



# **VDSP Commutability Study Results: Total 25(OH)D nmol/L**

**Commutability of SRM 972a, and CAP ABVD Survey and DEQAS Test  
Materials in the Selected Measurement Systems**

**Karen W. Phinney, Ph.D.,  
Joyce Merkel, M.S., R.D.,  
Christopher T. Sempos, Ph.D.,  
And the VDSP Members**

**November 14, 2013**



# Vitamin D Status Measurement

Total 25-Hydroxyvitamin D or 25(OH)D

- Total 25(OH)D is defined as

$$\text{Total 25(OH)D} = 25(\text{OH})\text{D}_2 + 25(\text{OH})\text{D}_3^*$$

- Units: ng/mL or nmol/L where:

$$\text{ng/ml} * 2.5 \approx \text{nmol/L}$$

**\* Assumes that Vitamin D<sub>2</sub> and D<sub>3</sub> are of equal biological value.**

**NB: Total 25(OH)D does not include epimer concentrations!**



# Protocol Overview: # 1

- Same analysis protocol as for VDSP interlaboratory comparison study (this study is an add on to it)
- 50 single donor patient samples, blinded
- 1 NIST SRM (4 levels), 5 CAP ABVD and 8 DEQAS test materials, non-blinded
- All samples run in duplicate on 3 different days
- NIST and Ghent reference measurement procedures (RMP) used to determine “Target Values” for patient samples and test materials.



# Protocol Overview: # 2

- DEQAS, CAP and NIST test materials were analyzed together with patient samples to minimize effects that can confound commutability assessment such as lot-to-lot variability, variability in specimen preparation etc.
- Due to sample volume limitations samples sent to selected laboratories (3 MS labs, 17 IA labs).



# Approach to Assessing Commutability

Calculate mean from 6 replicates for each **patient sample**

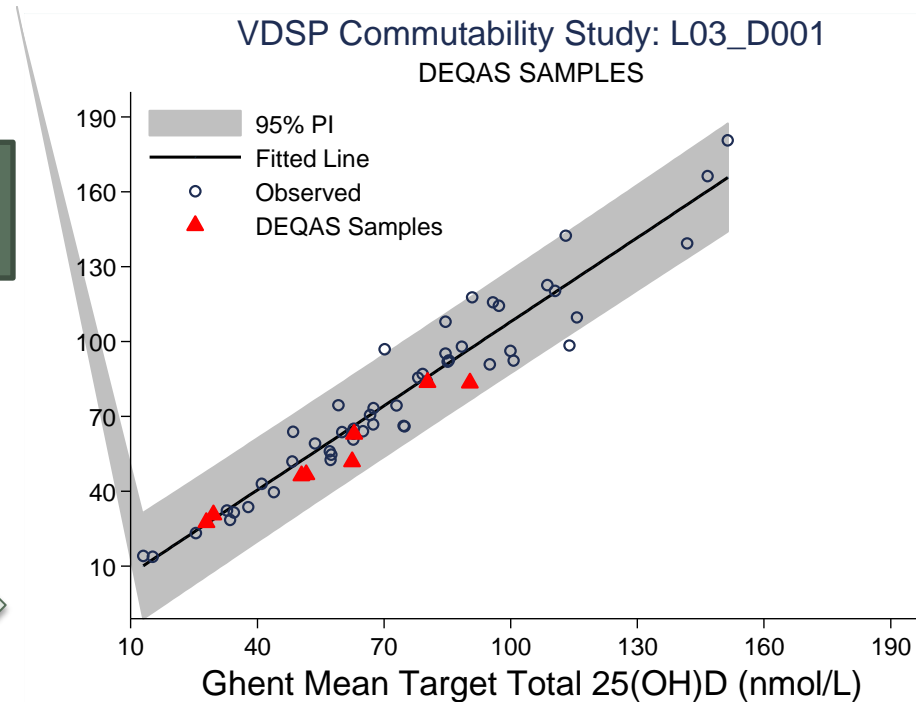
Plot patient sample means (Y) vs. mean target values (X)

Calculate and plot OLS regression line, & 95% prediction interval

Calculate mean from 6 replicates for each **test material**

Plot test material means over target values in same graph

Results for test materials, i.e. SRM 972a (Levels 1-4), & DEQAS & CAP CTM, are shown separately vs. Ghent and NIST RMP Target Values



Test materials with values inside the 95% prediction interval are considered commutable



# Approach to Assessing Commutability

Calculate mean from 6 replicates for each **patient sample**

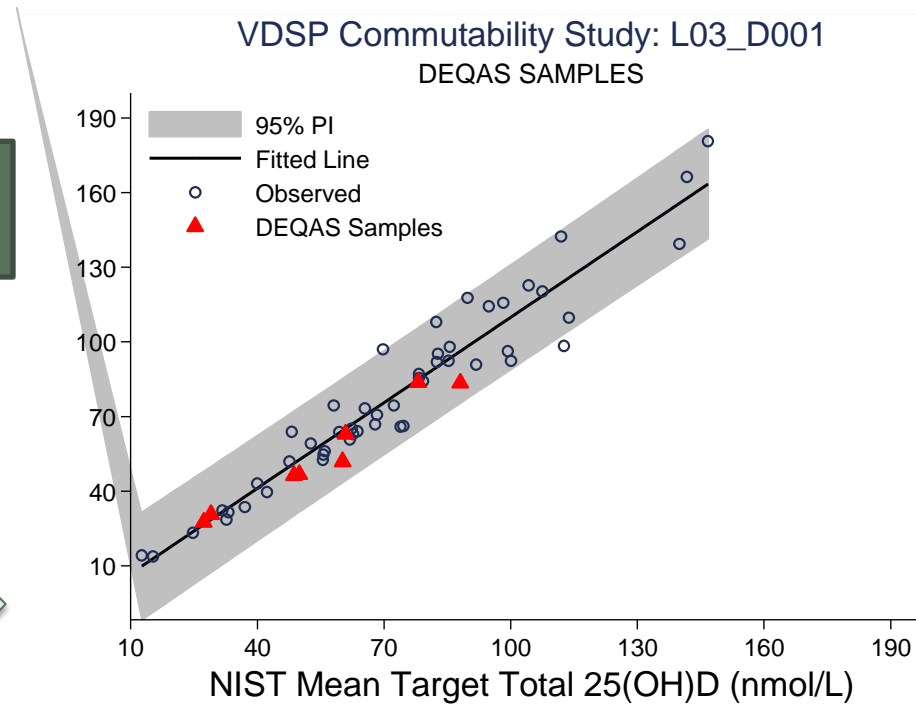
Plot patient sample means (Y) vs. mean target values (X)

Calculate and plot OLS regression line, & 95% prediction interval

Calculate mean from 6 replicates for each **test material**

Plot test material means over target values in same graph

Results for test materials, i.e. SRM 972a (Levels 1-4), & DEQAS & CAP CTM, are shown separately vs. Ghent and NIST RMP Target Values



Test materials with values inside the 95% prediction interval are considered commutable



# VDSP Commutability Studies

- Reference Material and EQA/PT Materials Tested:
  - NIST 972a – (4)
  - CAP – (5)
  - DEQAS - (8)
- Participating Labs:
  - 20 Total: 4 LC-MS/MS and 16 Immunoassay
    - 2 dropout
    - 5 – Open reporting
    - 4 – Anonymous reporting
    - 2 – Results not to be used
    - 7 - TBA





# Suggested Assay Performance Limits Based on Biological Variation\*

Measurements	CV (%)	Bias (%)
Reference Labs	$\leq 5\%$	$\leq 1.7\%$
“Routine” Labs	$\leq 10\%$	$\leq 5\%$

\*Stöckl D et al. Clin Chim Acta 2009;408:8-13



# VDSP Commutability Studies

Lab #	Mean CV%	Lab #	Mean CV%
1	7.5	12	14.8
2	6.2*	13	3.3
9	15.0	16	3.9
10	4.3	17	4.3
11	10.3		

\*Baseline study results. No replicates measured in commutability study.



# Organization of Slides

- Results are given below in turn for 9 Laboratories (1, 2, 9-13, 16, 17) as follows:
- Plots of Lab Mean (Y) vs. Ghent or NIST (X) final assigned target values first for SRM 972A superimposed
- Repeat sequence for CAP ABVD Survey and then for DEQAS test materials

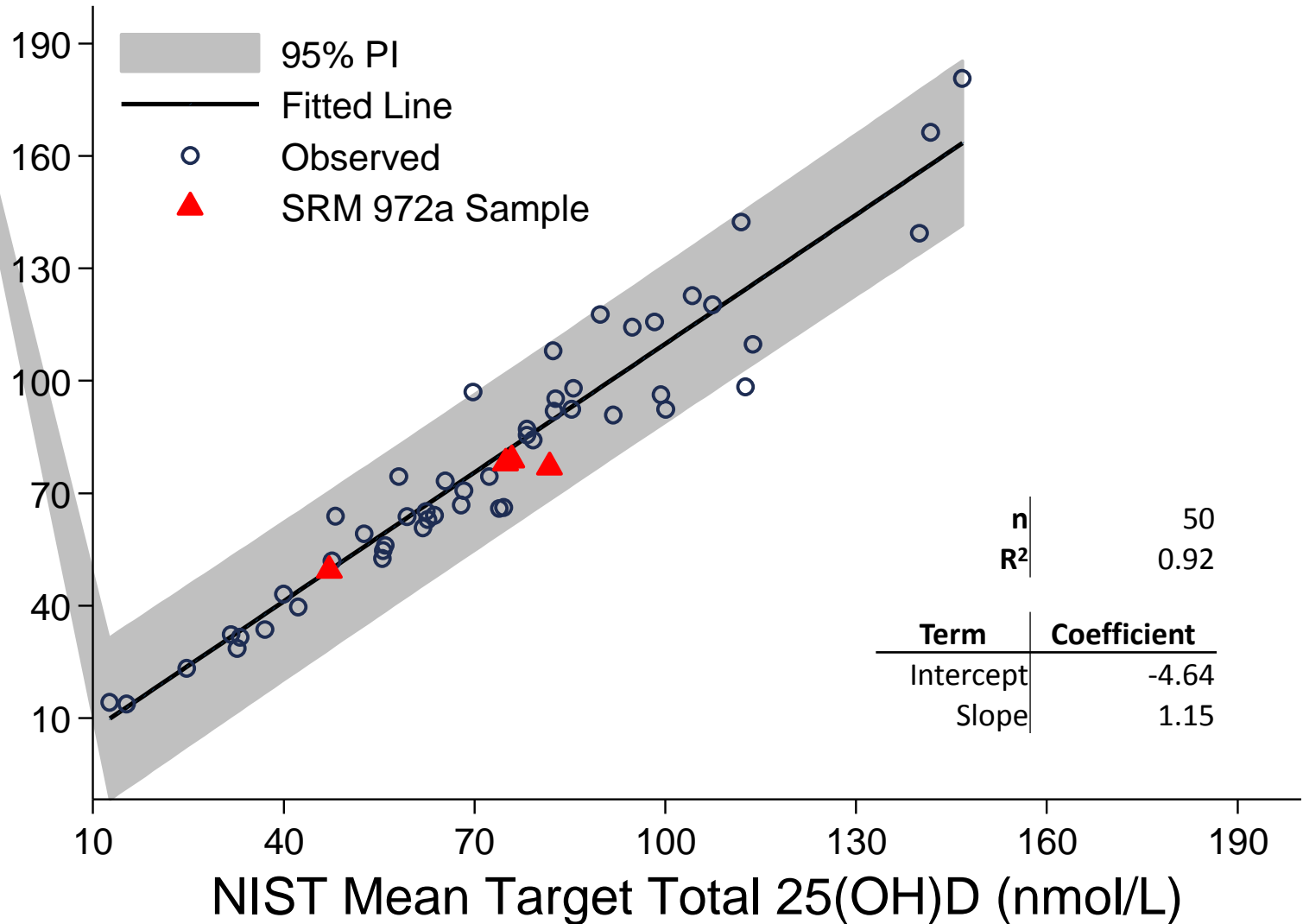


# SRM972a

## Levels 1-4

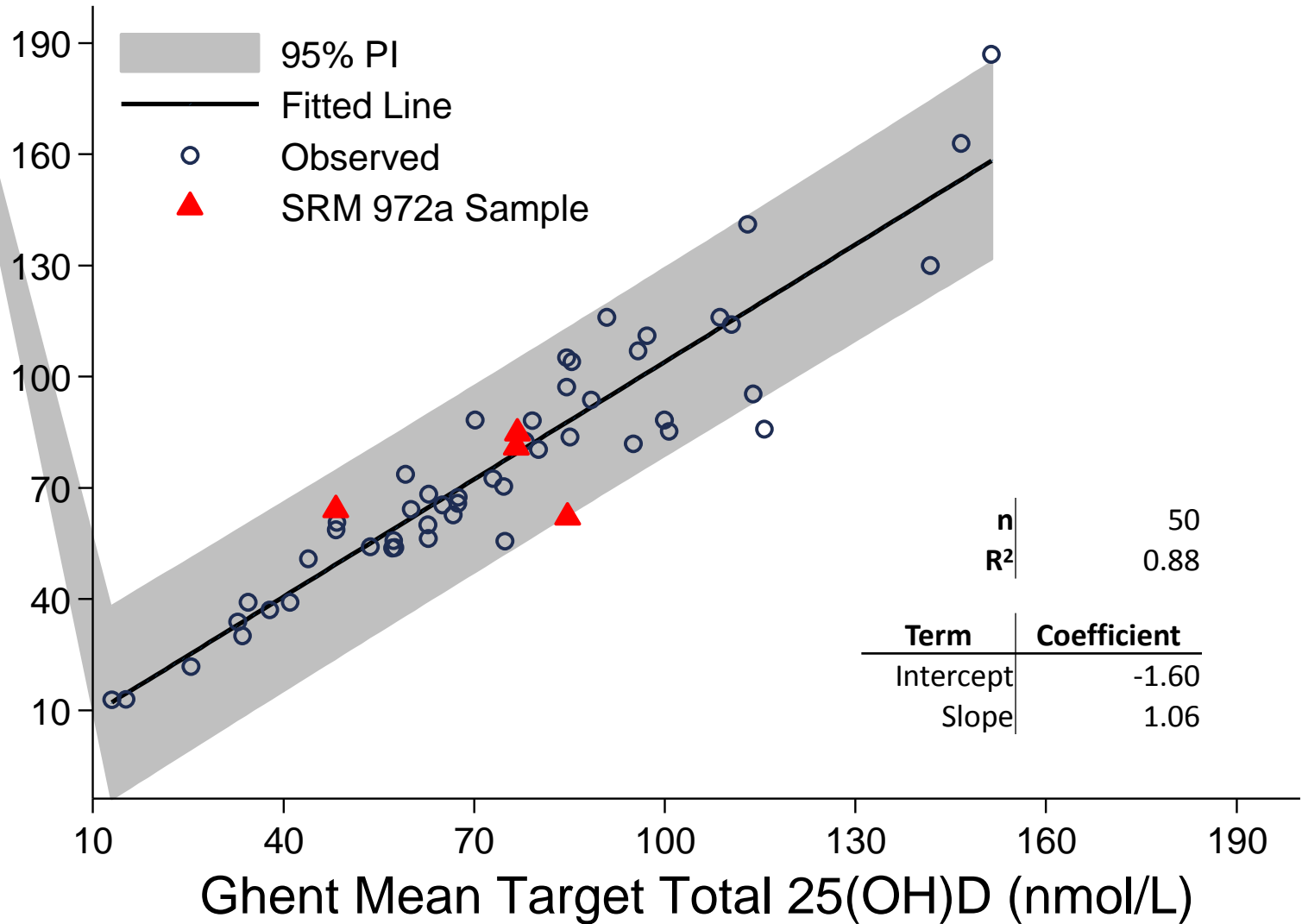
# VDSP Commutability Study: Immunoassay

## Lab 1: SRM 972a Levels 1-4



# VDSP Commutability Study: Immunoassay

## Lab 2: SRM 972a Levels 1-4



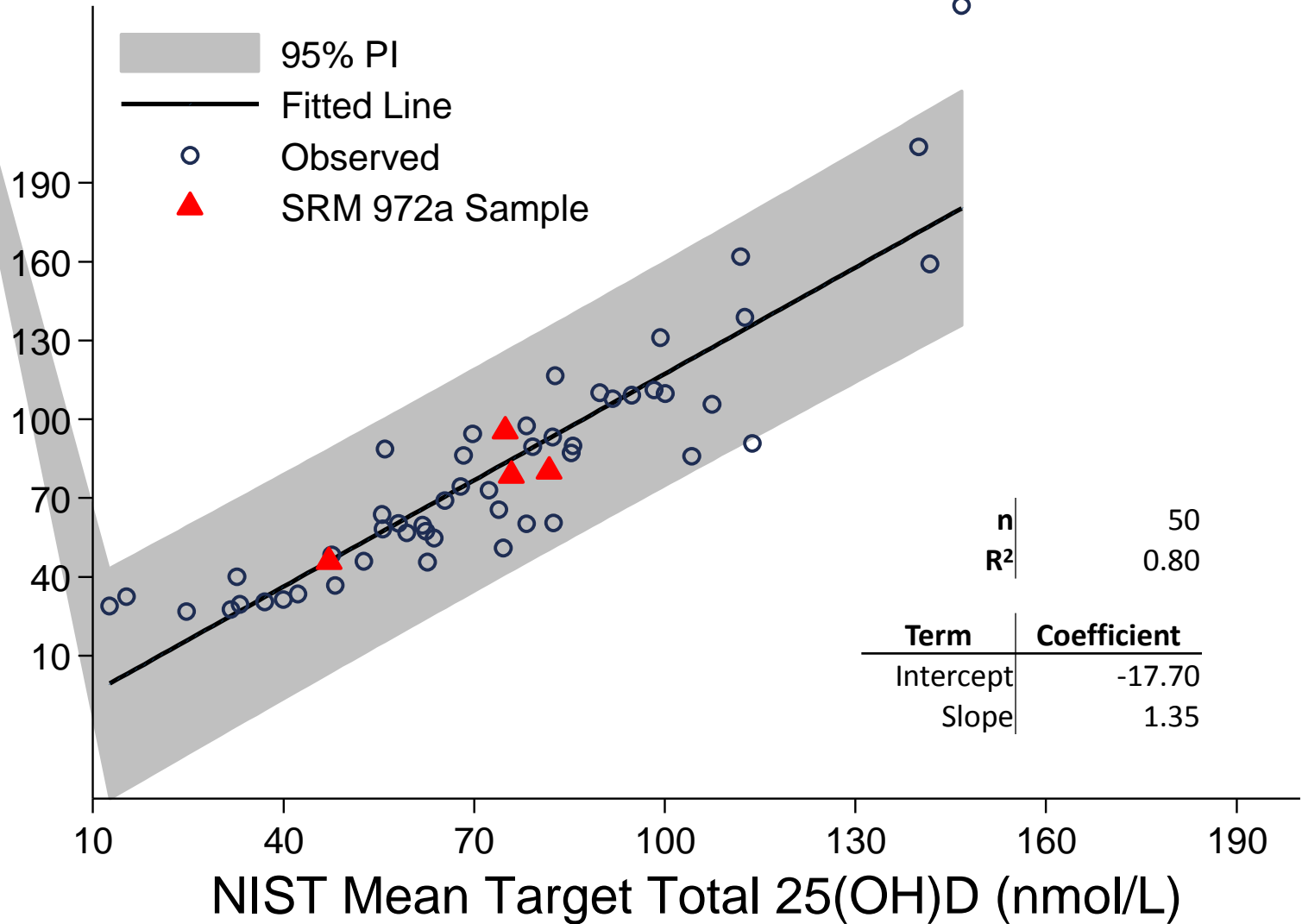


# Lab 2 Outlier vs. Ghent Target Values [nmol/L]

	Lab 2	Ghent Target Values			
Sample	DT	DT	D3	3-Epimer	D2
SRM 972a Level 3	65	85	51	3	34

# VDSP Commutability Study: Immunoassay

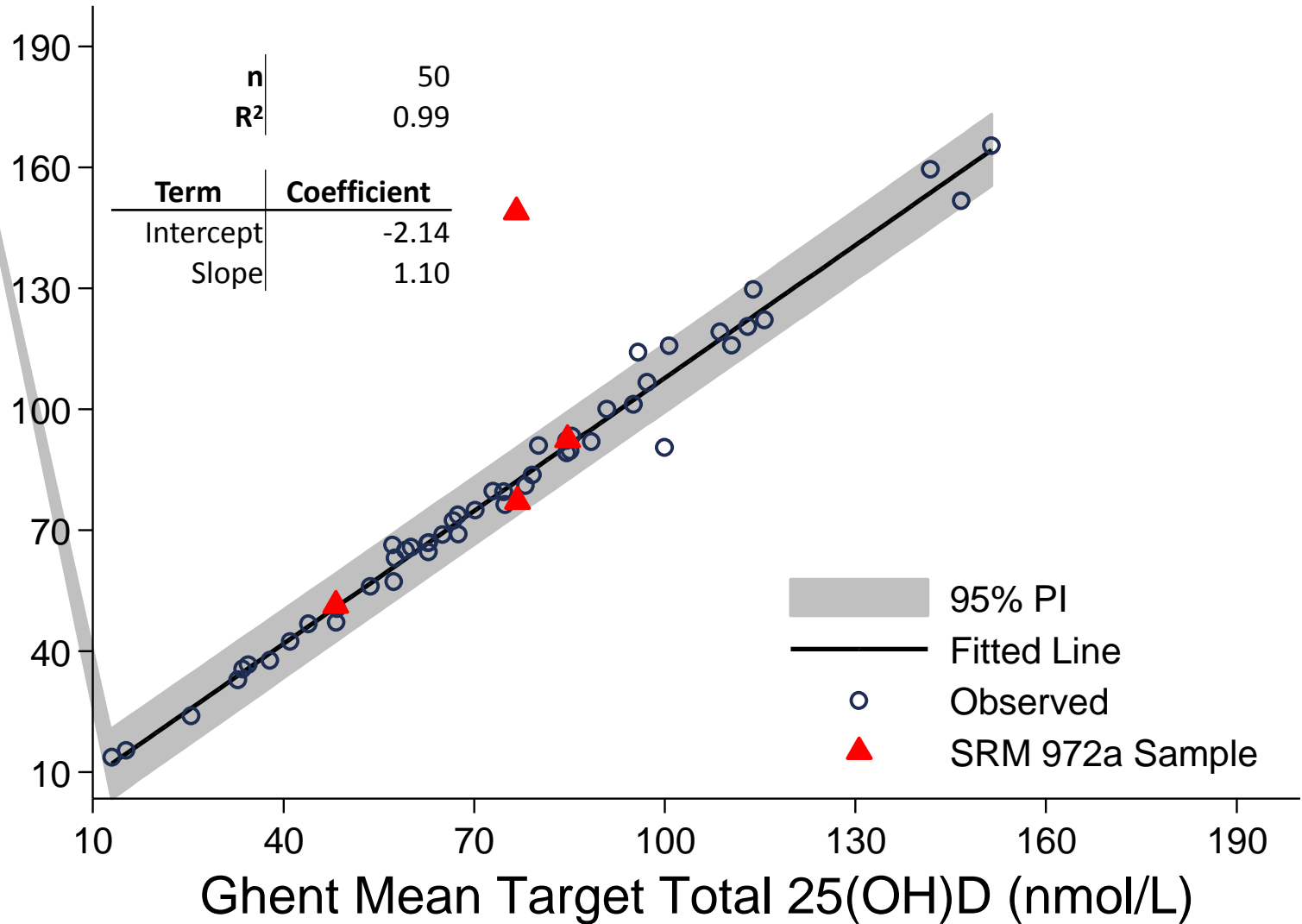
## Lab 9: SRM 972a Levels 1-4





# VDSP Commutability Study: LC-MS/MS

Lab 10: SRM 972a Levels 1-4



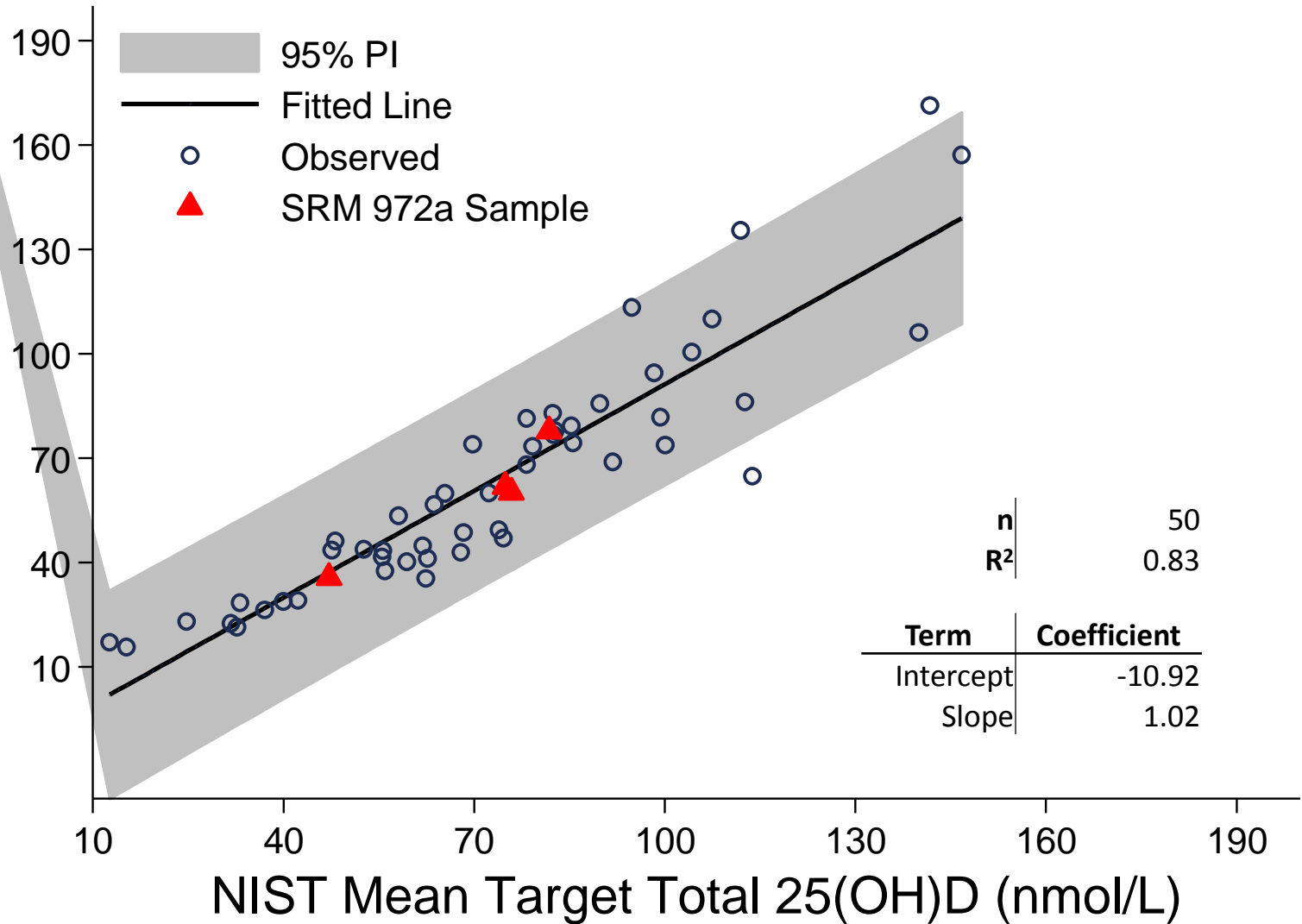


# Lab 10 Outlier vs. Ghent Target Values [nmol/L]

	<b>Lab 10</b>	<b>Ghent Target Values</b>			
<b>Sample</b>	<b>DT</b>	<b>DT</b>	<b>D3</b>	<b>3-Epimer</b>	<b>D2</b>
<b>SRM 972a Level 4</b>	<b>149</b>	<b>77</b>	<b>76</b>	<b>75</b>	<b>&lt; LOQ</b>
<b>DEQAS 5</b>	<b>113</b>	<b>52</b>	<b>51</b>	<b>63</b>	<b>&lt; LOQ</b>

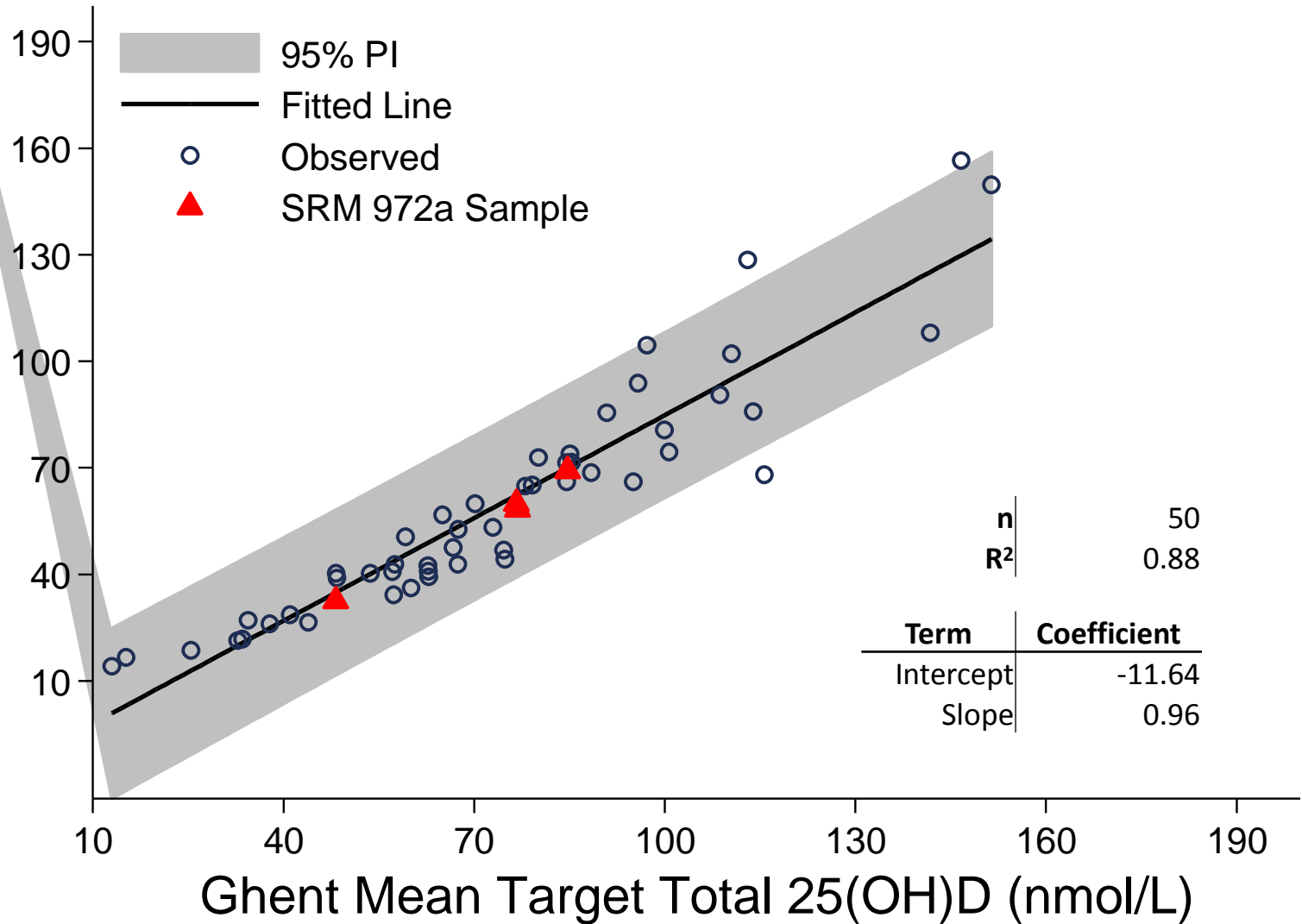
# VDSP Commutability Study: Immunoassay

## Lab 11: SRM 972a Levels 1-4



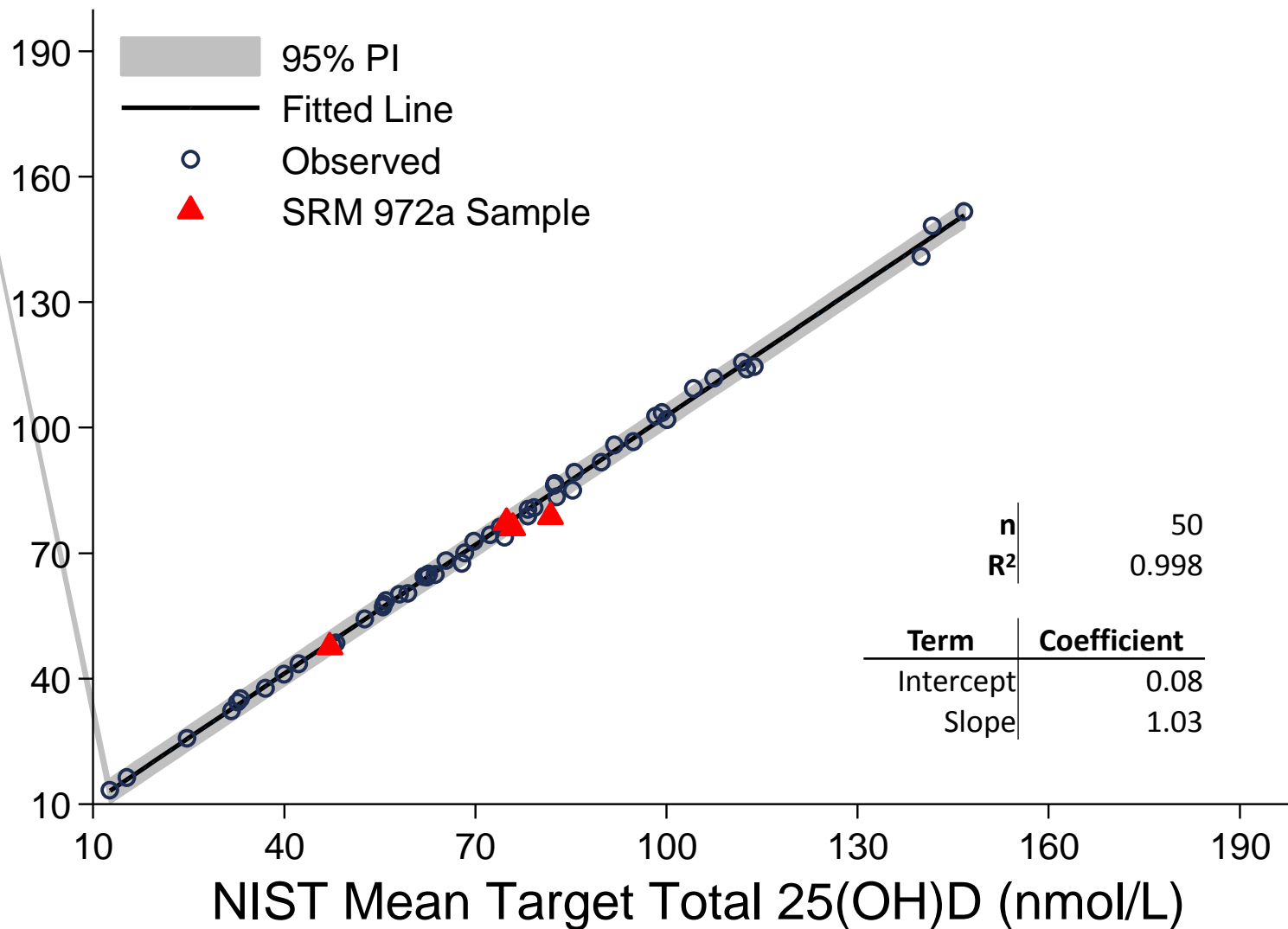
# VDSP Commutability Study: Immunoassay

## Lab 12: SRM 972a Levels 1-4



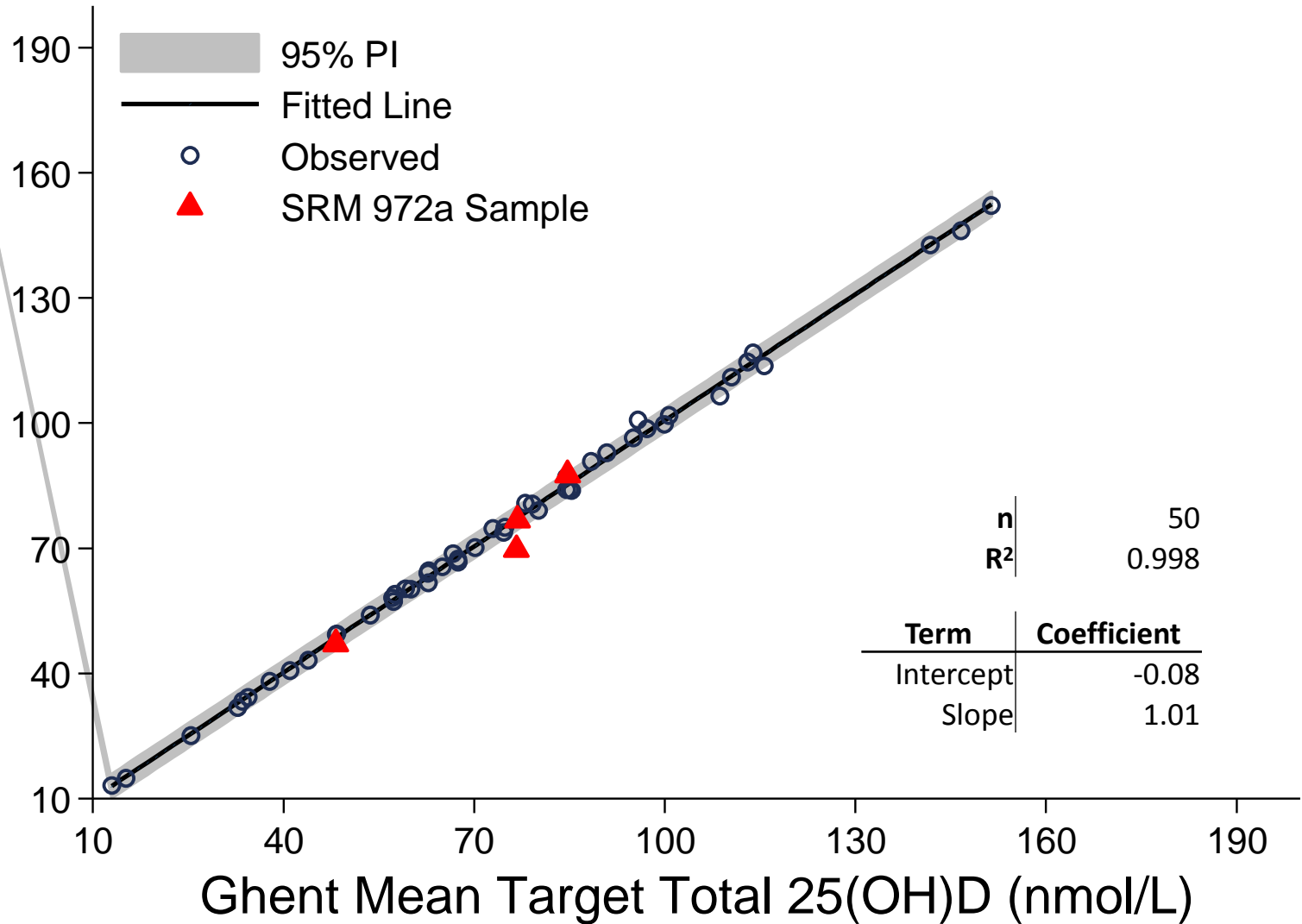
# VDSP Commutability Study: LC-MS/MS

Lab 13: SRM 972a Levels 1-4



# VDSP Commutability Study: LC-MS/MS

Lab 16: SRM 972a Levels 1-4



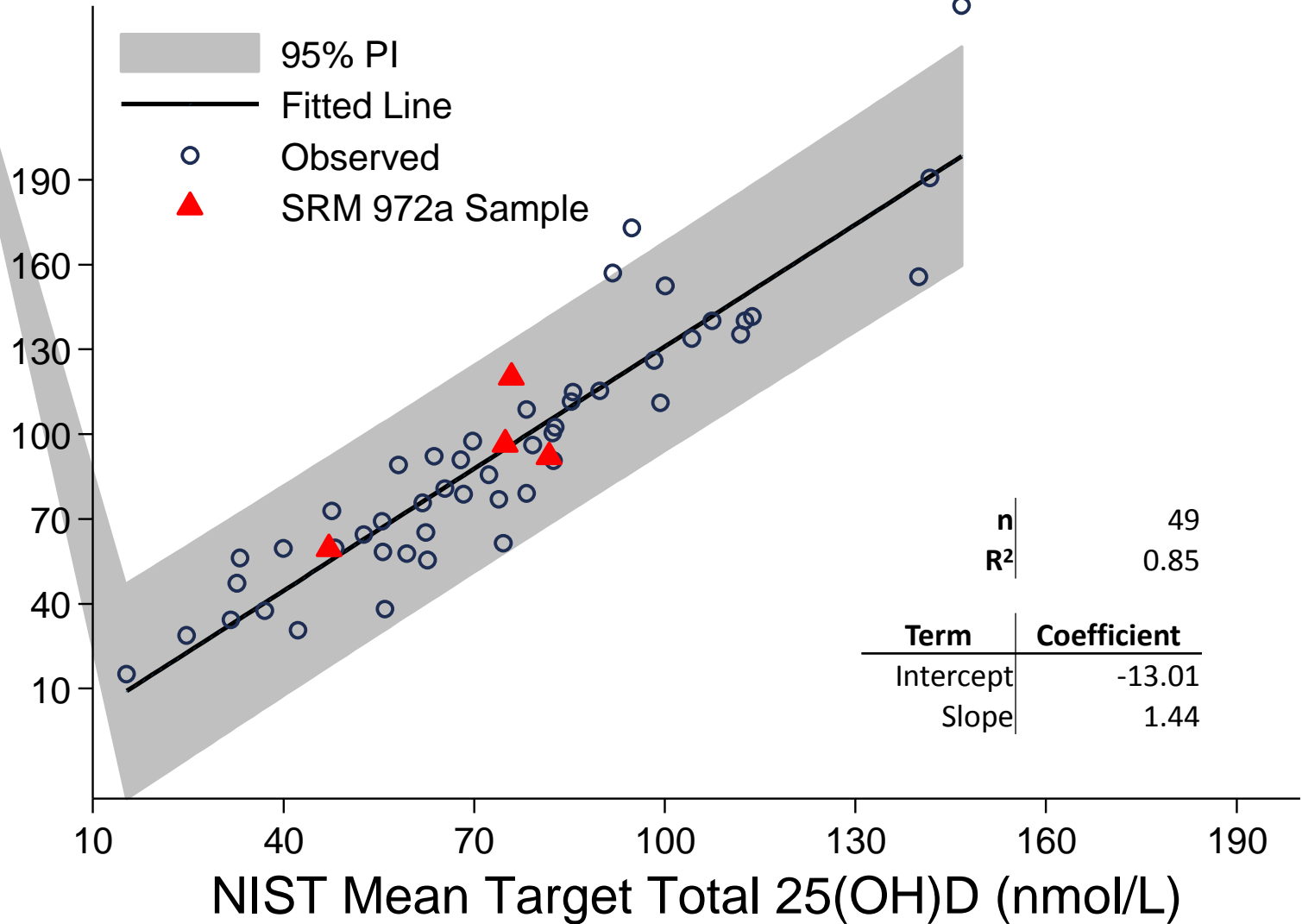


# Lab 16 Outlier vs. Ghent Target Values [nmol/L]

	<b>Lab 16</b>	<b>Ghent Target Values</b>			
<b>Sample</b>	<b>DT</b>	<b>DT</b>	<b>D3</b>	<b>3-Epimer</b>	<b>D2</b>
<b>SRM 972a Level 4</b>	<b>70</b>	<b>77</b>	<b>76</b>	<b>75</b>	<b>&lt; LOQ</b>

# VDSP Commutability Study: Immunoassay

Lab 17: SRM 972a Levels 1-4





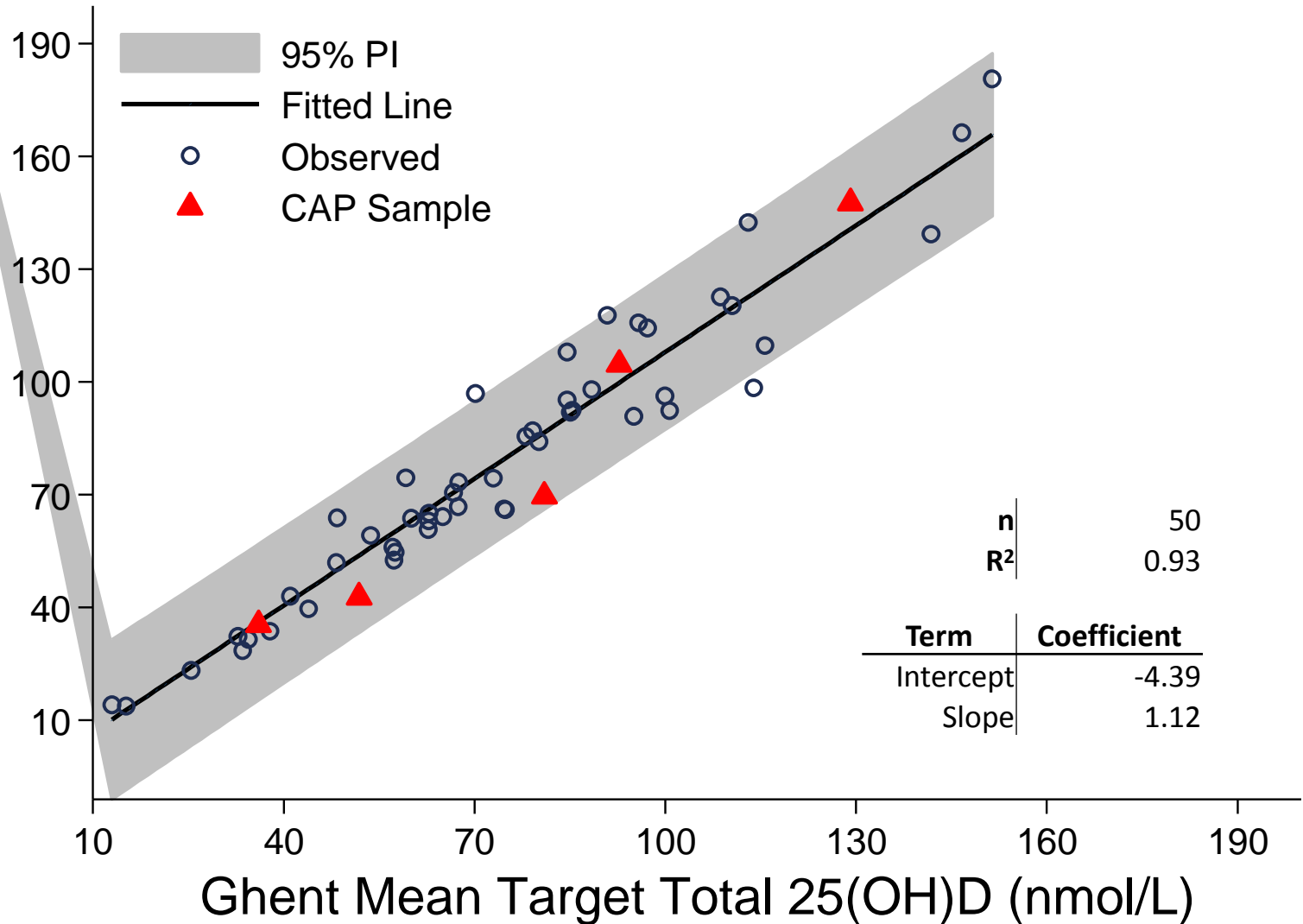


# CAP ABVD

## 5 Samples

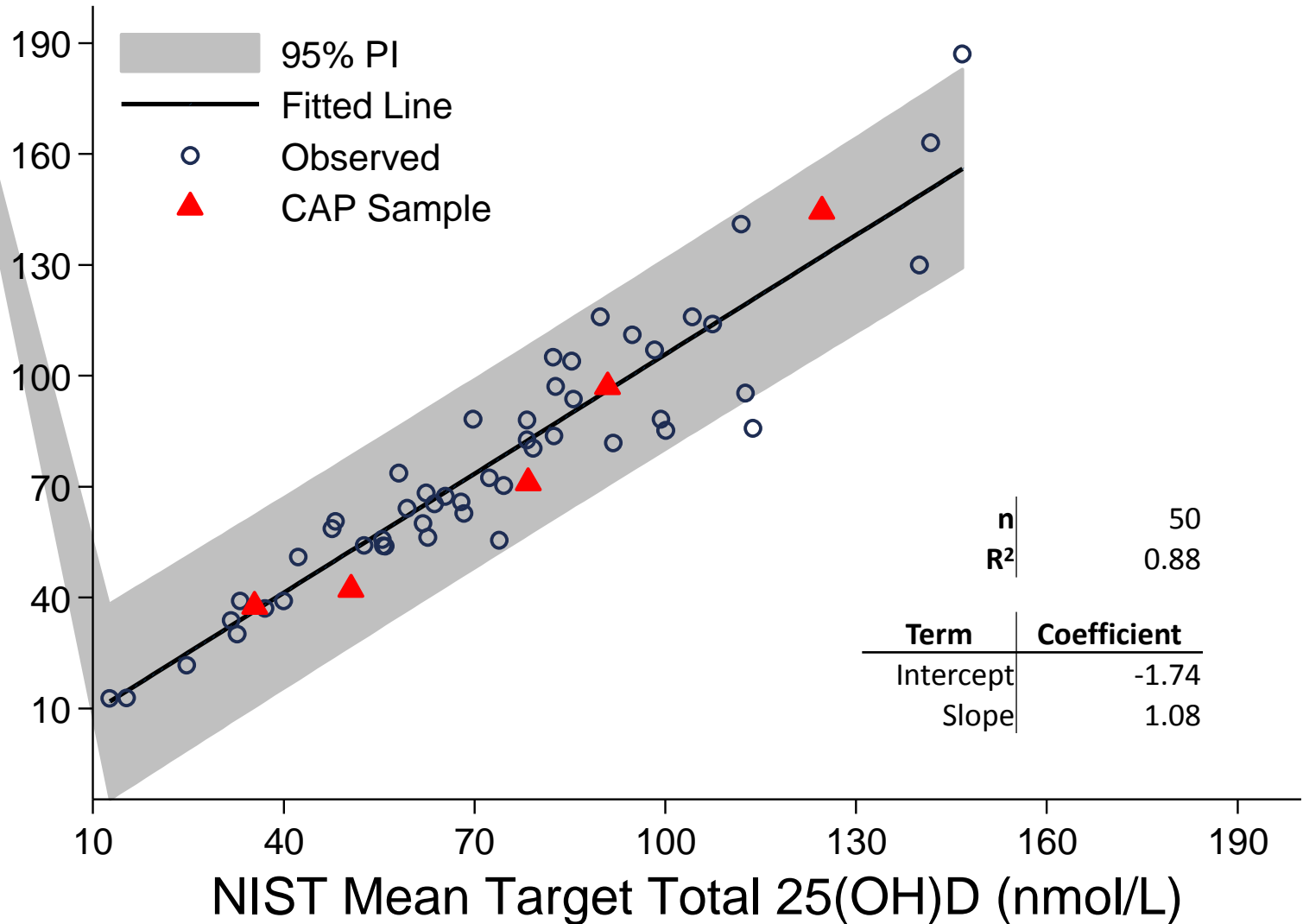
# VDSP Commutability Study: Immunoassay

## Lab 1: CAP ABVD Survey Samples



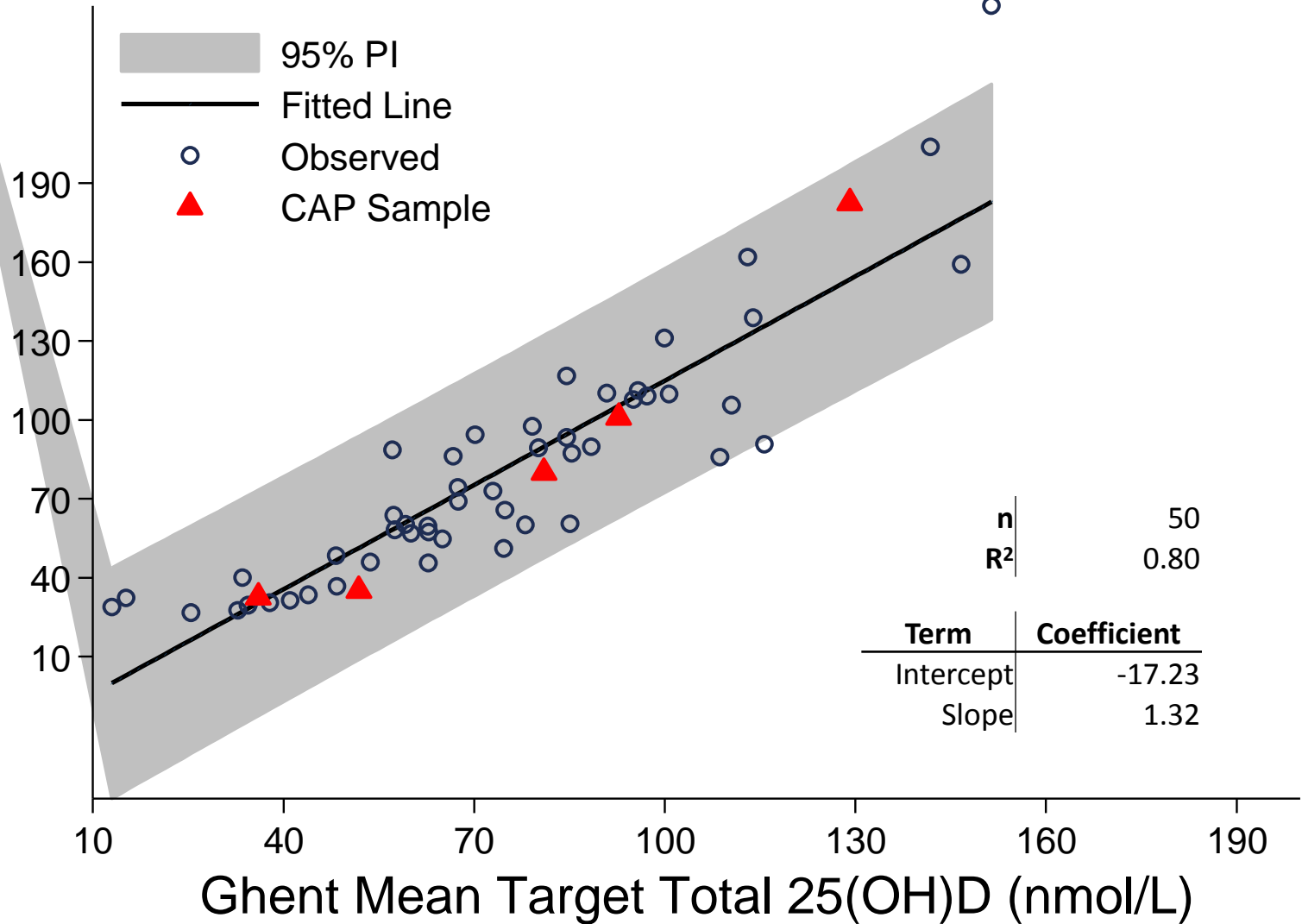
# VDSP Commutability Study: Immunoassay

## Lab 2: CAP ABVD Survey Samples



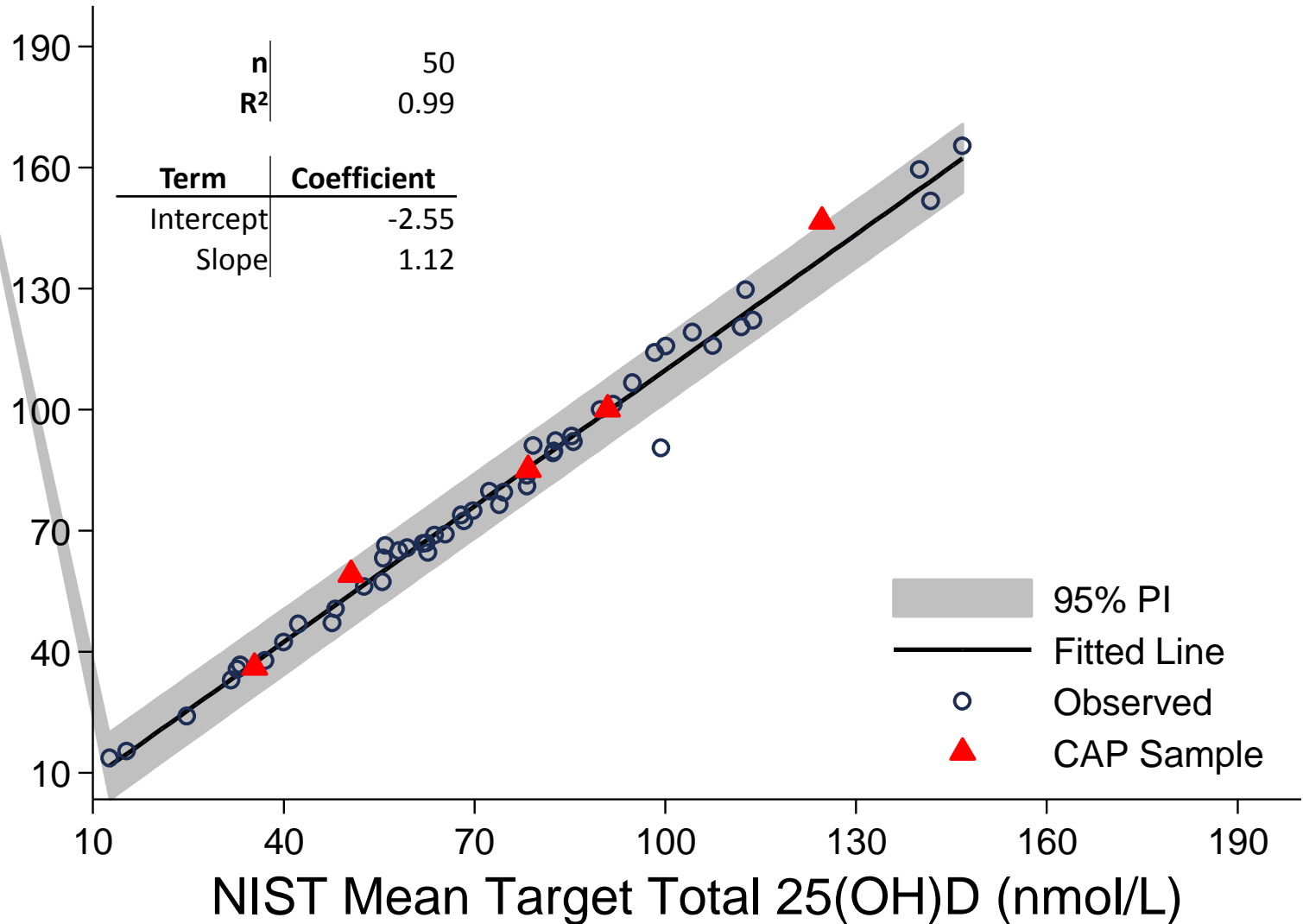
# VDSP Commutability Study: Immunoassay

## Lab 9: CAP ABVD Survey Samples



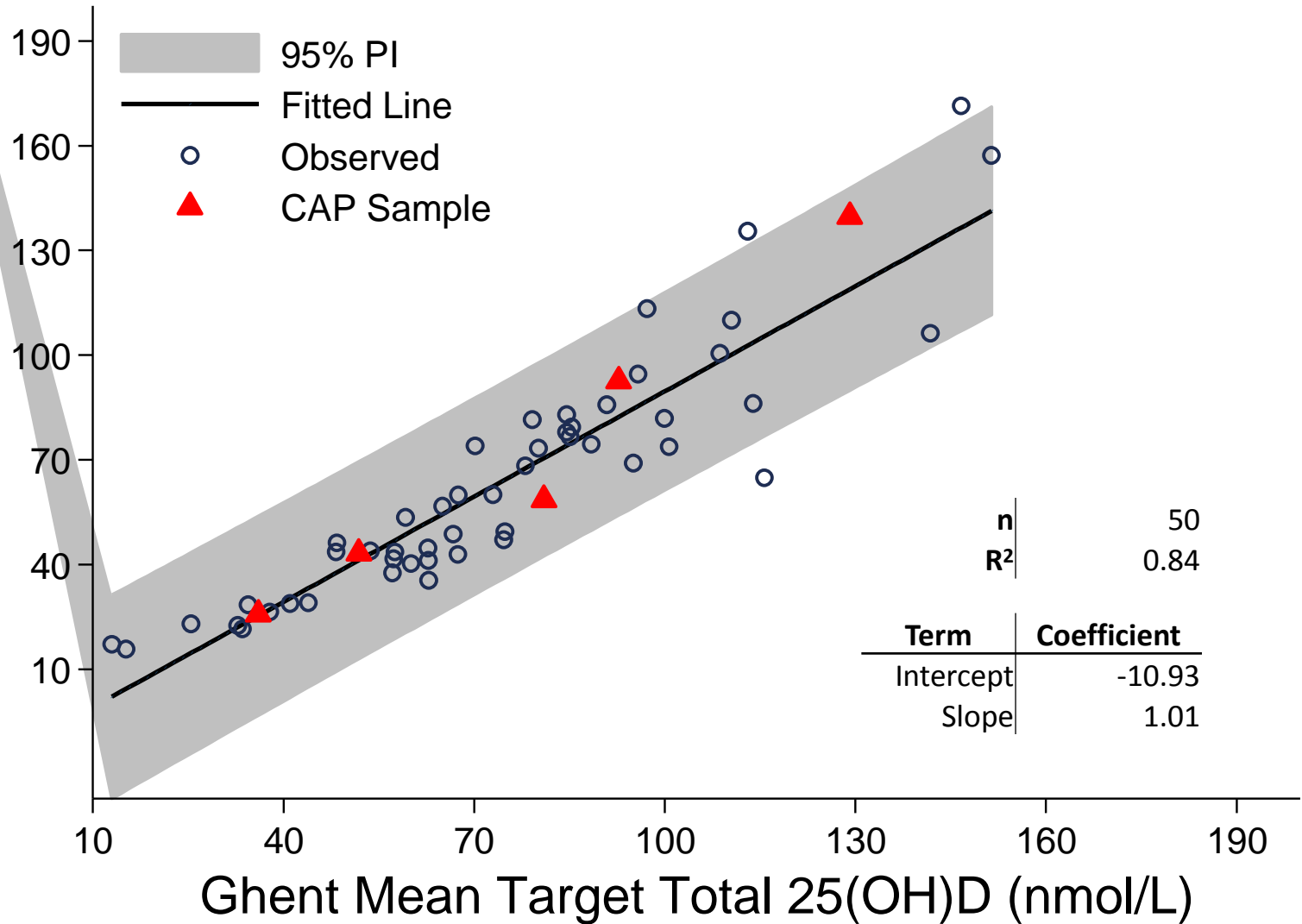
# VDSP Commutability Study: LC-MS/MS

## Lab 10: CAP ABVD Survey Samples



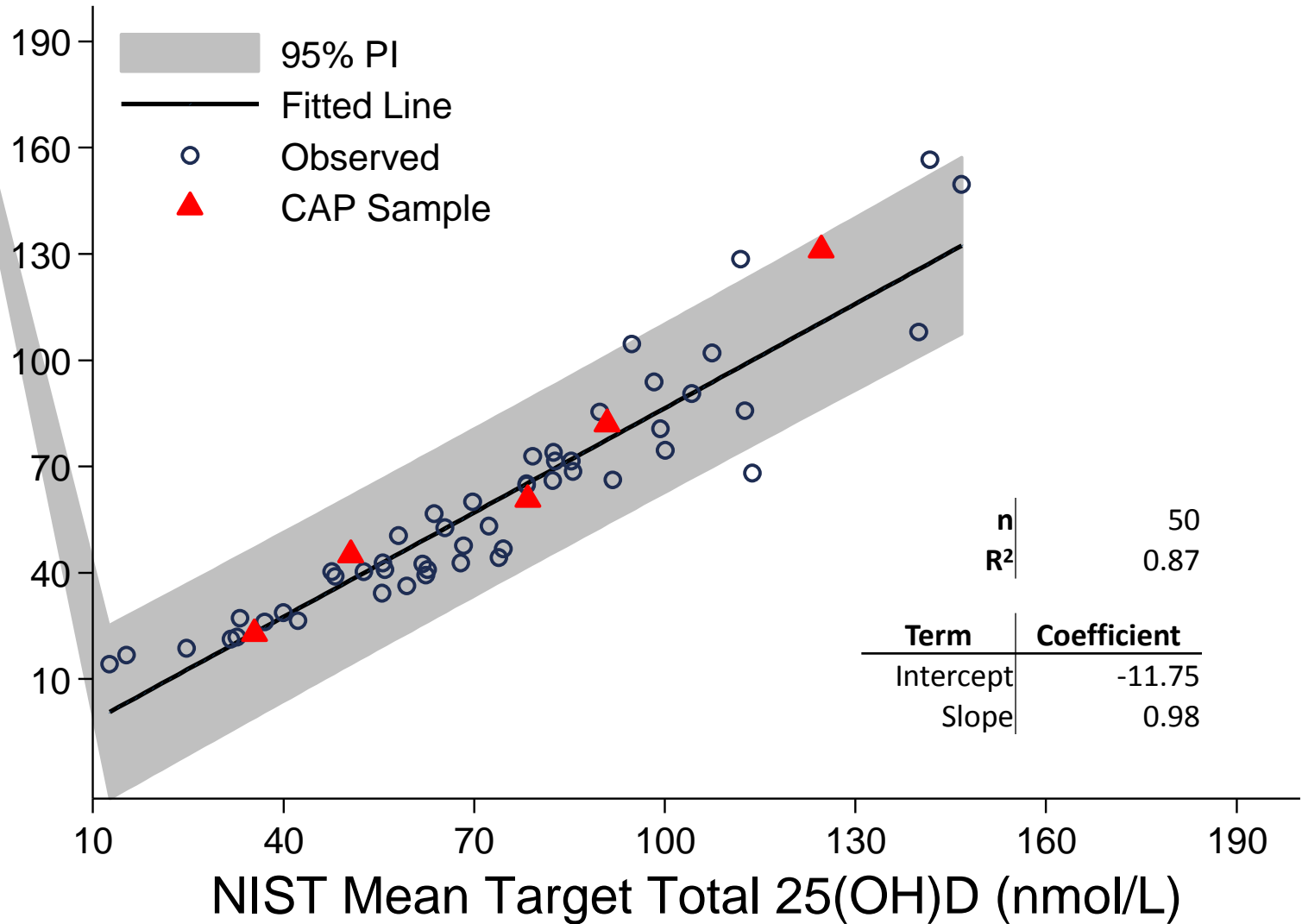
# VDSP Commutability Study: Immunoassay

## Lab 11: CAP ABVD Survey Samples



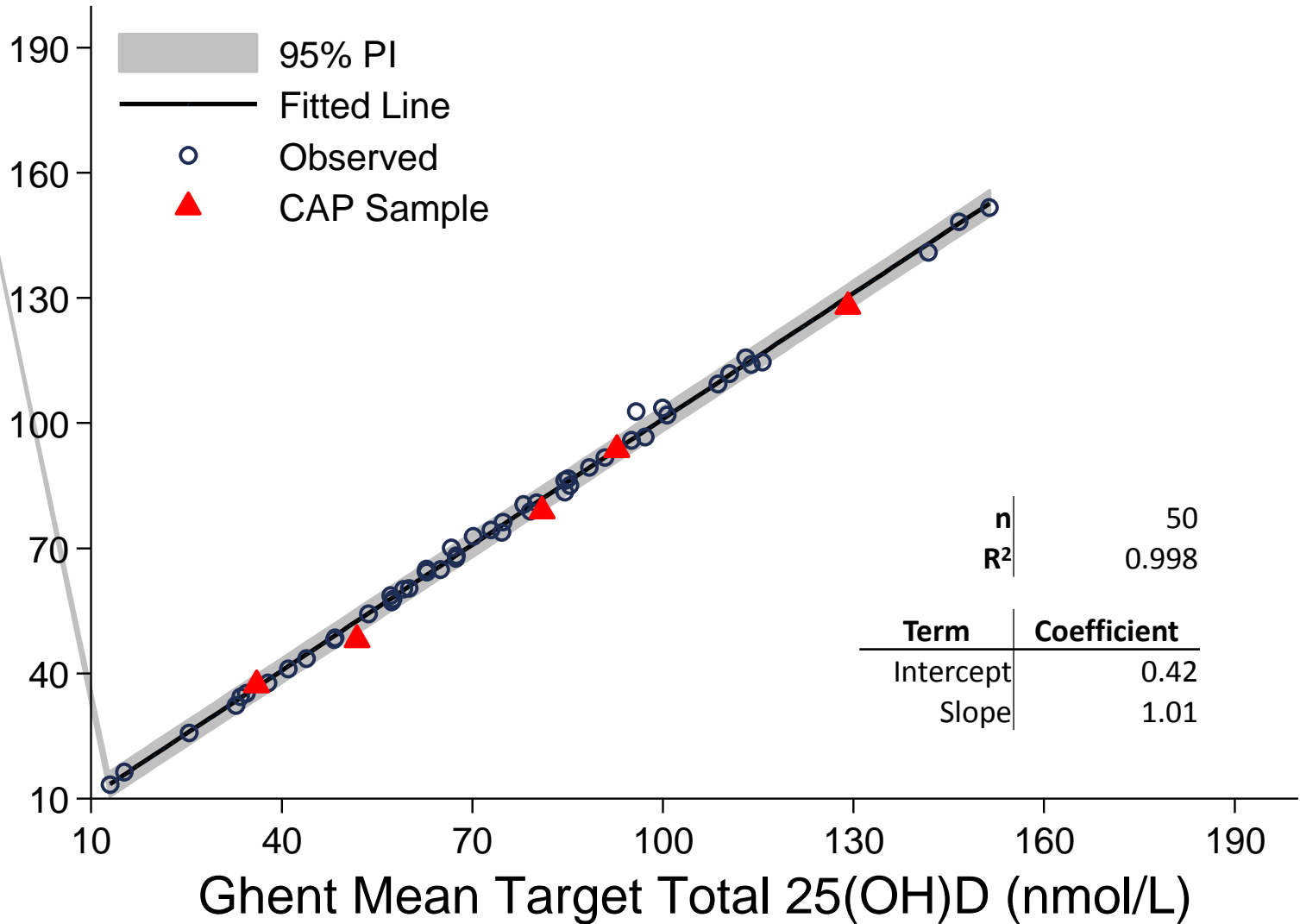
# VDSP Commutability Study: Immunoassay

## Lab 12: CAP ABVD Survey Samples



# VDSP Commutability Study: LC-MS/MS

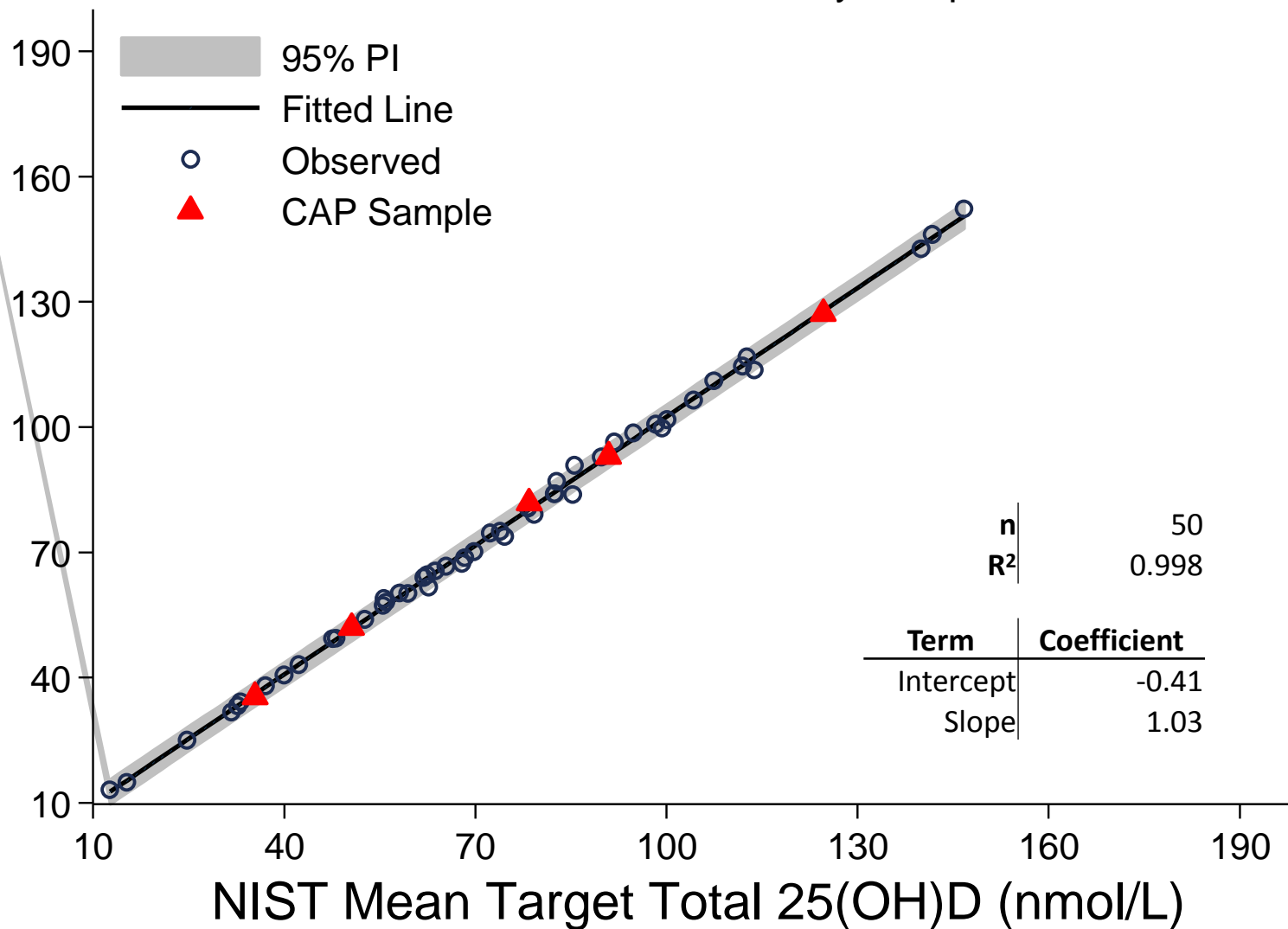
## Lab 13: CAP ABVD Survey Samples





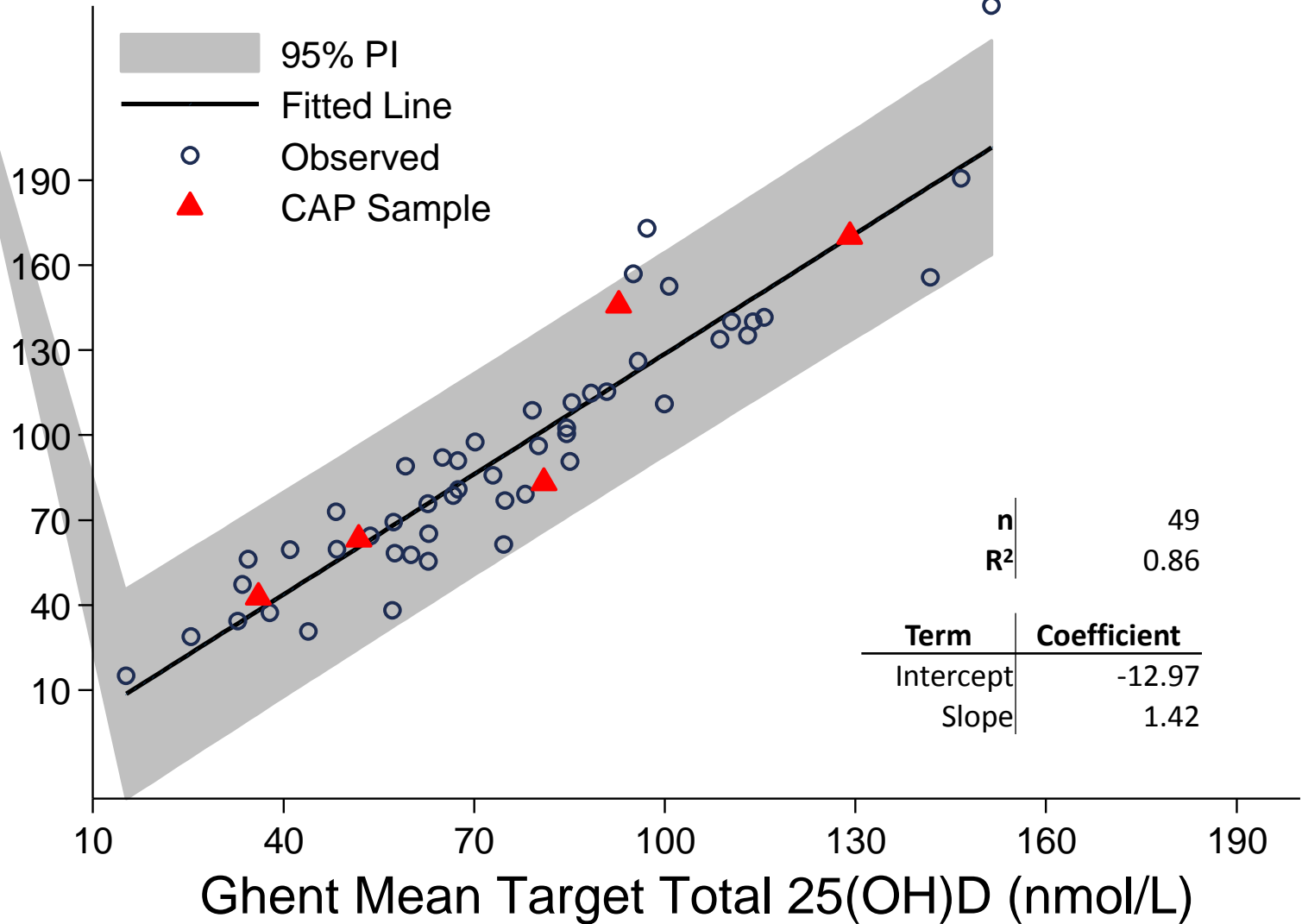
# VDSP Commutability Study: LC-MS/MS

## Lab 16: CAP ABVD Survey Samples



# VDSP Commutability Study: Immunoassay

## Lab 17: CAP ABVD Survey Samples



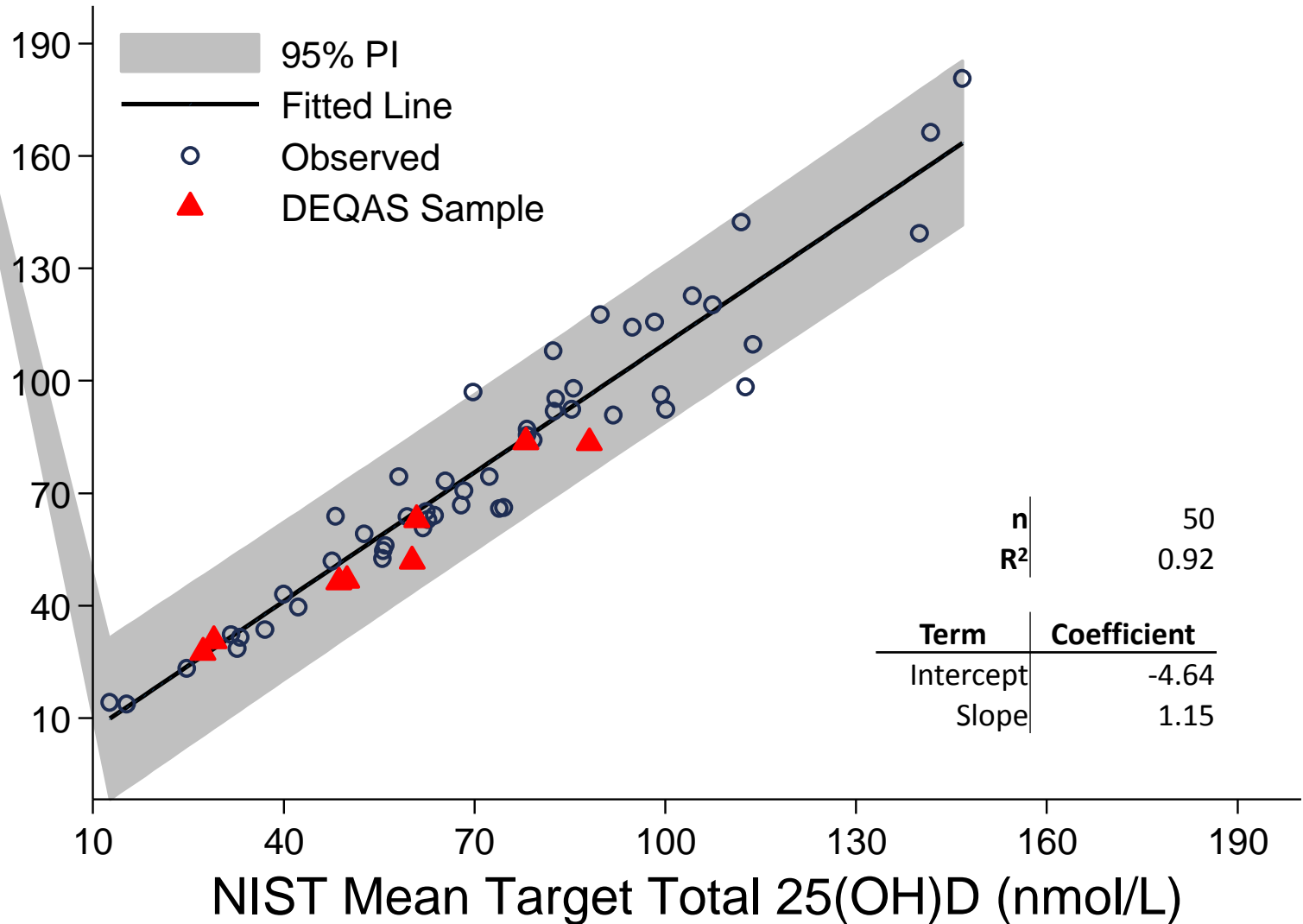


**DEQAS**

**8 Samples**

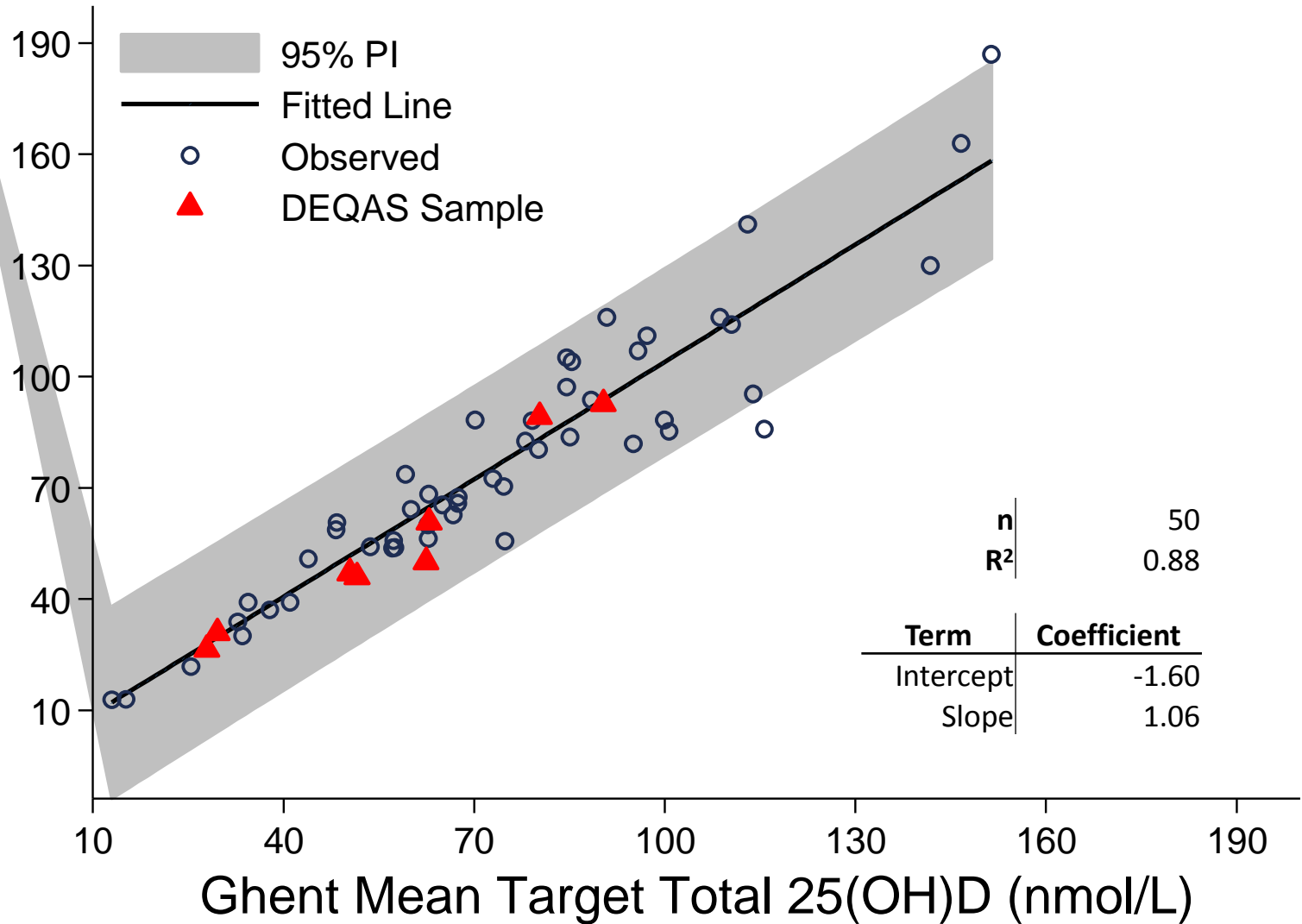
# VDSP Commutability Study: Immunoassay

## Lab 1: DEQAS Survey Samples



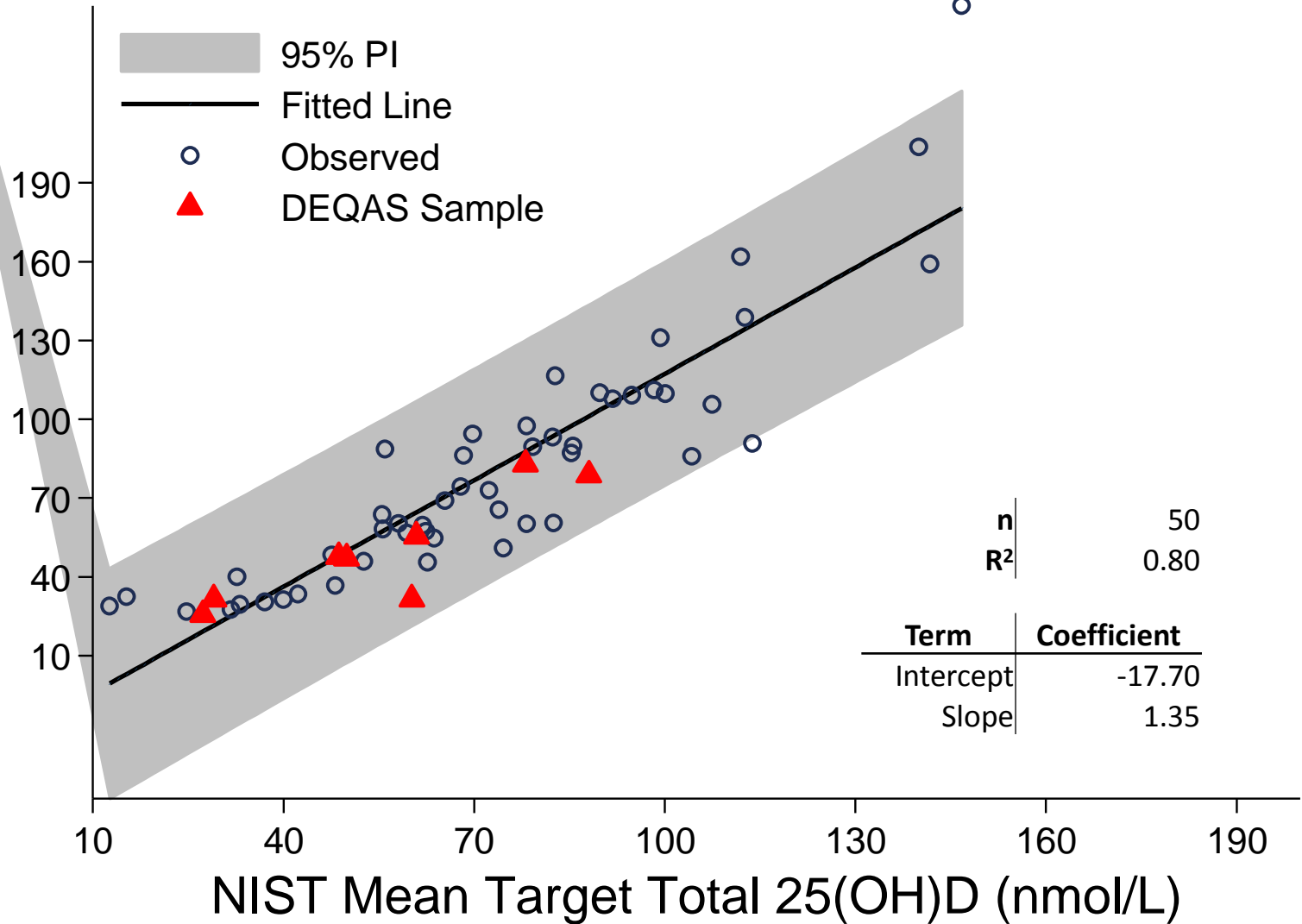
# VDSP Commutability Study: Immunoassay

## Lab 2: DEQAS Survey Samples



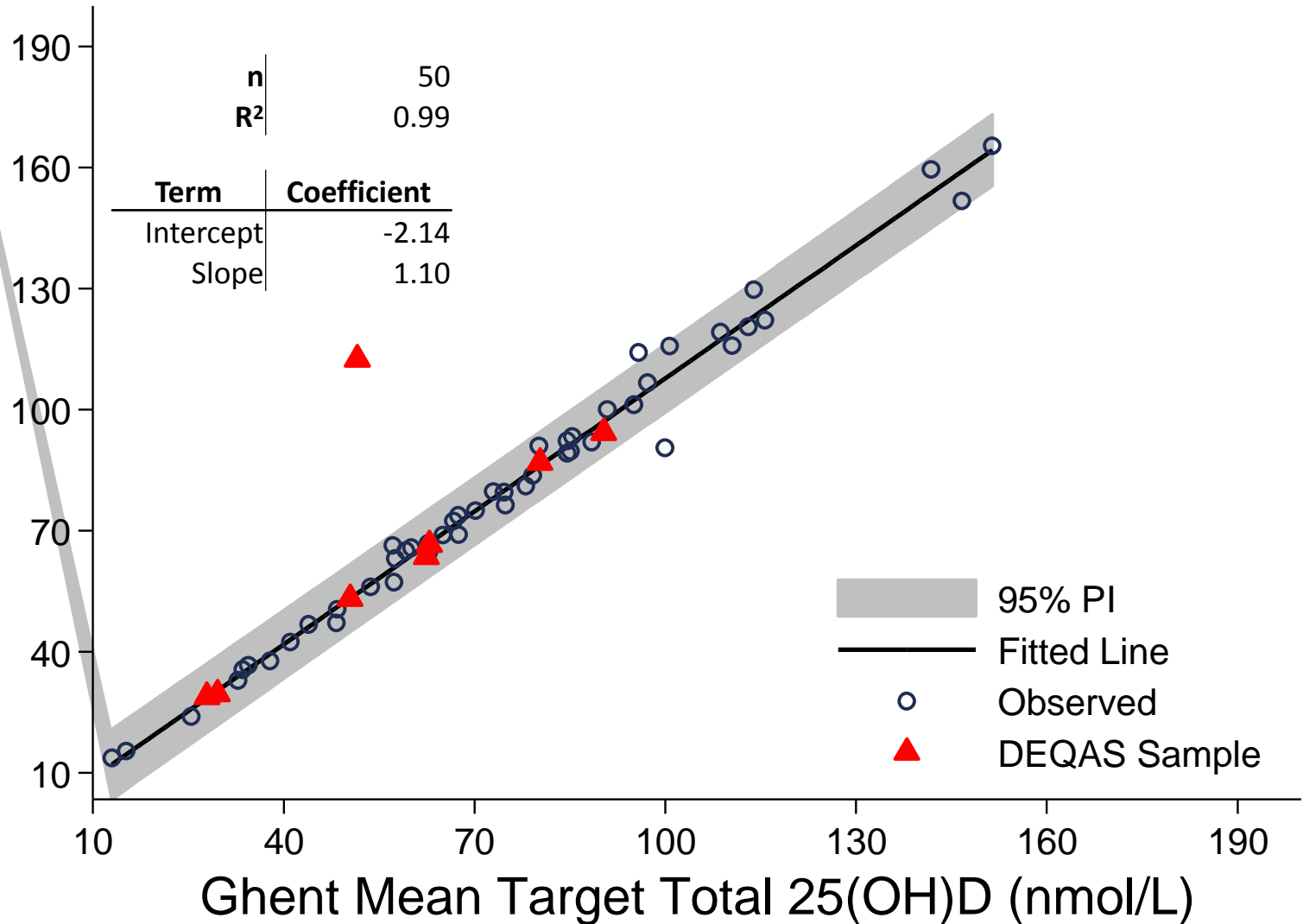
# VDSP Commutability Study: Immunoassay

## Lab 9: DEQAS Survey Samples



# VDSP Commutability Study: LC-MS/MS

## Lab 10: DEQAS Survey Samples





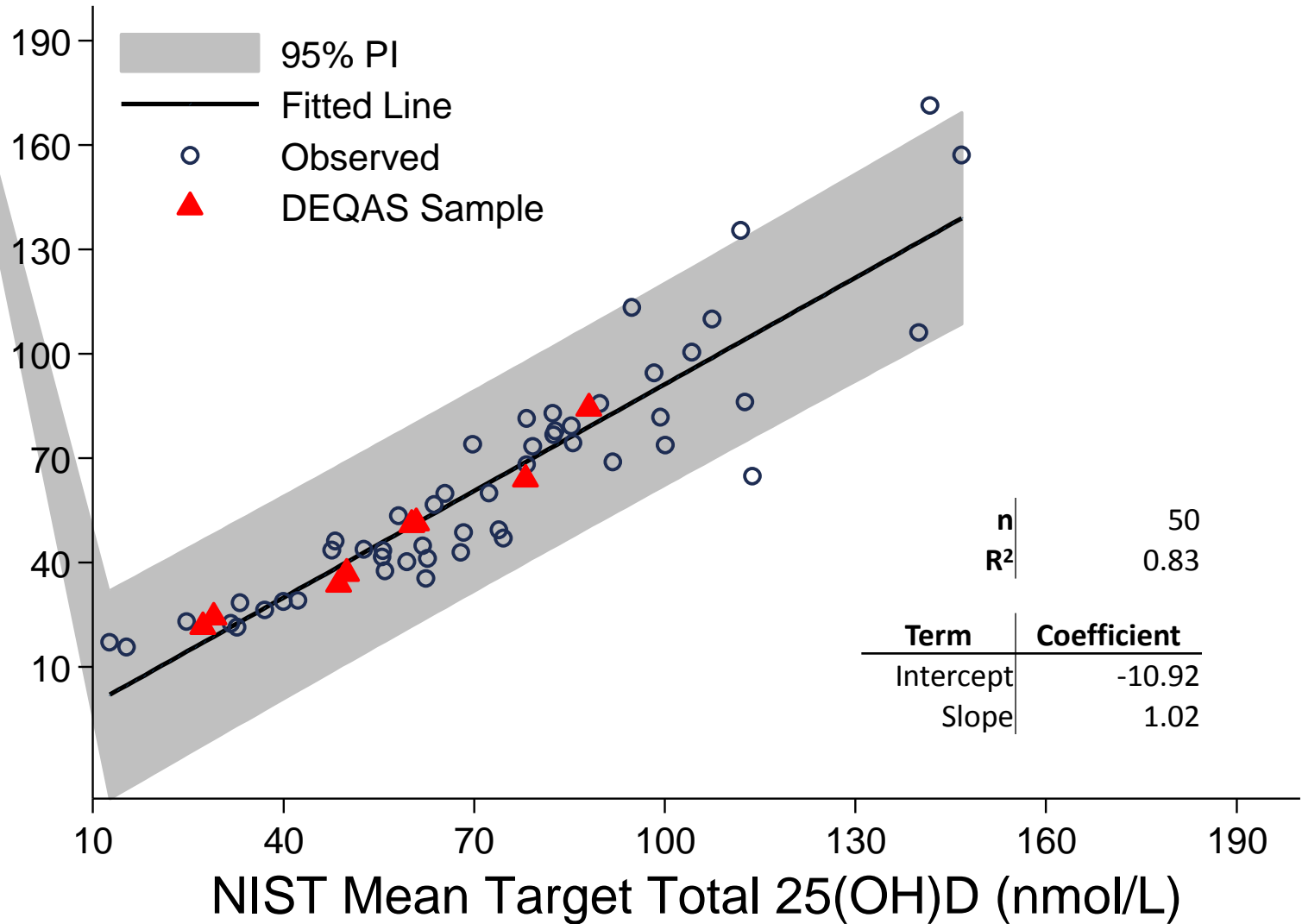
# Lab 10 Outlier vs. Ghent Target Values [nmol/L]

	Lab 10	Ghent Target Values			
Sample	DT	DT	D3	3-Epimer	D2
SRM 972a Level 4	149	77	76	75	< LOQ
DEQAS 5	113	52	51	63	< LOQ



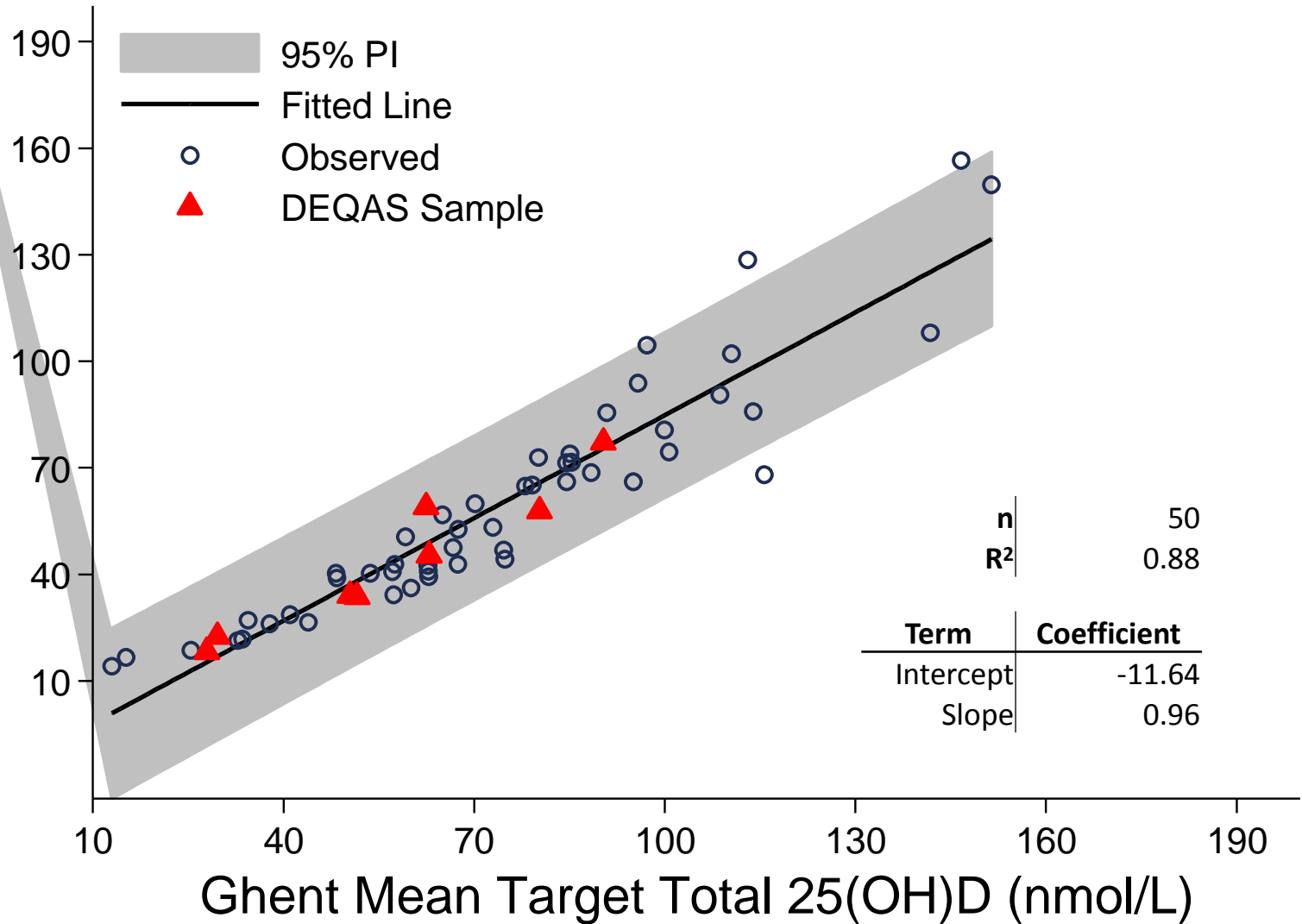
# VDSP Commutability Study: Immunoassay

## Lab 11: DEQAS Survey Samples



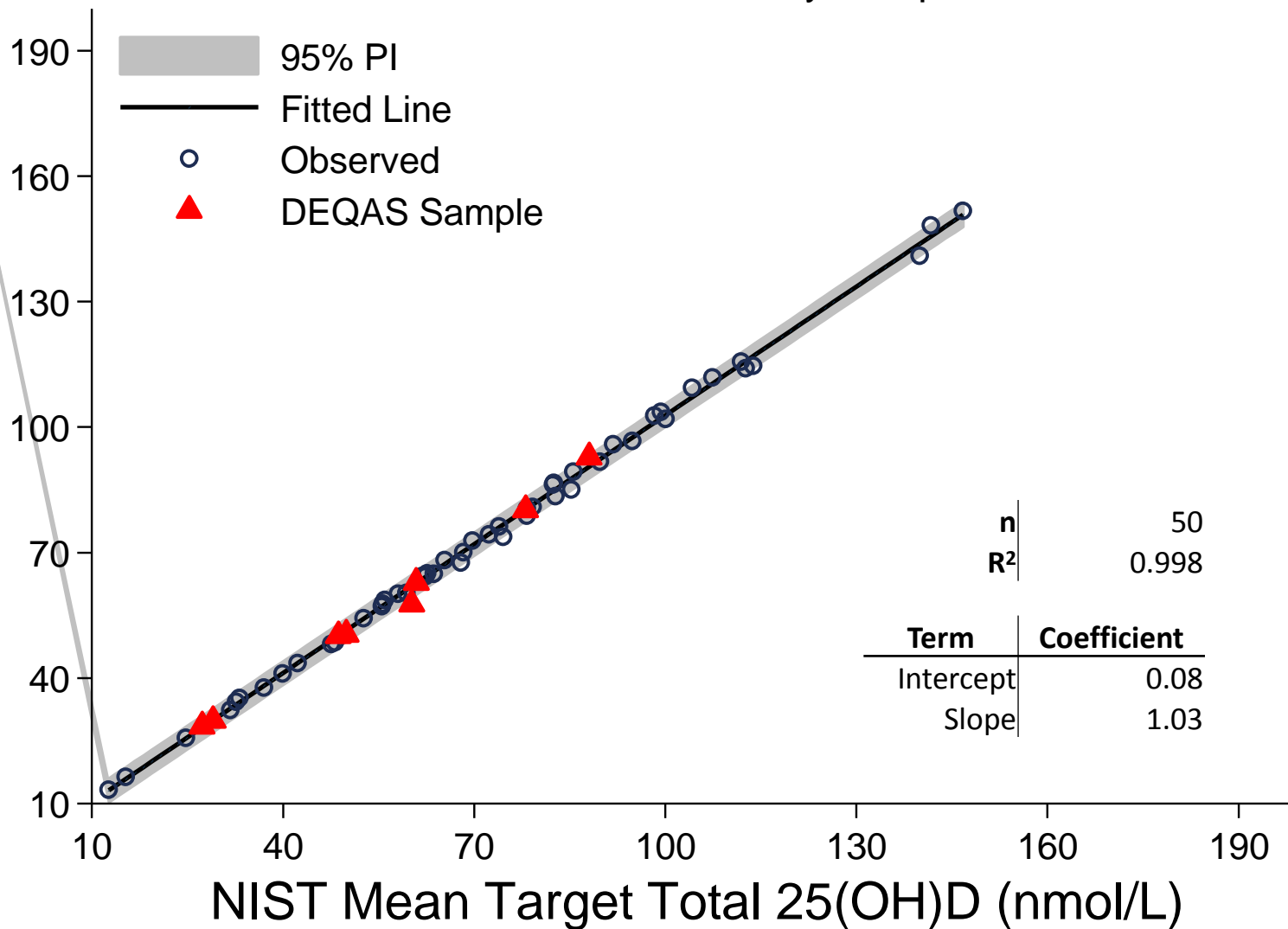
# VDSP Commutability Study: Immunoassay

## Lab 12: DEQAS Survey Samples



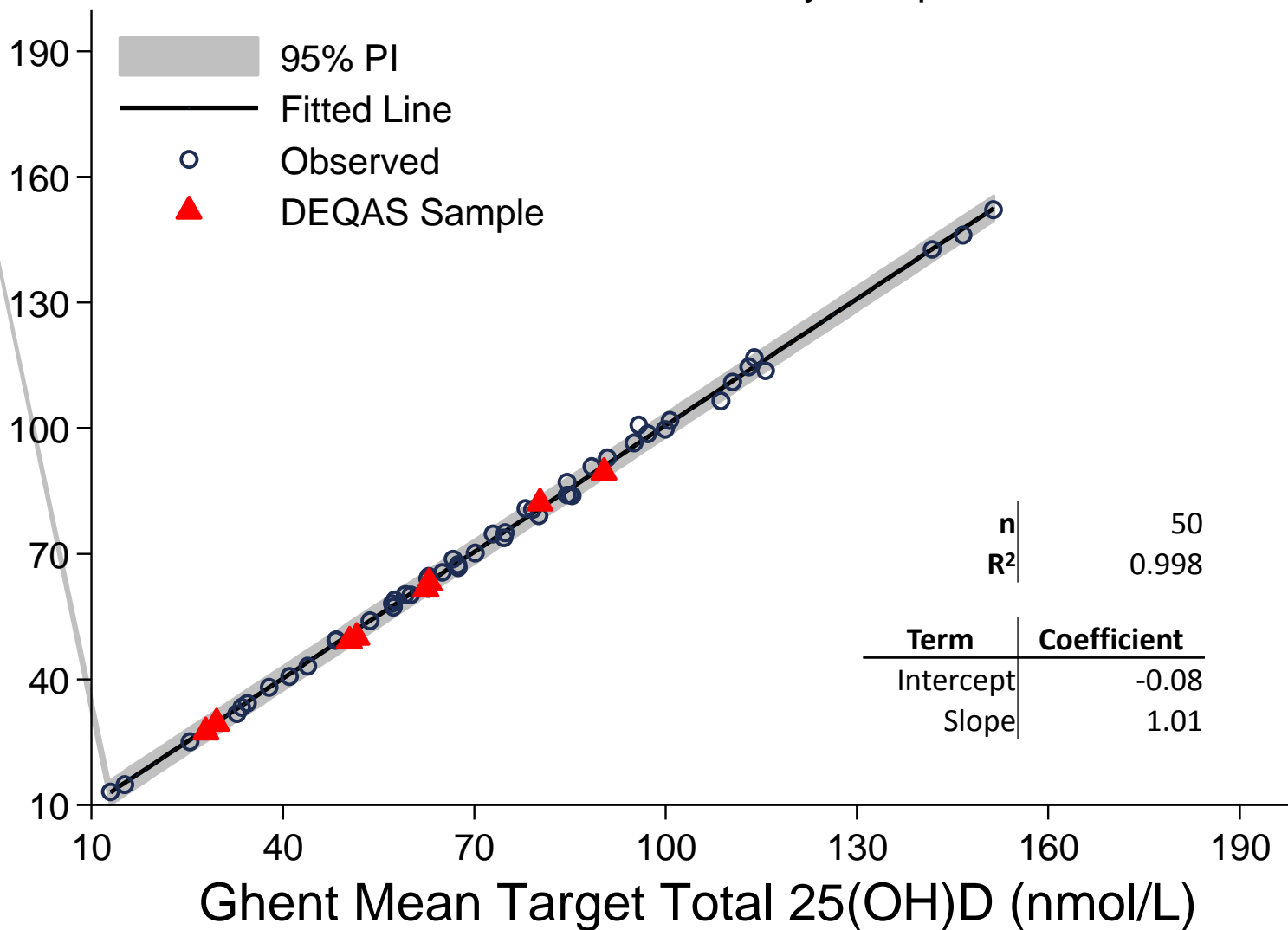
# VDSP Commutability Study: LC-MS/MS

## Lab 13: DEQAS Survey Samples



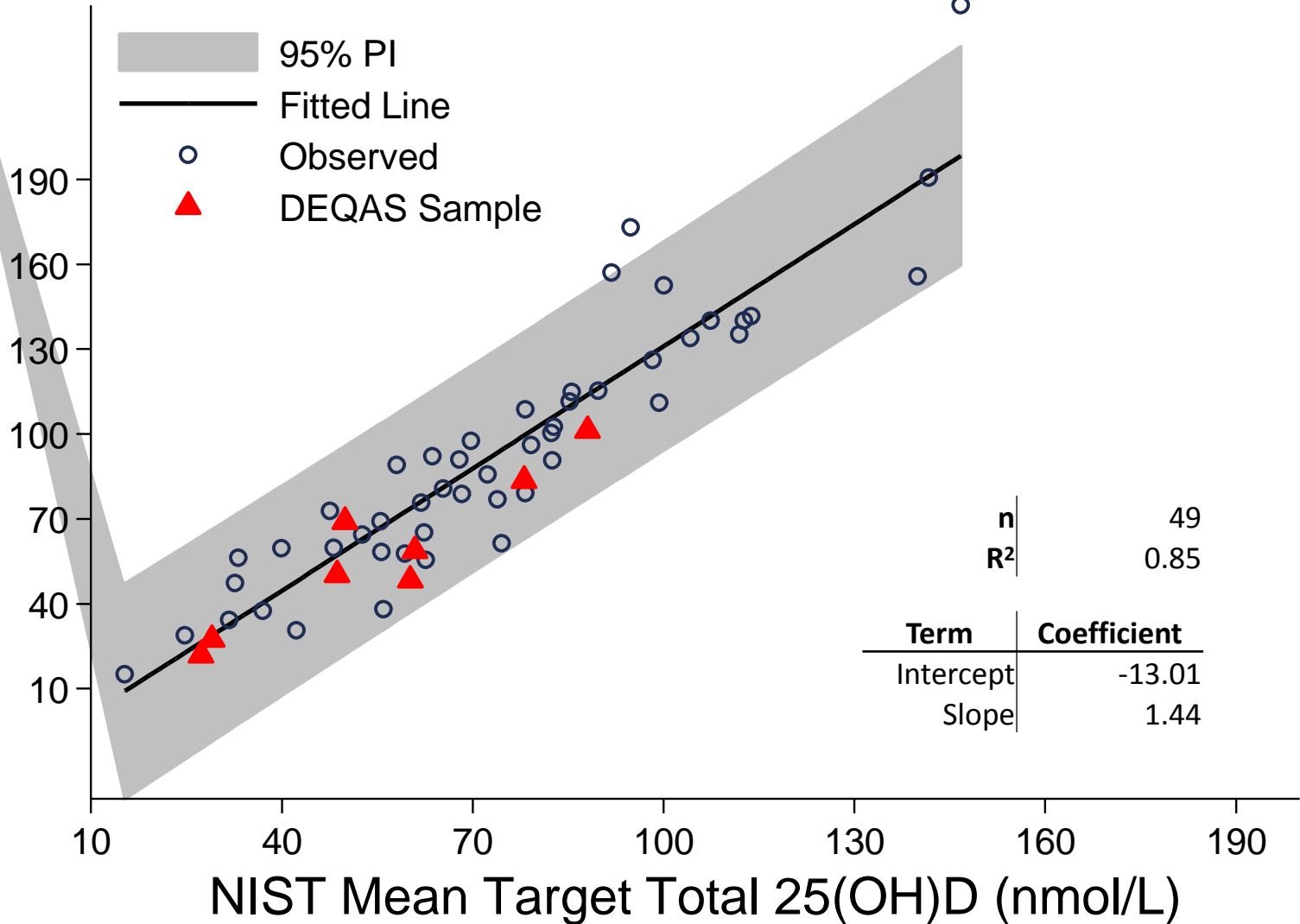
# VDSP Commutability Study: LC-MS/MS

## Lab 16: DEQAS Survey Samples



# VDSP Commutability Study: Immunoassay

## Lab 17: DEQAS Survey Samples





# VDSP Contributors

- **ODS: Overall Coordination**

- Paul Coates
- Joseph Betz
- Claudia Faigen
- Joyce Merkel
- Mary Frances Picciano\*
- Christopher Sempos\*\*
- Anne Thurn
- Elizabeth Yetley

- **International Organizations:**

- **AACC** - Gary Myers

- **IFCC** - Ian Young

- **CAP**

- Andrew Hoofnagle
- Nataliya Polyakov
- Sharon Burr

- **DEQAS**

- Graham Carter
- Julia Jones
- Jayne Shannon

\* Deceased

\*\* VDSP Coordinator

## Reference Laboratories

- **USA – NIST**

- Stephen Wise
- Lane Sander
- Karen Phinney
- Susan Tai
- Johanna Camara
- Mary Bedner
- Katrice Lippa
- Carolyn Burdette

- **Belgium: Ghent University**

- Linda Thienpont
- Linde De Grande
- Katleen Van Uytfanghe

- **CDC Standardization-Certification Program**

- Hubert Vesper
- Yasamin Rahmani



# VDSP Contributors: Surveys

- **Australia**
  - Juanita Pettit
  - Andy Liu
  - Grahame Caldwell
- **Canada**
  - Steven Brooks
  - Kurtis Sarafin
  - Evan Green
- **Germany**
  - Michael Thamm
  - Thea Riedel
  - Christa Scheidt-Nave
  - Gert Mensink
- **Ireland**
  - Kevin Cashman
  - Mairead Kiely
  - Albert Flynn
  - Michael Kinsella
- **Mexico**
  - Ricardo Martín Robledo Pérez
  - Simón Barquera
  - Mario Efraín Flores Aldana
  - Salvador Villalpando
- **South Korea**
  - Kyungwon Oh
  - Chae Lim Jung
- **United Kingdom**
  - Alison Tedstone
  - Ann Prentice
  - Lorna Cox
  - Gail Goldberg
  - Kate Guberg
- **USA – CDC**
  - Rosemary Schleicher
  - David Lacher
  - Christine Pfeiffer



# VDSP Contributors: Scientific Consultants

- **Australian National University**
  - Robyn Lucas
- **Cornel University**
  - Patsy Brannon
- **Food Standards Australia New Zealand**
  - Janis Baines
- **Loyola University Chicago**
  - Ramón Durazo
  - Holly Kramer
- **Neil Greenberg Consulting Services, LLC**
  - Neil Greenberg
- **Queen's University, Canada**
  - Glenville Jones
- **Stanford University**
  - Lu Tian
- **University of Minnesota**
  - John Eckfeldt
- **University of Otago, NZ**
  - Murray Skeaff
- **University of Washington**
  - Andrew Hoofnagle
- **University of Wisconsin-Madison**
  - Hector DeLuca
  - Neil Binkley
  - Gary Lensmeyer
- **Virginia Commonwealth University**
  - Greg Miller
  - Lorin Bachmann





**Thank you!**



# Questions - Discussion