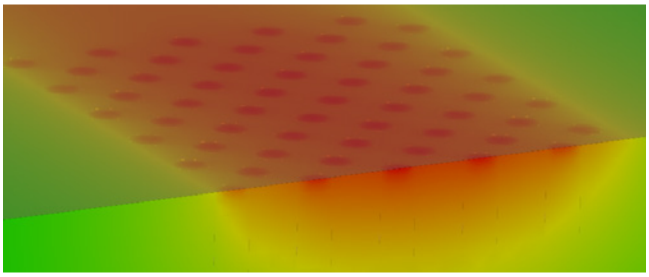
# FAAST-Phase™
# Revolutionary X-ray source designed for Talbot interferometry



World's brightest X-ray source... Designed for unlocking the potential of phase contrast X-ray

Finite Element Analysis results of Sigray's patent-pending FAAST-Phase x-ray source target, demonstrating the thermal advantages of its microstructured design and using a diamond substrate. The specific model shown below employs cylindrical copper microstructures.

Accelerate your phase contrast research

Highest brightness x-ray beam for developing grating-based systems

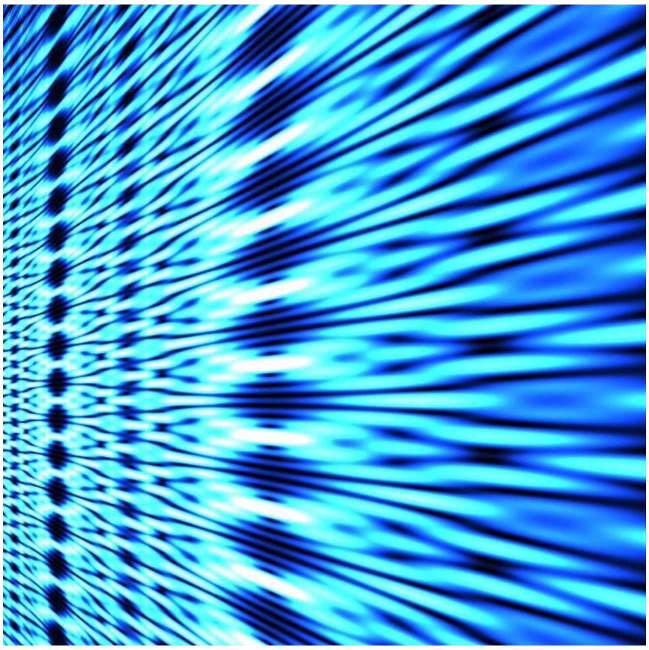
Grating-based Talbot Interferometry is one of the most exciting new methods that has emerged in x-ray physics over recent years. Synchrotron experiments have demonstrated significant promise for medical imaging and polymeric material analysis. Laboratory-based approaches have also developed, typically by placing a high aspect ratio source grating (G0) in front of a large extended x-ray source to effectively produce an array of small x-ray sources with the spatial coherence required for the technique to succeed.

However, the use of G0 also introduces numerous problems:

- Inefficient use of x-rays that limits throughput
- Constraints on field of view
- Contrast limitations from partial transmission of x-rays through the grating
- Manufacturing challenges make it near-impossible to achieve usable gratings with openings of 1 µm

Benefits over using the combination of a rotating anode source w/G0 grating:

- High source brightness for rapid phase contrast data acquisition
- Throughput gains of ~4x over the high powered rotating anode & source grating (G0) approach
- Effective source size is 1 µm, which produces large Talbot fringes to reduce requirements on downstream detector and detector grating components
- Optimized contrast preservation due to an improved patterned microbeam with darker nodes and brighter anti-nodes
- Reduced complexity in system design by removing G0



Grating-based images by Pfeiffer et al., ETH Zurich of a tumorous breast cancer tissue sample (left) and by Bech et al., Lund University of a rat (right three)

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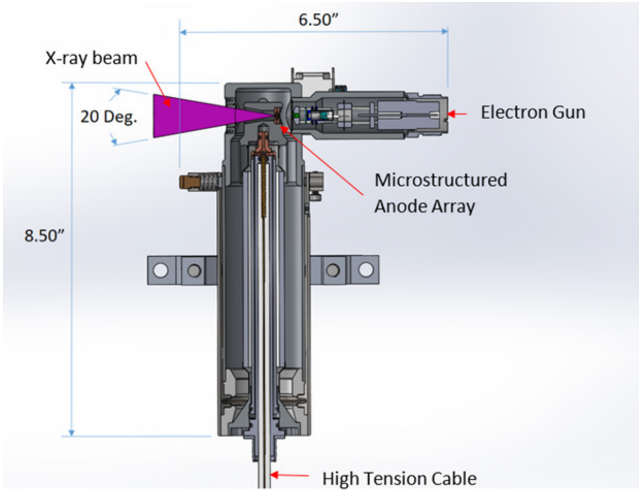
SIGRAY

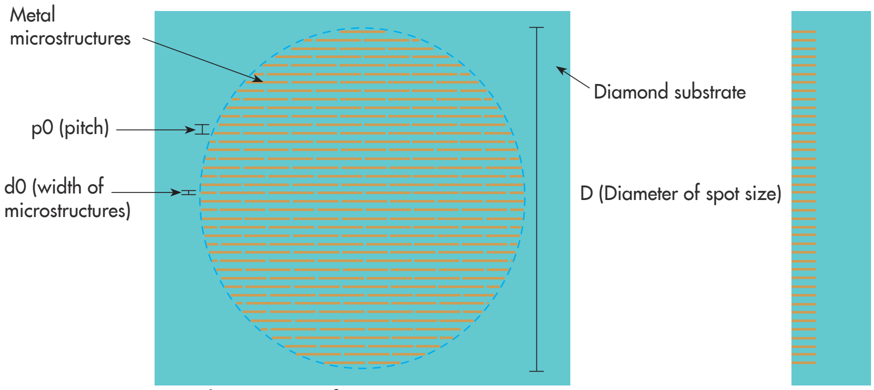
# FAAST-Phase™
# Revolutionary X-ray source designed for Talbot interferometry

The Sigray FAAST-Phase™ (Fine Array Anode Source Technology) features an innovative x-ray target comprised of an array of fine microstructured metal x-ray emitters embedded in a diamond substrate. The target is designed to combine the advantages of:

- Rapid thermal dissipation, provided by high degree of contact between the microstructures and diamond (thermal conductivity: 22 W/cm$^2$) to enable highly localized thermal gradients so that the target remains cool under high power loading
- Low atomic number of diamond, which results in a near-ideal electron energy deposition in the metal microstructures so that x-rays are efficiently produced by the metal microstructures for high contrast Talbot fringes
- 1 micron microstructure size for high spatial coherence, which relaxes requirements for downstream gratings and detector




| Parameter | Specification |
|---|---|
| Anode design | Periodic linear array of x-ray micro-emitters (2D array option also available upon request), circular pattern |
| Microstructure material | Copper (Cu) standard. Other materials (Ti, Cu, Rh, W, Pt, Zr, etc.) available on request. |
| Microstructure dimensions | Width (d0): 1 µm, Pitch (p0): 3 µm |
| Spot size diameter (D) | 20 and 50 µm diameter round |
| Maximum power | 75 W (50 µm) |
| Power density | 75 kW/mm$^2$<br>Note that a fair comparison to rotating anode would include account for self-absorption of take-off angle and aspect ratio of the grating (around a factor of 9) - the effective power density of a 1 kW 75 µm rotating anode is around 19 kW/mm$^2$) |
| Voltage | 20 - 50 kV |
| Current | 4 mA |
| Dimensions (W x L x H) | 6.5" x 6.5" x 8.5" \| 16.5 cm x 16.5 cm x 21.6 cm (source)<br>13" x 11" x 13" \| 33 cm x 28 cm x 33 cm (cooling unit) |
| AC Power requirements | 110 V or 220 V (selectable) |




Top-down view of X-ray target

Side view

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