Xe doping analysis update
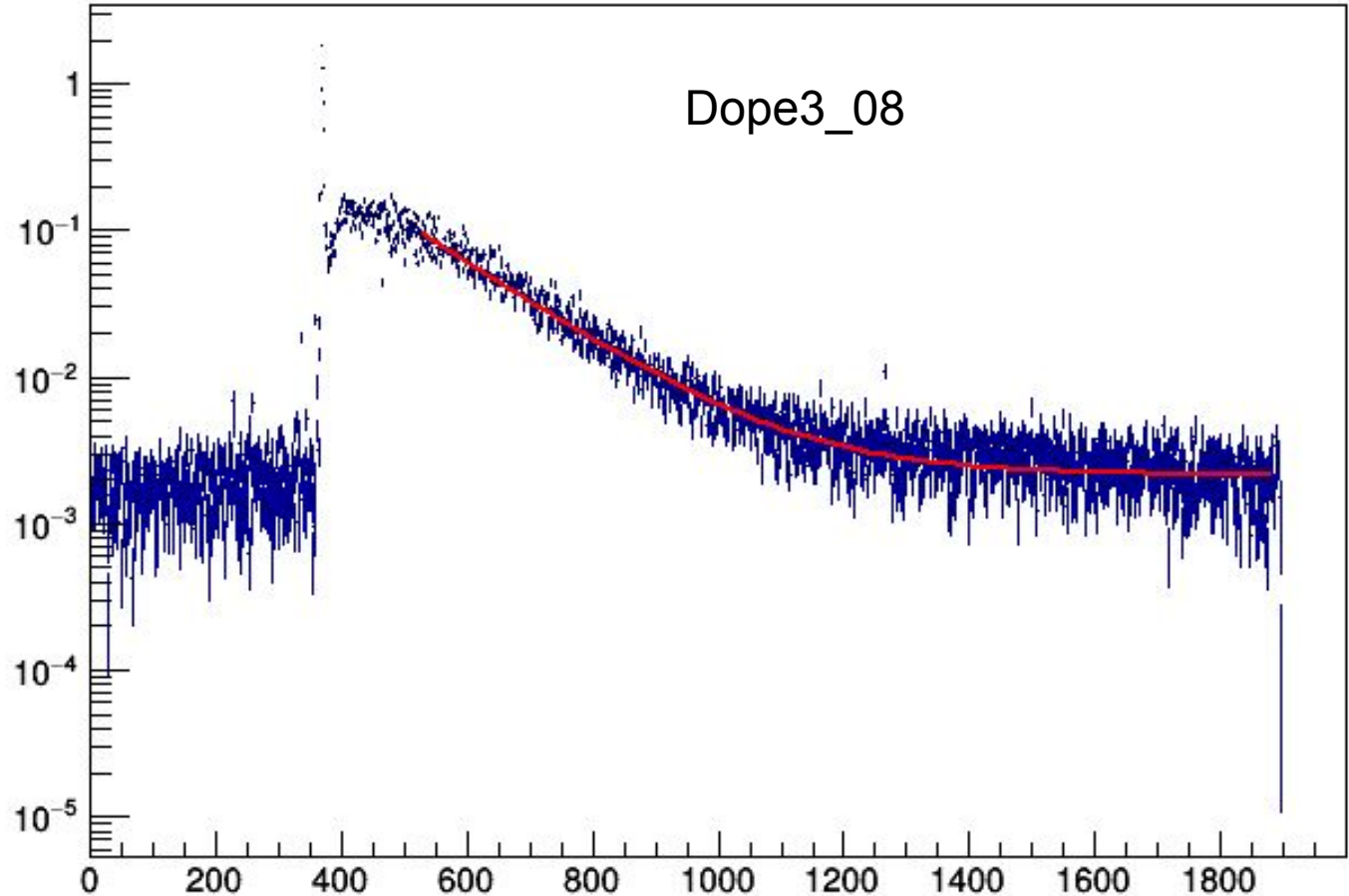
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Improvements on <wfm> analysis

- a single <wfm> (calibrated in # of photons) is now computed for each XArapuca module, by summing the 3 channels → increase statistics for following operations
- error for each bin is estimated as sqrt(# of photons)

Dope3_08

Subtracting the Xe light from the No Quartz <wfm>
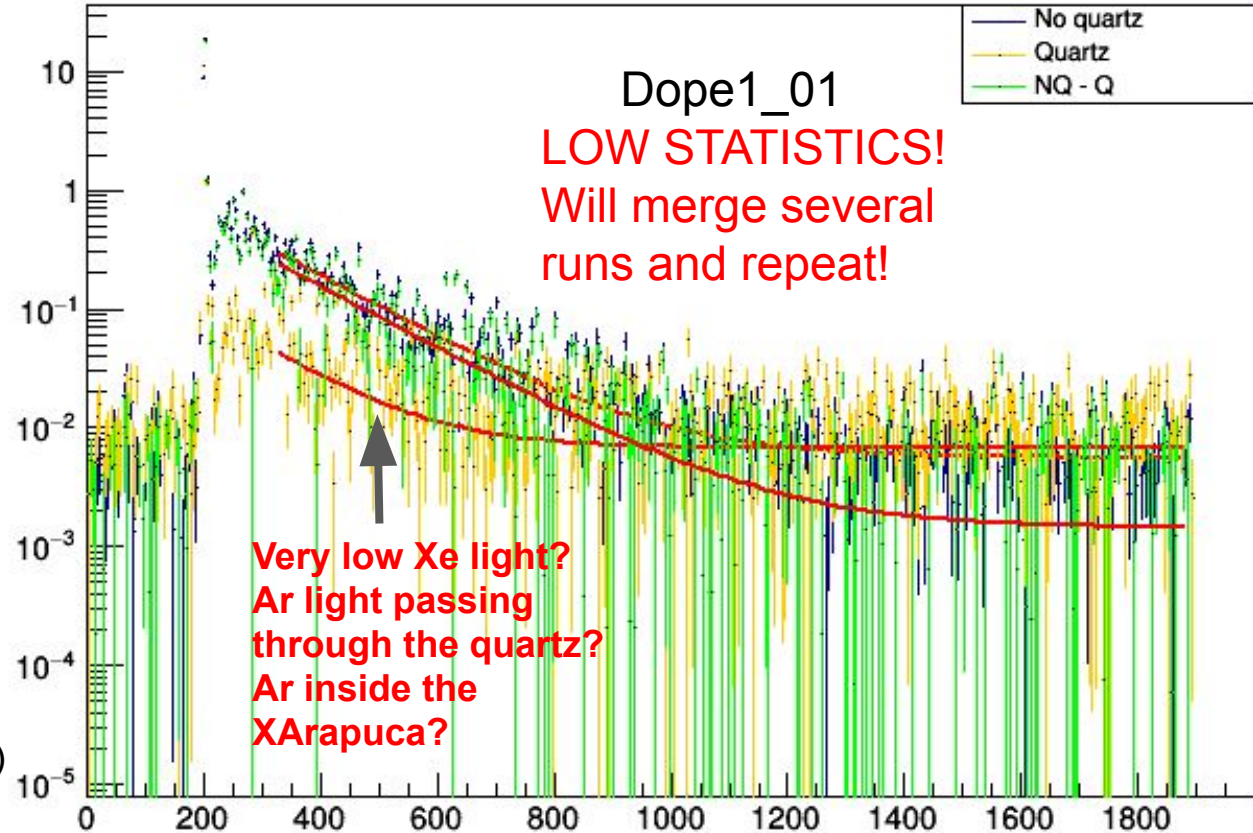
- the quartz XArapuca <wfm> is subtracted from the no-quartz → get the residual Ar light fraction
- the NQ-Q <wfm> SNR suffers → re-binning by a factor 4
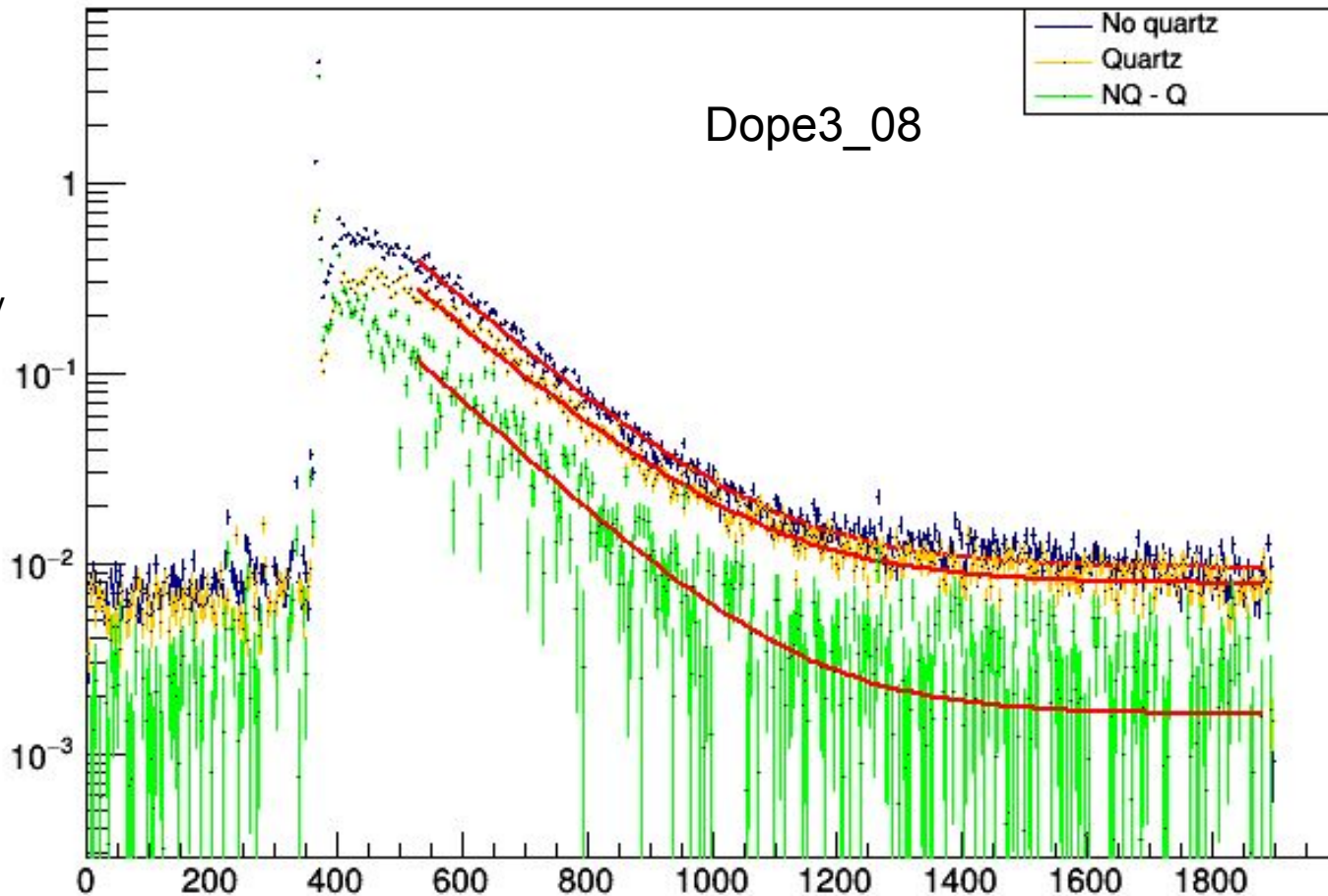
NQ - Q <wfm>: start of doping 1

	<wfm> integral	τ_{slow} [ns]
NQ	60.4(0.3)	1079(17)
Q	22.0(0.3)	869(134)
NQ-Q	38.5(0.4)	1113(29)

Ar/Xe = $Int_Q/(Int_{NQ} - Int_Q)$ = 1.75(0.03)

Dope1_01
LOW STATISTICS!
Will merge several
runs and repeat!

Very low Xe light?
Ar light passing
through the quartz?
Ar inside the
XArapuca?

NQ - Q <wfm>: start of doping 2

	<wfm> integral	τ_{slow} [ns]
NQ	38.7(0.1)	1553(9)
Q	17.2(0.1)	1619(19)
NQ-Q	21.4(0.1)	1498(15)

Ar/Xe = $Int_Q/(Int_{NQ}-Int_Q)$ = 1.24(0.01)

Dope2_01
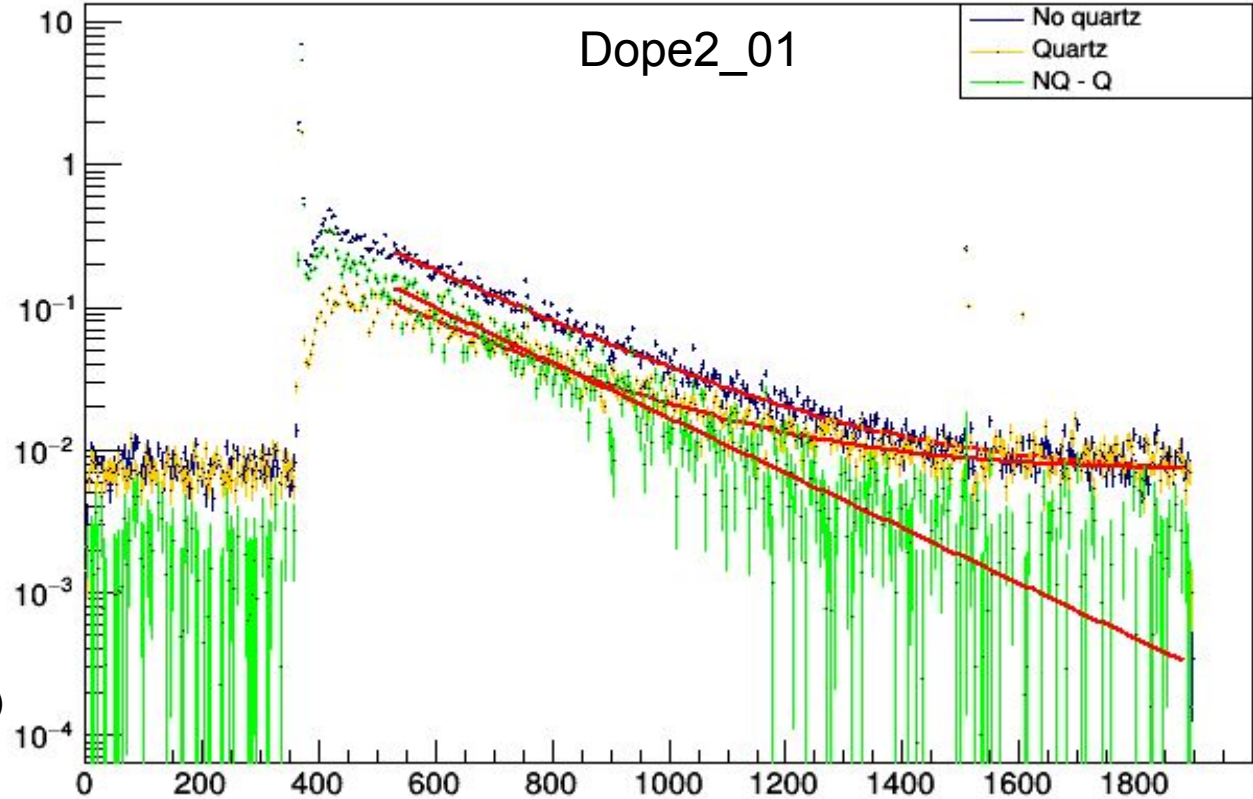
NQ - Q <wfm>: start of doping 3

	<wfm> integral	τ_{slow} [ns]
NQ	44.3(0.1)	1267(6)
Q	25.5(0.1)	1281(8)
NQ-Q	18.9(0.1)	1256(22)

Ar/Xe = $Int_Q/(Int_{NQ}-Int_Q)$ = 0.74(0.01)

Dope3_01

Legend:
- No quartz
- Quartz
- NQ - Q
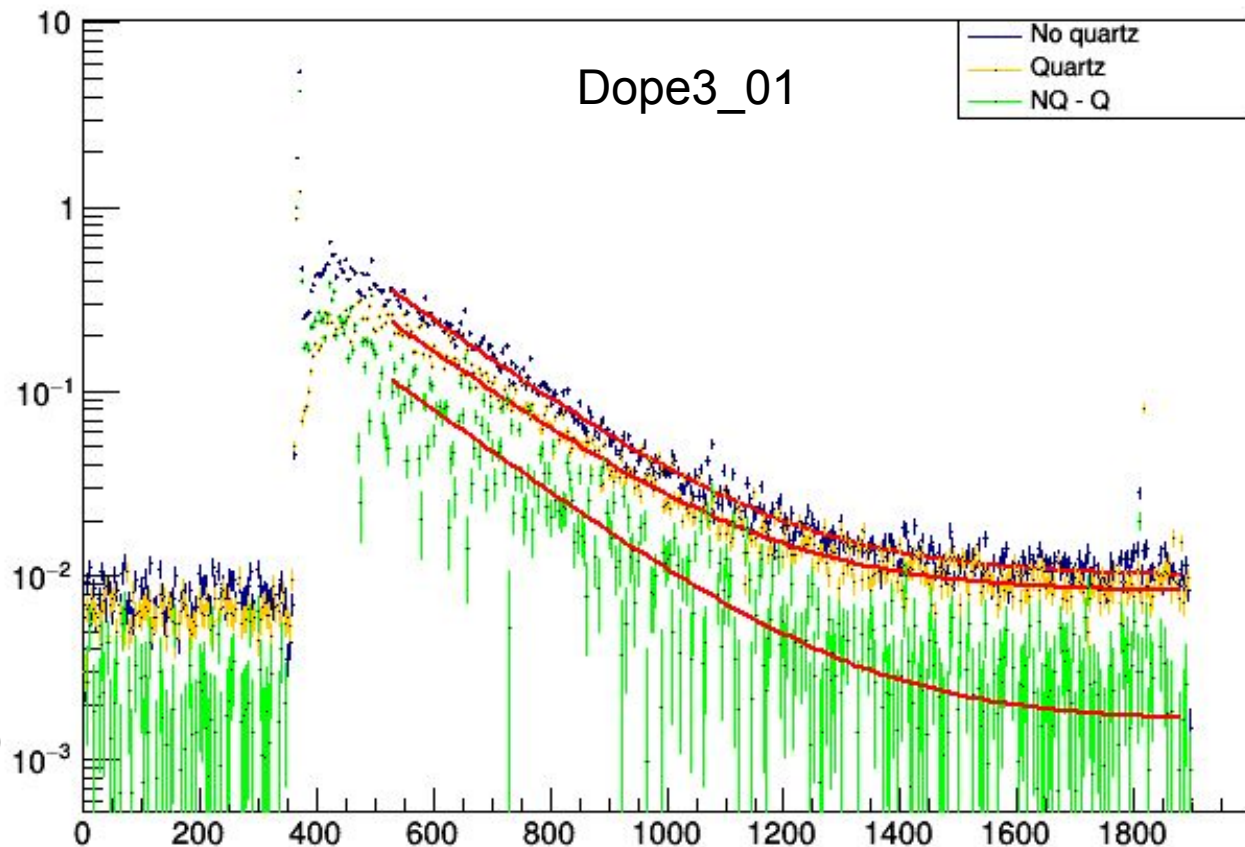
NQ - Q <wfm>: start of doping 4

	<wfm> integral	τ_{slow} [ns]
NQ	50.9(0.1)	812(4)
Q	35.3(0.1)	838(5)
NQ-Q	15.6(0.1)	723(25)

$Ar/Xe = Int_Q/(Int_{NQ}-Int_Q) = 0.44(0.01)$

Dope3_post_29

Legend: No quartz, Quartz, NQ - Q
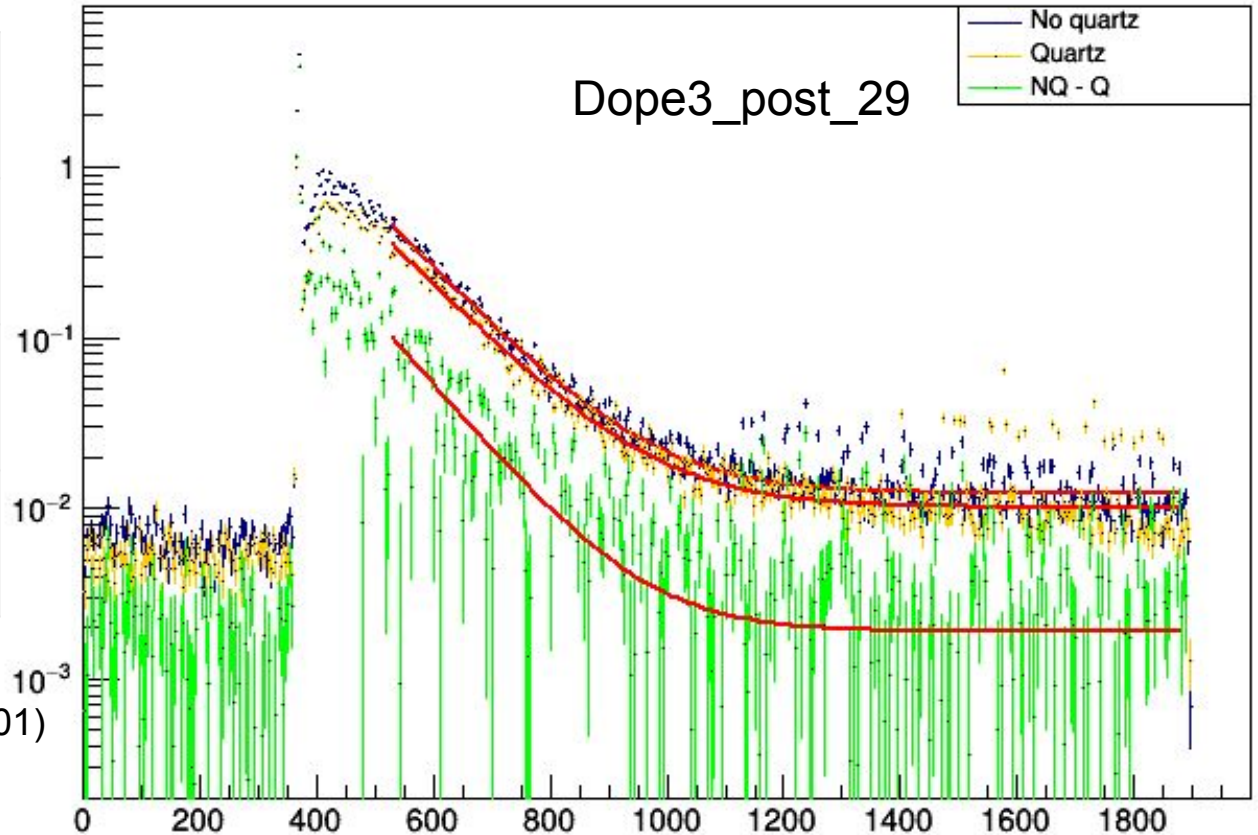
NQ - Q <wfm>: end of doping 4

	<wfm> integral	τ_{slow} [ns]
NQ	39.6(0.1)	620(4)
Q	28.3(0.1)	619(4)
NQ-Q	11.3(0.1)	625(34)

Ar/Xe = $Int_Q/(Int_{NQ}-Int_Q)$ = 0.40(0.01)

Dope4_post_26
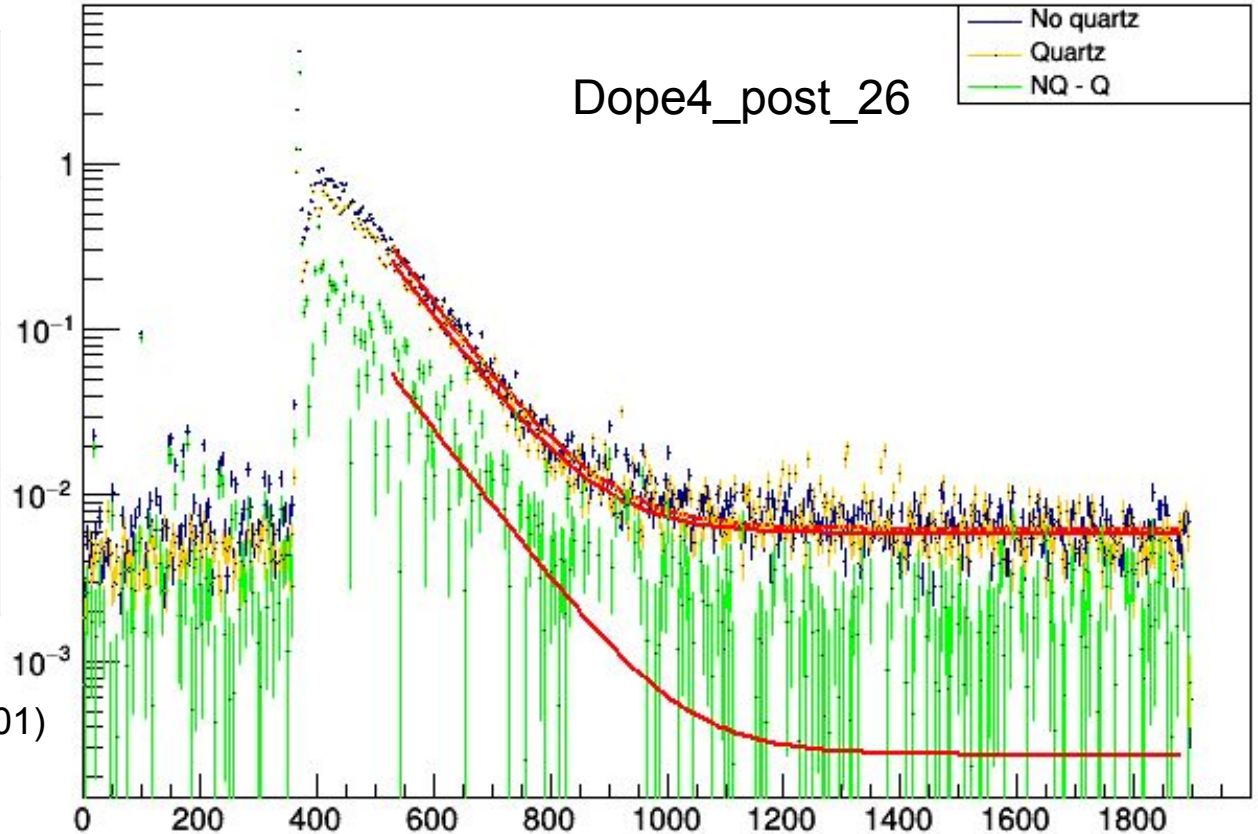
Conclusions

- Improved the <wfm> analysis by adding together the channels of a given XArapuca module and estimating the error on each point in the <wfm>
- Obtained the residual Ar <wfm>s
    - as expected, the Ar/Xe light ratio decreases with doping

Doping period	Ar/Xe (integral ratio)
Start D1	1.75(0.03)
Start D2	1.24(0.01)
Start D3	0.74(0.01)
Start D4	0.44(0.01)
End D4	0.40(0.01)