m35.p05

Front coupling waveguides for present and future X-ray sources

D. Pelliccia[1,2], A. Cedola[2], F. Scarinci[2], M. Ilie[2], I. Bukreeva[2], W. Jark[3] and S. Lagomarsino[2]
[1] *Dipartimento di Fisica, Universitá di Roma "La Sapienza" and Sezione INFN, Roma 1, Piazzale A. Moro 2, 00185, Rome,* [2] *Istituto di Fotonica e Nanotecnologie – CNR, Via Cineto Romano, 42, 00156 Rom,* [3] *Sincrotrone Trieste, Area SciencePark, Trieste*

Keywords: X-ray optics, X-ray techniques, dispersion

Waveguides and fiber optics are widely used devices in photonics application exploiting the possibility to transmit light pulses at distance with low attenuation and distortion. In the last ten years waveguides have been successfully used with hard x-ray radiation, producing the smallest x-ray beam today available in this spectral region, by confining radiation in a very tiny channel [1]. Thin film WGs are constituted of a dielectric film sandwiched between two metal layers. . In a resonant beam coupling scheme the incoming radiation, transmitted by the very thin upper layer, is trapped by the central film when the incident angle satisfies the resonance conditions. This scheme can produce a considerable increase in flux density [2], and several applications in phase contrast microscopy and x-ray microdiffraction have been demonstrated [3,4]. An alternative coupling scheme, i.e. front coupling, has been proposed, where the incident radiation enter into the WG from the side [5]. In this case the WG spacing gap can be made simply of air or vacuum, thus minimizing losses during transmission and allowing lower energy x-ray radiation to be used. This scheme allows also to easily block the incoming radiation not trapped in the WG, thus providing a better Signal-to-Noise ratio at the exit.
We will present the advancement carried out at IFN in fabrication of air-gap front-coupling WGs, together with experimental results at synchrotron and laboratory sources. Theoretical considerations and computer simulations of the behaviour of WGs in different working conditions will be as well presented.
Future x-ray sources as Free Electron Lasers (FEL) will soon provide beams of very high brightness and extremely short time duration (few femtoseconds). In order to exploit these outstanding properties, optical elements capable to preserve the time structure and the coherence properties of the FEL beams must be conceived. WGs' are good candidates in this respect. We therefore studied the transmission of very short pulses in WGs', finding: i) conditions for dispersion-free transmission and ii) conditions for possible use of WGs' as dispersive optical elements capable to reduce the temporal width of pulses [6].

[1] S. Lagomarsino et al, J. Appl. Phys. 79, (1996) 4471
[2]W. Jark et al, Appl. Phys. Lett. 78, (2001) 1192
[3]S. Di Fonzo et al, Nature (London) 403, (2000) 638
[4]S. Lagomarsino, A. Cedola, Synchrotron Radiation News, 17 (3) (2004) 30.
[5]A. Jarre et al, Phys. Rev. Lett. 94 (2005) 074801
[6] D. Pelliccia, et al, Appl. Opt. ,in press

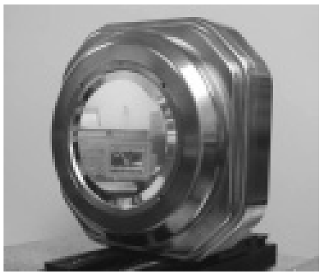
m10.p07

First Results of Åxiom 200, a High-speed, Photon-counting X-Ray Area Detector

Bram Schierbeek [a], Matt Benning[b], Yacouba Diawara[b], Roger Durst[b]
[a]*Bruker AXS B.V, Delft, the Netherlands.* [b]*Bruker AXS Inc., Madison WI, USA. E-mail: bram.schierbeek@bruker-axs.nl*

Keywords: accurate data collection, detector development, X-ray detector technology

We describe here the Åxiom 200: A new type of imaging detector for X-ray crystallography based on resistive microgap technology. This new micro pattern detector technology has been developed for high-energy particle physics experiments [1]. The Åxiom 200 exhibits a number of compelling advantages over the conventional, analog detectors typically used in crystallography experiments (viz., CCD's and image plates). The Åxiom 200 is a pure digital photon-counter and thus exhibits true single-photon sensitivity with essentially zero intrinsic noise and zero frame readout dead time. This allows it to acquire both very long exposures on weakly diffracting samples without data degradation and also extremely fast exposures for time resolved experiments. It also demonstrates a very high counting rate capability of up to 106 Xrays/mm2-sec with a linear dynamic range of over 9 orders of magnitude (over a thousand times higher than CCD or image plate detectors). With an active area of 20 cm and a spatial resolution better than 100 microns the Åxiom 200 can resolve over 400 diffraction orders. Also, the Åxiom 200 is extremely robust, does not require cooling and has no internal dead areas. Because of the short read-out time the Åxiom can be used in shutter-free mode, where the shutter is only opened once at the start of the experiment and closed again at the end of the experiment. The high sensitivity and low noise in combination with the absence of errors caused by shutter jitter make the Åxiom 200 a good candidate for SAD phasing experiments. Results of high quality data collections and successful S-SAD phasing will be shown.



[1] Bachman S., Bressan A., Ropelski L., Sauli F., Nuclear Physics A, 2000, 663, 1069C-1072C.