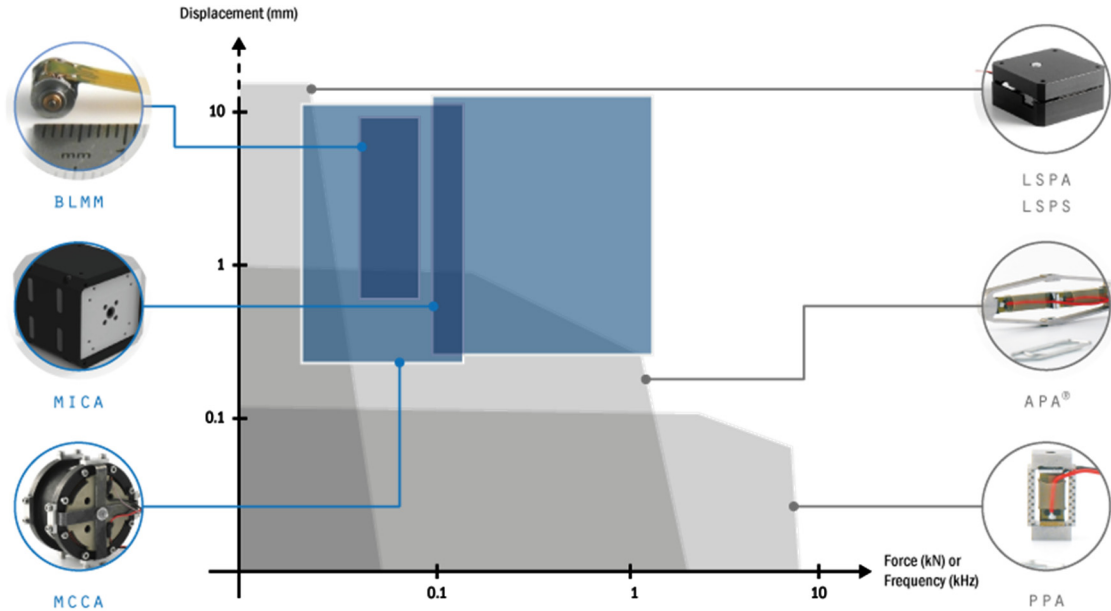


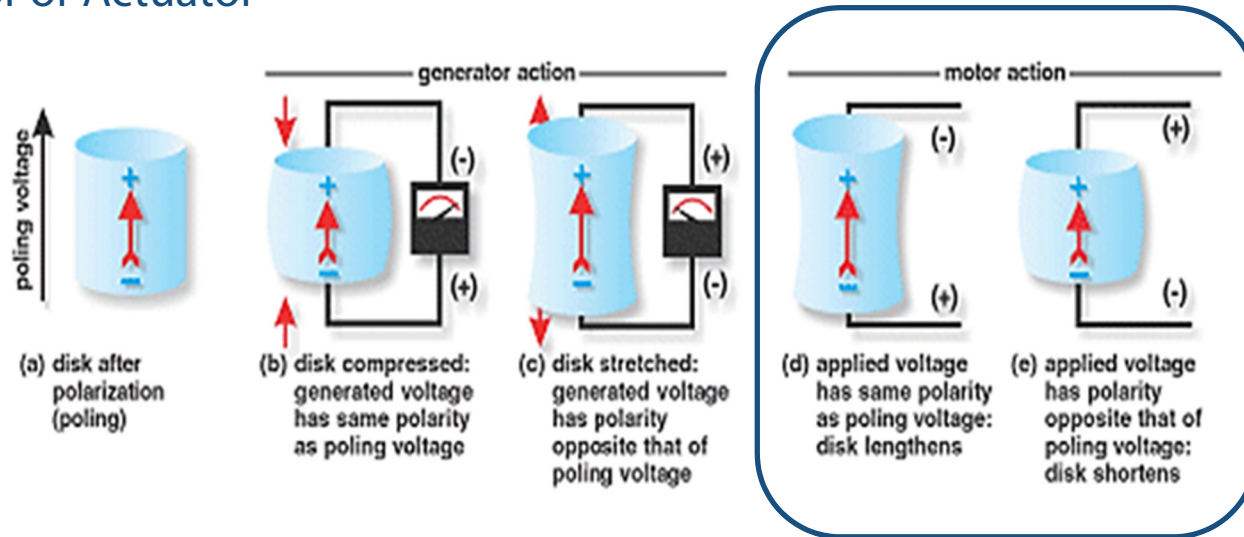
PIEZO TECHNOLOGY IN SYNCHROTRONS

BORIS LALUC
SALES APPLICATION ENGINEER
28/06/2018

- > Actuators
- > Motors
- > Piezo
- > Magnetic



> Generator or Actuator



Courtesy of APC

> 0,1 % Active Deformation:

- 500 μm displacement -> 0,5 m piezo stack !

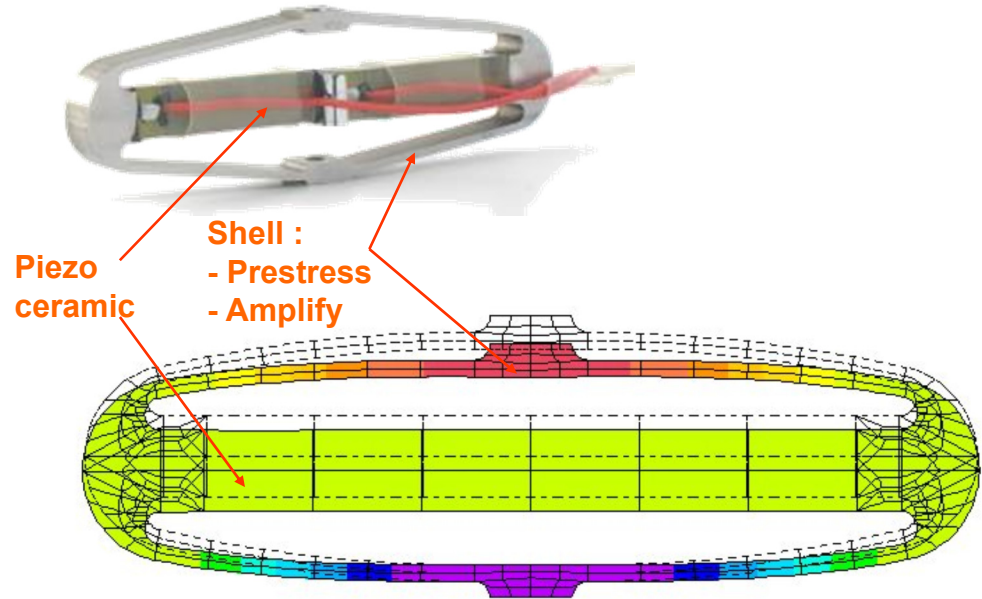
PIEZOELECTRIC EFFECTS – APA LINEAR ACTUATOR

> Key figures

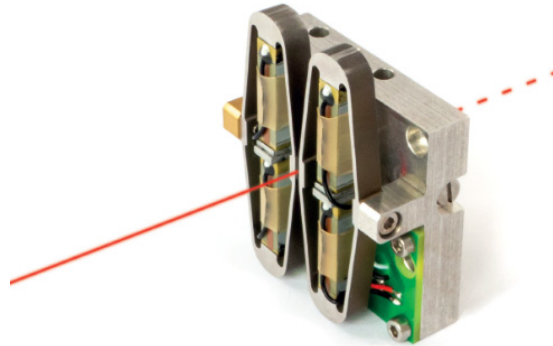
- Strokes from 25 μ m to 2mm
- Forces up to 2kN
- Pulling actuator
- Pre-stress actuator
 - resistance to shock & vibrations
 - no weakness

> Example with APA600M

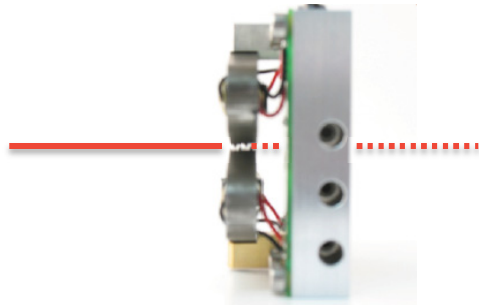
- APA600M – 15 mm height
- Full Stroke @ 170 V range (-20/+150 V)
- Stroke: 600 μ m
- Active deformation 3,7 %
 - x 37 / Piezo ceramic



FAST PIEZO SHUTTER – FPS



FPS200M



> History

- First CTEC product developed for the Synchrotron Market
- Collaboration with the EMBL / MAG shutter

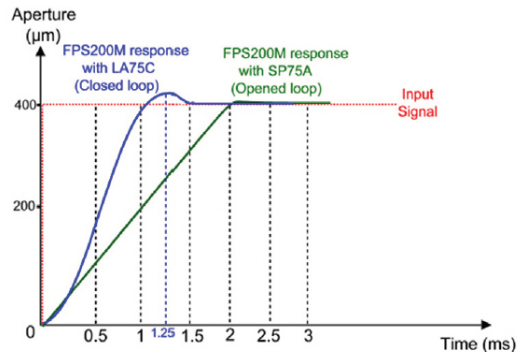
> Application

- Fast Shutter for X Ray beamlines
- Control/Define the exposure time
 - “Protect” the sample

> Example FPS200M

- Beam: Ø 0.30 mm
- Aperture & Closing time: 2 ms
- Low Jitter < 100 μ s, Low self heating

FAST PIEZO SHUTTER – FPS



> Example FPS200M

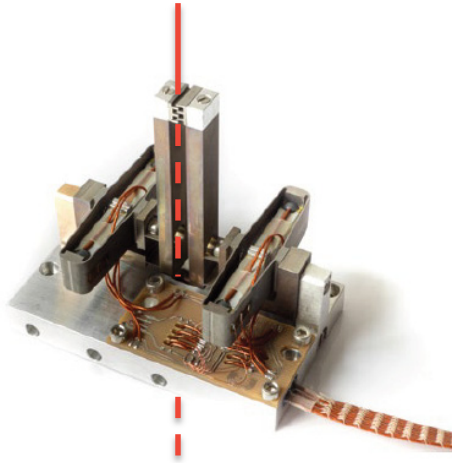
- Specifications explanation
 - 2 x APA200M
 - Stroke: 200μm / Actuator
 - Mechanical frequency @900 Hz in Blocked-Free
 - Period: 1.1 ms
- Driver Optimized with pre-shaped signal

> Higher Beam diameter

- Bigger APA
 - Less Stiff
 - Lower Resonance Frequency
 - Period impacted (increased)
- FPS400M
 - Ø 0.7 mm
 - 4 ms
- FPS900M
 - Ø 1.1mm
 - 10 ms
- If More : Lever Arm !



FAST AMPLIFIED PIEZO SHUTTER – FAPS



> History

- Developed for PAL, XFEL beamline
- Beam: $\varnothing > 1$ mm

> Application

- Fast Shutter for beamlines
- Control the exposure time of a sample behind it

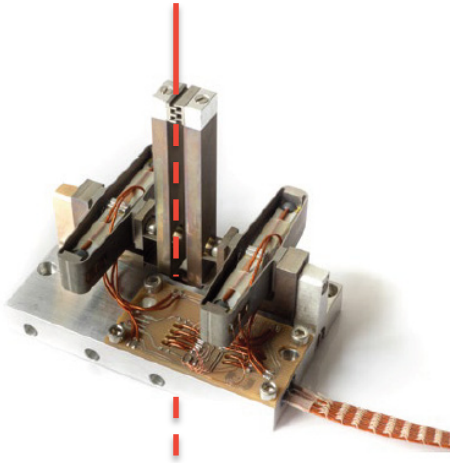
> Specifications

- Beam: up to $\varnothing 3$ mm
- Aperture & Closing time: 8 ms

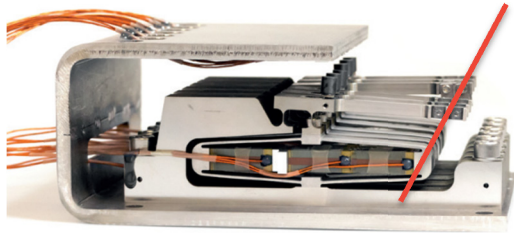
FAST AMPLIFIED PIEZO SHUTTER – FAPS

> Example FAPS400M

- 2 x APA400M
 - Stroke: 410 μm
 - Resonance frequency: 380 Hz
 - Period: 2,7 ms
- Lever arm amplifies the movement
 - Stroke: 3 mm
- Opening/Closing time: 8ms
 - Stiffness



FAST BEAM ATTENUATION ACTUATOR



> History

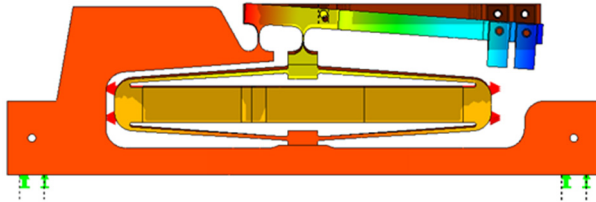
- Co-design with SOLEIL, SixS beamline

> Application:

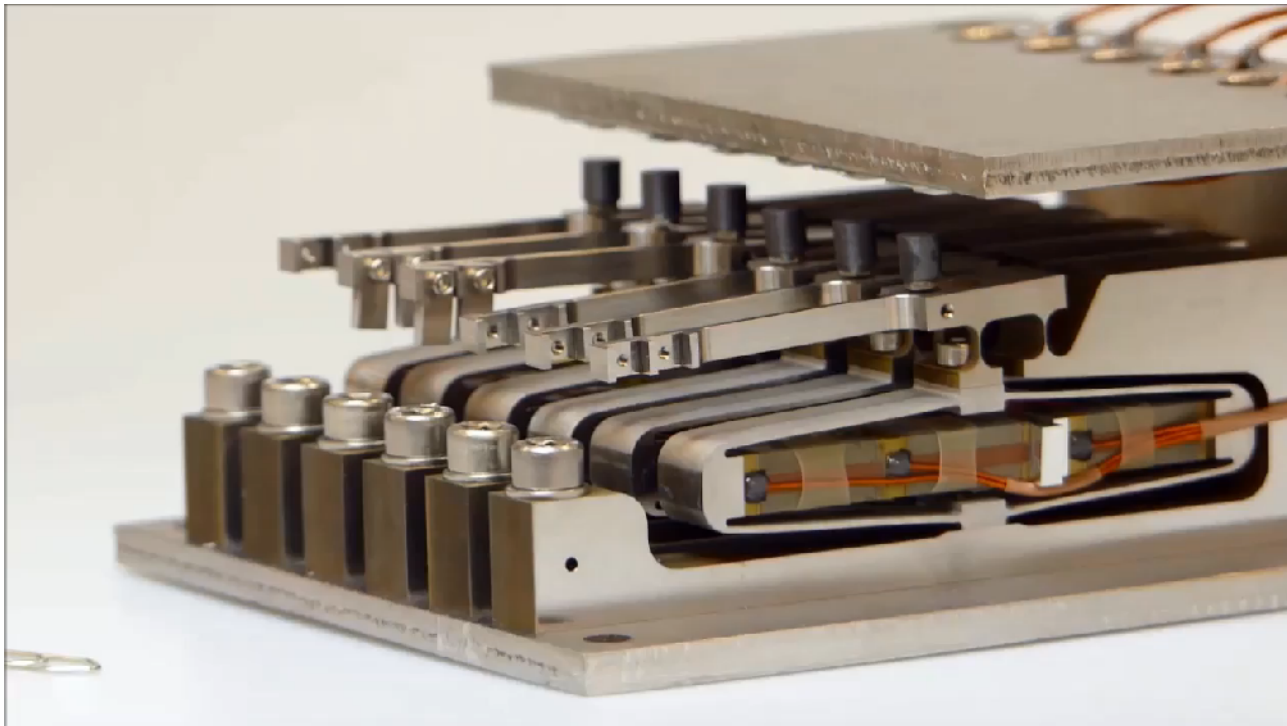
- Attenuate the energy of the beam
 - Protect the sensor
 - Avoid sensor saturation

> Specifications:

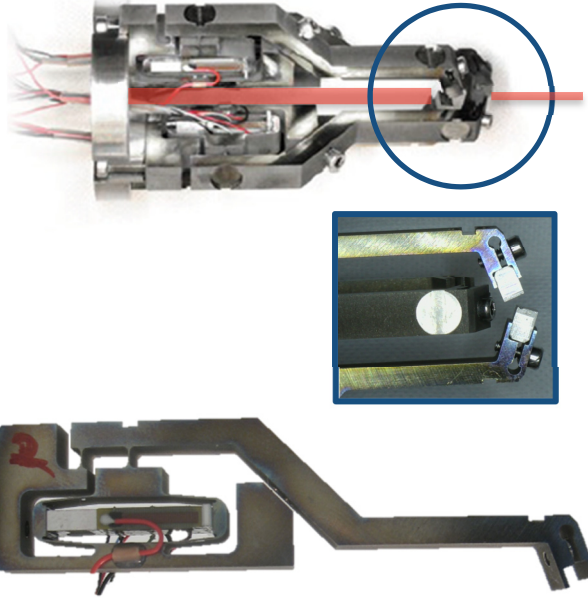
- 6 Piezo Actuators
- Lever Arms by bending :
 - $120\text{ }\mu\text{m} \rightarrow 650\text{ }\mu\text{m} \rightarrow 3\text{ mm}$
 - x 25 amplification
- Movement done in 10 ms (100 Hz)



FAST BEAM ATTENUATION ACTUATOR



ACTIVE PIEZO MICRO SLITS MECHANISM



> History

- Co-design with SOLEIL, SWING beamline

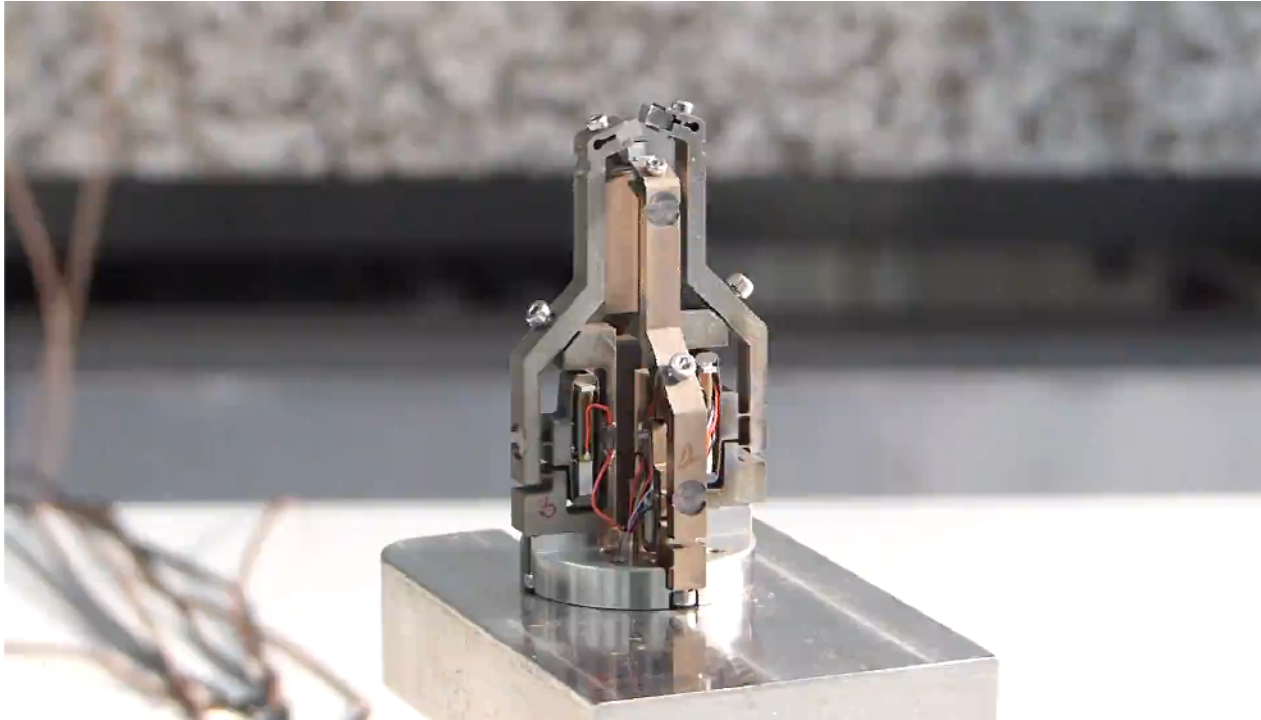
> Application:

- Shape the beam section to a rectangle
- Adjust the shape

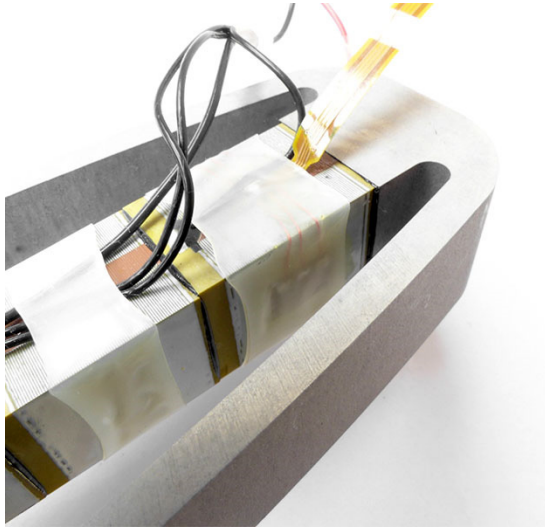
> Specifications :

- 4 Piezo Actuators with SG Sensors
- Lever Arms by bending :
 - $40\text{ }\mu\text{m} \rightarrow 66\text{ }\mu\text{m} \rightarrow 670\text{ mm}$
 - x 18 amplification
- Movement done in 25 ms (40 Hz)

ACTIVE PIEZO MICRO SLITS MECHANISM

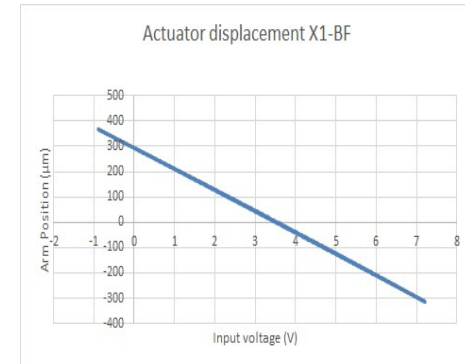
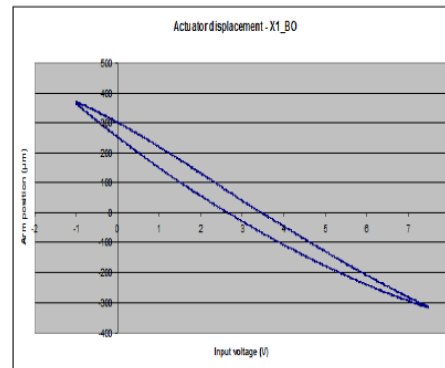


ACTIVE PIEZO MICRO SLITS MECHANISM - SENSOR



> High Stability required

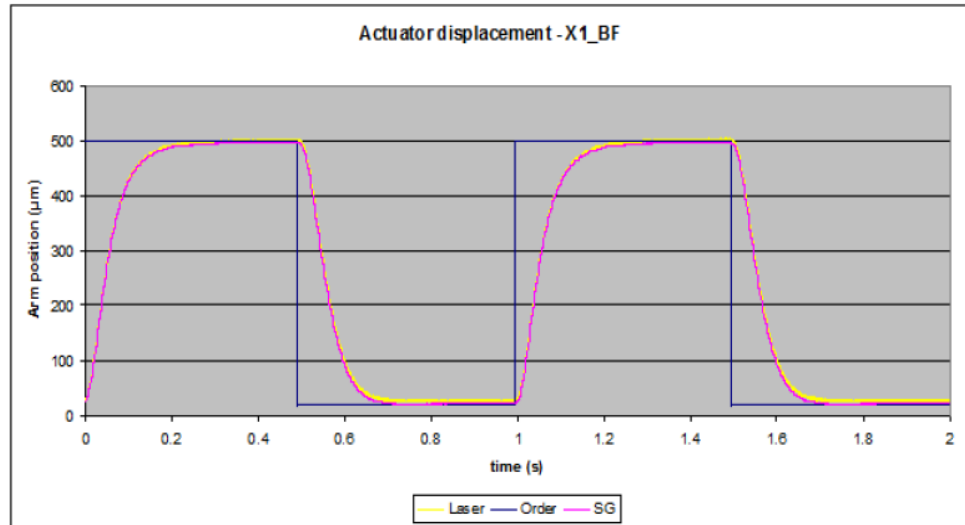
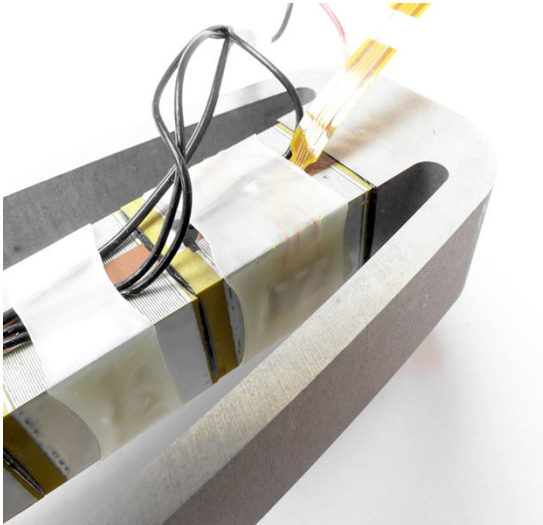
- $\pm 0,5 \mu\text{m}$ for $0,5^\circ\text{C}$ variation
- Strain Gauges sensors chosen
- Compact
 - " Patch " Stuck on the piezo stack
 - Space heritage from CTEC



ACTIVE PIEZO MICRO SLITS MECHANISM - SENSOR

> Comparison

- Laser vs SG vs Order



QUESTIONS?

- › Thanks for your attention!
- › Merci !
- › Questions?
- › Come see us at booth **#32**