

# APEX Summary:

January 9, 2008

Fulvia Pilat

Time Meeting, January 15, 2008

# APEX Schedule

January 9 2007

<b>6 Au bunches with different intensities BBQ</b>	<b>Store Limited #bunches</b>	<b>Injection</b>	<b>Mostly ramps</b>	
<b>08-36</b> <b>IBS measurement: Coupled and decoupled</b>	<b>06-31</b> <b>ORM data (dAu82)</b>	<b>08-29</b> <b>Profile with Cni polarimeter Huang, Sivertz, et al.</b>	<b>08-14</b> <b>Collimation on the ramp</b>	<b>Back 2</b>
<b>Fedotov</b> <b>Fischer, Ptitsyn</b>	<b>Satogata, Bengtsson</b>	<b>08-28</b> <b>Hybrid Tune Tracker Cameron et al.</b>	<b>Drees</b>	<b>physics</b>
<b>5am</b>	<b>8:30am</b>	<b>12:30pm</b>	<b>2:30pm</b>	<b>4:30pm 5pm</b>

C7 injection kicker failure → 4h, effective start at 9am

**APEX experiment on IBS with decoupling.**

**January 9, 2008**

**R. Connolly, A. Della Penna, A. Fedotov, W. Fischer, V. Ptitsyn, S. Tepikian**

# Purpose of the experiment

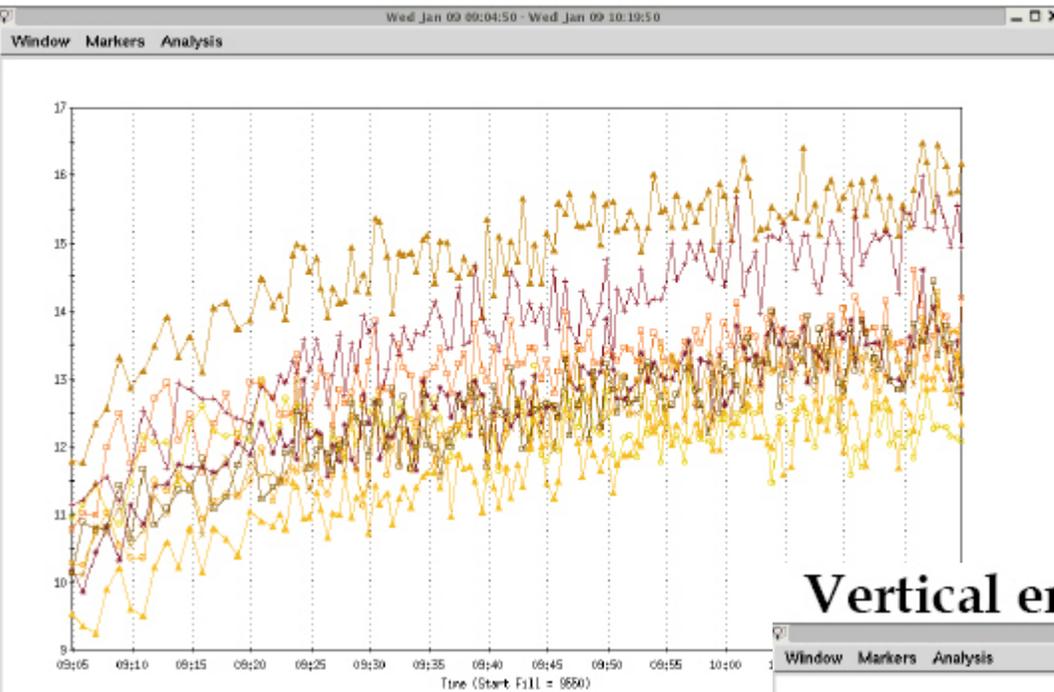
To understand what portion of vertical emittance growth comes from x-y coupling.

Quantitative understanding of emittance growth in horizontal and vertical planes should help us to conclude whether single-plane transverse stochastic cooling will be sufficient to counteract both horizontal and vertical emittance growth.

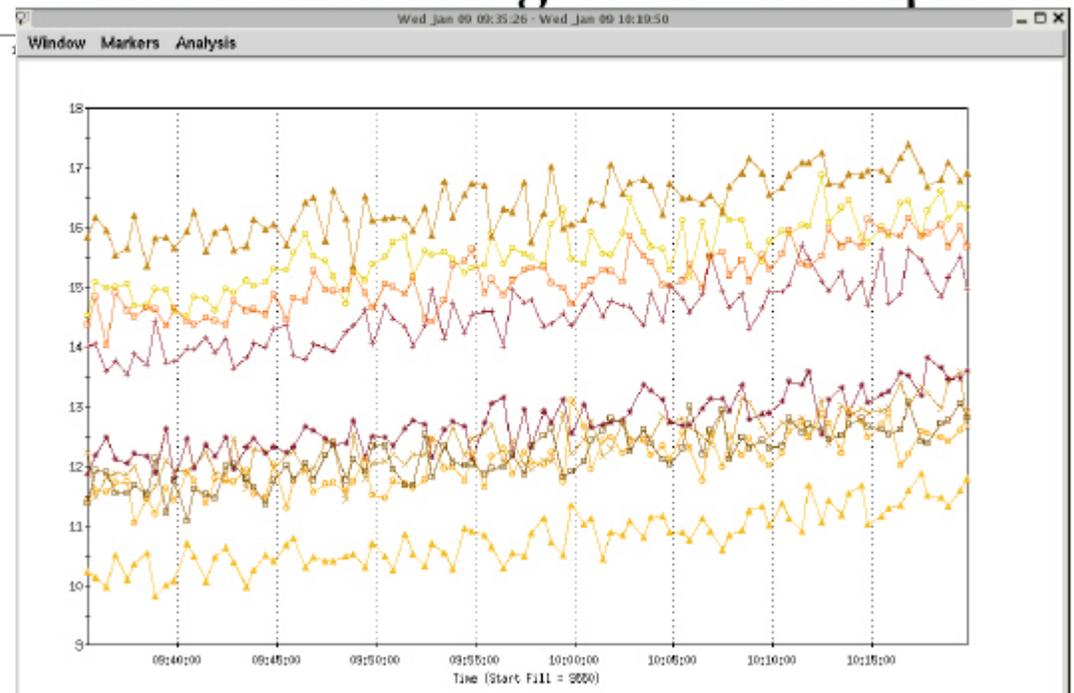
## Experiment

- 1 Create condition of clean IBS experiment (minimize contribution of all other effects: at store,  $h=360$ ,  $RF=300\text{kV}$ , no collisions, no stochastic cooling).
2. Decouple machine. Measure emittance growth due to IBS.
3. For coupled machine - measure emittance growth due to IBS.

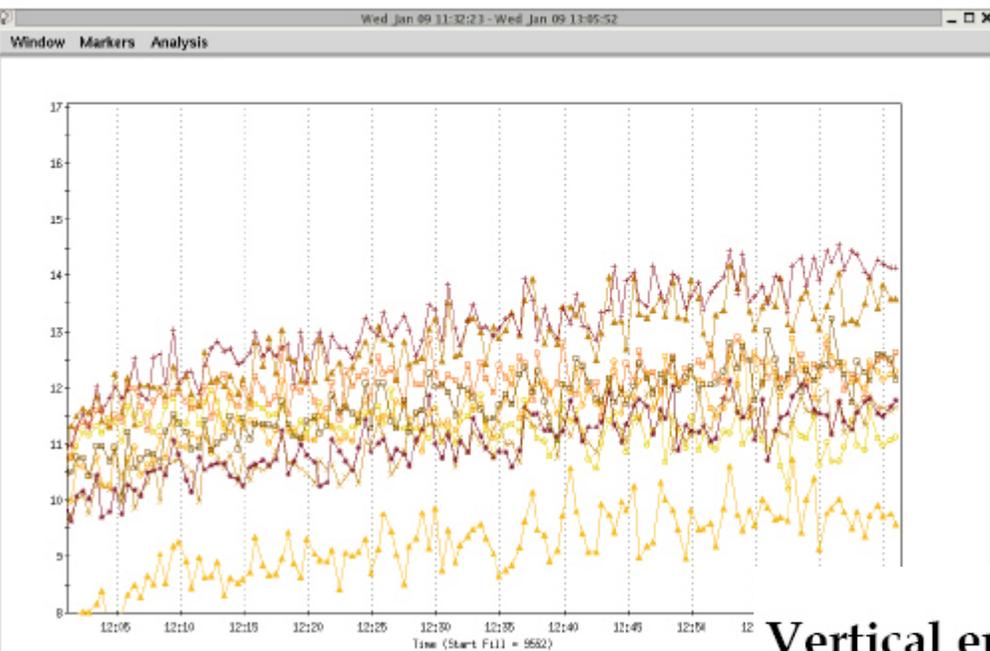
# Horizontal emittance growth - decoupled case



# Vertical emittance growth - decoupled case

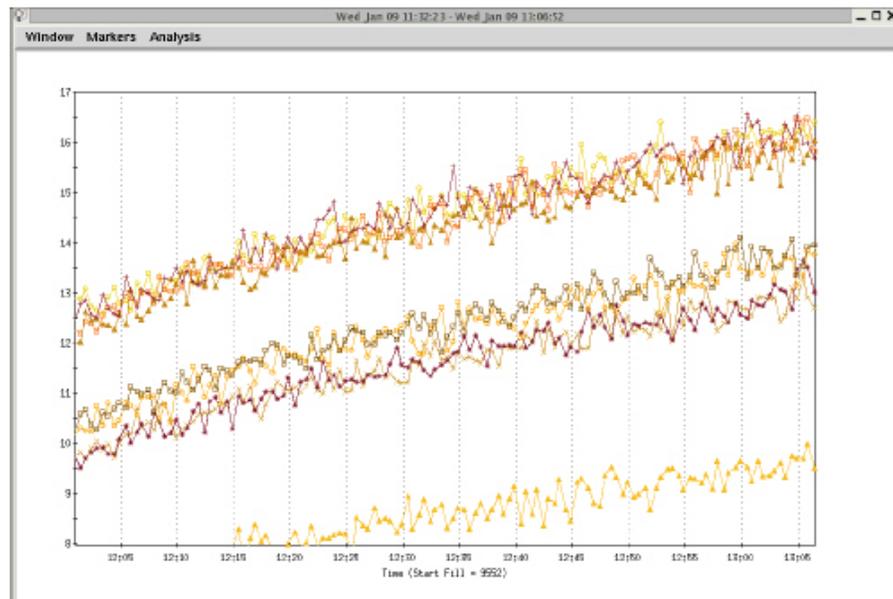


# Horizontal emittance growth - coupled case



Horizontal growth rate decreased compared to decoupled case.

# Vertical emittance growth - coupled case



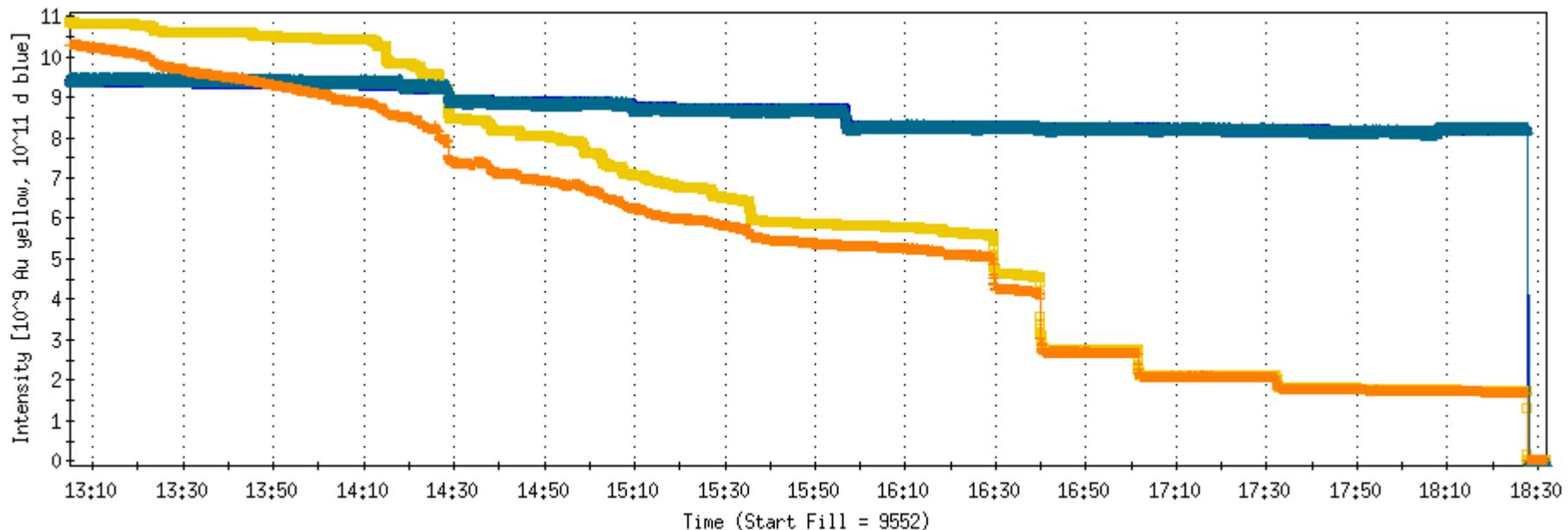
Vertical growth rate increased compared to decoupled case.

# Summary

1. We got data.
2. Going from decoupled to coupled case horizontal emittance growth should be shared between x and y. It seems that in measurements horizontal growth rate is decreased, vertical growth rate is increased. However, no conclusions yet - quantitative analysis will be performed.
3. For decoupled case: Instead of zero vertical emittance growth linear emittance growth of about  $1 \pi/h$  was measured. Although decoupling was done only in a global sense.
4. Quantitative analysis and simulations will be performed.

# ORM APEX Jan 8 2007

- Goal: Acquire data for ORM analysis of dAu82::store
  - Used leftover beam from IBS store measurement
  - 5 hours of continuous data taking: 13:30-18:30
  - Full data set (horizontal/vertical) acquired in both



# ORM APEX Jan 8 2007

- Analysis performed with Johan Bengtsson Thu Jan 10
  - ORM analysis tends to diverge unless degeneracies are limited
    - This leads to inapplicably large correction strengths
  - Originally lumped triplets together, fit Q4-9 separately
  - Best analysis so far fits lumped triplet, Q4,6,8
    - This meets ORM preference for both planes of BPMs between quadrupoles used in fit
    - All fits reduced  $\chi^2/\text{dof}$  from 700+ to 5-7 within a small number of iterations
  - **These fits correct beta-beat by 15-30%**
    - **This analysis does not promise that these are the actual errors in the magnets, but do provide settings to correct beta beating**
    - No coupling analysis done yet; this is next iteration of effort; therefore little likely improvement in vertical dispersion

# ORM APEX Jan 8 2007 $\beta^*$

Fill	Ring	File	Plane/IR	<u>oddbeta</u>	<u>evenamp</u>	<u>evenbeta</u>	beta* [m]
ORM dAu82	blue		h/8 <u>dx</u>	108.6		101.6	0.66
ORM dAu82	blue		h/6 <u>dx</u>	91.2		92.9	0.75
ORM dAu82	blue		v/8 <u>dx</u>	93.9		90.2	0.75
ORM dAu82	blue		v/6 <u>dx</u>	98.7		89.5	0.74
ORM dAu82	yellow		h/8 <u>dx</u>	144.2		65.1	0.66
ORM dAu82	yellow		h/6 <u>dx</u>	103.6		97.4	0.69
ORM dAu82	yellow		v/8 <u>dx</u>	49.8		89	1
ORM dAu82	yellow		v/6 <u>dx</u>	87		82.2	0.82
						ave <u>bstar</u>	
						6	0.75
						8	0.77

- Calculated  $\beta^*$ s from fitted DX betas to account for waist
- Blue  $\beta^*$ s are remarkably consistent with 0.75m
- Yellow horizontal seems to compensate yellow vertical  $\beta^*$ s

# ORM APEX Status

- Convergence looks very good in both rings
  - This should improve beta beating! Corrections can be applied!
  - Blue much better than yellow, so try blue first
  - Corrections and scripts to apply corrections are ready for testing
- Test on-diagonal correction ASAP
  - Can be verified with AC dipole, difference orbits, other optics
  - Re-measure dispersion with new optics to evaluate
  - Vertical dispersion is likely from quad roll errors and operations near diagonal
- Next iteration should correct off-diagonal terms
  - Preference is to correct coupling with new data set with on-diagonal terms corrected
  - Can be tried with existing data set to test feasibility

# APEX Schedule January 15-16 2008

Injection	Injection BBQ	Ramps	Ramps	Store 6-12 bunches	Store BBQ
<b>08-29</b> <b>Profile with polarimeter</b> <b>Huang, Sivertz, +team</b>	<b>08-25</b> <b>Chrom Jump @inj</b> <b>Montag</b>	<b>08-14</b> <b>Collimation on the ramp</b> <b>Drees</b>	<b>08-03</b> <b>Longitudinal matching @transition</b> <b>Abreu Bai Blaskiewicz</b>	<b>06-31</b> <b>8-27</b> <b>ORM Corrections.</b> <b>Optics</b> <b>Satogata Bai</b>	<b>08-17</b> <b>IP Knobs</b> <b>Ptitsyn Malitsky</b>
<b>08-28</b> <b>Hybrid Tune Tracker</b> <b>Cameron +team</b>	<b>08-24</b> <b>Au77</b> <b>Trbojevic +team</b>		<b>08-03</b> <b>Longitudinal matching @transition</b> <b>Abreu Bai Blaskiewicz</b>	<b>06-31</b> <b>8-27</b> <b>ORM Corrections.</b> <b>Optics</b> <b>Satogata Bai</b>	<b>08-17</b> <b>IP Knobs</b> <b>Ptitsyn Malitsky</b>

8pm

10pm

12am

2am

4am

6am

8am

**7:00 am**  
**Injectors**  
**OFF**