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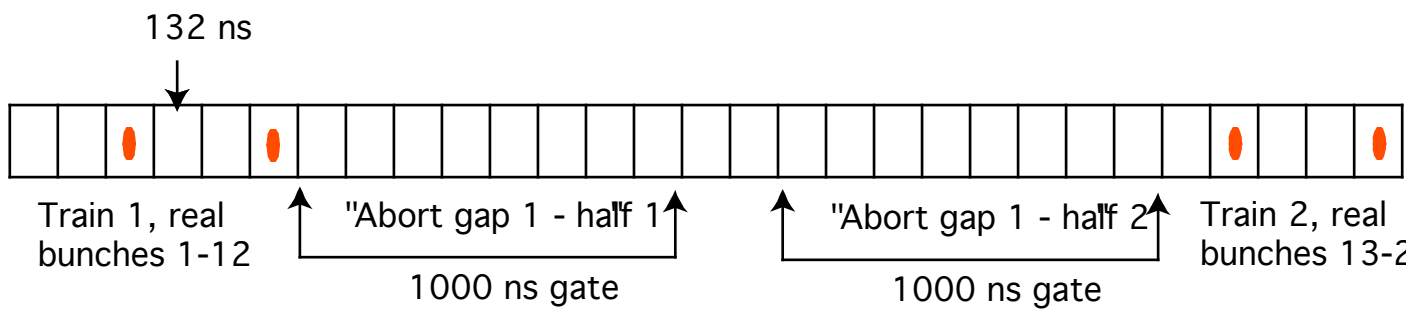
Synclite abort gap study II

Last time (March 26) increased gain by factor of 66 by:

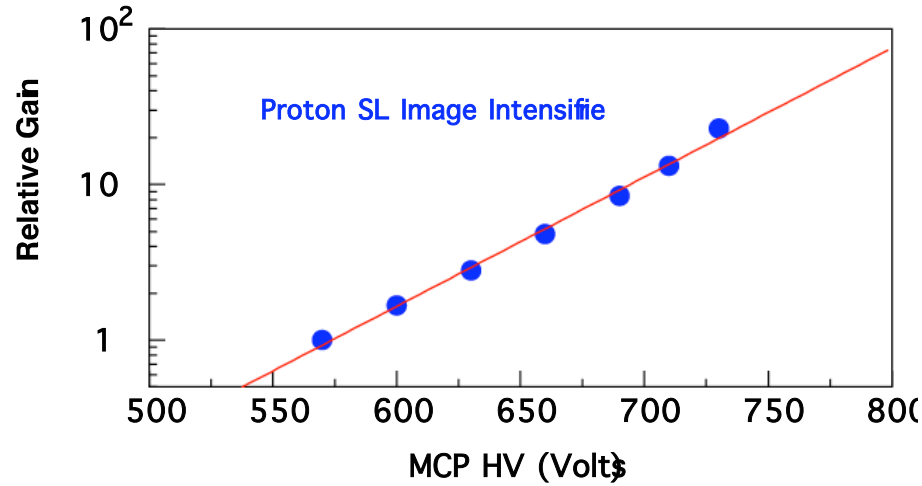
- Changed MCP high voltage: protons: 570 V to 730 V
- Gate MCP 1-in-2 turns instead of 1-in-6 turns
- Also gate width changed from 200 ns to 1000 ns with timing in the abort gaps:



- Saw hints of signal with TEL off but difficult to tell
- Definitely saw beam with RF station trip (normal running data logged)

DC beam with RF Station trip

- Need gain at HV = 730V compared to 570V: is = 22.8
- From SL logged data and normalizing to FBI intensities I find in the 1000ns gaps:

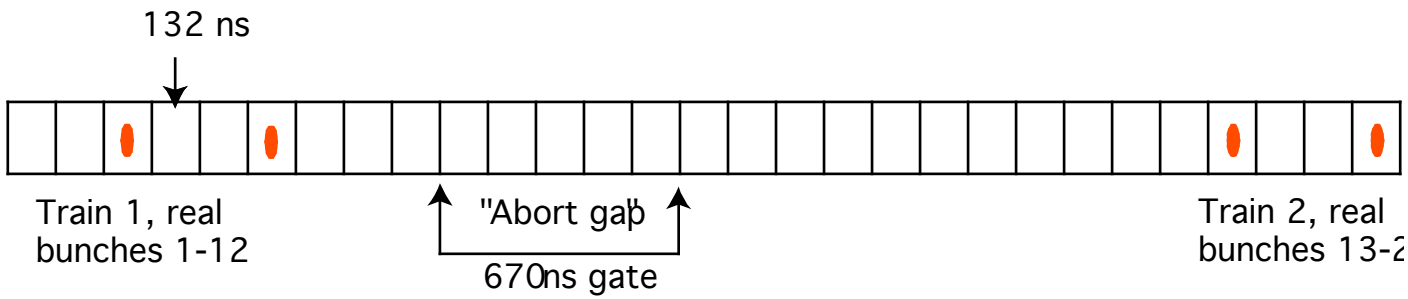


	Abort gap 1		Abort gap 2		Abort gap 3	
	Half 1	Half 2	Half 1	Half 2	Half 1	Half 2
# protons (10^9)	2.21	2.34	2.15	2.43	2.11	2.29

- So assuming perfect DC beam, in whole ring (159□132 ns): DC beam = 47□10^9 protons (c.f. V.S. gets 36□10^9 from IBEAM/FBI)

Changes for Study II (April 22)

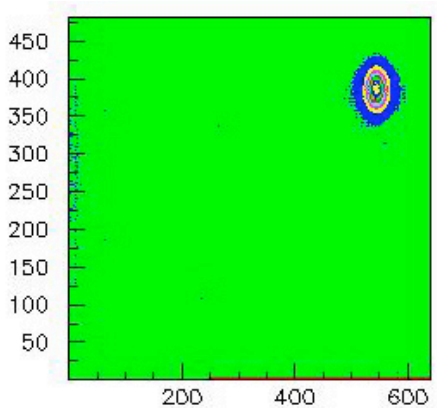
- Same MCP HV = 730V but gate width = 670 ns:



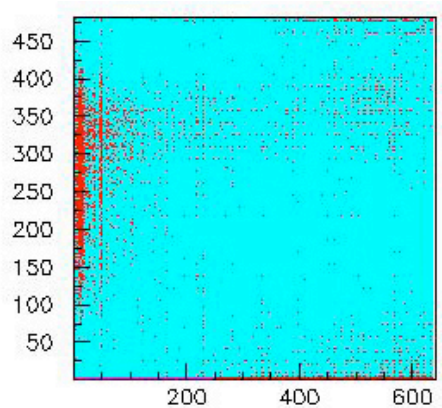
- Can leave as-is for normal running, BUT max. gate = 1-in-5 turns (pulser shuts off if gated at higher frequency)
- Use calibration procedure, collect 100 images and add together
  Signal ∝ N, background ∝ N, so gain factor of 10 (but lost ∝3.7)
- End-of-Store study April 22, 8-9am turn TEL off
  Again hardly see any beam in individual images
- First calibrate by setting gate to first bunch and c.f. FBI intensity

Sum of 100 images

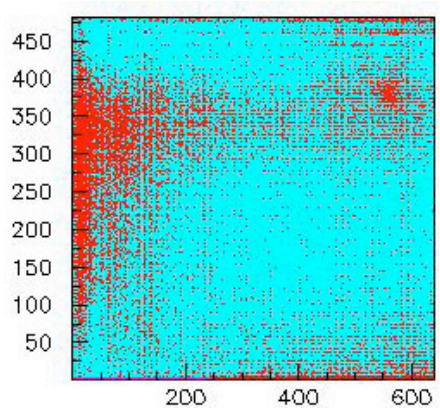
Bunch #1



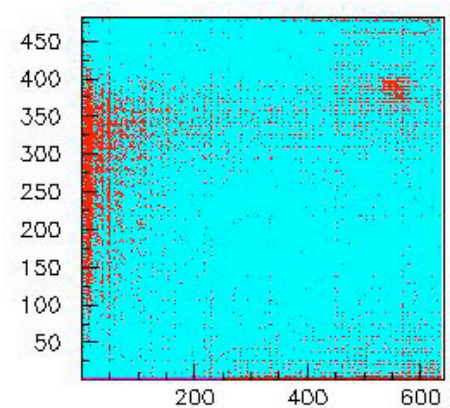
TEL on



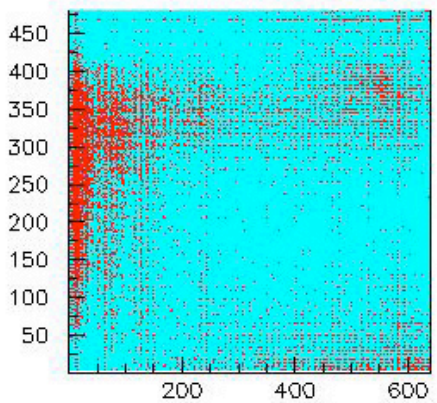
25 mins. after TEL off



42 mins. After TEL off and gap 3 BS earlier

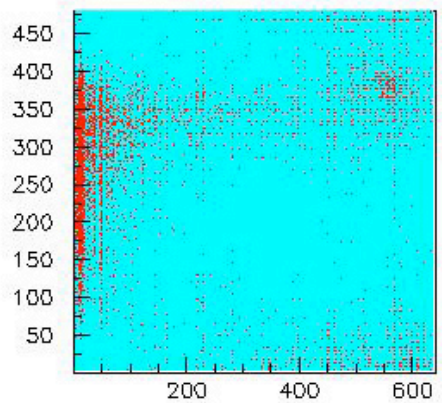


2D



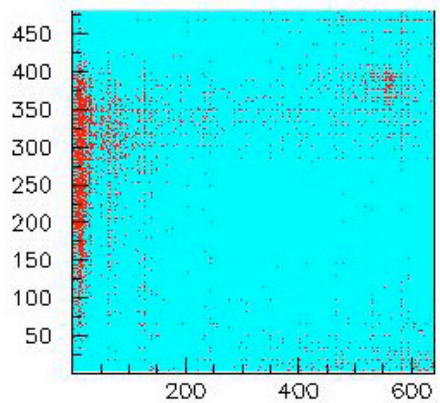
7 mins. after TEL off

2D



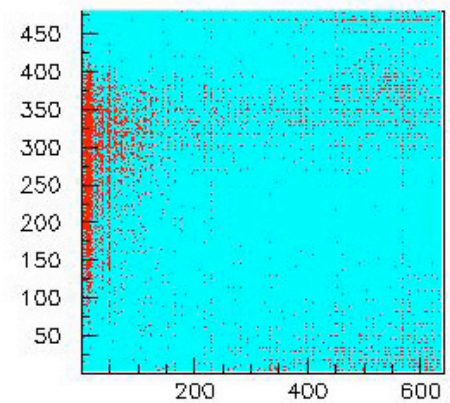
17 mins. after TEL off

2D



49 mins. after TEL off

2D

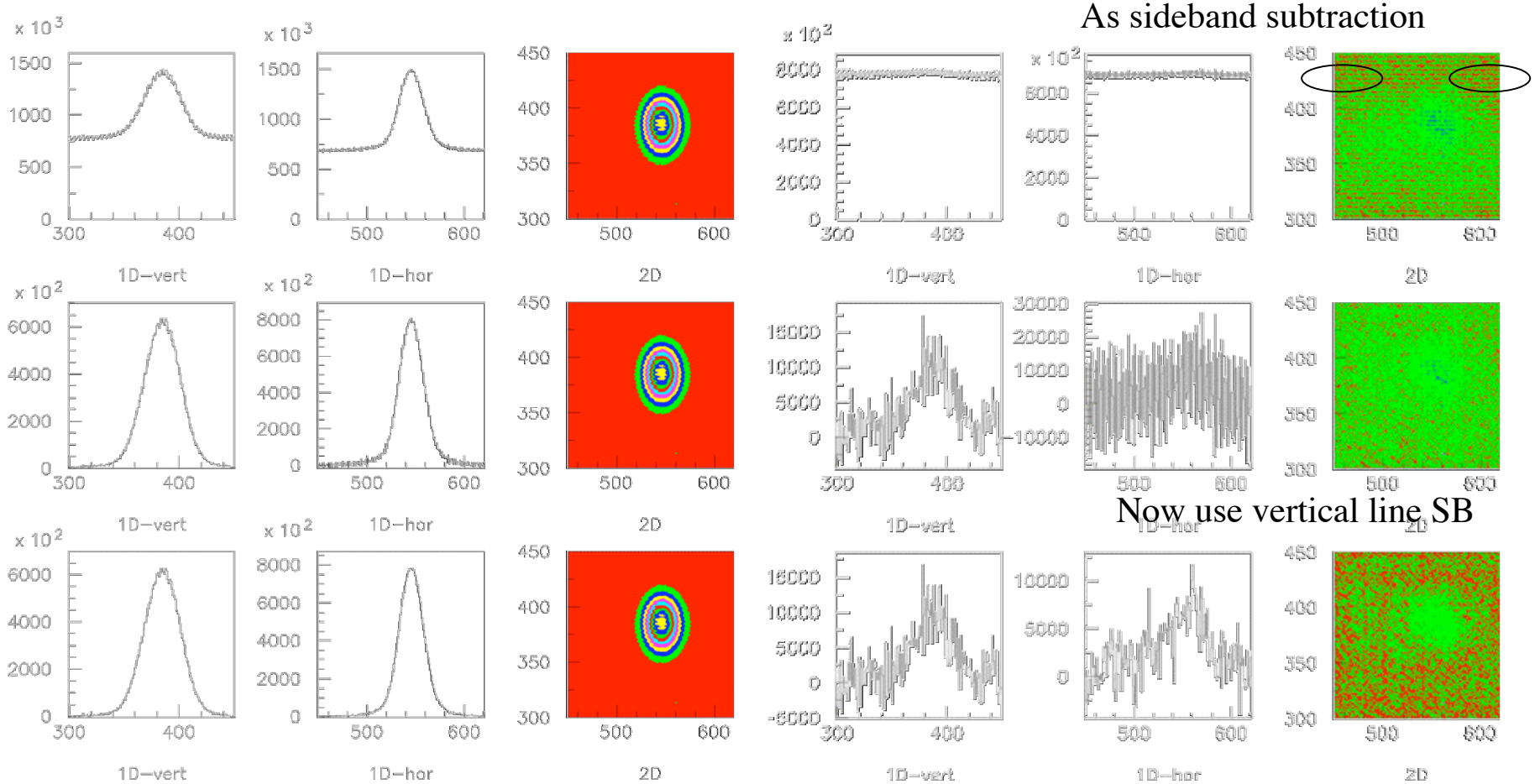


2 mins. after TEL ON

Analysis of Images

Bunch #1 and 42 mins. after TEL off

Take 10+10 pixels per hor. Line
As sideband subtraction

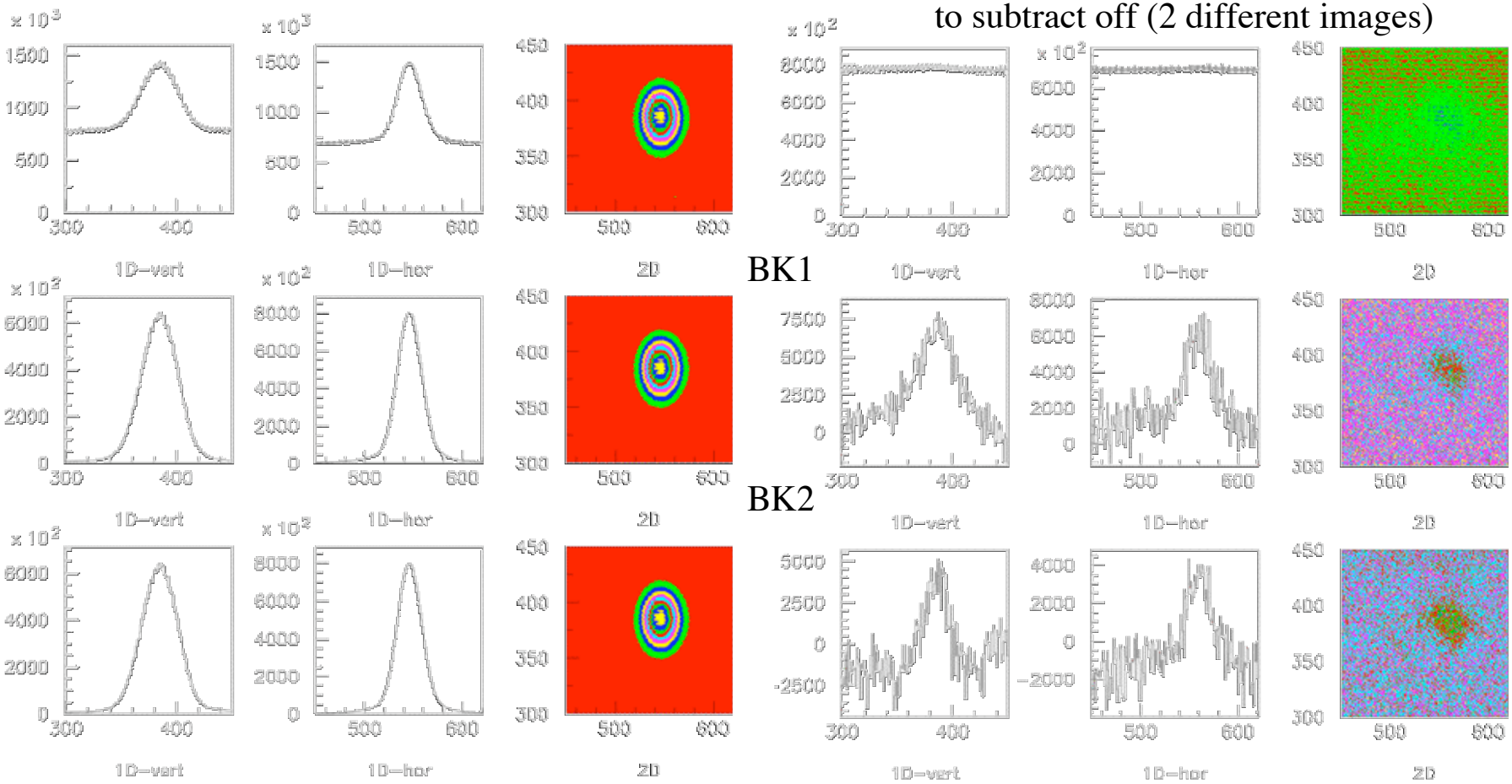


Now use vertical line SB

Analysis of Images II

Bunch #1 and 42 mins. after TEL off

Use TEL-on image as background image to subtract off (2 different images)



Analysis of Images III

- Use bunch #1 and data logged FBI intensity to normalized images
- Fit vert and hor images with both bkgd image subtractions and average
- Assume DC beam, so multiply # protons seen in SL by 159□132/670

Minutes after TEL off	#Protons in DC (10^9)	V (mm)	H (mm)	$\square_v$ (mm)	$\square_h$ (mm)
Bunch #1	181.2	0	0	16.3	13.1
7	~ 0	-	-	-	-
17	1.4	+0.1	-1.0	17.5	11.7
25	1.4	+0.3	-1.0	17.4	9.2
42(+ timing change)	1.9	-0.1	-0.8	14.8	14.0
49	1.9	-0.1	-1.0	18.9	11.4

DC Beam with TEL off is ~ 2□10^9 protons and ~ 1mm more inside hor.

Summary

- We have set up a way to look at DC beam without any need for hardware setup. Just run a feature of calibration
- We have tested this with the TEL turned off and we see DC beam of ~ $2\square10^9$ protons (V.S. expects ~ $6\square10^9$)
- With current setup cannot see beam with TEL on

  To increase gain we need:

  - Gate more often (every turn) and longer gate
  - Higher HV could be tried
  - Wider band filter (resolution may suffer)
  - Forget 2-D info and use a PMT with unfiltered light