

# A Chromaticity Mystery

C.Y. Tan  
06 Mar 2009

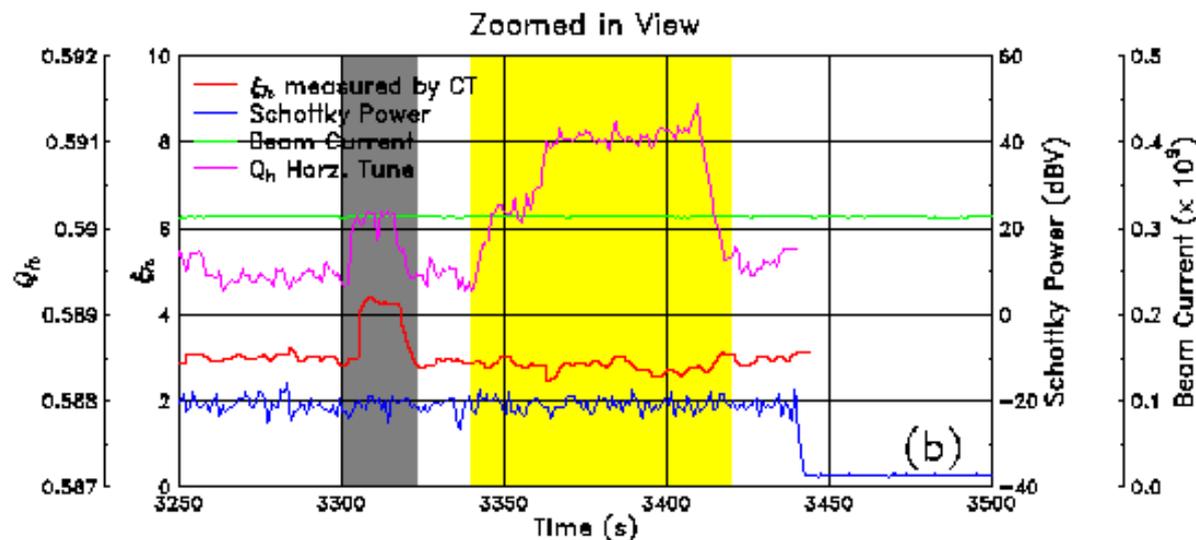
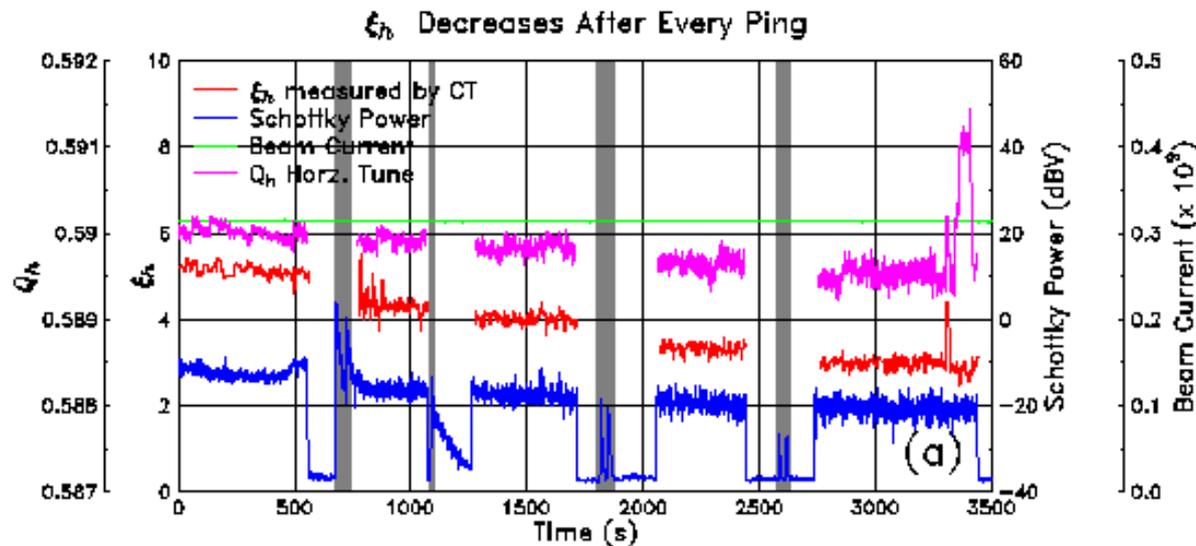
# Motivation

After every ping, the chrom gets smaller.

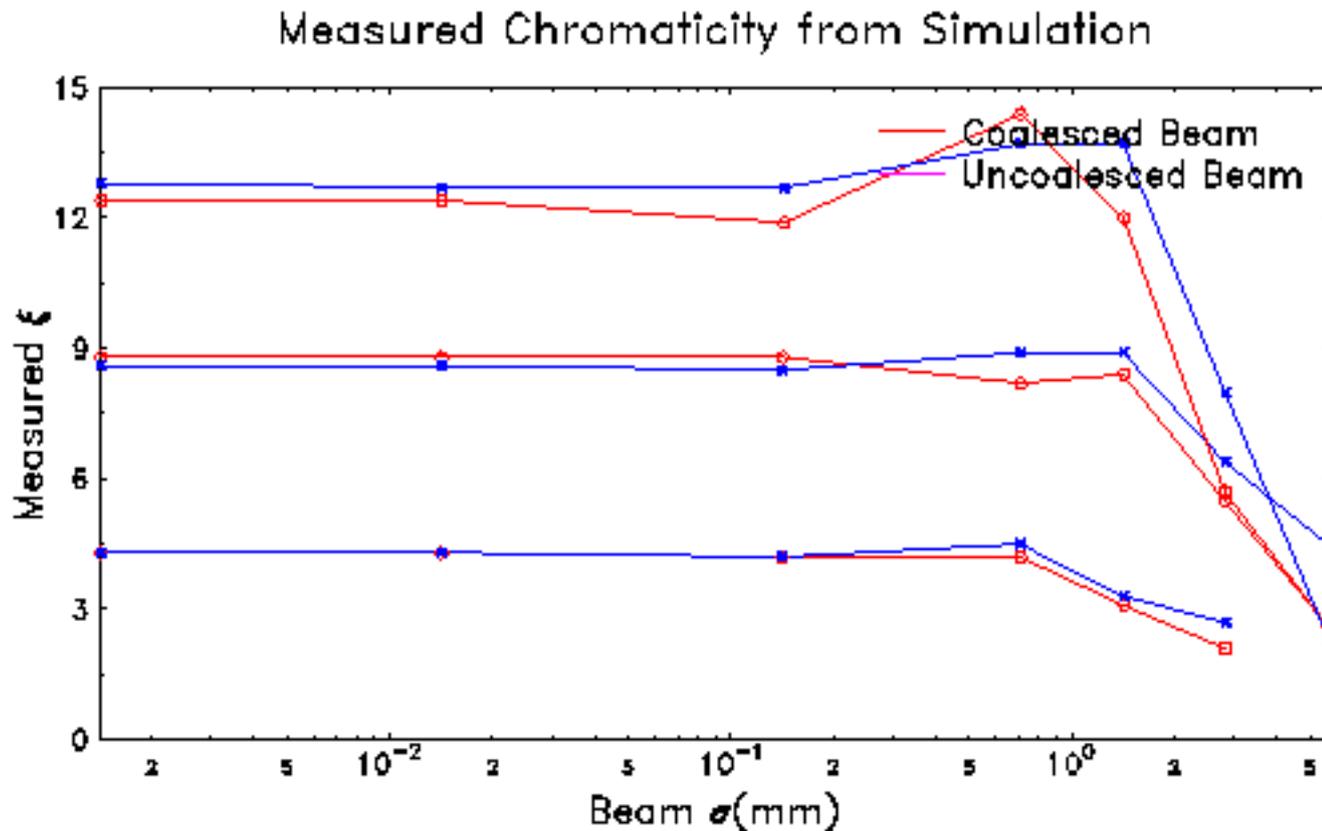
There is some tune movement also.

Moving the chrom does change the tune.

However changing the tune does not change chrom.



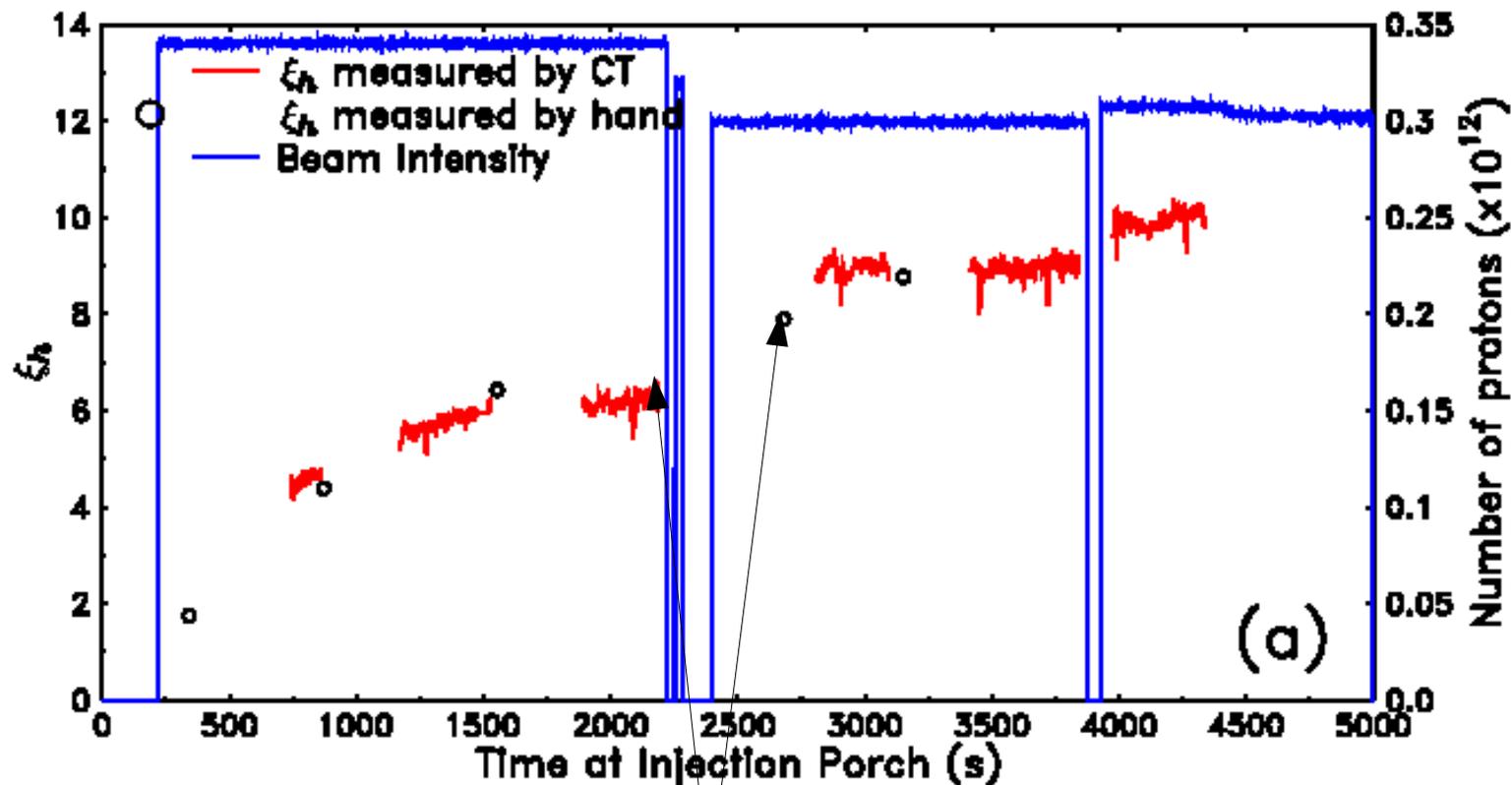
# My Simple Simulation



Beam size  $> 1$  mm,  
chrom measurement is  
dependent on beam  
size?

# Jump in Chromaticity

Evolution of  $\xi_h$  at Injection Porch



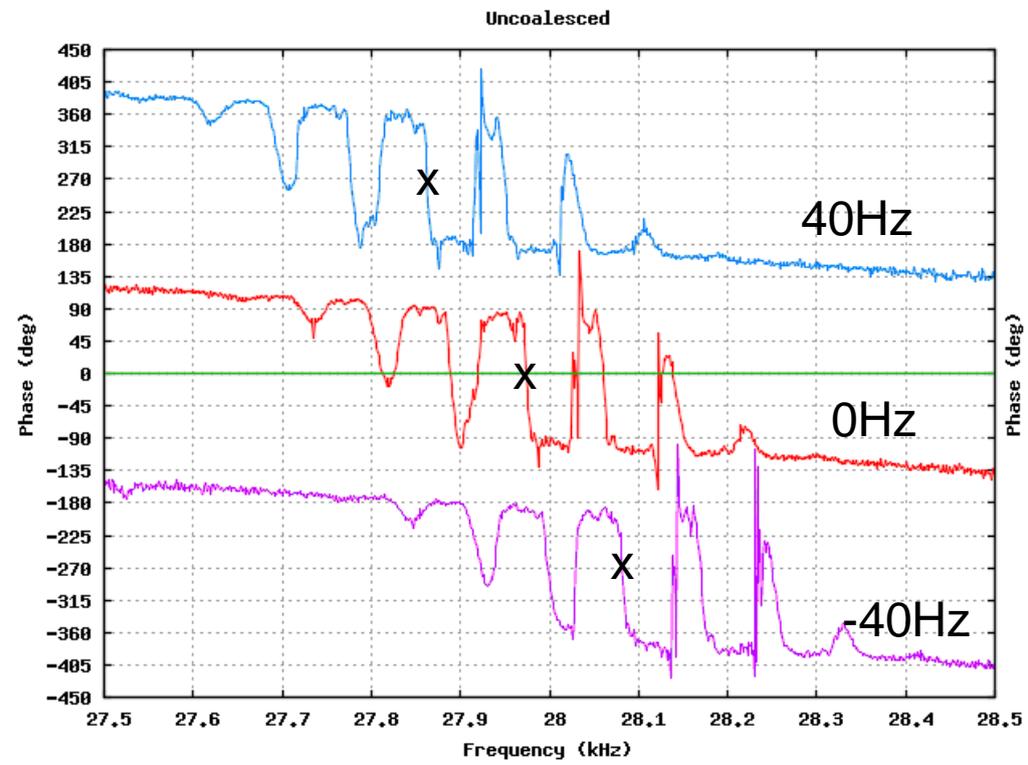
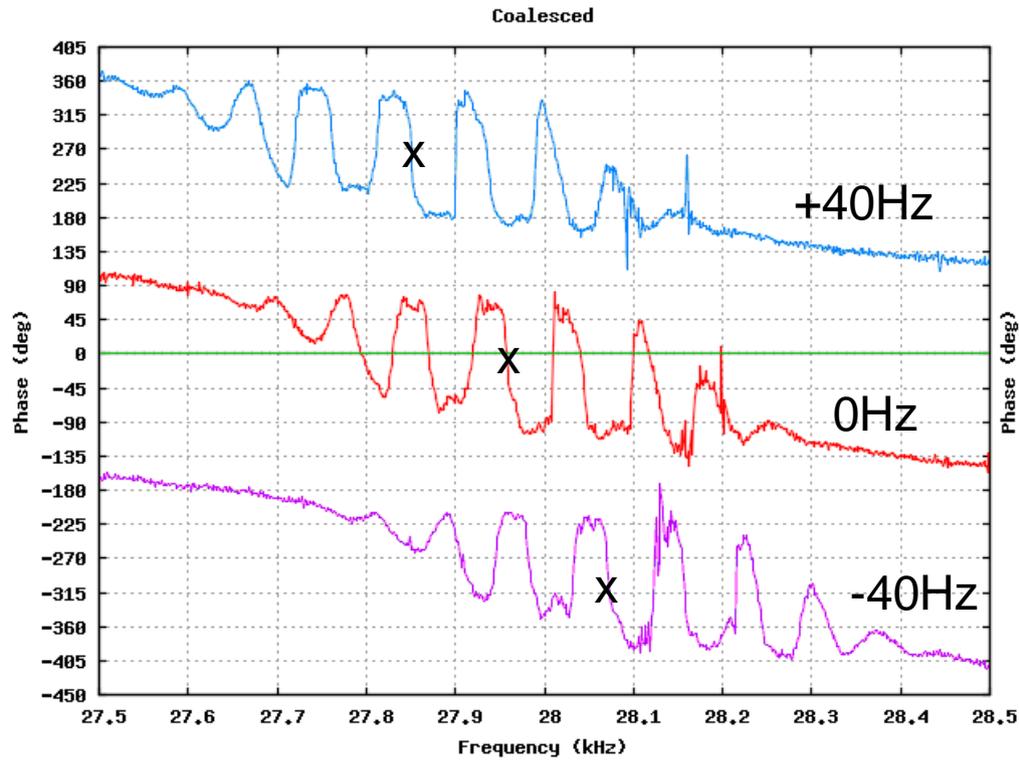
6 to 8

In fact much larger  
jump (data point  
thrown out)

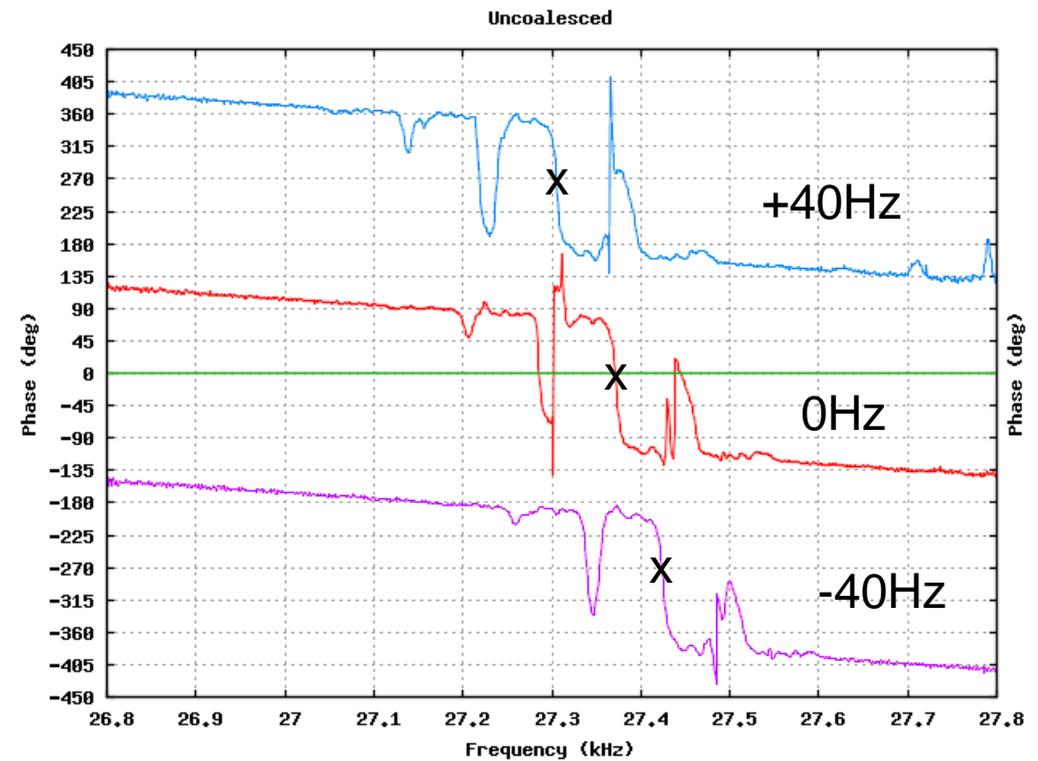
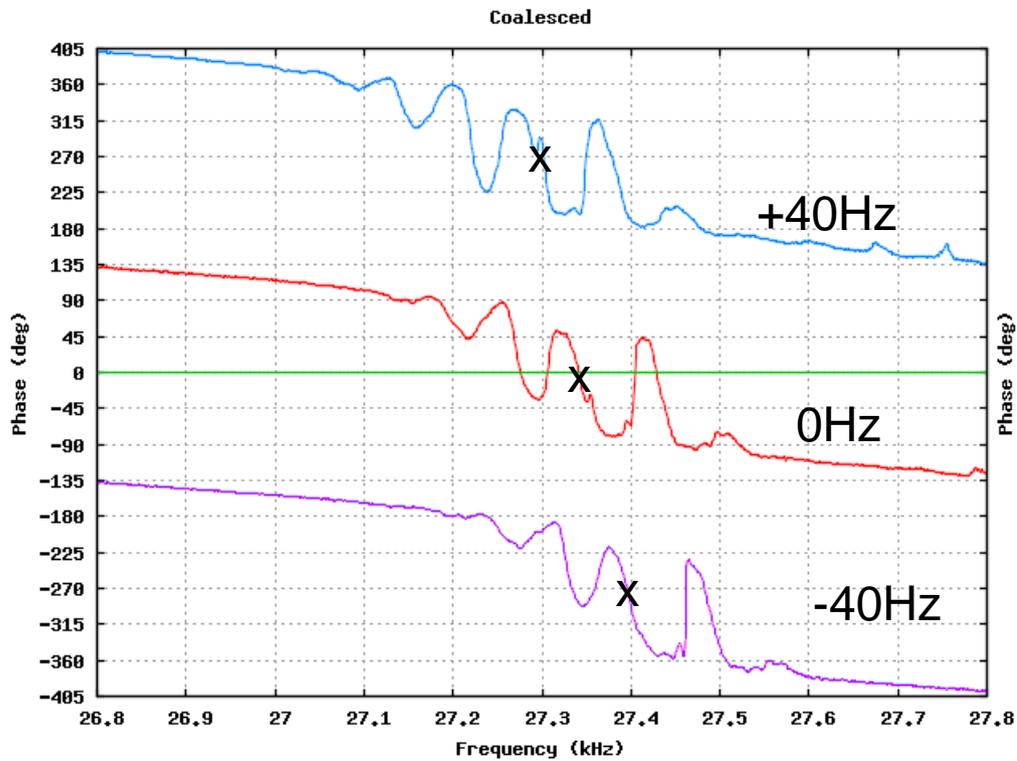
# Where's the beef?

- Is this a physics or a measurement problem?  
Hard to separate the two in this case.
  - Is chrom measurement technique using phase tracking always dependent on transverse beam distribution?
    - Should not be too surprising, since beam distribution is embedded in frequency response.
  - Non linear effects? Octupoles are OFF for the experiment.
- I have always seen a difference between coalesced and uncoalesced beam. Especially in the vertical.  $C_v$  smaller for coalesced.

# Example Phase Response (Horz)



# Phase Response (Vert)



**NOTE: Due to operator error, the chrom knobs were NOT changed during the experiment**

Beam type	Time stamp	CXINJ	VFKNOB	Picture	Data (binary)	Data(ascii)	sigmax	sigmay	emit pic	Calculated chrom
CYINJ=27										
Flyspec=25 for uncoalesced		dp/p measured using T:SBPMS: uncoalesced = 3.8e-4, coalesced = 5.4e-4								
Flyspec=3 for coalesced										
uncoal	23:49:00	38.75	0	ch6.tif	traceh6.dat	traceh6.asc	1.04	1.34	ch6.gif	7.9
	00:01:00		40	ch6_40.tif	traceh6_40.dat	traceh6_40.asc				
	00:06:00		-40	ch6_-40.tif	traceh6_-40.dat	traceh6_-40.asc				
coal	01:23:00	38.75	0	cch6.tif	ctraceh6.dat	ctraceh6.asc	1.21	1.83	cch6.gif	8.9
	01:27:00		40	cch6_40.tif	ctraceh6_40.dat	ctraceh6_40.asc				
	01:31:00		-40	cch6_-40.tif	ctraceh6_-40.dat	ctraceh6_-40.asc				
uncoal	00:48:00	43.75	-40	ch11_-40.tif	traceh11_-40.dat	traceh11_-40.asc	1.05	1.43	ch11.gif	8.8
	00:52:00		0	ch11.tif	traceh11.dat	traceh11.asc				
	00:57:00		40	ch11_40.tif	traceh11_40.dat	traceh11_40.asc				
coal	01:36:00	43.75	-40	cch11_-40.tif	ctrace11_-40.dat	ctrace11_-40.asc	1.24	1.71	cch11.gif	8.9
	01:39:00		0	cch11.tif	ctrace11.dat	ctrace11.asc				
	01:43:00		40	cch11_40.tif	ctrace11_40.dat	ctrace11_40.asc				
CXINJ=38.75										
Beam type	Time stamp	CYINJ	VFKNOB	Picture	Data (binary)	Data(ascii)	sigmax	sigmay	emit pic	Calculated chrom
uncoal	00:15:00	27	-40	cv4_-40.tif	tracev4_-40.dat	tracev4_-40.asc	1.05	1.31	cv4.gif	5.1
	00:21:00		0	cv4.tif	tracev4.dat	tracev4.asc				
	00:26:00		40	cv4_40.tif	tracev4_40.dat	tracev4_40.asc				
coal	01:52:00	27	40	ccv4_40.tif	ctracev4_40.dat	ctracev4_40.asc	1.22	1.84	ccv4.gif	4.2
	01:56:00		0	ccv4.tif	ctracev4.dat	ctracev4.asc				
	01:59:00		-40	ccv4_-40.tif	ctracev4_-40.dat	ctracev4_-40.asc				
uncoal	00:33:00	33	40	cv10_40.tif	tracev10_40.dat	tracev10_40.asc	1.05	1.43	cv10.gif	4.8
	00:36:00		0	cv10.tif	tracev10.dat	tracev10.asc				
	00:41:00		-40	cv10_-40.tif	tracev10_-40.dat	tracev10_40.asc				
coal	02:17:00	33	40	ccv10_40.tif	ctracev10_40.dat	ctracev10_40.asc	1.26	1.72	ccv10.gif	3.8
	02:07:00		0	ccv10.tif	ctracev10.dat	ctracev10.asc				
	02:14:00		-40	ccv10_-40.tif	ctracev10_-40.dat	ctracev10_-40.asc				

# Results

- Horz chroms are 8.9 units regardless of beam conditions
  - Note: Ch is drifting. Start of experiment, 4 units end of units 8.8 units (measured using C43). 1<sup>st</sup> data point is 1 hr from the next three.
    - No difference between coal and uncoal
  - Cv was pretty constant throughout the entire experiment which lasted about 5 hrs. Start 4.6, stop 4.4 units.
    - Assume that Cv did NOT change during experiment
    - Cv for uncoalesced is 1 unit higher than for coalesced!

# Results (cont'd)

- Using beam sigma at E11 (note pickups are at A17):
  - Coalesced  $\sigma_{\text{mah}}$  is 18% larger.
  - Coalesced  $\sigma_{\text{mav}}$  is 29% larger.

# To do

- Ping the beam to increase emittance.
  - This experiment should really settle it.
- Hopefully Vahid can simulate and confirm the observation.