

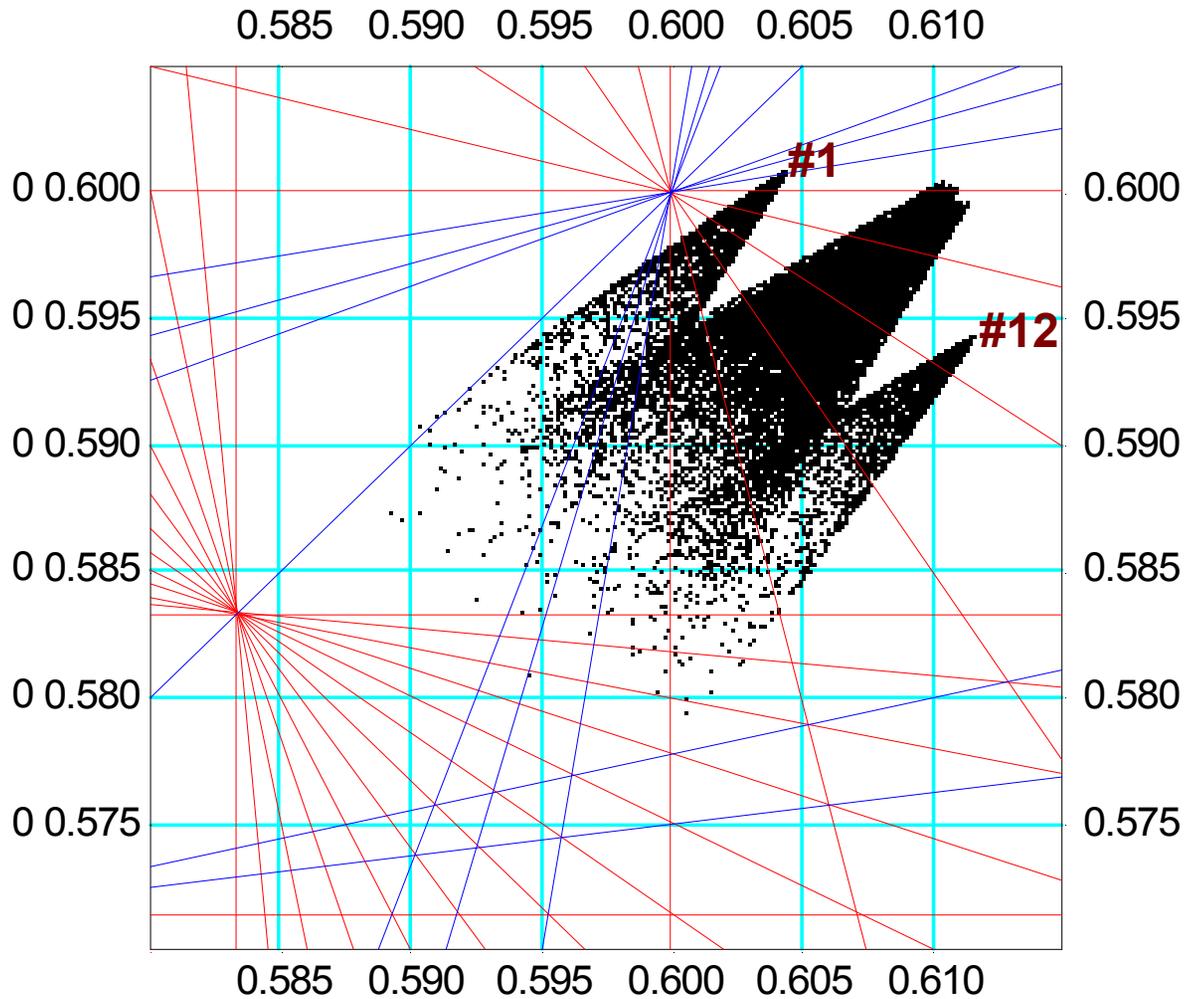
# Specs on Tune Measurement System (draft)

- accuracy of  $dQ \bullet 0.001$  with typical intensities
- reports every 2 seconds or faster
- both protons and pbars
- for every bunch
- non-destructive, tolerable  $d\mathcal{M}_\perp/dt < 0.2 \square \text{ mm mrad/hr}$
- measures chromaticity - desirable
- measures coupling - desirable
- works for uncoalesced beam
- potential to be used for tune feedback  $df \simeq 0.5\text{Hz}$

# History of TEV Tune Measurement Systems

- 21MHz Schottky
  - since last century, main tool nowadays
  - automatic tunefitter by Lebrun (2003) – operational, 15 sec
  - unsuccessful attempt to separate pbars – Huening, 2003
  - TevChrom application by Lebrun (2004) – to be tested
- 21MHz Schottky and bunch tickler:
  - 1996 Bagley successful measurements
  - 2002 Tan, Shiltsev, Zimmermann, Zhang used TEL and Damper
  - Significant emittance growth, losses
- Tan's Pbar Tunemeter
  - Built in 2001, in 2002 found “not good” by Sen and Tan
  - Fast emittance growth, beam loss... disassembled (parts for dampers)
- New 1.7GHz Schottky:
  - 2003 Pasquinely&Co, soft (fit) by Jansson
  - pbar/p bunch tunes and chromaticity – still questions
  - New tunefitter under development by Lebrun (2004)
- Tan's “tunetracker” – great expectations, early 2004
- Vahid's “Head-tail” monitors – same, tunes+chroma+coupling

# Pbar bunch tunes in collisions –



P.Bagley

Yu.Alexahin

T.Sen

D.Shatilov

In 1996, P.Bagley found a good agreement between his calculations and measurements (though the lattice was somewhat different)

# Tickler Experiment

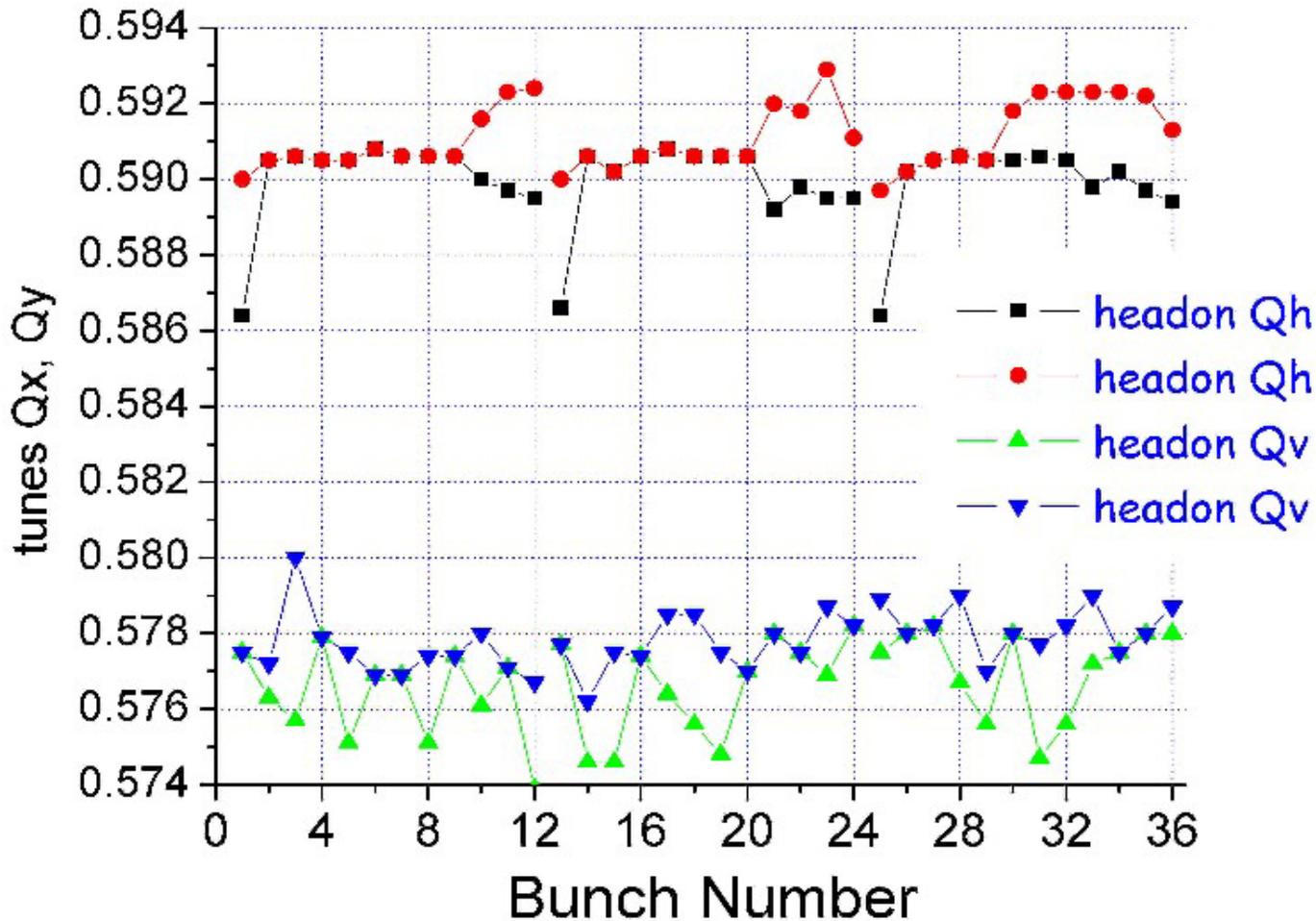
EoS Measurements of pbar bunch tunes - 12/03/2002

CYTan

XLZhang

F.Zimmermann

V.Shiltsev



either TEL or damper  
tickler were used as  
noise source

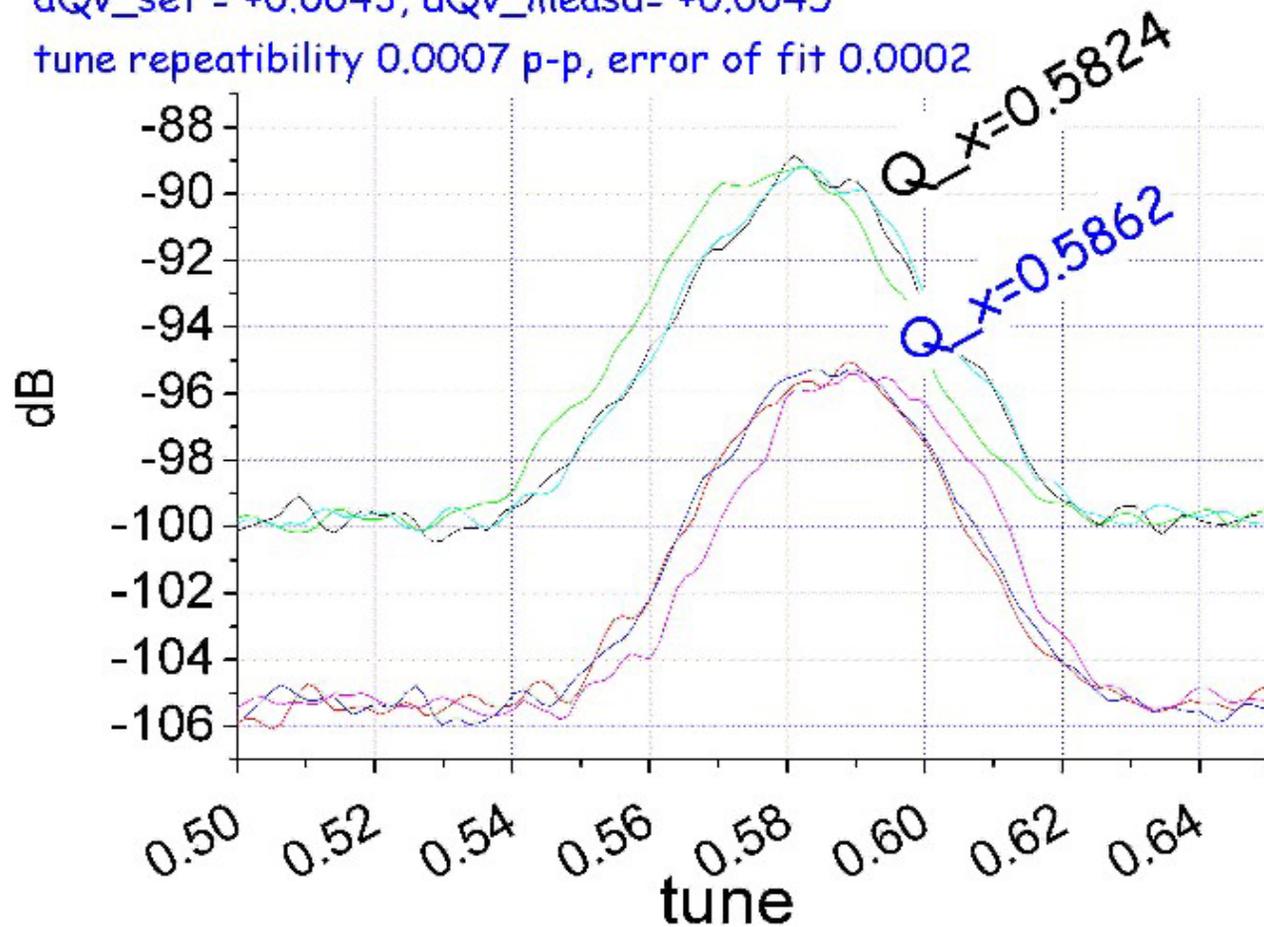
# 1.7GHz Schottky Spectra

EoS #2538: 1.7GHz Schottky for All Pbars

$dQ_h\text{\_set} = -0.0043$ ,  $dQ_h\text{\_measd} = -0.0048$ ,

$dQ_v\text{\_set} = +0.0043$ ,  $dQ_v\text{\_measd} = +0.0045$

tune repeatability 0.0007 p-p, error of fit 0.0002



# Pbar Bunch Tunes Measured by 1.7GHz Schottky detector

