Updates to DABAM: an open-source DAtaBAse of Metrology for x-ray optical simulations.

call for contribution

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Since its release in 2016, the database for metrology **DABAM** has been an **important tool** for accurate **beamline design** and tolerancing providing **metrology profiles** of mirrors for **optical simulations** [1]. Its **success** is due to the **collaborative efforts** of various authors and laboratories using an **open-source platform**. We propose to create the **DABAM2D** database by **extending DABAM** to include **2D maps** of **mirrors**, **refractive lenses** or any **free-form optics**. We expect to populate the database with profiles coming from both ***ex-situ*** and ***at-wavelength*** techniques. We invite x-ray optics **community** to **contribute with profiles** to this database.

1. In line with modern **open-source practices**, the **new database** is **not tied** to a specific **web repository**, allowing for the use of multiple **local** or **private repositories**. The **height profiles** are stored in a `HDF5` file and a supplementary metadata `json` file:

```
<url-prefix>/data/dabax2d-XXXX.h5
<url-prefix>/data/dabam2d-XXXX.txt
```

The data is in SI units. Each surface and its corresponding info file are sequentially numbered:

- 0xxx – single x-ray lenses;
- 1xxx – stacked lenses (CRL);
- 2xxx – mirror profiles;

The structure of the h5 file as well as the contents of the metadata file are described in detail in the GitHub repository (see QR code).

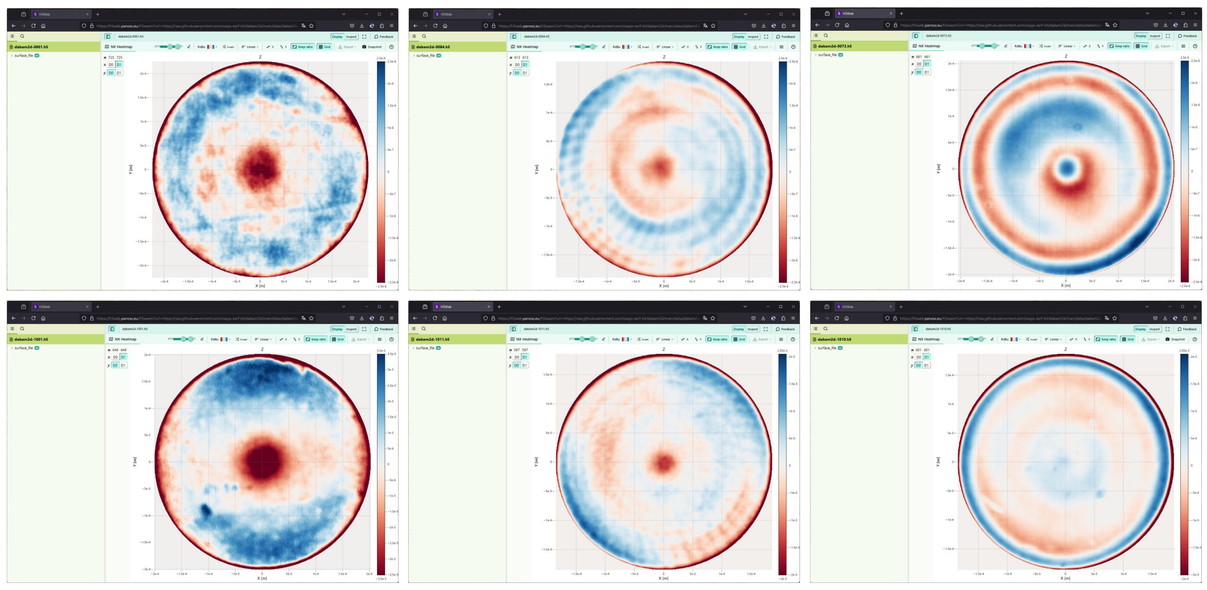

Fig. 1 DABAM2D maps can be visualised using the **PaNOSC online H5Wasm viewer** in a conventional web browser. Top row: examples of **single lens metrology** (profiles 0001, 0073 and 0084). Bottom row: examples of **CRL metrology** (profiles 1001, 1011 and 1010).

2. DABAM2D is fully **integrated** in the **OASYS** ecosystem [2], which interfaces ray-tracing codes **SHADOW** 3 and 4 and wave-propagation packages like **SRW** and **WOFRY**.

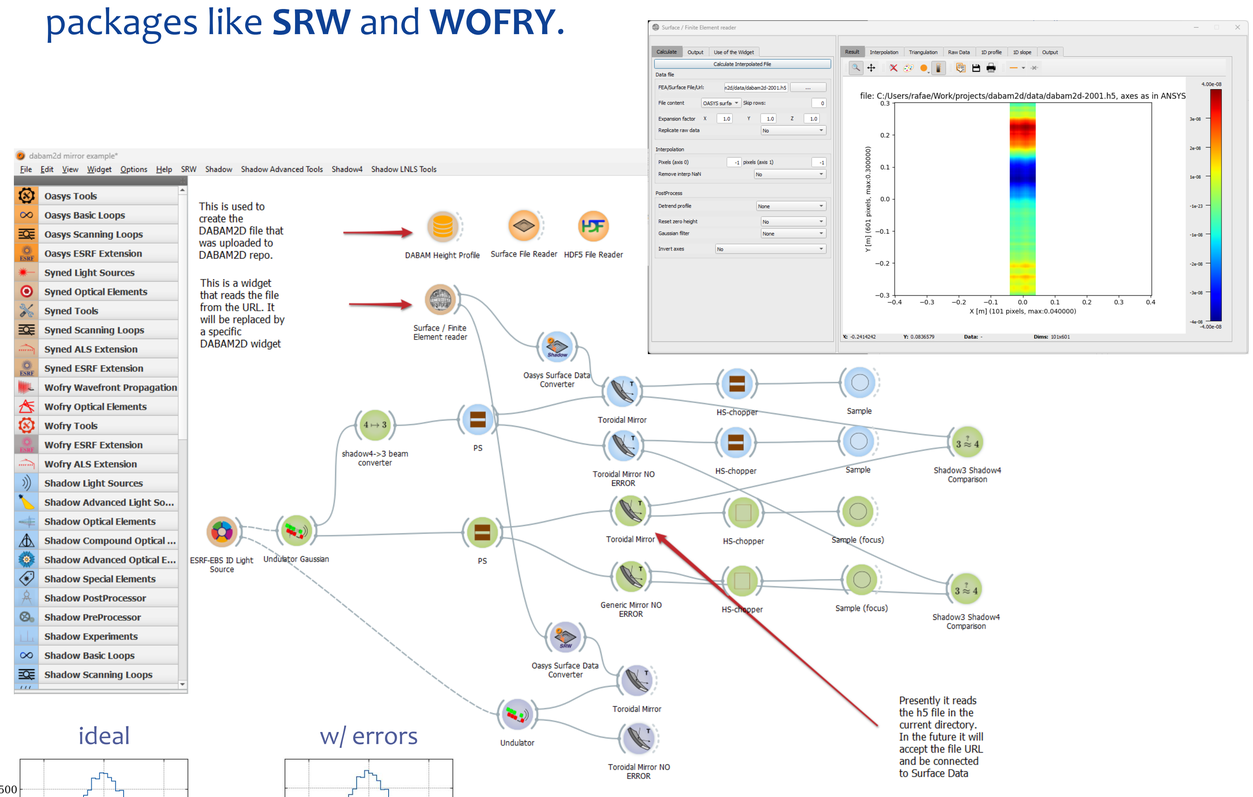

Fig. 2 DABAM 2D mirror example. The top right window shows the OASYS preprocessor widget Surface/FE reader importing directly a map of a 2D mirror. The OASYS workspace show how a 2D profile file can be created, imported and used together with SHADOW 3, 4 and SRW workflows. Bottom left: simulation result using SHADOW 4 for an ideal beamline and using DABAM2D errors. This example is available in the GitHub repository (QR code).

3. Simulations using real **measured error profiles** are able to **reproduce** with high fidelity **what is observed** at the **beamlines**:

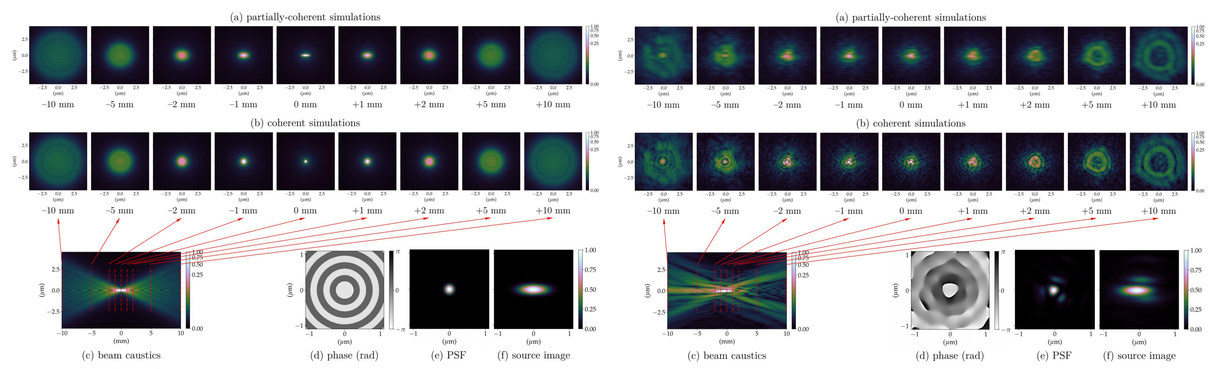

Fig. 4 (left) **simulations** of an **ideal** x-ray **lens stack** focusing at 8keV and (right) **aberrated lens stack** focusing using the metrology profiles 0001-0010. Reproduced from Celestre et al, *J. Synch. Rad.* **27**(2), 629-643 (2020).

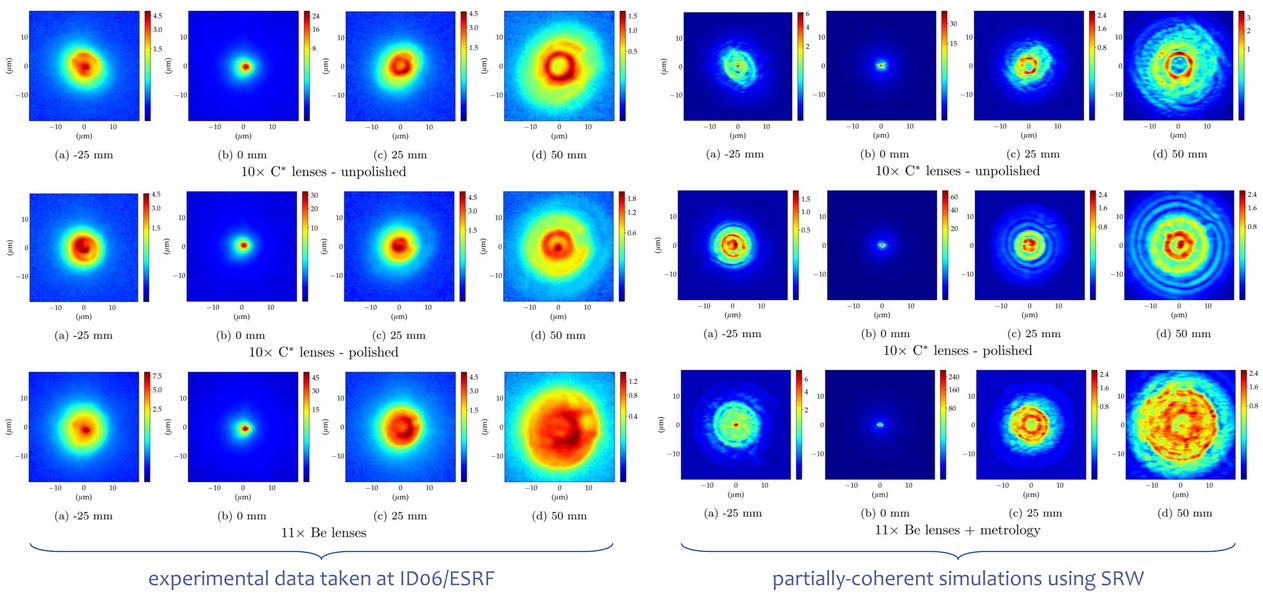

Fig. 5 Example of how the **simulations** are able to **capture the features** of an **aberrated** focused beam from an **x-ray lens stack**. Experimental data was collected at ID06/ESRF and the partially-coherent simulations were done using the CRL metrology profiles 1001, 1011 and 1010 in SRW. Reproduced from Celestre et al, *J. Synch. Rad.* **29**(2), 629-643 (2022).

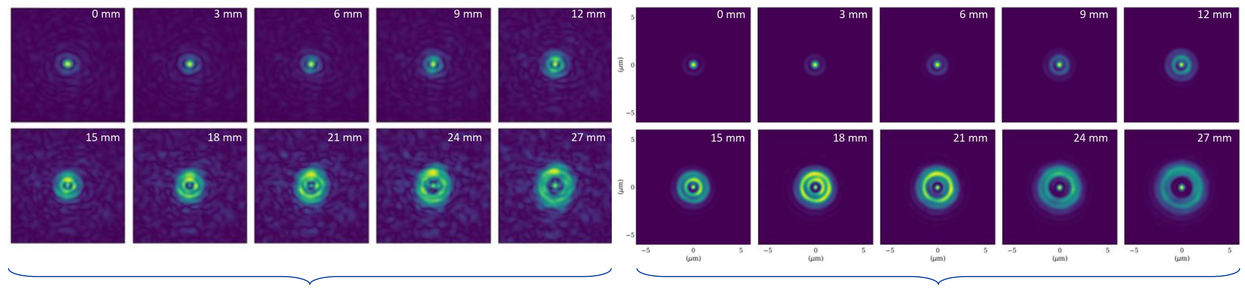

Fig. 6 Example of how the **simulations** are able to **capture the features** of an **aberrated** focused beam from an **x-ray lens stack**. Ptychographic reconstruction based on experimental data collected at ID01/ESRF (courtesy of E. Bellec and S. Leak). The coherent simulations were done using the lens metrology profiles 0022-0025 in SRW.

4. Contributing to **DABAM2D** is simple: prospective collaborators are invited to contact us and **submit** several profiles of **single lens profiles**, **lens stacks**, or **2D mirror maps**, ideally in the DABAM2D data structure, though this is not mandatory. **Contributors** will participate and **co-author** an **upcoming DABAM2D publication**.

5. We aim to **collect profiles** until late **October 2024** and submit a **manuscript for publication** with an extended author list before the end of **November 2024**.

6. The DABAM2D database is currently hosted at:

`GitHub.com/oasys-esrf-kit/dabam2d`

Acknowledgemet

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References

[1] Sanchez del Rio et al, J. Synchrotron Radiat. **23** 665–678 (2016).
[2] Rebuffi and Sanchez del Rio, Proc SPIE 10388. 0S (2017).