

Motion Control & Positioning Solutions for Semiconductor Manufacturing

22 NM → 14 NM → 7 NM NODE

HIGH PRECISION @ HUGE TRAVEL RANGES

UPTIME
24/7 APPLICATION

INSTANT TECHNICAL FIELD SERVICE

COST OF OWNERSHIP

<< REPAIR CYCLE TIME

RELIABILITY

DUV/EUV/DIRECT E-BEAM WRITING

CLEAN ROOM COMPATIBILITY

“There is not a Single Modern Chip in Mass Production, where PI has not been involved in its Manufacturing or Testing Process.

It is PI’s high priority to contribute to the long-term development and success of the global semiconductor industry”.

Dr. Karl Spanner, President of Physik Instrumente

Why Rely on PI?

Reliability & Confidence

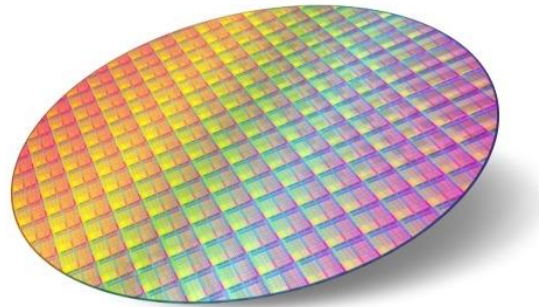
PI serves all major semiconductor equipment manufacturers for

- Reticle positioning
- Objective positioning
- Wafer positioning
- Inspection tools

Passion for Technology

... is in our DNA, and the basis of our reputation for

- High quality engineering
- Manufacturing precision of world-class positioning systems and components



Technological Depth

World leading depth in R&D and production

- From piezo ceramics powder and multilayer actuators
- To highly integrated motion control and positioning systems
- With sub- μm to sub-nanometer precision

Technological Breadth

Very broad range of

- Drive Technologies,
- Sensor Technologies,
- Positioning Technologies
- Control Technologies

The PI Group – Enabling Innovation since 1970

Moving the State-of-Art in Motion Control and Piezo Technology Forward

- 1300+ Employees / 15 Subsidiaries
- Design & Manufacturing in USA, Europe, Asia
- >350 patents
- \$200M Net Sales
- Privately Owned, Independent, Stable
- All Core Technologies Developed In-House
- Vendor to Partnership: OEM Development Together with the Customer

Close to our Customers – All Around the World

America

PI USA
5 Locations

Israel



Asia

PI Japan
PI Shanghai
PI Singapore
PI Taiwan
PI Korea

Europe

PI UK
PI France
PI Italy
PI Benelux
miCos Iberia

Germany

PI HQ Karlsruhe
PI Electronics
PI Ceramic
PI miCos

+ Distributors in Australia, South America, Russia



The Whole is Greater than the Sum of its Parts!

Smarter Motion Control for Semiconductor Manufacturing Equipment

PI Strengths

Nanometer and Sub-Nanometer Precision
Actuators, Stages, Drives and Multi-Axis Systems

ACS Strengths

High-throughput Industrial Motion Controllers, w/
Distributed Intelligence, Deep Integration.
Vast experience in semiconductor applications.



In 2016, PI acquired the majority
of ACS **to join forces**

Combined, PI Mechanics and ACS Controls achieve
exceptional levels of performance & speed,
enabling high yield in industrial processes.

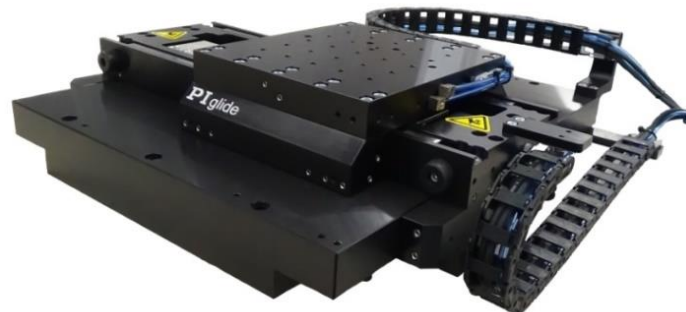
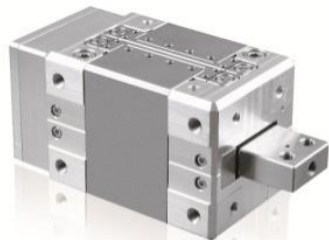
PI + ACS enable the next generation of
demanding applications in semiconductor
manufacturing, including **EUV-L, Wafer & Mask
Inspection, Metrology, Lithography, etc.**

Precision Motion Control and Positioning Solutions

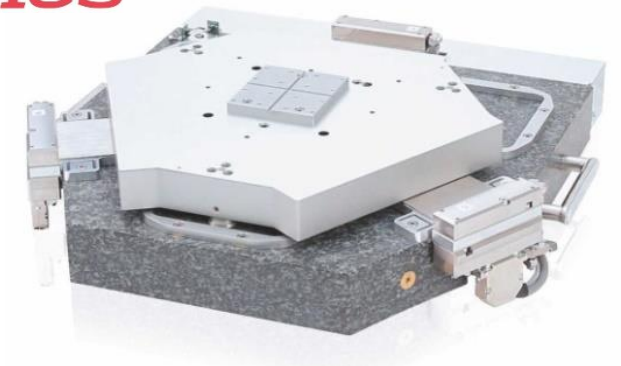
Throughput and Precision for Numerous Applications at Different Levels of Integration

Wide Range of Solutions

- Piezo based actuators
- Piezo motors with nanometer precision and a high feed force
- Multi-axis systems with controllers
- Gantry systems with mechanical, air or hybrid bearings
- Magnetic Levitation: clean and active guiding technology

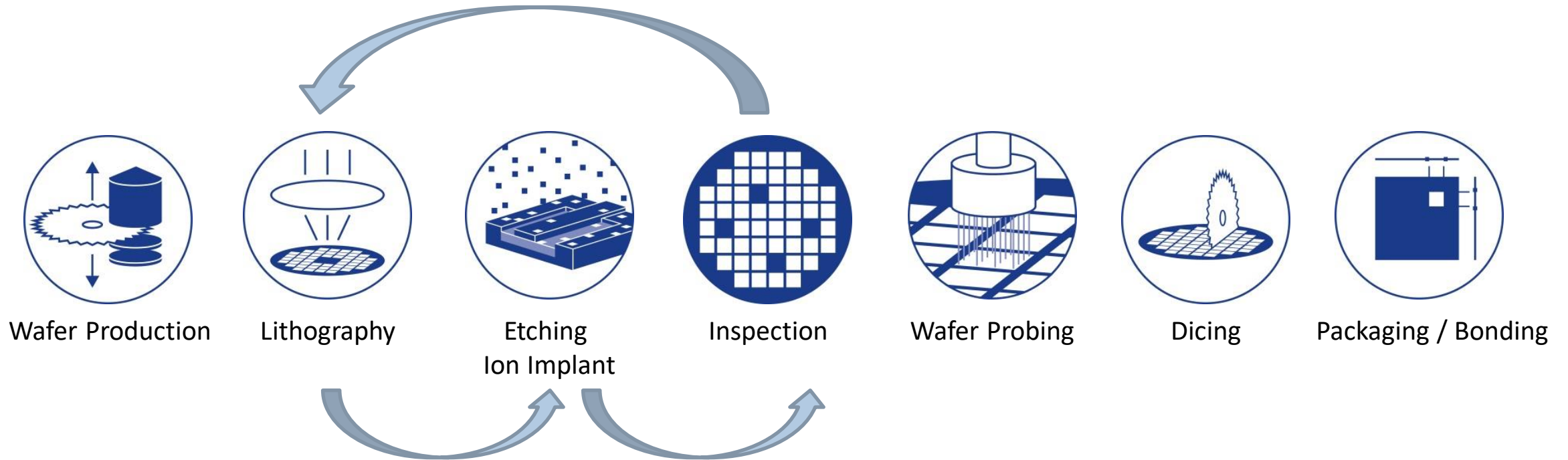


Controlled by
ACS



Countless Tasks for Positioning, Motion Control, Sensing

In Semiconductor Manufacturing – from the Wafer to the Packaged Chip

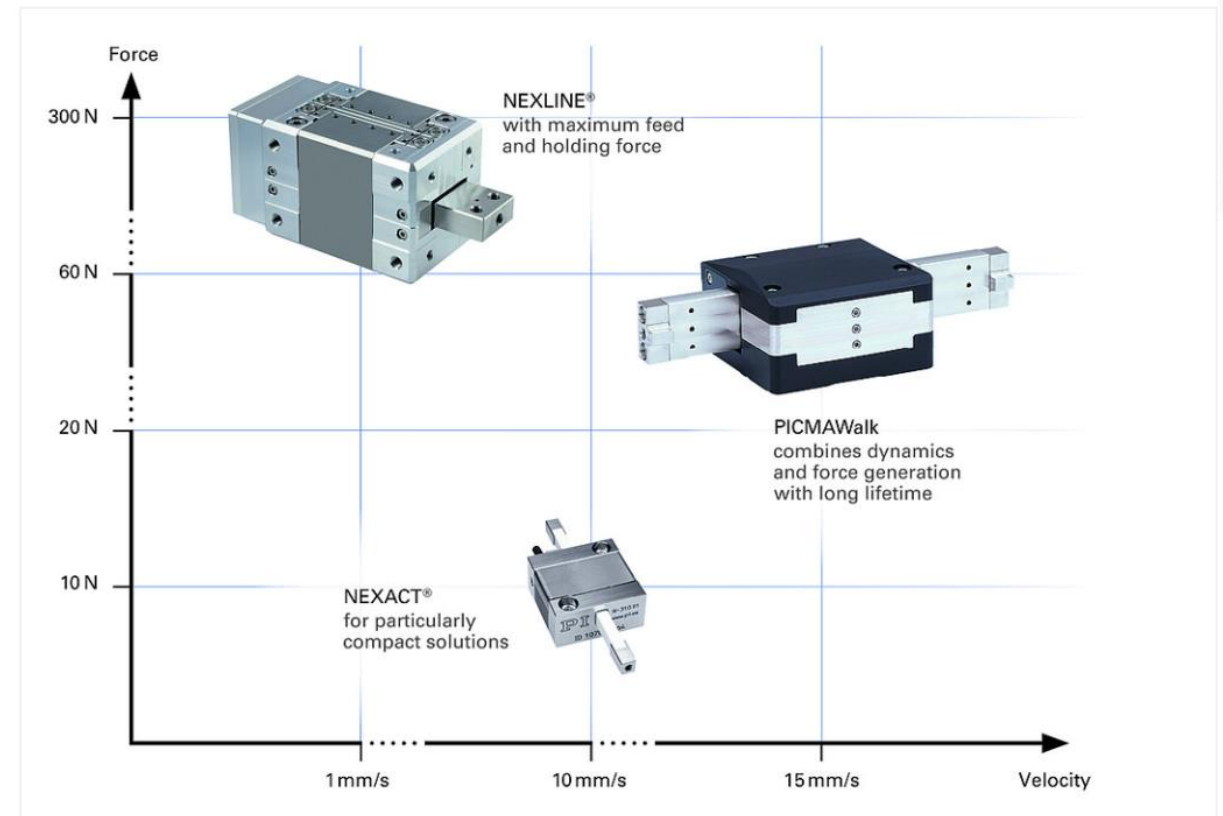


Lithography – Picometer Precision Ceramic Motors / Actuators

Ultra Precise Piezo Motors for Positioning of Optical Components

Nanometer Precision with a High Feed Force

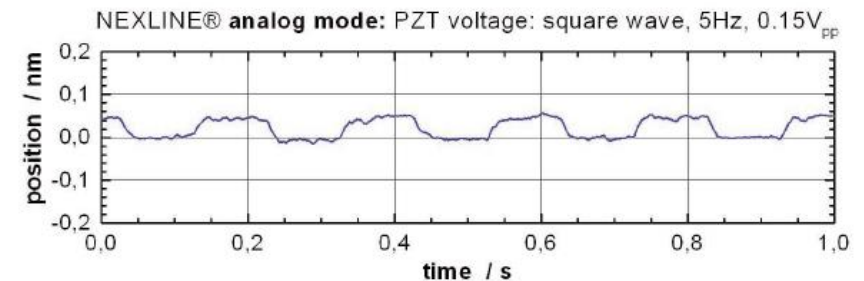
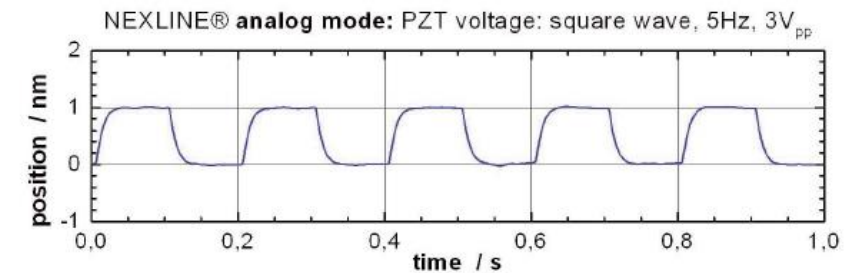
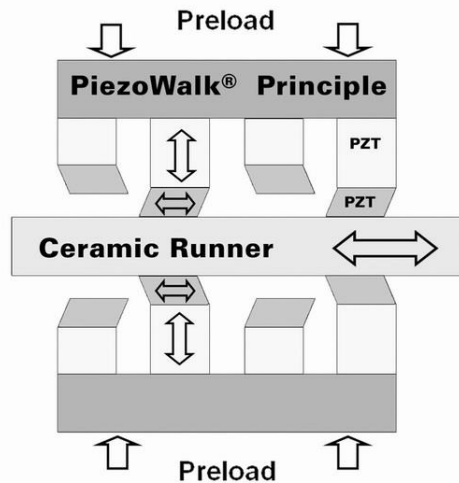
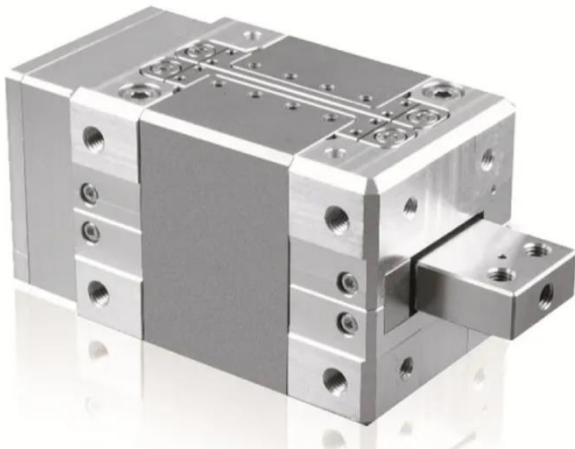
- Scalable travel range due to scalable runner length
- Resolution to 30 picometers
- Self-locking when at rest, no heat generation
- Nonmagnetic and
- vacuum-compatible operating principle



PiezoWalk Motor – Picometer Resolution (NEXLINE®)

Multiple Motion Modes

- 50 Picometer Steps in Analog Linear Mode Clearly Visible
- Step Mode for Long Travel Motion



NEXLINE® analog (shear) mode provides picometer position resolution

EUV-L and Rapid Prototyping

Proven Competence in the Latest IC Production Technology

High-Precision Positioning System
even in Strong Magnetic Fields

- Nonmagnetic
- UHV-compatible to 10^{-9} hPa
- Ultra-compact 6 axis design
- Parallel-kinematic motion



UHV-compatible Piezo Flexure Nanopositioning Stages 1 to 6-Axis



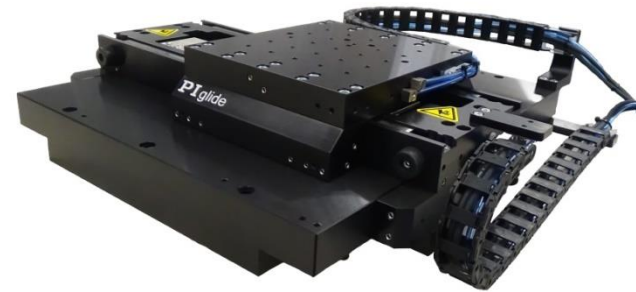
P-911 UHV-Compatible Miniature Piezo Hexapod, highly customized development

Reticle and Wafer Inspection

Reticle / Wafer Positioning in X, Y and Z

PIglide: Cleanroom compatible air bearing stage for metrology

- High precision over huge travel ranges
- Low profile
- Bidirectional repeatability $\pm 0.1 \mu\text{m}$
- High load capacity
- Optional granite base plates
- Cleanroom compatible



A-311 Compact Planar XY Air Bearing Scanner



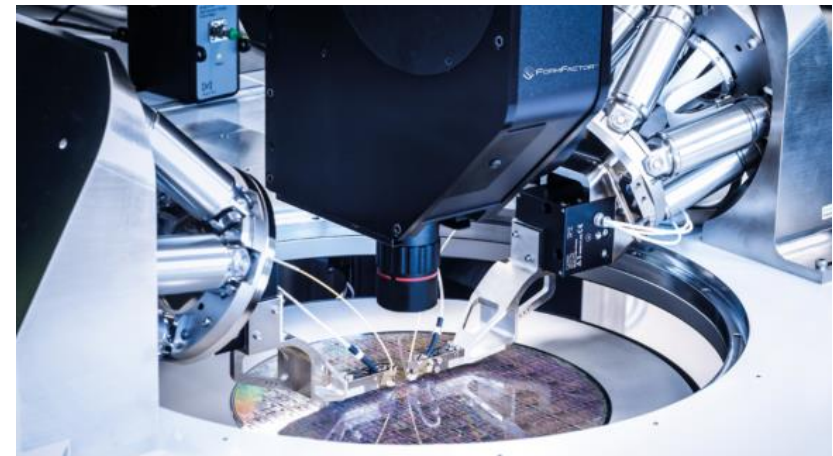
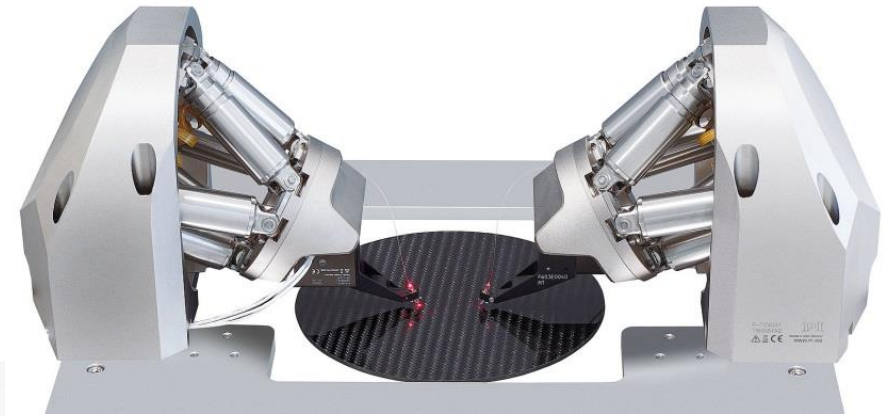
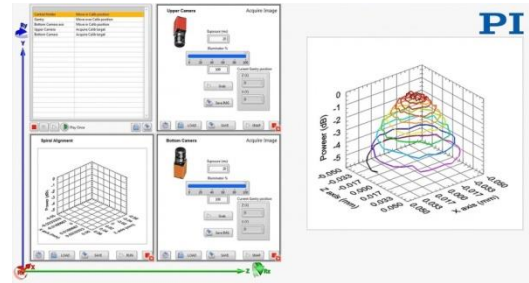
A-322 XY-Theta Air Bearing Scanner

Silicon Photonics – Fast Alignment Systems

Waver-Level Active Alignment and Optimization for Silicon Photonics

Simultaneous measuring & optimization of in- AND outputs of wafer level optical components

- High-Speed firmware-based alignment routines
- Scriptable Modular Software
- Area scan and gradient search
- Multiple in- and outputs
- 6-Axis hexapod PKM systems or multi-axis stacked positioners



Cascade CM300xi SiP Wafer Prober (Image: FormFactor)

Inspection / Bonding / Testing

On the Fly Focusing / Z- Positioning

PIFOC Nano-Focus Z-positioner with broad range of customizable characteristics

- Sub-Nanometer Resolution Driven and Sensor Technology
- High Speed - Millisecond Settling Time
- High Stiffness – Very Stable
- Broad Variety of Travel Ranges



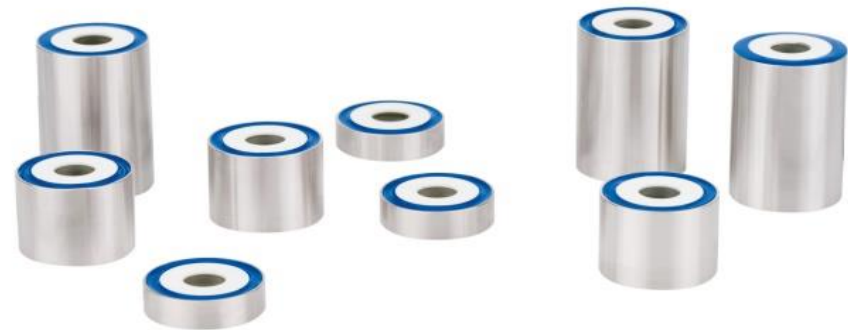
*Outstanding lifetime due to Mars-Mission Tested
PICMA® piezo ceramic actuators*

PIRest Piezo Shims – Programmable to Nanometer Tolerances

Latest Technology for Adjustment of Consistently Stable Gaps

Long-term stable positioning of heavy optical elements

- Variable shimming for easy alignment of optical components
- For system qualification and calibration
- During first installation
- Realignment as a consequence of relaxation or temperature drift
- μm travel range and nm resolution



P-131 PIRest Programmable Spacers

Physik Instrumente

PI USA HQ

16 Albert St
Auburn, MA
01501

Email info@pi-usa.us

Visit us: www.pi-usa.us

PI Germany HQ

Auf der Roemerstrasse 1
76228 Karlsruhe
Germany

Email info@pi.ws

Visit us: www.pi.ws



© 2019 Physik Instrumente (PI) GmbH & Co. KG

Using these texts, images and drawings is only allowed with written consent of PI and by indicating the source.

