Current Status and Future Plan for 2026

9. January 2026

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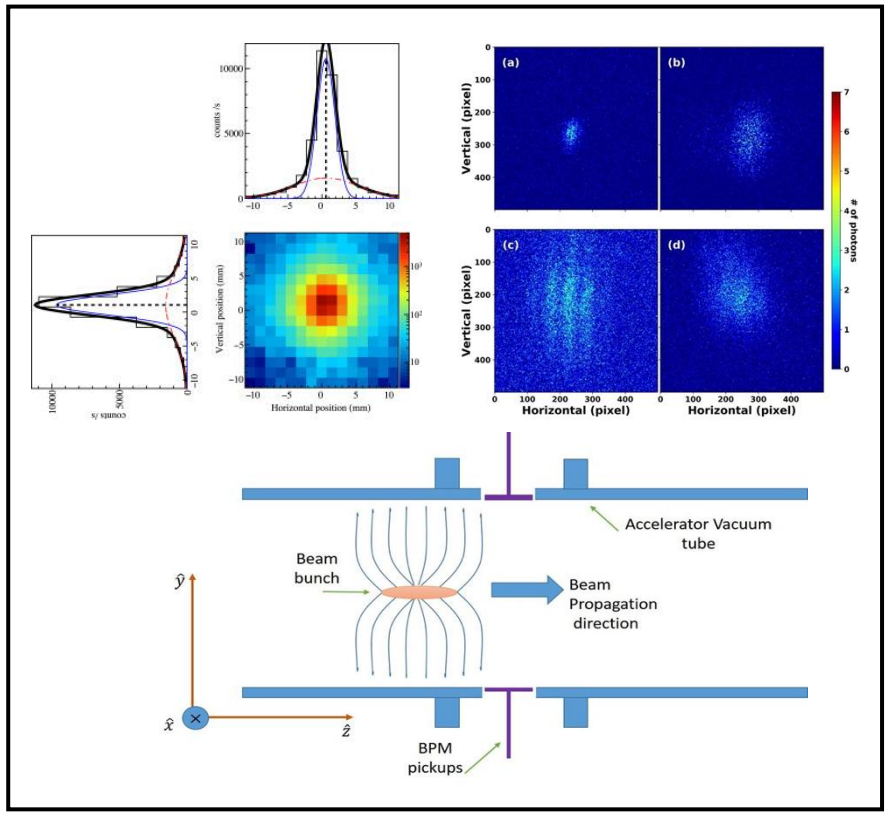
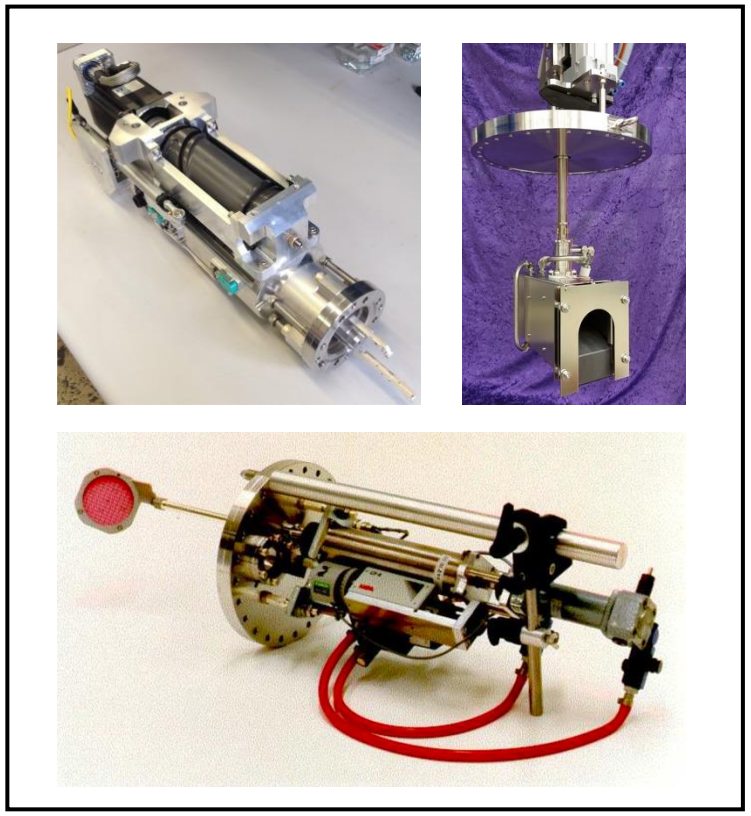
Master’s Program

Pohang University of Science and Technology

Research interest

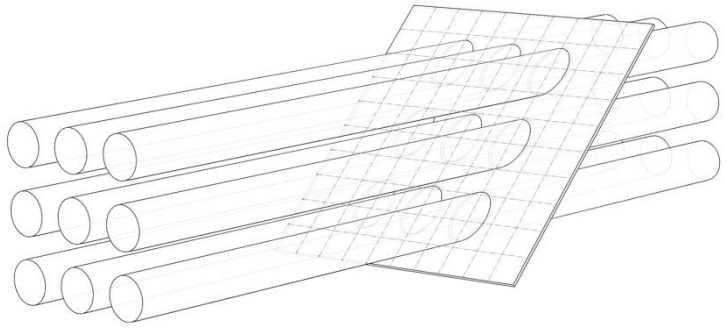


Beam diagnostics

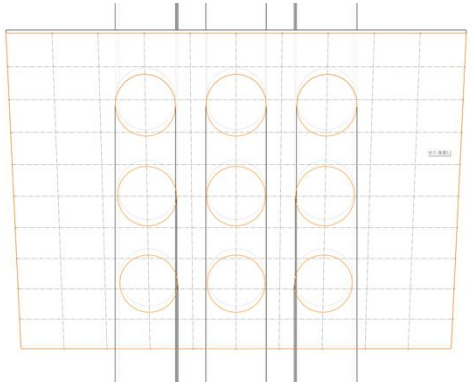


Precise measurement devices

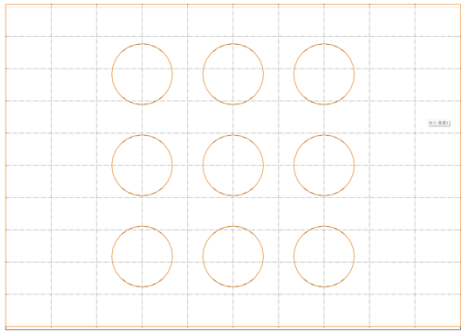
Current project: Overview



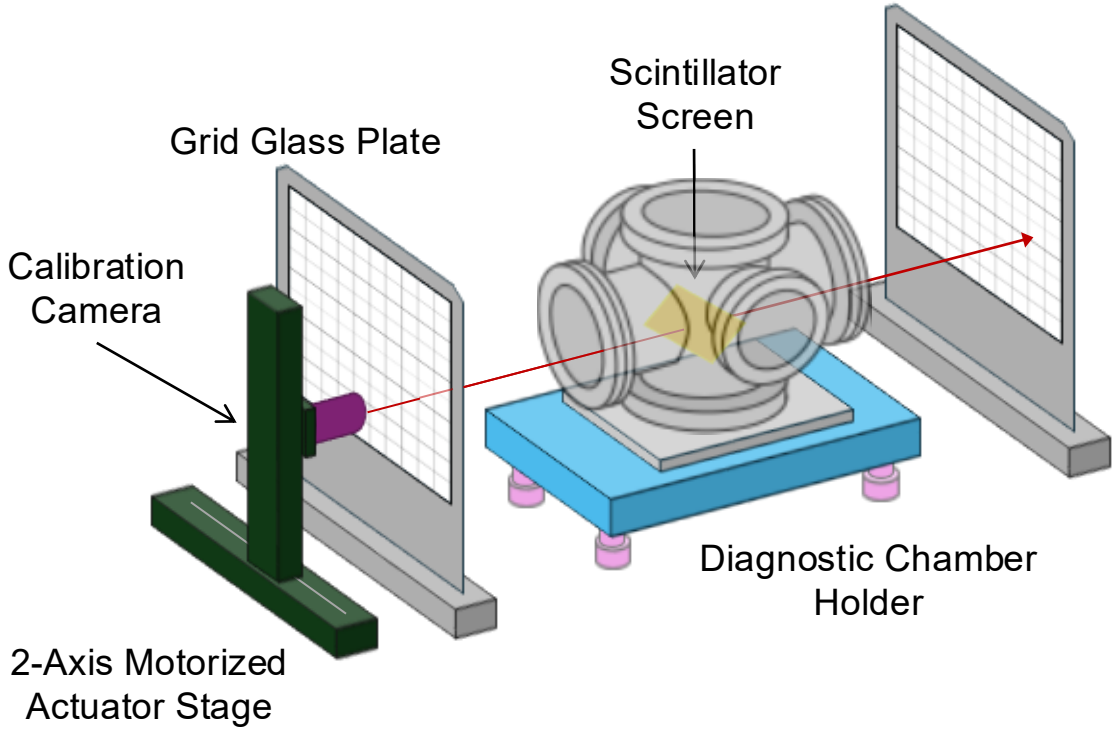
Tilted screen distorting beam profile



Raw image from camera



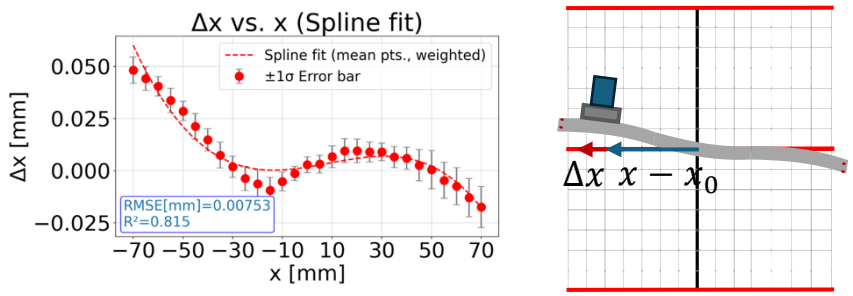
Desired transverse image



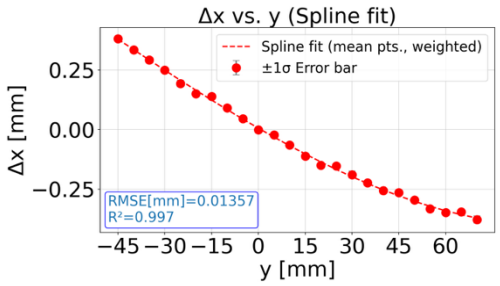
Absolute coordinate measurement device for transverse plane orthogonal to the beam path

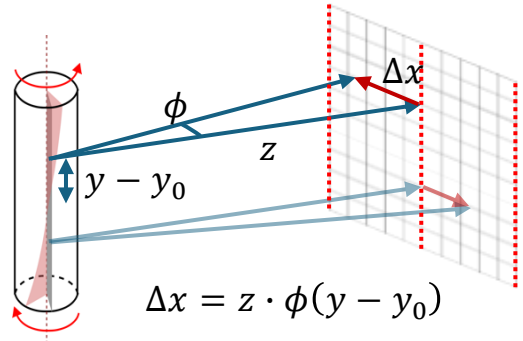
Current project: Device accuracy experiment

X-Coordinate Mapping (Δx)



$$\Delta x(x_{motor}) = spline_x(x_{motor})$$

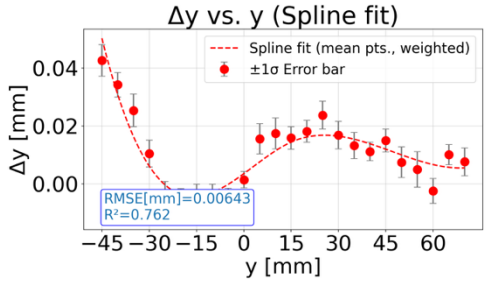


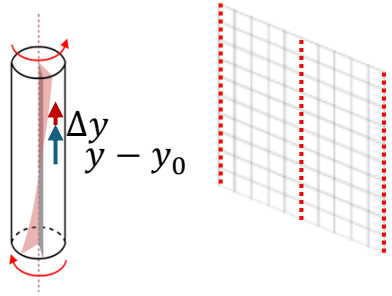


$$\Delta x(y_{motor}, z) = spline_x(y_{motor}, z)$$

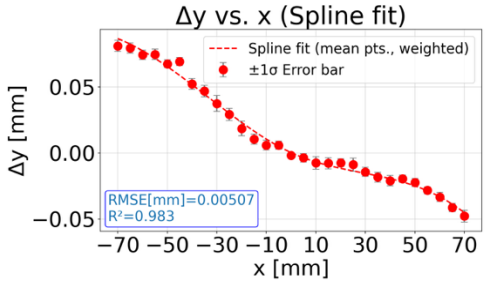
- $\Delta x = \Delta x_x(x_{motor}) + \Delta x_x(y_{motor},\ z)$

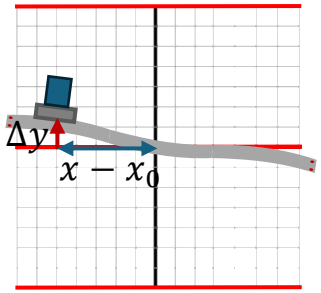
Y-Coordinate Mapping (Δy)





$$\Delta y(y_{motor}) = spline_y(y_{motor})$$

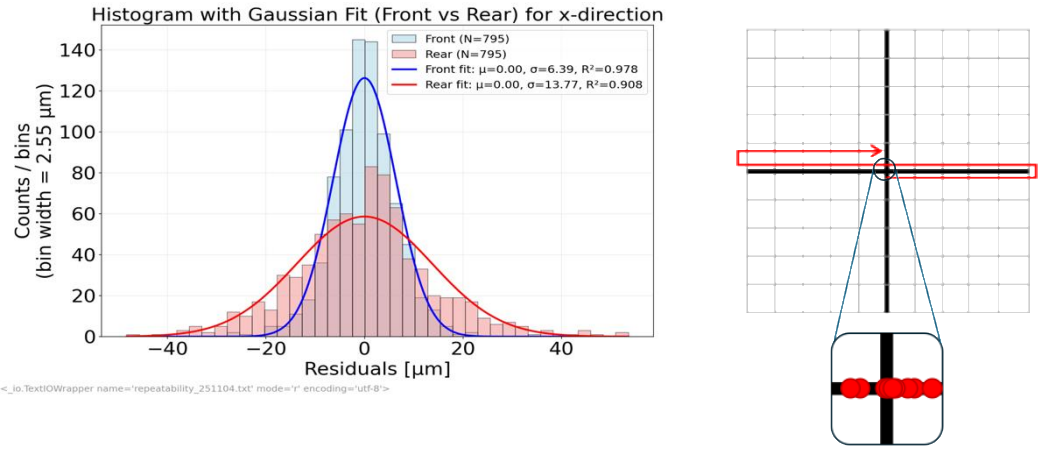


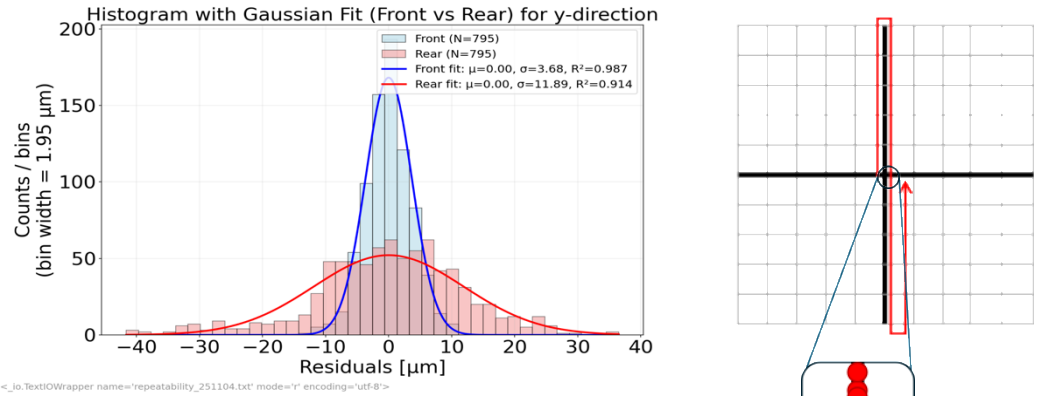


$$\Delta y(x_{motor}) = spline_y(x_{motor})$$

- $\Delta y = \Delta y_y(y_{motor}) + \Delta y_y(x_{motor})$

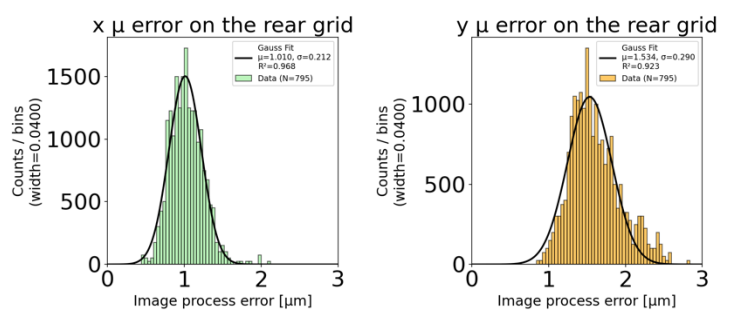
Current project: Device resolution experiment





Measurement repeatability error

$\sigma_{rep,x} = 13.73\ \mu m, \sigma_{rep,y} = 11.79\ \mu m$



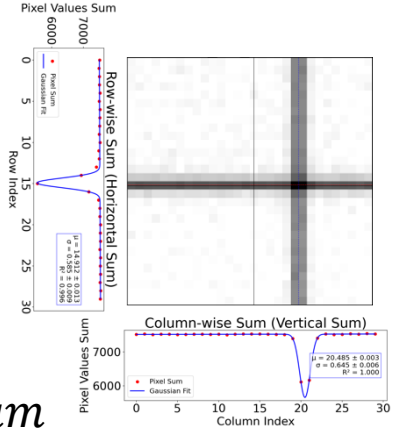
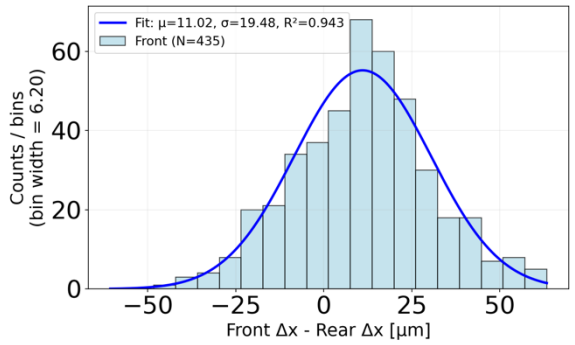
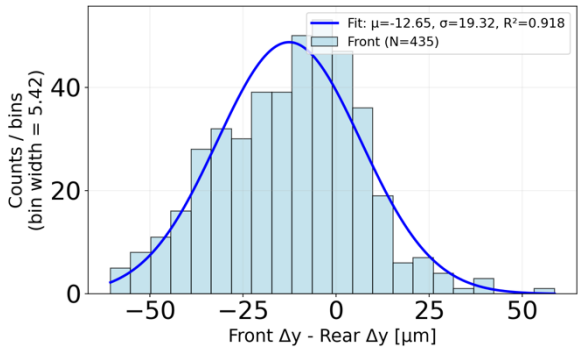


Image processing error

$\sigma_{img,x} = 1.010\ \mu m, \sigma_{img,y} = 1.534\ \mu m$

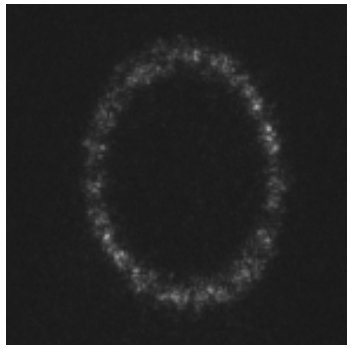


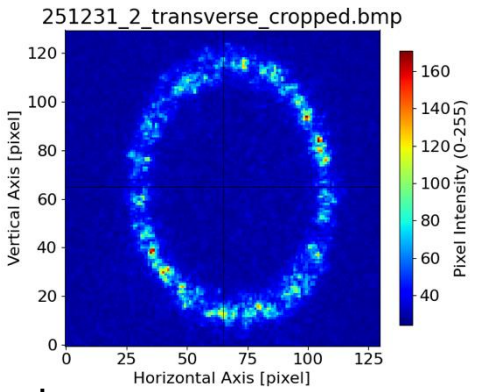


Front/Rear grid difference error

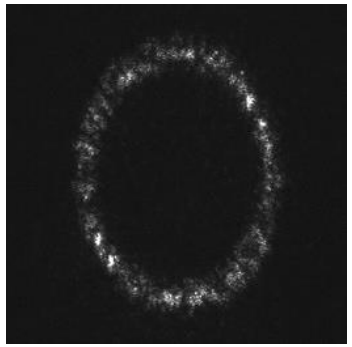
$\sigma_{grid,x} = 13.78\ \mu m, \sigma_{grid,y} = 15.22\ \mu m$

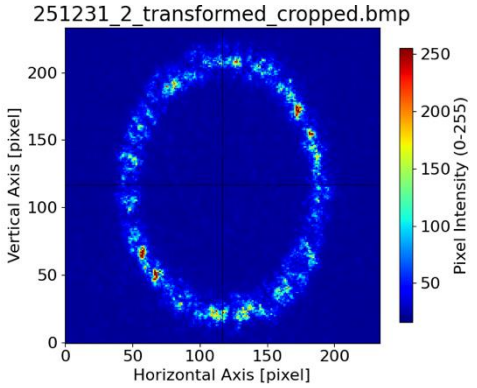
Current project: Measurement validation



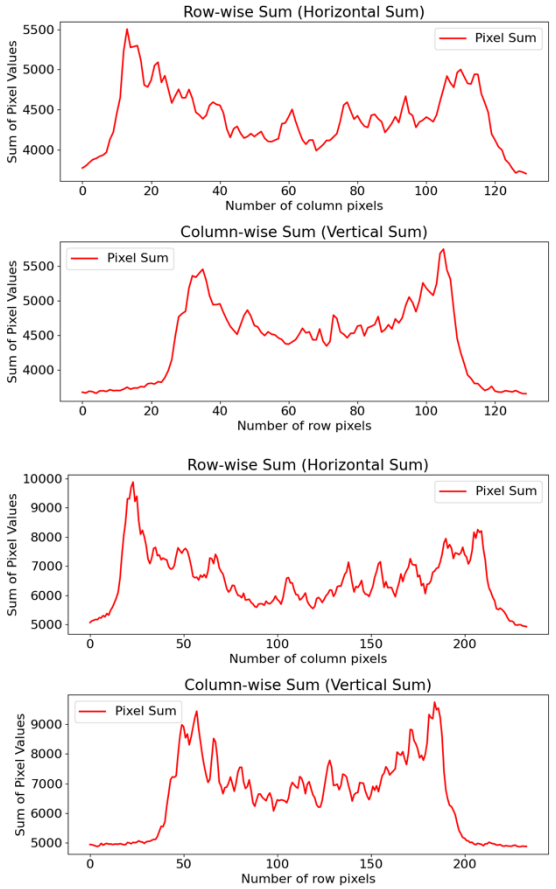


빔단면 투영 이미지 (Ground truth)

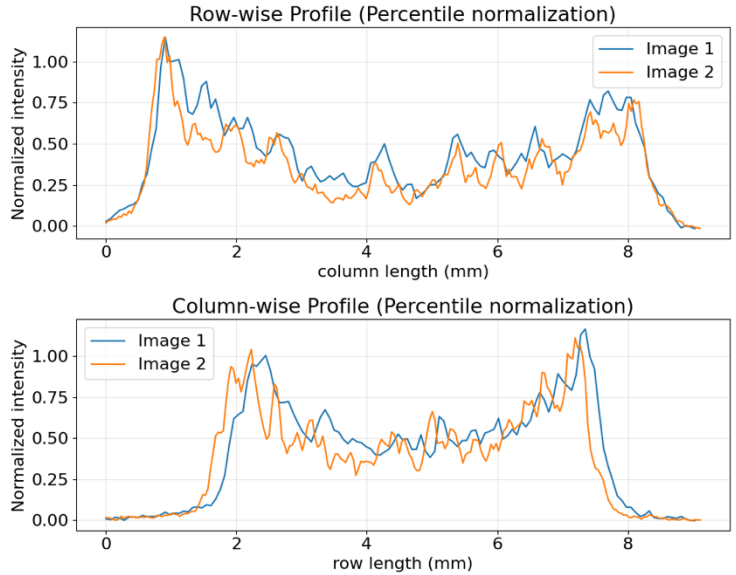




원근변환 후 이미지 (검증 대상)



1D 픽셀 합 프로파일



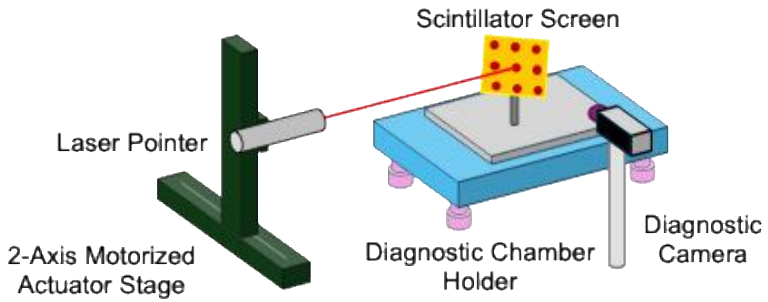
차이값 정량화: $RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(I_{g.t} - I_{meas}\right)^2}$

Short term plan

~Next week

- 레이저 포인터 궤적 분석
- 포인터 궤적이 2축 스테이지와 일치하는지
- 5x5 격자점 형태로 에러 벡터 플롯

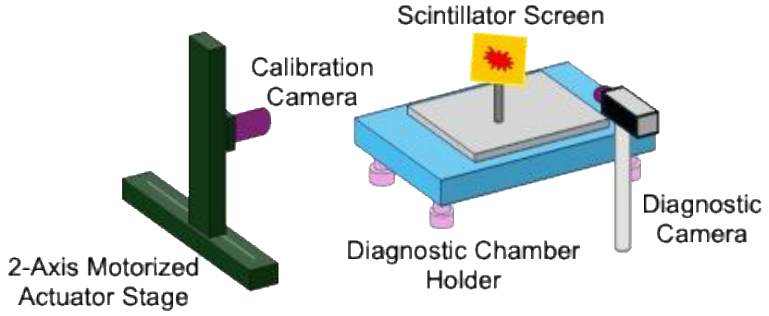
=> 장치 작동을 검증하는 실험



~End of January

- 레이저 빔 프로파일 측정
- Ground truth 재설정
- 극단적인 환경 가정하여 개선 효과 강조

=> 실제 빔 진단에 사용 가능성을 보이는 실험



~End of February

- Result & Conclusion 작성 완료
- Manuscript 완료 후 최종 피드백
- NIM-A 논문 제출

=> 제출 후 다음 연구 진행하면서 revision

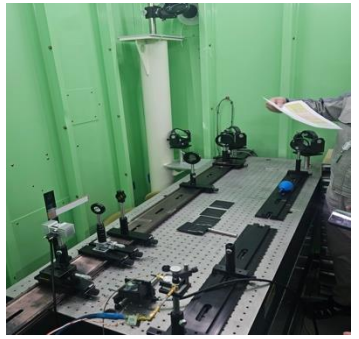
Future plan: What to be aimed

Topic	Justification	Research method	Expected outcome

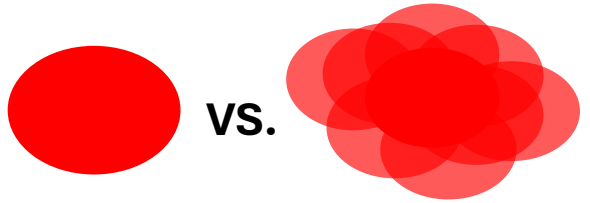
Beam profile monitoring device at the Diagnostic Beamline of PLS-II (1B)

Optical measurement tools
- Optics: Streak camera, CCD camera, CMOS camera for beam profile measurement
- Measurement: Photodiode, wavefront sensor, interferometer

Mechanical alignment
- Precision setting of optical systems and diagnostic devices



Mechanical vibration
- Device vibrations occurring during the measurement process



Future plan: How and why to do

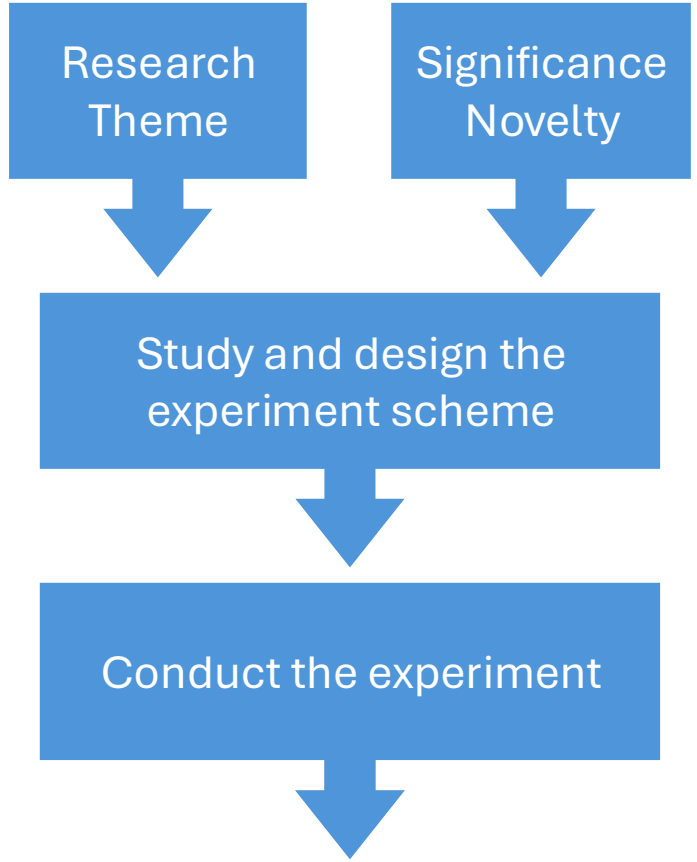
Topic | **Justification** | Research method | Expected outcome

How to set up the research

- Specify the subject appropriate to master's research
- Study the basic principle of each device
- Define the problem requiring mechanical improvement

Why this subject is needed

- To improve the quality of beam profile
- Minimize the error derived by the apparatus
- Design the diagnostics applicable to the beamline

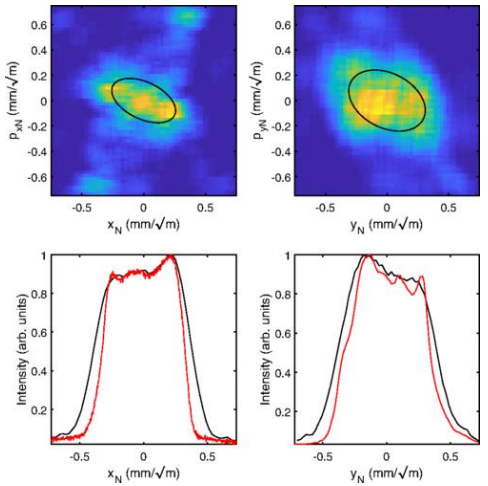


Future plan: Available methodology

Topic | Justification | **Research method** | Expected outcome

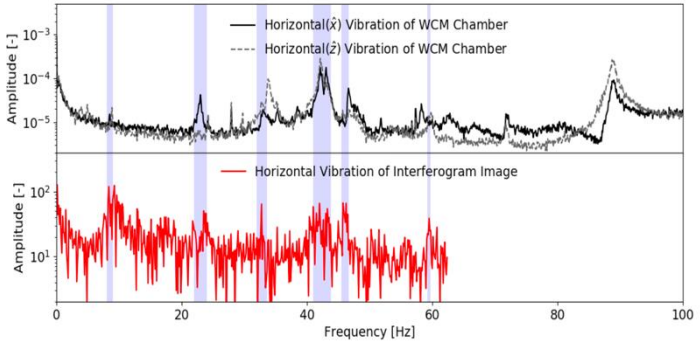
Quantitative data collection

- Electron beam parameter such as transverse size, emittance, positional information
- Choose proper fitting model for data processing



Analyze the device's mechanical error

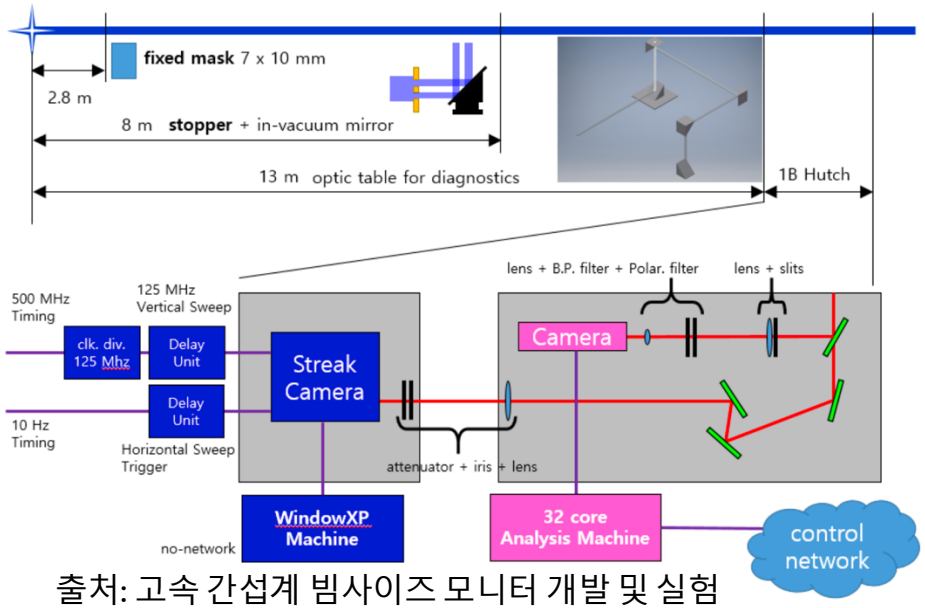
- Optics: objective lens, mirror, viewport alignment
- Vibration: Sort out the error source from various components

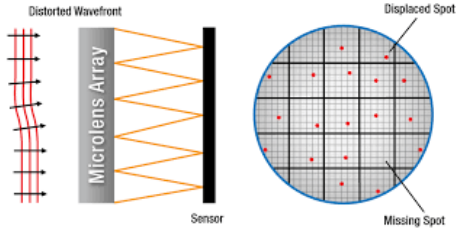


출처: 고속 간섭계 빔사이즈 모니터 개발 및 실험

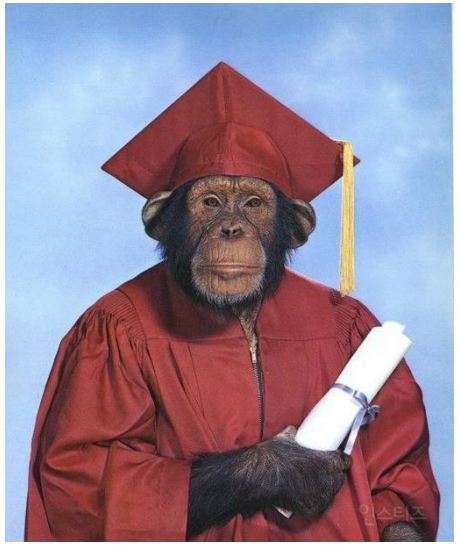
Future plan: Meaningful achievement

Topic | Justification | Research method | **Expected outcome**





출처: 고속 간섭계 빔사이즈 모니터 개발 및 실험



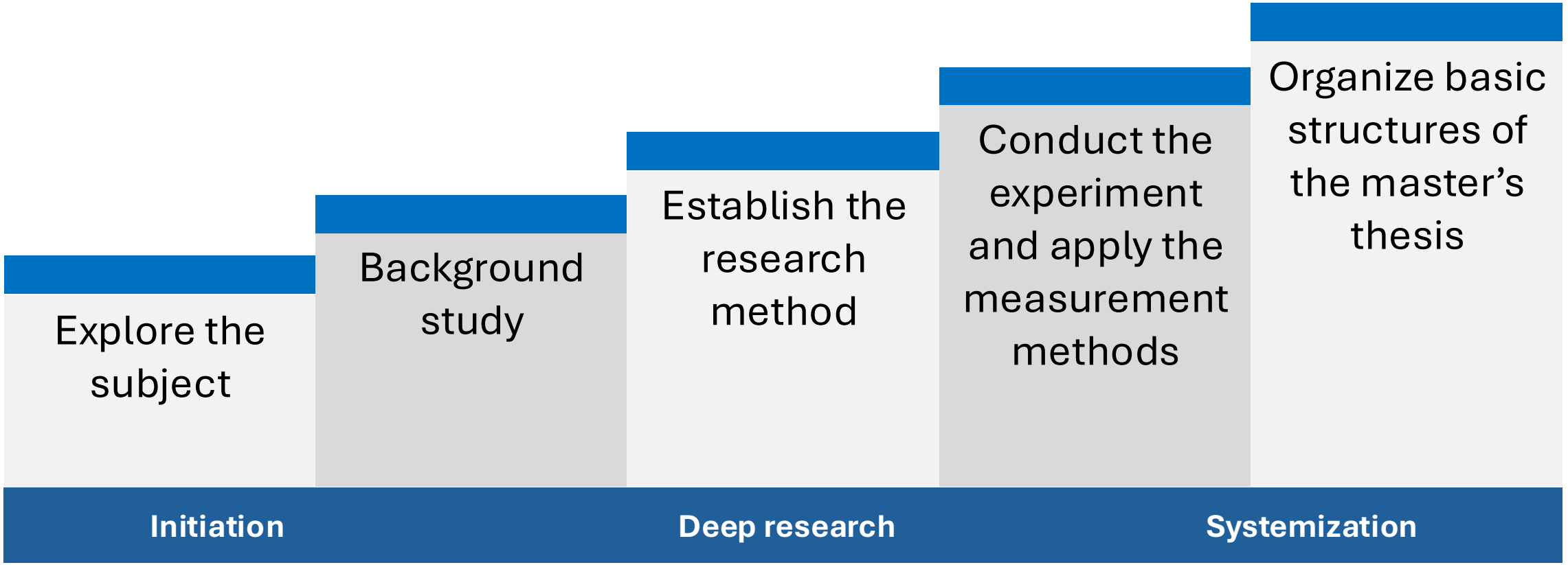
Can construct a series of diagnostic table

- Deep understand of the diagnostic tools
- Adopt my research to the beamline

Prepare for master's thesis

- Collect and assemble the acquired data
- Analyze the result
- Show the imporvement

Overall framework



THANK YOU