Summary of reconstruction and analysis

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CYGNO meeting,

15 July 2021

$He-CF_4$ vs $Ar-CF_4$

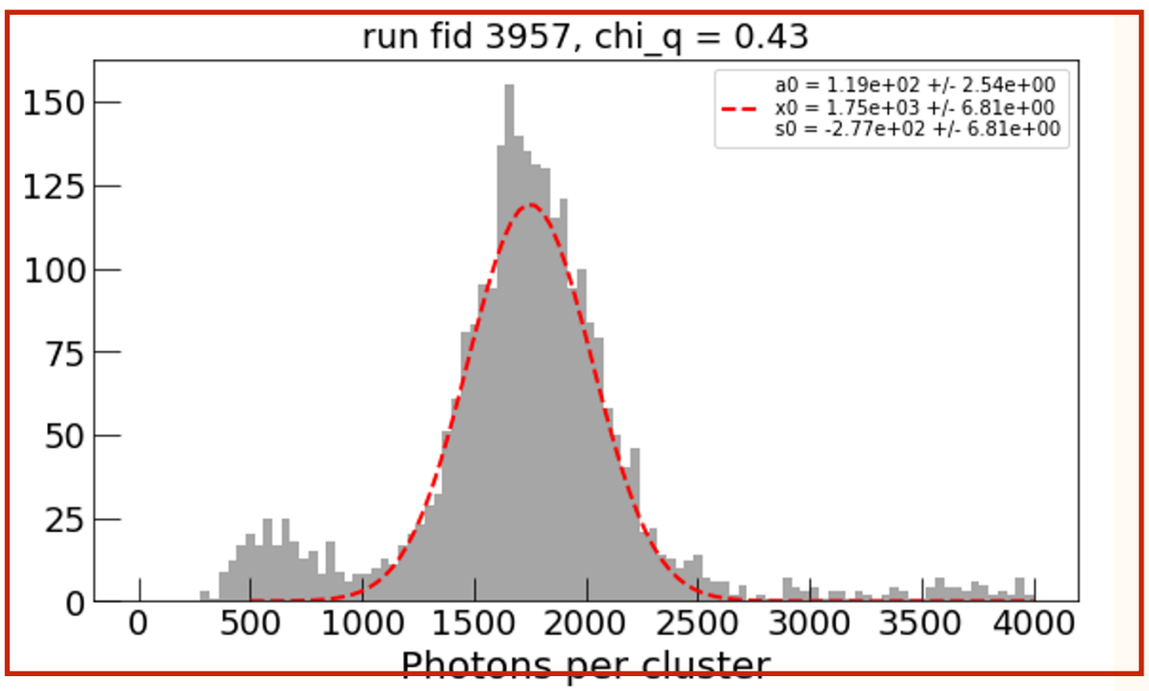
Study the light yield, diffusion effects in 2 mixtures: $He-CF_4$ and $Ar-CF_4$ using response of LEMON at ^{55}Fe source

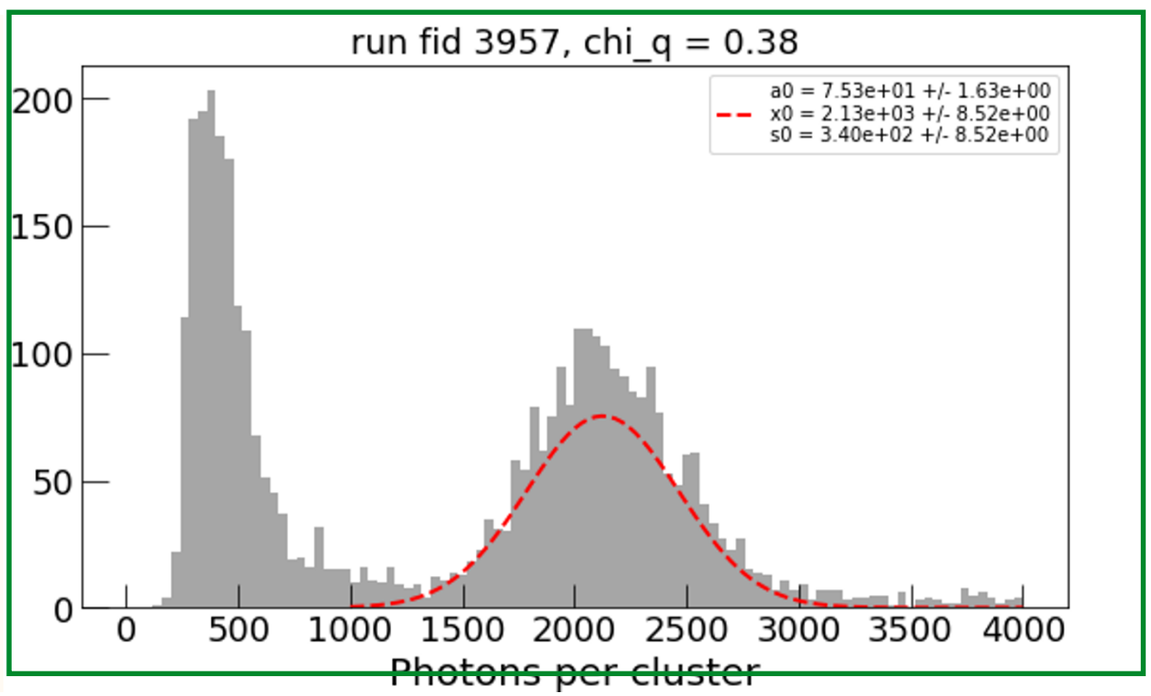
Variables under study:

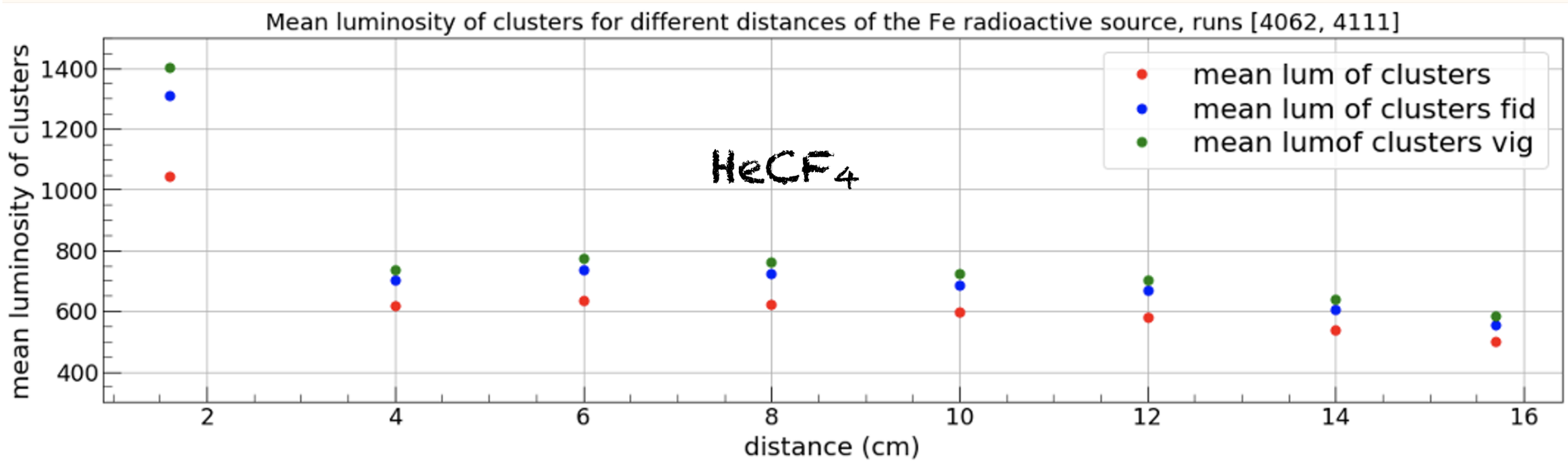
D. Marin, D. Caudo, M. Benati

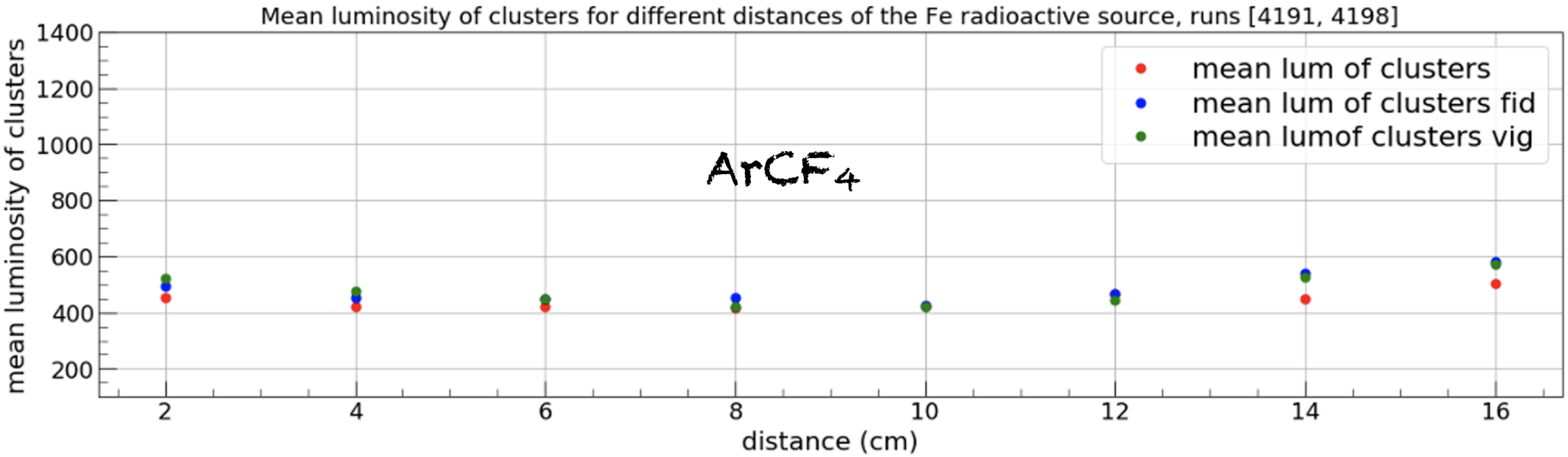
- light yield = photons / cluster
- cluster size = pixels / cluster

as a function of the GEM distance and for the two mixtures



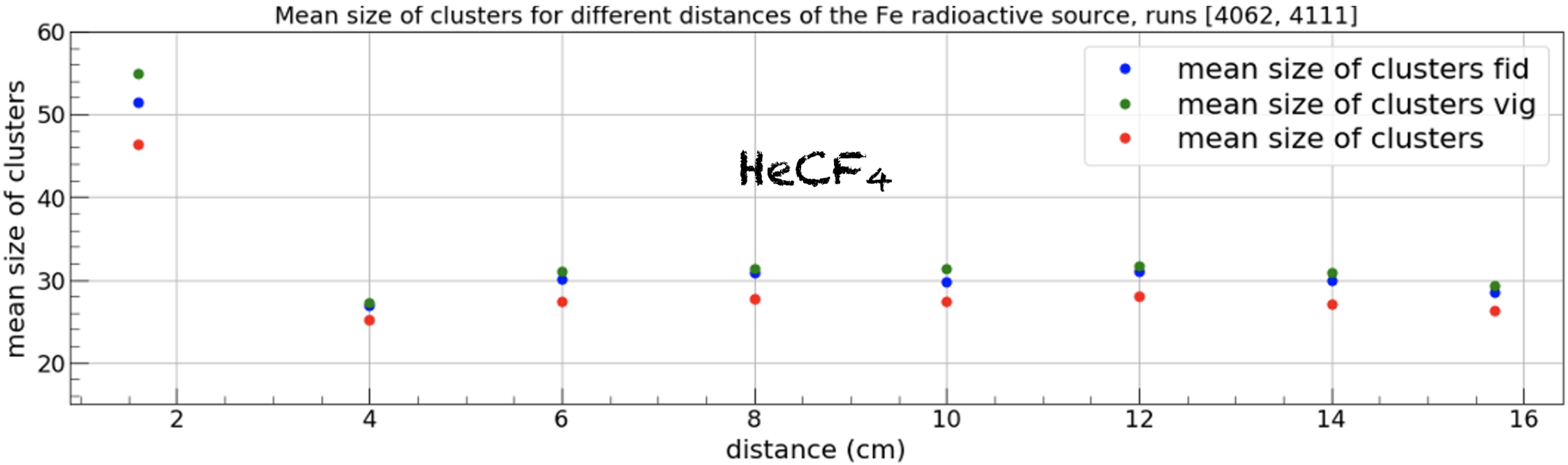


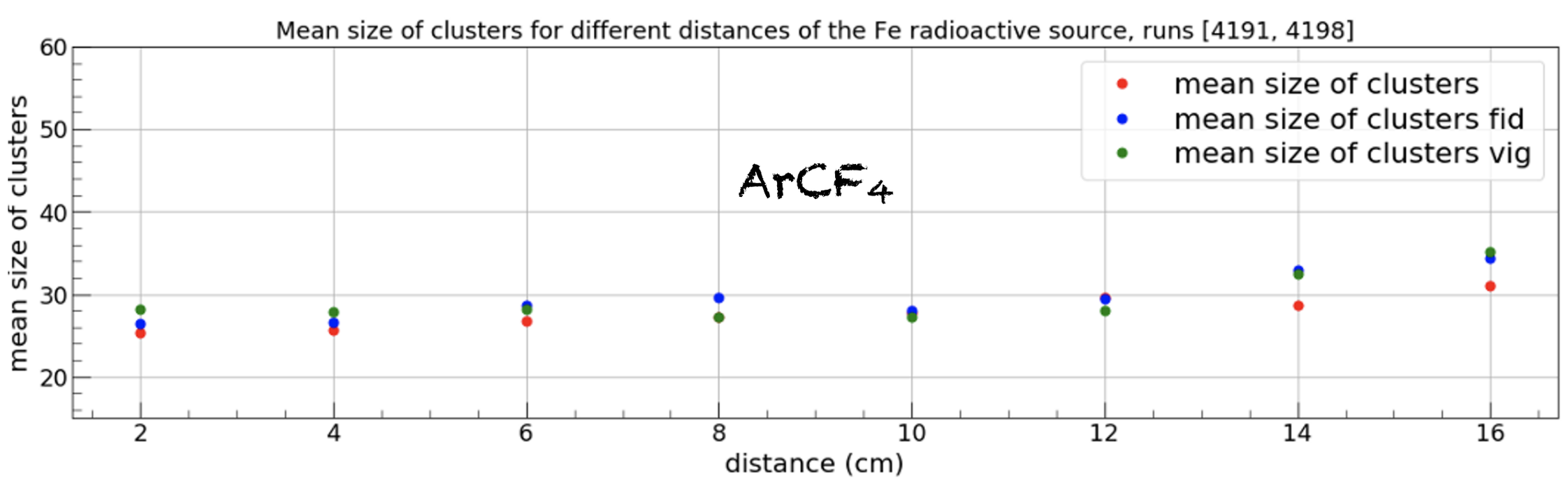




HeCF4 has larger light yield than ArCF4

cluster size





Ar has smaller clusters (i.e. drops the low-luminous cluster edges)

mixture conclusions

The $HeCF_4$ shows larger light yield than $ArCF_4$, and $HeCF_4$ shows a trend of cluster size as expected from diffusion

The efficiency of the two mixtures was also studied and $HeCF_4$ was also found better

Moreover, HeCF4 was found to run more stably (less discharges) for the same applied HV

2D geometrical effects

Possible distortions of the light collection efficiency as a function of the x-y position were studied:

- optical vignetting = purely a camera effect

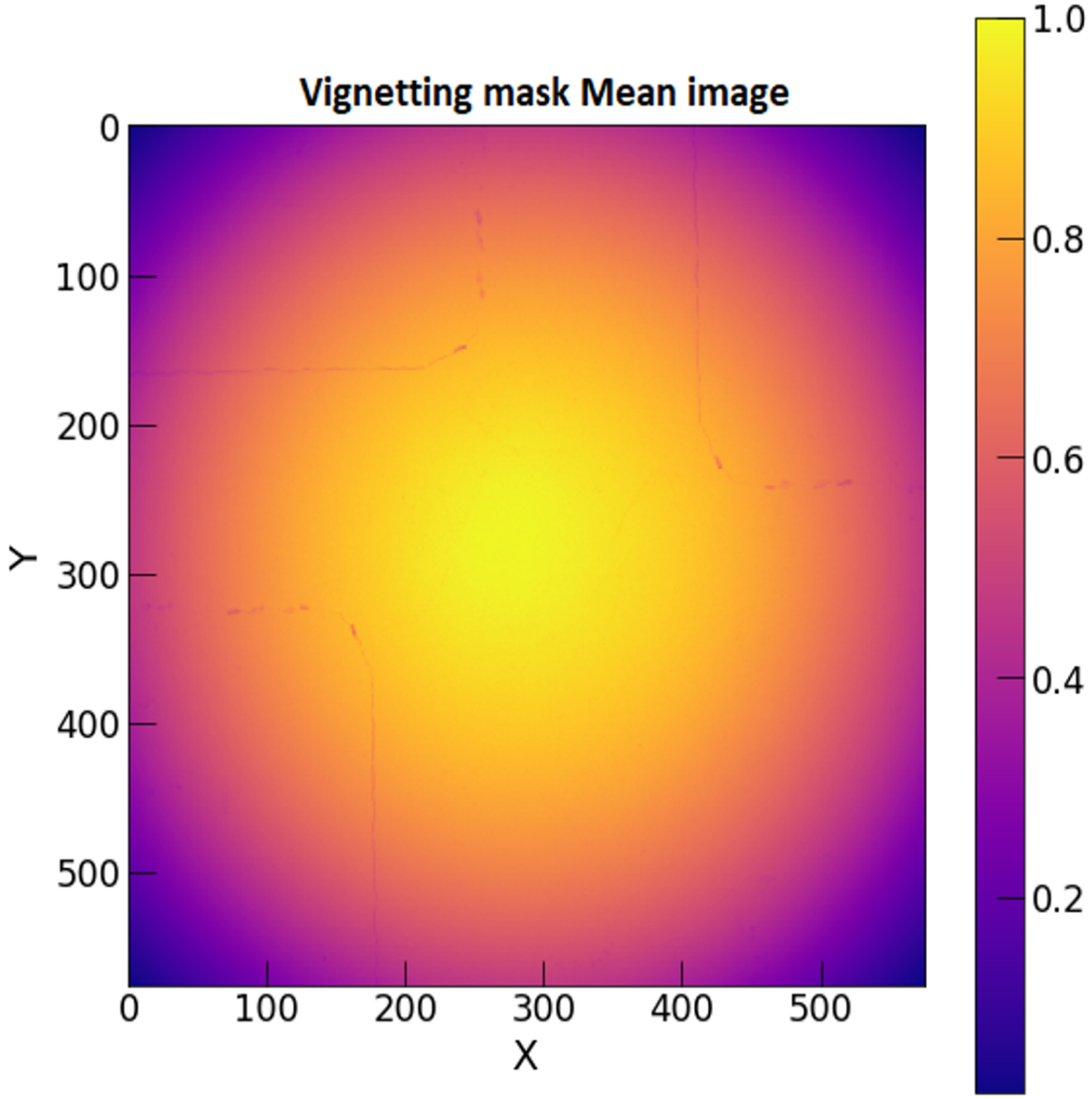
- electrical field effects = field cage-induced distortions and other

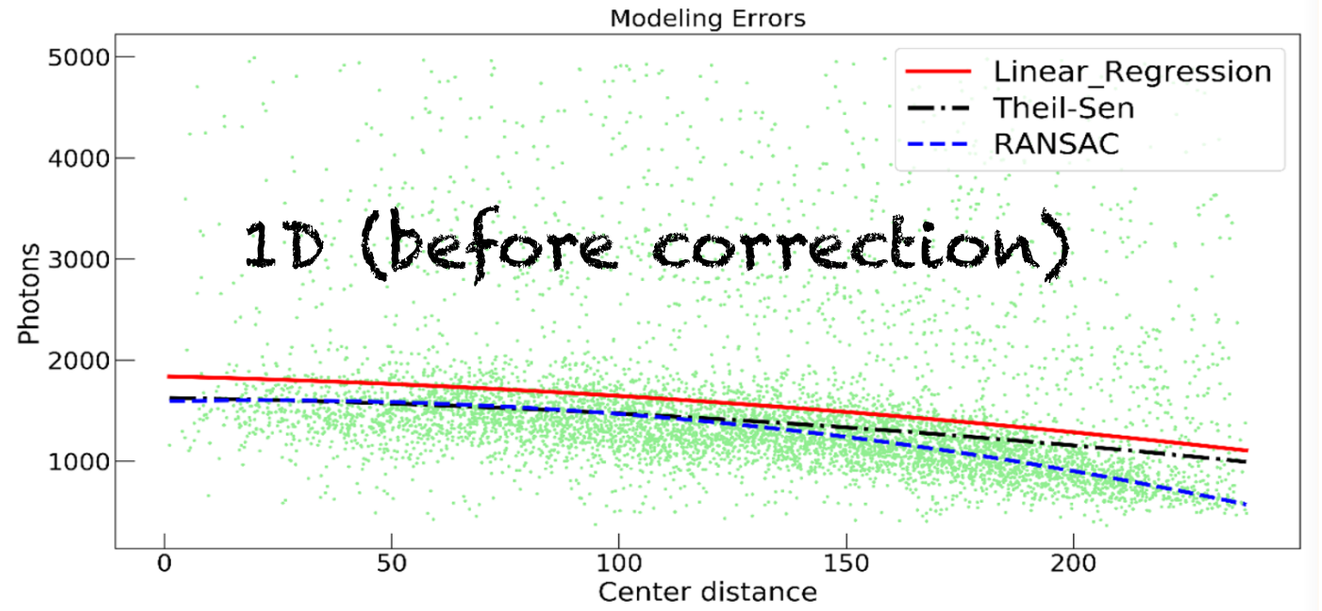
the aim is to understand / decouple the different sources of 2D non-uniformities of the light yield efficiency

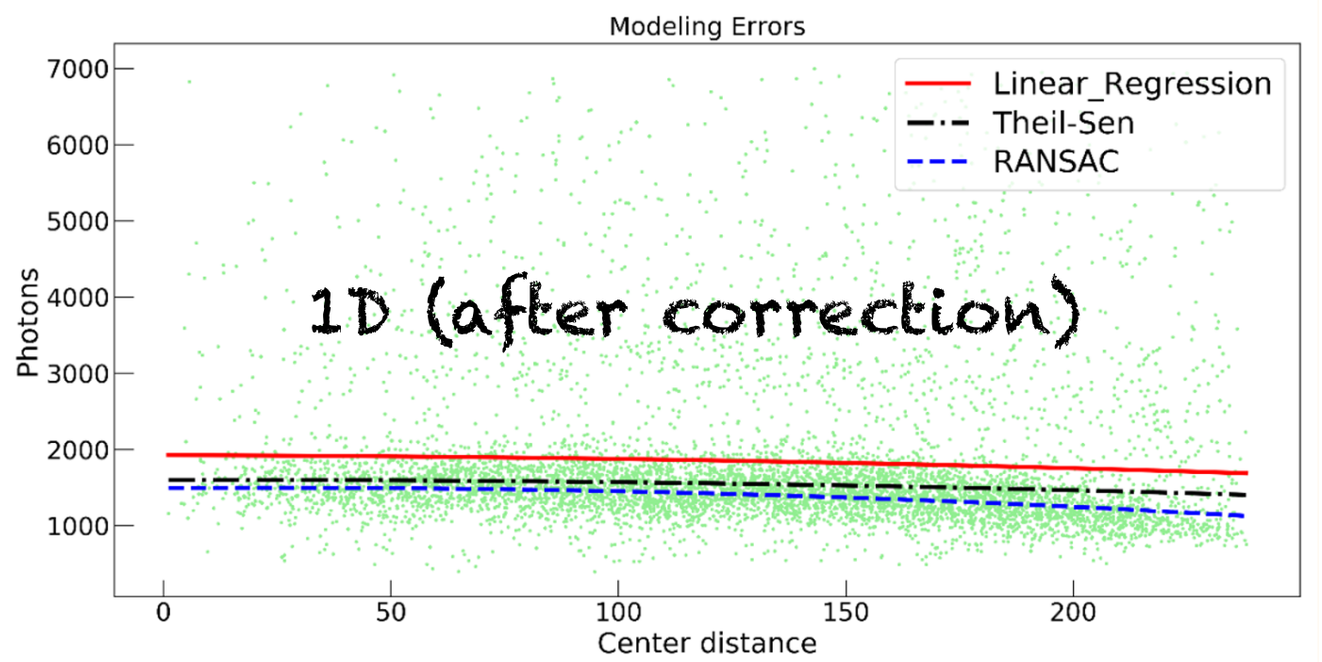
N.B. An "effective" efficiency map can be obtained with a long exposure bkg-only run, which includes all the effects

vignetting

Map obtained from pictures of a white area. LY drops down to 20% in the far corners







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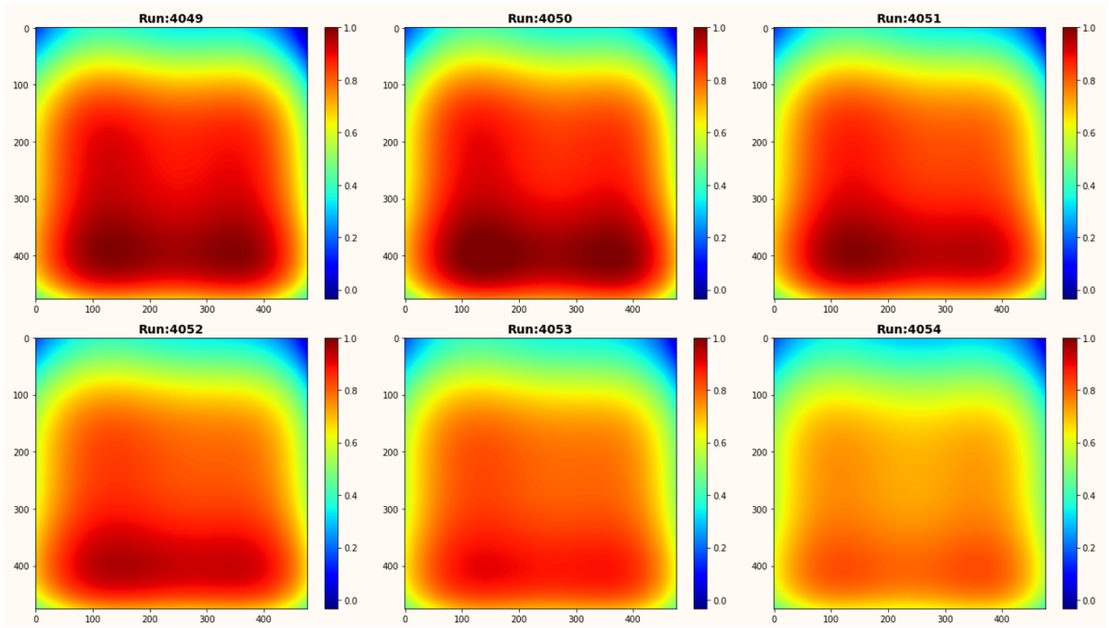
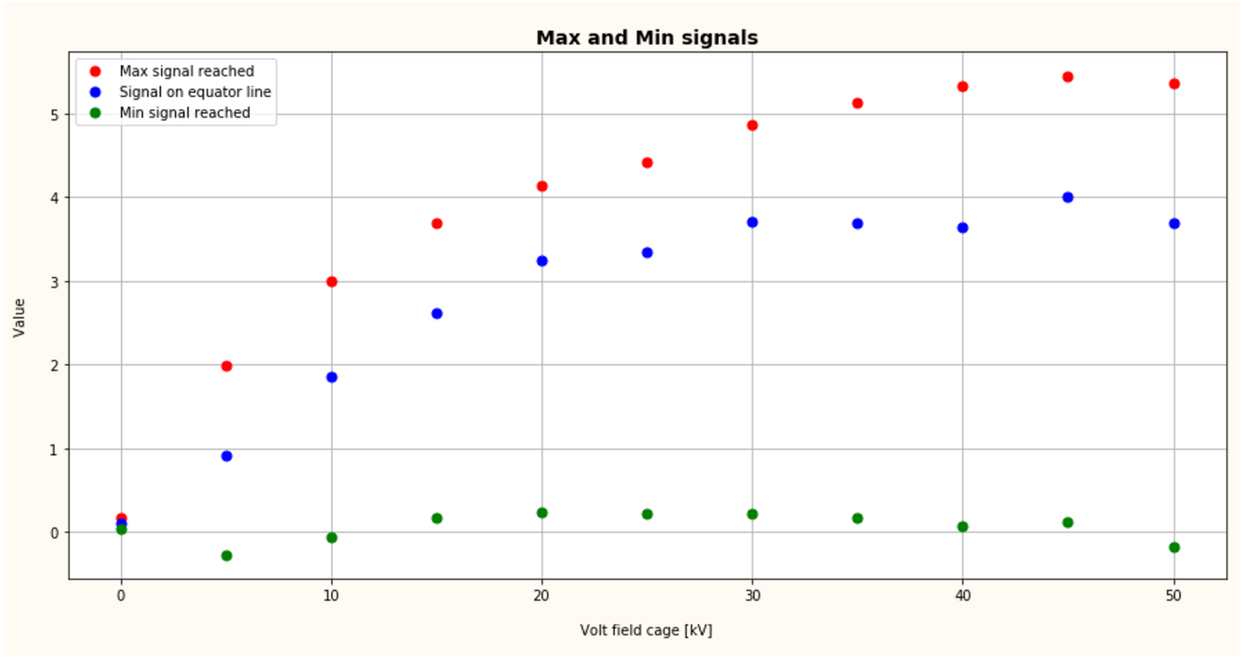
Correction derived and the closure test works.

electrical field effects

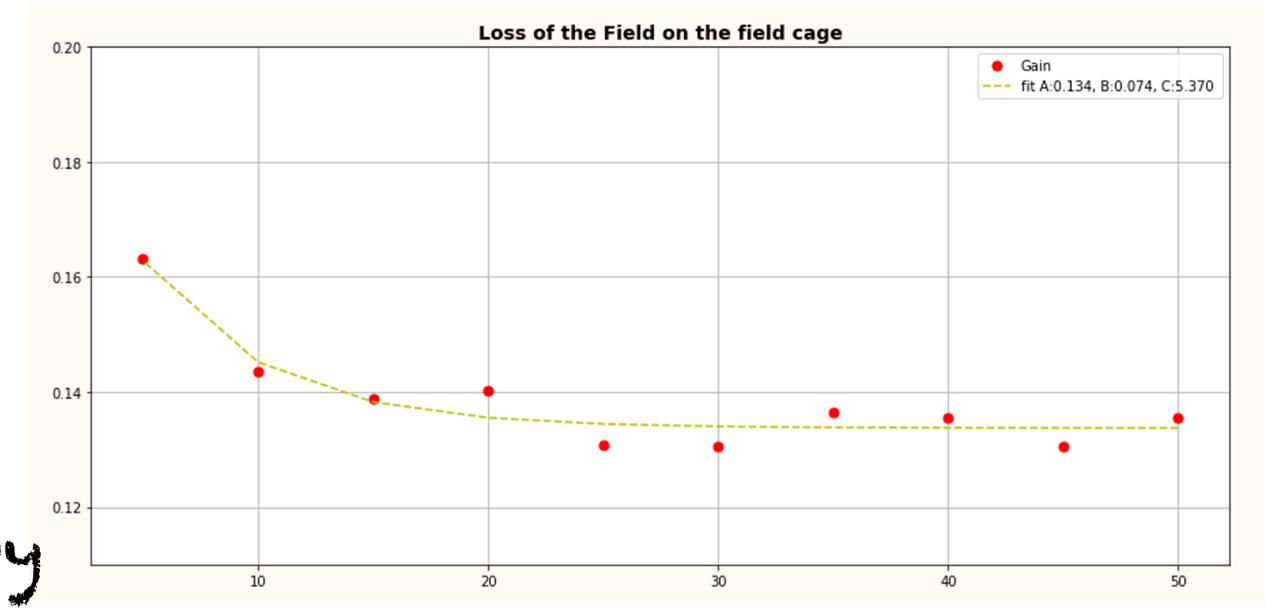
Runs taken with LIME with varying HV up to 50 kV

light response ratio wrt the max value





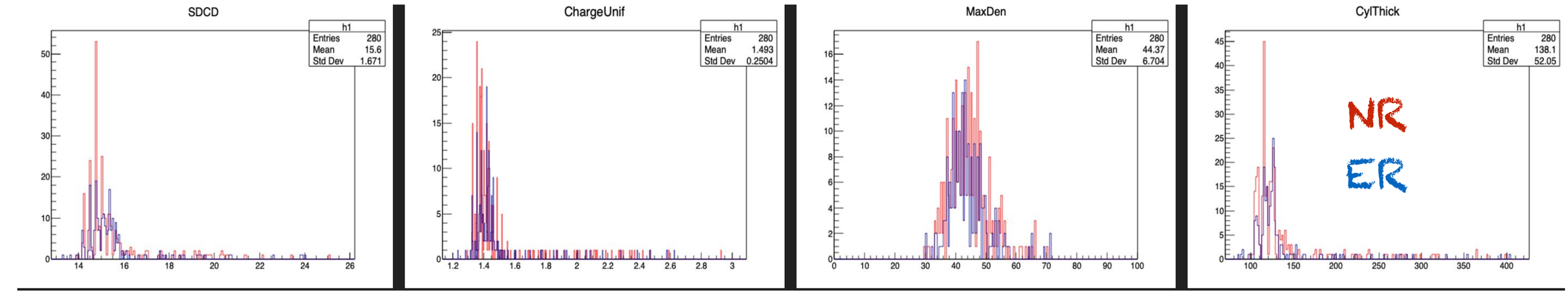
RMS as a function of HV
it seems that it doesn't improve with HV: maybe field cage is not the main responsible of anisotropy



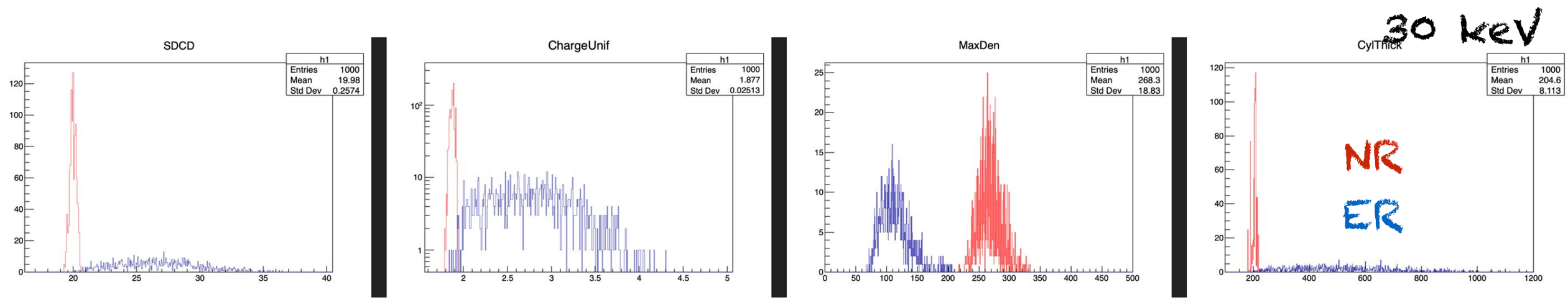
ER vs NR separation

Many variables studied for eletron-recoil (ER) vs nuclear-recoil (NR), beyond the first simple light density (photons/pixels)

3 keV



30 keV

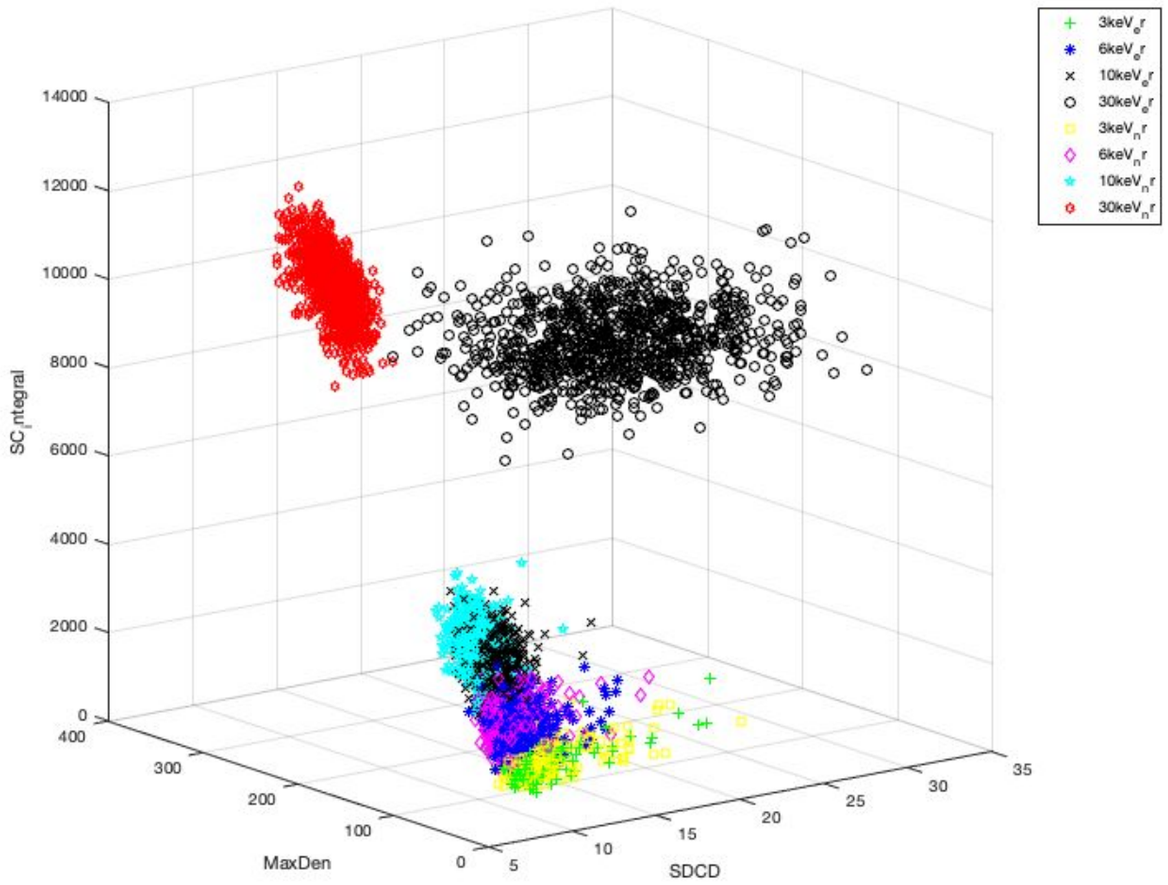


Discrimination improves with E, and it seems feasible with 1 variable for E > 6 keV

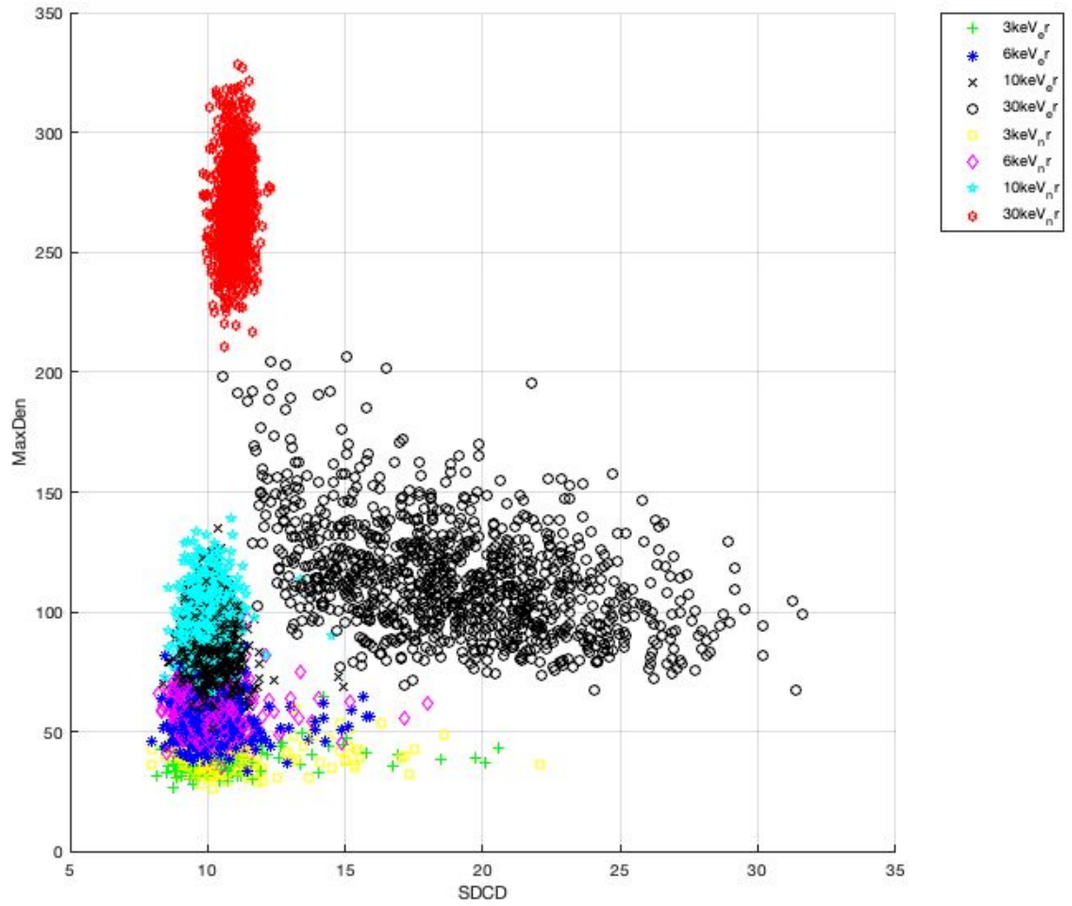
A. Prajapati

E-dependent discrimination

One can think about a Energy - dependent selection to improve the ER / NR discrimination



3D: Energy - density
- charge distribition RMS

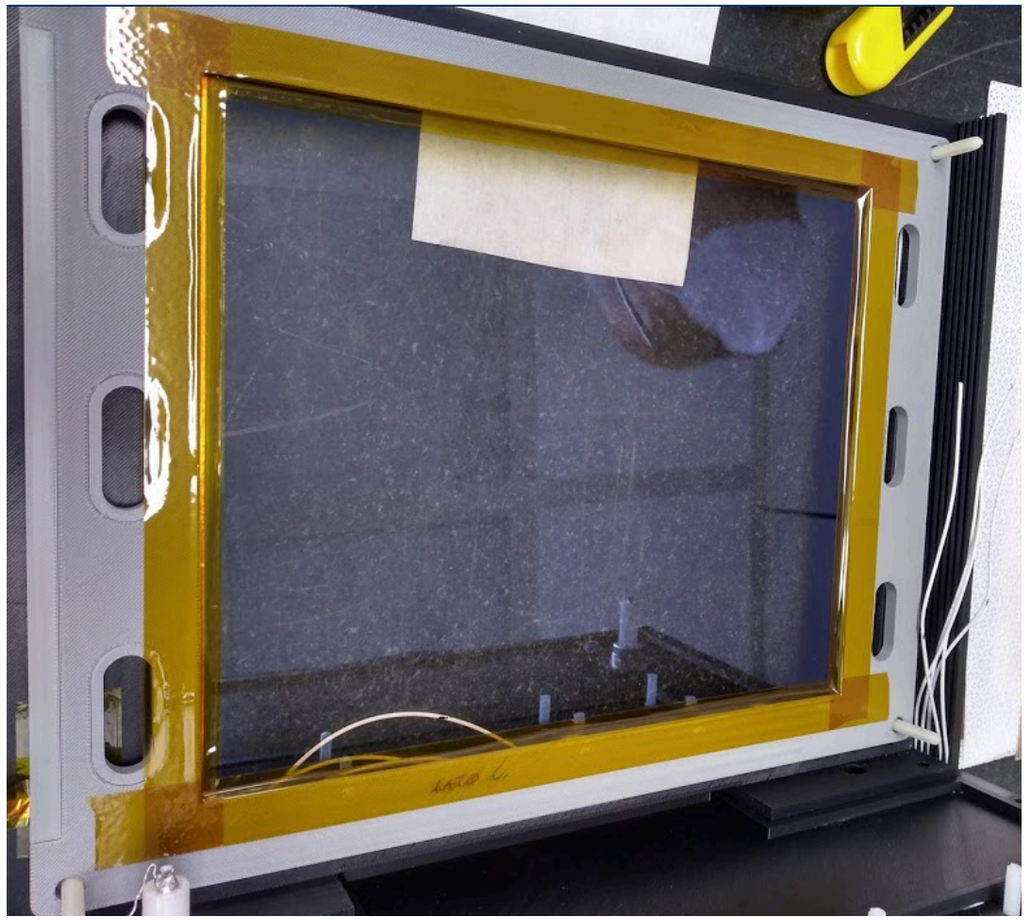


2D: density
- charge distribition RMS

studies on ITO glass

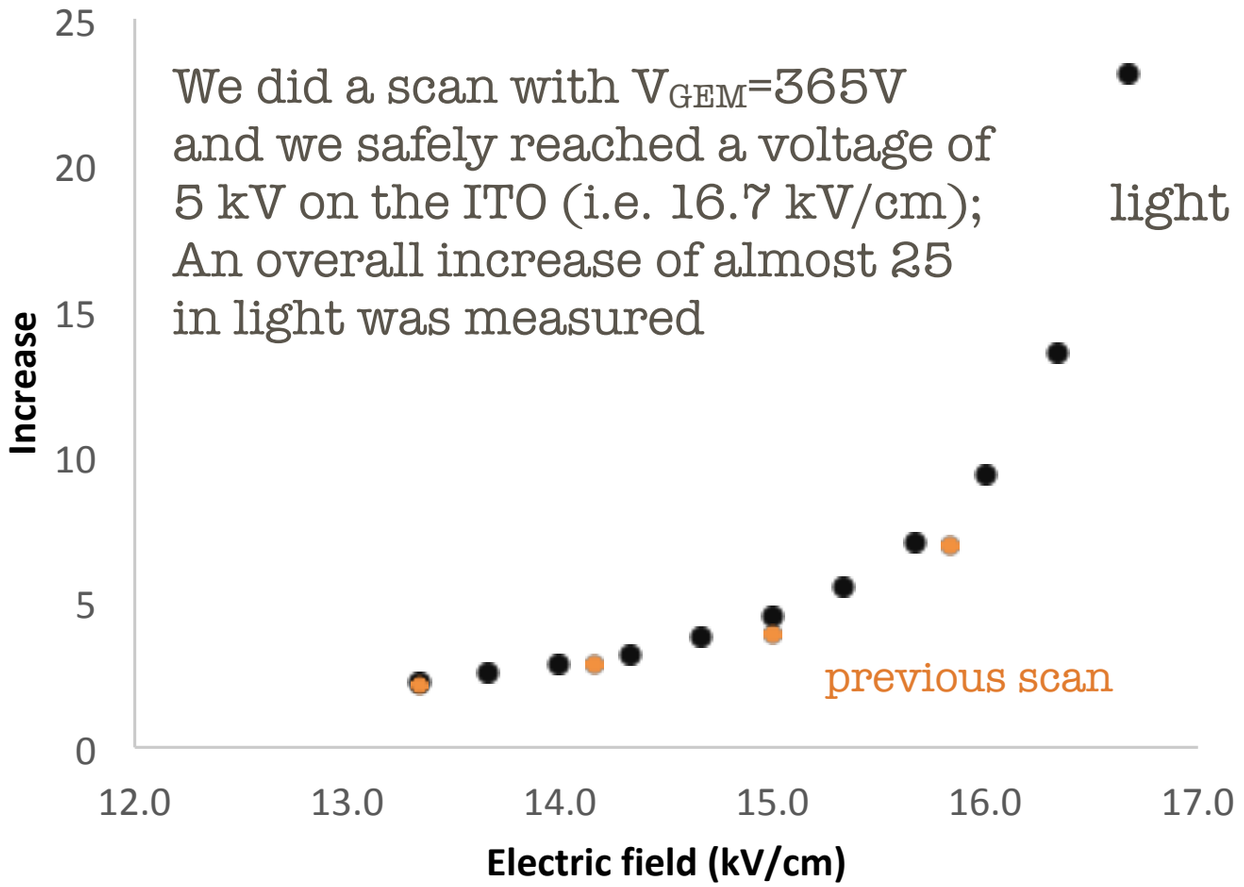
Within the studies for electroluminescence, induced by electrons below the last GEM, an attempt was made with a conductive glass ITO-coated as last stage acceleration

LEMON is used



D. Pinci

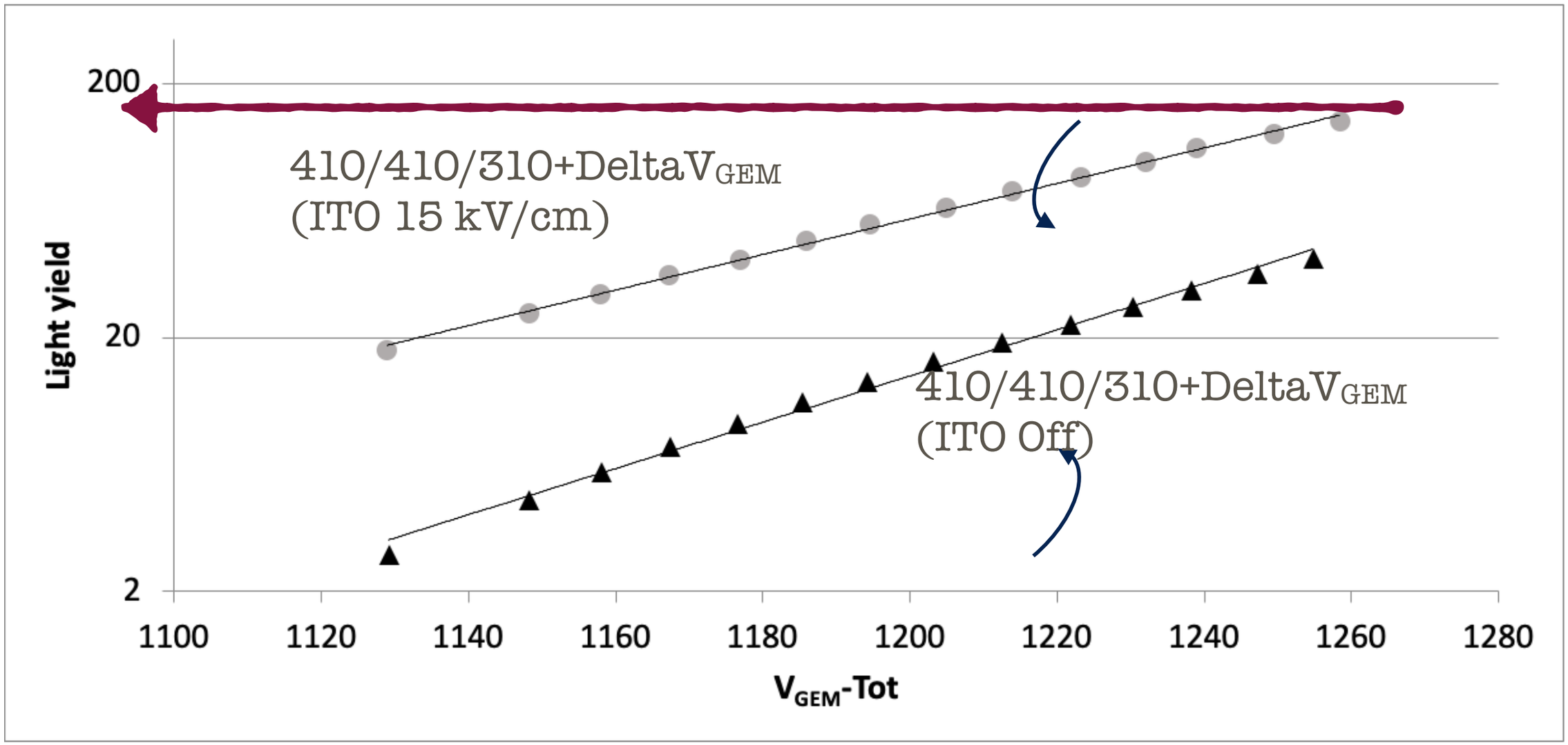
We did a scan with V_{GEM}=365V and we safely reached a voltage of 5 kV on the ITO (i.e. 16.7 kV/cm); An overall increase of almost 25 in light was measured



x 25 light gain reached for a max Voltage of 5 kV on ITO

effects on saturation

Turning ON the HV on ITO plane with low GEM2/GEM3 gain is much better than having GEM1 at high gain (because of saturation)



=> so it seems that the light yield can be completely recovered