R.Carosi, Oct. 1, 2002

New SVT Patterns & Constants

Items:

- **New Patterns**
- **New Constants**
- **Effects**
  (first look at SVT special run 152133)
- **Next**

Patterns: what is new

- **New geometry files (*.rgeo)**
  - **alignment version "100030-1-GOOD"**
  - **includes global shift and internal alignment (wedge-wedge alignment)**
  - **it is in the CDF ref. frame**
  - **wide superstrips (as before)**
  - **2345 layer combinations included (2 wedges)**
  - **patterns are centered very close to the real beam position**
    - **better coverage**
  - **random number generator bug fixed**
- **Flat coverage vs d and P_T**

Random number generator

- rand() was used by default
- on SGI it particularly bad, the period is only 32767
- on Linux the period is 2*10**9
- on Linux there is still the “Marsaglia effect” (correlations between consecutive numbers)
- bad random generators: rand, rndm, ...
- good random generators: ranecu, ranmar, ranlux
- because of the rand() problems, in some wedges there are too few patterns (instead of 32k)
- so the coverage is too low and overestimated

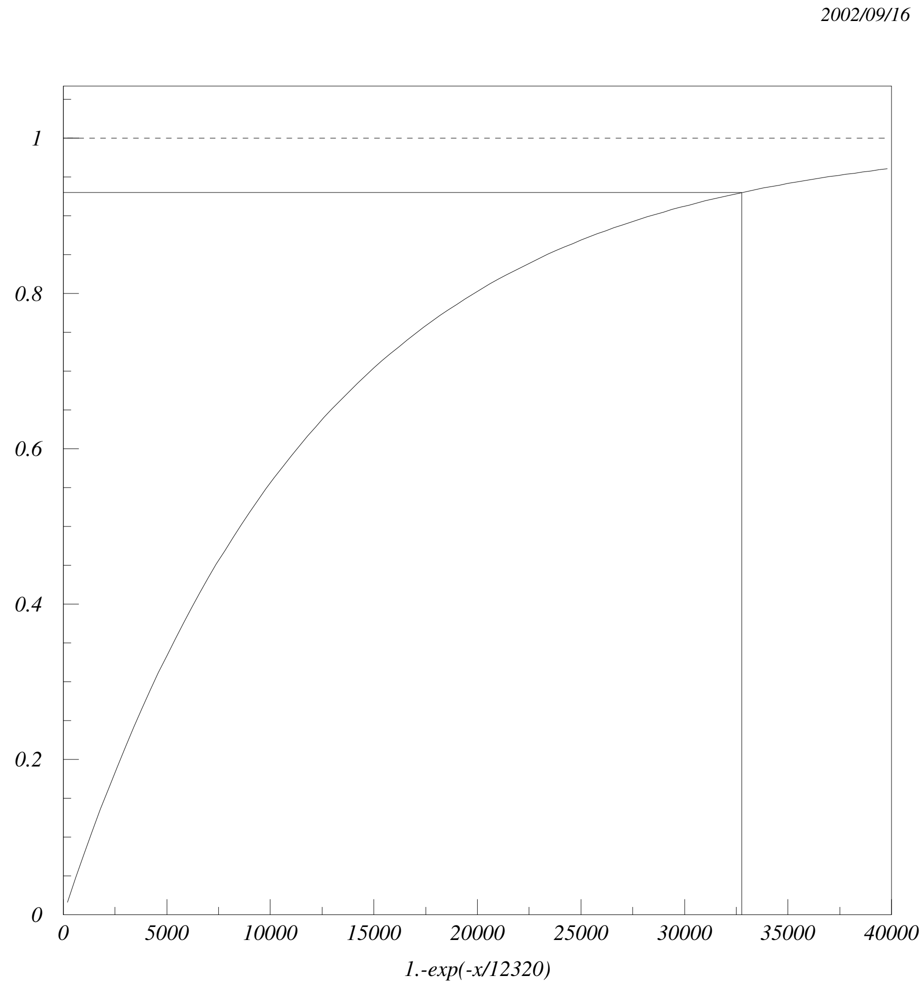

Figure 1: Pattern coverage vs number of patterns

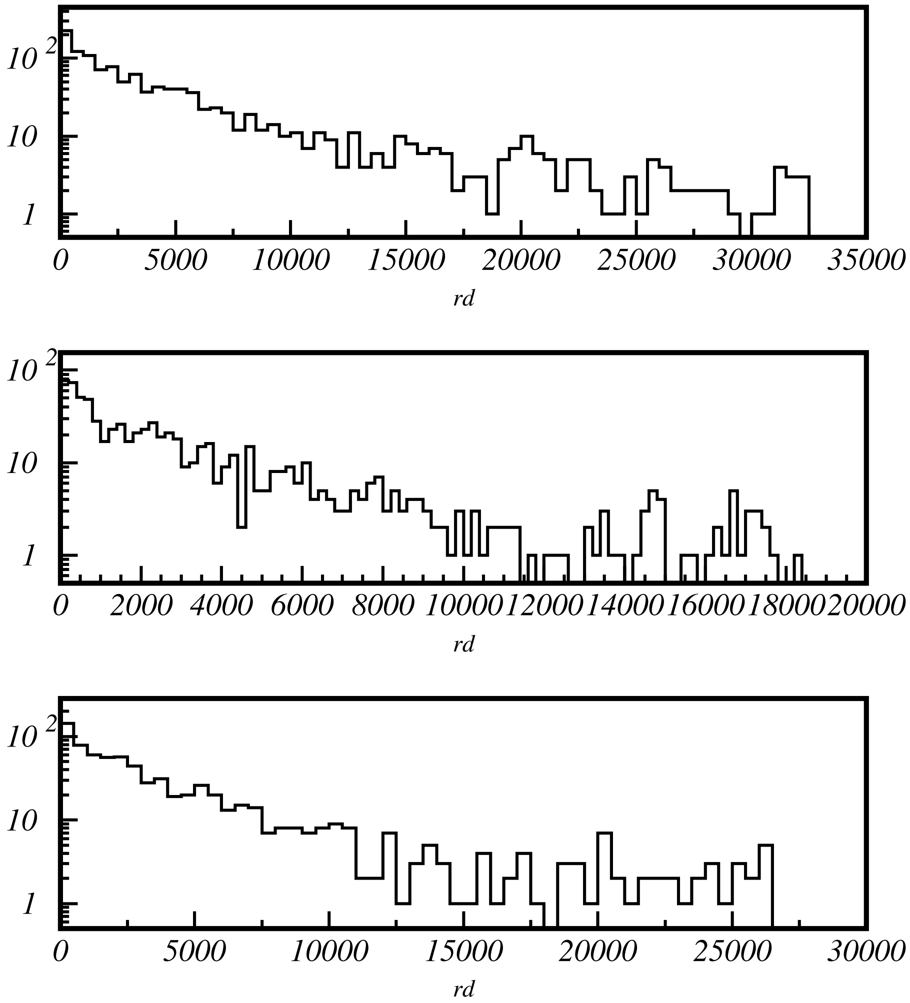

Figure 2: Pattern occupancy in wedges 4,6 and 8 in run 151902

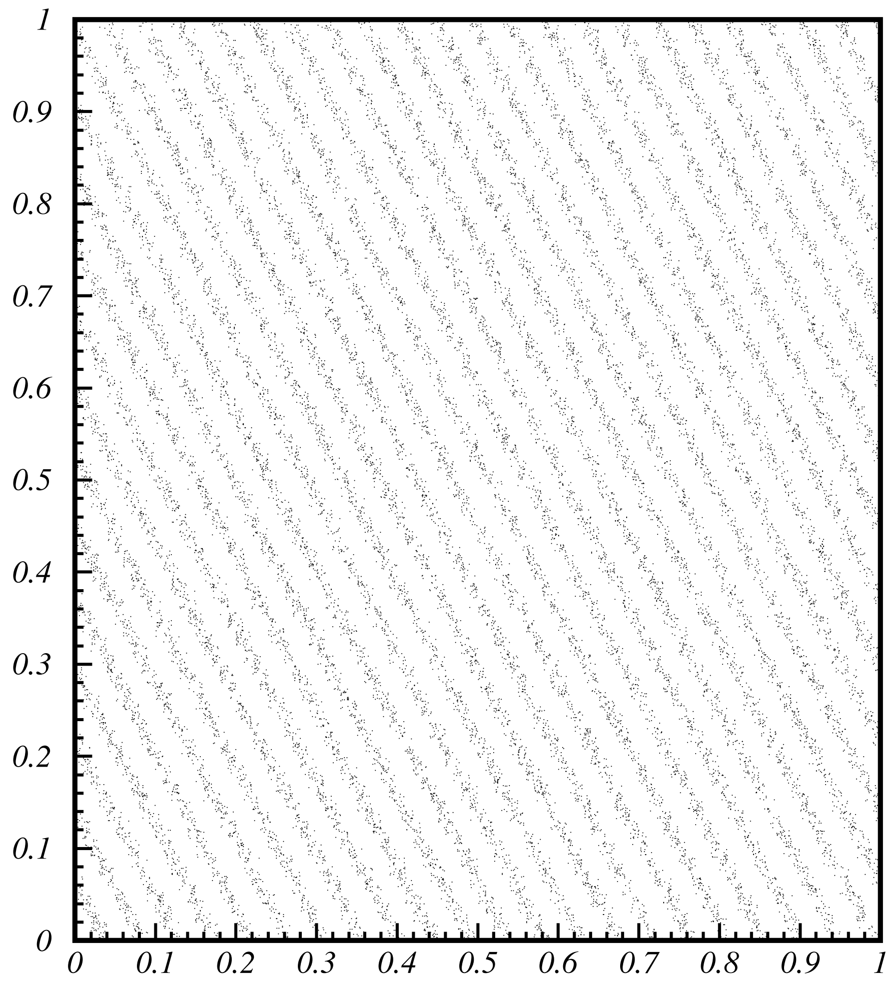

Figure 3: Correlation between consecutive random number, used for P_T and ϕ, when $|\eta| < 0.01$

Effects of the random generator on pattern coverage

Wedge	New coverage	Old cov.	No. patterns	No. wedges affected
1	93%	91%	29k	6
6	93%	78%	18.5k	4
8	93%	89%	27k	4
others	93%	93%	32k	52
Total	93%	92%		66

Fit constants: what is new

- **100030-1-GOOD geometry file, with global shift, internal alignment, CDF ref. frame**
- **correction for the 30 μm bias in i.p.**

  (half strip difference with the offline)
- **2345 layer combinations included**
- **origin close to the real beam position**

  This is more critical than in the pattern generation, because of

  the non-linearity
- **the random number generator bug affects the fit constants (in principle)**

  the effect is not known

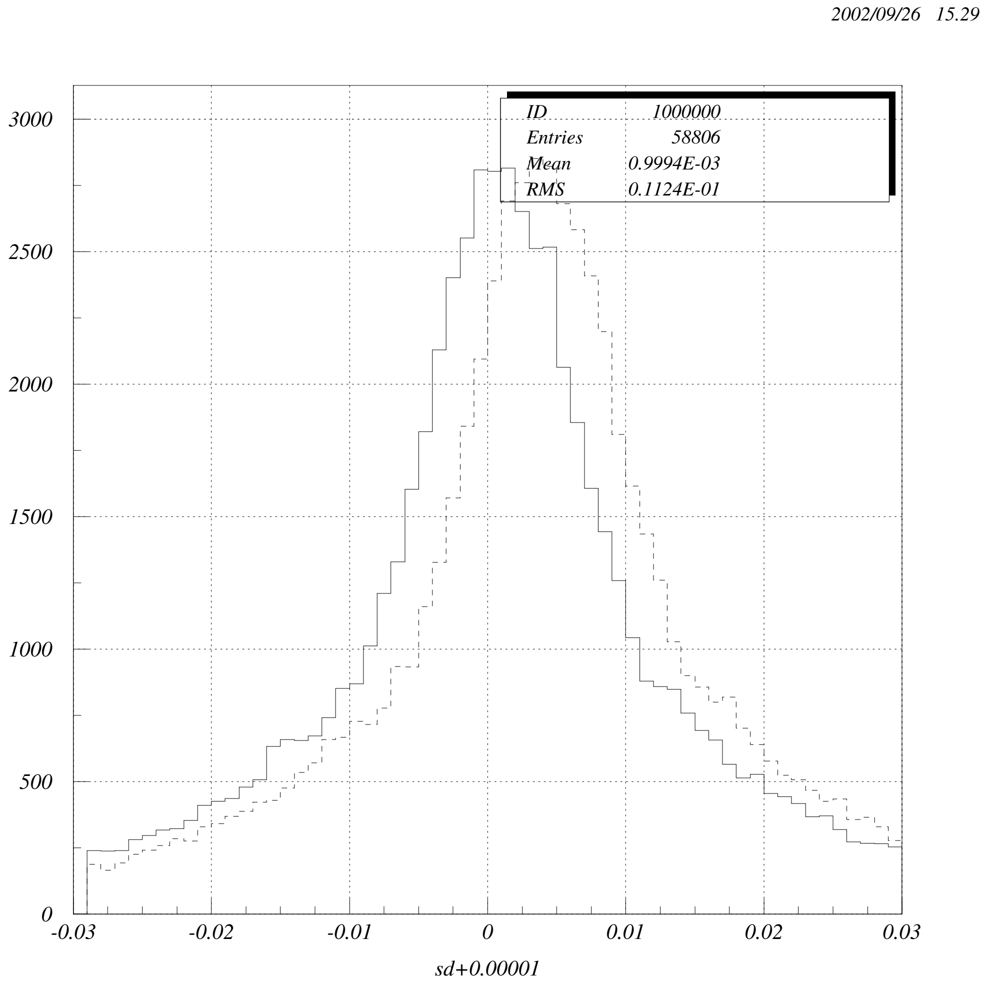

Figure 4: i.p. distribution, for run 151902, when constants are corrected for the bias (solid line) and when they are not (dashed line)

Beam position problem:
where to put the TF reference frame?

- to generate fit constants, we need to know where to put the origin, i.e. the real beam position

  (definition of the TF reference frame)

- the TF ref. frame is arbitrary

  the only requirement is that it must be close to the position of the beam in the transverse plane

  (to minimize non-linearity effects)

- actually it is about 500 um away

- SVT can find the beam, but in a reference system defined by the old constants and the old geometry file

- old constants are in a reference frame defined by the L3 COT tracks, which is different from the CDF ref. frame, because of the L3 bias

- the difference is about 400 um

- **the new geometry files are in the CDF ref. frame**
- **there is no trivial relationship between the L3 and CDF reference frames**

  (it must be measured)

How to put the origin of the TF reference frame in the right place

- take present beam pos., in the L3 COT ref. frame
- use it as the origin of the TF ref. frame for the new constants
- using SVTSIM on real track with the new constants, calculate the beam offset in the TF ref. frame
- use initial beam position + svtsim beam offset as origin of a new TF ref. sys. and generate new constants
- generate new patterns, centered on the beam

How good is the new geometry file?

- check constraints
  - old constraints (old rgeo)
  - new constraints (new rgeo)
  - aligned constraints
    (PCA, diagonalize covariance matrix, see e.g. cdf note 5511)
    (parameters are not affected, χ^2 only)
- if alignment is good, constraint distributions should be centered at 0 and should be narrow (with a possible background)
- χ^2 can also give useful info

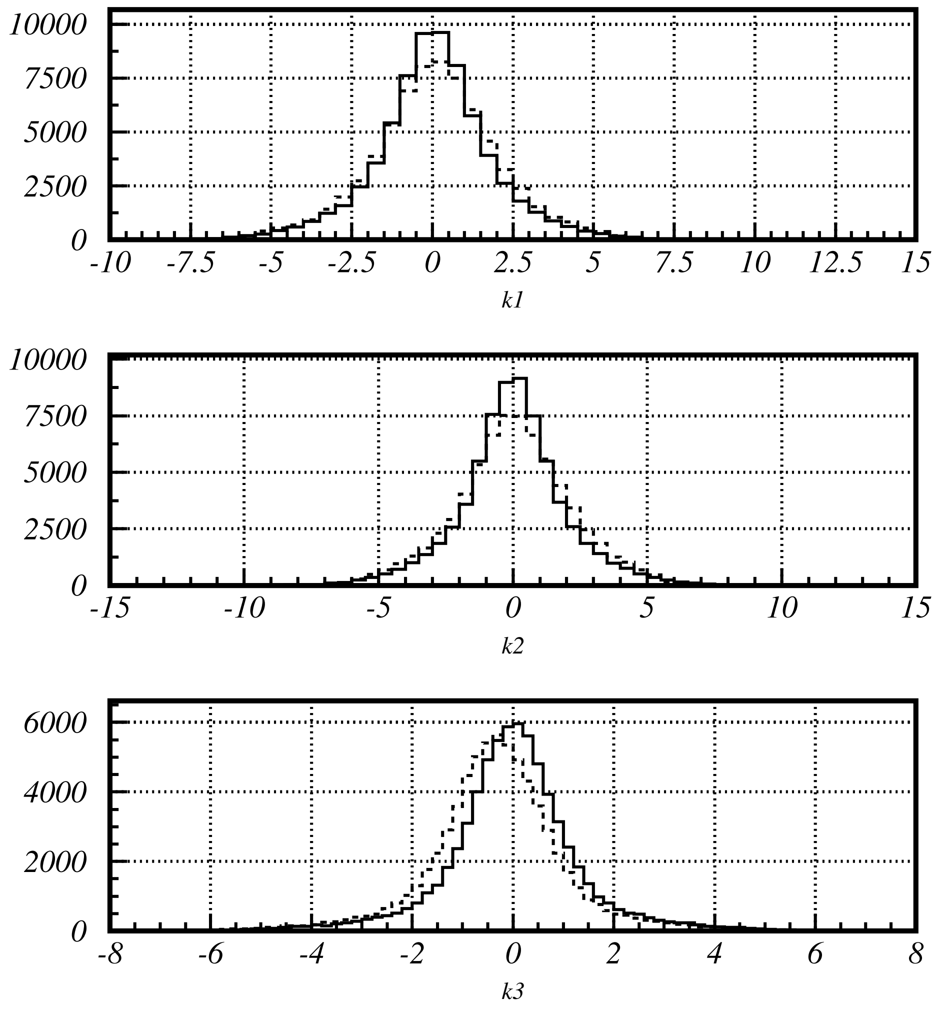

Figure 5: Constraint distributions, using new constants (solid line) and old constants (dashed line), for run 151902

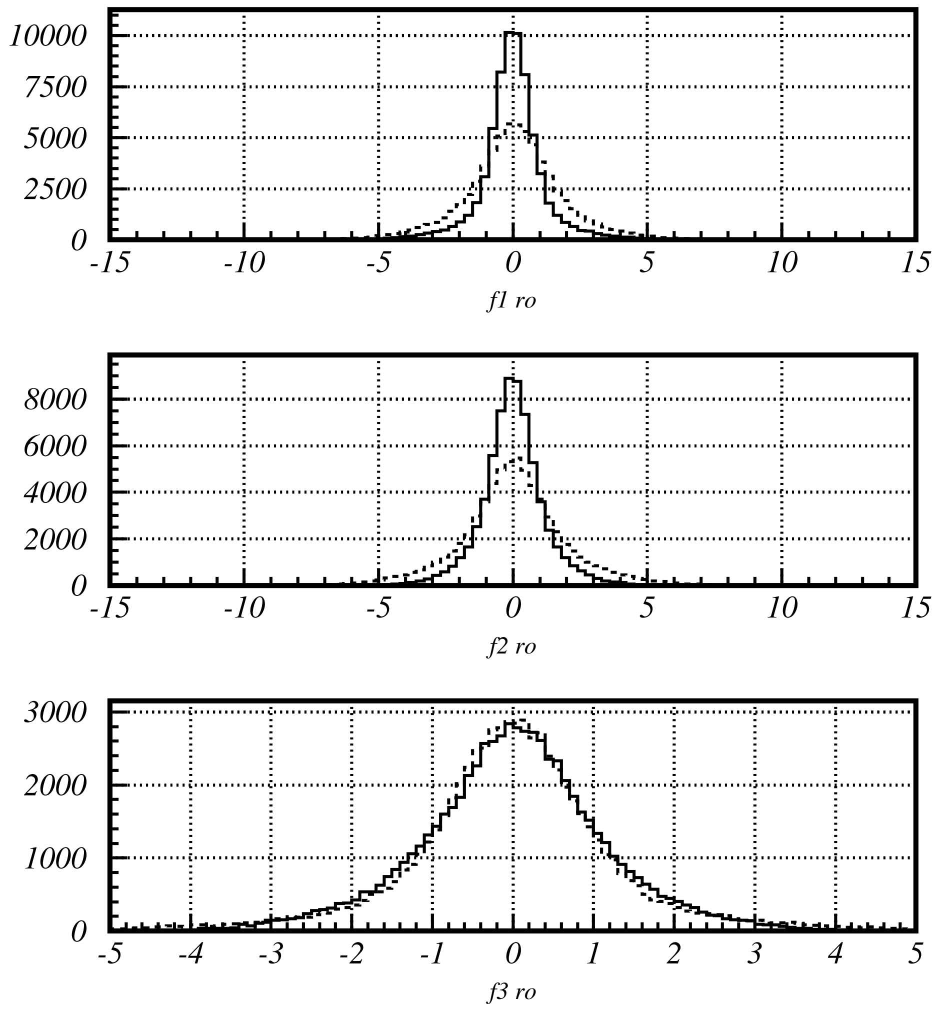

Figure 6: Constraint distributions, using aligned contants (solid line) and new constants (dashed line)

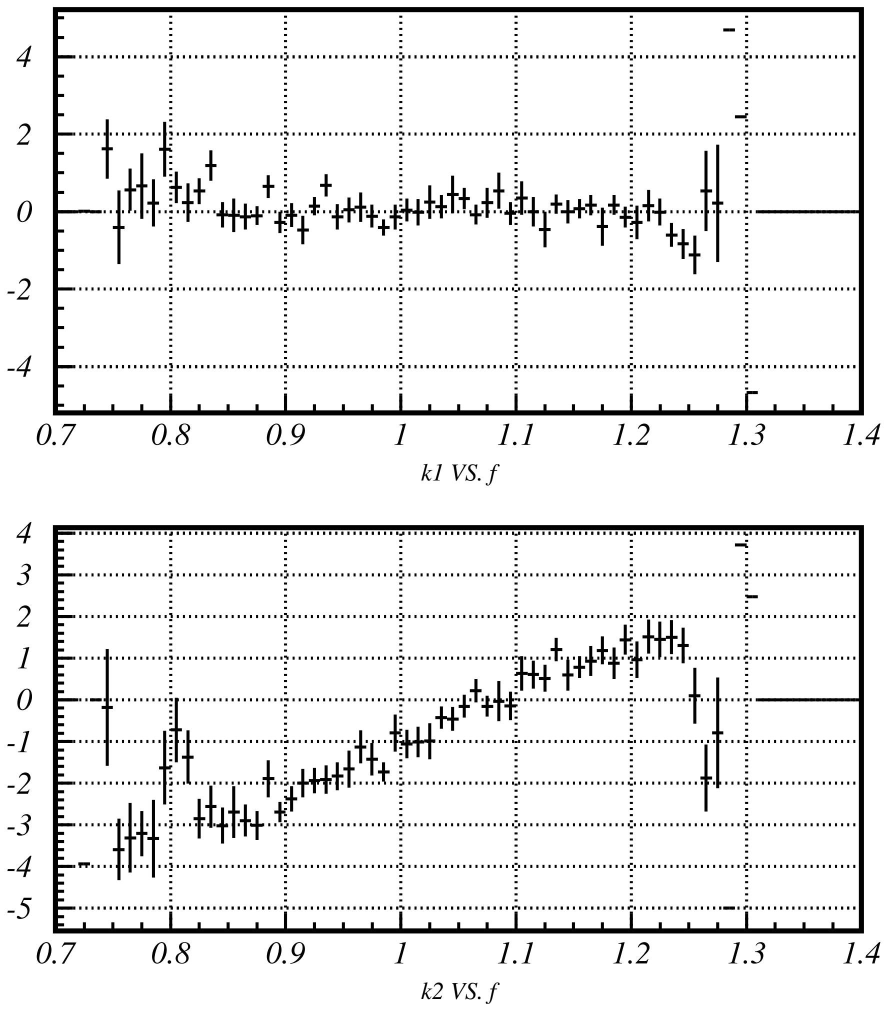

Figure 7: Second constraint (k_2) vs ϕ, for wedge 2, barrel 3, run 151902: new constants (top) and old constants (bottom)

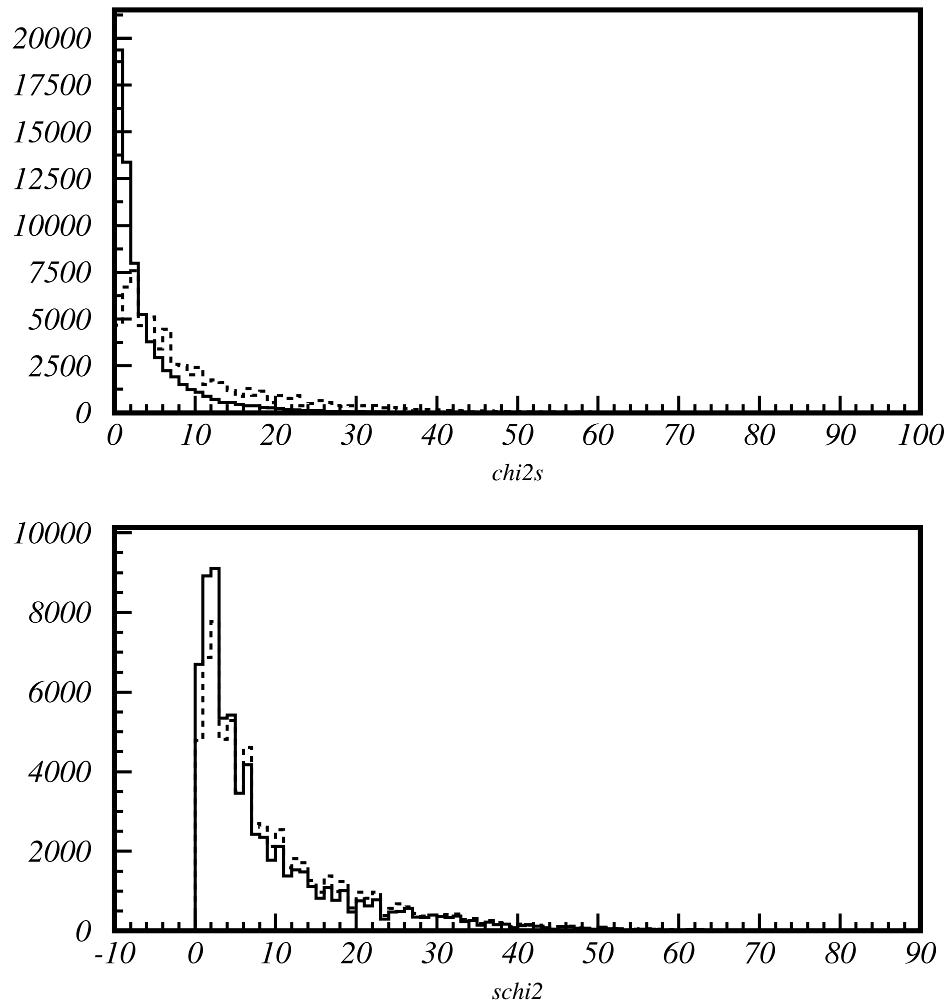

Figure 8: χ^2 distributions: top: new constants (solid line) and old constants (dashed line); bottom: aligned constants (solid line) and new constants (dashed line)

Effects

- **fitted beam position is in the CDF ref. frame**
- **non linearity is close to 0**
  - **i.p. resolution is better**
- **i.p. distribution width (all wedges, all barrels):**
  - **run 152133: 52 um**
  - **run 149484: 56 um**
- **i.p. distribution tails (over 100 um)**
  - **run 152133: 9.3%**
  - **run 149484: 13%**
- **how do the wedges with missing layers 0 perform?**
  - **B2W4 (0123): $\sigma = 53$ um, tail 10%**
  - **B1W3 (1234): $\sigma = 57$ um, tail 17%**
- χ^2 **is better**
- **efficiency is higher (hopefully)**

- **wedge-wedge alignment correction smaller**
  (already in rgeo)
  (still to prove)

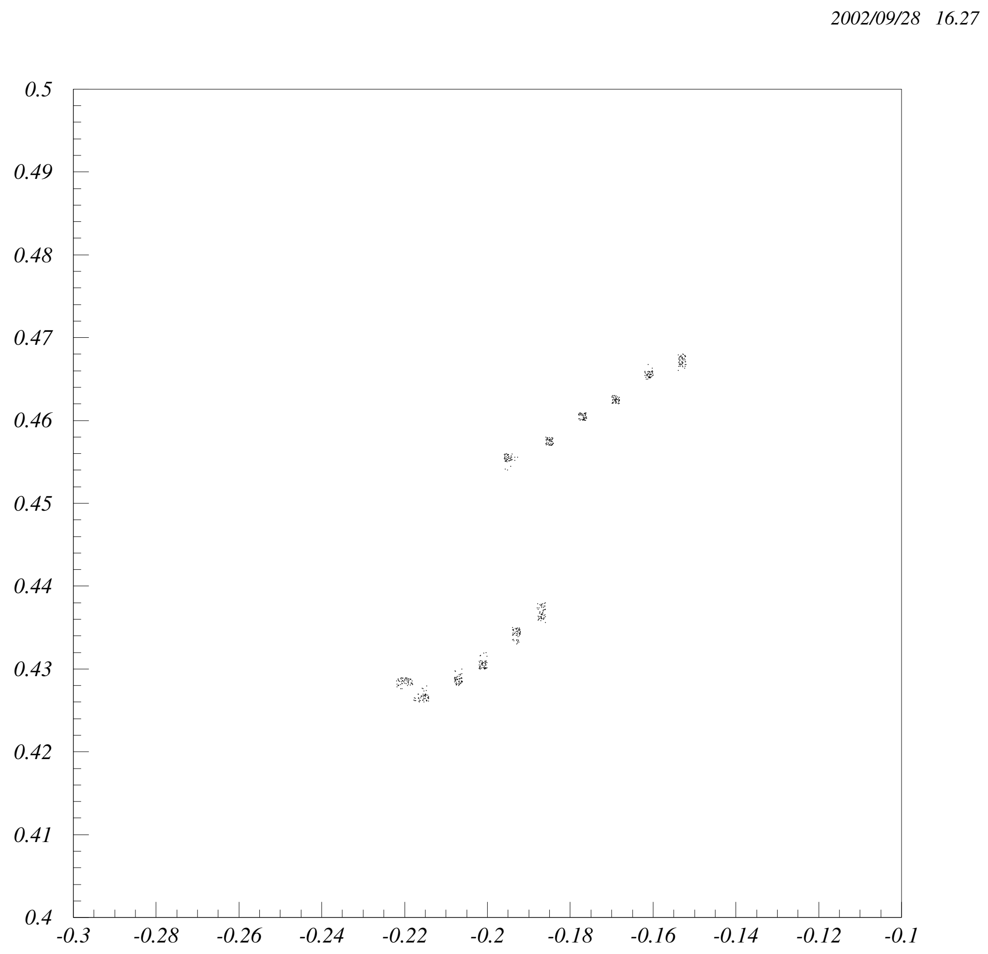

Figure 9: beam position in the transverse plane (y vs x), in the 6 barrels for runs 152133 and 149484

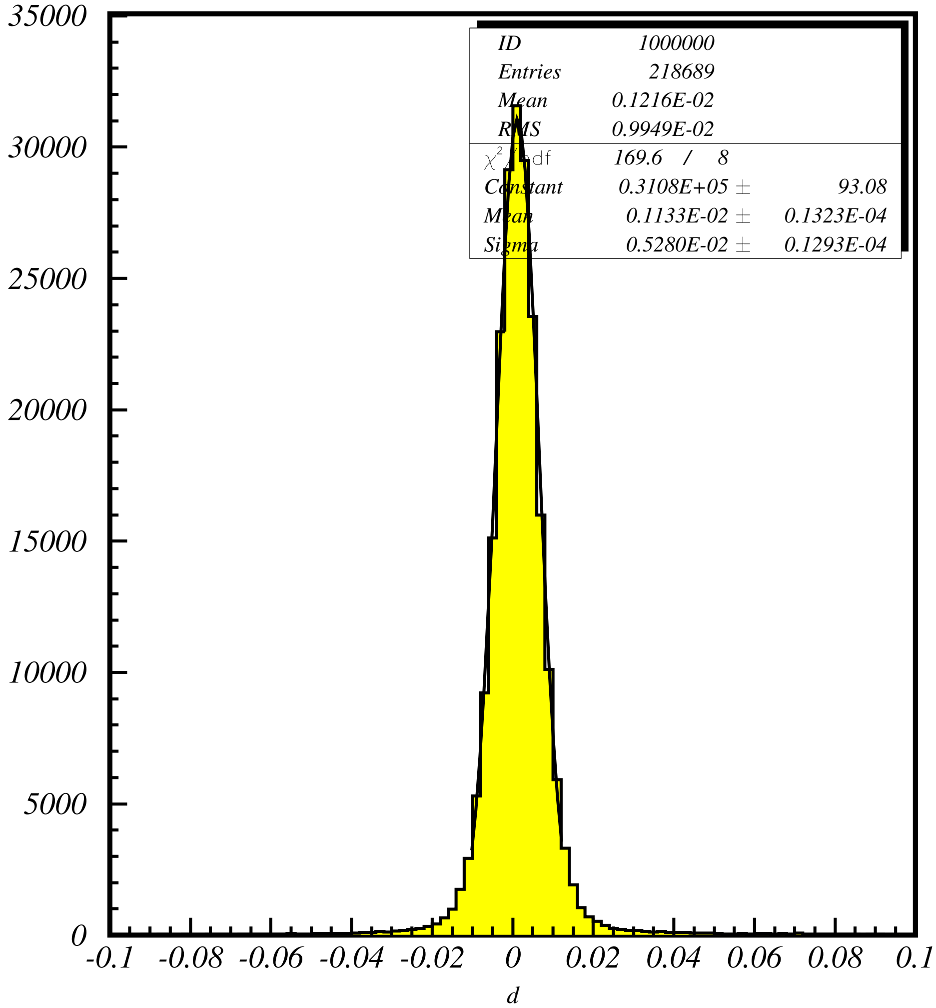

Figure 10: i.p. distribution, run 152133, for all the wedges and all the barrels

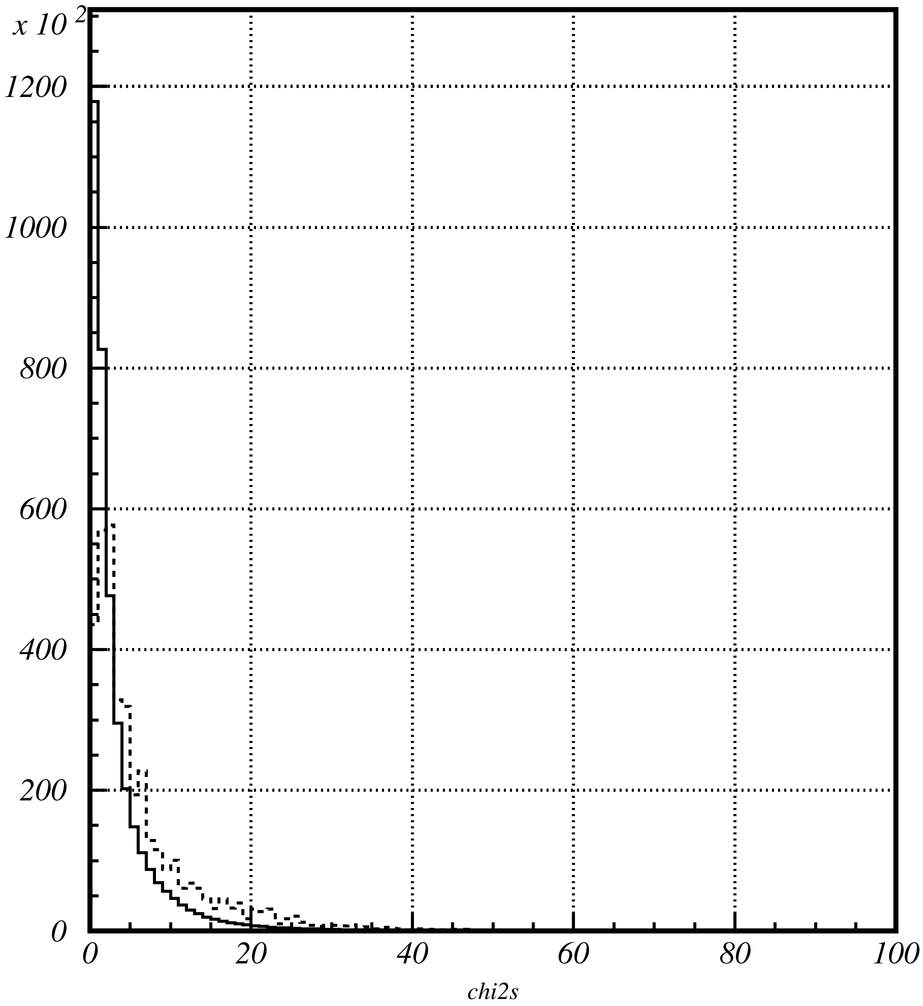

Figure 11: χ^2 distributions for run 152133 (solid line) and run 149484 (dashed line)

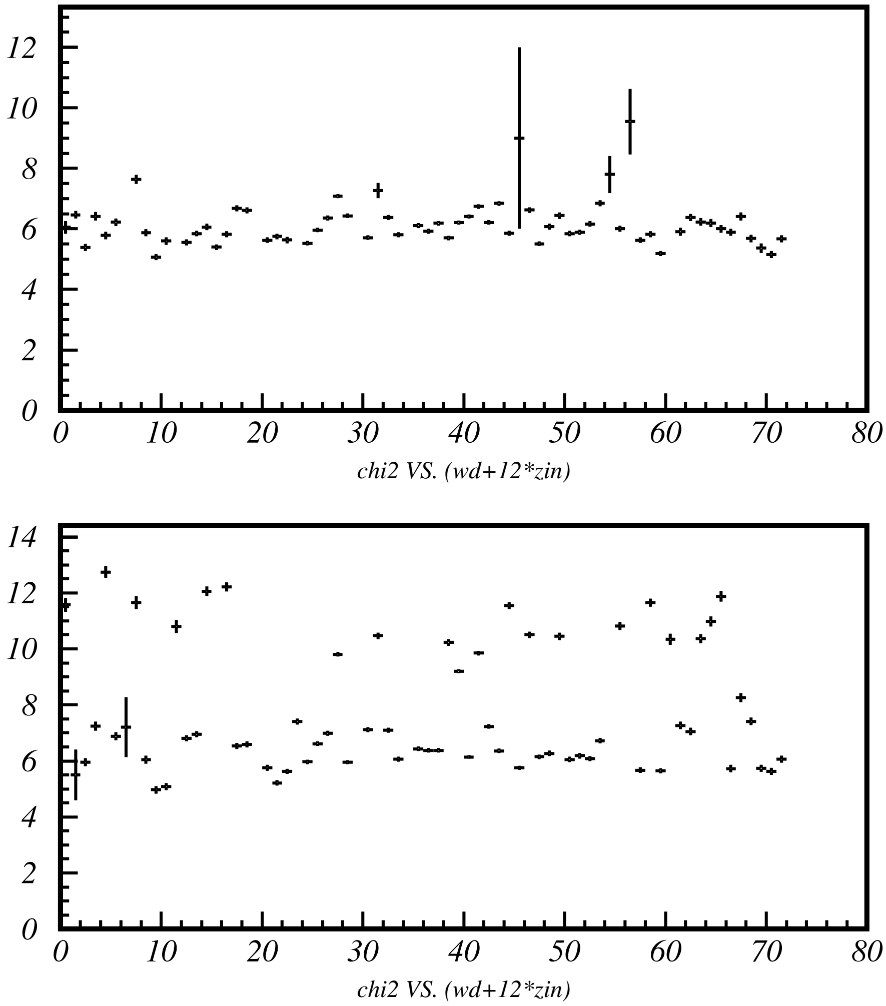

Figure 12: Average χ^2 vs sector number, for run 152133 (top) and run 149484 (bottom)

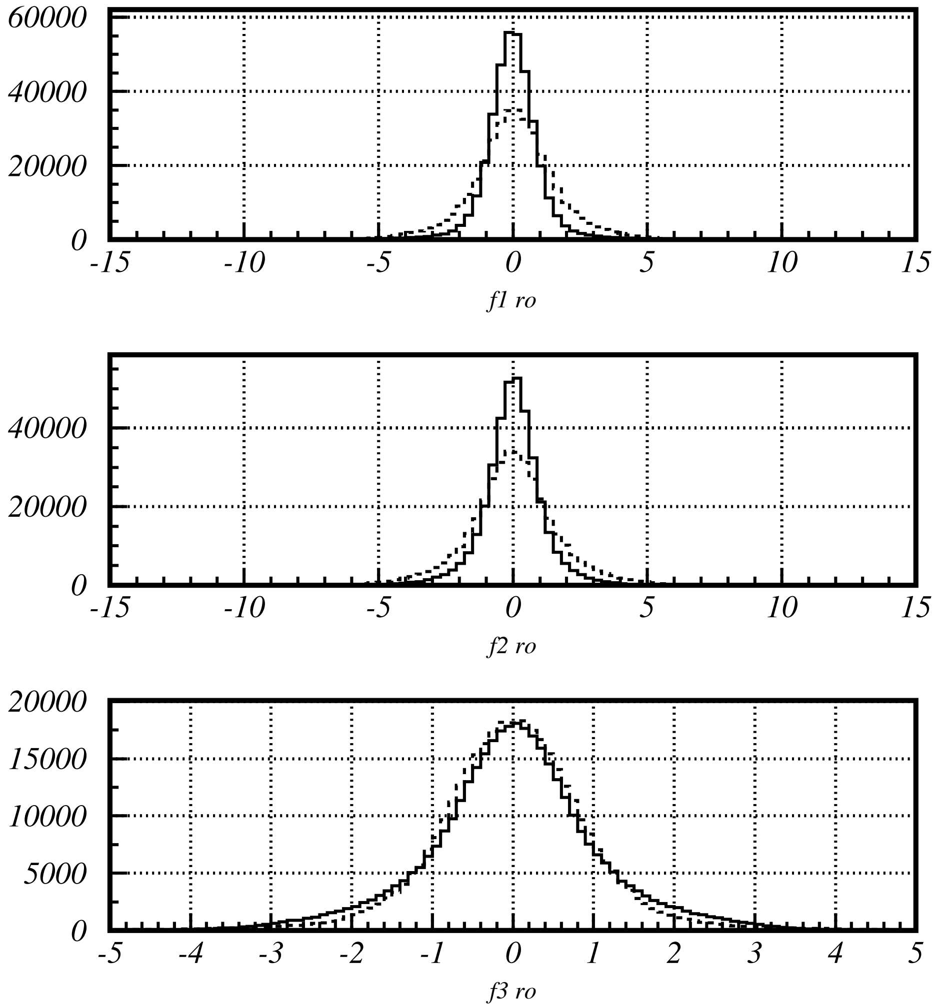

Figure 13: Constraint distributions for run 152133 (solid lines) and run 149484 (dashed lines)

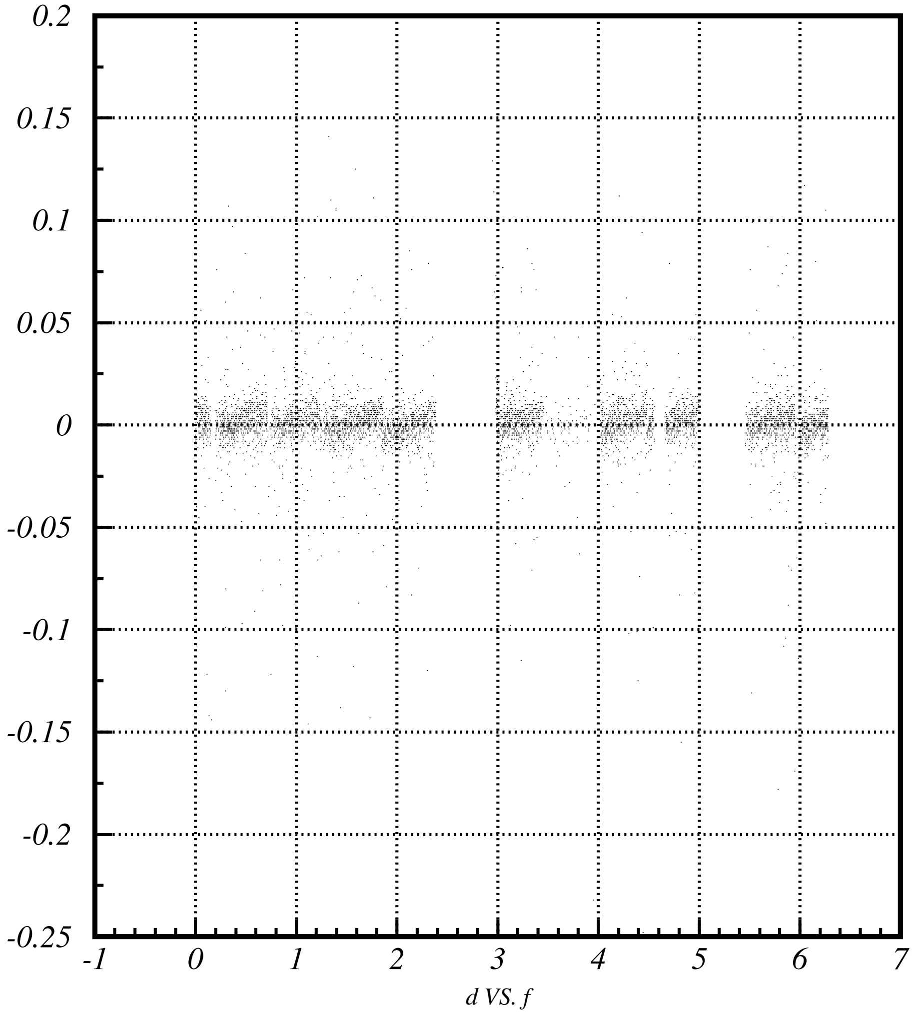

Figure 14: **d** vs ϕ, run 152133, barrel 3

SVT wedges efficiency

2002/09/28 12.04

6.0214

	0	1	2	3	4	5
11	2/272 0.01+/-0.01	5/411 0.01+/-0.01	543/666 0.82+/-0.05	466/719 0.65+/-0.04	354/450 0.79+/-0.06	199/251 0.79+/-0.08
10	221/289 0.76+/-0.07	333/414 0.8+/-0.06	10/666 0.02+/-0	566/710 0.8+/-0.04	324/477 0.68+/-0.05	209/268 0.78+/-0.07
9	193/237 0.81+/-0.08	323/400 0.81+/-0.06	401/697 0.58+/-0.04	8/725 0.01+/-0	381/470 0.81+/-0.06	112/264 0.42+/-0.05
8	191/259 0.74+/-0.07	333/416 0.8+/-0.06	479/609 0.79+/-0.05	537/716 0.75+/-0.04	6/486 0.01+/-0.01	200/268 0.75+/-0.07
7	185/244 0.76+/-0.07	1/414 0+/-0	116/626 0.19+/-0.02	487/637 0.76+/-0.05	326/419 0.78+/-0.06	161/242 0.67+/-0.07
6	10/277 0.04+/-0.01	317/421 0.75+/-0.06	514/644 0.8+/-0.05	536/693 0.77+/-0.04	8/450 0.02+/-0.01	220/281 0.78+/-0.07
5	187/244 0.77+/-0.07	363/462 0.79+/-0.06	11/703 0.02+/-0	600/759 0.79+/-0.04	393/492 0.8+/-0.05	194/283 0.69+/-0.06
4	192/265 0.72+/-0.07	336/466 0.72+/-0.05	604/762 0.79+/-0.04	580/733 0.79+/-0.04	395/506 0.78+/-0.05	247/336 0.74+/-0.06
3	153/263 0.58+/-0.06	304/459 0.66+/-0.05	552/690 0.8+/-0.05	587/722 0.81+/-0.05	437/534 0.82+/-0.05	243/314 0.77+/-0.07
2	223/288 0.77+/-0.07	302/407 0.74+/-0.06	558/694 0.8+/-0.05	474/684 0.69+/-0.04	367/476 0.77+/-0.05	230/293 0.78+/-0.07
1	173/237 0.73+/-0.07	285/372 0.77+/-0.06	523/664 0.79+/-0.05	544/683 0.8+/-0.05	317/434 0.73+/-0.05	224/292 0.77+/-0.07
0	66/204 0.32+/-0.05	237/344 0.69+/-0.06	342/478 0.72+/-0.05	303/462 0.66+/-0.05	256/352 0.73+/-0.06	3/192 0.02+/-0.01

-0.2618

-46.095 46.095

Figure 15: Vladimir efficiency, run 152133

SVT wedges efficiency 2002/08/08 18.56

6.0214

	0	1	2	3	4	5
11	187/265 0.71+/−0.07	436/569 0.77+/−0.05	679/818 0.83+/−0.04	652/852 0.77+/−0.04	461/592 0.78+/−0.05	273/366 0.75+/−0.06
10	209/275 0.76+/−0.07	424/529 0.8+/−0.05	9/810 0.01+/−0	671/857 0.78+/−0.04	430/611 0.7+/−0.04	231/318 0.73+/−0.06
9	216/271 0.8+/−0.07	423/510 0.83+/−0.05	484/824 0.59+/−0.03	680/870 0.78+/−0.04	462/580 0.8+/−0.05	222/286 0.78+/−0.07
8	198/242 0.82+/−0.08	369/477 0.77+/−0.05	606/800 0.76+/−0.04	606/803 0.75+/−0.04	5/646 0.01+/−0	228/303 0.75+/−0.07
7	215/295 0.73+/−0.07	4/507 0.01+/−0	547/757 0.72+/−0.04	662/839 0.79+/−0.04	421/553 0.76+/−0.05	228/340 0.67+/−0.06
6	2/290 0.01+/−0	414/568 0.73+/−0.05	665/844 0.79+/−0.04	685/874 0.78+/−0.04	5/555 0.01+/−0	207/295 0.7+/−0.06
5	222/292 0.76+/−0.07	424/543 0.78+/−0.05	6/852 0.01+/−0	723/917 0.79+/−0.04	468/608 0.77+/−0.05	274/375 0.73+/−0.06
4	200/279 0.72+/−0.07	396/579 0.68+/−0.04	746/915 0.82+/−0.04	785/999 0.79+/−0.04	495/631 0.78+/−0.05	258/356 0.72+/−0.06
3	167/270 0.62+/−0.06	18/560 0.03+/−0.01	683/867 0.79+/−0.04	735/948 0.78+/−0.04	498/627 0.79+/−0.05	247/369 0.67+/−0.06
2	219/279 0.78+/−0.07	356/542 0.66+/−0.04	604/760 0.79+/−0.04	643/904 0.71+/−0.04	467/613 0.76+/−0.05	278/367 0.76+/−0.06
1	3/238 0.01+/−0.01	387/493 0.78+/−0.05	644/804 0.8+/−0.04	721/885 0.81+/−0.04	411/579 0.71+/−0.05	273/381 0.72+/−0.06
0	122/214 0.57+/−0.06	277/379 0.73+/−0.06	454/638 0.71+/−0.04	483/639 0.76+/−0.05	316/455 0.69+/−0.05	158/252 0.63+/−0.06

-0.2618

-46.095 46.095

Figure 16: Vladimir efficiency, run 149484

Conclusions

- **new patterns/constants are much better than the old ones**
  - **bug fixed**
  - **better geometry**
  - **better correction for non linearity**
- **internal alignment is not perfect**
  - **radial shift of the wedges?**
  - **aligned constraints look better**
- **the CDF ref. frame is used instead of the L3 COT.**
- **if we want to go back to the L3 COT ref. frame, there are two additional steps:**
  - **find the relationship between CDF and L3**
  - **convert the fcon**

  this has been done with the previous "global shift" geometry file

Proposal

- **use new patterns/constants as default in SVT as soon as possible**
  - **big improvement**
  - **bug fixed**
  - **for the first time they have been tested *before* going into the DB**
- **ref. frame has changed, so there is a jump in the beam position vs time (it happened already in march)**
- **this is not important beacause it is an "internal" svt ref. frame**
- **shall we use the PCA aligned constants for the constraints and chi-square?**
  - **wait: the improvement is small**
  - **check that does not create a bias on the parameters**