AOM ZBR Command Line User Manual v1.0



AOM Stitching Software ZBR

- ZBR stitches sub-aperture measurements enabling full surface map measurement of large optics
 - Stitching is necessary for large flats (larger than the available TF), large convex spheres and aspheres (larger than the beam size of a TS), long cylinders, etc.
 - ZBR takes sub-aperture measurement inputs in a variety of data formats, such as Zygo's datx and xyz, 4D's H5, ESDI's hdf, etc
 - To facilitate sub-aperture measurements that covers the entire surface, precision mechanics that allows rotation and/or translation of the surface is required
 - ZBR is available with a self-calibrating option, which removes systematic contributions of each subapertures, reducing error in the final stitched map





Sub-aperture measurements of a large convex optic with a CGH



Example setup for large flat measurements



Software Requirements

The distortion correction tool requires Matlab 9.10 (R2021a) Runtime. This is a free runtime tool which can be downloaded from the MathWorks website here:

https://www.mathworks.com/products/compiler/mcr/ index.html

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	3. Double click the installer and	follow the instructions in the ins	tallation wizard.			
	See the MATLAB Runtime Instal	ler documentation for more inforr	mation.			1
	Release (MATLAB Runtime Version#)	Windows	Linux	Mac		
	R2023b (23.2)	64-bit	64-bit	Intel 64-bit / arm64		
	R2023a (9.14)	64-bit	64-bit	Intel 64-bit		
	R2022b (9.13)	64-bit	64-bit	Intel 64-bit		
	R2022a (9.12)	64-bit	64-bit	Intel 64-bit		
	R2021b (9.11)	64-bit	64-bit	Intel 64-bit		
	R2021a (9.10)	64-bit	64-bit	Intel 64-bit		
	R2020b (9.9)	64-bit	64-bit	Intel 64-bit		
	R2020a (9.8)	64-bit	64-bit	Intel 64-bit		
	R2019b (9.7)	64-bit	64-bit	Intel 64-bit		
	R2019a (9.6)	64-bit	64-bit	Intel 64-bit		
	R2018b (9.5)	64-bit	64-bit	Intel 64-bit		
	R2018a (9.4)	64-bit	64-bit	Intel 64-bit		_
	R2017b (9.3)	64-bit	64-bit	Intel 64-bit		_^

Select the correct installer for your computer

Software Inputs and Outputs

<u>Inputs</u>

- 1. Measurement of your subapertures, in .xyz OR .datx format
- 2. ZBR (.zbr) file detailing your subapeture details
- 3. ZBR config file (.txt) detailing the stitching configuration data

Outputs

- 1. Undistorted measurement of your part, in .xyz or .datx format
- 2. Figures of the stitching performance, in .pdf format



Stage 1

Data Preparation

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- 1. Create your ZBR file
- 2. Create your ZBR Configuration file

A ZBR file defines the subapertures, surface, and more stitching details required by ZBR.

The full file format is a UTF-8 formatted text file saved with a .zbr extension. See the full file description to the right for how to write your own.

Line #	File Content		Remark
1	Filename.zbr		ZBR file name
2	C:\Path\To\Measurements		Path to your subaperture measurements
3	Cylinder		Type of surface. Enum of Cylinder Flat Sphere
4		90	If cylinder type, cylinder's power axis angle with respect to the +x axis of the stitched map
5	2		Number of sub-aperture data maps
6	Test_x1_y1xyz		No. 1 subaperture data file name
7		0	No. 1 SA map's reference pixel x coordinate (0 means the CENTER pixel's x coordinate). The lower left pixel is (1,1).
8		0	No. 1 SA map's reference pixel y coordinate (0 means the CENTER pixel's y coordinate). The lower left pixel is (1,1).
9		464.1	X coordinate of No. 1 SA map's reference pixel in the stitched map coordinate (round to integer in calculation)
10		926.9	Y coordinate of No. 1 SA map's reference pixel in the stitched map coordinate (round to integer in calculation)
11		0	Clocking angle of the SA map wrt to the +x of the stitched map in degrees (+ means clockwise)
12	Test_x1_y1xyz		No. 1 subaperture data file name
13		0	No. 1 SA map's reference pixel x coordinate (0 means the CENTER pixel's x coordinate). The lower left pixel is (1,1).
14		0	No. 1 SA map's reference pixel y coordinate (0 means the CENTER pixel's y coordinate). The lower left pixel is (1,1).
15		464.1	X coordinate of No. 1 SA map's reference pixel in the stitched map coordinate (round to integer in calculation)
16		926.9	Y coordinate of No. 1 SA map's reference pixel in the stitched map coordinate (round to integer in calculation)
17		0	Clocking angle of the SA map wrt to the $+x$ of the stitched map in degrees (+ means clockwise)
18	Test_ref.hdf		Reference data file name (optional)



1. Create your ZBR file

2. Create your ZBR Configuration file

A ZBR file defines the subapertures, surface, and more stitching details required by ZBR.

An example for a flat surface called CTMT.zbr is provided to you for your reference.

File Edit Format View Help		
CTMT.zbr		
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240,000000		
-235,000000		
-235.300000		
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G1 4.datx		
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1. Create your ZBR file

2. Create your ZBR Configuration file

A ZBR configuration file defines the location to save your stitched data and the self-calibration terms to use.

The full file format is a UTF-8 formatted text file saved with a .txt extension. See the full file description to the right for how to write your own.

Line #	File Content	Remark
1	C:\Path\To\Save\To.datx	Save file path for where to save your stitched map to. Must have matching extension to input data (.xyz or .datx depending on your input subaperture maps)
2	5,7:21	Zernike terms to use in self-calibration. Can format as comma separated or with a colon to be inclusive of numbers. NOTE: NEVER include terms 1,2,3,4 for fitting! These are degenerate modes and cannot be fit. If fewer than 2 rotations are available in the subaperture measurements, you cannot fit astigmatism (Zernike terms 5 and 6).



- 1. Create your ZBR file
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A ZBR configuration file defines the location to save your stitched data and the self-calibration terms to use.

An example for a surface, which fits Zernike terms 5:11 for selfcalibration, called CTMT_config.txt is provided to you for your reference.

CTMT_config - Notepad				-)	
le Edit Format View Help					
:\GIT\zbr\stitched_twe_map.datx :11					
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Running ZBR from Command Line



1. Starting ZBR

- 1. Open command prompt (or create bash file)
- 2. Run ZBR command with ZBR and config file args passed in.
- 2. Viewing status and log file
- 3. Viewing results
- 4. Running in GUI mode





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ZBR command input:

ZBR.exe -zbr_file "full_zbt_ file_name.zbr" - config_file "full_config_file_name.txt"





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The final output of the command window will let you know if the stitching was successful, and, will inform you of the log file location, which details all of the runtime events for ZBR. This can be helpful for debugging as well. The log file is always written to "C:\AOM\zbr_log_YYYY_MM_DD_HH_MM_SS" where 'YYYY_MM_DD_HH_MM_SS' is the time of running in year, month, day, hour, minute, second format.

Command Prompt	<u> </u>		×
C:\Users\LoganGraves≻C:\Users\LoganGraves\Desktop\zbr\ZBR.exe -zbr_file "C:\Users\LoganGraves\Desktop\zbr\ fig_file "C:\Users\LoganGraves\Desktop\zbr\CTMT_config.txt" Running stitching. Please be patient Calculating weighting mask	CTMT.z	br" -	con ^
time4mask =			
0.3039			
Flat Calculating Qmat			
time4Qmat =			
1.6952			
time_SAVariation =			
0.1235			
time_Stitching =			
0.3125			
Saved undated measurement surface man to C:\GIT\zbr\stitched_twe_man_daty			
C:\Users\LoganGraves>			~



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ZBR will let you know where your saved stitched map is. This save location was defined in your config file. The stitched map and the figures detailing the stitching performance are located here.

Command Prompt	-		\times
C:\Users\LoganGraves≻C:\Users\LoganGraves\Desktop\zbr\ZBR.exe -zbr_file "C:\Users\LoganGraves\Desktop\zbr\ fig_file "C:\Users\LoganGraves\Desktop\zbr\CTMT_config.txt" Running stitching. Please be patient Calculating weighting mask	CTMT.	zbr"	-con /
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0.3039			
Flat Calculating Qmat			
time4Qmat =			
1.6952			
time_SAVariation =			
0.1235			
time_Stitching =			
0.3125			
Saved updated measurement surface map to C:\GIT\zbr\stitched_twe_map.datx. Stitching completed succes+ully. See log +ile at: C:\AUM\zbr\zbr_log_2024_01_31_14_16_46.txt for details.			
C:\Users\LoganGraves>			



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Navigate to your save folder to find the stitching results and stitched map. You can load your .xyz or .datx stitched map in Zygo Mx software for further analysis. You can open the pdfs to view details of the stitching.

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	stitched_twe_map_2024	4-01-31_14-17-05_figure5	1/31/2024 2:17 PM	Foxit PDF Reader	220 KB	
	stitched_twe_map_2024	4-01-31_14-17-05_figure4	1/31/2024 2:17 PM	Foxit PDF Reader	597 KB	
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You can also run ZBR in GUI mode, which launches the traditional ZBR user interface. To do so, run ZBR.exe with no arguments passed in. C:\Users\LoganGraves>C:\Users\LoganGraves\Desktop\zbr\ZBR.exe





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Surface Type: Flat Cylinder Power axis angle in degrees: Sphere	Subtract a saved reference Galibration Zernike Curvature Terms r	e map? map before stitching? epresenting the reference(e.g. "4.5, 1	0.37'):				

