BEAM HALO MONITOR- **Accelerator Physics**

L.Cremaldi*, Igor Ostrovskii U. Mississippi cremaldi@phy.olemiss.edu
Contact : Mark Ross, SLAC ph 662-915-5311

I. OVERVIEW

Beam halo "tails" often representing < 10^{-6} of a main e,p beam core is often the major cause of detector background problems and unwanted background radiation in beamline areas. Beam profile monitors generally focus on the beam core and loose sensitivity in the halo region where a large dynamic range of detection is necessary.

In a most common implementation of a beam profile monitor a thin wire is moved across the beam and a correlation is formed between secondary emissions and mechanical position of the wire. This wire will suffer irrevocable damage in cased of high power density beams 10^{14}/s intended for future accelerators. A few techniques are still plausible in these situations, (1) a "laser wire" system in which a laser beam is scanned across the beam and scattered emissions are detected and correlated, (2) A low density vapor-jet is sprayed across and detected. (3) A diamond-like material is moved in to the beam and direct ionization reading s recorded as a function of distance.

Systems of type (1) are being proposed for the NLC and may well lead to a successful profiling device but may have difficulty in the halo region where particle densities have dropped. Perceived difficulties in implementation of (2) leads to an interest in developing CVD diamond detection of the halo (3).

CVD diamond with high thermal conductivity, low thermal expansion coefficient, good mechanical rigidity, radiation hardened, high dark current resistivity, and acting as a solid state particle detector may offer a solution. Diamond pixel detectors have been successfully operated in particle beams as ionization detectors. We can imagine a CVD diamond wand moved inside the beam pipe on a mechanical cold finger taking ionization reading in real time. Small sub-millimeter size detectors can be micro-fabricated. For the purpose of passive beam insertion.

II. WORK, GOALS, DELIVERABLES

(A) We will obtain diamond detectors in a range of thickness from Norton, and other sources. We presently have small detectors from Kiev Shevchenko University, Ukrain. A metallisation and attachments of leads is nontrivial, but we have close contacts with US and Ukranian groups on this matter.

These first detectors will be tested under high rate conditions with radioactive sources (Sr^{90}) and later with external accelerator beams, to be specified. conditons. If the initial testing goes well full cooling and mechanical mounts will be fabricated for internal beampipe insertion tests.

(B) We are also interested in the Laser Compton Scattering technique when applied to the beam halo region. We would focus on detection of 10^6-10^8 /s-cm^2 beams from radioactive sources with laser scattering techniques.

III. FUTURE

CVD Diamond testing will continue in FY03-04 as needed. If feasibility of the project is found to be unlikely, then we would like to join efforts of US, UK, German, and Italian groups** focusing on "laser wire" scattering techniques in the beam halo regions.
** see PAC 2001

IV. BUDGET

	FY02	FY03	FY04
CVD Diamond samples	10K		
Metallisation and leads	5K		
Sr^{90} source	2K		
Charge Integrating Amp	3K		
Inspection photos	1K		
Materials&Supplies	5K		
Labor	5K		
	31K		