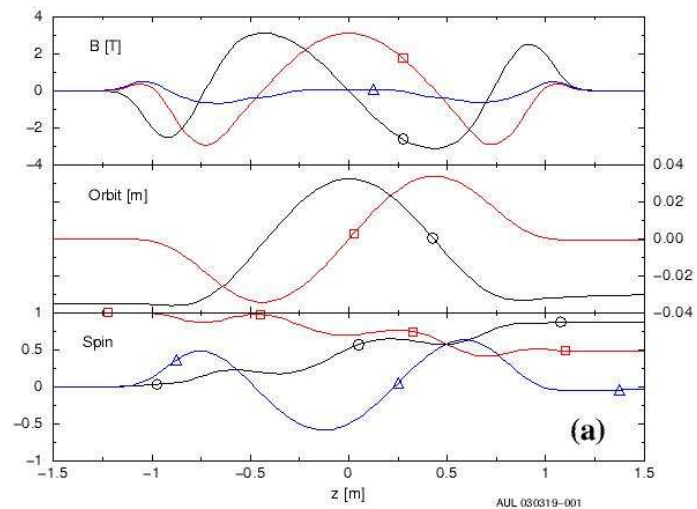
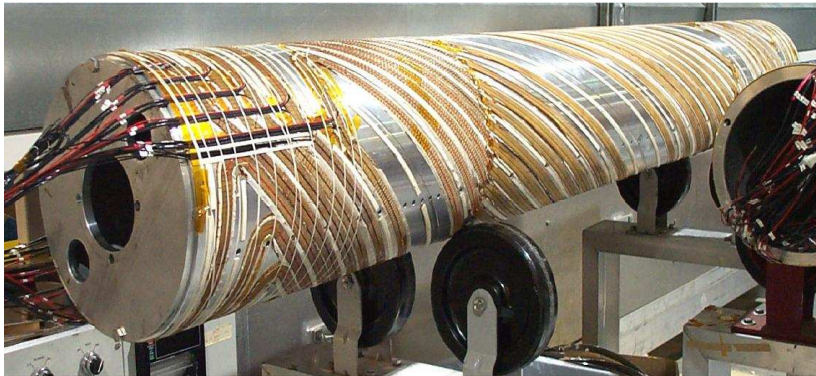


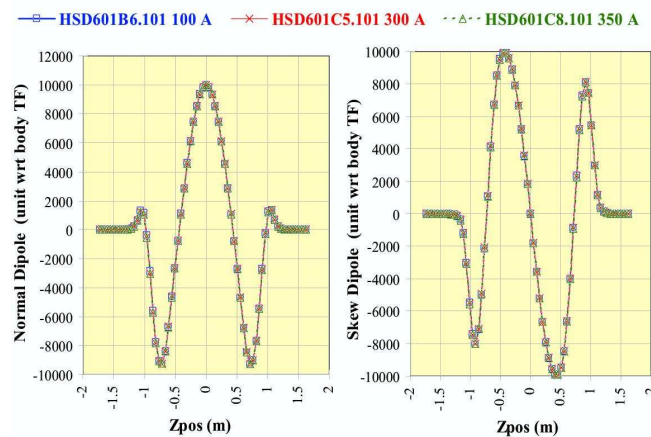
Status and Commissioning Plans of AGS Cold Snake

Waldo MacKay

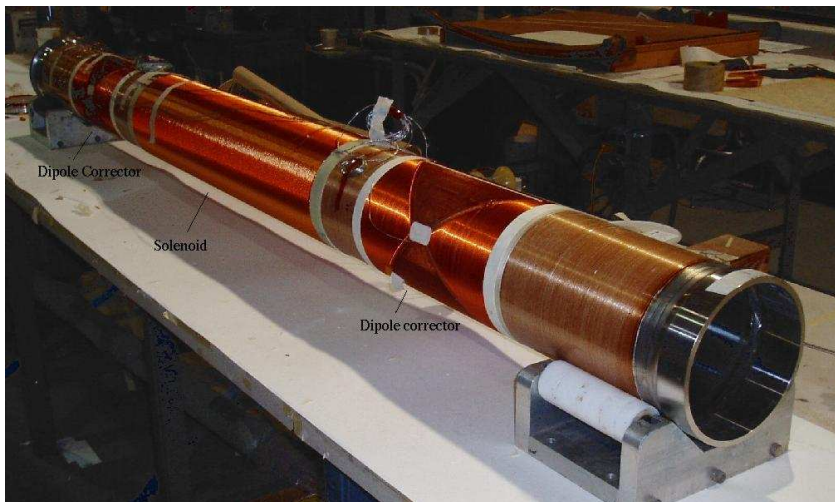
New AGS cryogenic snake



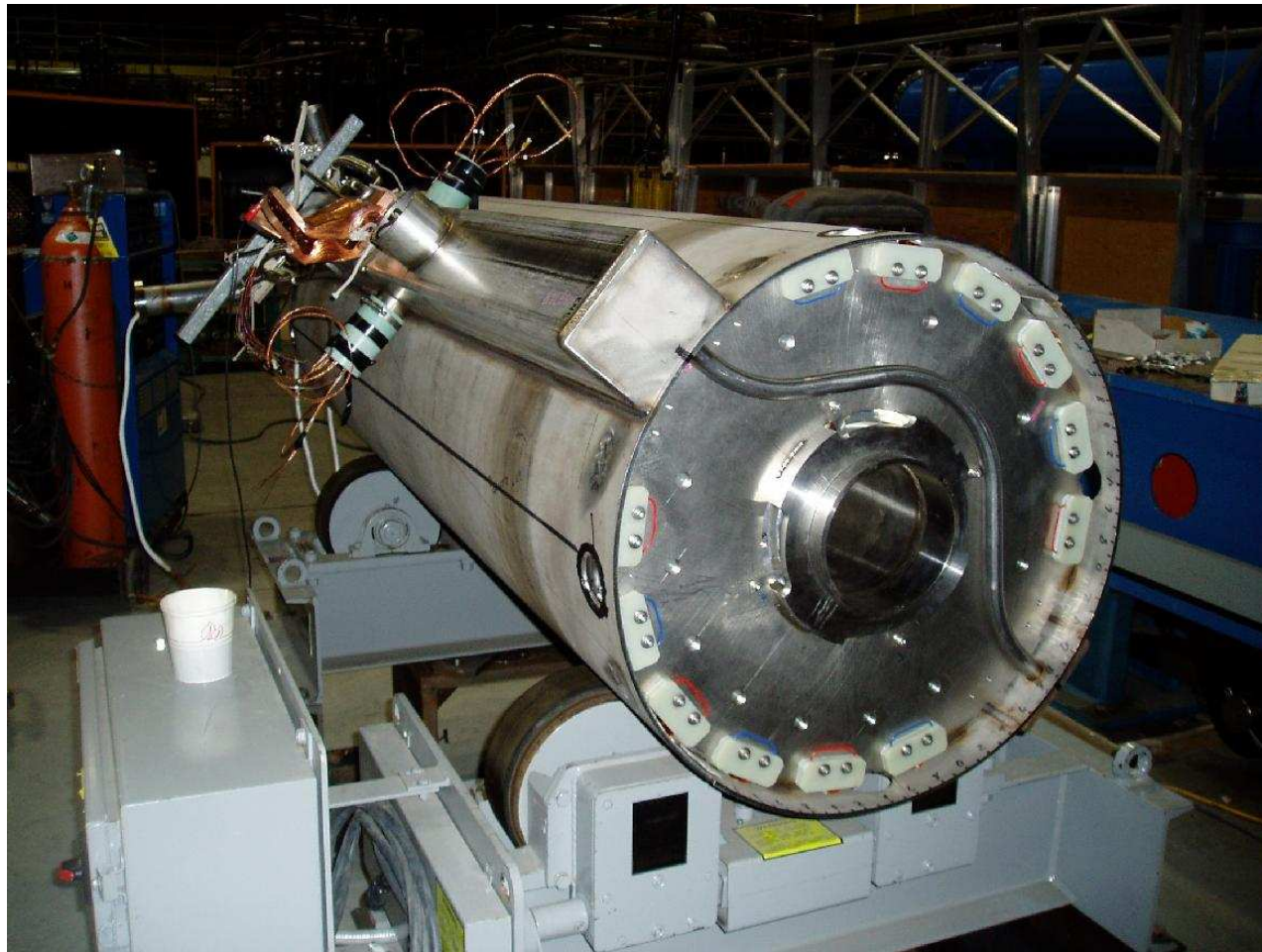
Axial Scans: Dipole Terms



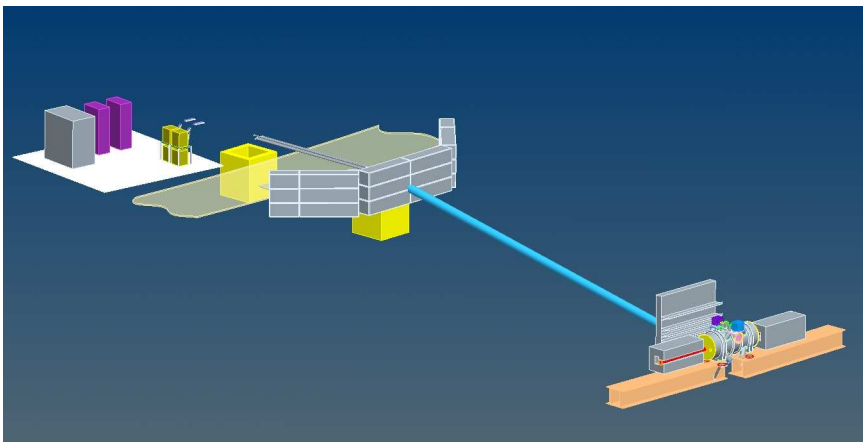
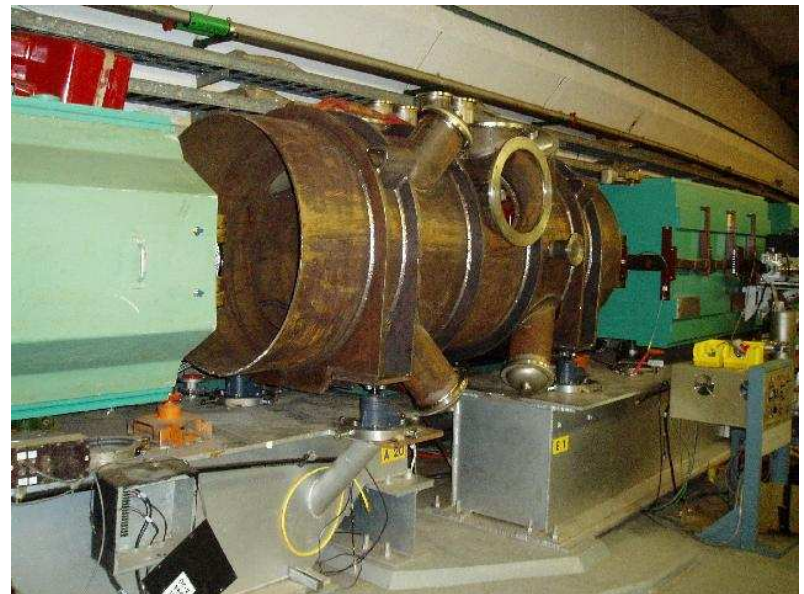
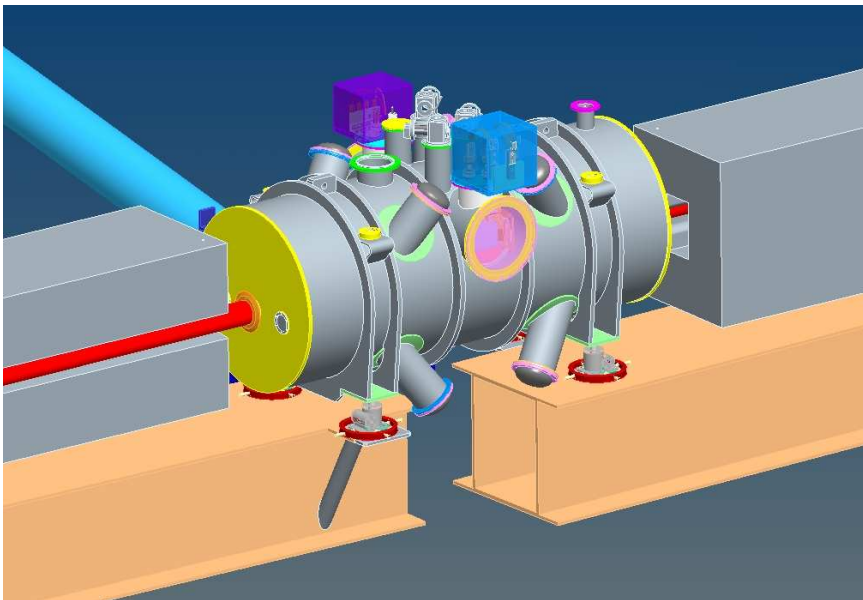
Courtesy of Animesh Jain



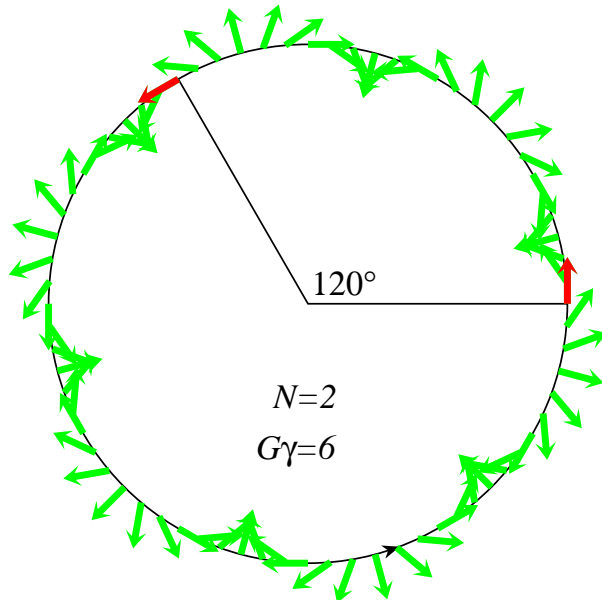
❧ Cold mass with buffer volume ❧



🐍 Cold Snake Cryostat 🐍

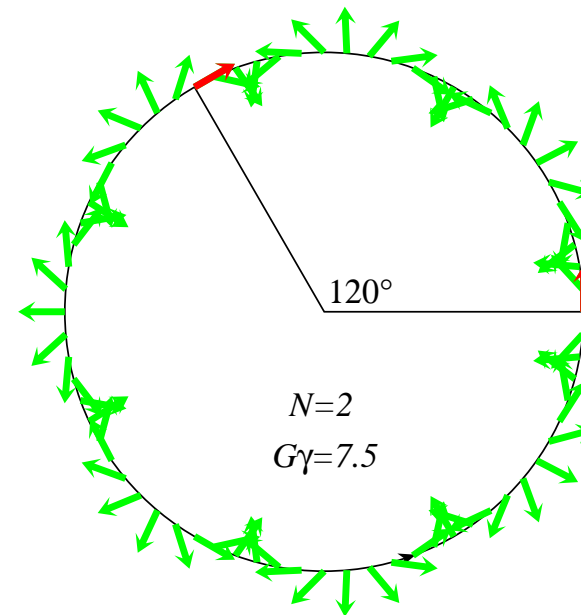


2 Partial Snakes spaced by 1/3 Ring



$$G\gamma = 3 \times N$$

Snakes strengths add.



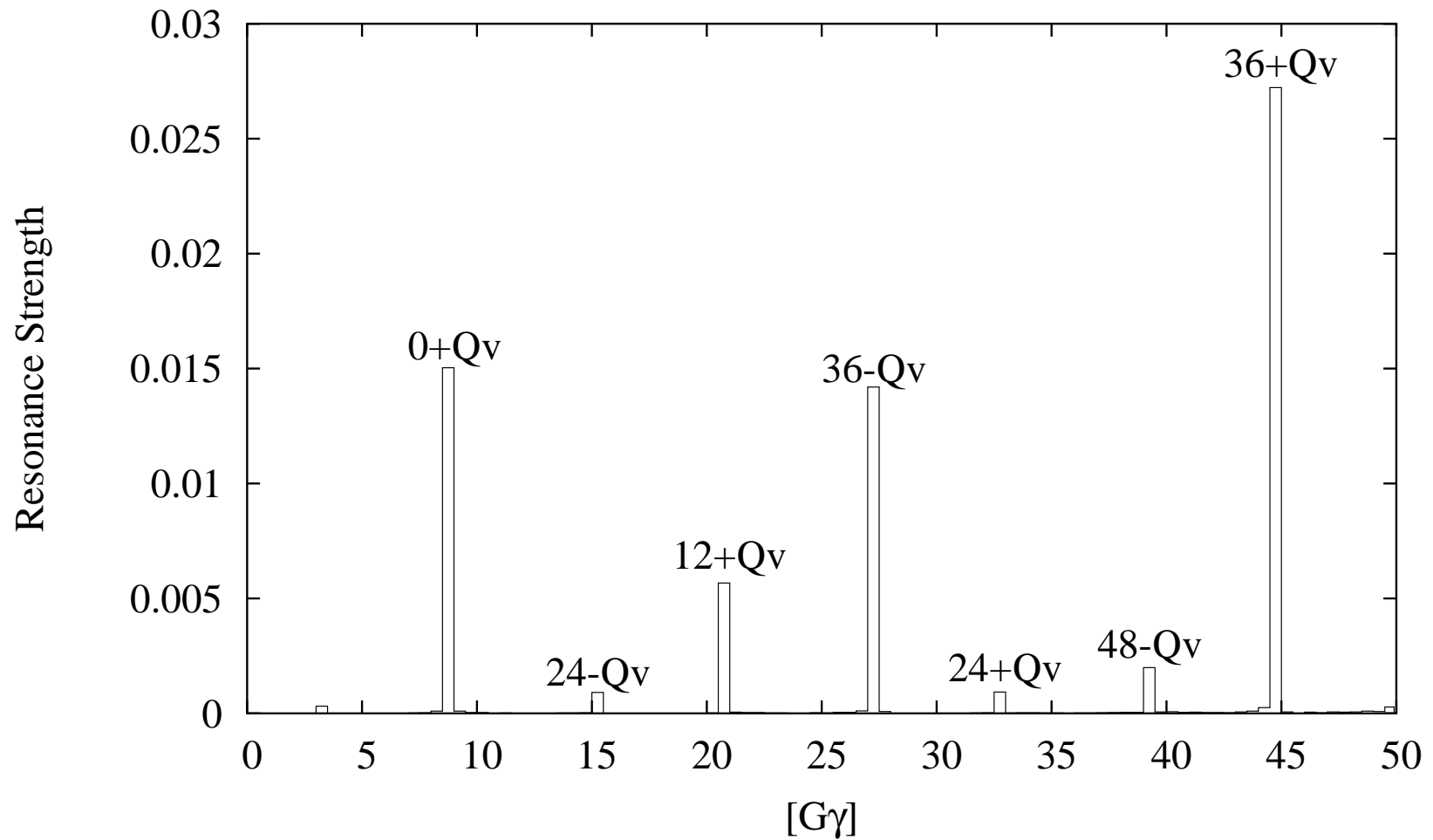
$$G\gamma = 3 \times (N + 0.5)$$

Snakes strengths subtract.

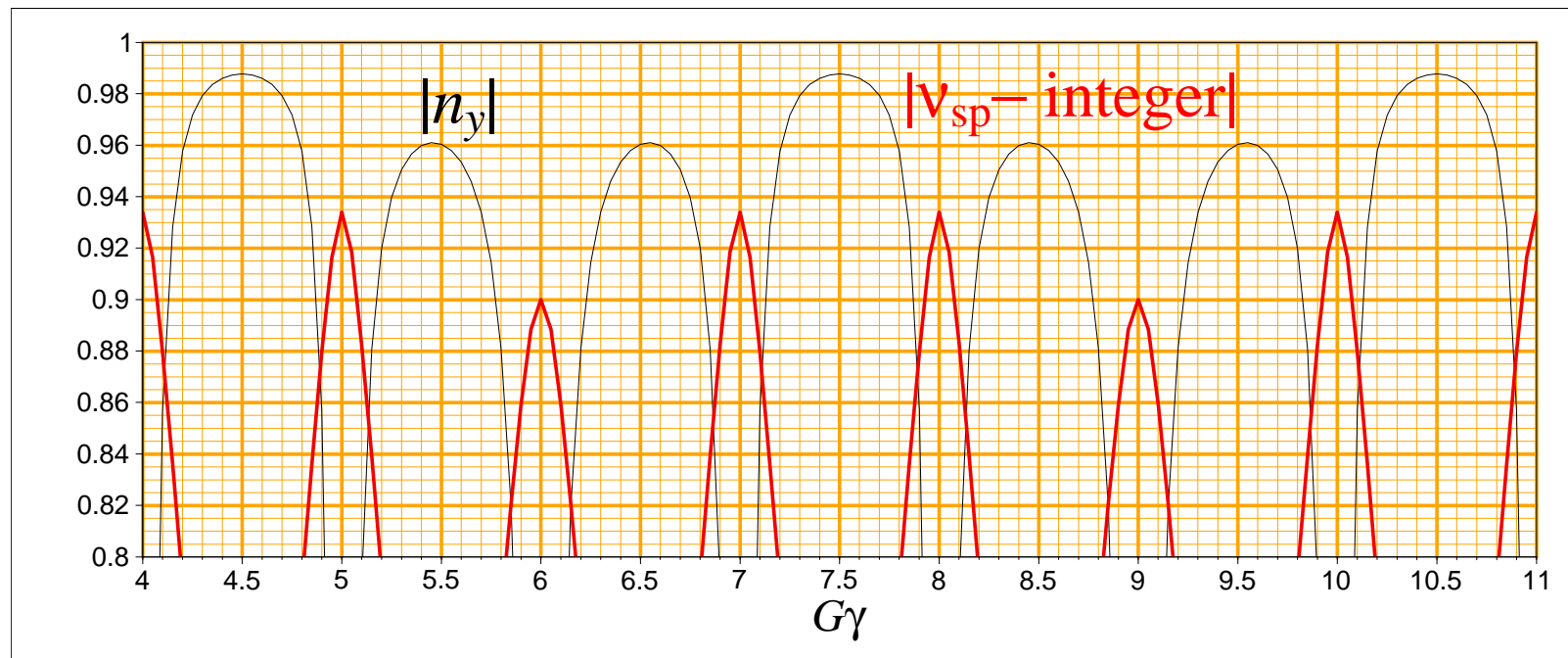
AGS has superperiodicity of 12.

Injection: $G\gamma = 4.5$ Extraction: $G\gamma = 46.5$

AGS Intrinsic Resonances



Two Helical Partial Snakes in AGS

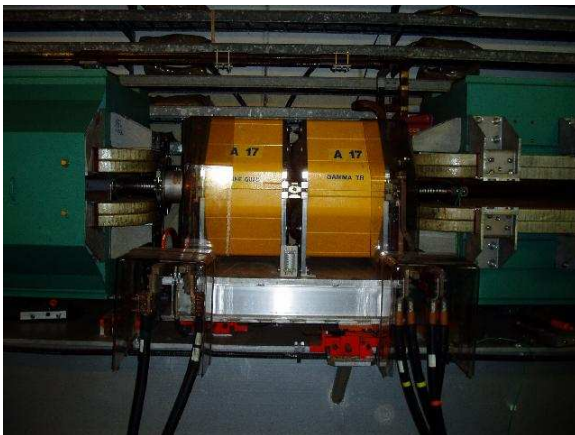
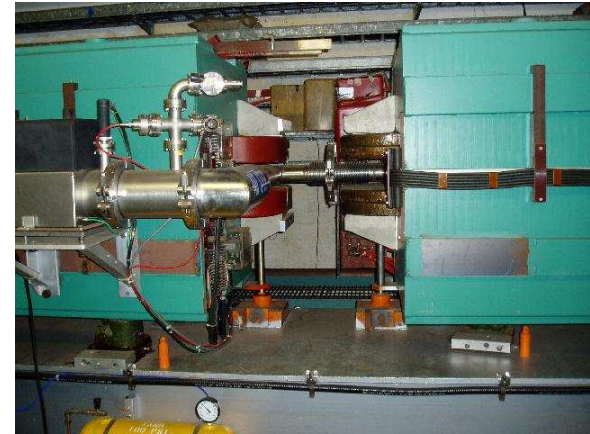
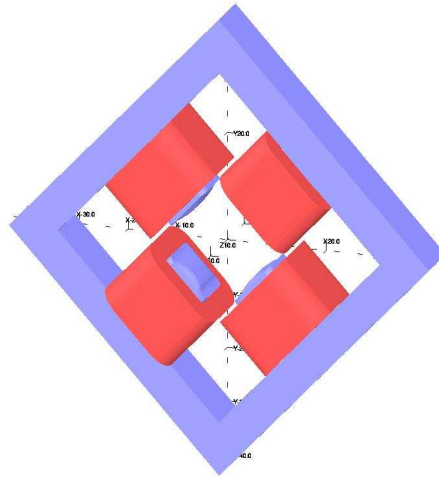


A20 Cold snake: 15%
 E20 Warm snake: 5%
 Superperiodicity: 12

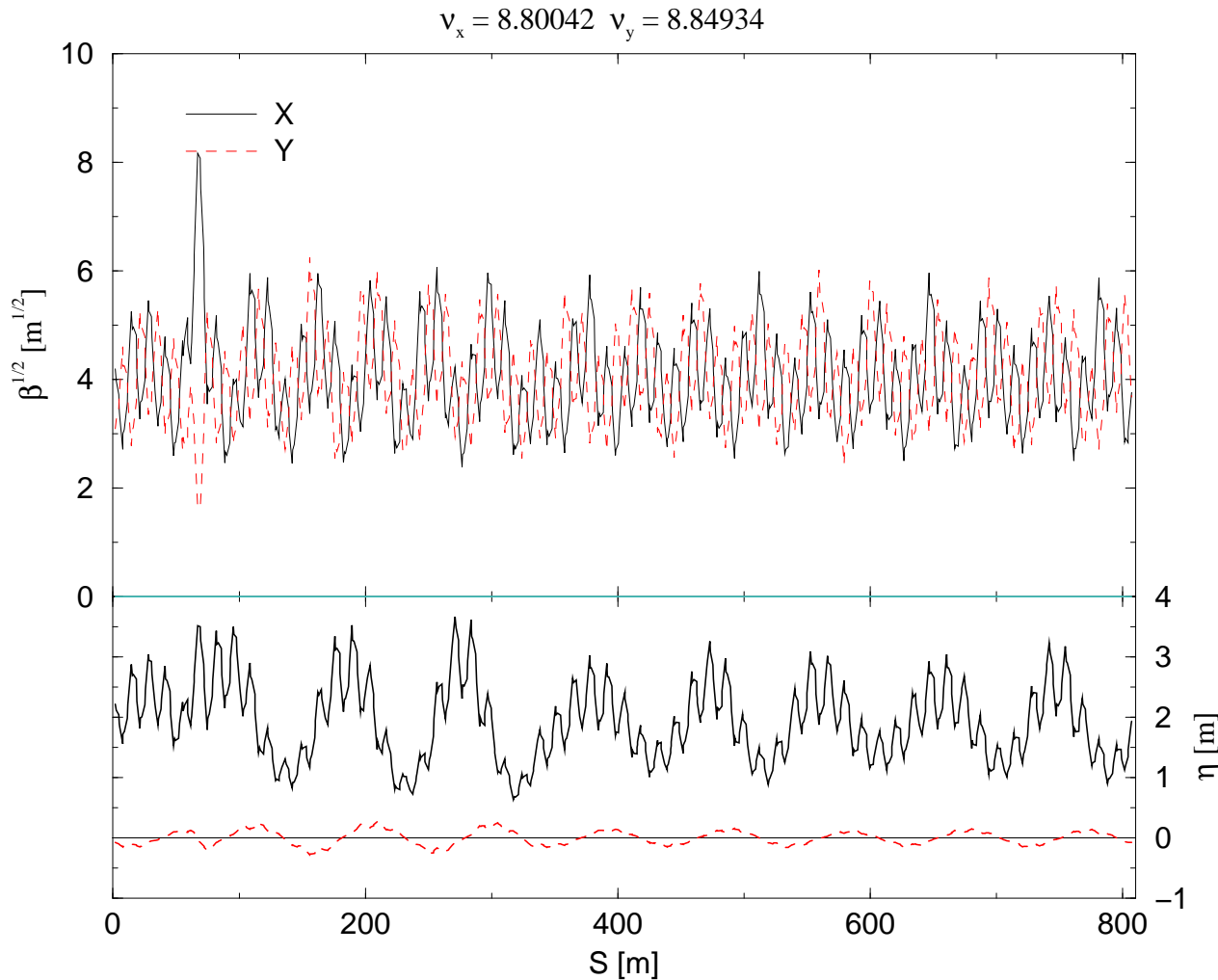
Spin tune stop bands: $\text{integer} \pm 0.065$
 Putting $Q_y = 8.96$ eliminates intrinsic resonances.
 Pattern repeats every 3 integers

Spin almost vertical at injection ($G\gamma = 4.5$) and extraction (46.5)

New Correction Quadrupoles



Two snakes 15% and 6.7% at injection



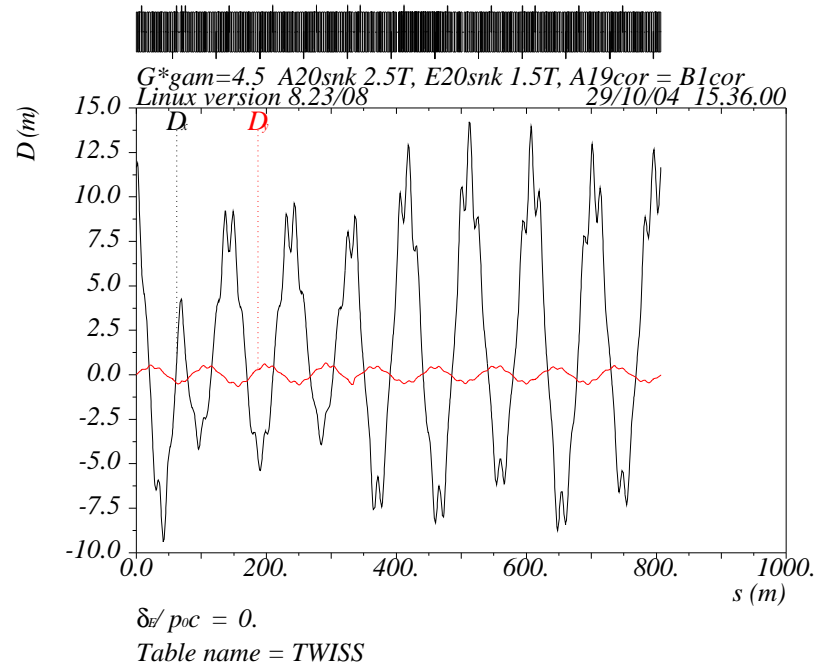
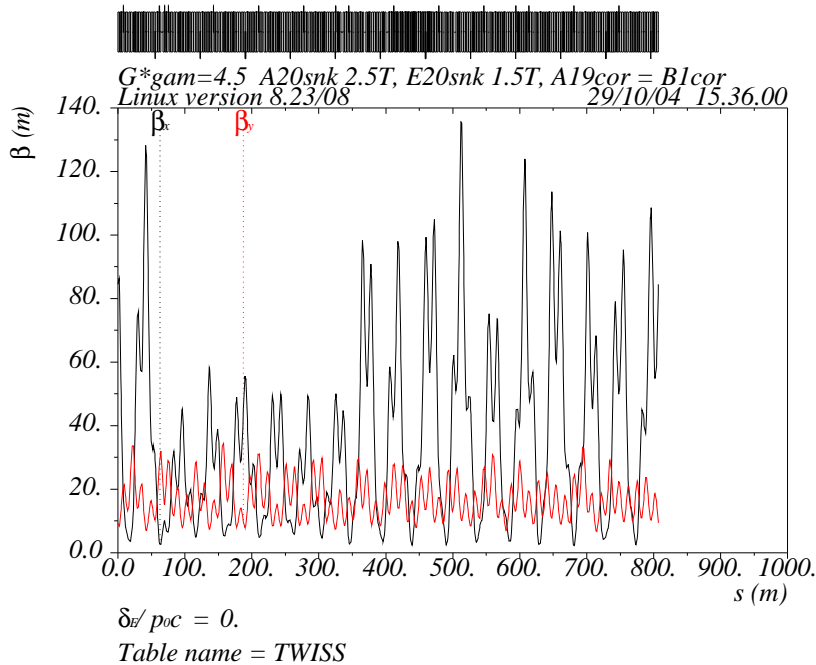
Cold snake:
A20

Warm snake:
E20

Extra Quads:
A17, A19,
B1, B3

Courtesy of
Mei Bai

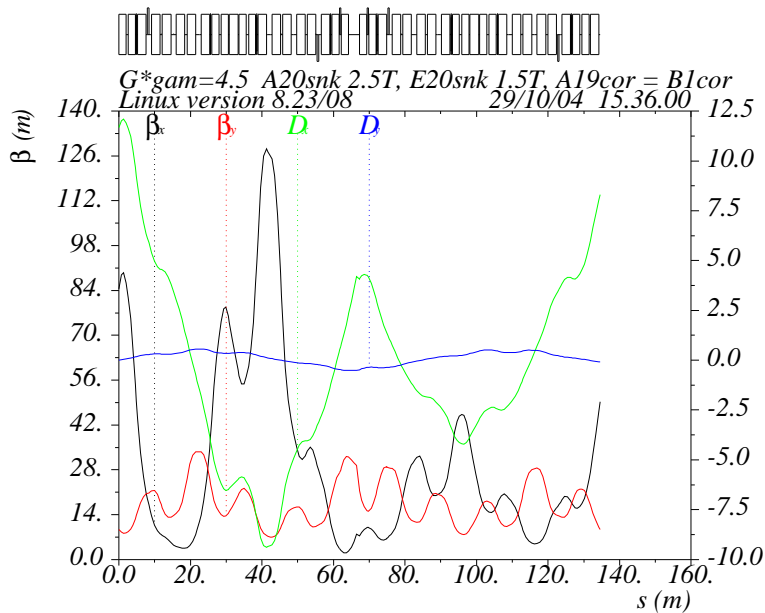
Optics correction with 2 Quads



Injection tunes: ($G\gamma = 4.5$)

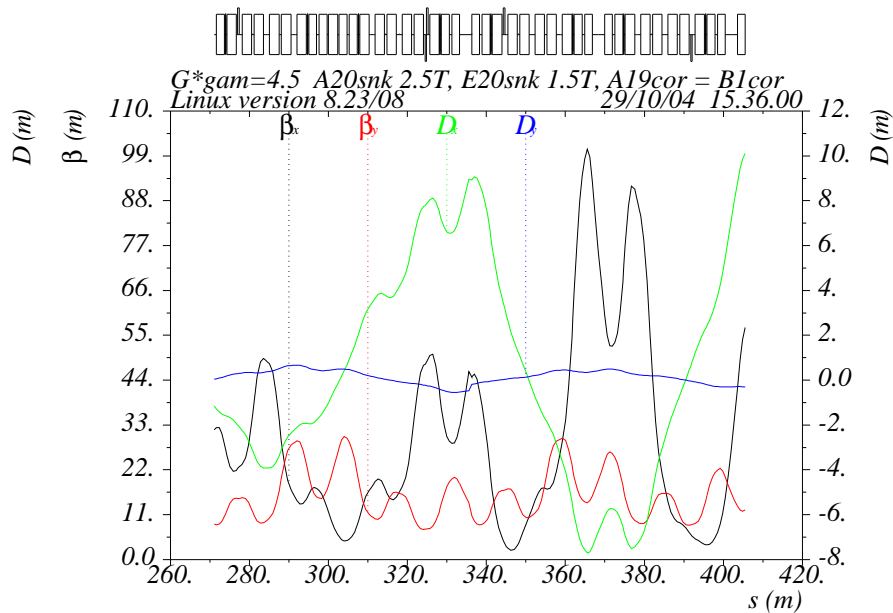
- $Q_x = 8.717$
- $Q_y = 8.743$

Optics correction with 2 Quads



$\delta_E/p_{oc} = 0.$

Table name = TWISS



$\delta_E/p_{oc} = 0.$

Table name = TWISS

Schedule

- Cryostat complete: End of Decemeber
- Testing in 902: 3–4 weeks
 - warm tests
 - quench tests
 - magnetic measurements
 - heat load and cryocooler performance
- Install in AGS: End of January
 - Put in ring
 - Finish connections during maintenance days (over next 2 or 3 weeks)
- Cool down
 - Check connections during maintenance
 - Turn on supplies (1st time) during maintenance

Commissioning Plan

Commissioning will occur during RHIC stores with polarized protons.

- Initial conditions:
 - Start with new copy of “AGS User” for single warm snake.
 - Turn off ac dipole pulses on this “User”.
 - Use single small bunches ($\lesssim 10^9$ protons).
 - Inject individual bunches on demand only.
 - Turn on J10 extraction bumps on injection porch to prevent losses up ramp (rf loops might fail).
- Set up injection with two snakes.
 - Turn cold snake on in steps with bumps and quad corrections. Measure orbits and correct.

With injection working at desired snake strength:

- Increase bunch intensity to $\sim 7 \times 10^{10}$.
 - Measure injected polarization.
- Turn off J10 dump bumps and accelerate the beam.
 - Adjust tunes up ramp: $Q_y = 8.96$ at $G\gamma = 7.5$ and above.
- Ramp to $G\gamma = 12.5$ and measure polarization.
- Ramp to extraction energy $G\gamma = 46.5$.
 - Measure polarization at top energy.
- Tune up extraction.
- Increase intensity — goal: 2×10^{11} per bunch at extraction.



- Starting tracking studies with 2-quad lattice.