Impact of different reflectivity parameters

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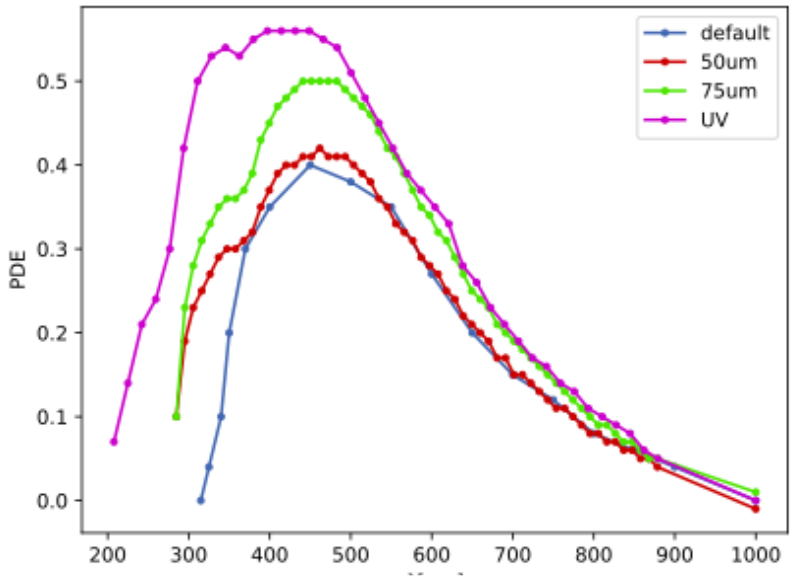
Summary-SiPMs

16, 30 of october and 13 of november we saw how the reconstruction results change by usign different SiPMs parameters

- Default SiPMs have a low PDE and detects down to 300nm (50um pixel pitch)
- 50um have a different coating. PDE is improved in the UV range
- 75um are like 50um but with a 75um pixel pitch (smaller dead area, better PDE)
- UV are SiPMs with PDE extended in the UV spectrum down to 200nm

- PDE comparison

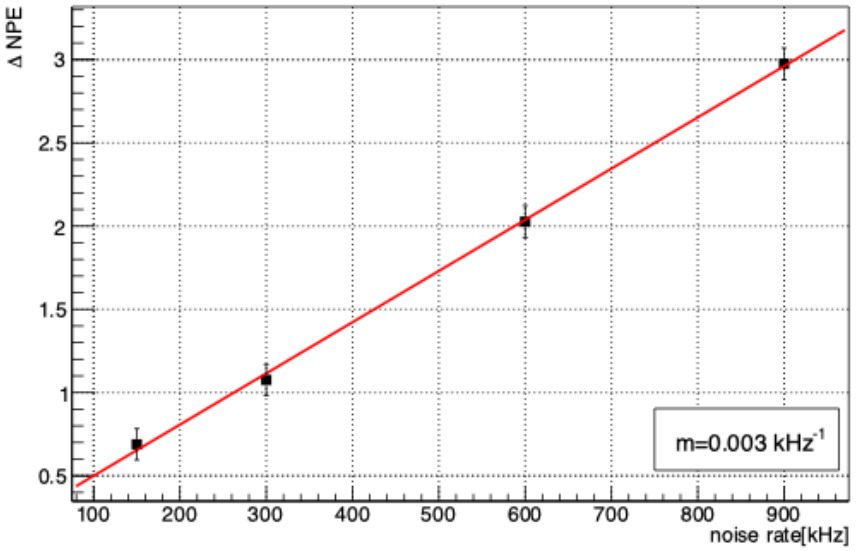


Injecting noise update

Last time (29 january 2026) I presented some simulation result injecting dark counts into the dRICH

To test the algorithm different noise were tested rates and looked at the difference of NPE with and without the noise

The amount of hits increase linearly with the noise rate, it's a good indication that the code is properly working



SiPMs: default
Time window: 3ns (29jan2026)

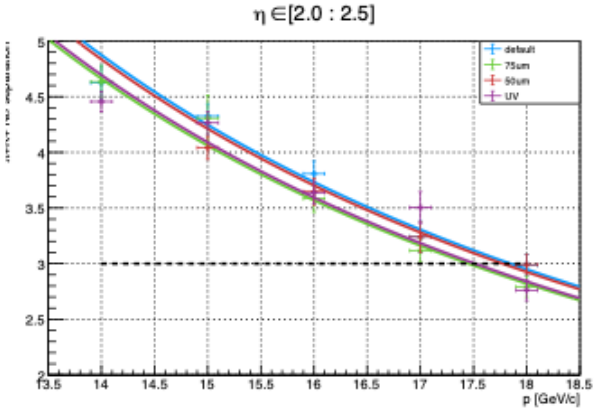
Noise effects

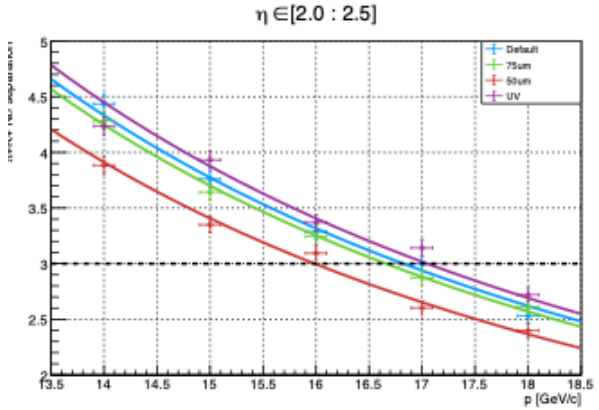
We see that default and 50um sipms are heavly affected by the injection of noise, while UV and 75um are more robust

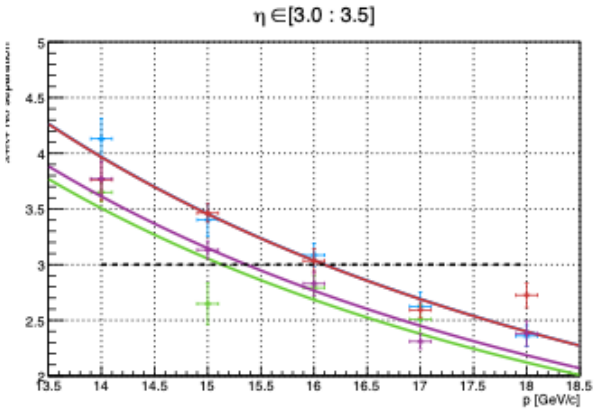
All studies are made with IRT2

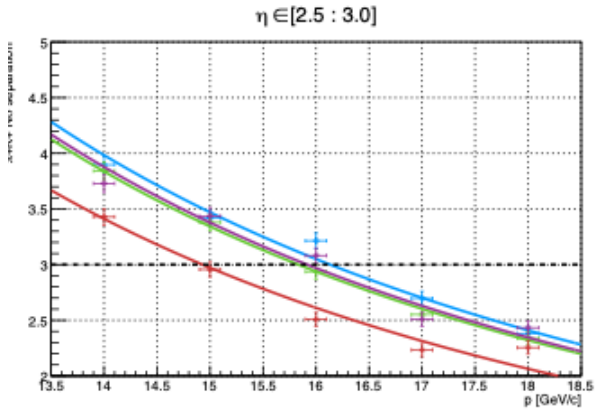
Without noise

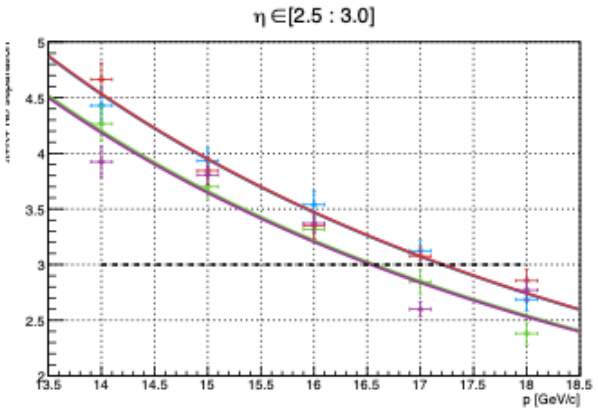
With noise

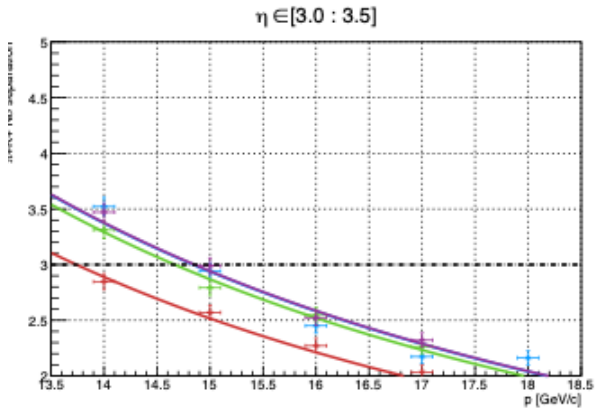








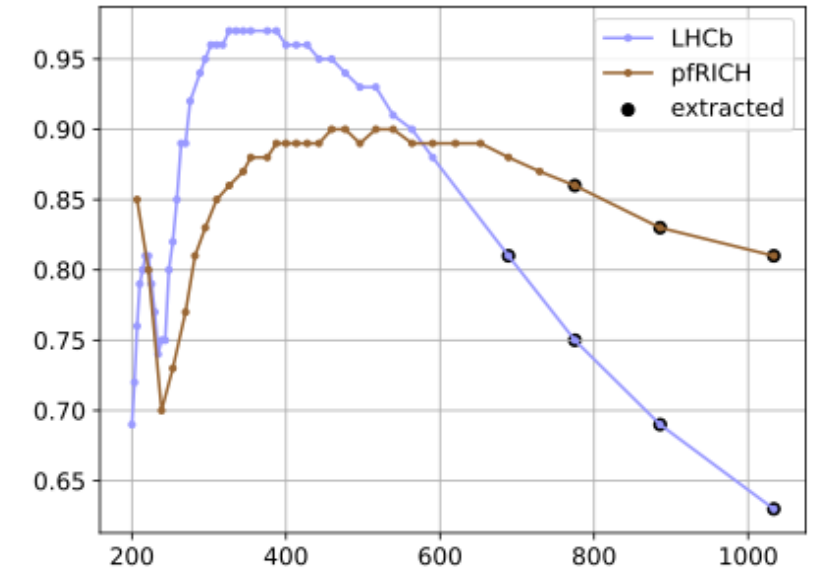




Reflectivities

Three reflectivities curves were compared

- Default: currently, in simulation, the reflectivity is 0.9 on the whole spectrum
- LHCb: the reflectivity curve of one of the mirrors at LHCb. Extracted from a presentation and extrapoalted by a linear fit up to 1000nm
- pfRICH: Reflectivity values taken from SBU mirror coatings



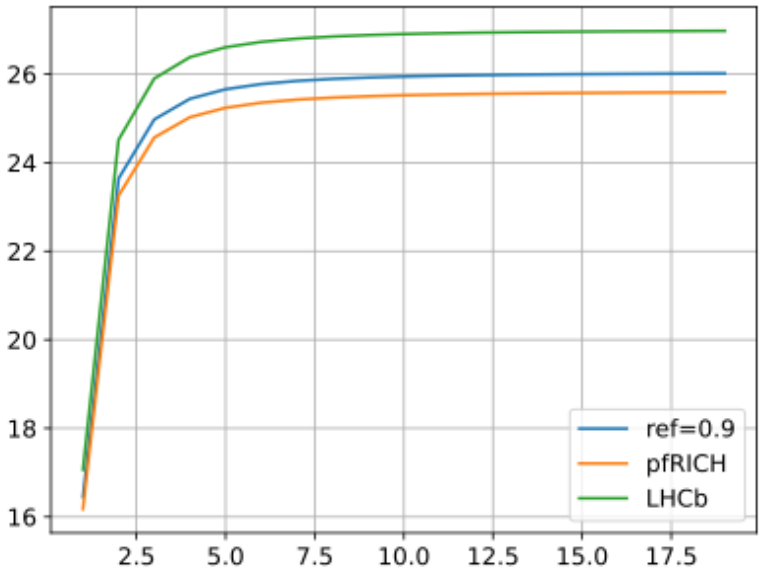
Effect on NPE (Aerogel)

We can estimate the number of photons in the three cases using the FrankTamm Law including in the integral PDE, absorptions and reflectivities.

Comparing the numbers with <NPE> of 1000 single particle events at saturation (p=50GeV/c) and without cutting the ring ($\eta = 2.0$) we see a good matching

Ref=0.9	Expected	Measured
default	17.2	17.9±0.2
50um	21.6	21.1±0.2
75um	26.0	24.6±0.2
UV	34.8	30.1±0.2

Expected NPE for pions 75um

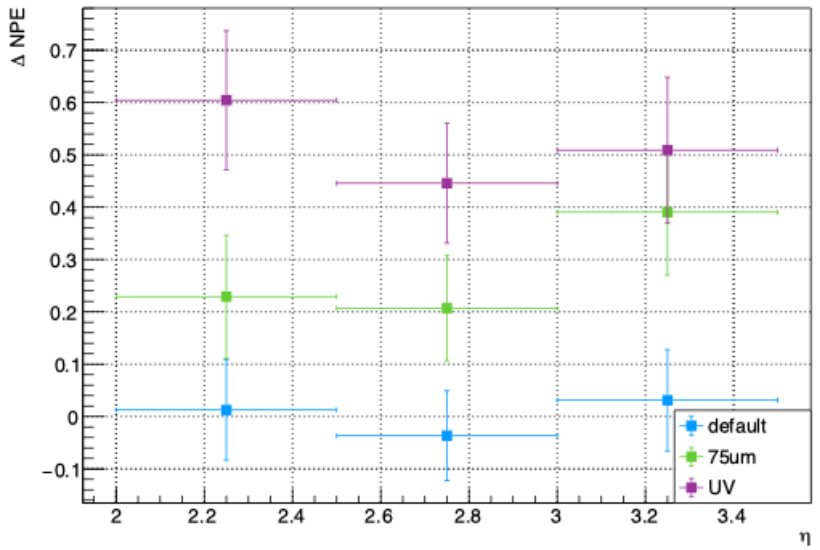


Effect on NPE (Aerogel)

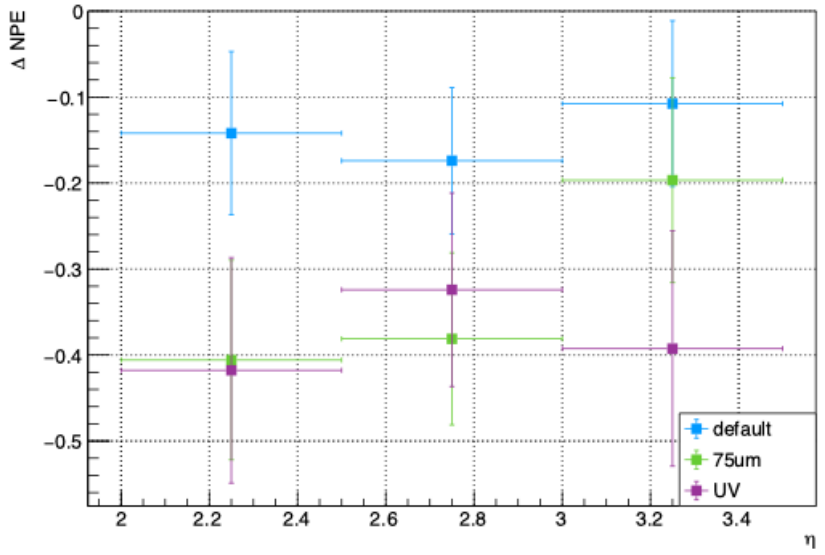
At different pseudorapidities part of the ring will be lost, so the difference in NPE will change

For UV, instead of gaining 1.3 photons with LHCb we see an increment of just 0.6

LHCb - 0.9



pfRICH - 0.9



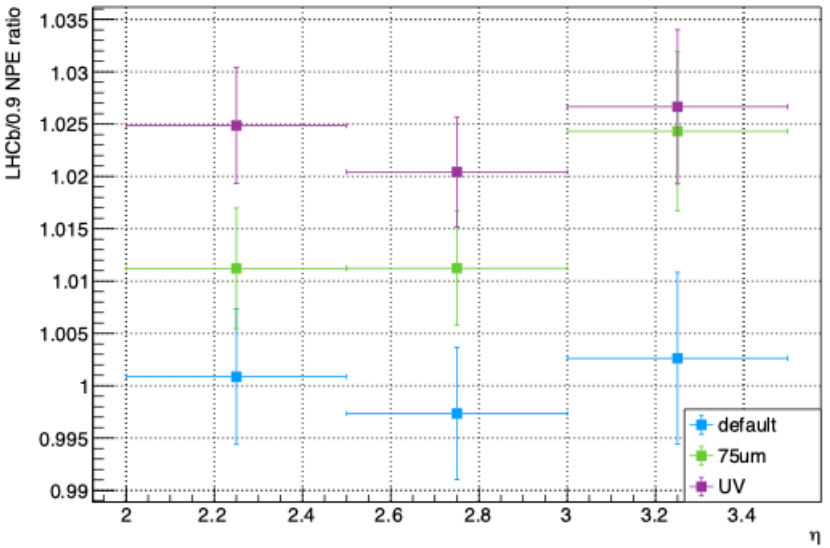
Effect on NPE (Aerogel)

What should be weel described is the ratio

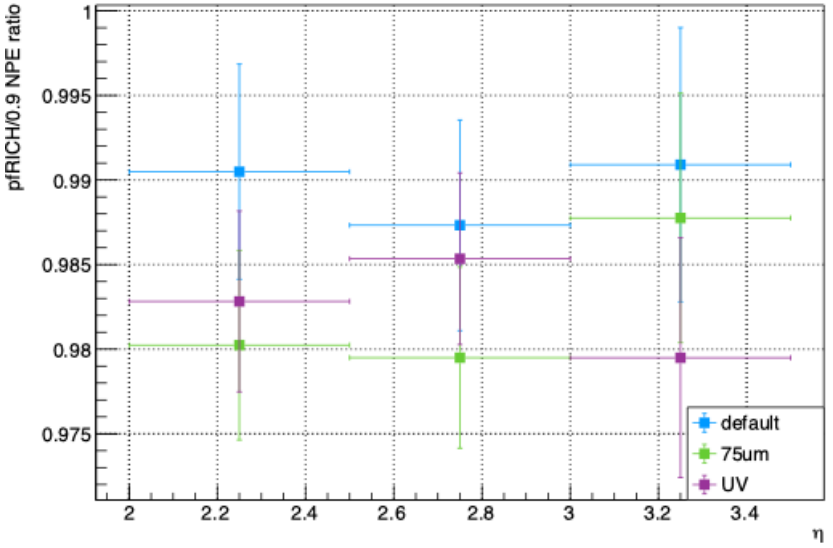
- ForLHCb/0.9 ratio we expect ~1.035 for 75um, we measure 1.01. Same for the other SiPMs, the effect is smaller than expected
- For pfRICH it is better. We expect ~0.98 for 75um and ~0.99 for default, as seen

(UV should be ~0.97, but as previously said, the prediction are not accurate for UV)

LHCb



pfRICH

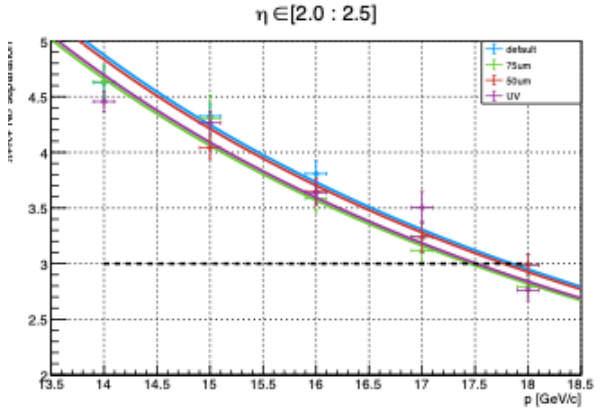


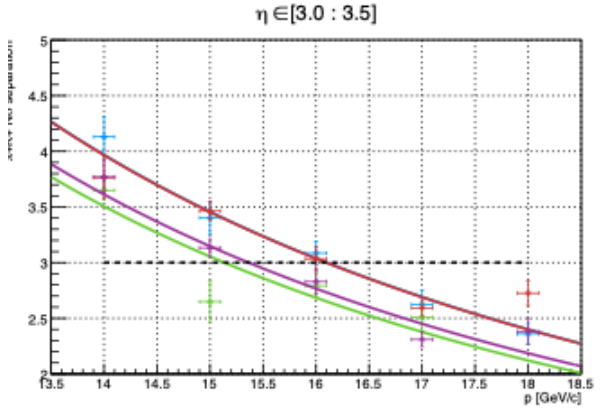
Effect on Nsigma (Aerogel)

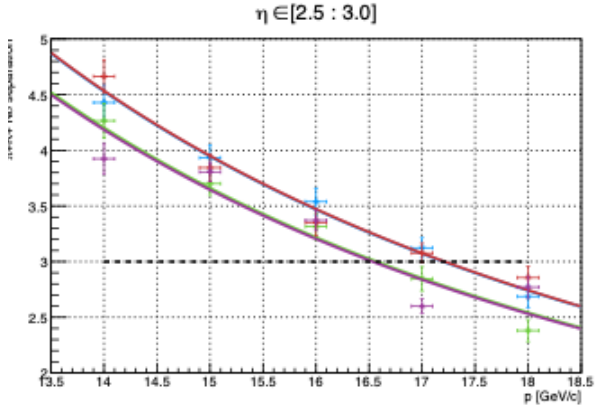
Effect on the single photon resolution are ~0.1% level

To estimate the effects on the pi-K separation power

- Fit: $[0]\frac{1}{p\hat{}2}$
- Estimate the upper limit 3= $[0]\frac{1}{p\hat{}2}$ ⟹ p = $\sqrt{[0]/3}$
- Do the difference to estimate the effect



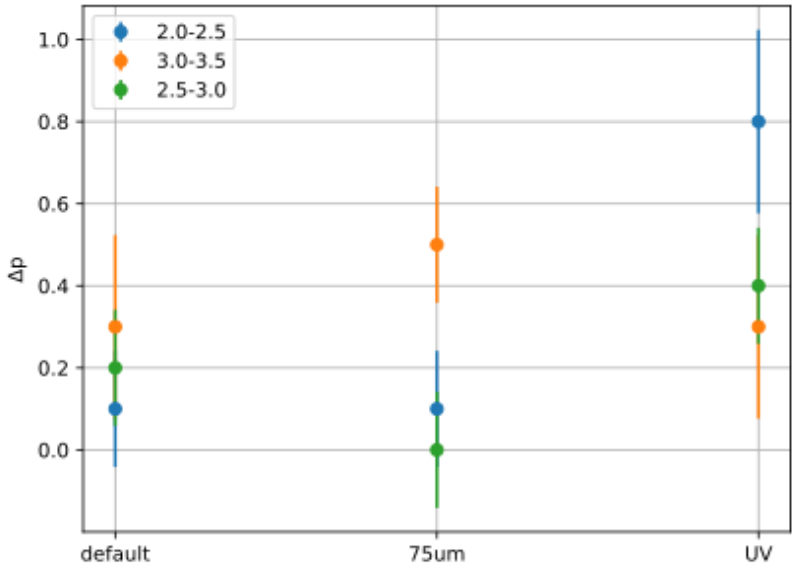




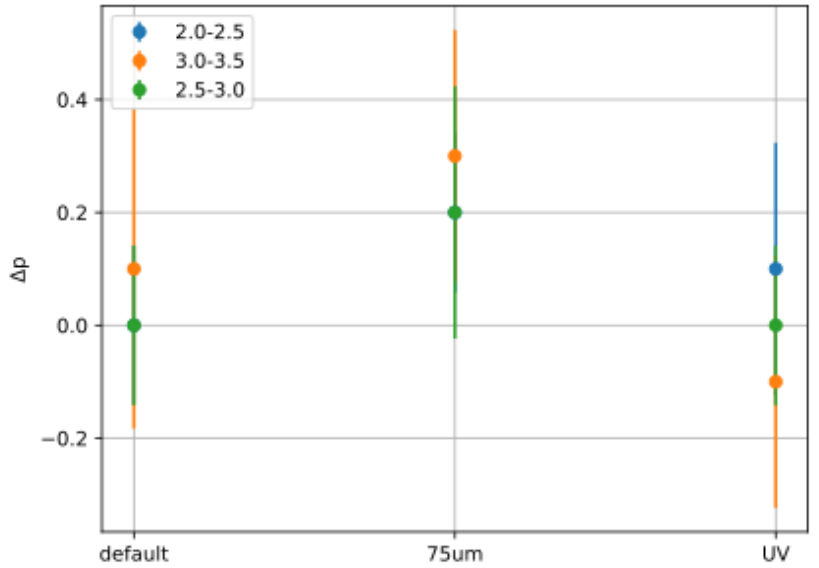
Effect on Nsigma (Aerogel)

The difference is compatible with 0 exept with UV sipms and LHCb

- LHCb



- pfRICH

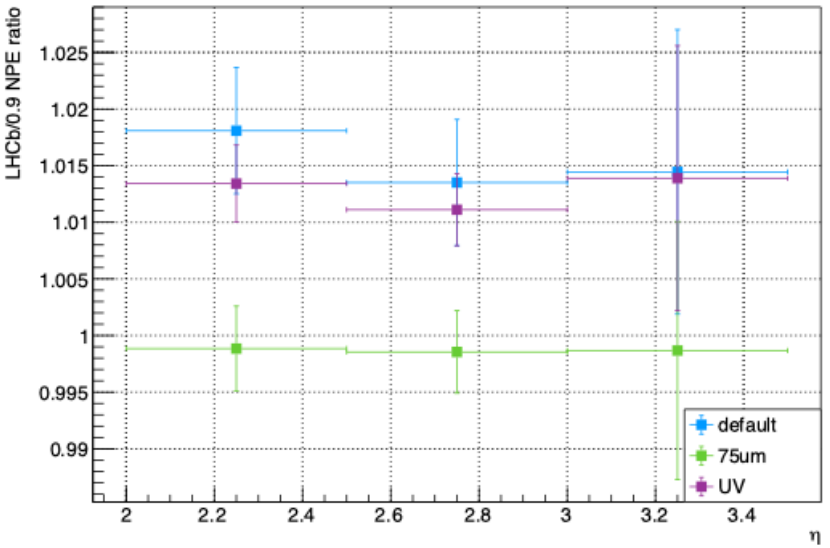


Effect on NPE (gas)

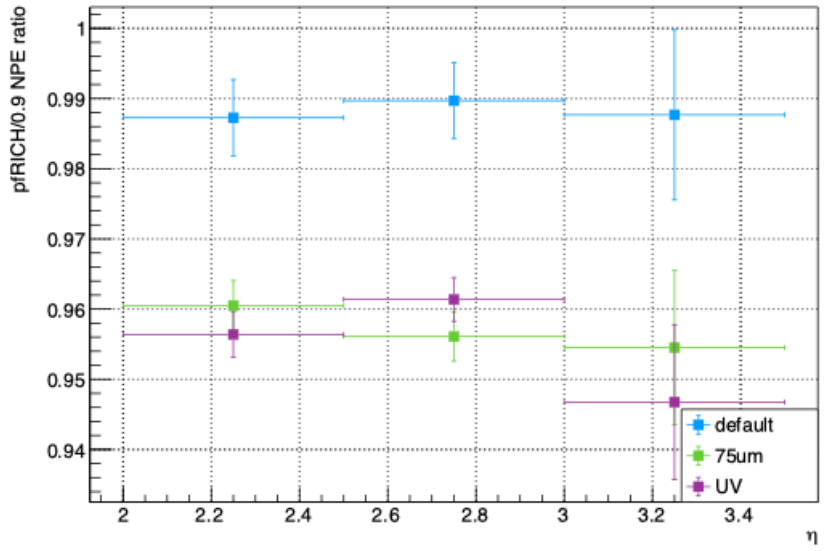
- pfRICH well predicted
  - 0.95 for UV, 0.99 for default
- Again LHCb effects underestimated

- 75um LHCb to be rechecked, can't be lower

- LHCb

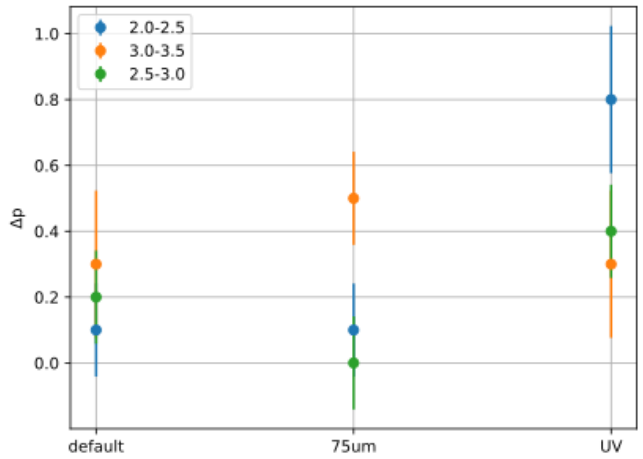


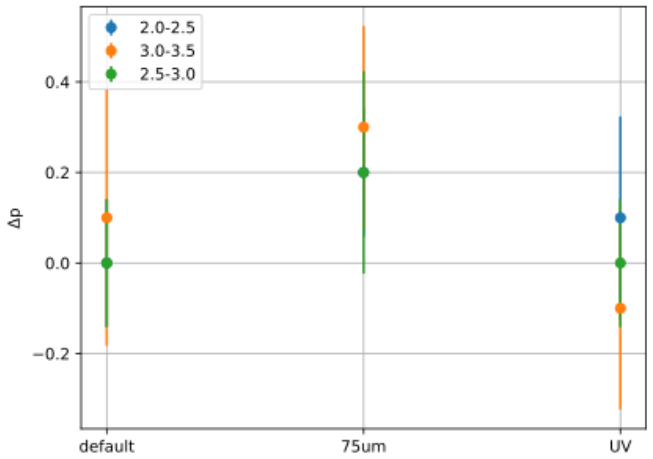
- pfRICH

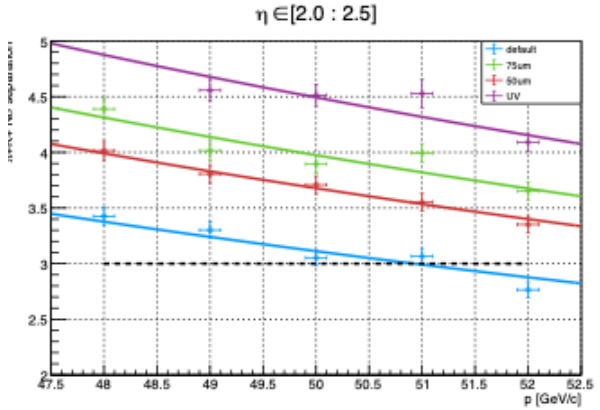


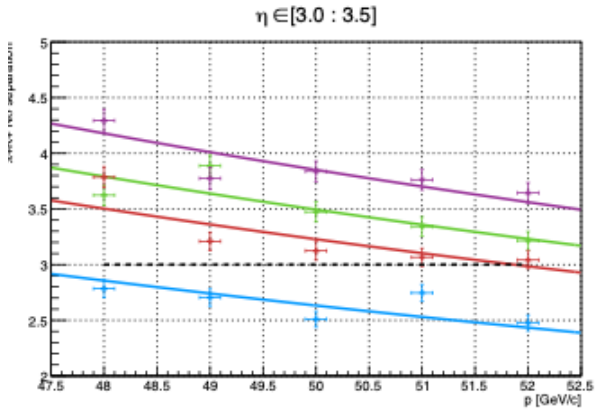
Effect on Nsigma (gas)

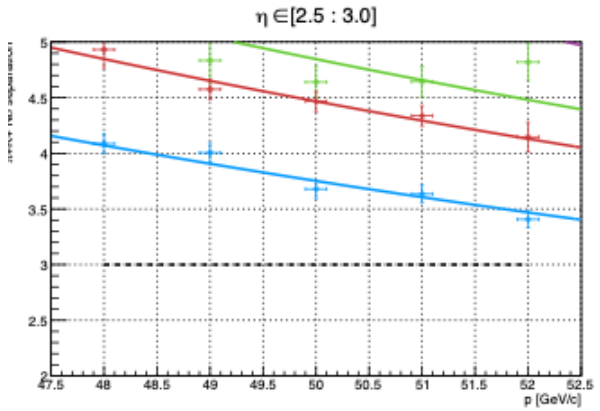
Again the effects are not comaptible with 0 only for LHCb UV











Conclusions

- Ref = 0.9 looks to be a good approximation to describe the effect of mirror reflectivities

- Different reflectivities will be checked