Single Shot Electron Diffraction on VELA

Mark Surman
Multi-MeV beam Electron diffraction

- Higher elastic scattering cross sections than X-rays
- Smaller energy transfer to sample than X-rays thus reduced sample damage
- Multi MeV beams provide sub-100 fs bunches with 1 pC charge (not possible at lower energies)
  - Dynamics time scale of making / breaking bonds
  - Pump – probe velocity matching
- Sufficient charge for single shot diffraction
Polycrystalline Al (DL)
1 sample grid only

Polycrystalline Au (DL)
1 sample grid only

Graphite particles (Agar)
1 sample grid only

Au single crystal
(Agar)

Uncoated TEM grid

Polycrystalline Au (DL)
2 sample grids stacked

Graphite particles (Agar)
3 sample grids stacked

Au single crystal
(Agar)
First diffraction patterns from VELA 4 MeV/c

York Platinum sample.
Sum 1000 shots at <1 pC
Au(poly) on VELA

Au(poly) on REGAE
Single Crystal Gold
Au(100)

Single shot,
40 fC transmitted
BUNCH LENGTH MEASUREMENTS USING A TRANSVERSE DEFLECTING CAVITY ON VELA

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Summary

• Succeeded in single bunch, ultra low charge diffraction from simple samples.

• Not yet observed dynamics
  • Pump laser conflicts

• Know how to reduce bunch length e.g move sample closer to gun
  • Conflict

• Need external science leader
Double-shot MeV electron diffraction and microscopy

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(Received 14 March 2017; accepted 1 May 2017; published online 19 May 2017)