MA SC

ICAR Sub-Commitee on Milk Analysis

Proficiency Testing scheme interlinkage

-

International laboratory anchorage

Olivier Leray, 39800 Poligny, France.

Outline

1- Reference in the ICAR AQA system

2- Relativeness of the reference

3- Choice for an universal reference

4- Linking PT schemes

5- Different levels of implementation

6- Application to somatic cell counting

7- Conclusion

The reference in the ICAR AQA System

☞ **Objective :**

- Establish the **true content** of component in DHI milk
- ICAR Guidelines :
  a- methods internationally standardized
  b- standardized methods tightly fitted / anchored to a-
- Ref methods slow => **calibration** of routine methods with reference

☞ **Calibration of routine methods**

- In-house calibration : individual laboratory
- Centralized calibration : interlaboratory study

☞ **Secure DHI analysis thr. Quality Control :**

- Internal (QC, SRMs) ; **external (CRMs, PTs)**
- **Reference** and routine methods

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What is / where is the « analytical truth » ?

« Truth » stated by **reference methods** but …

is a **relative concept**

⇩

Reference methods provide results with **uncertainty !**

⇩

Precision characteristics (ISO 5725) :

repeatability, r=2.8 sr ; reproducibility, R=2.8 sR,

$\Rightarrow$ *Between lab variation* $sL^2 = sR^2 - sr^2$

⇩

Deviations within limits are permitted :

> *max range between 2 laboratories L = 2.8 sL*

> *max lab bias from the reference +/-2 sL*

What is / where is the « analytical truth » ?

Component	ISO	sR	sr	sL	R	r	L	+/-2 sL
Fat g/100g	1211	0,02	0,014	0,014	0,056	0,039	0,040	0,029
Protein g/100g	8968	0,018	0,014	0,011	0,050	0,039	0,032	0,023
SCC(10^3 c/ml)	13366-2	45	20	40	126	56	113	81
SCC rel (750.10^3 c/ml)	13366-2	6%	3%	5%	17%	8%	15%	10%

Ranges allowed between two laboratories chosen at random

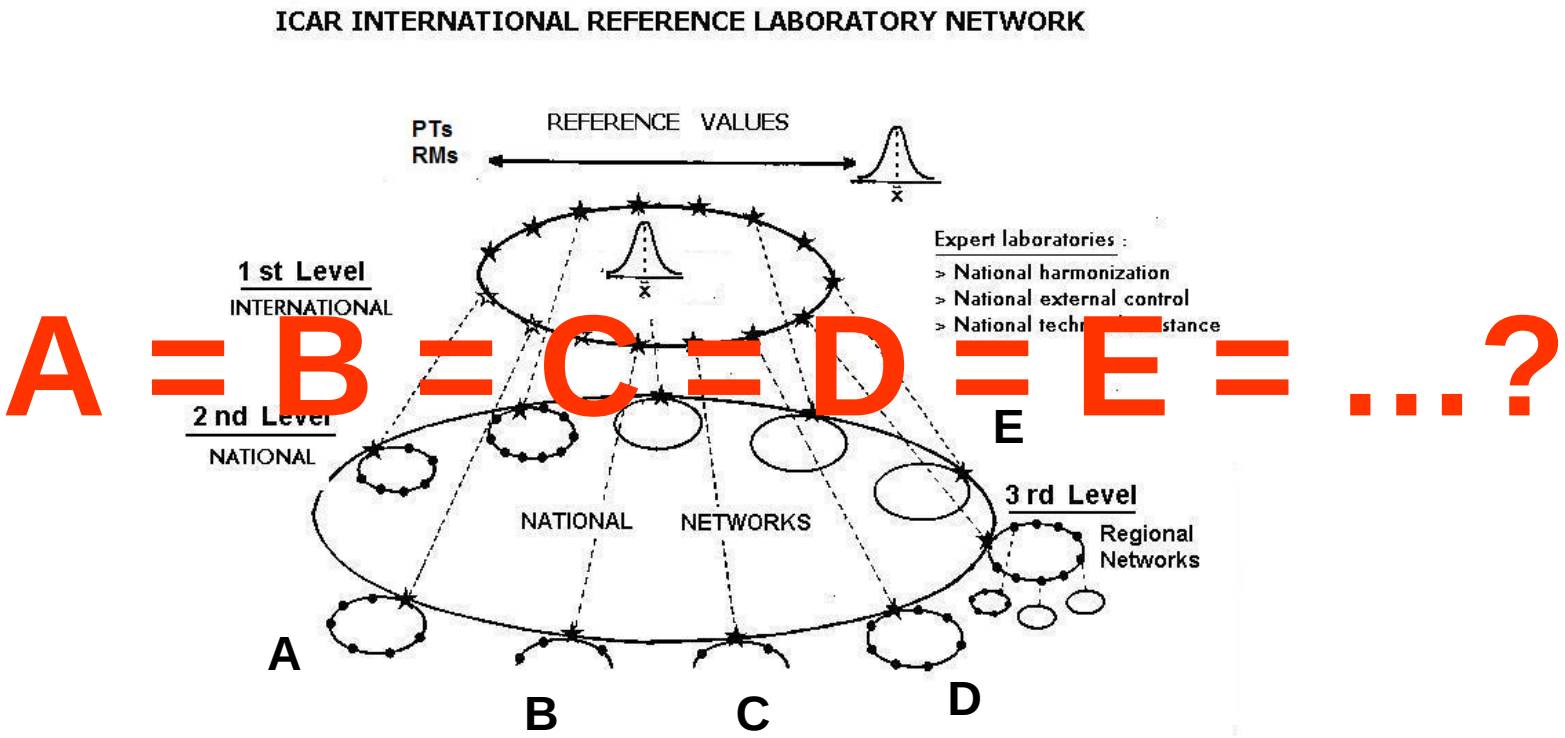
Lab bias limits allowed from the reference for « normal laboratories »

⇒ Reduction thr. AVERAGING ⇒ laboratory network MEANS as reference

Every national network defines its own reference

None knows whether it differs from the others

… nor how far !

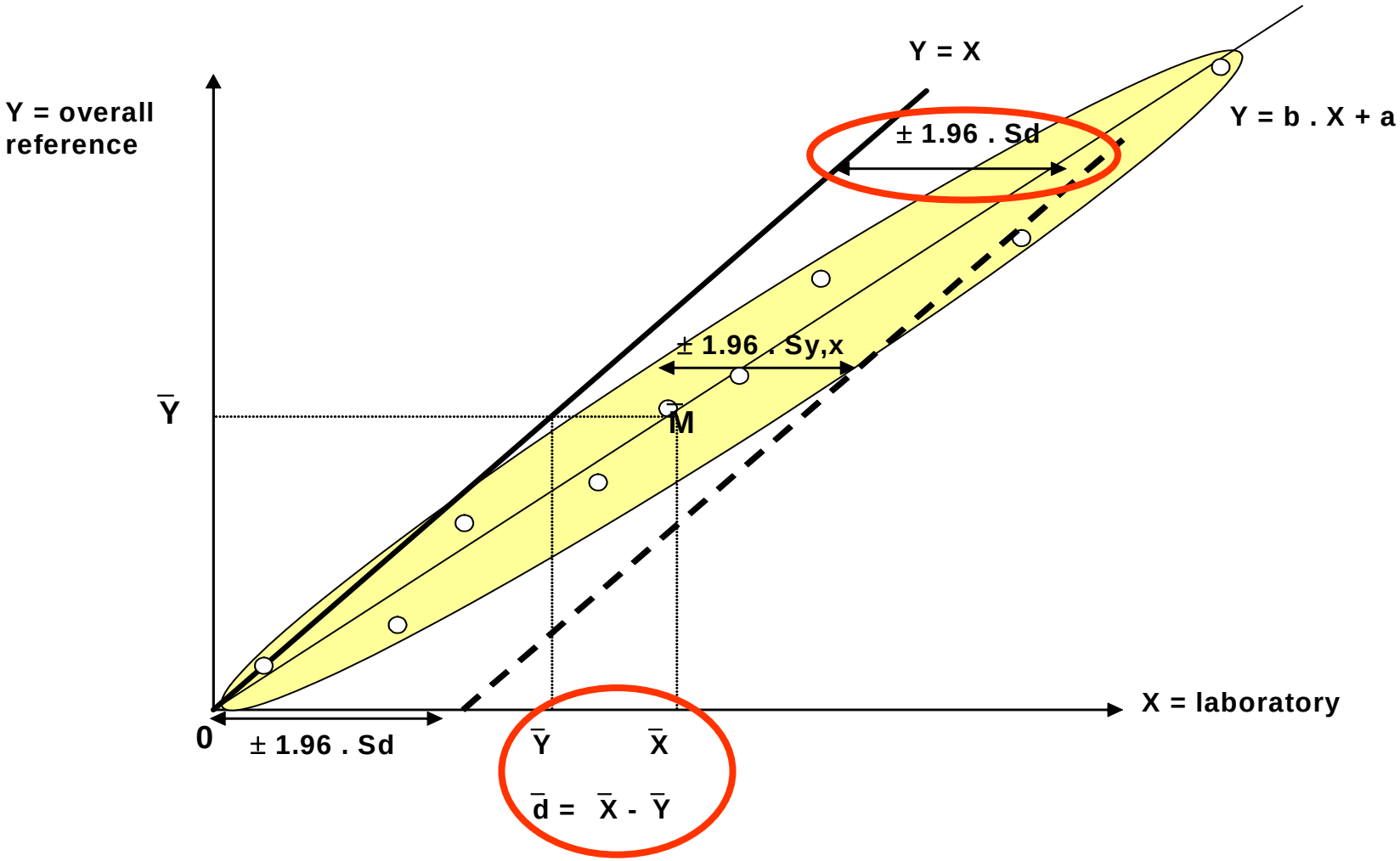


Assumption that the group gives the true reference is relative

Different conditions of interlaboratory studies (lab number, PT design and protocol, methods involved) can influence population results and the resulting references.

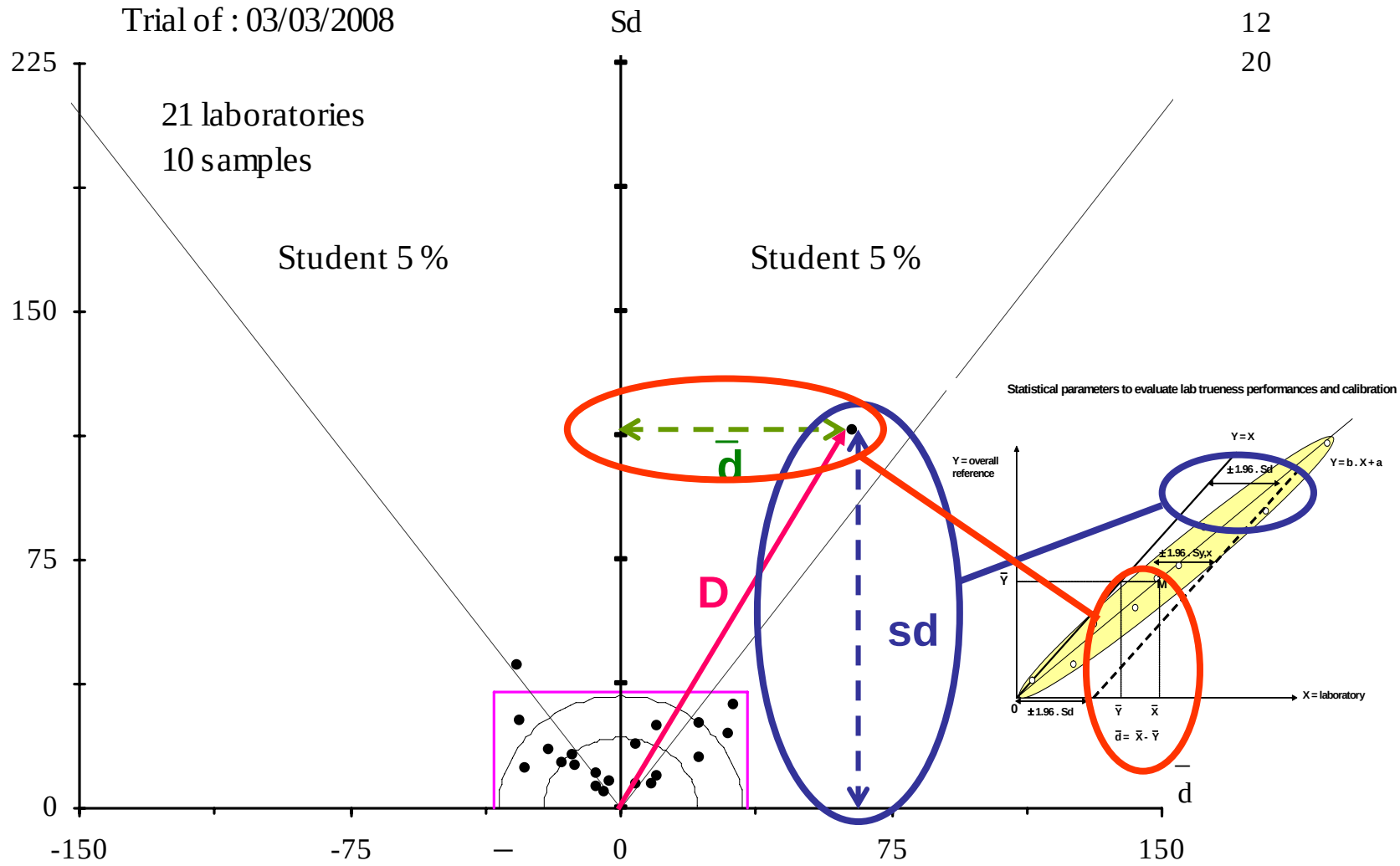
Recalls on calibration and PT Statistics

Statistical parameters to evaluate lab trueness performances and calibration



ICAR Interlaboratory Proficiency Study - March 2008

2 Labos OUT OF THE TARGET (10 %)



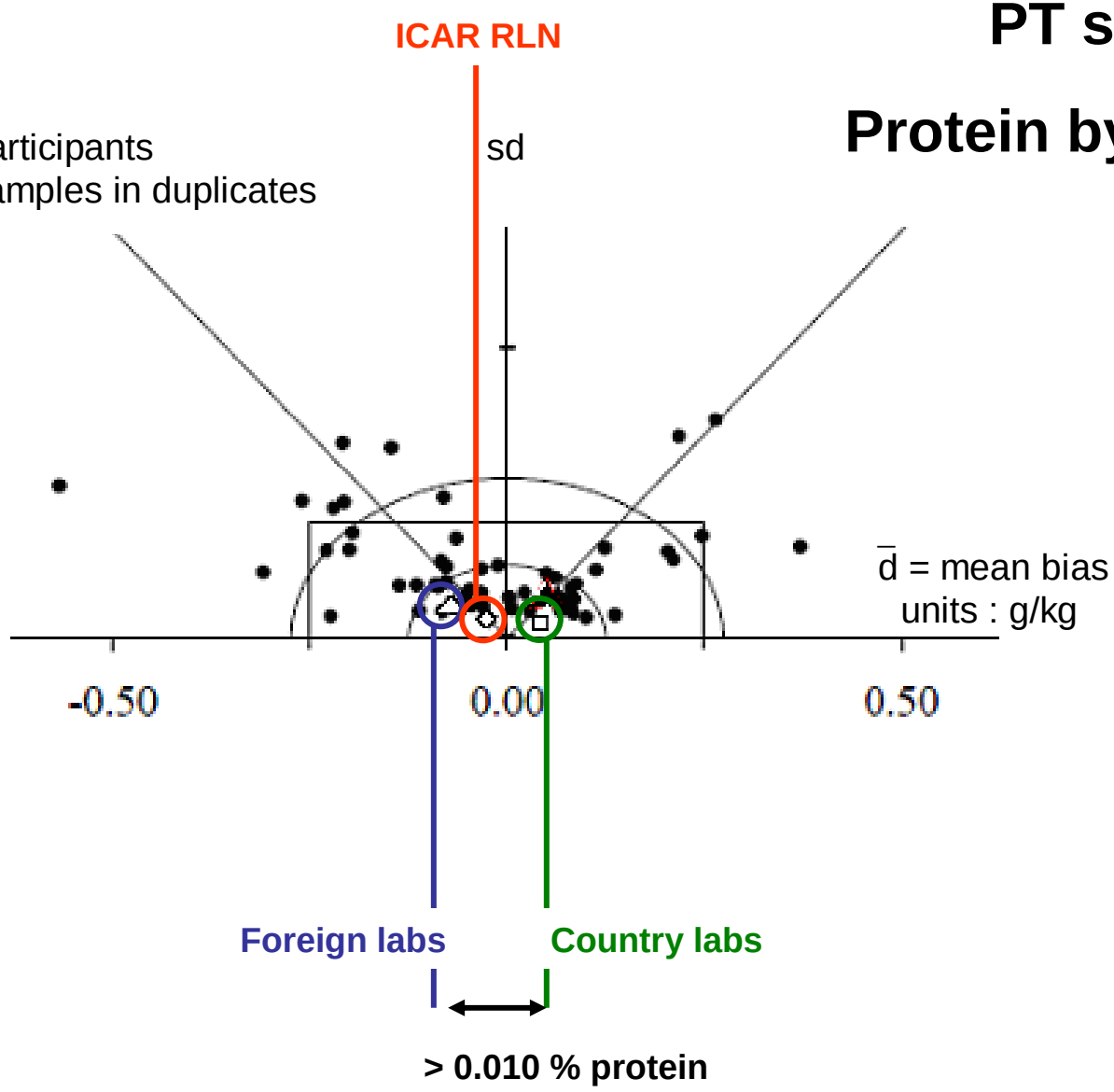
Target limits : d = +/- 35.10^3 cells / ml of milk

Sd = 35.10^3 cells / ml of milk

PT study

Protein by Kjeldahl

66 participants
10 samples in duplicates

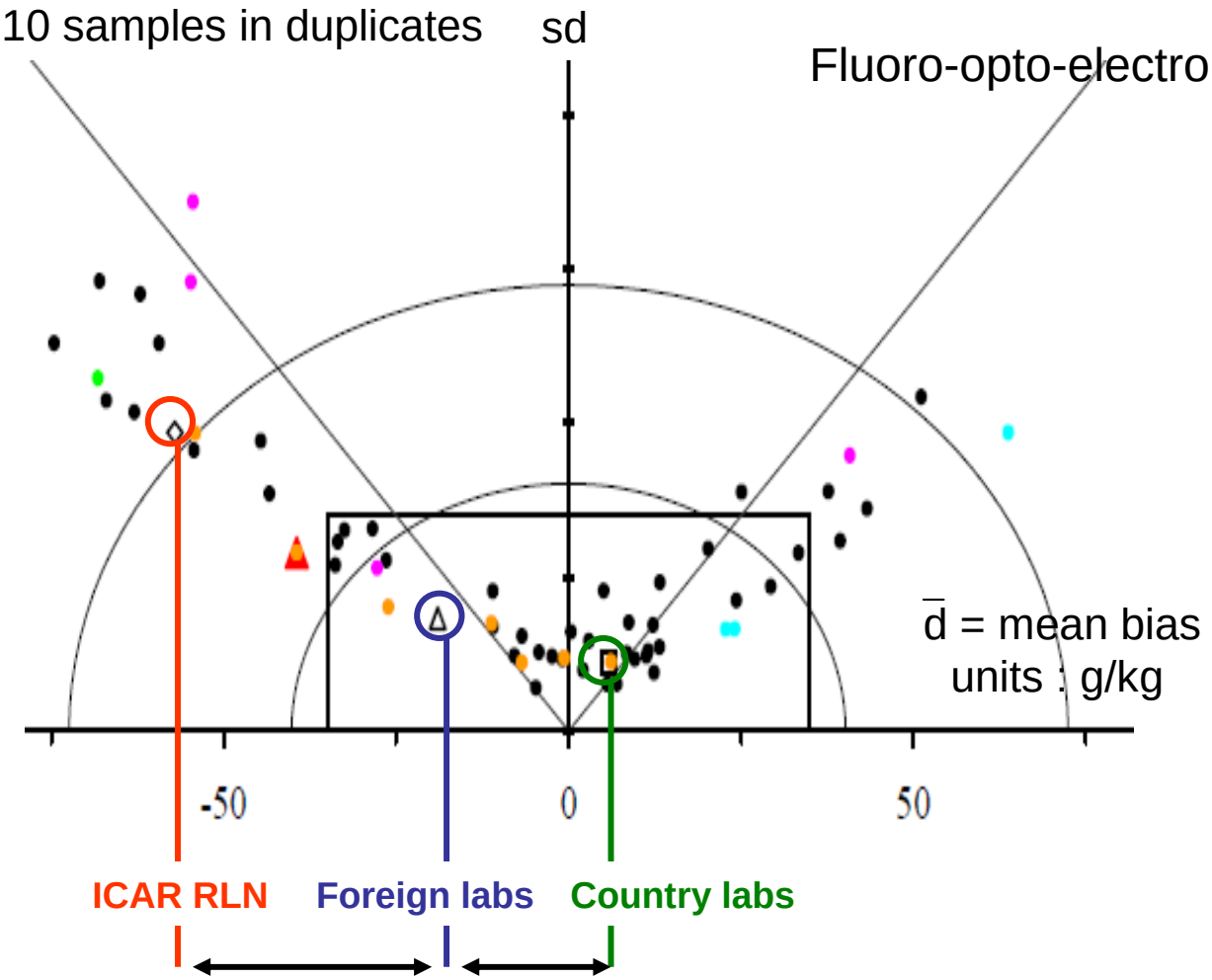


PT study

Somatic Cell Counting

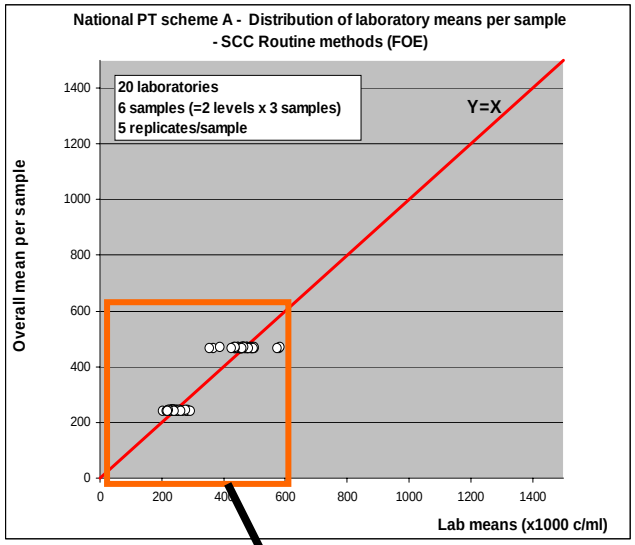
Fluoro-opto-electronic methods

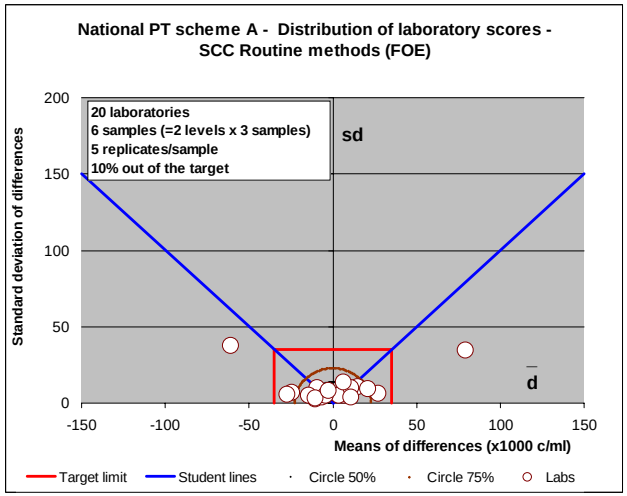
70 participants
10 samples in duplicates



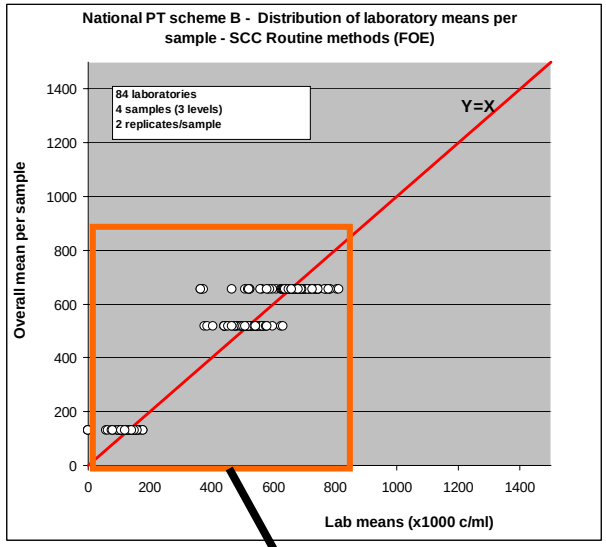
Diversity in PT scheme in Europe => different references ?

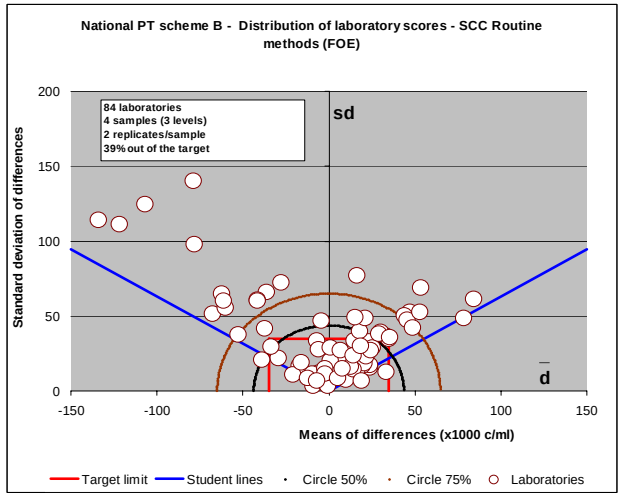
Scheme A



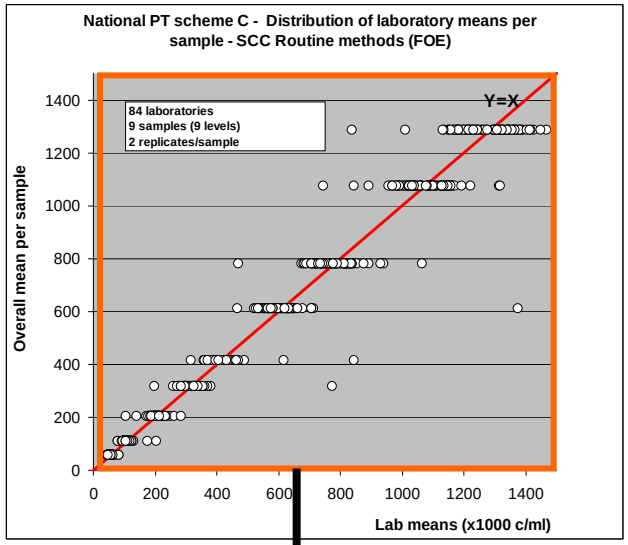


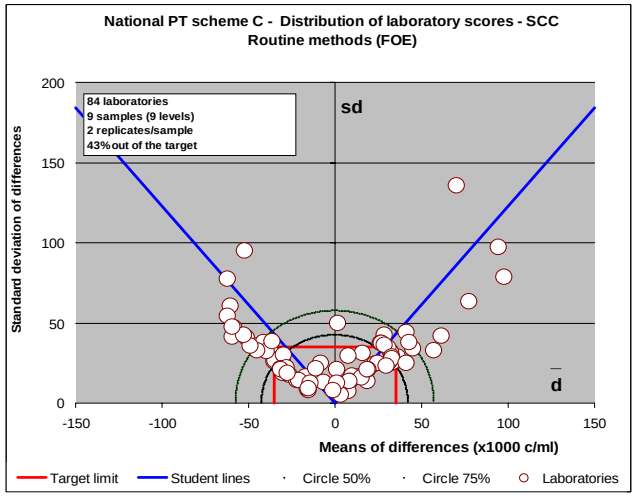
Scheme B





Scheme C





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Truth = agreement of all the stakeholders to reach common goals

i.e. worldwide harmonisation for ICAR

⇩

ICAR choice = International network of reference labs using reference methods

⇒ **International recognition** **representativeness (political),**

⇒ **Highest competence & training**

suitable methodology & capability (technical)

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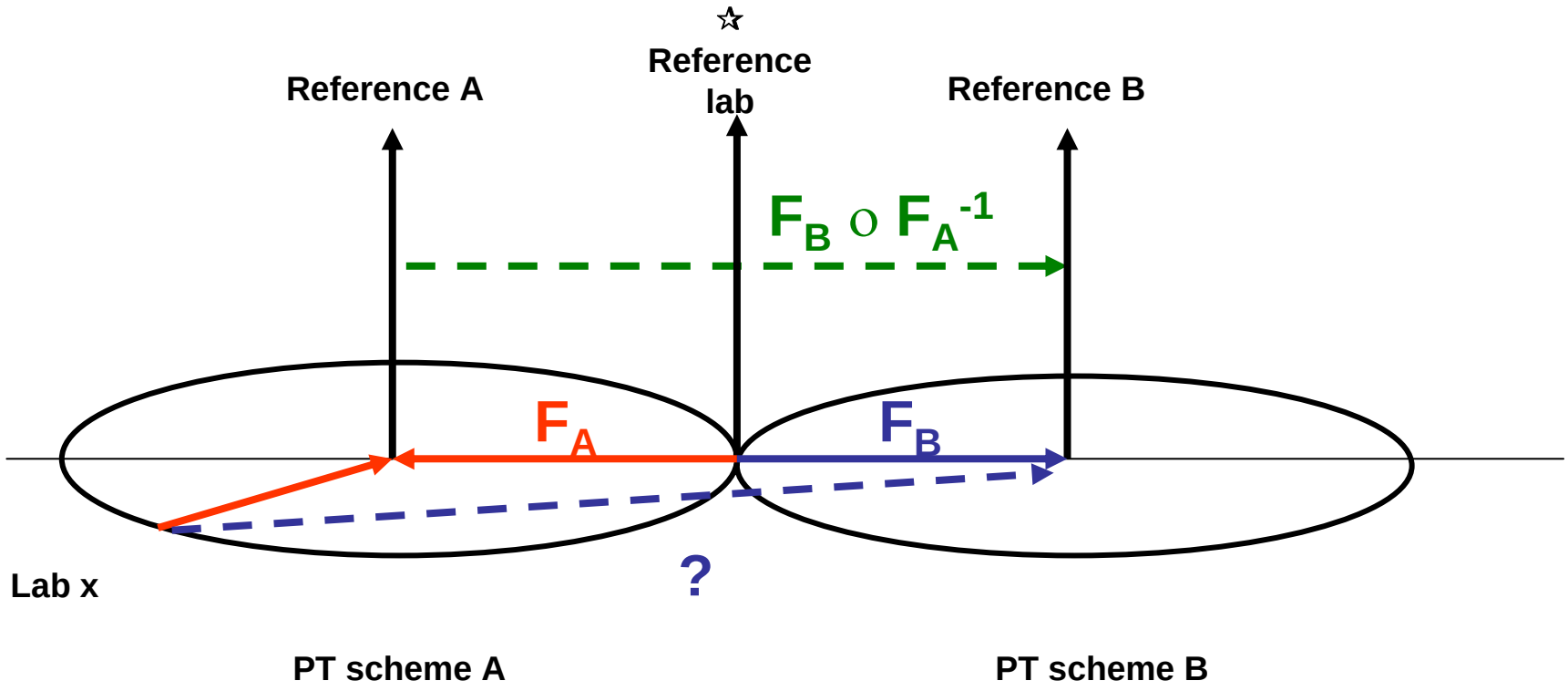
Principle of interlinking schemes with expert laboratories

O. Leray, ICAR Session, Niagara Falls, 2008 ; IDF | ICAR – SCC RS, 2010



Existing routes

Unknown direct routes

To each route there is a specific mathematical relationship for linking

Inter-linking relation using linear equations

O. Leray, 2010 – IDF | ICAR – SCC RS project (underway)

$F_A : \quad y = x \,.\, b_A + a_A$

$F_B : \quad z = x \,.\, b_B + a_B$

$\Leftrightarrow$ $F_A^{-1}: \quad x = y/b_A - a_A/b_A$

y = Real reference of scheme A

z = Virtual reference of scheme A in scheme B

$F_A^{-1} \circ F_B$ $\quad z = (y/b_A - a_A/b_A) \,.\, b_B + a_B$

$z = y \,.\, (b_B/b_A) + (a_B - a_A.b_B/b_A)$

No level effect => $\quad z = y + (a_B - a_A) = y + (\bar{d}_A - \bar{d}_B)$

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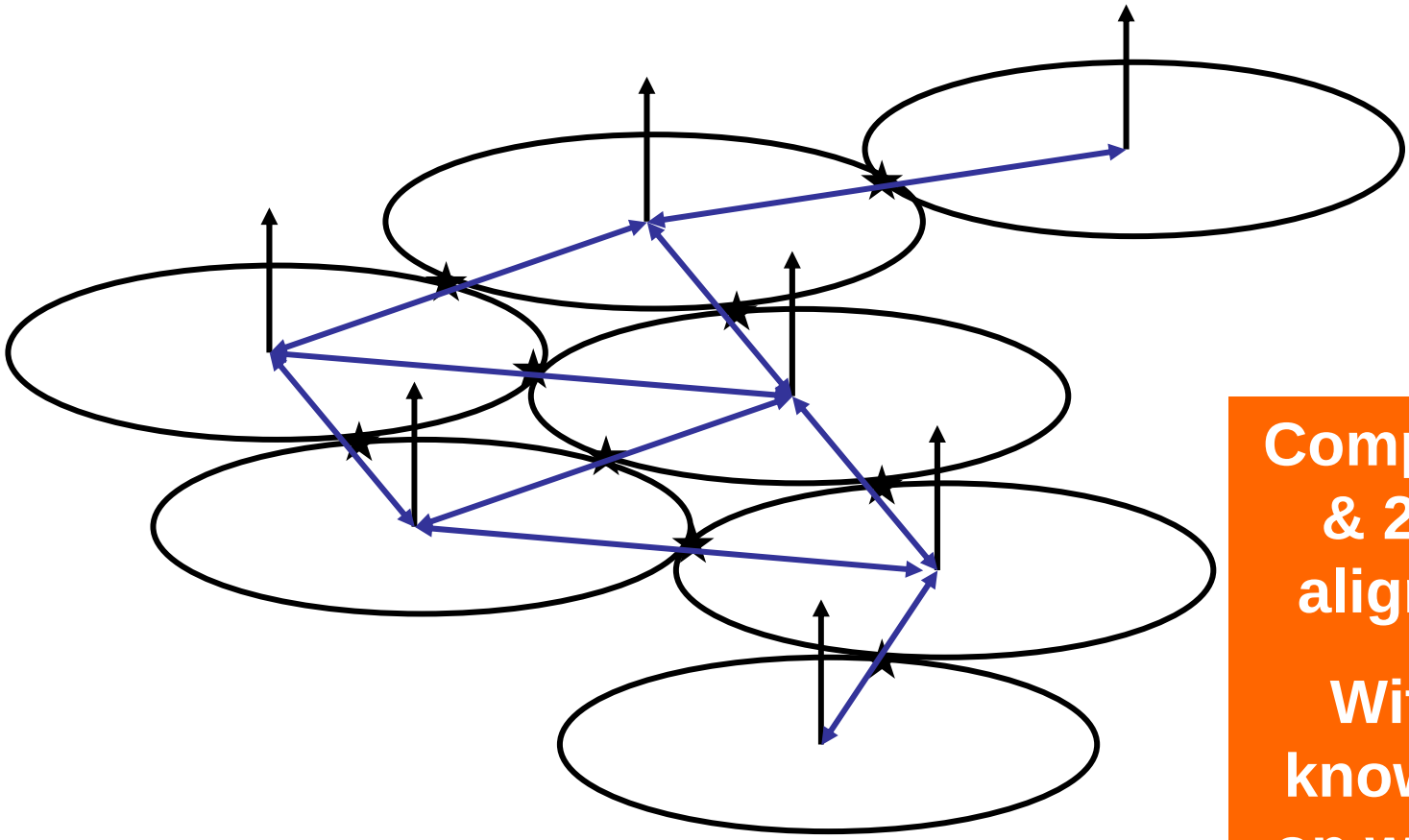
Interlinkage of national PT schemes <=> PT scheme networking

O. Leray, 2010 – IDF | ICAR – SCC RS project (underway)



Comparison & 2-by-2 alignment

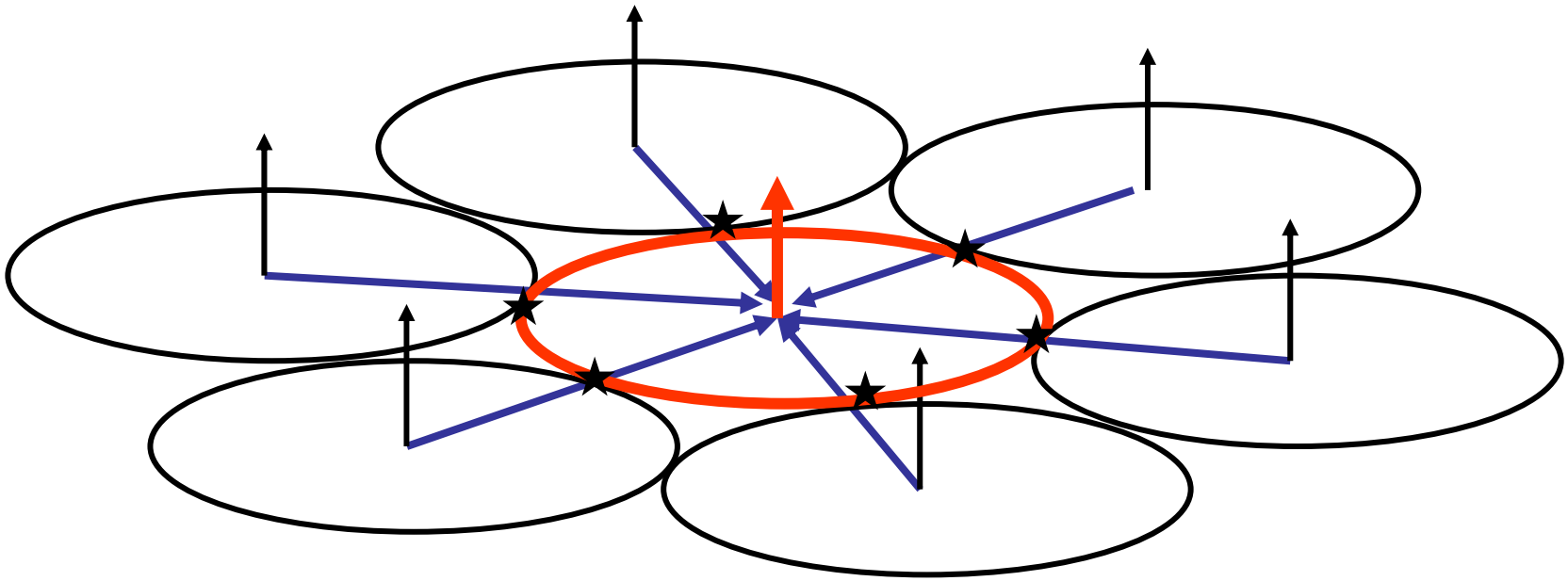
With no knowledge on where is real « Truth »

: Reference = Ideal consensus lab for the PT scheme

★ : Expert (reference) lab

Anchorage to an international reference scheme

O. Leray, 2010 – IDF | ICAR – SCC RS project (underway)



: Reference = Ideal consensus lab for the PT scheme

★ : Expert (reference) lab

Alignment to a real « Truth » stated by consensus & comparison

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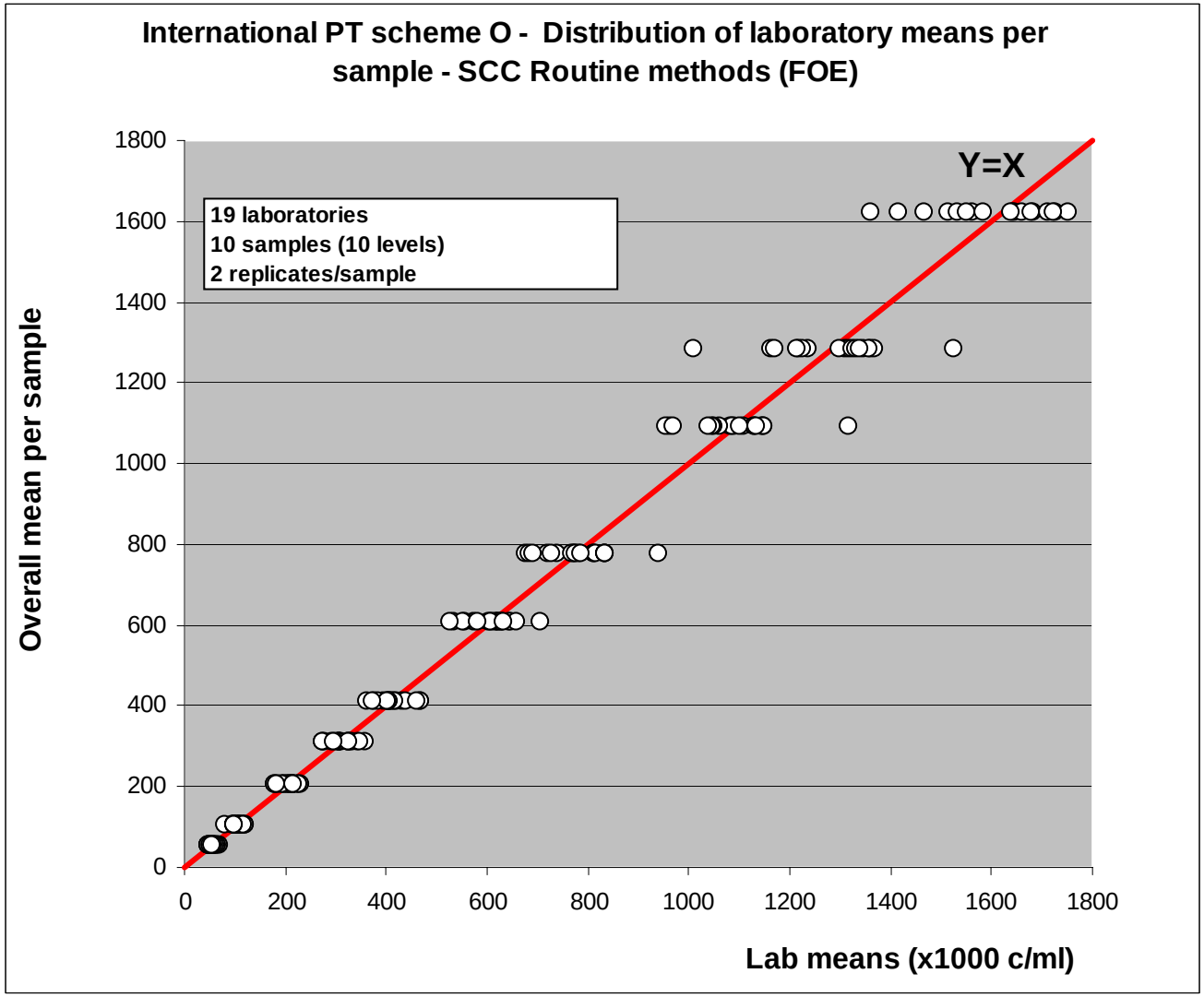
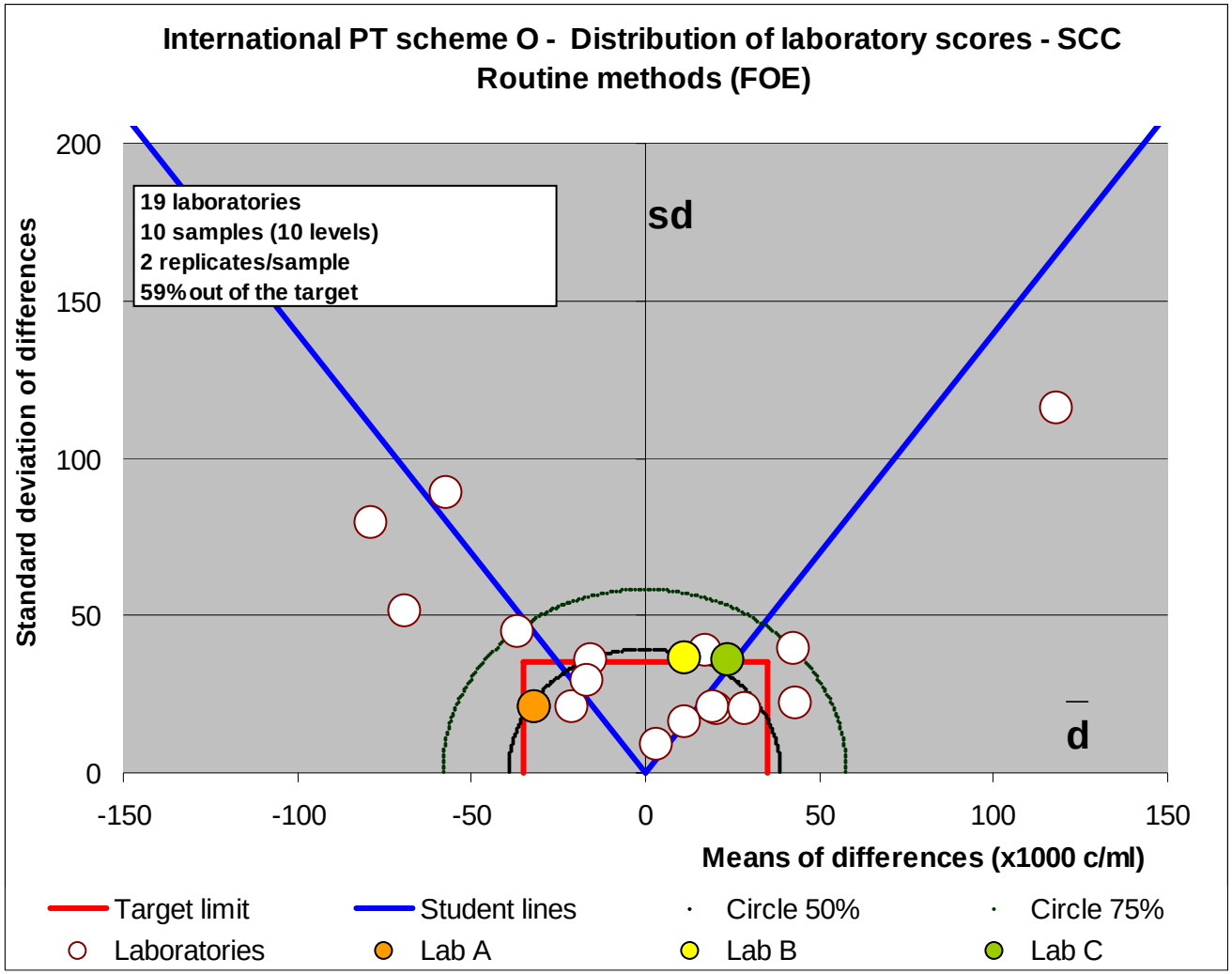
SCC International PT scheme : Levels and results



ICAR PT scheme Sept. 2009

International PT scheme : Reference Laboratory scores

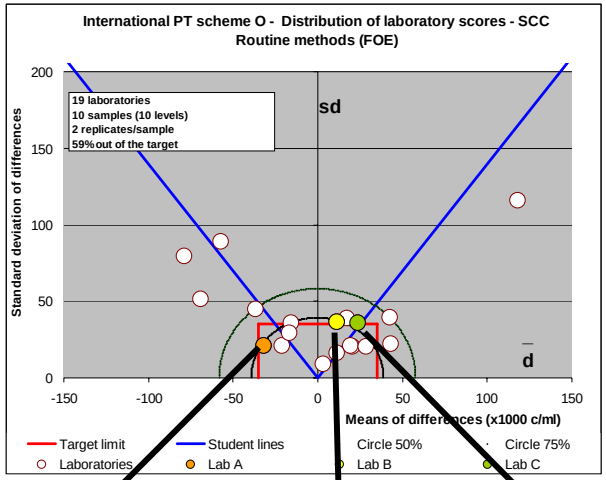


ICAR PT scheme Sept. 2009

International PT scheme anchorage

International level ⇨

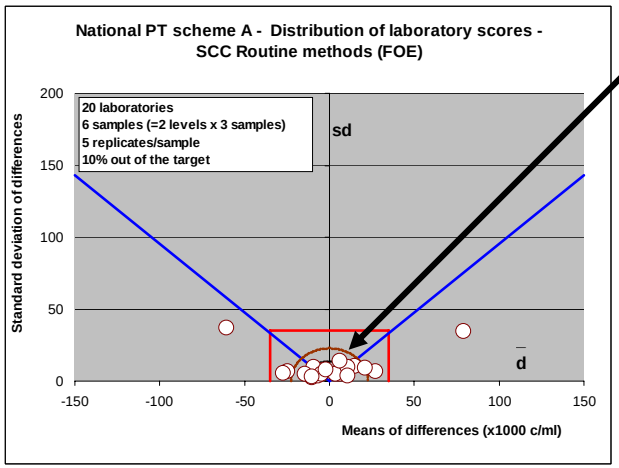
Scheme O



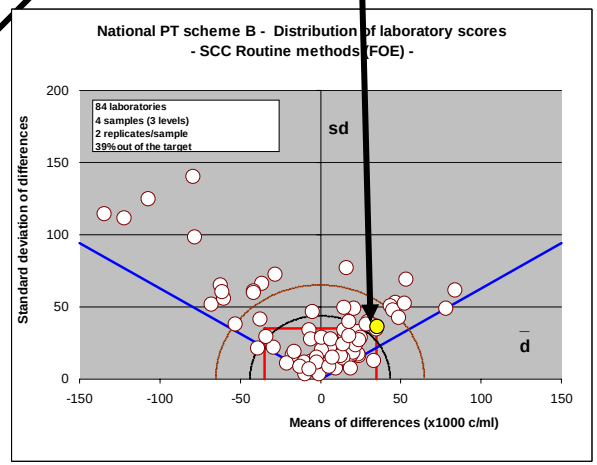
National / regional level

⇩

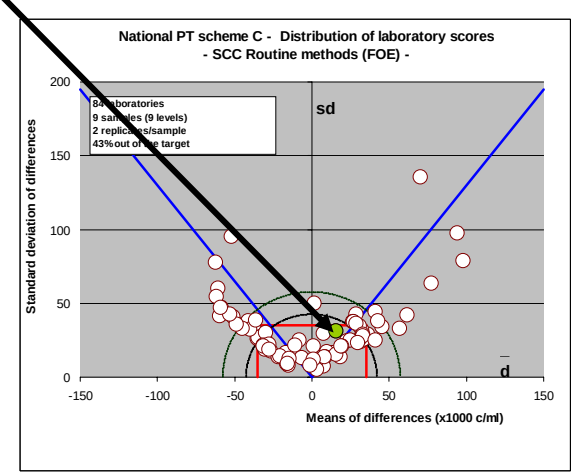
Scheme A



Scheme B



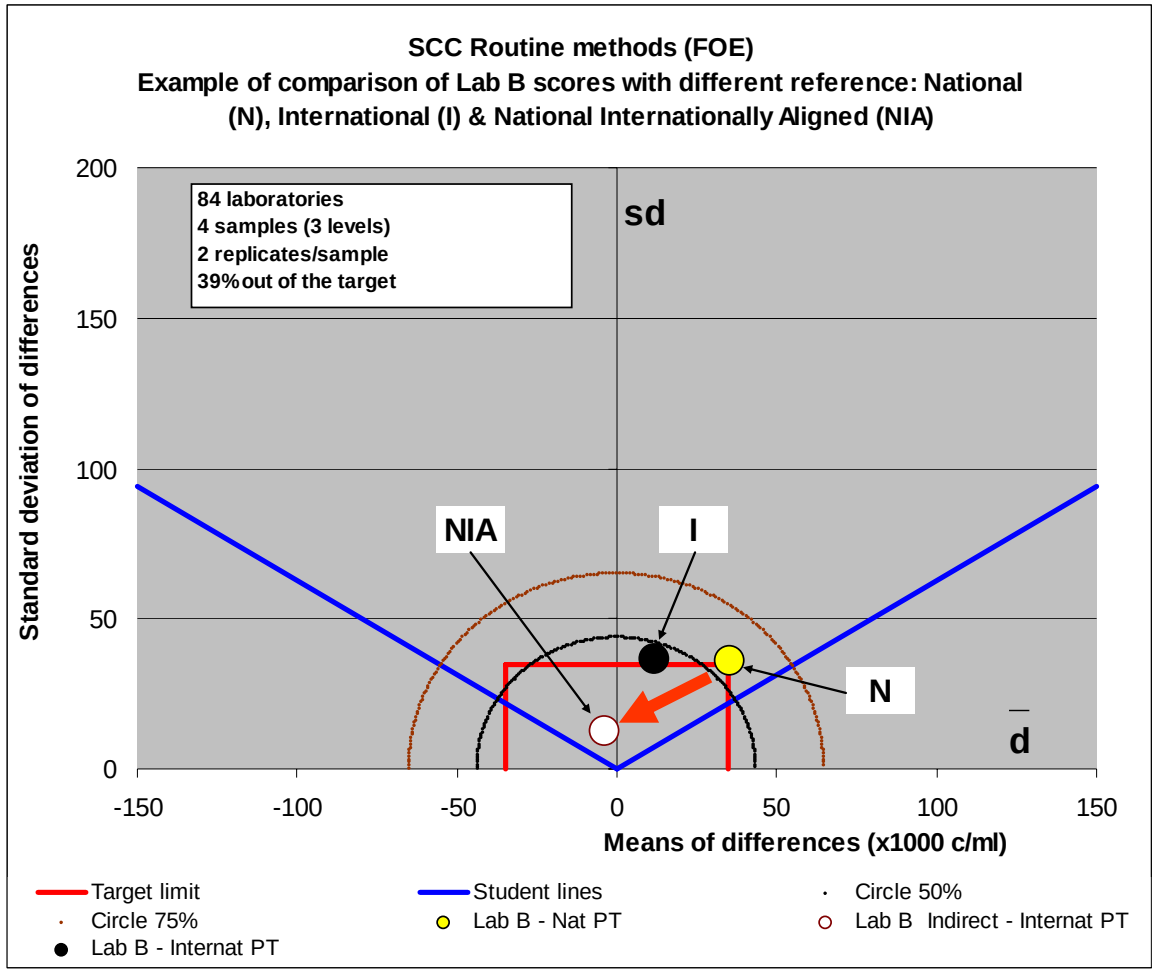
Scheme C



ICAR PT scheme Sept. 2009

Alignment of reference for a national scheme B onto an international scheme :

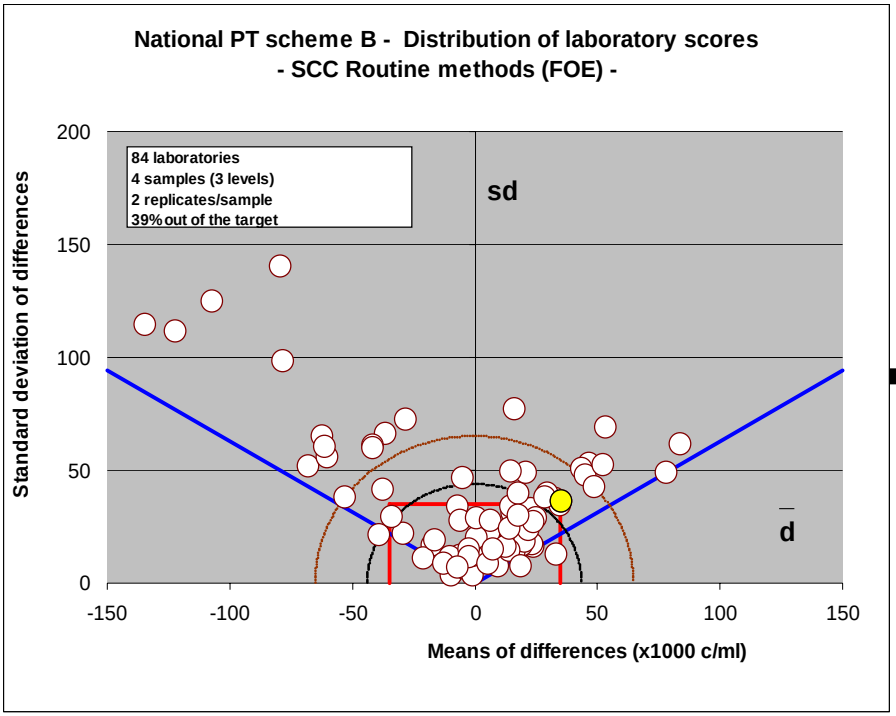
Different scores of Ref Lab B



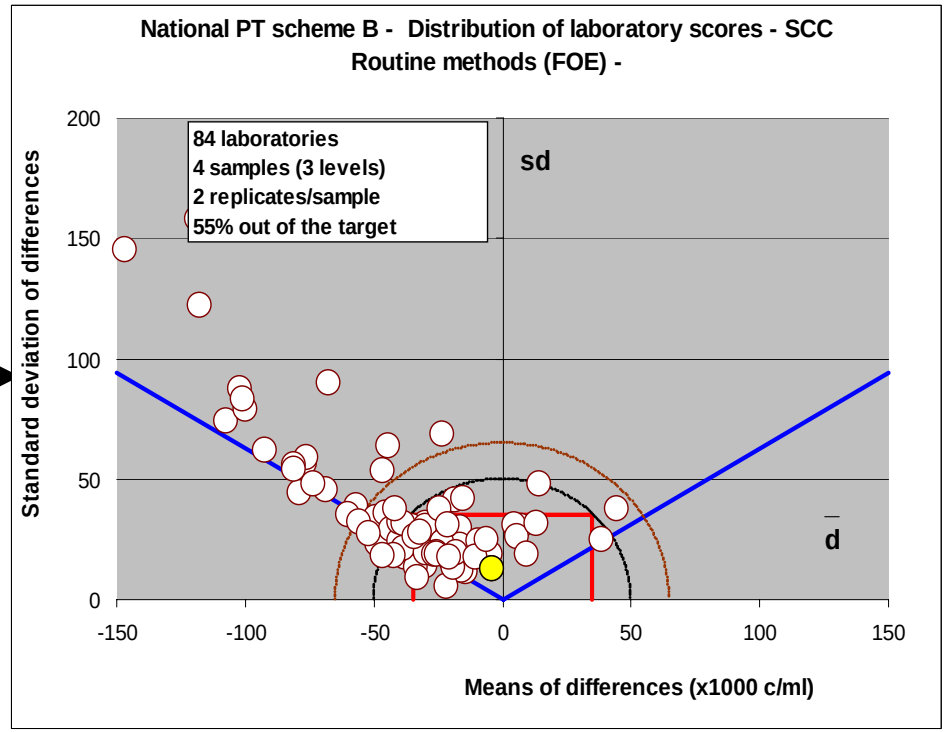
PT scheme interlinking of a national scheme B to an international scheme O

=> Evolution of labs scores of scheme B

National PT (actual)



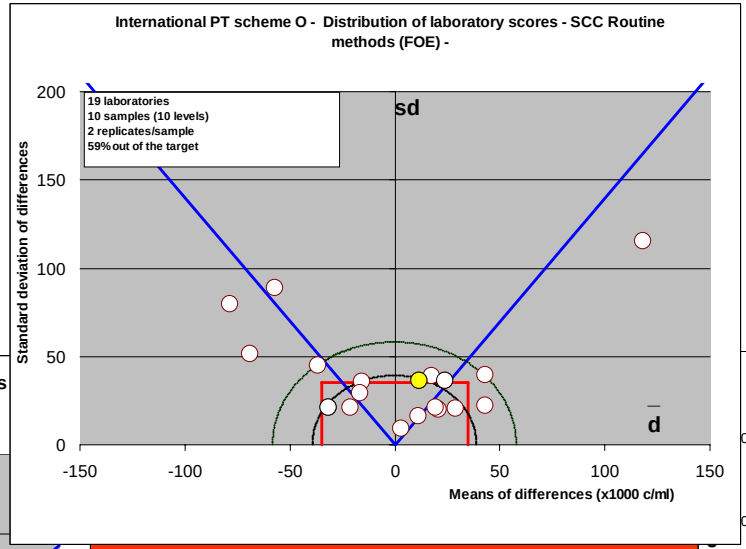
National PT Internat[ly] Aligned (virtual)

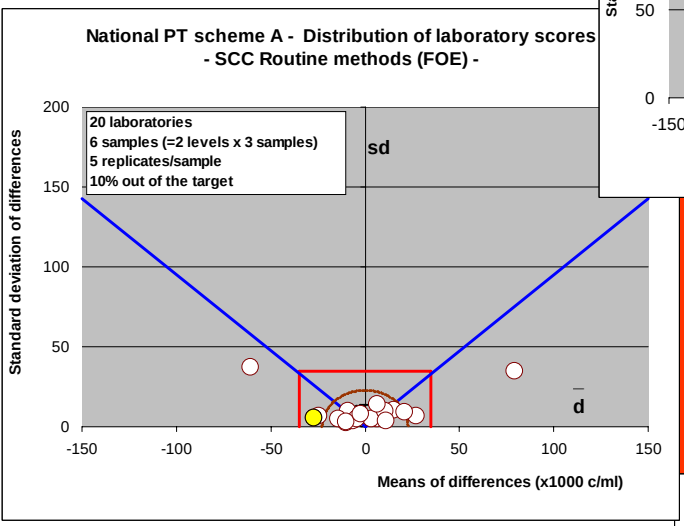


Local PT studies can show only a part of the problem if there si no external input (Reference PT or RMs) to « give the Truth »

Different locations of Lab B in 4 different schemes A, B, C & O

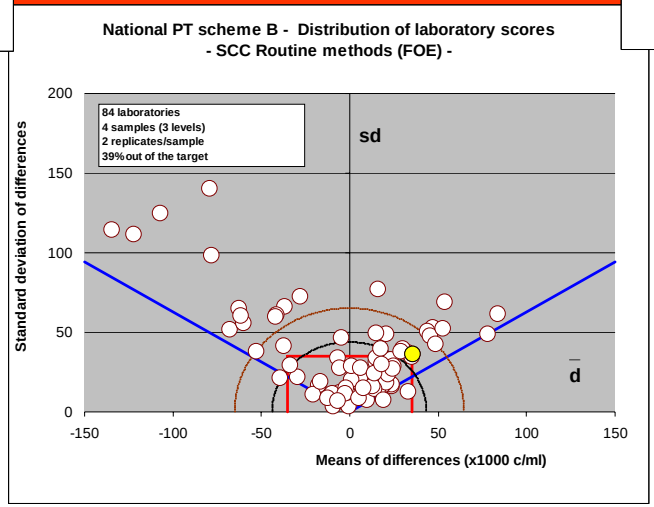
O



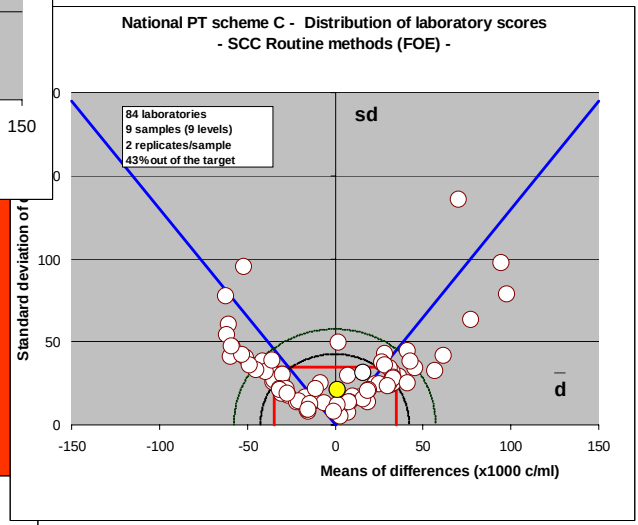


A

Ref Lab and/or references questionable ?



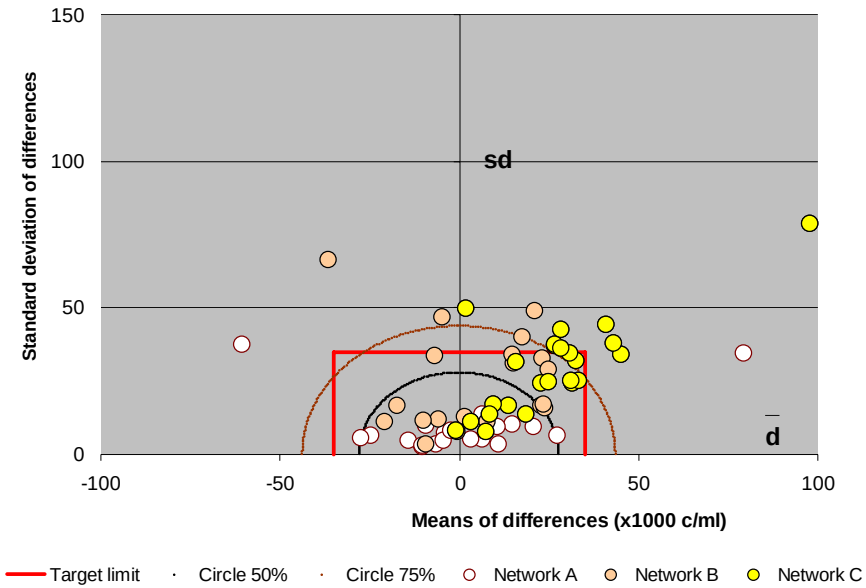
B



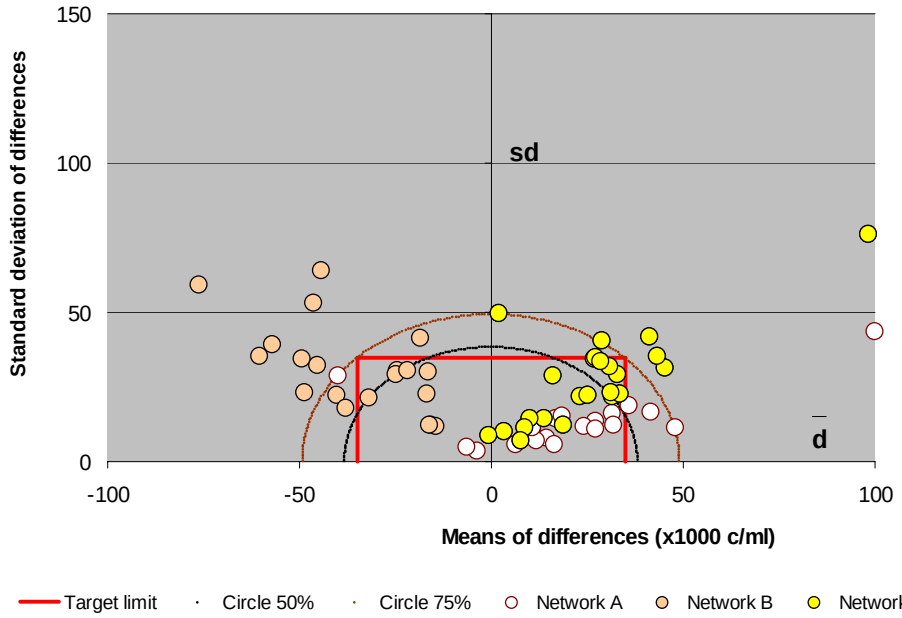
C

Simultaneous comparison of DHI labs of three countries (3 National PTs) in SCC

National (actual)



Internationally Aligned (virtual)



Score distributions broaden where ref lab scores differ between local and international (reference) PT

Ref Lab and/or references questionable ?

RANKING LABORATORIES

National (actual)

Rank	Rank%	ID	d	sd	D
1	2%	A6	3,4	4,9	6,0
2	3%	A11	-4,5	4,9	6,6
3	5%	A7	-6,4	3,6	7,4
4	6%	B8	-0,7	7,6	7,7
5	8%	C84	-0,9	8,0	8,0
6	9%	A3	6,3	5,0	8,0
7	11%	A1	-3,9	7,1	8,1
8	13%	A19	-2,3	8,1	8,5
9	14%	B9	-9,3	3,2	9,9
10	16%	A2	-10,1	2,4	10,4
11	17%	C21	7,4	7,6	10,6
12	19%	A17	-10,2	3,1	10,6
13	20%	C22	3,2	11,1	11,5
14	22%	A14	11,0	3,4	11,5
15	23%	B21	1,6	12,6	12,7
16	25%	B2	-5,9	12,0	13,4
17	27%	A9	-9,1	9,8	13,4
18	28%	B22	7,7	11,0	13,4
19	30%	A13	10,8	9,6	14,4
20	31%	A10	-14,3	4,7	15,0
21	33%	A15	6,4	13,8	15,2
22	34%	B18	-9,9	11,7	15,3
23	36%	C14	8,6	13,8	16,2
24	38%	A4	15,0	10,2	18,1
25	39%	C13	9,7	17,0	19,6
26	41%	C2	13,6	16,5	21,4
27	42%	A16	20,8	9,2	22,8
28	44%	C15	18,6	13,6	23,0
29	45%	B13	-20,8	11,0	23,5
30	47%	B4	-17,4	16,8	24,2
31	48%	A8	-24,5	6,5	25,4
32	50%	A20	-27,2	5,7	27,8
33	52%	A5	27,3	6,4	28,0
34	53%	B6	22,8	16,6	28,2
35	55%	B19	23,8	15,9	28,6
36	56%	B24	23,6	17,2	29,2
37	58%	C8	22,9	24,2	33,3
38	59%	B7	15,1	30,8	34,3
39	61%	B17	-6,9	33,7	34,4
40	63%	C19	24,9	24,8	35,1
41	64%	C25	16,0	31,3	35,2
42	66%	B11	14,8	33,8	36,9
43	67%	B23	25,1	28,7	38,1
44	69%	C1	31,5	24,0	39,6
45	70%	C17	31,1	25,3	40,1
46	72%	B3	23,1	32,8	40,1
47	73%	C12	33,3	25,2	41,8
48	75%	B15	17,7	39,9	43,6
49	77%	C10	32,6	31,7	45,5
50	78%	C6	26,6	37,1	45,7
51	80%	C20	28,5	36,1	46,0
52	81%	C18	26,9	37,4	46,0
53	83%	C16	30,8	34,3	46,1
54	84%	B5	-4,7	46,7	46,9
55	86%	C7	1,9	49,8	49,8
56	88%	C5	28,5	42,6	51,3
57	89%	B16	20,9	48,7	53,0
58	91%	C9	45,3	34,0	56,6
59	92%	C23	43,0	38,0	57,4
60	94%	C3	41,0	44,2	60,3
61	95%	A18	-60,6	37,3	71,2
62	97%	B14	-36,6	66,3	75,7
63	98%	A12	79,3	34,6	86,5
64	100%	C11	98,0	78,5	125,5

International aligned(virtual)

Rank	Rank%	ID	d	sd	D
1	2%	A8	-3,7	3,4	5,1
2	3%	A20	-6,4	4,6	7,9
3	5%	A10	6,5	5,6	8,6
4	6%	C84	-0,7	8,7	8,7
5	8%	C22	3,4	9,9	10,4
6	9%	C21	7,6	7,2	10,5
7	11%	A9	11,7	7,0	13,6
8	13%	C14	8,8	11,5	14,5
9	14%	A2	10,7	11,0	15,3
10	16%	A17	10,6	11,3	15,5
11	17%	A7	14,4	7,8	16,3
12	19%	A11	16,3	5,8	17,3
13	20%	C13	9,9	14,6	17,6
14	22%	B23	-14,4	11,8	18,6
15	23%	C2	13,9	14,2	19,8
16	25%	B19	-15,7	12,2	19,9
17	27%	B24	-15,9	12,1	20,0
18	28%	A1	16,9	14,5	22,3
19	30%	C15	18,8	12,1	22,4
20	31%	A19	18,5	15,0	23,8
21	33%	A6	24,2	11,7	26,9
22	34%	B6	-16,7	22,7	28,2
23	36%	A15	27,2	11,1	29,4
24	38%	A3	27,1	13,3	30,2
25	39%	C8	23,1	21,7	31,7
26	41%	C25	16,2	28,8	33,0
27	42%	C19	25,1	22,1	33,5
28	44%	A14	31,9	12,0	34,1
29	45%	B3	-16,4	29,9	34,1
30	47%	A13	31,7	15,9	35,5
31	48%	B15	-21,8	30,6	37,6
32	50%	B11	-24,7	29,1	38,2
33	52%	B22	-31,8	21,3	38,3
34	53%	C1	31,7	21,5	38,3
35	55%	C17	31,3	23,1	38,9
36	56%	B7	-24,4	30,3	38,9
37	58%	A4	35,8	18,8	40,4
38	59%	C12	33,5	22,7	40,5
39	61%	B21	-37,9	17,6	41,8
40	63%	C6	26,8	34,5	43,7
41	64%	C10	32,9	29,1	43,9
42	66%	C20	28,7	33,4	44,1
43	67%	C18	27,1	35,0	44,2
44	69%	C16	31,0	31,8	44,4
45	70%	A16	41,6	16,4	44,7
46	72%	B16	-18,6	41,3	45,3
47	73%	B8	-40,2	22,3	46,0
48	75%	A18	-39,8	28,8	49,1
49	77%	A5	48,1	11,4	49,4
50	78%	C5	28,7	40,3	49,5
51	80%	C7	2,1	49,5	49,6
52	81%	B9	-48,8	23,2	54,1
53	83%	C9	45,5	31,4	55,3
54	84%	B2	-45,4	32,3	55,7
55	86%	C23	43,2	35,4	55,9
56	88%	C3	41,2	41,8	58,7
57	89%	B18	-49,4	34,2	60,1
58	91%	B4	-56,9	39,0	69,0
59	92%	B13	-60,3	35,0	69,7
60	94%	B17	-46,4	53,2	70,6
61	95%	B5	-44,2	63,9	77,7
62	97%	B14	-76,1	58,9	96,2
63	98%	A12	100,1	43,7	109,2
64	100%	C11	98,2	76,0	124,1

Outline

1- Reference in the ICAR AQA system

2- Relativeness of the reference

3- Choice for an universal reference

4- Linking PT schemes

5- Different levels of implementation

6- Application to somatic cell counting

7- Conclusion

Pre-requisites for international lab anchorage and intercomparison

- A international network of national expert laboratories (e.g. ICAR Reference Laboratory Network)
- Acquiring high skill and competence :

⇒ High stability in performance : constant low bias & low repeatability.

⇒Tight anchorage thr. a net of RMs and PTs (QC)

- Simultaneous / close participation of expert labs in international and national PT schemes.

Anchoring labs to an international reference and comparing them on a unique scale is possible

- Existing PT schemes are appropriate tools
- PT schemes work independently with applying different protocols:

  ⇒ To **establish new ICAR guidelines** to harmonise PT protocols thereby enable comparable and fair lab performance evaluation
- Preliminary cautions of simultaneousness, analytical stability (QC), high ref lab performance to be achieved:

  ⇒To **establish new ICAR guidelines** to assure trusty correspondence between PT schemes.

Thank You for your attention !