ALPHA Beam Characterization

- Device Test Area Overview
- Beam Characteristics
- Diagnostic Equipment
- Calibration
- Measurement Accuracy
Device Test Area Overview

- Extraction Line
- DUT Table
- Beam Dump
Beam Characteristics

• What do we want to measure?
  – Incident Dose Intensity
    • Beam current incident on the sample
    • Temporal profile of the incident beam
      – Pulse length and uniformity
      – Debunching efficiency
  – Transmitted Dose Intensity
    • Beam current passing through the sample
  – Incident Dose Profile
**Diagnostic Equipment**

- **Wall Gap Monitor**
  - Incident beam current
  - Incident beam pulse length and uniformity
  - Debunching efficiency
Diagnostic Equipment

• Beam Position Monitor
  – Transverse beam position
  – Incident beam current
  – Incident beam pulse length and uniformity

Microstrip design allows a higher bandwidth than the WGM

UP
DOWN
LEFT
RIGHT
Diagnostic Equipment

A plastic scintillator produces a beam spot bright enough to view with an ordinary camera with minimal shower production.

- Removable Scintillator Screen
  - Transverse beam profile
  - Qualitative measure of beam current
  - Before or after DUT? Or both?
• **Faraday Cup**
  – Incident or transmitted beam current
  – Also designed to eliminate most backscattered radiation in the DUT area
Potential Diagnostic Equipment

• Ion Chamber
  – Thin ion chambers may be placed before and after the DUT with minimal beam perturbation
  – 2D Ion Chamber for real-time dose profile?
• PIN Diode Detectors
Calibration

• Beam current diagnostics calibration
  – The WGM and BPMs can be calibrated on the test bench using a current carrying wire to simulate beam
  • Beam time structure measurements can be similarly calibrated with a 3GHz pulse
    – The FC current measurement can be calibrated using the signal from the WGM or BPMs
Calibration

• Dose diagnostics calibration
  – TLD crystals will be used for calibration of delivered dose intensity
    • TLD analysis equipment will be available on-site
  – Dosimetry film can be used to verify dose intensity and distribution.
    • Intensity needs to be calibrated using TLDs

Gaussian Beam

Square Beam

ALPHA Film Profile Measurements
Measurement Accuracy

• Beam current diagnostics accuracy
  – When using well-shielded cables, the WGM and BPMs produce low-noise signals that can be calibrated precisely
  – The FC is designed to capture 95% of the incoming charge, but measurement is highly repeatable

• Dose diagnostics accuracy
  – TLD reader calibration will be NIST traceable
  – Dosimetry film is standard in radiation therapy
Any additional requests or suggestions?