中國醫藥大學附設醫院
China Medical University Hospital

檢驗方法學的驗證
Method Validation

中國醫藥大學附設醫院
檢驗醫學部
盧秀琴

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ISO 15189 2013

■ 5.3.1.2 設備驗收測試：實驗室設備於安裝與使用前，應查證可達到所需性能並符合所考量的任何檢驗相關要求

- 會影響檢驗品質的耗材，應在檢驗使用前加以查證其性能

■ 5.5.1.2 檢驗程序的查證

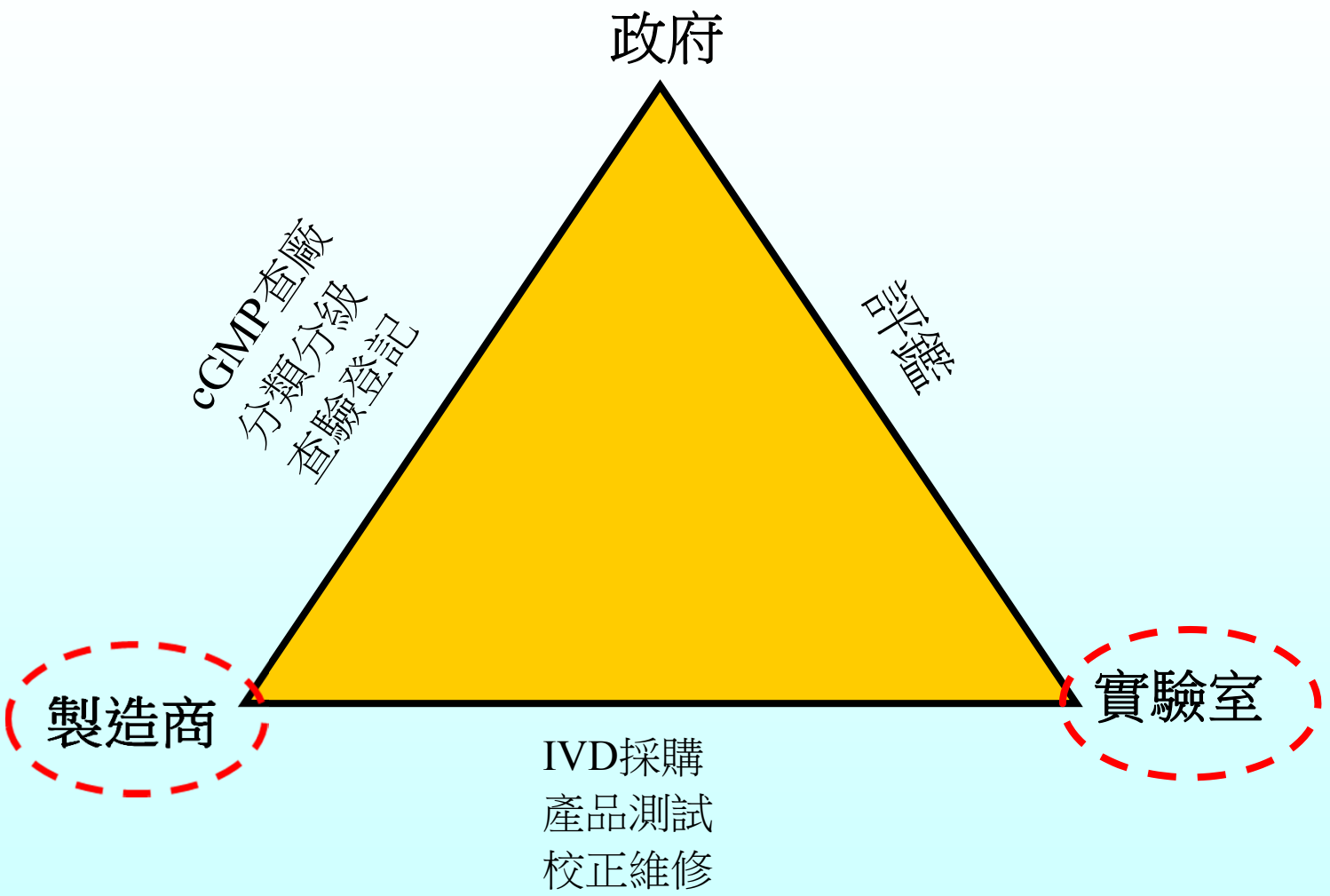
- 使用已確認且未經修改的檢驗程序，於導入例行檢驗使用前，應透過取得客觀證據(以性能特徵(performance characteristics)的型式)，應經過實驗室獨立查證，以證實已符合檢驗程序所宣告的性能。。
- 實驗室應取得來自於製造商／方法開發者的資訊，以證實程序的性能特徵。

ISO 15189 2013

■ 5.5.1.3檢驗程序的確認

- 一個檢驗程序的性能特徵，須考量包括到：
  - 量測真實度、量測準確度、量測精密度包括量測重複性與量測中間精密度；量測不確定度、分析特異性，包括干擾物質、分析敏感度、偵測極限與定量極限、量測區間、診斷特異性及診斷敏感度。

■ 5.5.2 當實驗室改變檢驗程序或檢驗前程序，實驗室應審查參考區間與臨床決策值


政府
cGMP查廠
分類分級
查驗登記
評鑑
製造商
實驗室
IVD採購
產品測試
校正維修

檢驗方法評估的時機

- 新增或變更現有檢驗項目之方法
- 變更或新置儀器之評估
- 開發檢驗項目之方法評估

Method Validation

- Precision
- Accuracy
- Linearity (reportable range)
- Detection limit (analytic sensitivity)
- Method comparison
- Reference Interval
- Interference substances
- Carryover

儀器的選購標準

- **根據美國IQLM-Equipment management/Selection criteria**
  - 臨床目的（Intended use）：符合醫療價值
  - 效能規格（Performance characteristics）
  - 實驗室的需求（Facility requirements）
  - 成本（Cost）
  - 試劑供應無虞（Reagent supply）
  - 操作容易（Ease of operation）
  - 保證期（Warranty）
  - 廠商的技術協助（Availability of manufacturer technical support）
  - 服務（維修）合約
  - 實驗室的空間、accessibility
  - 安全

Institute for Quality in Laboratory Medicine (IQLM)

測試效能審查

–依據廠商試劑說明書
–符合顧客需求

1. Precision
2. Linearity
3. Accuracy
4. Sensitivity（Low detection limit ）
5. Reference interval
6. Interference

顧客需求審查

1. 醫令申請方便性
2. 採檢及病人準備程序
3. 檢體運送程序
4. 報告時效(預計時間)
5. 檢驗報告格式及解釋(適當時請說明：參考值範圍、備註或解釋)
6. 人員操作難易度
7. 臨床問題諮詢能力

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China Medical University Hospital

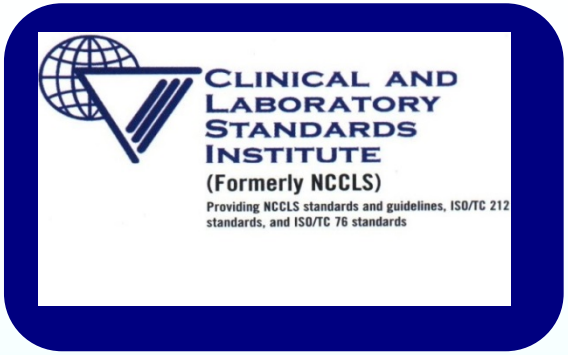
儀器需求審查

1. 分析速度或分析時間
2. 校正頻率/校正時間
3. 校正追溯
4. 機種參加CAP數目
5. 具LIS連線能力
6. 具UPS
7. 水質特殊需求(R/O, D/I)
8. 環境特殊需求
9. 廠商維修/持續供應之能力
10. 保固期（至少一年）
11. 儀器使用年限（至少五年）
12. 提供操作手冊及維修保養手冊
13. 具教育訓練能力

成本分析（依據廠商報價）

1.儀器價格
2.試劑價格/test (Dead volume estimated, if applicable)
3.QC價格/次
4.Calibrator價格/次
5.耗材價格（必要時表列）
6.檢驗項目成本分析（含人事費用）
7.QC連線費用
8.健保價（或自費金額）

參考資料



- CLSI, EP5-A, Evaluation of Precision Performance of Quantitative Measurement Methods; Approved Guideline
- CLSI, EP6-A, Evaluation of the Linearity of Quantitative Measurement Procedures: A Statistical Approach; Approved Guideline
- CLSI, EP17-A, Protocols for Determination of Limits of Detection and Limits of Quantitation; Approved Guideline
- CLSI, EP7-P, Interference Testing in Clinical Chemistry; Approved Guideline – Second Edition
- CLSI, EP10-A3 Preliminary Evaluation of Quantitative Clinical Laboratory Methods ; Approved Guideline-Second Edition
- CLSI, EP9-A2 Method comparison and Bias estimation using patient samples
- CLSI, C28-A2 How to Define and Determine Reference Intervals in the Clinical Laboratory; Approved Guideline—Second Edition

評估前準備
CLSI EP10-A2及EP12-A規範

- 醫檢人員於評估前5天完成教育訓練課程。
- 儀器設備於評估前完成裝機評估。新儀器功能測試包括：儀器操作速度(例如：急件上機時間、批次上機時間)、電腦程式之功能、儀器傳送速度等。
- 準備測試檢體，包括檢體量、不同濃度、數量的審查、採檢方式(例如：採檢容器、病人採檢時注意事項)、運送方法(例如：運送時的溫度)、保存方法、穩定度。
- 了解試藥需求量、儲存方式及穩定度。
- 確保比對的兩種儀器品管合格允收，完成儀器或新項目之校正(如果可行)及品管初步測試。
- 建立或修訂相關作業程序。

教育訓練

- 接受訓練人員

  --所有實驗室操作相關人員

- 訓練內容
  - 熟悉該項偵測之原理、檢體採集、處理與儲存的方式、偵測項目臨床應用等
  - 儀器功能介紹、儀器結構簡介、功能監測、異常訊號及保養程序、、儀器之操作、故障排除、 日常保養、品管及校驗之執行、異常檢體干擾處理
- 提供教育訓練證明

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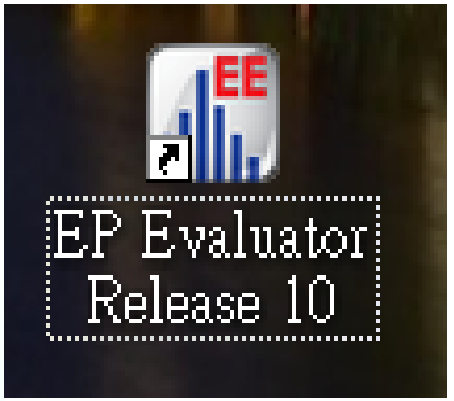
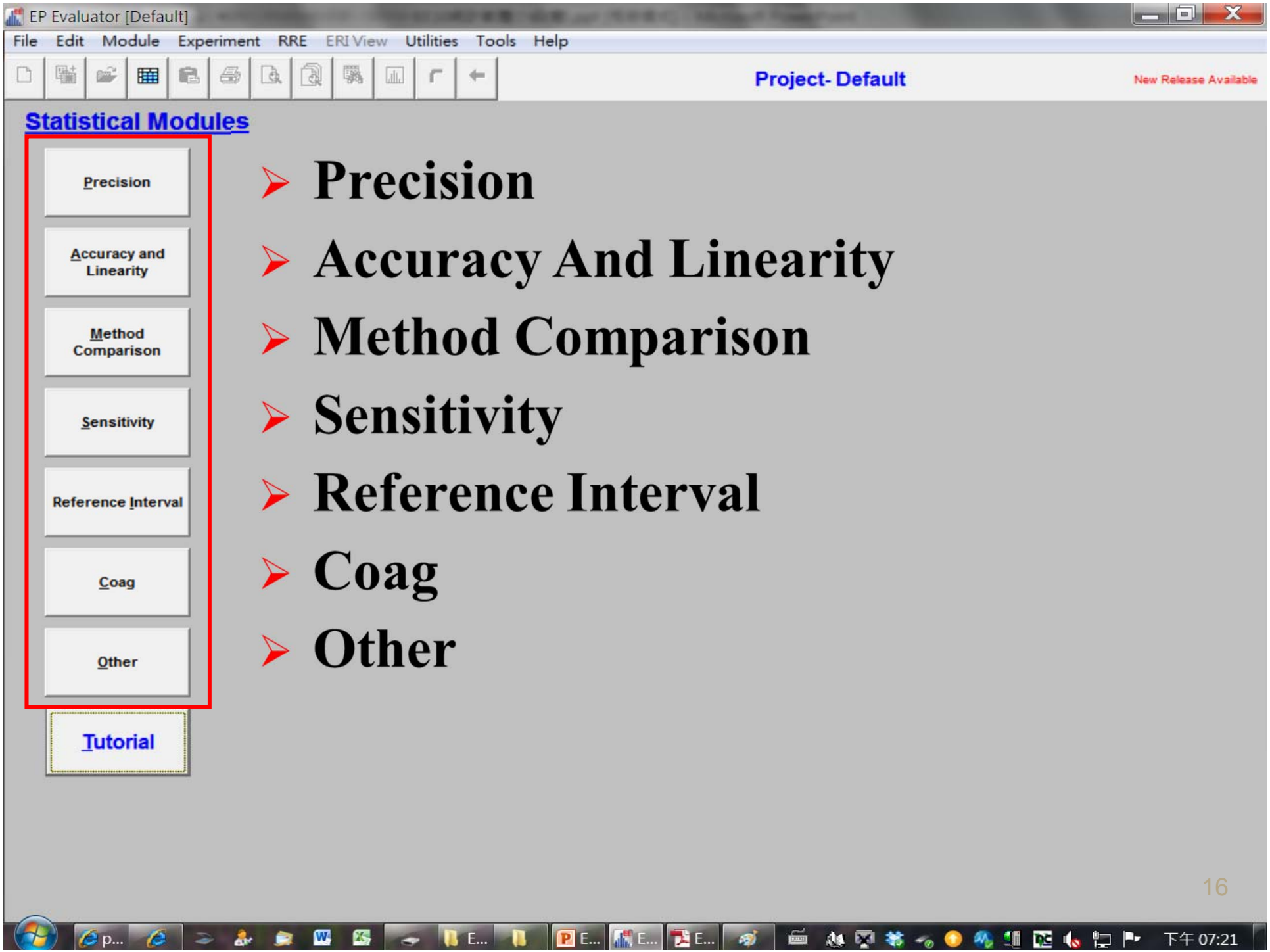
EP Evaluator Release 10 (EE10) software



	CLIA '88	CAP	JCAHO	COFRAC	EE Online	EE10 CLIA	EE10 Stnd	EE10 Stnd+DC	EE10 Pro
Accuracy and Linearity									
Clinical Linearity, Calibration Verification and Reportable Range	✔	✔	✔	✔	●	●	●	●	●
Simple Accuracy	✔	✔	✔			●	●	●	●
CLSI EP6 Linearity					●		●	●	●
Method Comparison									
Alternate (Routine Quantitative)		✔	✔	✔	●	●	●	●	●
CLSI EP9 Method Comparison		✔	✔				●	●	●
Two Instrument Comparison		✔	✔	✔	●	●	●	●	●
Multiple Instrument Comparison		✔	✔	✔			●	●	●
Qualitative / Semi-Quantitative		✔	✔	✔		●	●	●	●
POC Glucose		✔	✔				●	●	●
Hematology Studies		✔	✔				●	●	●
Precision									
Simple Precision	✔	✔	✔	✔	●	●	●	●	●
CLSI EP5 Precision	✔	✔	✔				●	●	●
Reference Interval									
Establish	✔	✔	✔	✔			●	●	●
Verify	✔	✔	✔	✔	●	●	●	●	●
ROC Plots							●	●	●
Sensitivity									
Limits of Blank (Analytical) *	✔	✔	✔	✔	●	●	●	●	●
Limits of Quantitation (Functional)*	✔	✔	✔	✔			●	●	●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Statistical Modules
Precision
Accuracy and Linearity
Method Comparison
Sensitivity
Reference Interval
Coag
Other
Tutorial
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Accuracy And Linearity
Method Comparison
Sensitivity
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Other
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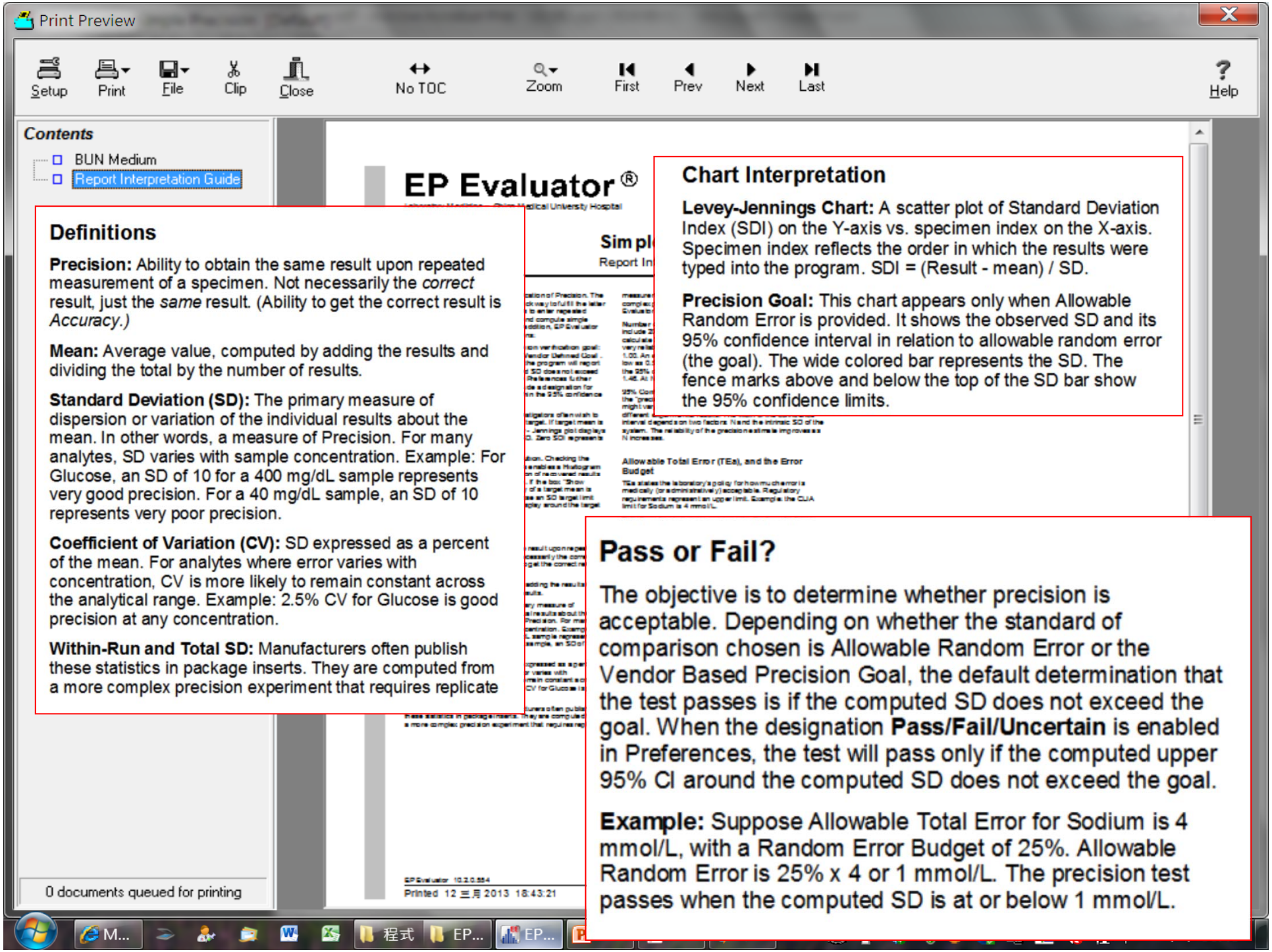
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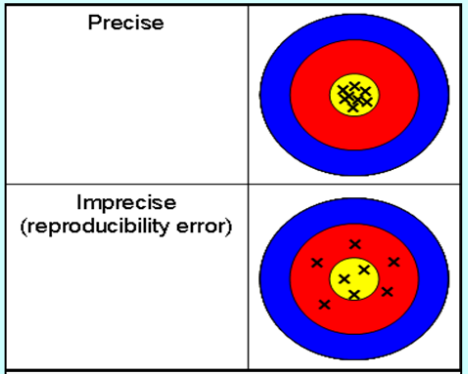
BUN Medium
Report Interpretation Guide
EP Evaluator®
Definitions
Precision: Ability to obtain the same result upon repeated measurement of a specimen. Not necessarily the correct result, just the same result. (Ability to get the correct result is Accuracy.)
Mean: Average value, computed by adding the results and dividing the total by the number of results.
Standard Deviation (SD): The primary measure of dispersion or variation of the individual results about the mean. In other words, a measure of Precision. For many analytes, SD varies with sample concentration. Example: For Glucose, an SD of 10 for a 400 mg/dL sample represents very good precision. For a 40 mg/dL sample, an SD of 10 represents very poor precision.
Coefficient of Variation (CV): SD expressed as a percent of the mean. For analytes where error varies with concentration, CV is more likely to remain constant across the analytical range. Example: 2.5% CV for Glucose is good precision at any concentration.
Within-Run and Total SD: Manufacturers often publish these statistics in package inserts. They are computed from a more complex precision experiment that requires replicate
Chart Interpretation
Levey-Jennings Chart: A scatter plot of Standard Deviation Index (SDI) on the Y-axis vs. specimen index on the X-axis. Specimen index reflects the order in which the results were typed into the program. SDI = (Result - mean) / SD.
Precision Goal: This chart appears only when Allowable Random Error is provided. It shows the observed SD and its 95% confidence interval in relation to allowable random error (the goal). The wide colored bar represents the SD. The fence marks above and below the top of the SD bar show the 95% confidence limits.
Pass or Fail?
The objective is to determine whether precision is acceptable. Depending on whether the standard of comparison chosen is Allowable Random Error or the Vendor Based Precision Goal, the default determination that the test passes is if the computed SD does not exceed the goal. When the designation Pass/Fail/Uncertain is enabled in Preferences, the test will pass only if the computed upper 95% CI around the computed SD does not exceed the goal.
Example: Suppose Allowable Total Error for Sodium is 4 mmol/L, with a Random Error Budget of 25%. Allowable Random Error is 25% x 4 or 1 mmol/L. The precision test passes when the computed SD is at or below 1 mmol/L.
0 documents queued for printing

精密度
Precision

精密度Precision

- 重複測定值之間的再現性與一致性。
- Repeatability(within-run)：2 replicates/run相同操作條件下的精密度，累積至少20點數據
- Intermediate Precision(Between-day)：1 or 2 runs / day，同一實驗室的變異程度，累積至少20天之數據
- 計算within-run、between-day、mean、SD、CV%並得到total precision。



Intermediate Precision Evaluation

(中間精密度評估)

針對實驗室每日實際發生的變異情況而定(同一個實驗室、同一個分析方法)，在不同分析日期、不同人員和不同設備的情況下所產生的差異性

- Different days：Minimum 20 days
- Different equipment
- Different reagent lots
- Multiple users

Evaluation of Precision

- **Concentration:**
  - Medical decision level
  - Upper and lower limits of the measuring interval
  - The concentration the manufacturer used to establish the precision claim for the assay
- **Acceptable material:**
  - QC
  - Standards
  - Previously analyzed patient samples

CLSI, EP5-A, Evaluation of Precision Performance of Clin. Chemistry Devices

精密度(Precision)

- 測試檢體包括品管液、標準品、已知結果之病人檢體、PT material
- 準備兩種濃度的樣品（如低、高品管液）進行二重複分析，連續操作5天。Day-to-day精密度之測量 (至少20天)，以兩個濃度的人體檢體每天各作一次分析(亦即各20組數據)
- 檢測數據需在廠商宣稱之分析範圍(AMR)內
- 每日或每批次分析時調動檢體排序。
- 若情況允許，可增加一個以上樣品，建議檢驗數值應接近醫學判定點（medical decision point），如: glucose為126 mg/dL。
- 檢視數據是否有離群值 (Outliers)。

TYPE OF PRECISION	SAMPLE TYPE	1 SD		CHANGEOVER VALUE		% CV
		IU/L	μ kat/L	IU/L	μ kat/L	
Within-Run	Serum/Plasma	3.0	0.05	85.7	1.43	3.5
	Serum/Plasma (ORDAC)	N/A	N/A	N/A	N/A	10.0
Total	Serum/Plasma	4.5	0.08	85.7	1.43	5.25
	Serum/Plasma (ORDAC)	N/A	N/A	N/A	N/A	15.0

使用 NCCLS 推薦指導方針 EP5-T2 評估 SYNCHRON System(s)的比較表現列於下表。每一個實驗室應當描繪出自己儀器的表現以便比較。

中國醫藥大學附設醫院
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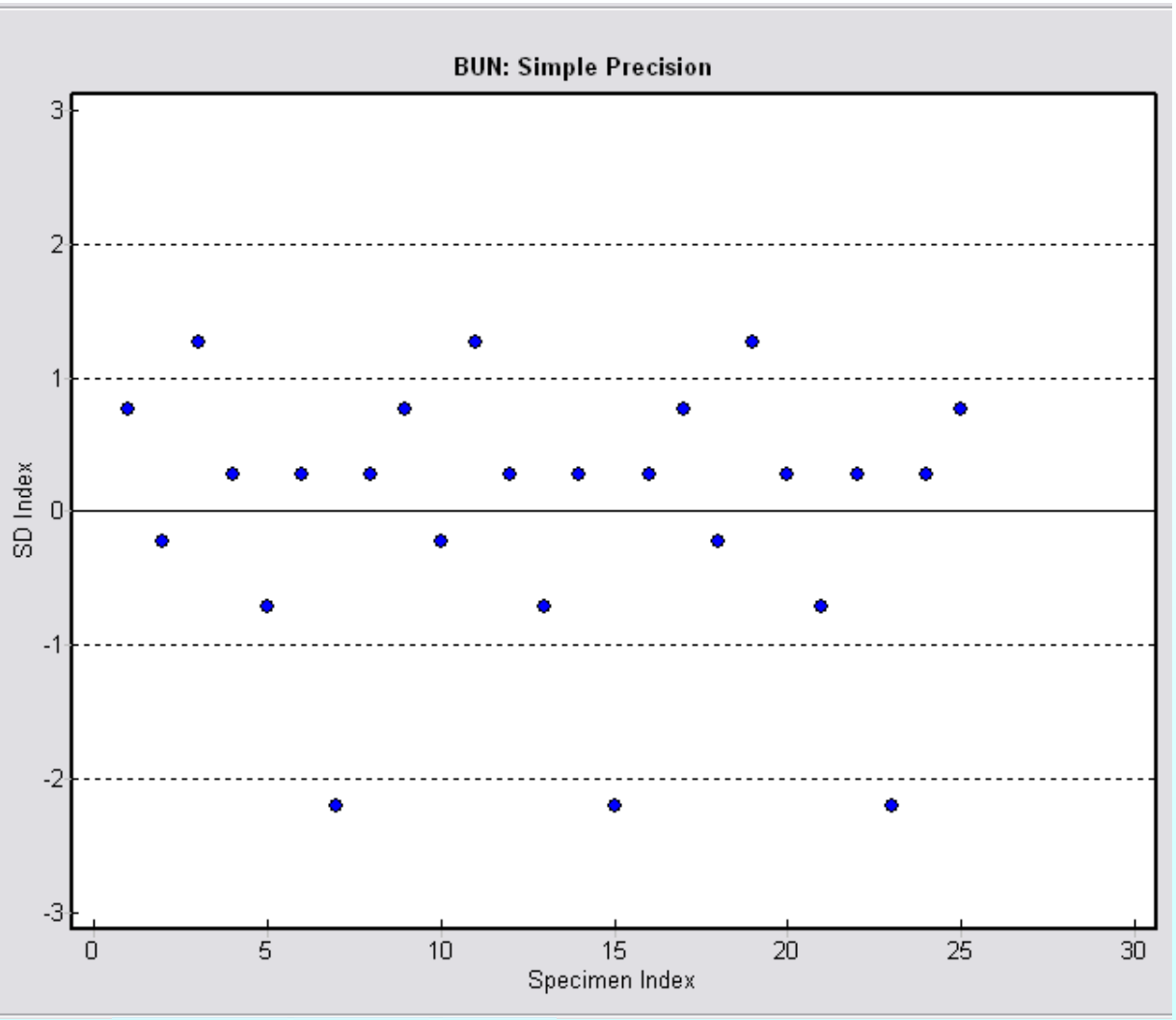
XX醫院新進體外診斷器材
定量檢驗測試工作表：精密度

SAMPLE DATA RECORDING SHEETS							
Operator：	Concentration： H, N, L				Analyte：		
Reagent /Lot#：	Calibrator /Lot#：				Device：		
Date	Run 1		Run 2		Means		
	Rep 1	Rep 2	Rep 1	Rep 2	Run 1	Run 2	Note

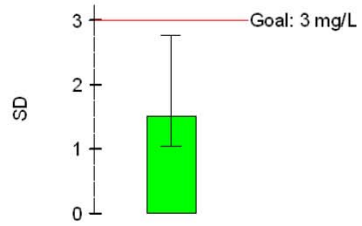
Index	Value
1	21
2	19
3	22
4	20
5	18
6	20
7	15
8	20
9	21
10	19
11	22
12	20
13	18
14	20
15	15
16	20
17	21
18	19
19	22
20	20
21	18
22	20
23	15
24	20
25	21



SDI=Result-mean/SD

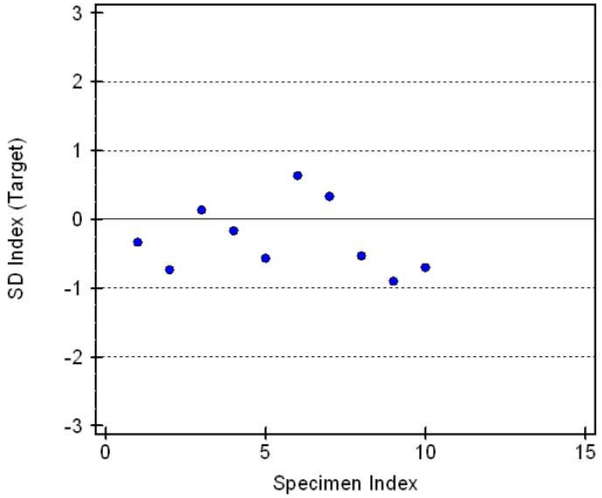
Simple Precision

Precision Statistics



Obs Standard Dev (SD)	1.52
Pass/Fail/Uncertain	Yes
95% Confidence for Obs SD	1.05 to 2.77
Obs Coef of Variation (CV)	10.0%
Obs Mean	15.15 mg/L
Number of Specimens (N)	10 of 10
95% CI for Obs Mean	14.06 to 16.24
Obs 2 SD Range	12.11 to 18.19

Precision Plot



User's Specifications

Precision Verification Goal	Vendor
Within Run SD	3
Conc at SD Goal	

Supporting Data

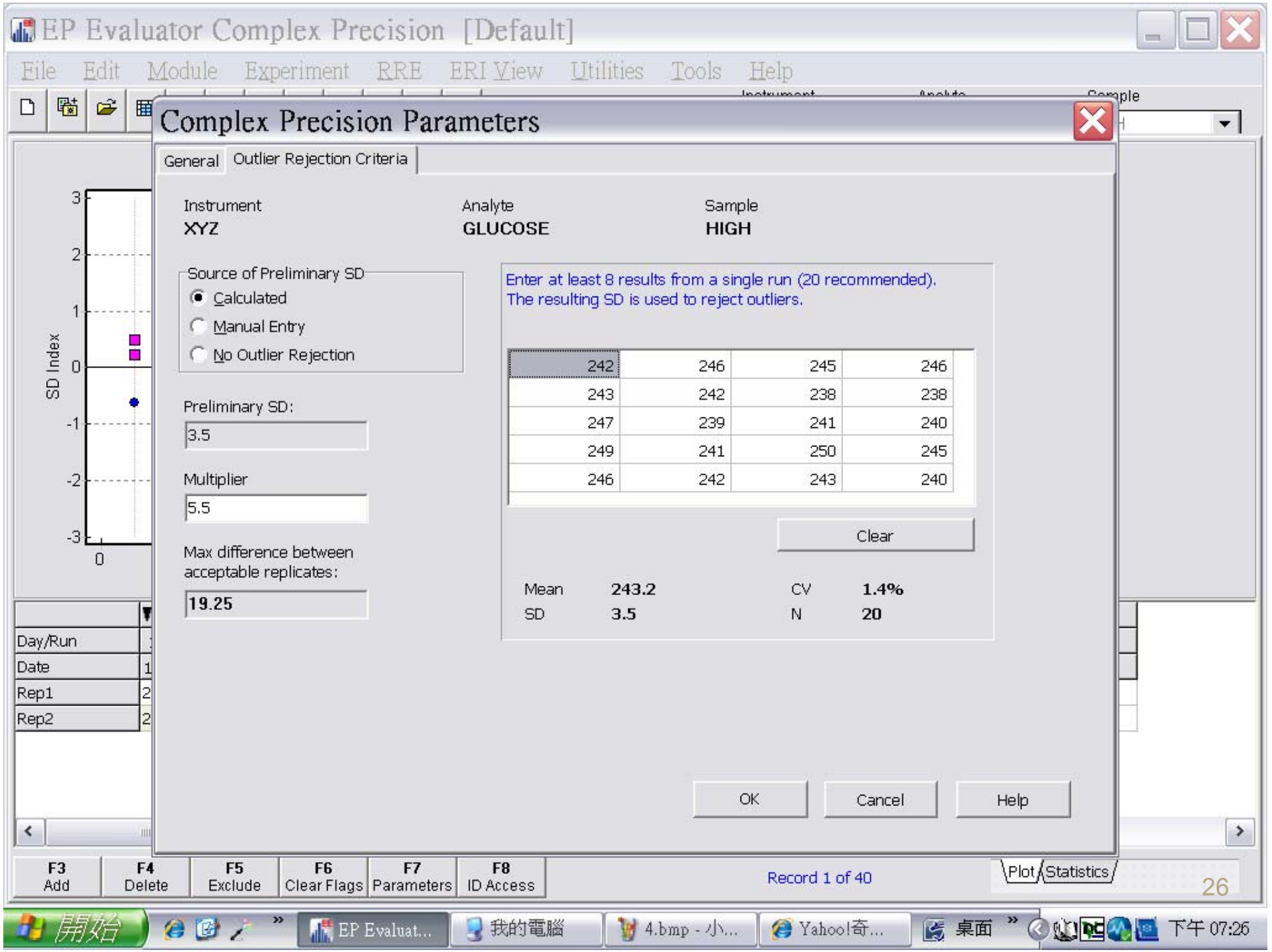
Analyst	HCLin
Expt Date	31 十月 2013
Units	mg/L
Target Mean	16
Target Range	--
Target CV	18.8
Control Lot	--
Reag Lot	太陽 327824D
Cal Lot	太陽 327873
Comment	

SDI=Result-mean/SD

Precision Data

Index	Result	Index	Result	Index	Result	Index	Result
1	15	4	15.5	7	17	10	13.9
2	13.8	5	14.3	8	14.4		
3	16.4	6	17.9	9	13.3		

O: outliers X: excluded from calculations


EP Evaluator Complex Precision [Default]
File Edit Module Experiment RRE ERI View Utilities Tools Help
Complex Precision Parameters
General
Outlier Rejection Criteria
Instrument
XYZ
Analyte
GLUCOSE
Sample
HIGH
Source of Preliminary SD
Calculated
Manual Entry
No Outlier Rejection
Preliminary SD:
3.5
Multiplier
5.5
Max difference between acceptable replicates:
19.25
Enter at least 8 results from a single run (20 recommended).
The resulting SD is used to reject outliers.
242 246 245 246
243 242 238 238
247 239 241 240
249 241 250 245
246 242 243 240
Clear
Mean 243.2
SD 3.5
CV 1.4%
N 20
OK
Cancel
Help
SD Index
Day/Run
Date
Rep1
Rep2
F3 Add
F4 Delete
F5 Exclude
F6 Clear Flags
F7 Parameters
F8 ID Access
Record 1 of 40
Plot
Statistics
開始
EP Evaluat...
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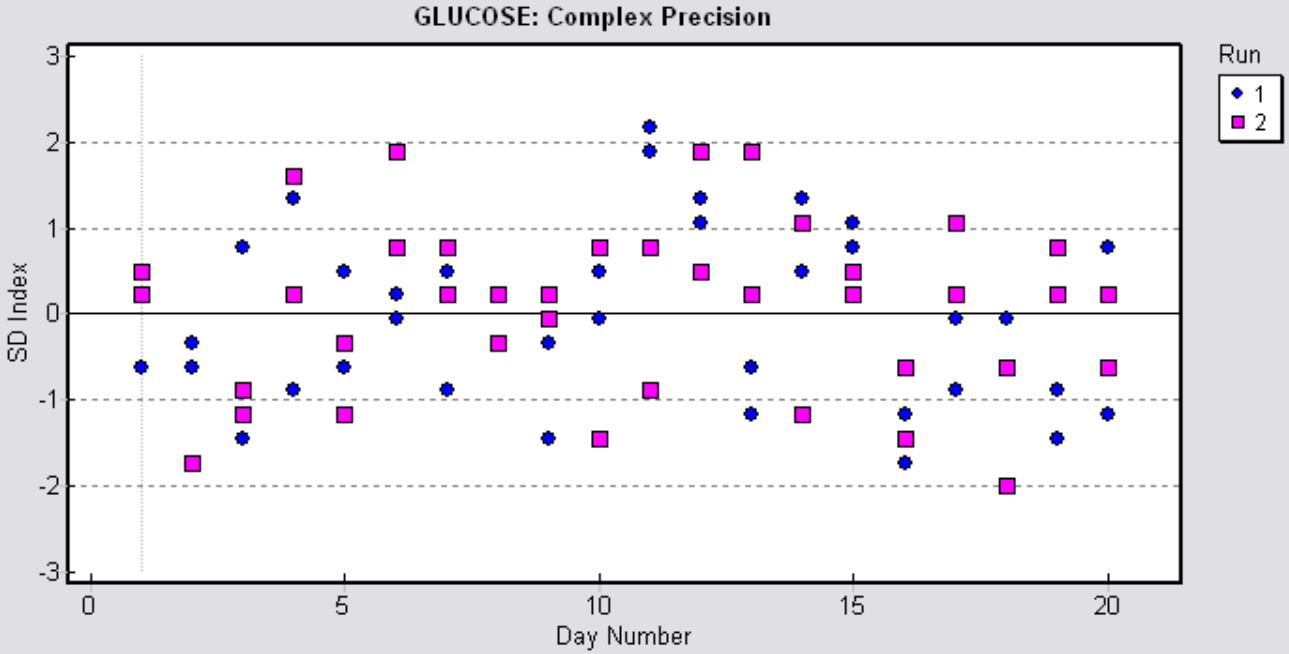
EP Evaluator Complex Precision [Default]

File Edit Module Experiment RRE ERI View Utilities Tools Help

Instrument: XYZ | Analyte: GLUCOSE | Sample: HIGH



Grand Mean
244.2

No Days (Tot/Excl)
20 / 0

Runs with Outliers
None

Within-Run SD
2.8

Total SD
3.6

Day/Run	1 / 1	1 / 2	2 / 1	2 / 2	3 / 1	3 / 2	4 / 1	4 / 2
Date	12 五月 2000	12 五月 2000	13 五月 2000	13 五月 2000	14 五月 2000	14 五月 2000	15 五月 2000	15 五月 2000
Rep1	242	245	243	238	247	241	249	250
Rep2	246	246	242	238	239	240	241	245

F3 Add | F4 Delete | F5 Exclude | F6 Clear Flags | F7 Parameters | F8 ID Access

Record 1 of 40

Plot Statistics

開始 EP Evaluat... 我的電腦 1.bmp - 小... Yahoo!奇... 桌面 下午 07:24

精密度結果評估

- 以標準偏差（SD）及變異係數（coefficient of variation；CV）表示其精密度。

- 儀器愈不精密則SD及CV愈大，一般以不影響到病人的診療判斷為原則。

TYPE OF PRECISION	SAMPLE TYPE	1 SD		CHANGEOVER VALUE		% CV
		IU/L	μ kat/L	IU/L	μ kat/L	
Within-Run	Serum/Plasma	3.0	0.05	85.7	1.43	3.5
	Serum/Plasma (ORDAC)	N/A	N/A	N/A	N/A	10.0
Total	Serum/Plasma	4.5	0.08	85.7	1.43	5.25
	Serum/Plasma (ORDAC)	N/A	N/A	N/A	N/A	15.0

Accuracy
準確度

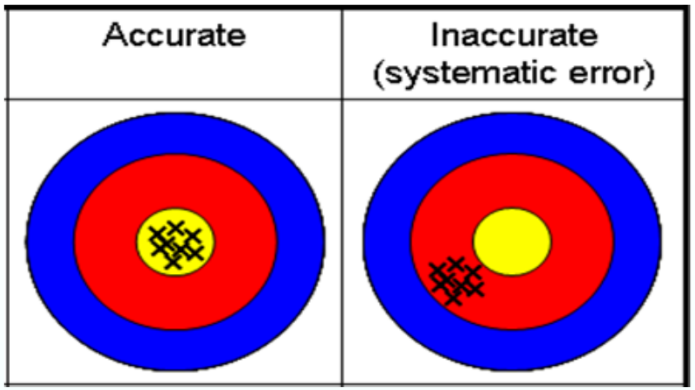
Accuracy test

- 將已知濃度的樣品直接分析：觀察值(observed value)與已知值(know/reference value)之間的評估，類似Method comparison的做法。
- 將高濃度的樣品經適當稀釋後分析：類似Linearity的做法，可合併進行AMR。
- 評估回收率：由添加量、為添加前樣品測定值、添加後樣品測定值來計算回收率。

已知值(know/reference value)

- The input data may be drawn from External Quality Assurance (EQA) Programs like CAP or EQAS Proficiency surveys,
- The result is compared to the selected group mean for the same specimen.

準確度（Accuracy）



- **Purpose**： Calculate Accuracy and Reportable Range.

- 準備2支病人檢體，至少2個不同濃度（低值與高值），重複分析至少2次；
- 如要進行驗證，則至少檢測3個不同濃度樣品，重覆分析至少2次。
- 分別於3~4天測試，一天測5-7個檢體，四小時內完成，每一個濃度至少20個分析數據。
- 檢體濃度須於廠商宣稱之分析範圍(AMR)內。

Linearity

Linearity

Calibration

Calibration Verification

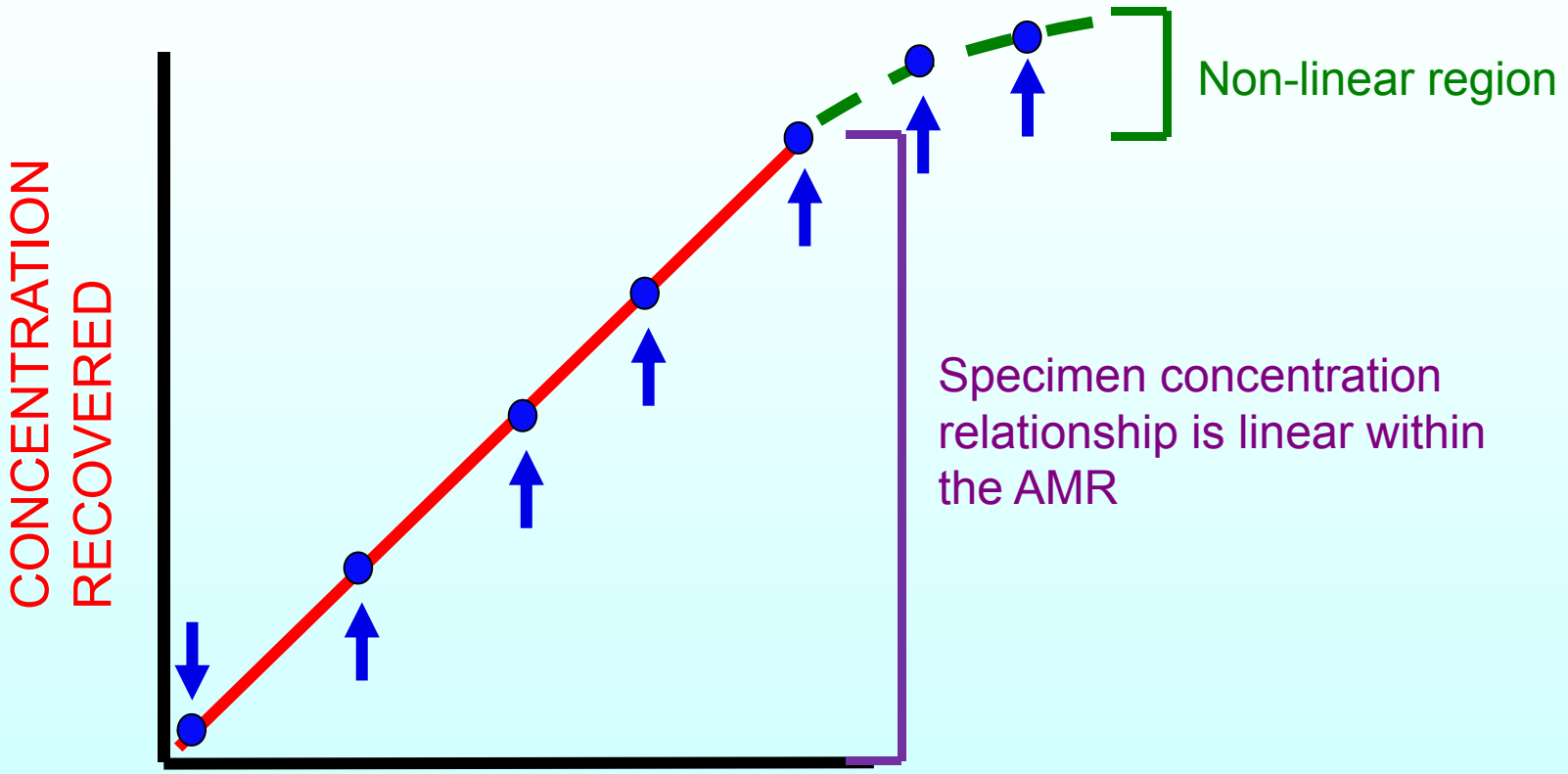
Analytical Measurement Range (AMR)

Reportable Range

線性檢查（Linearity check）

- 使用廠商之線性確認物質、proficiency testing 檢體、已知濃度之病人檢體、已知濃度之病人檢體作稀釋、calibrators、primary standards 或 secondary standards 或 reference materials進行AMR確認。
- 用一個檢體經不同程度(一般至少5點)的稀釋後分別加以分析。
- 使用高低兩種濃度的檢體經不同比例混合
  - 檢體濃度至少5點，一般為(1/0 , 3/1, 1/1, 1/3, 0/1)比例，或(5*A+0*B), (4*A+1*B), (3*A+2*B), (2*A+3*B), (1*A+4*B), (0*A+5*B)規則
- 各測試兩次，再將「檢驗結果」的平均值進行線性評估。

Analytical Measurement Range Verification



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China Medical University Hospital

Linearity(AMR)

檢驗醫學部_____組　　線性評估紀錄表

執行項目：ACTH	執行時間：	執行醫檢師：
檢體類別：High: Pool Serum; Low: Pool Serum		
AMR 確效範圍：5～1250 pg/mL		
本項目規範為 Allowable Error =Target Value ± %		
允收：分析後圖形呈線性 R^2> 0.95；Allowable Difference 需小於 Allowable Error		

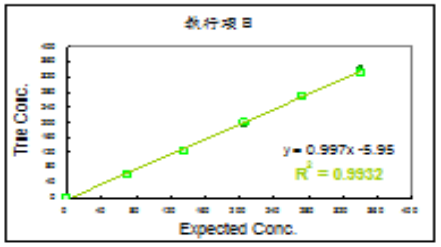
Dilution Procedure: unit: μL

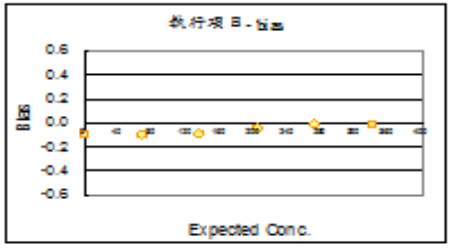
	Concentration	LN1	LN2	LN3	LN4	LN5	LN6
High	1112	0	100	200	300	400	500
Low	5.6	500	400	300	200	100	0
Expected Conc.		5.6	227	448	669	891	1112

上機方式: 檢體共 6 杯, 上機順序 1,1,2,2...,6,6

Raw data：

	Expected	Test 1	Test 2	Mean	difference	Allowable error
LN1	6	6.1	5.8	5.95	6.2%	±25%
LN2	227	211	199	205	-9.6%	±15%
LN3	448	411	401	406	-9.4%	±15%
LN4	669	621	613	617	-7.8%	±15%
LN5	891	829	839	834	-6.4%	±15%
LN6	1112	1075	1052	1064	-4.4%	±15%





評論：	
組長：	品管組：
主任：	

中國醫藥大學附設醫 China Medical University Hospital

EP Evaluator

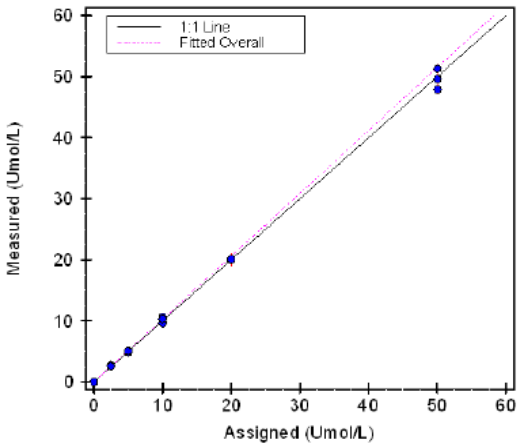
Biochemistry Laboratory -- Kmuh

Homocysteine

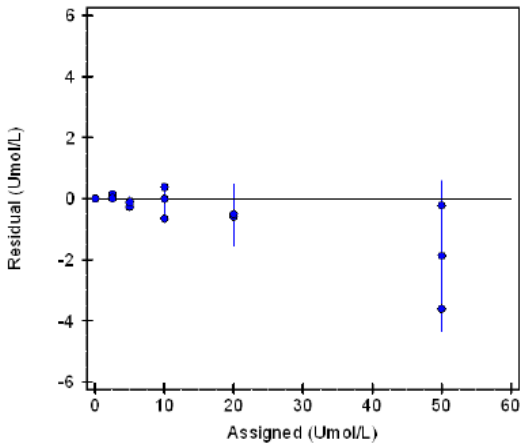
Instrument: I2000sr

Linearity

Scatter Plot



Residual Plot



Linearity Summary

	N	Slope	Intercept	Error
Overall	6	1.030	0.000	3.8%

LINEAR within Allowable Systematic Error of5.0%

Statistical Analysis and Experimental Results

	Assigned	Est	Mean	Resid	Linear?	Measured Concentrations		
1	0	0.000	0.000	0.000	Pass	0	0	0
2	2.5	2.574	2.677	0.102	Pass	2.71	2.73	2.59
3	5	5.149	4.993	-0.155	Pass	5.06	4.88	5.04
4	10	10.298	10.207	-0.091	Pass	9.65	10.68	10.29
5	20	20.595	20.067	-0.529	Pass	20.1	20	20.1
6	50	51.488	49.593	-1.895	Pass	51.27	47.89	49.62

See User's Specifications for Pass /Fail criteria

X: Excluded from calculations

User's Specifications

Allowable Total Error:	20.0%
Systematic Error Budget:	25%
Allowable Systematic Error:	5.0%

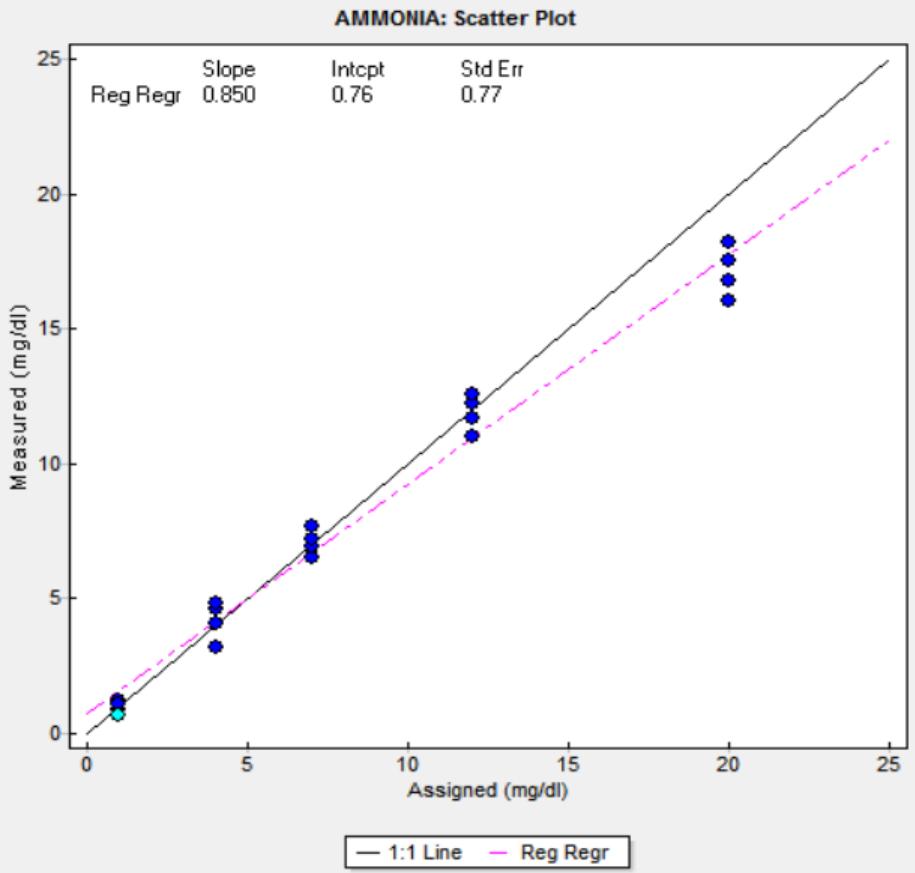
Supporting Data

Analyst:	Mandy
Date:	07 2012
Value Mode:	Preassigned
Units:	Umol/L
Lot Number:	10152UP00
Comment:	

EP Evaluator Linearity [Default]

File Edit Module Experiment RRE ERI View Utilities Tools Help

Instrument: ASSAYER Analyte: AMMONIA



Accuracy and Linearity

Spec ID	Assigned	Mean	% Rec	Residual
CalKit-1	1.0	0.97	97.5	-0.64
CalKit-2	4.0	4.17	104.4	0.01
CalKit-3	7.0	7.08	101.1	0.36
CalKit-4	12.0	11.88	99.0	0.91
CalKit-5	20.0	17.13	85.6	-0.64

	Spec ID	Assigned	Mean	Rep 1	Rep 2	Rep 3	Rep 4
1	CalKit-1	1.0	0.97	0.7	0.9	1.2	1.1
2	CalKit-2	4.0	4.17	4.6	4.1	3.2	4.8
3	CalKit-3	7.0	7.08	6.5	6.9	7.2	7.7
4	CalKit-4	12.0	11.88	11.0	12.2	11.7	12.6
5	CalKit-5	20.0	17.13	18.2	17.5	16.8	16.0

F4 Excl. Spec | F5 Exclude | F6 Clear Flags | F7 Parameters | F9 History

Scatter | History

EP Evaluator®

Laboratory Medicine -- China Medical University Hospital

GLUCOSE
Instrument ASSAYER

Accuracy and Linearity

	Assigned	N	Accuracy & Recovery			Linearity		
			Mean	% Rec	Status	Estimate	Residual	Status
CalKit-1	25.0	4	25.5	102.0	Pass	26.4	-0.9	Pass
CalKit-2	100.0	4	101.5	101.5	Pass	101.4	0.1	Pass
CalKit-3	250.0	4	249.5	99.8	Pass	251.4	-1.9	Pass
CalKit-4	400.0	4	407.8	101.9	Pass	401.3	6.5	Pass
CalKit-5	700.0	4	690.3	98.6	Pass	701.2	-10.9	Pass
CalKit-6	*1000.0*	*4*	*938.0*	*93.8*	*Fail*	*1001.1*	*-63.1*	*Fail*

See User's Specifications for Pass/Fail criteria

Linearity Summary

	Overall	*w/o Outliers*
Slope	0.971	1.000
Intercept	3.6	1.5
Obs Err	2.33 mg/dl or 3.9%	0.95 mg/dl or 1.6%
N	6	5

NON-LINEAR within Allowable Systematic Error of 1.5 mg/dl or 2.5%

Experimental Results

CalKit-1	24	26	25	27
CalKit-2	101	102	100	103
CalKit-3	243	252	248	255
CalKit-4	400	410	409	412
CalKit-5	690	696	680	695
CalKit-6	930	940	945	937

X: Excluded from calculations

User's Specifications

Allowable Total Error	6 mg/dl or 10.0%
Systematic Error Budget	25%
Allowable Systematic Error	1.5 mg/dl or 2.5%

EP Evaluator

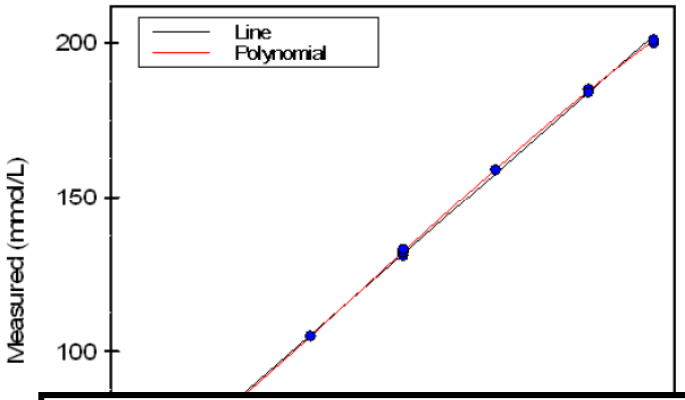
Clinical Chemistry Laboratory -- Kennett Community Hospital

Sodium

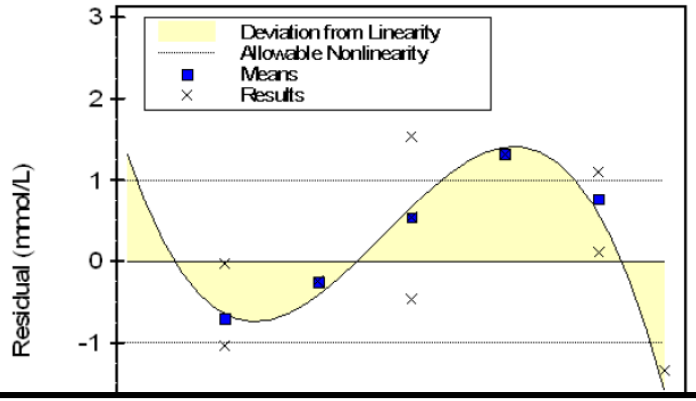
Instrument: Eximer

CLSI EP6 Linearity

Scatter Plot



Residual Plot



Linear Fit

Slope with 95% conf.	Intercept with 95% conf.	Std Error of Estimate
0.971 (0.958 to 0.984)	3.3 (1.3 to 5.3)	1.2

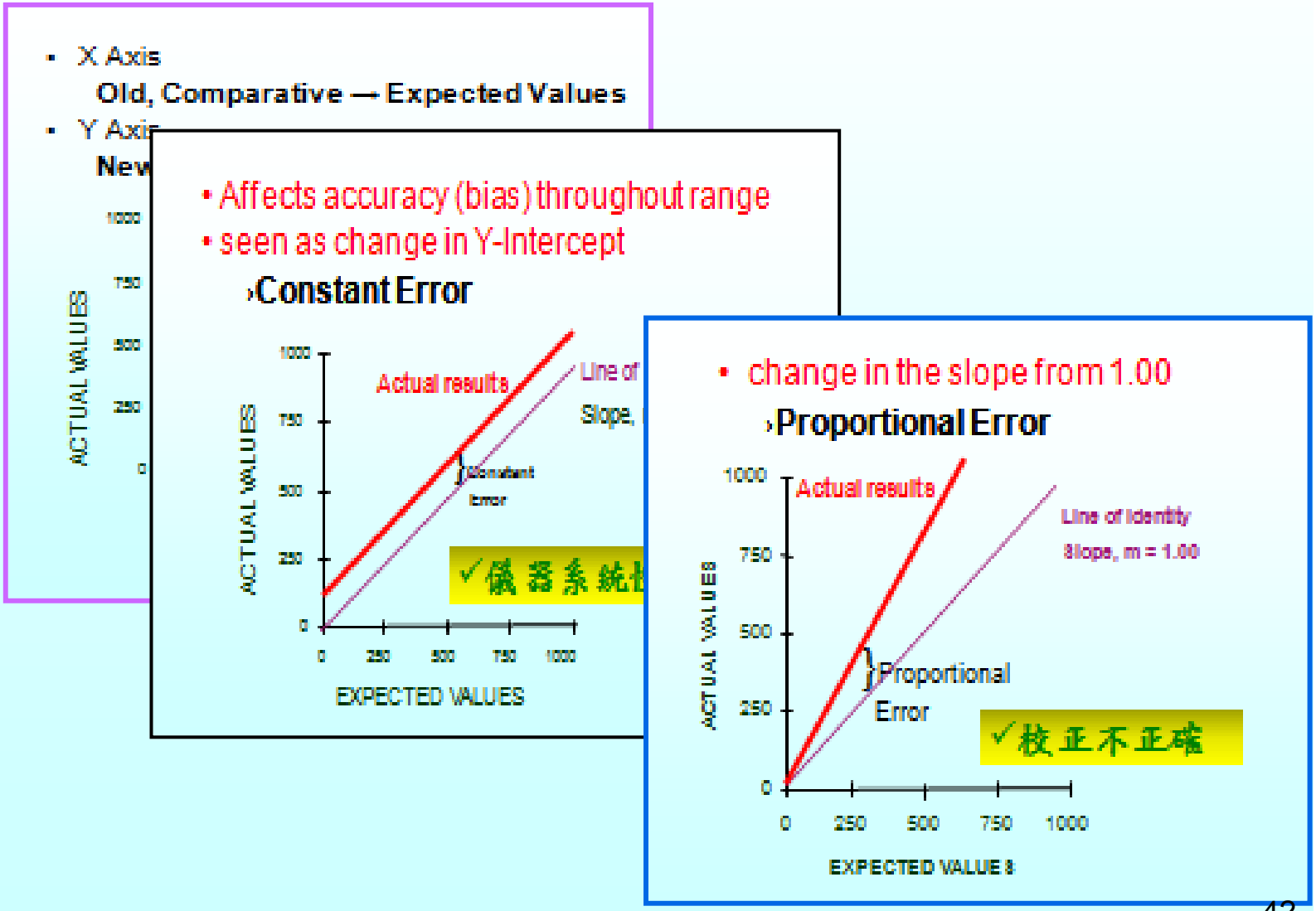
Analysis based on ordinary (unweighted) regression. Standard error expressed in concentration units (mmol/L)

Statistical Analysis

Specimen	Assigned Value (X)	Mean	Polynomial Fit at X	Line Fit at X	Deviation from Linearity	Deviation Percent	
Level L1	78	78.3	78.4	79.0	-0.6	-0.8	
Level L2	105	105.0	104.8	105.3	-0.4	-0.4	
Level L3	132	132.0	132.1	131.5	0.7	0.5	
Level L4	**159**	**159.0**	**159.1**	**157.7**	**1.4**	**0.9**	**o**
Level L5	186	184.7	184.5	183.9	0.6	0.3	
Level L6	**205**	**200.7**	**200.8**	**202.3**	**-1.6**	**-0.8**	**o**

***: Absolute value > 99% o: Exceeds allowable nonlinearity

Linear Regression



Calibration Verification

- ✓At least 3 specimens (minimal, midpoint, and maximal)
- ✓At least once every six months
- ✓More frequently for reasons - reagent change & major preventive maintenance.

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線性誤差來源

稀釋倍數是否合適

稀釋液的選擇

Pipette的使用方式

.....

檢驗項目	檢體種類	Linearity		建議倍數	最終倍數
		AMR	CRR		
Glucose	Plasma	3-600	10-2500	3	6
	Body fluid	3-600	10-1200	3	6
	Urine	3-600	10-1200	3	6
Albumin	Body fluid	1~7	1~7	NA	NA
	Plasma/serum	1~7	1~7	NA	NA
ALK P-taes	Plasma/Serum	5-1000	5-20000	6	21
ALT(SGPT)	Serum/Plasma	5-400	5-20000	6	51
Amylase	Plasma	5-400	5-20000	6	51
	Urine	5-800	5-48000	3	61
	Body fluid	5-800	5-48000	6	61
AST(SGOT)	Plasma/Serum	5-400	5-20000	11	51
B.U.N	Plasma/Serum	1-150	1-300	3	2
	Body fluid	1-150	1-300	3	2
	Urine	10-1500	10-16500	11	11
Calcium	Urine	2-30	2-30	NA	NA
	Plasma/Serum	2~20	2~20	NA	NA
	Body fluid	2~20	2~20	NA	NA
Chloride	Urine	15-300	15-300	NA	NA
	Plasma/Serum	50-178	50-150	NA	NA
	Body fluid	50-200	50-150	NA	NA
Cholesterol Total	Body fluid	5-750	5-3000	3	6
	Plasma/Serum	5-750	5-3000	3	6

儀器自動稀釋的問題


檢體詳細信息
檢體信息
名
中間名
姓
林廖煙
檢體號
870199509
病歷號
0010755178
年齡
78.歲
性別
女
位置
神經科
測試時間
2012/4/21 下午 04
檢體類型
Urine
測試類型
常規
備注
結果
處理過程
標誌 測試 結果 單位 錯誤信息 信息 儀器 參考值 結果(0) nstru
1 -V--- CALC 9.6 mg/dL DXC3 100.00-300
2 -V--- NA 75 mmol/L DXC3 40-220
3 -V--- K 53.6 mmol/L DXC3 25.0-125.0
4 -V--- CL 79 mmol/L DXC3 110-250
5 --R-D BUNm 288 mg/24h uri ORDAC HI DXC3 12000-2000 DXC3
6 --R-D CREm 90 mg/24h uri 超出自動審 DXC3 0.50-1.30 87.35 DXC3
7 -V--- MTP 23 mg/24h uri DXC3 50-100
8 ----- OUTA Pending
確認稀釋結果(前後差異需<5%)
上一個
下一個
刷新
確認
取消確認
重做
稀釋
添加測試
列印
第三方
獲取
關閉

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China Medical University Hospital

Test Item Specification

分類	檢驗項目	英文名稱	檢體種類	單位	Linearity			建議稀釋倍數	最終稀釋倍數	稀釋物質	生物參考區間
					AMR	ORDAC	CRR				
藥	**Acetaminophen**	Acetaminophen	P/S	ug/mL	2-300		**2-1200**	N/A	N/A		N/A
生	**ADA**	Adenosine deaminase	BF	U/L	2-250	N/A	2-250	N/A	N/A		<40
生	**ADA**	Adenosine deaminase	CSF	U/L	2-250	N/A	2-250	N/A	N/A		<9
免	**AFP**	α-fetoprotein	S	ng/mL	0.5-3000		0.5-54000	N/A	**(自動稀釋)**	wash	< 9.0
生	**ALB**	Albumin	P/S	g/dL	***1-7***	N/A	***1-7***	N/A	N/A		3.8-5.3
生	**ALB**	Albumin	BF	g/dL	***1-7***	N/A	***1-7***	N/A	N/A		N/A
生	**ALP**	ALK. P-tase	P/S	IU/L	5-1000	800-1650	5-20000	6	21		成人：38-126 孩童：58~252
生	**ALT(SGPT)**	SGPT (ALT)	P/S	U/L	5-400	350-2600	5-20000	6	51		5-40
藥	**Aminophylline(THEO)**	Aminophylline	P/S	ug/mL	2-40		*2-80*	N/A	N/A		Adult: 10-20 Neonate: 6-11
生	**AMM**	Blood ammonia	P	ug/dL	16-1700	N/A	16-1000	N/A	N/A		<70
生	**AMY**	Amylase	P/S	IU/L	5-800	600-2400	5-20000	6	51		27~131
生	**AMY**	Amylase	U	IU/L	5-800	600-2400	5-48000	3	61		0-450
生	**AMY**	Amylase	BF	IU/L	5-800	600-2400	5-48000	6	61		N/A
生	**AST(SGOT)**	SGOT (AST)	P/S	IU/L	5-400	350-2600	5-20000	11	51		5-34
免	**BHCG**	BHCG	P/S	mIU/mL	0.5-1000		0.5-200000	N/A	**(自動稀釋)**	wash	Males: < 2.67 Females: < 2.90
生	**BUN**	Blood Urea Nitrogen	P/S	mg/dL	1-150	130-300	1-300	3	2		5~26
生	**BUN**	Blood Urea Nitrogen	BF	mg/dL	***10-1500***	1300-3000	***10-16500***	11	11		
生	**BUN-U**	Urine Urea Nitrogen	U-24	mg/24hrs	10-1500	N/A	10-16500	11	11		12000-20000
生	**CA**	Calcium (Ca)	P/S	mg/dL	2-20	N/A	2-20	N/A	N/A		8.5~10.5

藥物線性 / 生化線性 \ 急檢組 / 稀釋倍數2010 /

方法比對
Method comparison

方法比對（Comparison of method)

- 以商業試藥、病人檢體、國家標準局出品的參考血清樣品進行定性、定量或半定量的測試。
  - ≧40 specimens.
  - Should cover a substantial portion of the reportable range.
  - Assay in duplicate by both methods within a 2 hour period.
  - ≤8 specimens a day.
- 無對照組定性項目的檢測，可使用已知數據分佈均勻的檢體10~20支，其一致性結果應達一致。如有不一致的部份，可利用CAP 保留檢體的數據佐證。
- 無對照組半定量結果以前後一個稀釋倍數為可接受依據。

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Sample grouping

	Group A		Group B		Group C		Group D		Group E	
Test	Range	%	Range	%	Range	%	Range	%	Range	%
Glucose (mg/dL)	<50	10	51-110	40	111-150	30	151-250	10	251-SL	10
BUN (mg/dL)	<15	10	15-25	40	26-50	20	51-100	20	100-SL	10
Na^+ (mmol/L)	120-130	20			131-140	40	141-150	30	151-160	10
K^+ (mmol/L)	<3.0	20	3-4.5	35	4.5-6.0	35	>6	10		
Cl^- (mmol/L)	80-95	30	95-105	40	105-	30				
CO_2 (mmol/L)			-2							10
Uric acid (mg/dL)										20
Calcium (mg/dL)	<8.0	10	8-9	20	9-11	40	11-13	20	>13-SL	10
Inorganic phosphates (mg/dL)	<2.5	10	2.5-4.5	60	4.5-6.5	20	>6.5	10		
Alkaline phosphatase (U/dL)	<NL/2	30	NL-2NL	20	NL-2NL	20	2NL-4NL	20	4NL-SL	10
Total protein (g/dL)	<5	10	5-7	40	7-9	40	>9	10		
Albumin (g/L)	<3	10	3-4	40	4-5	40	>5	10		
Total bilirubin (mg/dL)	0-1.0	30	1-2	30	2-5	20	5-10	10	10-SL	10
Cholesterol (mg/dL)	120-180	20	181-220	30	221-260	30	261-400	20		
Triglycerides (mg/dL)	<75	10	75-125	30	125-200	30	200-300	20	300-SL	10
AST/SGOT (U/L)	NL/2	20	NL/2-NL	30	NL/2-NL	30	2NL-4NL	10	4NL-SL	10
GGT (U/L)			0-NL	40	NL/2-NL	40	2NL-4NL	10	4NL-SL	10

40 x 20% = 8

40 x 35% = 14

40 x 10% = 4

評估結果

- Liner regression (slope, intercept)

  $Y = b X + a$

- Correlation coefficient (r)
  - if $r \geq 0.975$ (or $r^2 \geq 0.95$)

    - liner regression can be used
  - if $r < 0.975$ (or $r^2 \leq 0.95$)

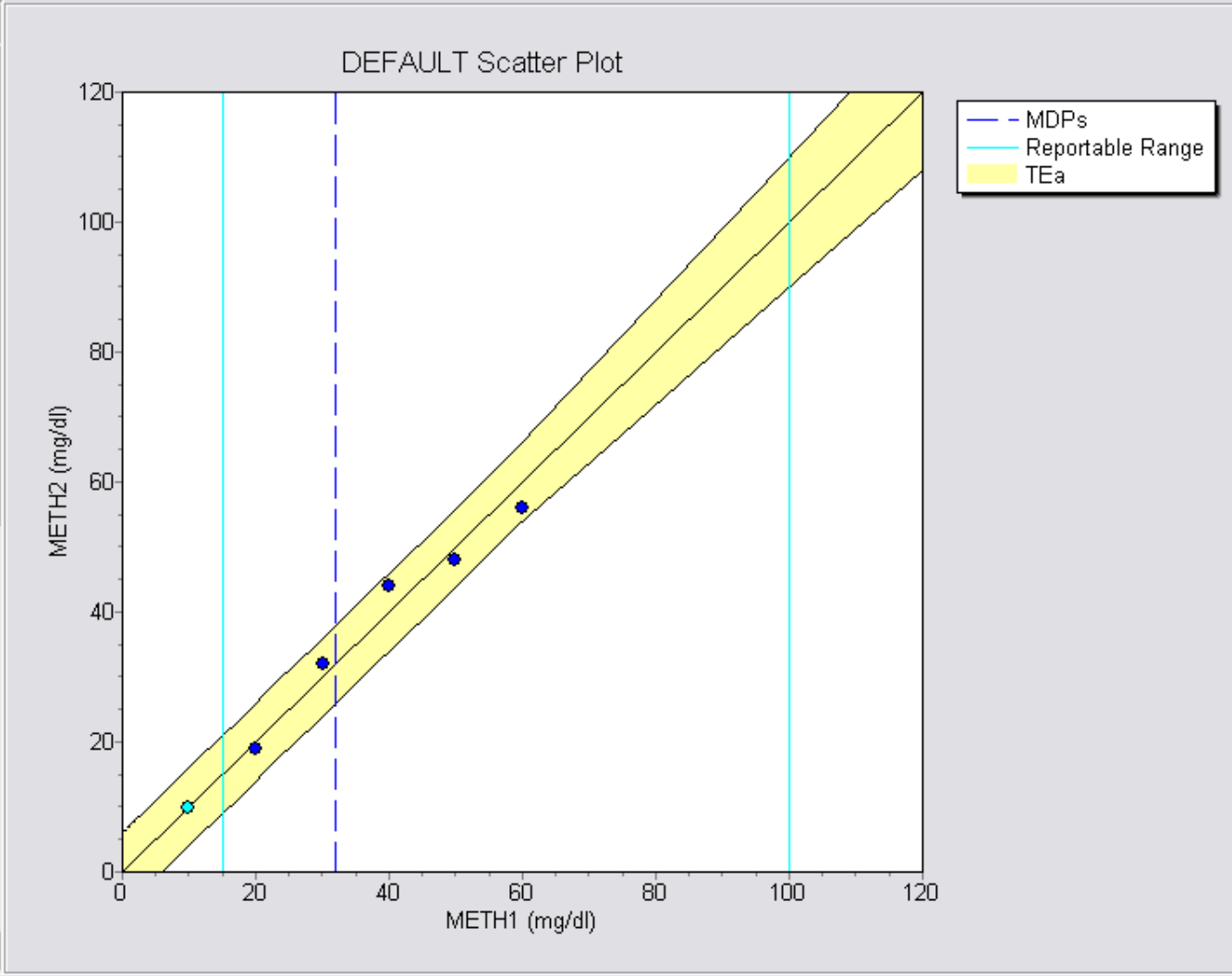
    - to be extended by assaying additional samples

EP Evaluator Two Instrument Comparison [Default]

File Edit Module Experiment RRE ERI View Utilities Tools Help

Y Method	X Method	Analyte
METH2	METH1	DEFAULT

Spec ID	X	Y
SPEC1	10	10
SPEC2	20	19
SPEC3	30	32
SPEC4	40	44
SPEC5	50	48
SPEC6	60	56



Passes? Yes | Error Index: -0.67 to 0.67 | >TEa: None | N: 6 of 6

F3 Add | F4 Delete | F5 Exclude | F6 Clear Flags | F7 Parameters | F8 ID Access | F9 Log Scale

Record 1 of 6

Scatter | Error Index | Statistics

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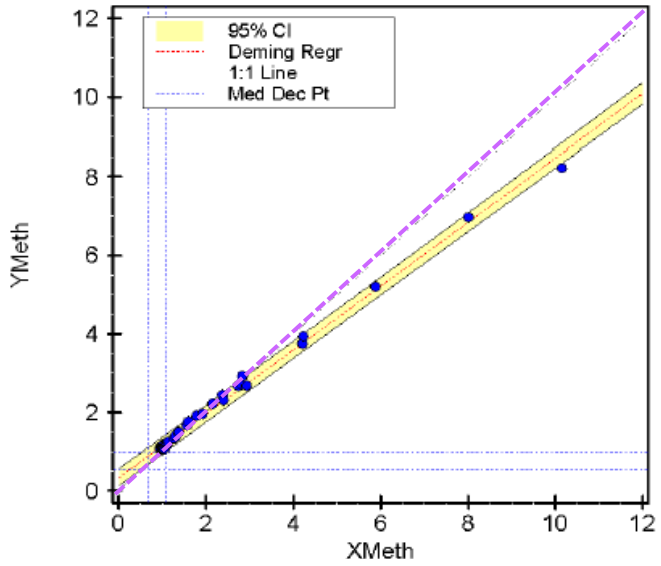
INR

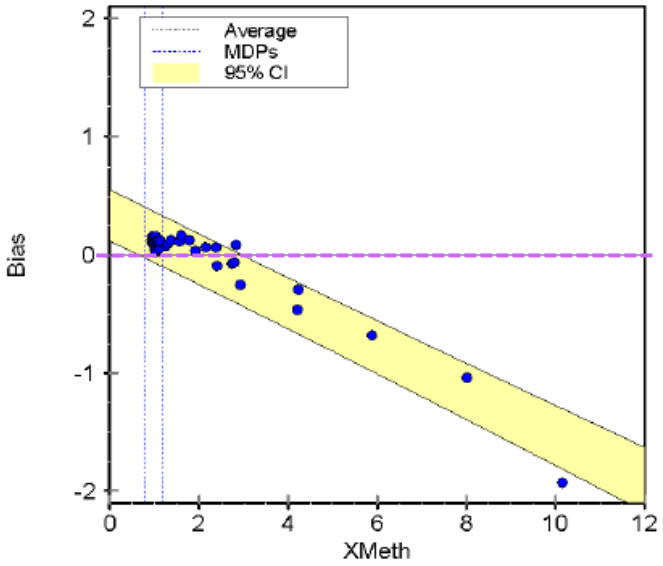
Method Comparison

X Method XMeth **Y Method YMeth**

Scatter Plot



Bias Plot



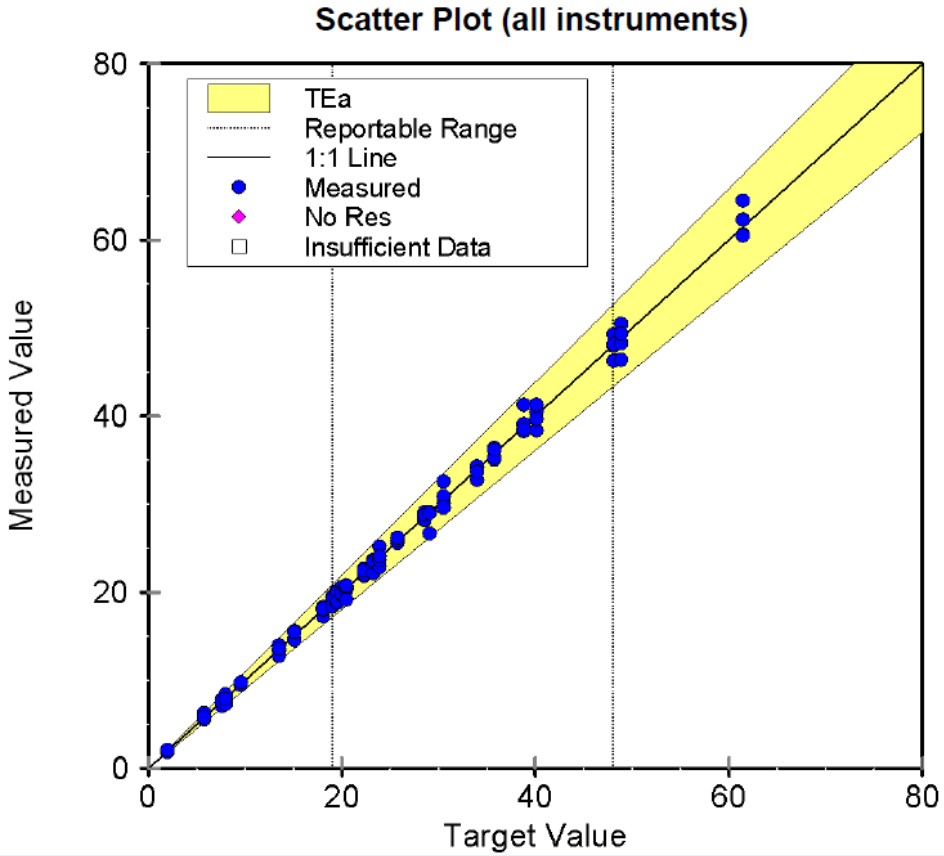
Deming Regression Statistics

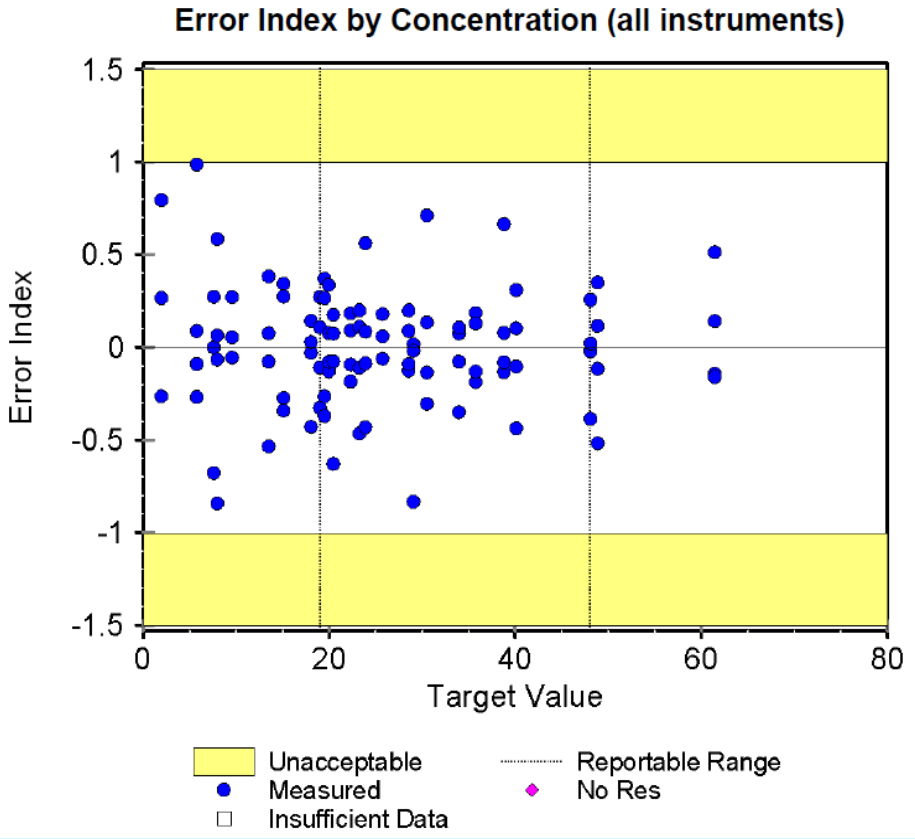
Correlation Coeff (R)	0.9977
Slope	0.813 (0.796 to 0.830)
Intercept	0.342 (0.294 to 0.389)
Std Error Estimate	0.106
N	43 of 43
Subrange	None

Medical Decision Point Analysis

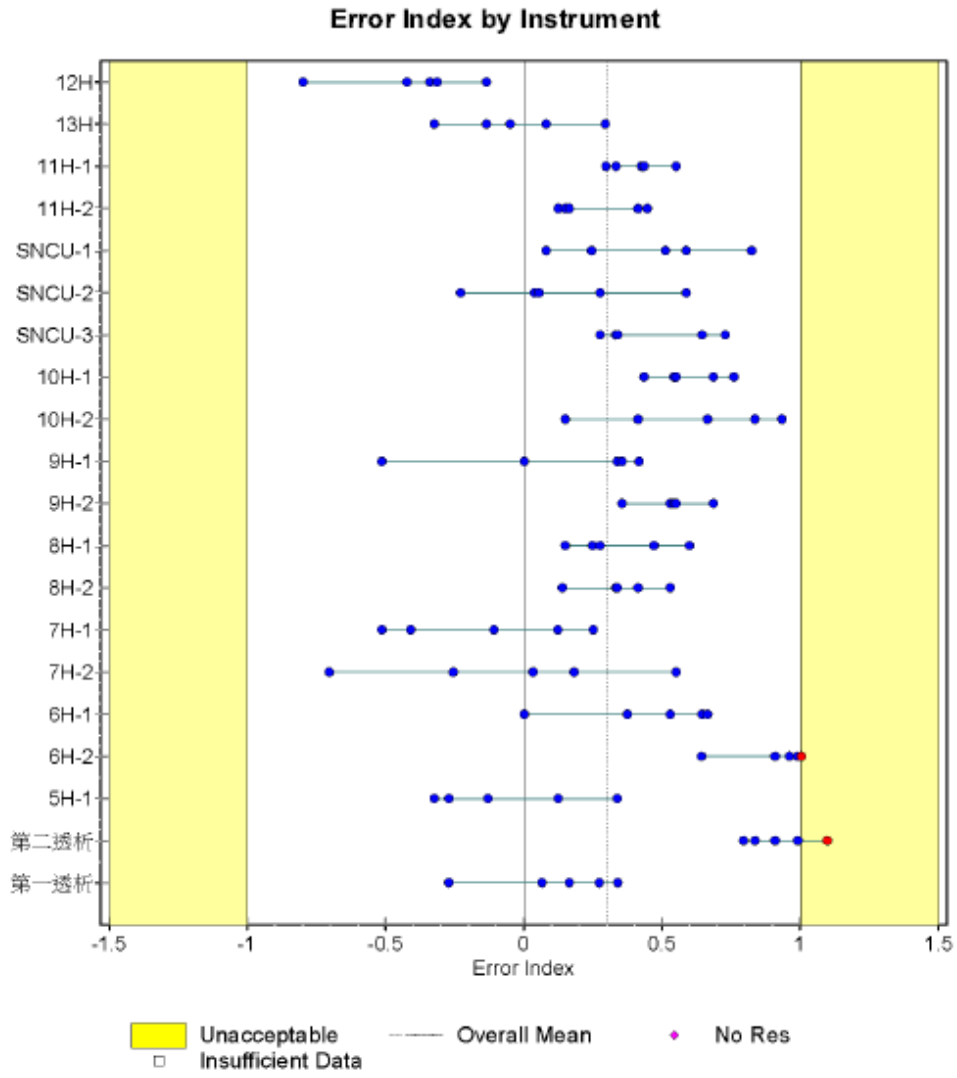
X MDP	Predicted Y	95% Conf. Limits Low	High
0.80	0.99	0.954	1.030
1.20	1.32	1.282	1.352

Multiple Instrument Comparison





Multiple Instrument Comparison



EP Evaluator®

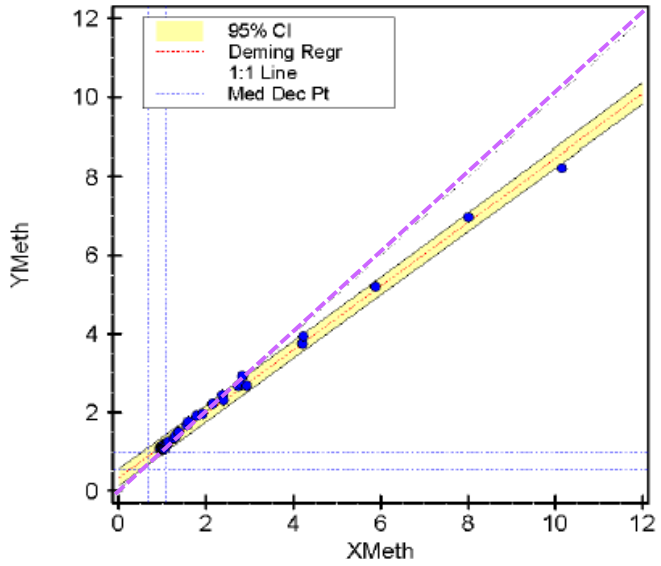
Laboratory Medicine -- China Medical University Hospital

INR

Method Comparison

X Method XMeth **Y Method YMeth**

Scatter Plot



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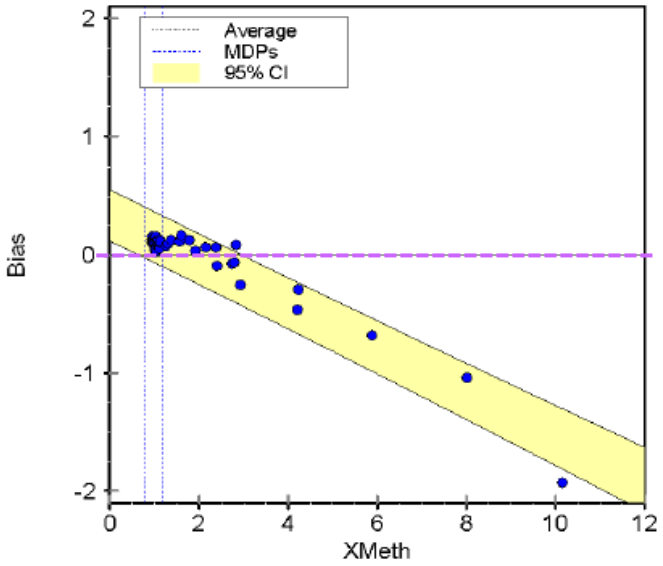

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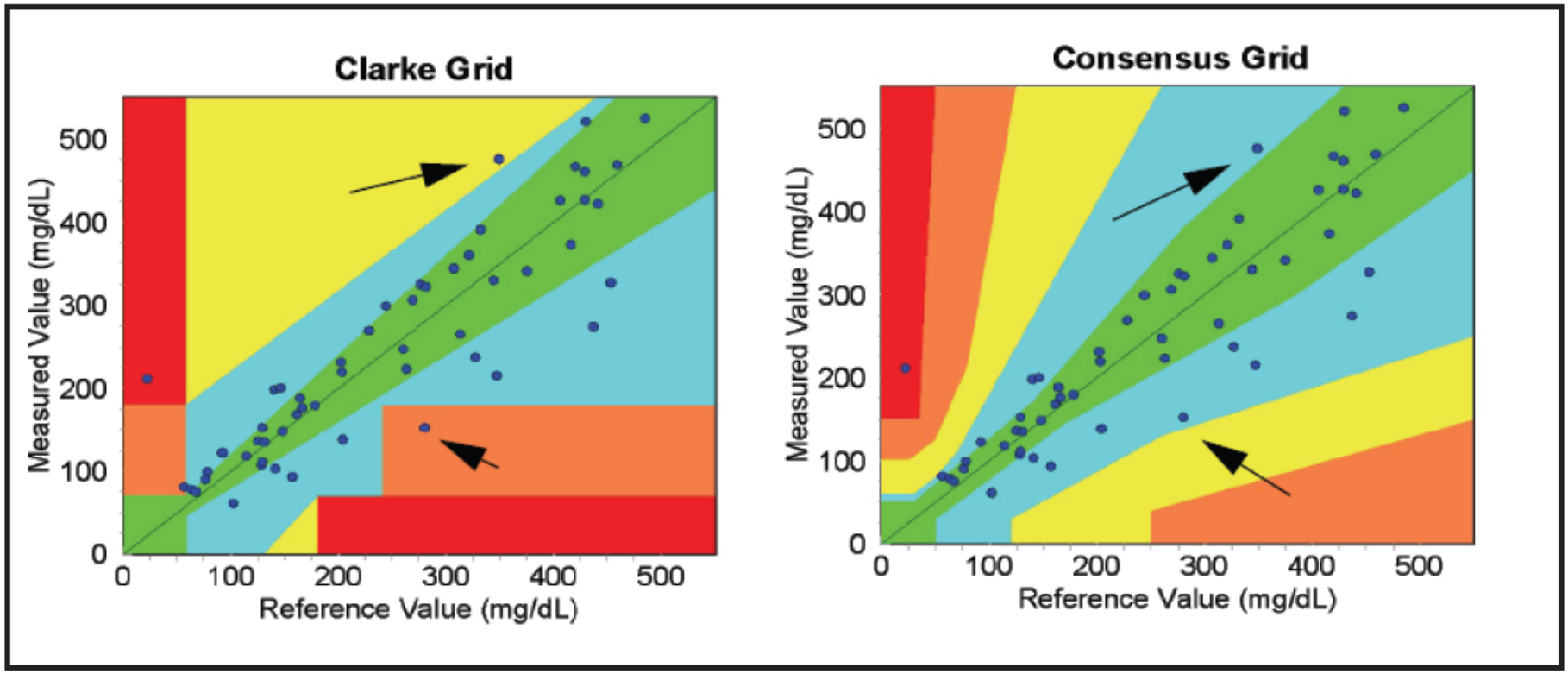
Glucose POC Instrument Evaluation

- Glucose is the single most popular analyte which is assayed in Point of Care (POC) locations.
- The point of this evaluation is to compare POC glucose results with those from laboratory instruments in a very specific format.
- A minimum of 20 specimens.

Results

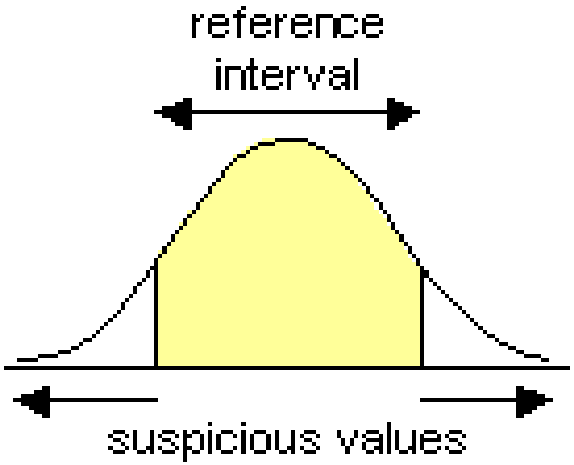


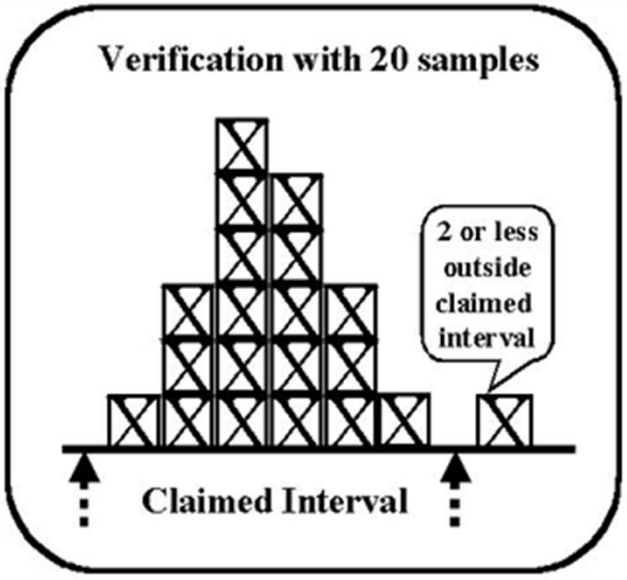
Glucose POC regions		
Region	Name	Color
A	Good Agreement	Green
B	Acceptable Agreement	Blue
C	Fair Agreement	Yellow
D	Poor Agreement	Orange
E	Potentially Lethal	Red

Reference interval

Verifying a reference interval

- **Measure 20 samples appropriate for reference interval on new method**
- **Exclude outliers**
- **If 2 or fewer are outside proposed intervals**
  - Accept intervals
- **If >2 are outside proposed intervals**
  - Measure another 20
  - If 2 or fewer are outside – accept intervals





生物參考區間驗證
(Reference Intervals)

(a) 取得健康正常人之基本資料

(b) 根據所訂標準刪除不合宜個體

(c) 取男生10名及女生10名。

(d) 針對欲進行驗證之項目進行檢測。

(e)檢驗數值應有90％ (至少18人)落入原廠生物參考區間範圍內，確認該生物參考區間為可接受。

(f) 若未達18人之結果落於原生物參考區間之範圍內，否則應將樣本數擴大為40人，才可確認該生物參考區間為可接受。

(g) 若擴大取樣仍超出可接受範圍則必須重新制定。

參考值驗證個案問卷

一、基本資料

個人編號 （檢驗室填寫）		檢體編號 （檢驗室填寫）	
姓名		電話	
年齡	（歲）	性別	男 / 女
地址			
身高	（公分）	體重	（公斤）
職業		就醫醫生姓名	

二、個案問卷

項次	內　　容	是	否
1.	您是否認為自己的身體健康?		
2.	您是否有習慣性運動? 如果是的話,請問您一個星期運動幾次?_____ 您運動的程度由 輕微1 2 3 4 5 6 7 8 9 10 激烈		
3.	您是否有病史? 如果是,何時發生?_____ 是什麼疾病?_____		
4.	您是否有定期的服用藥物? 如果是,您服用的藥物是什麼?_____		
5.	您是否有高血壓?		
6.	您是否有定期服用維他命? 如果是,您服用的維他命是_____		
7.	您的工作環境是否會暴露於一些化學毒性物質? 如果是,您所謂的化學物質是_____		
8.	您是否服用菸草的習慣? 如果是,那是什麼樣式?_____ 頻率?_____		
9.	您是否有特定的飲食習慣? 如果是,請您詳細的說明_____		
10.	您是否有飲用酒精類的飲料? 如果是?那是什麼樣式?_____ 頻率?_____		
11.	您目前是否於門診接受醫師治療中? 如果是, 那是什麼原因?_____頻率?_____		
12.	您是否有住院的紀錄? 如果是,原因_____何時?_____		
13.	您是否有家族性的遺傳疾病? 如果是,請您詳細說明_____		
14.	您平常是否有服用止痛劑或者是阿斯匹林? 如果是,是那種藥物?_____何時?_____		
15.	您是否有感冒或是對藥物過敏? 如果是,請您詳細說明之_____何時?_____		
16.	您是是否有服用抗酸劑或是腸胃道之病史? 如果是,請您詳細說明之_____何時?_____		
17.	您是否有在服用減肥藥物		
限女性回答			
18.	您是否在行經? 如果是,您最後一次的週期是_____ 如果不是,您是否有參與荷爾蒙替代治療? 是/否		
19.	您是否有在哺乳?		
20.	您是否懷孕? 如果是,您的預產期是_____		
21.	您是否有在服用避孕劑或植入性避孕?		

Verification of Reference Interval

Analyst Wang
Specimen Criteria

Date 05 二月 2015

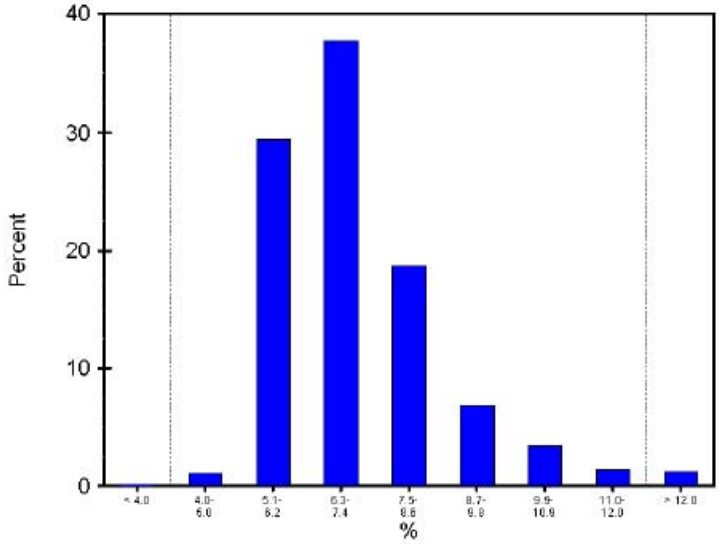
Reference Interval

Proposed	4 to 12 %
Results (Total/Excl)	8614 / 0
Max/Obs outside	10.0% / 1.3%
Passes	Yes

Statistical Analysis

Mean	7.13 %
SD	1.53
Median	6.80
Range	4.1 to 21.6
Central 95% Interval	5.2 to 11.1
Central 95% Index	215.4 / 8399.6

Reference Interval Histogram



Results Distribution

Interval	Percent	Count
< 4.0	0.0	0
4.0-5.0	1.1	91
5.1-6.2	29.5	2544
6.3-7.4	37.7	3247
7.5-8.6	18.7	1610
8.7-9.8	6.9	593
9.9-10.9	3.4	297
11.0-12.0	1.4	122
> 12.0	1.3	110

Verify Reference Interval

EP Evaluator

Prepared for: BIOCHEMISTRY – TRI-SERVICE GENERAL HOSPITAL
By: Clinical Laboratory – TRI-SERVICES GENERAL HOSPITAL

Verification of Reference Interval Summary

Instrument	*Analyte*	*Proposed Ref. Interval*	*N*	*% Outside*	*Passes?*
P800	✓ A/G Ratio	1.2 to 2.4	31 of 31	0.0%	Pass
	✓ ALB	3.4 to 4.8	31 of 31	0.0%	Pass
	✓ ALP	35 to 129	31 of 31	0.0%	Pass
	✓ ALT	0 to 41	31 of 31	0.0%	Pass
	✓ AMYL	28 to 100	31 of 31	0.0%	Pass
	✓ AST	0 to 37	31 of 31	0.0%	Pass
	✓ BUN	7 to 20	31 of 31	0.0%	Pass
	✓ CA	8.4 to 10.2	31 of 31	0.0%	Pass
	✓ CK	26 to 174	31 of 31	0.0%	Pass
	✓ CKMB	7 to 25	31 of 31	0.0%	Pass
	✓ CL	98 to 107	31 of 31	0.0%	Pass
	✓ CRE	0.5 to 1.2	31 of 31	0.0%	Pass
	✓ DB	0 to 0.30	31 of 31	0.0%	Pass
	✓ GGT	9 to 40	31 of 31	0.0%	Pass
	✓ GLU	70 to 105	30 of 30	0.0%	Pass
	✓ HDL-C	55 to 100	31 of 31	0.0%	Pass
	✓ IP	2.7 to 4.5	31 of 31	0.0%	Pass
	✓ IRON	37 to 158	31 of 31	0.0%	Pass
	✓ K	3.5 to 5.1	31 of 31	0.0%	Pass
	✓ LD	135 to 225	31 of 31	0.0%	Pass
	✓ LDL-C	0 to 100	31 of 31	0.0%	Pass
	✓ LIPAS	13 to 60	31 of 31	0.0%	Pass
	✓ Mg	1.58 to 2.55	31 of 31	0.0%	Pass
	✓ Na	136 to 145	31 of 31	0.0%	Pass
	✓ TBIL	0 to 1.0	31 of 31	0.0%	Pass
	✓ TCHO	0 to 200	31 of 31	0.0%	Pass
	✓ TG	0 to 200	31 of 31	0.0%	Pass
	✓ TIBC	228 to 428	29 of 29	6.9%	Pass
	✓ TP	6.4 to 8.3	31 of 31	0.0%	Pass
	✓ UA	2.4 to 7.0	31 of 31	0.0%	Pass
	✓ UIBC	110 to 370	29 of 29	0.0%	Pass

Interference substances

Interference

CK-MB

SUBSTANCE	LEVEL TESTED	OBSERVED EFFECT
Hemoglobin	<300 mg/dL	- 2 U/L[g]
Bilirubin	(3+) 30 mg/dL	3 U/L
Lipemia	(3+) 300 mg/dL	1 U/L
Pyruvate	2 mg/dL	1 U/L

1.

Lipemia檢體需採取高速離心

CK

SUBSTANCE	LEVEL TESTED	OBSERVED EFFECT[a]
Bilirubin (unconjugated)	30 mg/dL	NSI[c]
Hemoglobin	50 mg/dL	+12 IU/L
Lipemia	500 mg/dL	NSI
Adenylate Kinase	100 U/L	+8 IU/L

2.

Hemolysis退檢處理

RF

SUBSTANCE	LEVEL	OBSERVED EFFECT
Bilirubin	10-30 mg/dL	NSI
Lipid	140-700 mg/dL	NSI
Hemoglobin	100-650 mg/dL	NSI
Rheumatoid Factor	300 IU/mL	NSI

3.

從黃膽（膽紅素 60 mg/dL [1026 µmol/L]）、溶血（血紅蛋白 1000 mg/dL [0.62 mmol/L]）或脂血（三酸干油酯 1500 mg/dL [16.93 mmol/L]）中沒有觀察到臨床意義干擾。

採檢容器評估

- 如需異動或新購採檢容器時，需進行新試管對檢體或試劑干擾影響的評估，評估證明可由實驗室進行測試、臨床文獻之評論及廠商提供之資料。評估項目建議包括以下品項：
  - 採檢難易度
  - 檢驗數值差異(d%)
  - 儀器自動穿刺狀況
  - 離心後分離狀況
  - 標示辨識度

- 文件化程序
- 紀錄(真實呈現儀器原始紀錄)
- 總結報告書

中國醫藥大學附設醫院
China Medical University Hospital

【檢驗醫學部檢驗項目評估總結報告】

1 前言(Introduction)：

2 材料與設備(Materials and Equipments)：

2.1 材料：…

2.2 設備：…..

2.3 Sample preparation：….

3 人員(Personnel)：

Technician

4 作業程序(Protocol)：

4.1 ….....

4.2 ……

5 結果(Results)：

5.1 EP Evaluator 統計分析結果

5.2 ……

6 結論(Conclusion)：

☐ 本實驗室已審閱確效測驗的結果，此方法/儀器可以使用於檢驗病人檢體。

☐ 其他說明詳述如下：

7 參考資料(Reference)：

7.1 Burrin JM, Price CP. “M…..

組長：_____ 科主任：_____

品保暨教學組主任：_____部主任：_____

謝謝大家！