NLC - The Next Linear Collider Project

Electron Cloud and Other Issues

ARDA Collective Effects Group
Electron Cloud

- Positron damping rings
  - Currently being studied by Mauro Pivi at LBNL
  - My interpretation:
    - Sees rapid saturation of e- plasma
    - Plasma density not enough to drive rapid multi-bunch instability
    - Need to confirm simulations and study single bunch effects
  - What about TESLA?
Electron Cloud

• Single Pass effects
  – Beam emittance is tiny (smaller issue for e-cloud than ions but still sensitive)
  – Multi- and single bunch

• 180 degree turn around
  – there are lots of photons,
  – the energy is relatively low,
  – the vacuum chamber does not have an ante-chamber

  – What is the impact of the vacuum chamber aperture
  – Previous aperture was near multi-pactoring resonance
Electron Cloud

- **Linac**
  - There is some radiation from quadrupoles - can this drive dipole instability through photo-ionization
  - Bending magnets in chicanes will send radiation down linac - is this important?
• Beam Delivery
  – There are lots of bends and a lot of photons,
  – the beta functions are huge,
  – the vacuum chamber does not have an ante-chamber

  – What is the impact of the vacuum chamber aperture
  – How important is photo-ionization here
Dark current questions:
- Can dark current drive dipole modes or cause transverse beam jitter
- What is effect on BPMs?
- Can dark current cascade with a net increase between quadrupoles?
- What is effect in TESLA?
Ion Instabilities

- Fast Beam Ion instability is predicted to be a possible limitation in:
  - Damping rings
  - Low energy transport lines
  - Final focus

- Can ions at IP be important?

- Is there a single bunch effect that is important in the BC or linac (possibly similar by Emma to that described in EPAC 94)
Summary

- Lots of questions for both NLC and TESLA
  - Electron cloud
    - There is radiation everywhere!
    - Single and multi-bunch effects might be important
    - Need basic scaling to understand where it might be important
  - Dark current
    - Dipole deflections
    - Cascade development
  - Ions
    - Possibly important because of small beam sizes
    - Again single and multi-bunch effects