SPATIAL AND TEMPORAL COHERENCE EFFECTS IN PARAMETRIC X-RAY RADIATION

Alexander Potylitsyn[1]

National Research Tomsk Polytechnic University, Tomsk, Russia

Coherent emission from an electron bunch moving in magnetic fields is described using the phase shift for each electron in a bunch [1] $\varphi_{SR}^{(i)} = \exp\{i\ \mathbf{k}\ \mathbf{r}_i\}$, where $\mathbf{k}$ is the wave vector, $\mathbf{r}_i = \{x_i, y_i, z_i\}$ is the radius-vector of i-th electron. For such radiation mechanism as parametric X-ray radiation (PXR) for which atom electrons from a crystallographic plane are emission sources the time dependence has to be included into the phase shift:

$$\varphi_{PXR}^{(i)} = \exp\left\{i\left(\mathbf{k}\ \mathbf{r}_{pl}^{(i)} - \omega\ t^{(i)}\right)\right\} \tag{1}$$

Here $\mathbf{r}_{pl}^{(i)}$ is the radius-vector characterizing the point at the plane where i-th electron crosses it, $t^{(i)}$ is the time interval characterizing time of this crossing. The first term in (1) is responsible for spatial coherence, the second one - for temporal. If a crystallographic plane is tilted at the angle θ_B relative to the electron beam propagating along z-axis then we have:

$$\mathbf{r}_{pl}^{(i)} = \{x_i, y_i, x_i/\tan\theta_B\}\,, \omega t^{(i)} = \frac{2\pi}{\beta\lambda}\left(x_i/\tan\theta_B - z_i\right)$$

Influence of both terms on characteristics of coherent PXR produced by microbunched beams is considered in the report.

References

[1] Y.Shibata, K.Ishi, T.Ohsaka et al. NIM A **301** (1991) 161

[1] Corresponding author: potylitsyn@tpu.ru