Experimental demonstration of wakefield effects in a THz planar diamond accelerating structure

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Wakefield Mapping

Change in D-W spacing $\rightarrow$ energy gain/loss of a witness

Experimental drive + witness visualization

Spectrometer measurement

• Polycrystalline diamond, 75um thick
• 250 GHz slab-symmetrical structure
Why Diamond

Breakdown test at the AWA: 72nC goes through a standing wave diamond based structure (~70 MV/m, 35ns long) + scratch on a diamond → field enhancement ~ $\varepsilon$ times (300 MV/m field in the scratch)

Preliminary examination shows no evidence of breakdowns. Additional test will be carried out.

We are currently working on CVD diamond technology for THz DLA applications: ~200um aperture, 1-2 inches long high quality diamond
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ATF beam masking

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Transversely, flat beam is preferred, with max possible charge:

Longitudinally: 800 pC in 2.4 mm length [100 A]

Longitudinal $\rightarrow$ Transverse with **Energy spread**

Possibility of movable mask to sweep the position of the witness beam?

Triangle drive bunch (max charge $\sim$ 200pC) and small witness bunch (min possible)
Drive and Witness

At the mask

IPOP3 image (right after the mask) CTR interferometry is used to calibrate the IPOP3 image to the longitudinal current distribution
witness beam size effect

c• t, cm - position behind the drive beam

drive beam
wakefield from the drive
witness beam

Witness beam distorted

Drive beam

Image after spectrometer
Result: wakefield mapping

- Successful wakefield measurement at 0.25 THz
- Extremely valuable experience
PROPOSED EXPERIMENT:
HIGH TRANSFORMER RATIO