The misalignment of small CSCs in Xenon run

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SCIENCE BRINGING NATIONS TOGETHER

Analysis and Detector Meeting of the BM@N Experiment at the NICA facility
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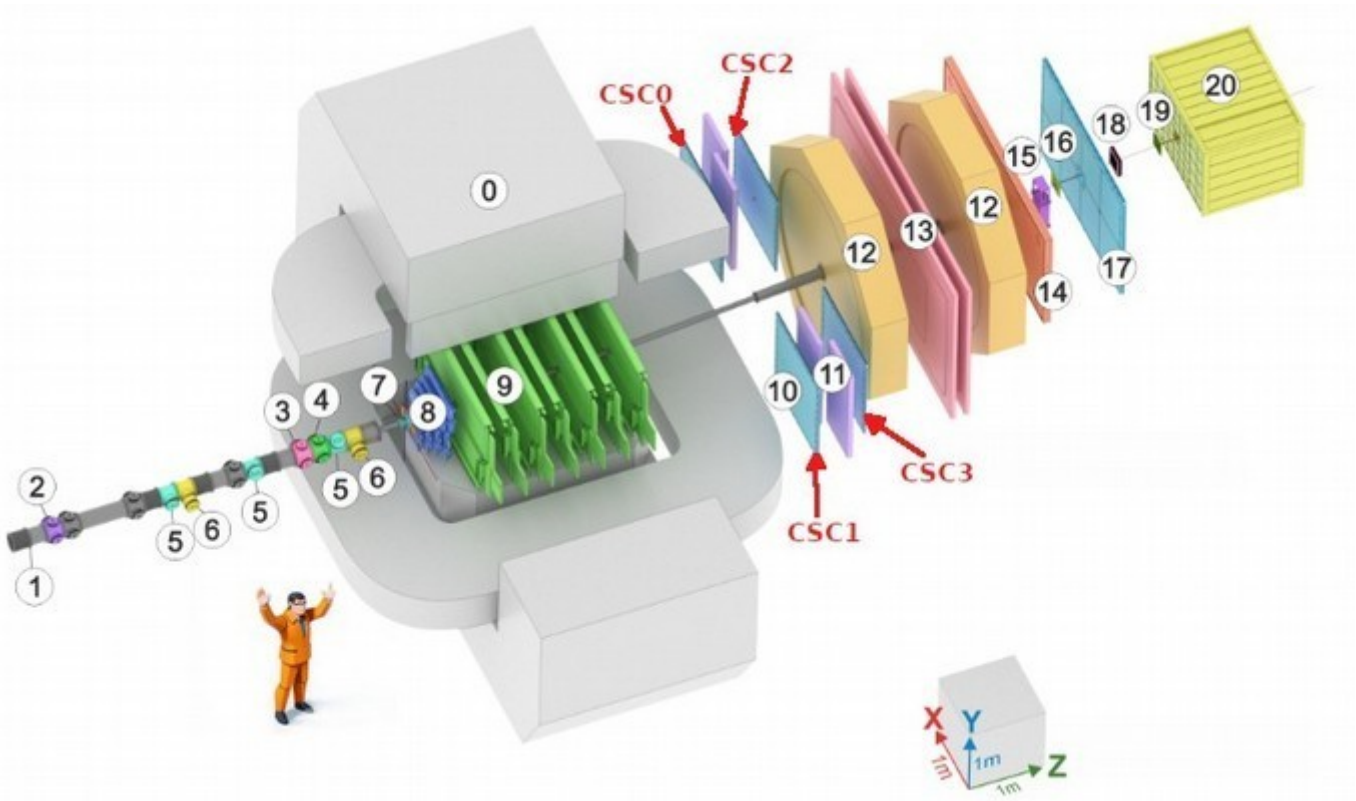
Outline

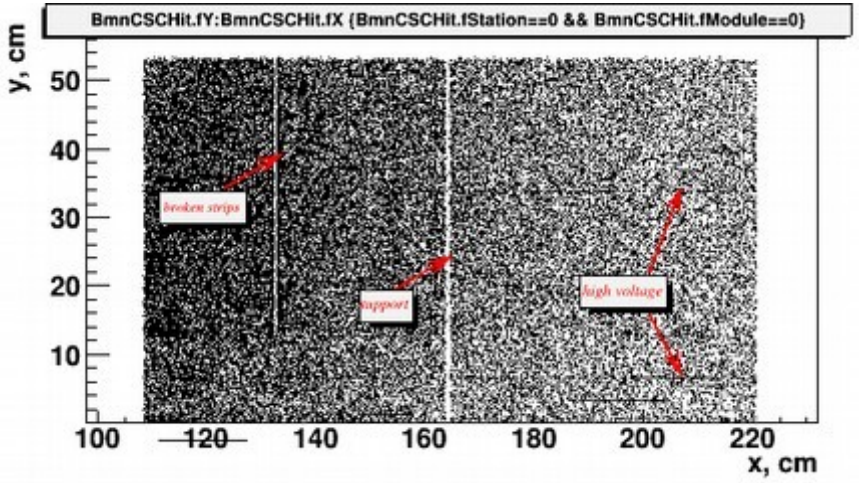
1. Run with xenon beam
   - ✓ Small CSCs numbering
2. Data analysis
   - ✓ Bad zones in CSC modules
   - ✓ Z shift
   - ✓ X and Y shifts
3. Summary

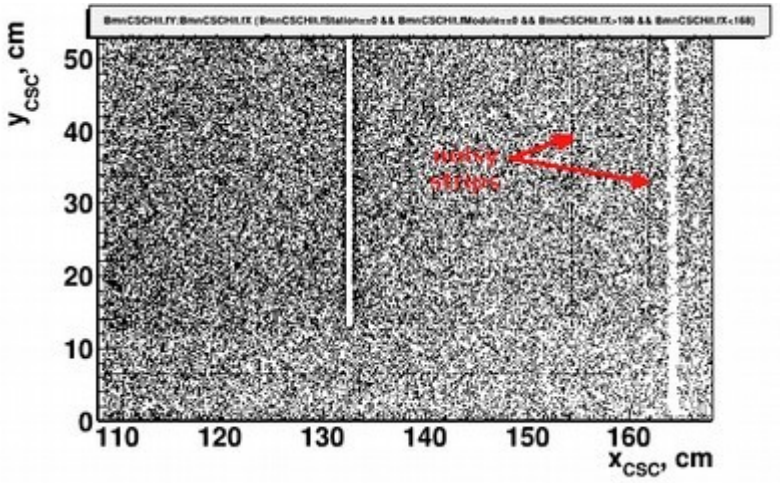
Small CSCs numbering

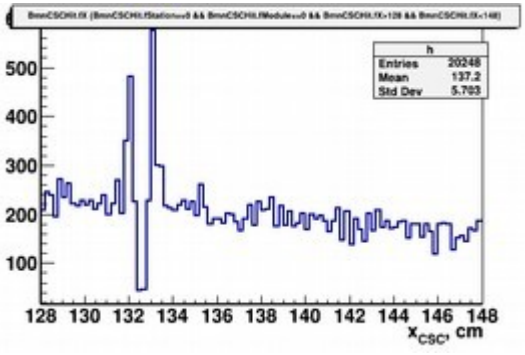


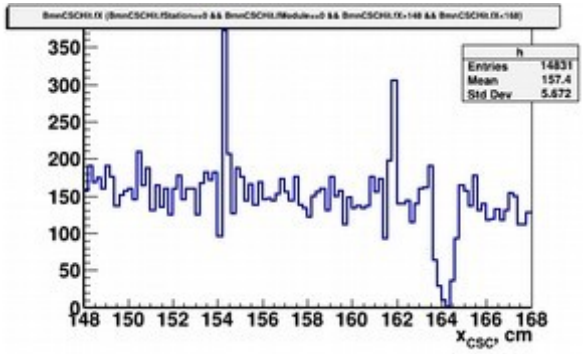
The four small CSCs are indicated by red arrows. Top module – 0, bottom - 1

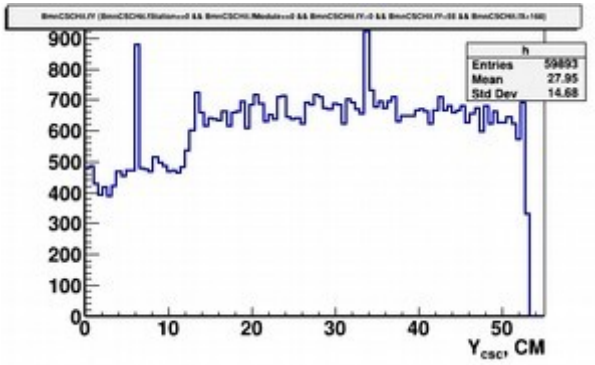
Bad zones in CSC0_0







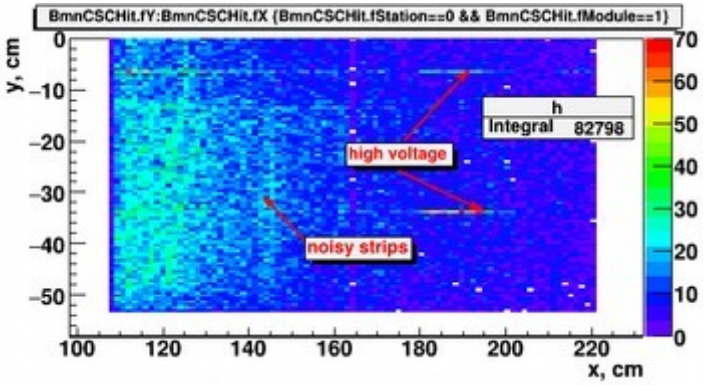


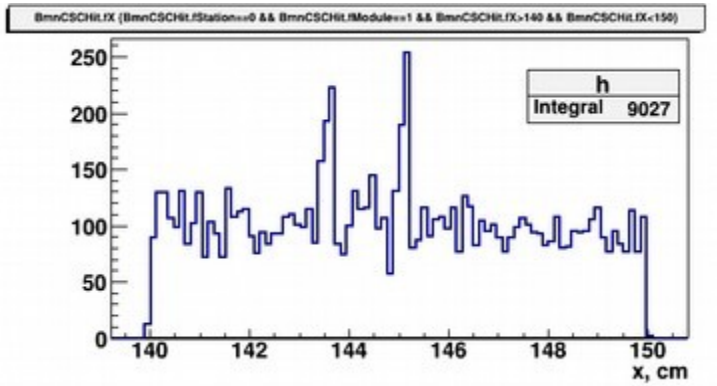


Broken strips, mechanical support, high voltage, noisy strips

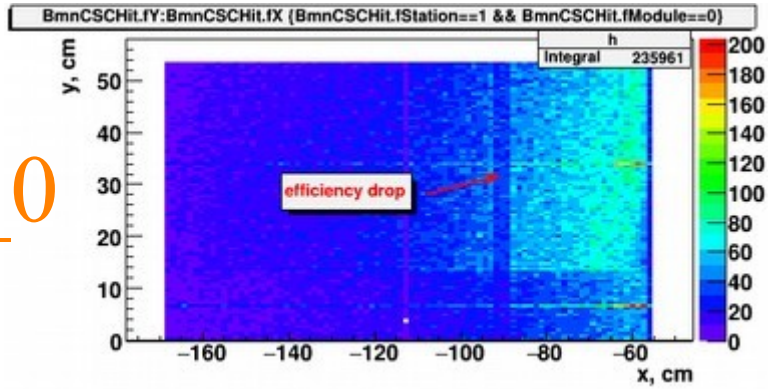
Bad zones in CSC0_1 and CSC1_0

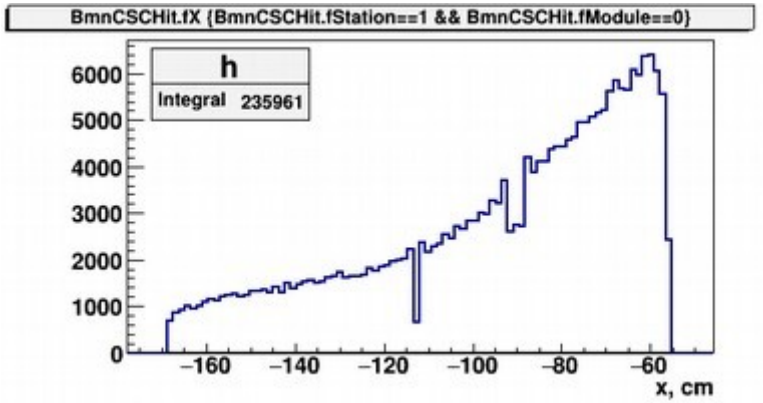
CSC0_1





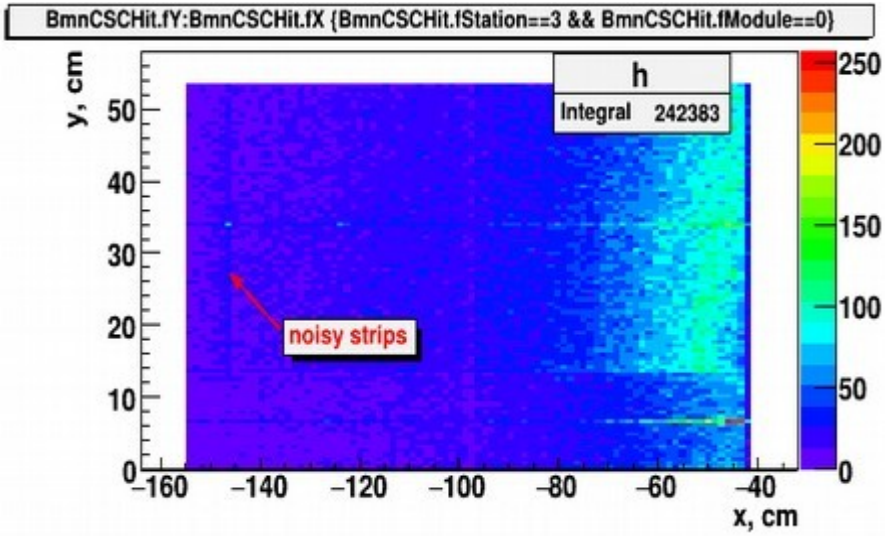
CSC1_0

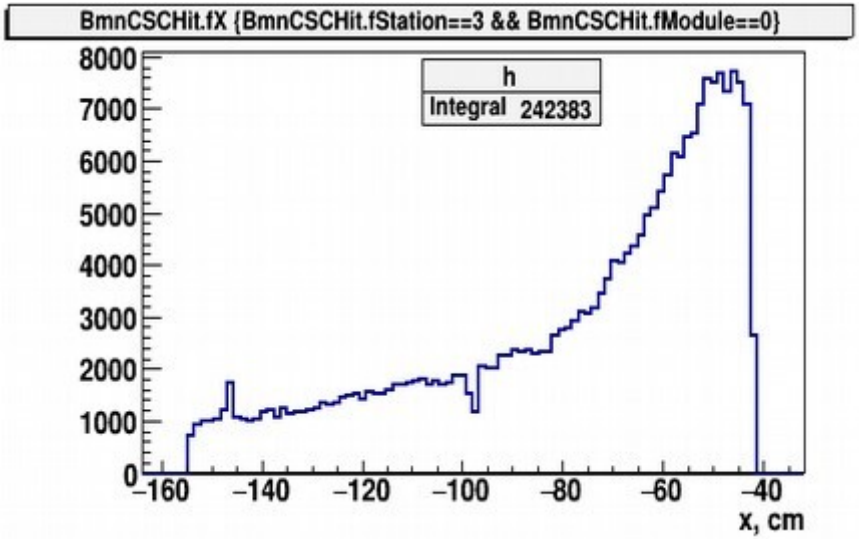




Noisy strips, high voltage, efficiency drop

Bad zones in CSC3_0



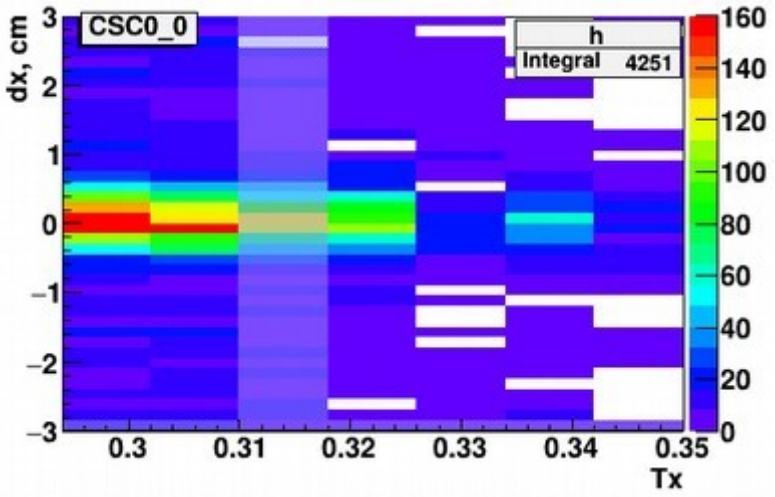


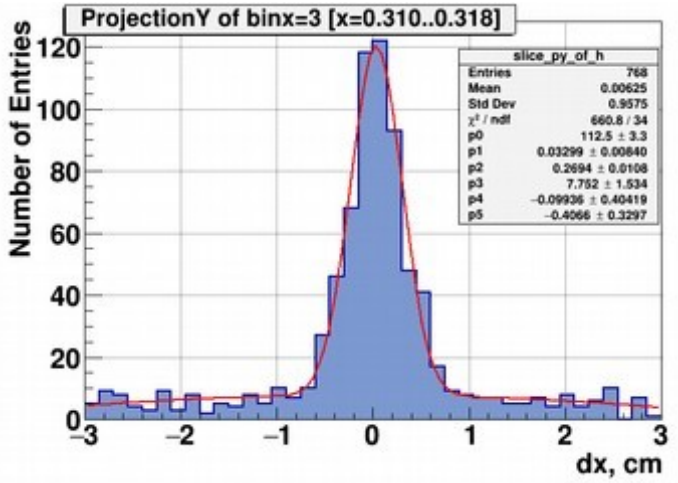
Noisy strips

Matching cuts

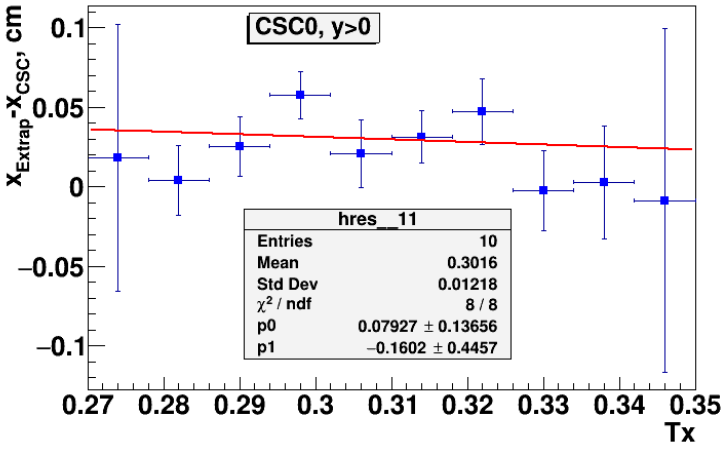
- ✓ NHits > 7
- ✓ NGemHits > 5
- ✓ $|\Delta_{X(Y)ToF\text{-}400Hit\text{-}Track}| < 6$ cm
- ✓ $|\Delta_{X(Y)CSCHit\text{-}Track}| < 3$ cm (all CSC hits)

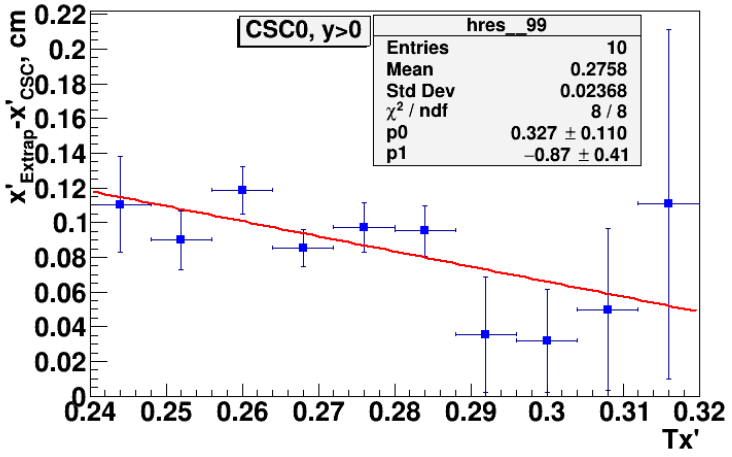
Z shift





Gaus + pol2

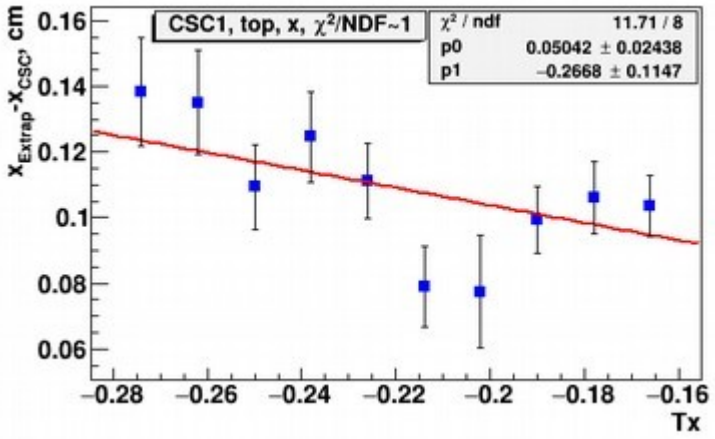


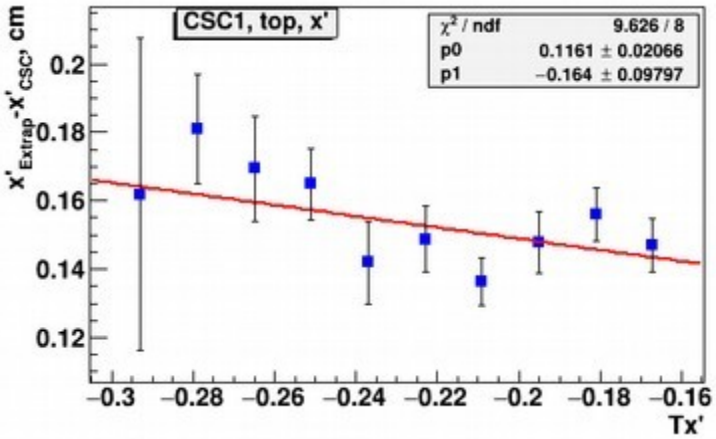


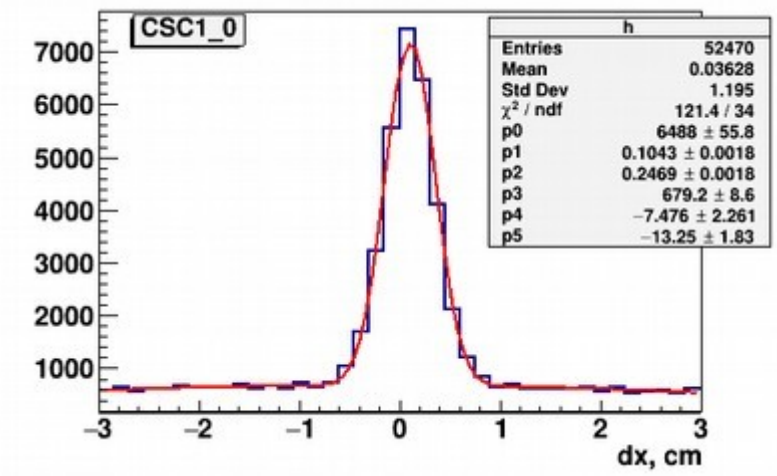
$$\langle dx \rangle = dz \cdot \langle Tx \rangle$$

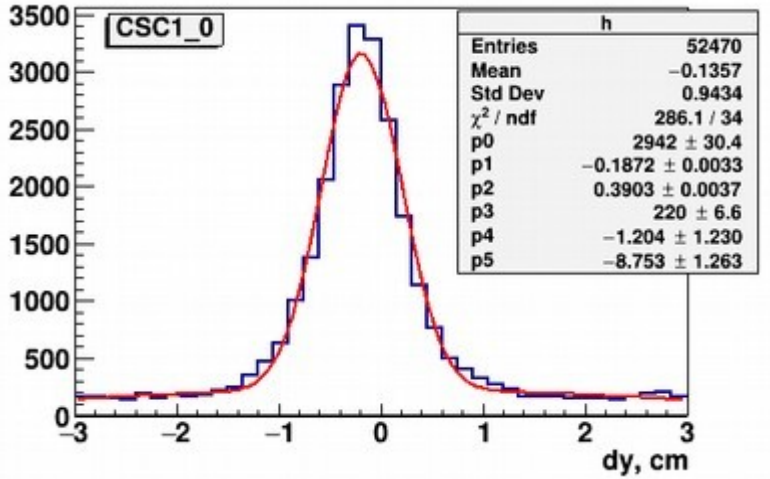
Z, X, Y shifts of CSC1_0

Z









X

Y

Results

Module	Broken zone	dz, cm	dx, cm	dy, cm
0_0	(131<x<134 | x≈154 | x≈162) cm & y>14 cm	-0.545 ± 0.302 $\Delta_{xx'}$ ≈0.7	0.030±0.005	-0.247±0.009
0_1	(x≈143.5 | x≈145) cm & y<-14 cm	-2.563 ± 0.306	-0.294±0.004	0.132±0.007
1_0	-93<x<-88 cm	**-0.2074±0.075≈0**	0.1043±0.0018	-0.1872±0.0033
1_1	-	1.019±0.030	0.089±0.003	0.061±0.006
2_0	-	**0±0.4**	0.075±0.007	**-0.443±0.009**
2_1	-	-1.676±0.271	-0.159±0.007	-0.049±0.010
3_0	x≈-147 cm & y>14 cm	**-0.08±0.08≈0**	**0.3359±0.0042**	-0.2404±0.0075
3_1	-	1.465±0.081	0.315±0.004	0.007±0.007

Results

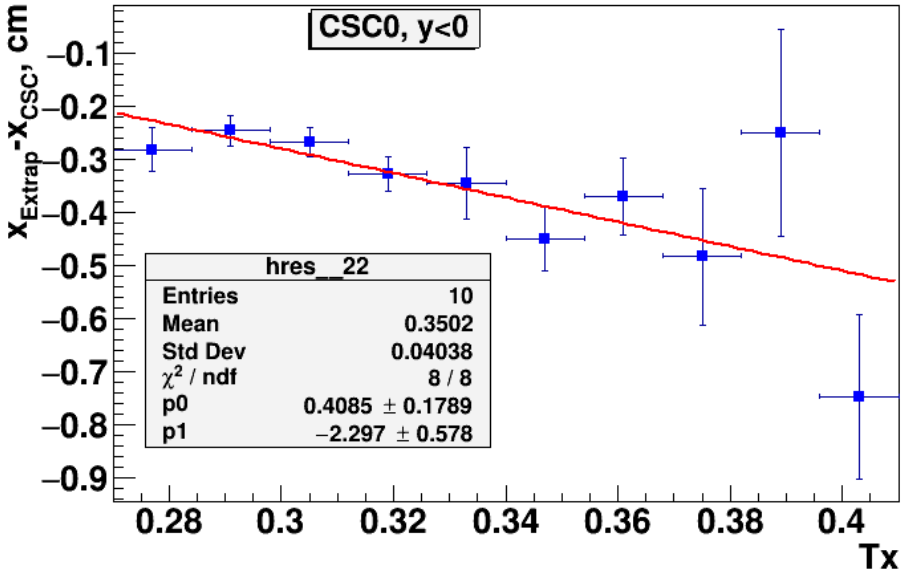
CSC Id	0	1	2	3
Δz_{01}, cm	2.018±0.430	-1.226±0.081	1.7±0.5	-1.545±0.114

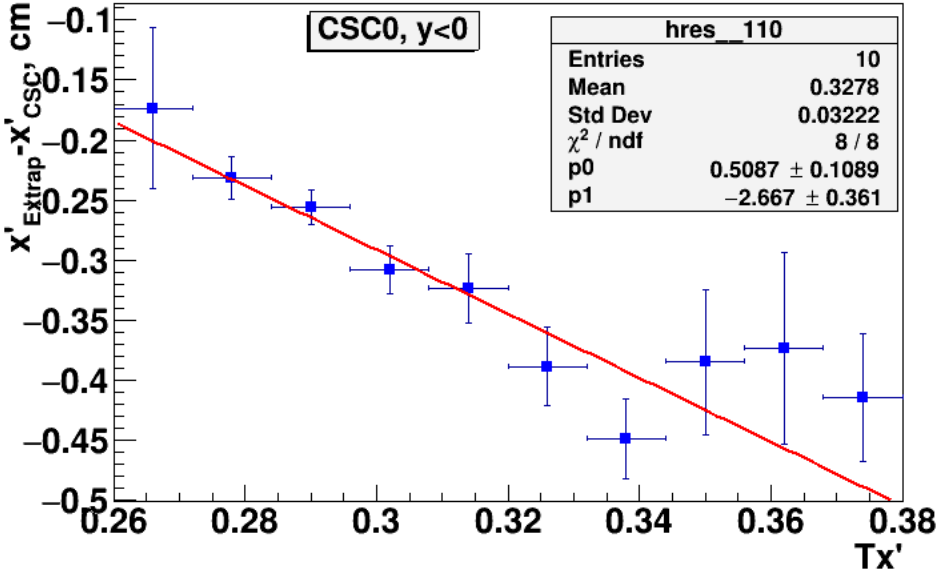
1. **Small CSCs are already well aligned.** Worst alignment for CSC0;
2. Between the top and bottom modules in each CSC chamber, the Z shift of about 1.5 cm is obtained;
3. For all modules except CSC0_1, the displacements dz obtained for X and X' coincided within the limits of uncertainty;
4. The maximum dz was obtained for CSC0_1. It was about 3 cm;
5. For all modules, the shifts in X and Y do not exceed 3 mm, with the exception of the CSC2_0 and CSC3_0 modules. $dy_{CSC2_0} \approx -0.44$ cm and $dx_{CSC3_0} \approx 0.34$ cm.

Thank you for attention!

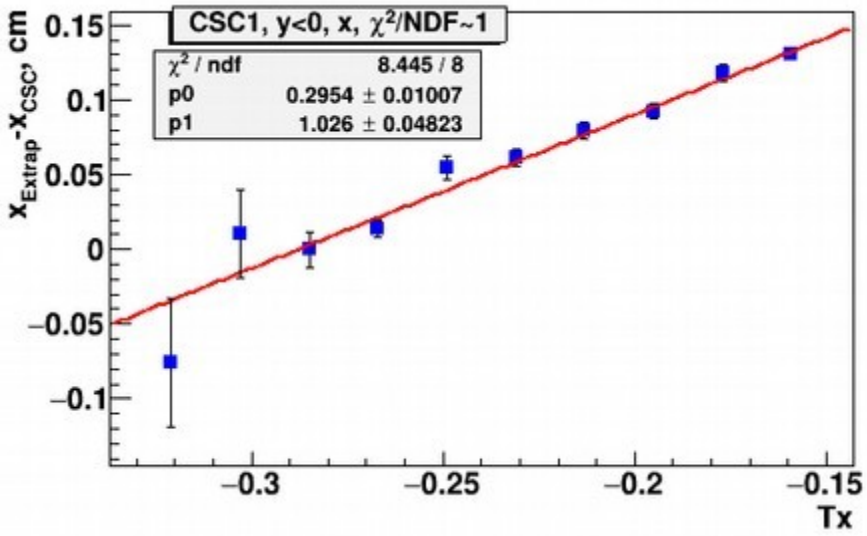
Backup

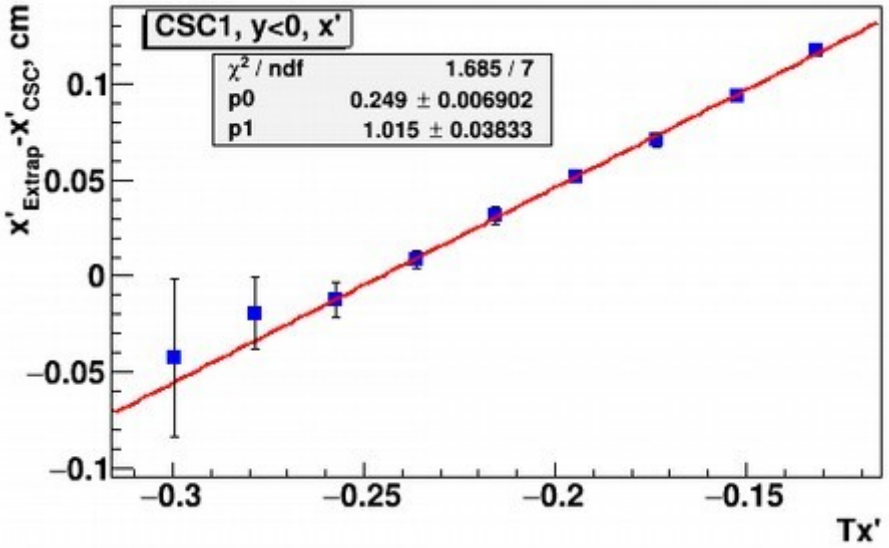
Z shift of CSC0_1





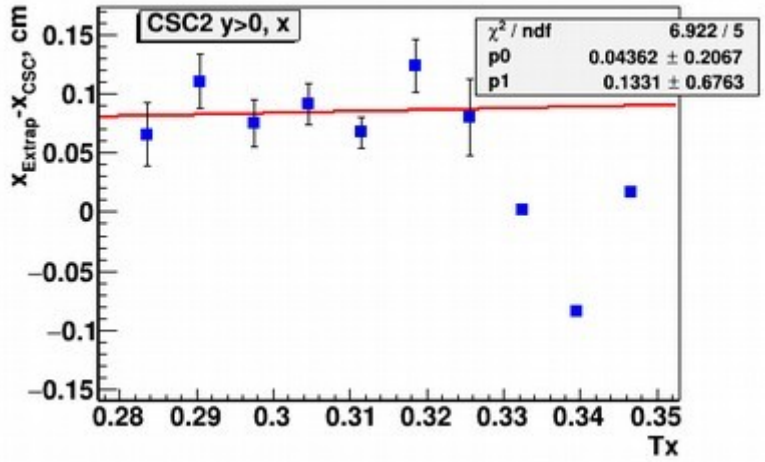
Z shift of CSC1_1

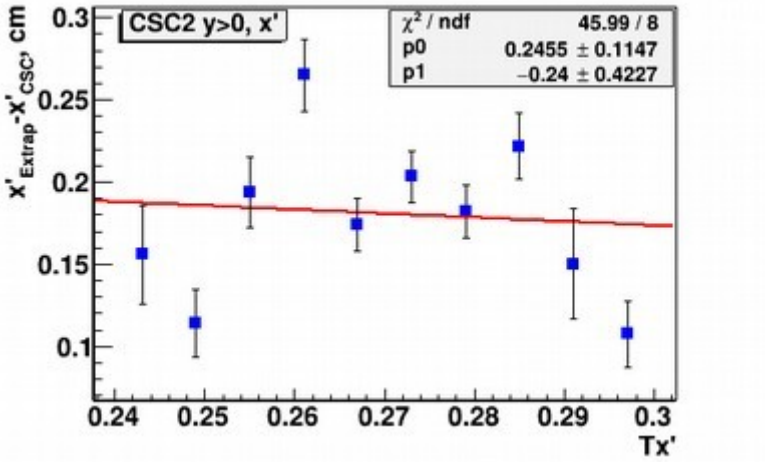


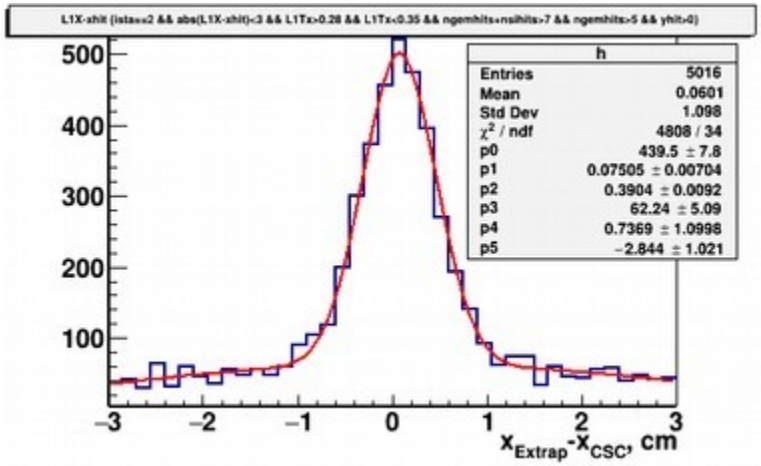


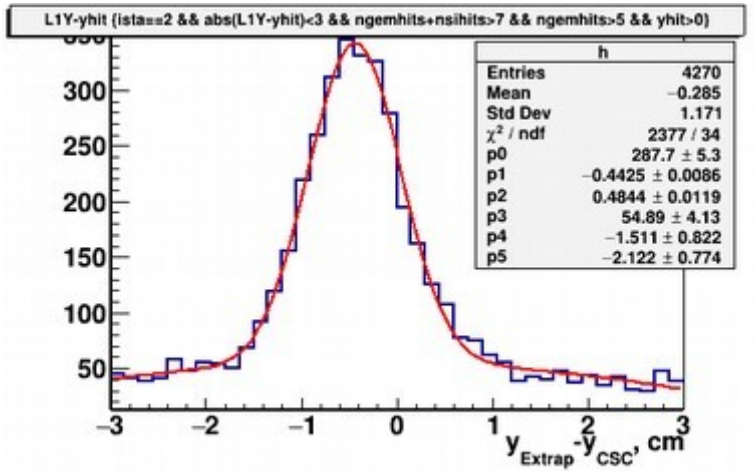
Z, X, Y shifts of CSC2_0

Z





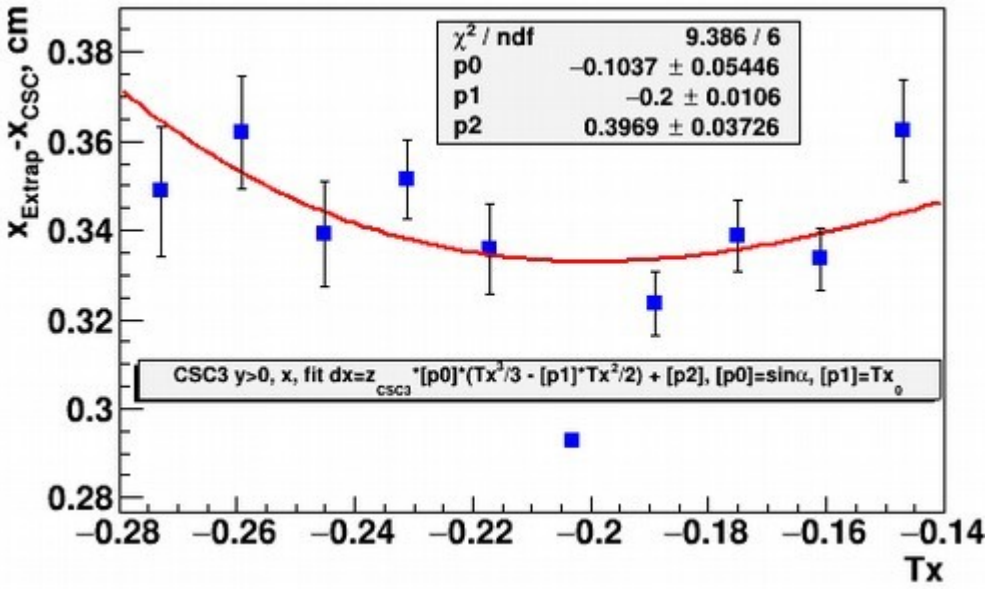




X

Y

Y rotation of CSC1_1



$$dx = \partial dx/\partial Tx$$

$$dz = (x - x_0)\sin\alpha$$

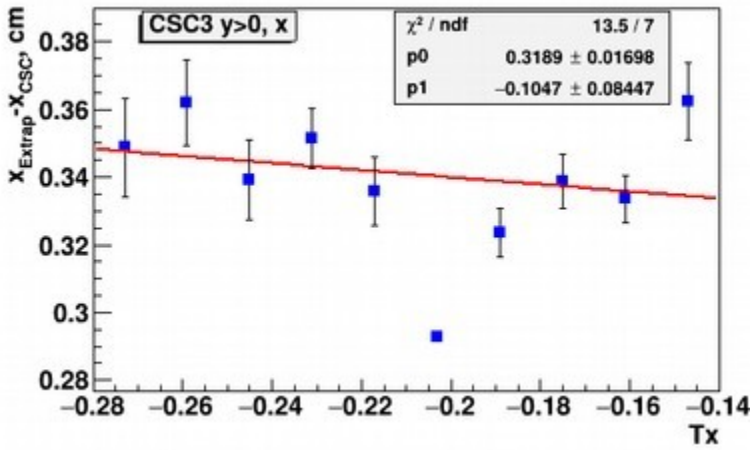
$$x = Tx \cdot z_{CSC3}$$

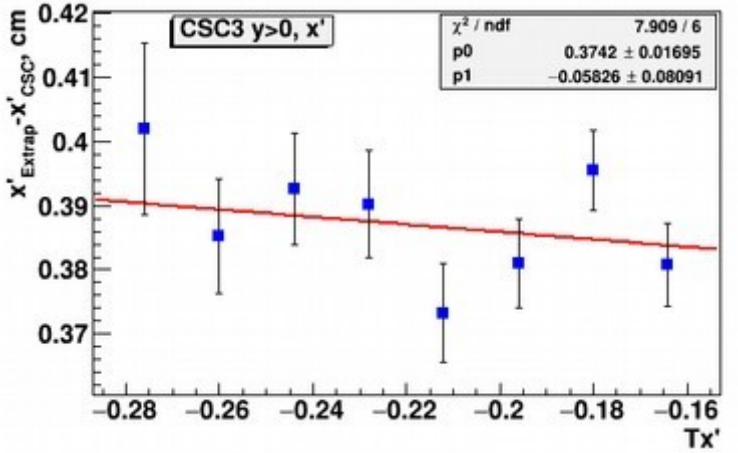
$$dx = z_{CSC3} \cdot \sin\alpha (Tx^3/3 - Tx_0 Tx^2/2) + [p2]$$

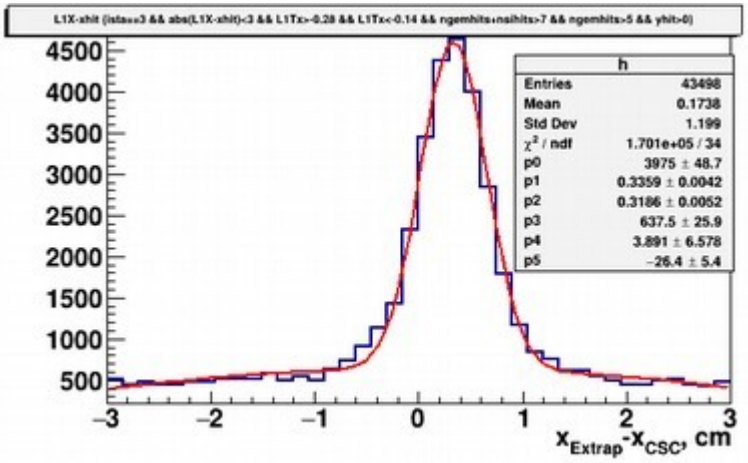
$$0.1037 \text{ rad} \approx 5.9 \text{ deg}$$

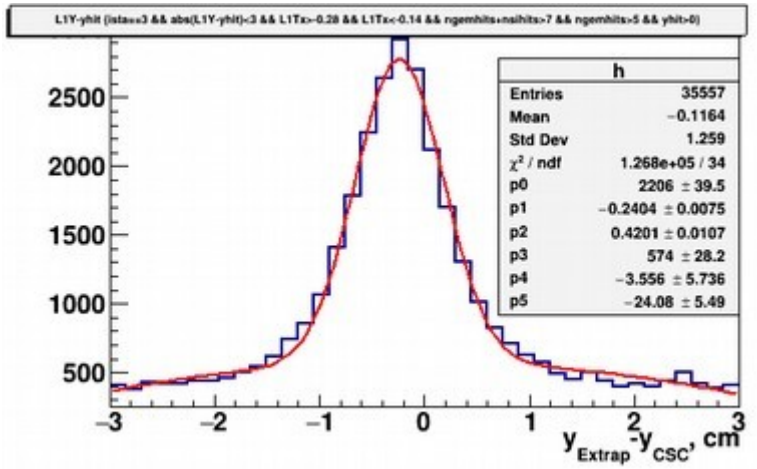
Z, X, Y shifts of CSC3_0

Z

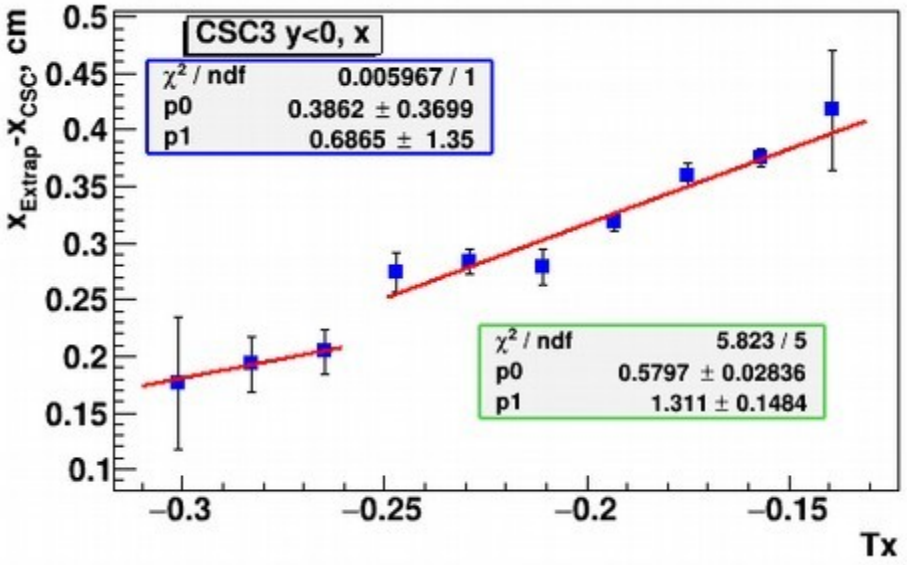
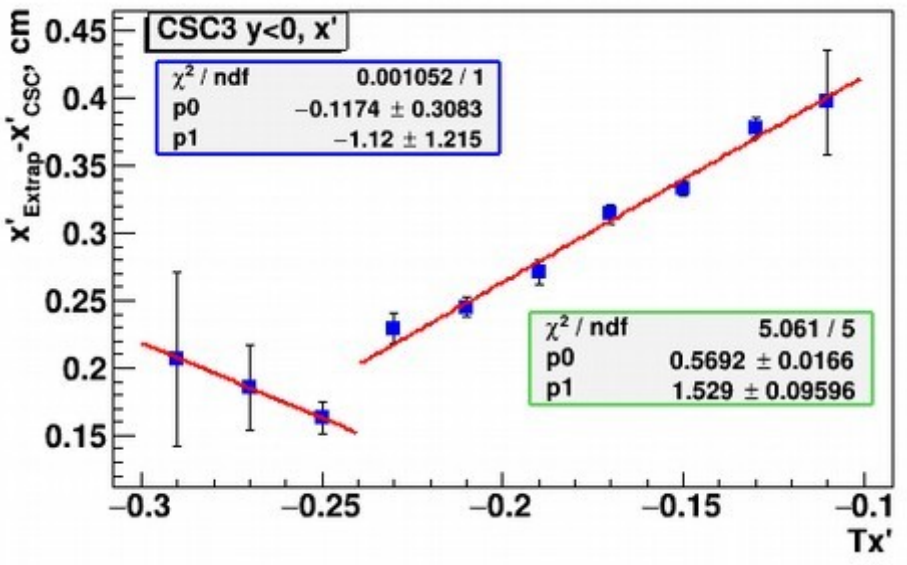








X

Y

Z shift of CSC3_1