New Machine tool inspection standard

机床精度检测新国家标准GB/T17421.7（ISO230-7）

2018.11.04

JON PRECISION

Lion Precision

- GB/T17421 (ISO230)&GB/T 17421.7 (ISO230-7)
- Lion Precision & Products
- Spindle Error Analyzer Basics

LION PRECISION

GB/T 17421 (ISO230)
&
GB/T 17421.7 (ISO230-7)

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ISO230

ISO 230 consists of the following parts, under the general title *Test code for machine tools*:

— *Part 1: Geometric accuracy of machines operating under no-load or quasi-static conditions*

— *Part 2: Determination of accuracy and repeatability of positioning numerically controlled axes*

— *Part 3: Determination of thermal effects*

— *Part 4: Circular tests for numerically controlled machine tools*

— *Part 5: Determination of the noise emission*

— *Part 6: Determination of positioning accuracy on body and face diagonals (Diagonal displacement tests)*

— *Part 7: Geometric accuracy of axes of rotation*

— *Part 9: Estimation of measurement uncertainty for machine tool tests according to series 230, basic equations* [Technical Report]

The following part is under preparation:

— *Part 8: Determination of vibration levels* [Technical Report]

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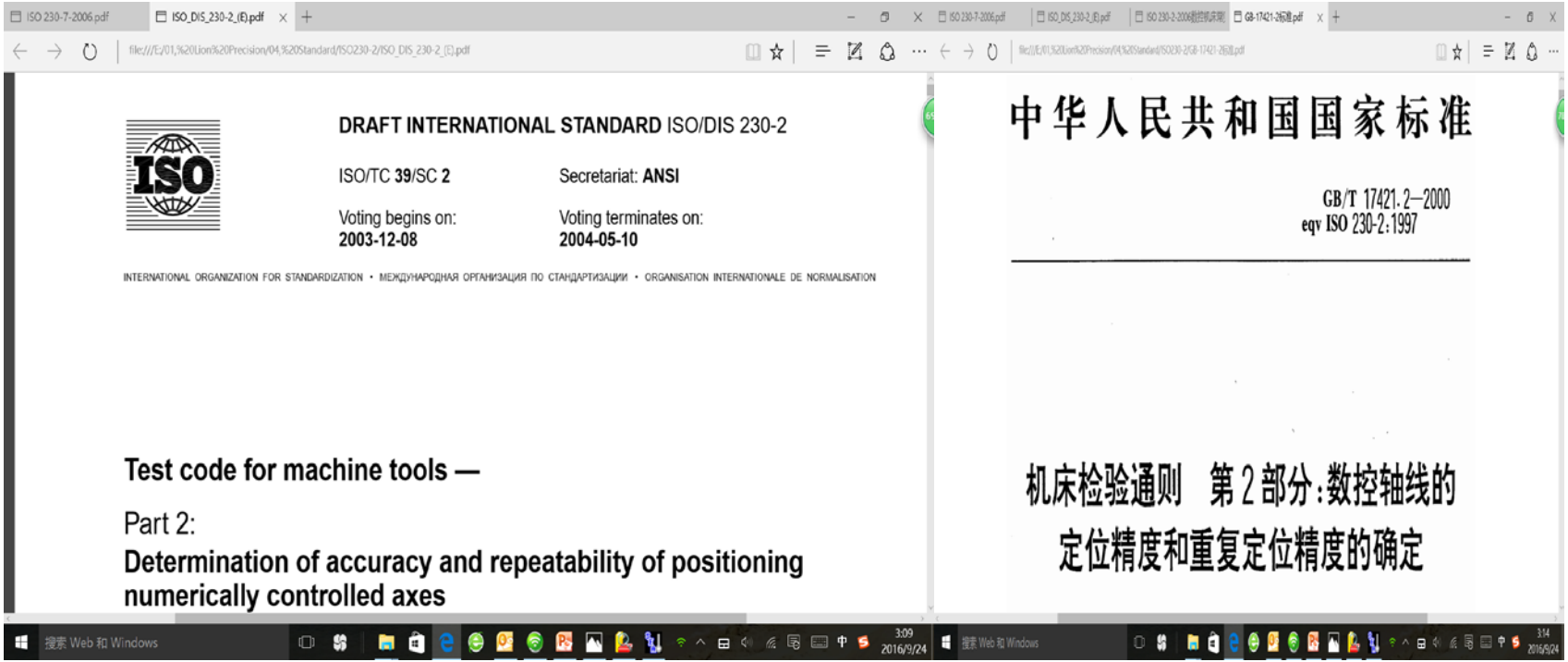
GB/T 17421.2-2000 eqv ISO230-2:1997



DRAFT INTERNATIONAL STANDARD ISO/DIS 230-2

ISO/TC 39/SC 2 Secretariat: ANSI

Voting begins on: 2003-12-08 Voting terminates on: 2004-05-10

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Test code for machine tools —

Part 2:

Determination of accuracy and repeatability of positioning numerically controlled axes

中华人民共和国国家标准

GB/T 17421.2—2000
eqv ISO 230-2:1997

机床检验通则 第2部分:数控轴线的定位精度和重复定位精度的确定

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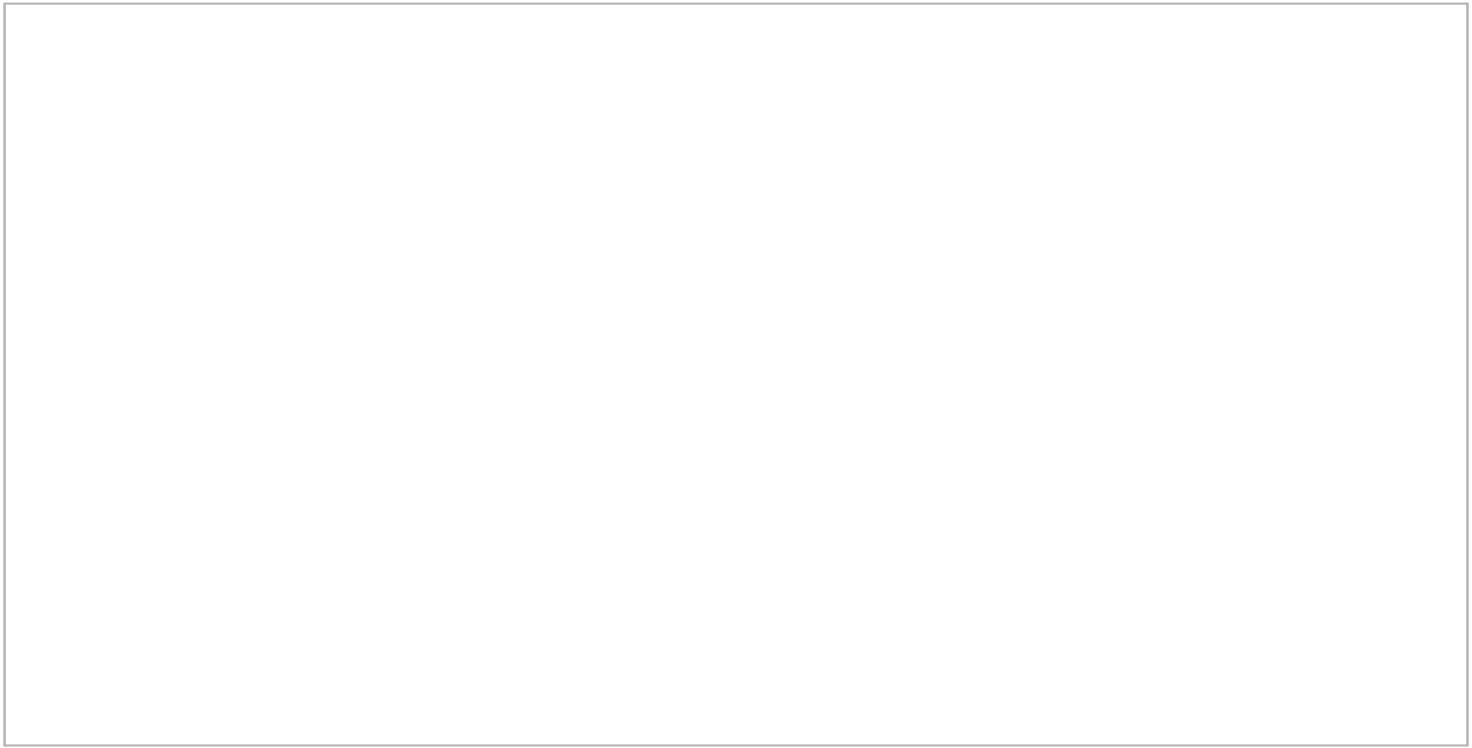
GB/T 17421.2



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GB/T 17421.4

国际标准 ISO 230-4:1996

机床检验通则 第 4 部分:
数控机床的圆检验

1 范围

本标准规定了两线性轴线同时运动所产生的圆轨迹的圆滞后、圆偏差及半径偏差的检验和评定方法。有关的检验工具在ISO 230-1:1996中的6.63说明。

本标准的目的是提供一种检验数控机床轮廓特性的方法。

2 引用标准

下列标准所包含的条文，通过在本标准中引用而构成为本标准的条文。本标准出版时，所示版本均为有效。所有标准都会被修订，使用本标准的各方应探讨使用下列标准最新版本的可能性。IEC 和 ISO 各成员都保留有现行有效的国际标准。

ISO 230-1:1996 机床检验通则 第 1 部分：在无负荷或精加工条件下

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GB/T 17421.4

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GB/T 17421.6-2016

机床检验通则
第 6 部分：对角线位移检验

前　　言

ISO（国际标准化组织）是世界范围内各国标准化组织（ISO成员）的联合组织。国际标准的制定工作通常由ISO的技术委员会完成。对技术委员会设立的某一专题感兴趣的每个ISO成员都有权在该技术委员会表达自己的意见。与ISO有联系的国际组织、官方或非官方机构也可参与此项工作。ISO在电工标准的所有问题上与国际电工委员会（IEC）合作密切。

国际标准的起草应符合ISO／IEC技术工作导则第3部分的规定。

经技术委员会接受的国际标准草案，在发往各成员征求意见后表决。国际标准的发布要求至少75%的成员投票通过。

国际标准ISO 230-6是由ISO/TC 39“机床”技术委员会的SC 2“金属切削机床检验条件”分委员会制定的。

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GB/T 17421.6

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Spindle Error Analyzer (SEA)

GB/T17421.7-2016/ISO230-7:2006

The Spindle Error Analyzer performs tests in compliance with these standards:

ANSI/ASME Standard B5.54-2005: "Methods for Performance Evaluation of CNC Machining Centers"

ISO230: Test Code for Machine Tools, 3:"Determination of Thermal Effects" 7:"Geometric Accuracy of Axes of Rotation"

ANSI/ASME B5.57-1998: "Methods for Performance Evaluation of CNC Turning Centers"

ANSI/ASME B89.3.4: "Axes of Rotation, Methods for Specifying and Testing"

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GB/T 17421.1

DRAFT INTERNATIONAL STANDARD ISO/DIS 230-1

ISO/TC **39**/SC **2** Secretariat: **ANSI**

Voting begins on: **2009-10-15** Voting terminates on: **2010-03-15**

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Test code for machine tools —

Part 1:
Geometric accuracy of machines operating under no-load or quasi-static conditions

Code d'essai des machines-outils —

Partie 1: Précision géométrique des machines fonctionnant à vide ou dans des conditions quasi-statiques

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GB/T 17421.1

ISO_DIS_230-1_(E).pdf

file:///E:/01,%20Lion%20Precision/04,%20Standard/ISO230-1/ISO_DIS_230-1_(E).pdf

A check of the run-out of the spindle by machining and testing a cylindrical workpiece will take into account only defects in the bearings of the spindle.
This practical turning test gives no information on the exact shape of the cylindrical or conical bore, or of the actual position of the bore in relation to the axis of rotation.

Spindles which are automatically centred during rotation (e.g. by hydraulic pressure; hydrodynamic spindle) can be tested only when running at normal speed. In such a case, non-contact measuring instruments shall be used, e.g. a capacitive pickup, an inductive pickup or any other suitable instrument.

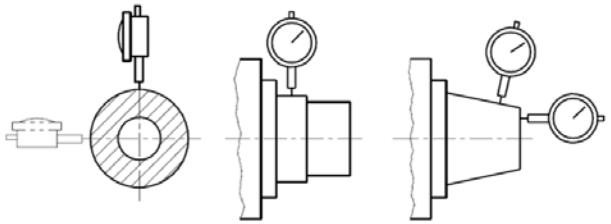

Figure 147 — Measurement of external run-out

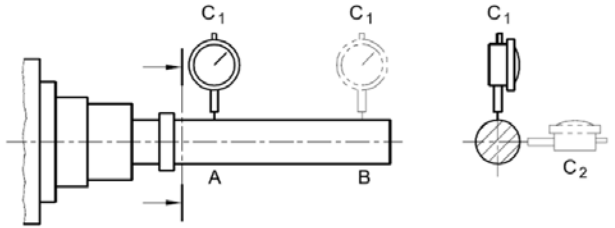

Figure 148 — Measurement of internal run-out

有问题尽管问我

9:56
2016/9/29

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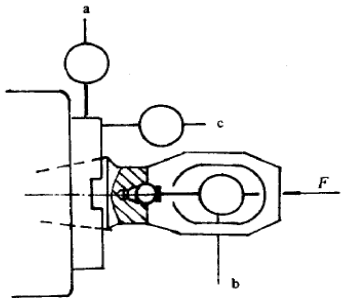
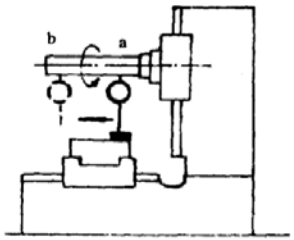
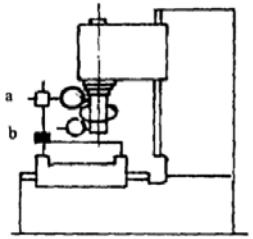
序号	简　　图	检验项目	允　差 mm		检验工具	检　验　方　法 参照 GB/T 17421.1—1998 的有关条文
G5		主轴端部的跳动： a. 主轴定心轴颈的径向跳动（用于有定心轴颈的床身铣床）； b. 主轴的轴向窜动； c. 主轴轴肩支承面的跳动	普通级	精密级	指示器 专用检验棒	a. 5.6.1.2.2 b. 5.6.2.2.1；5.6.2.2.2 c. 5.6.3.2 固定指示器，使其测头分别触及：a. 主轴定心轴颈表面；b. 插入主轴锥孔中的专用检验棒端面中心处；c. 主轴轴肩支承面靠近边缘处。旋转主轴进行检验。 a、b、c 的误差分别计算。跳动或窜动误差以指示器读数的最大差值计。 b、c 项检验时，应通过主轴中心线加一个由制造厂规定的轴向力 F（对已消除轴向游隙的主轴，可不加力）
			a			
			0.010	0.006		
			b			
			0.010	0.006		
			c			
			0.020	0.012		

序号	简　　图	检验项目	允　差 mm		检验工具	检　验　方　法 参照 GB/T 17421.1—1998 的有关
G6	 	主轴锥孔轴线的径向跳动： a. 靠近主轴端面； b. 距主轴端面 300 mm 处	普通级	精密级	指示器 检验棒	5.6.1.2.3 在主轴锥孔中插入检验棒。固 示器，使其测头触及检验棒的表 a. 靠近主轴端面；b. 距主轴端面 mm 处。旋转主轴进行检验。 拔出检验棒，相对主轴旋转 90 新插入主轴锥孔中，依次重复检 次。 a、b 的误差分别计算。径向跳 差以四次测量结果的算术平均值
			a			
			0.010	0.006		
			b			
			0.020	0.012		

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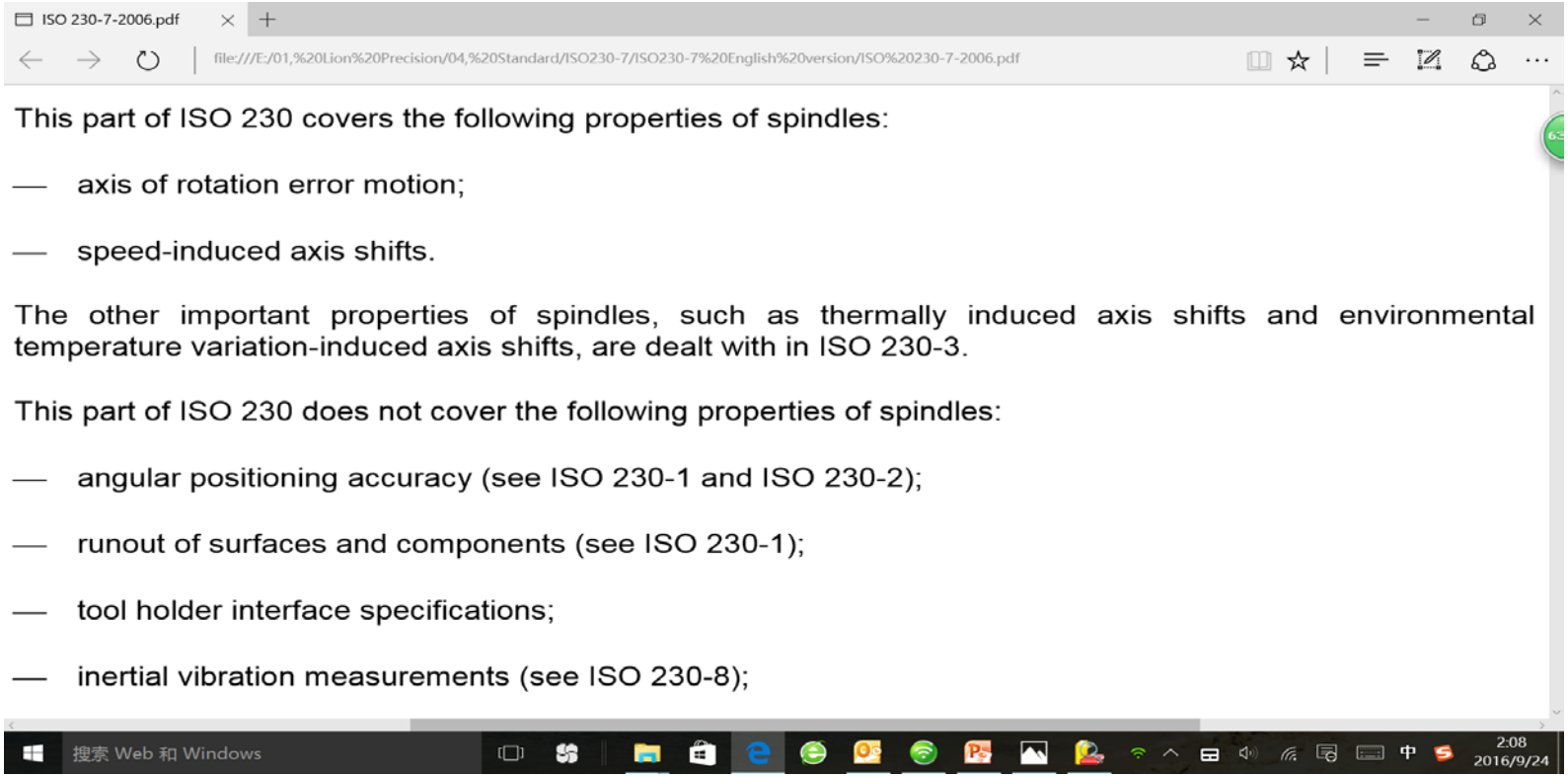
GB/T 17421.7 (ISO230-7)



LION PRECISION

GB/T 17421.7 (ISO230-7)

3.5.1 total error motion value scaled difference in radii of two concentric circles from a specified error motion centre just sufficient to contain the total error motion polar plot

NOTE Four total error motion values are defined: total radial error motion, total tilt error motion, total axial error motion and total face error motion.

3.5.2 synchronous error motion value scaled difference in radii of two concentric circles from a specified error motion centre just sufficient to contain the synchronous error motion polar plot

3.5.3 asynchronous error motion value maximum scaled width of the asynchronous error motion polar plot, measured along a radial line through a specified polar profile centre

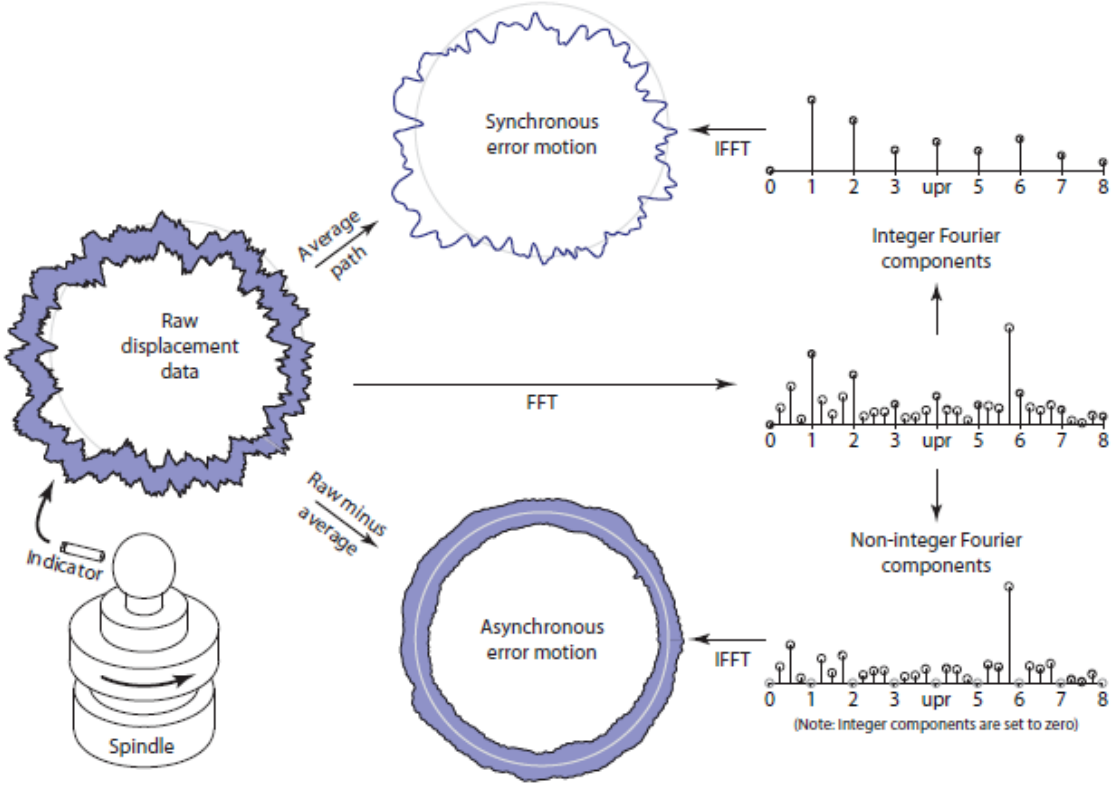
See Figure 6.

3.5.4 fundamental axial error motion value value equivalent to twice the scaled distance between the PC centre and a specified polar profile centre of the synchronous error motion polar plot

3.5.5 residual synchronous error motion value scaled difference in radii of two concentric circles from a specified error motion centre just sufficient to contain the residual synchronous error

LION PRECISION

GB/T 17421.7 (ISO230-7)



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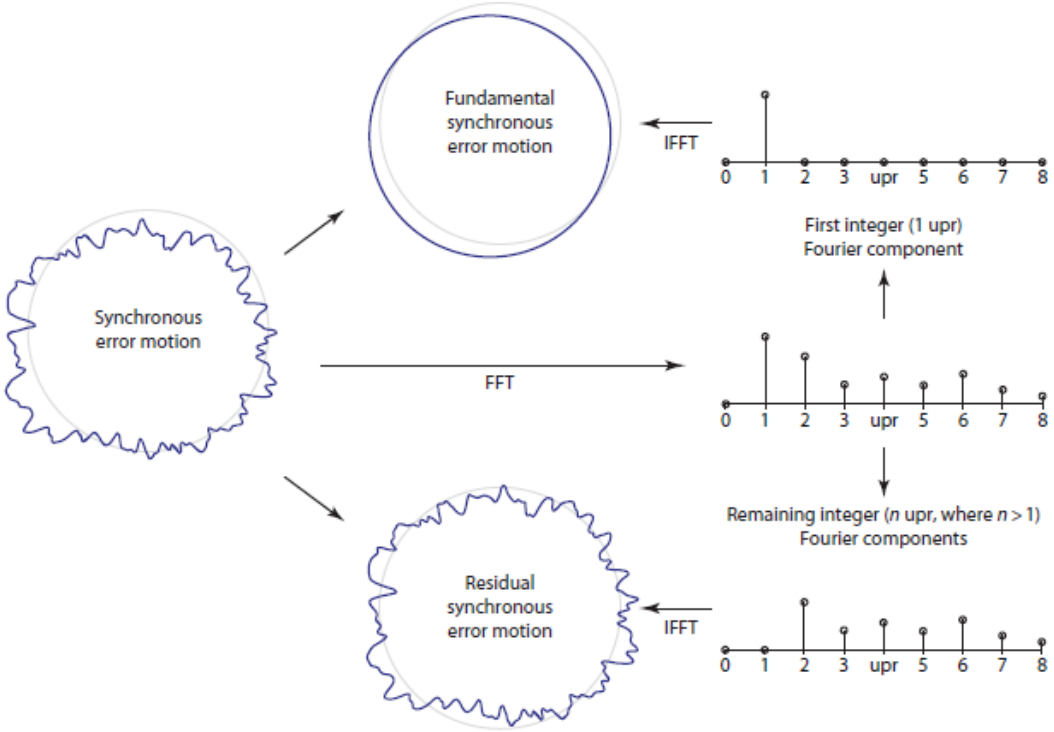
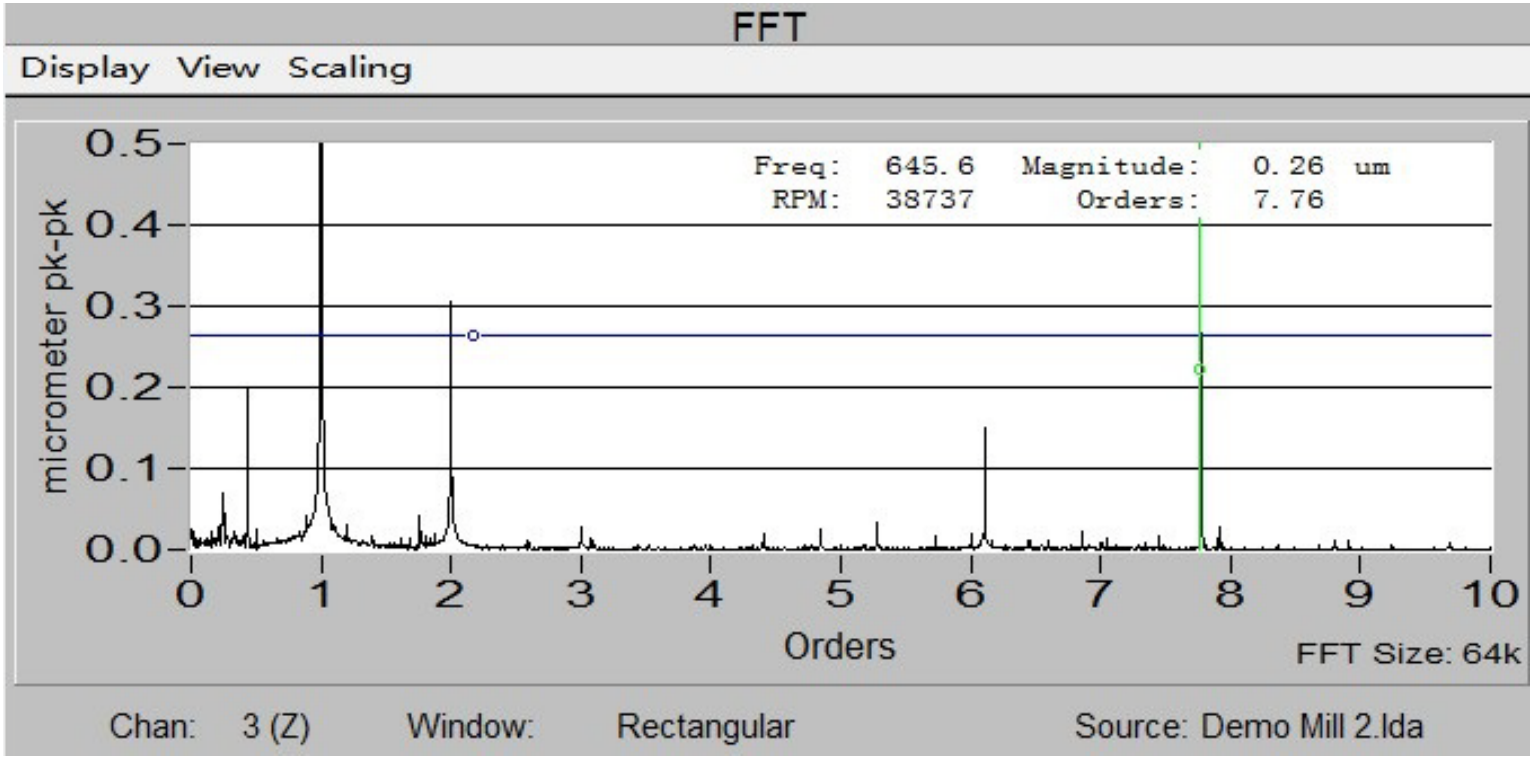
Decomposition of synchronous error motion into fundamental and residual components
同步误差分解为基本和残余同步误差



LION PRECISION

GB/T 17421.7 (ISO230-7)



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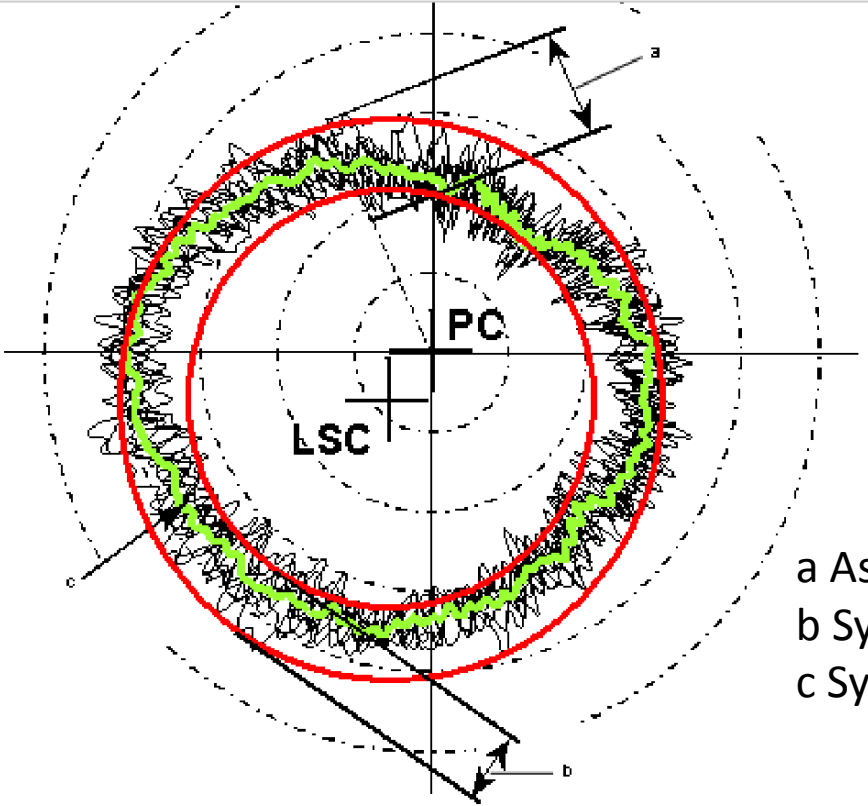
GB/T 17421.7 (ISO230-7)

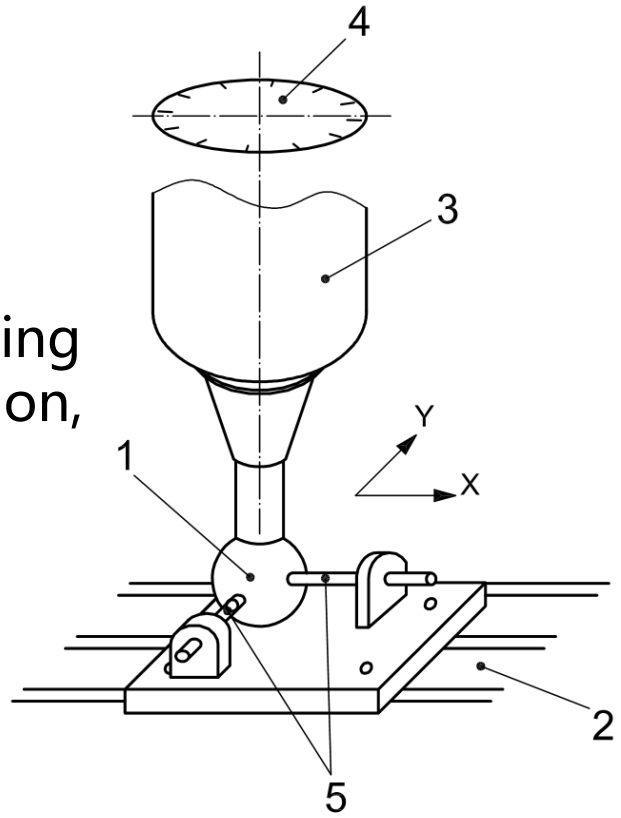


a Asynchronous error motion value.
b Synchronous error motion value.
c Synchronous error motion plot.

LION PRECISION

Rotating Sensitive Direction

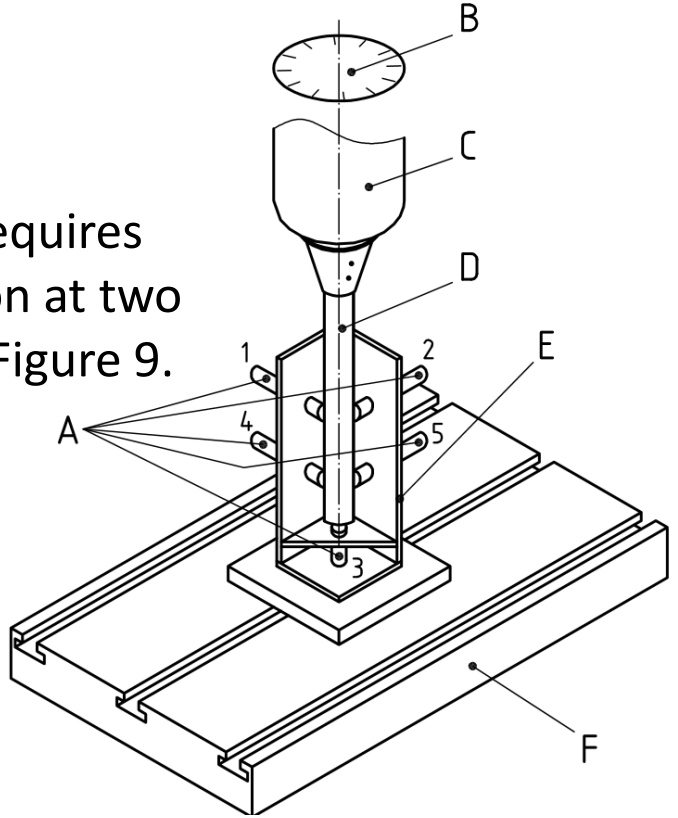
- 5.4 Spindle tests — Rotating sensitive direction
- 5.4.1 General
  These tests are applicable to the machining operations with rotating sensitive direction, for example, boring, milling, drilling and contour grinding.



LION PRECISION

Tilt Error Motion

- 5.4.3 Tilt Error Motion
  Measurement of the tilt error motion requires measurements of the radial error motion at two spatially separated points, as shown in Figure 9.



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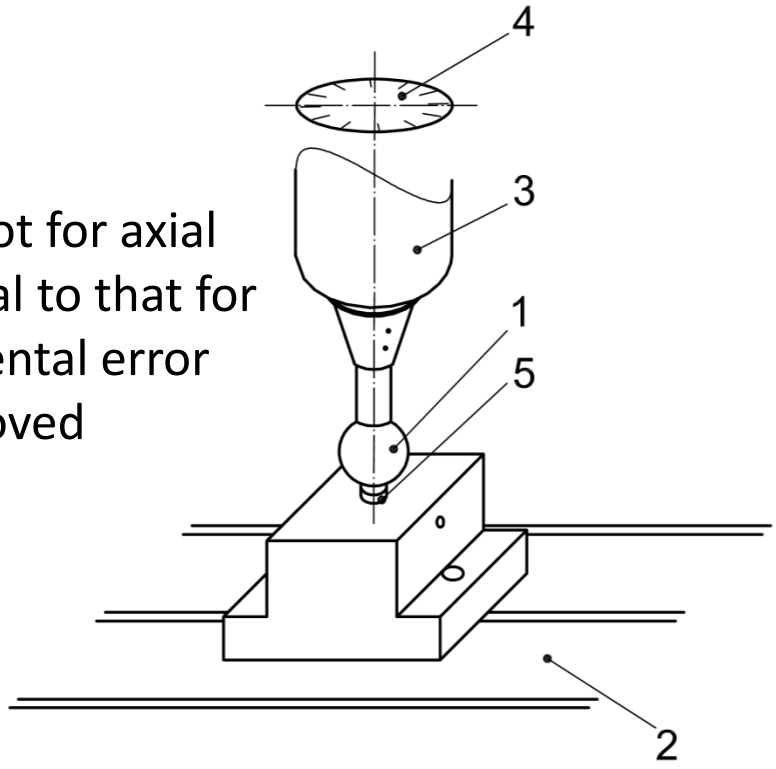
Axial Error Motion

- 5.4.4 Axial Error Motion
  The analysis of the error motion polar plot for axial error motion is also conceptually identical to that for radial error motion, except that fundamental error motion (eccentricity) should not be removed analytically.



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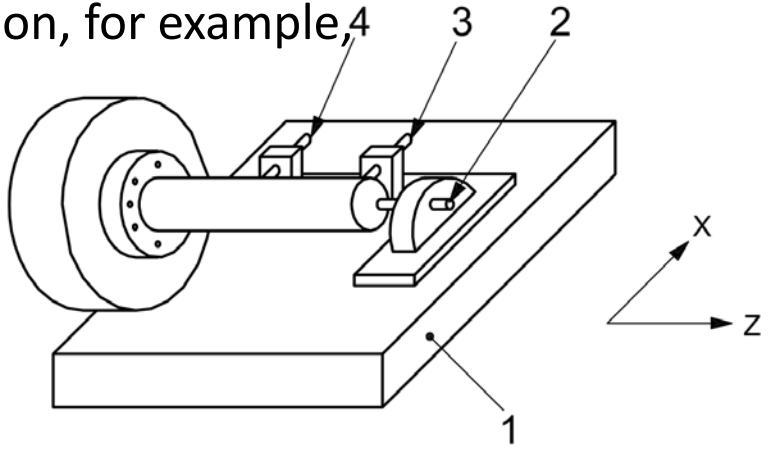
Fixed Sensitive direction

- 5.5 Spindle tests — Fixed sensitive direction
  These tests are applicable to the machining operations with fixed sensitive direction, for example, turning and cylindrical grinding.



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Lion Precision & Products

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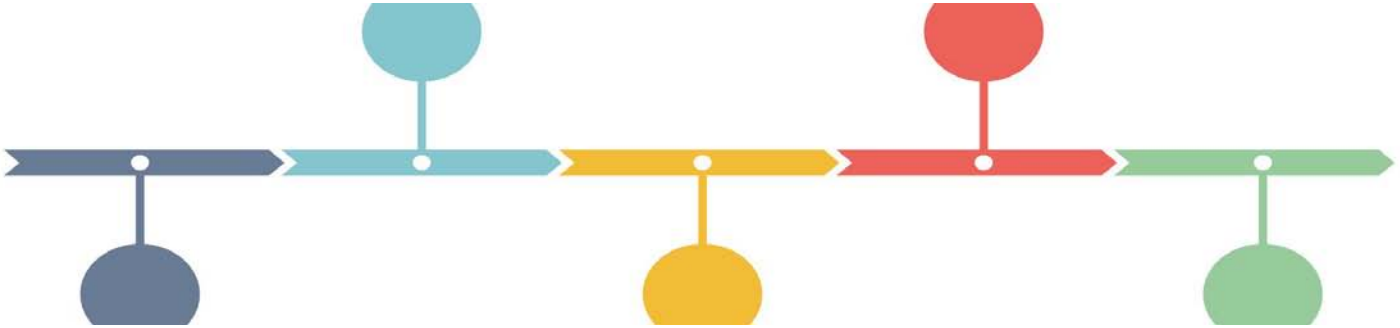
History



LION PRECISION

Ownership

- Established in 1958
  by Dr. Kurt Lion, of MIT
- First manufacturer of commercial capacitive sensors
- Purchased in 1986 by Automated Quality Technologies (Don Martin and others)
- Purchased 2015 by Motion Tech Automation

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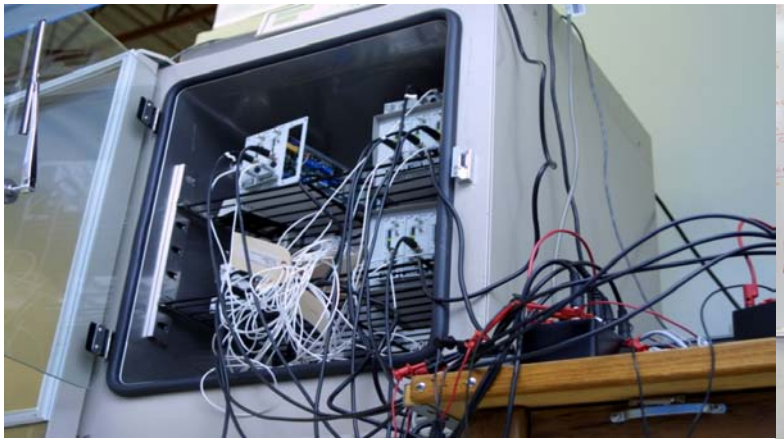
Product Development



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Product Families

- 1958 – Capacitive Products
- 1992 – Spindle Error Analyzer
- 1995 – Label Sensors
- 2001 – Eddy-Current Products
- 2015 - SpindleCheck

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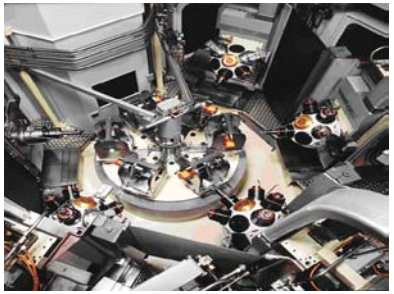
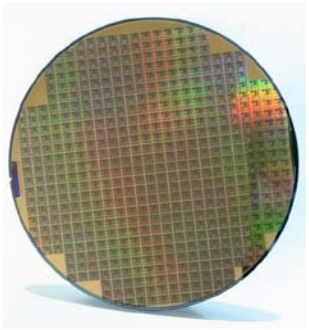
Industries Served

- Machine Tool
- Packaging
- Medical Device
- Semiconductor
- Disk Drive





LION PRECISION

美国雄狮精仪公司的主轴运动误差分析仪（SEA）和主轴检测仪SpindleCheck采用雄狮公司高分辨率无接触式的位移传感器，是世界领先的主轴误差运动测量系统和分析工具。

该系统采用软件分析和显示被测主轴在全速运动时X,Y和Z轴向的主轴性能。用户能够充分描述主轴的性能，包括受温度影响的主轴伸长和倾斜，FFTs分析的主轴轴承，及主轴性能相关特点的位置，圆度和表面粗糙度。测量分辨率可小于一个纳米。

SEA和SpindleCheck二个系统完全符合ANSI， ISO，和JIS主轴性能测量标准。

Main Products for Machine Tool

Dynamic Spindle Measurement

- Spindle Error Analyzer (SEA)
- SpindleCheck

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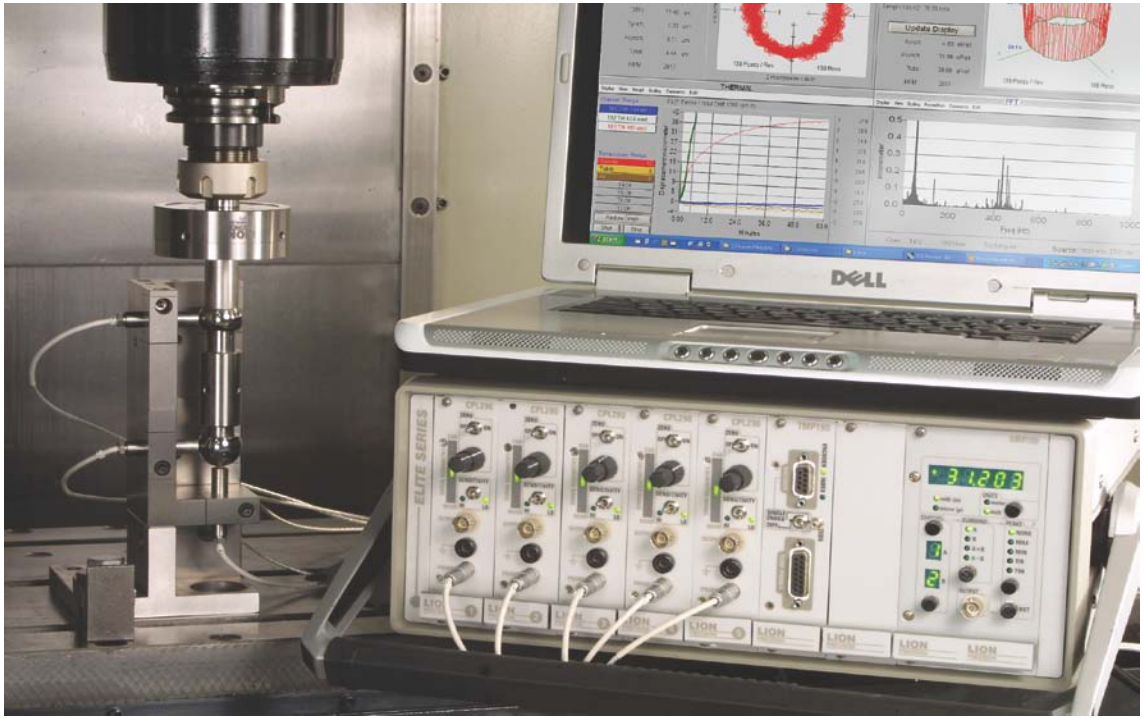
Spindle Error Analyzer (SEA)

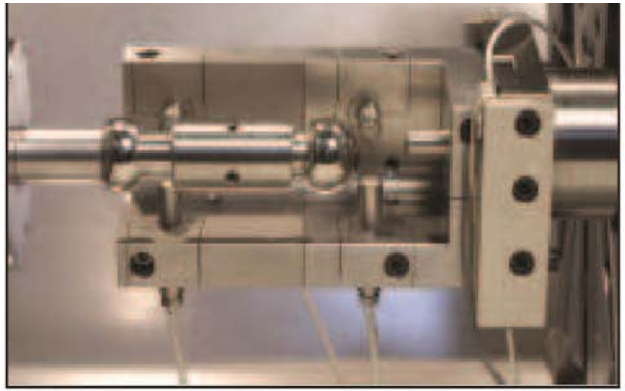


LION PRECISION

SpindleCheck

LION PRECISION

Spindle Error Analyzer (SEA)



The Spindle Error Analyzer performs tests in compliance with these standards:

ANSI/ASME Standard B5.54-2005: "Methods for Performance Evaluation of CNC Machining Centers"

ISO230: Test Code for Machine Tools, 3:"Determination of Thermal Effects" 7:"Geometric Accuracy of Axes of Rotation"

ANSI/ASME B5.57-1998: "Methods for Performance Evaluation of CNC Turning Centers"

ANSI/ASME B89.3.4: "Axes of Rotation, Methods for Specifying and Testing"

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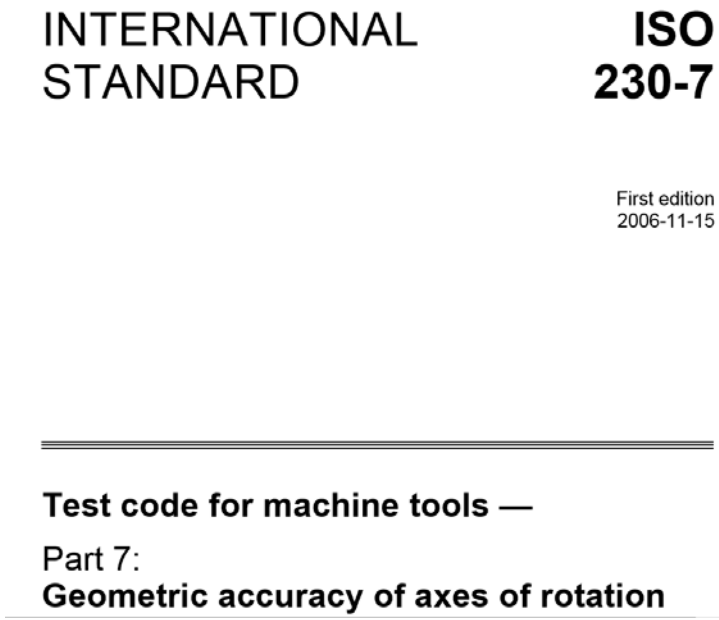
Spindle Error Analyzer (SEA)



INTERNATIONAL STANDARD

ISO 230-7

First edition
2006-11-15

Test code for machine tools —

Part 7:
Geometric accuracy of axes of rotation

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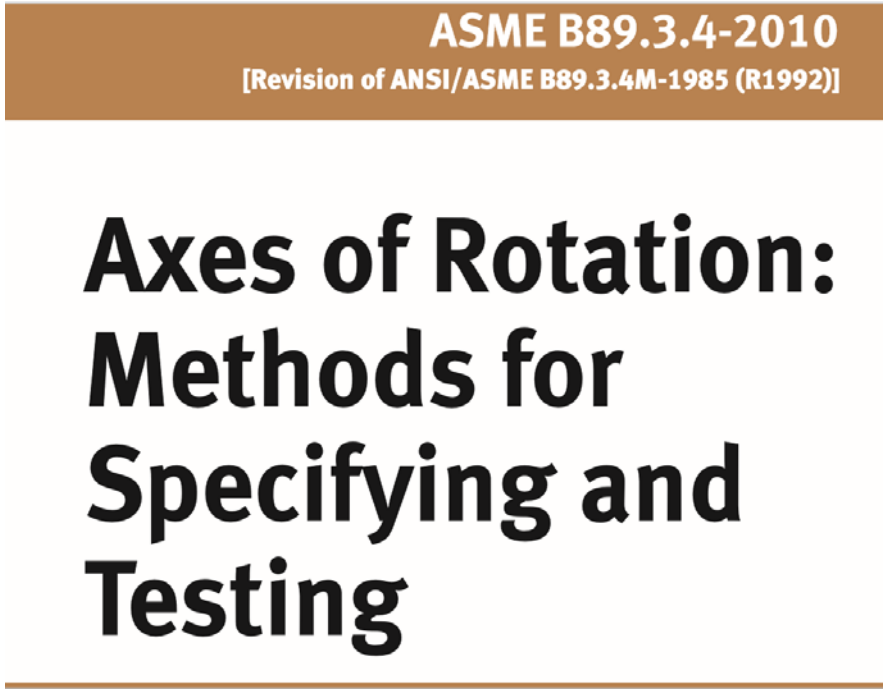
Spindle Error Analyzer (SEA)



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Spindle Error Analyzer (SEA)

GB/T17421.7-2016 / ISO230-7:2006

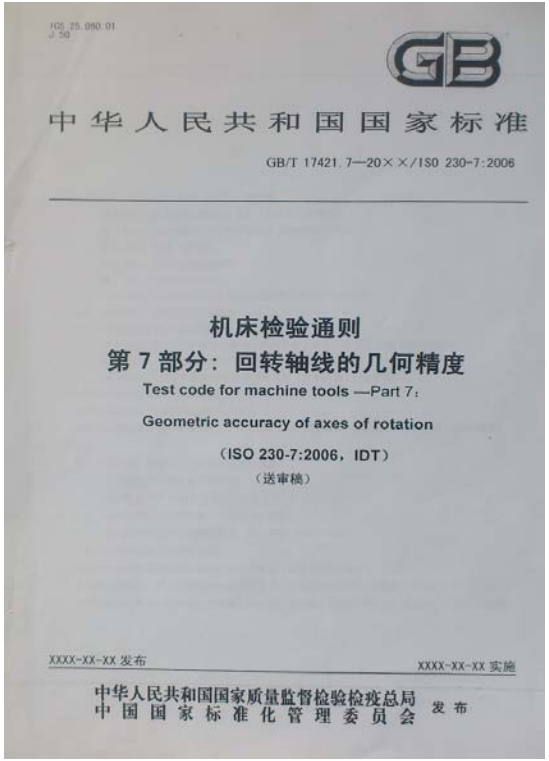
机床检验通则

第 7 部分：回转轴线的几何精度

Test code for machine tools —Part 7：

Geometric accuracy of axes of rotation

（ISO 230-7:2006，IDT）



GB

中华人民共和国国家标准

GB/T 17421.7—20××/ISO 230-7:2006

机床检验通则

第 7 部分：回转轴线的几何精度

Test code for machine tools —Part 7：

Geometric accuracy of axes of rotation

（ISO 230-7:2006，IDT）

（送审稿）

XXXX-XX-XX 发布　　XXXX-XX-XX 实施

中华人民共和国国家质量监督检验检疫总局
中国国家标准化管理委员会　发布

LION PRECISION

A Few Well-Known Customers

A Few Well-Known Customers in China

国家机床质量监督检验中心

北京精密机床研究所
沈阳机床集团
昆明机床集团
北京机电院
青海第一机床集团
哈尔滨量具刃具集团

中国国家计量科学研究院

北京精密机床研究所
沈阳机床集团
昆明机床集团
北京精雕机床集团
上海机床厂集团
无锡机床集团
富士康科技集团

股份公司和民营企业
北京，上海，天津，广东，浙江，江苏，陕西，河南，湖北，辽宁等地大学

LION PRECISION

Spindle Error Analyzer Basics

LION PRECISION

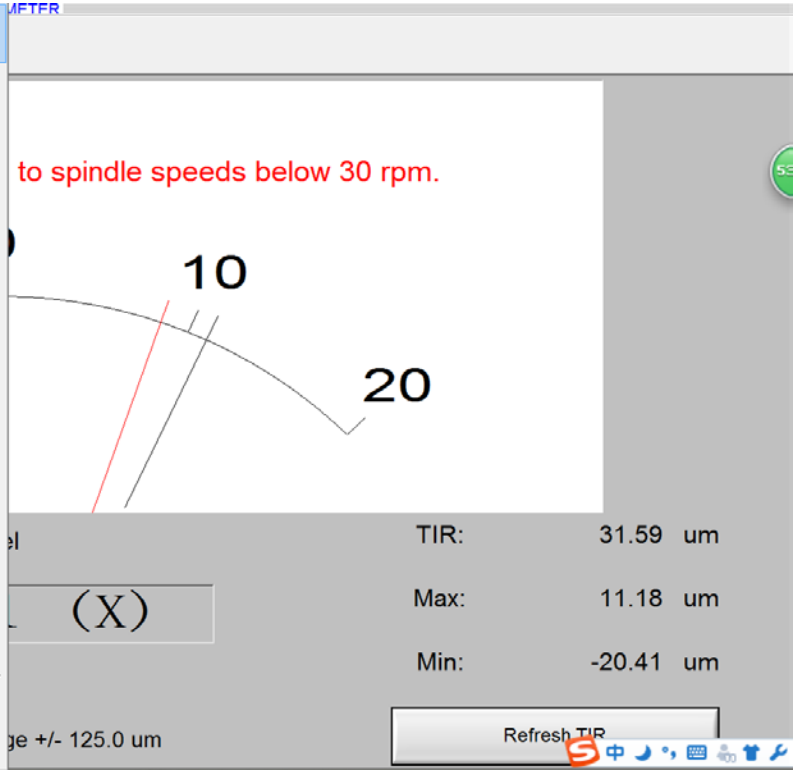
Spindle Error Analyzer Basics

- Dynamic Spindle Analyzer
  - **Drift** (ISO230-3)
  - **Shift** (speed-induced axis shift
  - Axis of rotation error motion
  - **Synchronous**
  - **Asynchronous**
  - **Total**

LION PRECISION

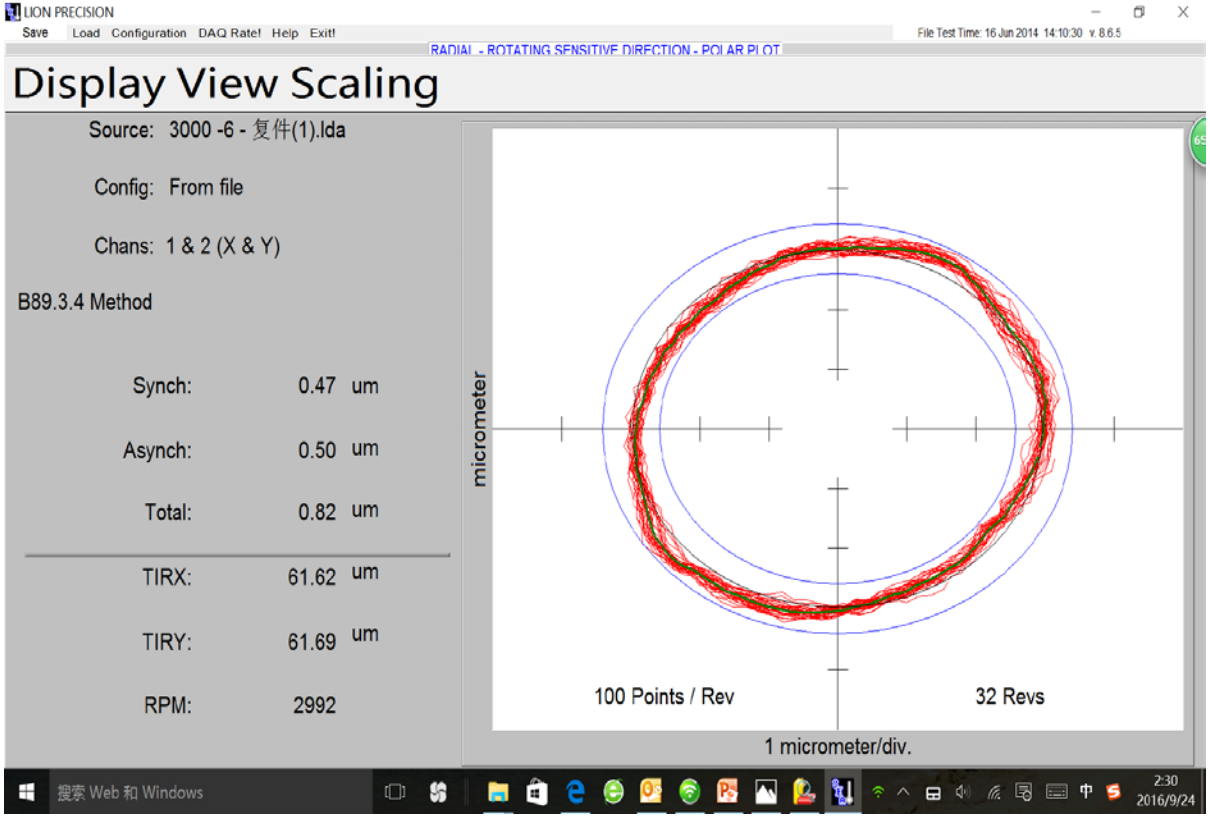
Spindle Error Analyzer Basics

- Radial - Rotating Sensitive
- Radial - Fixed Sensitive
- Axial
- Tilt - Fixed Sensitive
- Thermal
- Shift vs.RPM
- Donaldson Reversal
- Automated Measurements
- FFT
- Oscilloscope
- Probe Meter
- Configuration Displays
- Logo

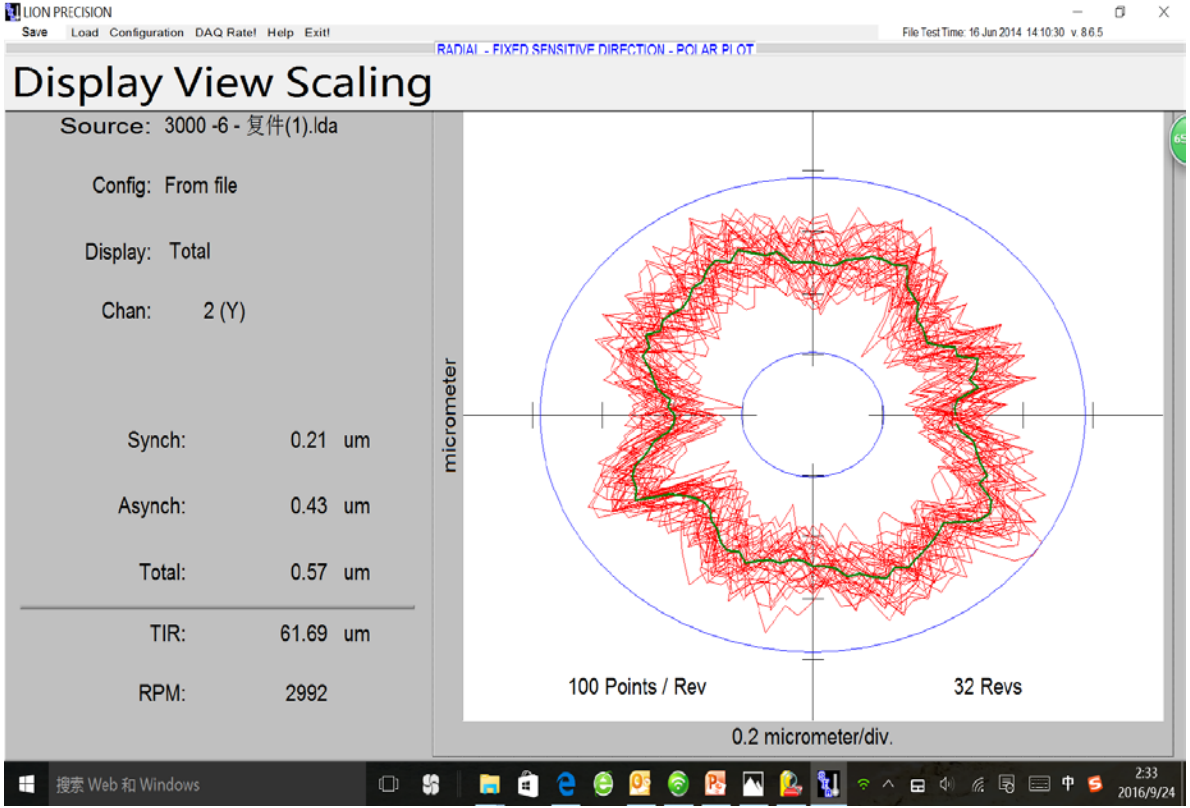


LION PRECISION

Rotating Sensitive Direction

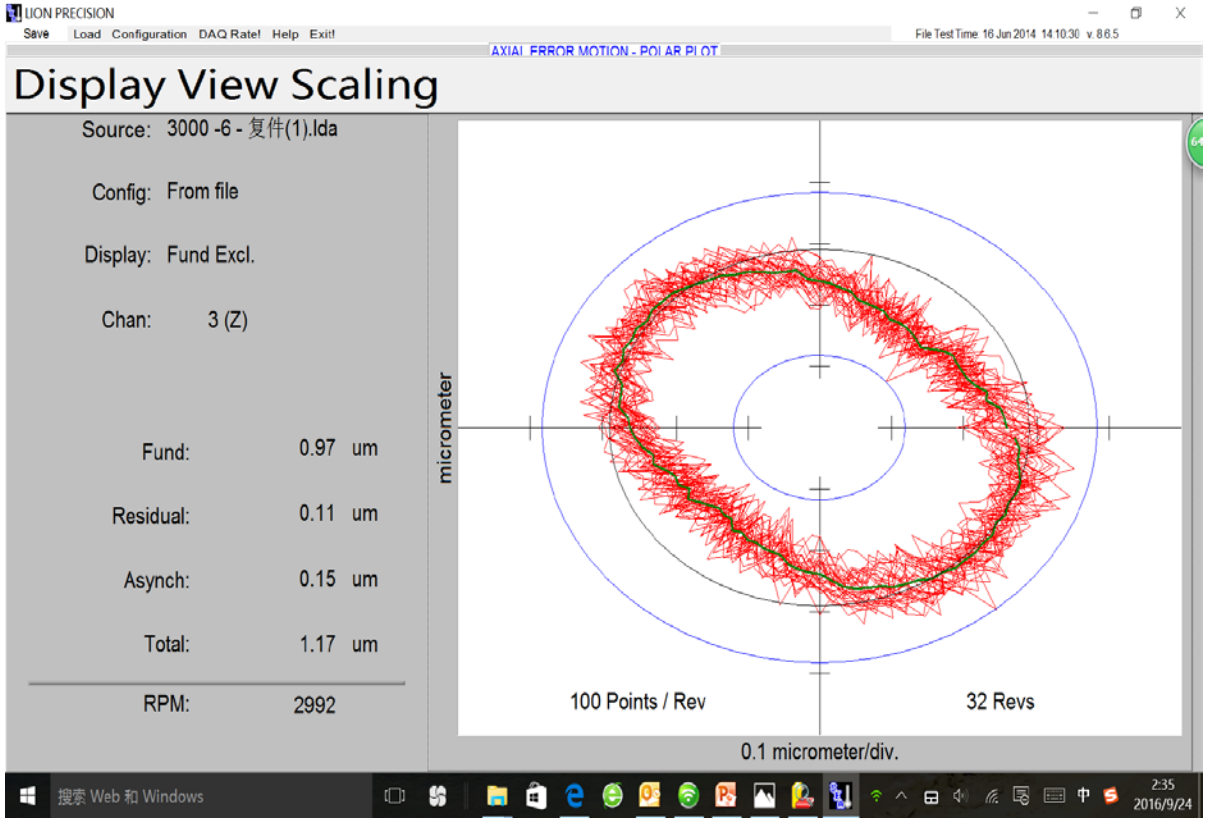


Fixed Sensitive direction



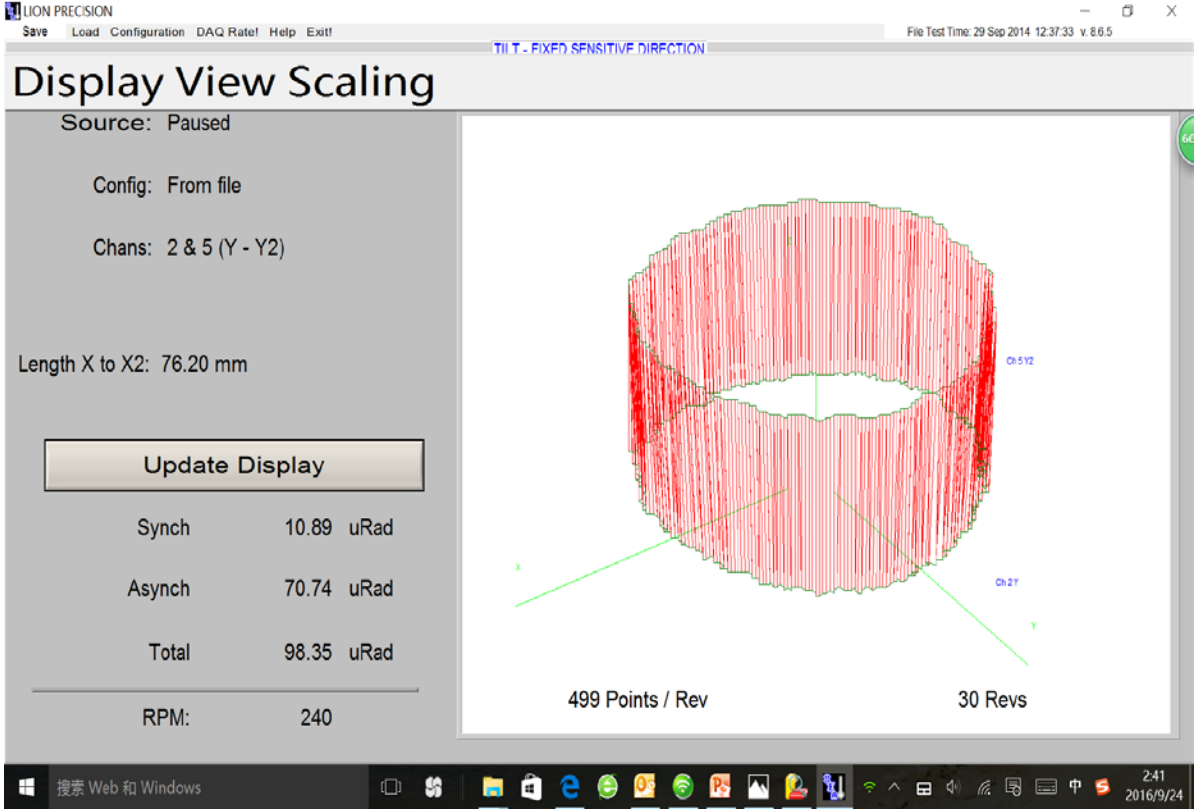
LION PRECISION

Axial Error Motion



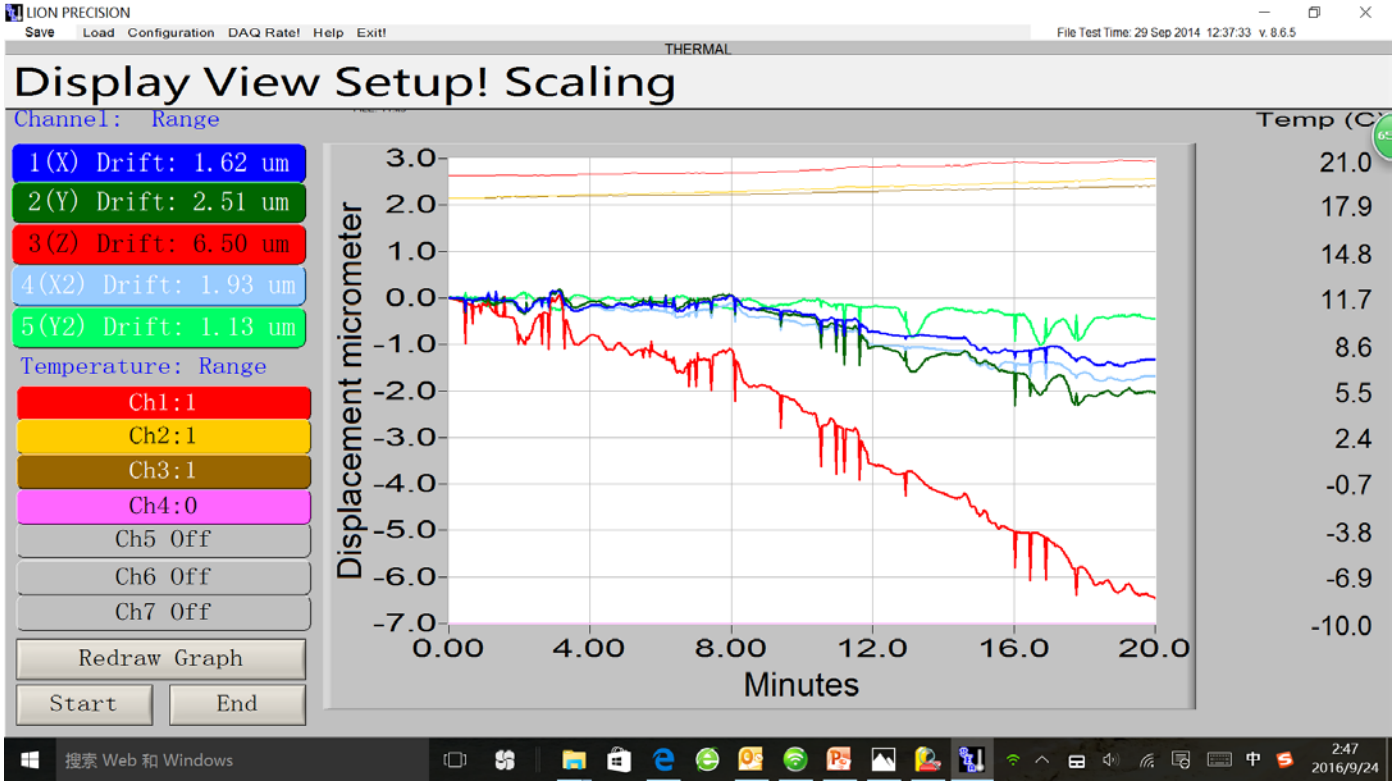
LION PRECISION

Tilt Error Motion



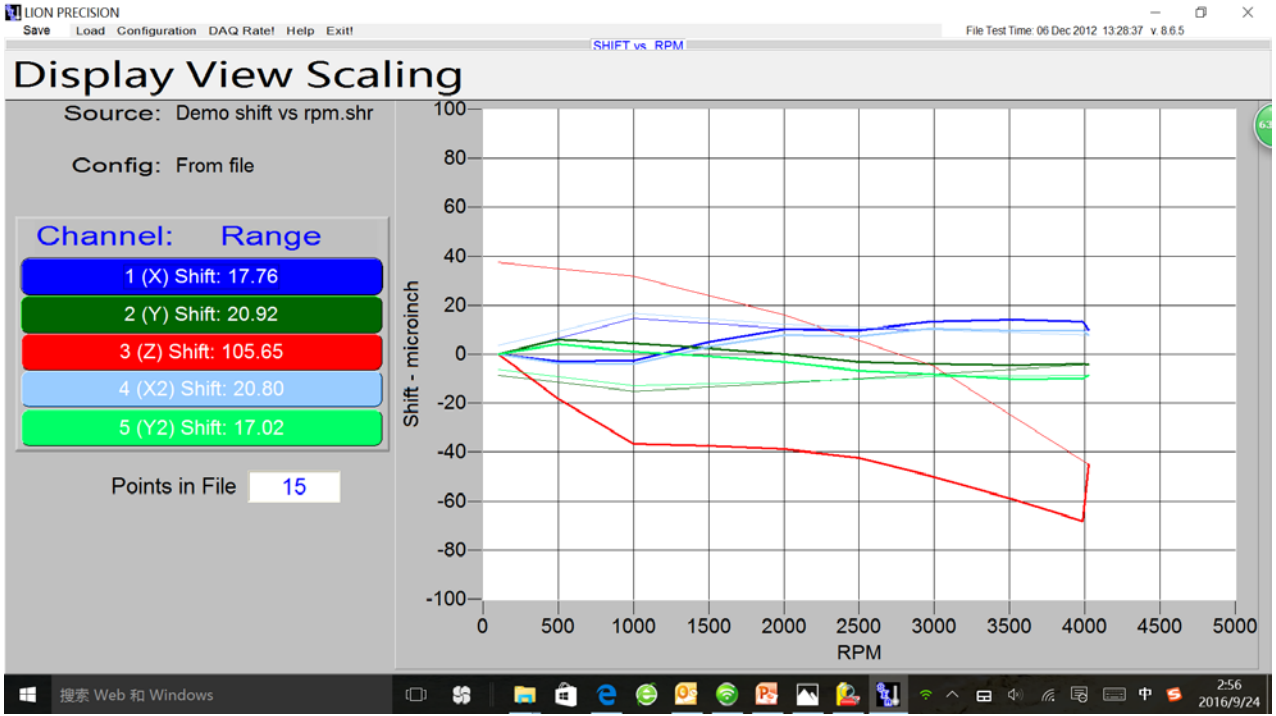
LION PRECISION

Thermal (ISO230-3)



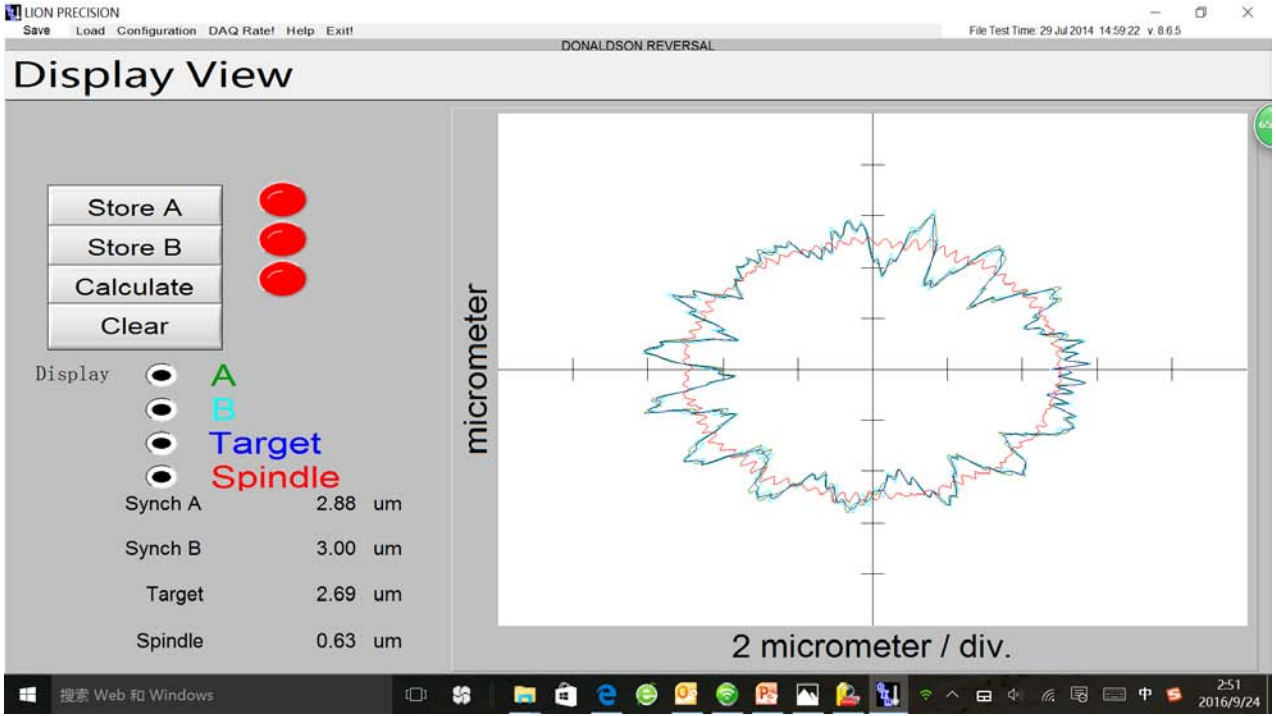
LION PRECISION

Shift vs RPM

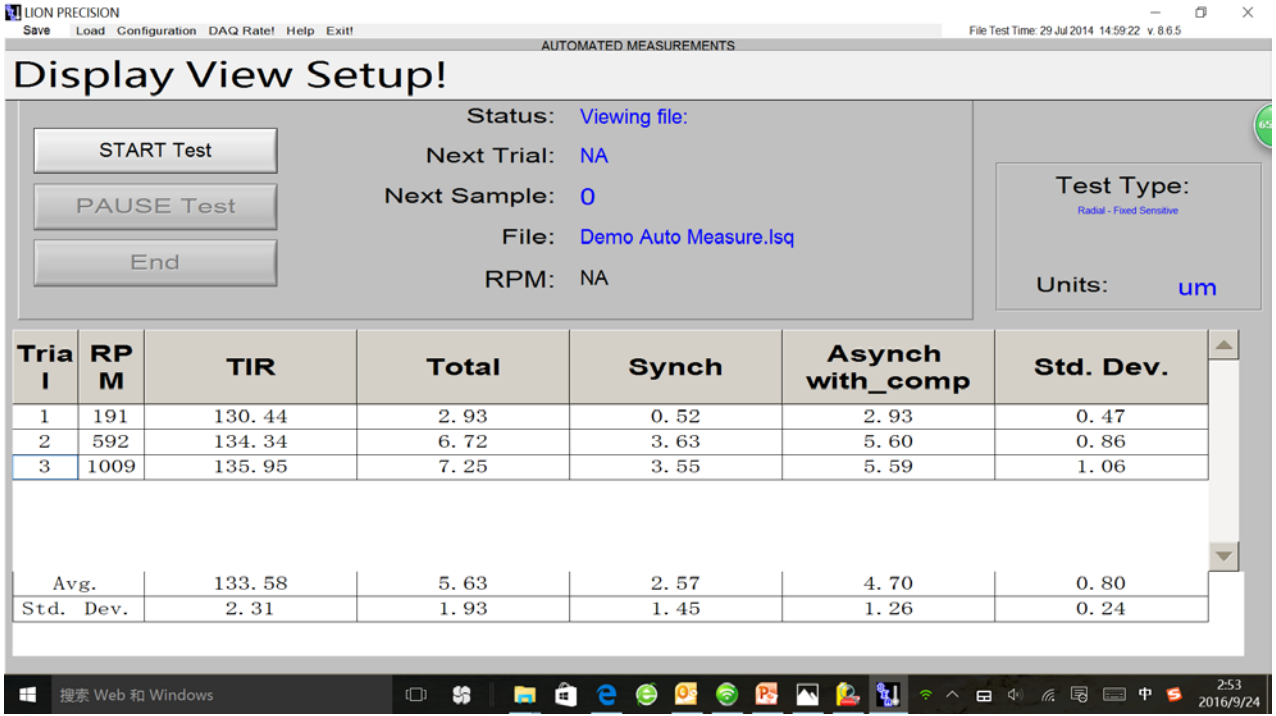


LION PRECISION

Donaldson Reversal

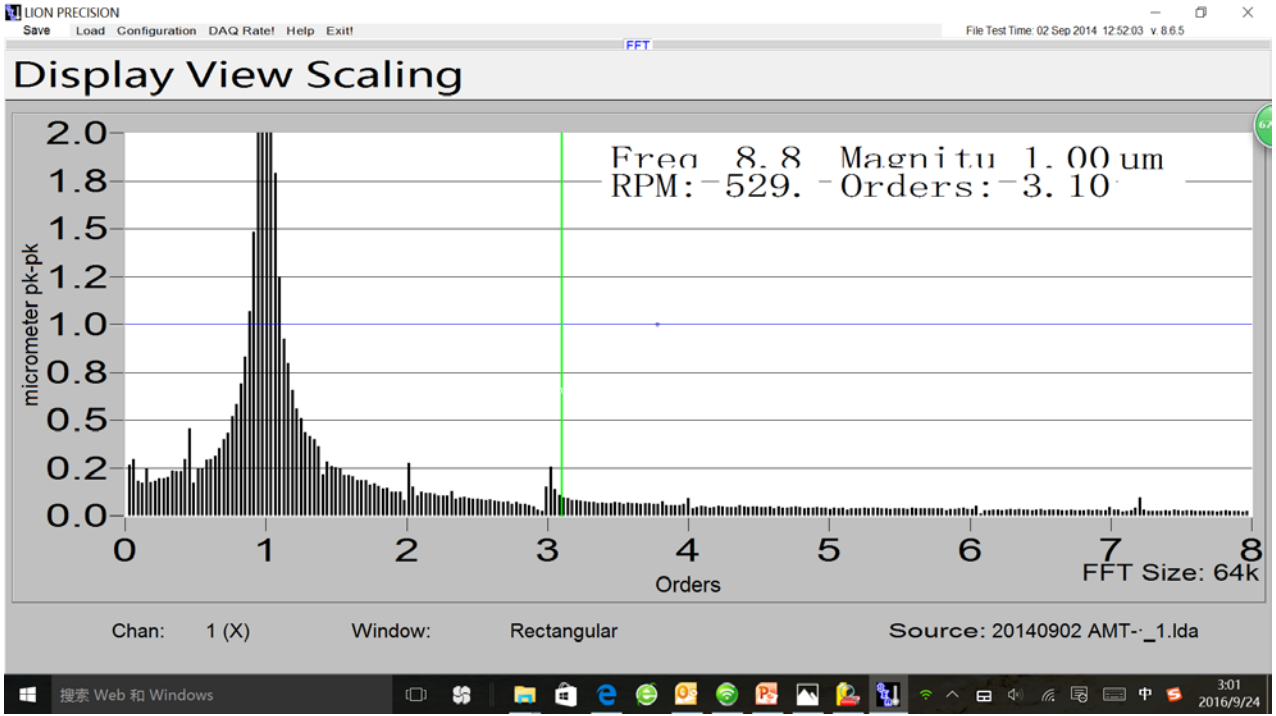


Automated Measurements



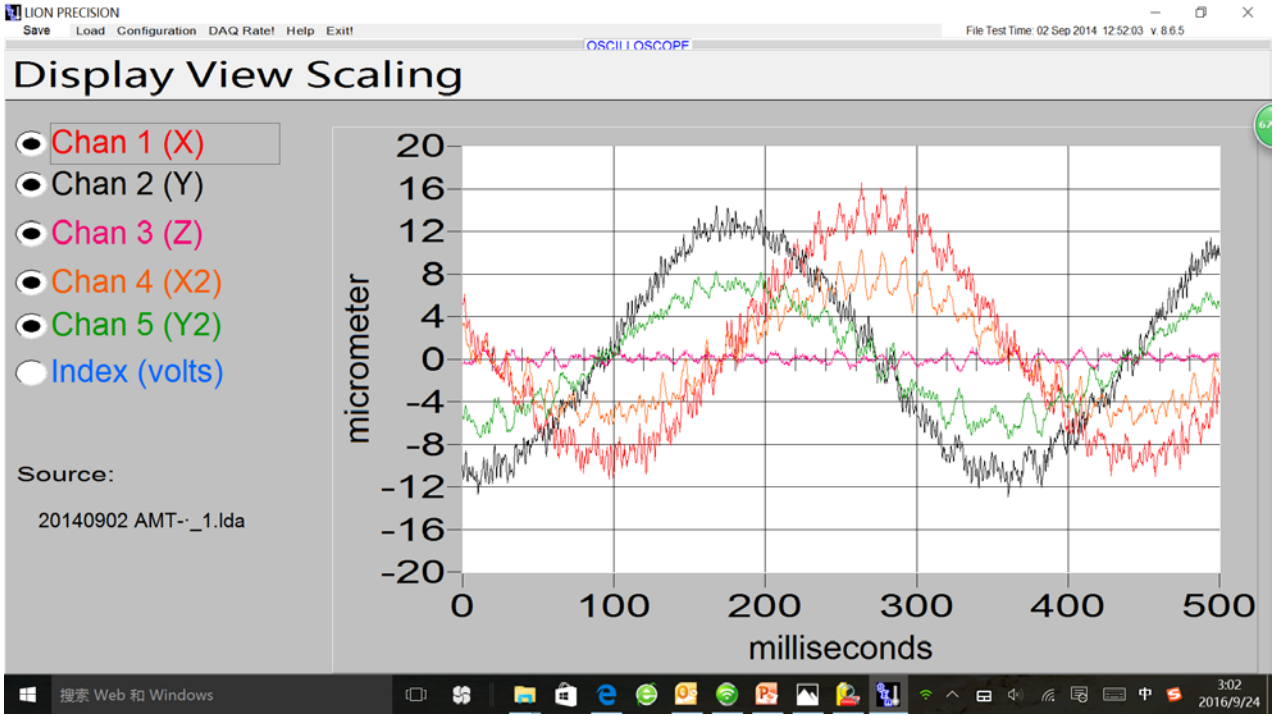
LION PRECISION

FFT



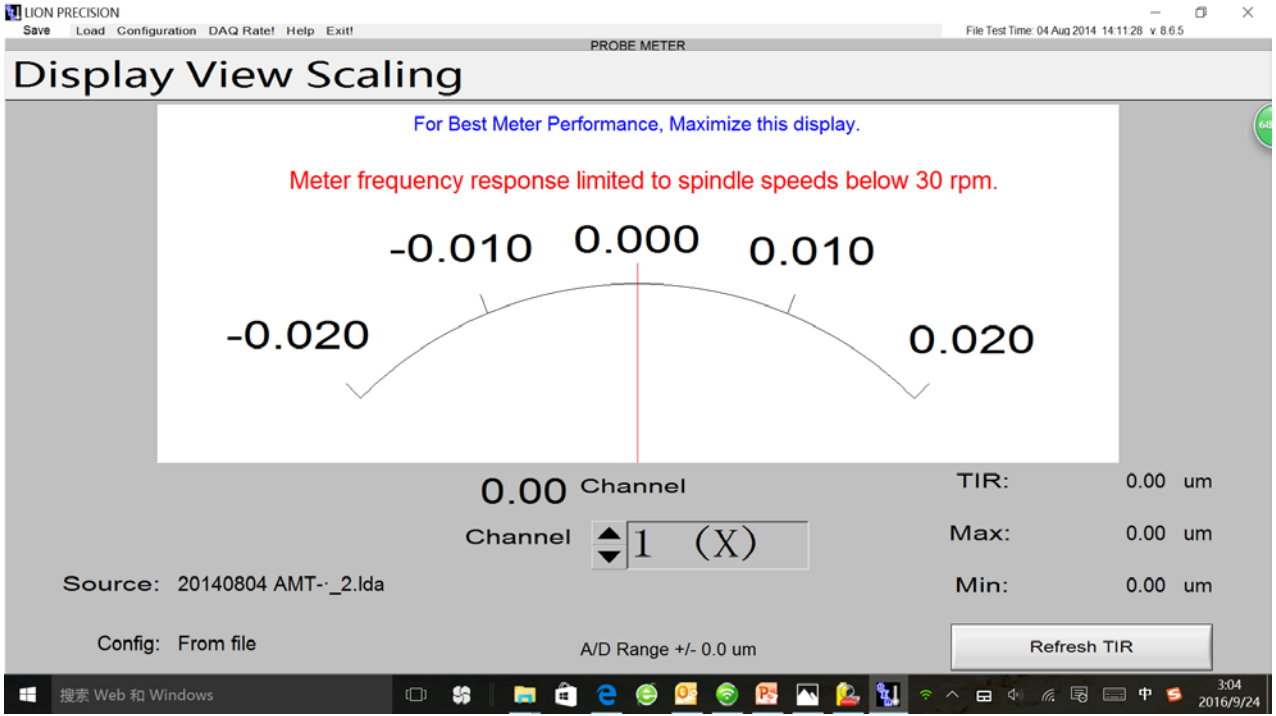
LION PRECISION

Oscilloscope



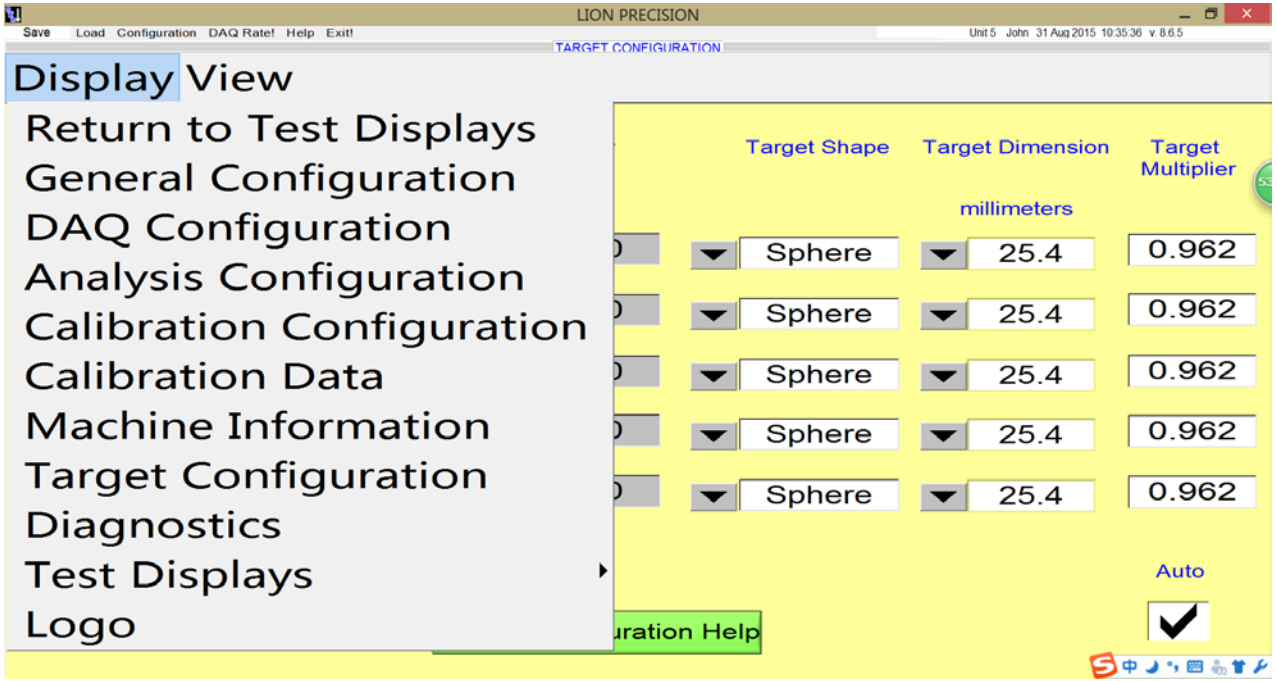
LION PRECISION

Probe Meter



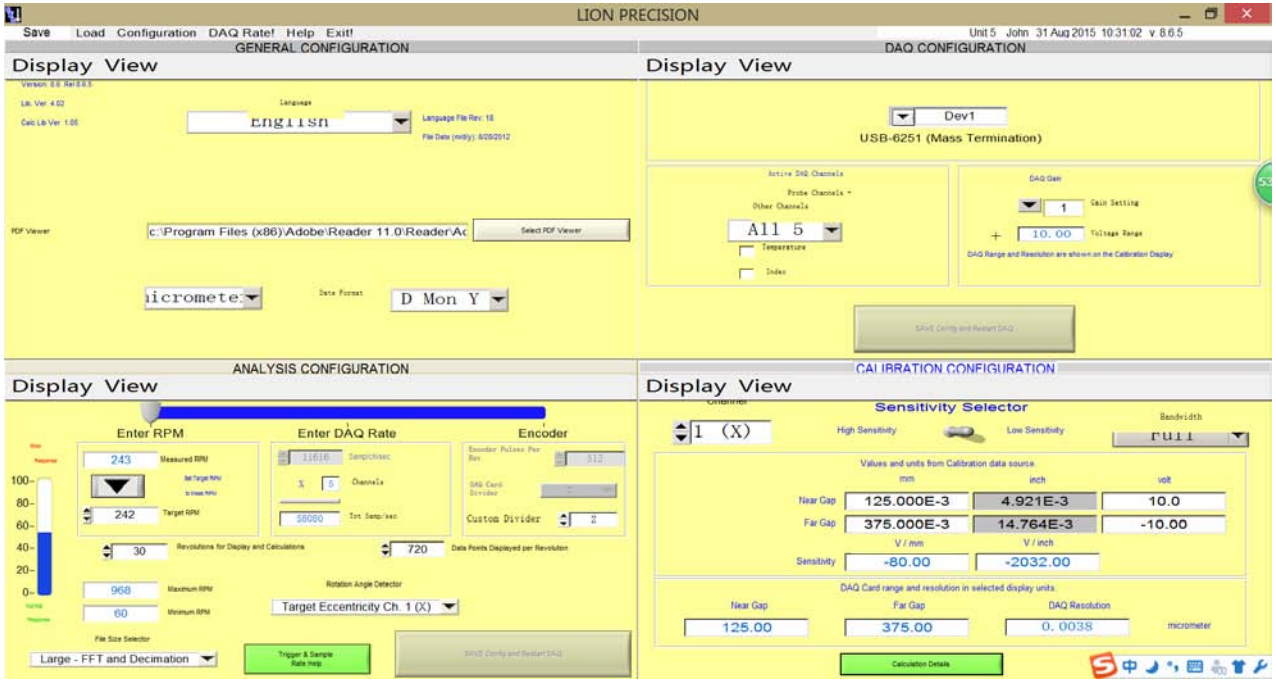
LION PRECISION

Spindle Error Analyzer Basics



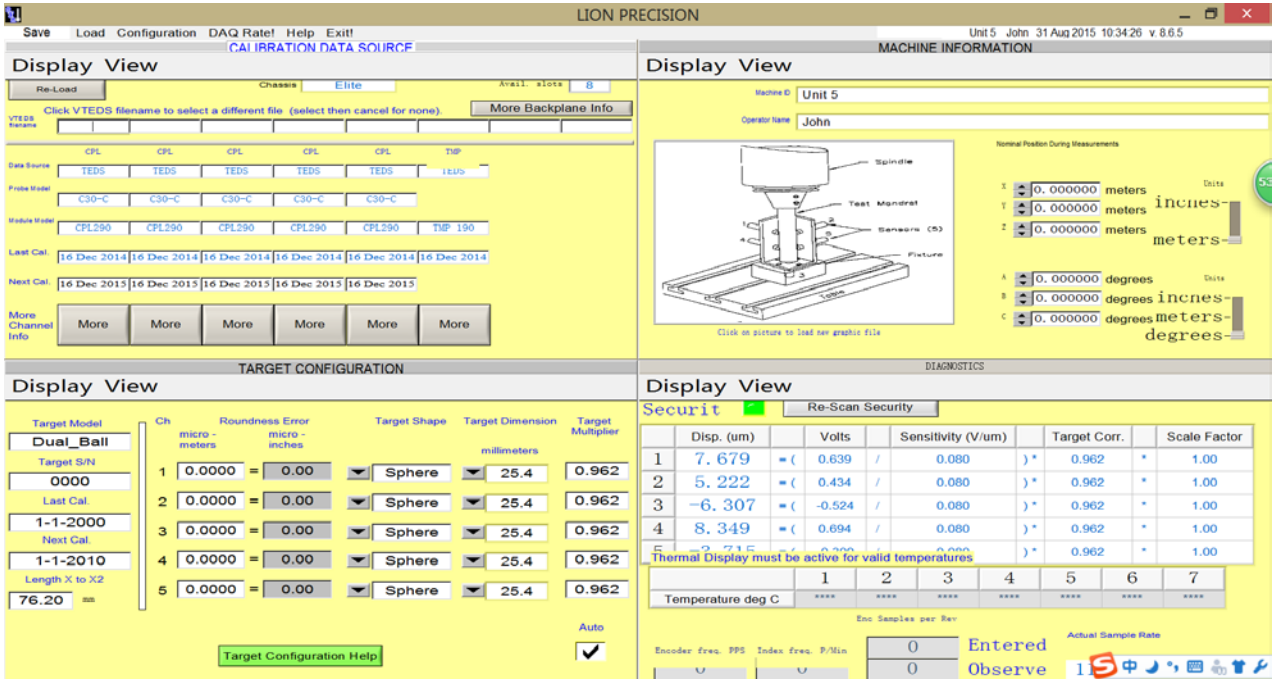
LION PRECISION

Spindle Error Analyzer Basics



LION PRECISION

Spindle Error Analyzer Basics



Spindle Error Analyzer Basics

- Development was Collaboration between UNCC (北卡罗来纳大学) and Lion Precision
- Now on Version 8.6.5 of software
- Supports Windows 8
- Supports ISO 230-3 and ISO 230-7

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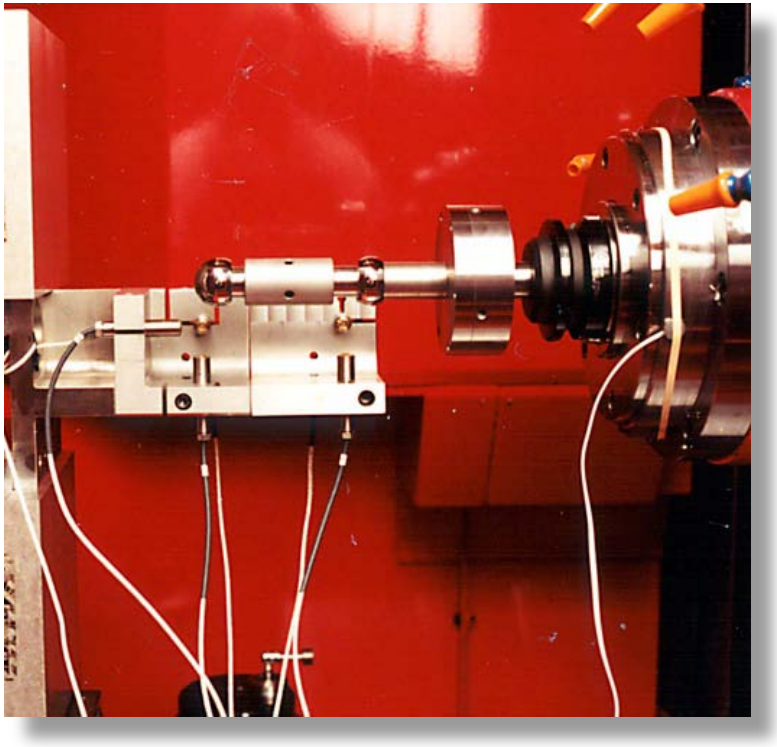
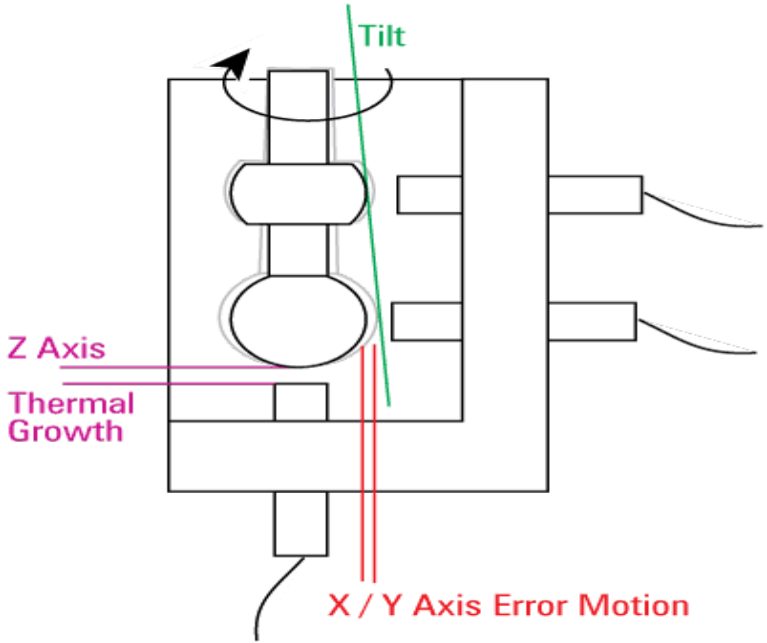
Spindle Error Analyzer (SEA) :HMC



LION PRECISION

Spindle Error Analyzer (SEA): VMC



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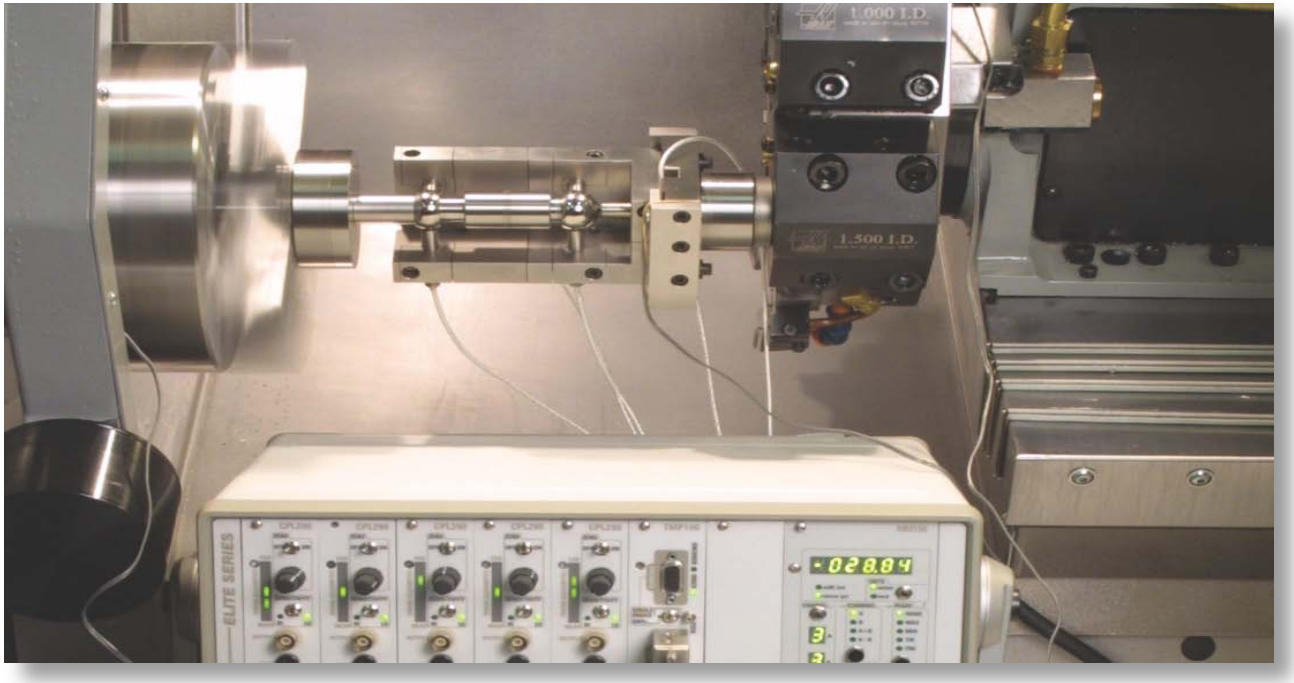
Spindle Error Analyzer (SEA): CNC Lathe



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Thank You

2016.11.04

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