

ACCELERATOR LABORATORY
ADVANCED RESEARCH CENTER FOR BEAM SCIENCE
INSTITUTE FOR CHEMICAL RESEARCH
KYOTO UNIVERSITY

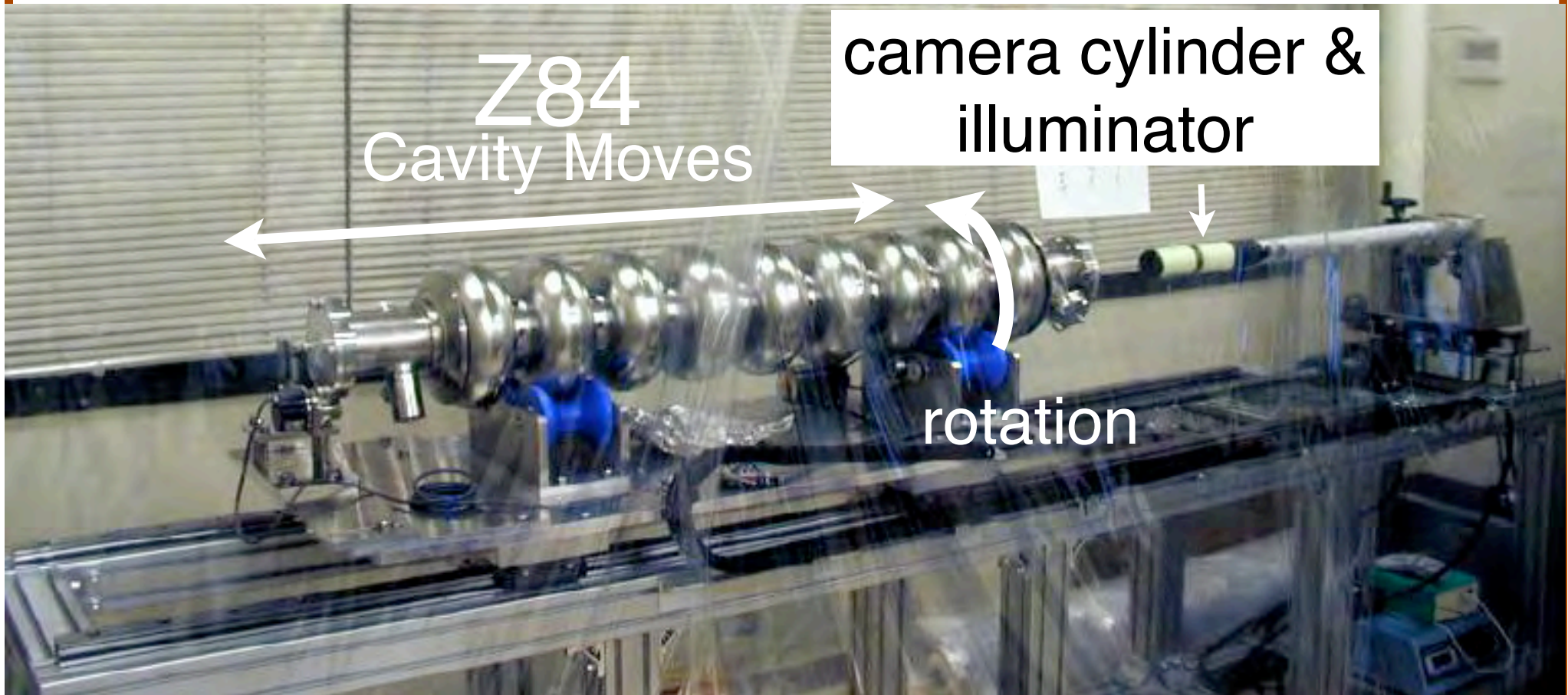


Continued Development of High Resolution Camera

Y. Iwashita, Y. Tajima and H. Hayano

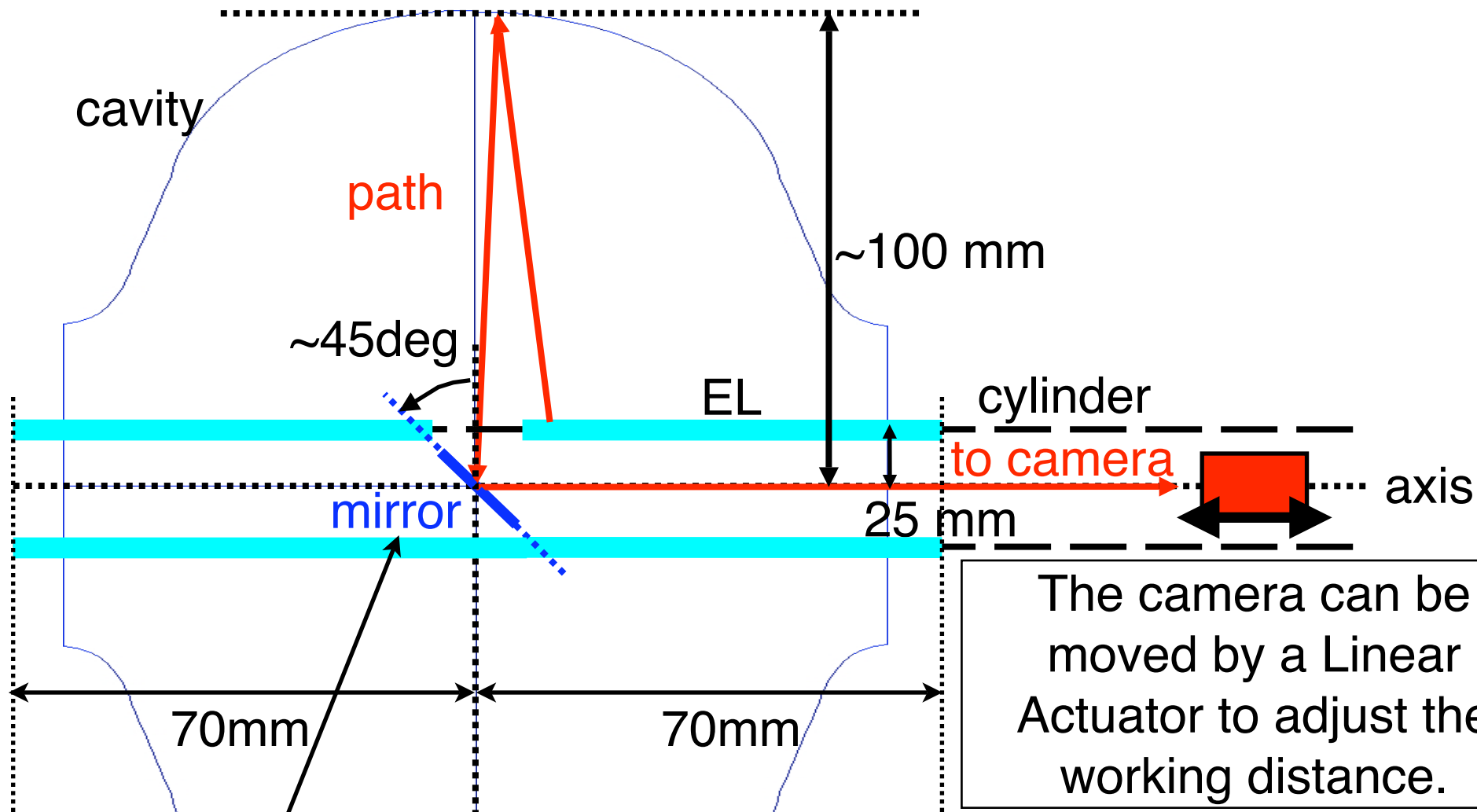


Early System



Cavity is rotated and moved longitudinally.
The cavity moves to swallow the camera cylinder.

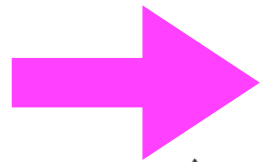
Inside the Cylinder



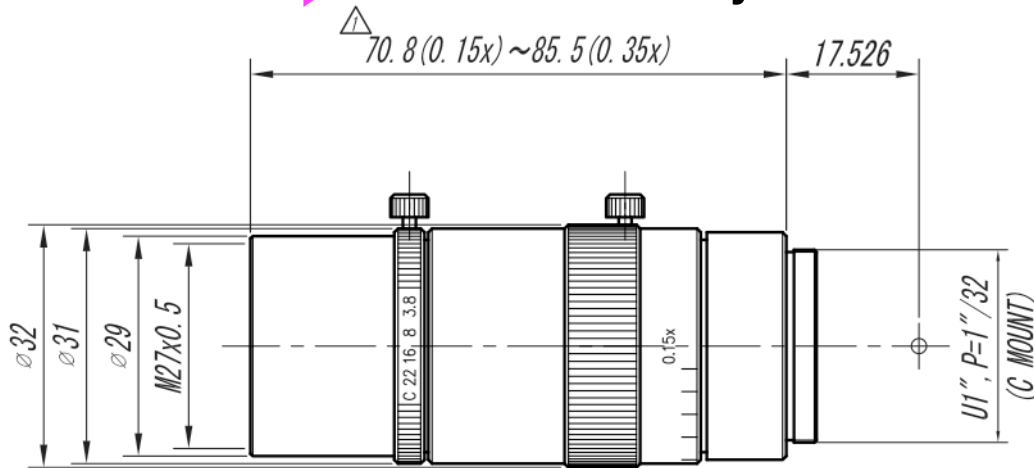
Mirror can be tilted by a Pulse Motor.

Camera Specification

- 1.5M-pixel CMOS Color Camera
1400px X1000 px: 5.0 μ m/px
Toshiba teli CSF5M7C3L18NR
- Distortionless Lens(0.15x ~ 0.35x, f75mm)
V.S. Technology Corp. VS-LD75
- 40mm Extension Tube (later)



Maximum resolution: $\sim 0.70x$, $\sim 7\mu\text{m/px}$ ($\sim 15\mu\text{m/px}$)
Limited by the Working Distance $\sim 120\text{mm}$

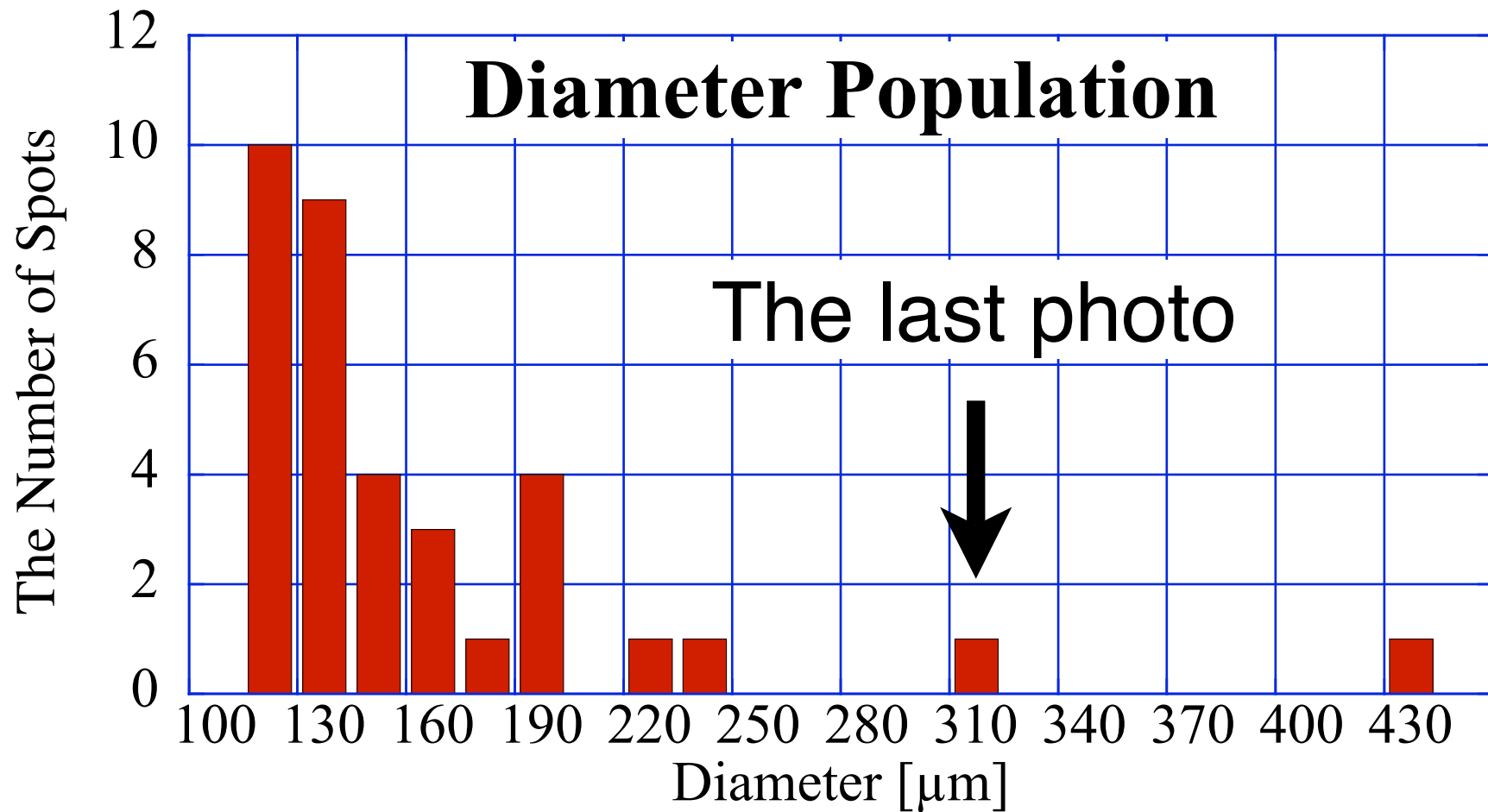


VS-LD75



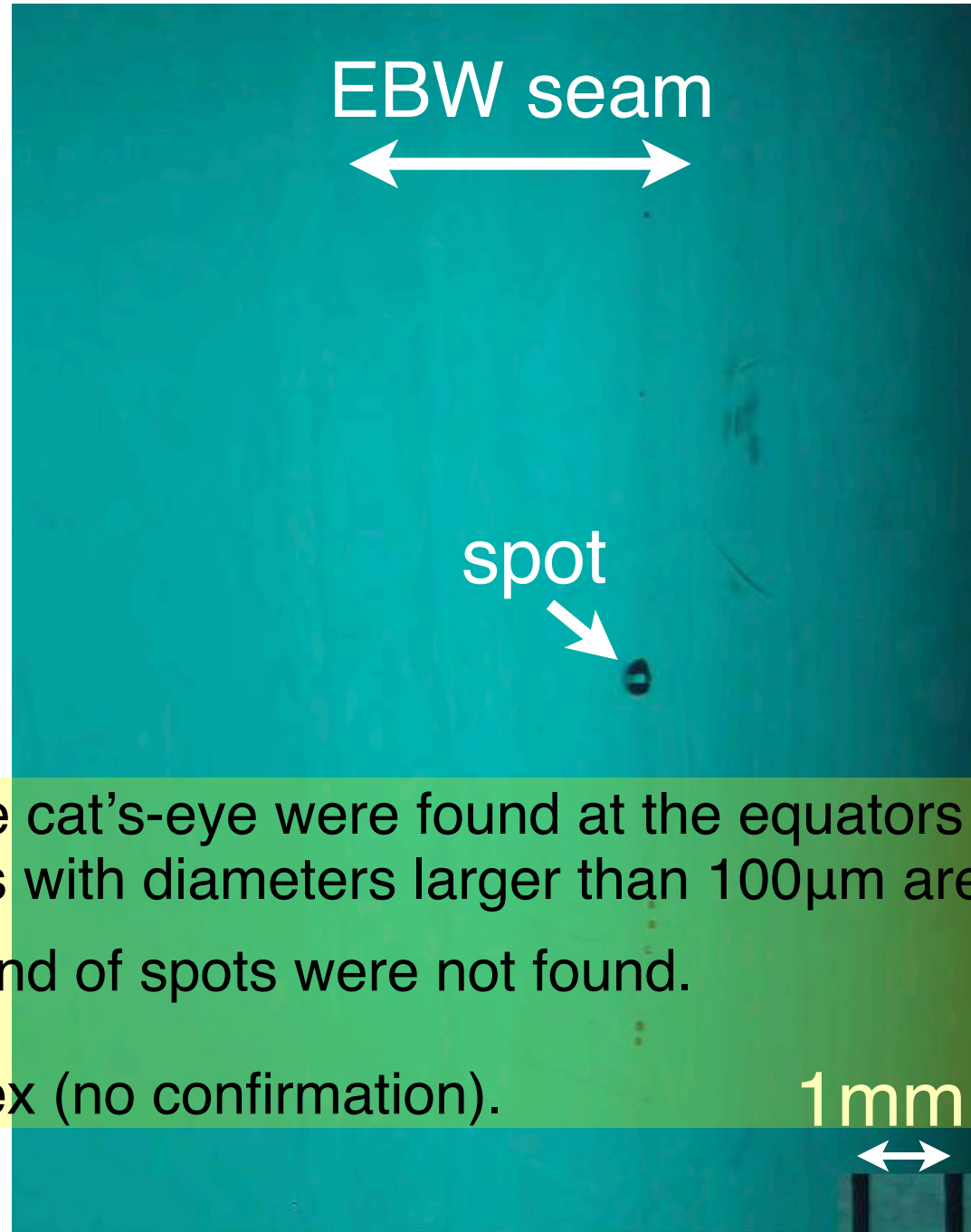
CSF5M7C3L18NR

Statistics of spots(>100 μm) in Z84



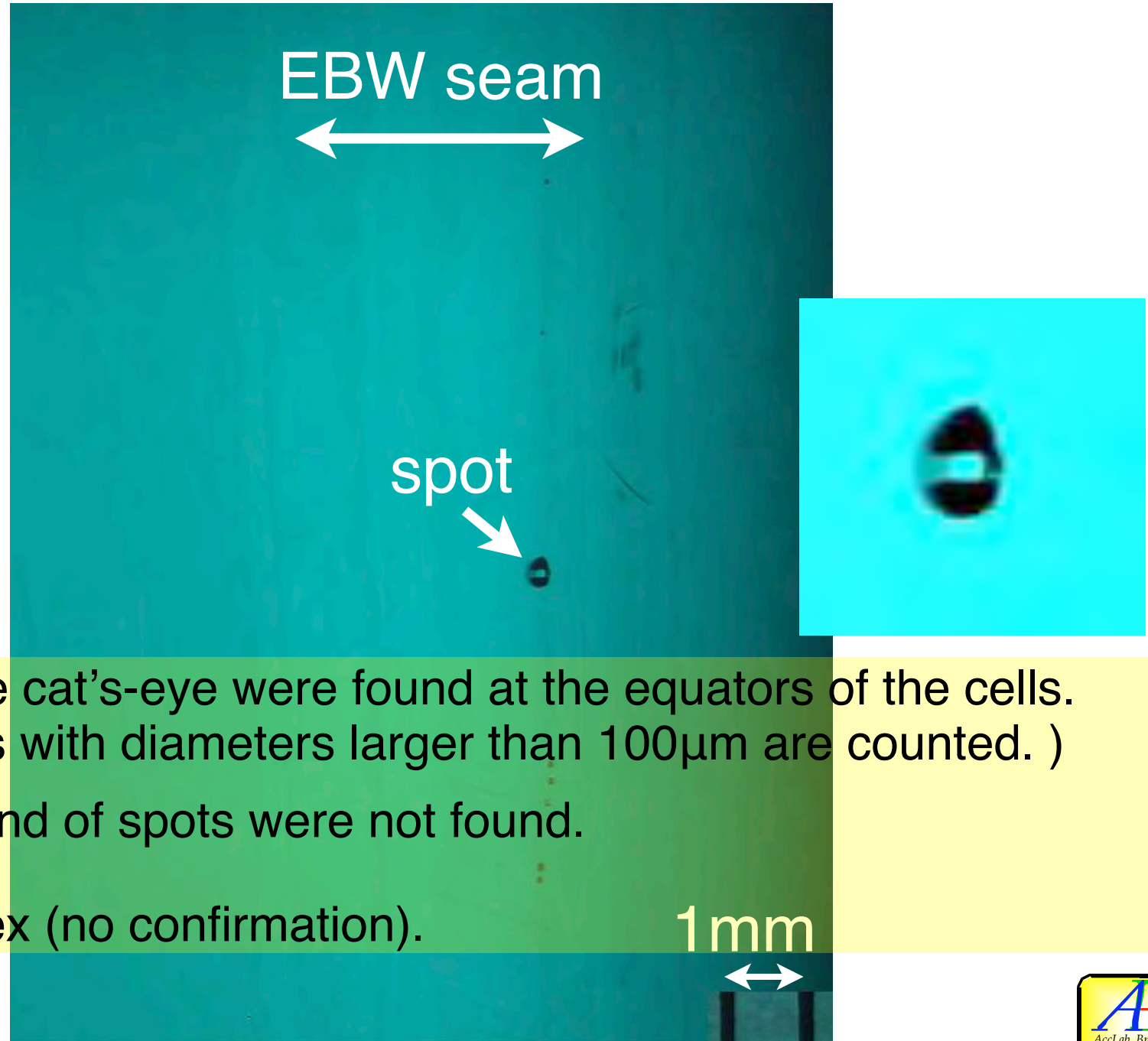
REMARK: All the spots were found at the input coupler side of the EBW seam.

Interior Surface of Zanon #84



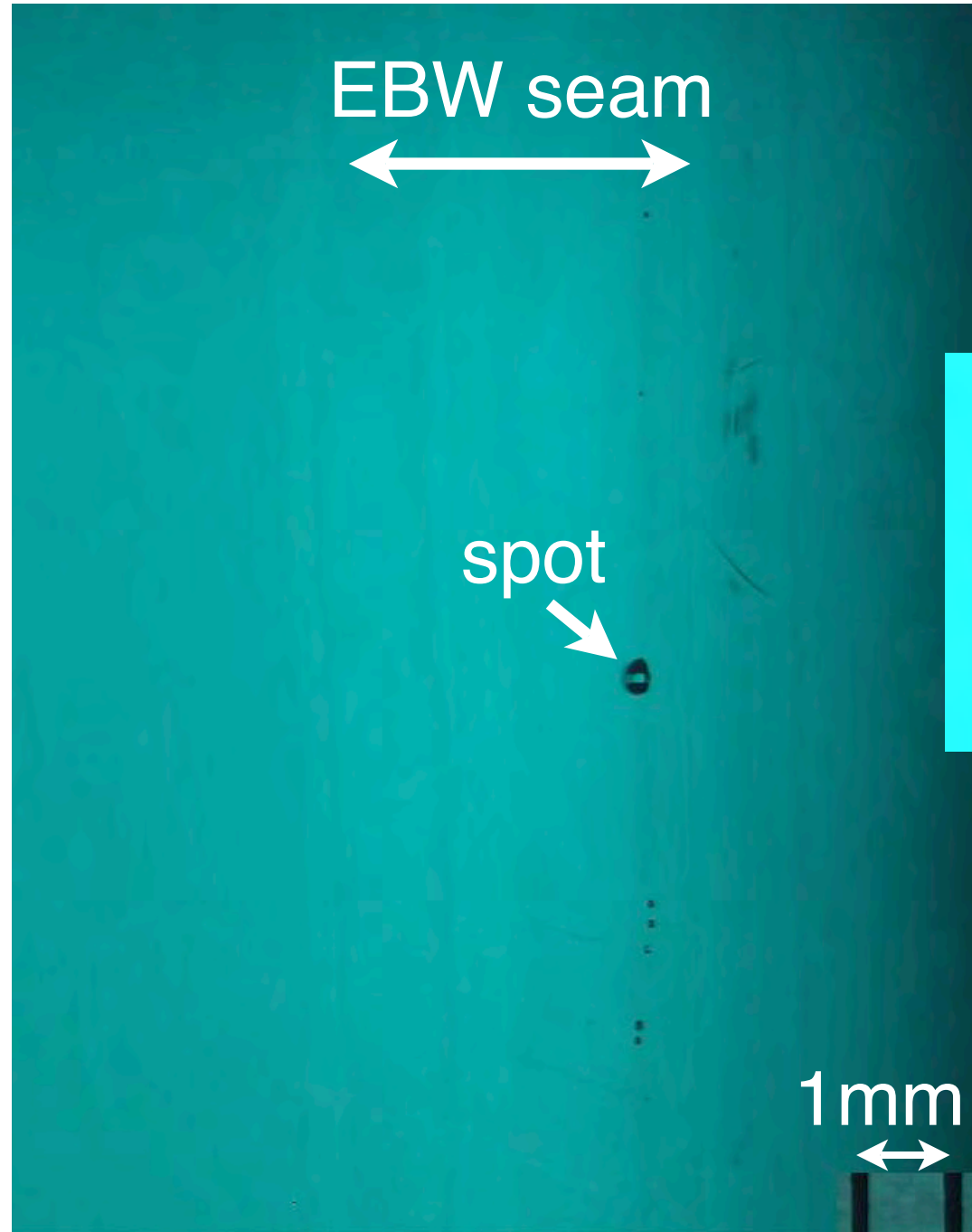
- 28 spots like cat's-eye were found at the equators of the cells. (only the spots with diameters larger than $100\mu\text{m}$ are counted.)
- Any other kind of spots were not found.
- Likely convex (no confirmation).

Interior Surface of Zanon #84

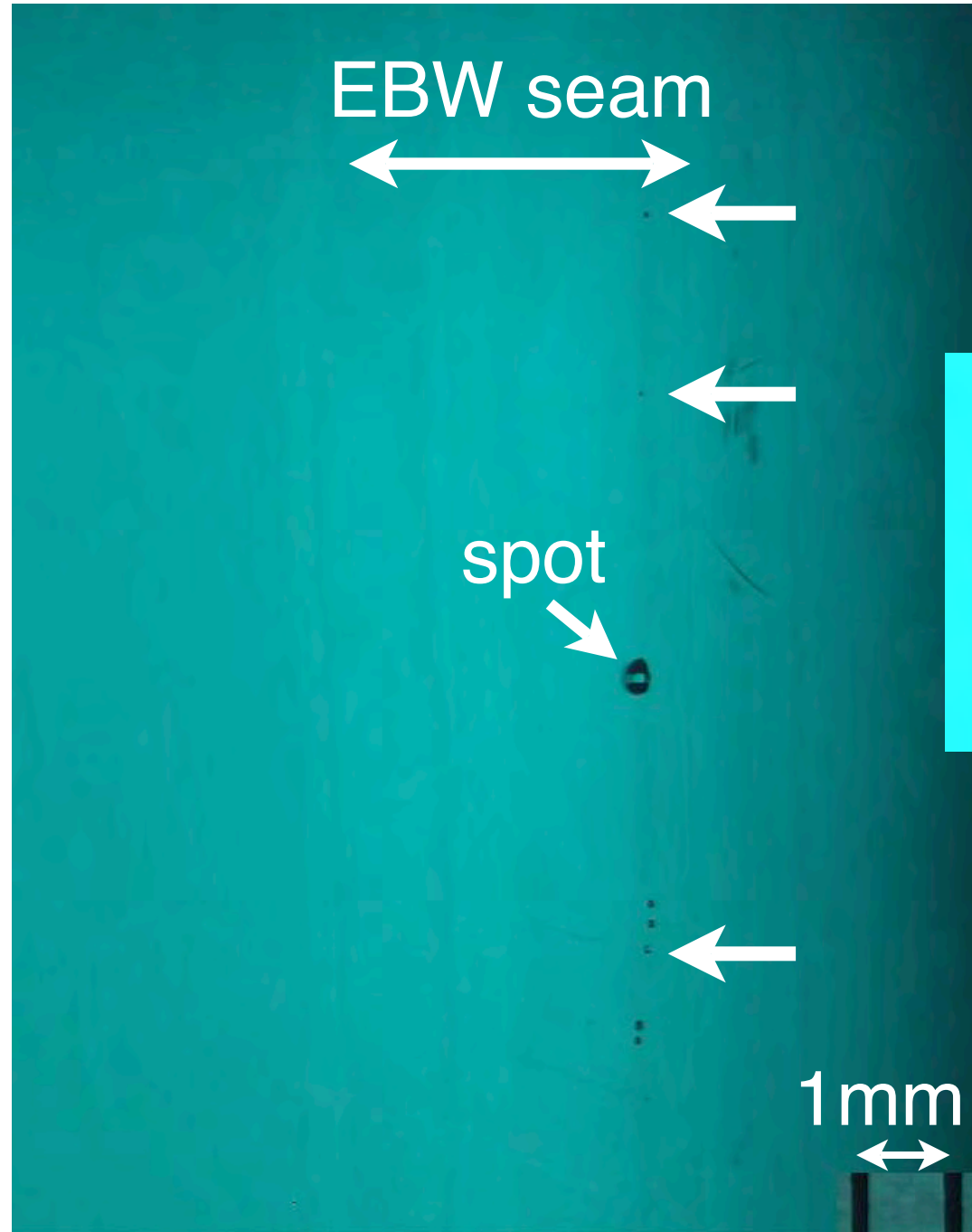


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Interior Surface of Zanon #84



Interior Surface of Zanon #84



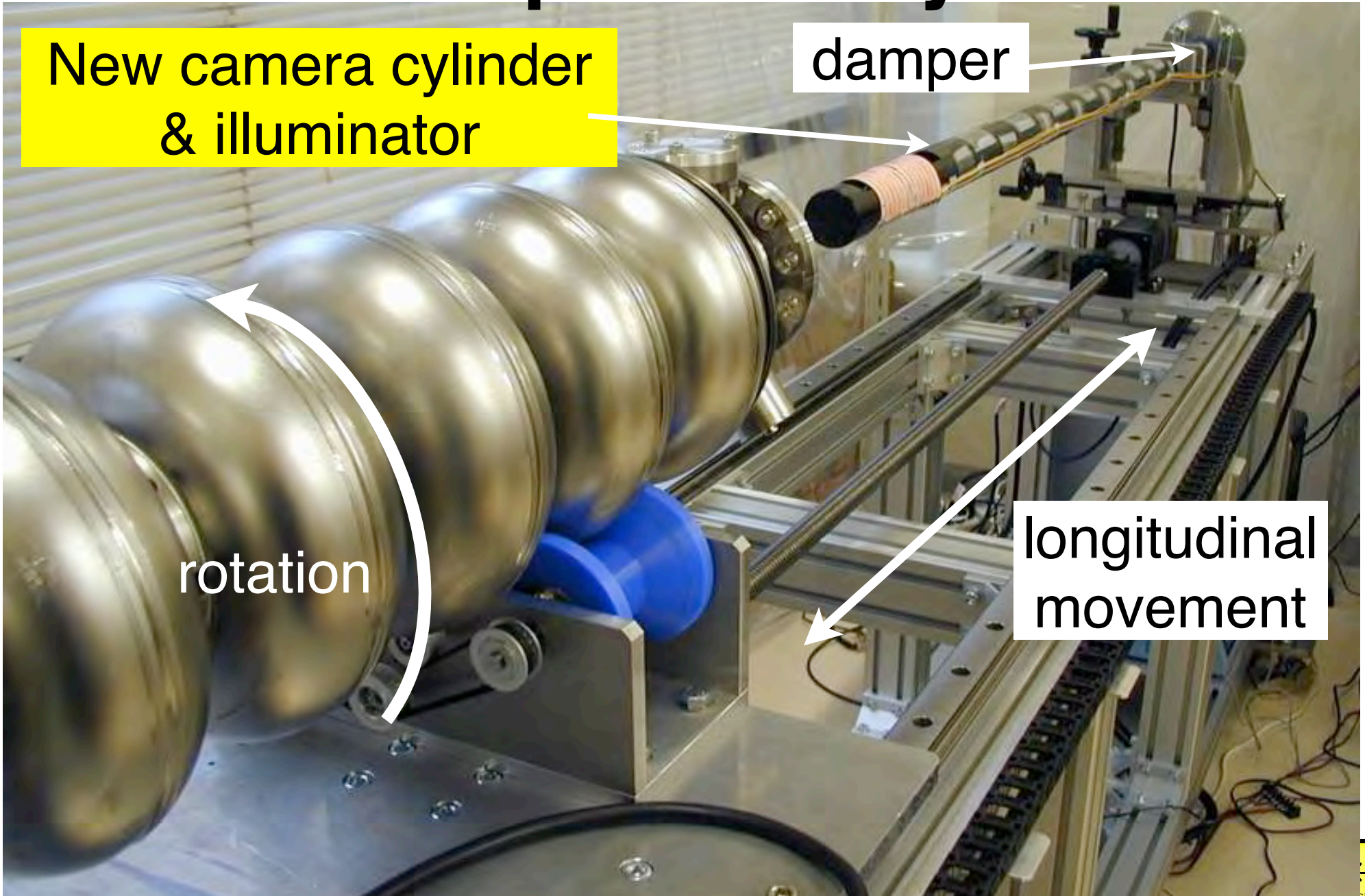
New Inspection System

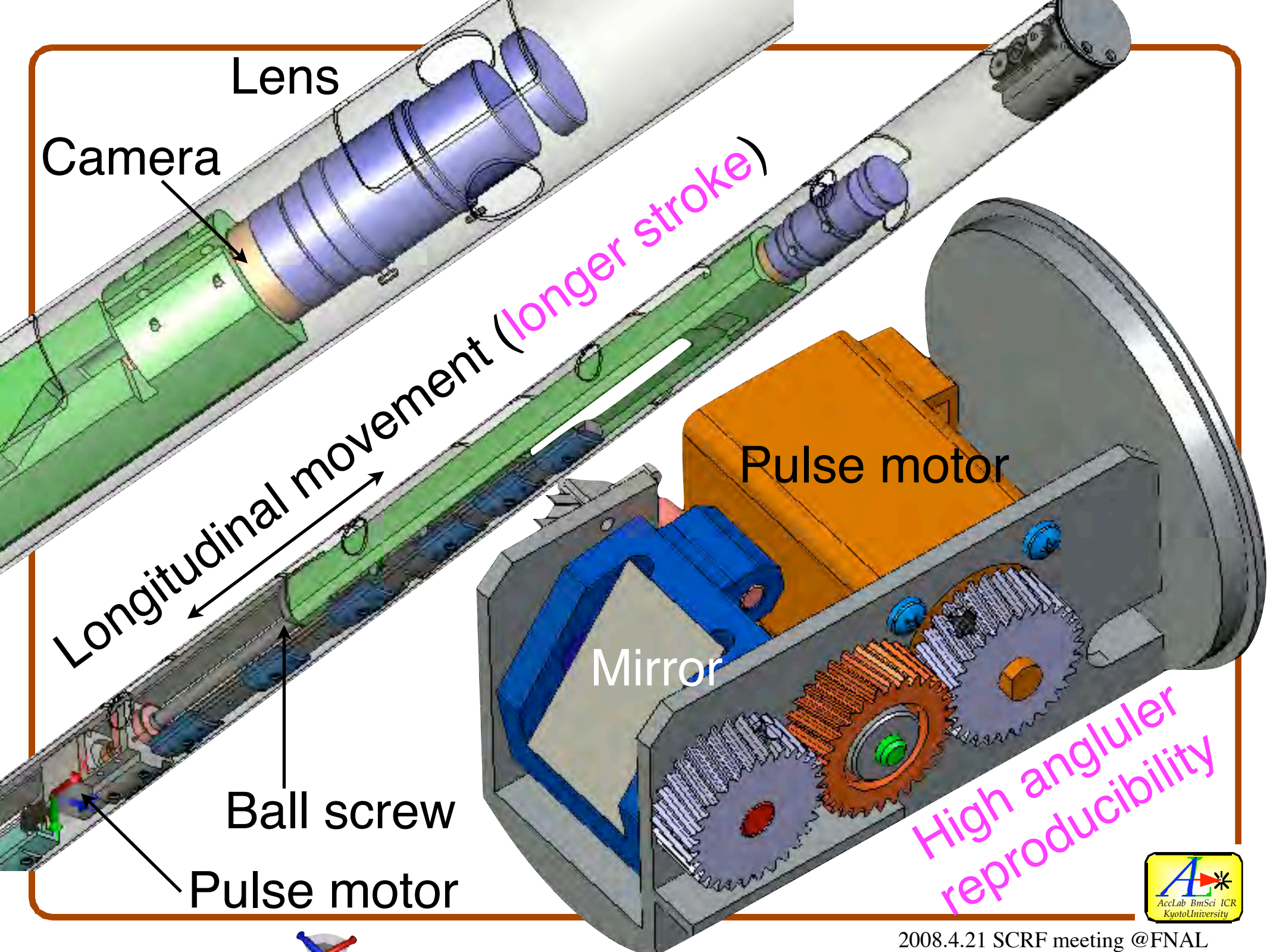
New camera cylinder
& illuminator

damper

rotation

longitudinal
movement





Lens

Camera

Longitudinal movement (longer stroke)

Pulse motor

Mirror

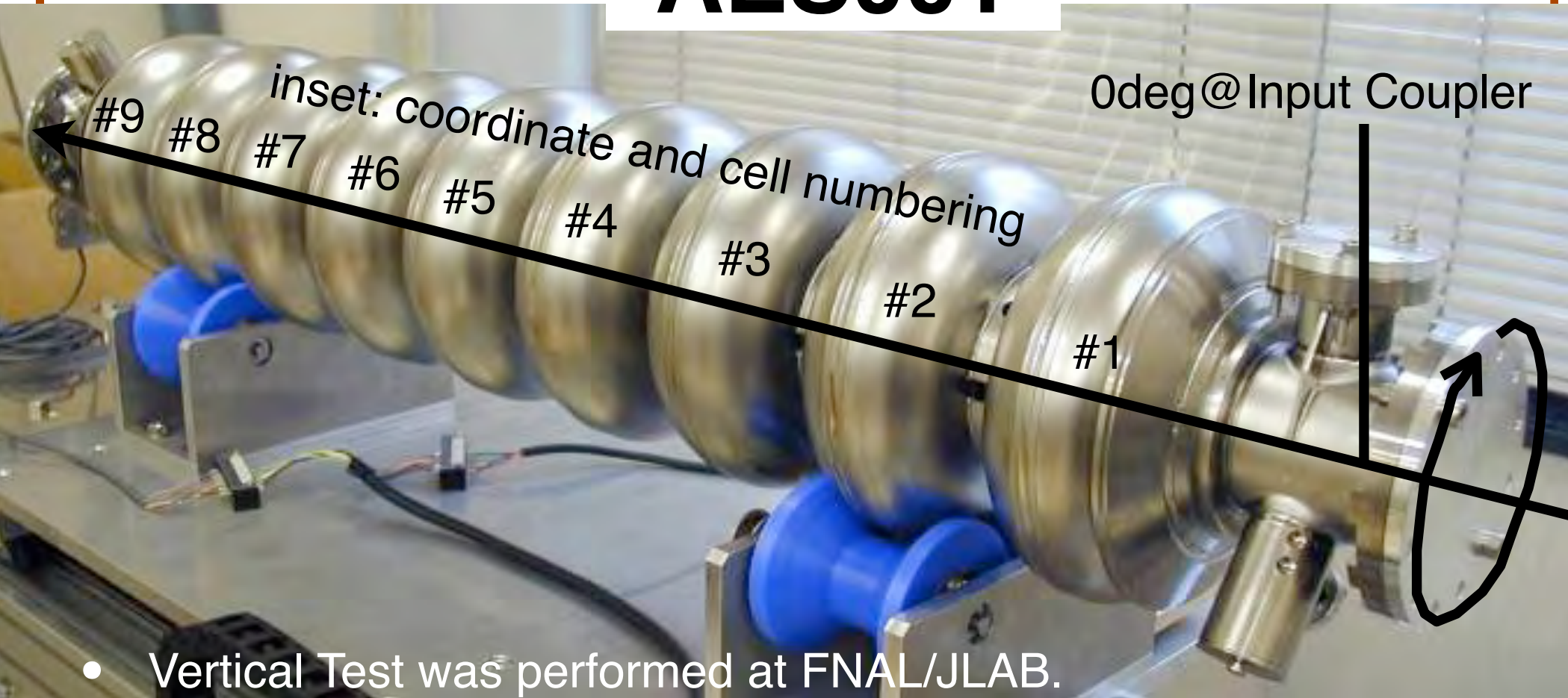
Ball screw

Pulse motor

High angluler reproducibility

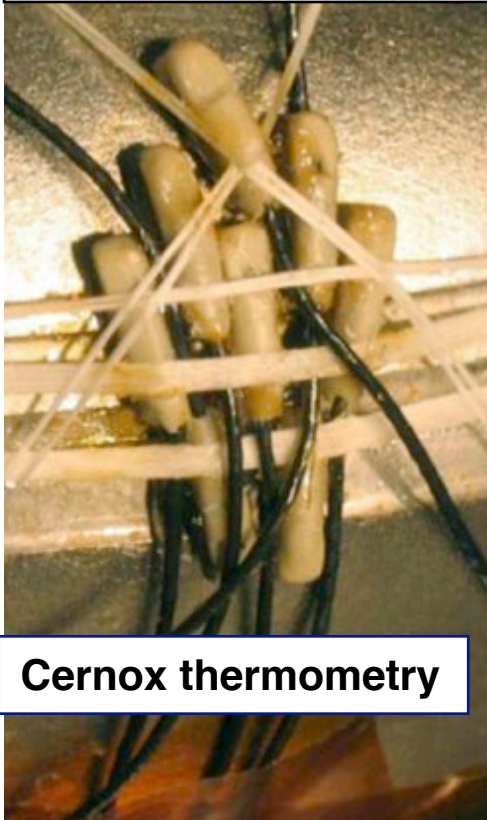
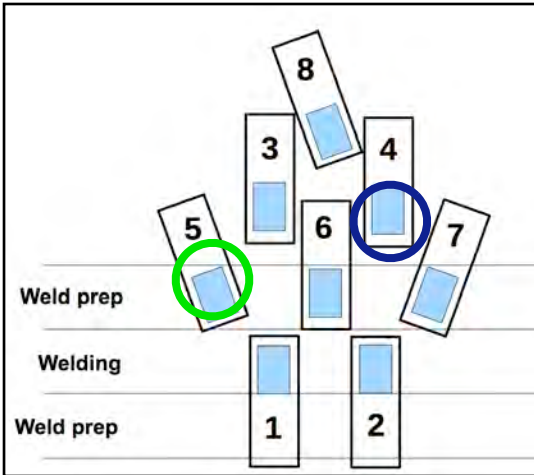


AES001

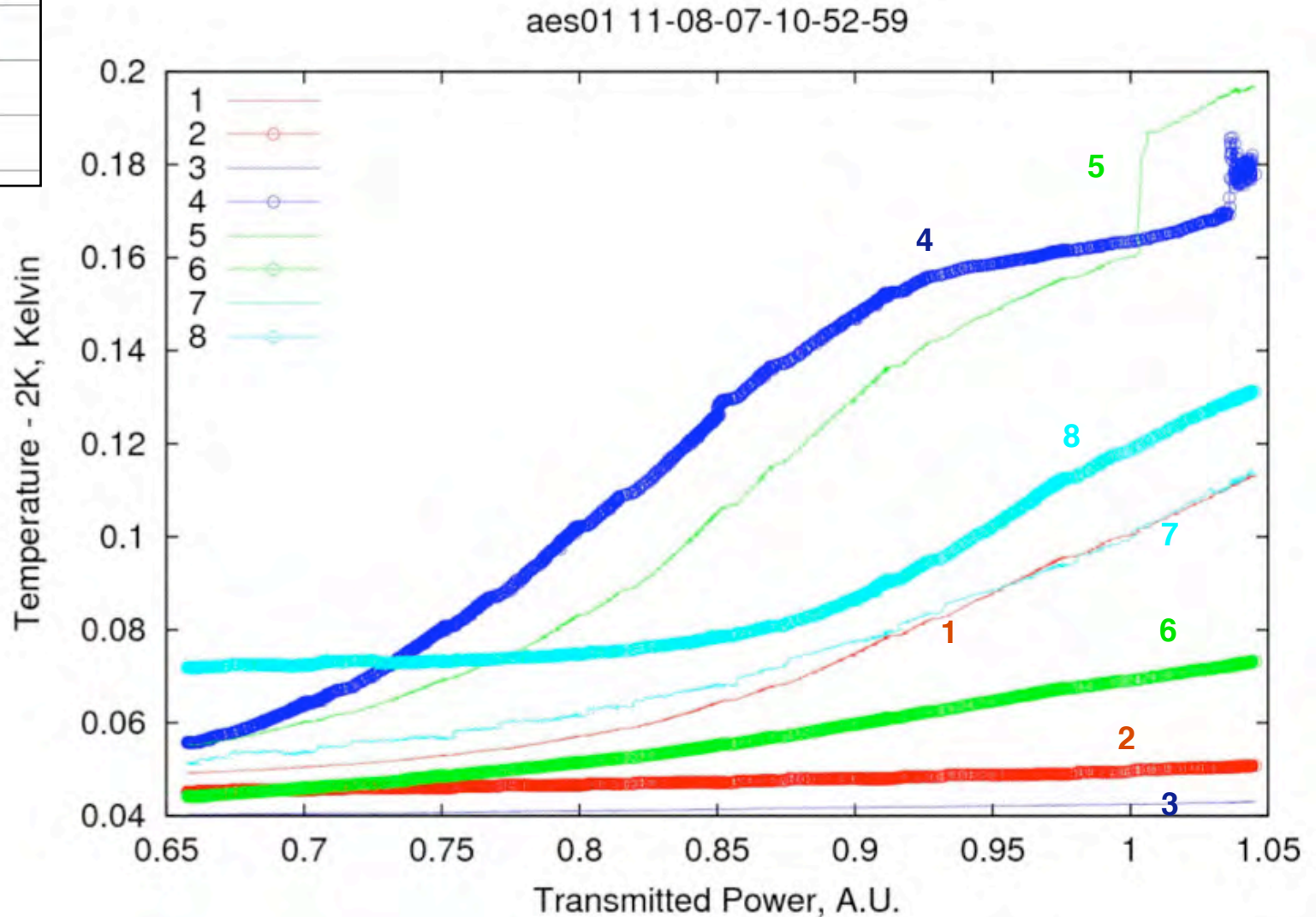


- Vertical Test was performed at FNAL/JLAB.
- Quenched at $E_{acc} \sim 15 \text{ MV/m}$ without field emission (no Xray).
- Passband mode measurements shows that #3 and #7 cell are suspicious.
- In CERNOX measurements two hot spots were found at the equator region of #3 cell.

AES001 has hard quench at 15MV/m, where its location was identified by Cernox at FNAL.



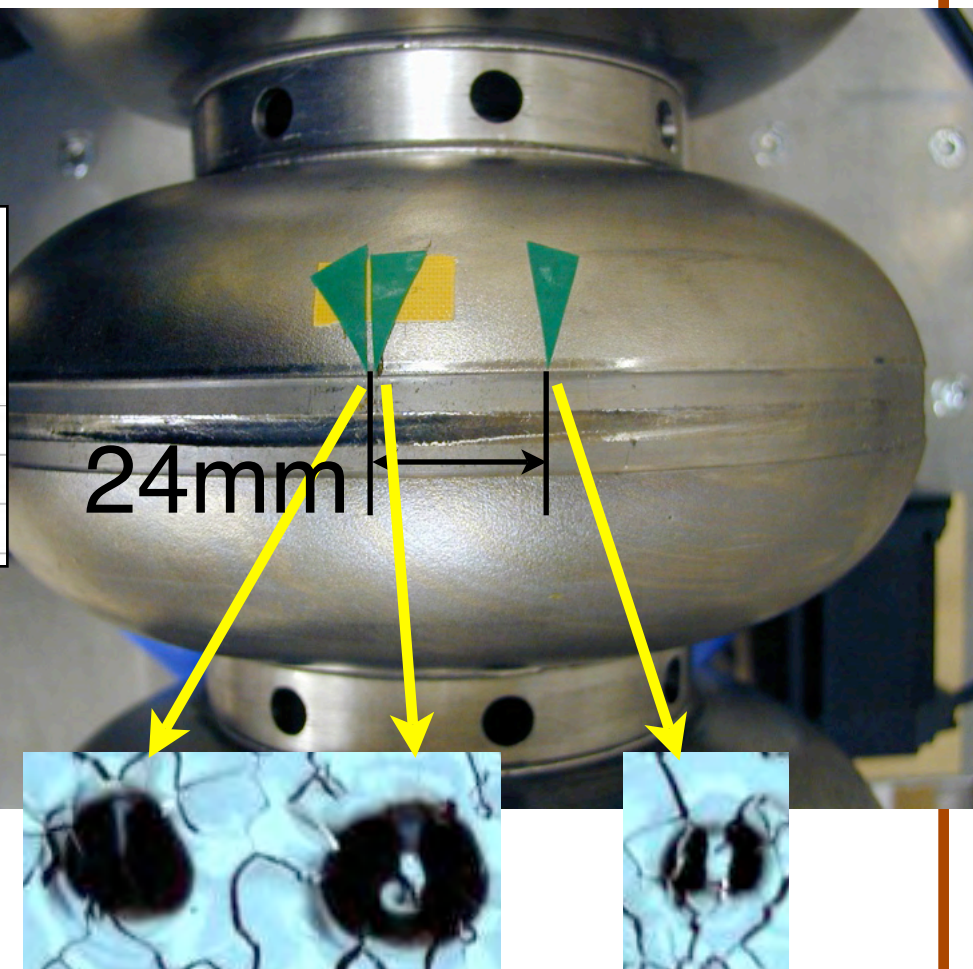
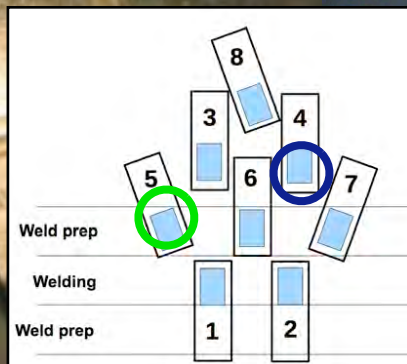
Cernox thermometry



Correlation with Thermometry

Two thermometers shows the temperature rise.

24mm?
The width of the thermometers are about 5mm.

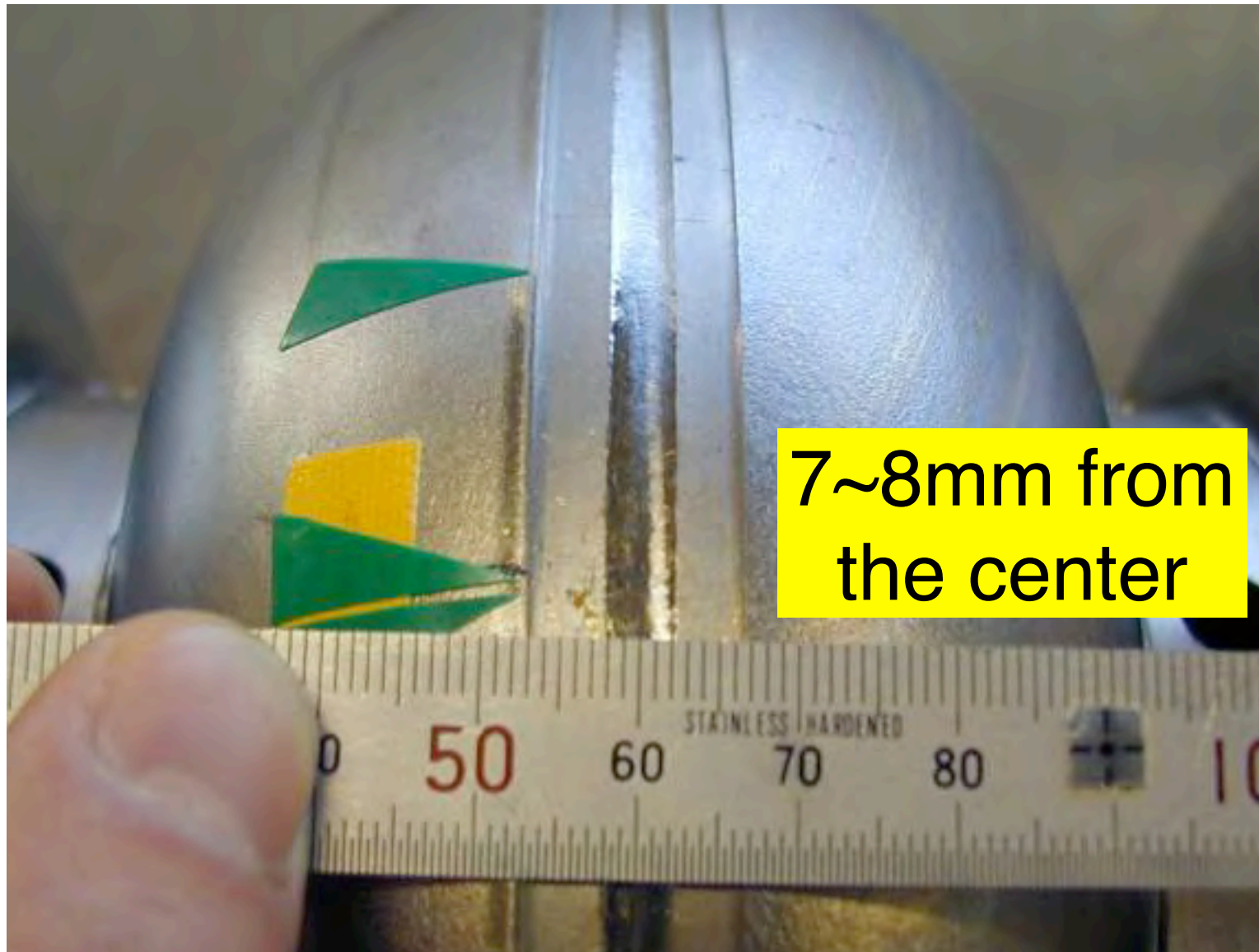


Dmitri A. Sergatskov: Thermometry on AES01 cavity at Fermilab
@webex20071204

Two hot spots@FNAL/JLAB

Three spots found@Kyoto

The location



AES001 #7 cell 325°

EBW affected area

Largest grains

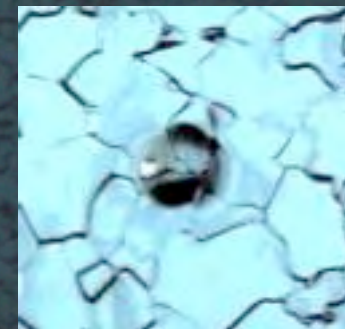
spot

Larger grains

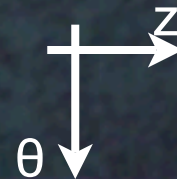
Transition?

to Equator
and #6 cell

Fine grains

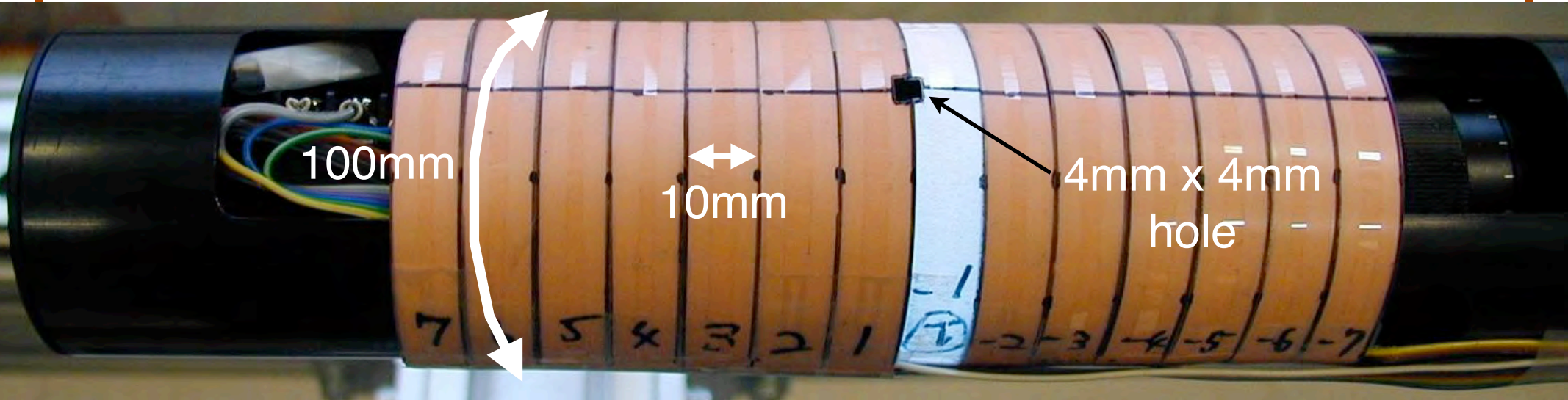


200 μm/div



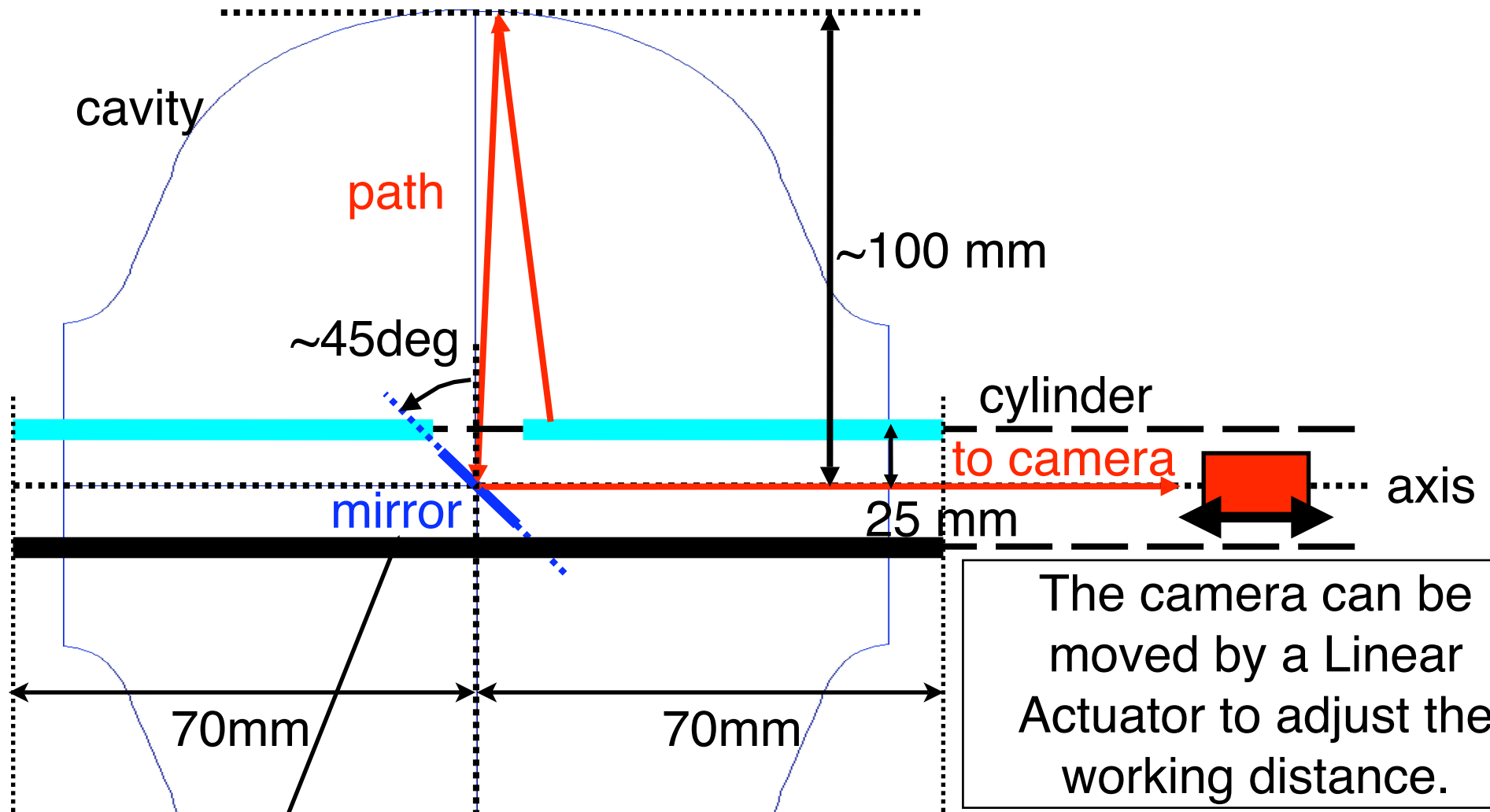
1mm

Stripe Illumination(SI)



- Fourteen Electro-Luminescence(EL) strip sheets are 10mm in axial direction and cover 100mm in azimuthal direction.
- These fourteen strips can be turned ON/OFF one by one.
- Assuming that cavity's interior surface is a complete mirror, we can measure wall gradients of the cavity's interior surface with these ELs.

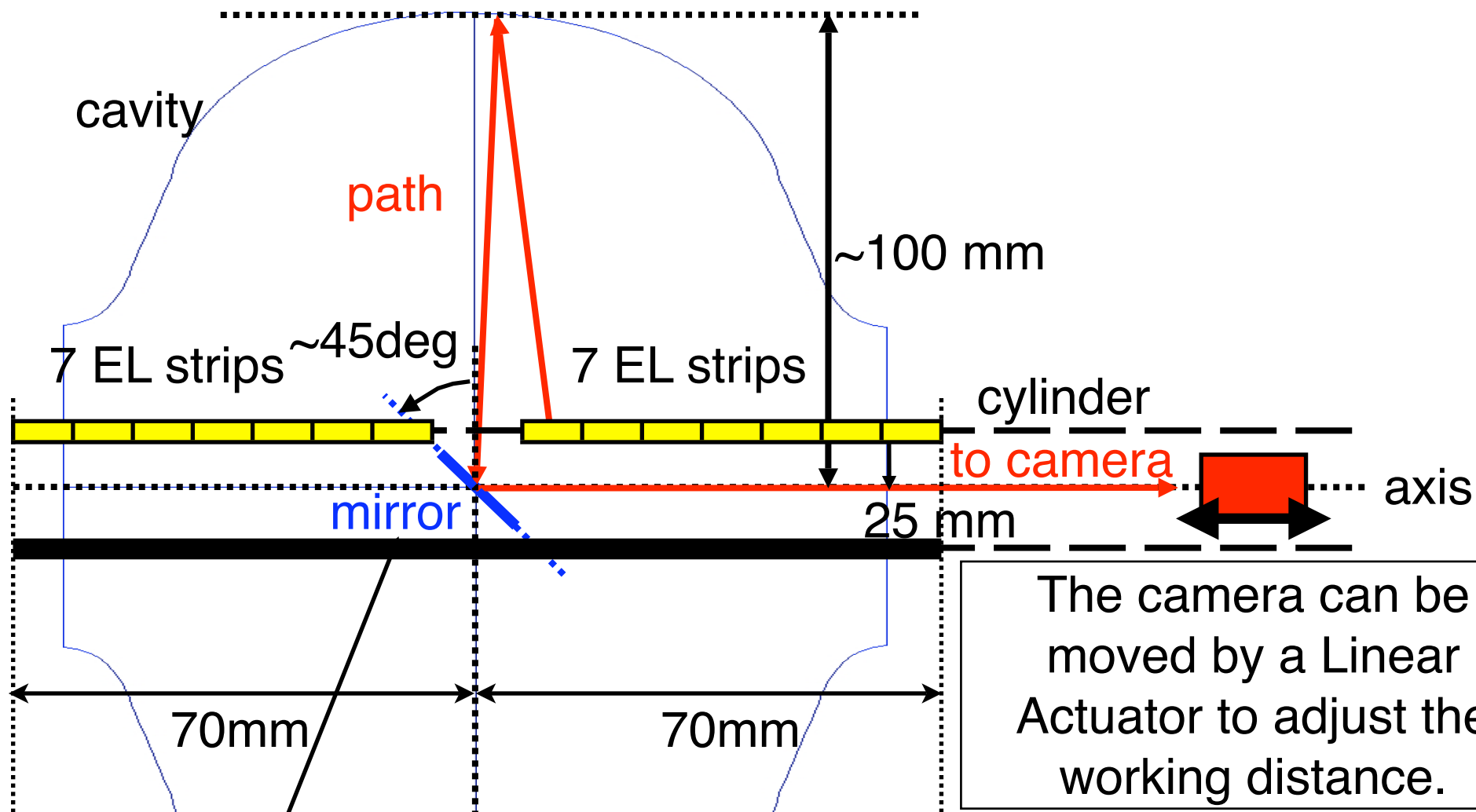
Inside the Cylinder



Mirror can be tilted by a Pulse Motor.

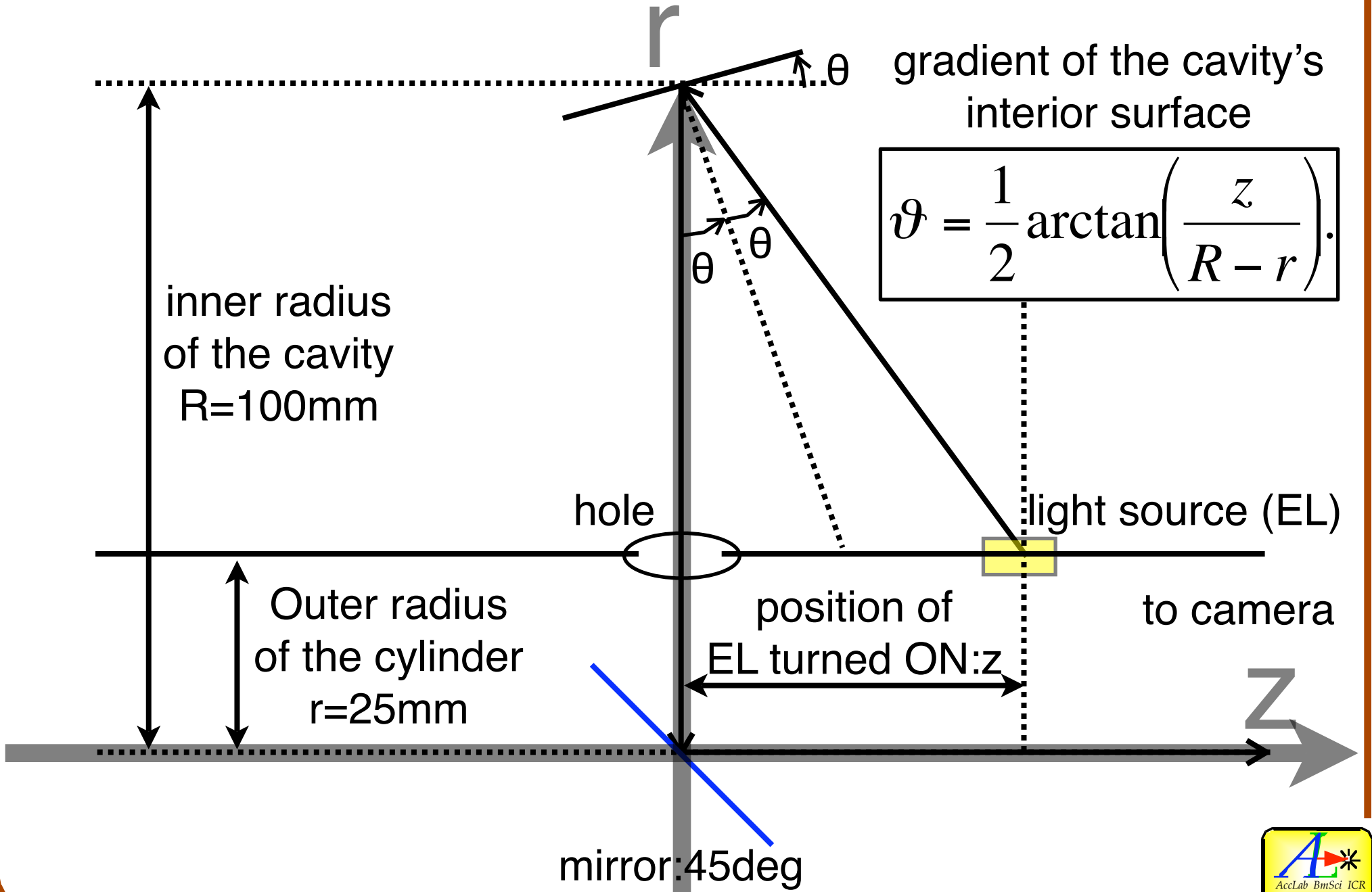
The camera can be moved by a Linear Actuator to adjust the working distance.

Inside the Cylinder

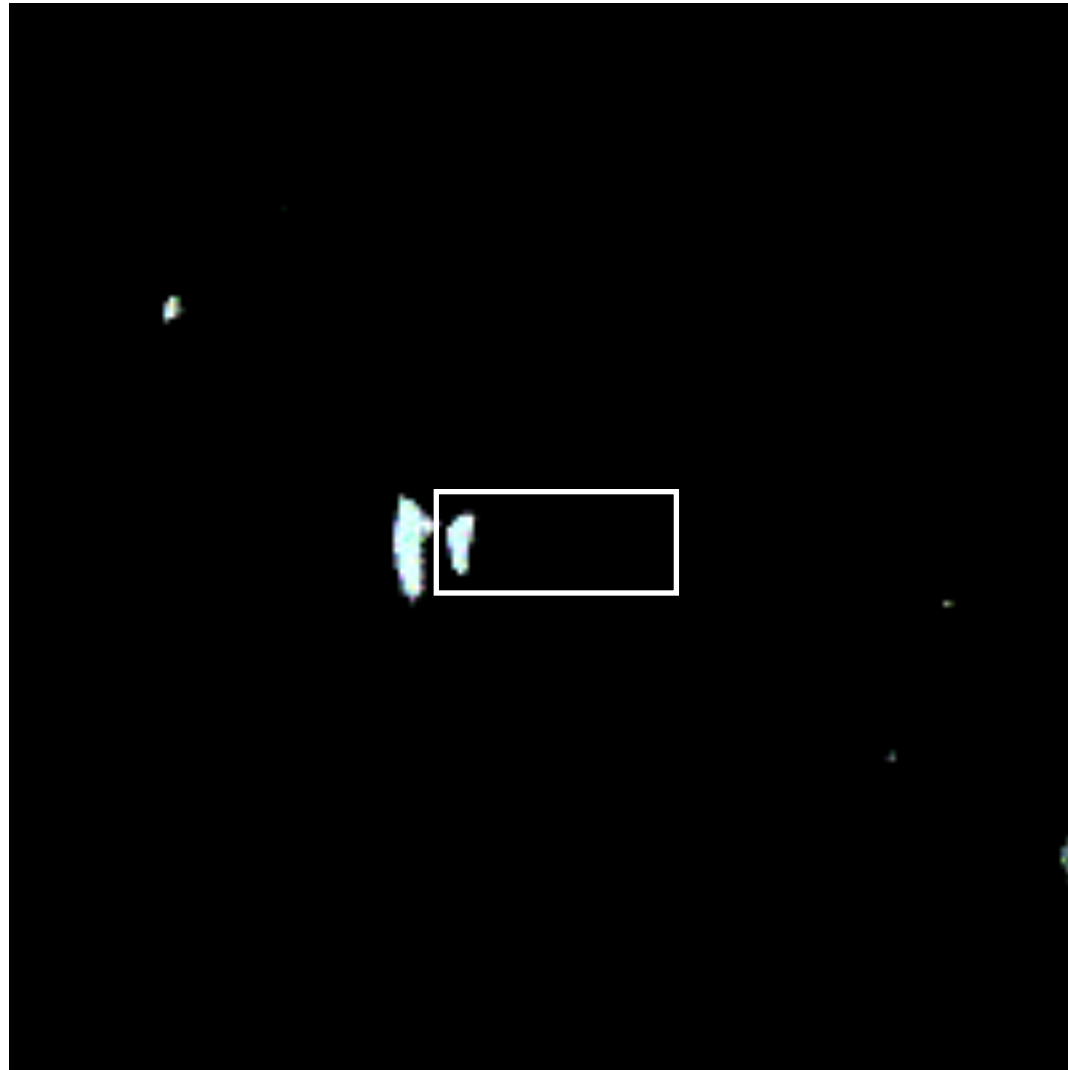


Mirror can be tilted by a Pulse Motor.

Wall Gradient Measurement

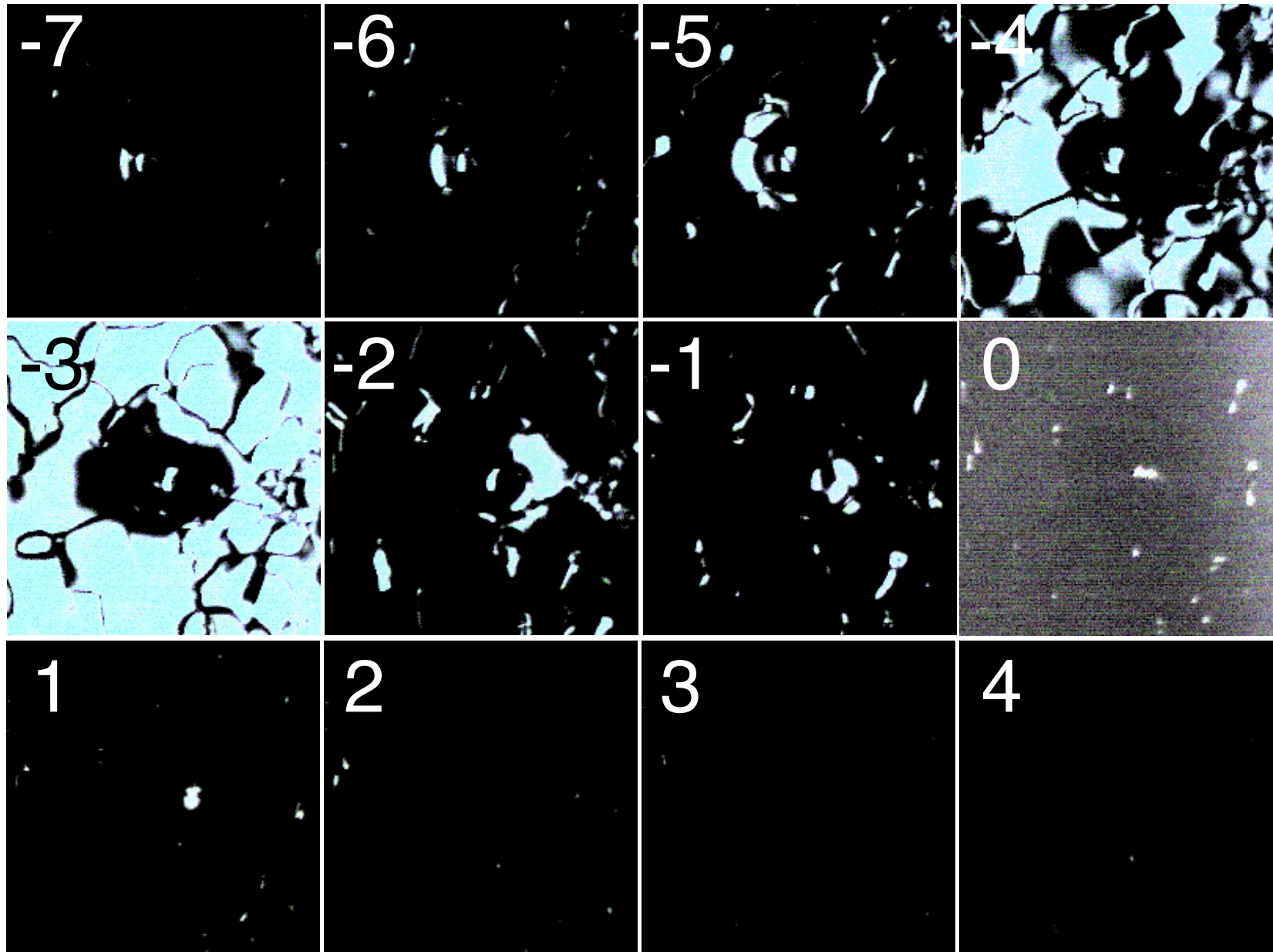


Wall Gradient Measurement

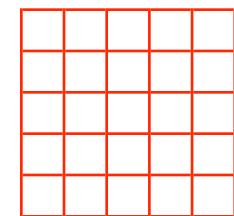
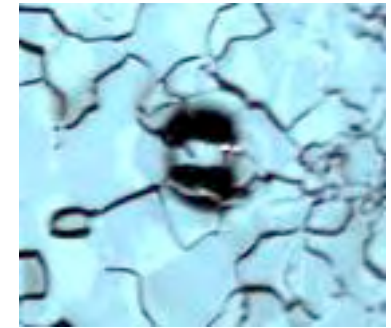
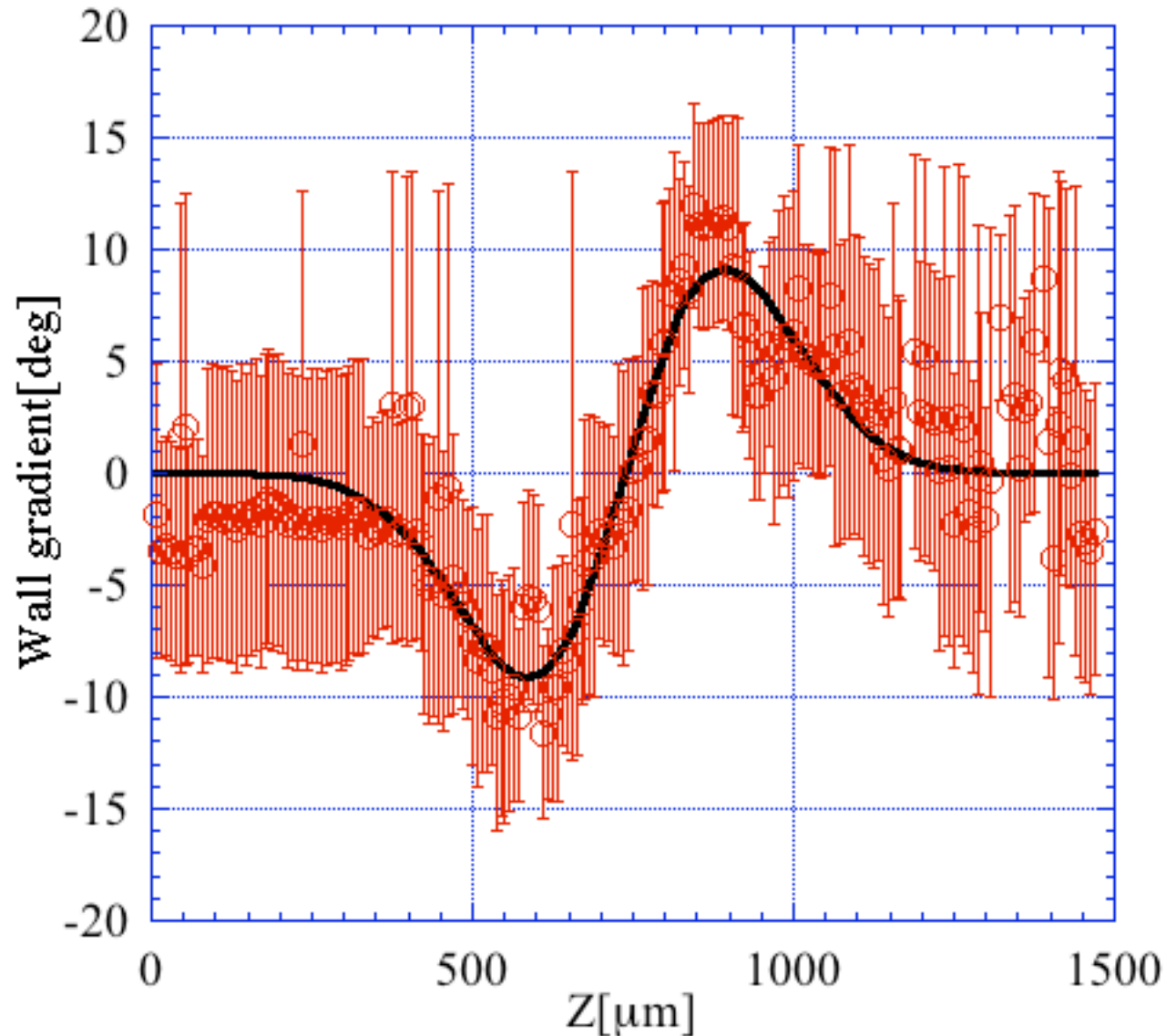


The center spot move left to right

Wall Gradient Measurement



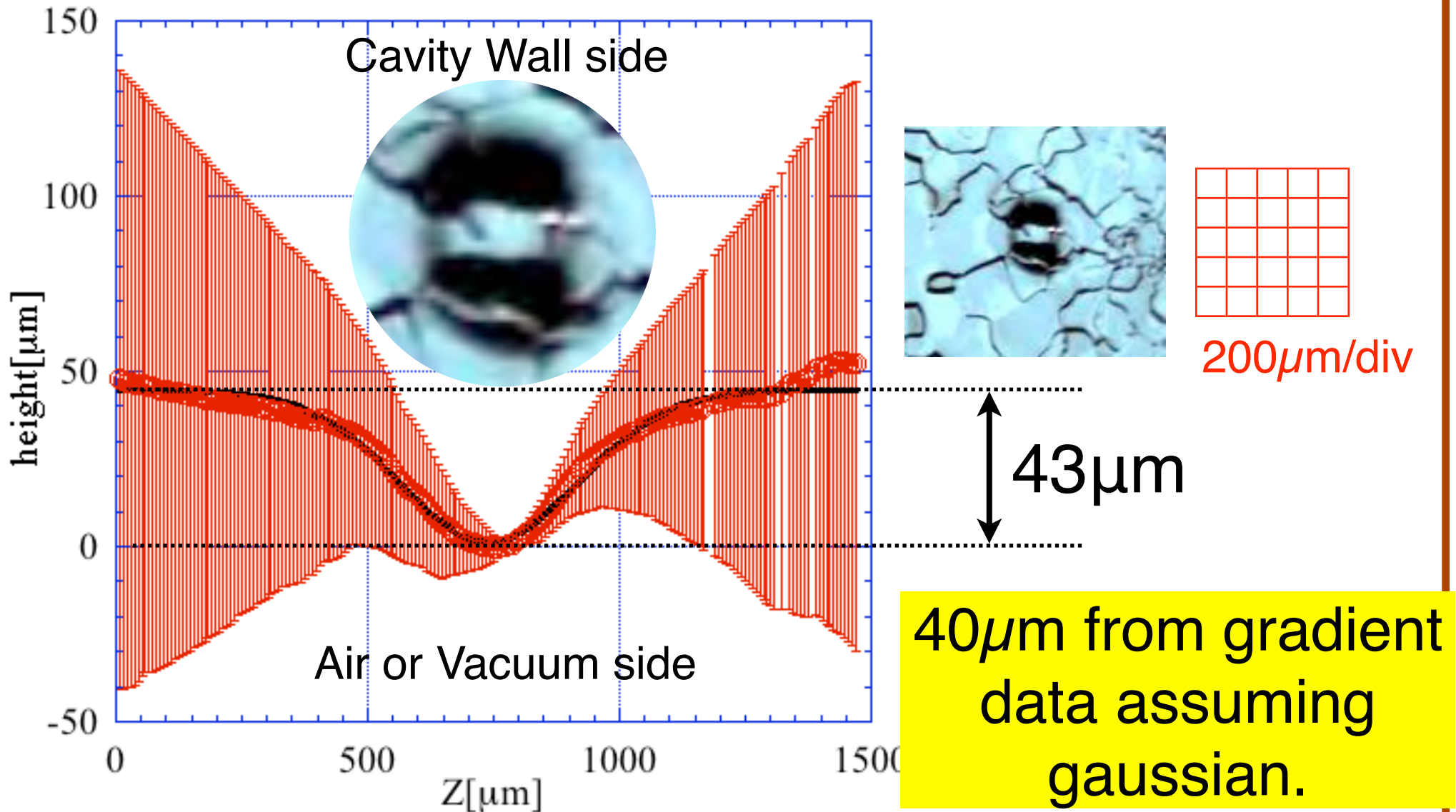
Wall Gradient of spot at #3 cell 181°



200 $\mu\text{m}/\text{div}$

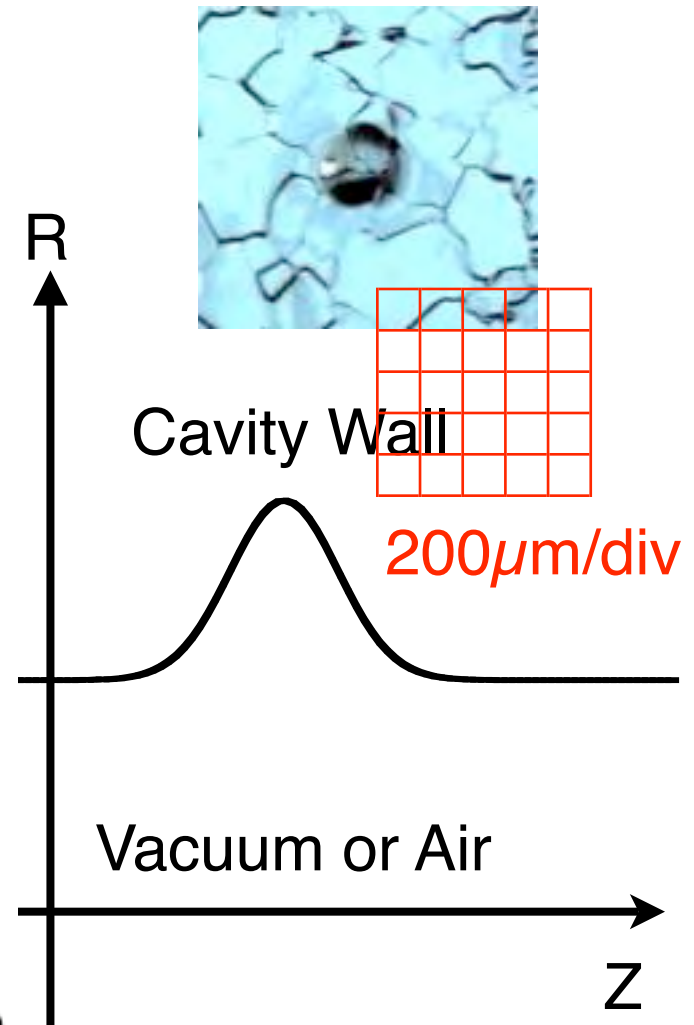
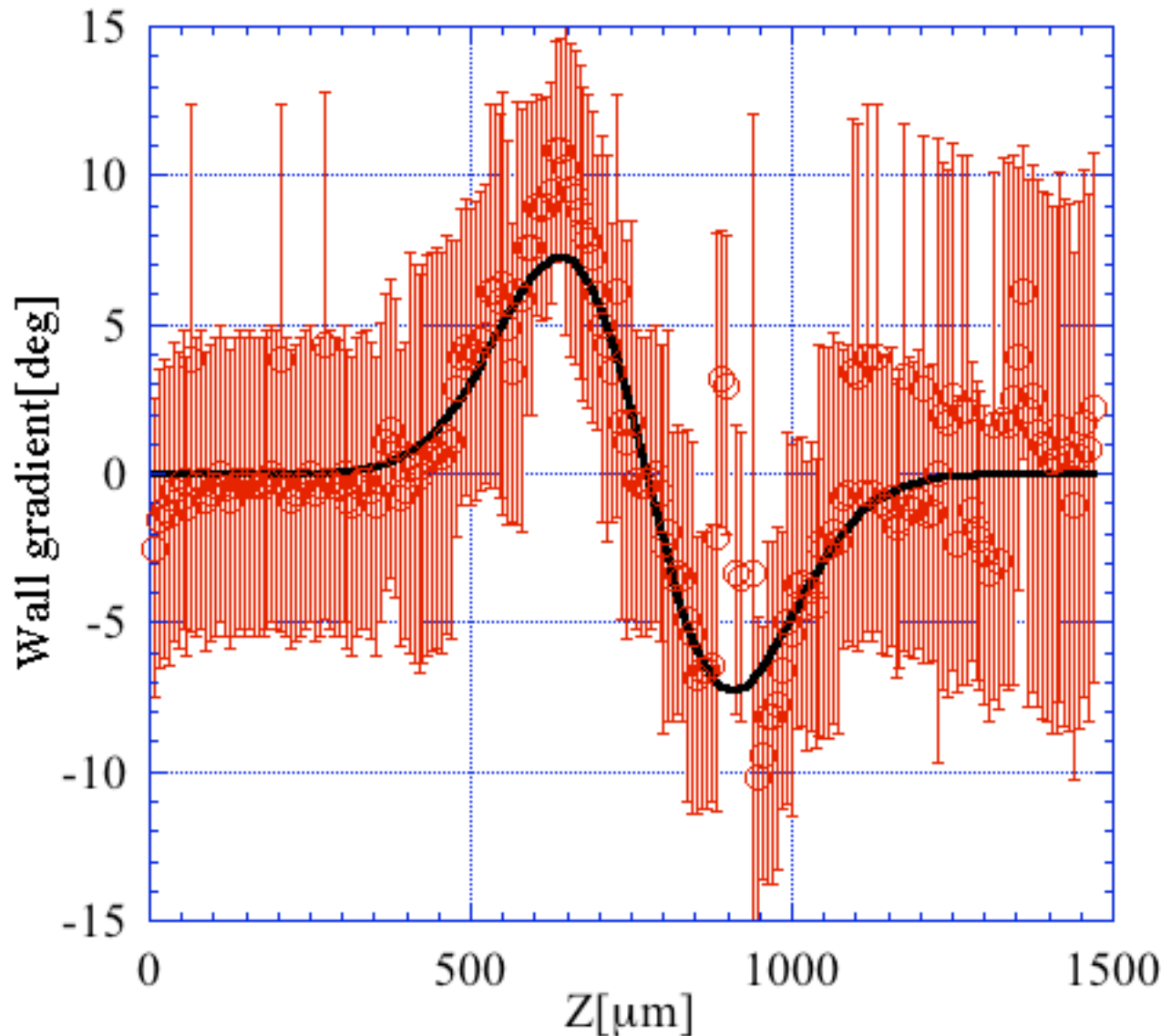
- This data shows that the spot is a convex(ball).
- Because of the continuity of the measured gradient, we can integrate the gradient to estimate the height of the spot.

Height of spot at #3 cell 181°



Black curve is a fitted gaussian.

Wall Gradient of spot at #7 cell 325°

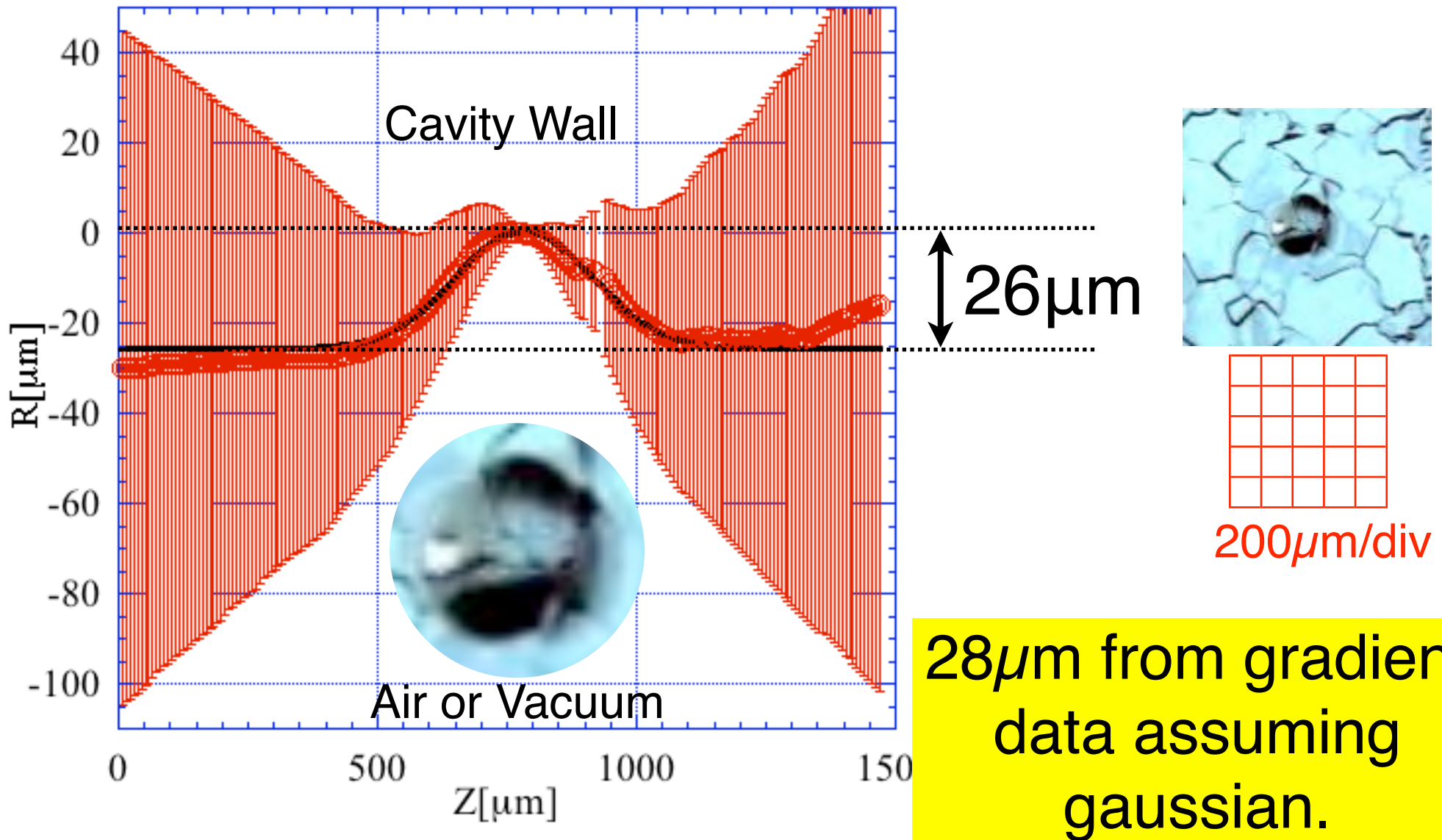


Left: Measured gradients and a fitted differential gaussian.

Right: Schematic drawing of the integral of the fitted curve in the left.

This data shows that the spot is a concave(pit).

Height of spot at #7 cell 325deg



$28\mu\text{m}$ from gradient data assuming gaussian.

Black curve is a fitted gaussian.

Spot location

AC74

#3 ←

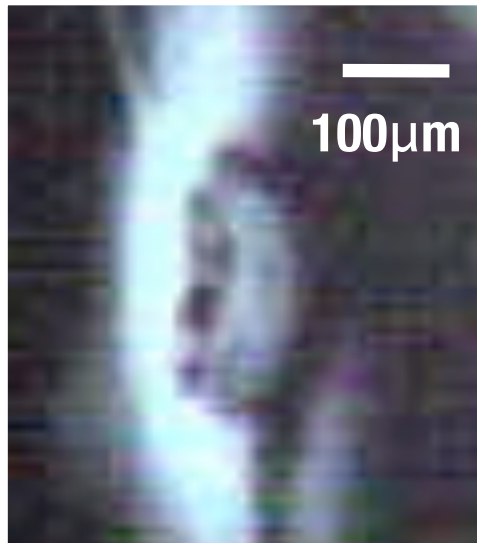
Cell #4

→ #5

Stiffener out side?

95°, 141°

AC74: spot1 95°



AC74: spot2 141°



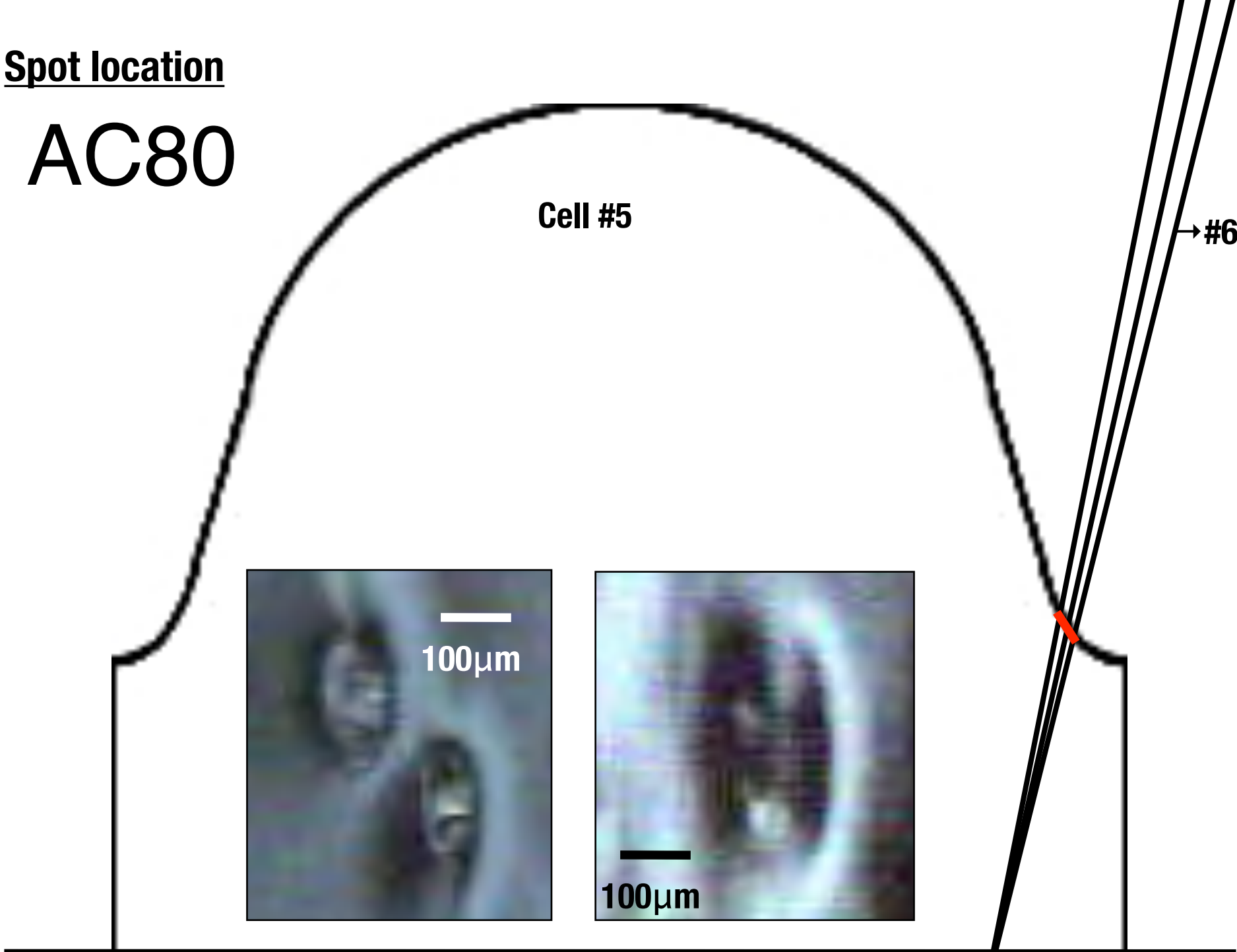
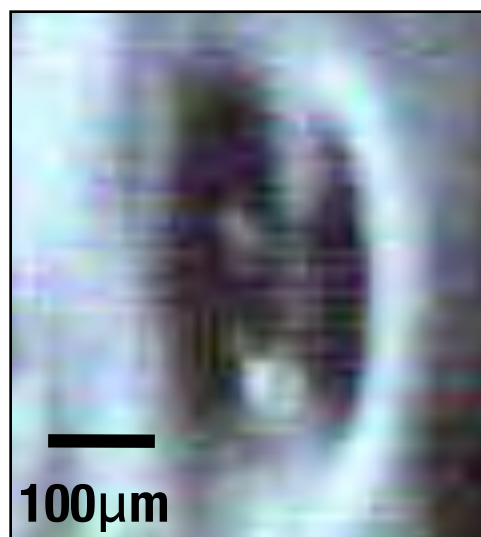
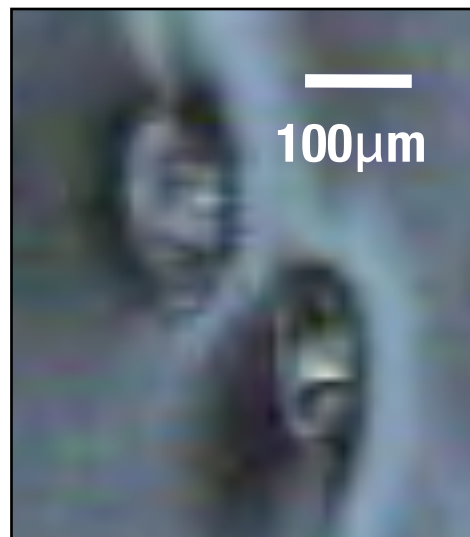
Spot location

AC80

#4 ←

Cell #5

→ #6



AC80: bubble sign@equator

Bubble sign exist on cell #1,2,3 equator.
Reduce it for #4,5,6..., Nothing in cell
#9. .

1mm



ERL single-cell cavity内面観察(1)

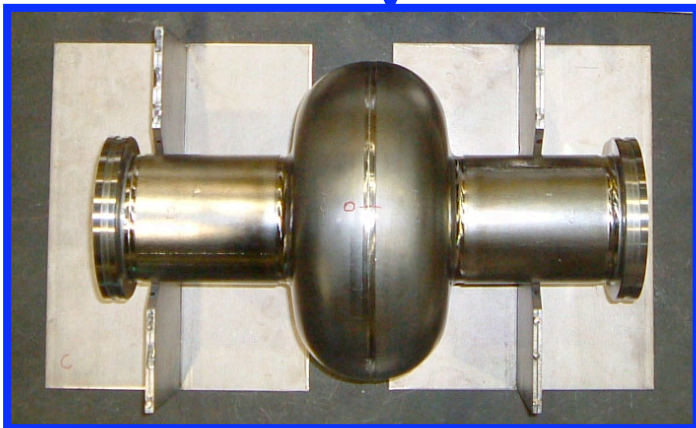
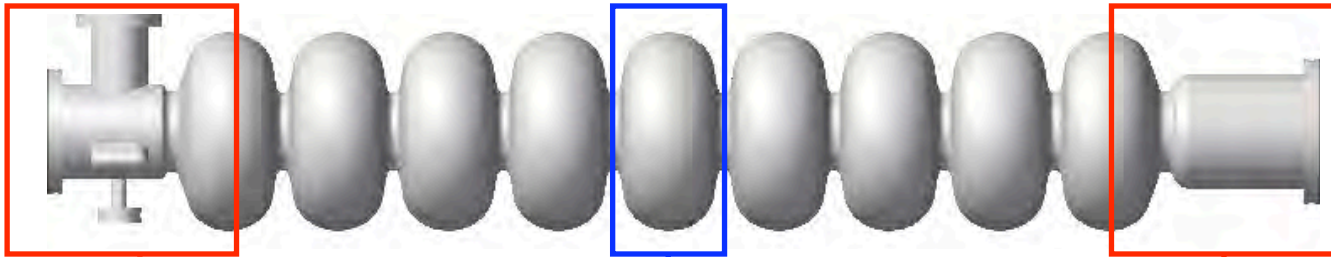
(エンドシングルセル)

渡邊 謙

STF Baseline group meeting

2008/3/28

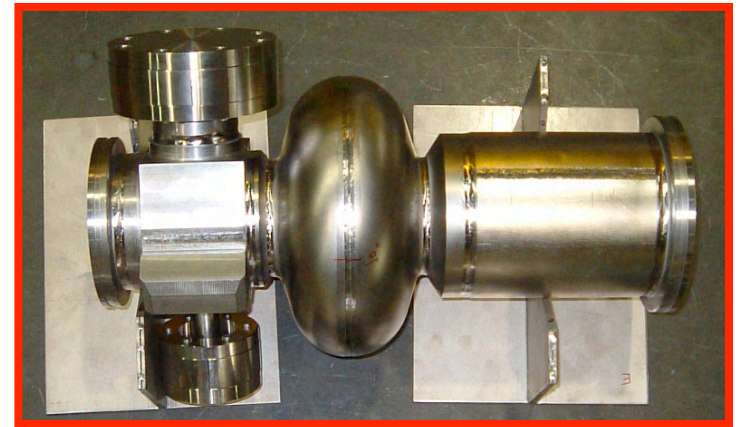
観察した空洞：エンドシングル空洞



- センターシングル空洞
 - セル形状の検証
 - 表面処理工程の確認

4月？に観察予定

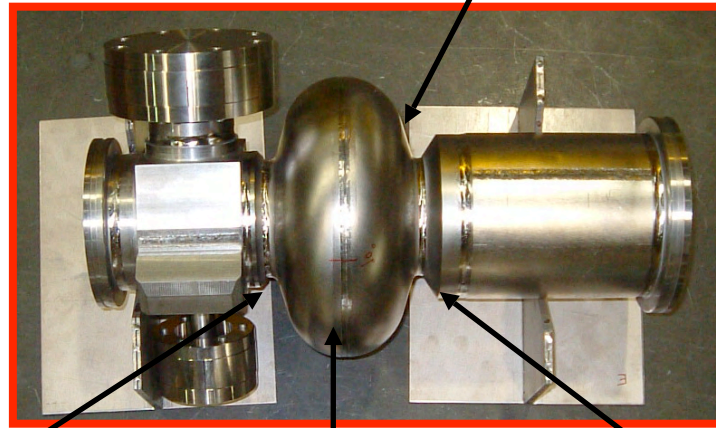
• 9セル空洞



- エンドシングル空洞
 - ビームパイプ構造の検証
 - 大口径ビームパイプ
 - 偏心フルート
 - インポートポート
 - ピックアップポート

観察位置

④赤道からLBPアイリスに向かう面



③SBPのアイリス部

①LBPのアイリス部

②赤道部:EBW後バフ研磨

①LBPのアイリス部

ビーム軸方向



5mm



所々ボール状のものやピットがあった。

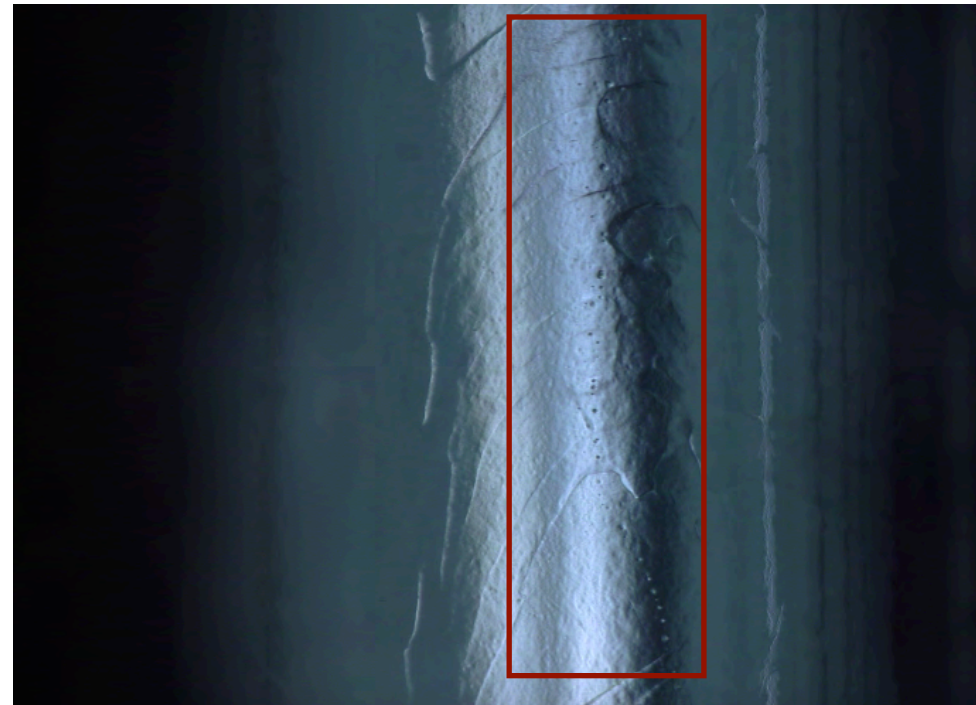
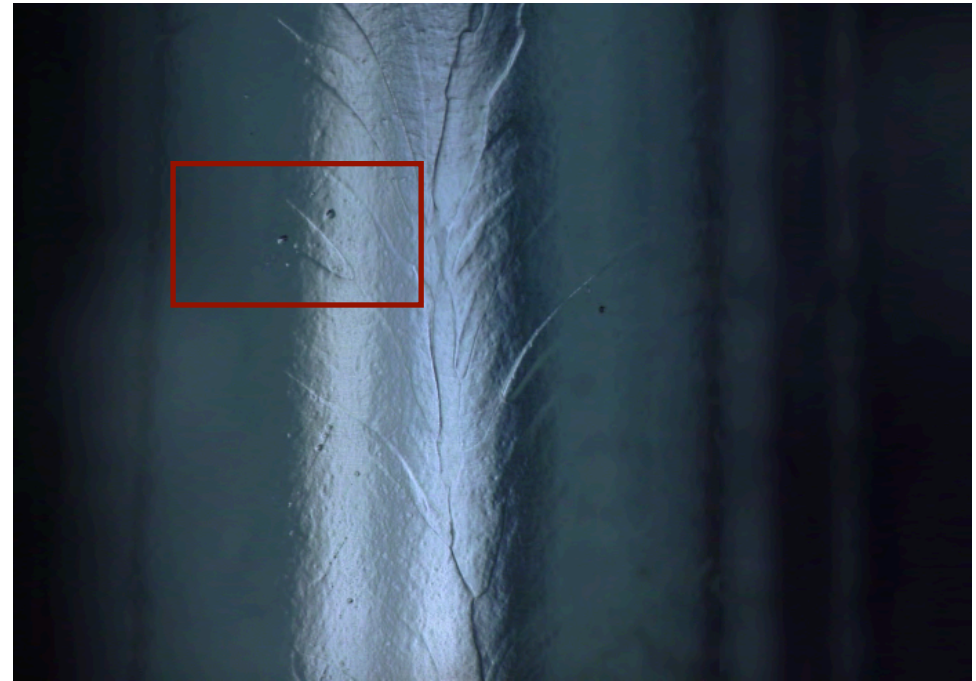
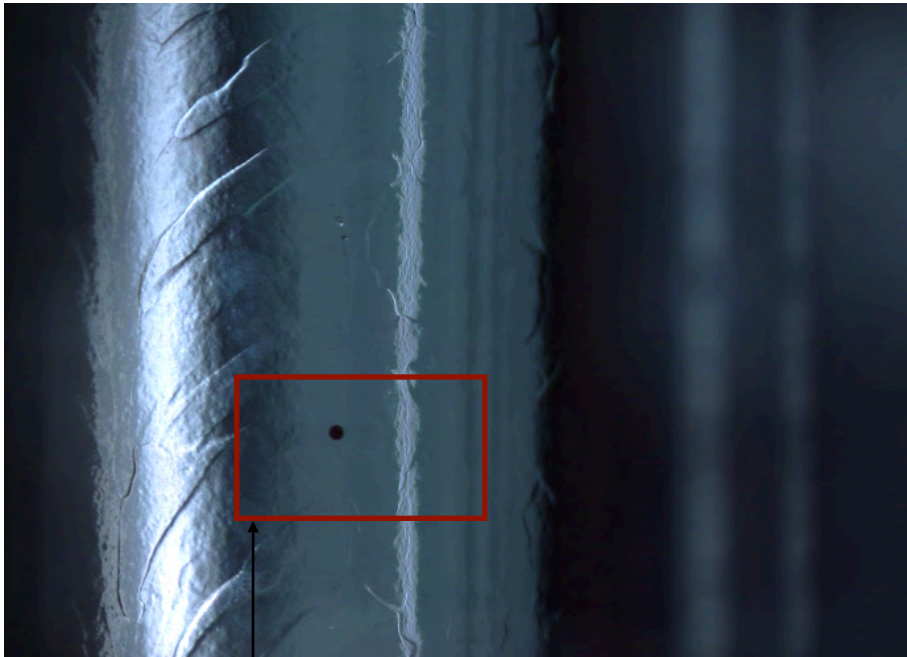
②赤道部:EBW後バフ研磨



ボール？(突起)らしきものが見えた

赤道部はバフ研磨しているため、溶接痕は消えていた。

③SBPのアイリス部



アイリスから外れた部分に大きな穴らしきものがあった。

溶接痕の上にも全体的にピットが観測された。

④赤道からLBPアイリスに向かう面



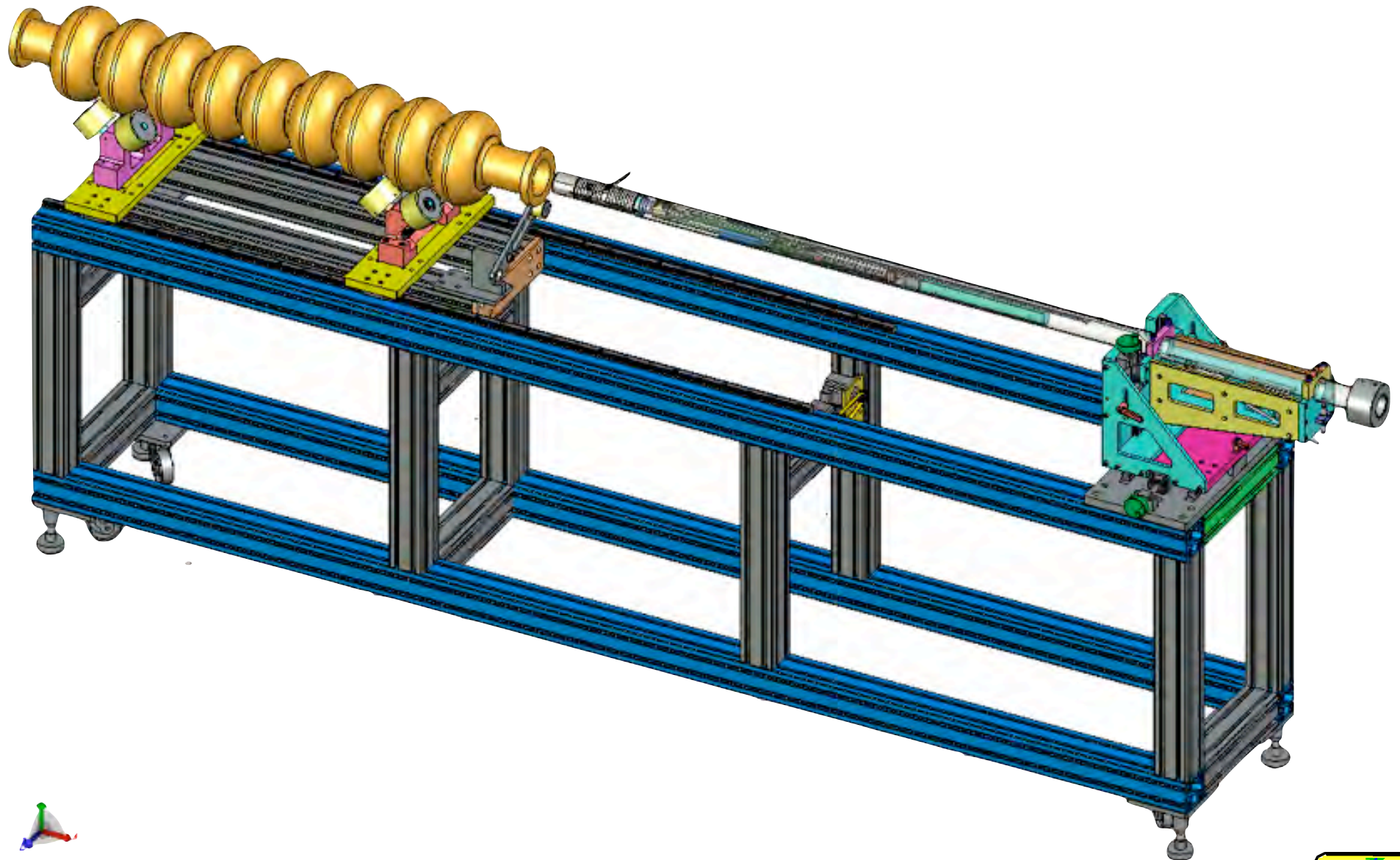
レンチを落とした傷をベビーグラインダーで一部分研磨したとのこと(#800?)

研磨した面では傷が残っていた。

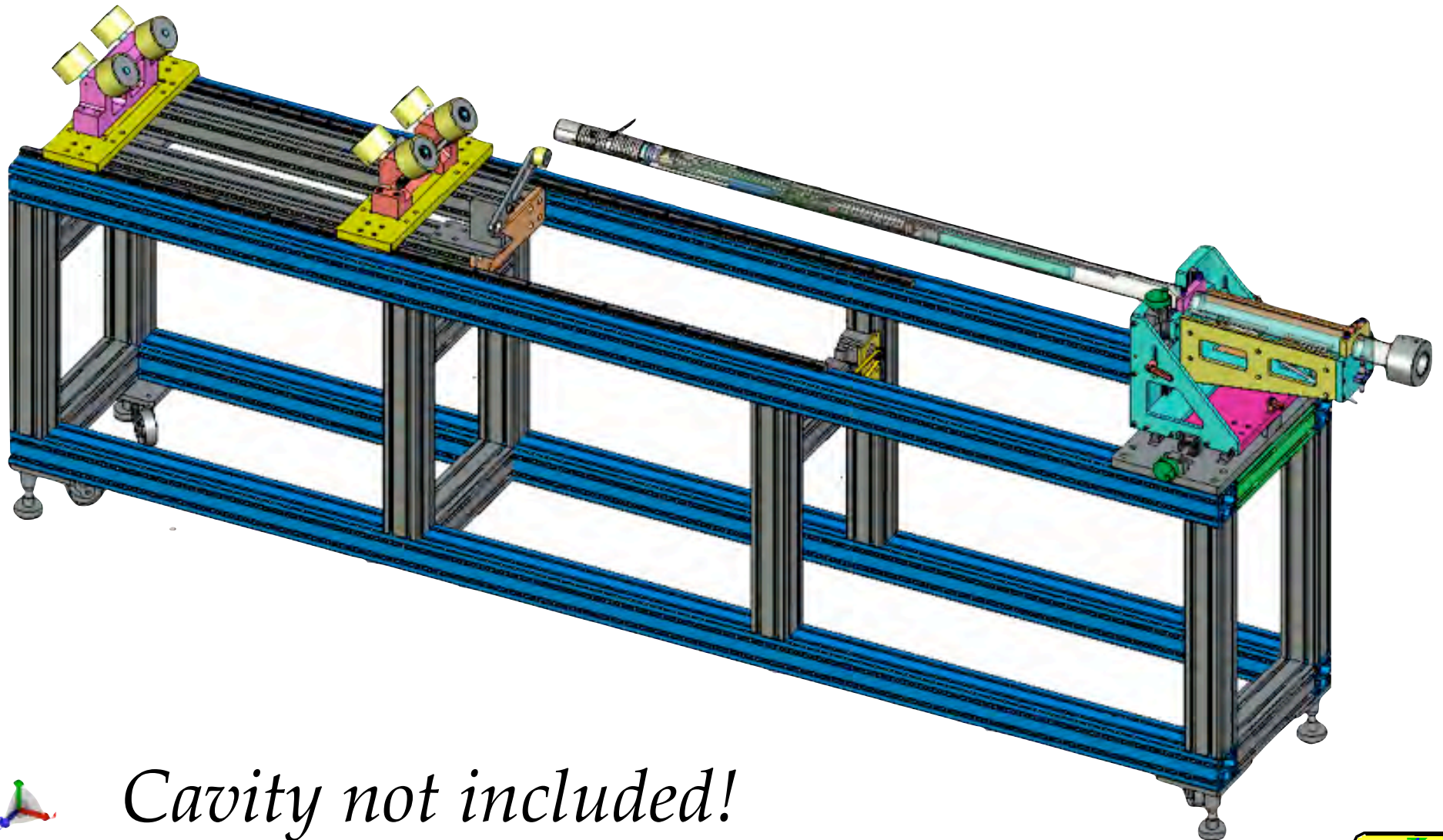
目視でも確認できるレベルの傷であった。

このような傷はEP(30 μ m)で取れないことが分かる。

Prototype design for production series

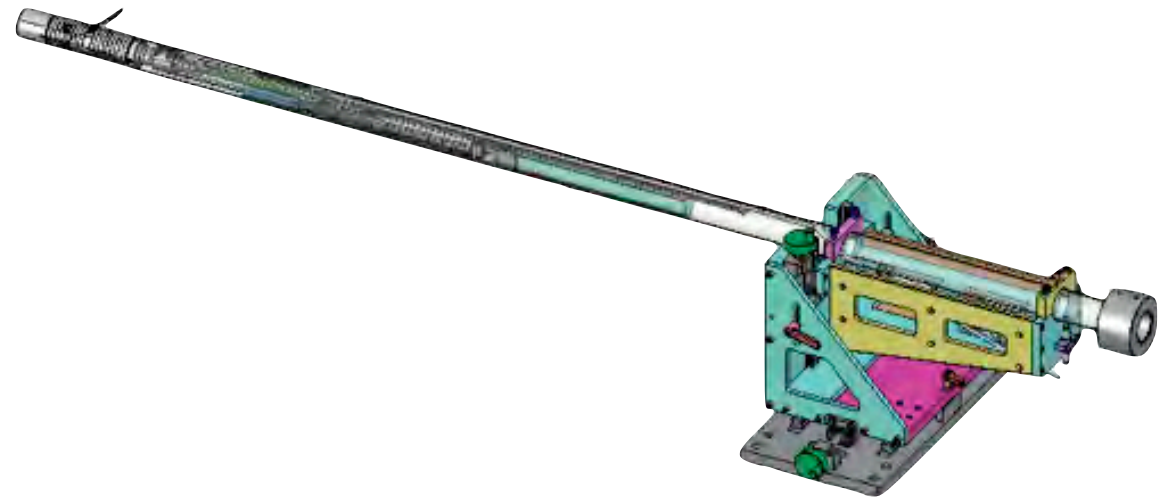


Prototype design for production series



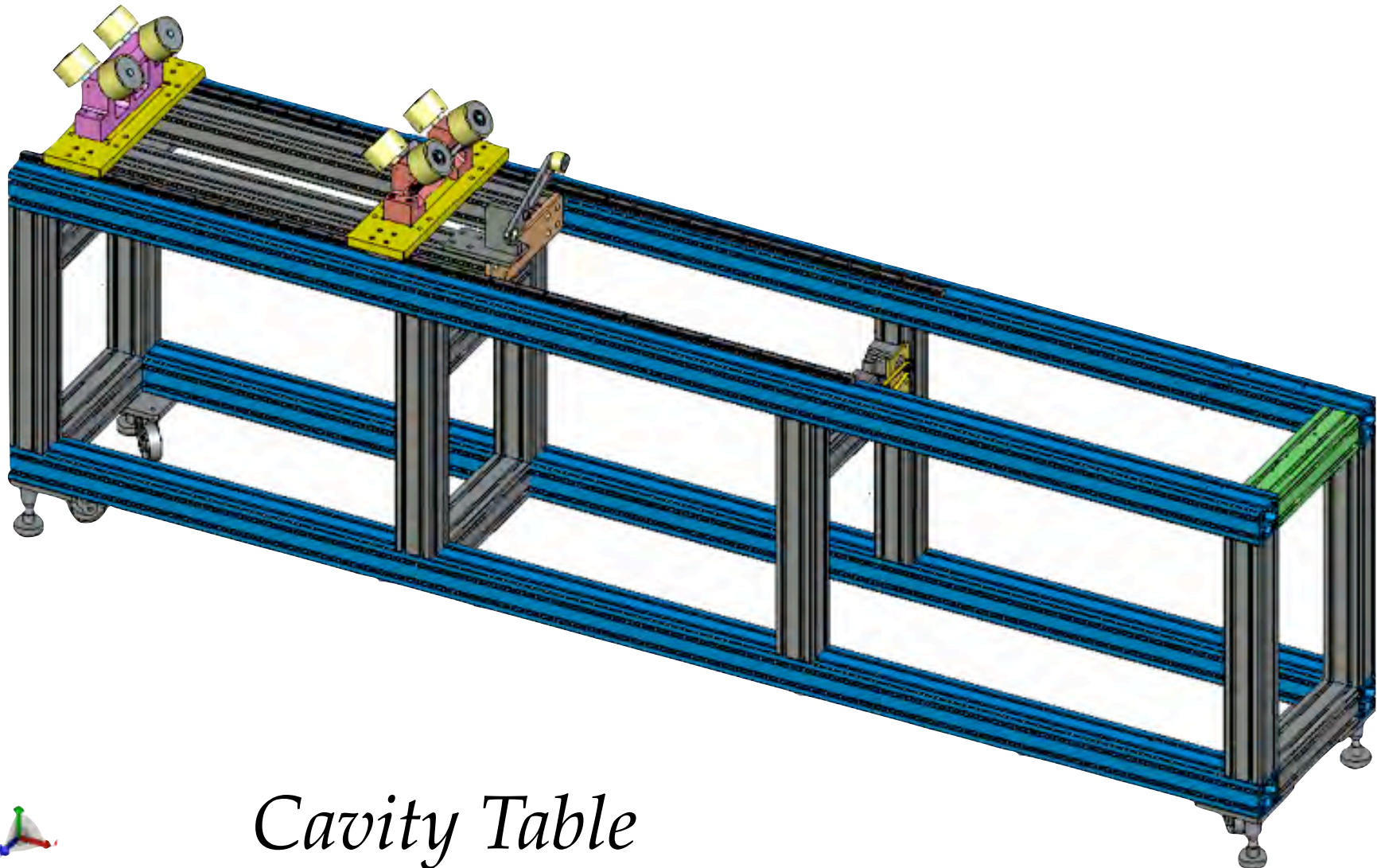
Cavity not included!

Prototype design for production series



Upper Module

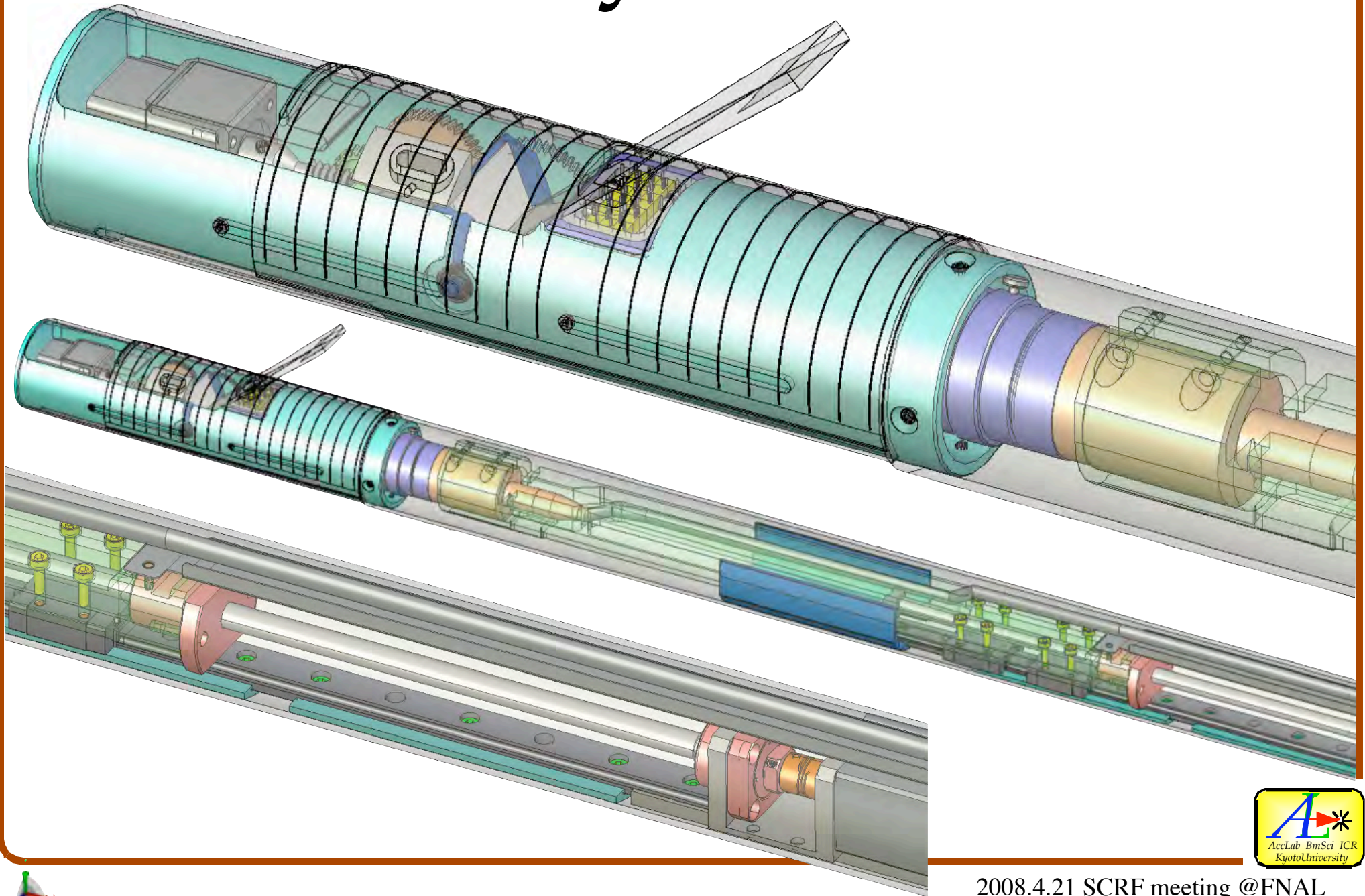
Prototype design for production series



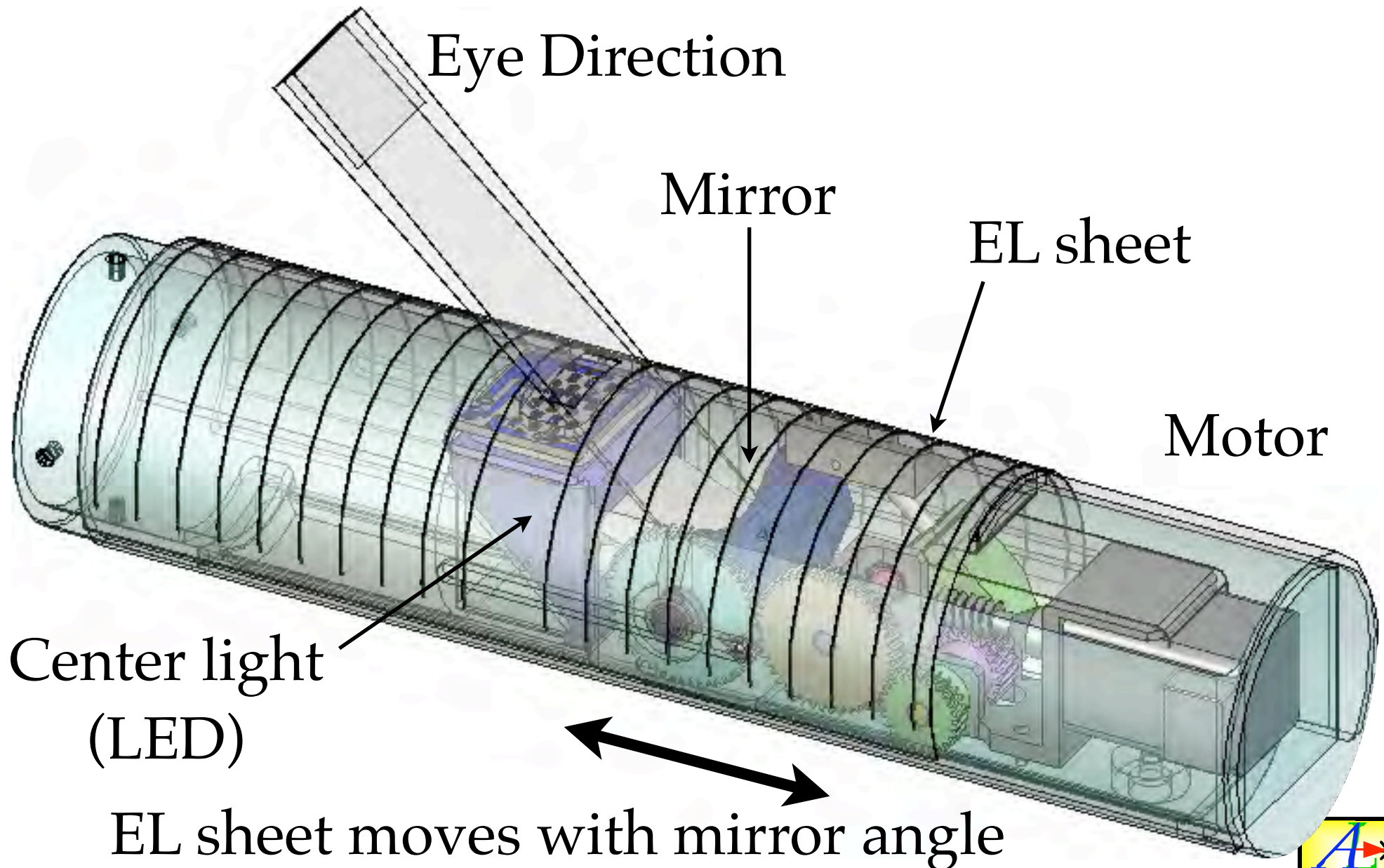
Cavity Table



Camera Cylinder Head



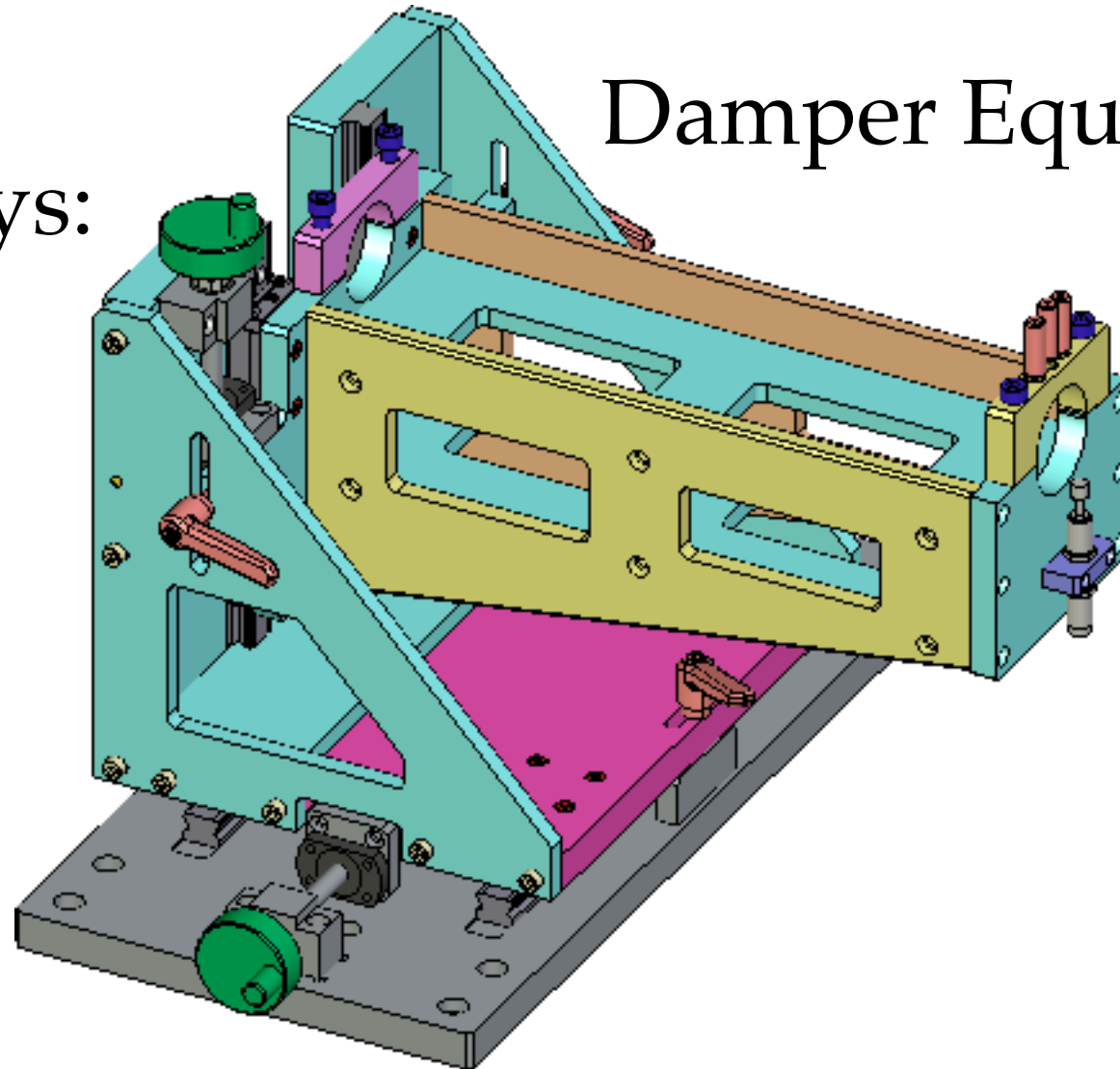
The Camera Head



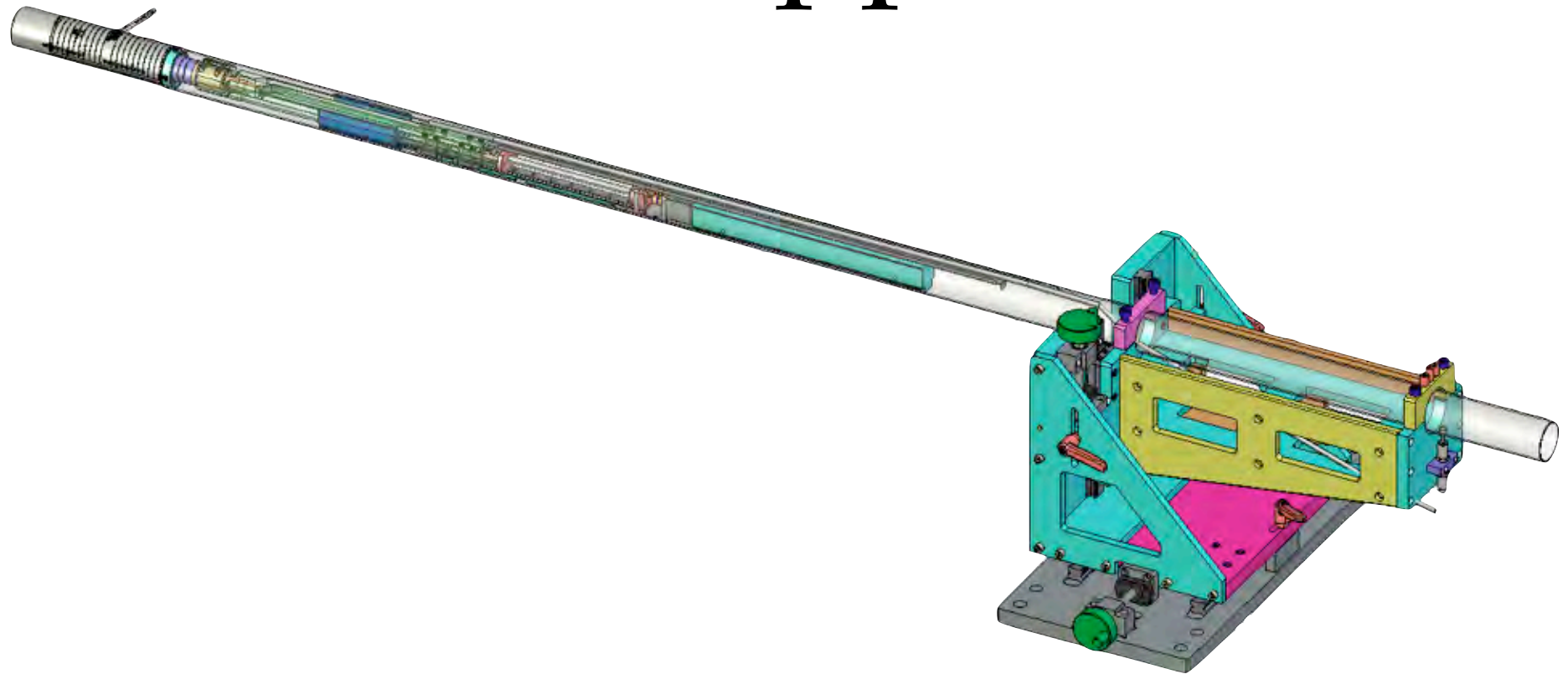
Cylinder Support

Moves 2 ways:
up down
and
left right

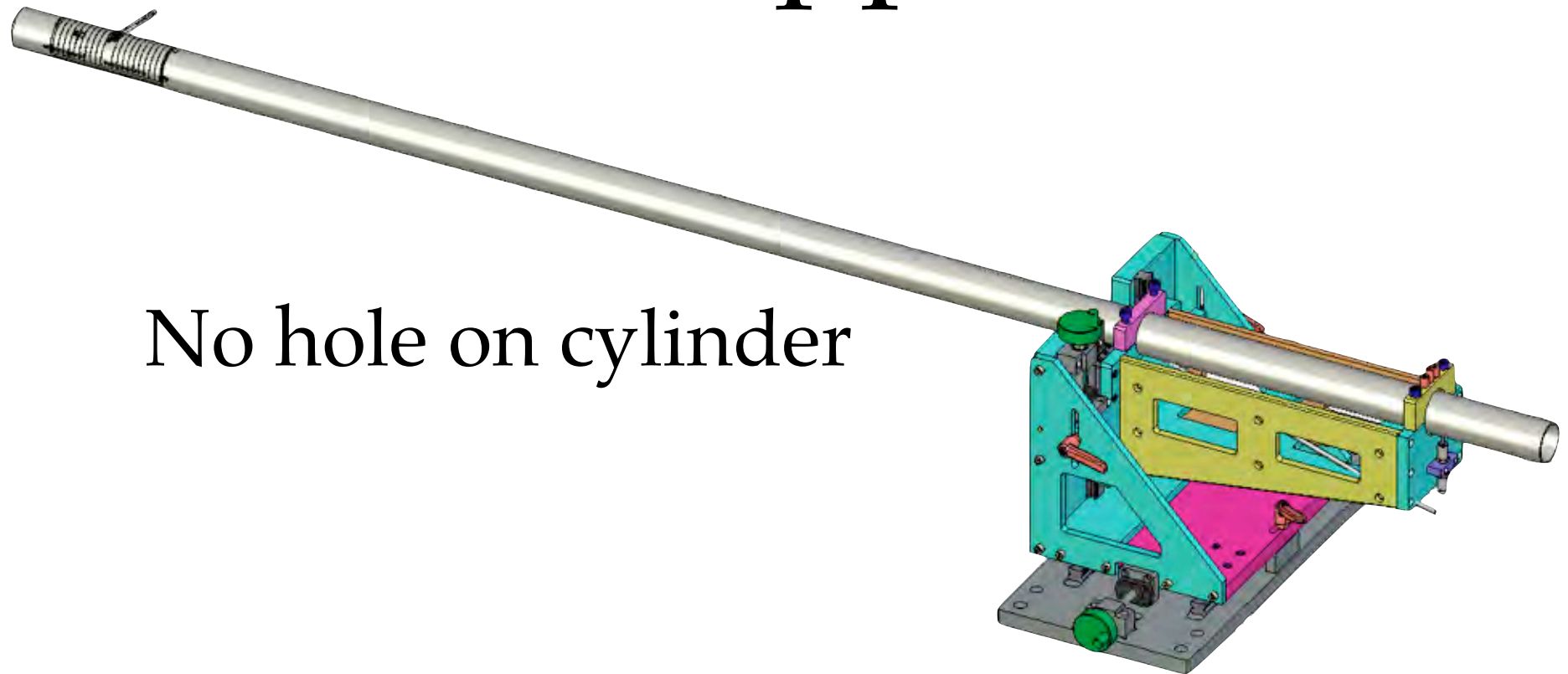
Damper Equipped



Camera Cylinder and its Support



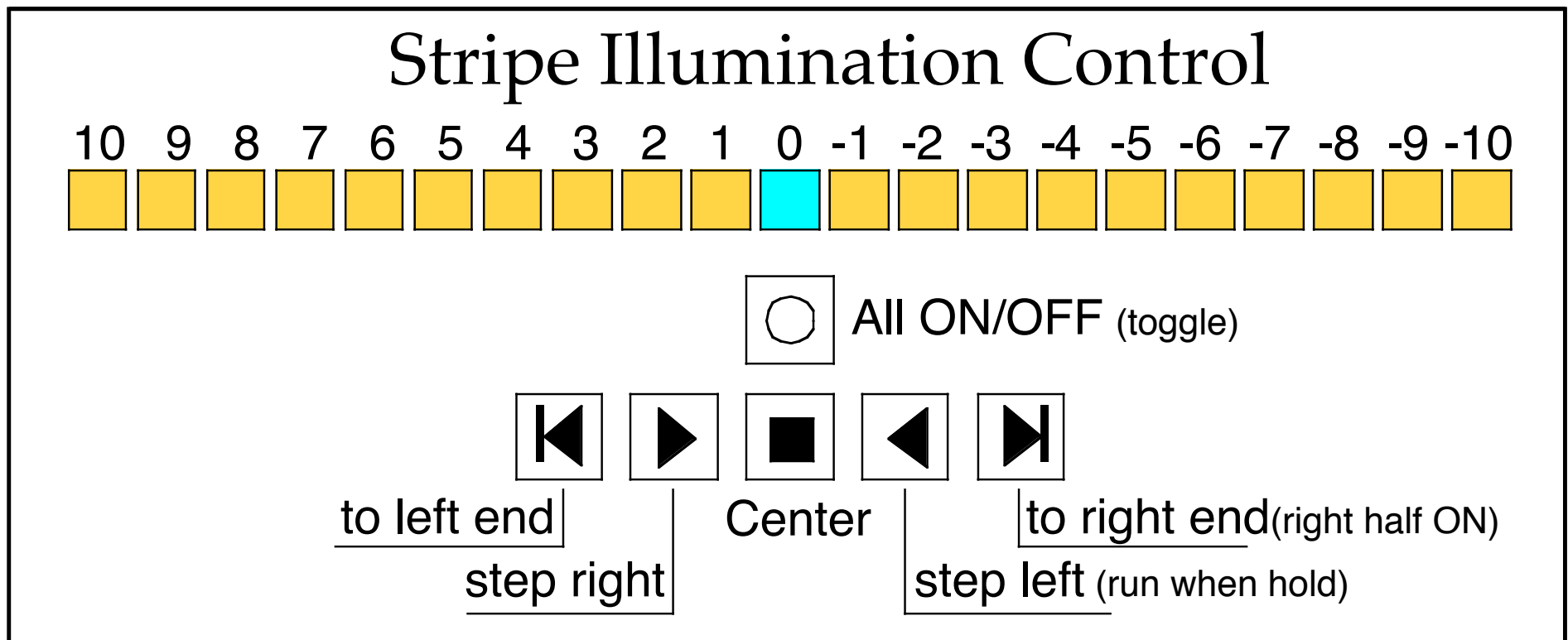
Camera Cylinder and its Support



No hole on cylinder



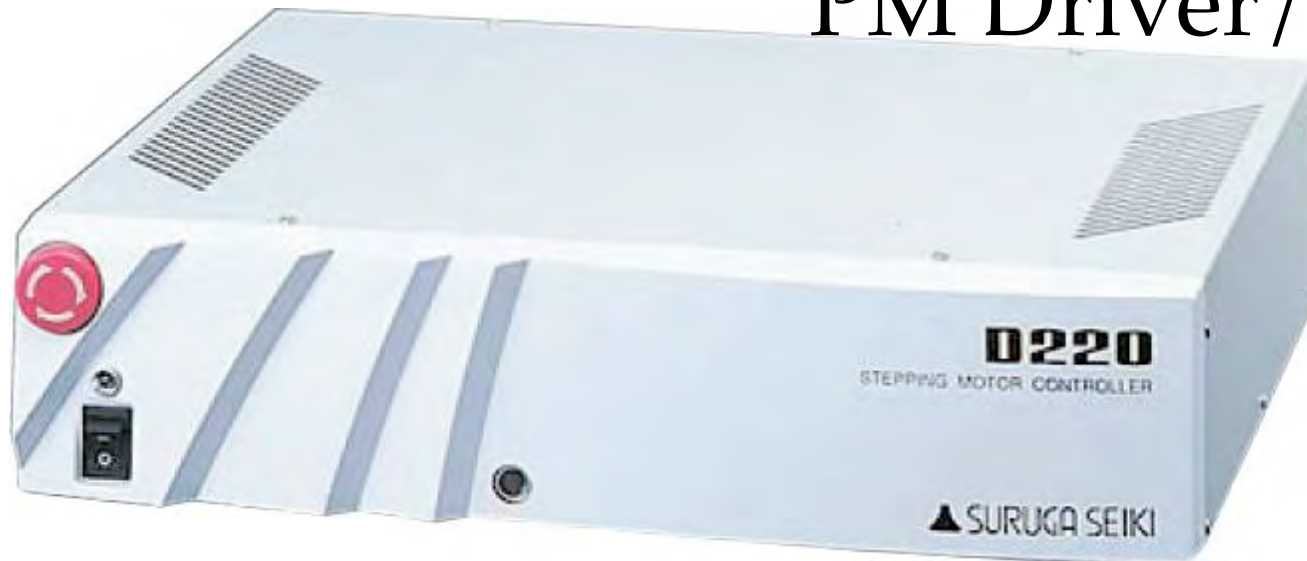
Illumination Control Panel Layout (tentative)



Pulse Motor Controller



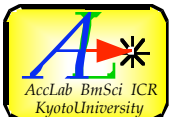
Suruga Seiki
Handy Terminal D200



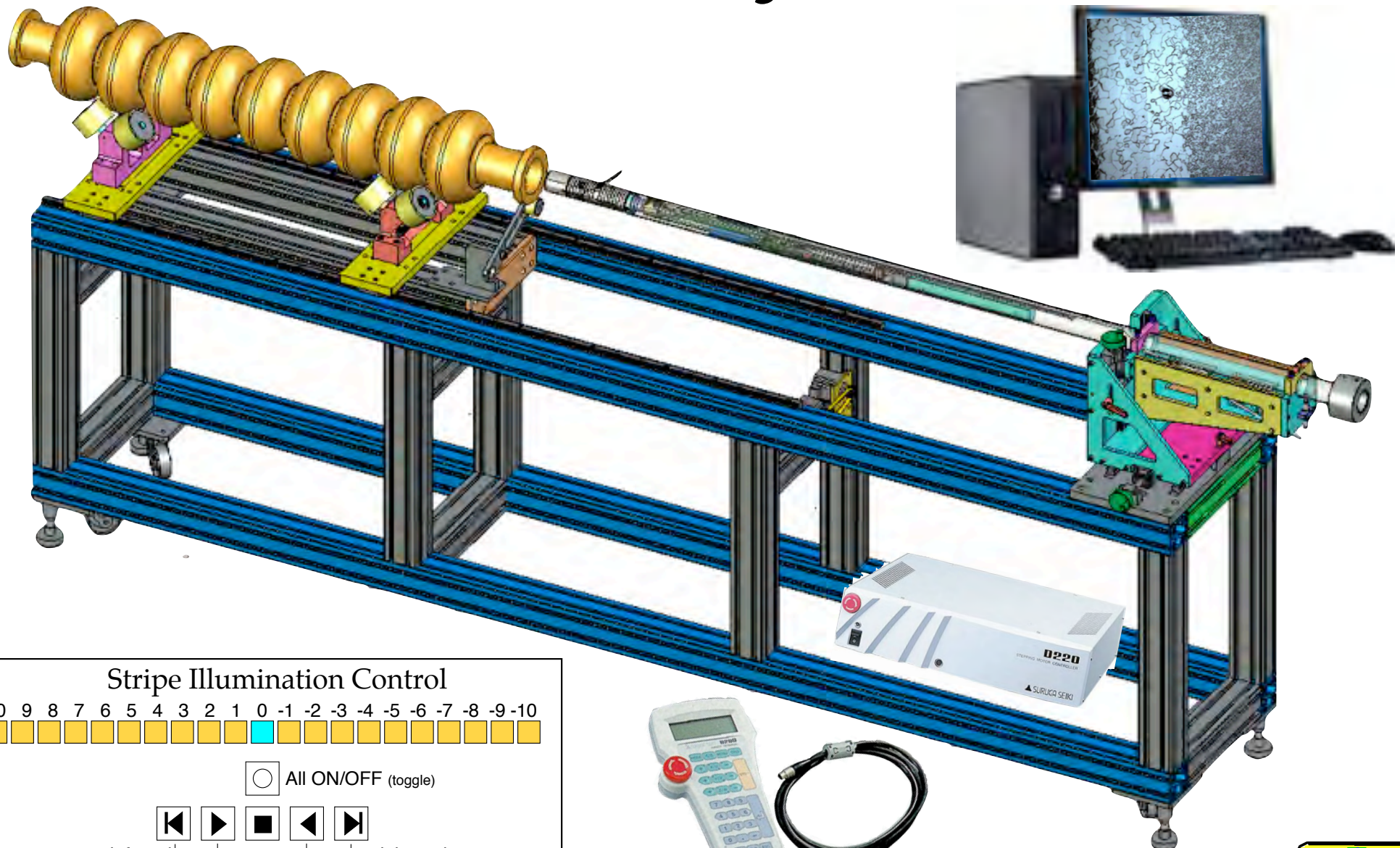
Suruga Seiki
PM Driver / Controller D22x

GP-IB, RS232C,
USB

1~6 Axis

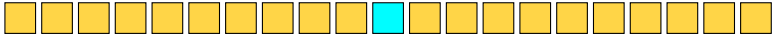


Whole System



Stripe Illumination Control

10 9 8 7 6 5 4 3 2 1 0 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10



All ON/OFF (toggle)



to left end | Center | to right end (right half ON)
 step right | step left (run when hold)



Summary

- I. The resolution of $7.4\mu\text{m}$ is achieved.
- II. AES1 spot locations agree with the results from passband mode and thermometry.
- III. The wall height/depth can be estimated by integrating the measured gradient.
- IV. Design of the production model is finished.
- V. The first lot will be delivered to KEK soon.
- VI. Searching trading company to handle exporting bureaucracy.