events
Time Down
I-Unit
MC
FM
Tag nr.
Bypass
Time up
01/01/2006 08:00
P0901
mc
electromotor
xyz
0
03/01/2006 07:00
23/07/2006 08:00
P0901
Unknown
Unknown
Unknown
0
09/09/2199 00:00

Managing Defect Elimination

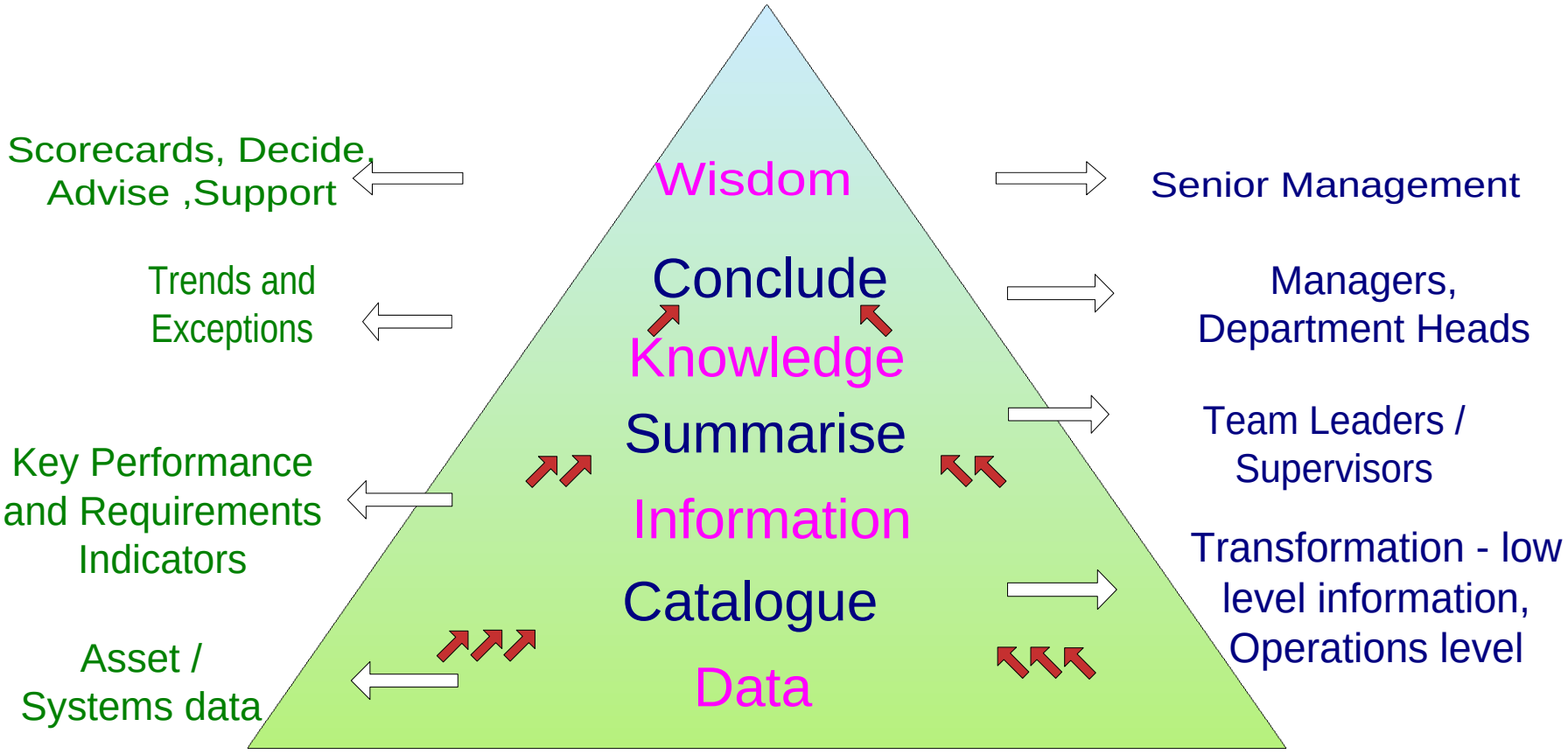


- Influence the Future Risk (Solution Implementation)
- Ability to predict future Failures (Root Causes)
- Recognise Conditions & Actions that affect susceptibility to failure (Possible Causes)
- (Incident Capture, List of Facts)

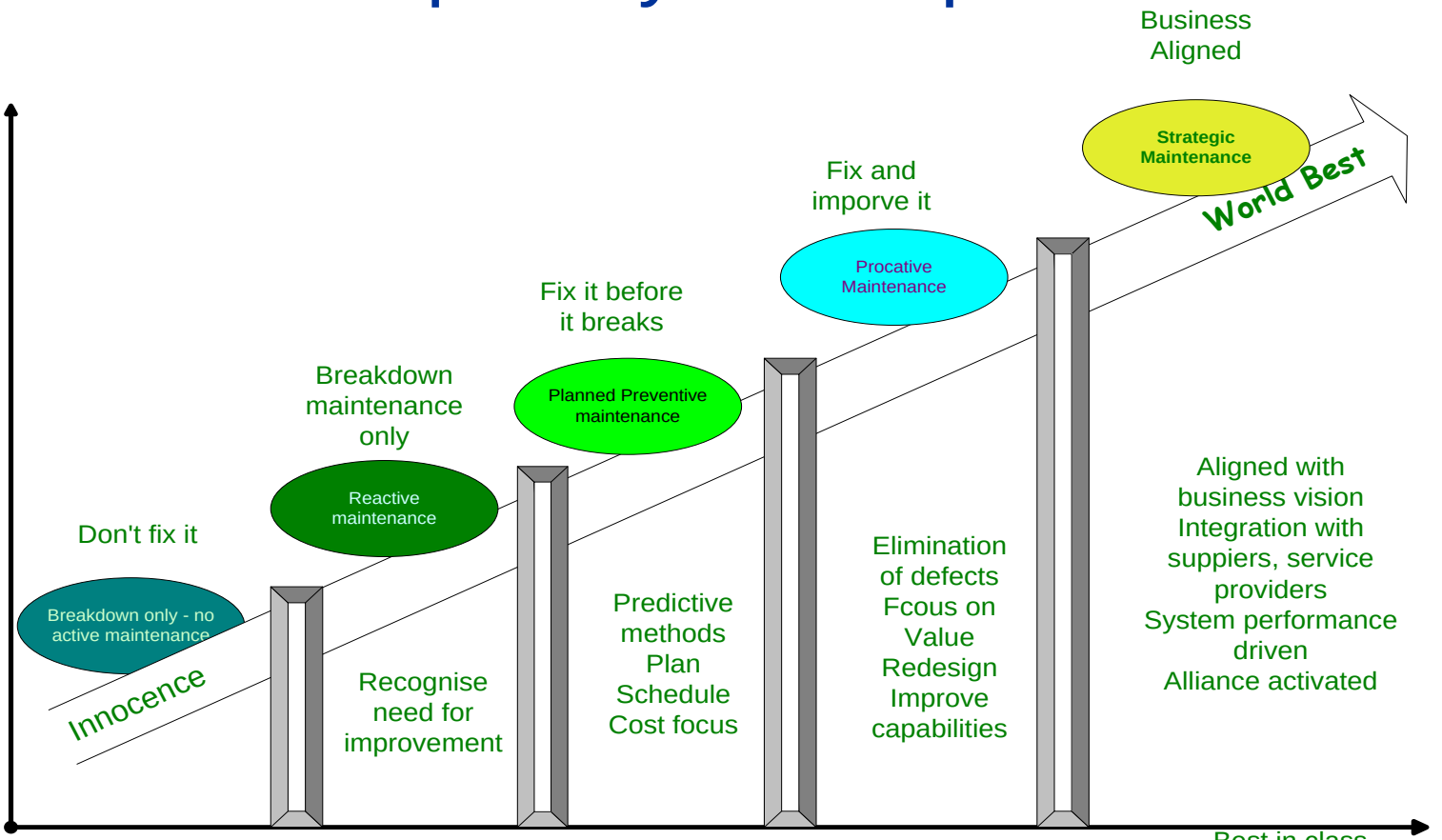
manage

investigate

Building of Corporate Knowledge (and in support of Asset Management)



Organisational capability development



Rewards:	Decaying equipment, Short term savings	Excessive efforts and cost	Few surprise failures, becoming competitive	High Availability, Relaibility, higly competitive	Best in class Operator of choice Recognition for optimised cost / activity
Motivation:	Budgets only	Breakdown	Avoid failures, reduce cost	Increase uptime	Growth and optimistation
Behaviour:	Decaying	Responsive	Organsied and Disciplined	Structured Learning and improvement	Inventive and Constructive