

Rate dependence of Polarization measurements in RHIC.

A.Zelenski for polarimetry group

- The rate dependence may produce large systematic errors in polarization measurements at high bunch intensities.
- This errors depend on:
 - bunch intensity;
 - number of bunches;
 - bunch spacing;
 - target thickness.

APEX Workshop, Dec.4, 2008

Measurements with p-Carbon CNI polarimeter

- Polarization, polarization profile measurements in the scanning mode.
- Polarization losses during acceleration and store.
- Polarization decay during store.

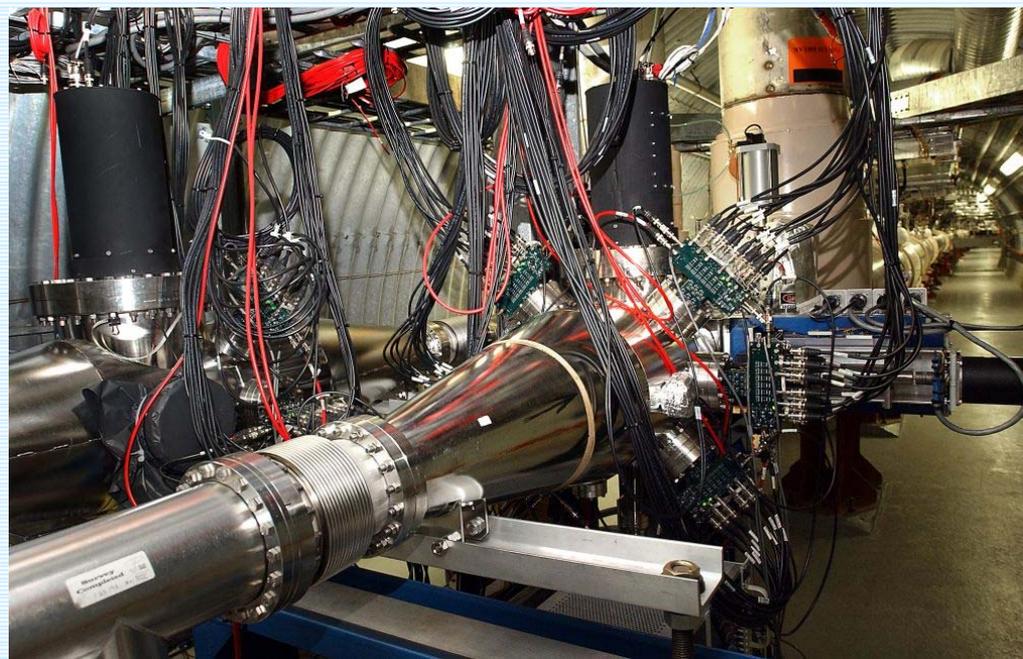
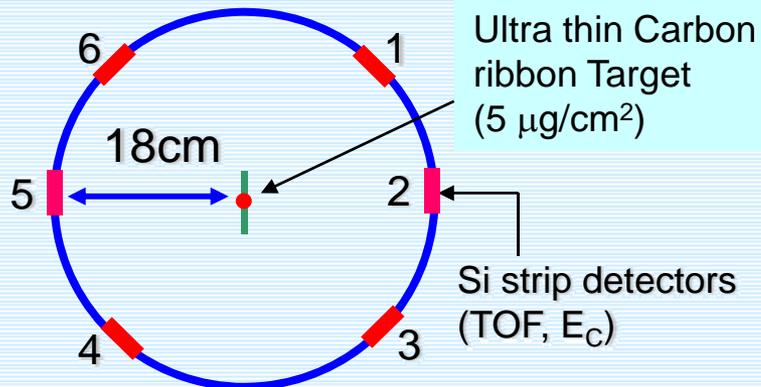
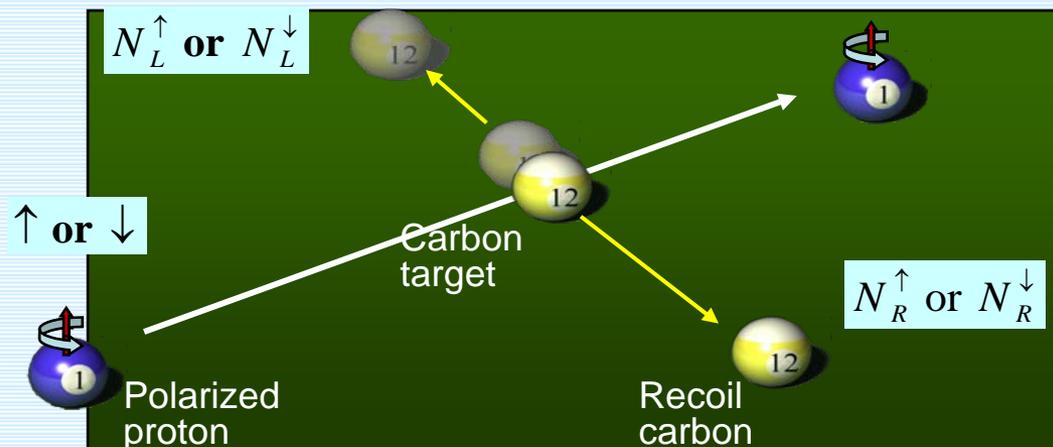
- Beam intensity profile (emittance) including bunch-by-bunch.
- Emittance measurements cross-calibrations.
- Emittance measurements on the ramp.

The RHIC p-Carbon CNI polarimeter.

Elastic scattering: interference between electromagnetic and hadronic amplitudes in the Coulomb-Nuclear Interference (CNI) region.

$$P_{beam} = - \frac{\mathcal{E}_N}{A_N^{pC}} \quad A_N(pC) \sim 1\%$$

$$\mathcal{E}_N = \frac{N_L - N_R}{N_L + N_R}$$



New detectors development using BNL tandem facilities

- Carbon ion beam from BNL tandem facilities revealed (confirmed observation in RHIC) strong effect of carbon beam intensity on silicon strip detector operation presently used at RHIC polarimeter, which appeared as spectrum shift and distortion.
- New types of silicon detectors were selected, which have better properties and we plan to test these detectors during 2009 Run in RHIC polarimeter.

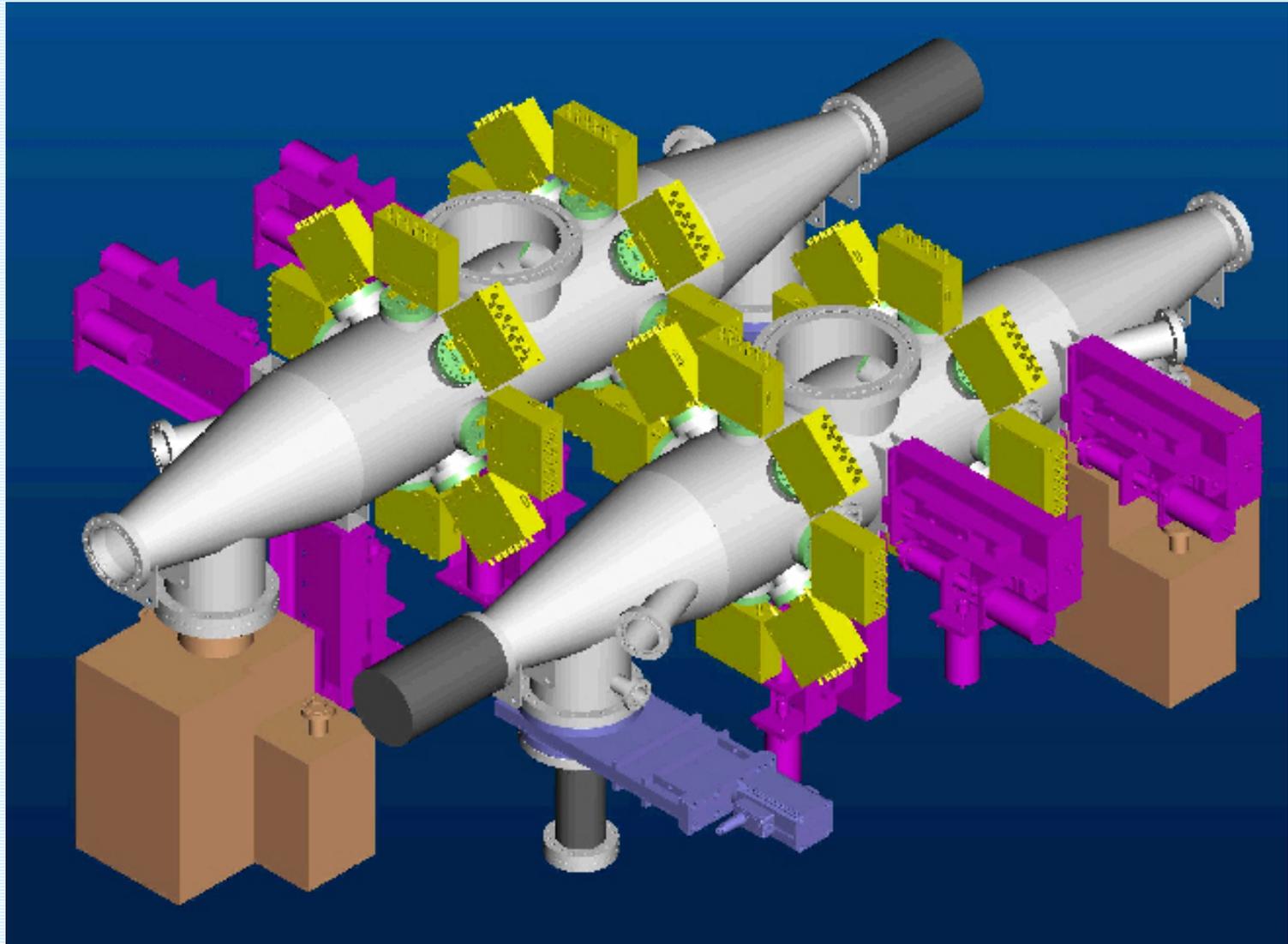
APEX proposal

- **Experiment Goal:** Study the rate dependence of the RHIC p-Carbon CNI Polarimeter measurements for different types of detectors.
- **Benefits:** Reduction of systematic errors of polarization measurements.

Experiment Description: Measure polarization, recoil carbon energy spectra and silicon detector integral characteristics at different bunch intensities, different number of bunches and bunch patterns, target thickness.

Most of measurements can be done at injection energy. Measurements at store in particular at 250 GeV will be required as well.

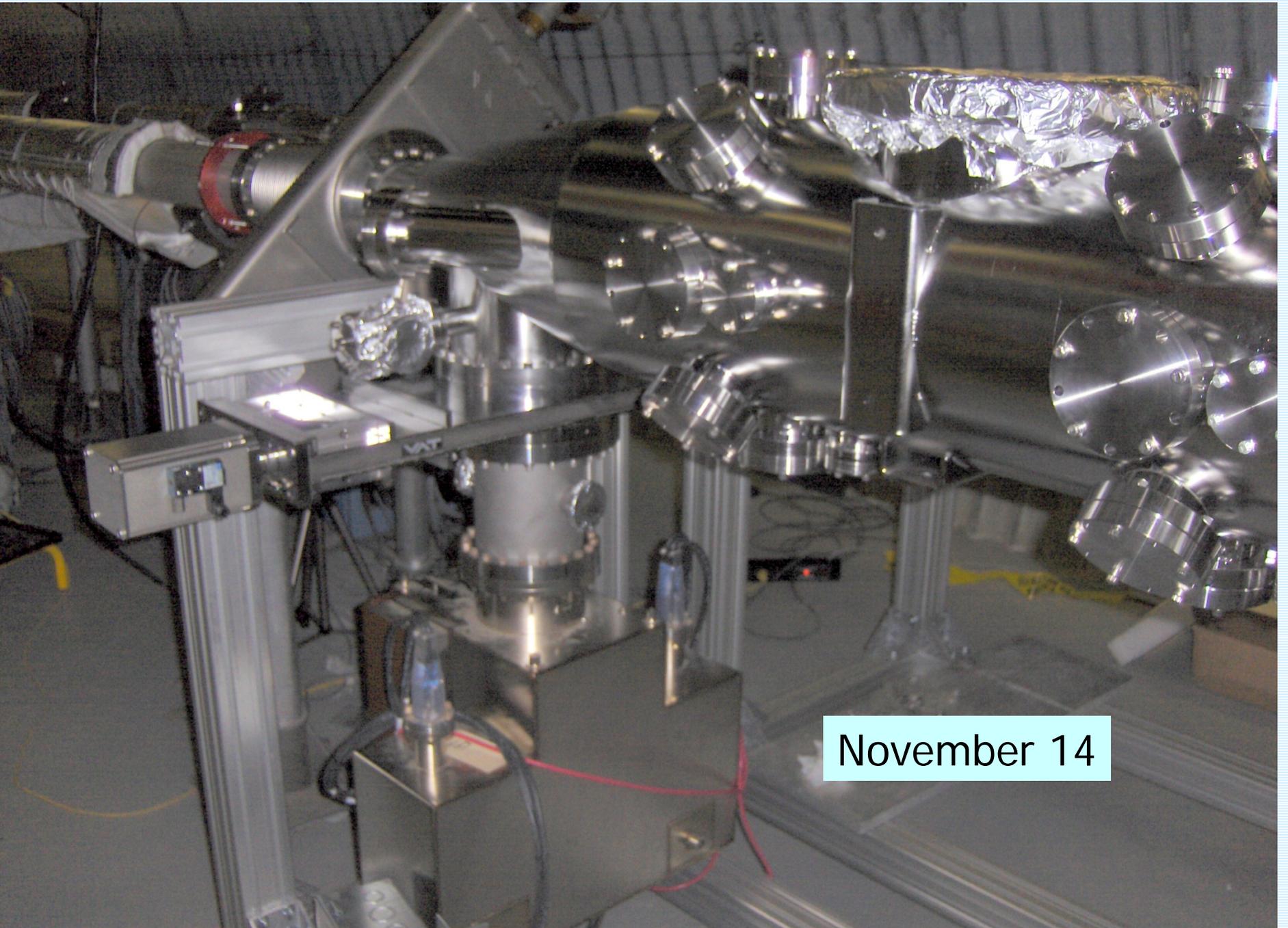
The RHIC p-Carbon CNI polarimeter upgrade for the beam polarization and intensity profile measurements
(G.Mahler, S.Bugros)



- ❑ Additional set of detector ports will facilitate new detectors development, while keeping the established technique intact.
- ❑ Two sets of targets will extend the period between target replacements and reduce the machine downtime.
- ❑ Additional polarization and emittance measurements can be done with extra set of targets (**polarization and emittance measurements during the energy ramp**).

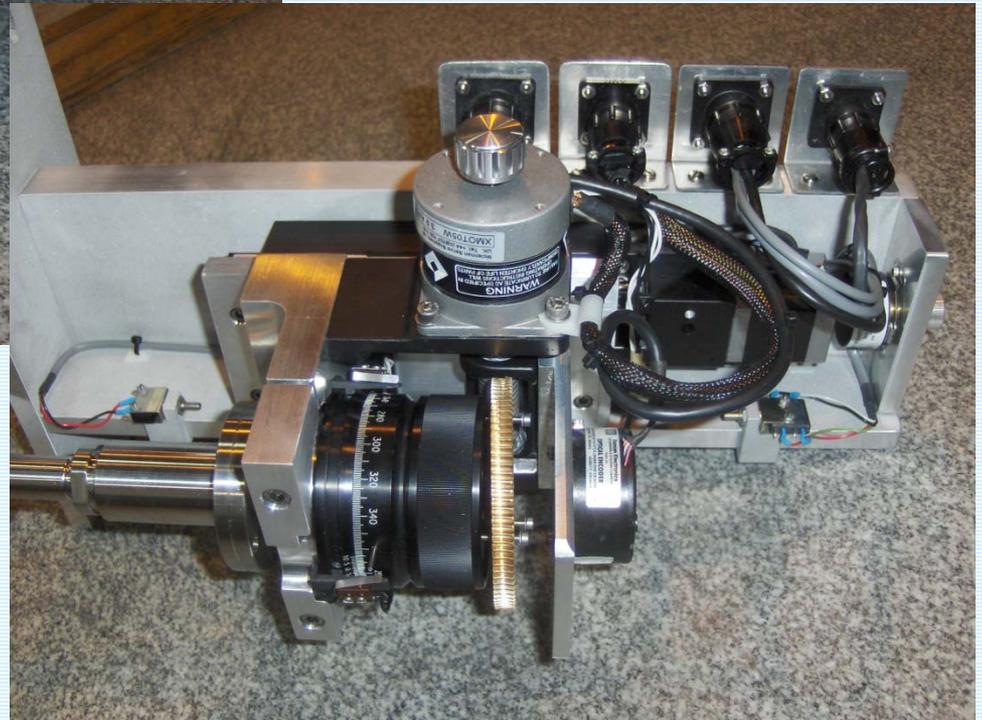
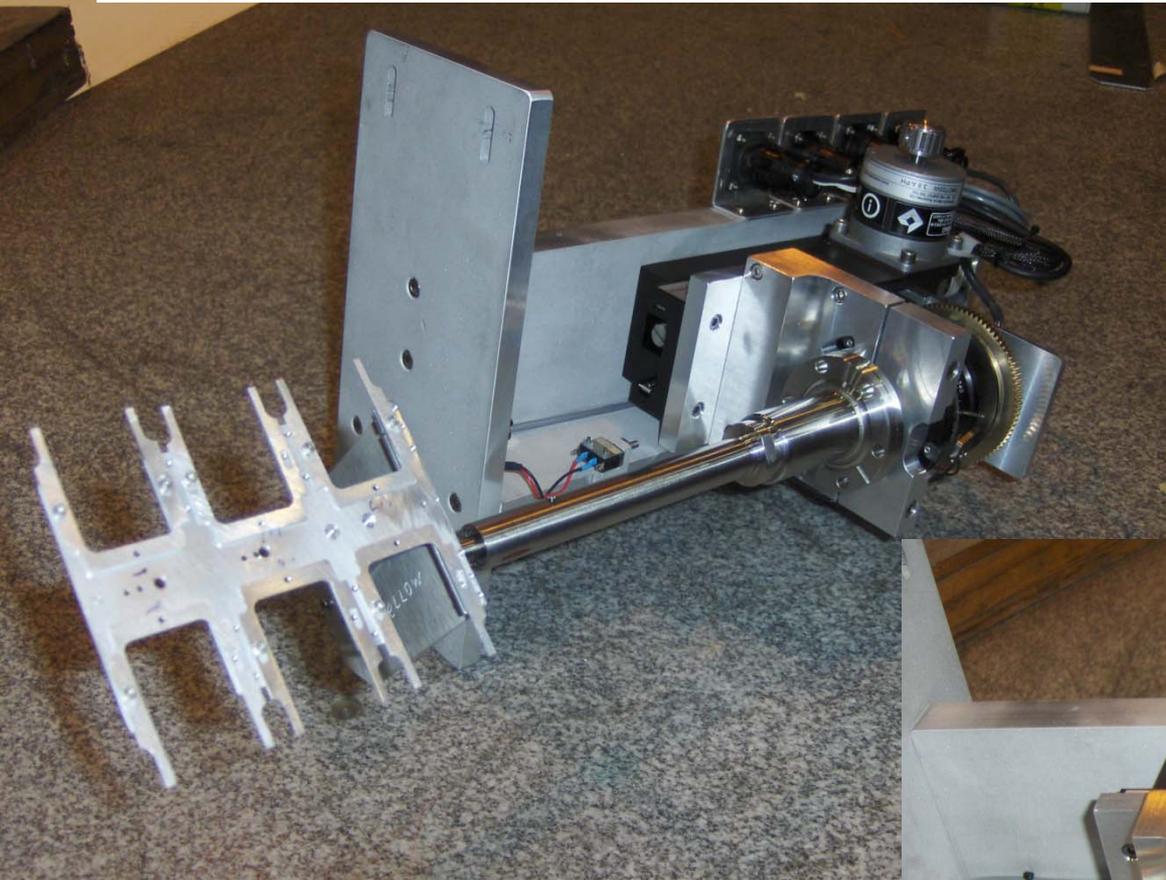
The ongoing CAD polarimeter upgrade project will address these problems for the 2009 polarized run.

- ❑ The plan is to build and install the second polarimeter in each RHIC ring. These two polarimeters will be installed in new vacuum chambers with more powerful vacuum systems to improve RHIC vacuum conditions. Two identical Carbon target motion mechanisms and detectors assemblies will be installed in each chamber (both rings).
- ❑ One polarimeter can be used for the vertical polarization and intensity profile measurements and the second can be used for the horizontal profile measurements. It will minimize the number of target motions, speed up the measurements (increase the efficiency of the stored beam use for about 5-10%) and reduce the risk of target damage.

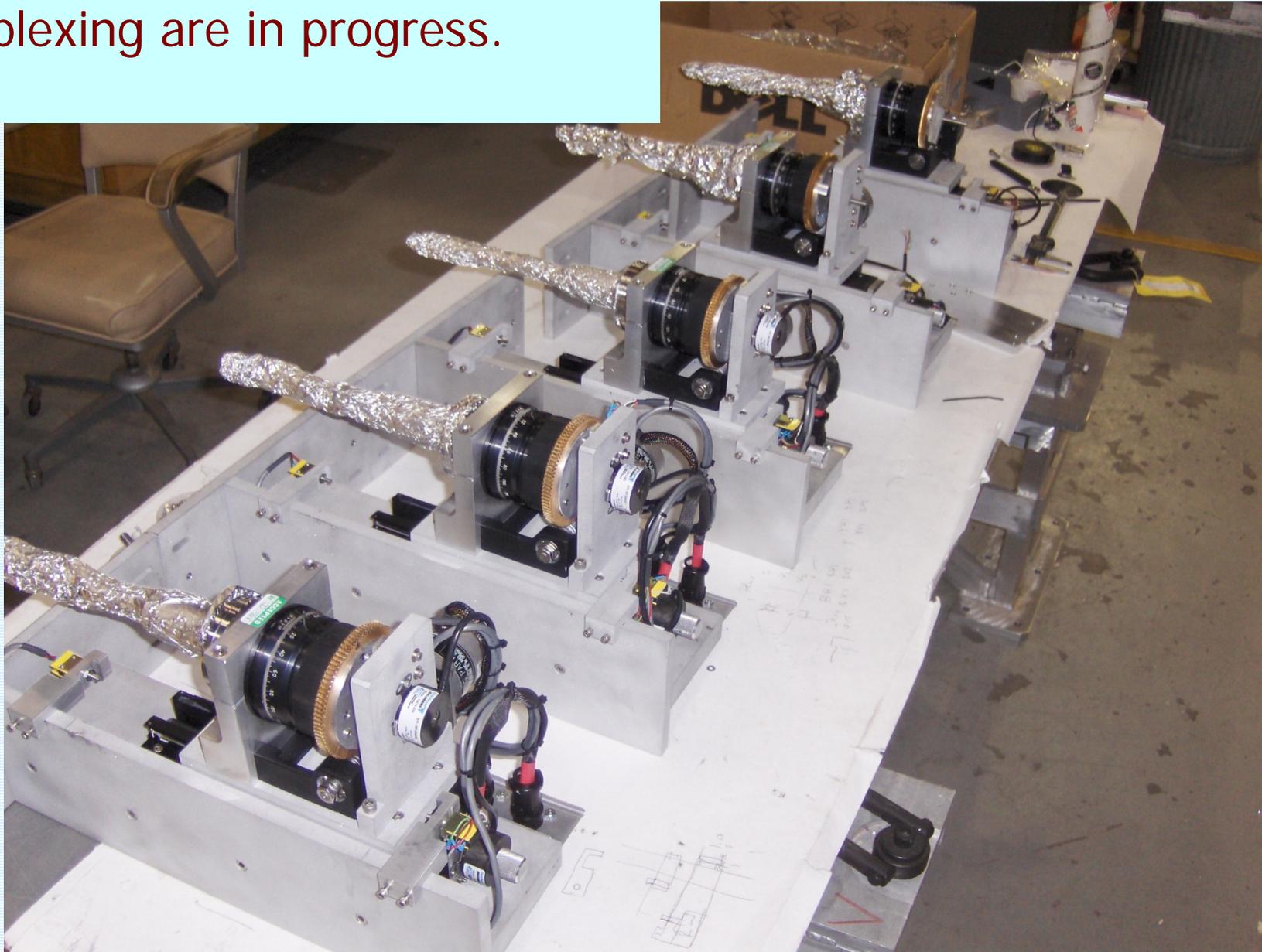


November 14

New target motion mechanism.



Target drives mechanical part
Is near completed. Motion control tests
and multiplexing are in progress.



Polarimeter upgrade commissioning.

- August-September Design, procurement, target drive prototype.
- October. Vacuum chamber delivery, baking, leak-check, installation. Target drive manufacturing.
- November. Installation in the tunnel. Vacuum system commissioning. Wiring. Tests.
- December. Pumping. Detector installation. Target motion control commissioning. Tests.
- January 5-15. Final tests. Targets installation.
- Jan.15- Febr.10. Pumping.
- Nov.-Jan. Software upgrade. Testing.

December 4, Blue-target drive installation
Yellow-pumping, baking.

November 21



Operation modes.

- Polarization measurement scan (main mode).
Polarization, polarization profiles, beam intensity profile (including bunch-by bunch).
- Polarization measurement on the ramp (fixed target with some position adjustment, if necessary).

Emittance measurements and calibration in fast scan mode, with dedicated targets.

Beam request.

- Experiments can be done in one ring in parallel to some other study.
- For the rate dependence studies of different types detectors:
- beam request is two session x 2 hrs each.