

Incomplete RCCA Insertion

Program Status

NRC Meeting

June 17, 1997

Agenda

- **Bow Sensitivity to Oxide**
- **Bow / Growth Sensitivity to Power History**
- **Fuel Assembly Bow Impact on RCCA Drag**
- **South Texas - Model Benchmark Results**
- **Impact of Lower Span Drag on Upper Span Drag**
- **Wolf Creek Model Renormalization**
- **Model Presentation**

Bow Sensitivity to Oxide

Growth and Bow vs. Relative Time - Span 6 (Zircaloy & ZIRLO)



Bow Sensitivity to Oxide

ZIRLO Growth and Bow vs. Oxide Thickness - Span 6



Bow Sensitivity to Oxide

Zircaloy 4 Growth and Bow vs. Oxide Thickness - Span 6



Power History Sensitivity

- Ground Rule:
 - Burnup is conserved @ 50,000
 - to determine allowable power
 - histories(P1,P2,P3)
- Example:
 - 3, 18month cycles
 - WC H-50 FA used to generate study
 - Represents a limiting condition
 - Specific only to this design(V5H,noIFM)

Bow/ Growth Sensitivity to Power History

Cycle 3 Power vs. Power History



Bow/ Growth Sensitivity to Power History

Span 1 Bow vs. Power History



Bow/ Growth Sensitivity to Power History

Assembly Growth vs. Power History

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Fuel Assembly Bow Impact on RCCA Drag

Calculations & Assumptions

abc

Fuel Assembly Bow Impact on RCCA Drag

Calculations & Assumptions



Fuel Assembly Bow Impact on RCCA Drag

Selected Assembly Bow and Drag Results - Wolf Creek Data



Fuel Assembly Bow Impact on RCCA Drag

Selected Assembly Bow and Drag Results - South Texas Data

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Fuel Assembly Bow Impact on RCCA Drag

Results and Conclusions

abc

Mechanical Model Applied to South Texas

South Texas - Model Benchmark Results

Measured vs. Predicted Assembly Growth

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South Texas - Model Benchmark Results

Measured vs. Predicted Total Drag



South Texas - Model Benchmark Results

Measured vs. Predicted Upper Span Drag



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South Texas - Model Benchmark Results

Measured vs. Predicted Dashpot Drag



Impact of Lower Span Drag on Upper Span Drag



Impact of Lower Span Drag on Upper Span Drag



Impact of Lower Span Drag on Upper Span Drag



Impact of Lower Span Drag on Upper Span Drag

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Impact of Lower Span Drag on Upper Span Drag

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Impact of Lower Span Drag on Upper Span Drag



Wolf Creek Model Renormalization

Measured vs. Predicted Assembly Growth

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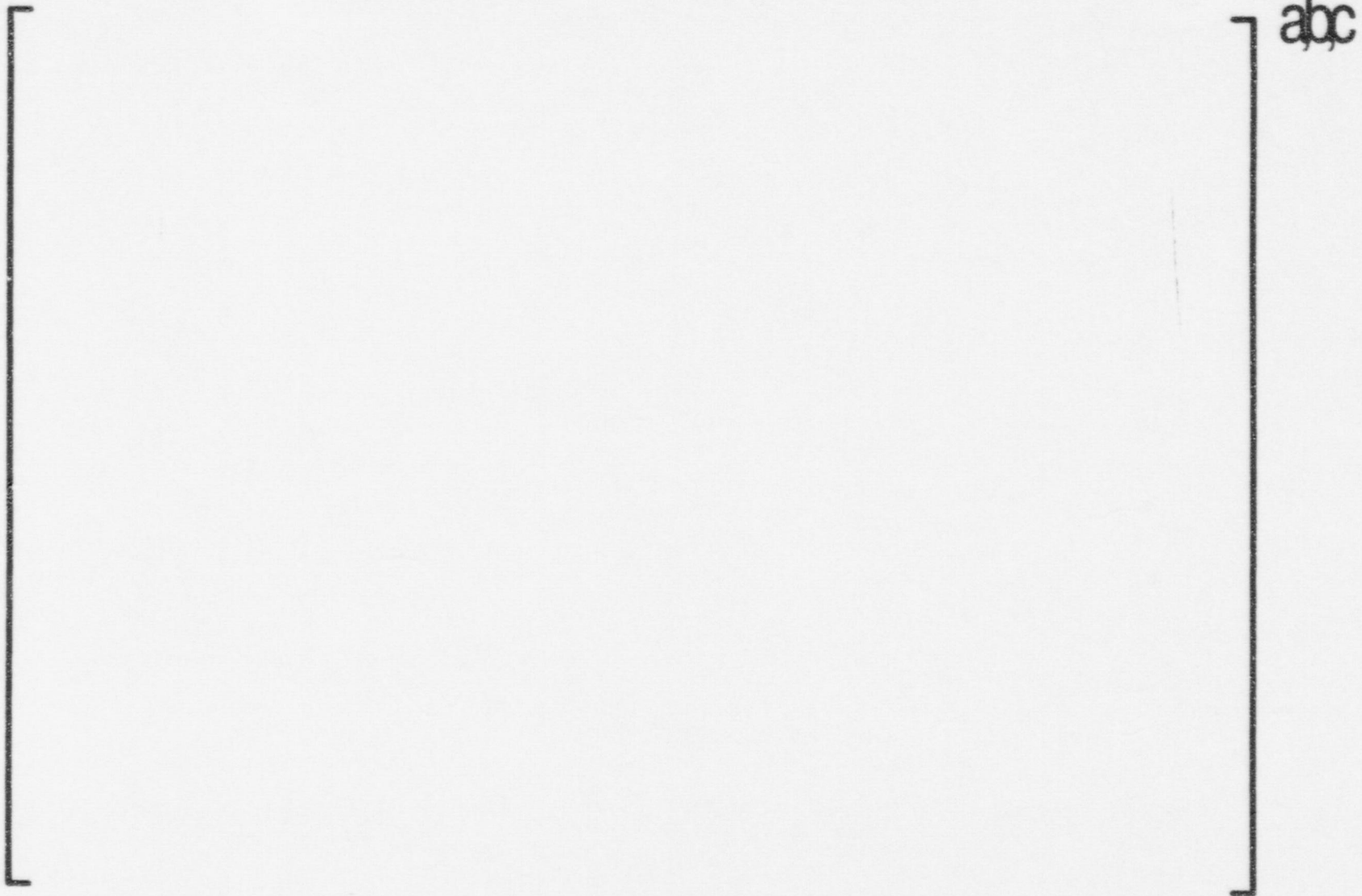
Model Presentation

Fuel Assembly Schematic and GROBOW Model Representation

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Model Presentation

Thimble Growth and Bow Model Calculation Schematic



SPECIFY SYSTEM PARAMETERS

a,b,c

SKELETON ROD LOADING

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] a,b,c

APPLY EXTERNAL FORCES

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] a,b,c

MAKE BOC LOAD ADJUSTMENTS

[

] a,b,c

ROD/THIMBLE GROWTH CREEP LOADS

[

] a,b,c

RATIO OF ZORBA TO REVNAC PREDICTIONS IN WC H50

a,b,c

MODEL FOR AXIAL GROWTH DUE TO OXIDE

a,b,c

MPR GROWTH vs FLUENCE

a,b,c

MPR GROWTH vs FLUENCE

a,b,c

THIMBLE BOW/DRAW

a,b,c

Thimble and RCC Bow Interference



a,b,c

FUEL ASSEMBLY GROWTH

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HOLDDOWN SPRING LOADS

[

] a,b,c

GRID DRAG LOADS

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] a,b,c

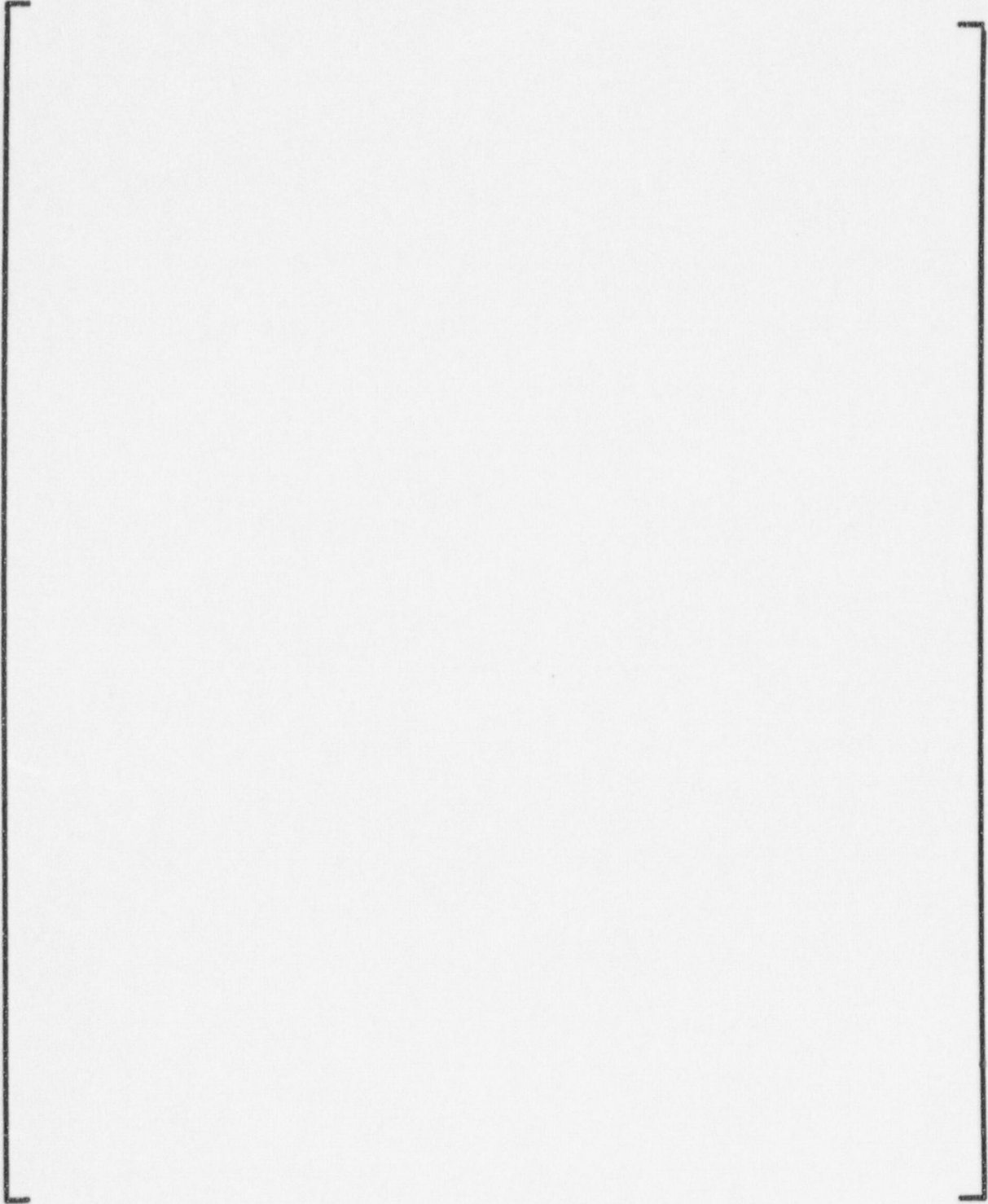
ZIRC Grid Spring Force Relaxation

a,b,c

INCONEL 718 Grid Spring Force Relaxation

a,b,c

a,b,c



Drag Work vs Fluence for Different Design Type

- Fuel Types :

- 17x17 w/o IFM
- 17x17 w IFM
- 15x15 OFA
- 14x14 OFA

Fuel Features not considered explicitly BUT
will have a positive on IRI: ZIRLO, P-grid

Operating Parameters not consider explicitly
will have impact: Temperature, cycle length

Figure 5a
IRI Fuel Category Study - 14 OFA

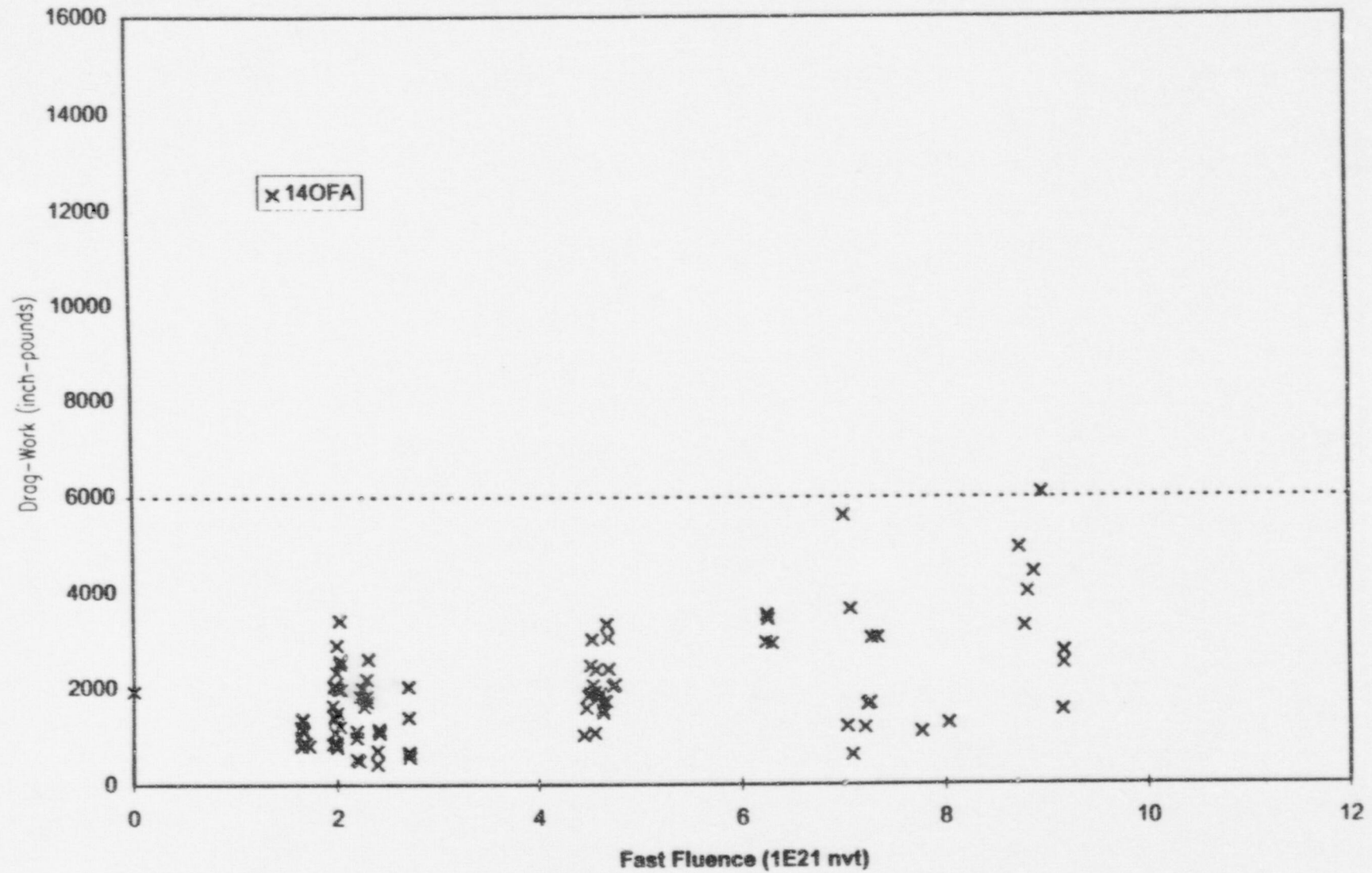


Figure 5b
IRI Fuel Category Study - 15OFA

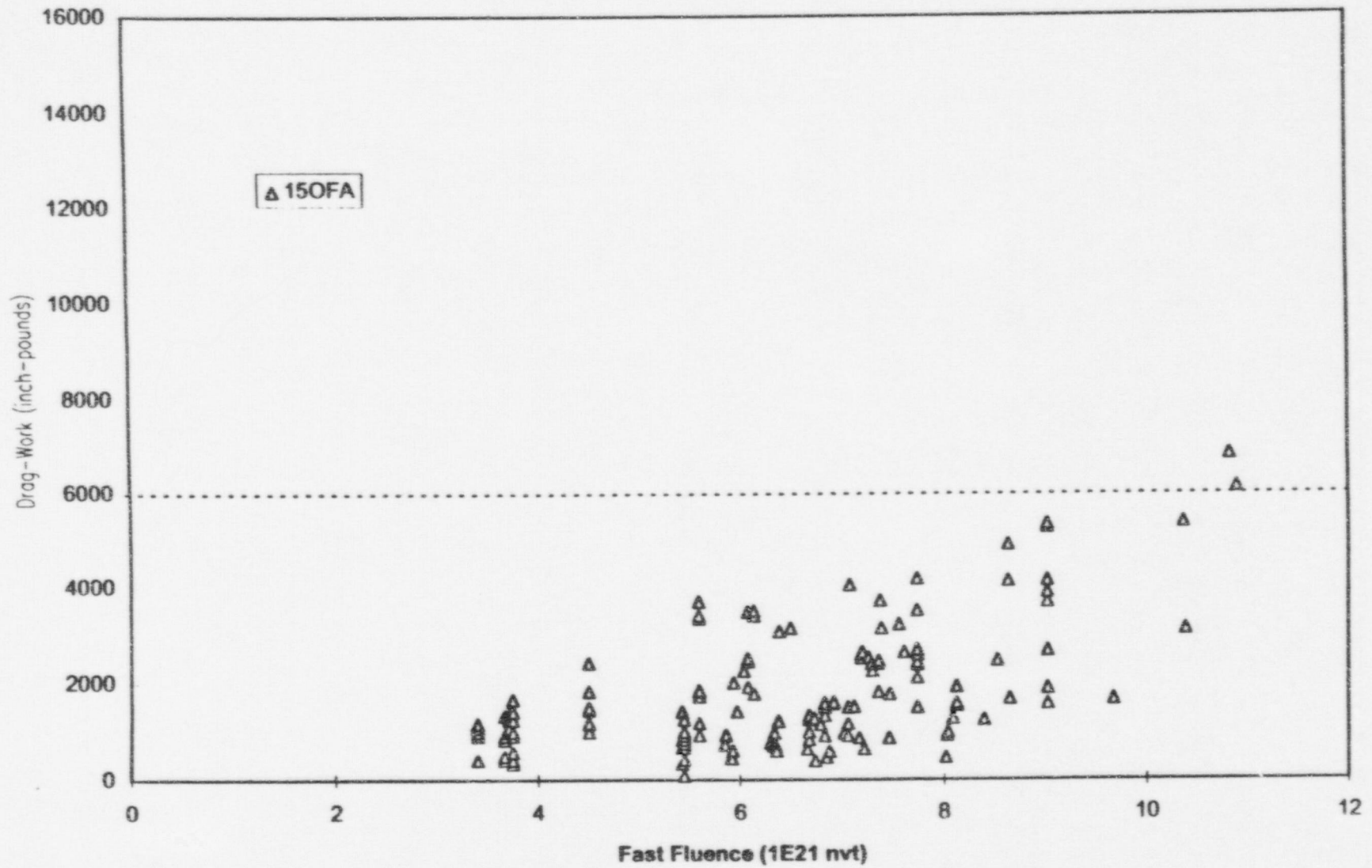


Figure 5d

IRI Fuel Category Study - 17 w IFMs

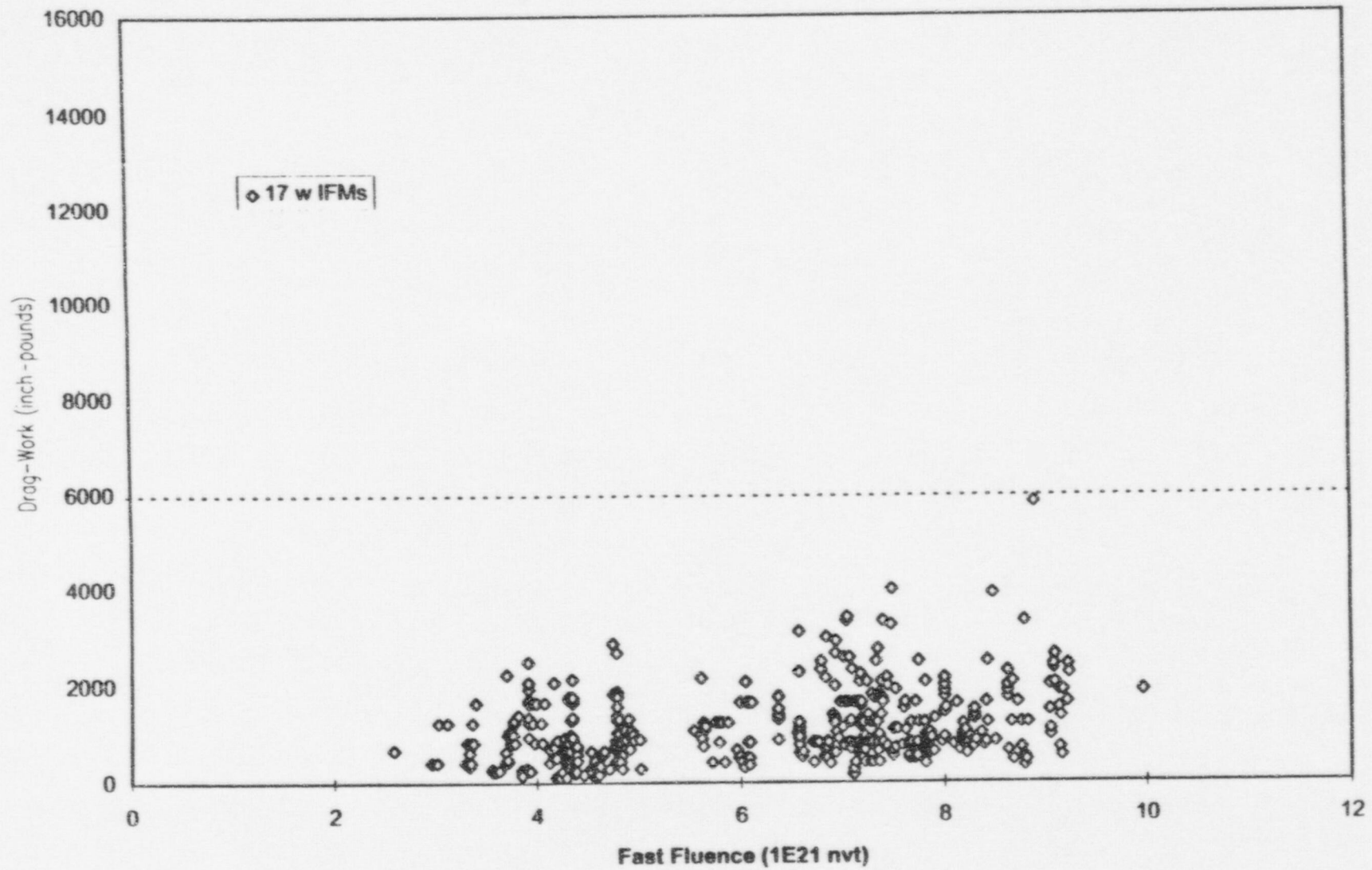
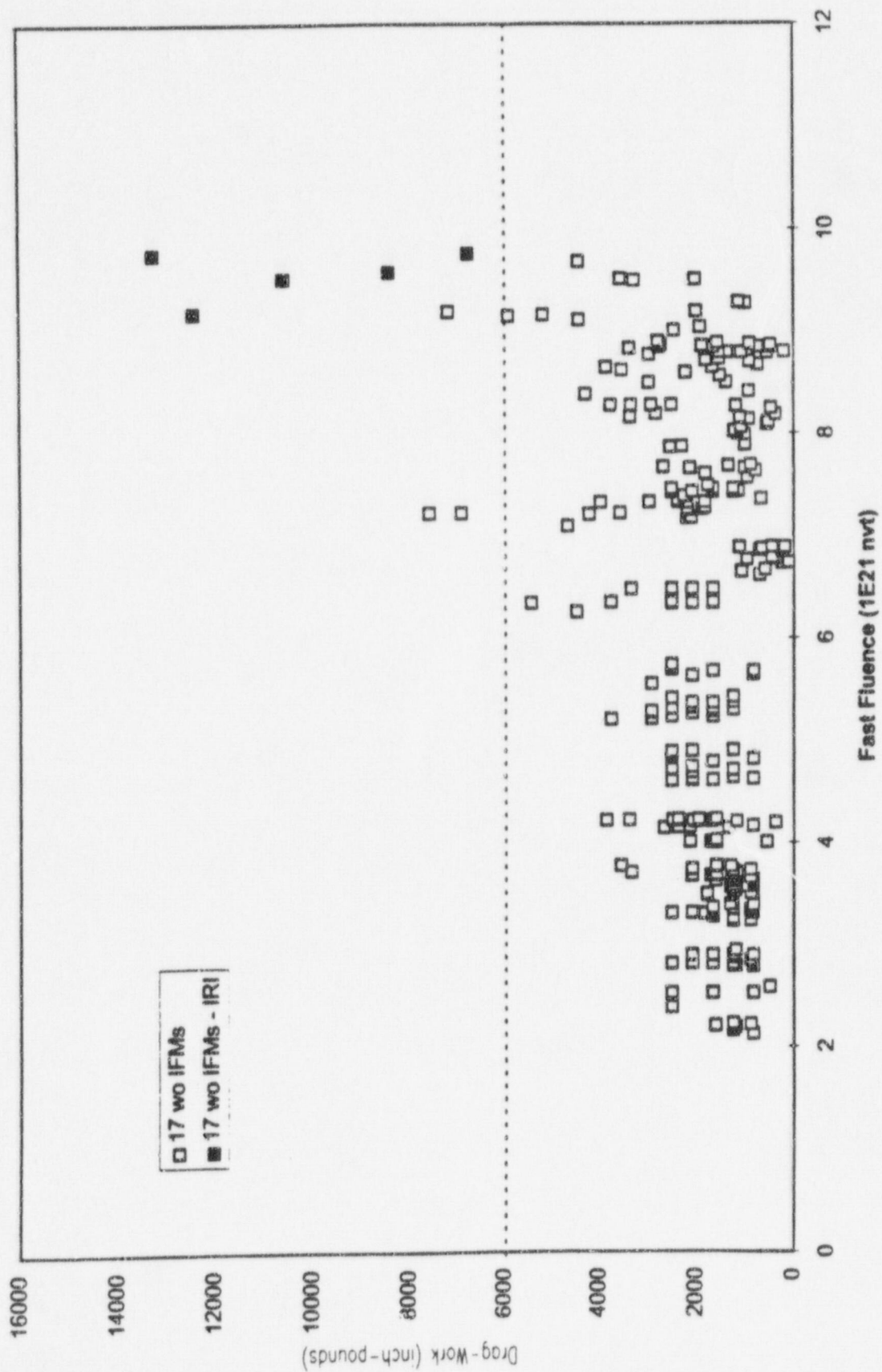


Figure 5e

IRI Fuel Category Study - 17 wo IFMs



•Proactive Actions to Address IRI

- Recommend use of ZIRLO for Skeleton especially for high temperature plants and P-grids

South Texas : ZIRLO guide thimble,P-grids (Fall '97)

Introduction of Thicker Guide Thimble

Wolf Creek 8 LTA: ZIRLO Skeleton

Thicker GuideThimble(25%inc)

P-grids

MV5R mid - grids

IFMs

Proactive Actions to Address IRI

- Additional Field Data and PIE

Praire Island: Oxide measurement, drag test, length,
ZIRLO Inst Tube to Hot Cell

North Anna : Drag tests/length/oxide measurment

South Texas : Drag tests/length/oxide

VC Summer : ZIRLO skeleton to hot cell(high Bup)

- Redesign of Double Dashpot

First application in '98 in Europe