# Update on the AGS Polarization Offline Analysis

H. Huang, BNL

June 17, 2002

for

RHIC Spin Collaboration Meeting X

RIKEN BNL Research Center

# AGS Polarization Analysis

Calibration runs for $G\gamma=7.5$

Partial snake to overcome $0+\ \nu_y$

Spin tracking for all intrinsic resonances

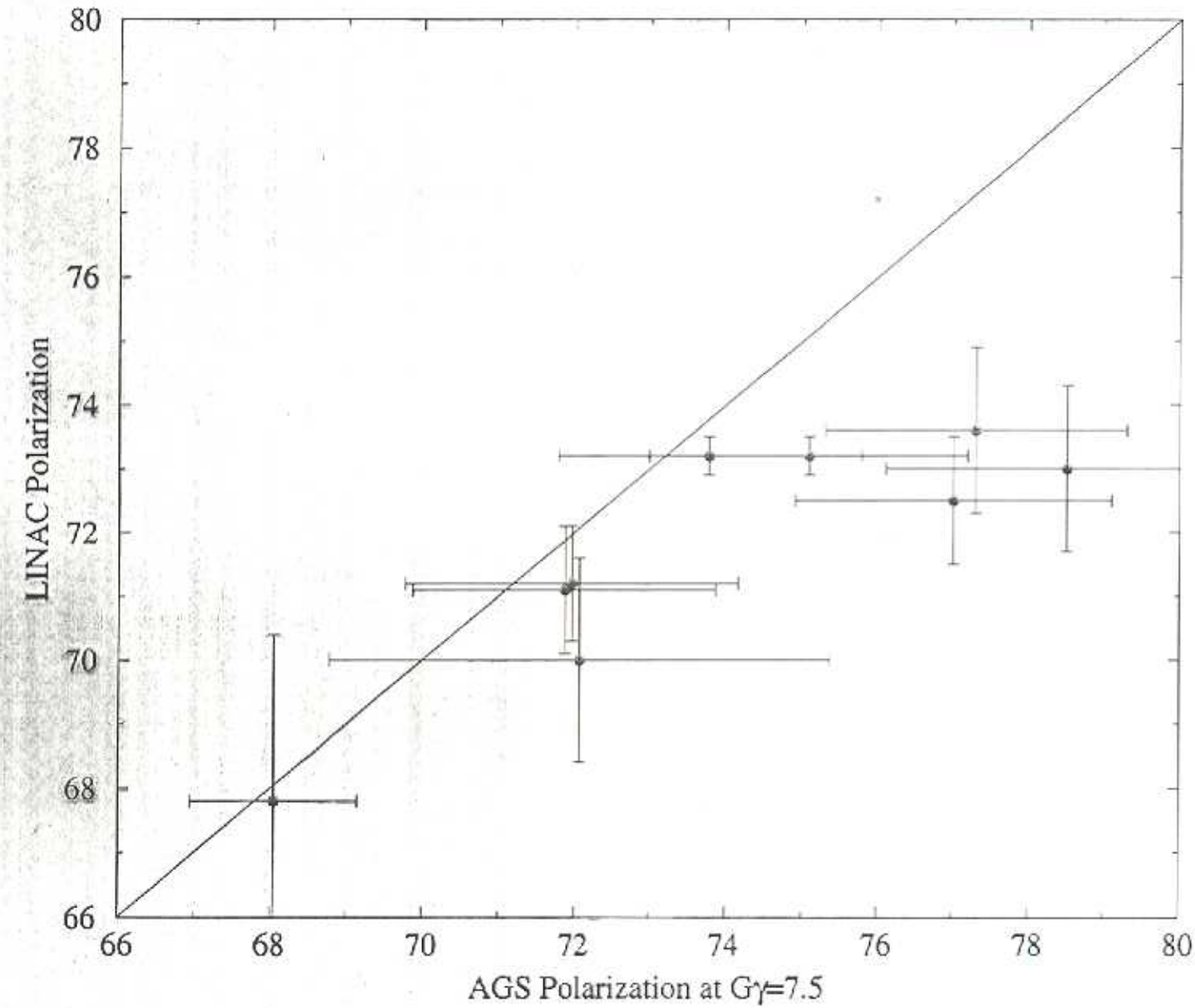
# Calibration of AGS polarimeter at G $\gamma$ =7.5

Two forward arms were installed to detect inclusive p-p scattering for several low energies: G$\gamma$ =4.7, 7.5, 13.5. Combined with the recoil arms, we can select elastic scattering. The purpose is to solve the puzzle of injection beam polarization. Due to the limited time, only G$\gamma$ =7.5 detectors were used.

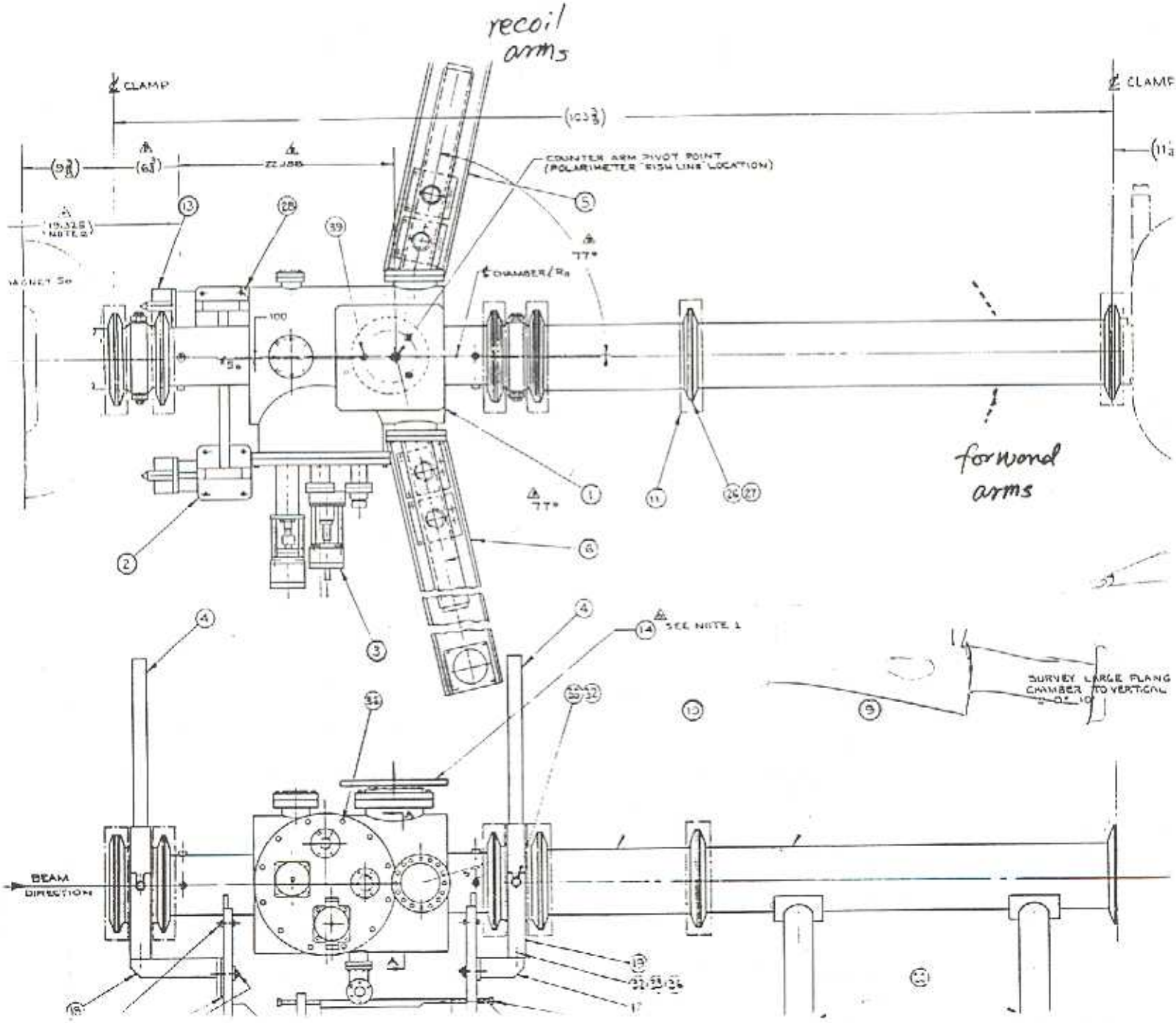
1. Polarization measured at G$\gamma$ =7.5 agreed with 200 MeV measurements.
2. We still do not have explanation for the low asymmetry measured at G$\gamma$ =7.5 in Sep. 2000.



BROOKHAVEN
NATIONAL LABORATORY


LINAC Polarization
AGS Polarization at Gγ=7.5
66
68
70
72
74
76
78
80

C-20 E880 polarimeter

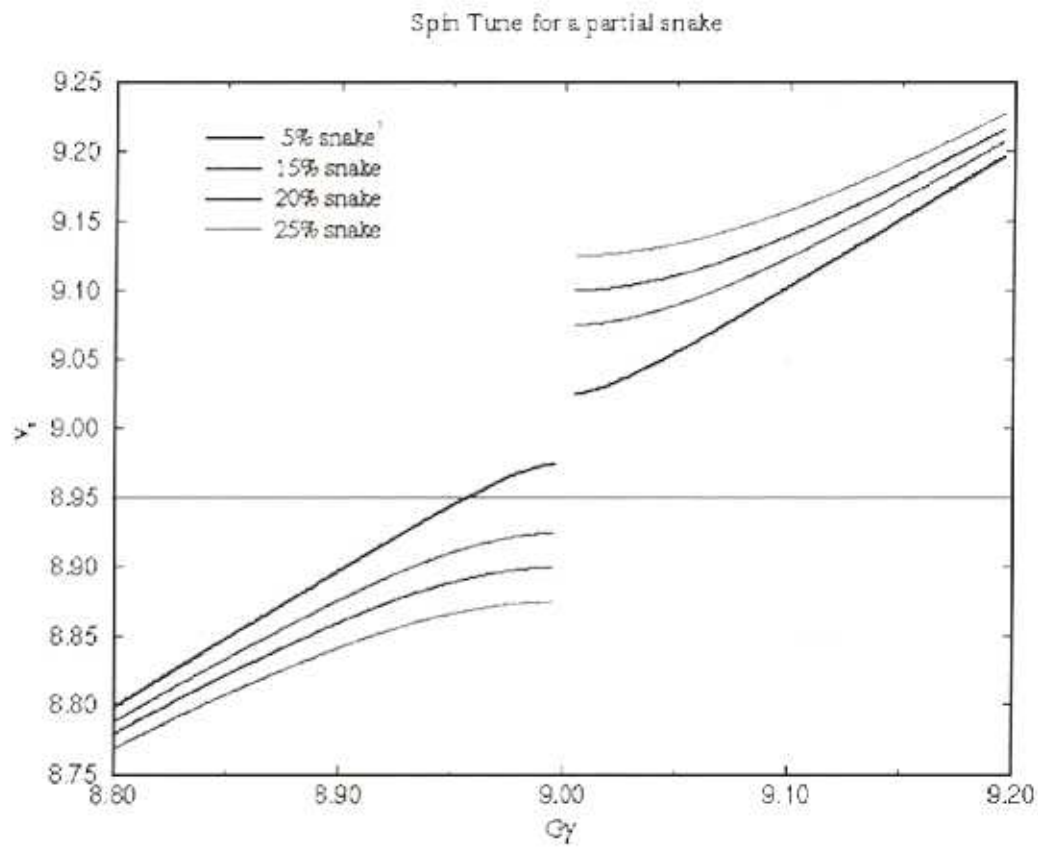



beam pipe thickness 0.109 in (0.28 cm) diameter 7 in.

available space ~2 meters

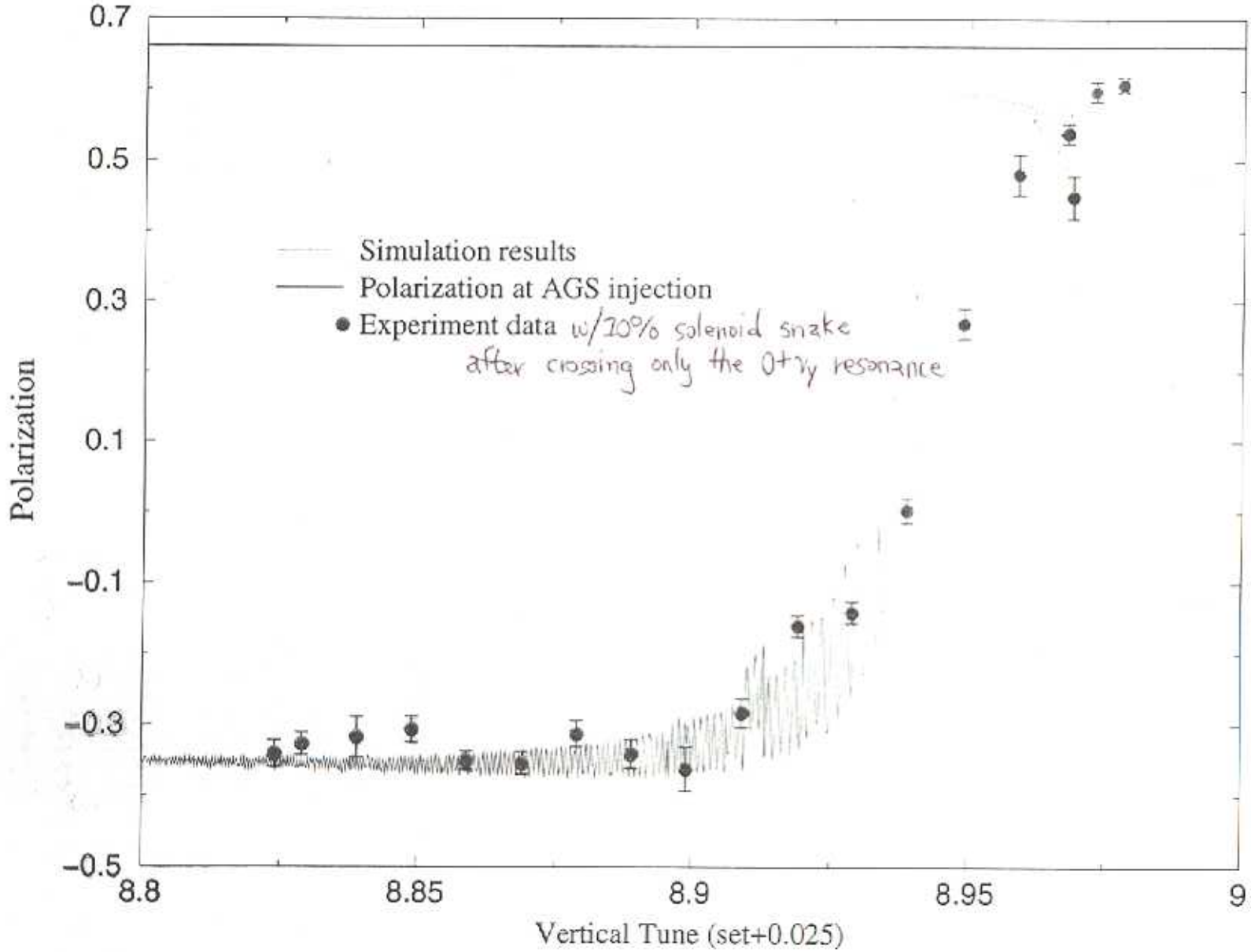
# How a strong snake works

- The stronger the snake, the larger the spin tune gap when Gγ=N. When the snake is strong enough so we can put betatron tune in the gap, then the resonance condition will never be met.
- In a different view, The snake acts as a resonance at Gγ=N. If the intrinsic resonance is overpowered by the snake, then full spin flip can be achieved.






BROOKHAVEN
NATIONAL LABORATORY


Simulation results
Polarization at AGS injection
Experiment data w/20% solenoid snake
after crossing only the 0+νy resonance
Polarization
Vertical Tune (set+0.025)
0.7
0.5
0.3
0.1
−0.1
−0.3
−0.5
8.8
8.85
8.9
8.95
9

# Emittance and Ramp Rate

There is emittance growth in the AGS even without AC dipole.
---AtR beam profile measurements.
---Careful beam profile study with AGS IPM.

There were three runs with beam accelerated to $G\gamma=46.5$:
Nov. 97, Sep. 00, and Jan. 02.

The spin tracking shows agreement with Nov. 97 and Sept. 00 runs.
These two runs used fast ramp (Siemans).

There is discrepancy in Jan. 02. The polarization measurements suggest polarization loss around $0+\nu_y$ and $24-\nu_y$. Similar mystery happened for slow ramp case in April 94.



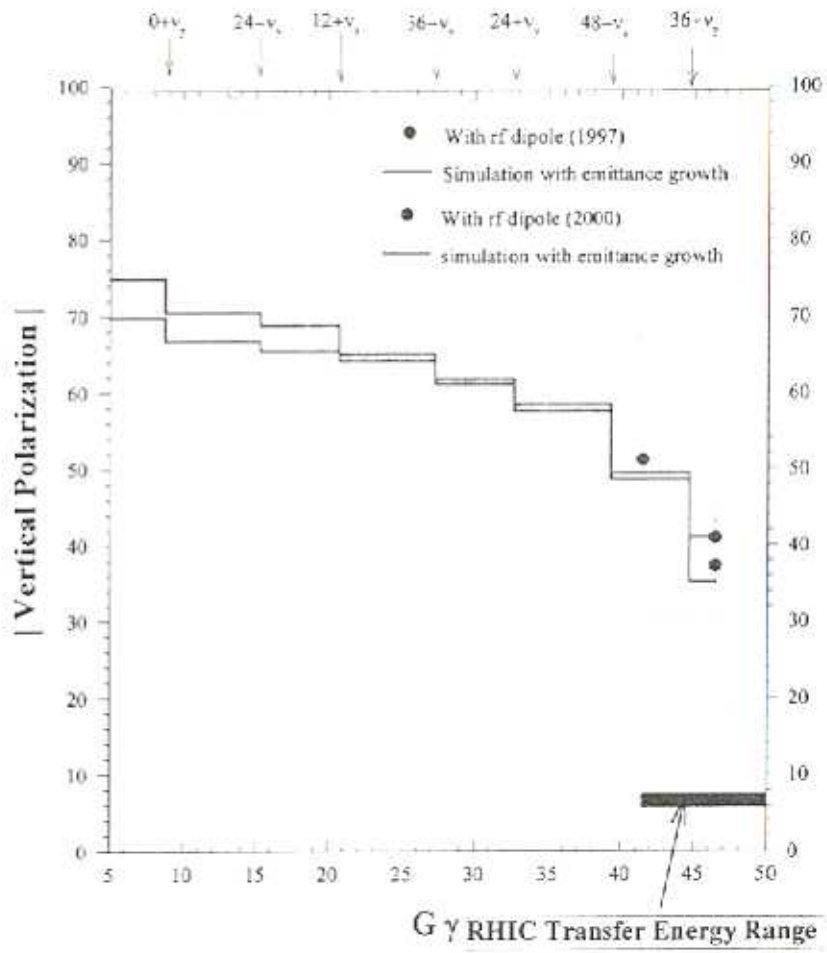
BROOKHAVEN
NATIONAL LABORATORY

# AGS Performance in 97 and 00

Red line: Simulation with 1997 running conditions, 75% as input from LINAC. Betatron tune separation 0.15 except $36+\nu_y$ and $48-\nu_y$ with 0.13. Horizontal emittance was big: ~40π.

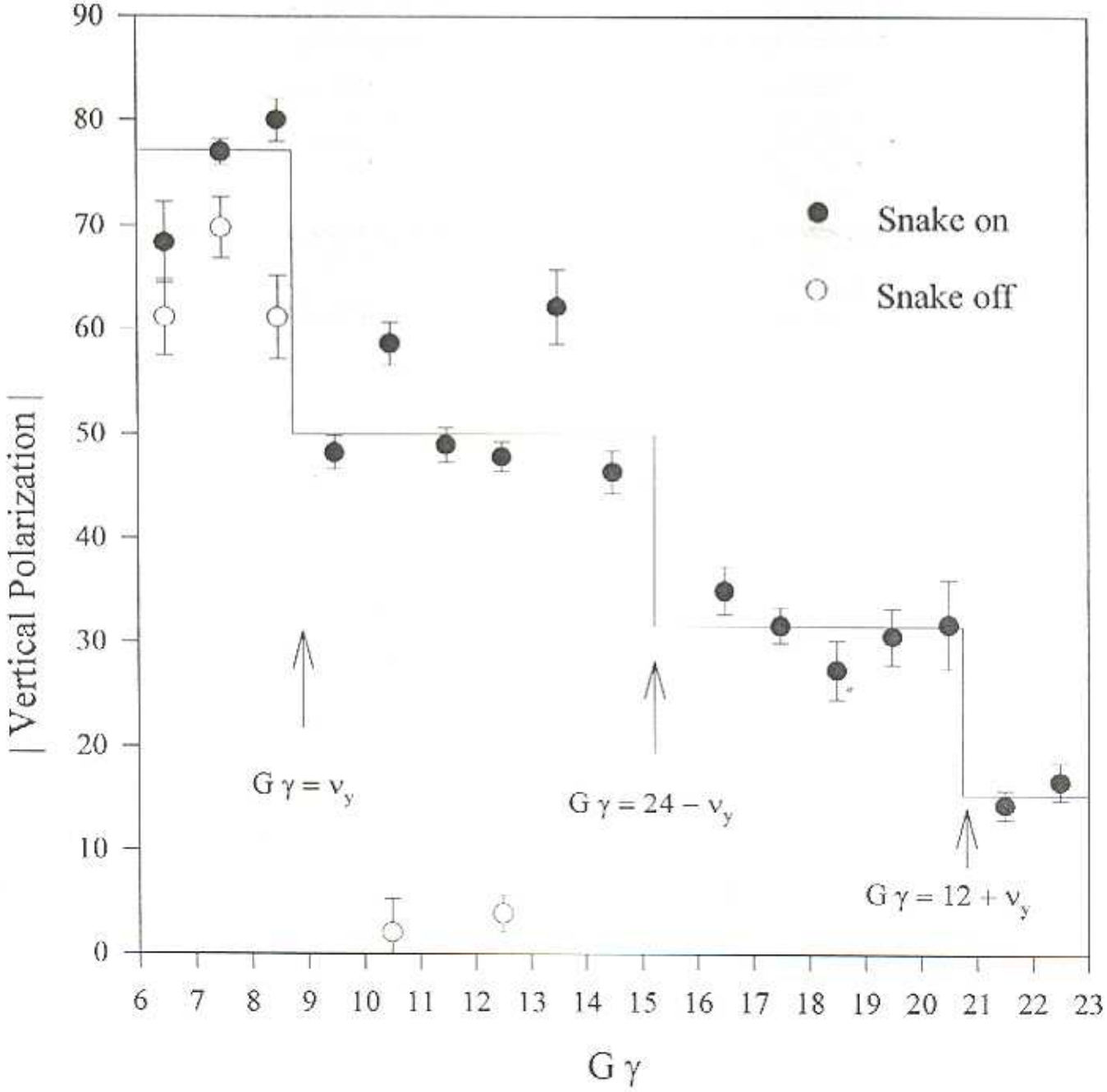
Green line: Simulation with 2000 commissioning conditions. 70% as input from LINAC. Betatron tune separation 0.15 except $36+\nu_y$ with 0.11. Horizontal emittance was reduced: 15 π at injection and 22π at extraction.

$\nu_x$ =8.85, $\nu_y$ =8.70 for both years.




BROOKHAVEN
NATIONAL LABORATORY

# E880 April 1994 Run

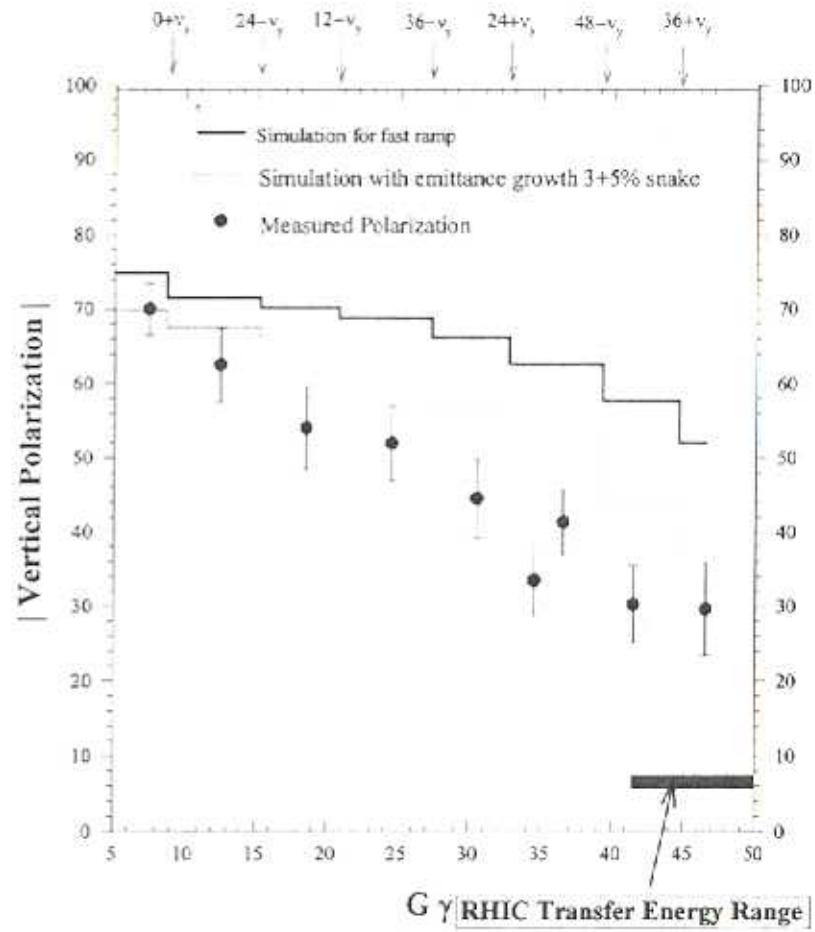


# AGS Performance in 02

Red line: Simulation with 2002 running conditions, 70% as input from LINAC. Emittance taken as measured.

$\nu_x$ =8.70, $\nu_y$ =8.80 for most resonance except 36+ $\nu_y$ with $\nu_x$ =8.68, $\nu_y$ =8.90 and ac dipole not fired.

Blue line: use sept. 00 running condition except more tune separation at 36+ $\nu_y$ and good betatron tunes for 48-$\nu_y$.




BROOKHAVEN
NATIONAL LABORATORY

# Depolarization around $0+\nu_y$ and $24-\nu_y$

1. A stronger resonance at $24-\nu_y$.
2. Synchrotron motion . Since this resonance is very close to the AGS transition, the momentum spread can be large and may cause beam crossing through this resonance multiple times.
3. J10 bump power supply noise.

These will be the focus of spin tracking study in the coming month.



BROOKHAVEN
NATIONAL LABORATORY