Photon emission enhancement studies from the interaction of ultra intense laser pulse with shaped targets

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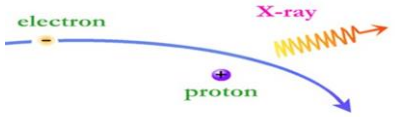
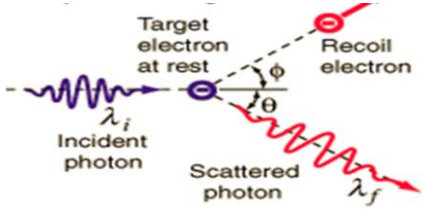
Introduction

- The Bremsstrahlung radiation is emitted when a charged particle is deflected by another charged particle.



- NCS given by the equation ($e^- + n\gamma_l \rightarrow e^- + \gamma_h$) Where γ_l is laper photon and γ_h is emitted high energy photon.



PIC Simulation

Laser Parameters:

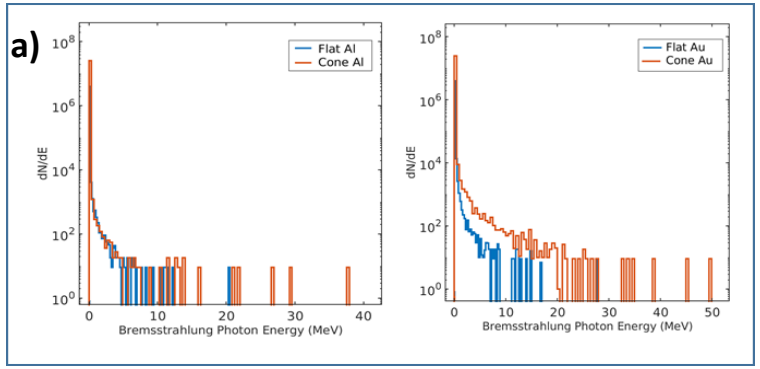
- Laser wavelength = 1 µm
- Laser intensity = 2×10^{22} Wcm^{-2}
- Pulse duration = 30 fs
- Laser beam profile is Gaussian

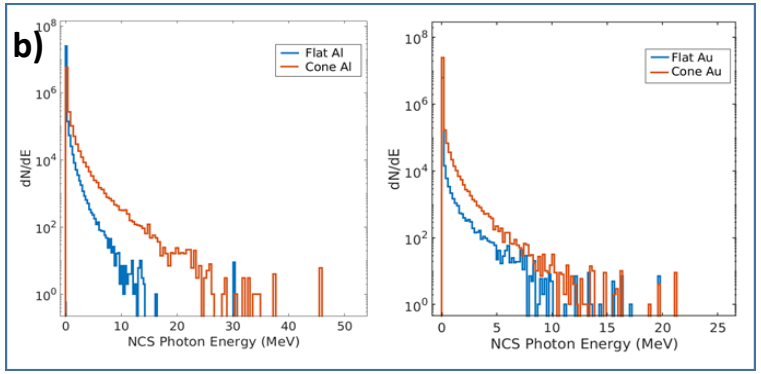
Target is fully ionized (Al or Au) foil with 1 µm thickness.

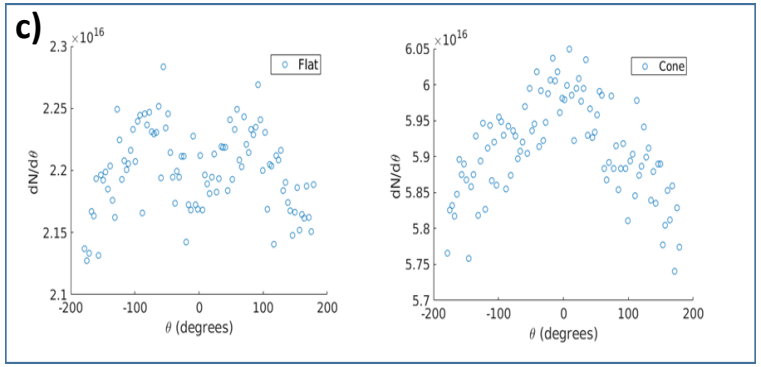
Simulation box sizes:

- Domain size 10 µm × 10 µm, for flat case. 20 µm × 20 µm for cone case. With 4 nm gird size.

EPOCH 2D particle-in-cell simulations results





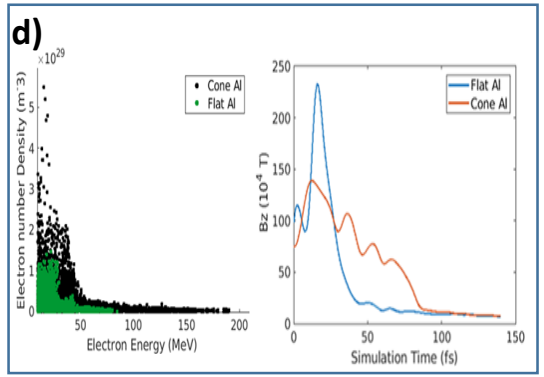


a) The energy of the Bremsstrahlung photon is higher in Au compared to Al target in both cone as well as flat configurations.

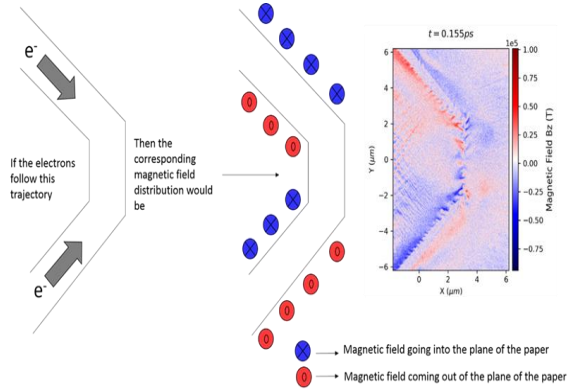
b) The photon energy in NCS is higher for cone configurations irrespective of targets chosen.

c) More electrons are found along the laser propagation direction in case of cone target compare to flat target.

d) The electron number and electron energy are significantly higher in case of cone compared to that of the flat target. And corresponding magnetic field decay is slow in case of cone compared to flat case.



Particle tracing



- This enhancement in photon emission is due to the guiding of surface electrons from the surface of the cone towards the tip of the cone by the magnetic fields generated along the cone surface

Conclusions

- The Bremsstrahlung and NCS process dominates in the cone configuration over flat configuration for both low Z and high Z targets.

References

- T D Arber et al Plasma Phys. Control. Fusion 57 113001 (2015