

Tracker Calibration and Test Beam Requirements

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AMS TIM Meeting, February 4, 2008

Available at:

http://ams.cern.ch/AMS/vitali/ams02_bt.pdf

Outline

- Motivations
- Requirements
- Positions
- Total Time
- Other Ways to Calibrate Tracker

Motivations

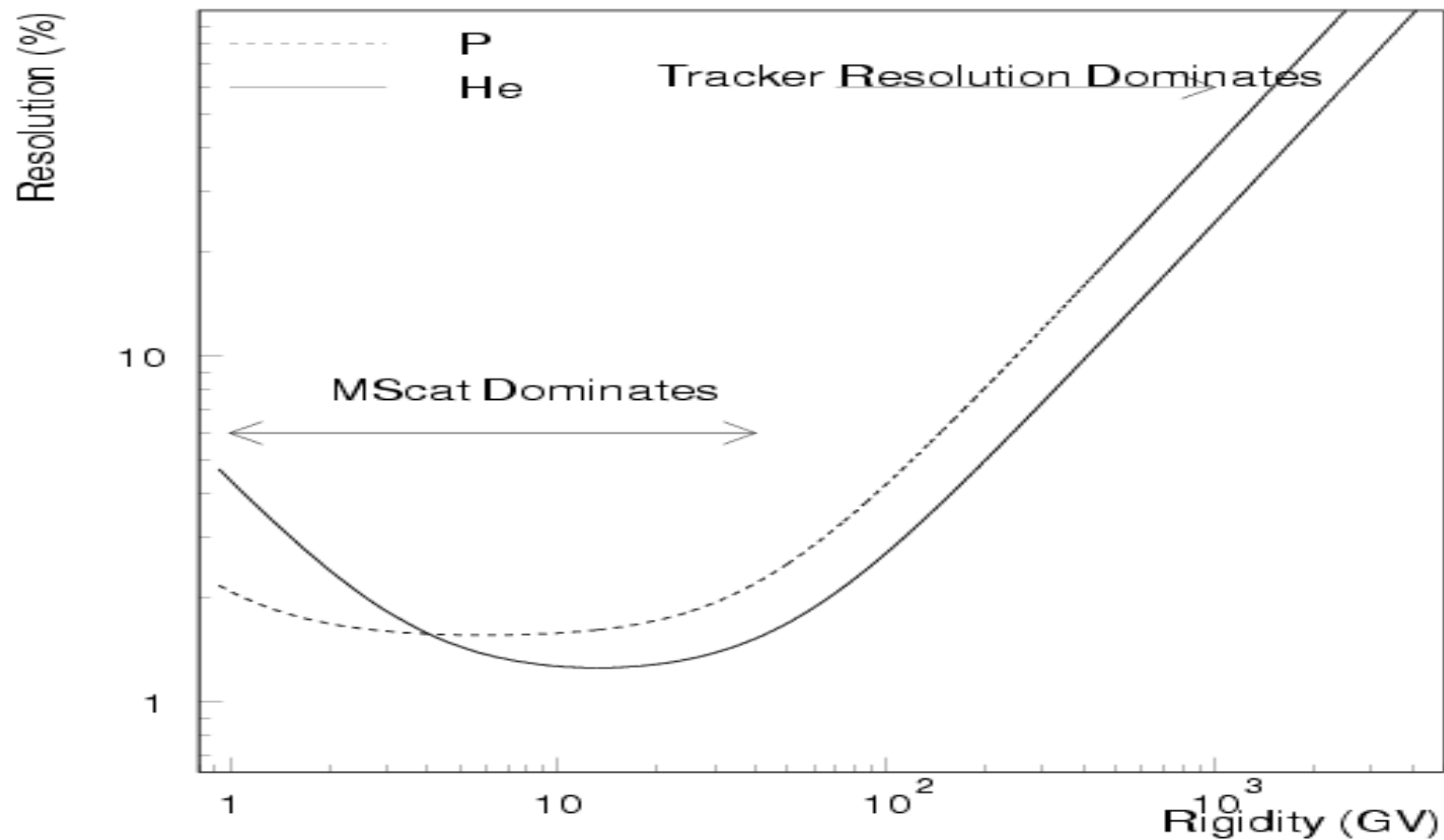
- Controlled Environment: Known Momentum & Direction;
- High Statistics ($> 10^9$ Events Reachable);
- High Momenta Particles, Negligible Multiple Scattering;
- Simultaneous Tracker Alignment and Alignment Verification;
- Ultimate Calibration Proof for the Data Analysis;

As there is no plans of returning AMS on Earth, the October 2008 test beam may well be the only AMS-02 remaining beam test¹

¹as opposite to the LHC detectors, which might well be recalibrated later.

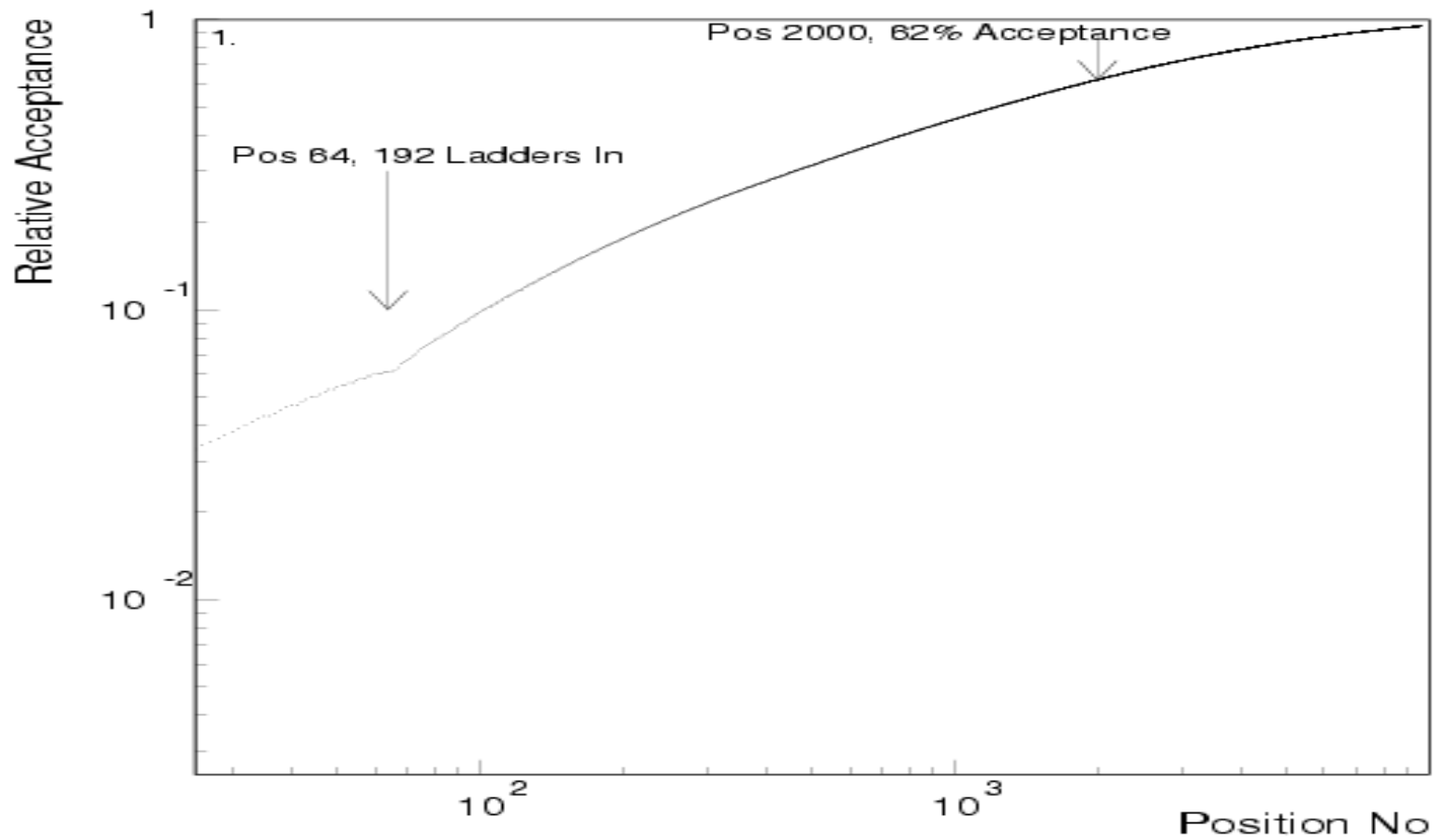
Requirements

- Highest Possible Momentum (300 GeV/c is OK);



- A Platform/RAS with Rotations/Shifts as Shown Below;

Positions

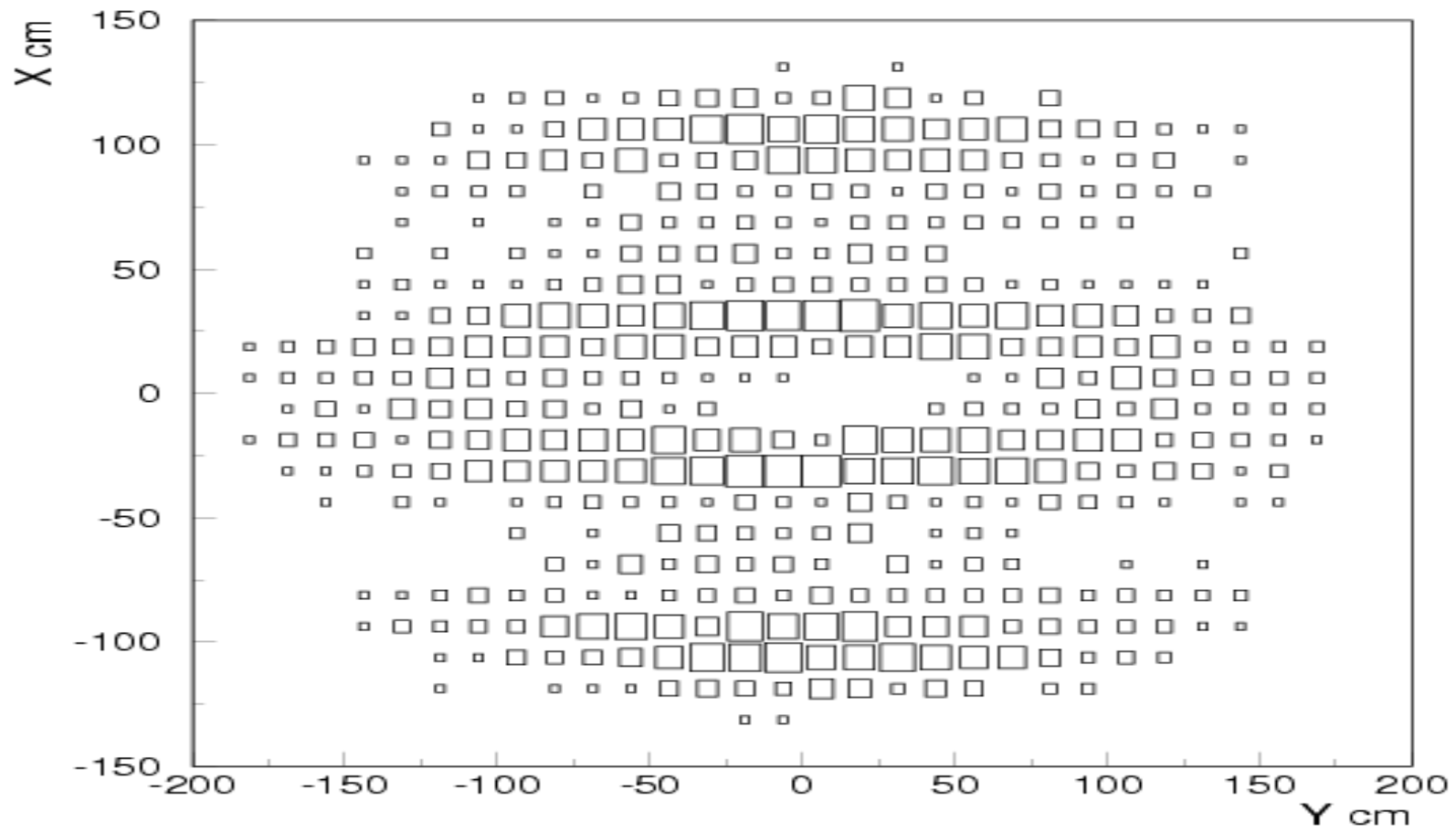


Positions

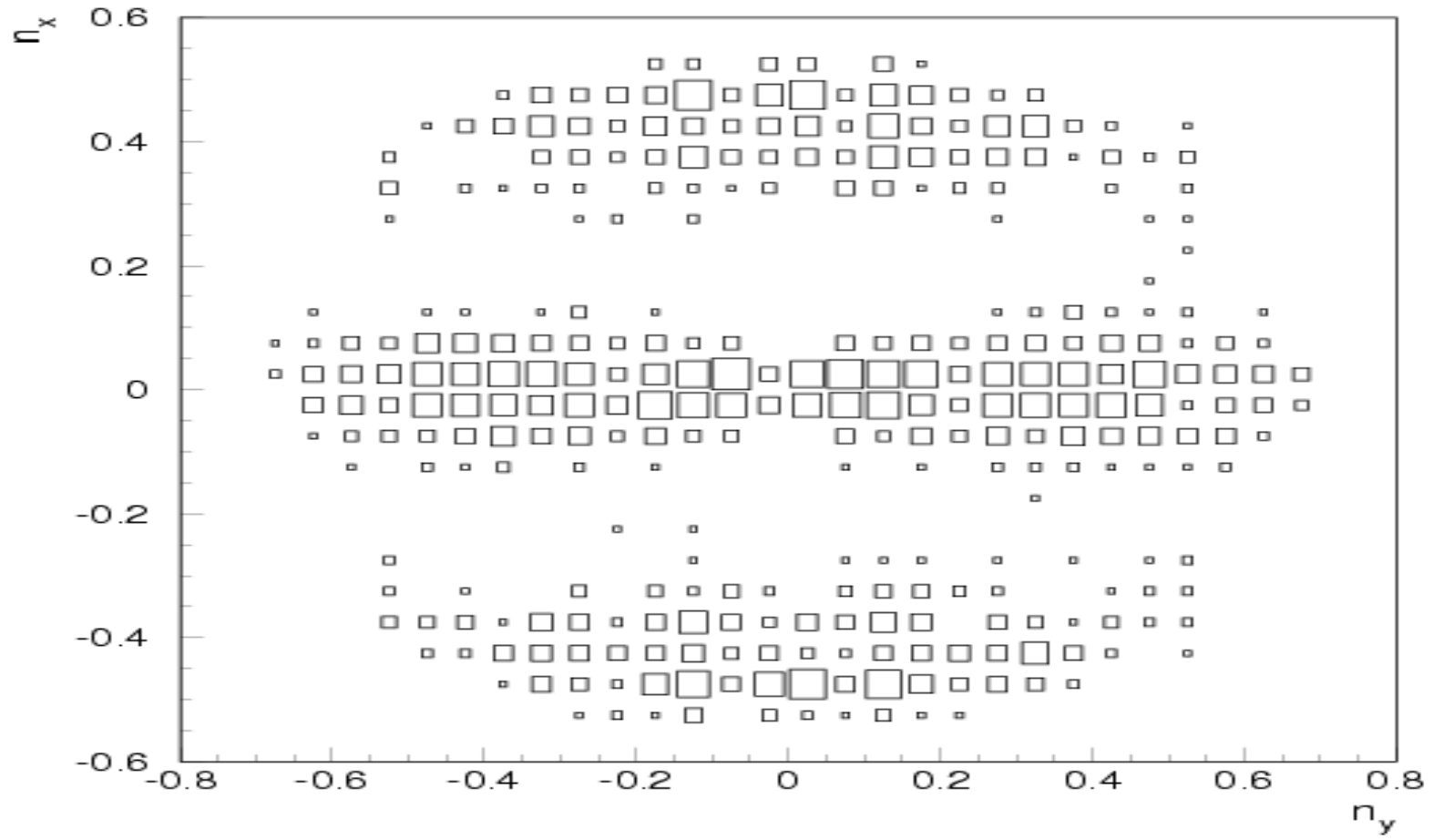
Pos	x	y	z	nx	ny	nz	rel acc
0	22.74	22.12	195	0.022	-0.056	-0.998	0.001
1	24.39	7.07	195	0.012	-0.055	-0.998	0.003
2	-32.3	-0.34	195	0.021	-0.053	-0.998	0.004
3	-28.21	-6.8	195	0.005	0.053	-0.998	0.006
4	27.17	-28.8	195	0.001	0.054	-0.998	0.007
5	-26.08	6.99	195	-0.005	-0.054	-0.998	0.009
6	27.87	7.87	195	-0.012	0.052	-0.998	0.01
7	-29.59	-21.69	195	0.018	0.054	-0.998	0.011
8	-27.09	6.71	195	-0.002	0.059	-0.998	0.013
9	-31.27	-14.82	195	0.005	0.057	-0.998	0.014
10	25.04	0.95	195	-0.004	0.051	-0.998	0.015
11	-24.34	14.6	195	-0.011	-0.055	-0.998	0.017
12	27.02	-21.61	195	0.01	0.054	-0.998	0.018
13	-24.75	28.4	195	-0.011	-0.051	-0.998	0.019
14	-29.33	-0.28	195	0	0.057	-0.998	0.02
15	25.45	-13.73	195	-0.007	0.051	-0.998	0.022
16	17.06	29.39	195	0.042	-0.057	-0.997	0.023
17	-28.62	-6.81	195	0.011	-0.058	-0.998	0.024
18	33.16	31.2	195	-0.036	-0.211	-0.976	0.025
19	33.37	-7.94	195	-0.024	0.059	-0.997	0.027
20	-30.47	-14.78	195	0.023	-0.055	-0.998	0.028

The complete position file is available at <ams.cern.ch:/Offline/AMSDDataDir/v4.00/DirFile.txt>

Positions



Positions



For the routine operation assuming 15 min (10 min DataTaking, 5 min position change) per position,
96 positions/day ,
2000 positions/3 weeks.

Other Ways to Calibrate AMS

- Tracker Alignment:
 - Sea Level Muons, Straight Tracks. Should (and will) be tried first. Suffers however from very low momenta, less than few GeV/c in average, completely MS dominated input events.²
 - Cosmic Rays, Straight Tracks. Somewhat higher momenta, possibility to use geomagnetic cutoff to further shift to the O(20) GeV/c momenta. Should be tried to check for eventual tracker misalignment due to the launch.
 - Cosmic Rays, Curved Tracks. AMS-01 and probably PAMELA examples show that it is not easy, if at all possible used them to align the tracker.
- Tracker Alignment Verification:
 - None identified, as e.g. there is no Z particles in cosmic rays to verify the alignment a-la LHC experiments.

²According to V.Blobel, author of alignment program Millipede II, adopted by CMS, “contribution of low-momentum tracks with large multiple-scattering effects to the precision of an alignment is small”

Conclusion

It seems that there is no alternative to the beam test to calibrate the detector, and, as there is no plans of returning AMS on Earth, the October 2008 test beam may well be the only remaining possibility to calibrate AMS.