

CMS Pixel Upgrade : 22 Dec 2011

ROC Linearity Studies

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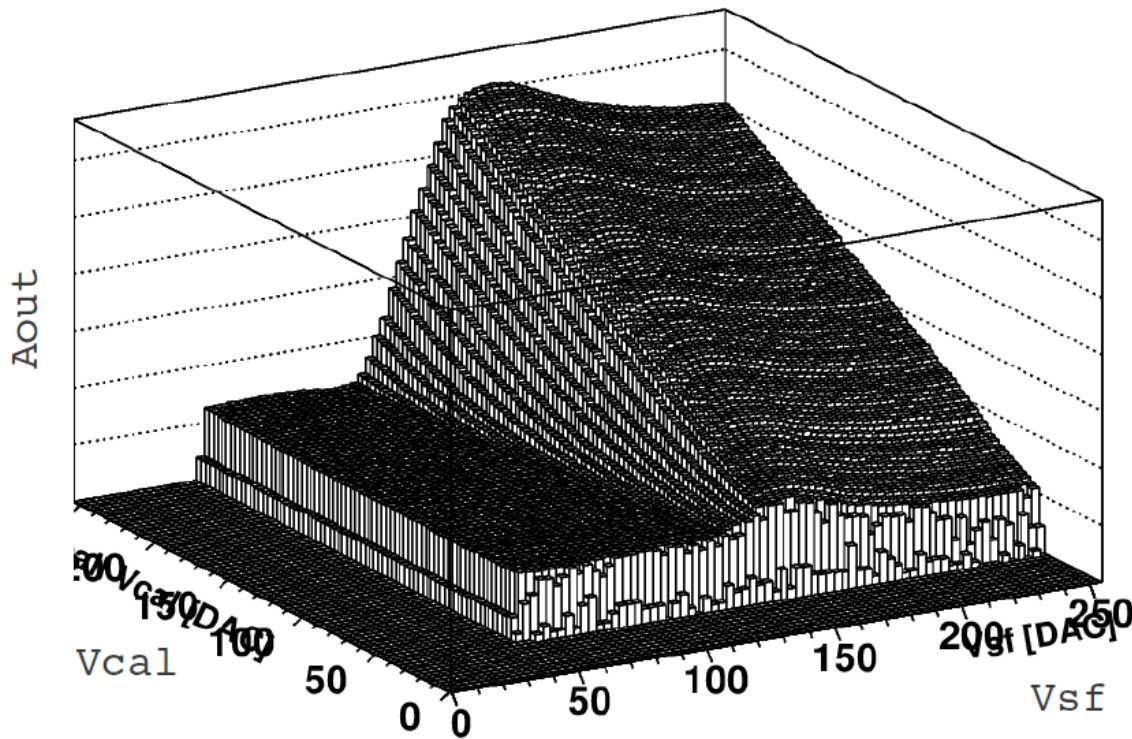
Outline:

Reminder

Results

Reminder

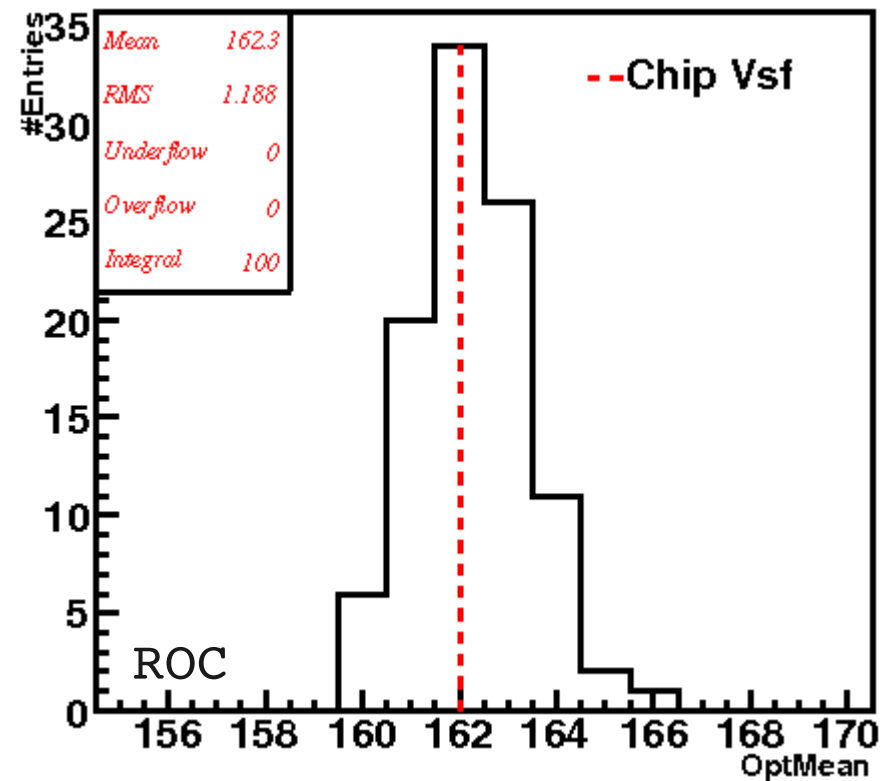
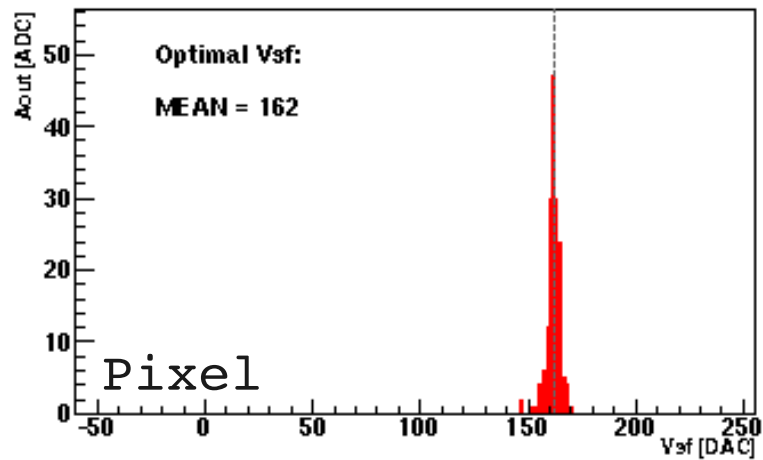
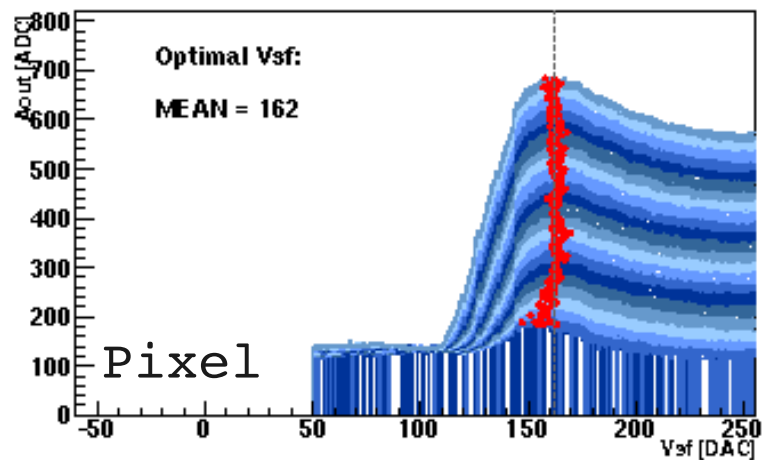
`Aout = Aout (Vcal ; Vsf, VhldDel, Vana ...)`



Output has
max. linearity
around ridge where
the output is max.

Reminder

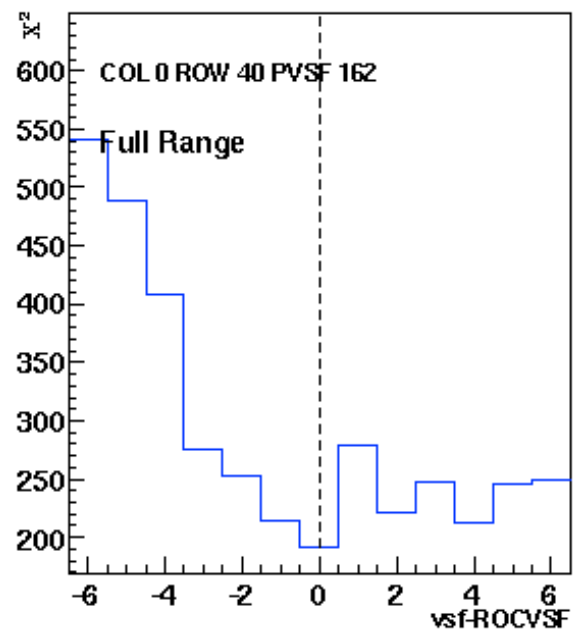
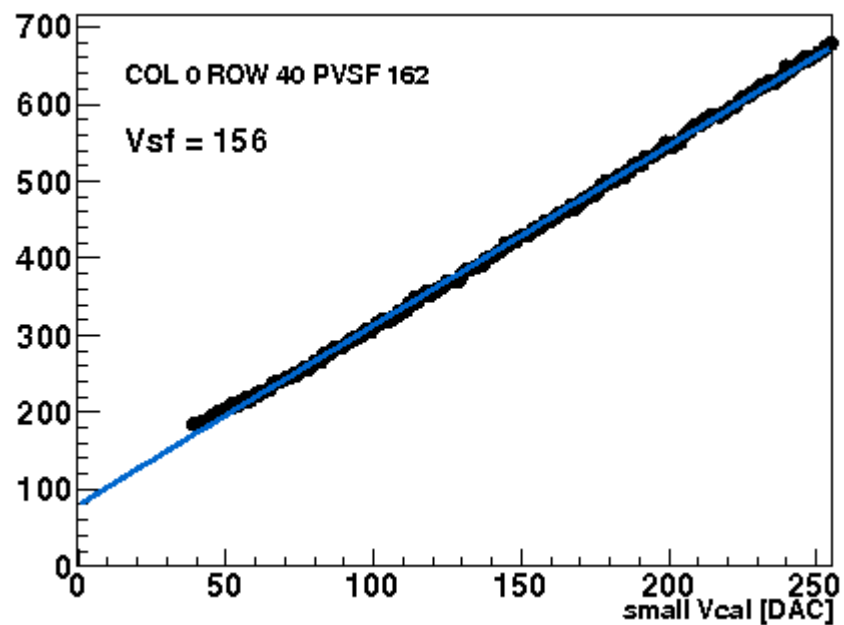
$A_{out} = A_{out}(V_{cal} ; \mathbf{Vsf}, V_{hldDel}, V_{ana} \dots)$



Reminder

Measures of Linearity :

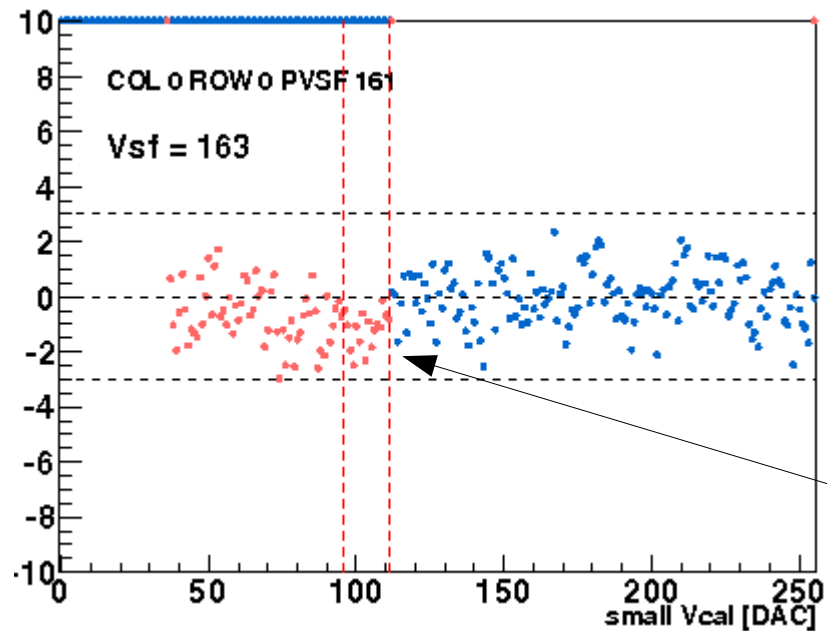
1. χ^2/ndf over full Vcal range



Reminder

Measures of Linearity :

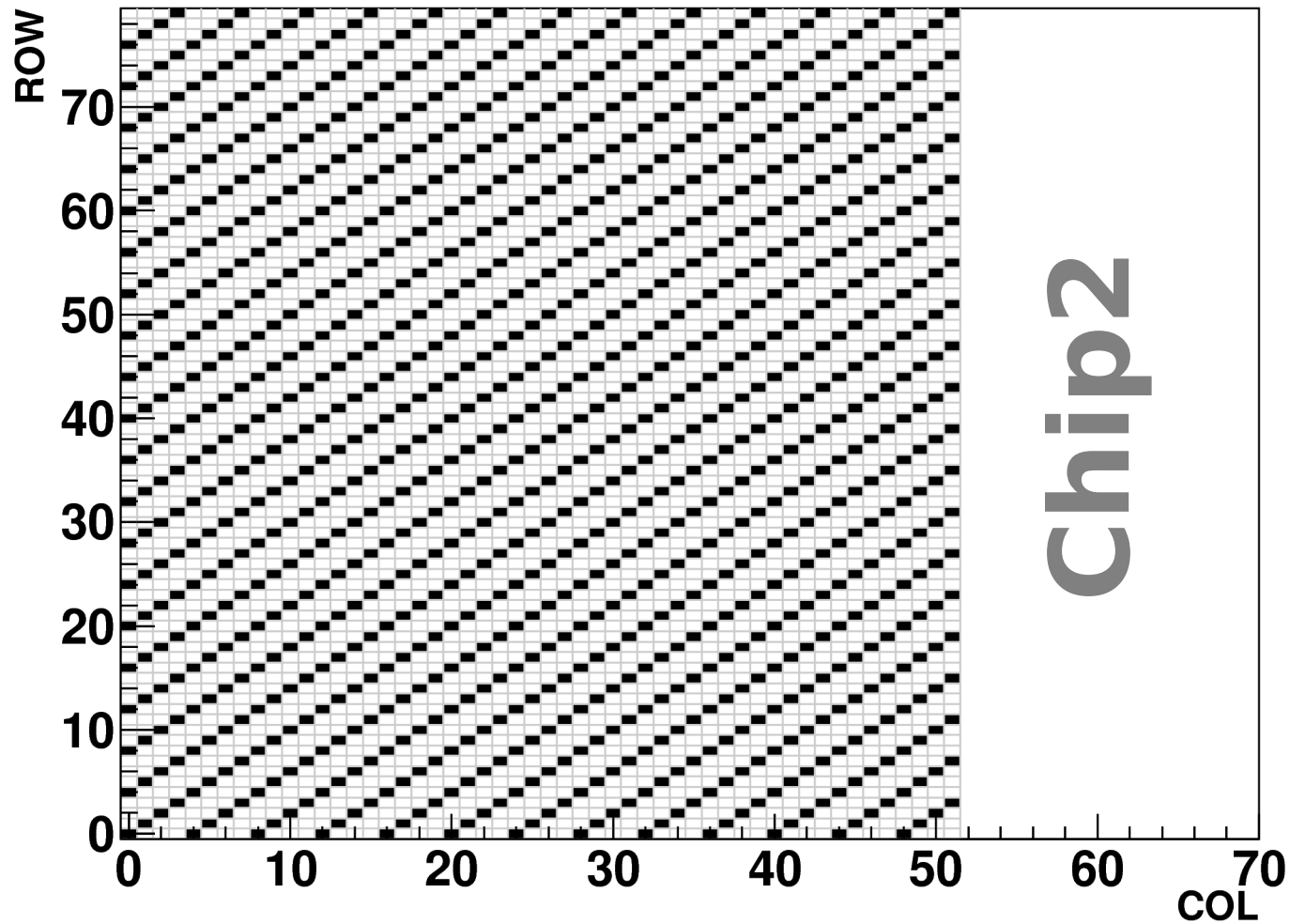
2. #lost points



16 consecutive points with
same sign pull :
60 points lost

Today

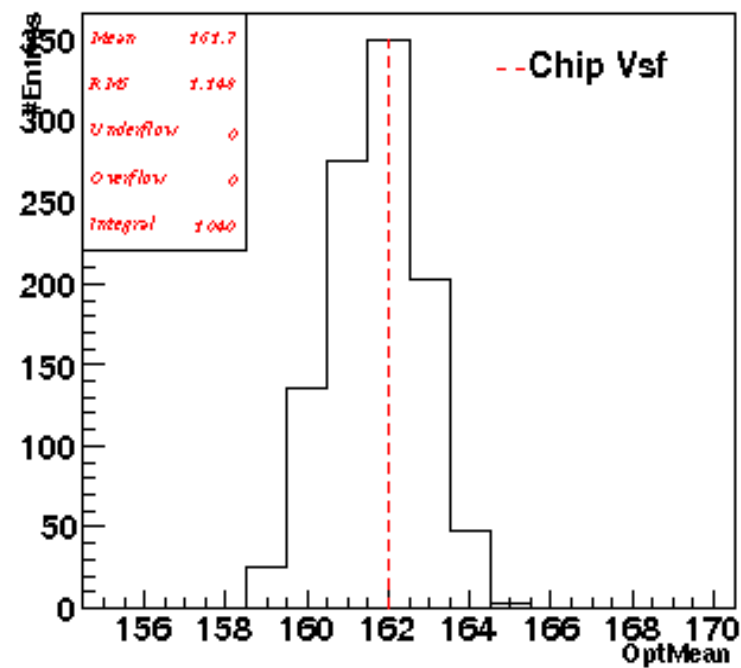
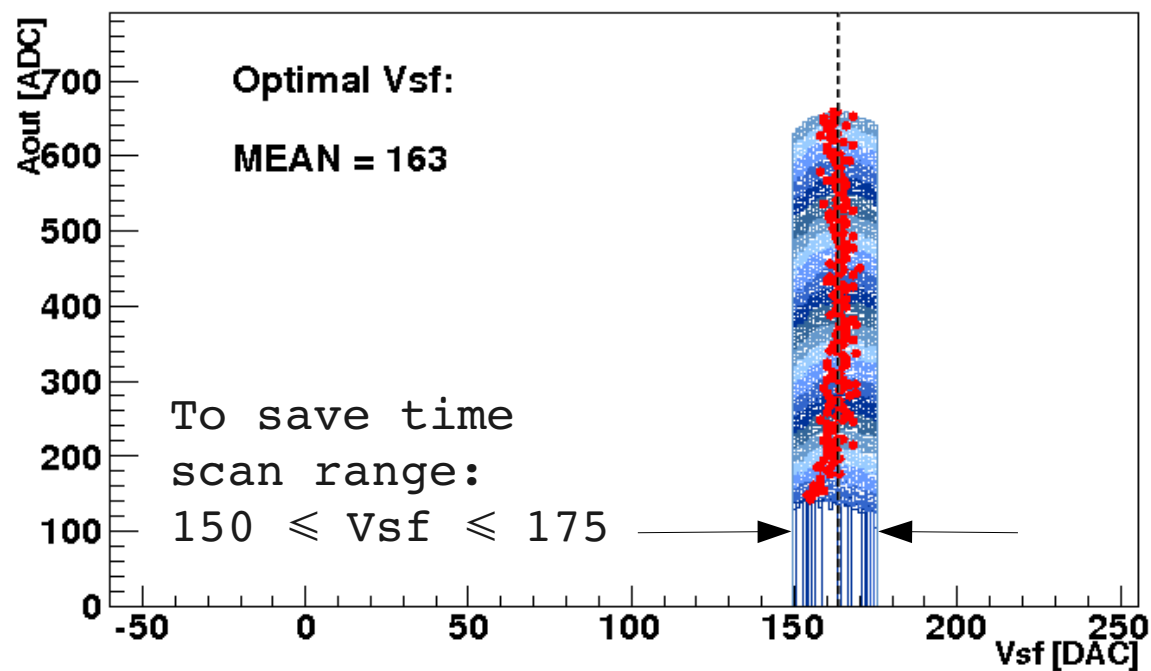
“Measures” of linearity across entire chip



1040 pixels calibrate

Results

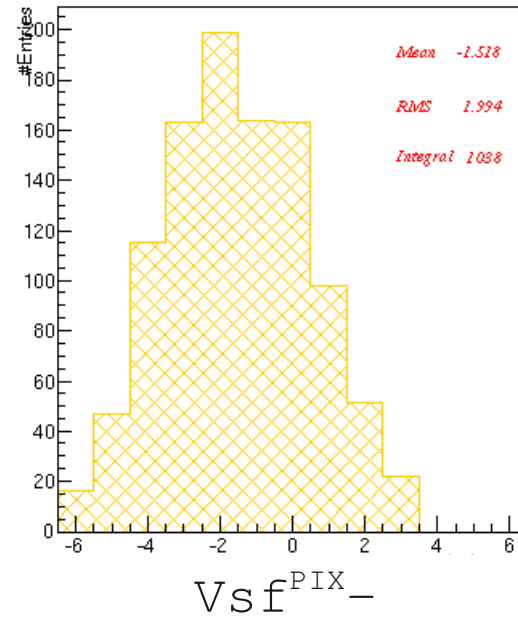
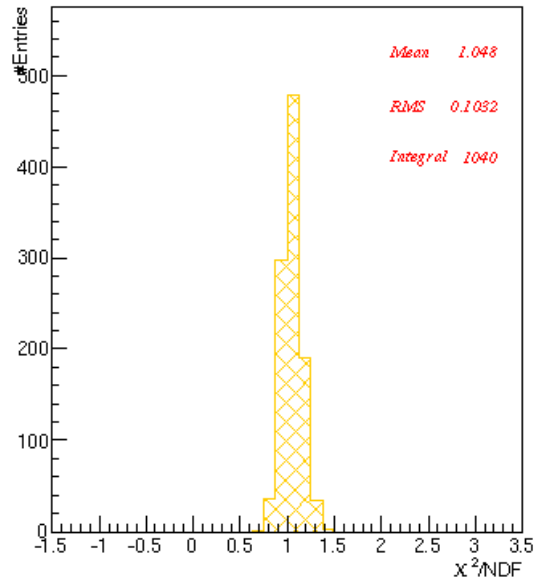
Measures of linearity across entire chip (Vsf, pixel position)



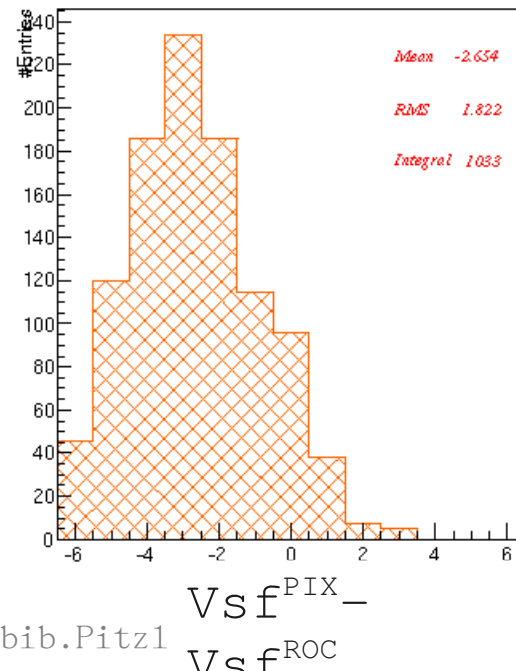
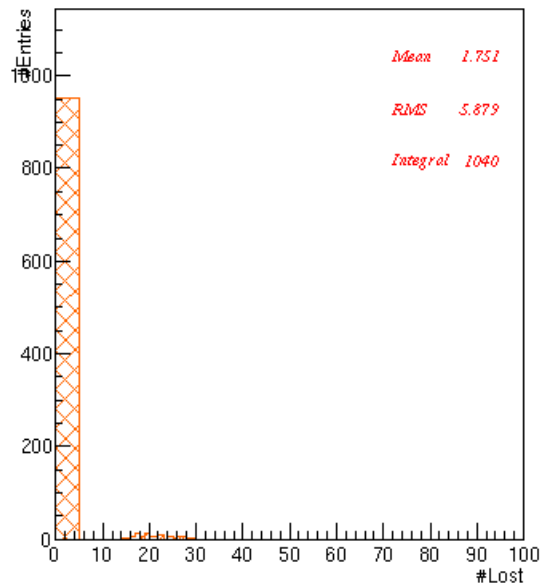
ROC Vsf = 162
 Fraction of pixels within ± 2 of ROC Vsf = 0.972 ± 0.005

Results

Best χ^2/ndf

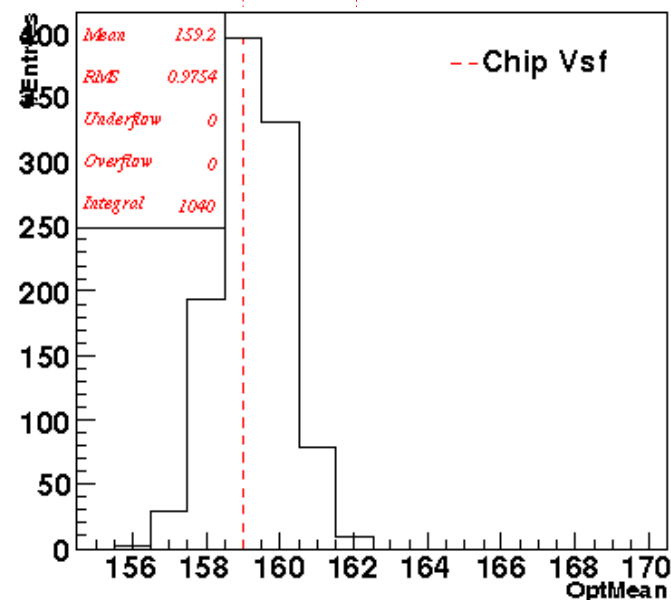
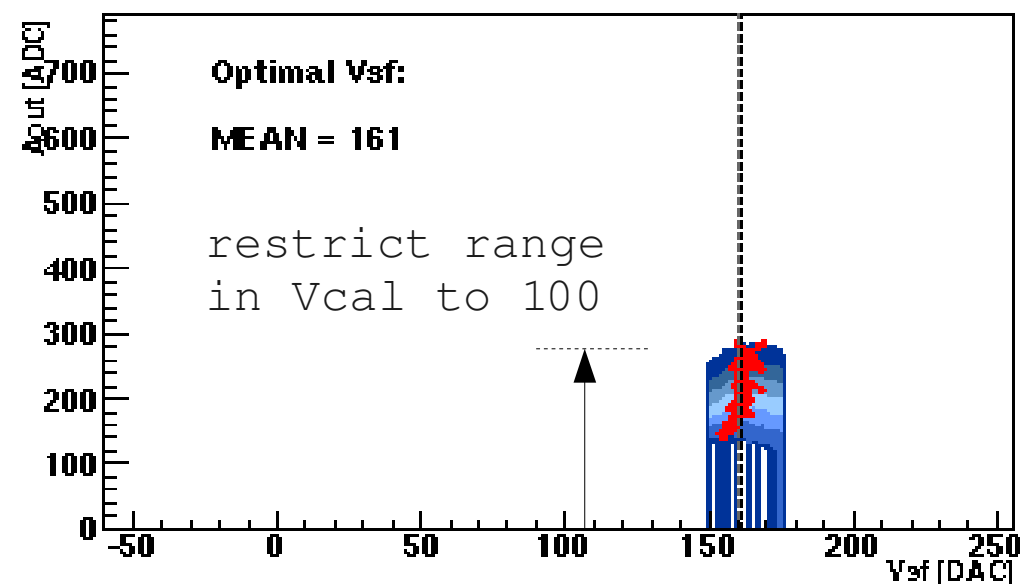
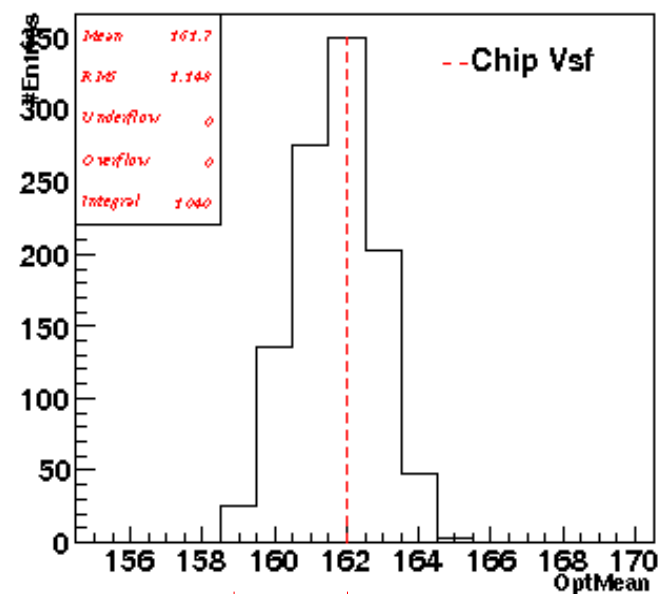
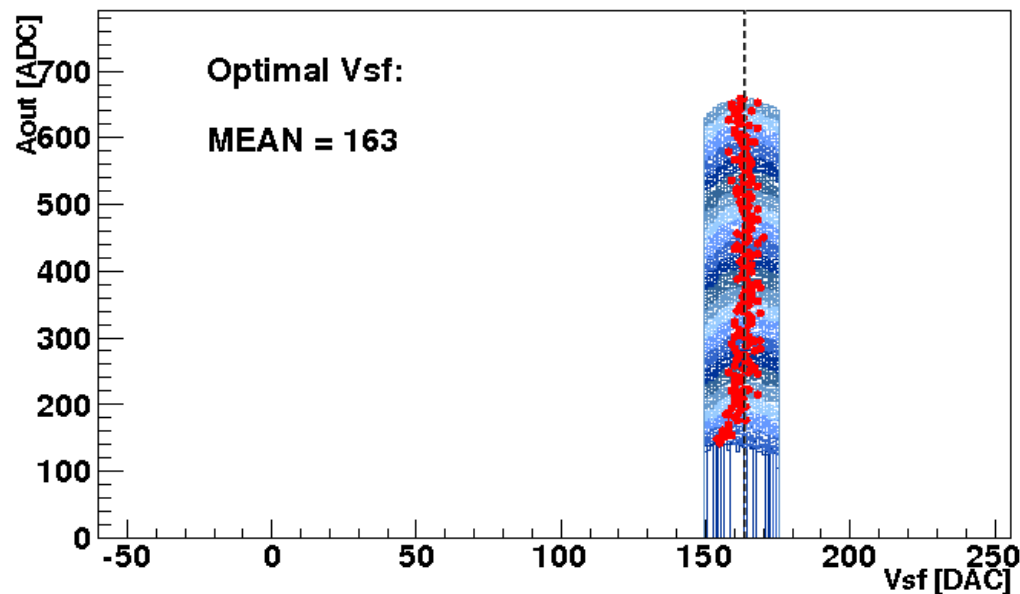


Min #Lost Vsf^{ROC}



1. You're not gonna be able to operate at optimum Vsf for each pixel.
2. Optimum Vsf is to the left of the ridge.

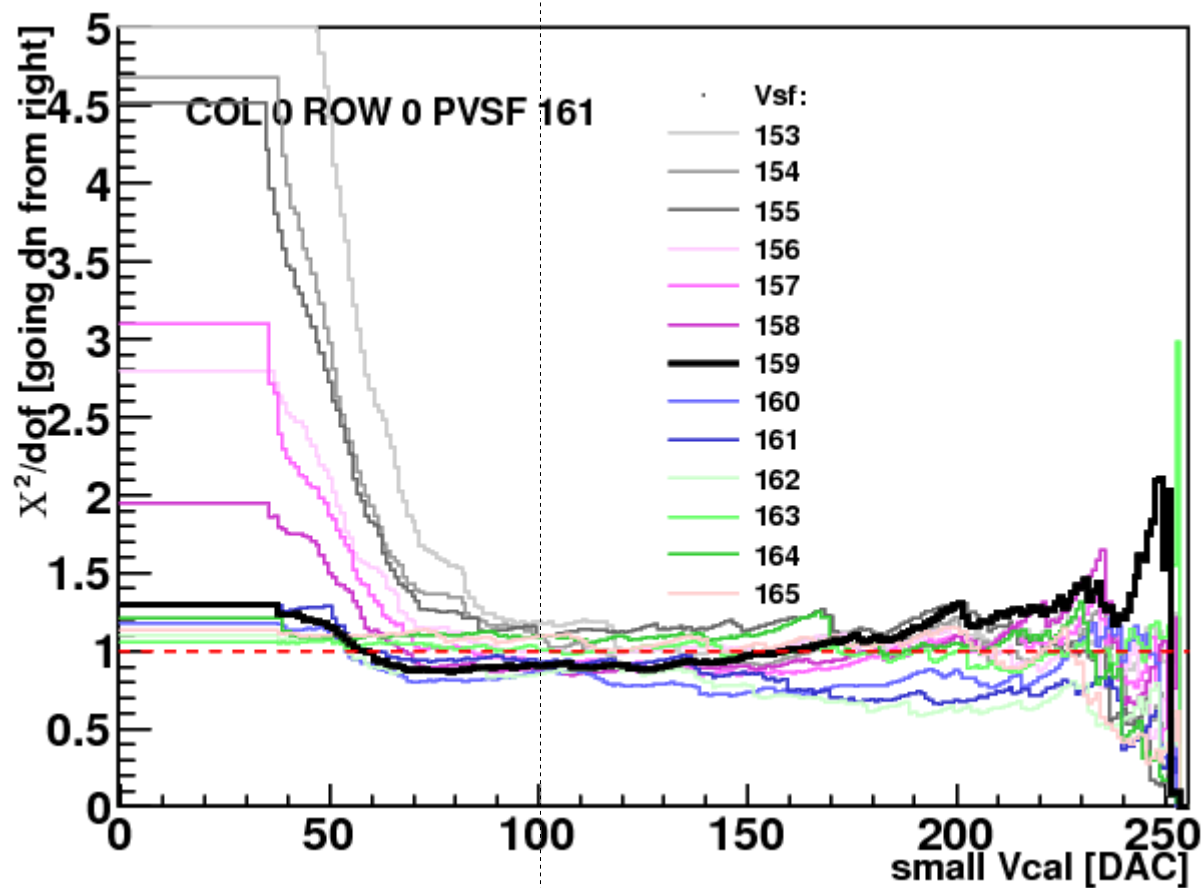
Results



ΔV_{sf}^{ROC}

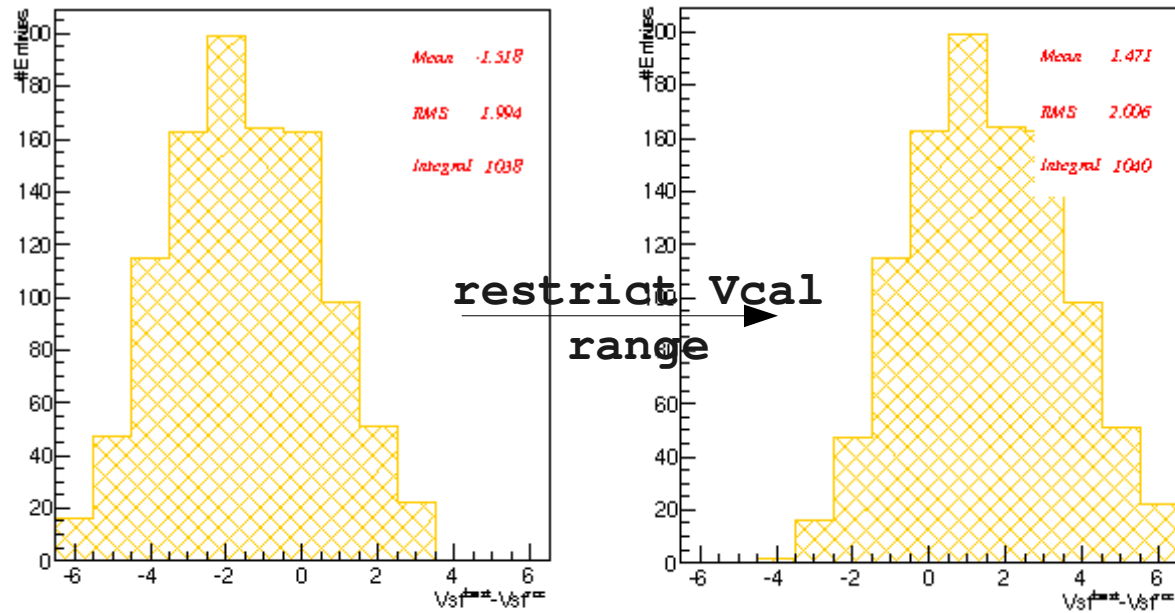
Results

<100 non-linearity begins

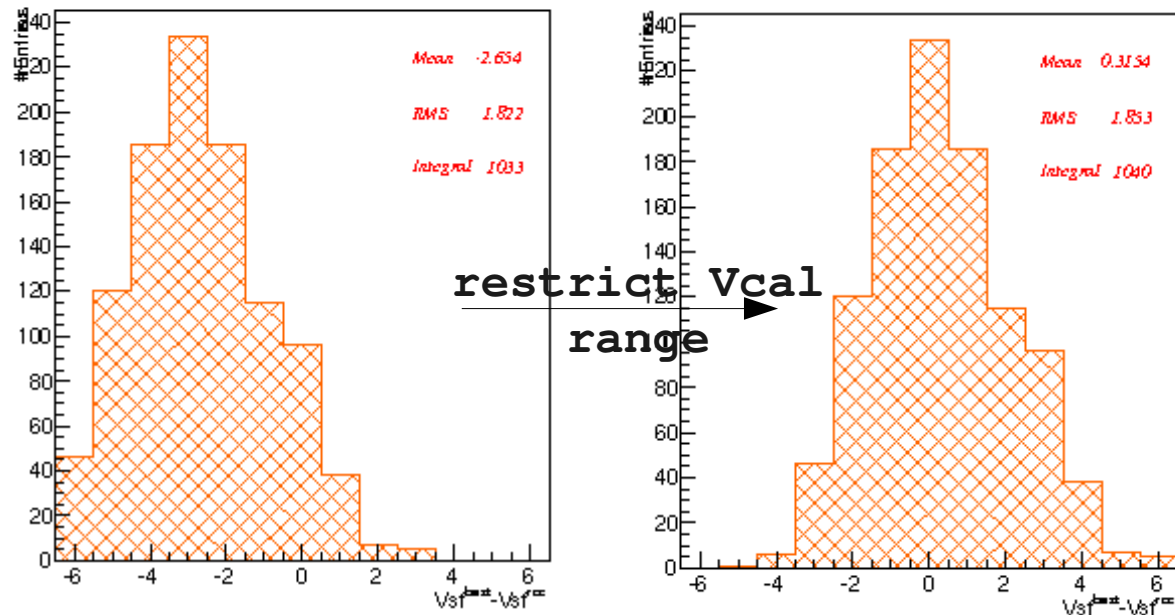


Results

Best χ^2/ndf



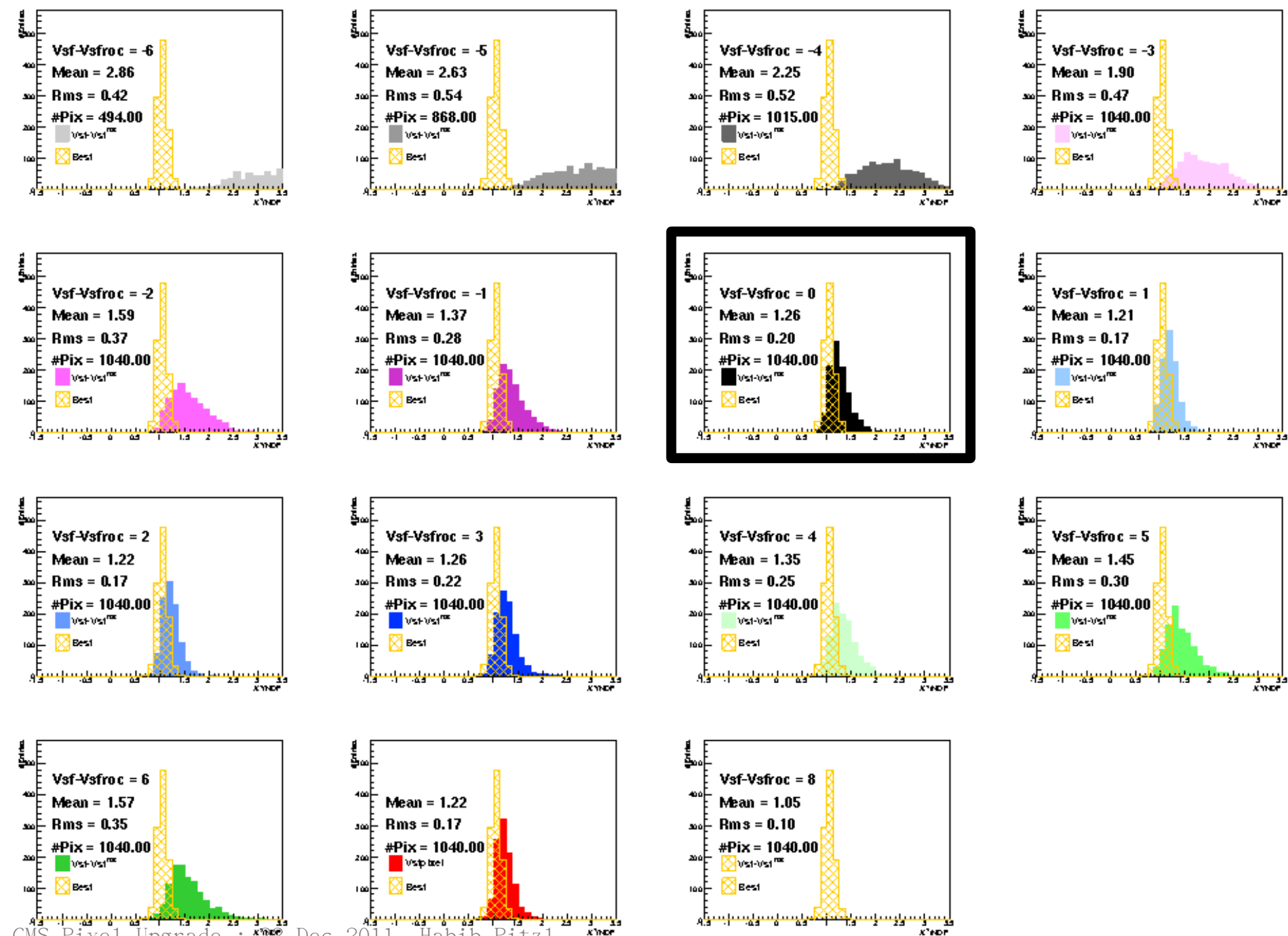
Min #Lost



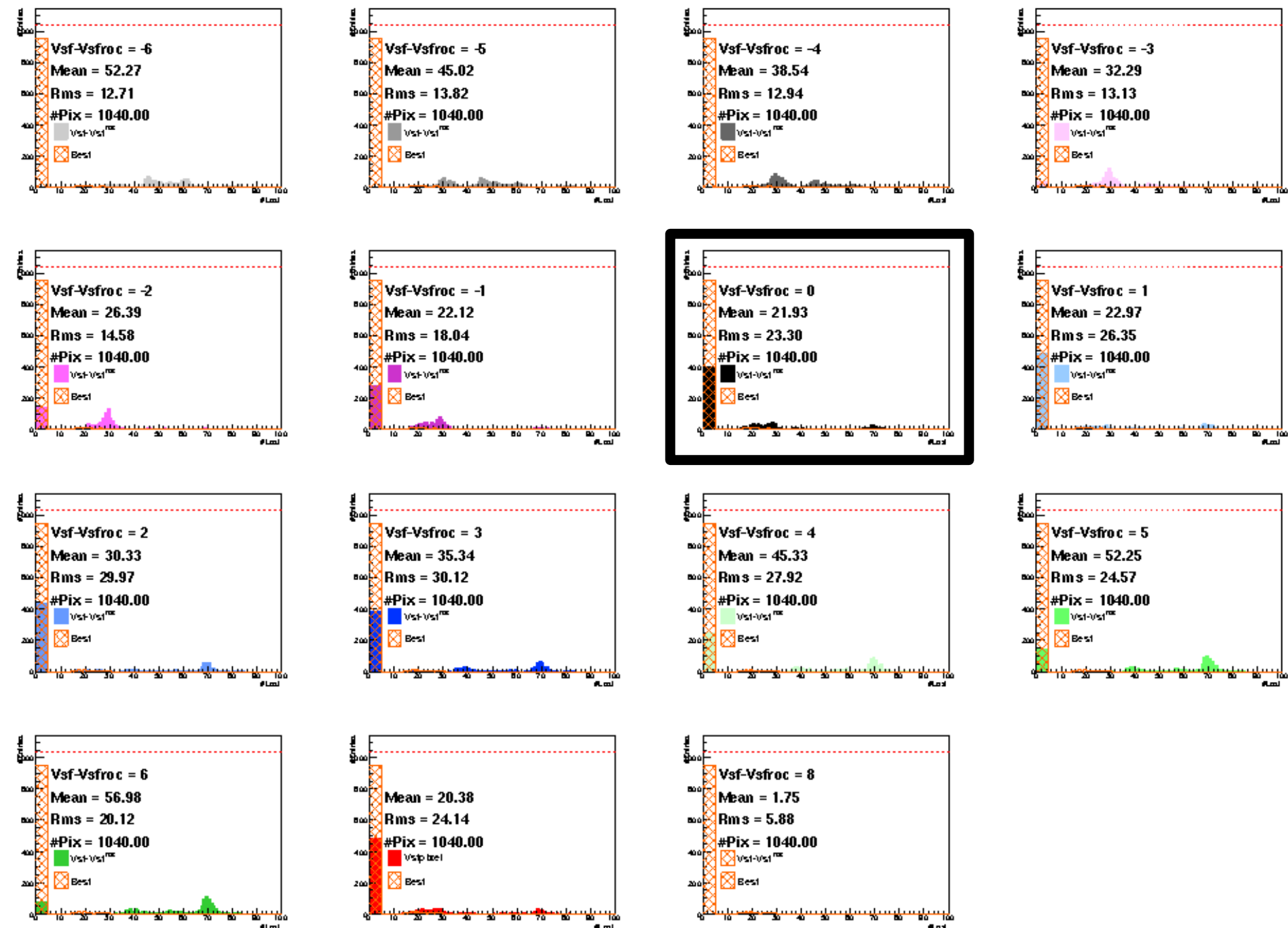
Vsf^{ROC} now reflects the max linearity in terms of number of points lost.

Best Linearity $\simeq$ Best χ^2

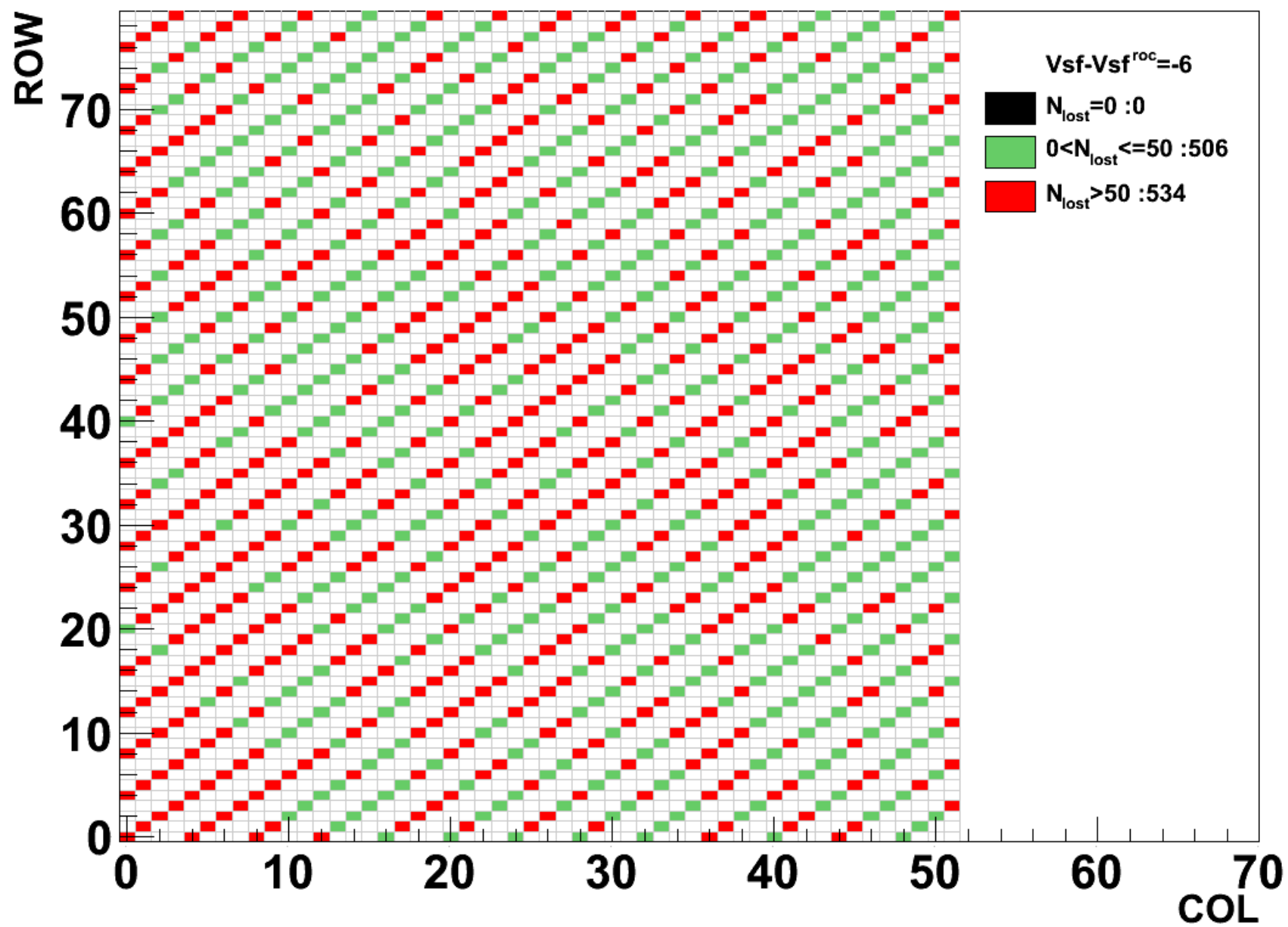
Results



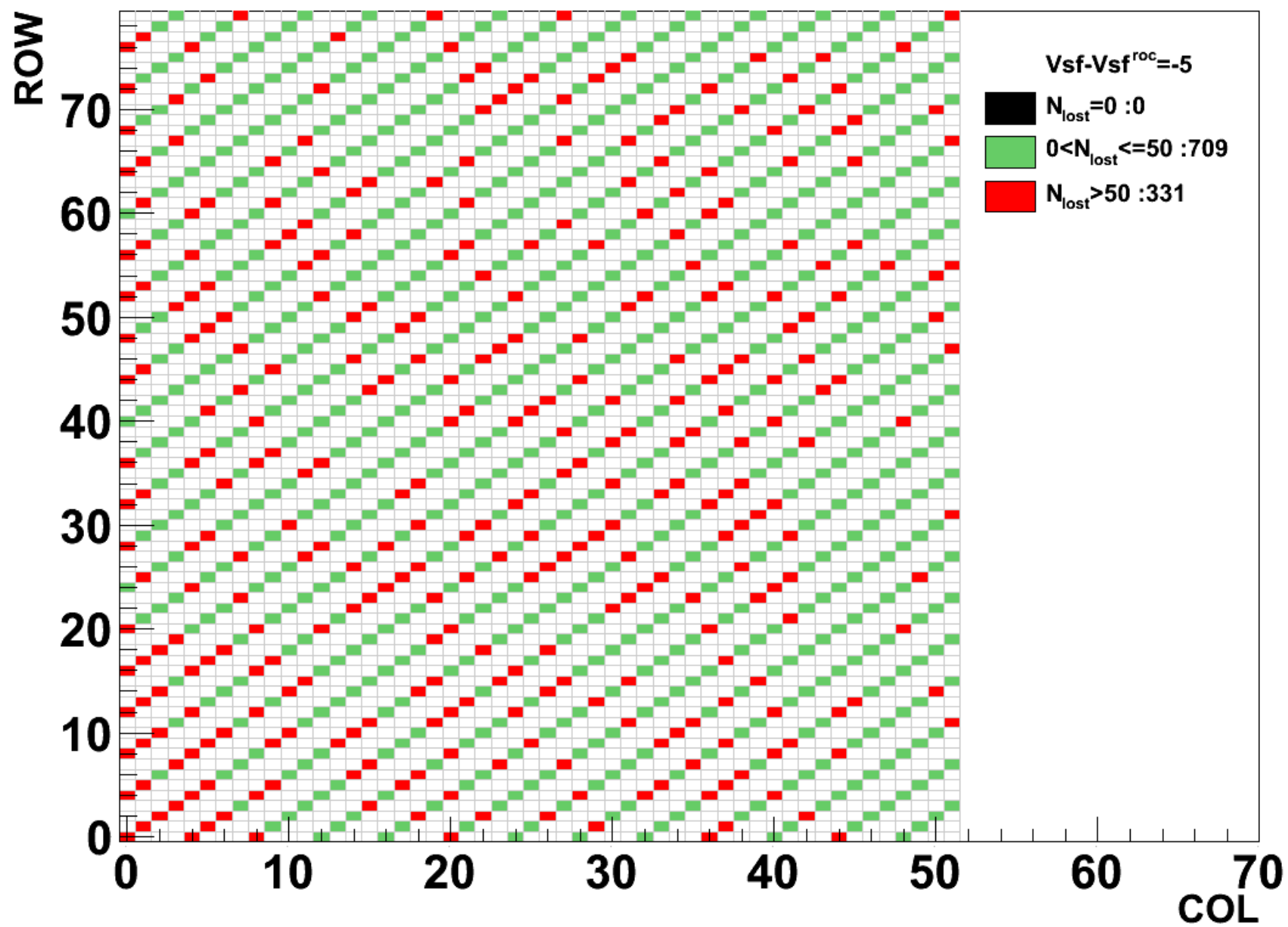
Results



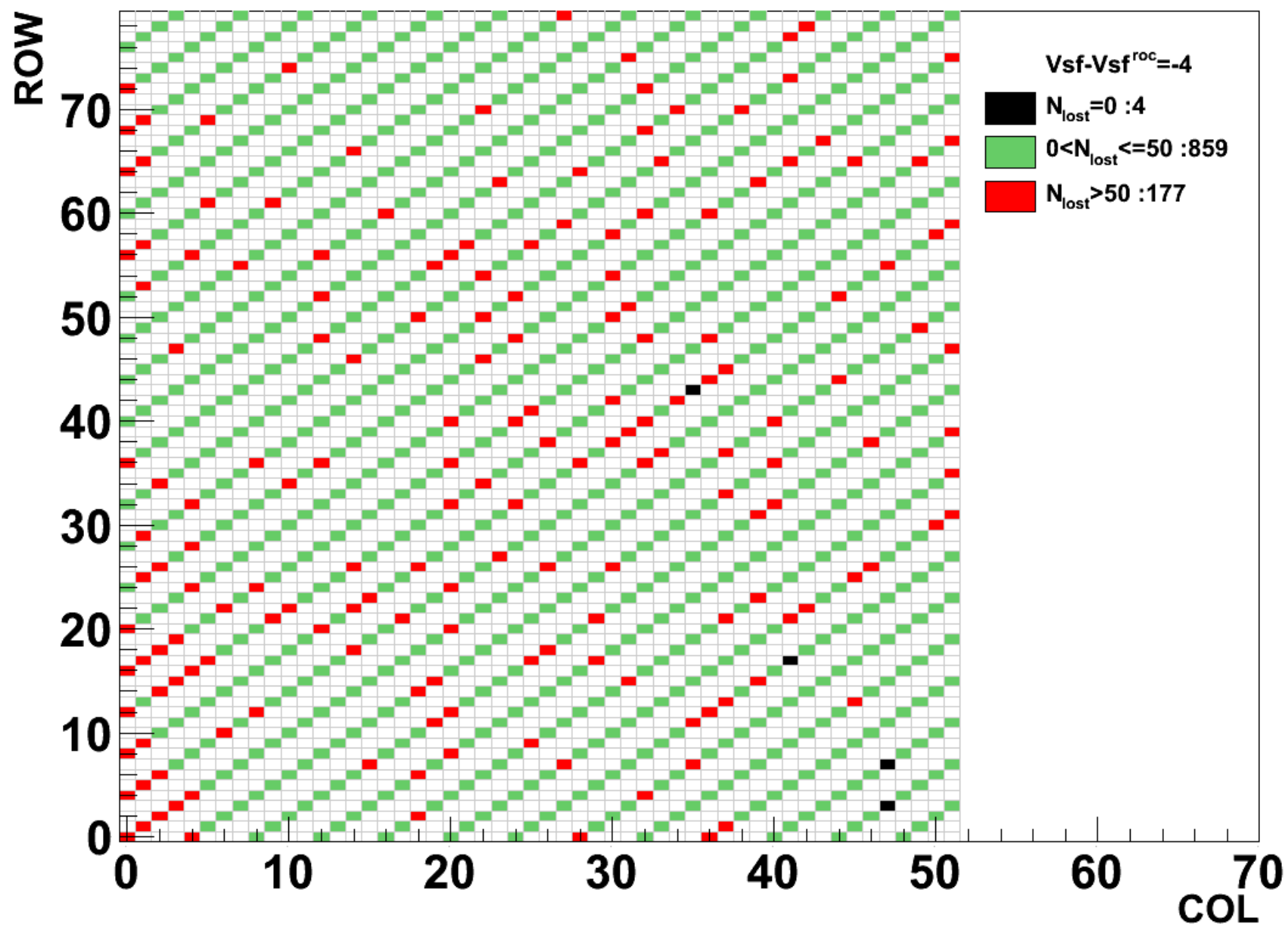
Results [pixel position]



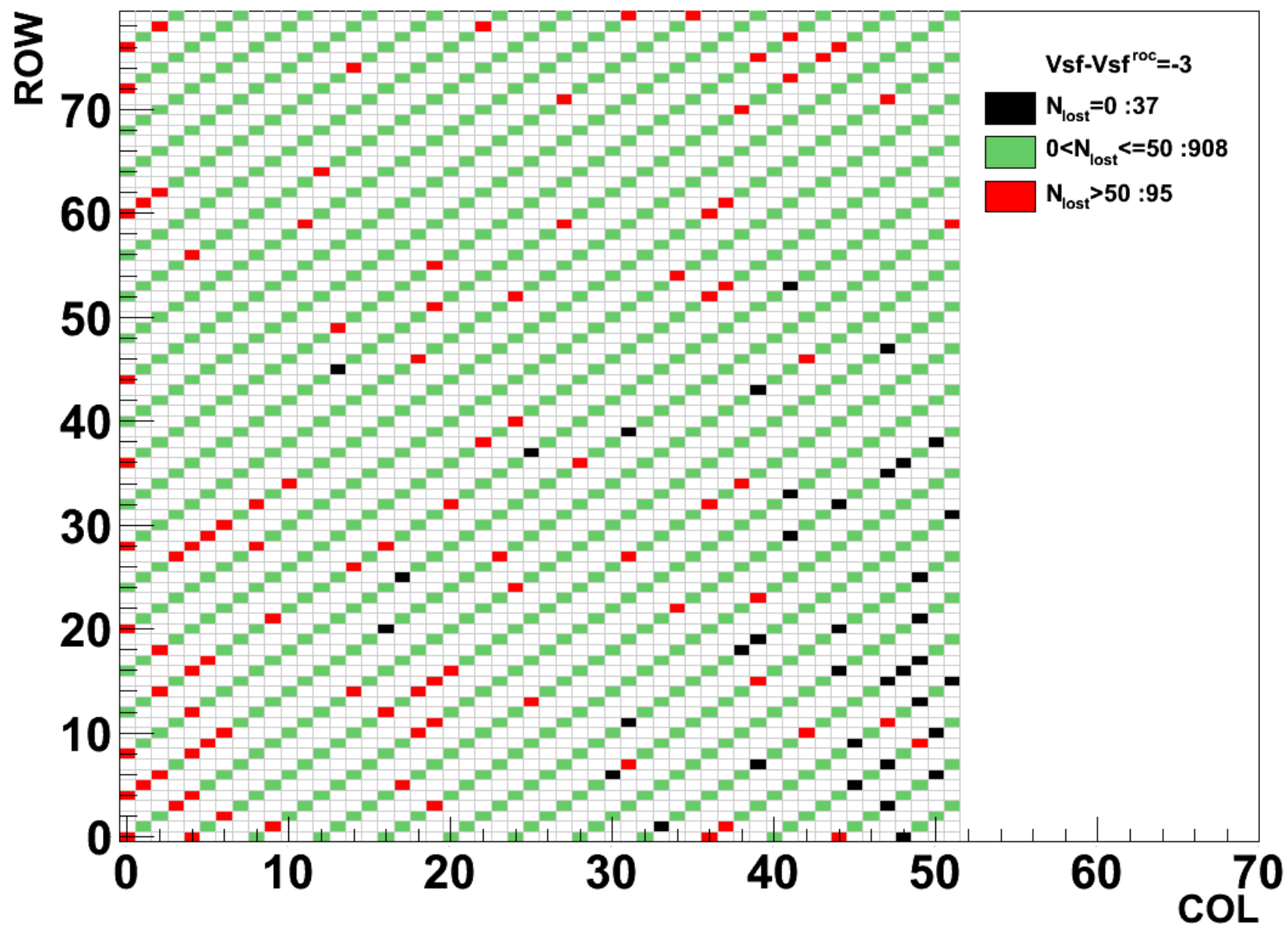
Results [pixel position]



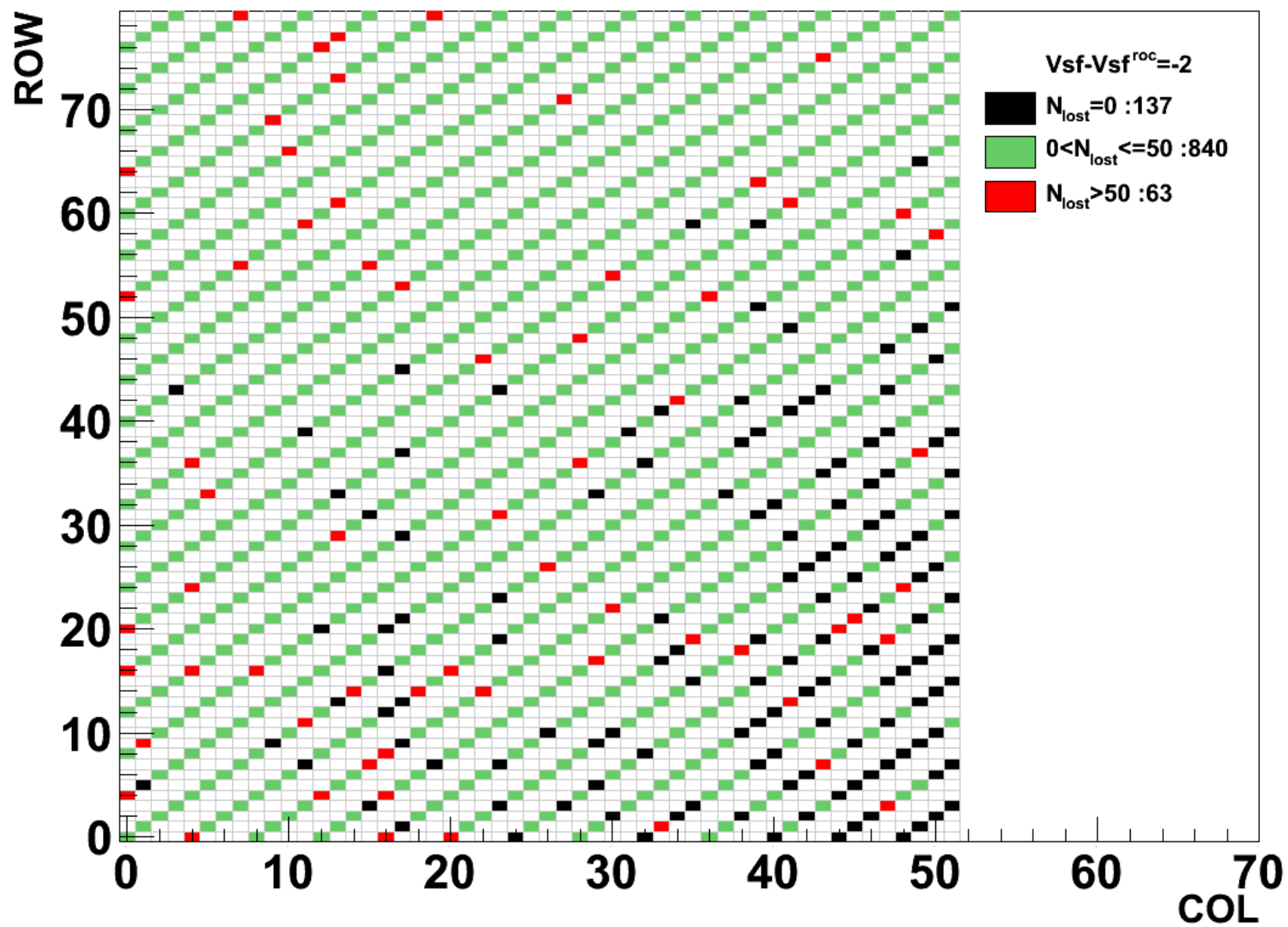
Results [pixel position]



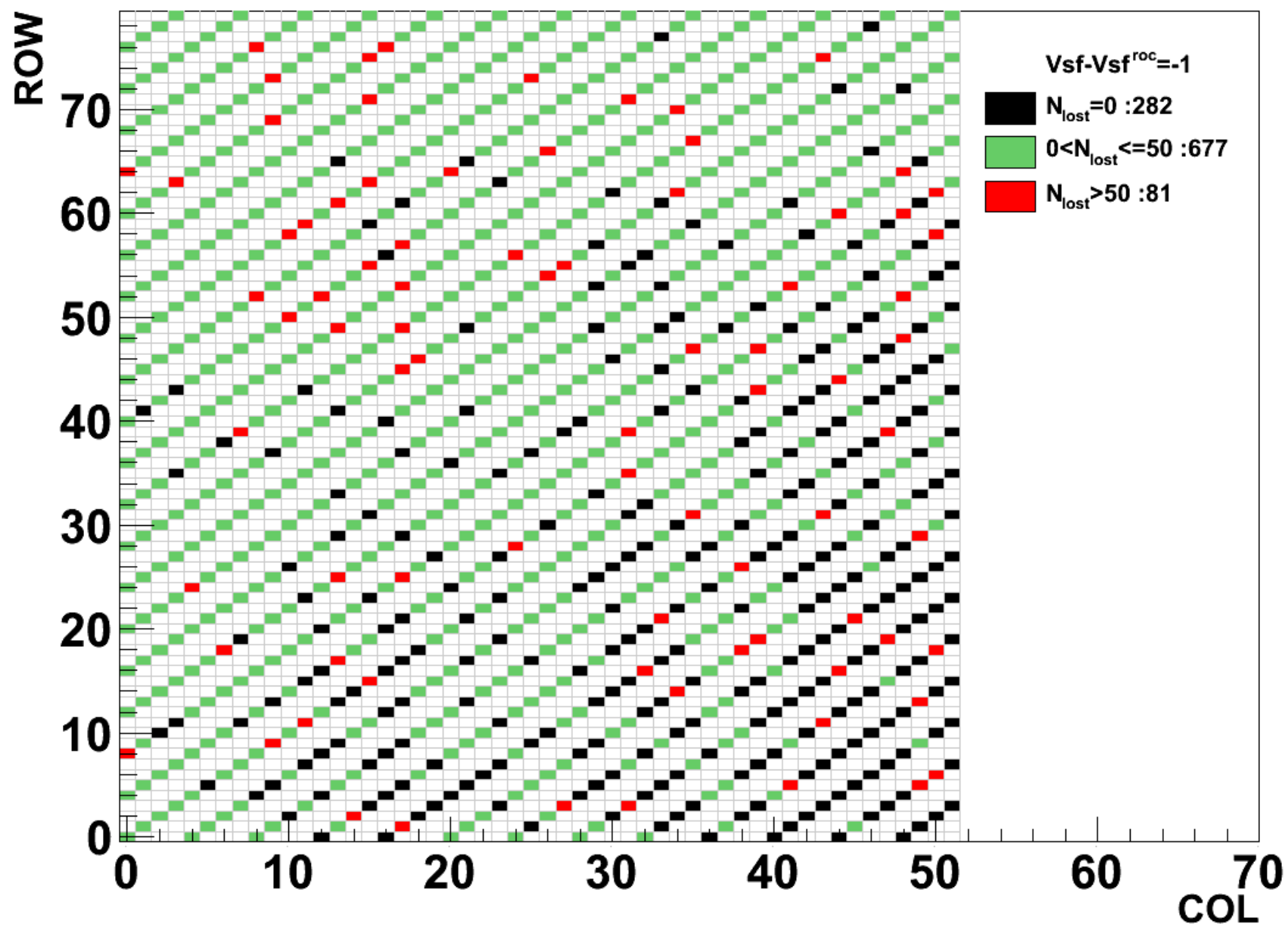
Results [pixel position]



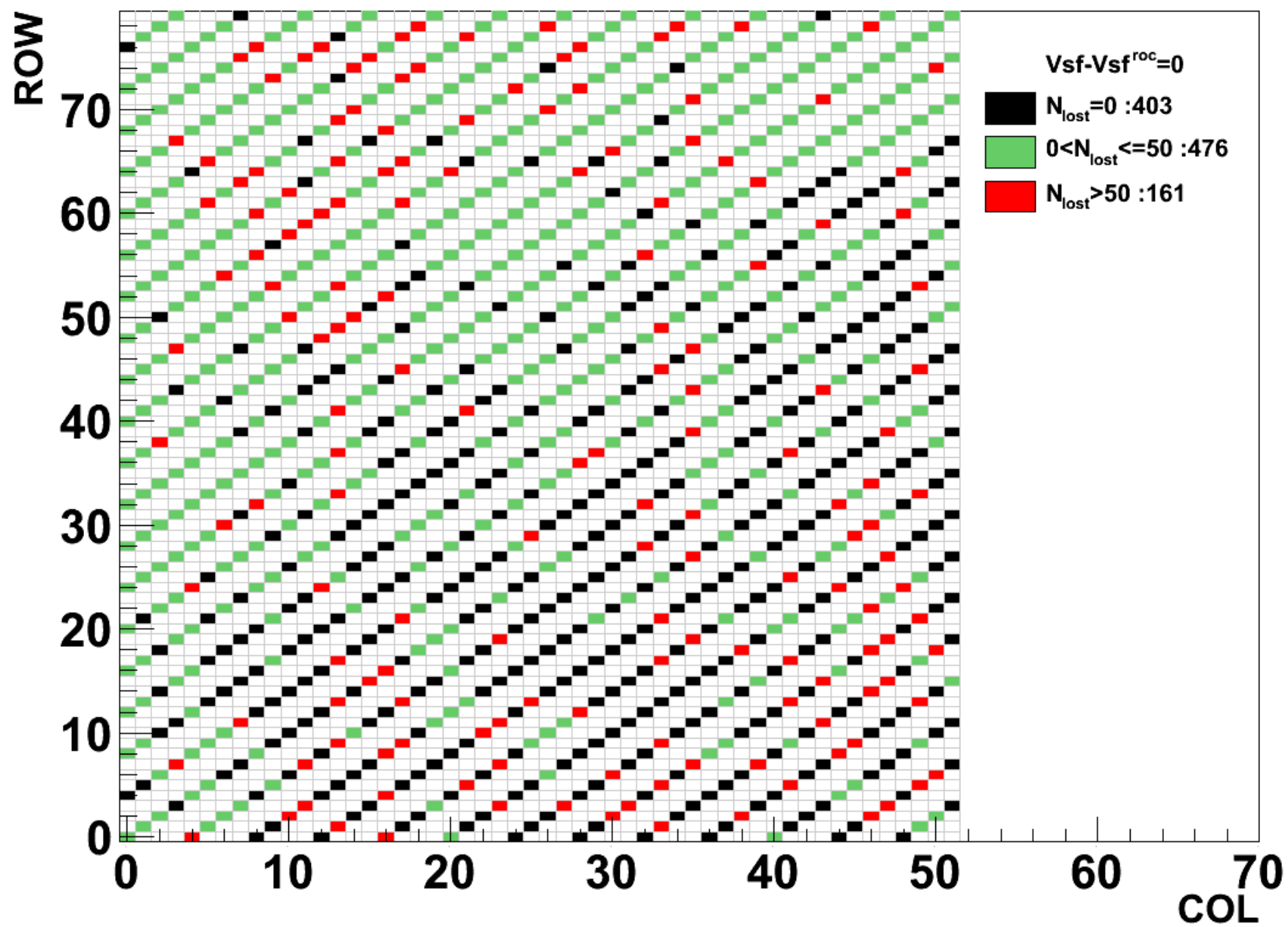
Results [pixel position]



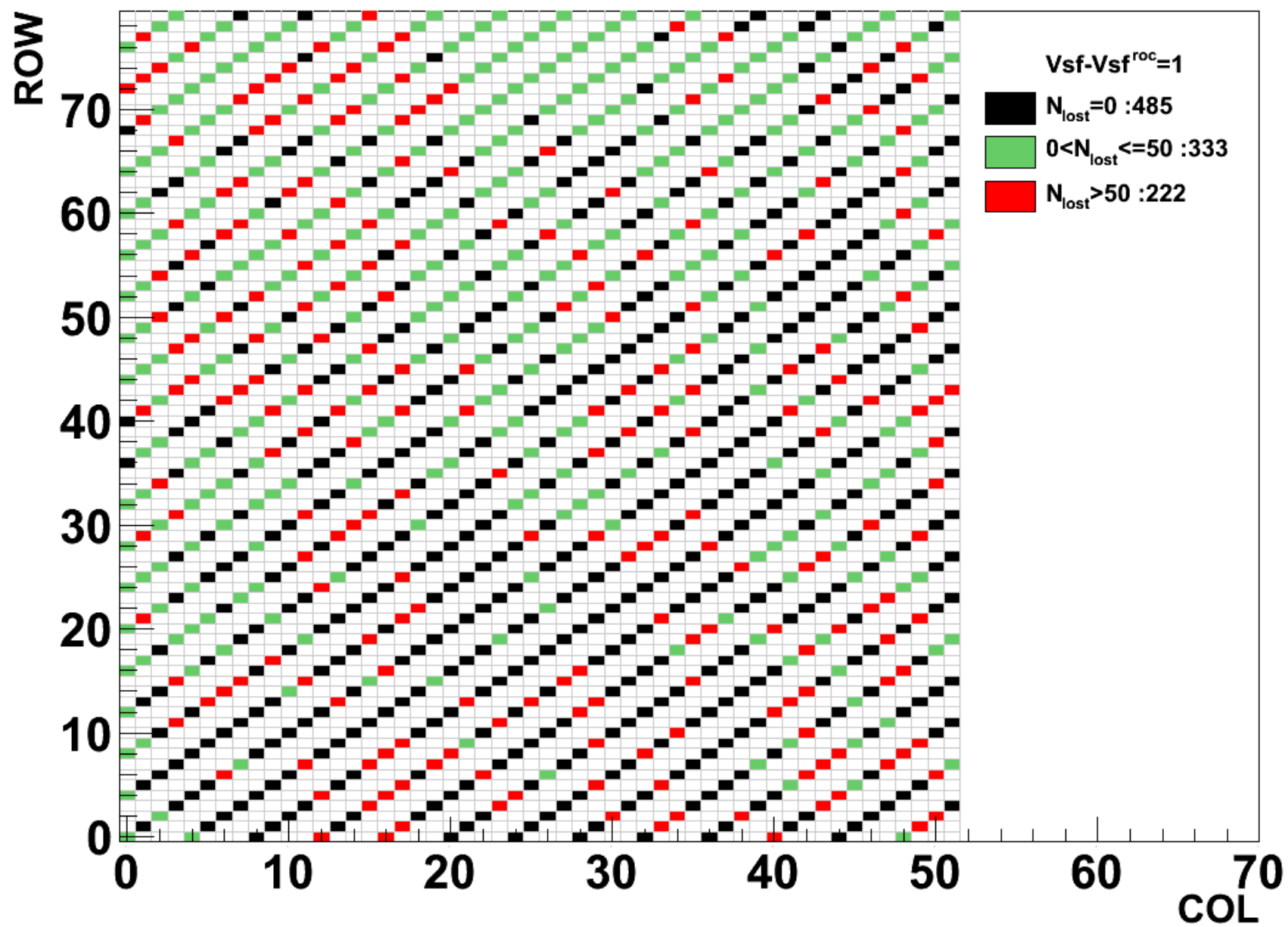
Results [pixel position]



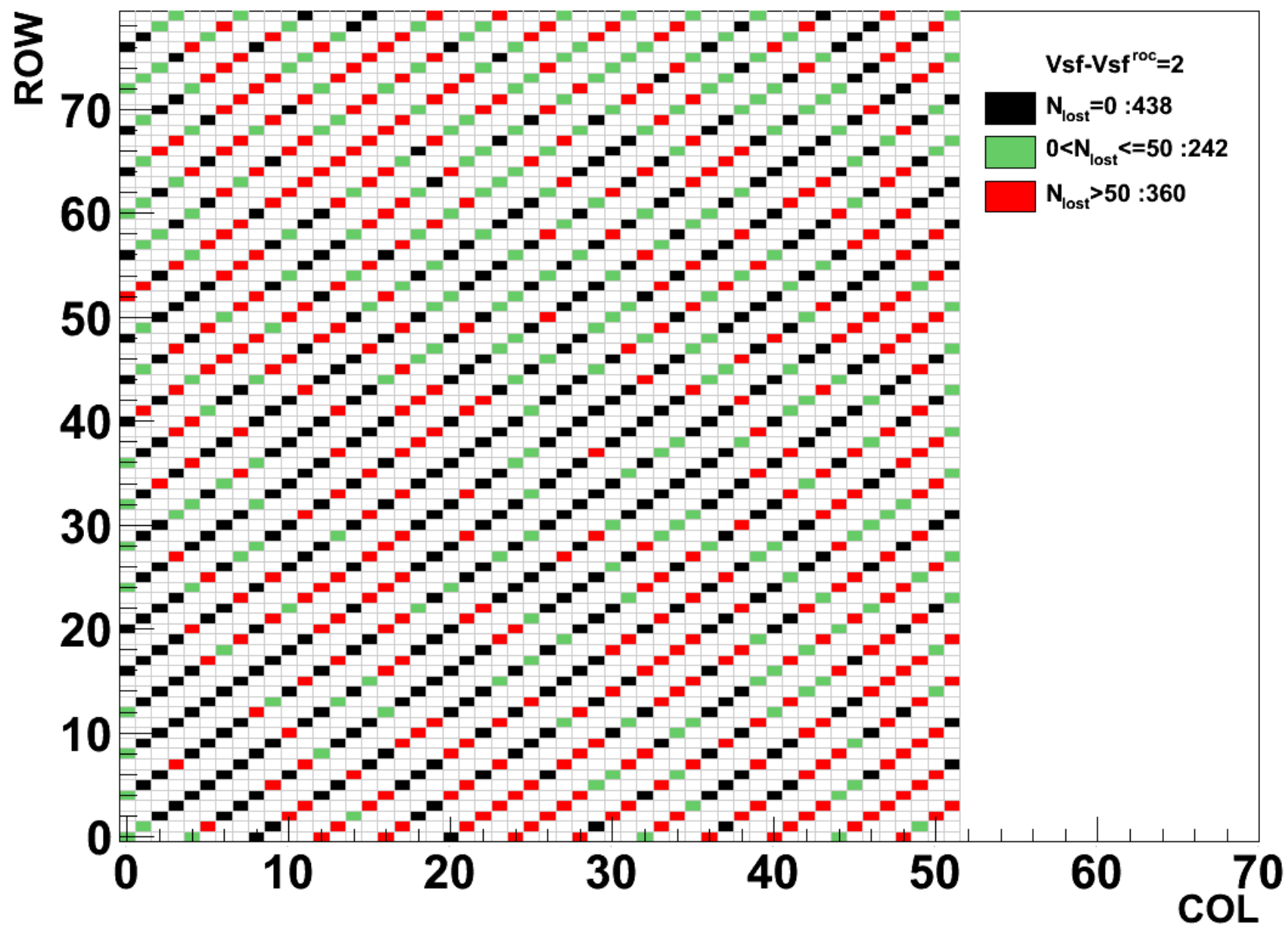
Results [pixel position]



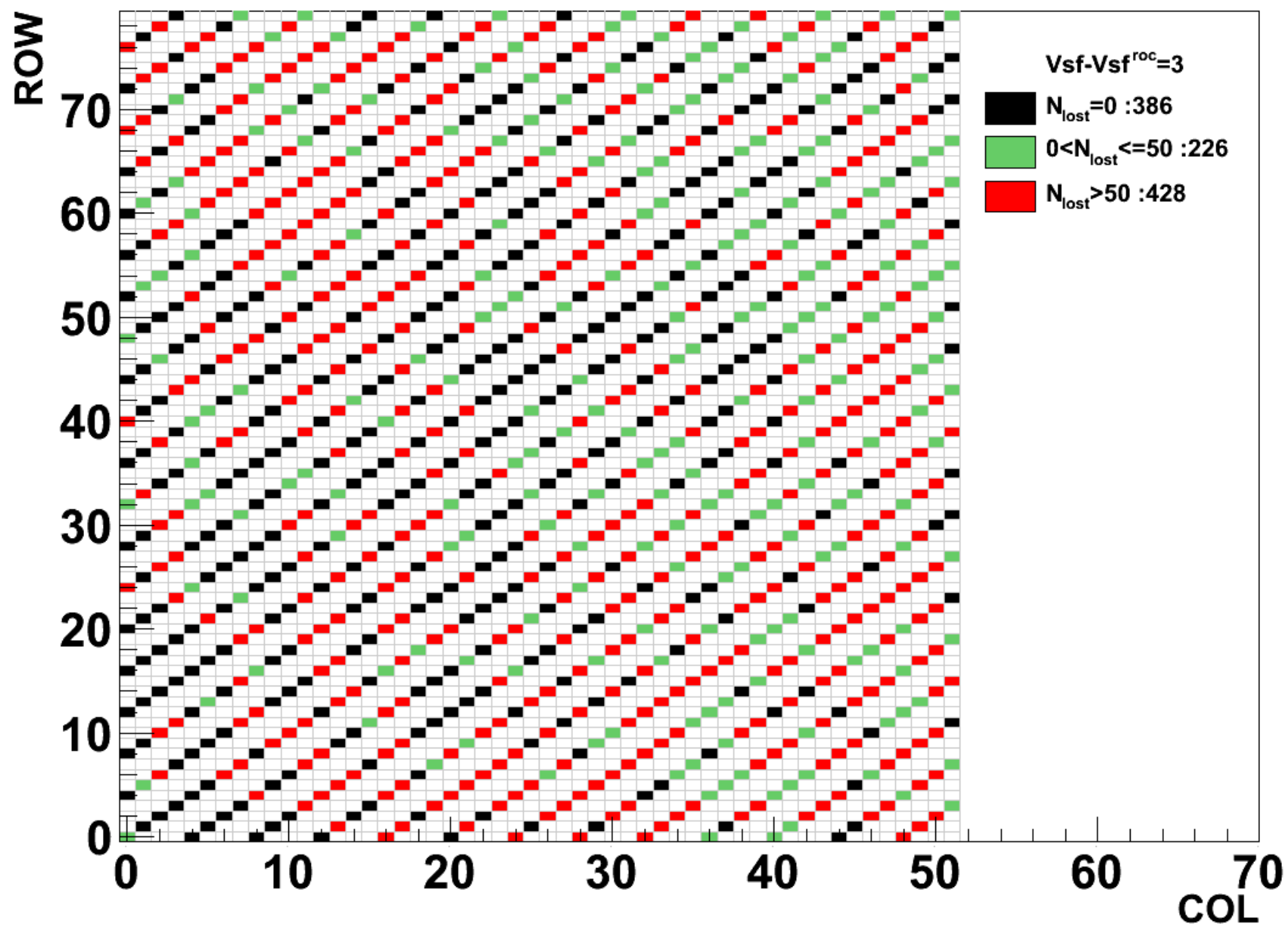
Results [pixel position]



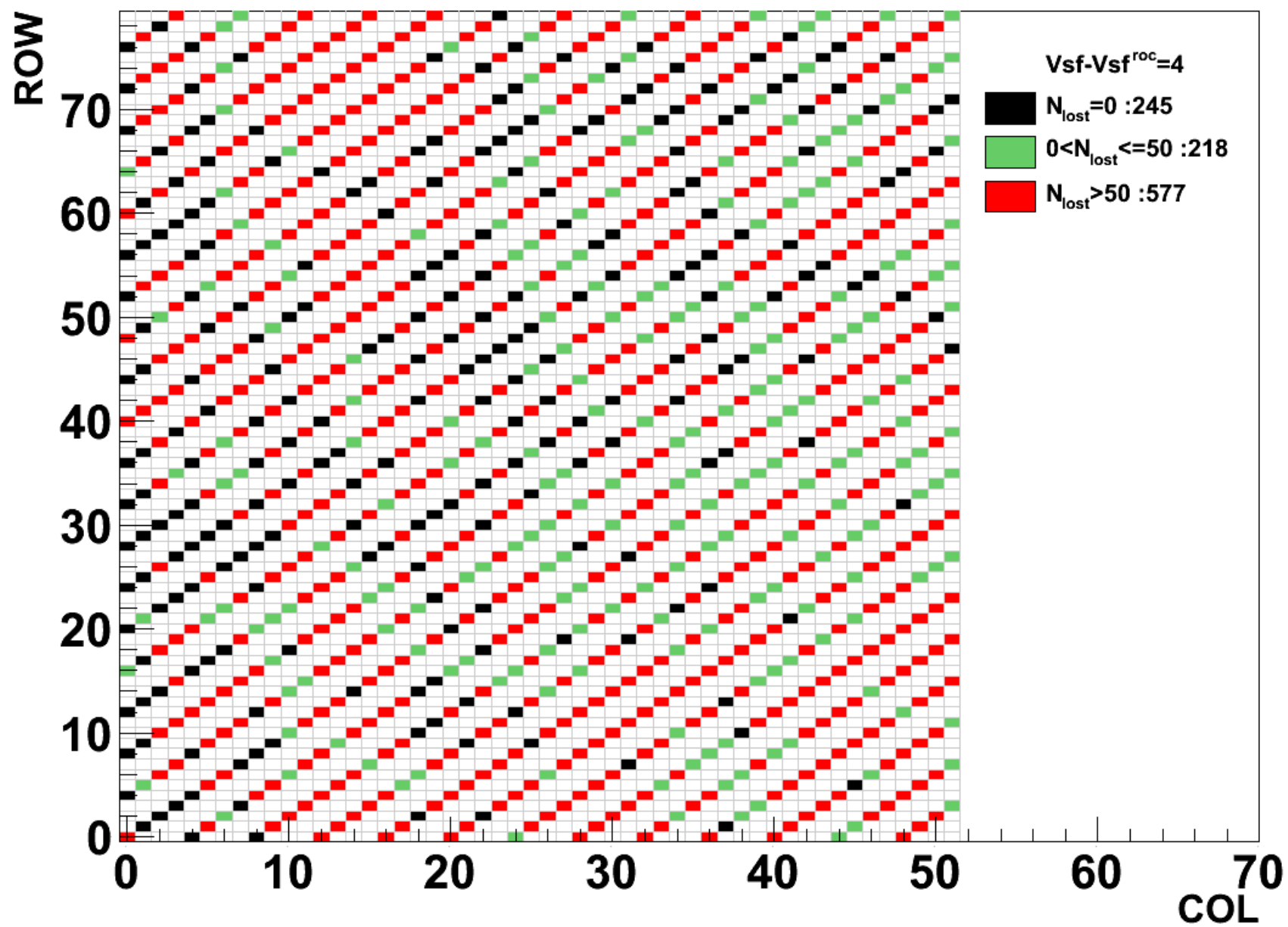
Results [pixel position]



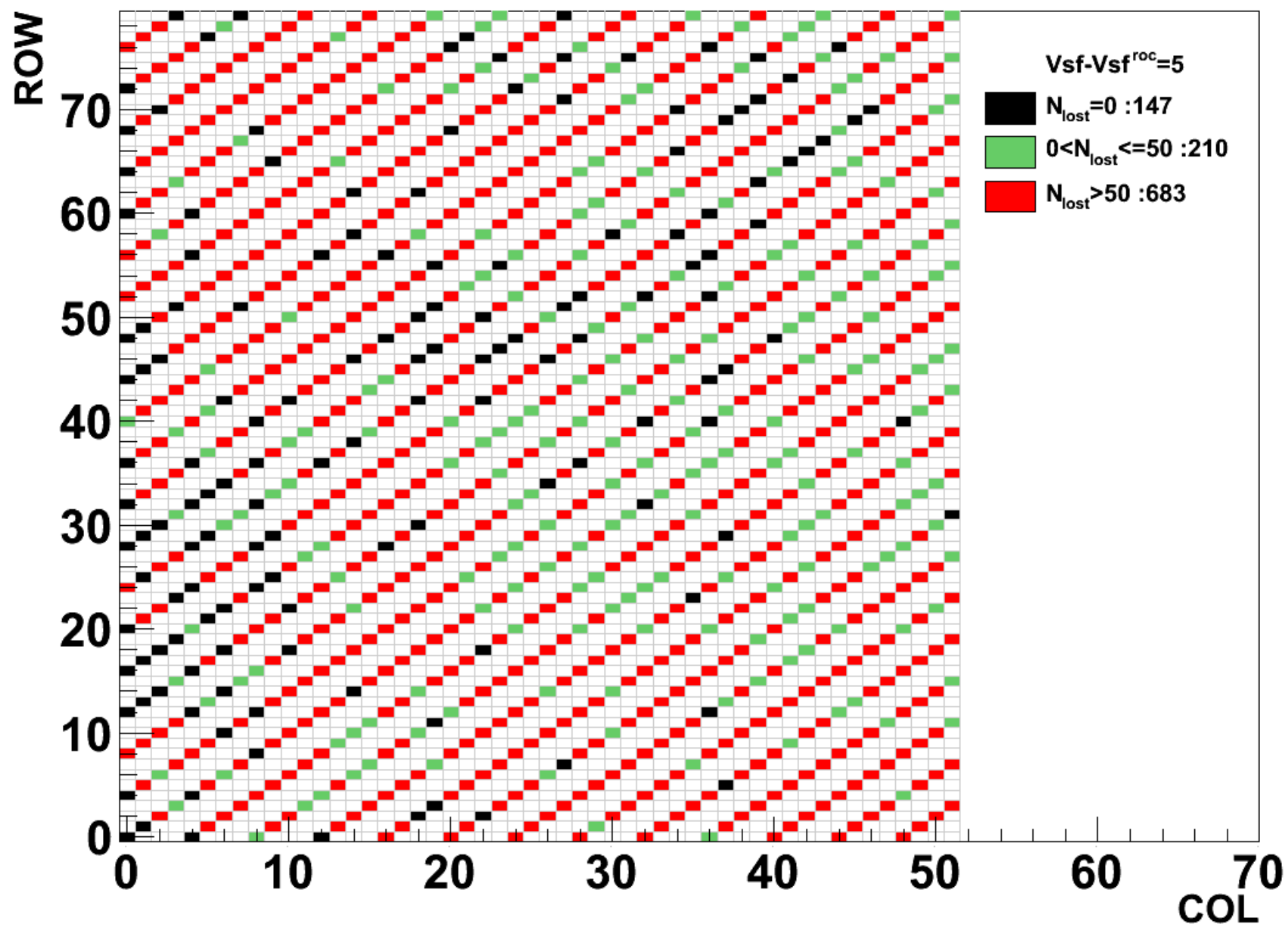
Results [pixel position]



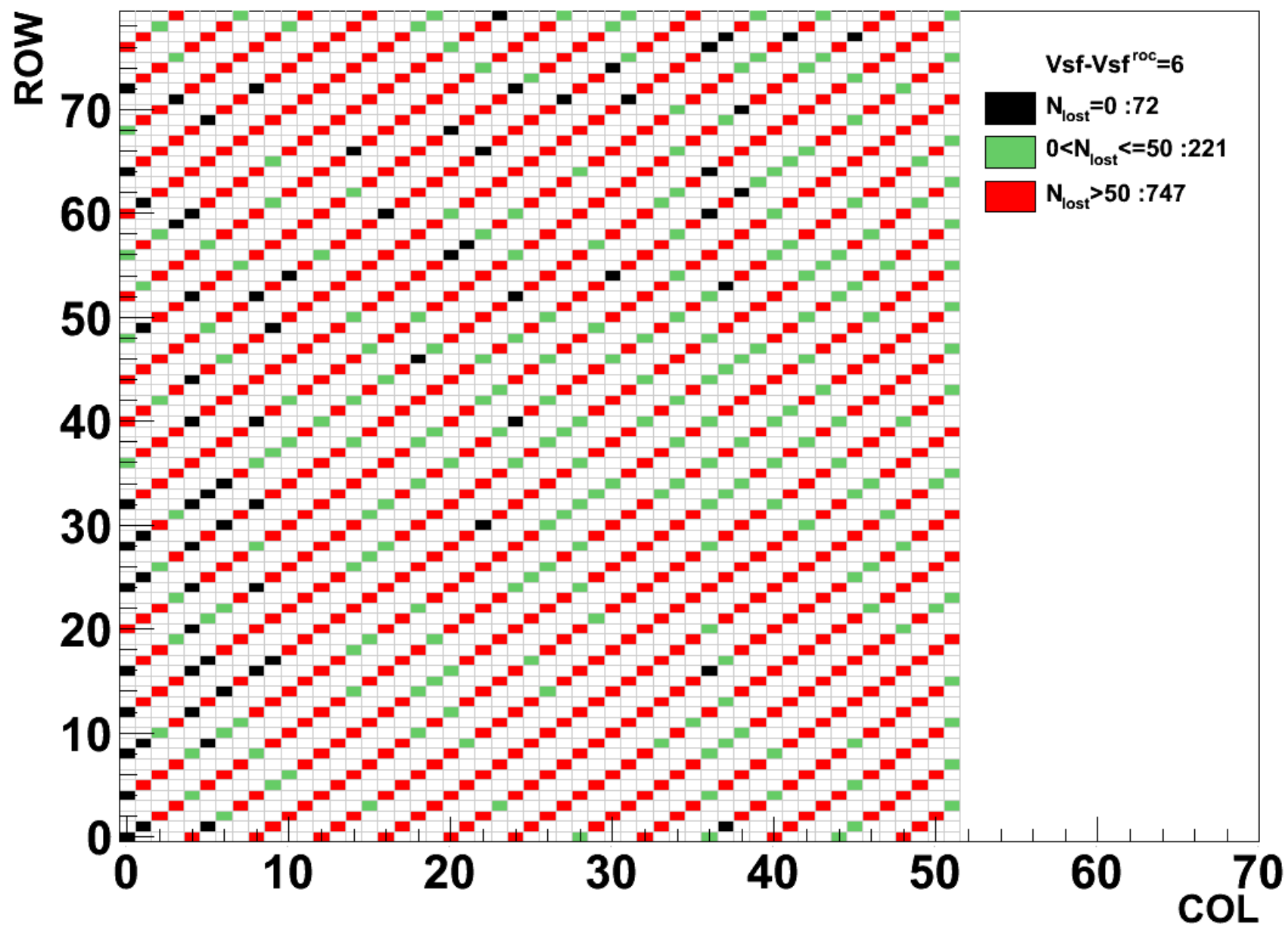
Results [pixel position]



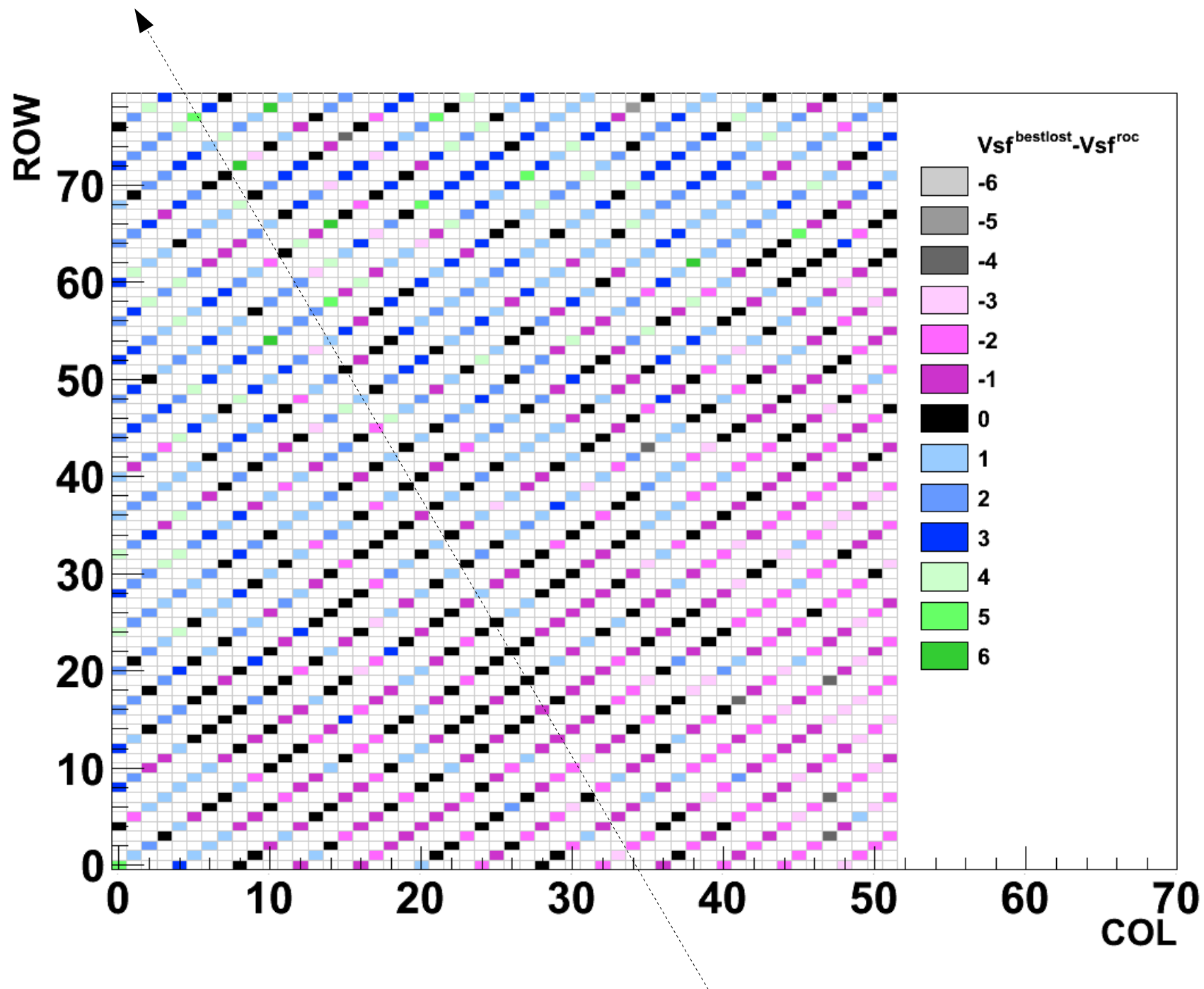
Results [pixel position]



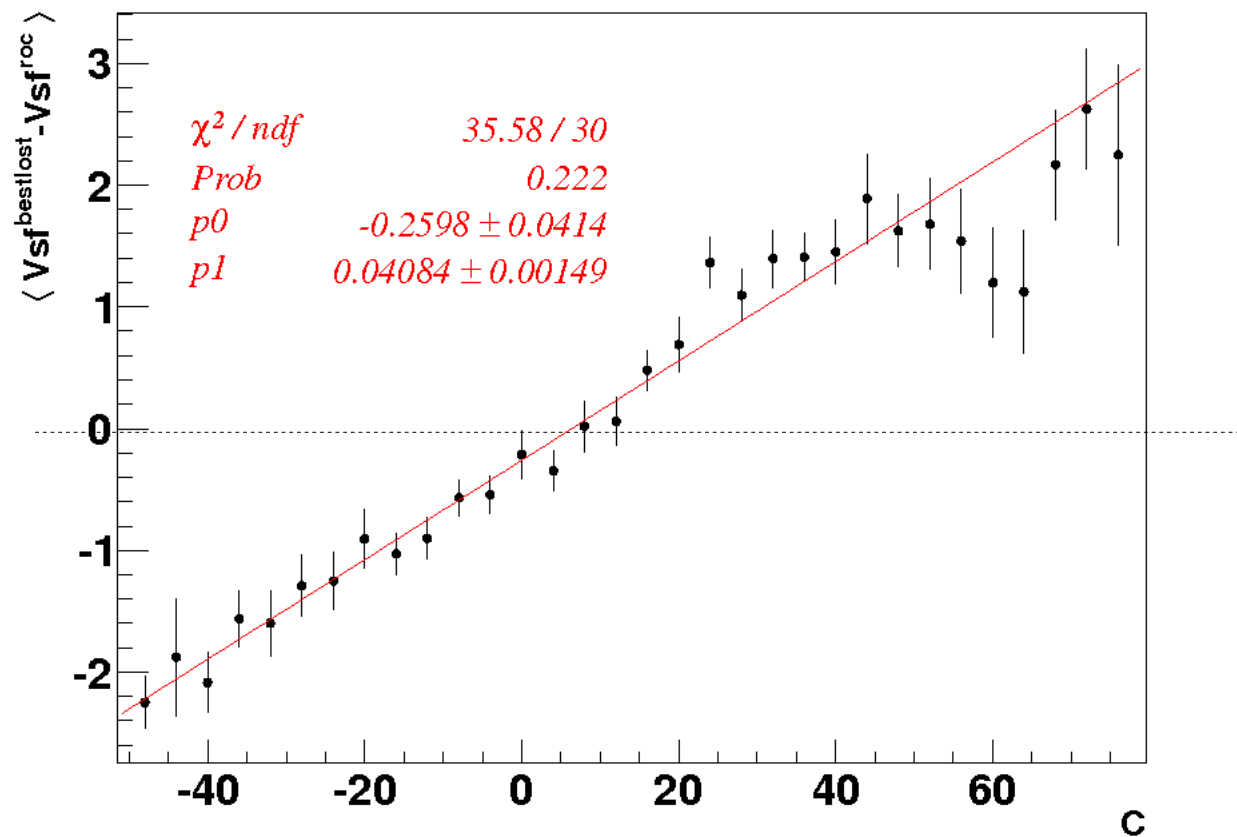
Results [pixel position]



Results [pixel position]



Results [pixel position]



Maybe Vcal drops across chip
Maybe Pixel changes across chip

Conclusion & Outlook

Conclusions:

χ^2/ndf and #lost points are good measures of linearity

Both measures agree to within 1 unit of best working V_{sf} of the chip

The **spread** of optimum V_{sf} for each pixel seems to be a limitation

Outlook:

Testing on other chips [Aout can be negative – mess me up!]

Started to look at **Vh1dDel** (code)