X-Ray Camera Scan of Aerogel
Preliminary tests

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RICH Meeting
10.10.2014

Dependence of aerogel refractive index on density

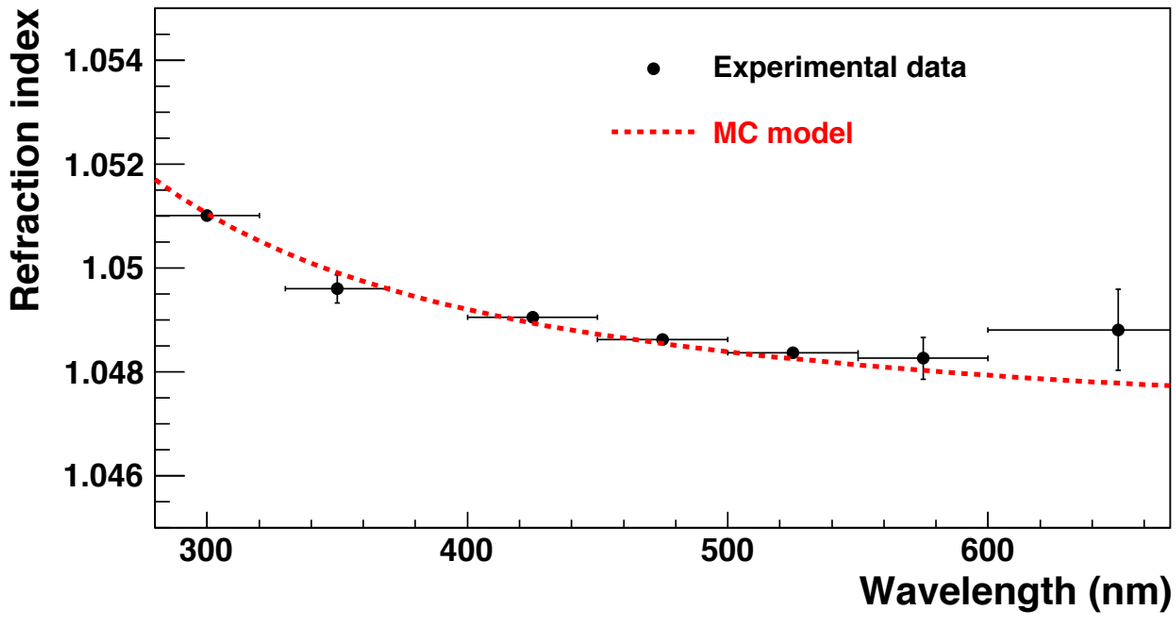
$$n^2 = 1 + \alpha\rho \quad (\alpha = 0.438)$$

Inhomogeneity in density → Inhomogeneity in refractive index

Uncertainty in numerical precision of estimates

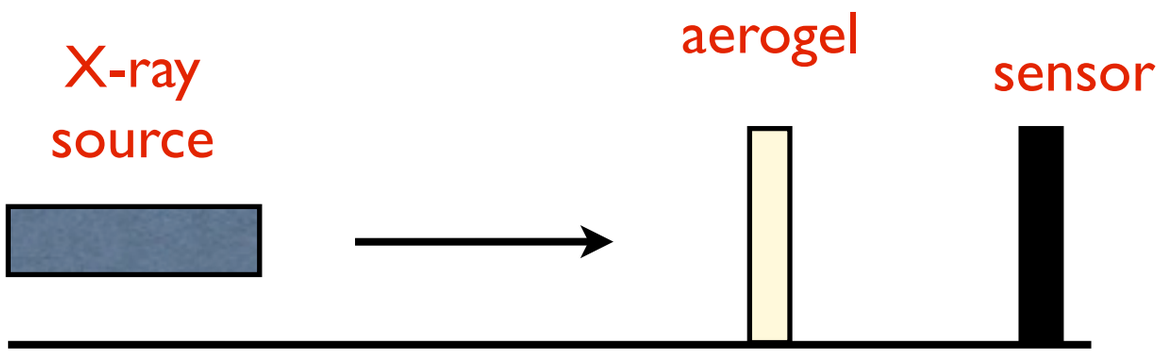
$$\frac{dn}{n} = \frac{1}{2}\left[1 - \frac{1}{n^2}\right]\frac{d\rho}{\rho}$$

$$\frac{dn}{n} = 0.0464\frac{d\rho}{\rho}$$



Goal → Measure the variations of refractive index over the surface of the aerogel tiles with high precision

Introduction

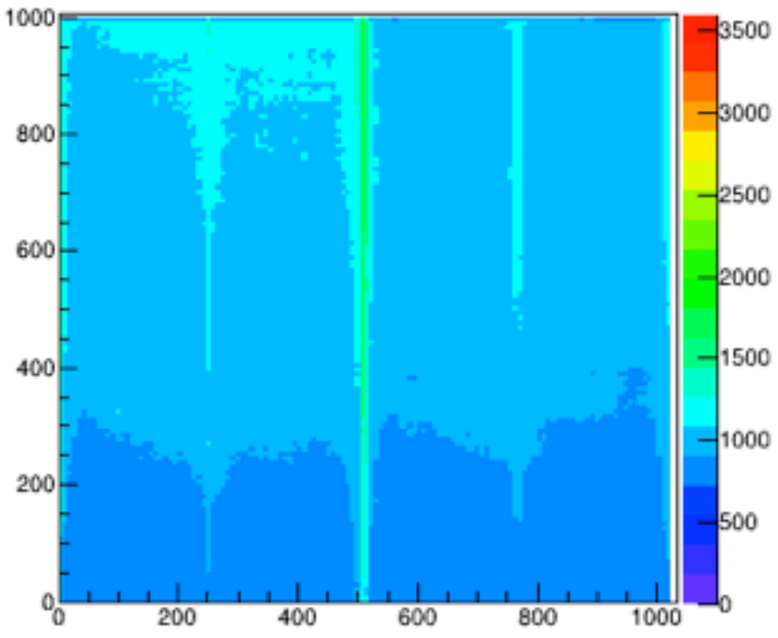


1. Dark image : Source switched off
2. White image : Source on & w/o aerogel
3. Aerogel image : Source on & with aerogel

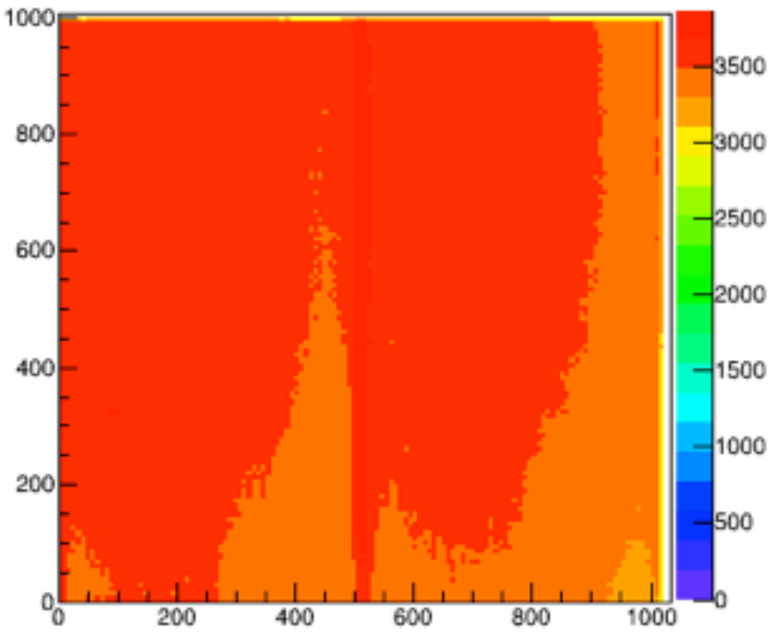
Measurement options:

- Different beam energies (12, 16, 18,20, 25 kV).
- Different measurement time periods (25,30,..,50s).
- Possibility to combine multiple frames.

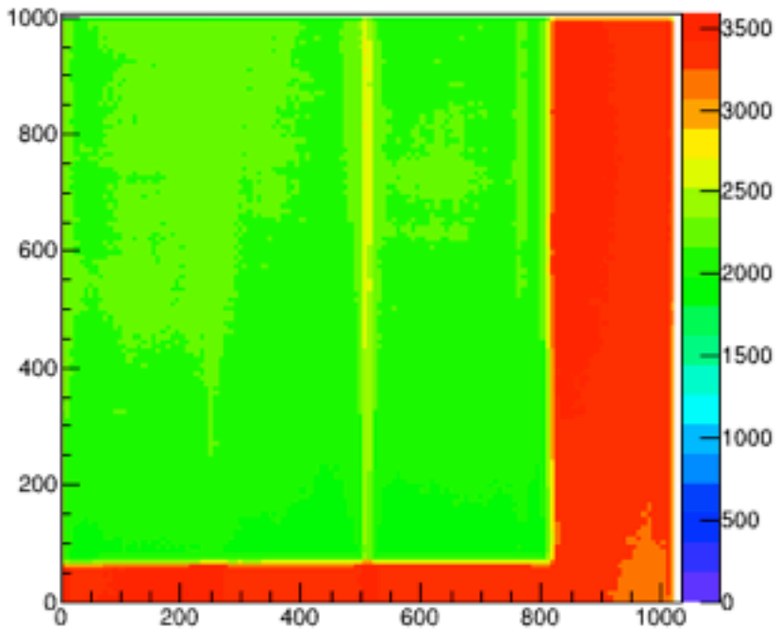
Dark



White



Aerogel



Summery of measurements: e-logbook

Dark

White

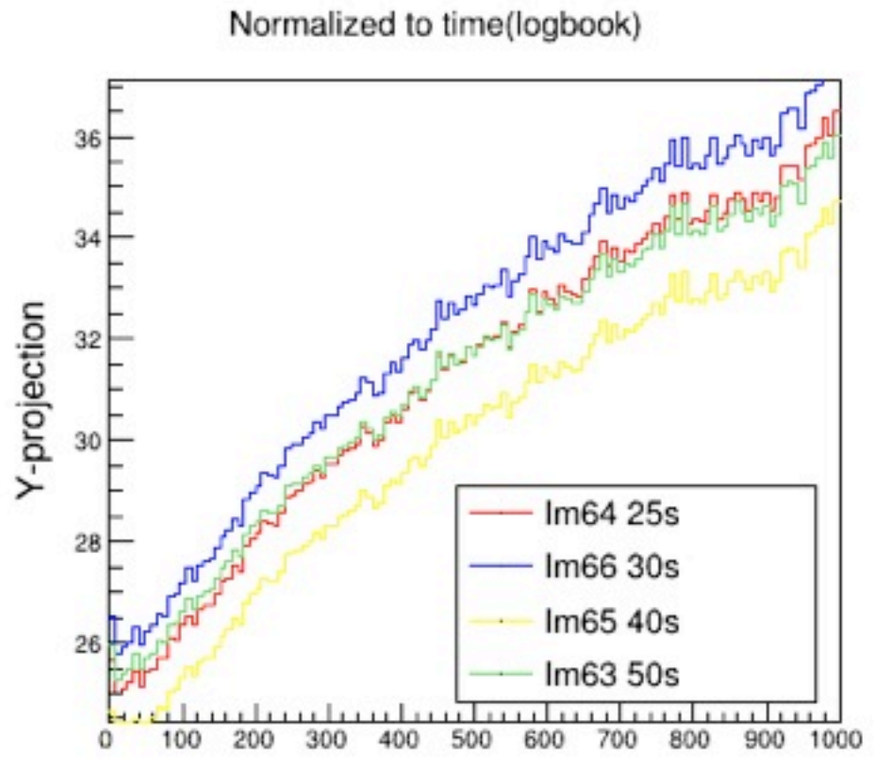
Aerogel

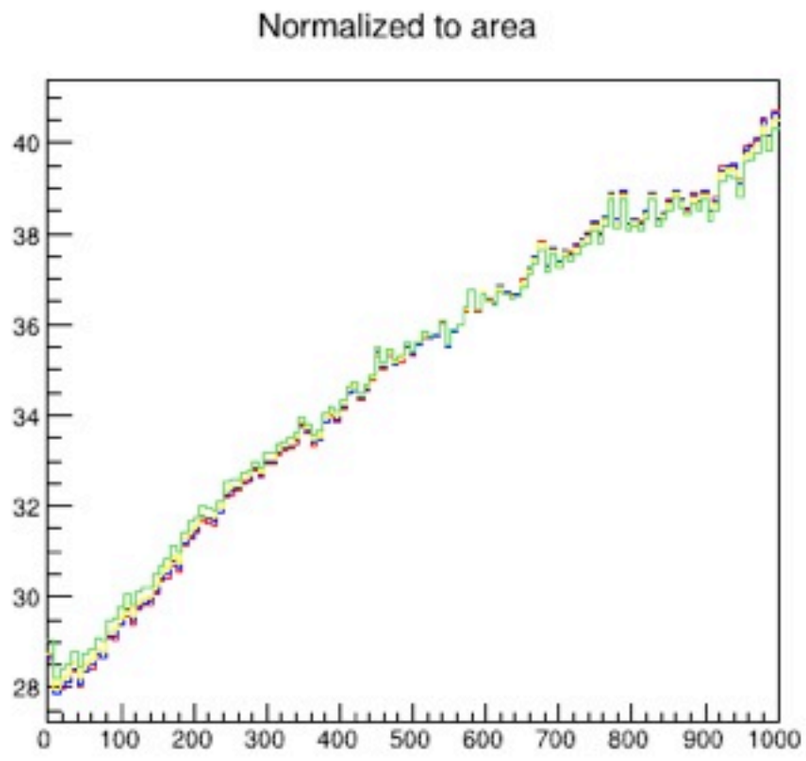
Image2_12s_15kV
Image3_20s_15kV
Image4_20s
Image5_22s_15kV
Image6_35s_15kV
Image8_20s
Image9_5s_25kV
Image10_20s_25kV
Image11_8s_25kV
Image12_20s_25kV
Image13_50s
Image14_40s
Image16_25s
Image18_25s_25kV
Image20_30s
Image23_30s_25kV
Image25_35s
Image27_35s_25kV
Image29_28s_25kV
Image30_28s_25kV
Image31_32s_25kV
Image32_27s_15kV
Image33_30s_25kV
Image34_27s_25kV
Image35_26s_25kV
Image36_21s_25kV
Image38_40s
Image39_10s_20kV
Image40_35s_20kV
Image38_40s

Image39_10s_20kV
Image40_35s_20kV
Image42_34s
Image44_37s_18kV
Image46_27s
Image48_35s
Image50_35s_16kV
Image51_30s
Image53_35s_15kV
Image55_40s
Image56_45s_15kV
Image57_20s_15kV
Image58_45s_15kV
Image59_50s
Image61_45s_12kV
Image62_45s_12kV
Image63_50s -10f
Image64_25s -10f
Image65_40s -10f
Image66_30s -10f
Image67_30s_25kV -10f
Image68_30s_25kV - 10f
Image69_35s_20kV - 10f
Image70_40s_18kV - 3f
Image71_40s_16kV - 3f
Image72_35s_16kV - 3f
Image73_30s_25kV - 3f (russian)
Image74_30s_25kV - 10f (russian)
Image75_30s_25kV - 10f (big russian)
Image2B_30s_25kV - 10f

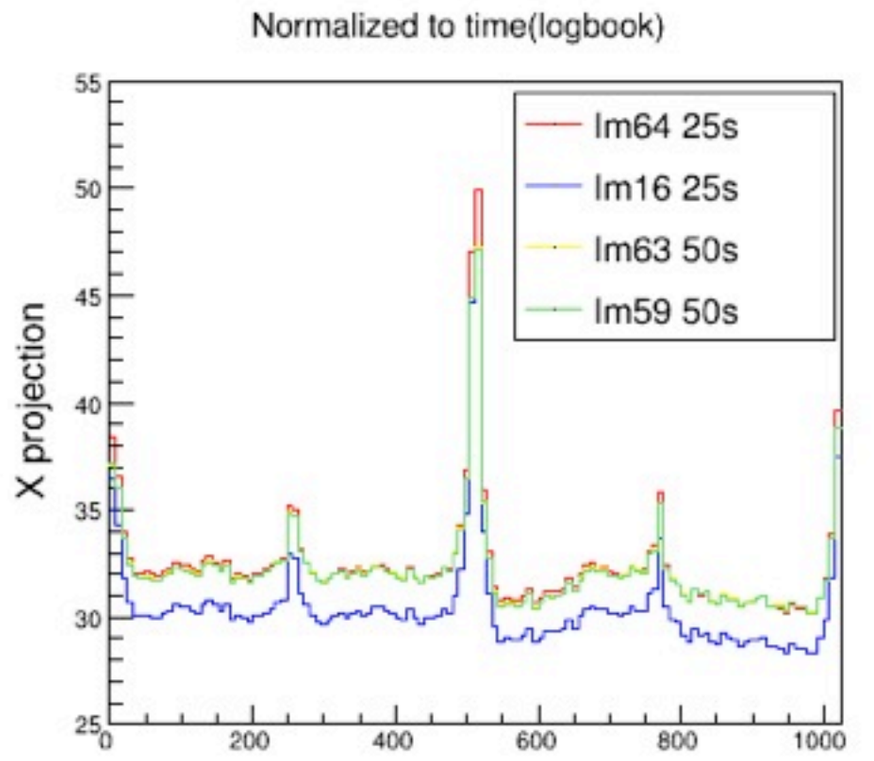
Dark image comparisons(Im 63,64,65,66,16,59)

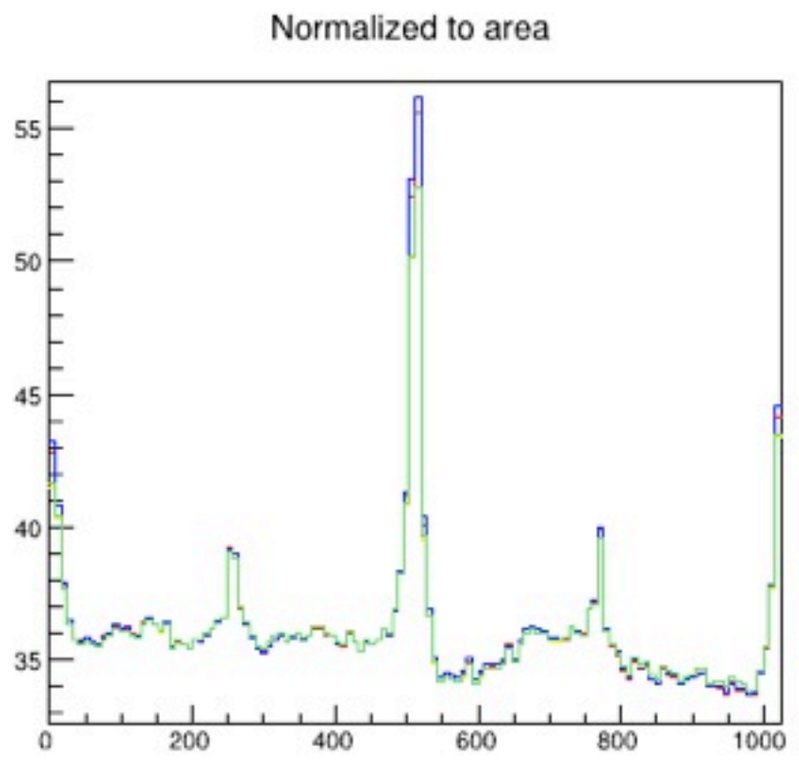
Y-projection



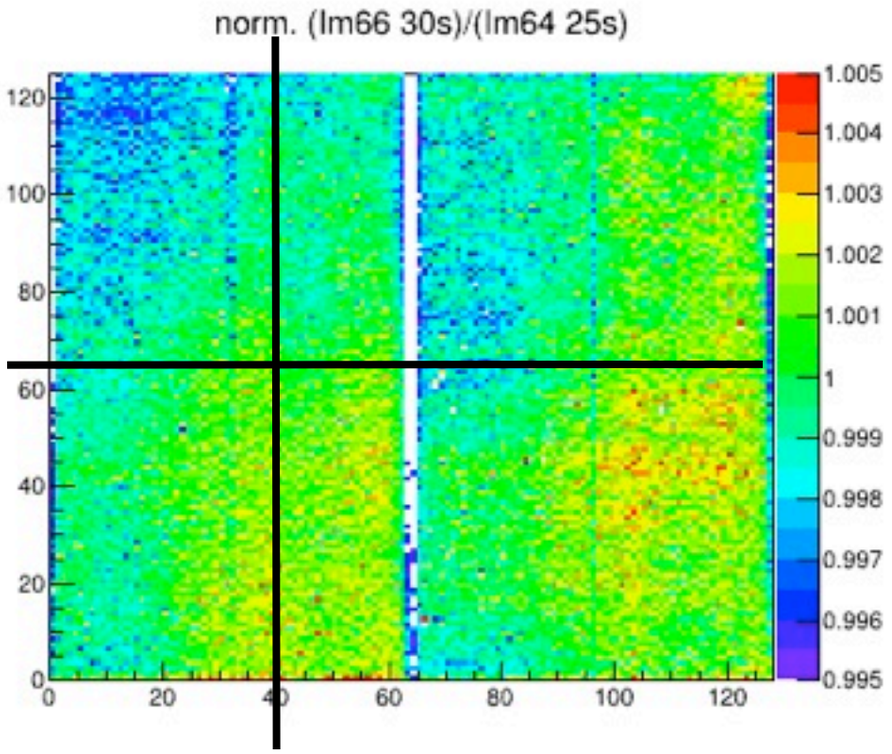


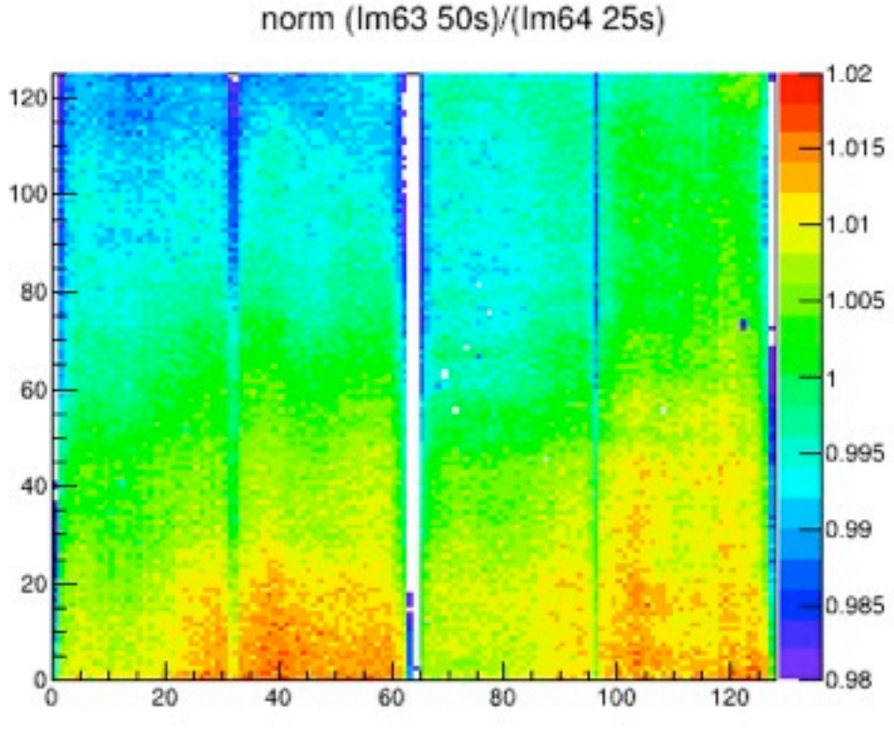
X-projection

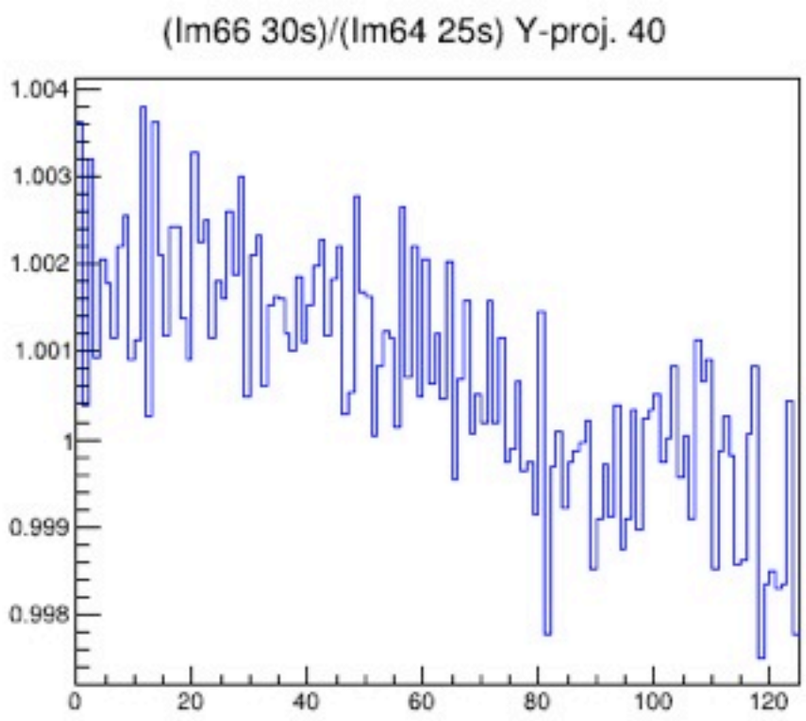


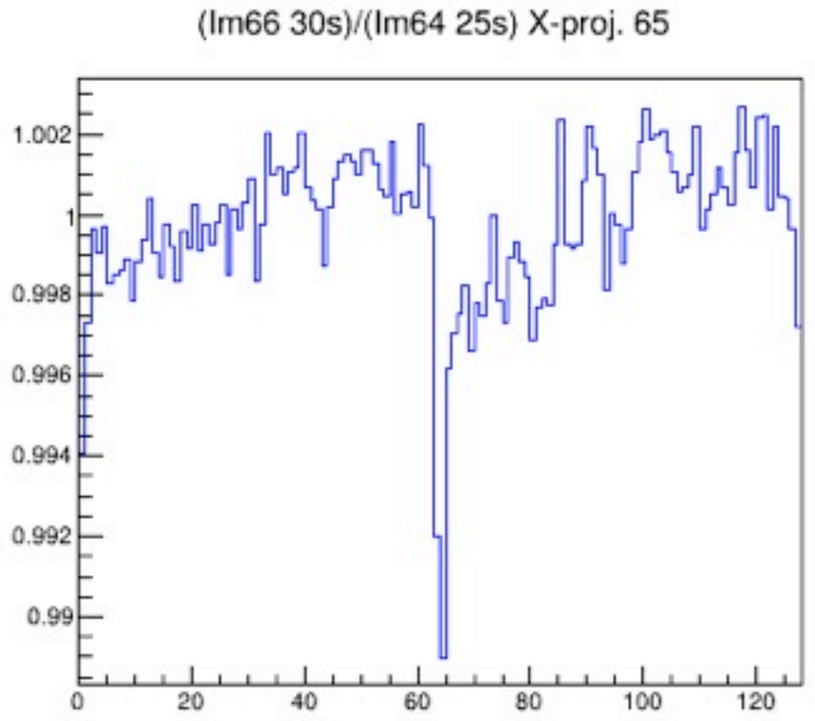


Dark image comparisons(Im 63,64,66)









Conventional definitions

$A - meas.\ image\ with\ aerogel$

$D - meas.\ image\ of\ dark\ rate$

$W - meas.\ image\ w/o\ aerogel$

Observable of interest:

$$R = \frac{(a+d)\tau_A - d\tau_d}{(w+d)\tau_W - d\tau_d}$$

Under the assumptions of equal measurement times for all 3 images:

$$R = \frac{A - D}{W - D}$$

Measurement times of A & W can be synchronized using the control region

$$\tau_A = c\tau_W \qquad c = \frac{Integral_A}{Integral_W}$$

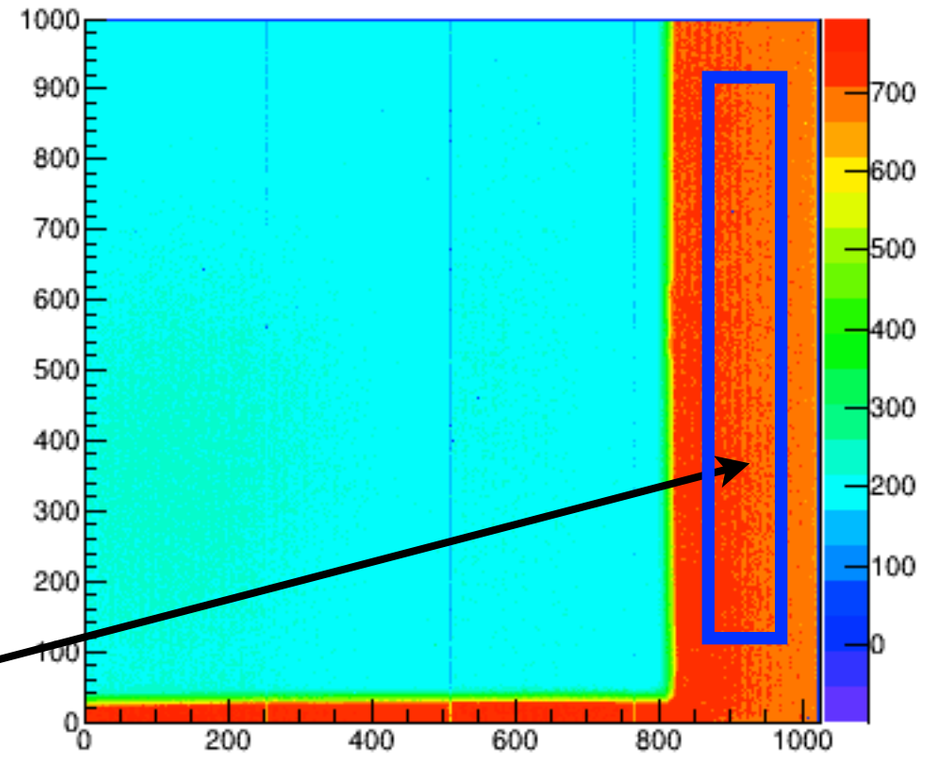
In terms of rates at unit time

$A = (a+d)\tau_A$

$D = d\tau_D$

$W = (w+d)\tau_W$

$\tau - meas.\ time$

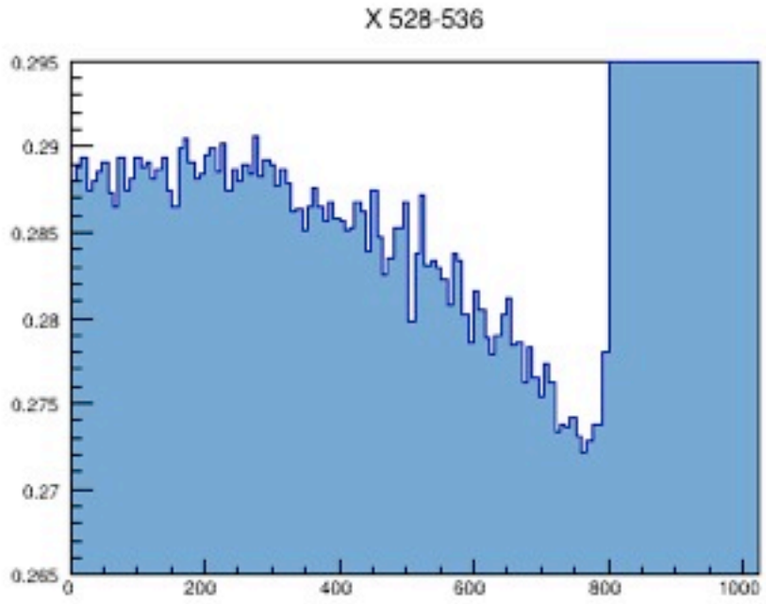


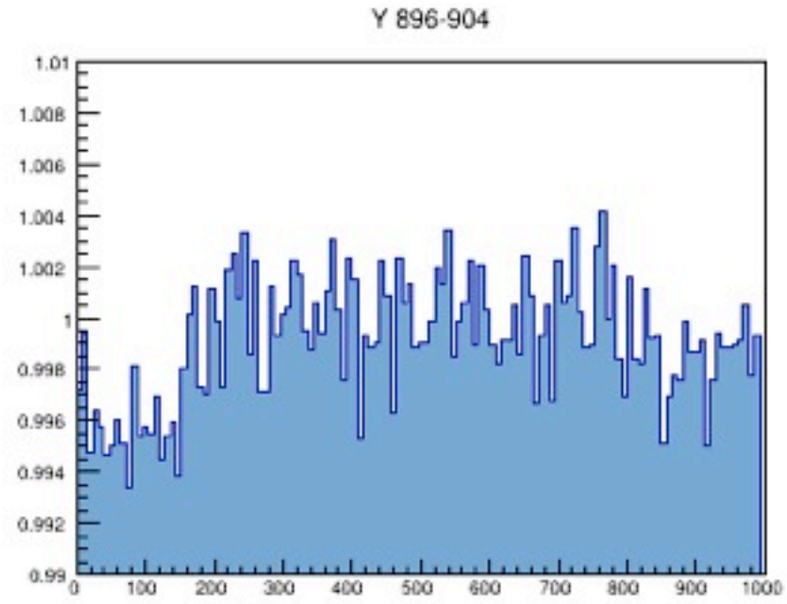
Synchronization of Dark images is not possible.

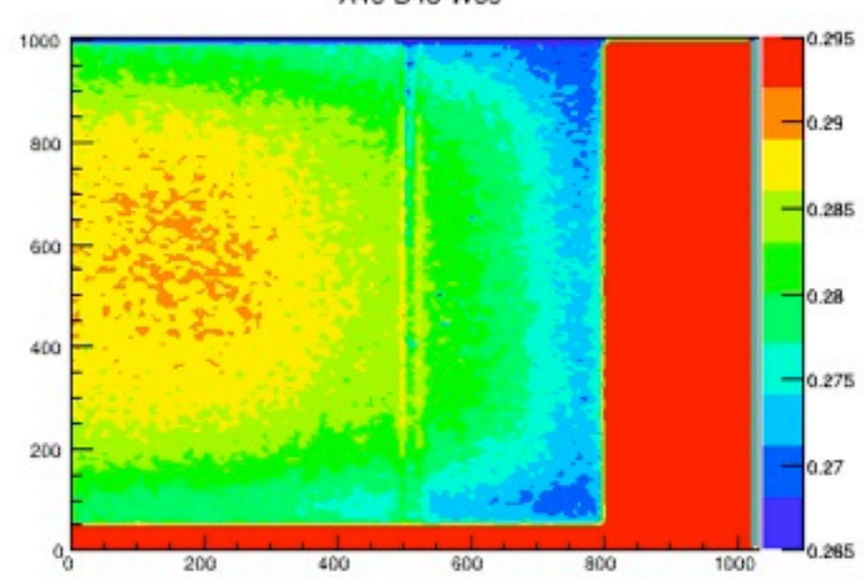
20 kv A-35s W-35s D-35s

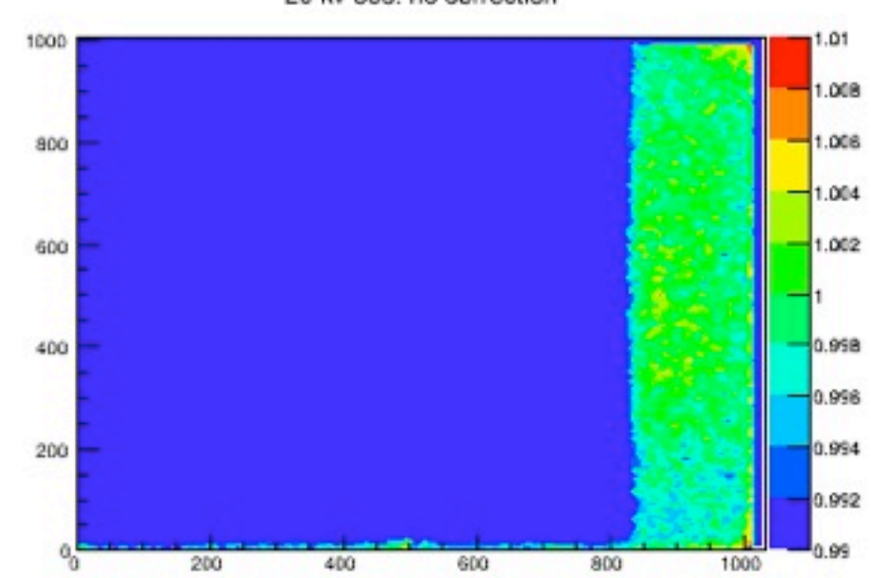
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.00





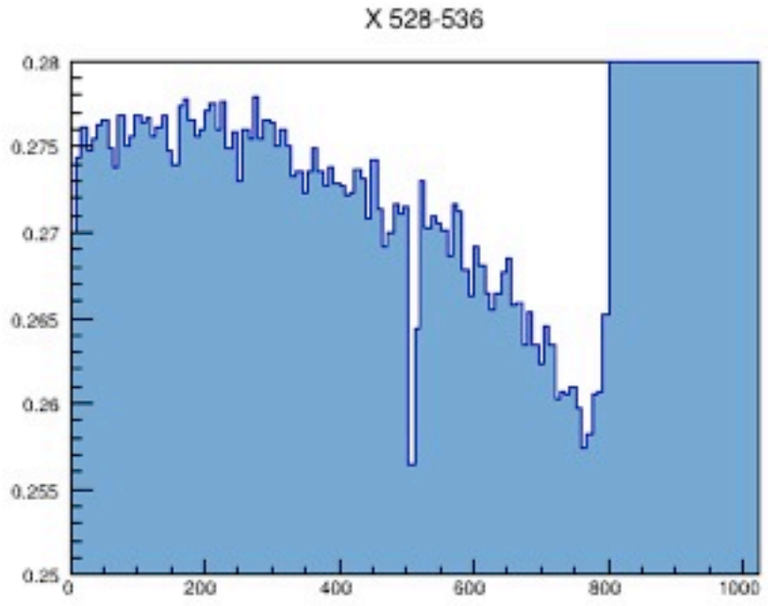


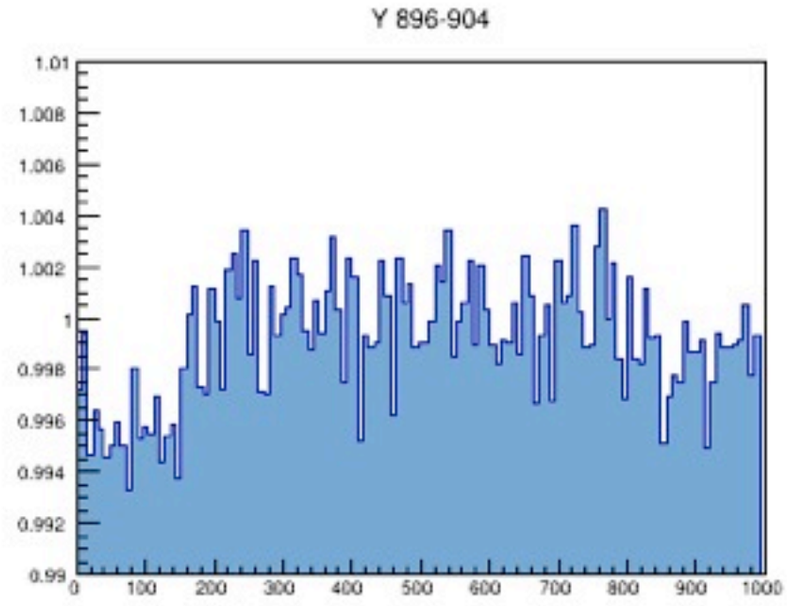


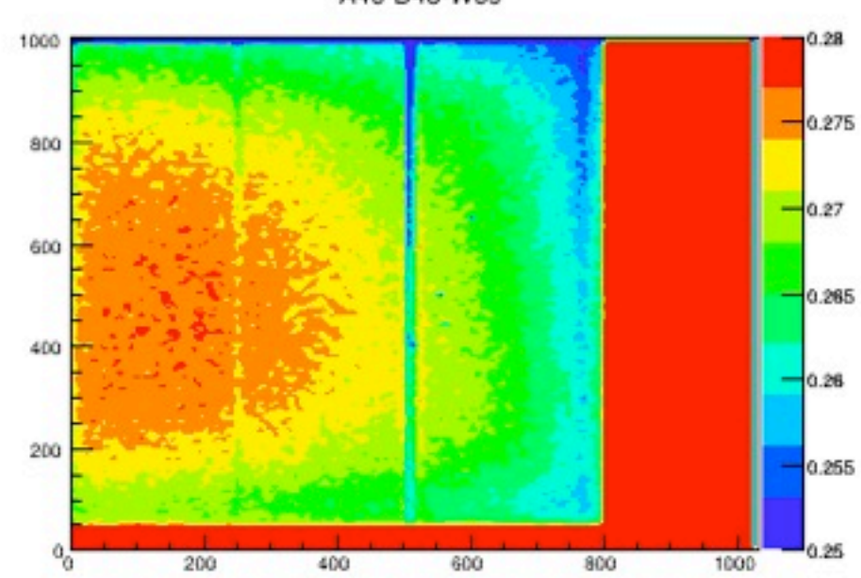
20 kv A-35s W-35s D-35s

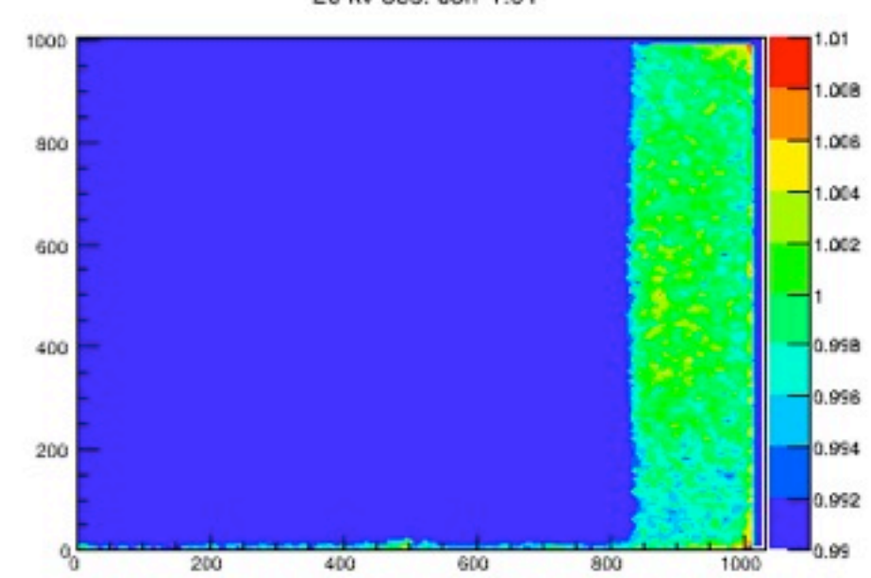
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.01





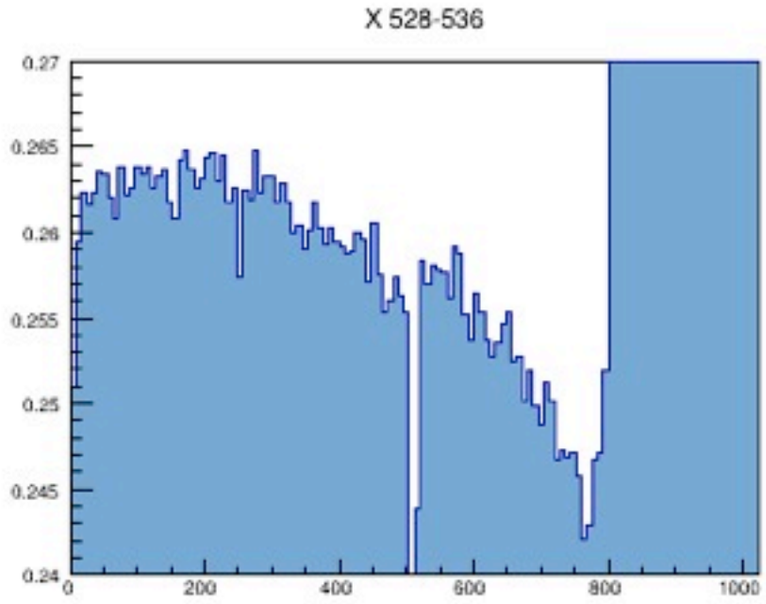


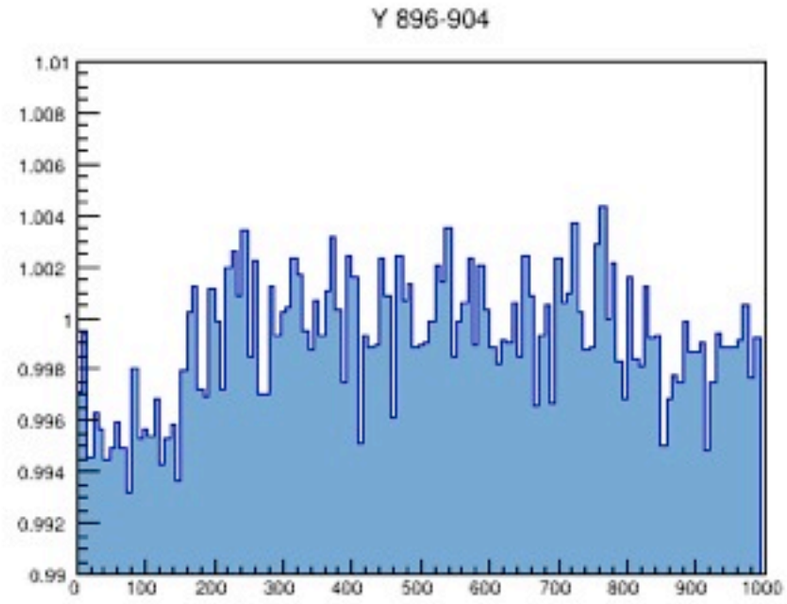


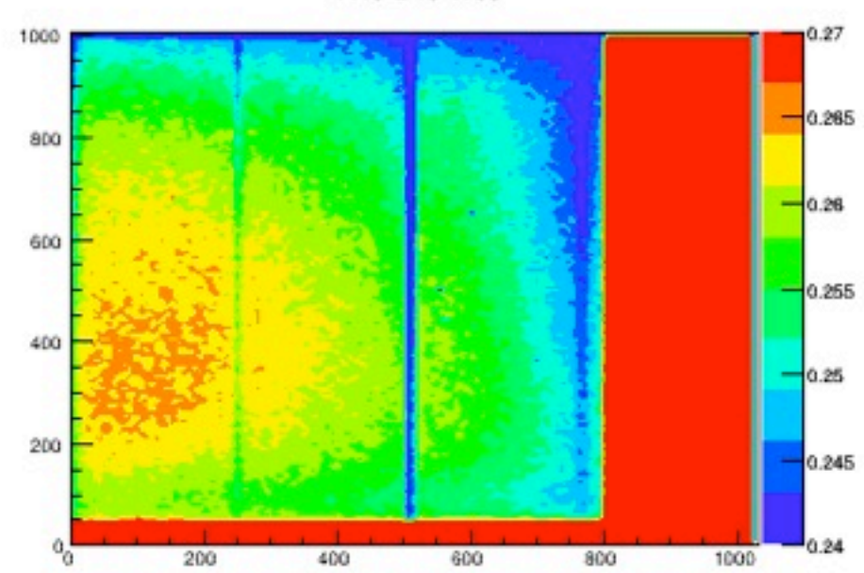
20 kv A-35s W-35s D-35s

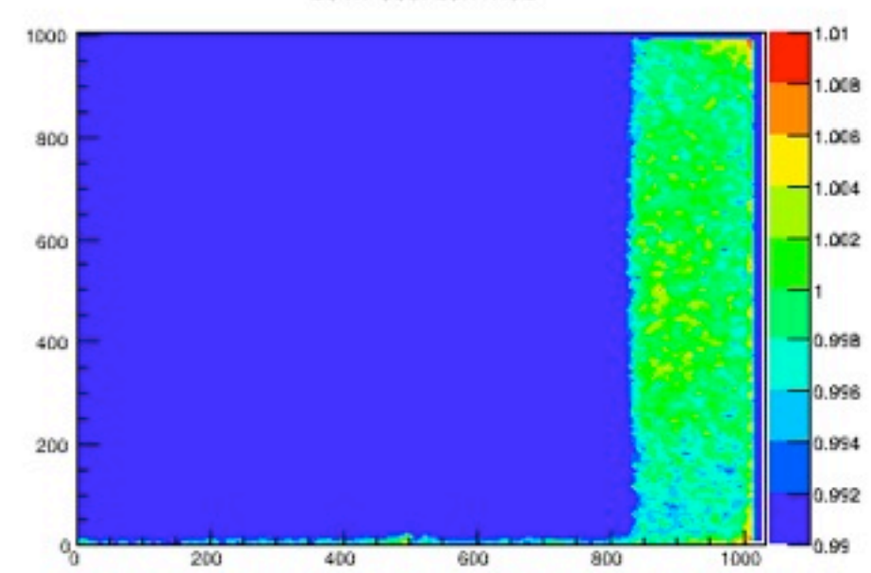
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.02





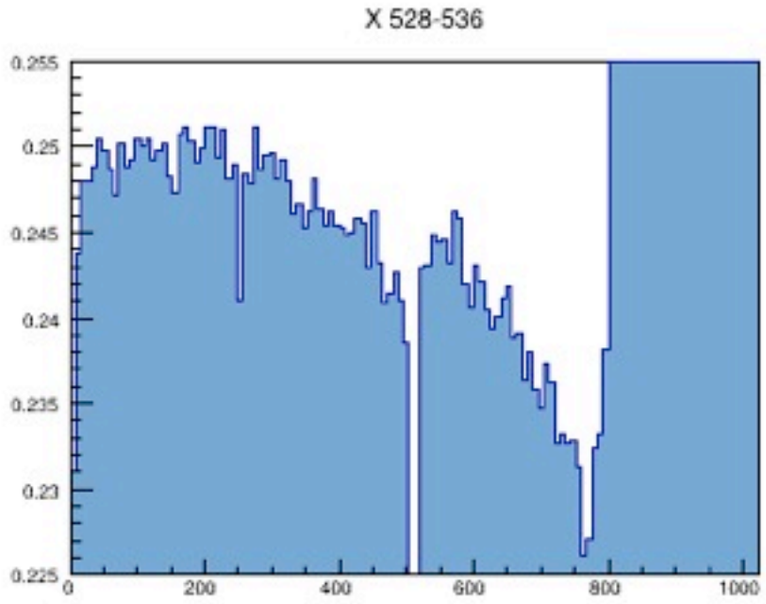


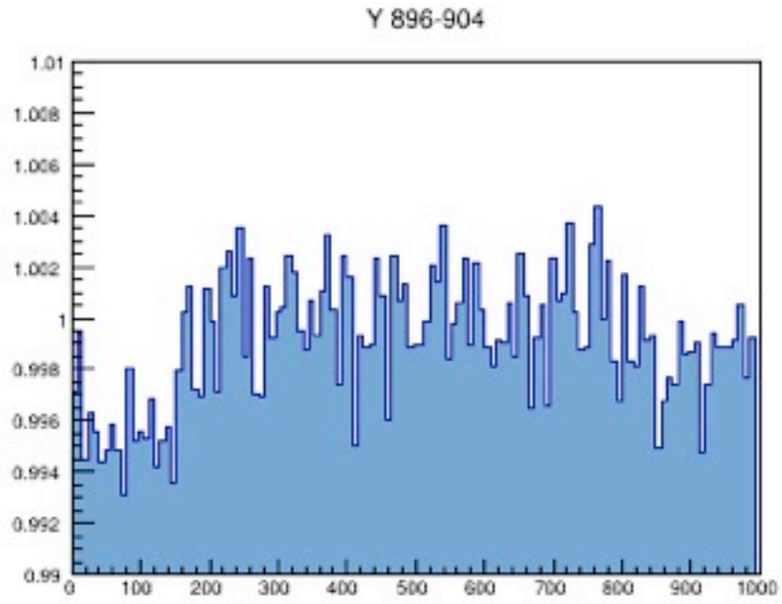


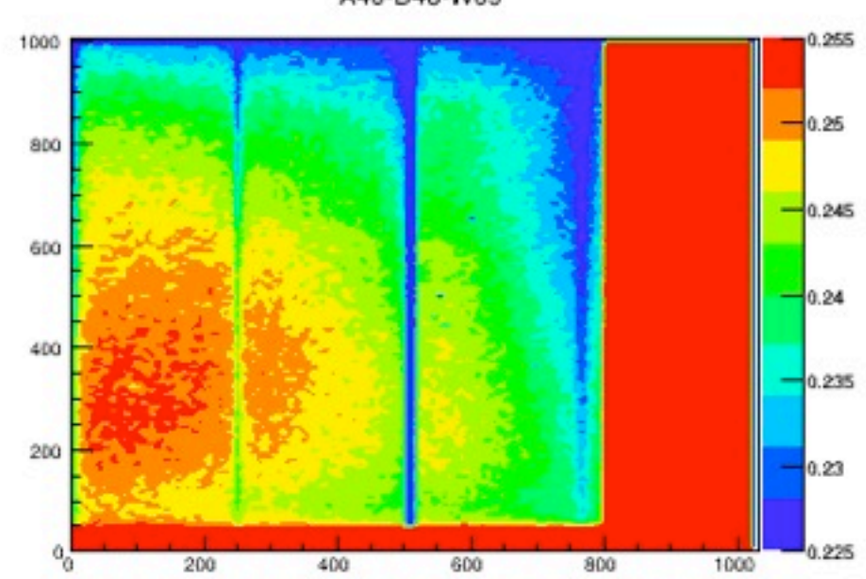
20 kv A-35s W-35s D-35s

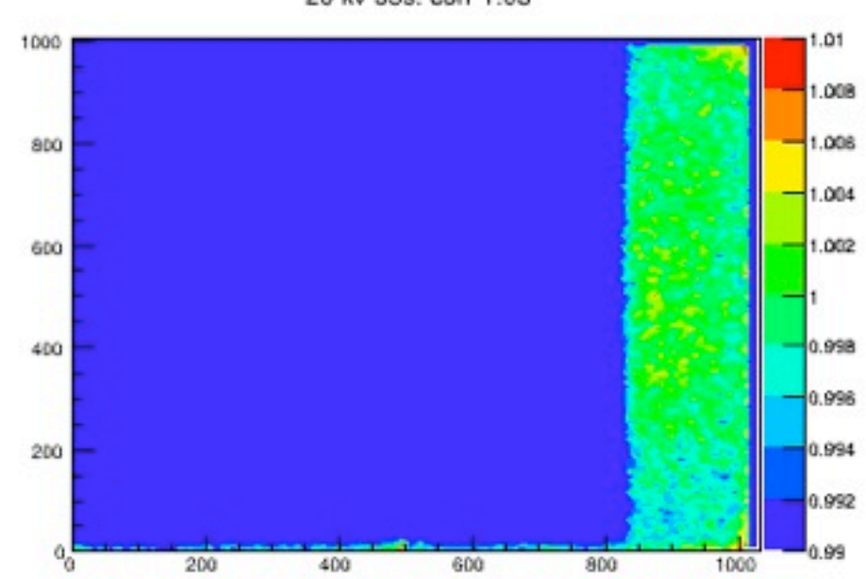
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.03





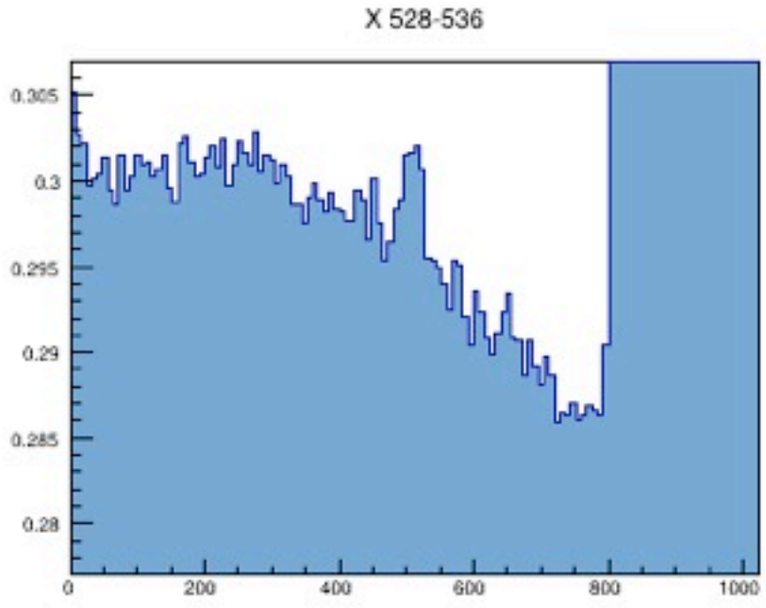


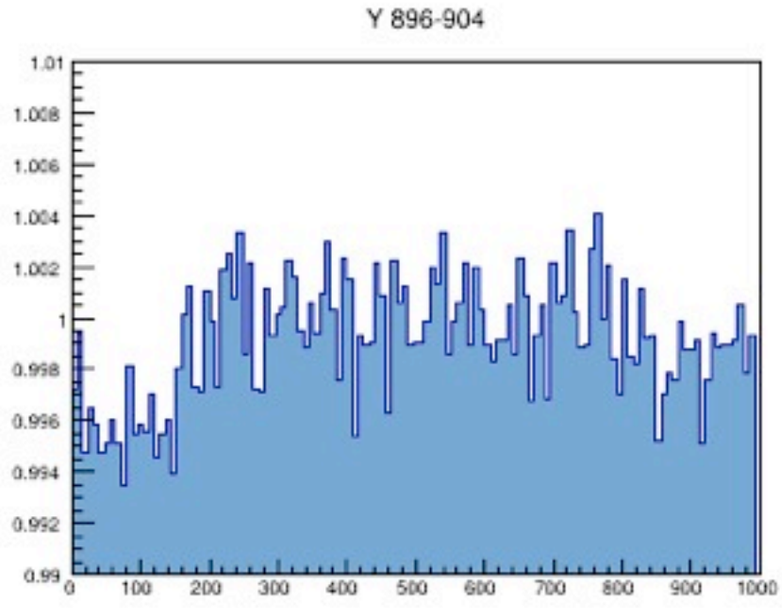


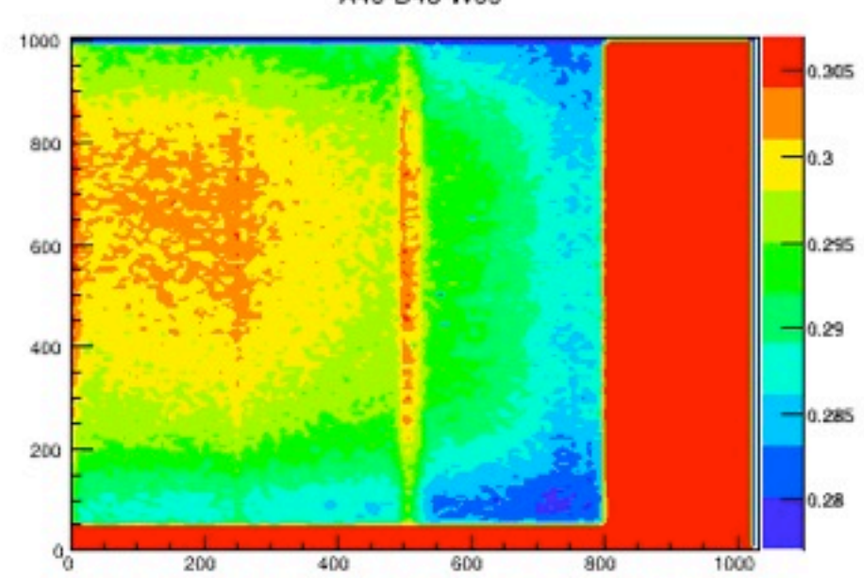
20 kv A-35s W-35s D-35s

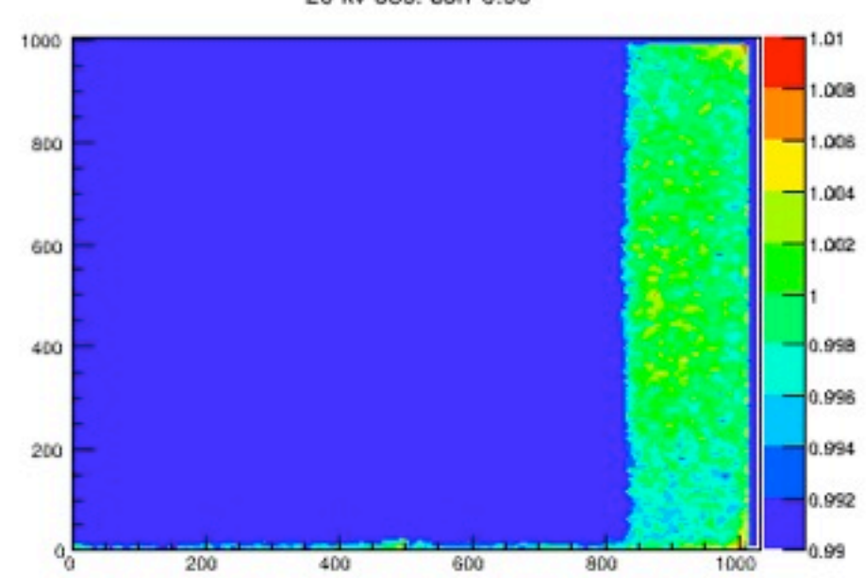
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=0.99





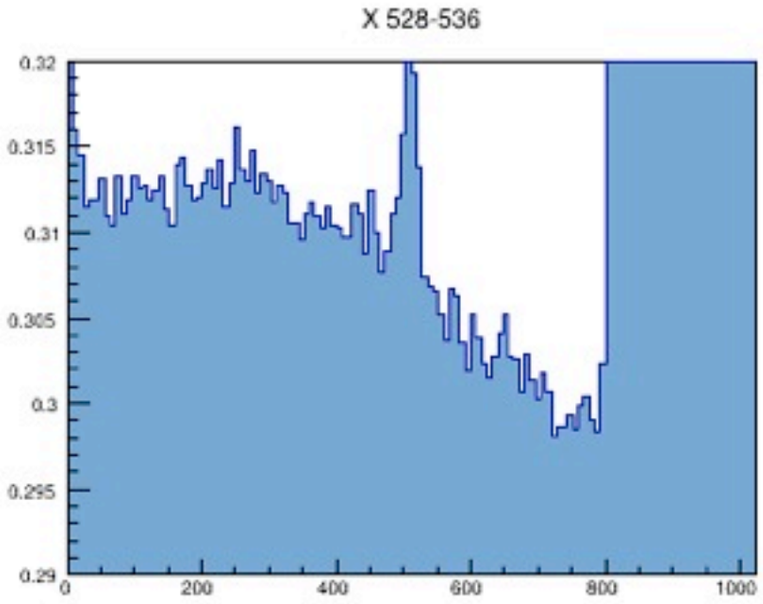


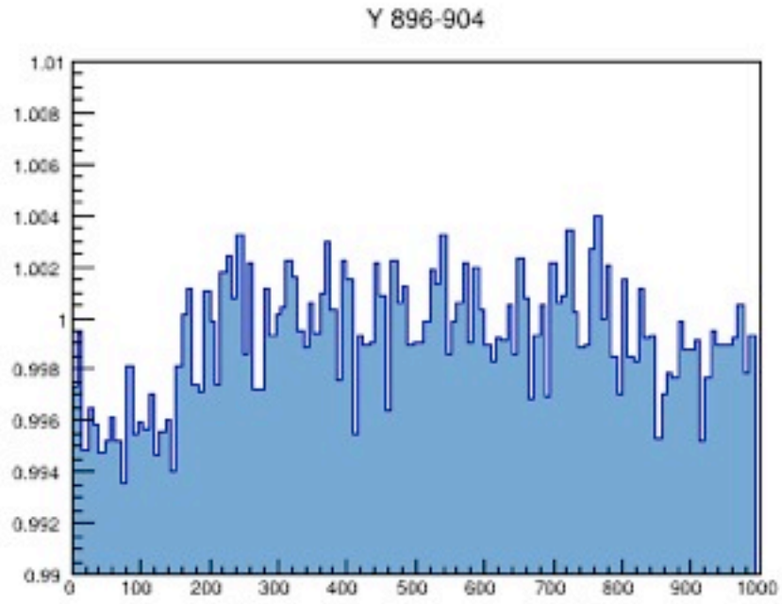


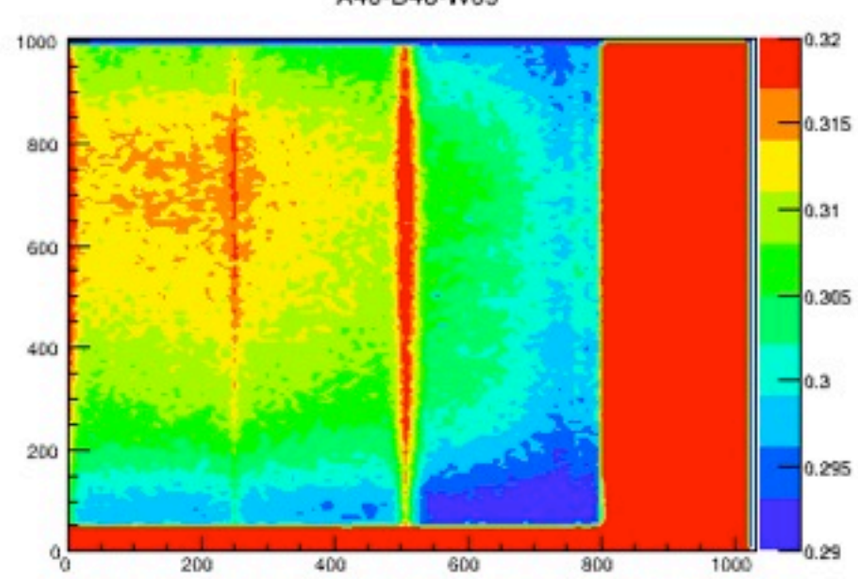
20 kv A-35s W-35s D-35s

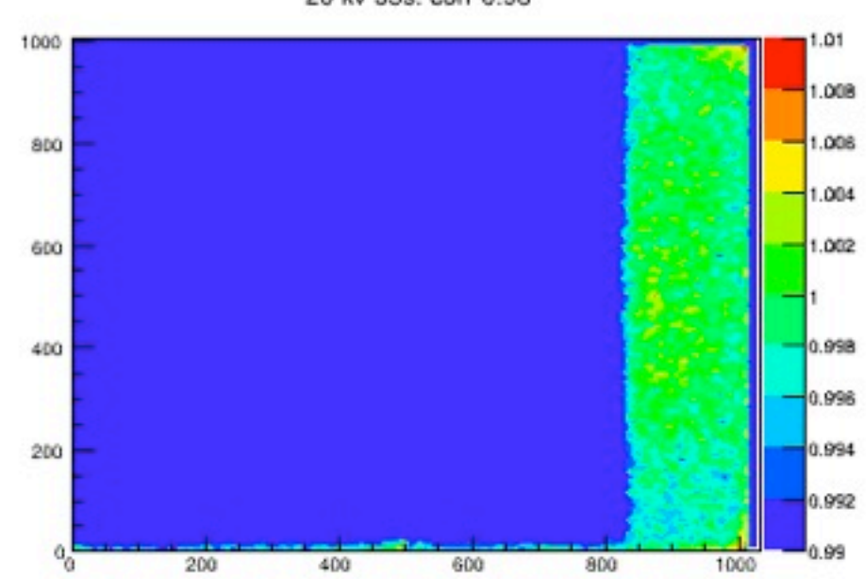
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=0.98





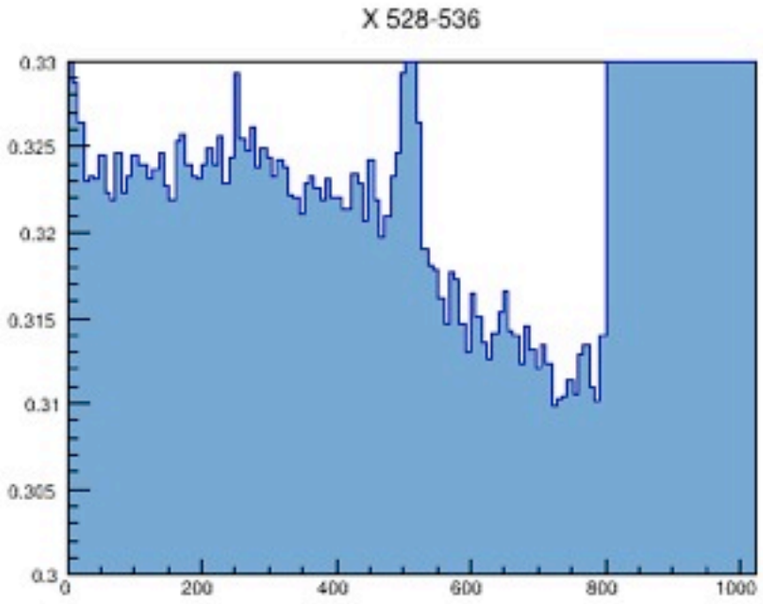


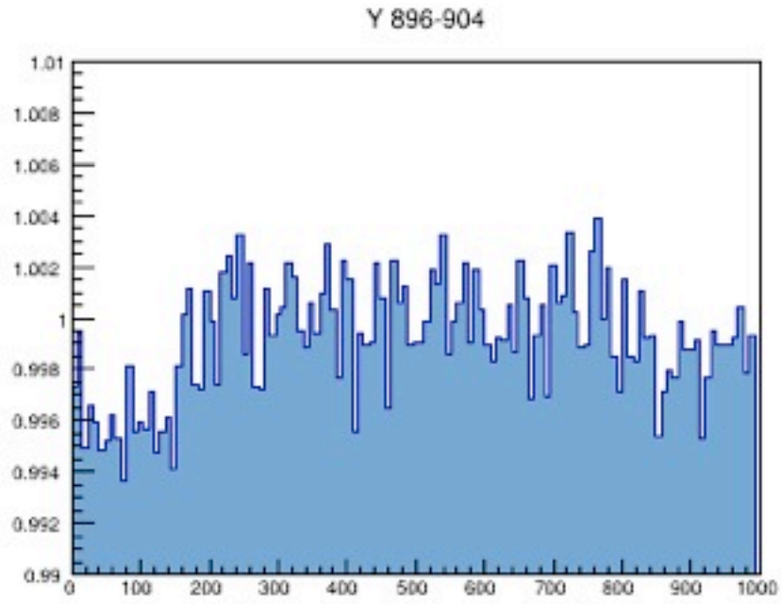


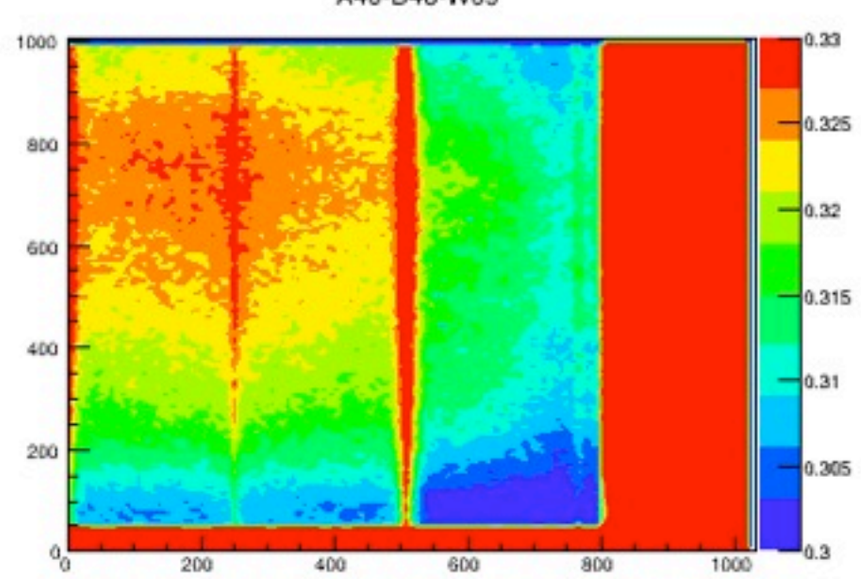
20 kv A-35s W-35s D-35s

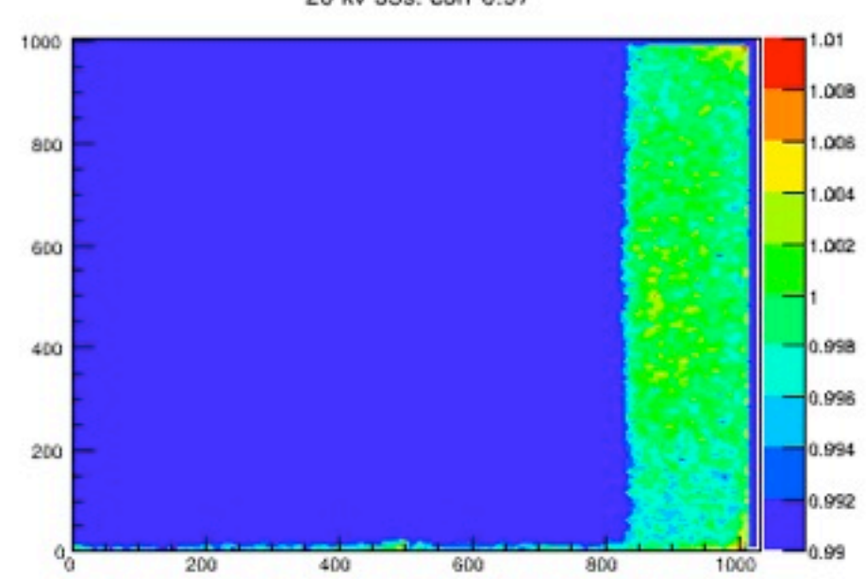
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=0.97





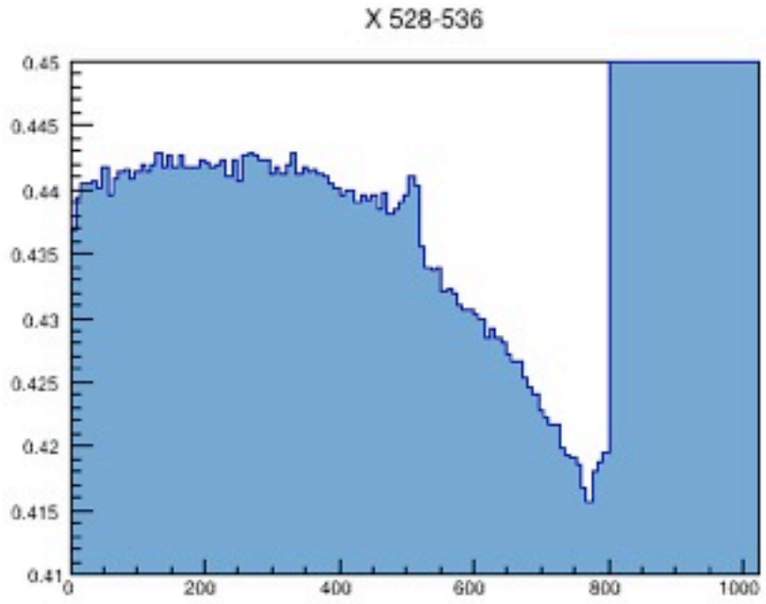


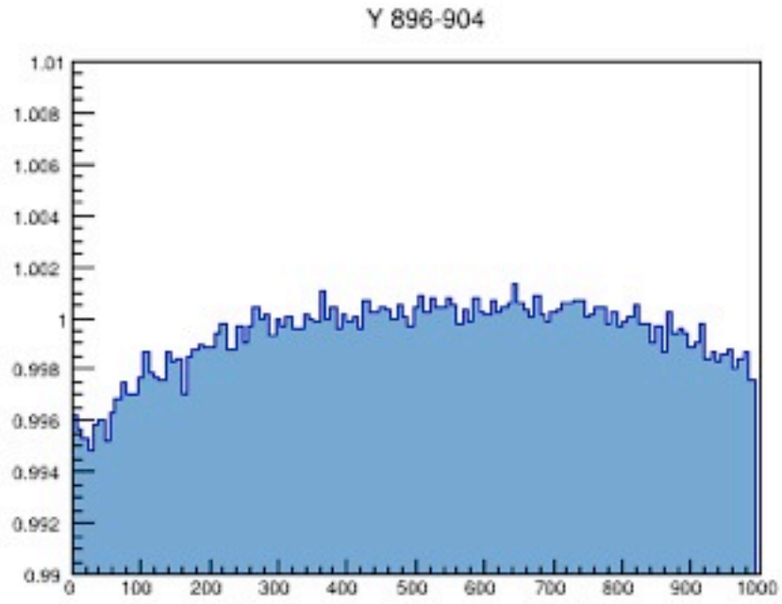


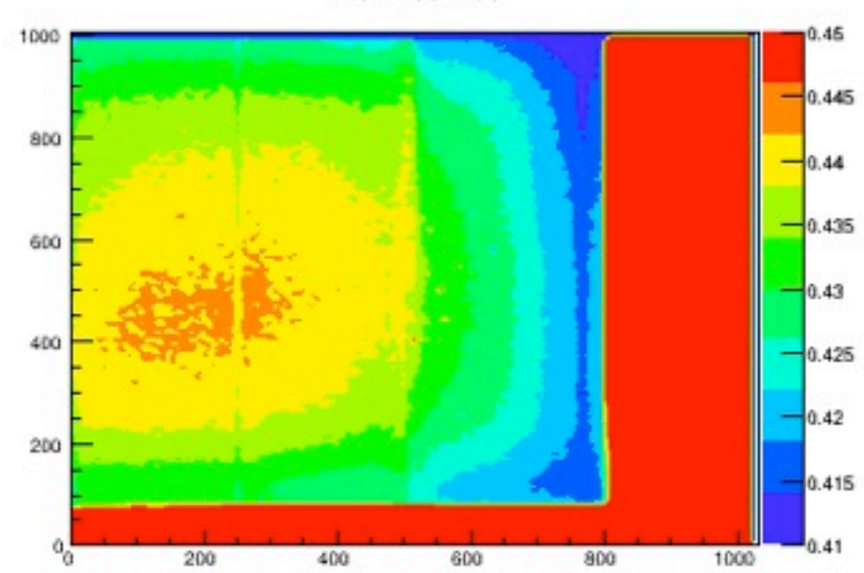
25 kv A-30s W-30s D-30s

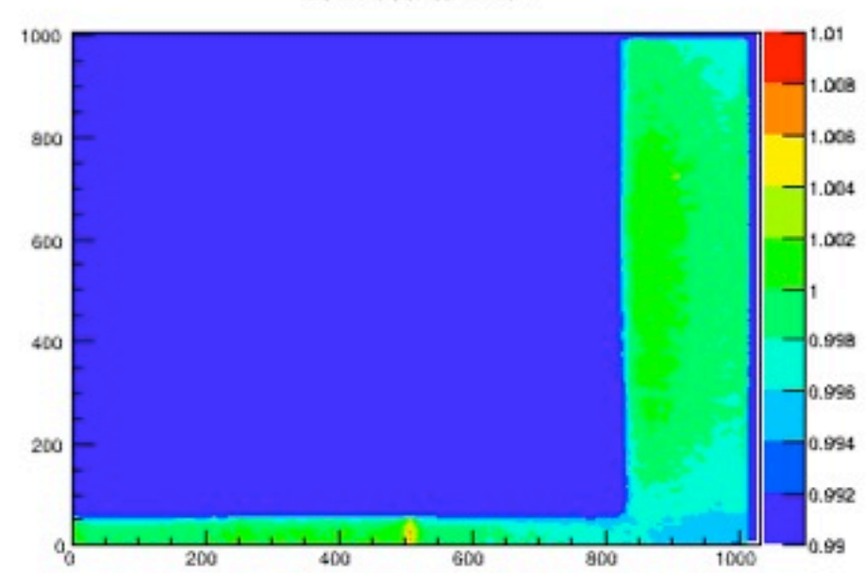
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.07





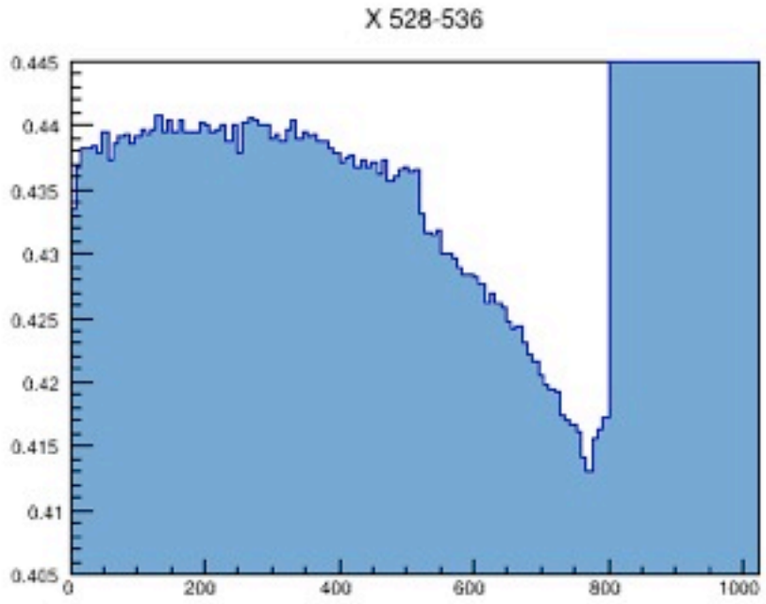


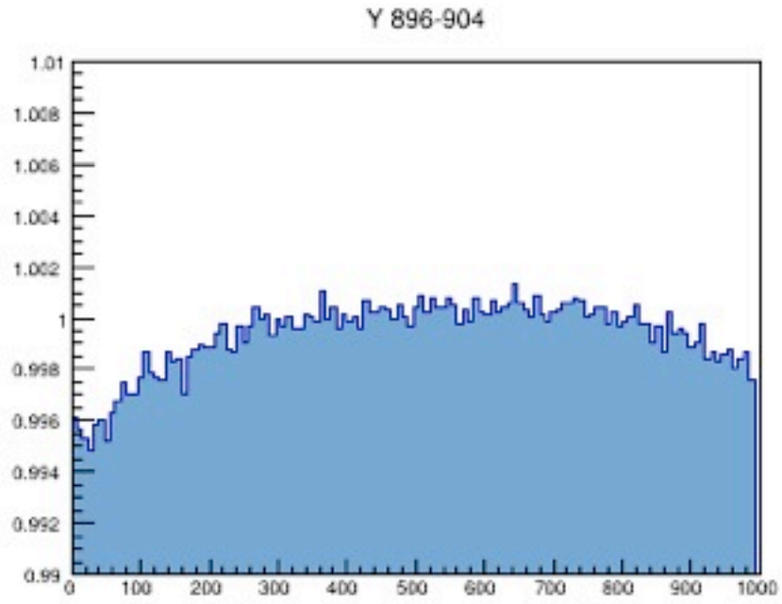


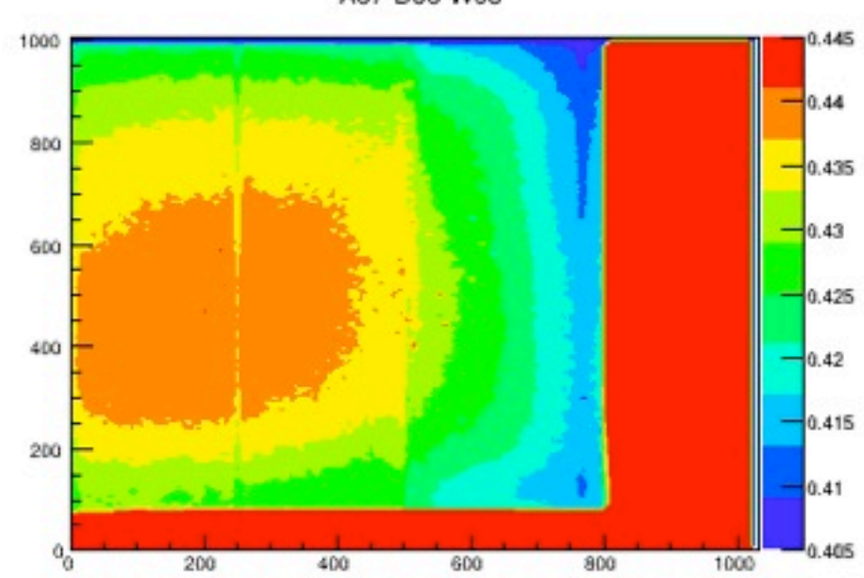
25 kv A-30s W-30s D-30s

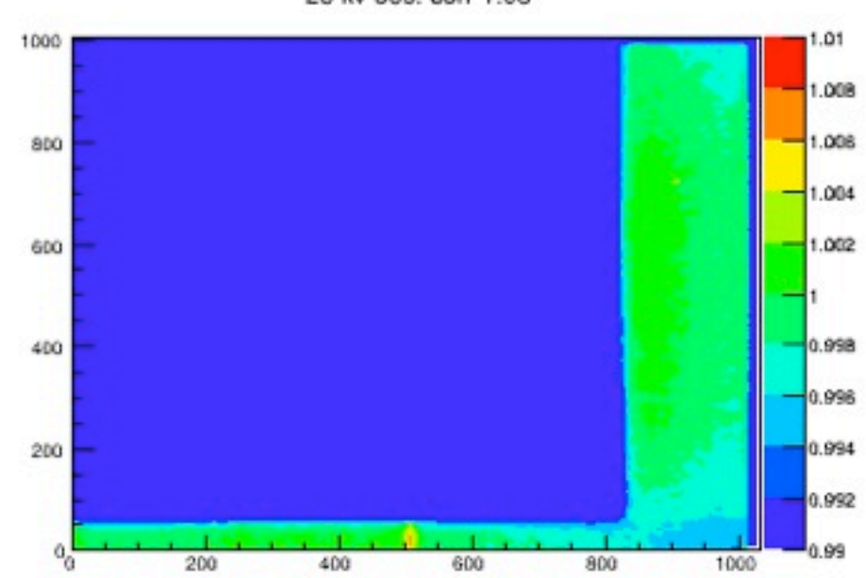
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.08





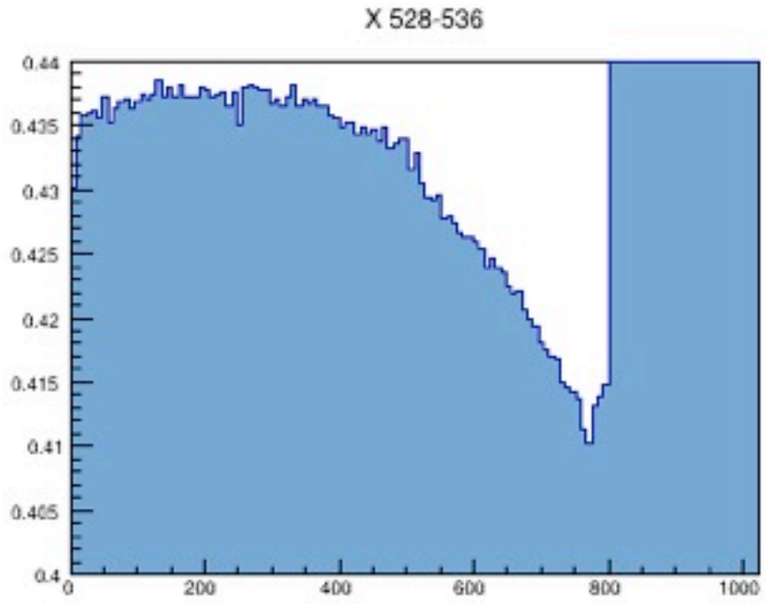


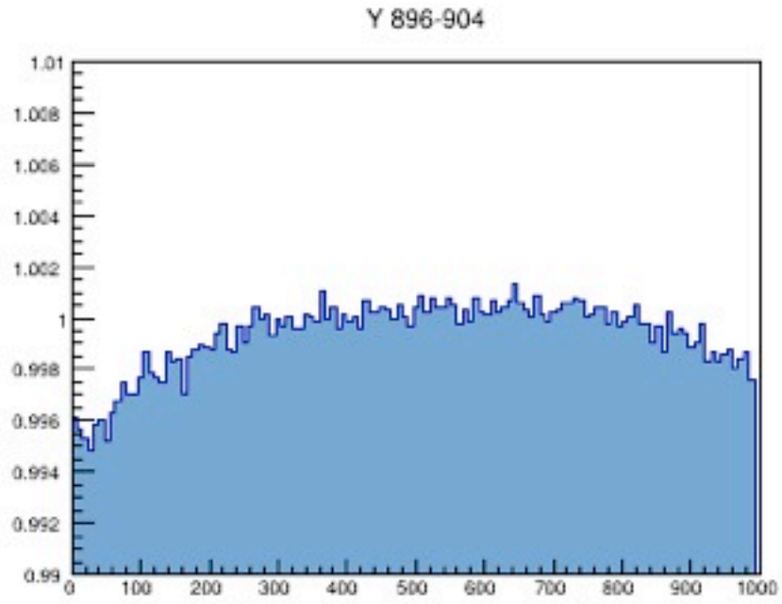


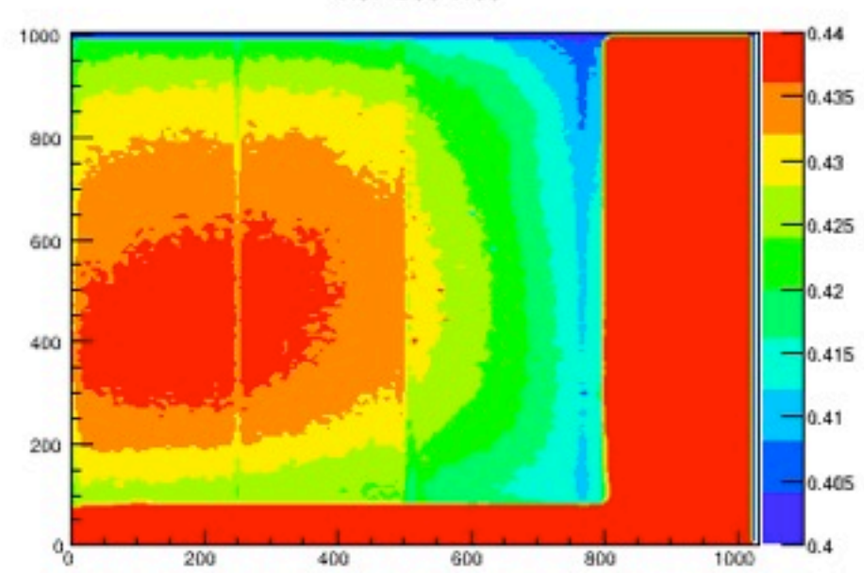
25 kv A-30s W-30s D-30s

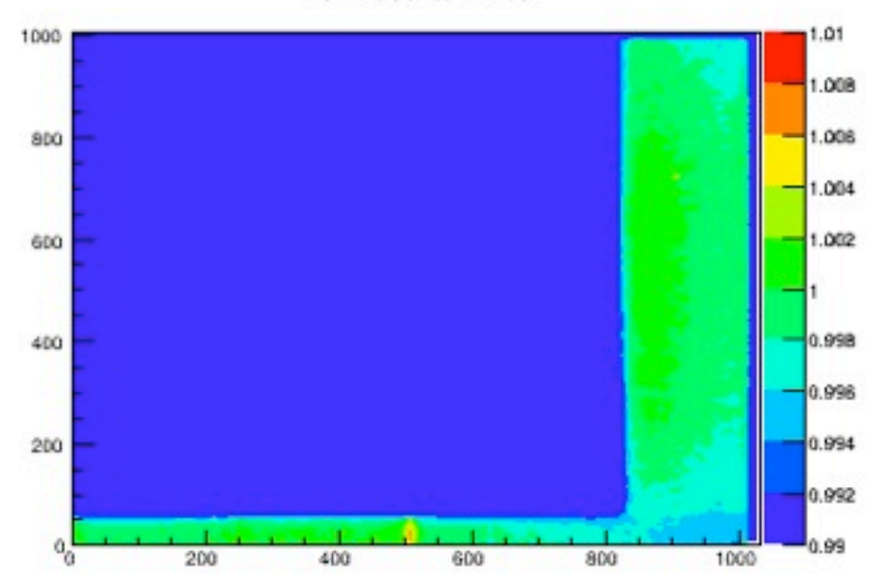
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.09





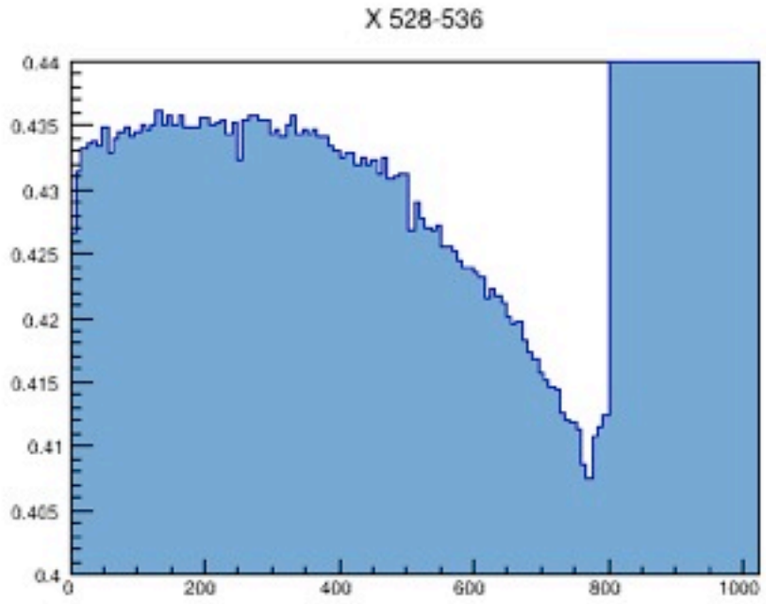


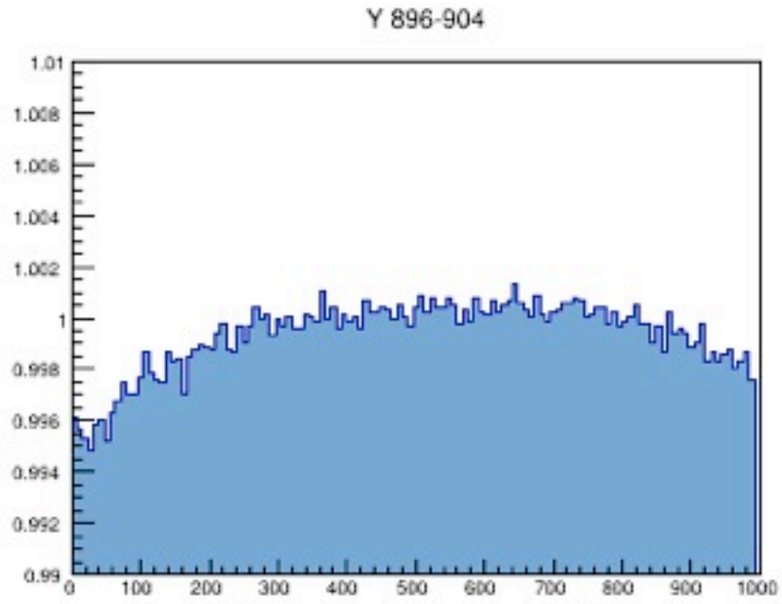


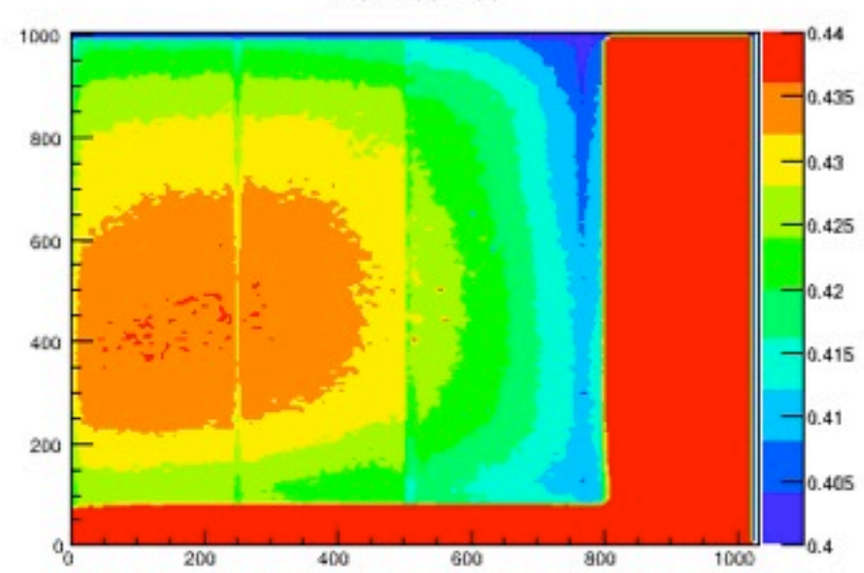
25 kv A-30s W-30s D-30s

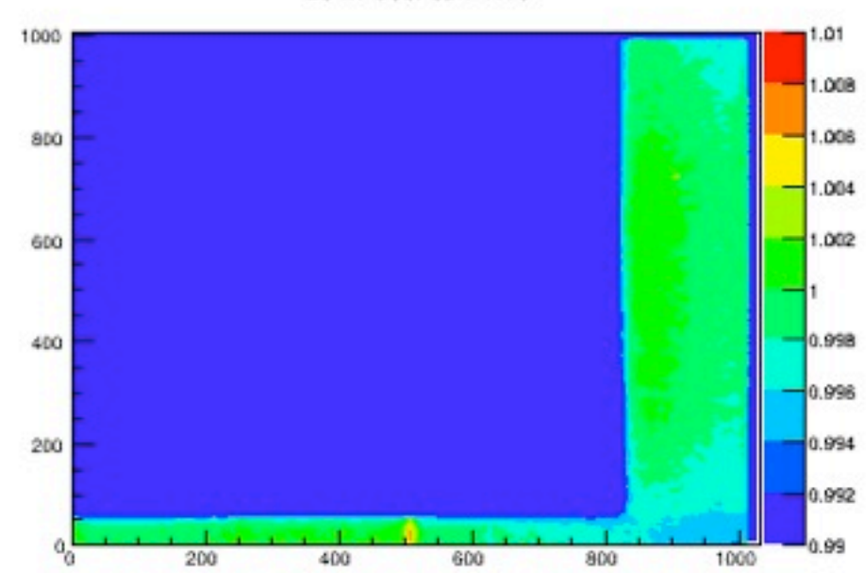
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.10





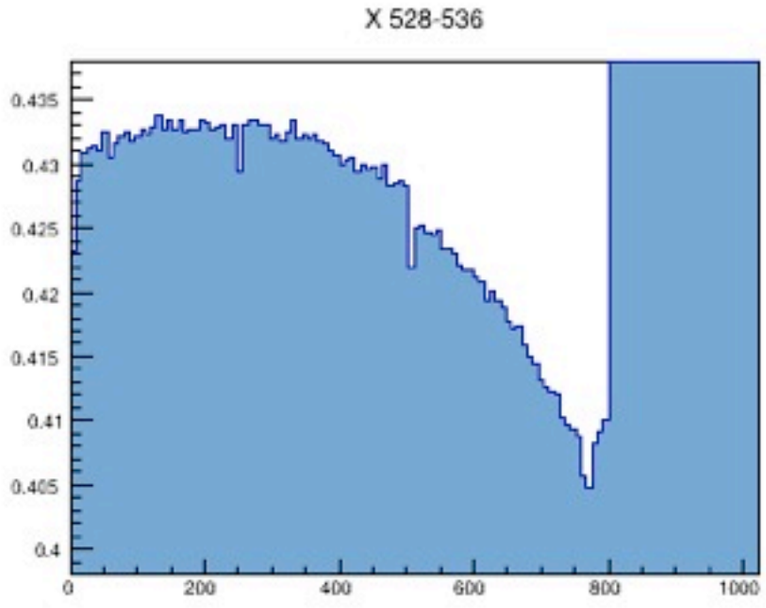


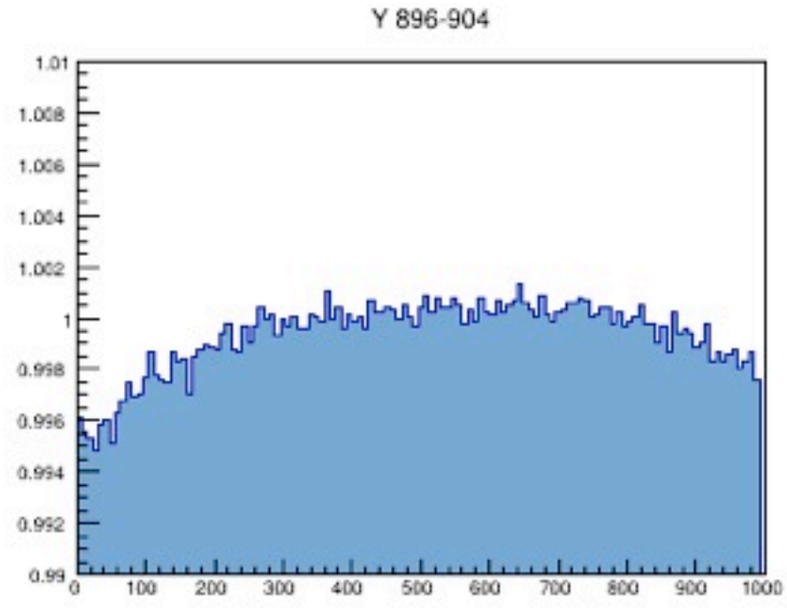


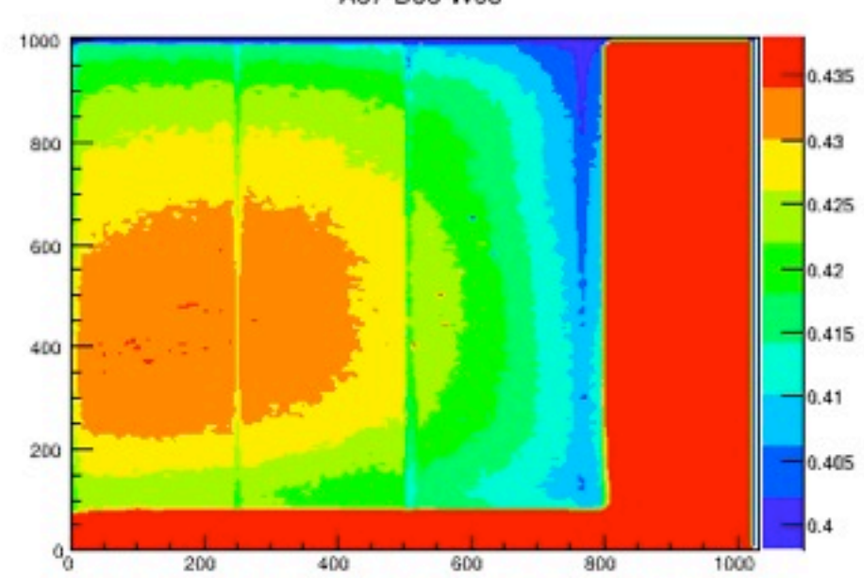
25 kv A-30s W-30s D-30s

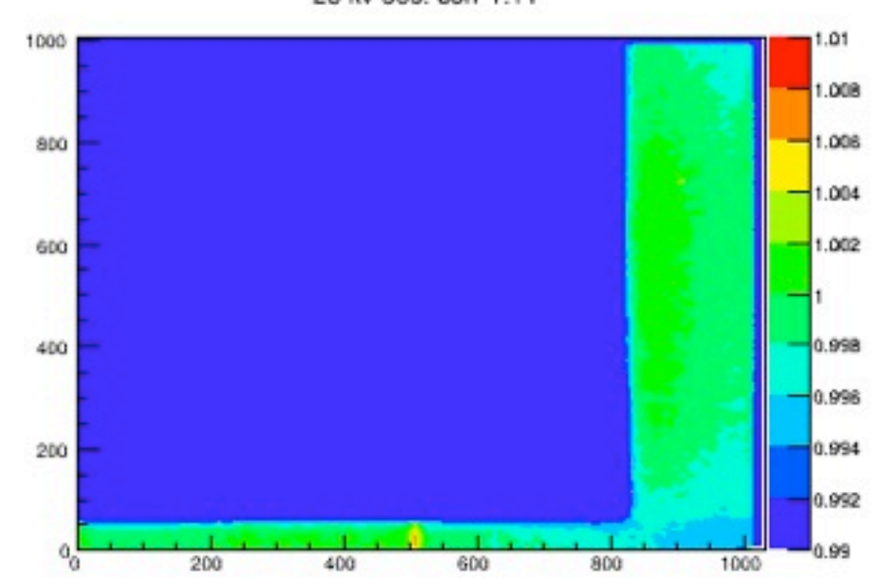
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.11





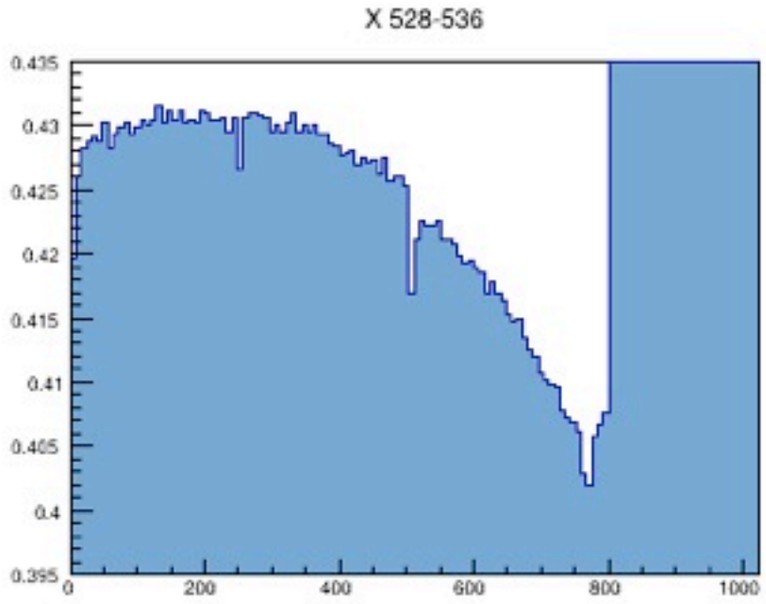


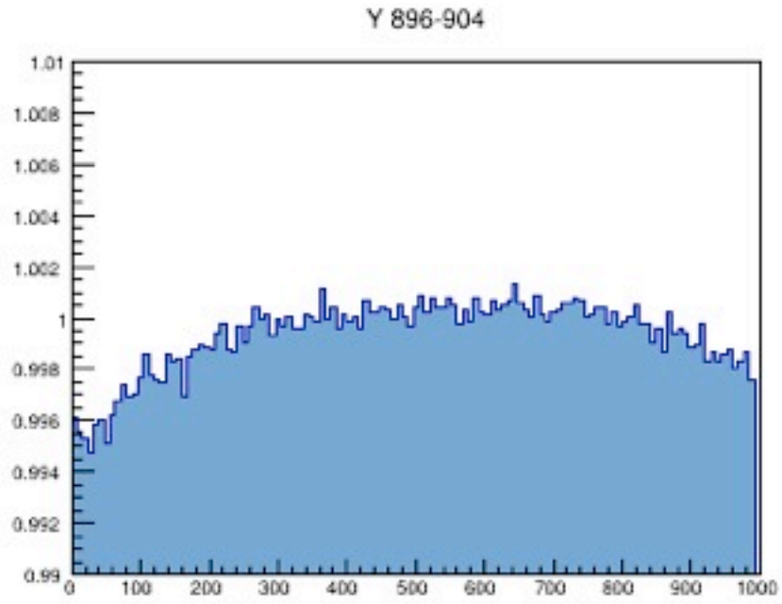


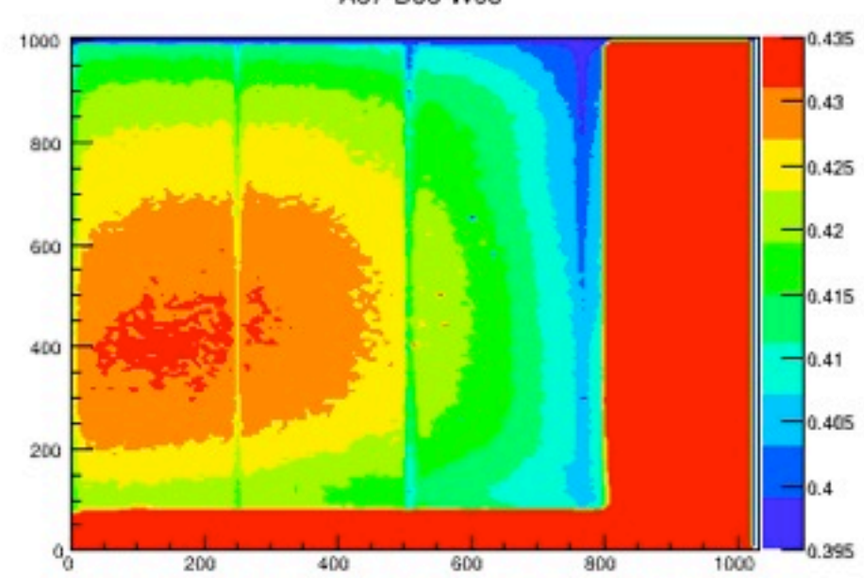
25 kv A-30s W-30s D-30s

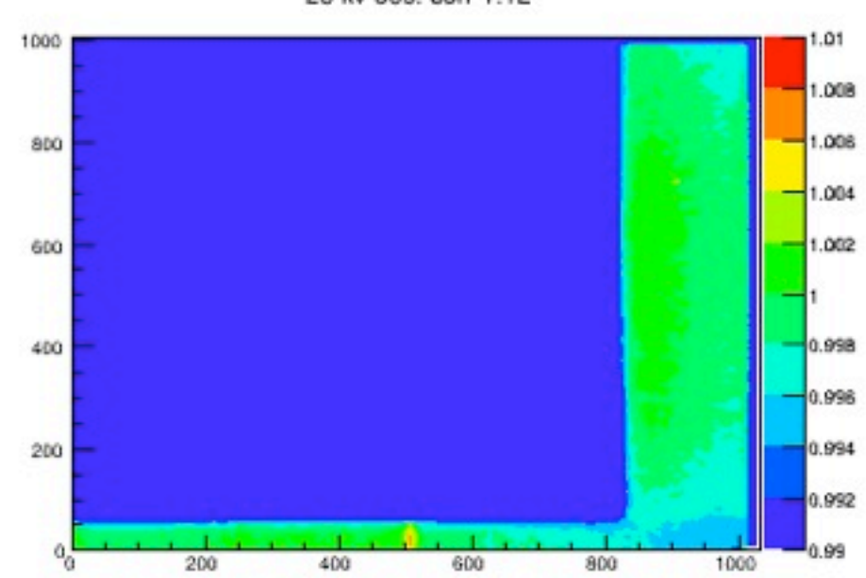
$$R = \frac{A - Bc_1}{Wc - Bc_1}$$

c1=1.12

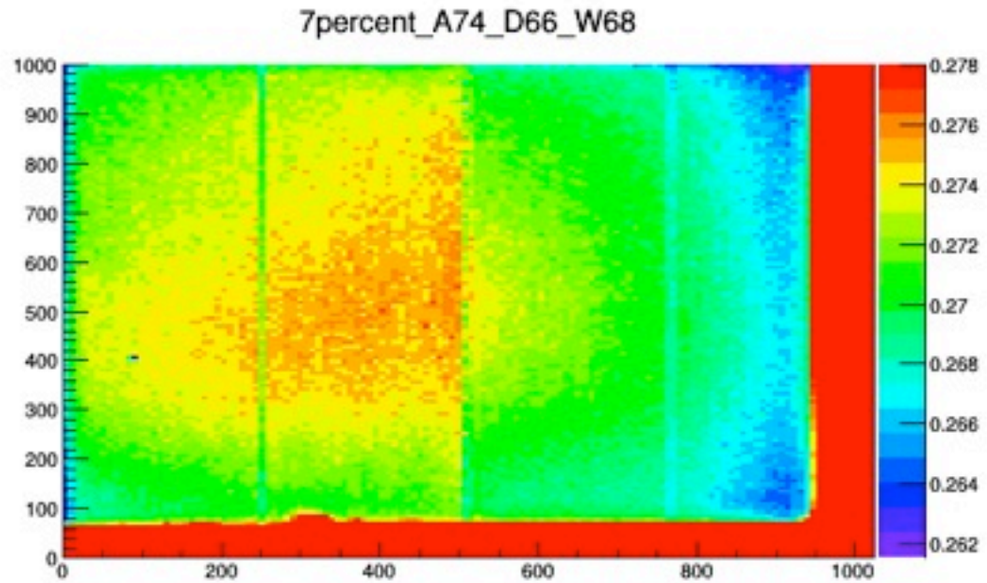


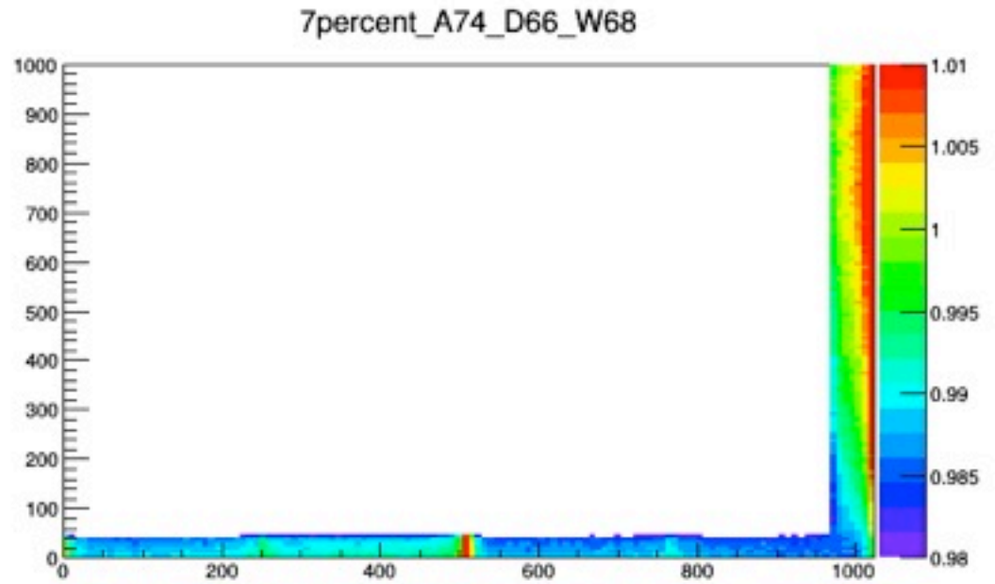


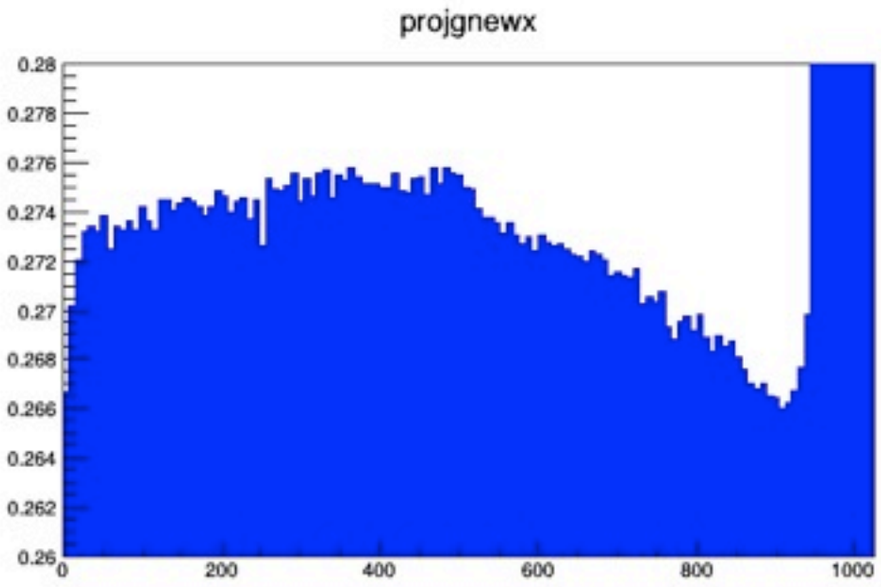


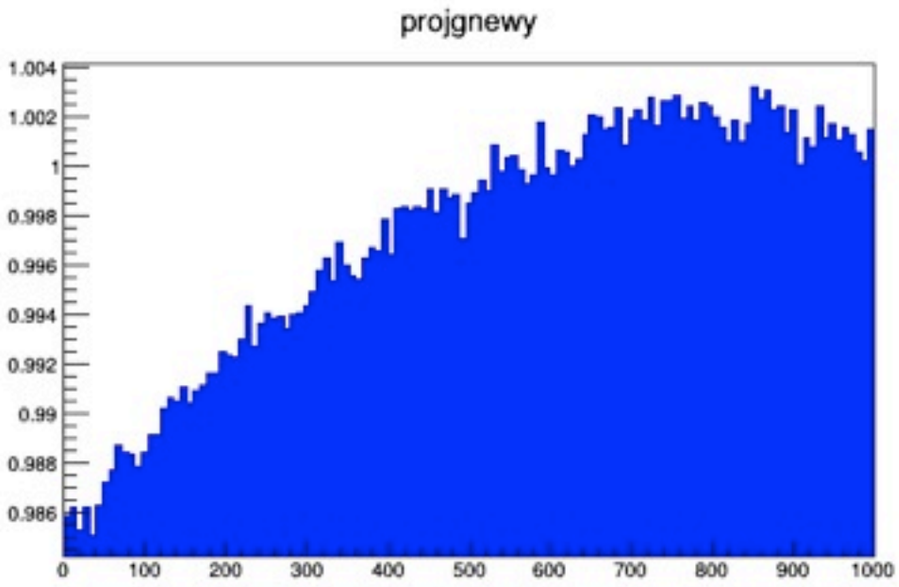


Russian Aerogel:small 25 kv A-30s W-30s D-30s

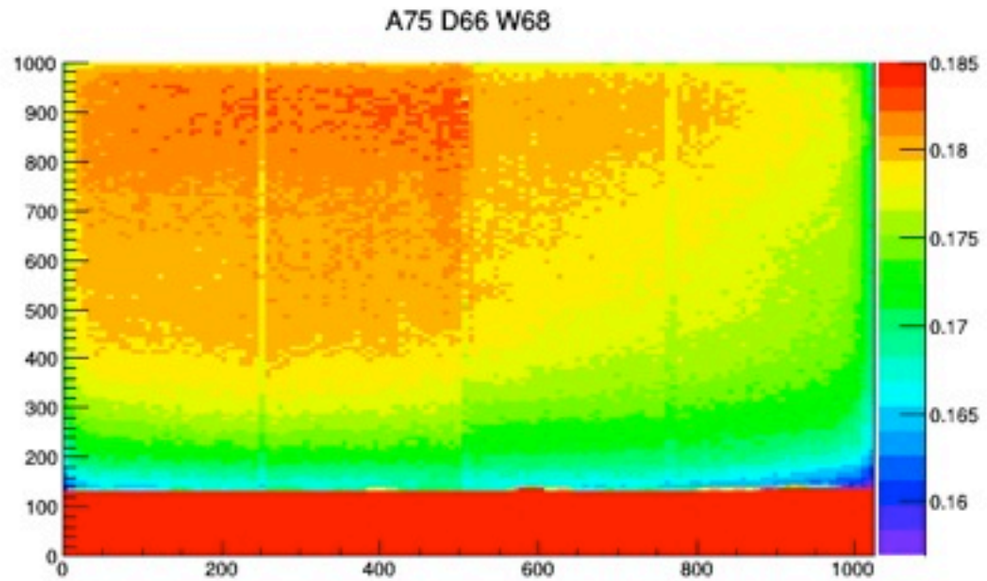


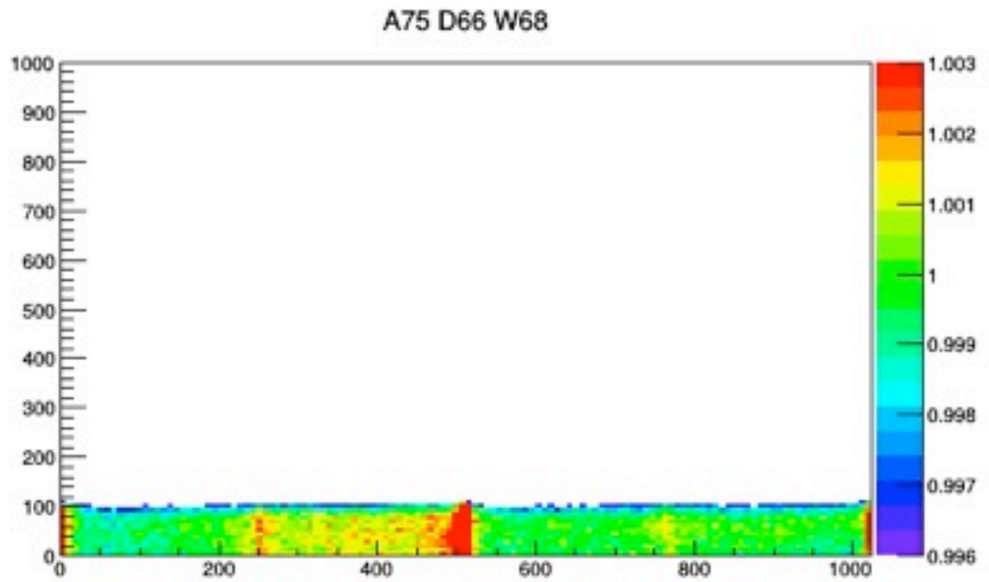


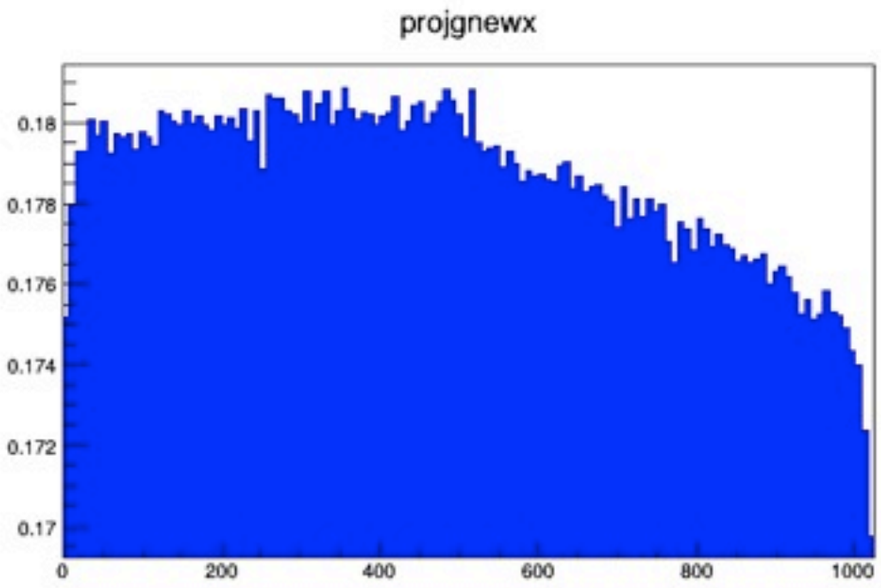


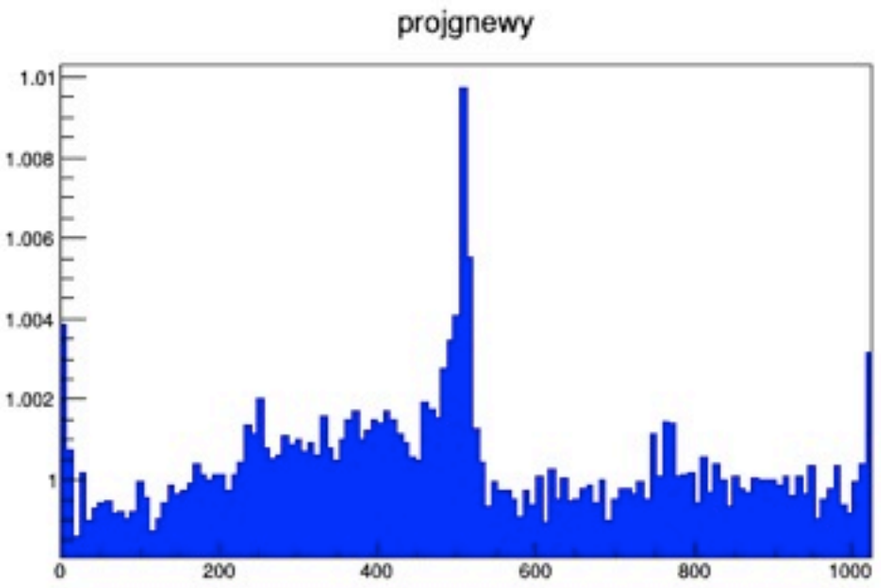


Russian Aerogel:big 25 kv A-30s W-30s D-30s









Russian:big(rotated) 25 kv A-30s W-30s D-30s