Optimisation and control of synchrotron emission in ultra-intense laser-solid interactions using machine learning - Supplementary material

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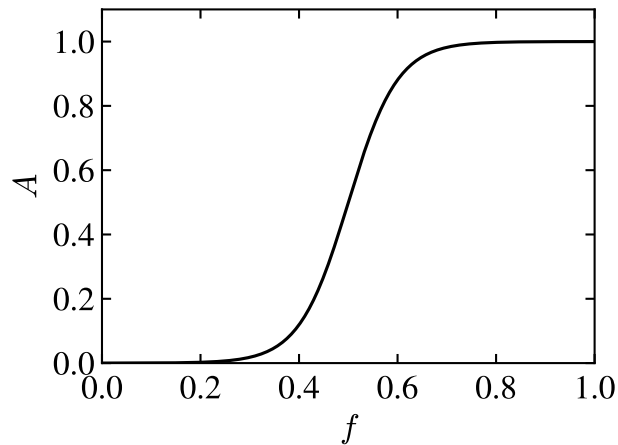
1. Acceptance function

Figure 1 : The acceptance function used in the objective function f_{M2} for Bayesian optimisation, with $f_{max} = 1$.

The acceptance function $A(f) = 1/(1+\exp(-(20/f_{max})(f - 0.5f_{max})))$ described in section 4 of the main text is shown in figure 1, where $f_{max} = 1$ is arbitrarily chosen.

2. Spatial profiles of synchrotron emission for $I_l = 3 \times 10^{23}\,\mathbf{W\,cm^{-2}}$ in 3D

The angle-resolved total energy of synchrotron emission, $d\sum\varepsilon_{sy}/d\Omega$, is shown in figures 2, 3 and 4 for p-, s- and left-hand c-polarisation, respectively, for 3D simulations of the interaction with peak laser intensity $I_L = 3 \times 10^{23}\,\mathrm{W\,cm^{-2}}$, as described in the main text. Results for target thicknesses of $l = 1\,\mu$m and $3\,\mu$m are shown for laser pulse angle-of-incidence values of $\theta_i = 0, 45°$ and $67.5°$.
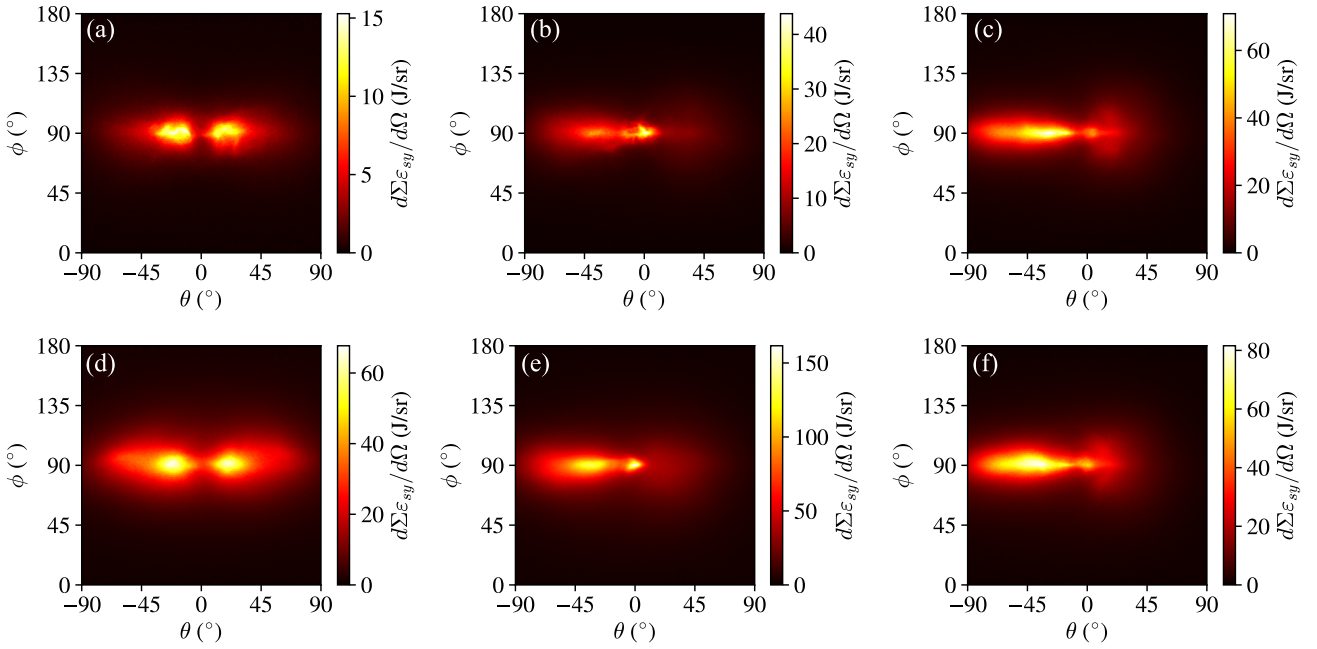
Figure 2 :   Angle-resolved total energy of synchrotron emission for a p-polarised laser pulse, for **(a)**–**(c)** 1 μm target thickness and **(d)**–**(f)** 3 μm target thickness. The angle-of-incidence is **(a)** and **(d)** 0°, **(b)** and **(e)** 45°, **(c)** and **(c)** 67.5°.
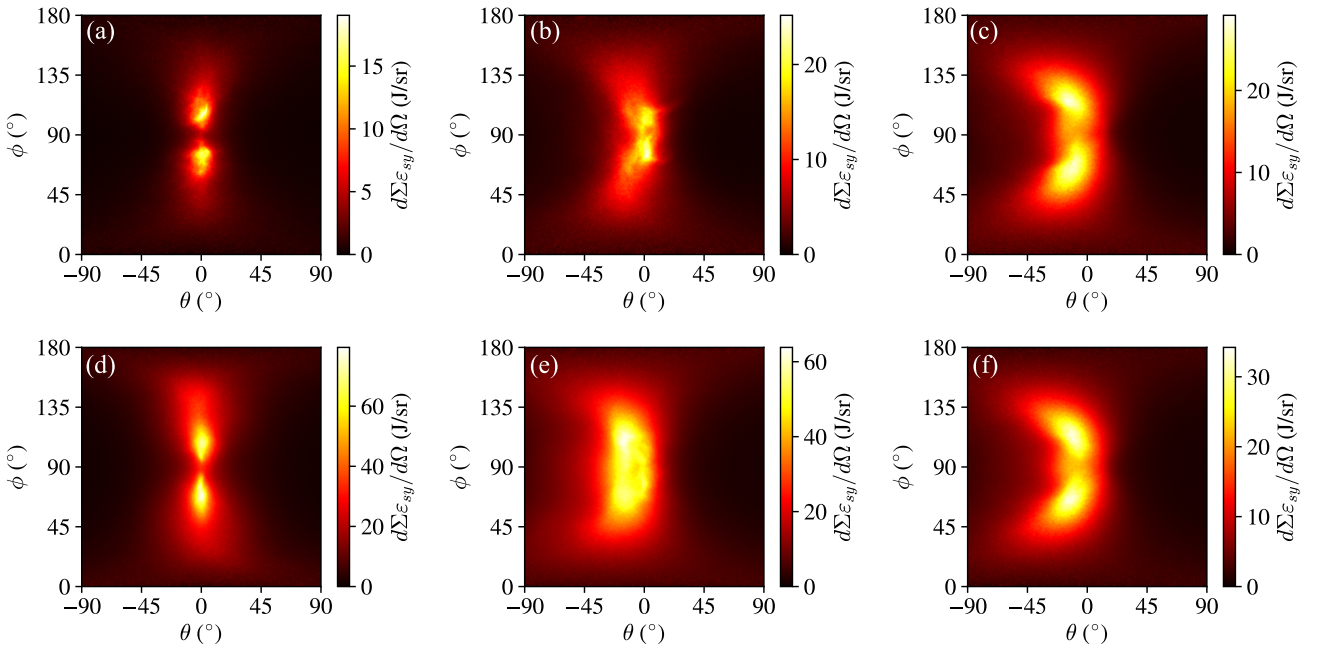

Figure 3 :   Angle-resolved total energy of synchrotron emission for an s-polarised laser pulse, for **(a)**–**(c)** 1 μm target thickness and **(d)**–**(f)** 3 μm target thickness. The angle-of-incidence is **(a)** and **(d)** 0°, **(b)** and **(e)** 45°, **(c)** and **(c)** 67.5°.
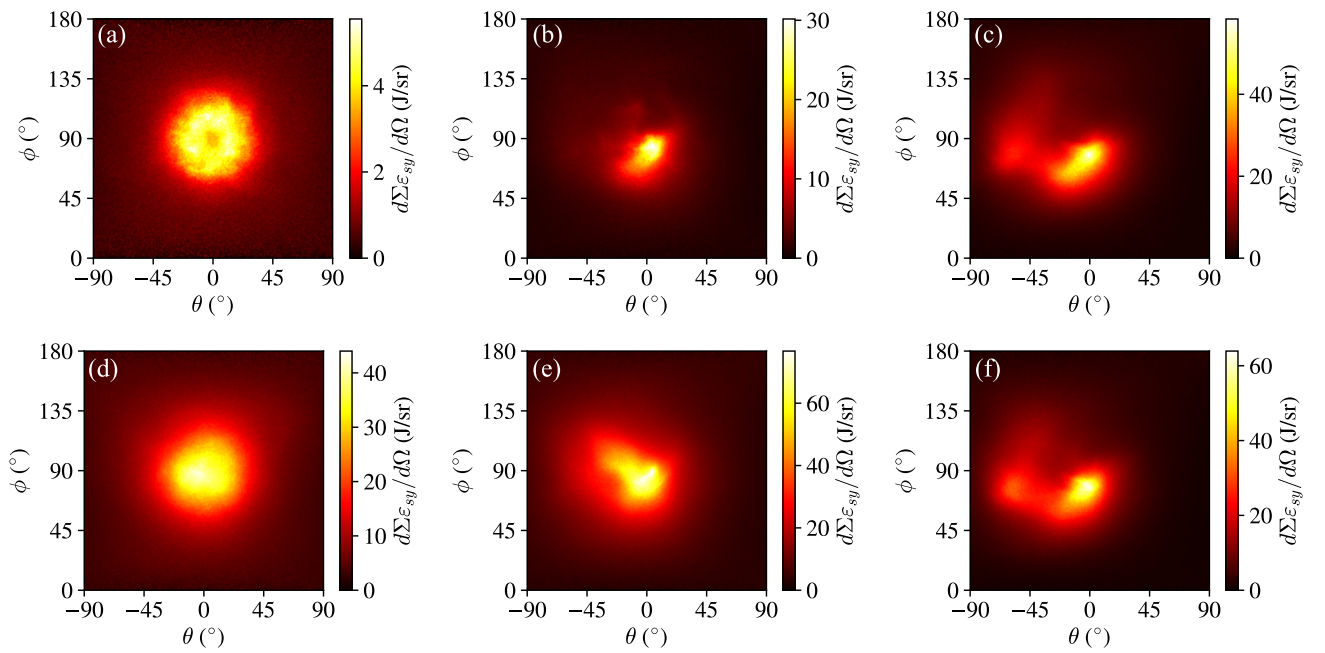
Figure 4 : Angle-resolved total energy of synchrotron emission for a left-hand c-polarised laser pulse, for **(a)**–**(c)** 1 μm target thickness and **(d)**–**(f)** 3 μm target thickness. The angle-of-incidence is **(a)** and **(d)** 0°, **(b)** and **(e)** 45°, **(c)** and **(c)** 67.5°..