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PSM PRESENTATION

Engineering Process and Tools Organization (EP&TO)

Deploying Cost-Effective Software Quality Metrics Using Dynamic Process Modeling:A Methodology & Case History

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DEPLOYING COST EFFECTIVE SOFTWARE QUALITY METRICS USING DYNAMIC PROCESS MODELING: A METHODOLOGY & CASE HISTORY

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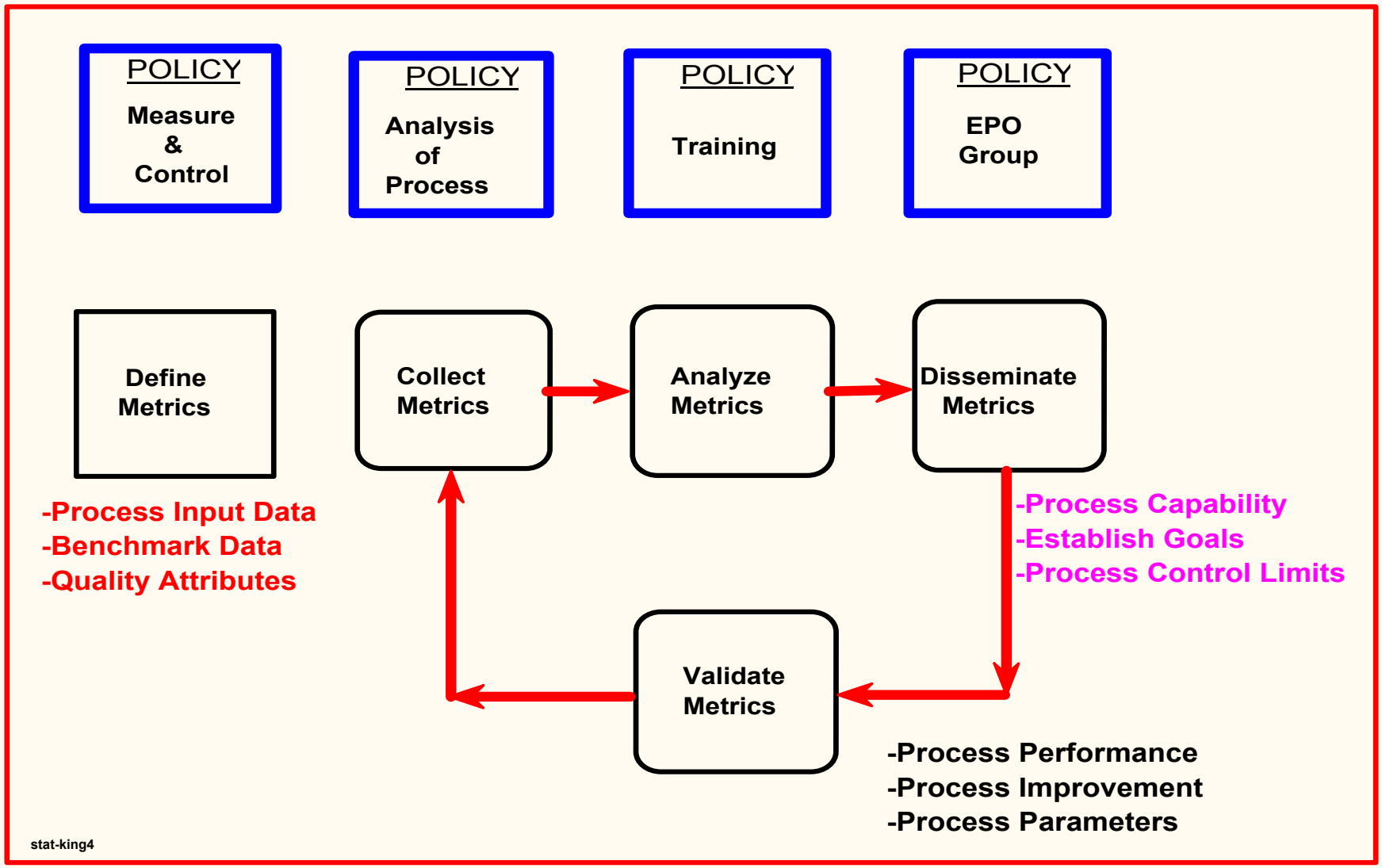

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SOFTWARE METRICS

I. PROGRAMMATIC METRICS

1. SOFTWARE COST
2. SOFTWARE SCHEDULE
3. SOFTWARE EFFORT (PERSON-MONTHS)
4. SOFTWARE SIZE (EXECUTABLE LINES OF COD
5. SOFTWARE COMPLEXITY
6. SOFTWARE RISK (ECONOMIC & TECHNOLOGY)
7. STAFF (HEADCOUNT)

II. PERFORMANCE METRICS

1. SOFTWARE DEFECTS (SEVERITY LEVELS)
2. SOFTWARE DEFECT DENSITY (DEFECTS PER 1,000 SLC
3. SOFTWARE PRODUCTIVITY (SLOC / STAFF-MONTH)
4. SOFTWARE CPU & MEMORY
5. SOFTWARE SLOC GROWTH RATE
6. SOFTWARE STABILITY & VOLATILITY
7. SOFTWARE OPERATIONAL AVAILABILITY

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costmet1

SOFTWARE METRICS

III. QUALITY METRICS

1. SOFTWARE RELIABILITY
2. SOFTWARE MAINTAINABILITY
3. SOFTWARE DEPENDABILITY
4. SOFTWARE INTER-OPERABILITY
5. SOFTWARE SURVIVABILITY
6. SOFTWARE EXPANDABILITY
7. SOFTWARE PORTABILITY

IV. COMPUTER SCIENCE METRICS

1. NUMBER OF COMMON & UNIQUE OPERATOR
2. NUMBER OF COMMON & UNIQUE OPERANDS
3. SOFTWARE CYCLOMATIC COMPLEXITY
4. SOFTWARE VOLUME
5. SOFTWARE EFFICIENCY
6. OOA / OOD--DEPTH OF INHERITANCE TREE
7. OOA / OOD--LACK OF COHESION

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"SEVEN (7) GOLDEN" METRICS

I. COST PERFORMANCE INDEX (CPI)

II. SCHEDULE PERFORMANCE INDEX (SPI)

III. DEFECTS (DEFECT DENSITY & CONTAINMENT)

IV. SOFTWARE PRODUCTIVITY

V. LEARNING

VI. RETENTION

VII. DIVERSITY

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CPI & SPI METRICS

INPUT PARAMETERS:

A) BCWS: BUDGETED COST OF WORK SCHEDULE
B) BCWP: BUDGETED COST OF WORK PERFORM
C) ACWP: ACTUAL COST OF WORK PERFORMED

CALCULATED VALUES:

SCHEDULE PERFORMANCE INDEX: SPI=BCWP/BCWS

COST PERFORMANCE INDEX: CPI=BCWP/ACWP

SCHEDULE VARIANCE: SV=(BCWP)-(BCWS)

COST VARIANCE: CV=(BCWP)-(ACWP)

PERCENT SCHEDULE VARIANCE: PCTSV=((BCWP-BCWS)/BCWS)*100.

PERCENT COST VARIANCE: PCTCV=((BCWP-ACWP)/BCWP)*100.

PRODEF1C.STG
COSTMET1

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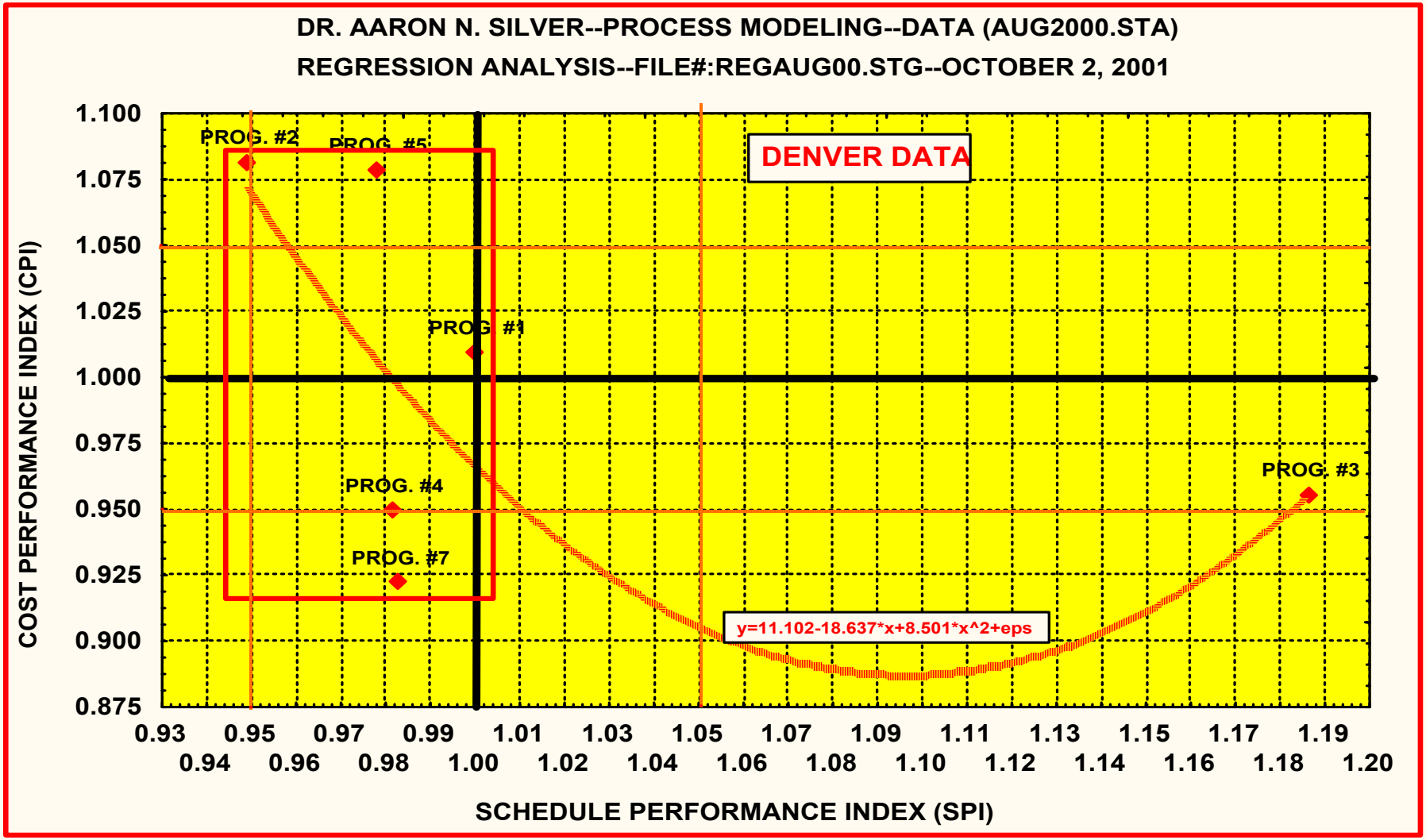

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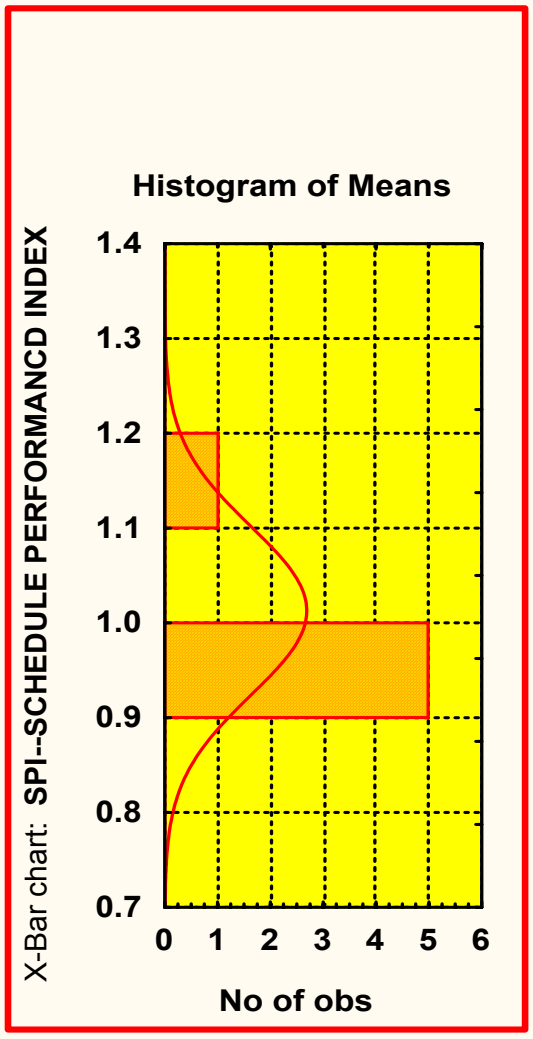

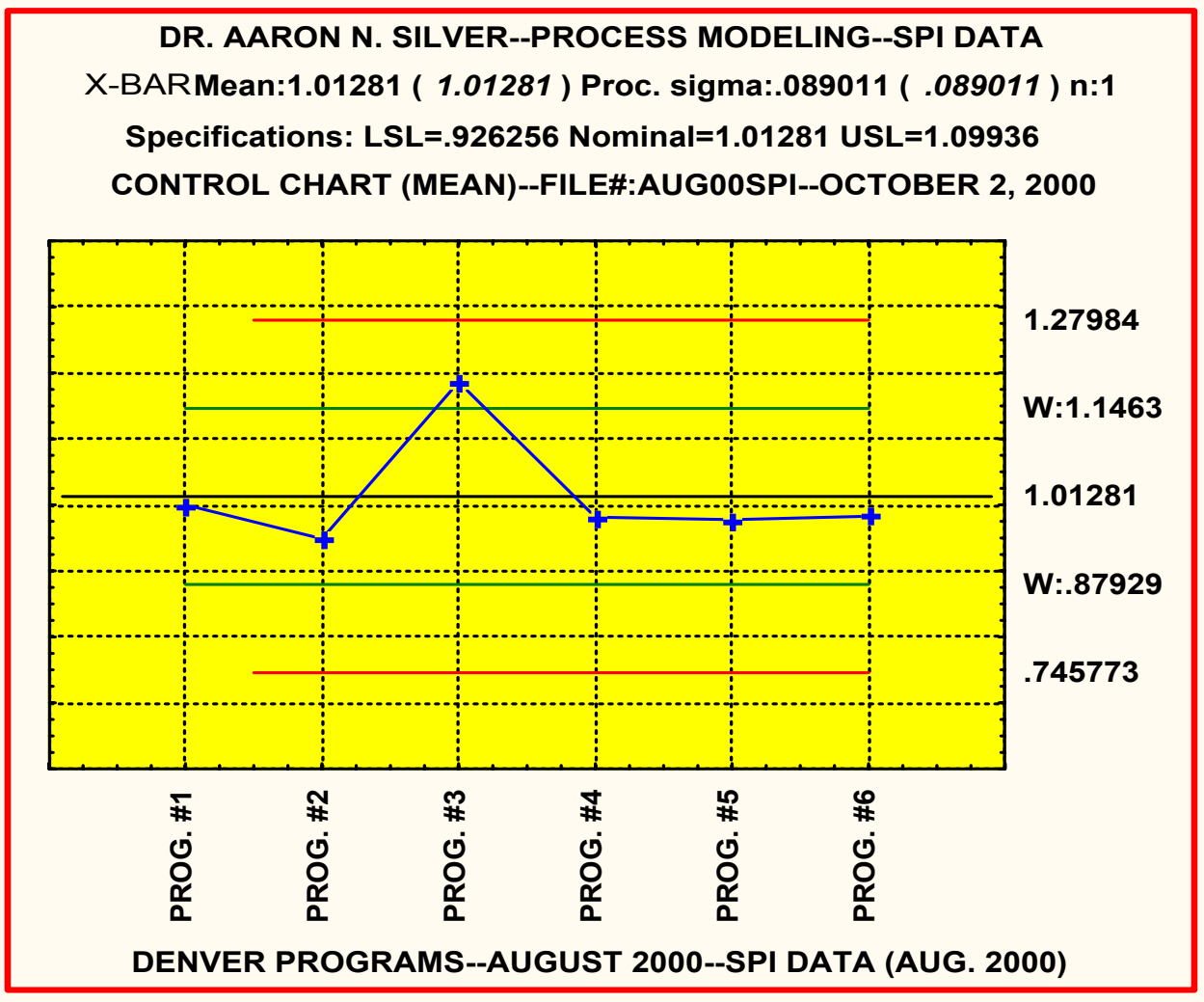

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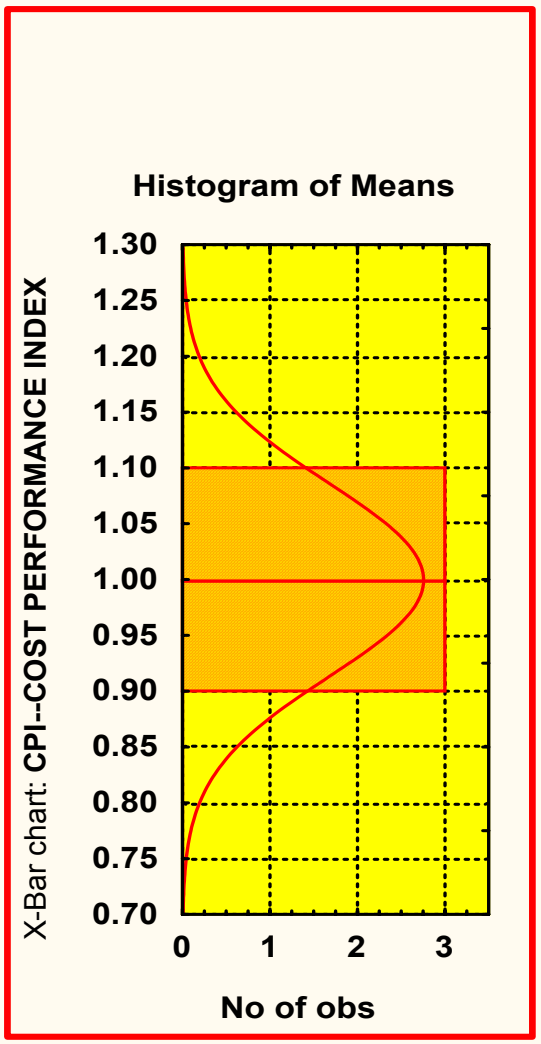

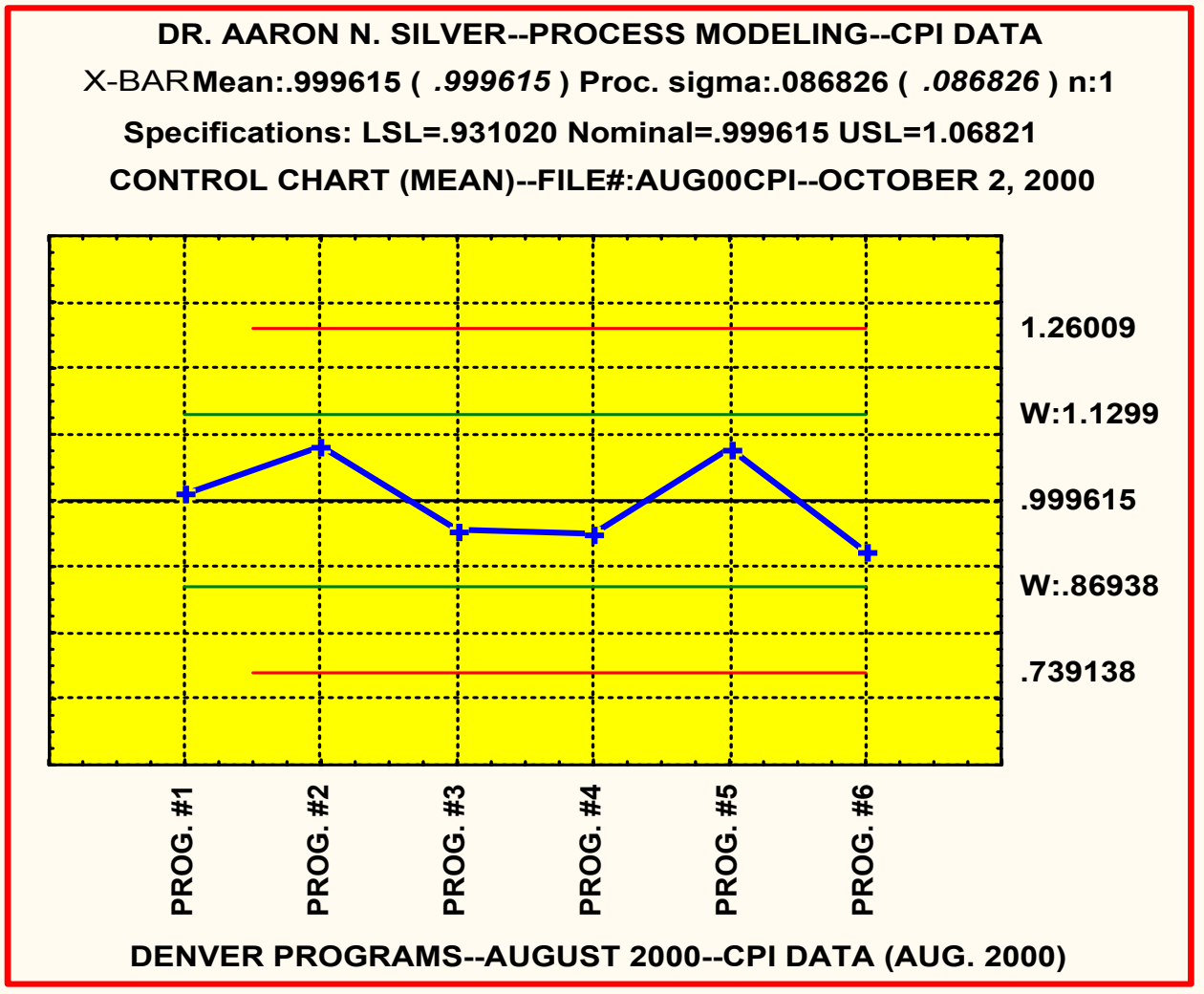

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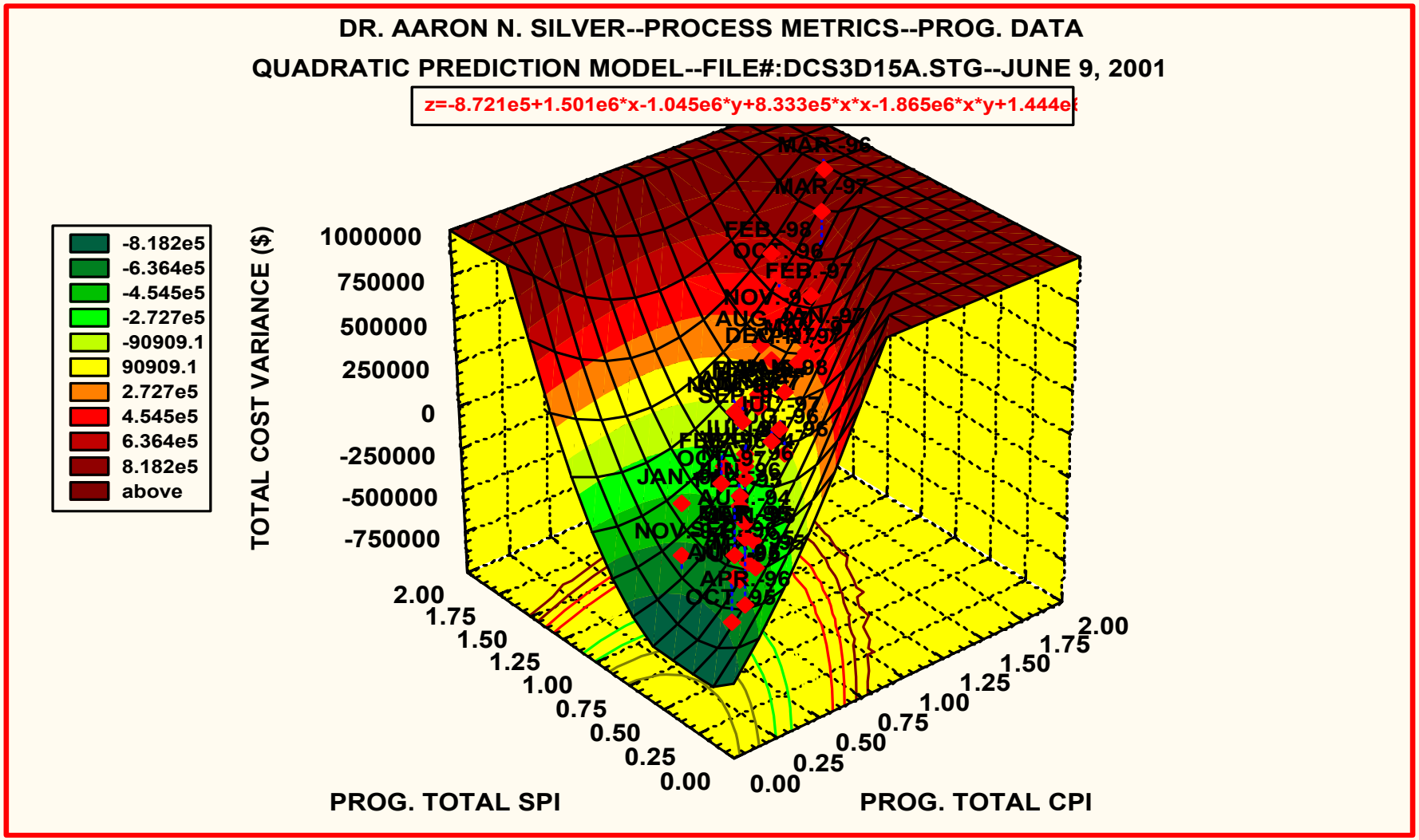

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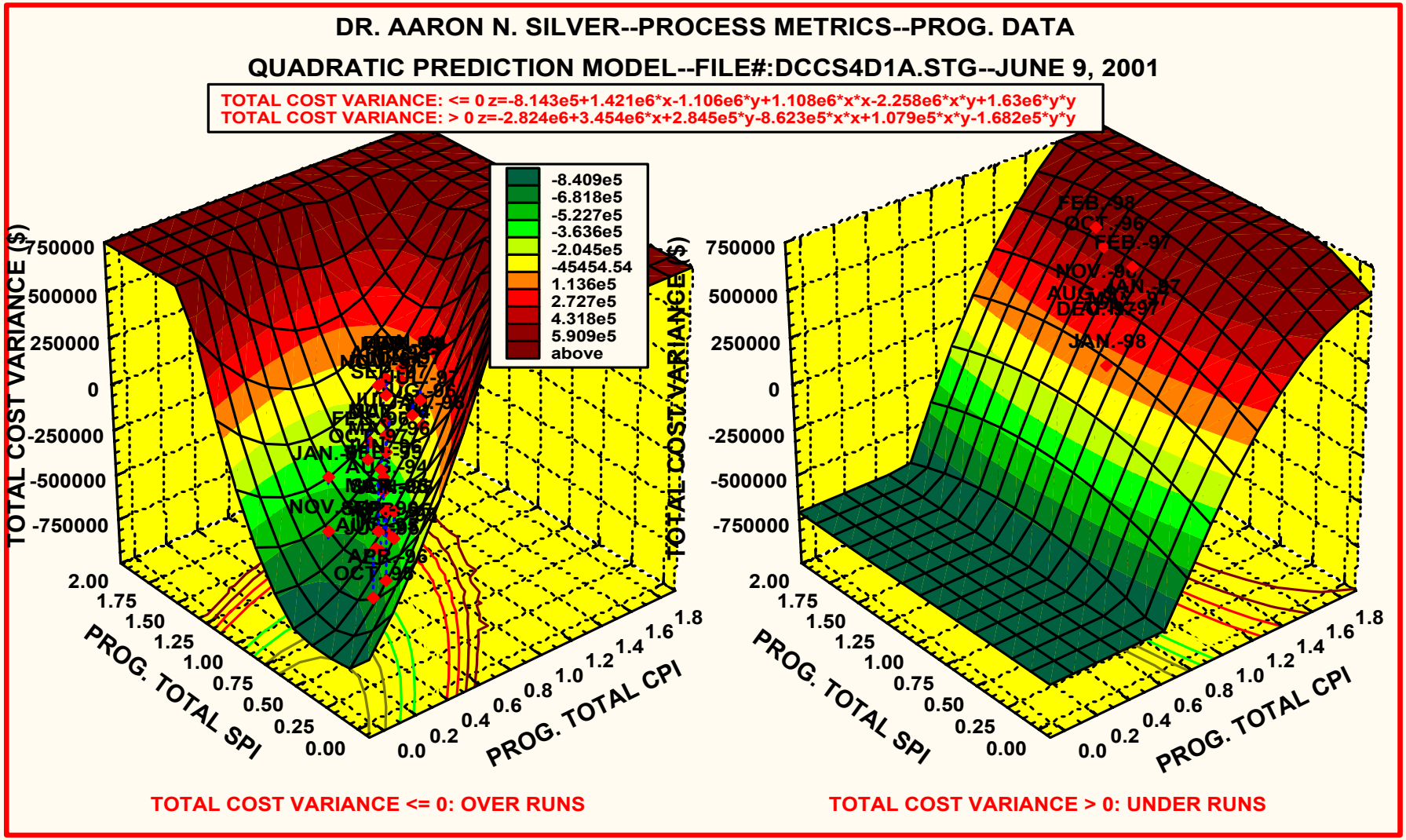

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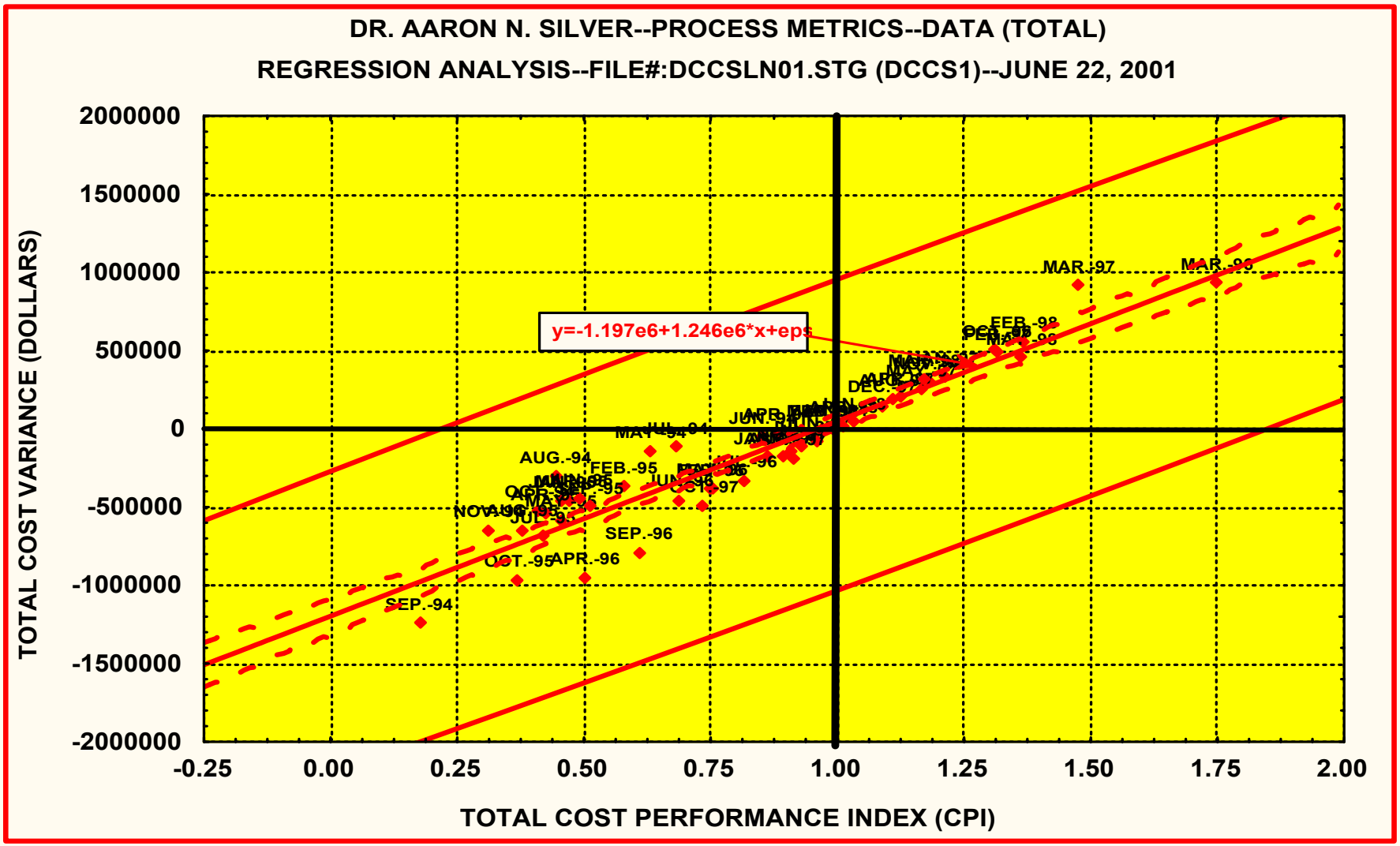

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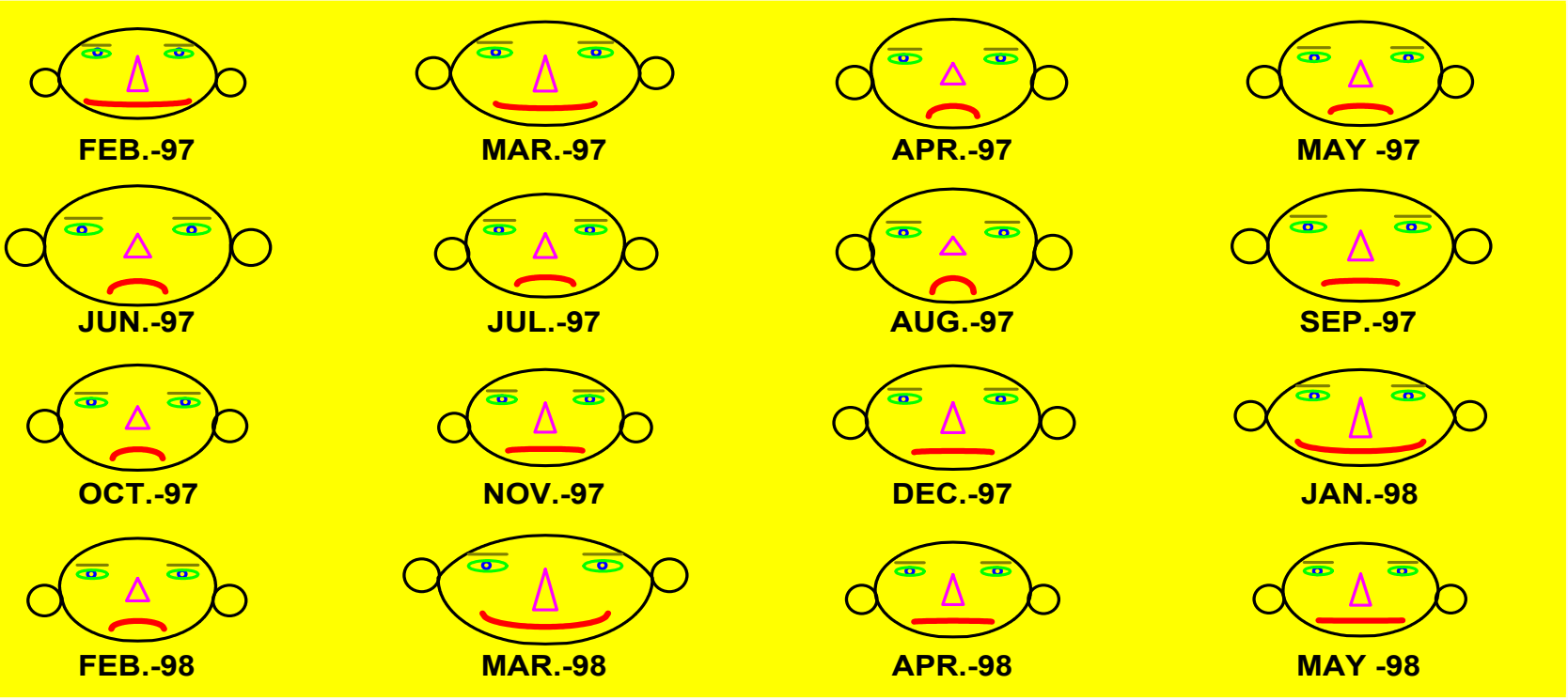
DR. AARON N. SILVER--PROCESS METRICS

FILE#:DCCSCHR2.STG (DCCS1)--JULY 7, 2001



CHERNOFF FACES--MANAGEMENT COMPONENT (DOLLAR DERIVED)

LEGEND: face/w = MGT. BCWS, ear/lev = MGT. BCWP, halfface/h = MGT. ACWP,
upface/ecc = MGT.SCH.VAR., loface/ecc = MGT.PCT.SCH.VAR., nose/l = MGT.PCT.COST VAR.,
mouth/cent = MGT. SPI, mouth/curv = MGT. COST VAR., mouth/l = MGT. CPI,

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Balanced Scorecard

Planning

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Command, Control, Communication and Information Systems (C^3I)

Financial

Strategic Objective	*Measurement*
• Growth Orientation & Financial Strength	**Negotiation metric** *Cash* *Revenue - 2004* *Margin* *Annual growth* *ROIC*

Process

Strategic Objective	*Measurement*
• Process Improvement	**Defect Rate** *ROI on Improvements* *Productivity Improvement (O/H)*
• Integrated Planning & Forecasting	**% Functional Groups in Plans** *Performance to Plan*
• FEOTB - Market, Capture, Propose	**Funnel of Opportunities** **Balance of Business Portfolio** *Capture Rate* *ROIC*
• Develop Business Solutions / Products & Services	**Product Development Cycle Time** *% License & Maintenance Fees / Sales*

Customer

Strategic Objective	*Measurement*
• Meet Commitments, Expectations Easy to do Business with	**Gate 5 reviews** *Composite award fee* *SPI* *CPI*
• Protect, Expand, Diversify Customer Base	**# of New Acquisition Sources** *Market Share*

Learning

Strategic Objective	*Measurement*
• Share Best Practices and Lessons Learned	**Build / Reuse Ratio** *Gate II Completion*
• Focused People Strategy	**Strategic Job Coverage Ratio** **# Successors / Critical Positions** *Retention Rate*
• Skill Development	**Critical Skill / Need Ratio** **Skill Training Plan** *Performance to Plan*
• Investment - People, Assets, Technology	**Targeted R&D to Sales** *Actual R&D to Sales* *ROIC*

Lead
Lag

"Classic Balanced Scorecard"

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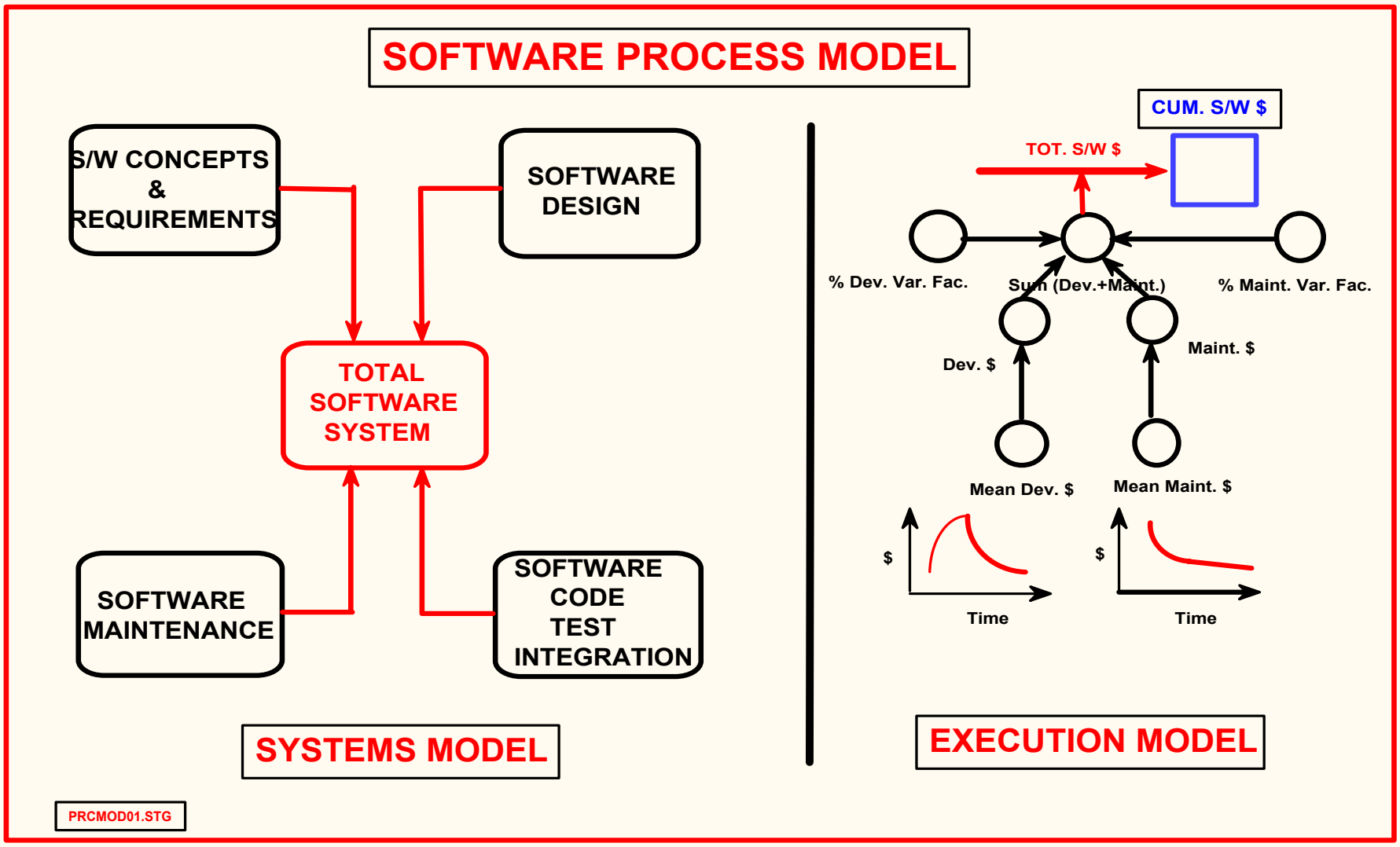

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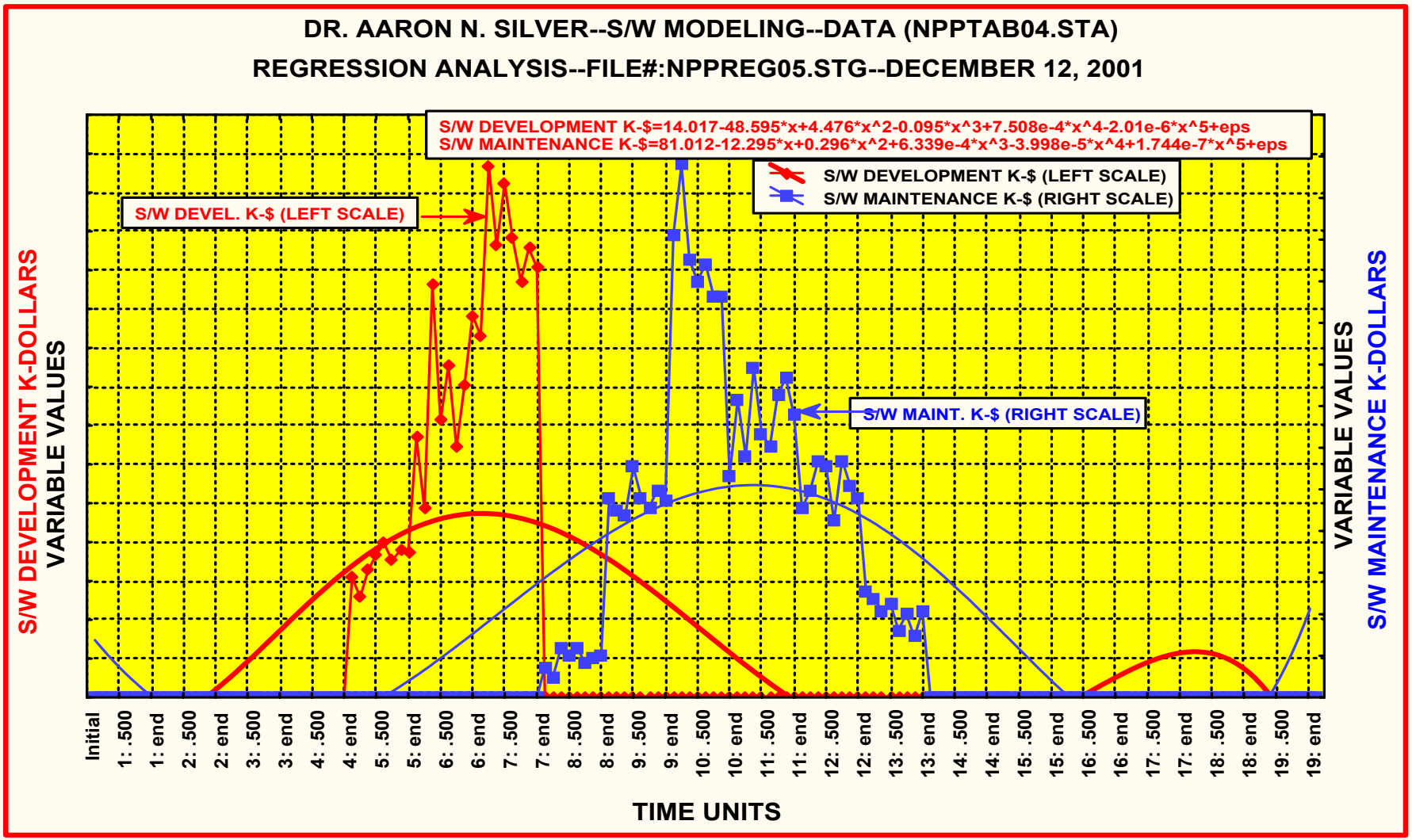

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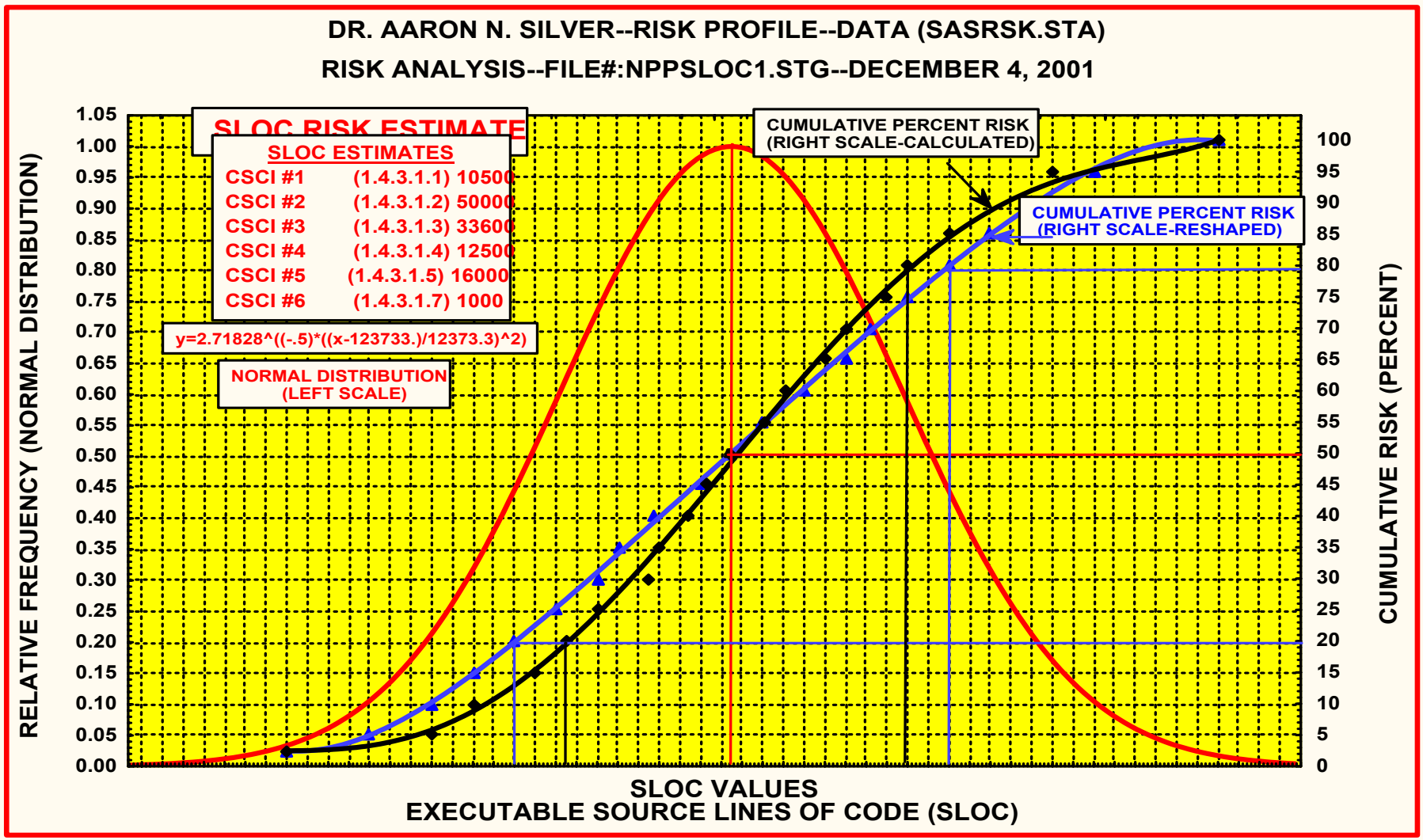

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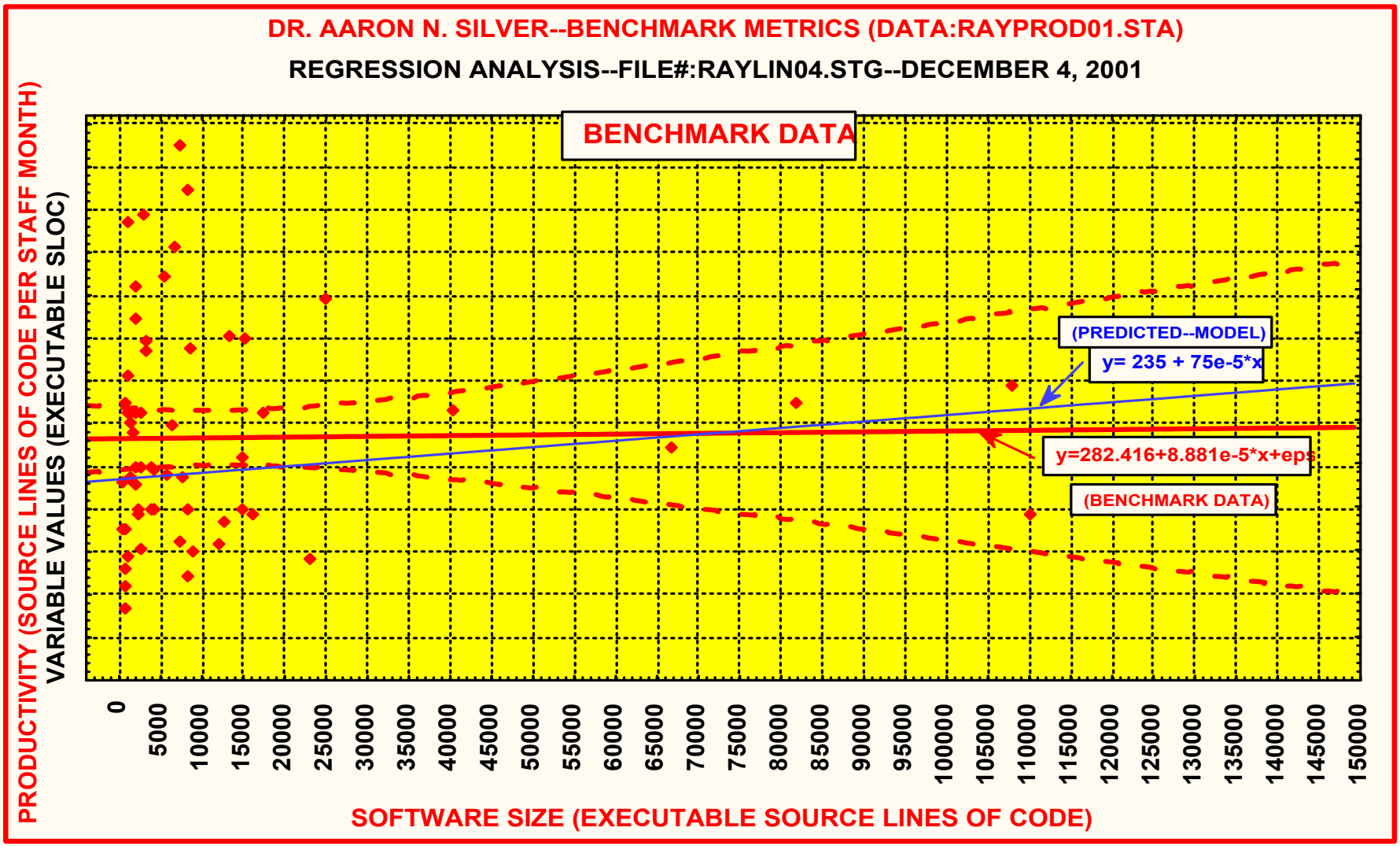

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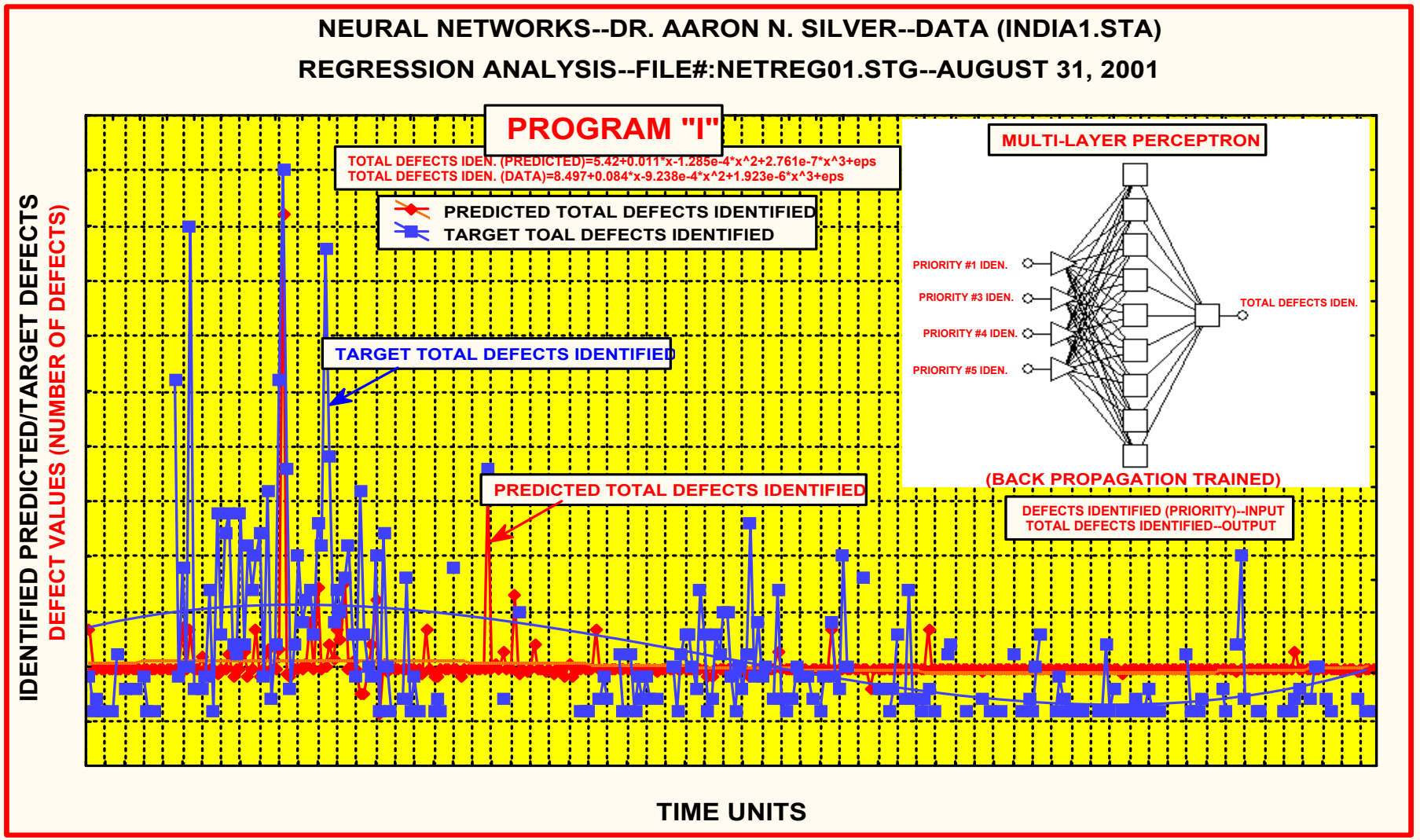

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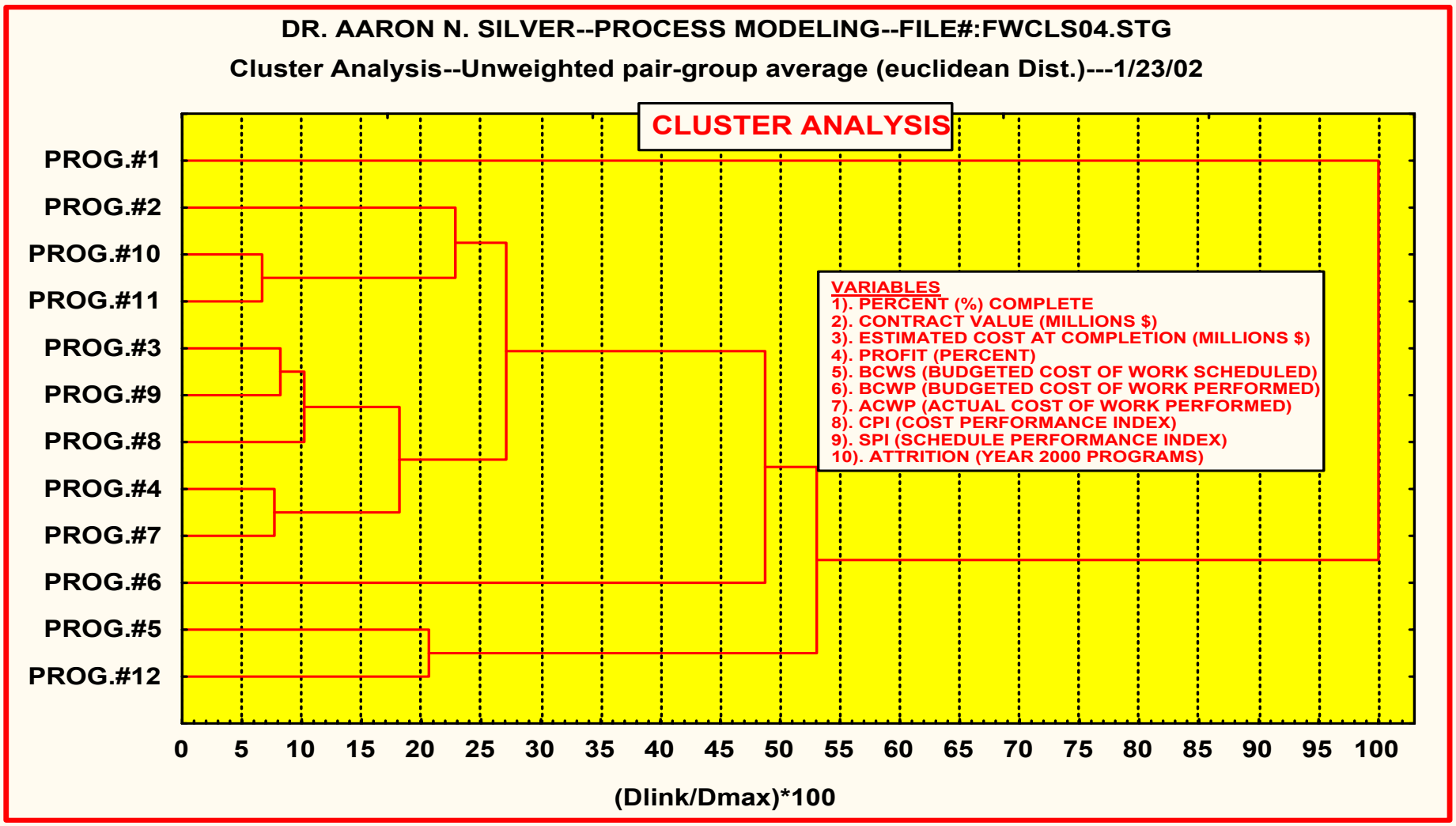

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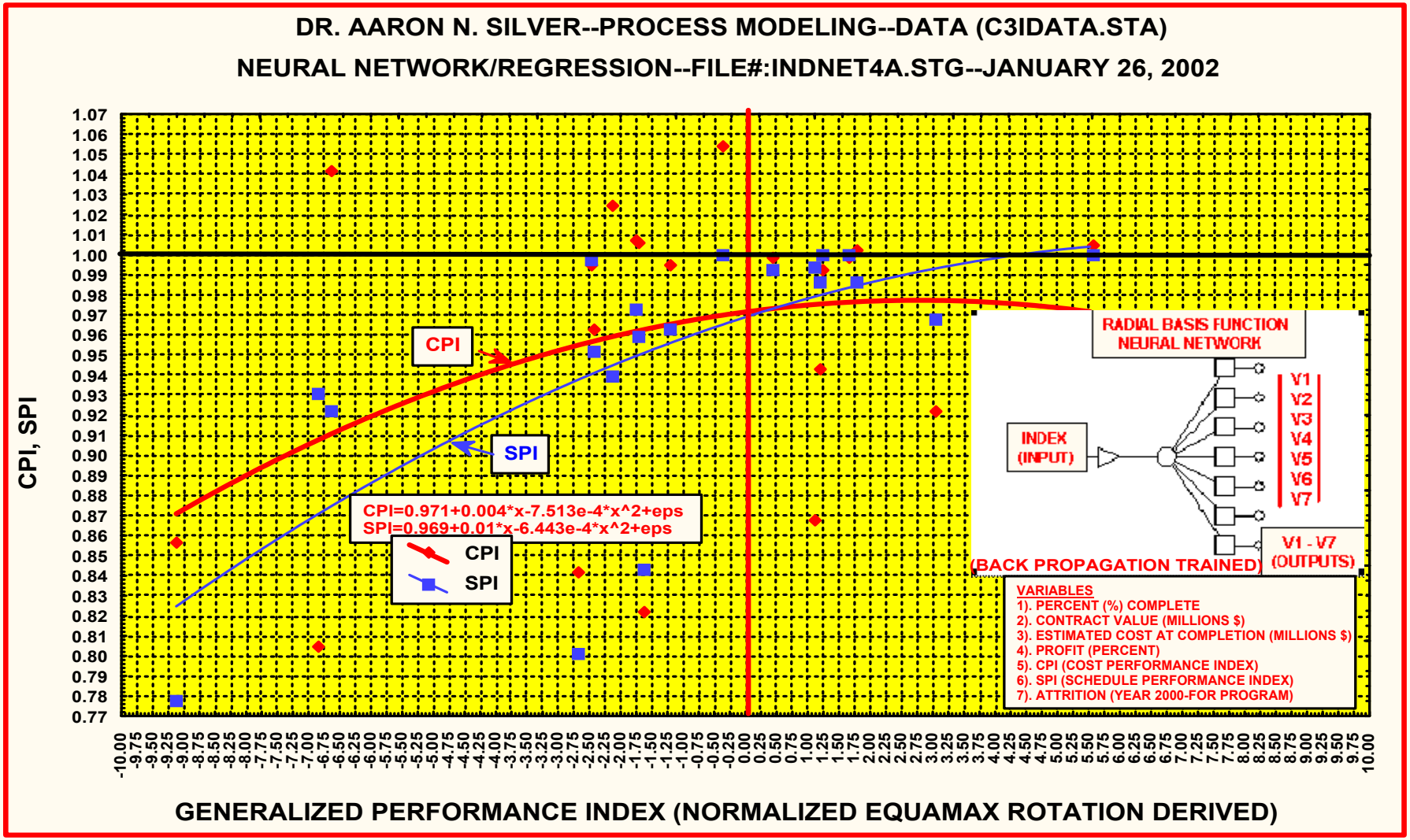

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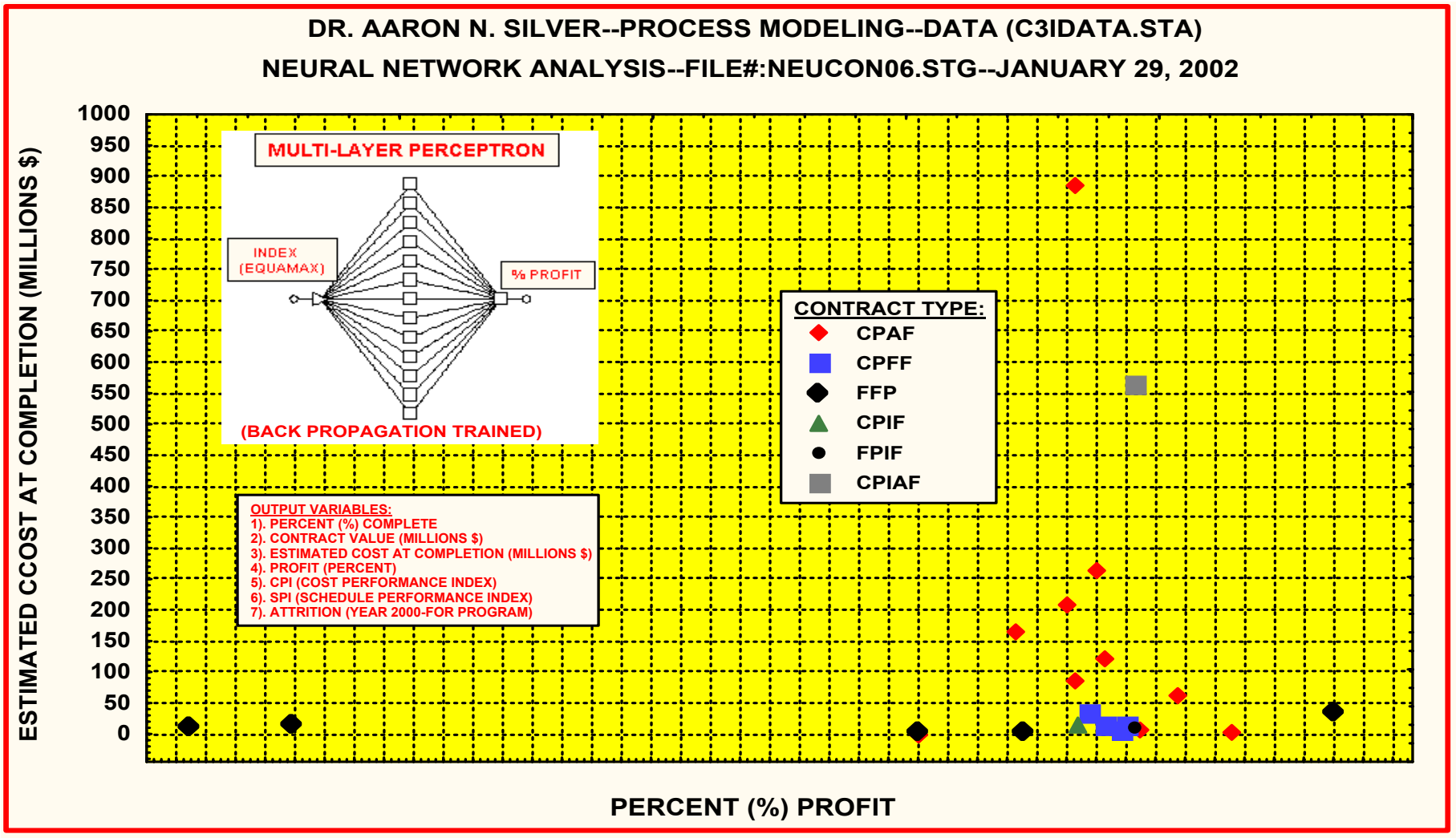

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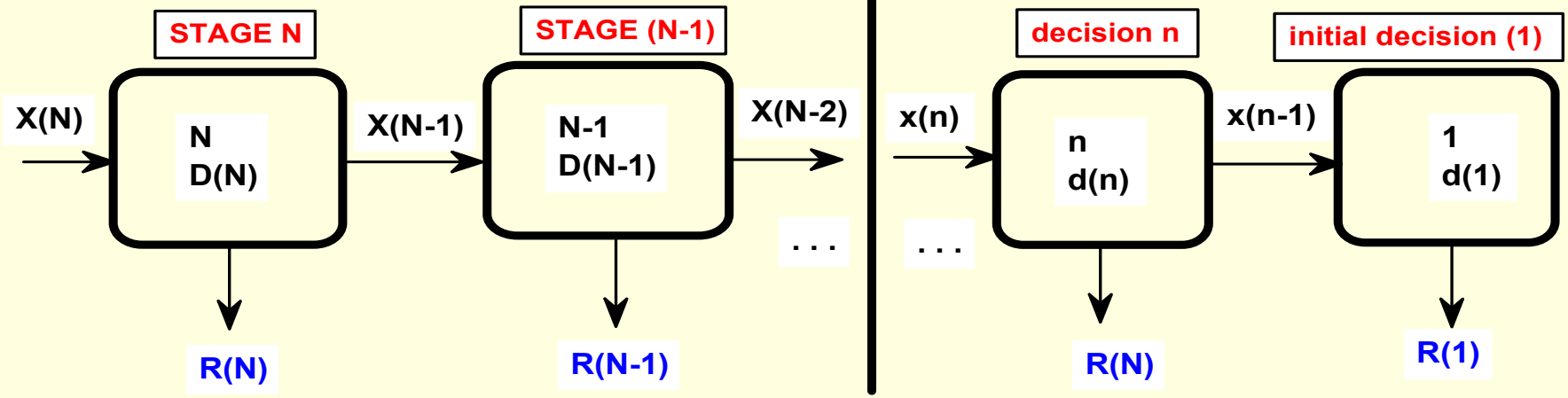
DR. AARON N. SILVER--FILE#:DYNCPC04.STG--OCTOBER 6, 2001

X(N)=STATES OF SYSTEM AT STAGE N
R(N)=RETURN FROM STAGE N
D(N)=DECISION AT STAGE N

n=specific stage "n"
d(n)=specific decision at stage "n"



BELLMAN'S PRINCIPLE OF OPTIMALITY

"An optimal set of decisions to an n stage process has the property that no matter what the state of the input of the system is at stage n, and no matter what decision is made at stage n, the remaining decisions must be optimal with respect to the state resulting from the nth stage decision."

$$Q_n (X_n, D_n) = R_n (X_n, D_n) + F_{n-1} (X_{n-1})$$
$$\text{and } F_n (X_n) = \max_{d_n} \{ Q(X_n, D_n) \}$$

DYNCPC04.STG

Process Modeling

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DR. AARON N. SILVER--PROCESS MODELING--DATA (SILTXT.STA)
DYNAMIC PROGRAMMING--FILE#:DYNDAT01.STG--FEBRUARY 5, 2001

REQUIREMENTS ANALYSIS

NUMERIC VALUES	1 STATE_0	2 STATE_1	3 STATE_2	4 STATE_3	5 STATE_4	6 STATE_5	7 STATE_6	8 STATE_7	9 STATE_8	10 STATE_9	11 STATE_10
STAGE_1	0.000	40.000	10.000	60.000	20.000	80.000	40.000	100.000	60.000	100.000	80.000
STAGE_2	0.000	5.000	30.000	20.000	50.000	40.000	70.000	60.000	90.000	80.000	100.000
STAGE_3	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000
STAGE_4	0.000	50.000	15.000	40.000	30.000	60.000	50.000	80.000	70.000	95.000	100.000
STAGE_5	0.000	7.500	40.000	50.000	15.000	45.000	75.000	50.000	65.000	75.000	100.000
STAGE_6	0.000	2.500	5.000	6.500	8.500	10.500	12.500	15.000	17.500	20.000	100.000
STAGE_7	0.000	80.000	82.500	85.000	87.500	89.500	91.500	93.500	95.000	97.500	100.000

STATE VARIABLES = PERCENT OF RESOURCES (REQUIREMENTS) DEPLOYED
STAGES (ALTERNATIVES) = PROPOSED REQUIREMENTS
MATRIX ENTRIES = PERCENT EFFECTIVENESS

OBJECTIVE:
ALLOCATE REQUIREMENTS TO PERCENT (%) RESOURCES DEPLOYED TO "MAXIMIZE" OVERALL EFFECTIVENESS.

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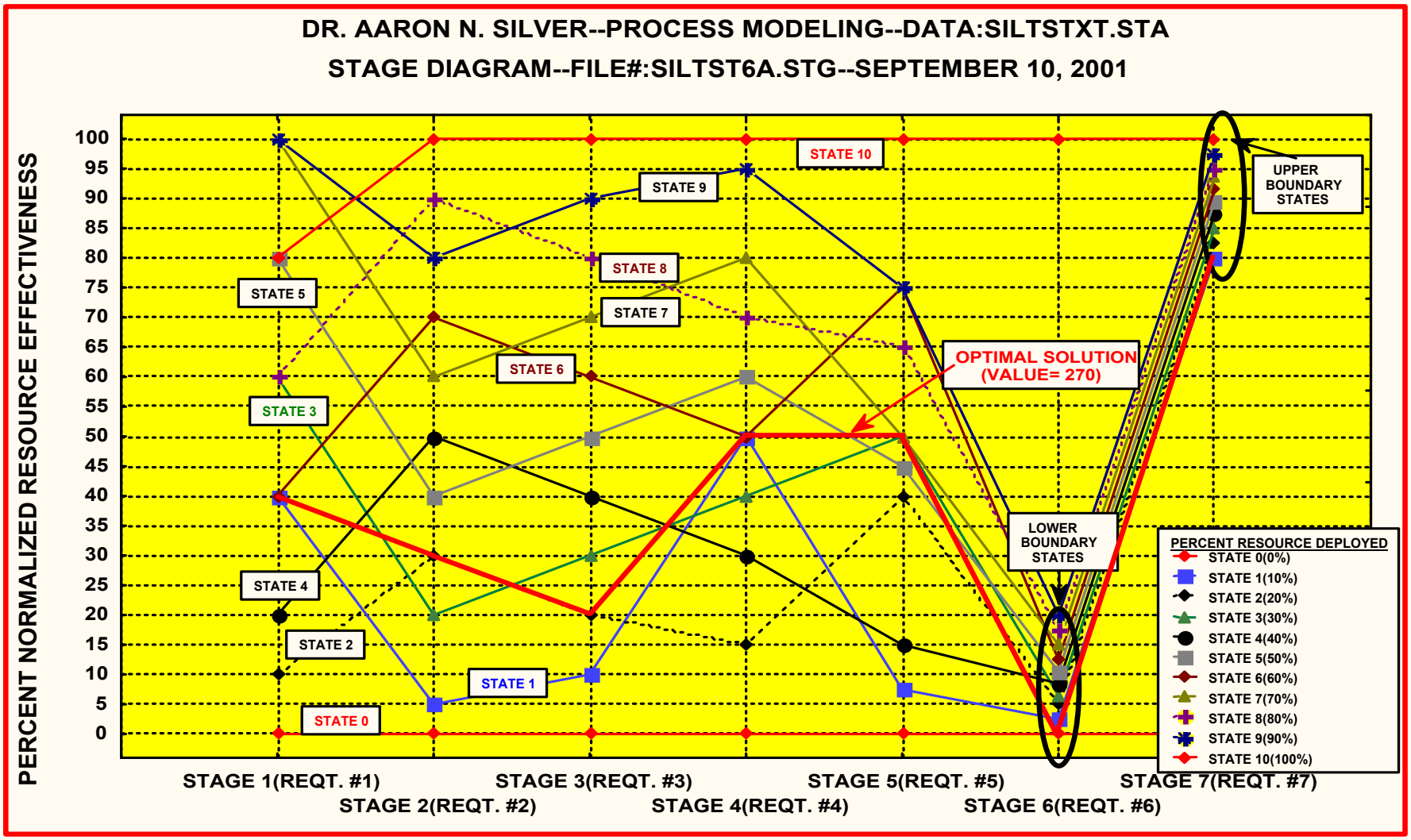

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