SVT beam lines and L3 Silicon tracking

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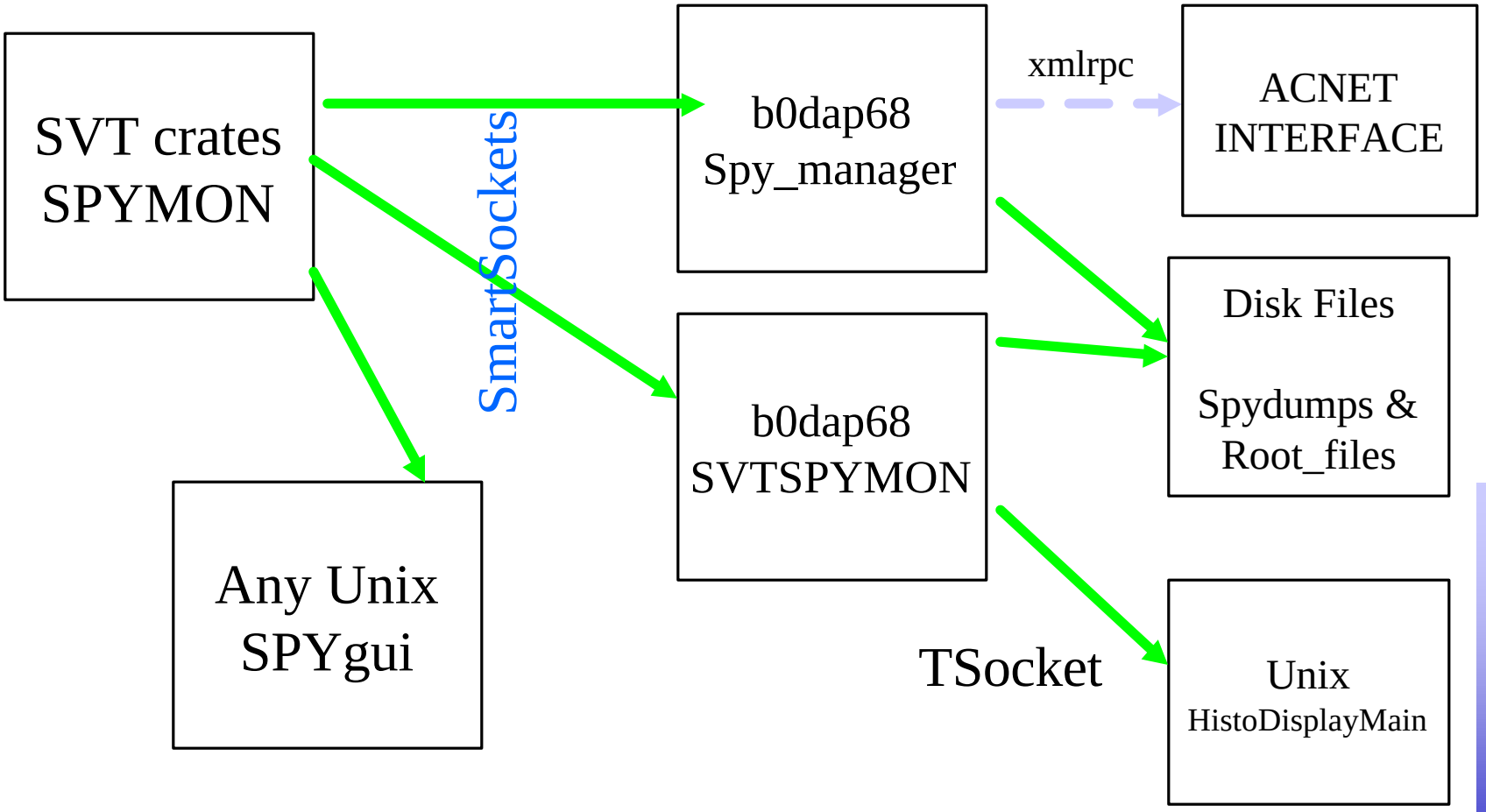
L3 meeting

10/31/02

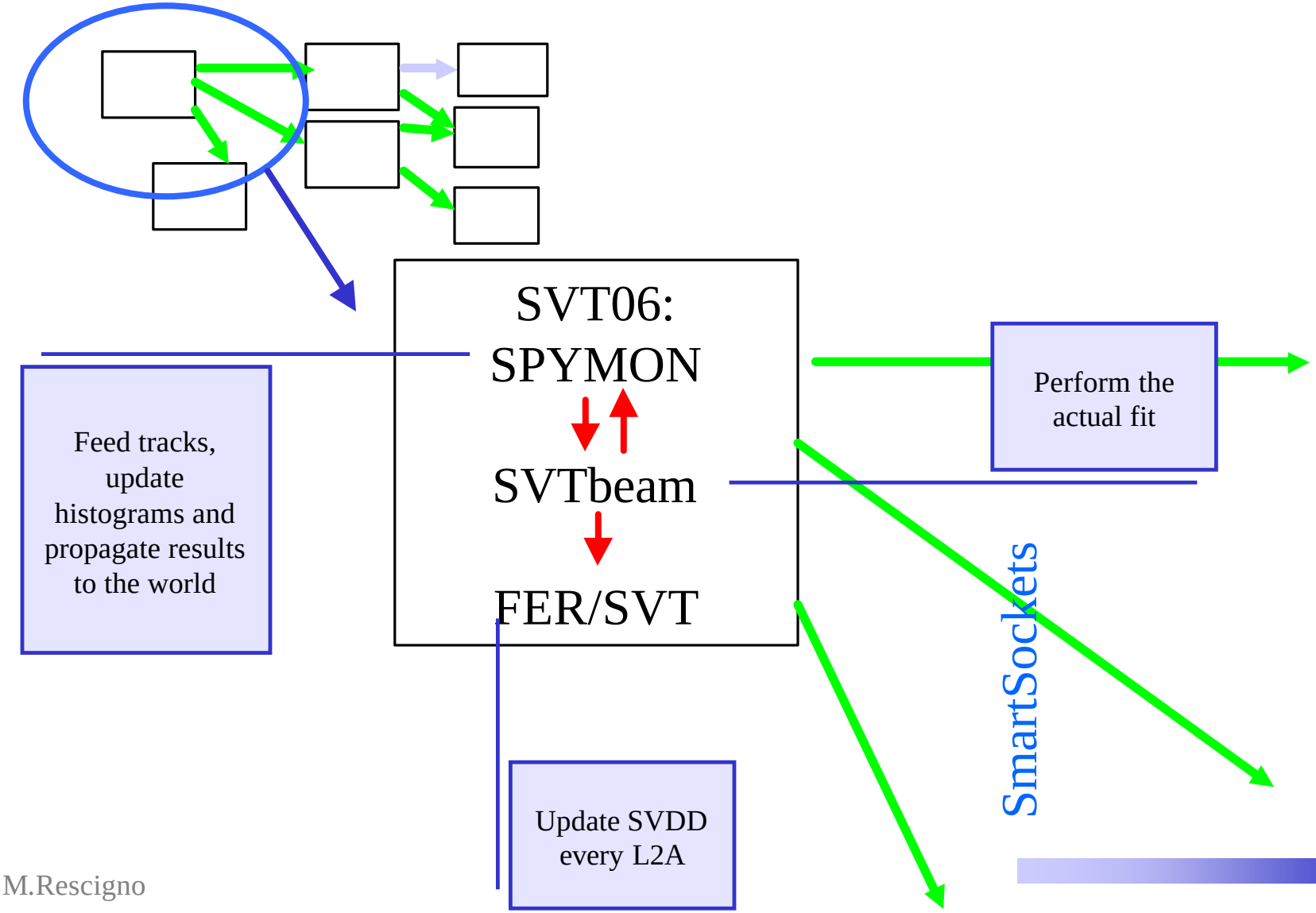
Outline

- SVT beam Fitter
- SVDD content
- SVT coordinate system
- Beam position as seen by SVT
- Offline vs SVT beam lines
- Rate reduction @ L3
- Plans

SPYMON and SVTbeam Scheme



SPYMON and SVTbeam Scheme



SVTbeam mechanics

- SPYMON run on b0svt06 with a cycle of 10 sec
- At every cycle SPYMON feeds the entire contents of a spybuffer to SVTbeam
- At each new run and each time there is un update in the fitted values a message is created with the current beam position and sent outside
- Every time there is a new valid beam position SPYMON updates GB memory for beam subtraction
- At each L2A an SVDD bank is formed with the latest beam position measurement

- When started from scratch 3 minutes are currently needed to report the first fit, otherwise we have a beam fit every 30 seconds or so.
- The message is recevied by spy_manager which then talk with ACNET via xml-rpc
- Still imperfect bookkeepoing at the time the beam position change

SVDD contents

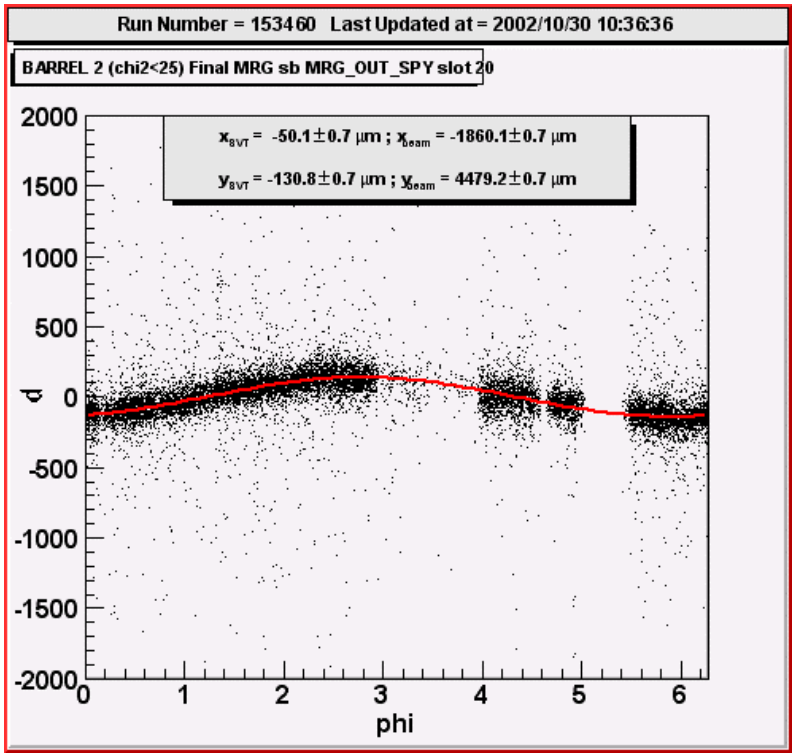
- Contains information on the actual value of beam centers for the 6 barrel used in each event by GhostBuster board
- A status word tells whether the beam fitter had problems (invalid fit)
- Recently added the result of the online 3D beam line fit
- Will replace firmware for GB soon that will allow an 100 % reproducibility of the SVT result when using SVDD values
- Can provide code to read back from SVDD beam lines

SVT coordinate system

SVT constants derived in a coordinate system centered on average (recent) beam position.

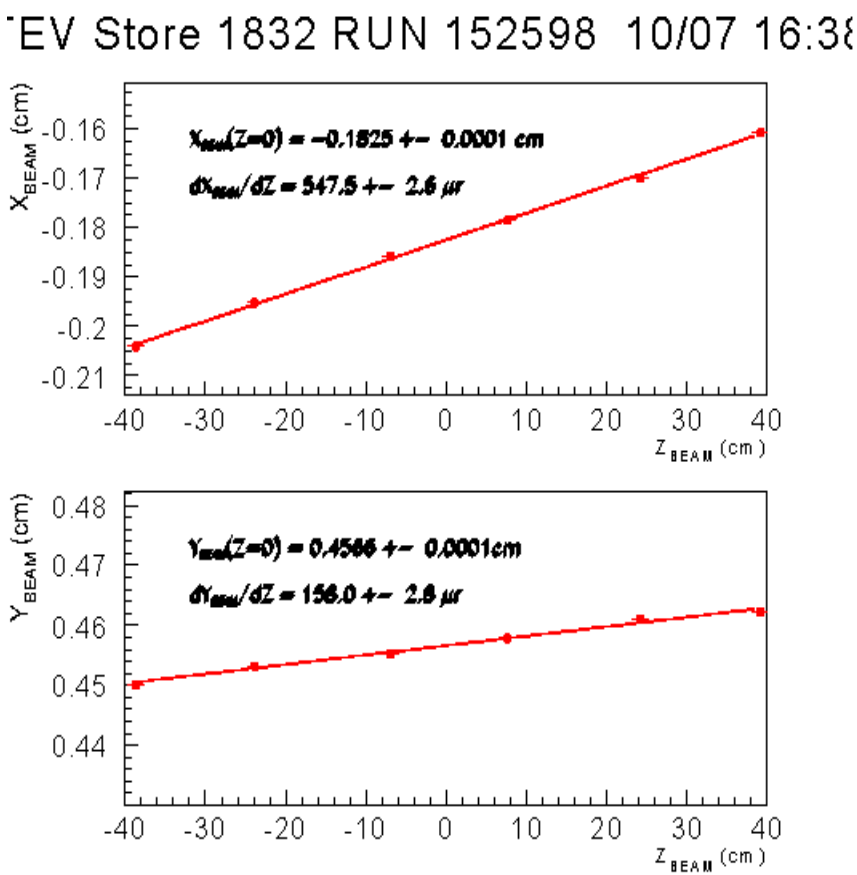
This is largely immaterial to the outside world except for reporting a beam line in CDF coordinate!

The needed offset used to be derived by a relative alignement to the beam position seen by L3 tracks (-> large biases from L3 HL tracking).

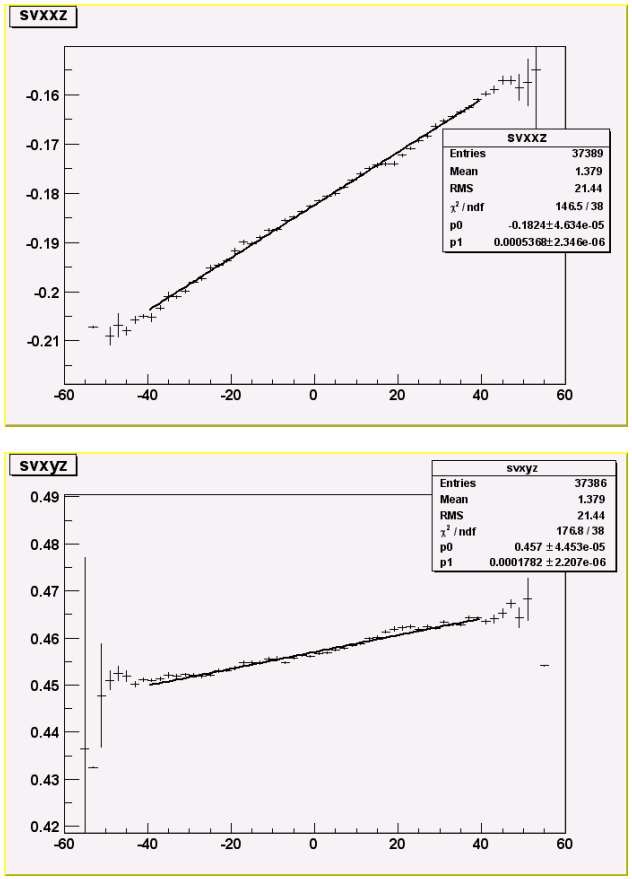


More recently constant derived from offline alignment tables do not suffer from this problem (but introduce a dependence on "alignment tables").

SVT 3D beam lines!



SVT

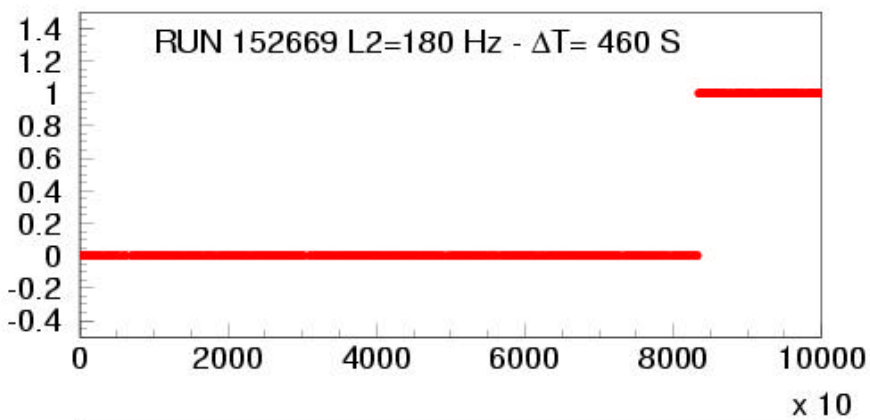


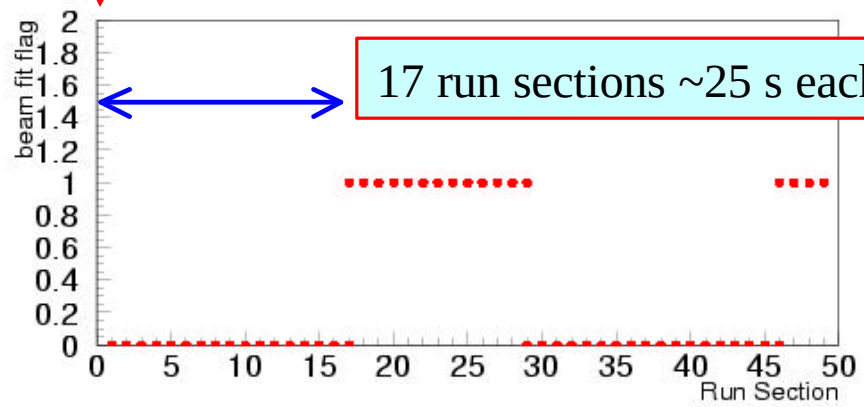
FitBeamModule

Time to first beam fit

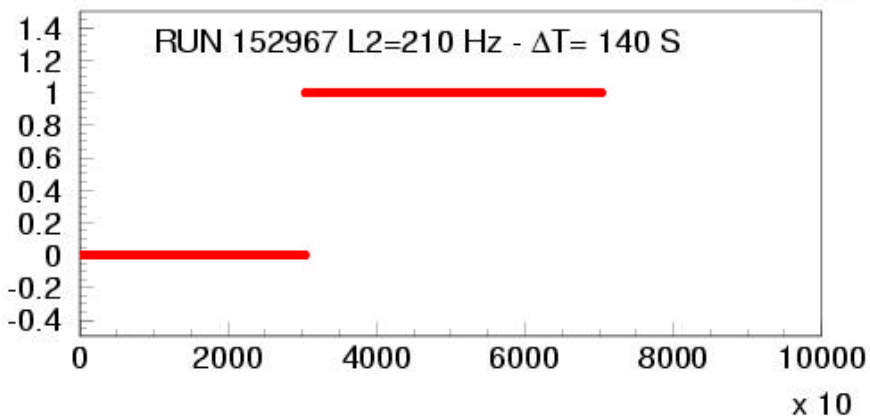
Start of store

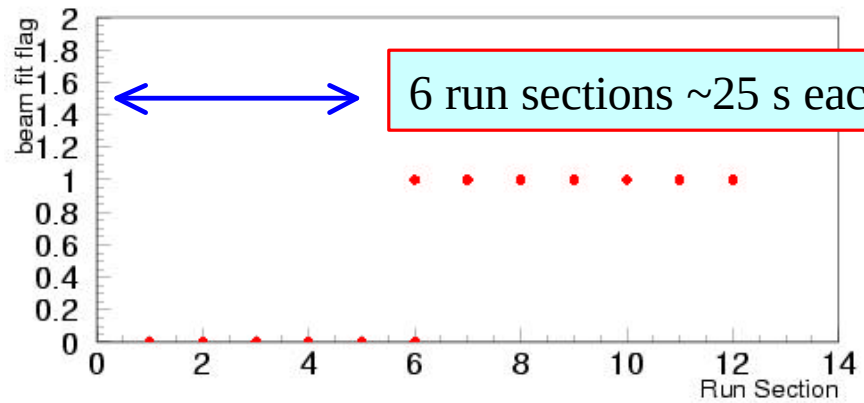
Start of store





17 run sections ~25 s each





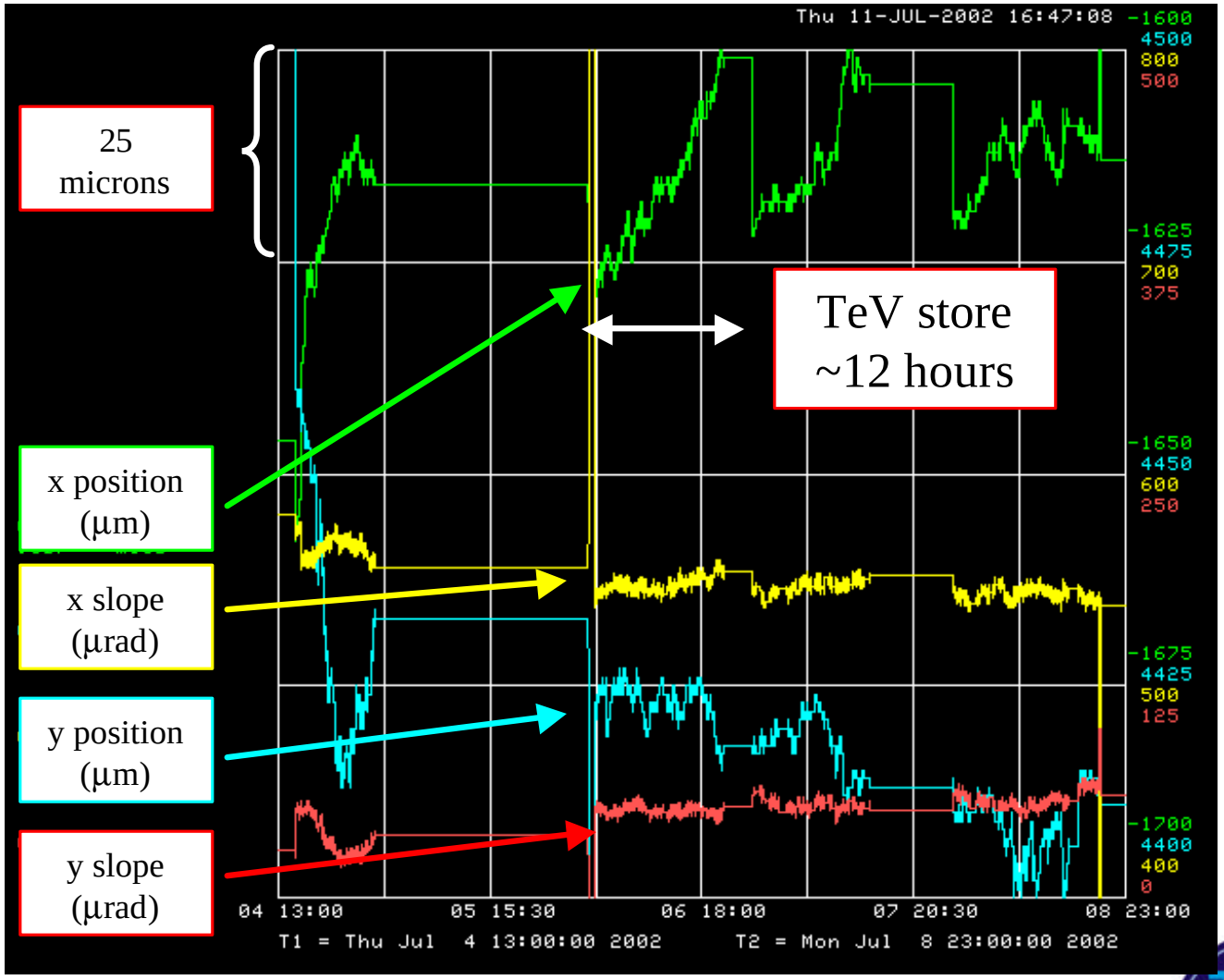
6 run sections ~25 s each

Tevatron Beam Moves!

Beam center at beginning of store normally stable within 20 microns.

Drift during the duration of a store of 20 to 30 microns in x,y (often correlated)

Beam slope more stable (variation <20 microradians)



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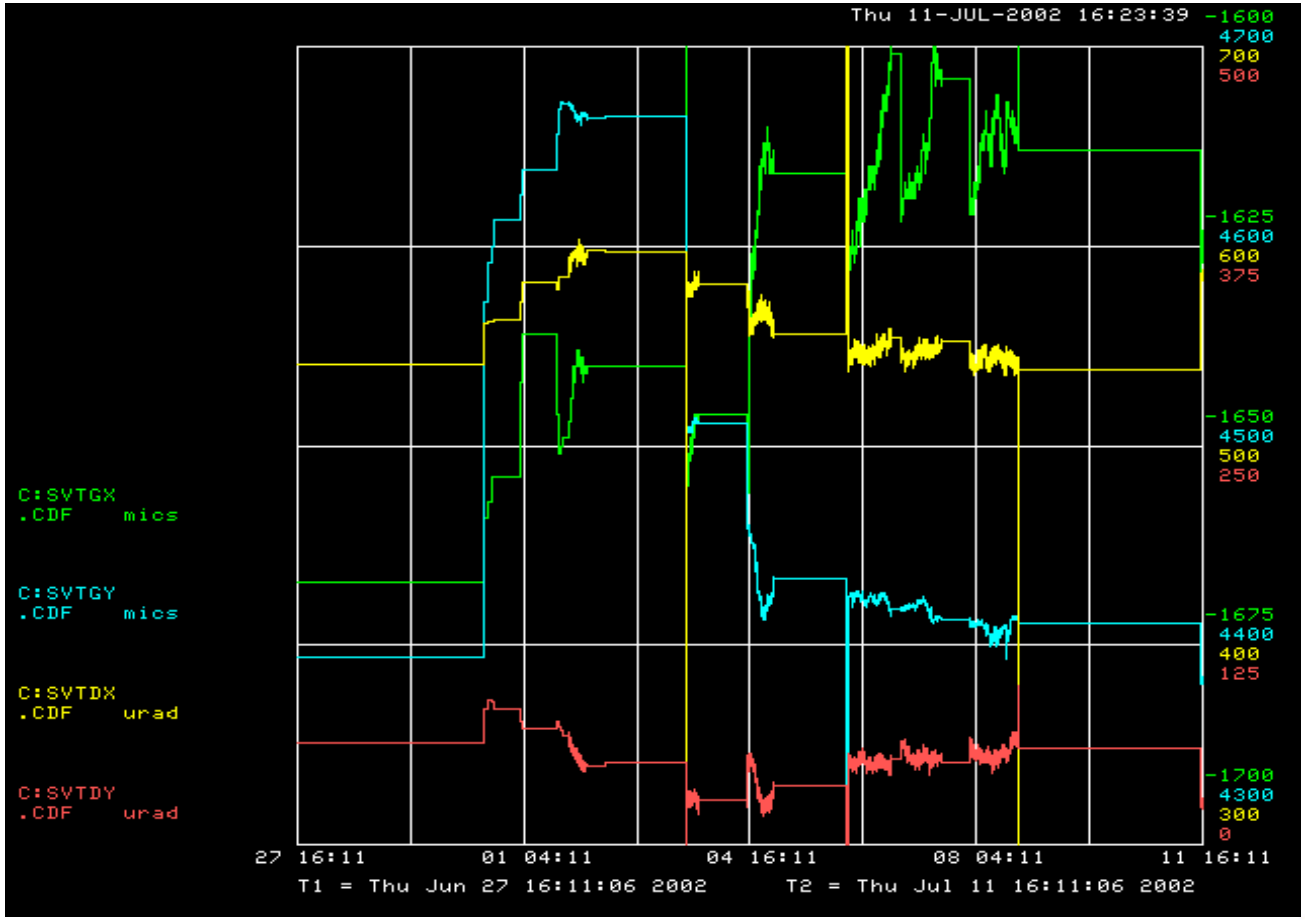
Tevatron Beam Rollercoaster

Occasional jumps of several hundred of microns!



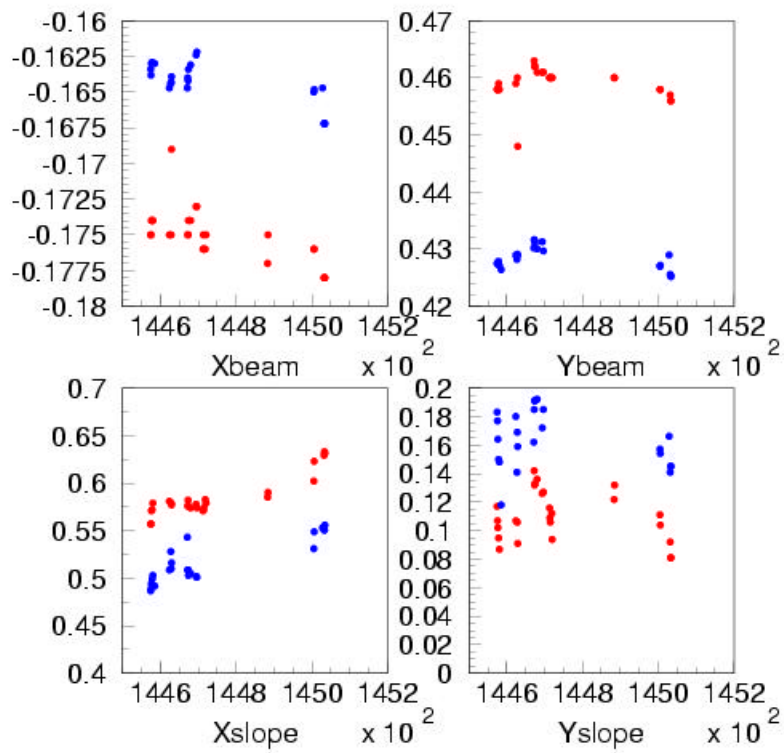
Beam Movements

- In the last ~ 2 months:
- 2 jumps in x (0.5 mm) and y (0.25 mm) probably correlated with deliberate orbit changes
- Slope constant within 200 μrad

	X	Y
MAX store to store beam center variation	500 μm	300 μm
MAX store to store slope variation	200 μr	100 μr
Typical end store beginning of next store beam center variation	30 μm	30 μm
Typical vairation within a store	50 μm	30 μm

SVT beam position shift

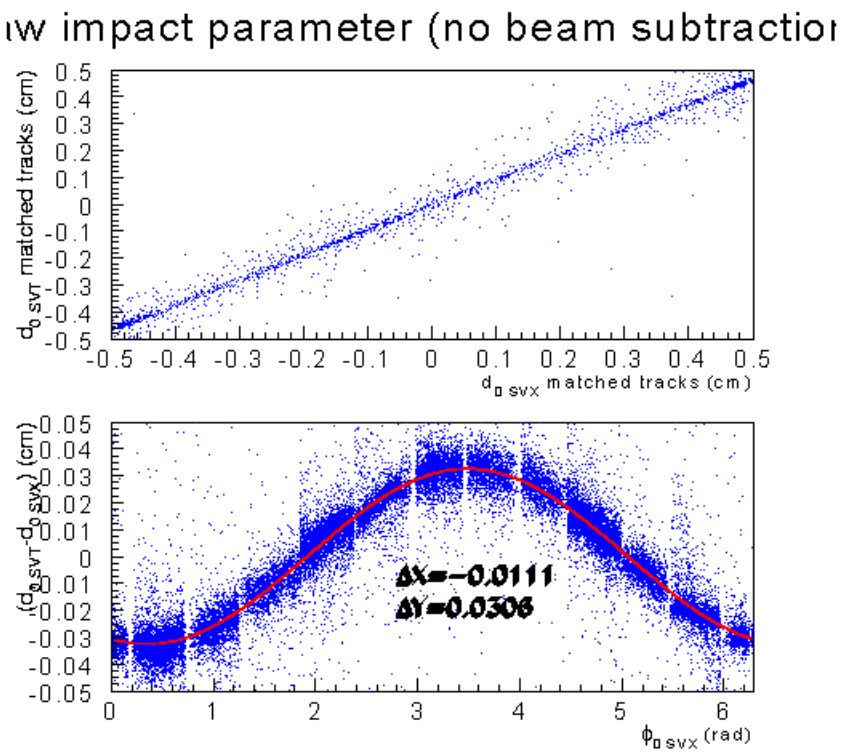
- Beam positions as reported by SVT are offset wrt to the offline beam position measurement
- Reason tracked down to a bias present in the L3 HL tracking on the measurement of impact parameter. Those tracks have been used to translate SVT coordinate in to CDF coordinate.
- We should have corrected this now by using offline alignment for deriving constans

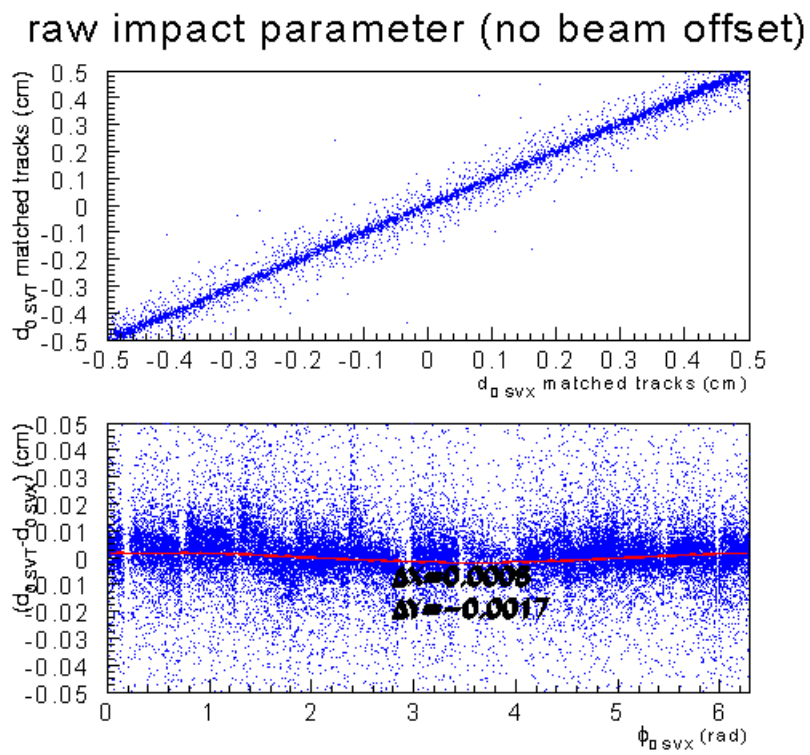


Offline vs SVT impact parameter

Older mapset

offline_100030_20020927111044 mapset and later



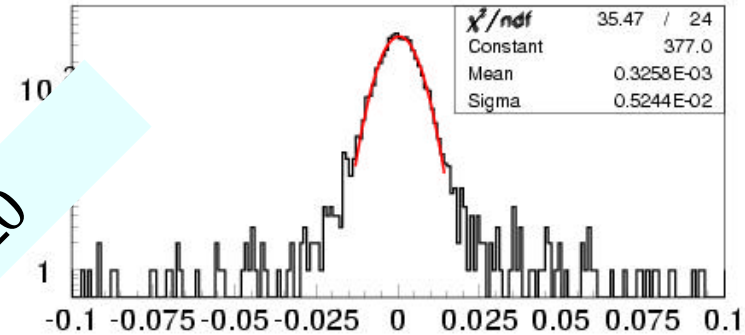


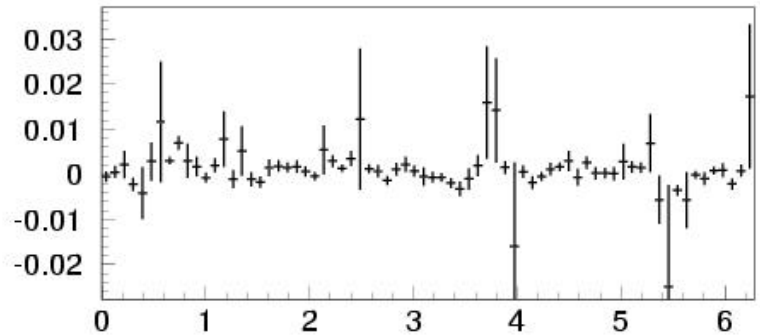
3D beam info in SVDD

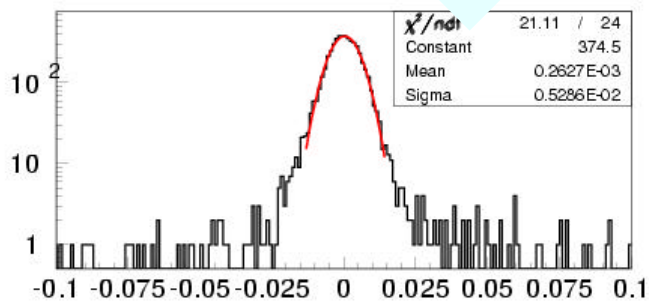
3D beam INFO

1	Card type = BEAM3DINFO =0xb
2	16bit X0 + 16 bit Y0 (microns)
3	16 bit DX+16 bit DY (microrad)
4	FIT status (1=OK)

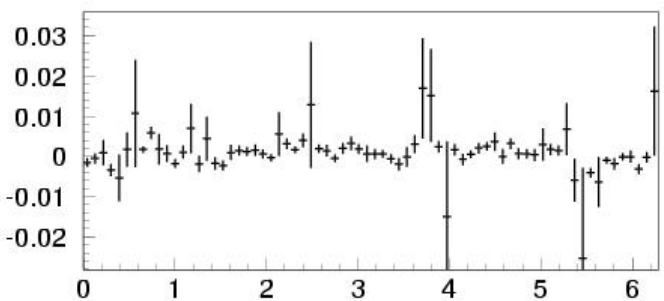
RUN 152520







SVT beam



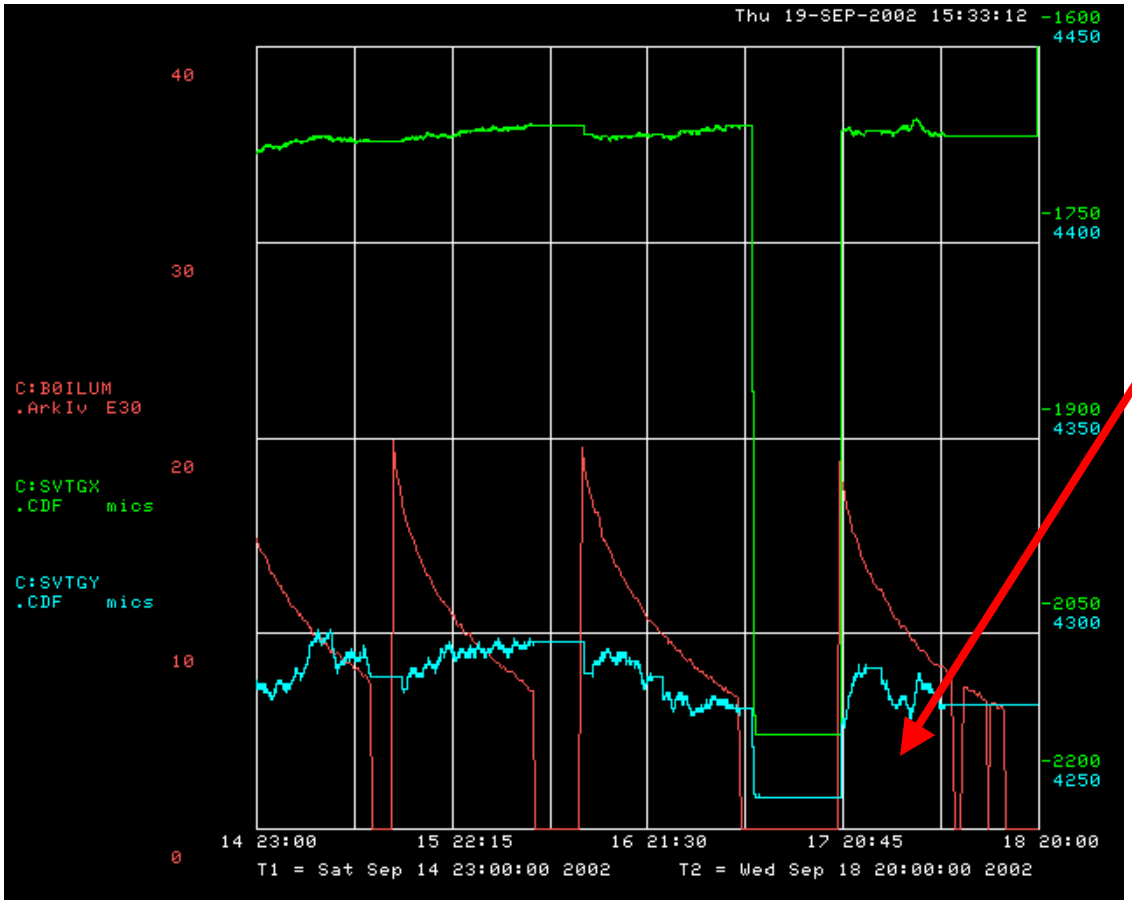
Offline : manual fit to FitBeamModule histogram in cdfprod0 area for v4.8.4a production

Beam Line Fits

	X0 (cm)	Y0 (cm)	dX/dZ ur	dY/dZ ur
152520 (BeamFitModule)	-0.1797	0.4546	533	135
152520 (SVT)	-0.1803	0.4565	530	162
152598 (BeamFitModule)	-0.1823	0.4570	537	178
152598 (SVT)	0.1825	0.4566	548	158
152599 (BeamFitModule)	-0.1820	0.4569	536	175
152599 (SVT)	-0.1821	0.4566	542	157

- Bias of the order or less than 10 microns
- Further investigation in progress

Beam Fitter problem n. 1



Fitter fooled by

replayed fake hits (and tracks)

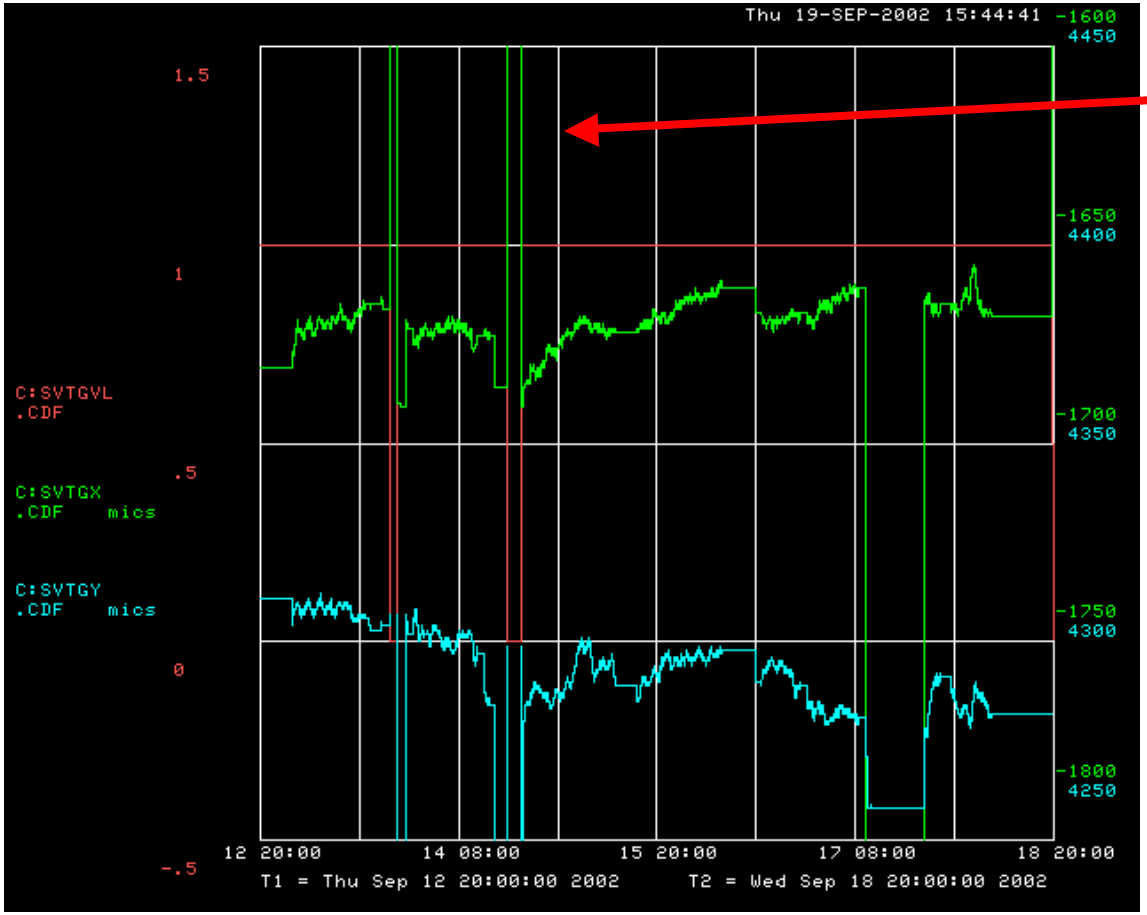
Added a flag to avoid this

B0ILUM

Xbeam

Ybeam

Beam fitter problem n. 2



Beam fitter started from scratch (0,0) when crate reboots

(SVTGVL=0)

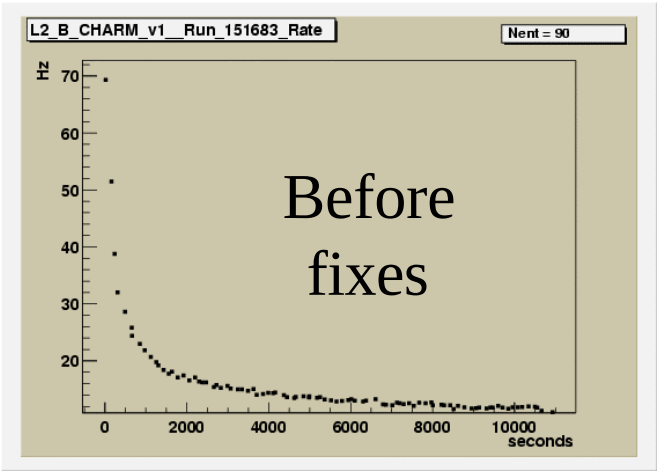
GB memory cleared when crate power cycled

SVTGVL

Xbeam

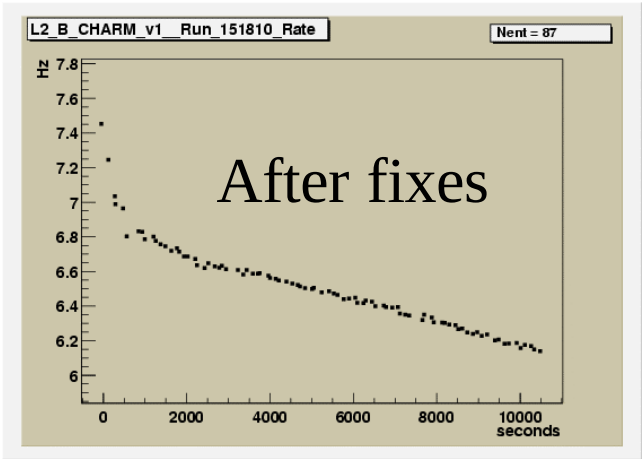
Ybeam

Beam instability versus SVT fitter problems



Start of stores

B_CHARM rate



- Problem 1 and 2 fixed by reloading GhostBuster at each run with whatever last good fit and by avoiding running the fitter on fake data.
- Outstanding problem is to avoid large beam shift at start of store (Tevatron problem)
- Need a way to veto trigger when beam fit is not yet available
- A flag in to an SVT word? (but, how do we account for lost luminosity?)

Effect of I.p. confirmation on SVT triggers

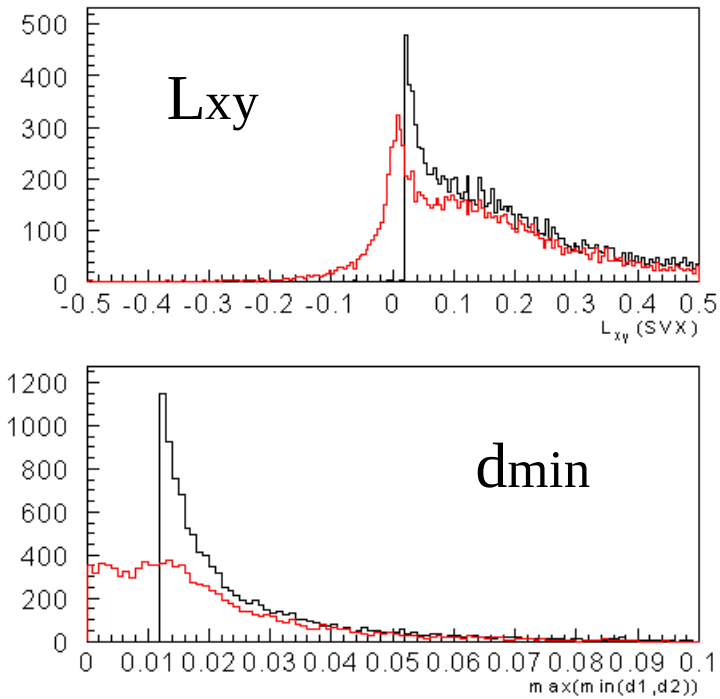
- Most recent data from 4.8.4 processing of stream h: 152520 (as of end of last week).
- SVT constant with odd barrel bug (bias in SVT impact parameter)…
- Compare offline and SVT impact parameter reduction
- Show effect of L3 i.p. confirmation (using SVT beam line)
- Study effect of Long Cluster

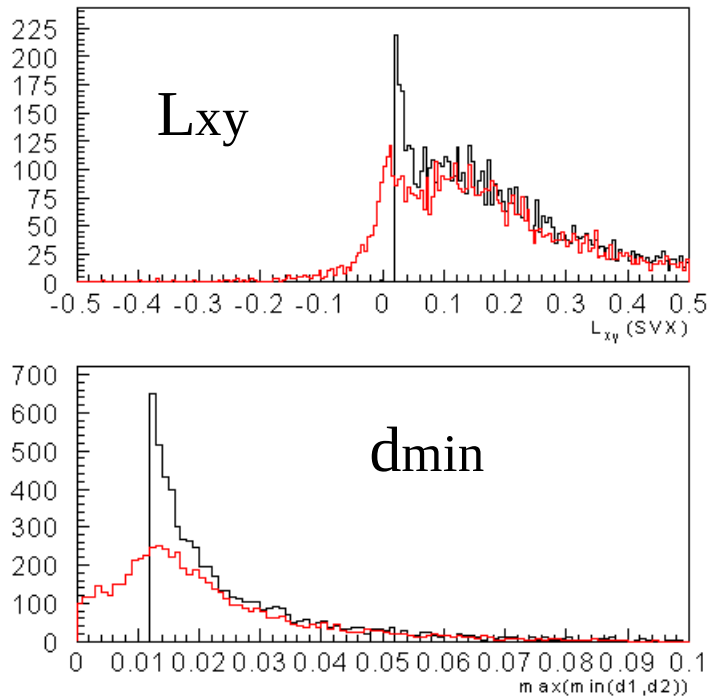
Decay length and min impact parameter for trigger tracks

SVT tracks

SVX tracks

No Long Cluster in Layer 0+1





Rate Reduction @ L3

Run 152520 - L =15-11 E30 – Scenario B (2 miss XFT?)

Long Cluster cut

L2 σ (nb)	410	160 %	215	164 %
L2 Hz@12E30	5.2		2.7	
L3 σ (nb)	251	100 %	131	100 %
L3 events	15669	100 %	8229	100 %
L3 Lxy cut	10030	64 %	5970	73 %
L3 d>60 μm	8003	51 %	5248	64 %
L3 d>120 μm	5968	38 %	4110	50 %

Conclusions

- SVT beam line with latest mapset consistent with offline within 10 micron
- SVT beam fitter reliable and fast
- SVDD records all the information
- L3 rejection potential ~2
- Need to test with latest config (XFT,SVT and offline production)
- Details of L2/SVT important
- Need to be very careful to understand implication of cutting on I.p. @ L3 (alignment, SVDD vs offline beam line, time dependent beam line, sensitivity to oscillations of very low impact parameter)
- L3 Silicon Tracking extremely valuable for monitoring SVT/SVX though!