

Sirius DCM Prototype

Desafios Sirius

Estágios Mecânicos de Precisão

Campinas, 06 de novembro de 2015

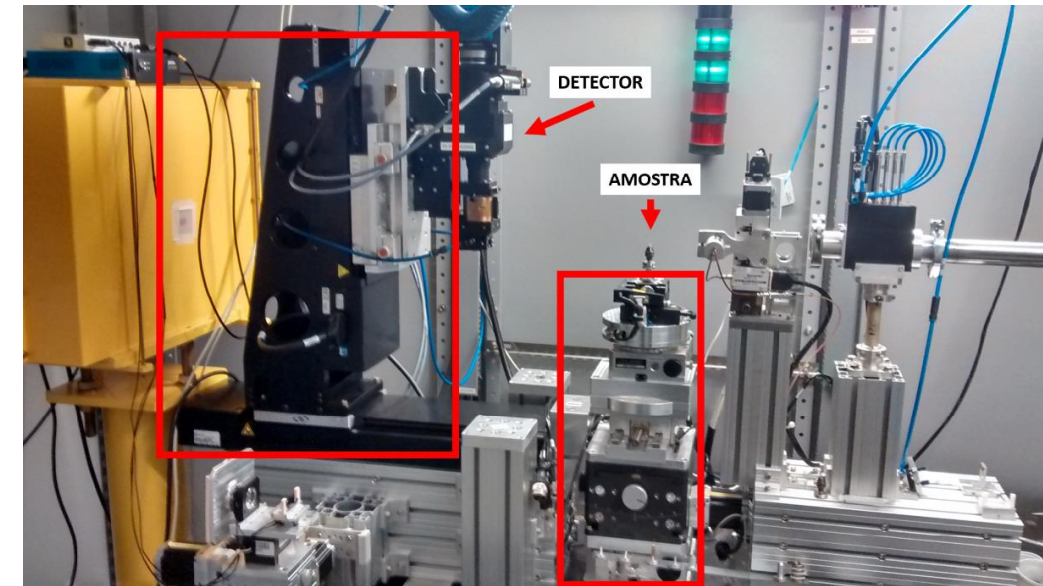
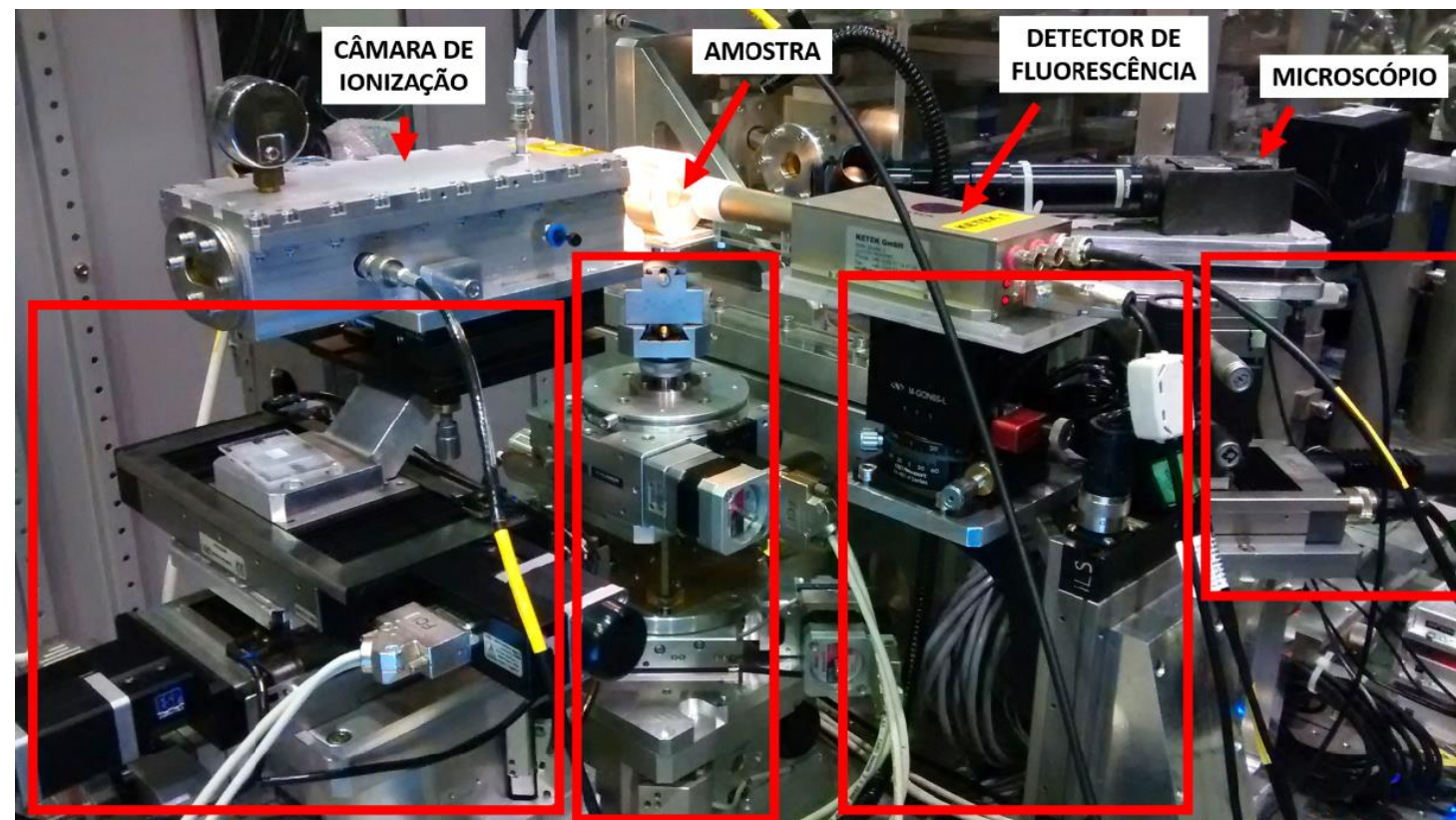
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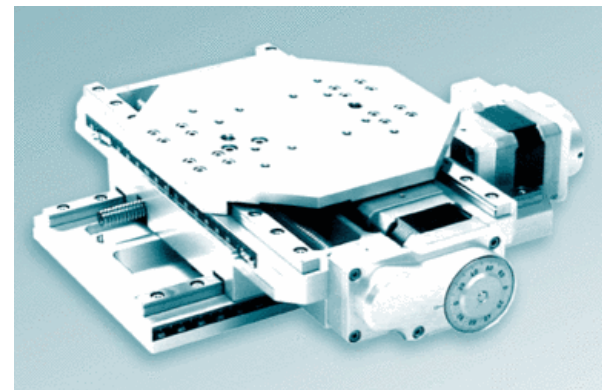
Conteúdo

- Motivação
- Descrição
- Exemplos
- Metrologia
- Conclusões

Motivação



- Desenvolvimento de sistemas de posicionamento, realimentados ou não, com projeto robusto para:
 - resolução, repetibilidade e precisão;
 - estabilidade (mecânica e térmica);
 - qualidade de movimento (controle rigoroso de movimentos parasitas);
 - compromissos adequado entre rigidezes (linear e rotacional) e capacidades de carga;
- Aplicações:
 - movimentos simples
 - movimentos compostos
 - cinemática paralela
 - vácuo



- Tecnologias de atuação:
 - motores de passo e/ou servomotores, associados a fusos roscados, fusos de esferas e worm-gears;
 - atuadores piezoelétricos;
 - atuadores de Lorentz;
 - motores lineares;
 - direct drives;
- Tecnologias de guia:
 - guias e patins convencionais (rolos ou esferas)
 - rolamentos a ar
 - sistemas elásticos

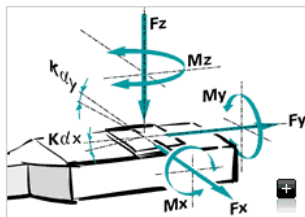
Exemplos Comerciais

[Fonte: PI-Micos]

<< Linear Stage LS-65 >>

DESCRIPTION

The NEW linear stage LS-65 features a compact, low profile construction for high strength in a lightweight package. Typical applications for this measuring stage are inspection stations and micro-manipulators for laser [learn more...](#)



KEY FEATURES

- Travel range up to 102 mm (4")
- Uni-directional repeatability down to 0.3 μm
- Maximum speed 20 mm/sec
- Load capacity up to 6 kg
- Integrated limit switches
- [Vacuum Datasheet](#)

FACTS

Load Characteristics	Fx (N)	Fy (N)	Fz (N)	Mx (Nm)	My (Nm)	Mz (Nm)	kax ($\mu\text{rad/Nm}$)	kay ($\mu\text{rad/Nm}$)
DC-B-026	50	15	60	7.5	7.5	7.5	140	80
2Phase-045	50	15	60	7.5	7.5	7.5	140	80
2Phase-042	50	15	60	7.5	7.5	7.5	140	80

TECHNICAL DATA

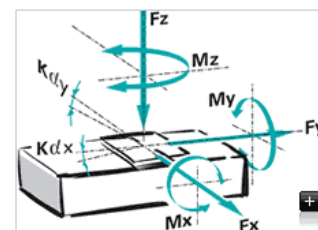
Travel range (mm)	26	52	102
Straightness / Flatness (μm)	± 2	± 4	± 8
Pitch (μrad)	± 70	± 90	± 130
Yaw (μrad)	± 70	± 80	± 100
Weight (kg)	0.6	0.7	0.9

Motor (Pitch 1mm)	DC-B-026	2Phase-045
Speed max. (mm/sec)	20	20
Resolution calculated (μm)	0.5 (RE)	5 (FS)
Resolution typical (μm)	0.5	0.2
Bi-directional Repeatability (μm)	± 5	± 5
Uni-directional Repeatability (μm)	0.5	0.3
Nominal Current (A)	0.98	1.2
Voltage Range (V)	24	
Accuracy	on request	
Velocity Range (mm/sec)	0.001 ... 20	
Material	Aluminium, black anodized	

<< Linear Piezo Stage LPS-65 >>

DESCRIPTION

The LPS-65 is a low profile linear stage utilizing synchronized piezo stepping motor for increased precision and load capacity. The big platform and the cross roller bearing are guaranteeing a smooth and high accurate movement... [learn more...](#)



KEY FEATURES

- Piezo driven stepping motor with subnanometer resolution
- Travel range up to 52 mm (2")
- Uni-directional repeatability down to 0.005 μm
- Maximum speed 10 mm/sec
- Load capacity up to 2 kg
- Encoder resolution 0.5 nm
- Integrated linear scale

FACTS

Load Characteristics	Fx (N)	Fy (N)	Fz (N)	Mx (Nm)	My (Nm)	Mz (Nm)	kax ($\mu\text{rad/Nm}$)	kay ($\mu\text{rad/Nm}$)
PM-012	50	10	20	2.1	1.7	2.1	100	80

TECHNICAL DATA

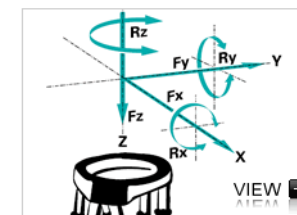
Travel range (mm)	13	26	52
Straightness / Flatness (μm)	± 1	± 2	± 3
Pitch (μrad)	± 30	± 40	± 80
Yaw (μrad)	± 30	± 40	± 70
Weight (kg)	0.3	0.4	0.6

Motor	PM-012	
Linear scale		LS-072
Speed max. (mm/sec)	10	
Resolution calculated (μm)		0.0005
Resolution typical (μm)		0.002
Bi-directional Repeatability (μm)		± 0.005
Uni-directional Repeatability (μm)		0.005
Nominal Current (A)		
Accuracy	on request	
Material	Aluminium, black anodized	

<< Hexapod HP-550 >>

DESCRIPTION

The HP-550 Hexapod system can perform motions in all six degrees of freedom. Due to the parallel kinematic design architecture, the system can achieve a much higher stiffness than a conventional stages stack. [Learn more...](#)



FACTS

Load Characteristics	Fx (N)	Fy (N)	Fz (N)
DC-B-027	300	300	500

TECHNICAL DATA

Travel Range	Linear X, Y, Z (mm) Rotation Rx, Ry, Rz (°)	100 x 100 x 100 * 40, 40, 60 *
Motor (Pitch 1 mm)	DC-B-027	
Speed max. X, Y, Z (mm/sec)	2	
Speed max. Rx, Ry, Rz (°/sec)	1	
Velocity Range (mm/sec)	0.01 ... 2 **	
Velocity Range (°/sec)	0.001 ... 1 **	
Weight (kg)	33	
Bi-directional Repeatability	Linear X, Y, Z (μm) Rotation Rx, Ry, Rz (°)	$\pm 4, \pm 4, \pm 3$ ± 0.002
Resolution calc. without load	Linear X, Y, Z (μm) Rotation Rx, Ry, Rz (°)	0.016 depending on the position of the pivot point
Resolution typical without load	Linear X, Y, Z (μm) Rotation Rx, Ry, Rz (°)	0.5 0.00057
Current (A)	0.9	
Voltage Range (V)	24	
Stiffness, theoretical Kx, Ky, Kz (N/ μm)	on request	
Material	Stainless steel, Aluminum black anodized	

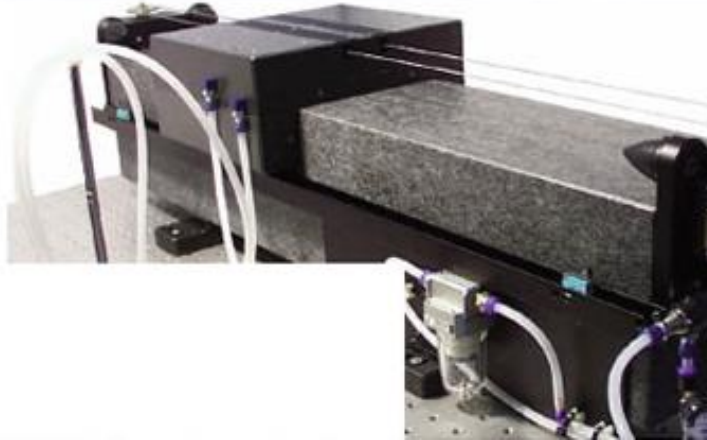
Exemplos Comerciais

AIR BEARING

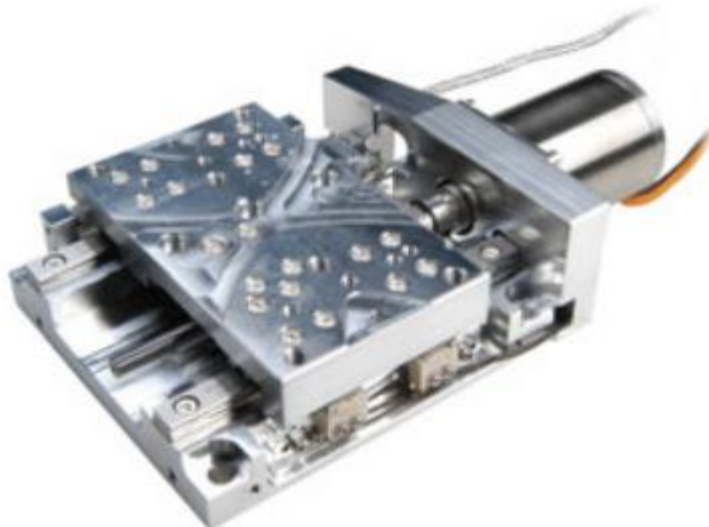
Test and Calibration Systems

Air bearing linear axis with a travel range of 600 mm. Used for the measurement of high precision linear scales, this system requires a positioning stage with optimized accuracies (minimal pitch, yaw and roll angle).

The system consists of a precision lapped granite plate and an aluminum carrier. The custom developed air bearing guiding system guarantees maximum accuracy and guiding stiffness.



Vácuo



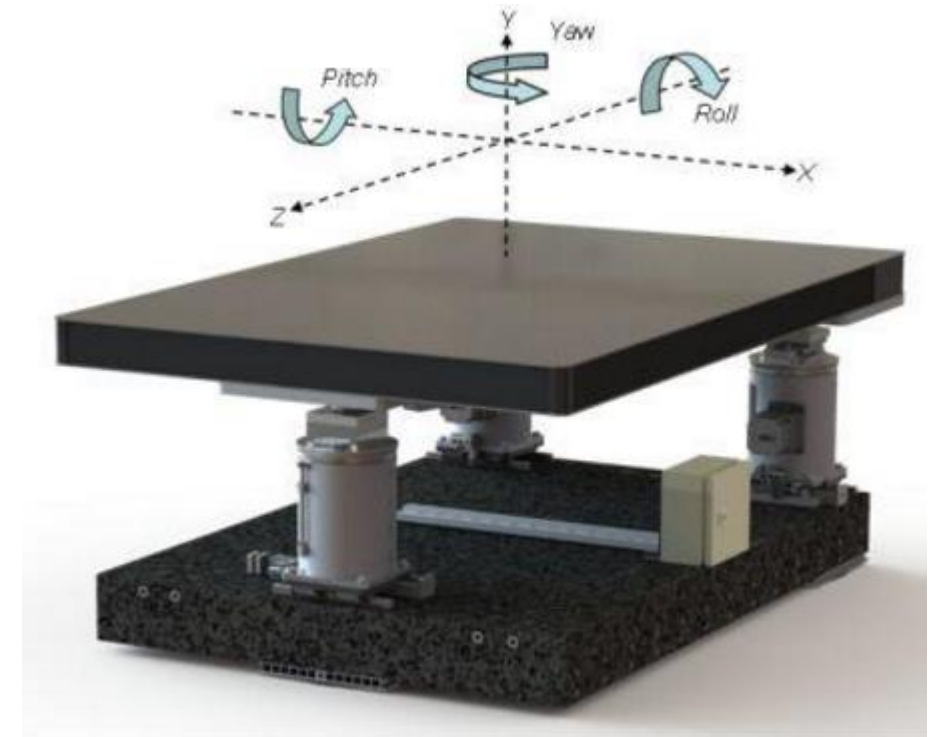
Cinemática paralela



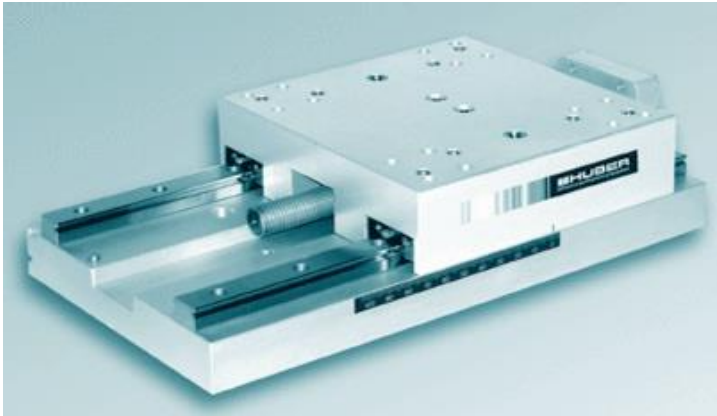
<http://www.pimicos.com/web2/en/1,3,000,robot.html>

Exemplos Comerciais

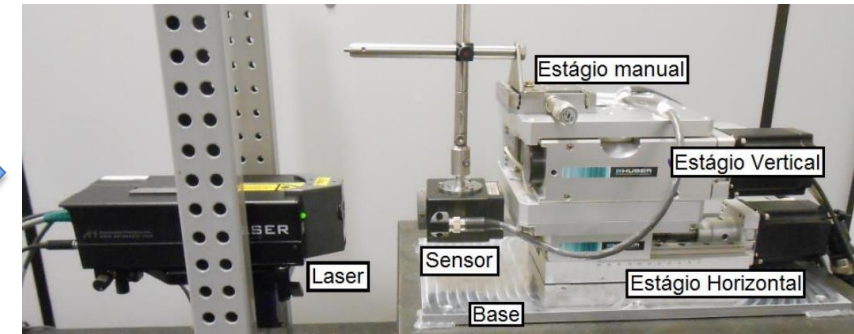
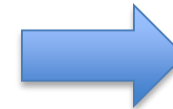
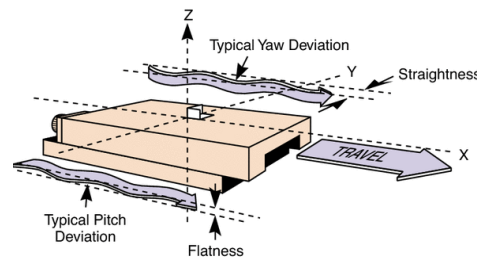
Cinemática paralela aplicada a mesas experimentais:



• Estágios lineares:



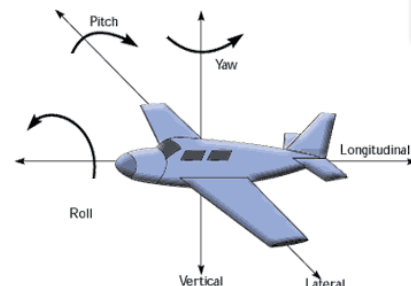
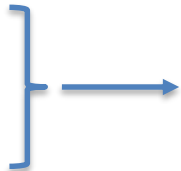
movimentos
parasitas



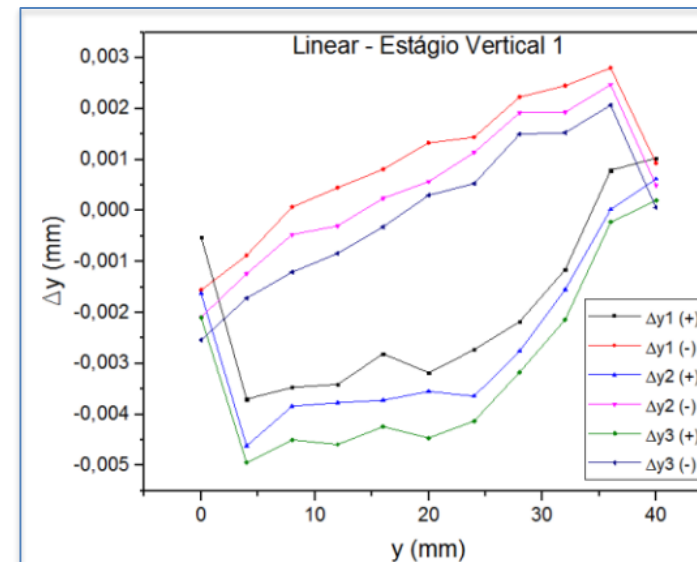
[Fonte: Huber]

Caracterização e calibração com interferômetro linear (técnica similar a calibrações de MMCs):

- movimento linear (x)
- movimentos parasitas:
 - retitudes (y e z)
 - movimentos angulares:
 - roll (Rx)
 - pitch (Ry)
 - yaw (Rz)



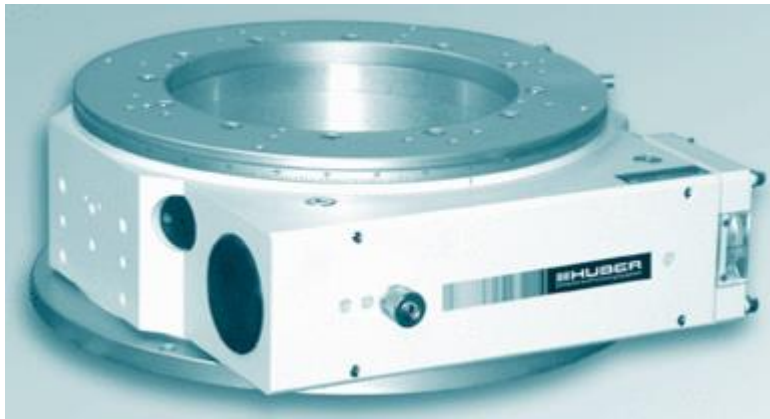
Exemplo



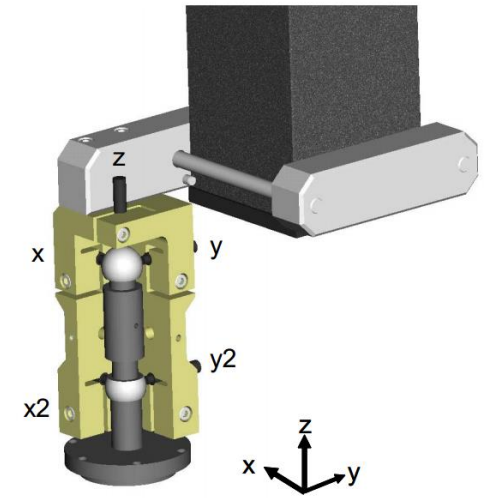
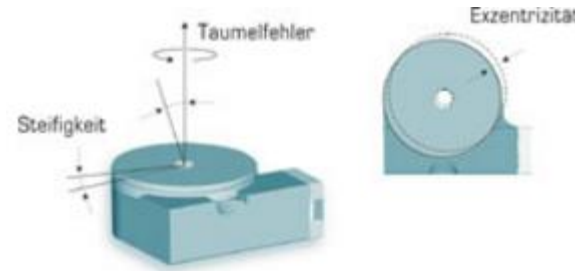
Informações:

- Resolução
- Repetibilidade (unidirecional e bidirecional)
- Precisão

• Estágios rotativos:

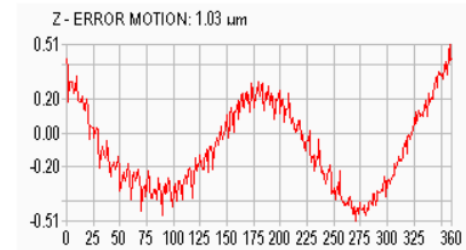
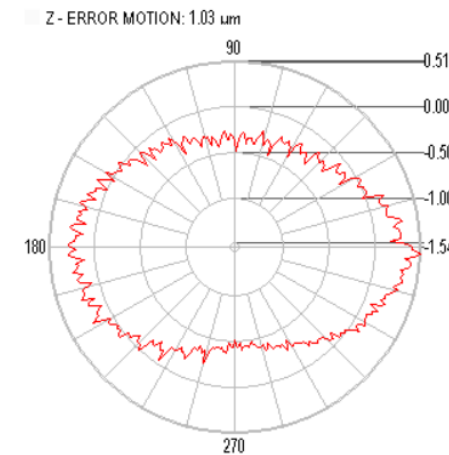
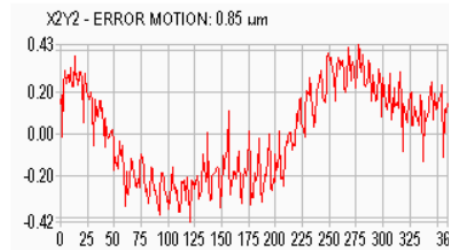
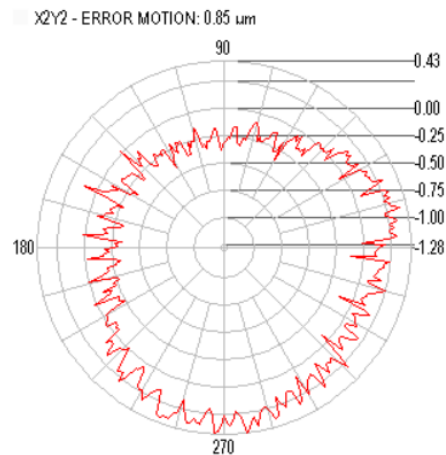


movimentos
parasitas



Caracterização com sensores
capacitivos e esferas de referência:

- excentricidade (x e y)
- oscilação axial (z)
- oscilação angular (wobble)

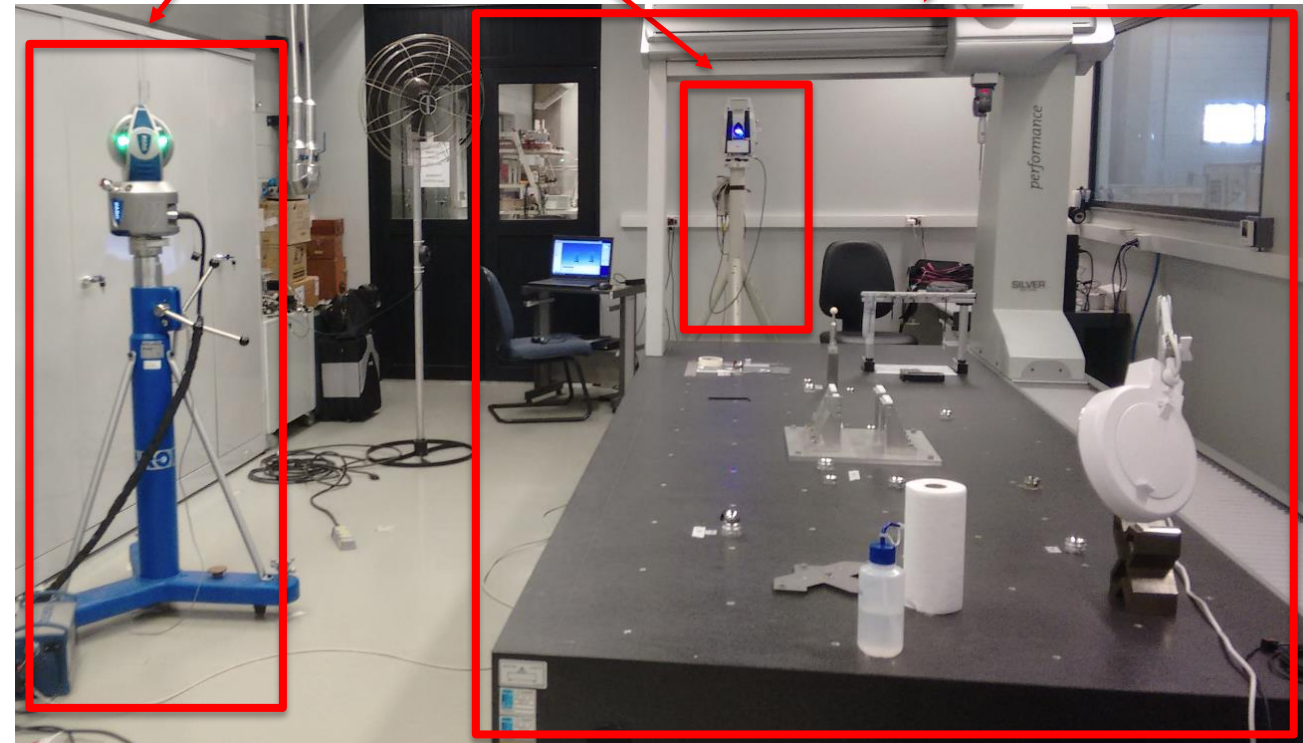
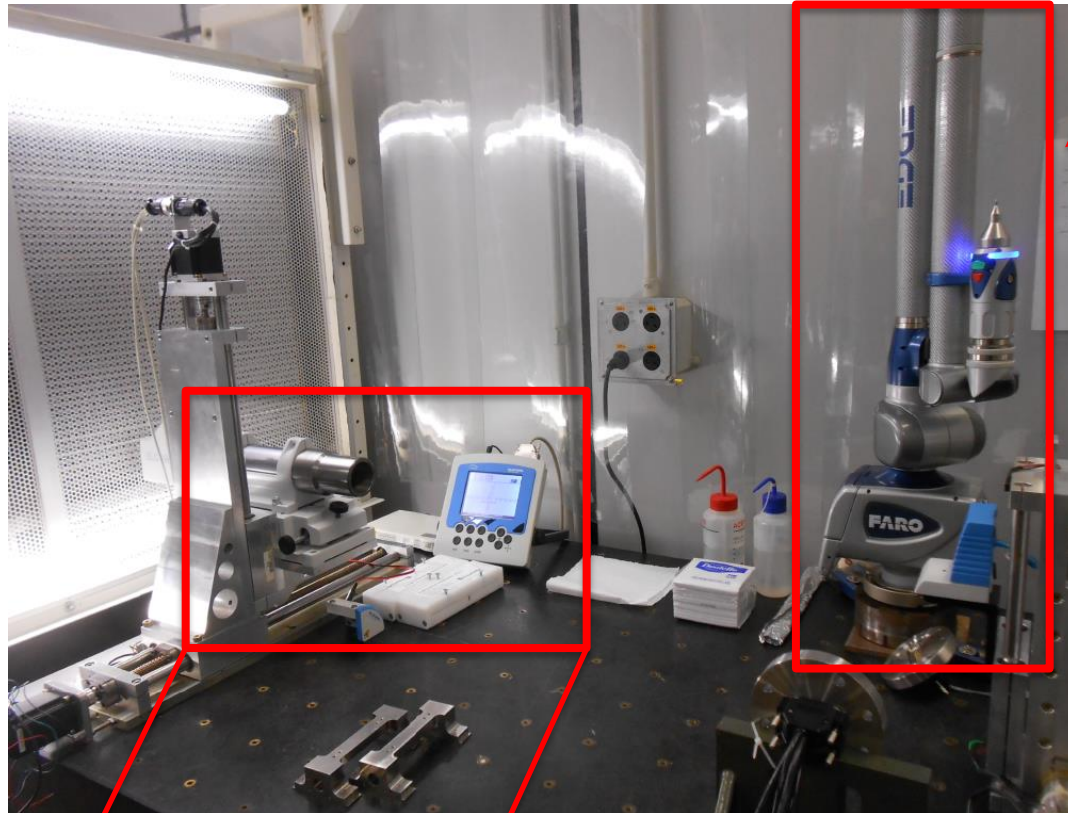


Metrologia

Braço de medição

Laser trackers

MMC



Autocolimador

- Buscamos parceiros nacionais para o fornecimento de estágios mecânicos de posicionamento para as mais variadas aplicações.
- A questão mais fundamental é a prova do domínio de tecnologias para o desenvolvimento de projetos robustos, que sigam boas práticas de engenharia e conceitos de engenharia de precisão e metrologia.
- Há virtualmente um potencial infinito de inovação, em campos que passam por: usinagem de precisão, tecnologia em vácuo e rigidez dinâmica de controle, para mencionar apenas alguns.
- É importante que as empresas adequem suas propostas a ganhos de capacidade real, que levem a um crescimento e ganho de competitividade no Brasil e/ou no exterior.

Obrigado!