



| The European Synchrotron

# **EBSL1-ID18**

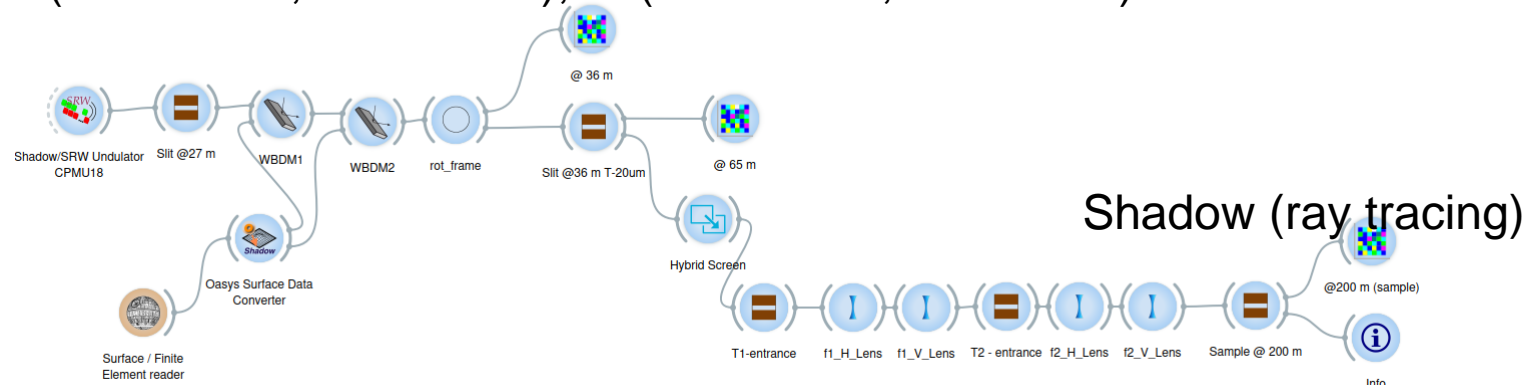
## **Ray tracing and wave optics study of WBDM**

**Juan Reyes Herrera**  
**Manuel Sanchez del Rio**  
**AAPU/MEG**

**11/08/2021 (version 1)**  
**18/11/2021 (version 2)**

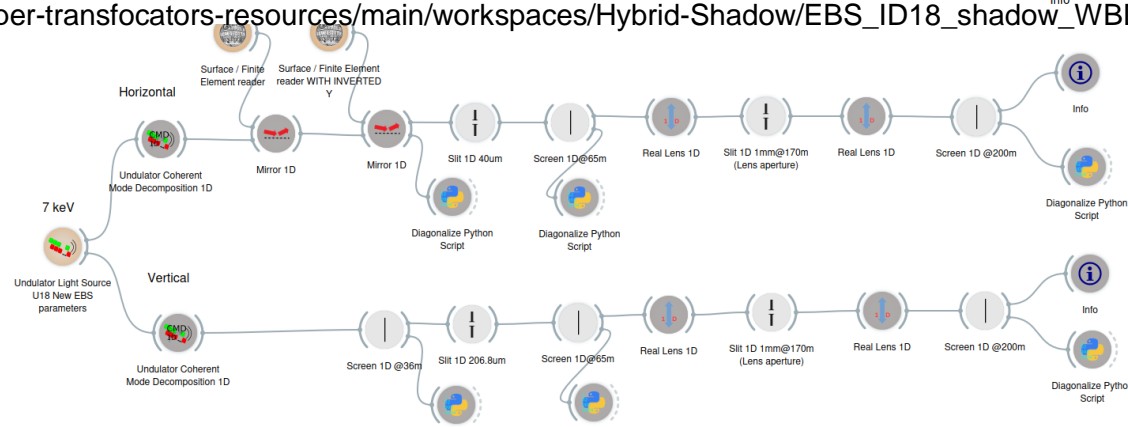
# OASYS models using SHADOW (ray tracing) and WOFRY (wave optics)

Configurations: 7 keV, WBDM Si @ 3 mrad, coherence slit: 40 x 206.8  $\mu\text{m}$ ,  
f1 (h: 41.69 m, v: 49.73 m), f2 (h: 26.15 m, v: 39.72 m)



[https://raw.githubusercontent.com/srio/paper-transfocators-resources/main/workspaces/Hybrid-Shadow/EBS\\_ID18\\_shadow\\_WBDM.ows](https://raw.githubusercontent.com/srio/paper-transfocators-resources/main/workspaces/Hybrid-Shadow/EBS_ID18_shadow_WBDM.ows)

## Wofry (wave optics)

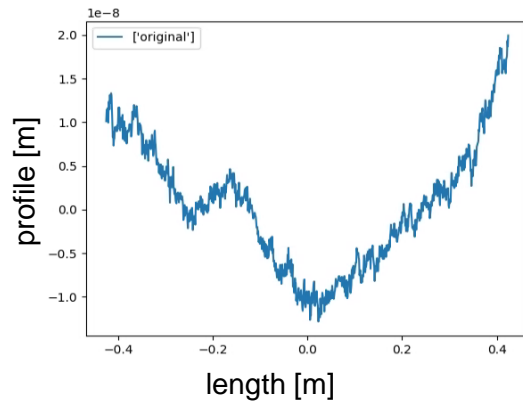


[https://raw.githubusercontent.com/srio/paper-transfocators-resources/main/workspaces/EBS\\_ID18\\_wofry\\_WBDM.ows](https://raw.githubusercontent.com/srio/paper-transfocators-resources/main/workspaces/EBS_ID18_wofry_WBDM.ows)

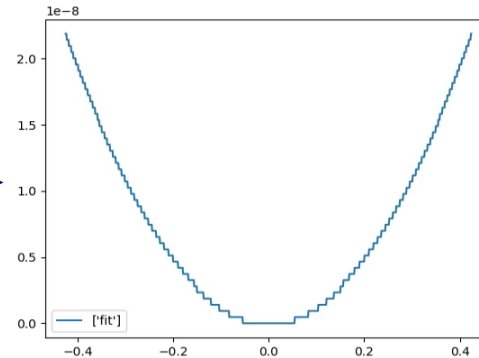
- Slope errors were considered for both WB mirrors in both SHADOW and WOFRY
- SHADOW used hybrid mode for the slit only (to get reasonable vertical sizes)

# Profile errors of WBDM

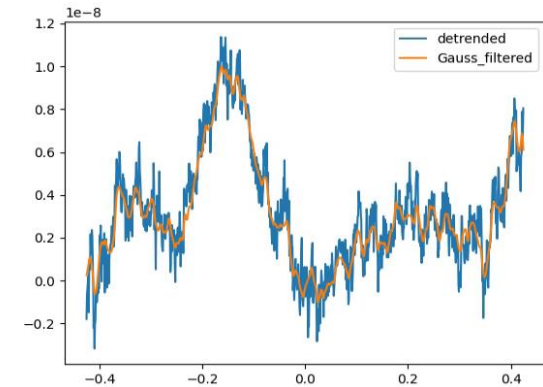
Original central profile\*



Best fitting curve



Detrending and Gaussian smoothing

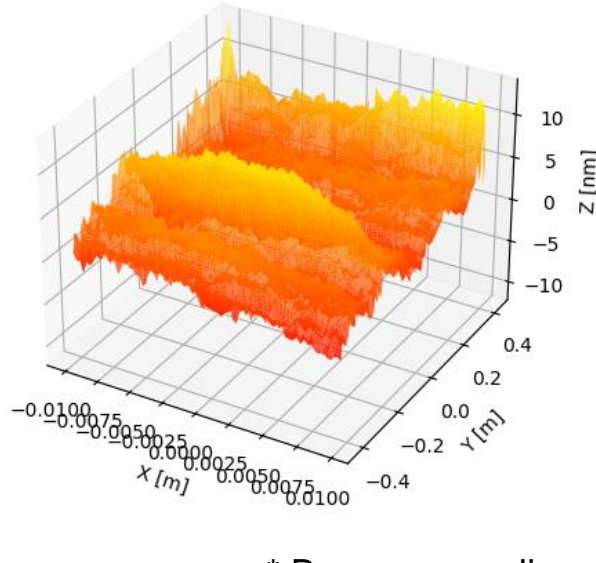


\*From file provided by Raymond Barrett (*ring256\_TypbeB\_F127001\_frontside\_ontissue\_meas2\_\_avg\_2D.txt*)

# Profile errors of WBDM

After applying the surface modification to the 2D surface:

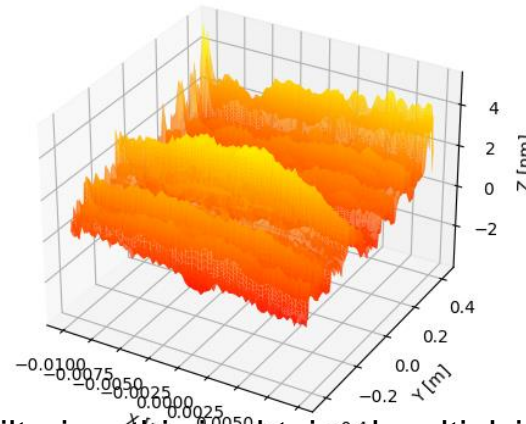
Slope error rms in X direction: 2.417105  $\mu\text{rad}$   
Slope error rms in Y direction: 0.165388  $\mu\text{rad}$   
Figure error rms in X direction: 1.275389 nm  
Figure error rms in Y direction: 3.115492 nm



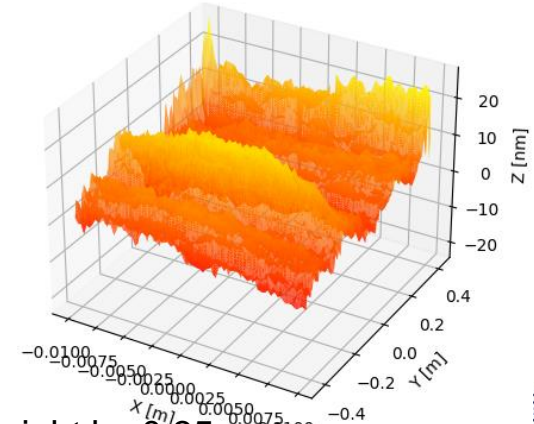
By simply scaling the profiles, simulation were performed for 4 conditions:

- Ideal surfaces
- mod. surface: 165 nrad
- mod. Surface to get about  $\frac{1}{2}$  slope error\*
- mod. Surface to get about 2x slope error

Slope error rms in X direction: 0.845987  $\mu\text{rad}$   
Slope error rms in Y direction: 0.079248  $\mu\text{rad}$   
Figure error rms in X direction: 0.446386 nm  
Figure error rms in Y direction: 1.213639 nm



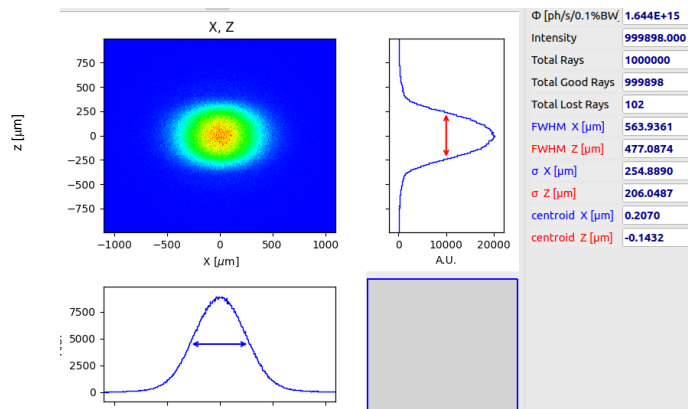
Slope error rms in X direction: 4.834209  $\mu\text{rad}$   
Slope error rms in Y direction: 0.328420  $\mu\text{rad}$   
Figure error rms in X direction: 2.550778 nm  
Figure error rms in Y direction: 6.248546 nm



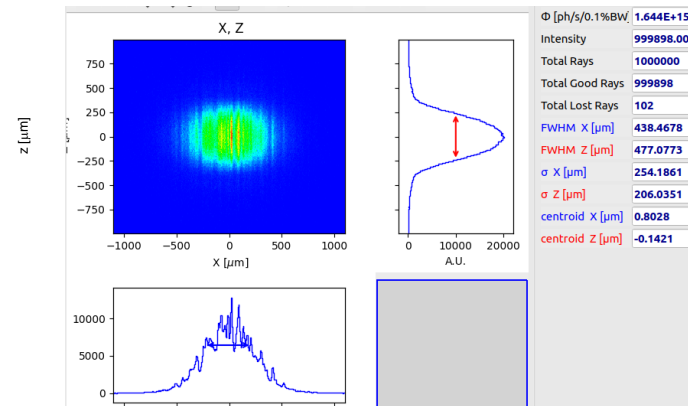
\* Because non linearity in Gaussian filtering, this is obtained multiplying height by 0.35

# Beam profile – Coherence Slit (36 m) SHADOW

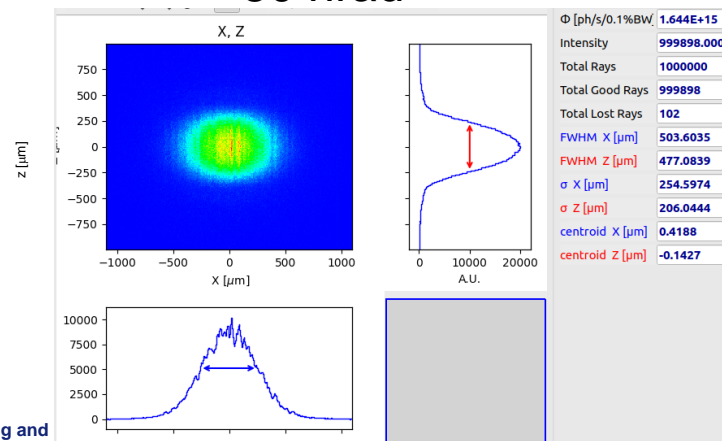
ideal



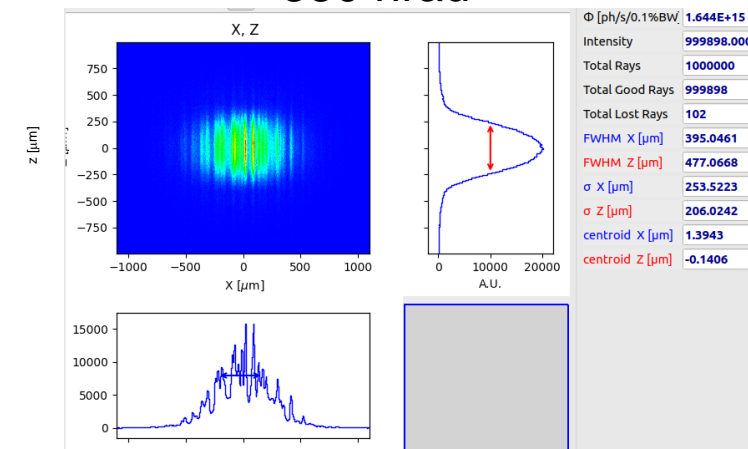
~165 nrad



~80 nrad

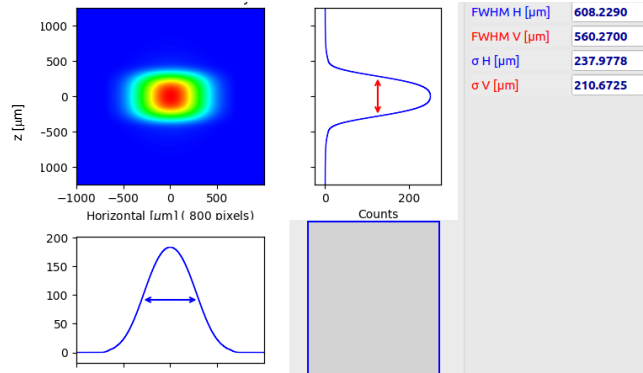


~330 nrad

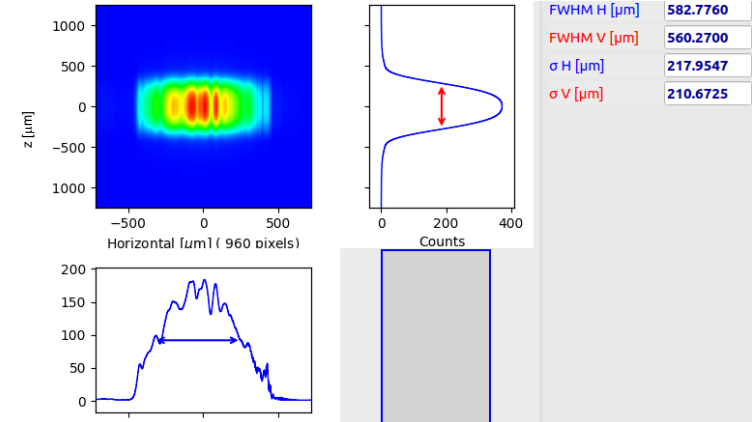


# Beam profile – Coherence Slit (36 m) WOFRY

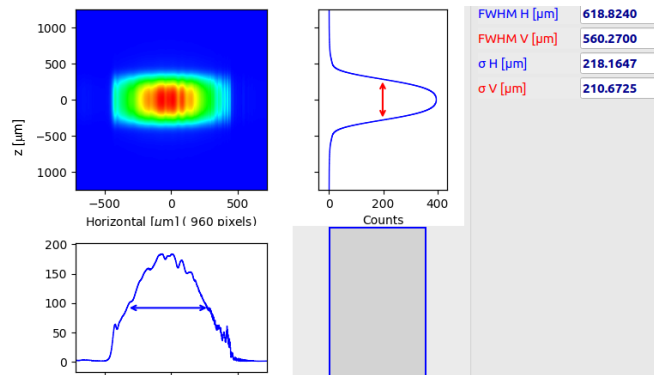
ideal



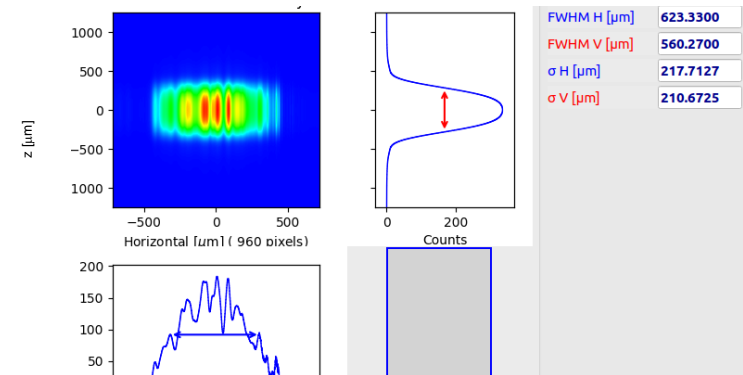
$\sim 165$  nrad\*



$\sim 80$  nrad\*



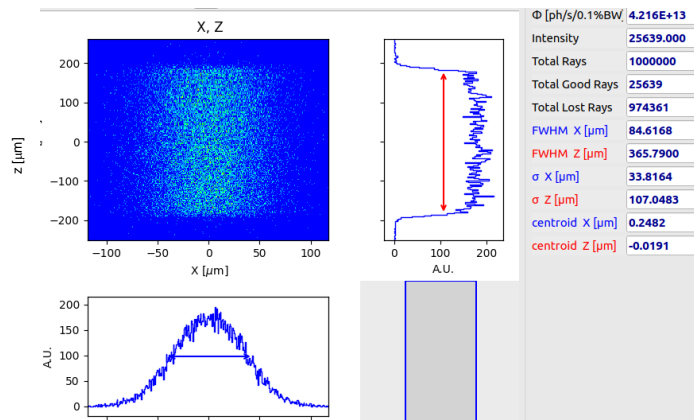
$\sim 330$  nrad\*



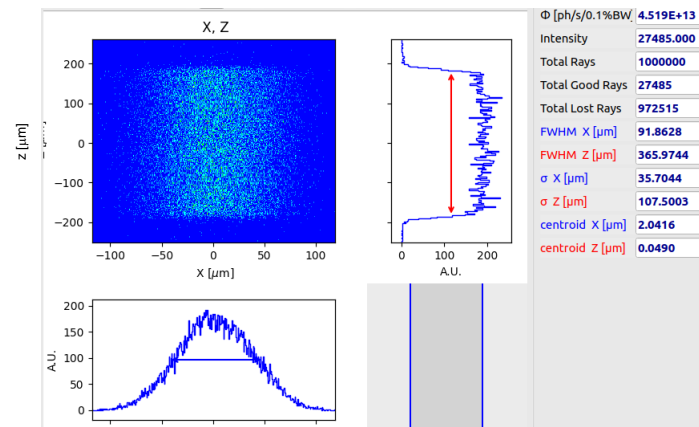
\*The horizontal intensity has an abrupt cut of the tails: this is an artifact due to the propagation of the high modes, and should be improved

# Beam profile – Transfocator 1 entrance (65 m) SHADOW

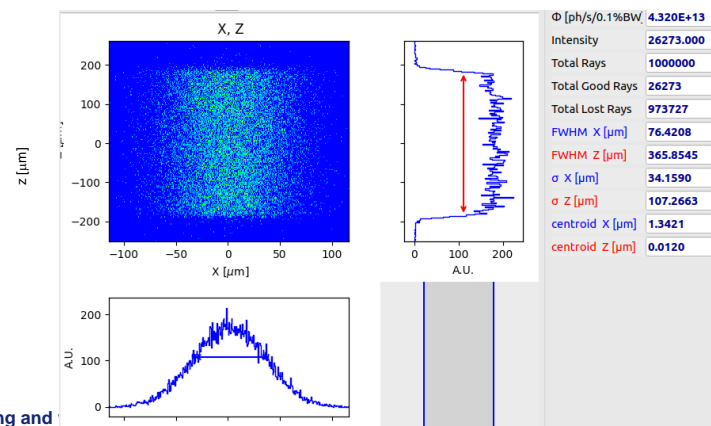
ideal



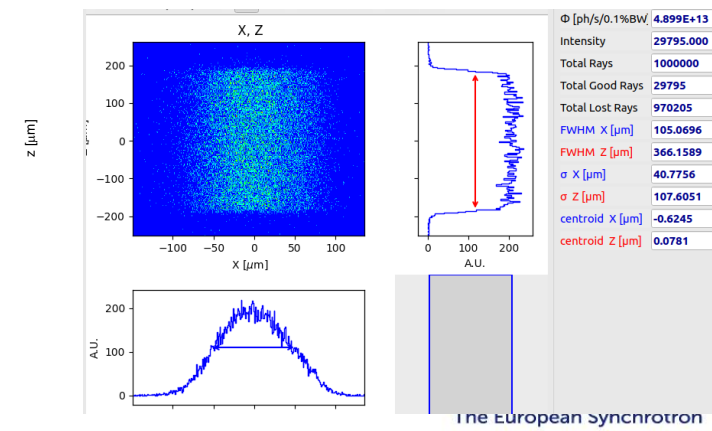
~165 nrad



~80 nrad



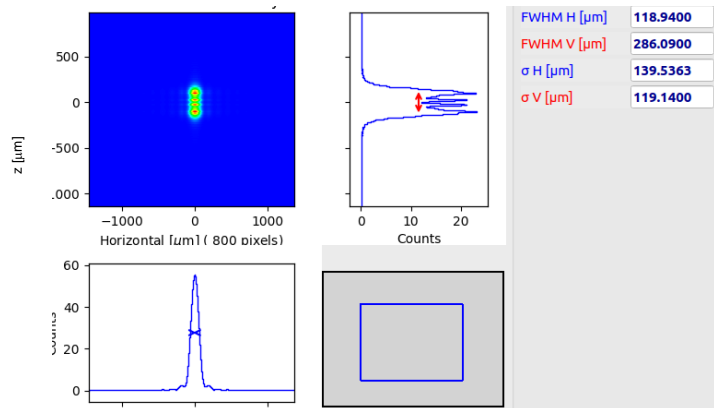
~330 nrad



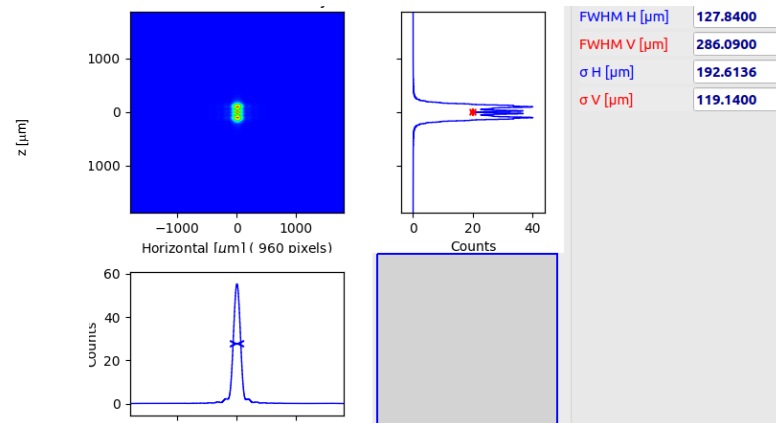


# Beam profile – Transfocator 1 entrance (65 m) WOFRY

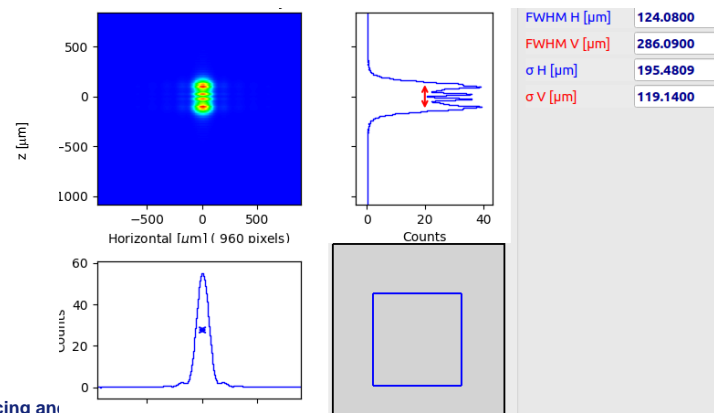
ideal



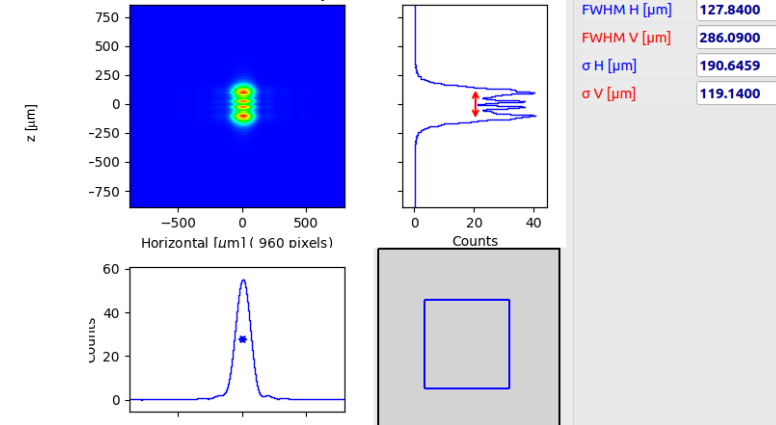
~165 nrad



~80 nrad

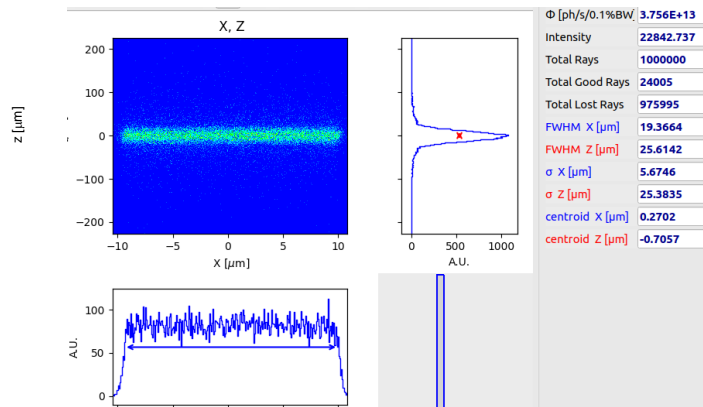


~330 nrad

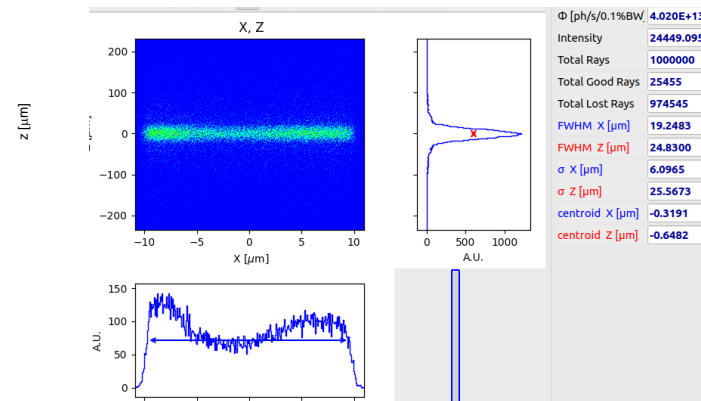


# Beam profile – Sample position (200 m) SHADOW

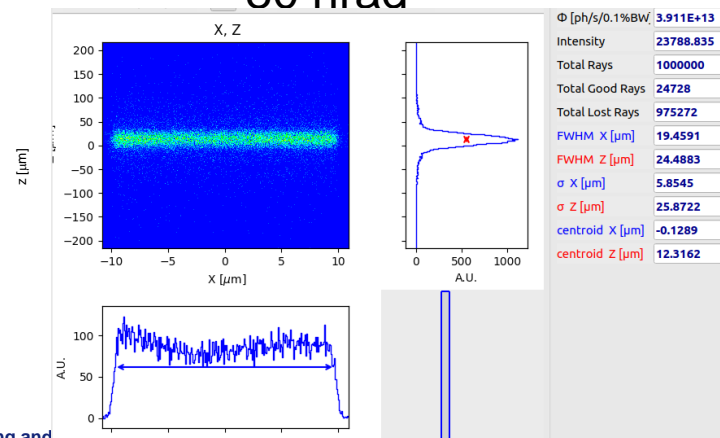
ideal



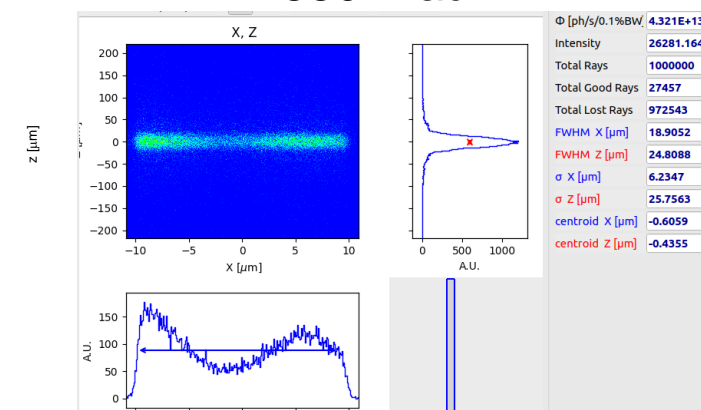
~165 nrad



~80 nrad

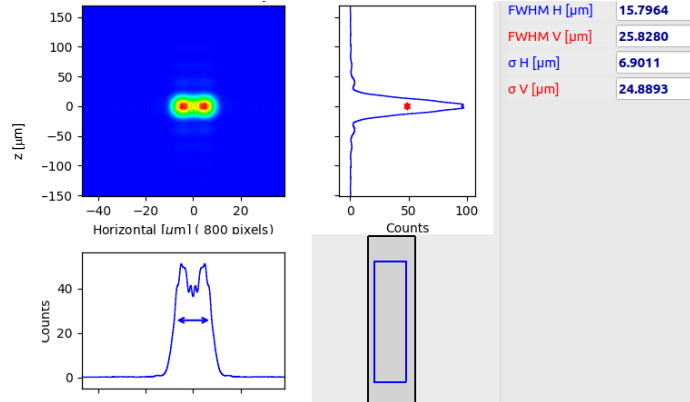


~330 nrad

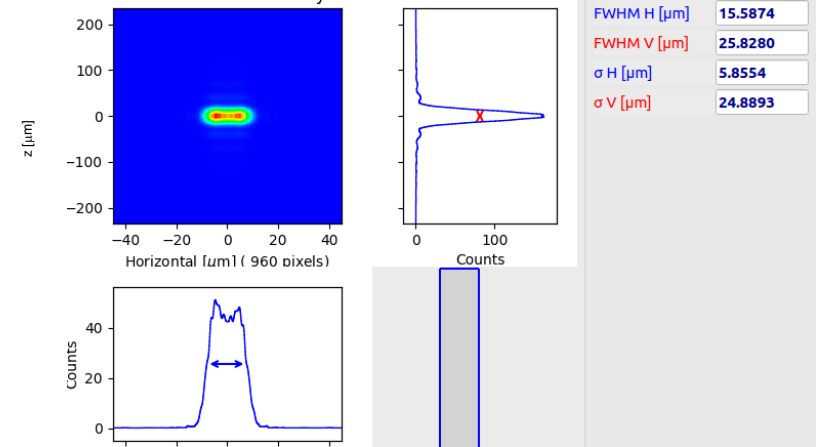


# Beam profile – Sample position (200 m) WOFRY

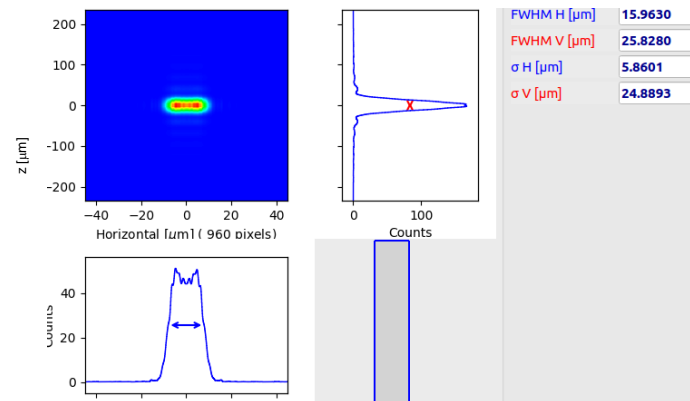
ideal



~165 nrad



~80 nrad



~330 nrad

