## WBS 1.6 Software

1. An internal review on PXL Survey and related software procedures has been scheduled for May 17 at BNL.

2. Full Simulations exploring the physics capabilities of various PXL prototype configurations were performed and reported to the Collaboration as part of the BUR 13/14 discussions. The bottom line is that if we get a few weeks worth of good mbias Au+Au data, we should be able to get initial results on charm cross section and  $R_{CP}$ , but it is up to the Collaboration to decide its priorites.



**Figure 1** Signal significance as a function of transverse momentum for a three-sector prototype PXL detector configured as *Adjacent*-sectors (left panel) or as a *Star* (right panel). Notice the different (complementary) pT acceptance of the two configurations.

- 3. Survey work is moving on well on both the PXL and SSD sides.
- On the SSD side we started making since measurements on a ladder shipped from Subatech. The figure below shows the ladder resting on the survey rachine (1 ft) and some fiducia is a ks and their relation to sensor strips (right).



Figure 2 An SSD ladder in the Survey equipment (left) and two fiducial marks and sensor strips as viewed with the survey camera (right).

• Initial measurements to determine the gravitational bending (sagging) of a ladder as well as repeatability of the measurements in general (see figure below).



Figure 3 Measurements of an SSD ladder planarity (left), showing a max bending of ~400 microns. The right panel shows results on how repeatable are the measurements of the same ladder but at different times.

• Initial measurements using a 3-sensor-prototype ladder were performed. The goal was to a) determine survey-able fiducial structures on the sensors, b) program the machine for automatic operation and c) check the sensor planarity when glued on the ladder support. The pictures below shows some results on these points.



Figure 4 (Left panel) The 3-chipe prototype ladder. (Right panel) One sensor with two possible fiducial features identified.

• Initial draft of PXL survey conventions (e.g. coordinate systems etc) and procedures is completed.



Figure 5 Space mapping of the 3-sensors on the ladder. Notice that deviations from planarity are only a tens of microns.

4. A full simulation was performed in order to determine the hit density for a fixed period of time (the frame readout rate) and therefore records all particles that pass through it during its **backgroundeduct** to relectrons generated in peripheral (non-touching) Au+Au there will be extraneous his and pileup in the detector during the other collisions at articles is simulation the hits coming from later times, tracks from beam gas showers in addition to hits from other background sources. The real densis privaling electrons in at the iPAL dayers was also determined. The results show pointing accuracy of the tracking system and how precisely tracks can be projected onto be fraction of the total number of hits. The reconstruction algorithms results from this sections and be wreced on the total number of hits. The frame readout rate, the beam juminosity, the interaction cross sections and background rates from outside sources. Pellow Shows the hits/cm<sup>2</sup> in the two PXL layers.



The parameters assumed for these calculations are shown in Table 7. In both layers of PXI detector and would will in Table 9. To example, the integrated yield of Figure 6 Hit densities (hits/cm<sup>2</sup>) in both layers of PXI detector and the figure for the second se

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Au+Au Luminosity (RHIC-II)	80 x 10 <sup>26</sup> cm <sup>-2</sup> s <sup>-1</sup>		PIXEL-1	PIXEL-2
dn/dŋ (Central)	700		Inner Layer	Outer Layer
dn/dn (MinBias)	170	Radius	2.5 cm	7.0 cm
MinBias cross section	10 barns	Central collision hit density	$17.8 \text{ cm}^{-2}$	2.3 cm <sup>-2</sup>
MinBias collision rate (RHIC-II)	80 kHz	Integrated MinBias collisions (pileup)	23.5 cm <sup>-2</sup>	5.2 cm <sup>-2</sup>
Interaction diamond size, $\sigma$	15 cm	UPC electrons	19.9 cm <sup>-2</sup>	0.8 cm <sup>-2</sup>
Integration time for Pixel Chips	200 µsec	Totals	61.2 cm <sup>-2</sup>	8.3 cm <sup>-2</sup>

Table 7: Luminosity and other RHIC II parameters that determine the particle of the particle o

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Ultra-Peripheral Collisions (UPC) are a copious source of low momentum electrons. They are created by the coherent interaction between the strong electromagnetic fields that occur when two nuclei 'miss' each other in an ultra-relativistic collision. The nuclei do not interact via the strong interaction, but they do interact electromagnetically (see Figure 27). A pair of virtual photons that are emitted by the colliding nuclei create the electrons and therefore the electrons have very low momenta and the momenta are determined (mostly) by the uncertainty principle. Since the characteristic radius of a Au nucleus is 7 fm, the characteristic transverse momentum for the electrons is 70 MeV/c or less. These electrons will enter the PIXEL detector and interact with it, leaving a hit in the detector. A precise calculation of the UPC electron spectrum is quite tedious and