***Supplementary Material***

1. **Derivation of Eq. 3.**

The partially coherent beam is produced via a Schell-model source (at source plane), the cross spectral density (CSD) can be expressed in the following well-known form [23]:

|  |  |  |
| --- | --- | --- |
|  |  | (13) |

Where *A*(*rα*, *θα*) (*α* = 1, 2) is a Gaussian amplitude and is expressed as:

Moreover, *g*(*r*1, *θ*1, *r*2, *θ*2) is the degree of the coherence function which satisfies the Schell-model correlation distribution and can be expressed as [32]:

Finally, *Ψα* is the phase term of the PC-PEPV beam and is written as:

Substituting Eqs. (14) - (16) into Eq. (13), the CSD function of the PC-PEPV beam can be expressed as follows:

|  |  |
| --- | --- |
|  | (17) |