I. DARK IMAGE (PEDESTALS)

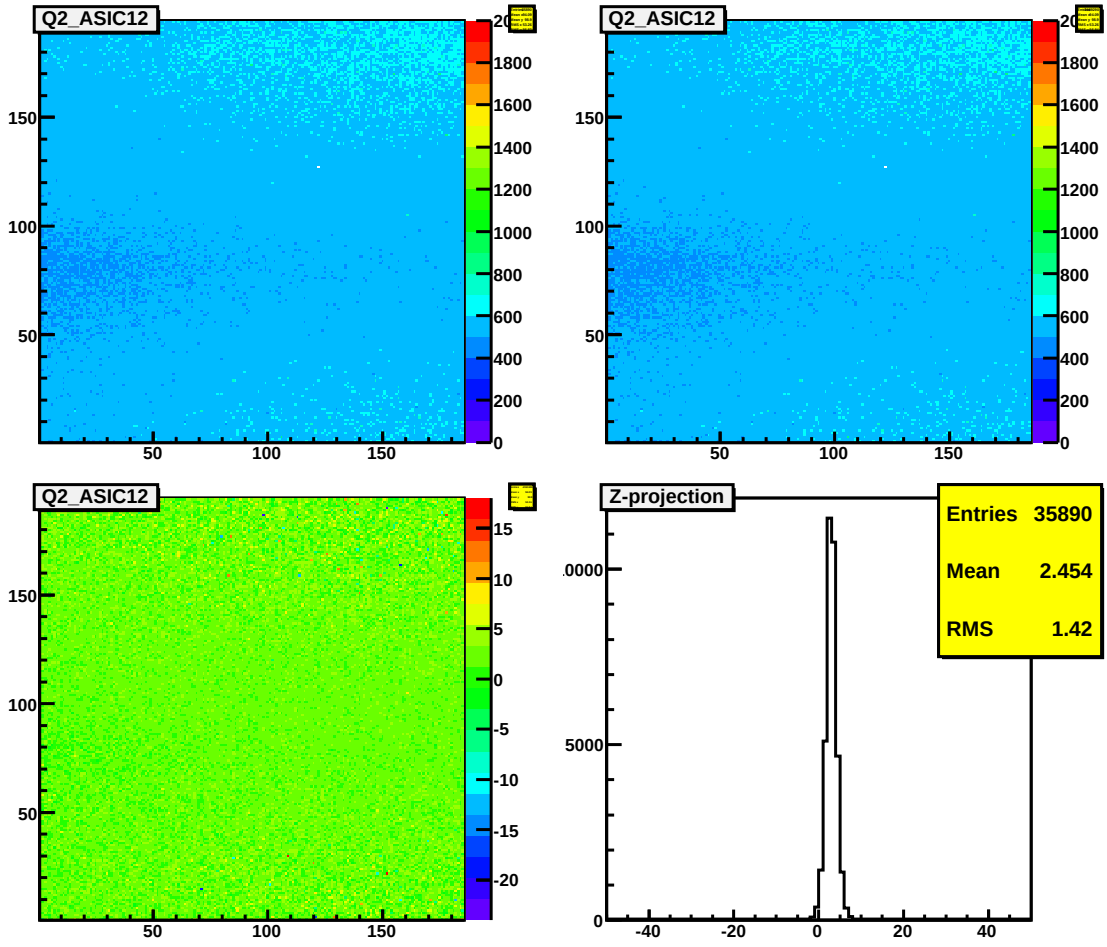

FIG. 1: r0546-s00-asic12, difference between event 1 and 60.

- Use run 546
- The difference between "dark" images has an (over pixels) RMS $\simeq$1 ADC count,
- but the average difference is drifting from event to event by $\pm$4 ADC count.

II. FIT TO DARK IMAGE

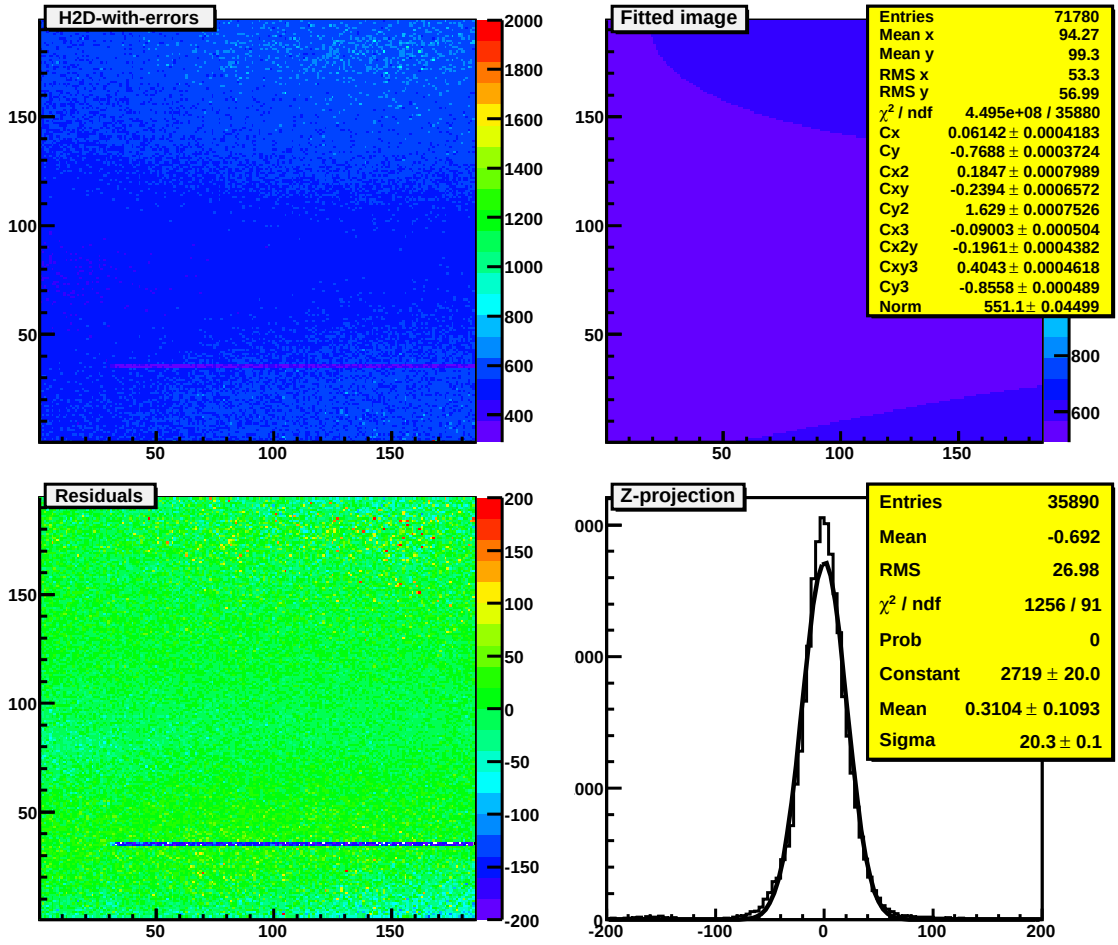

FIG. 2: r0546-s00-asic10, event 50: fit and residuals.

$$B(x,y) = \mathcal{N} \times [1 + C_x x + C_y y + C_{x^2} x^2 + C_{xy} xy + C_{y^2} y^2$$

$$+ C_{x^3} x^3 + C_{x^2 y} x^2 y + C_{xy^2} x y^2 + C_{y^3} y^3], \quad (1)$$

where $x = x_{bin}/185$ and $y = y_{bin}/194$,

- Run 546
- 2D polynomial function of 3d degree does not describe well the dark noise distribution over entire ASIC, $\sigma \simeq 20$ ADC count,
- this function can be used for selection of good pixels

III. ASIC ALIGNMENT USUNG RING IMAGES

PDF for azimuth-uniform ring intensity Gaussian-distribution

$$\mathcal{P}(x, y|x_c, y_c, r_0, \sigma, A) = \frac{A}{\sqrt{2\pi}\sigma} e^{-\frac{(r-r_0)^2}{2\sigma^2}} \tag{2}$$

where $r = \sqrt{(x-x_c)^2 + (y-y_c)^2}$, (x_c, y_c) are the ring center coordinates, r_0, σ, and A are the ring radial, Gaussian width, and amplitude parameters, respectively.

- Run 547, 549 for signal and 546 for background subtraction

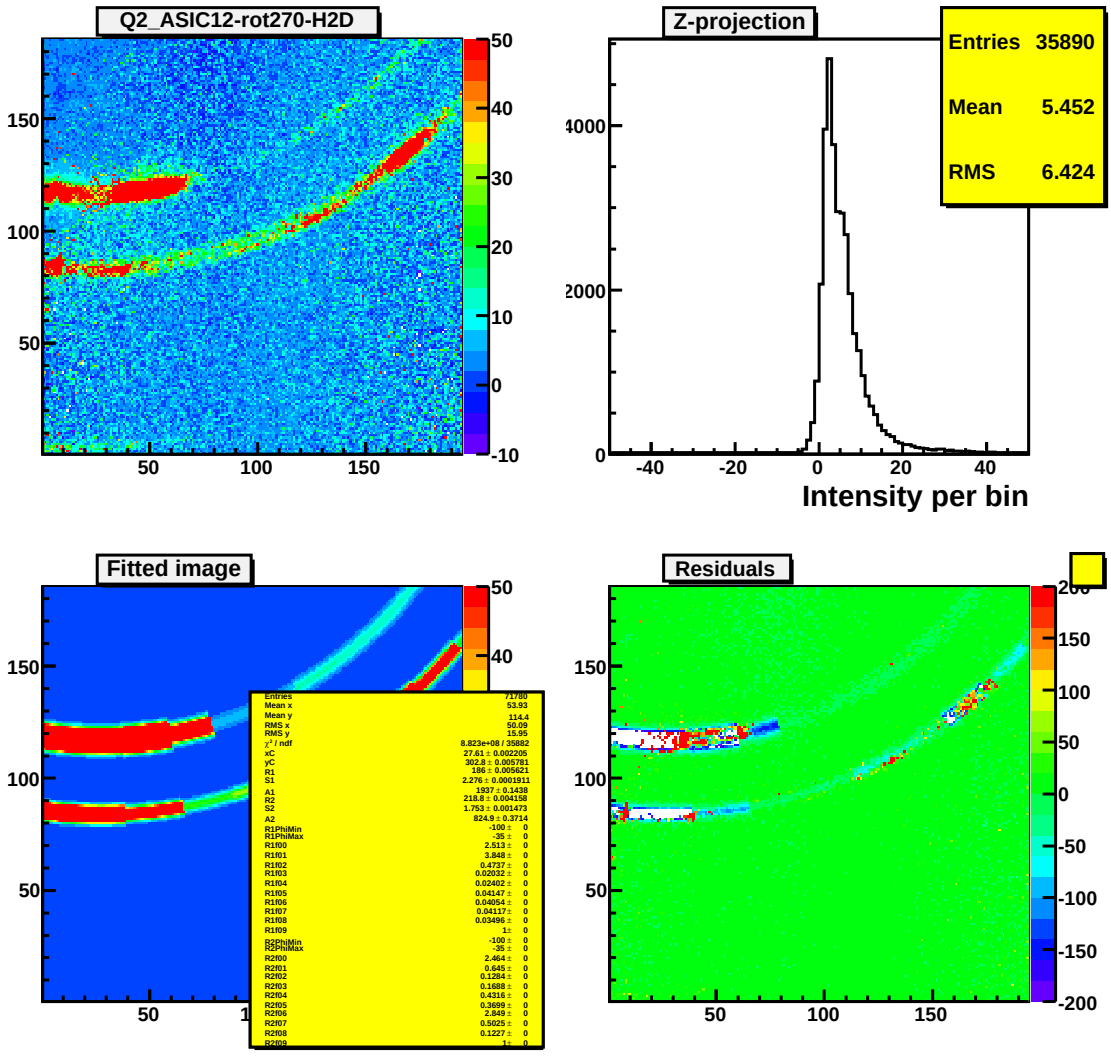

FIG. 3: r0547-s00-asic12, event 51: fit to the single rings 1 and 2 with modulated in ϕ PDF.

IV. CONFIGURATION PARAMETERS

TABLE I: Configuration parameters. gap = 194+4 (pixel).

ASIC	orientation (∘)	x_c (pixel)	y_c (pixel)
00	0	10	733+gap
01	0	10	733
02	0	-189	713+gap
03	0	-189	713
04	270	224+gap	713
05	270	224	713
06	270	214+gap	908
07	270	214	908
08	180	219.6	297
09	180	219.6	297+gap
10	180	414.1	311.2
11	180	414.1	311.2+gap
12	270	27.6	302.7
13	270	27.6-gap	302.7
14	270	5	510
15	270	5-gap	510

- Stat precision is better than 0.1 pixel size, but ...
- Alignment procedure is not straightforward because image is not uniform
- Propagation of rings from ASICs' pair-to-pair is not always good

V. COMBINED IMAGE

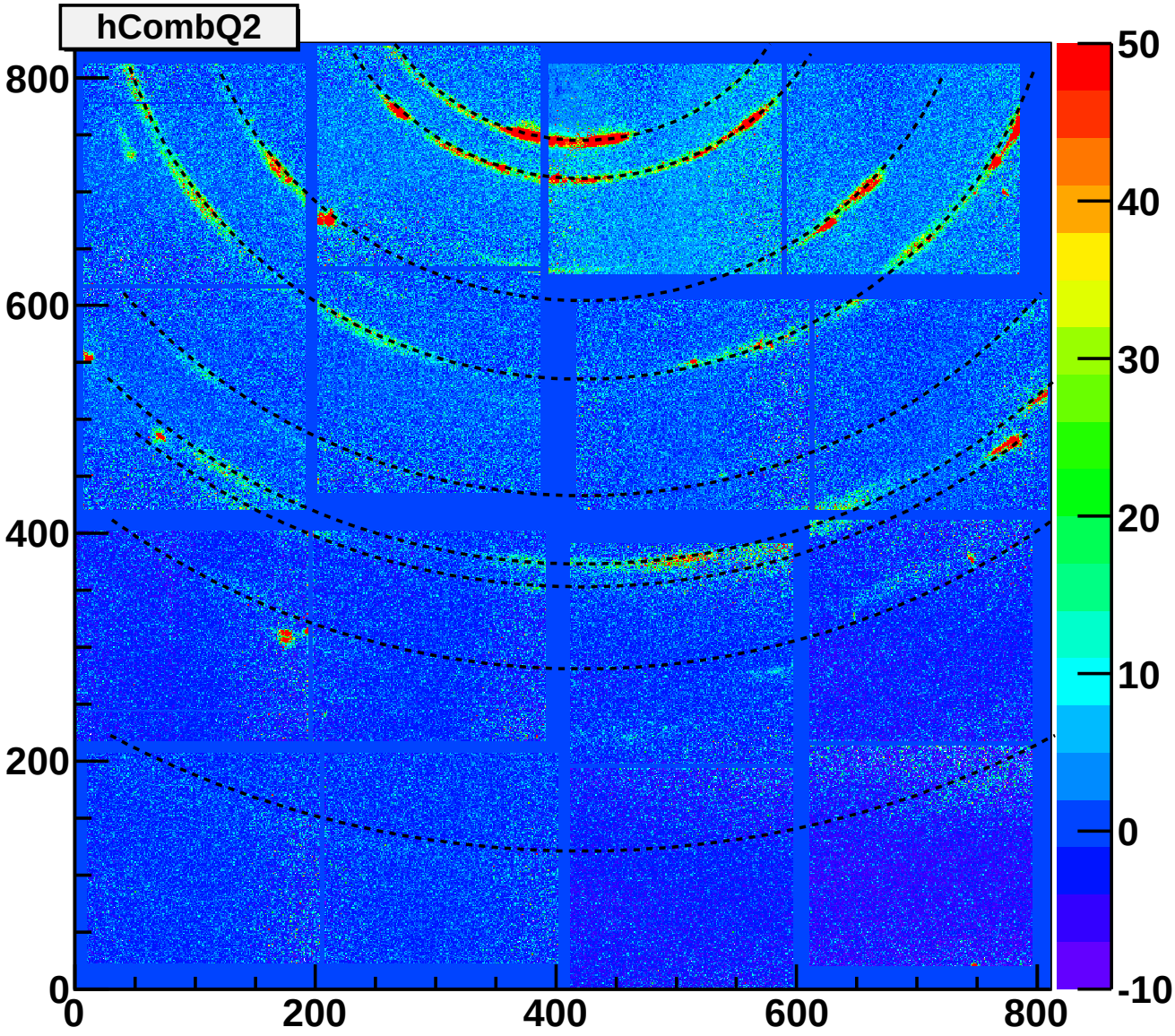

FIG. 4: r0547-s00, event 51, combined histogram array.

VI. TILT ANGLE OF ASICS

- Combined image is obtained in assumption that all ASICs are not tilted
- Combined image has some problems, most likely some of ASICs need to be tilted
- Re-define ASIC image histogram in case of tilt angle
- Use for tilt angle alignment run 678 for signal and 677 for background subtraction

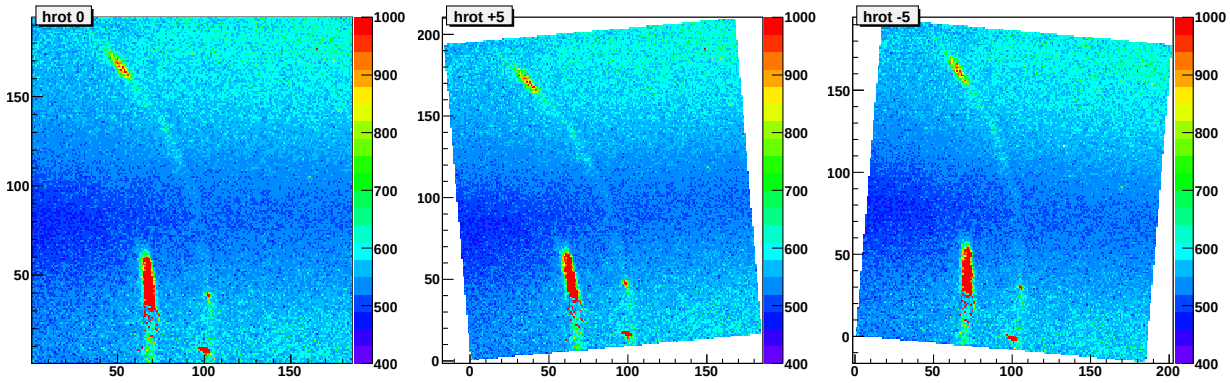

FIG. 5: Test of the tilt angle rotation.

VII. TILT ANGLE ALIGNMENT

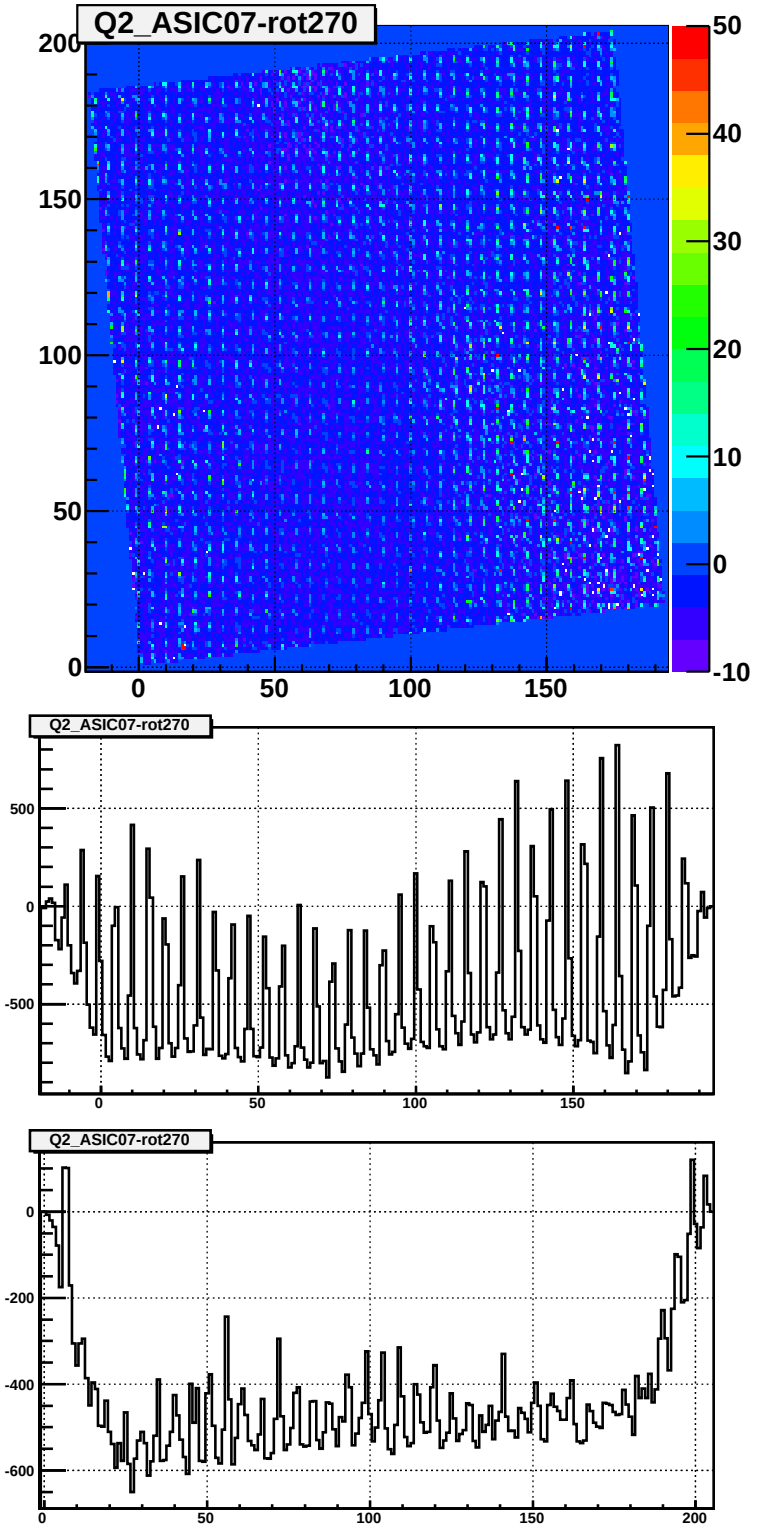

FIG. 6: r0678-s00: average of 50 events, ASIC 7.

TABLE II: Tilt angle of ASICs $\alpha = \overline{\alpha} + \Delta\alpha$ w.r.t. $\overline{\alpha} = 5.7°$.

ASIC	$\Delta\alpha$, (°)	ASIC	$\Delta\alpha$, (°)	ASIC	$\Delta\alpha$, (°)	ASIC	$\Delta\alpha$, (°)
00, 01	+ 0.2	04, 05	– 0.1	08, 09	– 0.4	12, 13	+ 0.1
02, 03	+ 0.7	06, 07	+ 0.1	10, 11	– 0.4	14, 15	+ 0.1

TABLE III: Comparison of my and Henrik Lemke tilt angle alignment.

	My alignment		H.L. alignment		My – Henrik
ASIC	Nominal angle	$\Delta\alpha$ (°) w.r.t. 5.8°	"Segment"	$\Delta\alpha$ (°) w.r.t. 5.8°	$\Delta\alpha$ (°)
00, 01	0	+0.1	4	–0.509	–0.609
02, 03	0	+0.6	3	–0.649	1.249
04, 05	270	–0.2	6	–0.776	0.576
06, 07	270	+0.0	5	–0.810	0.810
08, 09	180	–0.5	7	–0.351	0.149
10, 11	180	–0.5	8	–0.354	0.146
12, 13	270	+0.0	1	–0.006	0.006
14, 15	270	+0.0	2	–0.316	–0.316

- Grid itself is not $x - y$-orthogonal up to 1°
- Alignment procedure: adjusting tilt angle try to get the best visibility in X projection (or use vertical colons for alignment)
- Precision of this procedure is $\approx 0.1°$
- Note, that 1° misalignment corresponds to 3.3 pixels over the length of ASIC.

VIII. PLAN

- Fit to 2D histogram works slow (≈5 min)
- Work on fast procedure for alignment
- Plan to get configuration constants taking into account tilt angles
- For beter alignment need in better images; uniform rings covering all ASICs