

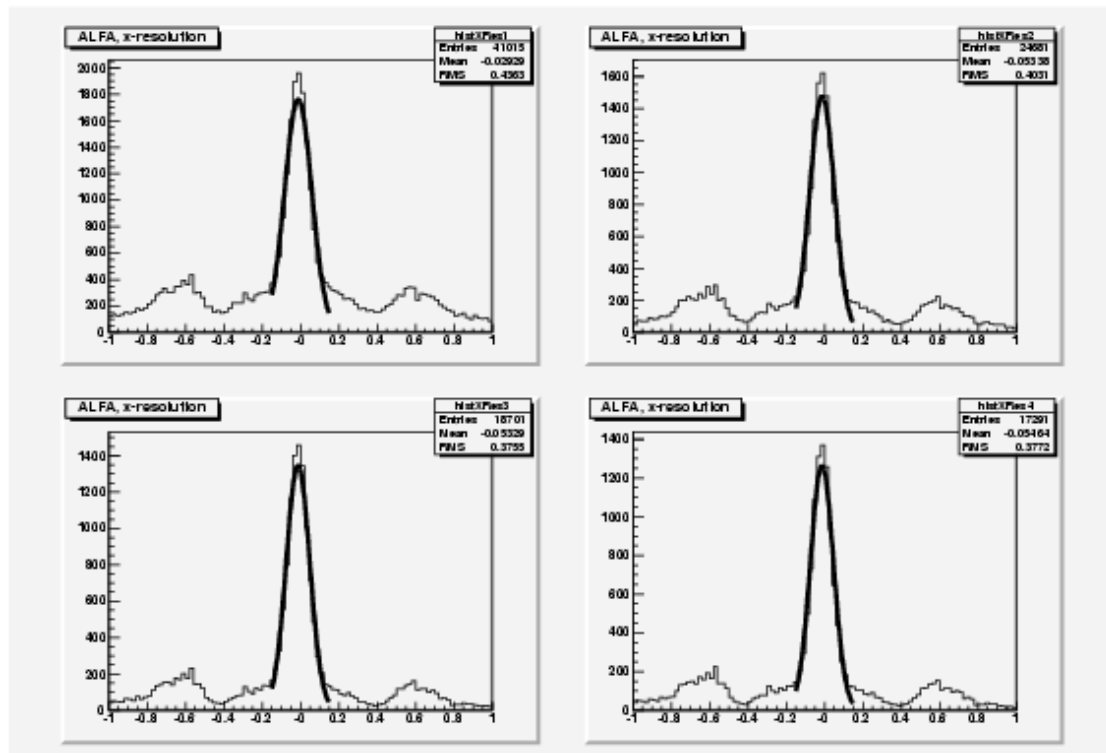
Table of Contents

ALFA (HALF-HALF) RESOLUTION STUDY.....	1
BRUTE FORCE == Care about efficiency later! (2 Feb 2007).....	1
The Ideal MC Simulation (6 Feb 2007, update 28 Feb).....	3
Thoughts on Efficiency (6 Feb 2007, update 28 Feb).....	3
Full vs Half detector resolution discussion (15 Feb 2007, update 28 Feb).....	4
Angle Scan.....	5
Edge Region.....	5
HV Scan.....	6
Error from fit range.....	7
Note Draft.....	7

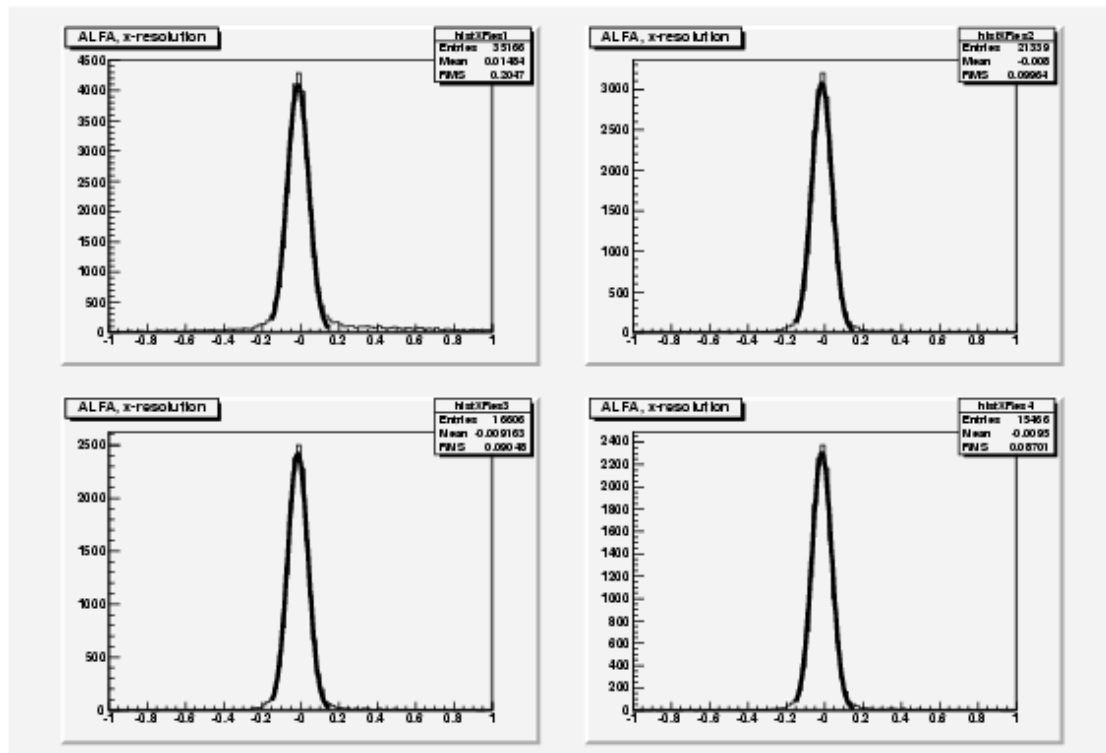
ALFA (HALF-HALF) RESOLUTION STUDY

BRUTE FORCE == Care about efficiency later! (2 Feb 2007)

- Run 10638 used (HV = 950V)
- Total number of events 200k
- All results obtained from:
 - Residual of two tracks reconstructed by one half of alfa each
- Plane selection:
 - Staggering value from note (ATL-LUM-PUB-2006-007) / 0.707:
[0.4, 0.8, 0.2, 0.6, 0.0, 0.9, 0.3, 0.7, 0.1, 0.5]
 - > The "naively chosen" two sets, 1-5 / 6-10, looks optimal
- Selection criteria:
 - S1: Each event must have one U and one V fiber hit in both ALFA halves
 - S2: Events selected only within 2mm from the middle of ALFA (i.e. good central region)
 - S3: Events selected only if total number of hits equal 16 to 22.
 - S4: Events selected only if the number of layers with more than 1 hit are less than 3
- Case I (only X-coordinate. Y is consistent)
- One candidate hit per layer selected. The first hit found in a layer selected, starting from the first fiber (i.e. What was used online == BAD algo.!)
- Reconstruct track using Over Lap algorithm
- S1 & S2: Accepted Events = 41015, Sigma = 72um
- S1&S2&S3: AE = 24681, Sigma = 64um
- S1&S2&S4 AE = 18701, Sigma = 62 um
- S1&S2&S3&S4 AE = 17291, Sigma = 60um
- Fit range, -0.15 to 0.15, used allways
- Clearly (seen in plot, where the number of entries show the selection criteria wrt above) the fit range is not optimal...
- Compatible (according to my memory) with what we saw online during testbeam, i.e. 58-56 after fiddeling with the fit range and strong similar cuts.



- Case IV (IV is for private log book reasons)
- One candidate hit per layer selected by the closest one wrt a seed track obtained by Hough Transform method
(presented briefly in talk 6, meeting <http://indico.cern.ch/conferenceDisplay.py?confId=a06490>)
- Reconstruct track using Over Lap algorithm
- S1: Accepted Events = 115797
- S1 & S2: Accepted Events = 35166, Sigma = 56um
- S1&S2&S3: AE = 21339, Sigma = 53um
- S1&S2&S4 AE = 16606, Sigma = 53 um
- S1&S2&S3&S4 AE = 15466, Sigma = 52um
- Fit range, -0.15 to 0.15, used allways
- QUITE A LOT BETTER!



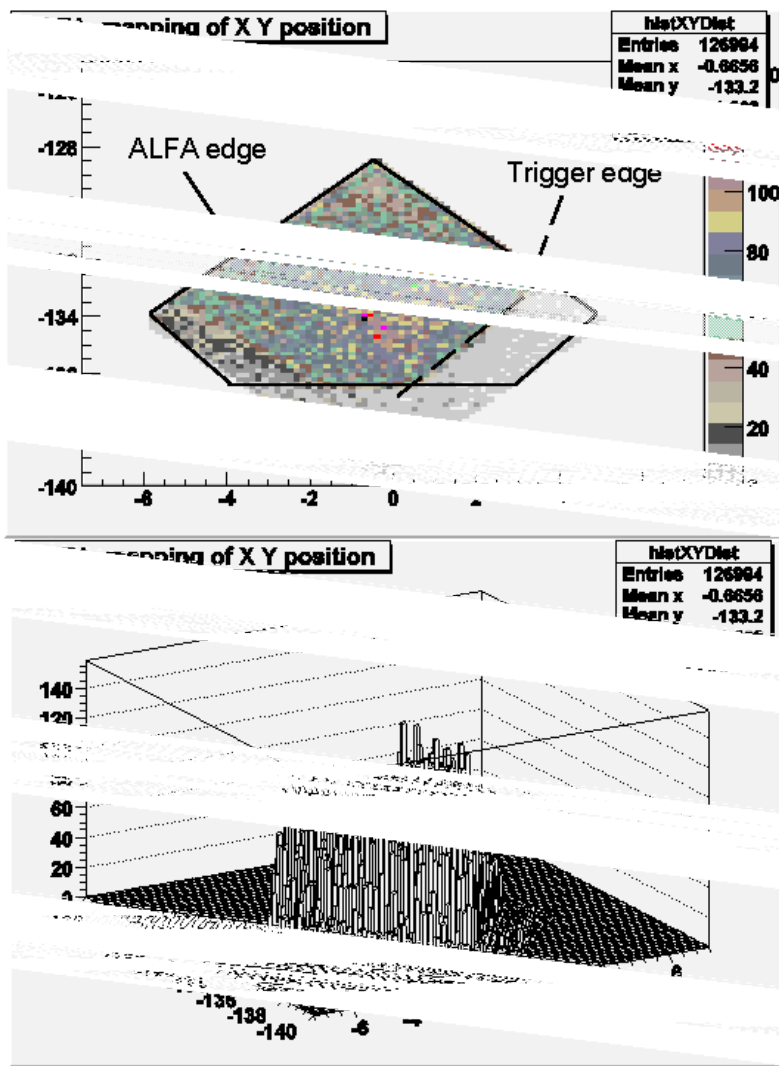
- Case XXX (Futuer)
- 3D Reconstruction and angular cuts.....

The Ideal MC Simulation (6 Feb 2007, update 28 Feb)

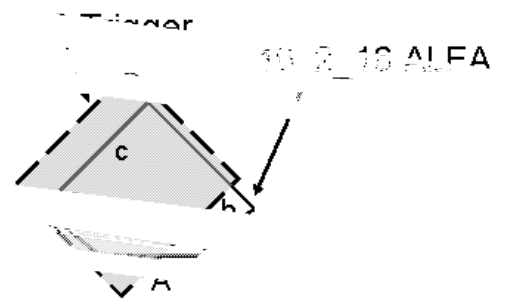
- The old (online) and new reconstruction give the same results for the fibersim (Christian) MC, ie makes sense since the MC only contain real hits.
- Full MC detector resolution = 20um, Half-half resolution = 44um

Thoughts on Efficiency (6 Feb 2007, update 28 Feb)

- **OBS: Trigger is 10x10mm² !**
- It seems like the assumption that the beam is uniformly distributed over the trigger surface is NOT valid, i.e. no conclusion about the absolute reconstruction efficiency can be made.
- To have the "chambers" (in the data) might be a good idea for a next TB to monitor the beam location and size.
- The plots below are obtained by the online reco. alg. using all 20 layers.
- **OLD (WRONG) ARGUMENTS FOR THE EFFICIENCY:**
- Assuming that the trigger, defined by S88, is 100% efficient and that the beam is uniform over the 8x8mm trigger surface, the reconstruction efficiency should be approximately, $eff \sim (N_{evt_spot} / N_{evt_triggered}) / (\pi * 2 * 2 / 8x8)$
- Errors are of course pretty unknown !!
- It should of course be reconstruction efficiency below and not trigger efficiency !!



My interpretation:



Noise hit a + b → A ("reco track")

2mm Spot → B ("reco track")

"Efficiency":

	Area	Events
• Visible ALFA:	13mm ²	41k (20%)
• 2mm Spot:	13mm ²	41k (20%)
		Online Reco
		New Reco
13/64 = 20%		
41/200 = 21%		
35/200 = 18%		
		18/20 = 90%

Trigger Efficiency ~ 0(90%)

Full vs Half detector resolution discussion (15 Feb 2007, update 28 Feb)

- **Full detector:**

- Theoretical sigma = $500/(10*\sqrt{12}) = 14.4\mu\text{m}$ (best possible!)
- Sigma MC = 20um

- MC = $\sqrt{14.4**2 + X**2} = 20 \rightarrow X=14\mu\text{m}$

A 14um contribution to the resolution was estimated from geometrical imperfections in the metrology note.

Constant error (perhaps also from cladding... (?)) which only becomes significant at maximum ALFA performance...

Beyond X, comes contribution from cladding, noise, alignment....

- **Half detector:**

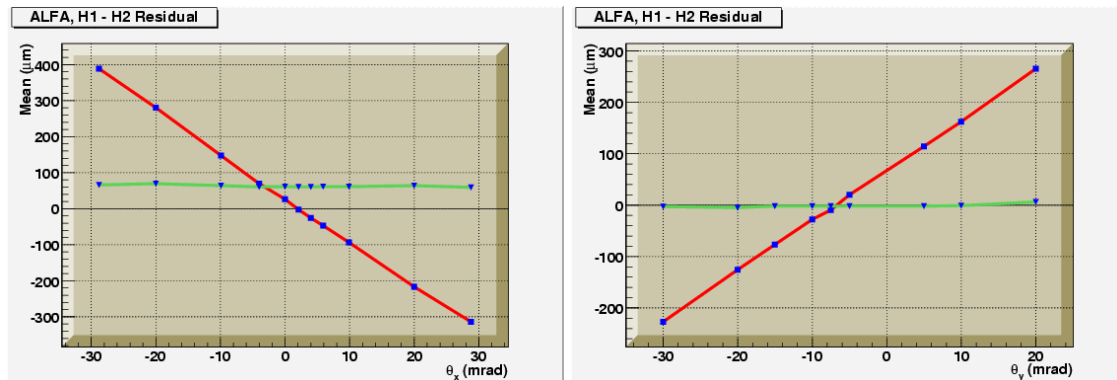
- Theoretical sigma = $500/(5*\sqrt{12}) = 28.8 \mu\text{m}$ (best possible !)
- Assume still X=14 --> sigma = $\sqrt{28.8**2 + 14**2} = 32\mu\text{m}$
- MC = $44/\sqrt{2} = 31\mu\text{m}$

- **Half detector (H1) data:**

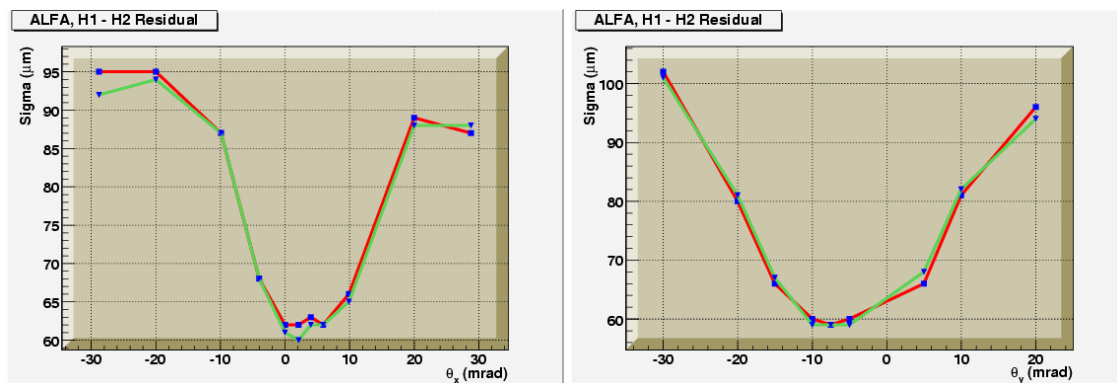
- Sigma H1 = $55/\sqrt{2} = 39\mu\text{m}$
- Sigma ALFA = $\sqrt{H1**2 + 3*X**2}/2 \sim 23\mu\text{m}$

Angle Scan

- All runs at 900V
- The θ_x scan (left plots) was done first and the θ_y scan (right plots) was done with the optimal θ_x angle.
- **WARNING: The colors in the plots below are a bit mixed (red = y in left plots and x in right plots)**
- The residual mean as a function of angle.
- A systematic shift between H1 and H2 is obtained due to the rotation and is about $12.5 \cdot \sin(\theta)$ as expected.



- The resolution as function of angle
- Fit range is chosen individually and the min sigma is about 59µm.
- The high statistics runs were taken with $\theta_x = 2.1$ and $\theta_y = -7.5$ mrad.



Edge Region

- Using run 10638
- Over all cuts:
 - && $x1 > -1.5$ && $x1 < 0.5$
 - && $y1 > -136$ && $y1 < -134.0$
- histXRes1: Over all cuts
- histXRes2: $y1 < -134.5$ && $y1 > -135.0$
- histXRes3: $y1 < -135.0$ && $y1 > -135.5$
- histXRes4: $y1 < -135.5$ && $y1 > -136.0$

- Fit #evts (Range) Resolution
histXRes1 12295 (-0.13, 0.13) 57 +/- 0.5
histXRes2 3000 (-0.13, 0.12) 57 +/- 1.1
histXRes3 3125 (-0.13, 0.12) 57 +/- 1.1
histXRes4 3172 (-0.13, 0.13) 55 +/- 1.0
histYRes1 12295 (-0.13, 0.13) 57 +/- 0.5
histYRes2 3000 (-0.13, 0.12) 57 +/- 1.1
histYRes3 3125 (-0.13, 0.12) 58 +/- 1.1
histYRes4 3172 (-0.13, 0.13) 54 +/- 0.9
- The 1mm region away from the (beam) edge show no decreased performance.

HV Scan

- 10638 (950V)
histXRes1 35227 (-0.14, 0.13) 54.5 +/- 0.3
histYRes1 35227 (-0.14, 0.13) 54.9 +/- 0.3
- 10639 (950V)
histXRes1 33702 (-0.14, 0.13) 54.1 +/- 0.3
histYRes1 33702 (-0.14, 0.13) 54.5 +/- 0.3
- 10642 (950V)
histXRes1 34407 (-0.14, 0.13) 54.6 +/- 0.3
histYRes1 34407 (-0.14, 0.13) 54.3 +/- 0.3
- 10643 (950V)
histXRes1 33738 (-0.14, 0.13) 54.6 +/- 0.3
histYRes1 33738 (-0.14, 0.13) 54.0 +/- 0.3
- RMS from 950V runs:
x-resolution = 0.4,
y-resolution = 0.7
- 10626 (900V)
histXRes1 33357 (-0.14, 0.13) 59.3 +/- 0.4
histYRes1 33357 (-0.14, 0.13) 58.7 +/- 0.4
- 10628 (900V)
histXRes1 33770 (-0.14, 0.13) 59.2 +/- 0.4
histYRes1 33770 (-0.14, 0.13) 58.8 +/- 0.4
- 10632 (900V)
histXRes1 33635 (-0.14, 0.13) 59.4 +/- 0.4
histYRes1 33635 (-0.14, 0.13) 59.2 +/- 0.4
- 10633 (900V)
histXRes1 33357 (-0.14, 0.13) 59.0 +/- 0.4
histYRes1 33357 (-0.14, 0.13) 58.6 +/- 0.4
- Mean vary from ~ -0.01 to -0.001
(no systematic effect, e.g. 900 vs 950, observed)
- 950 --> 900 = 55 --> 59 um

Error from fit range

- Using run 10638
- No cuts
(Mean = -0.0096 +/- 0.0003)
- Fit range Sigma
 - 0.41, 0.39: 57.3 +/- 0.3
 - 0.31, 0.29: 57.3 +/- 0.3
 - 0.11, 0.09 52.2 +/- 0.3
 - 0.16, 0.09 53.7 +/- 0.3
 - 0.21, 0.09 54.7 +/- 0.3
 - 0.11, 0.14 53.9 +/- 0.3
 - 0.16, 0.14 55.1 +/- 0.3
 - 0.21, 0.14 56.0 +/- 0.3
 - 0.11, 0.19 55.0 +/- 0.3
 - 0.16, 0.19 56.1 +/- 0.3
 - 0.21, 0.19 57.1 +/- 0.3
- Change fit range from 2 sigma to 8 sigma have 5um effect
Estimated full resolution
 - 57 -> 23.5 (um)
 - 55 -> 22.9
 - 52 -> 22.0
 - 50 -> 21.4
 - I.e. 55 +/- 3 --> 23 +/- 1
- Max cuts (S1&S2&S3&S4)
 - 0.11, 0.09 49.8 +/- 0.4
 - 0.16, 0.14 51.2 +/- 0.4
 - 0.21, 0.19 52.1 +/- 0.3
 - 0.31, 0.29 52.1 +/- 0.4
 - 0.41, 0.39 52.1 +/- 0.4
- With these cuts 2 to 8 sigma range have 2 um effect
 - 1. e. 55 +/- 1 --> 22 +/- 0.3

Note Draft

- Draft 0: alfa_note_tb06res.tar.gz
- Draft 0.1: note_080307.tar.gz
- Draft 0.2: note_270307.tar.gz
- Draft 1: note_020407.tar.gz
- Draft 2: atb06_note_260207.tar.gz

-- StefanAsk - 27 Mar 2007

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