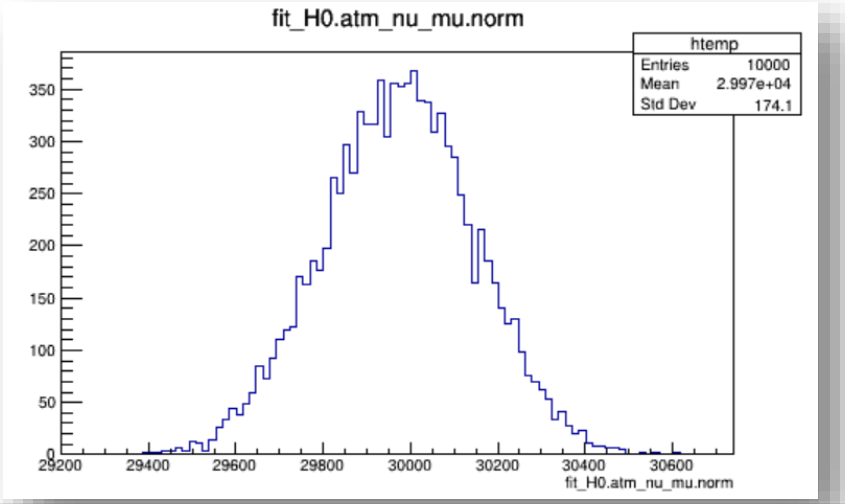
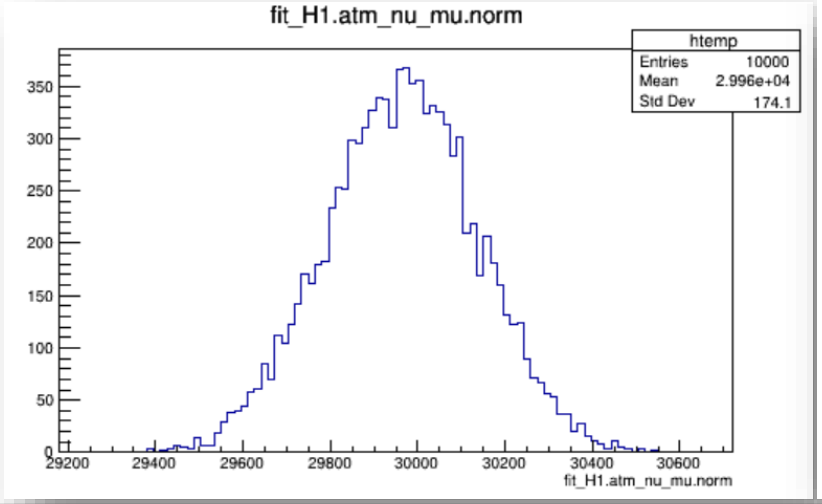
Pointsource analysis

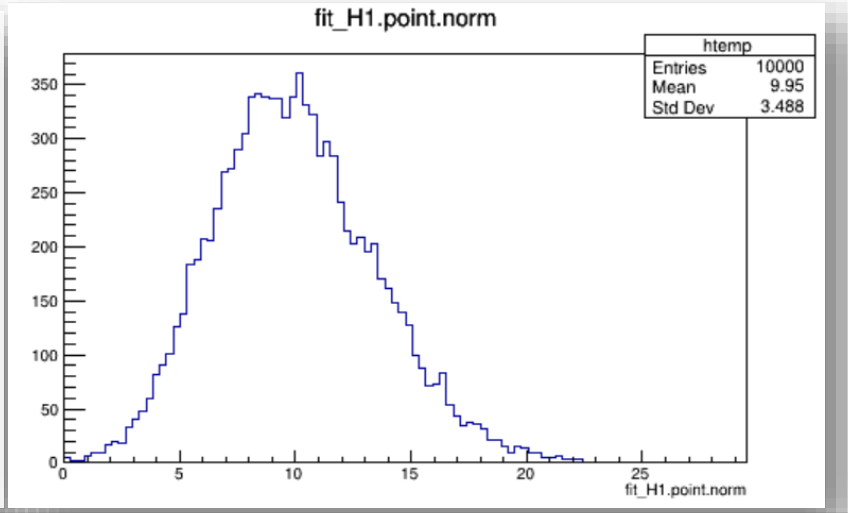
Displayed example:
Sig+bkg model
T = 1.0 yr
sin(δ) = -0.5
N_{sig} = 10
N_{bkg} = ~29.960

- Several **years of datataking**
- Several **declinations**

- Varying mean number of **signal** events in dataset
- **Background** distributions (atm ν & μ) from official monte carlo



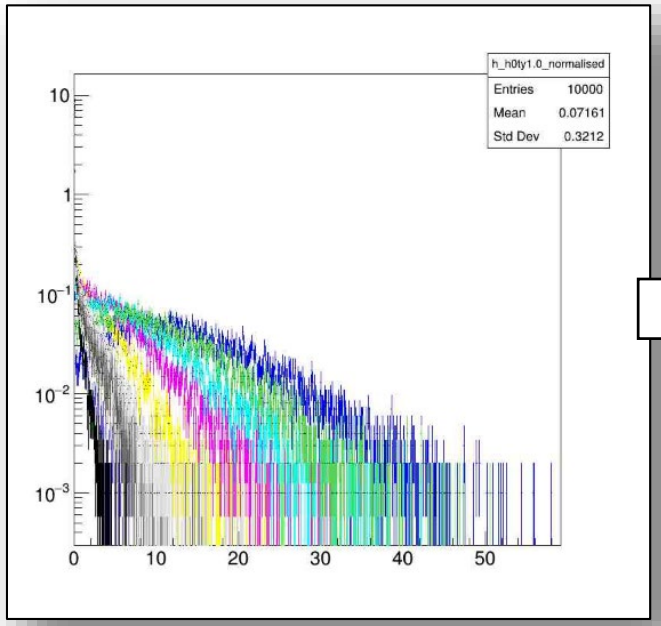




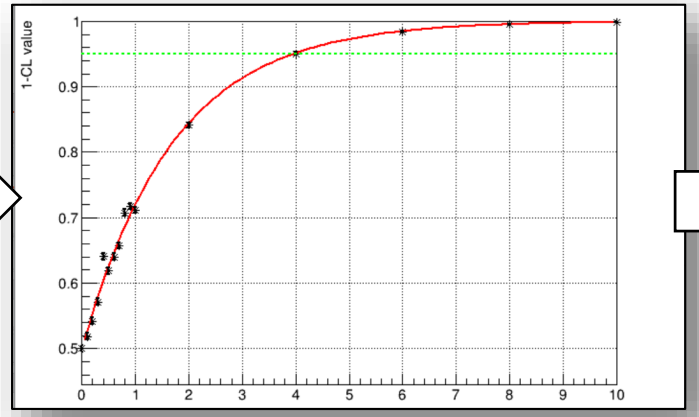
Pointsource analysis

I've shown plots on this page before
(NB: slightly different analysis than I present today: here spetral index was a free param in contrast to today's presented analysis, so expect better reults)
This is just for illustrational purposes

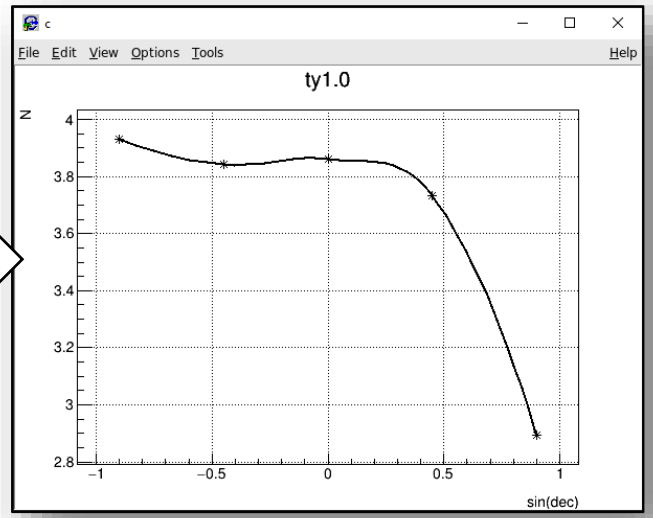
Test statistic distribution for varying N



CL-value as a function of N



N_{limit} as a function of sin(δ)



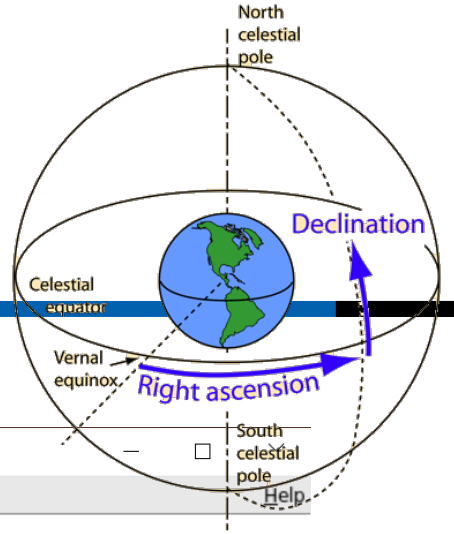
Pointsource analysis

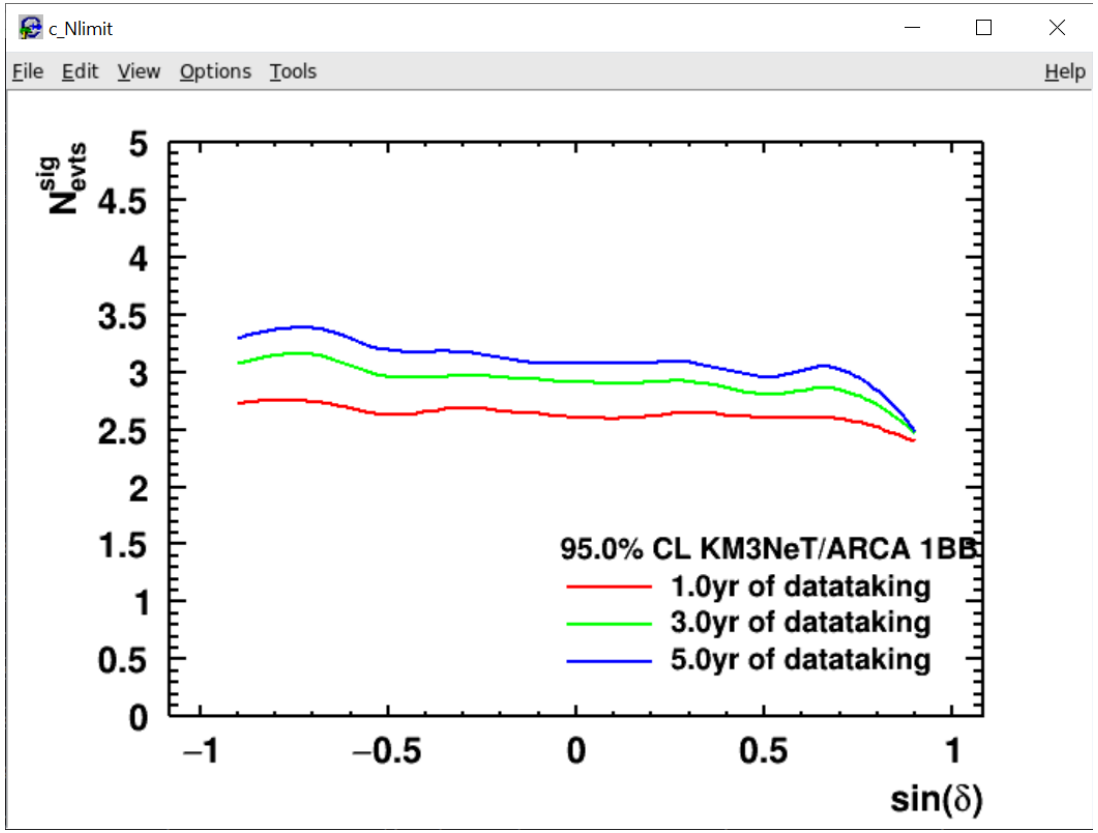
Parameters in fit:

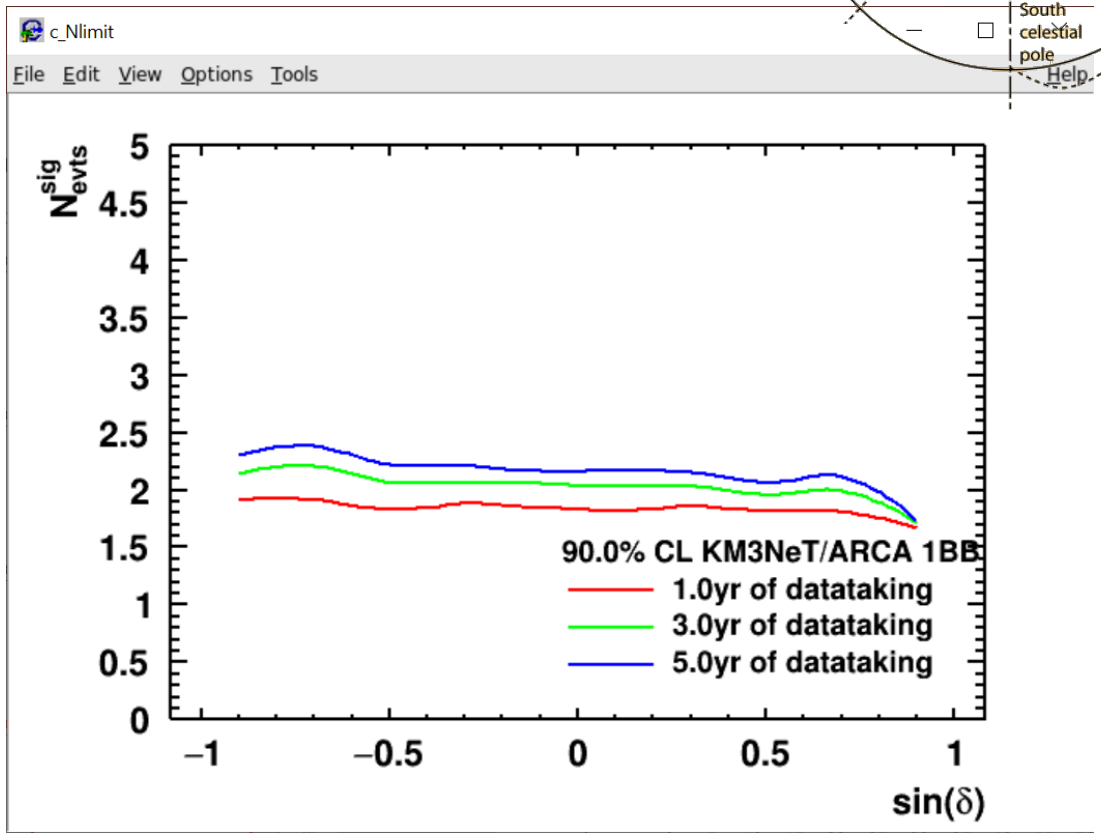
- **Fixed** spectral index for flux: E^{-2}
- **Fixed** position in sky
- Nsig events in dset: **Free**
- Nbkg events in dset: **Free**

Sensitivity

Defined as the median upper limit at 95%/90% CL

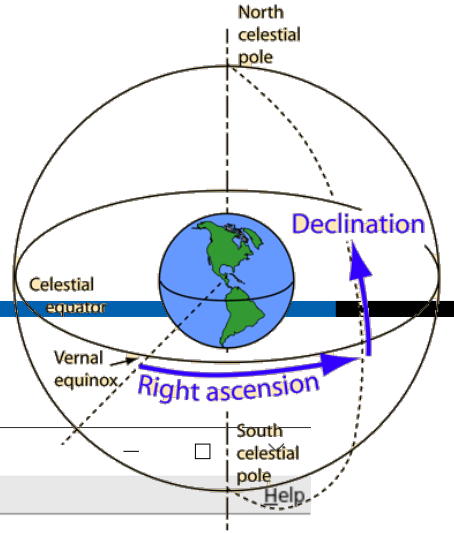


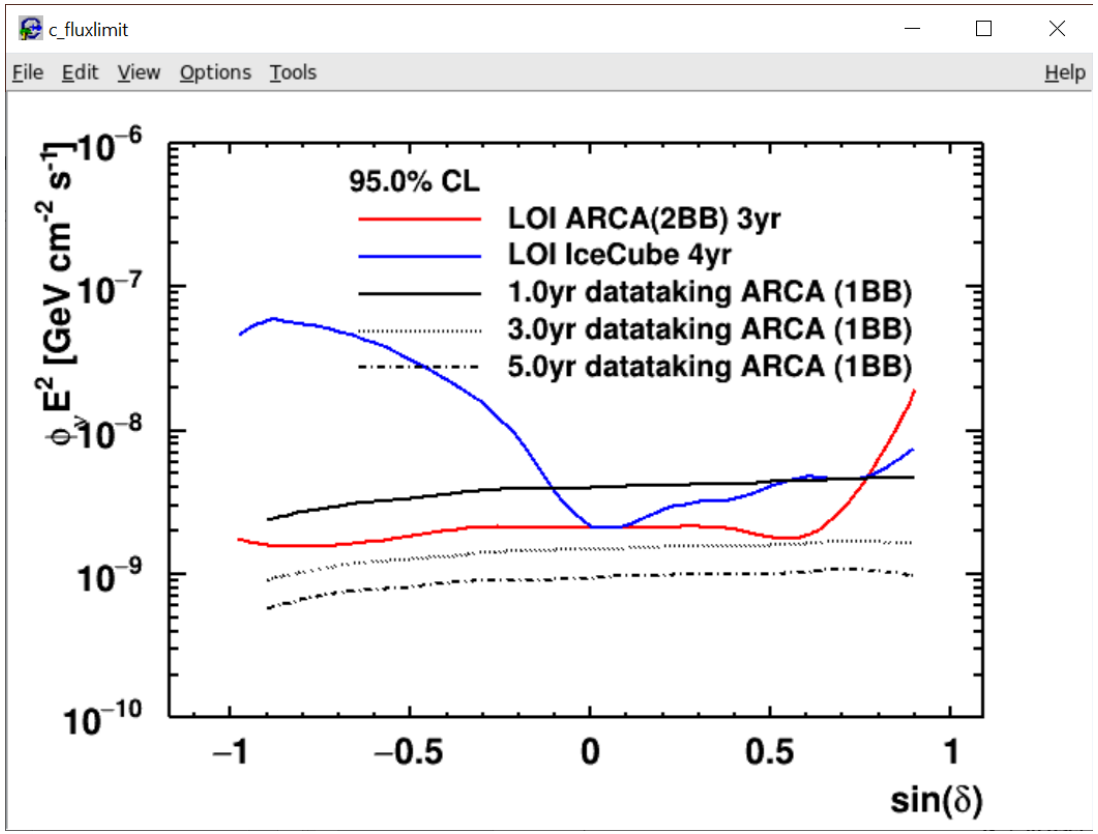


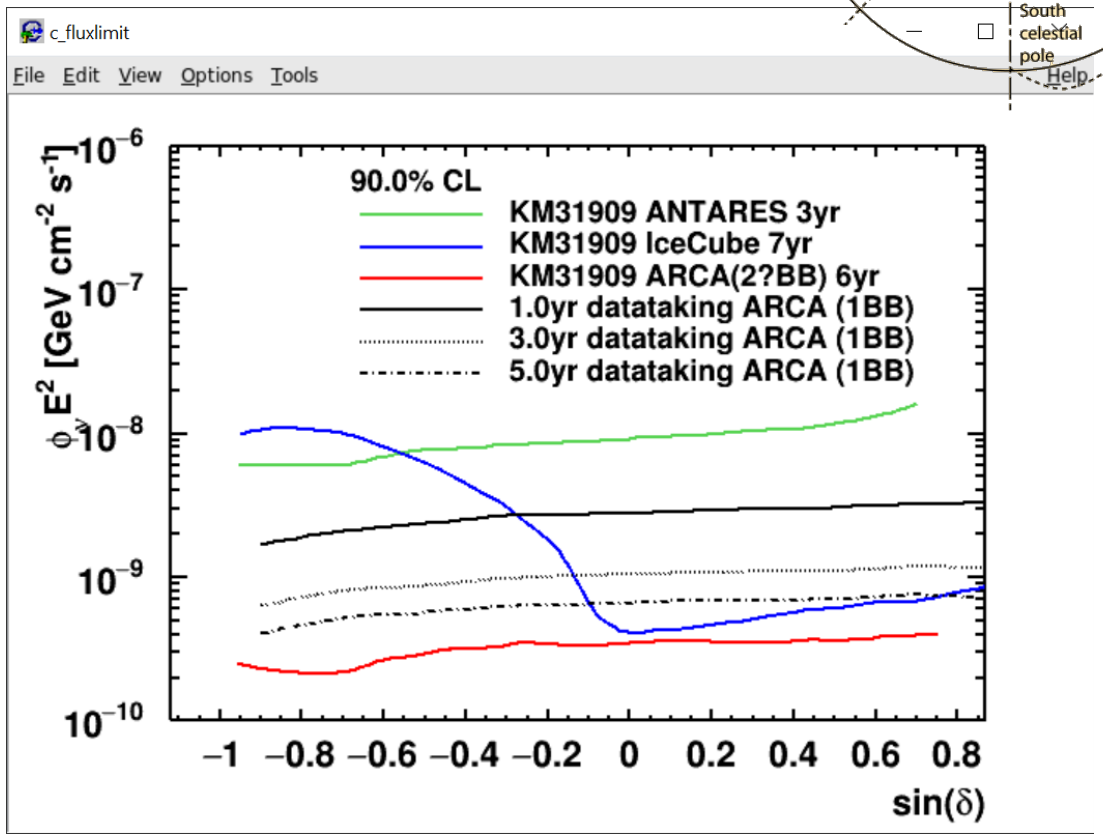


Sensitivity

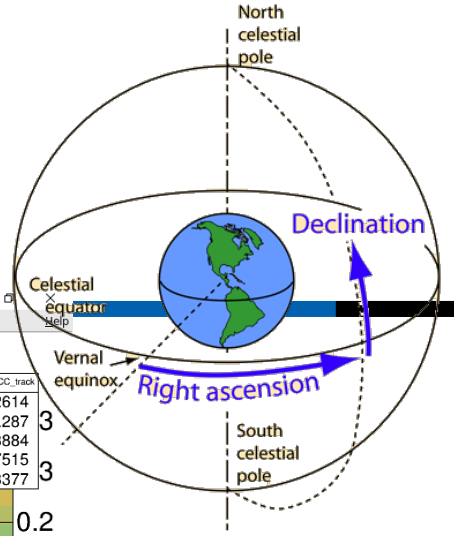
Defined as the median upper limit at 95%/90% CL







Signal events in area excluded by cuts



File Edit View Options Tools

Applied track cuts in function (Alfonso)
Rate conventional atmopheric neutrinos, 1 building block, 1 yr, numuCC_track

Entries	302614
Mean x	2.844
Mean y	−0.286
Std Dev x	0.692
Std Dev y	0.3204

log10(E [GeV])

Applied track cuts in function (Alfonso)
Rate prompt atmopheric neutrinos, 1 building block, 1 yr, numuCC_track

Entries	302614
Mean x	3.287
Mean y	−0.3884
Std Dev x	0.7515
Std Dev y	0.3377

log10(E [GeV])

Rate atmopheric muons that passed the cuts, 1 building block, 1 yr, track
h_ATMMU_reco_track

Entries	1185
Mean x	3.281
Mean y	−0.02312
Std Dev x	0.7562
Std Dev y	0.1887

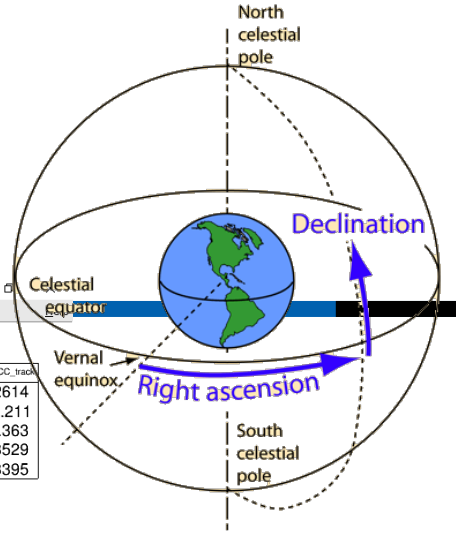
log10(E [GeV])

Applied track cuts in function (Alfonso)
Rate conventional atmopheric neutrinos, 1 building block, 1 yr, numuCC_track

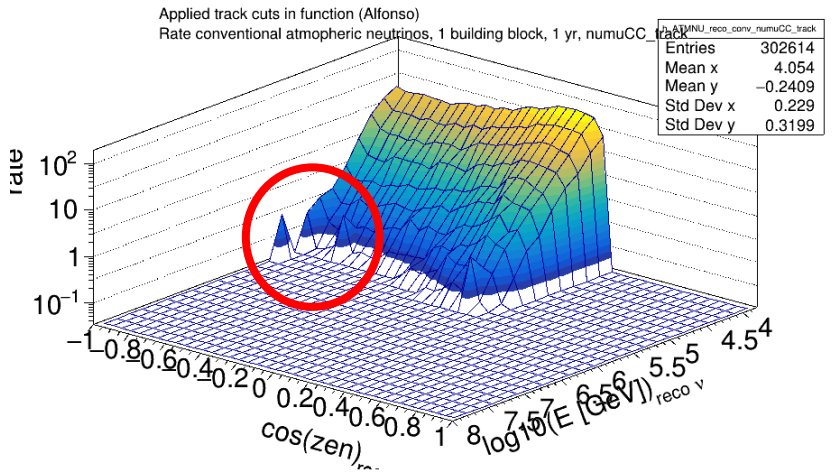
Entries	606413
Mean x	2.894
Mean y	−0.2567
Std Dev x	0.7133
Std Dev y	0.3195

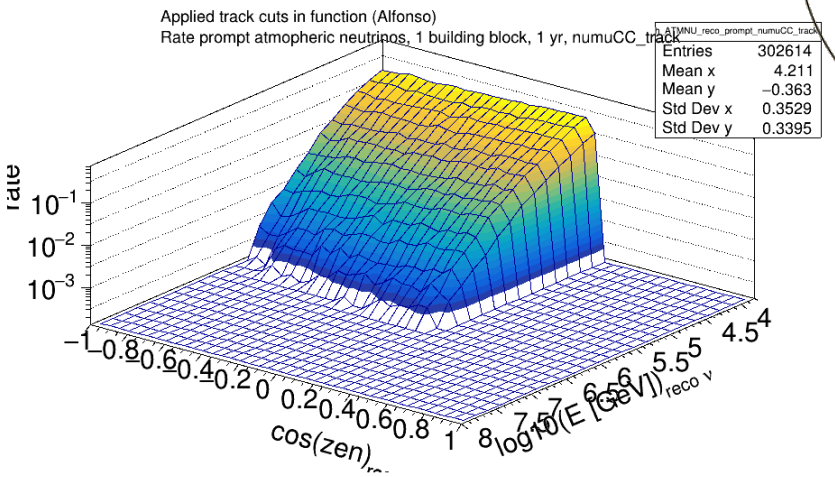
log10(E [GeV])

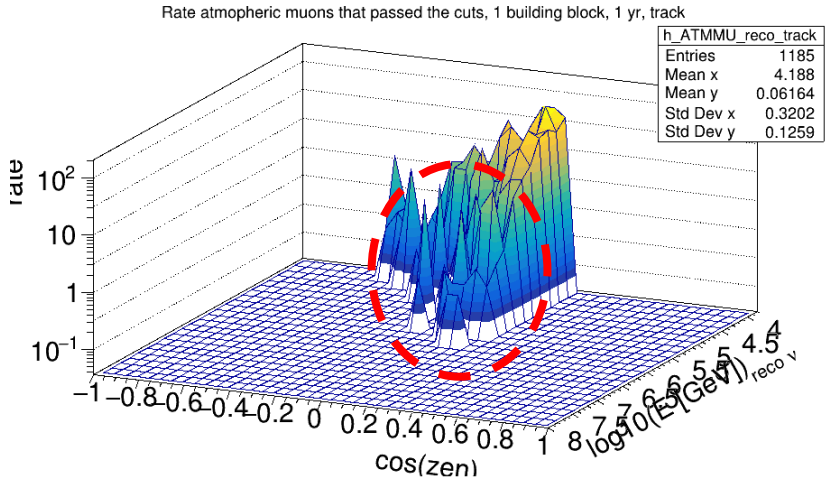
Signal events in area excluded by cuts

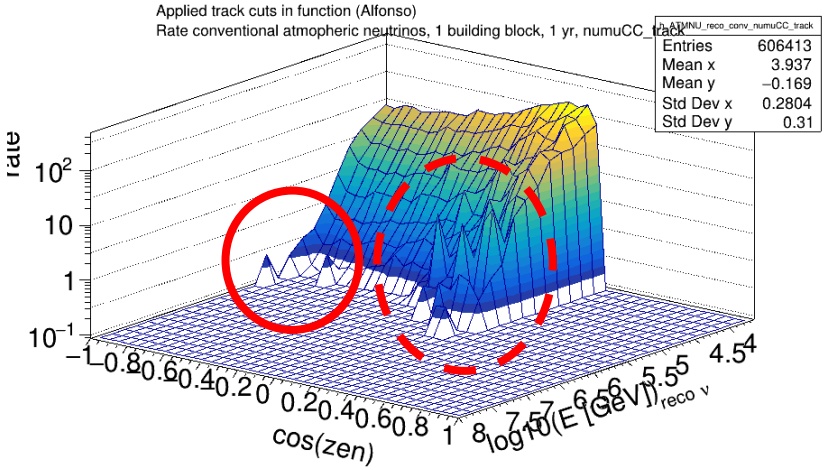


File Edit View Options Tools

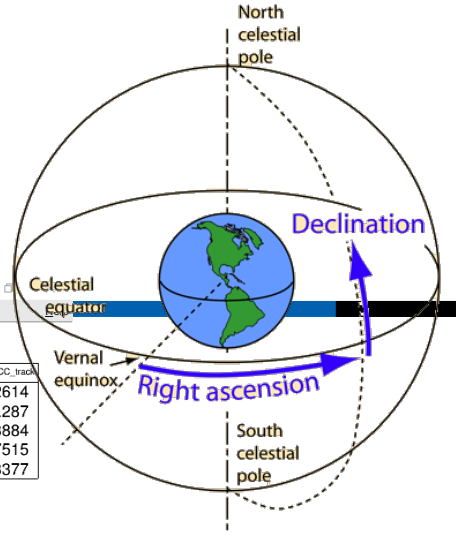




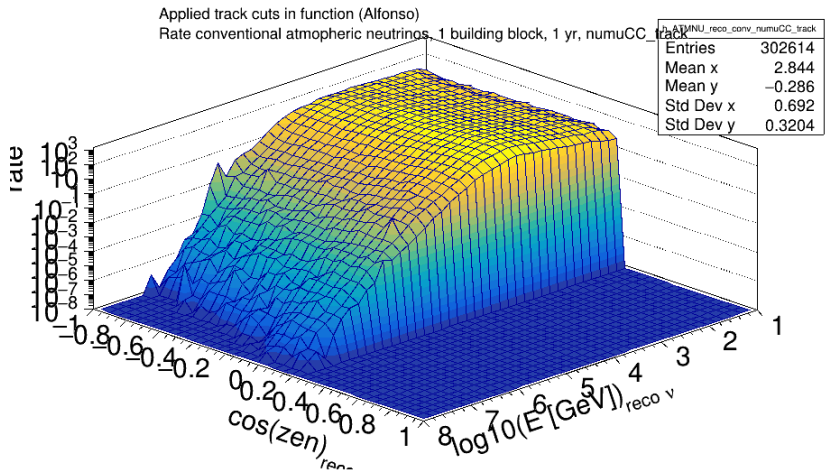


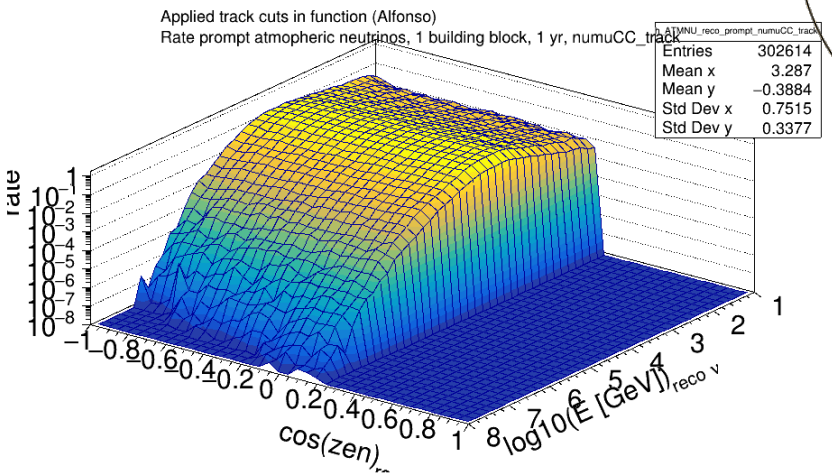


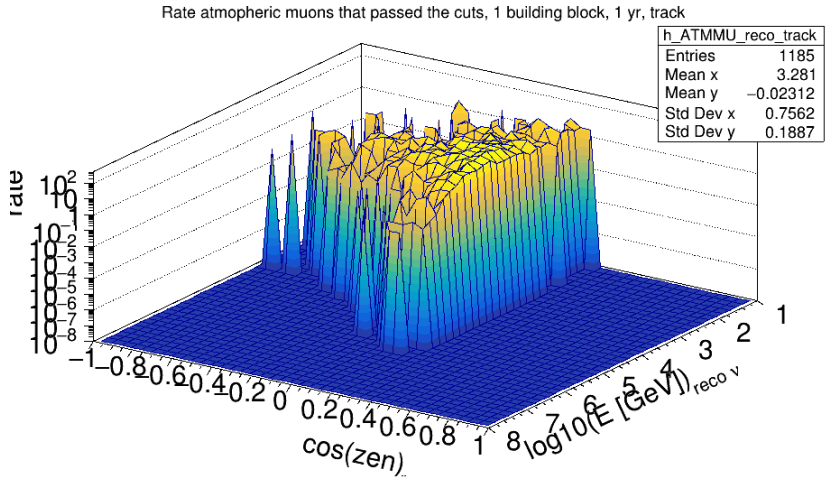
Signal events in area excluded by cuts

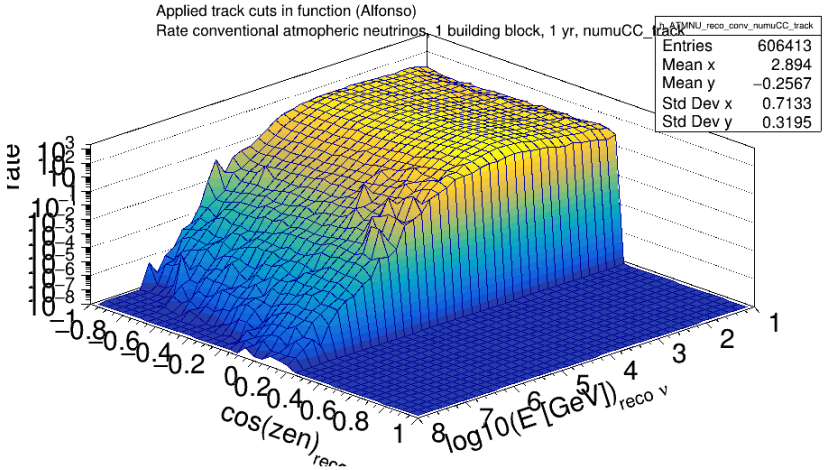


File Edit View Options Tools





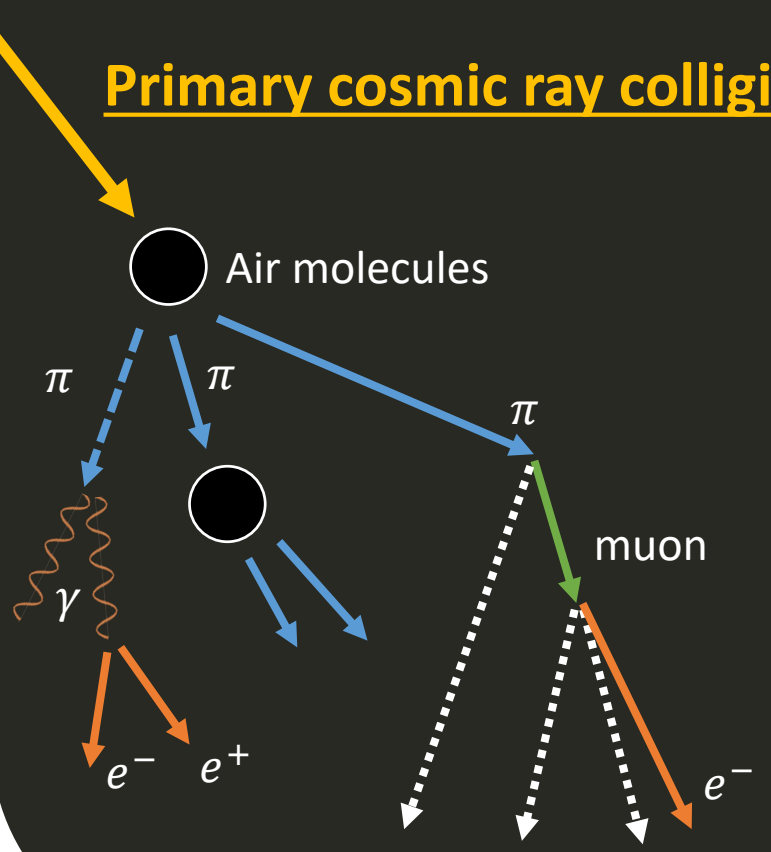




Extra

Atmospheric neutrinos

Primary cosmic ray colliging with the Earth's atmosphere



Conventional

- ν's produced from the decay of relatively long-lived charged particles: pions and kaons

- Dominates the neutrino data measured in the GeV to TeV

Prompt

- ν's produced from the (immediate) decay of heavier mesons, usually containing charm quarks

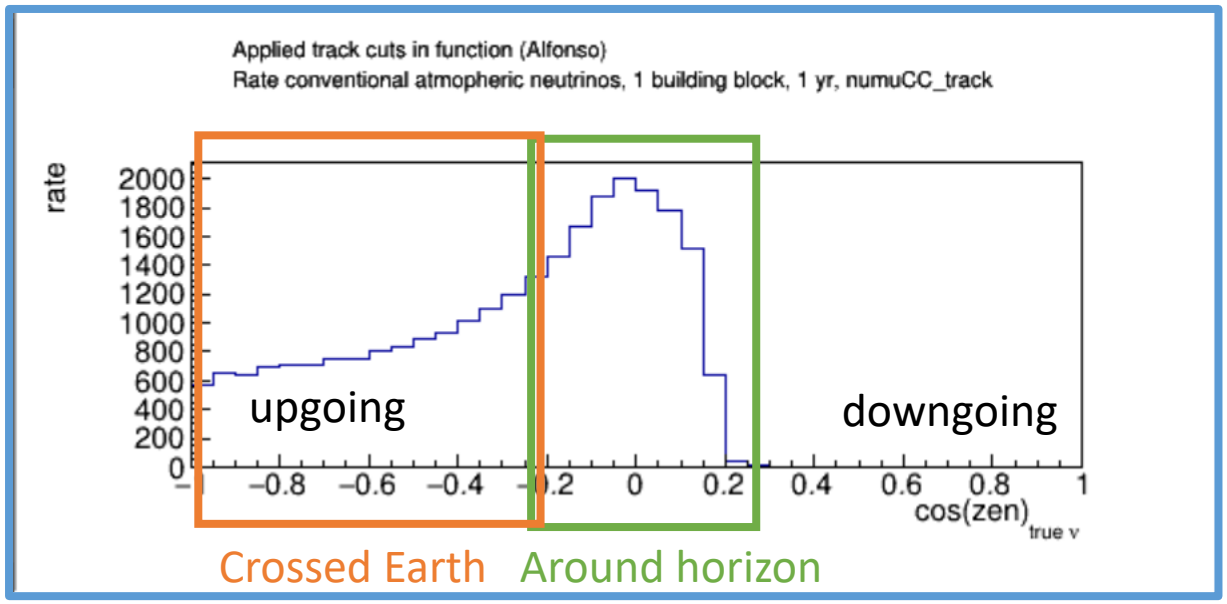
- Their production is strongly suppressed, but they are expected to exhibit a harder energy spectrum (= higher flux @higher E)

Ref:

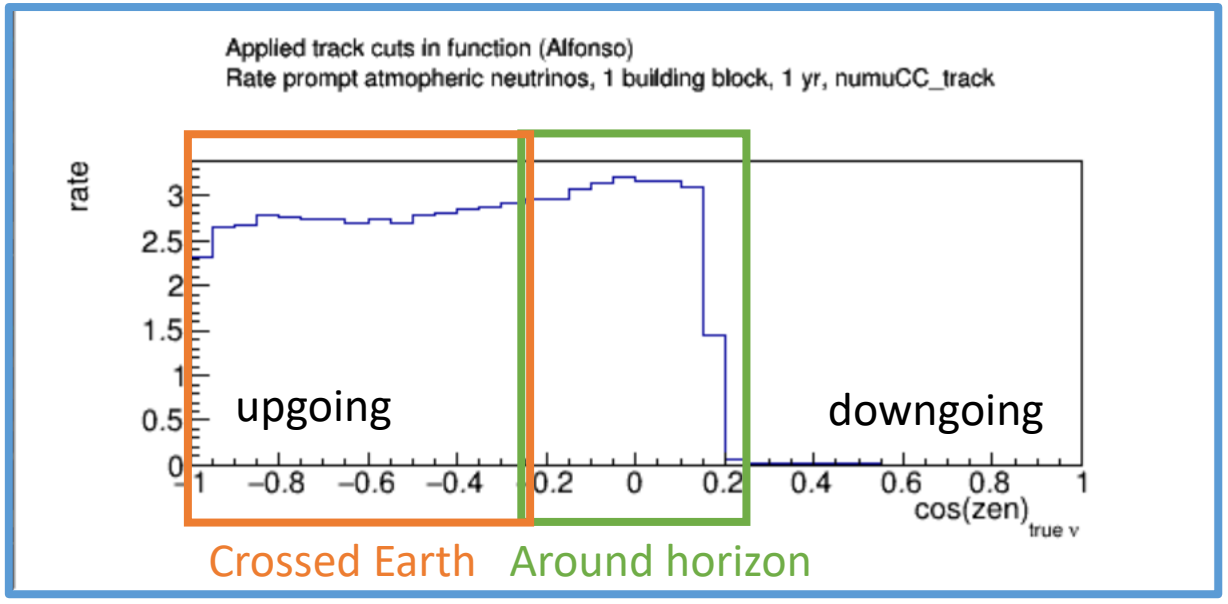
Relation decay / interaction & resulting products that Cannot cross the Earth

short lived => decay fast => into among other particles: neutrinos => they can cross the earth.

conventional



prompt

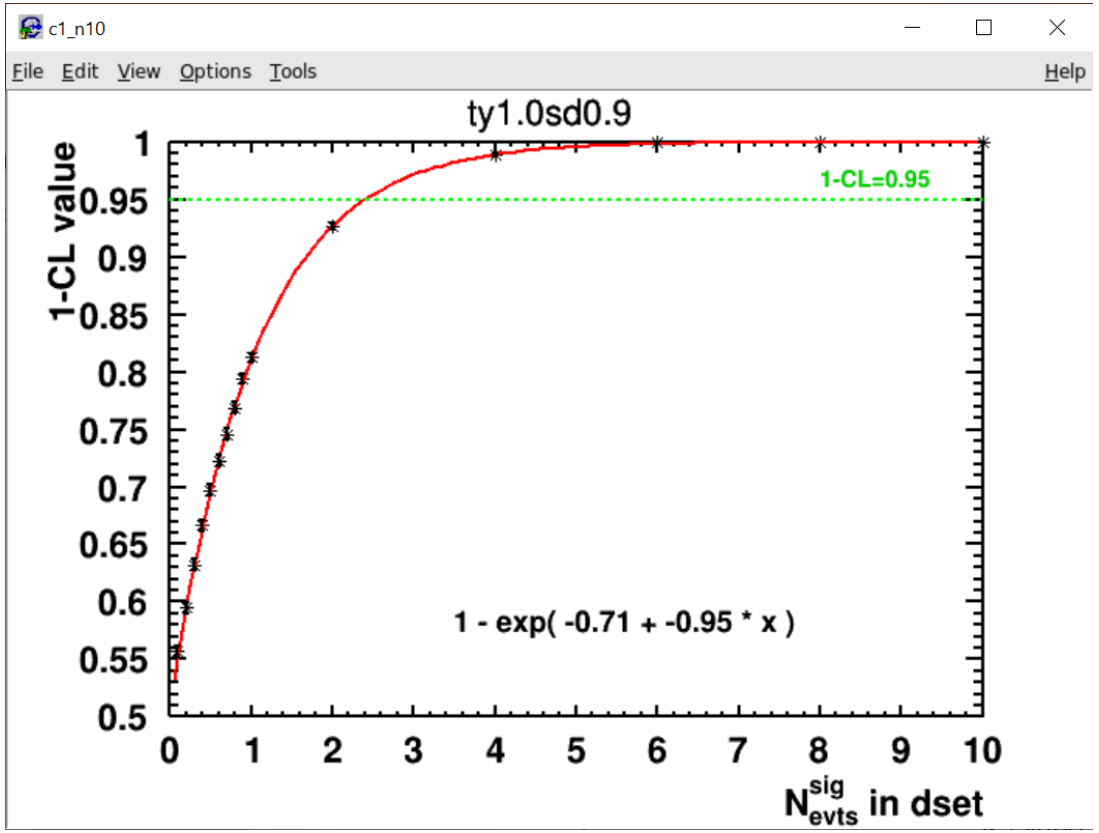


What’s underlying these results

NB: rootfiles of MC production itself can be found at:

/pbs/home/r/rmuller/private/workdisk/pointsources/likelihood_search/runs/20210115_BIGrun_point_fixed_flux/o_tmp/merged

1yr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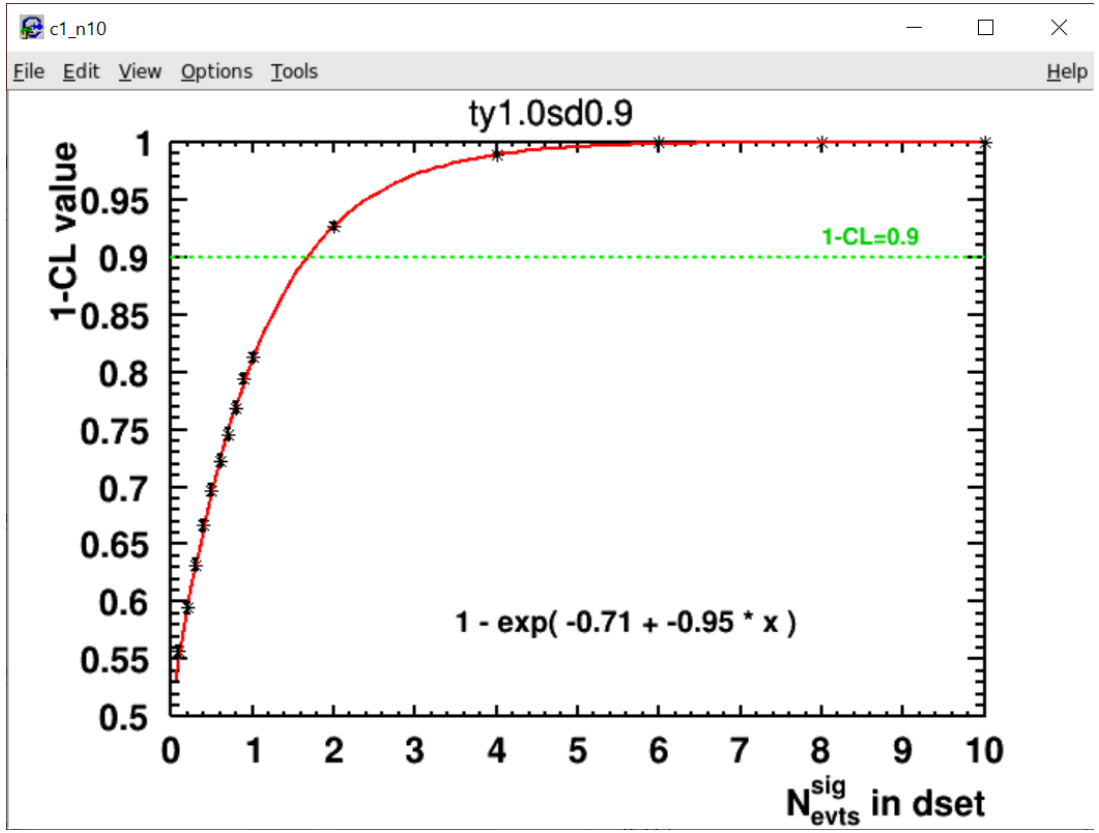
1-CL value
1-CL=0.95
1 - exp(-0.71 + -0.95 * x)
N^{sig}_{evts} in dset


c1_n10
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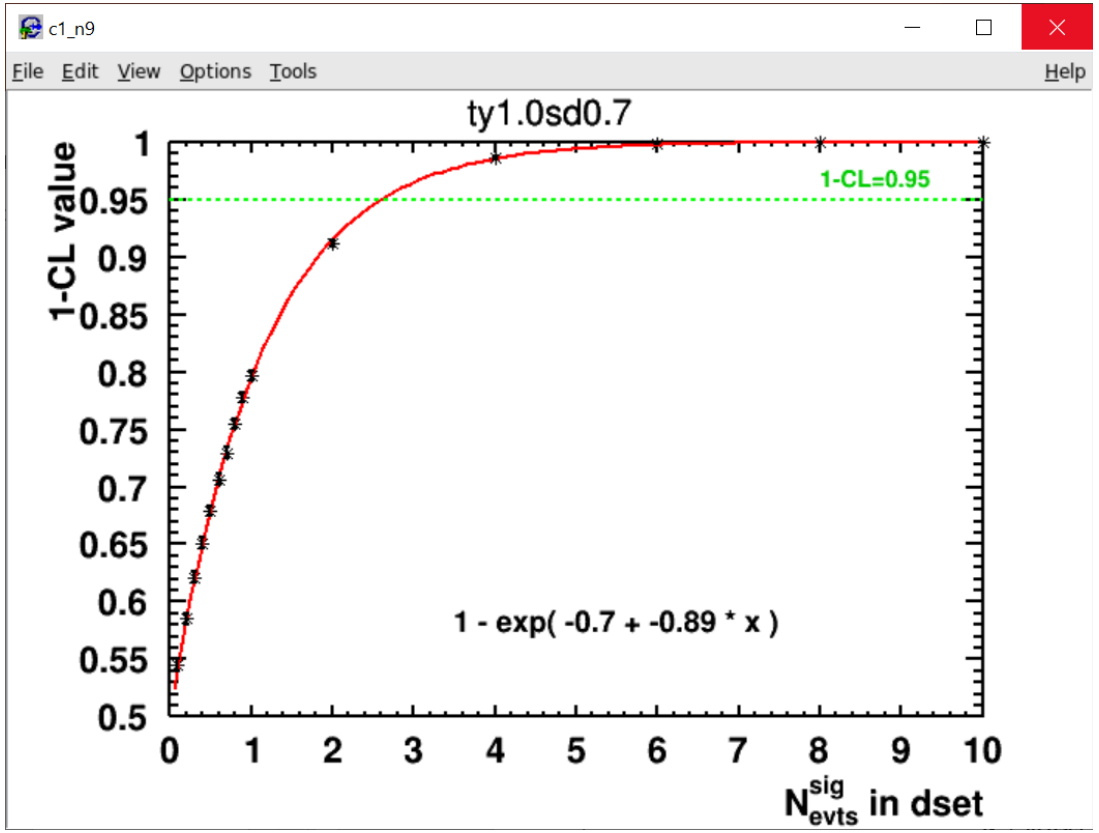
N^{sig}_{evts} in dset

1yr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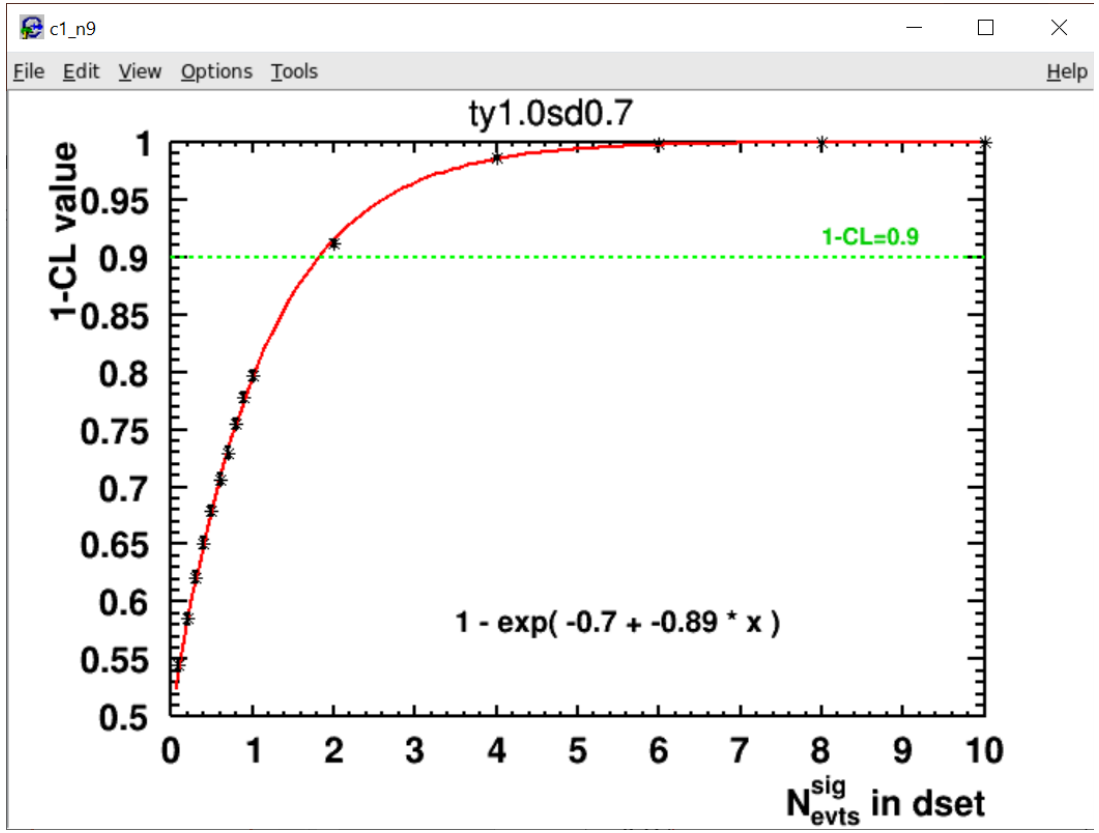
N^{sig}_{evts} in dset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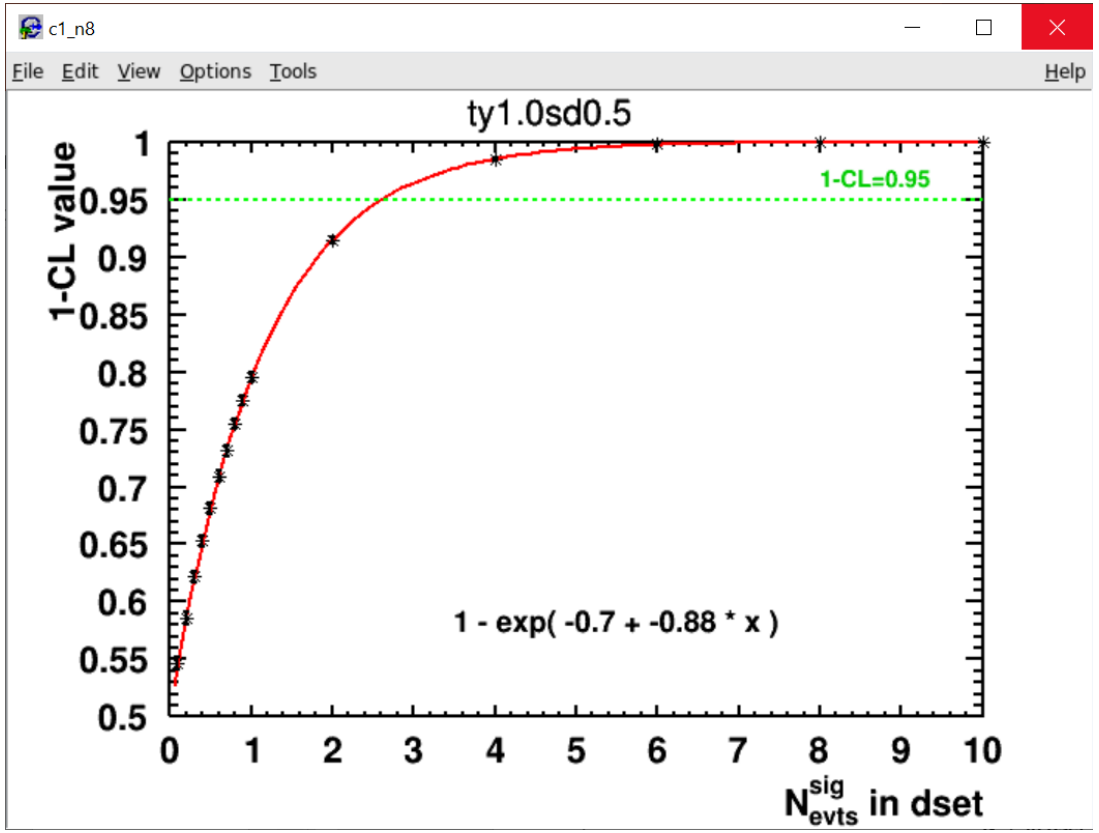
1 - exp(-0.7 + -0.89 * x)
N^{sig}_{evts} in dset

1yr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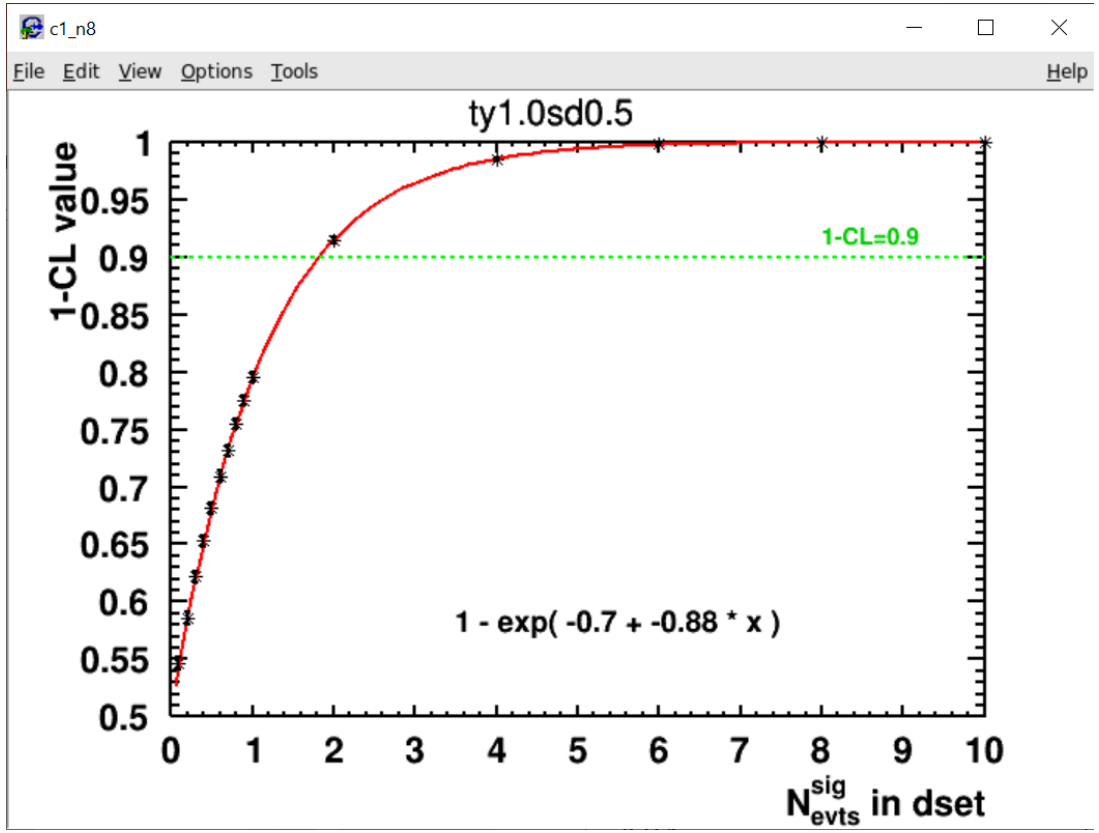
N^{sig}_{evts} in dset


c1_n8
File Edit View Options Tools Help
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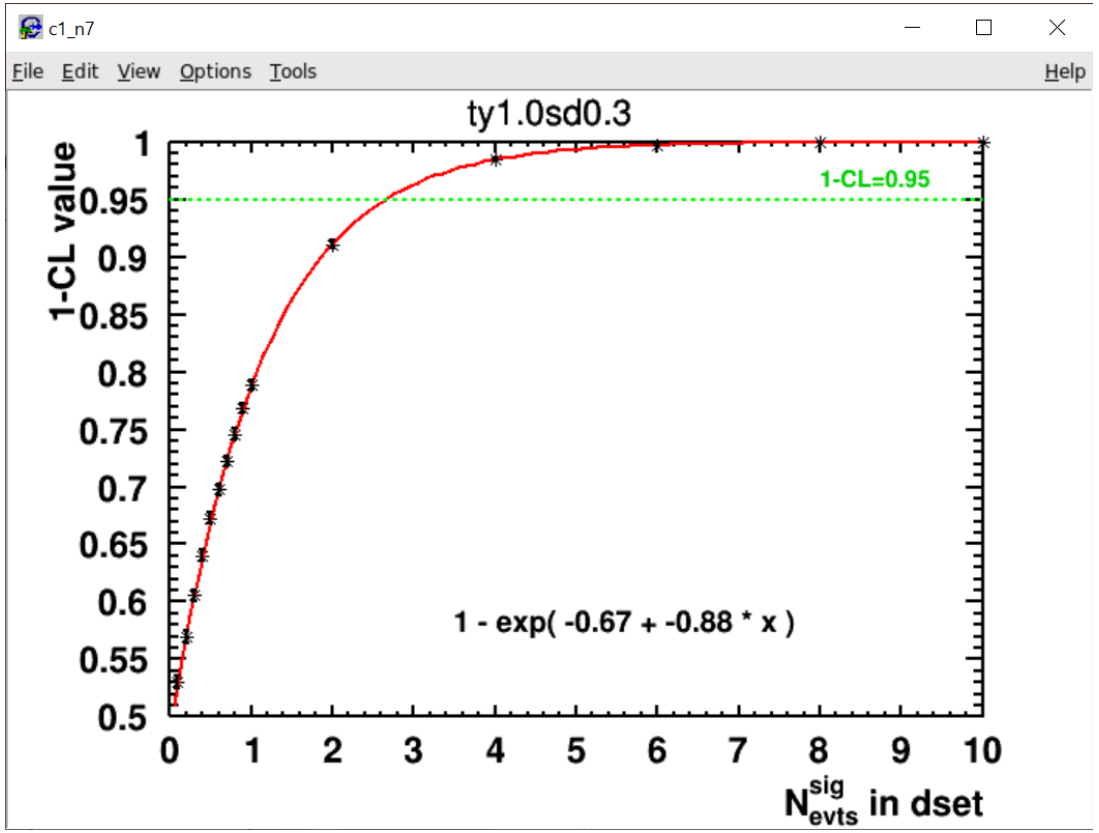
1 - exp(-0.7 + -0.88 * x)
N^{sig}_{evts} in dset

1yr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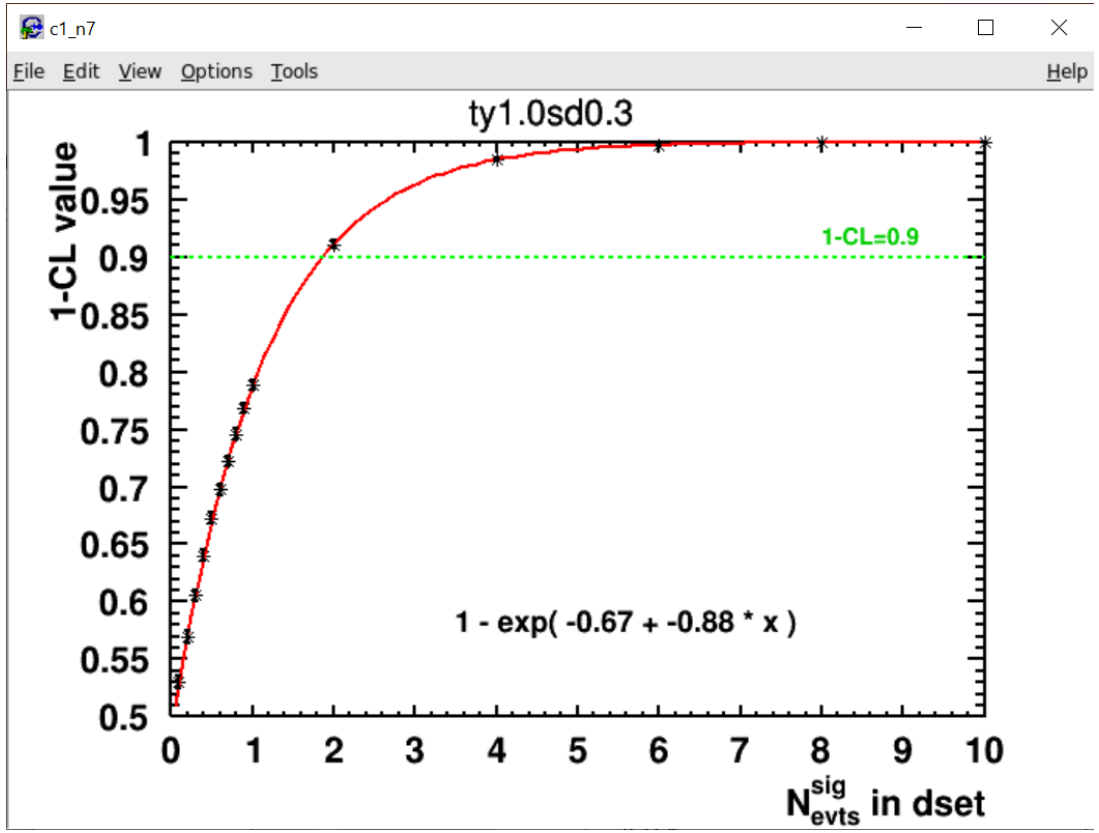
N^{sig}_{evts} in dset


c1_n7
File Edit View Options Tools Help
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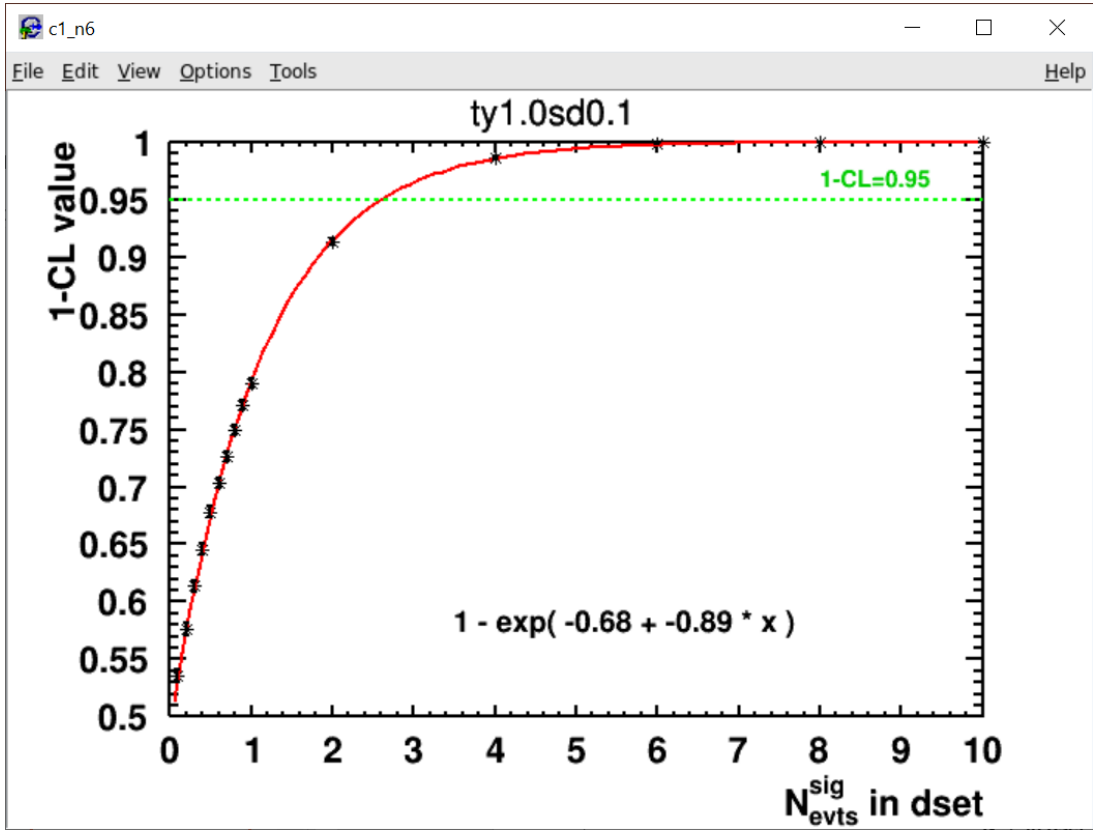
N^{sig}_{evts} in dset

1yr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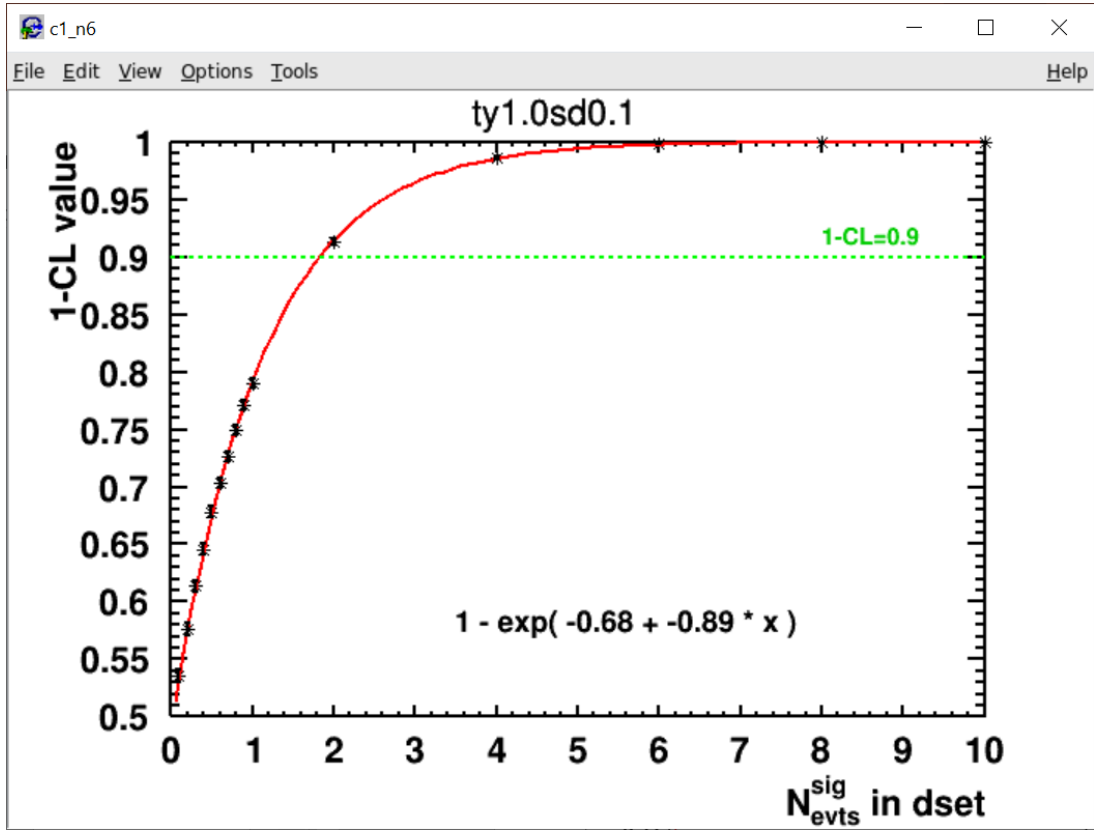
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File Edit View Options Tools Help
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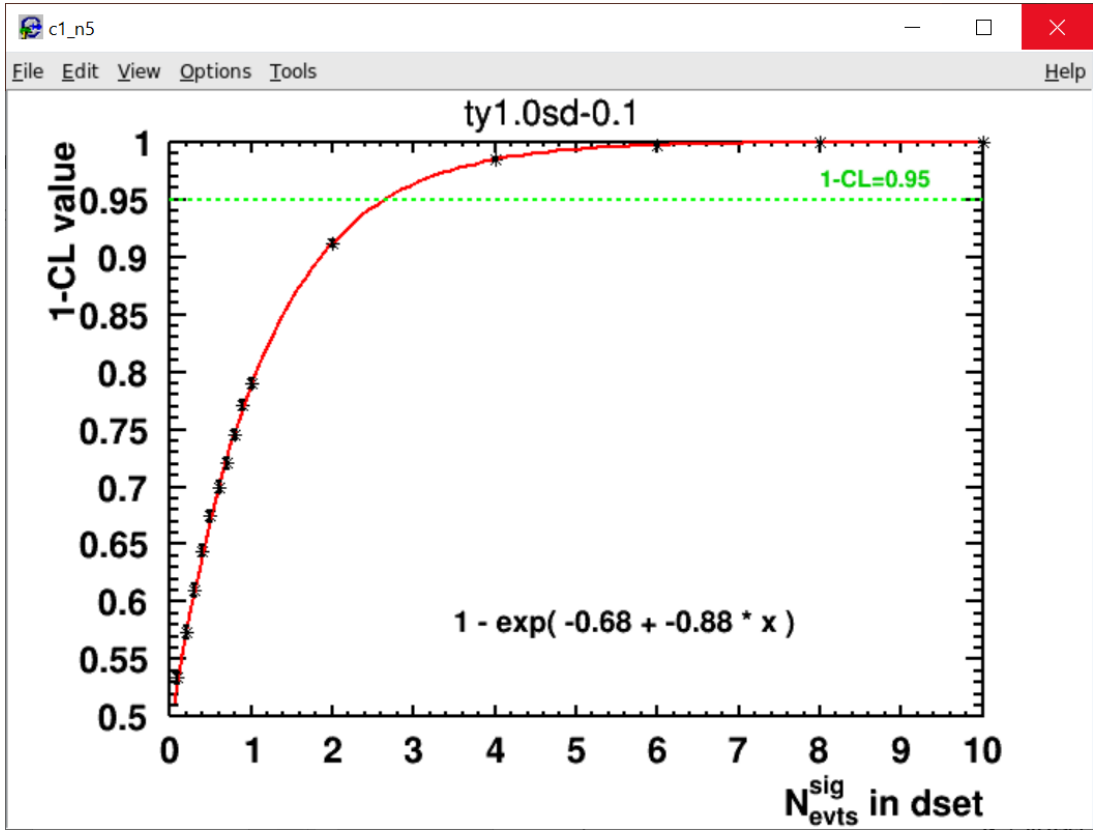
1 - exp(-0.68 + -0.89 * x)
N^{sig}_{evts} in dset

1yr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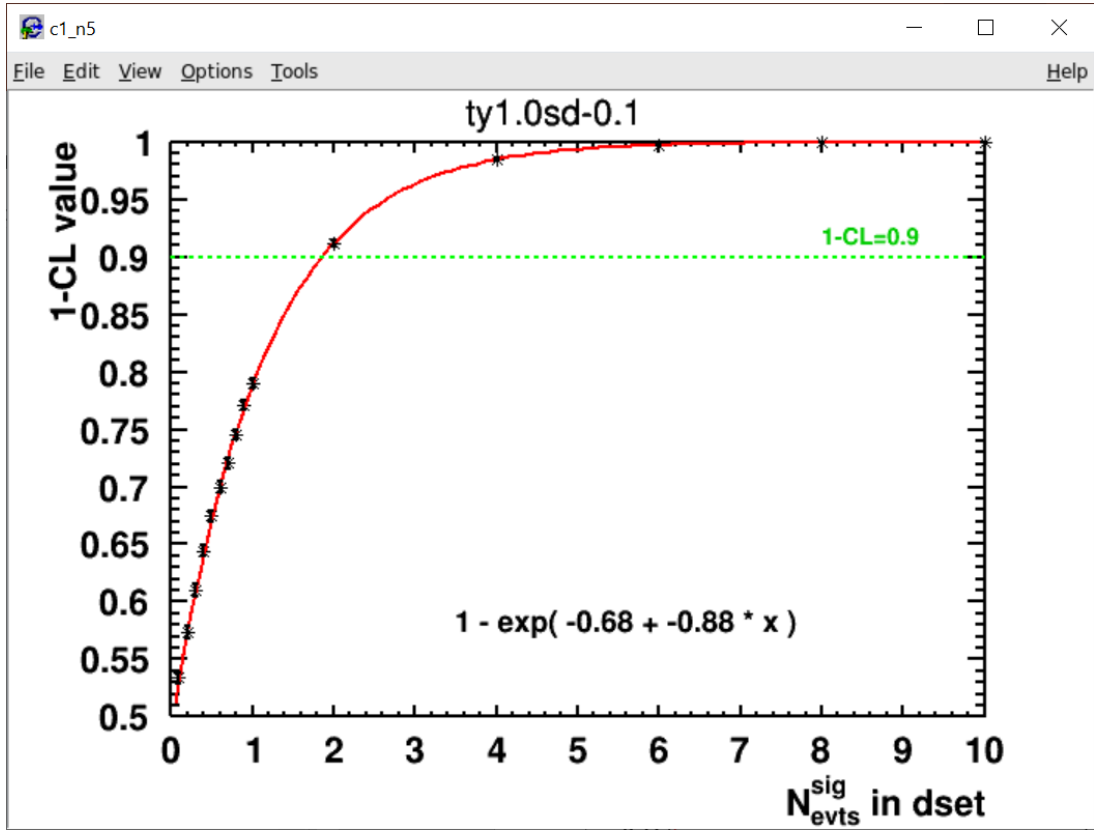
N^{sig}_{evts} in dset


c1_n5
File Edit View Options Tools Help
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1-CL value
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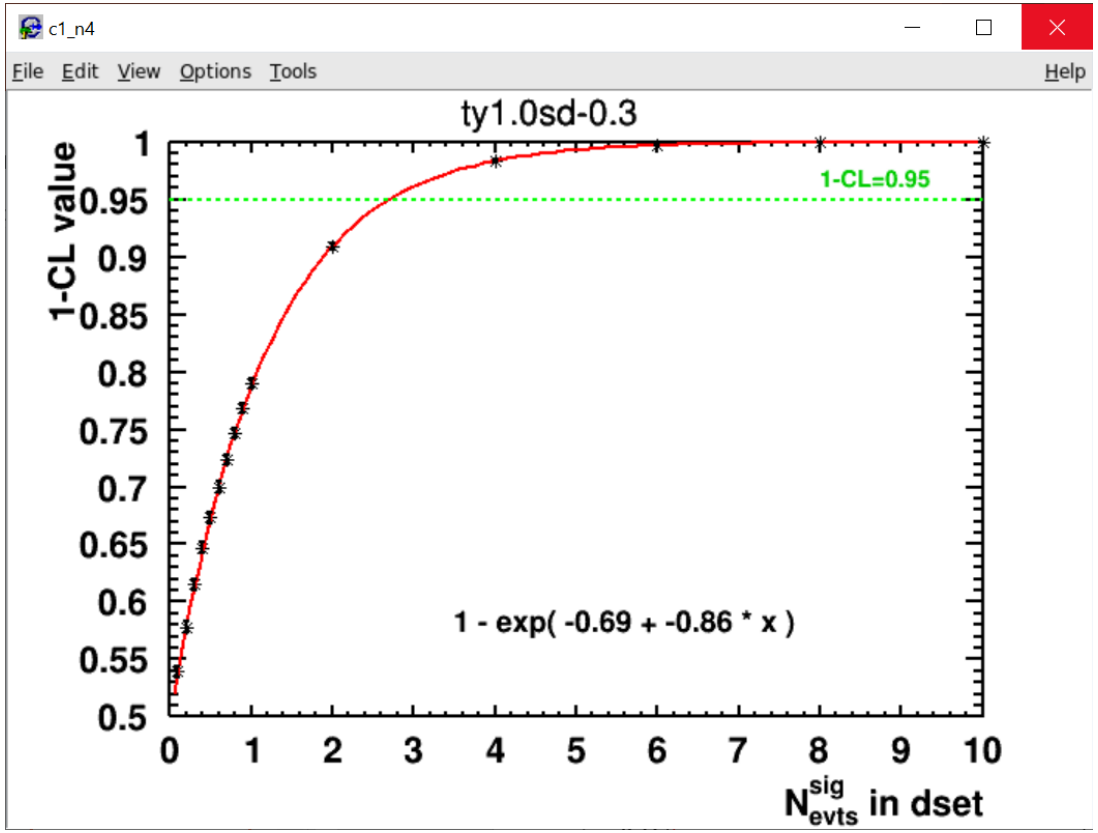
1 - exp(-0.68 + -0.88 * x)
N^{sig}_{evts} in dset

1yr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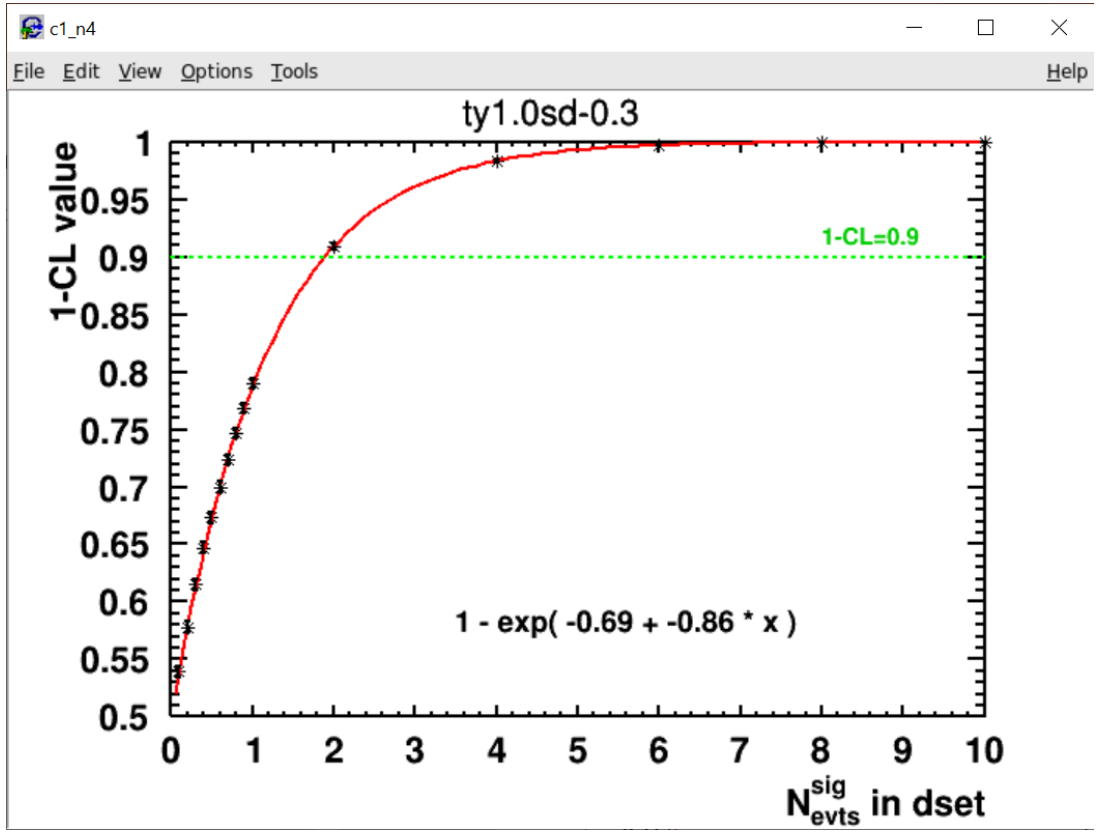
N^{sig}_{evts} in dset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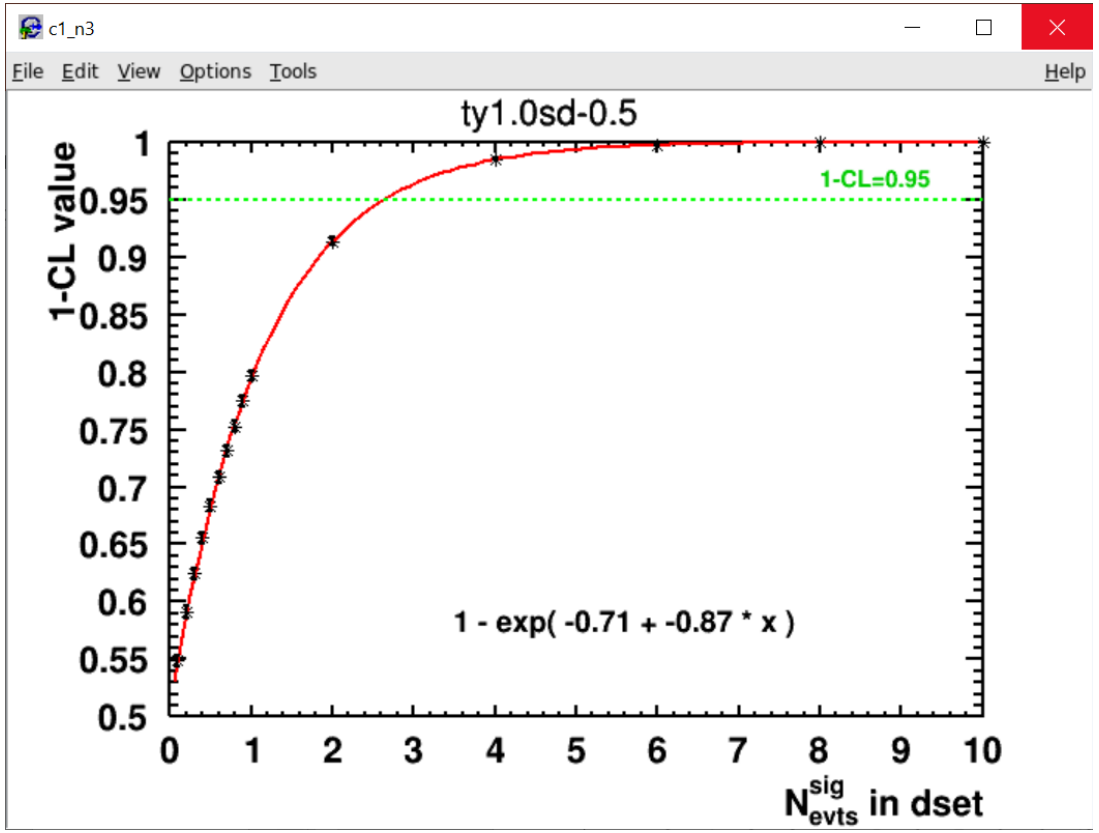
N^{sig}_{evts} in dset

1yr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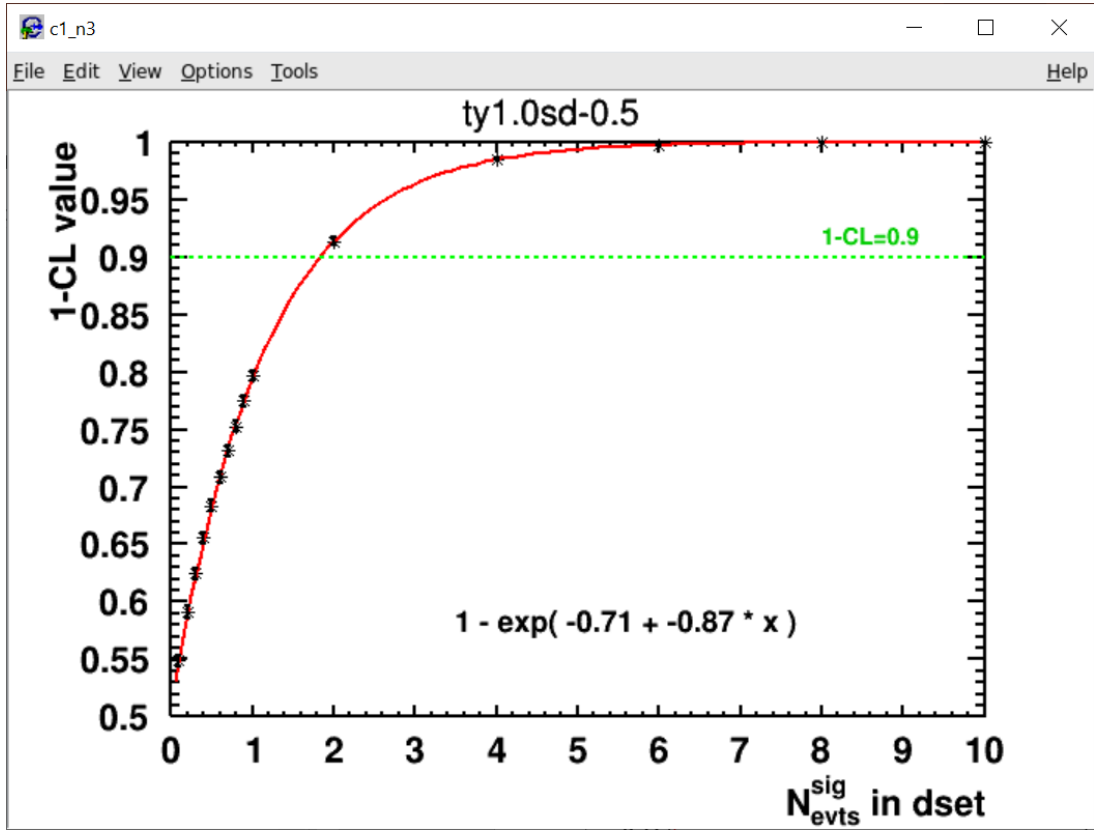
N^{sig}_{evts} in dset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File Edit View Options Tools Help
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1-CL value
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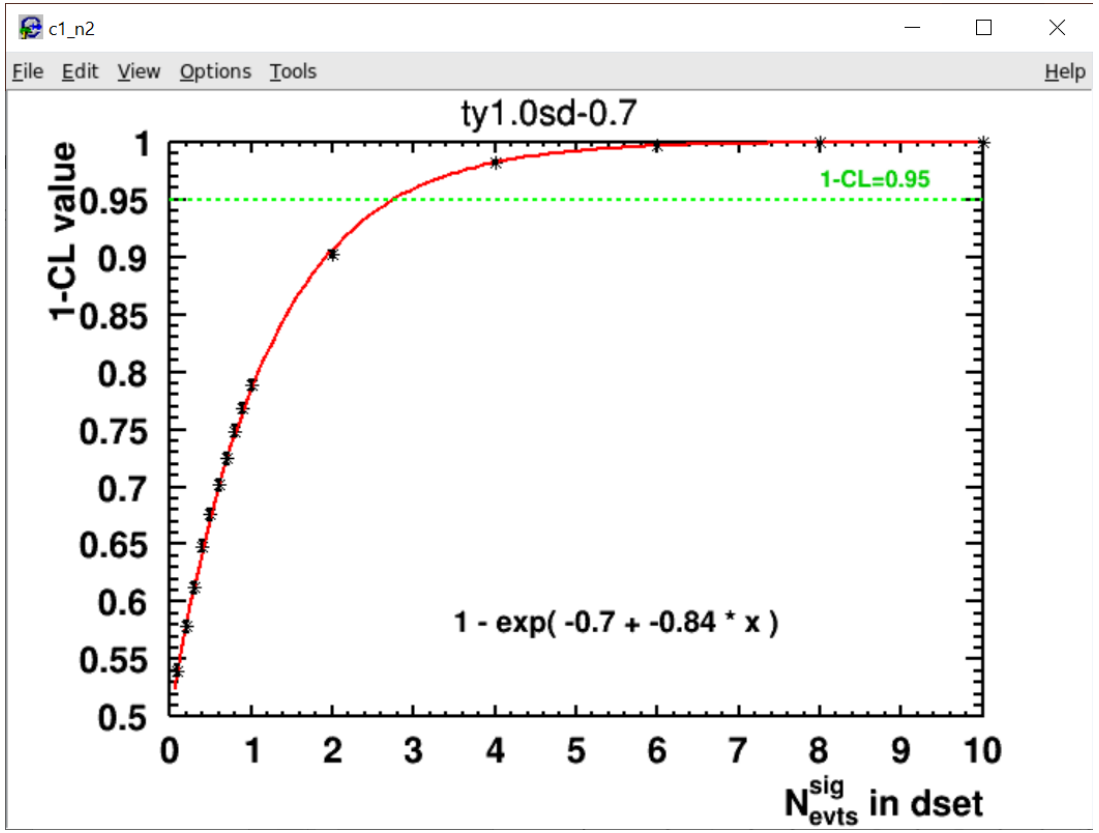
1 - exp(-0.71 + -0.87 * x)
N^{sig}_{evts} in dset

1yr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File Edit View Options Tools Help
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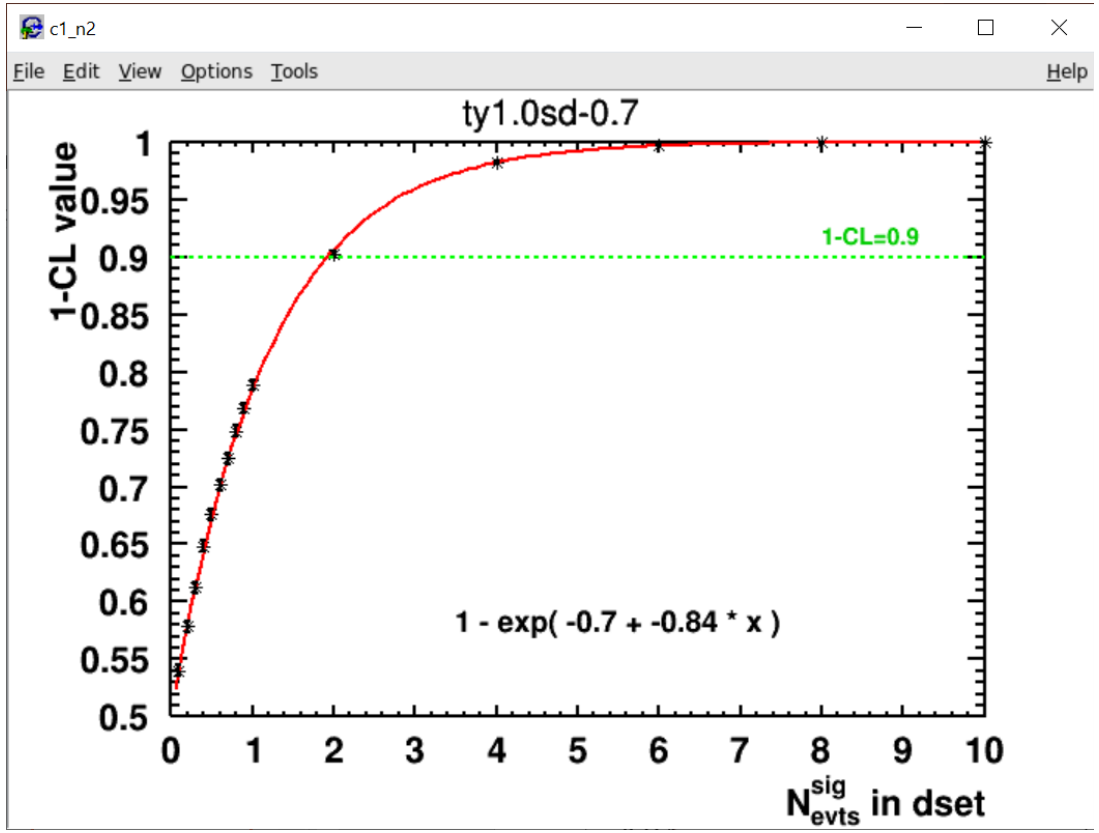
N^{sig}_{evts} in dset


c1_n2
File Edit View Options Tools Help
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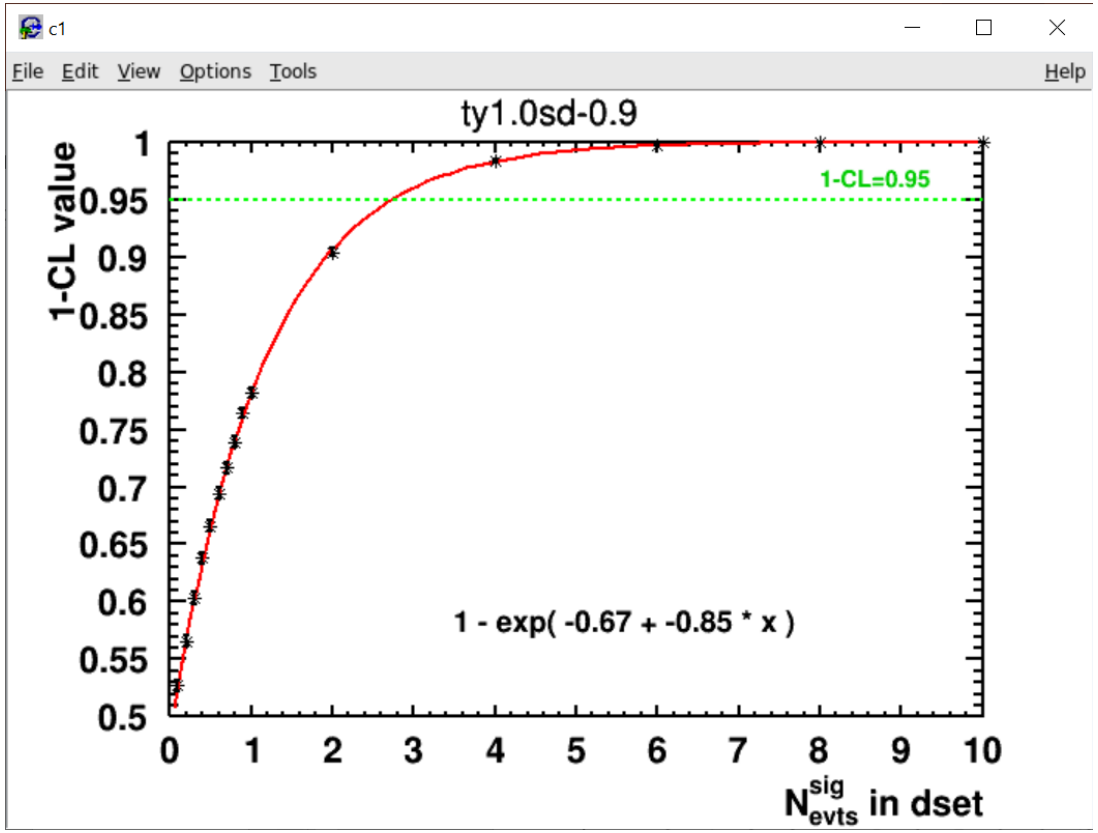
1 - exp(-0.7 + -0.84 * x)
N^{sig}_{evts} in dset

1yr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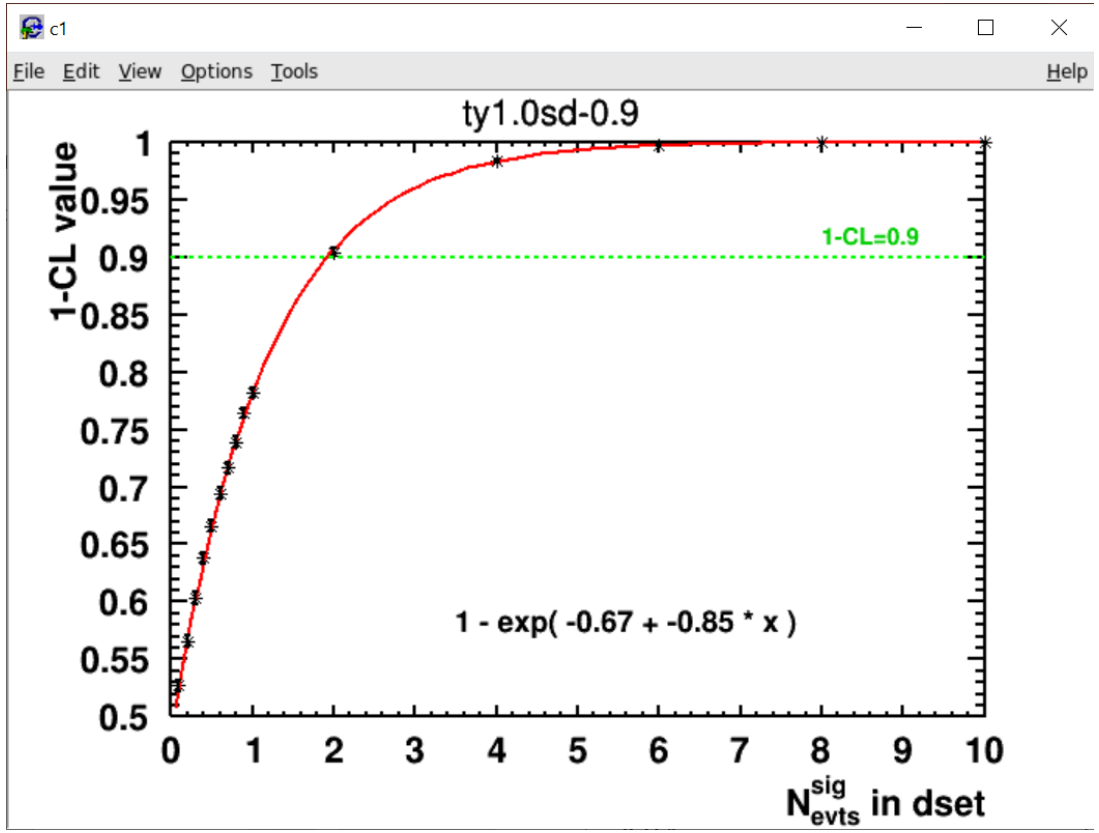
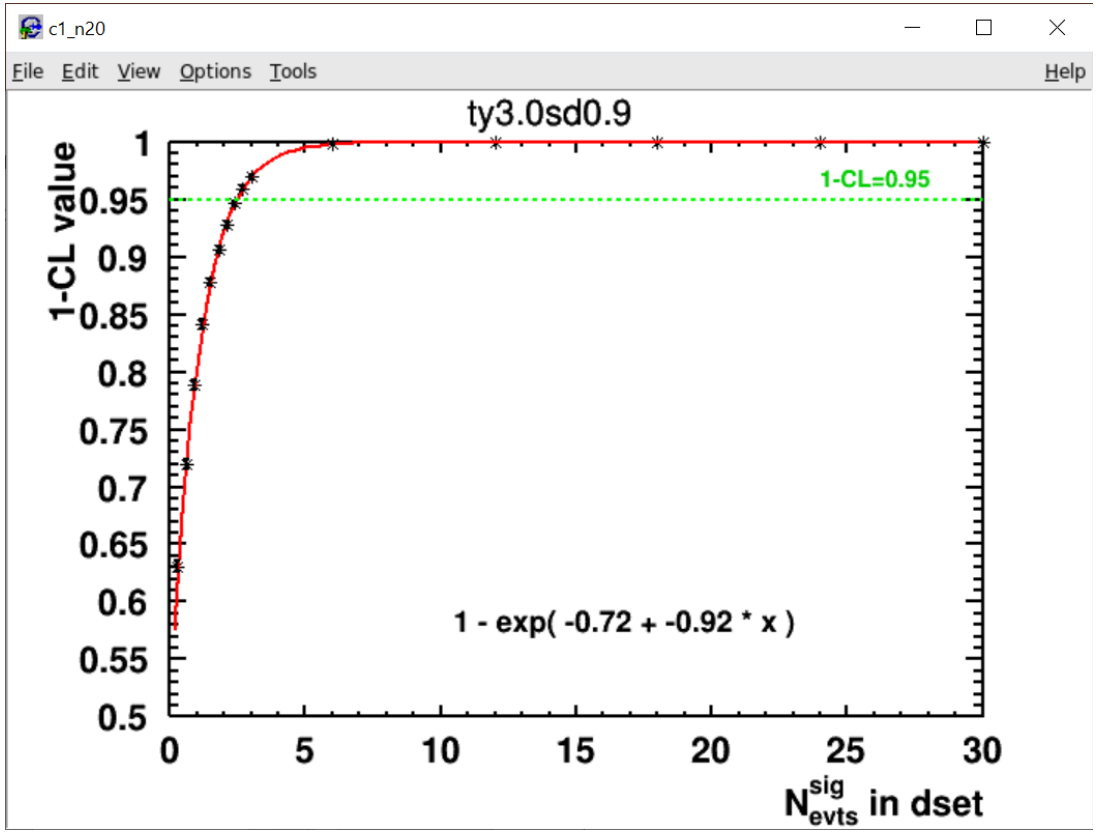
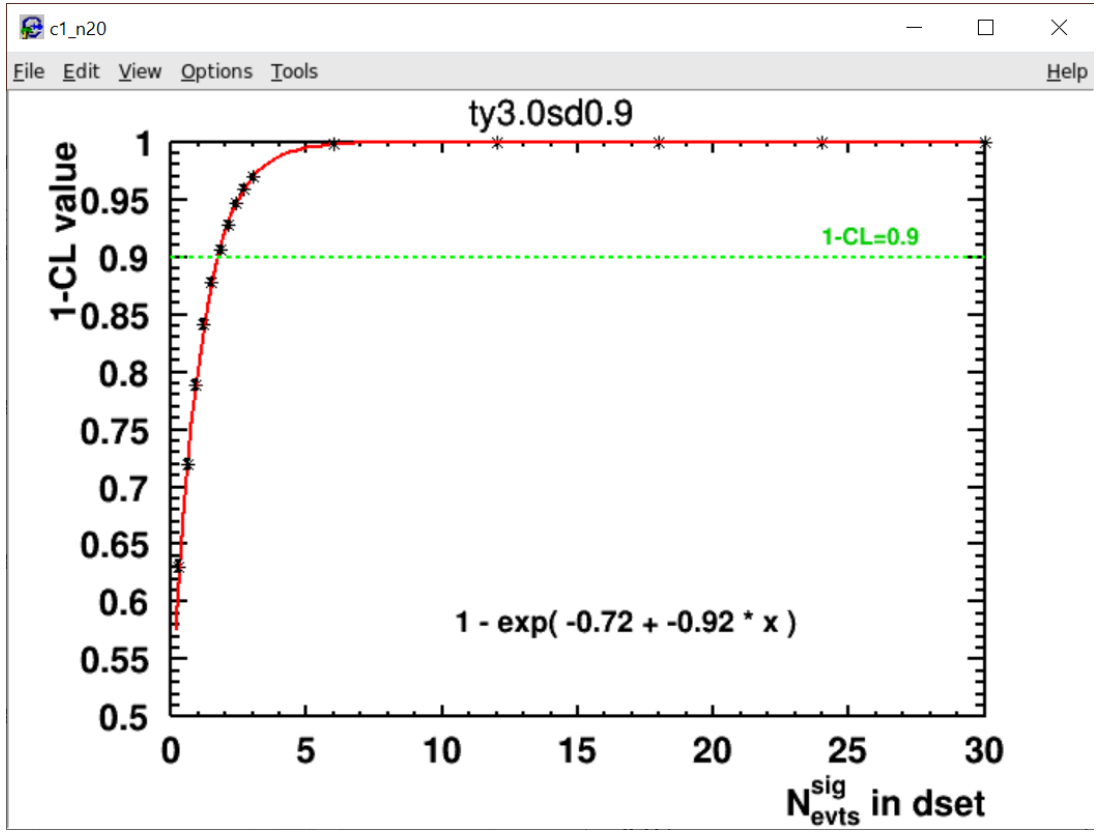
1 - exp(-0.67 + -0.85 * x)
N^{sig}_{evts} in dset

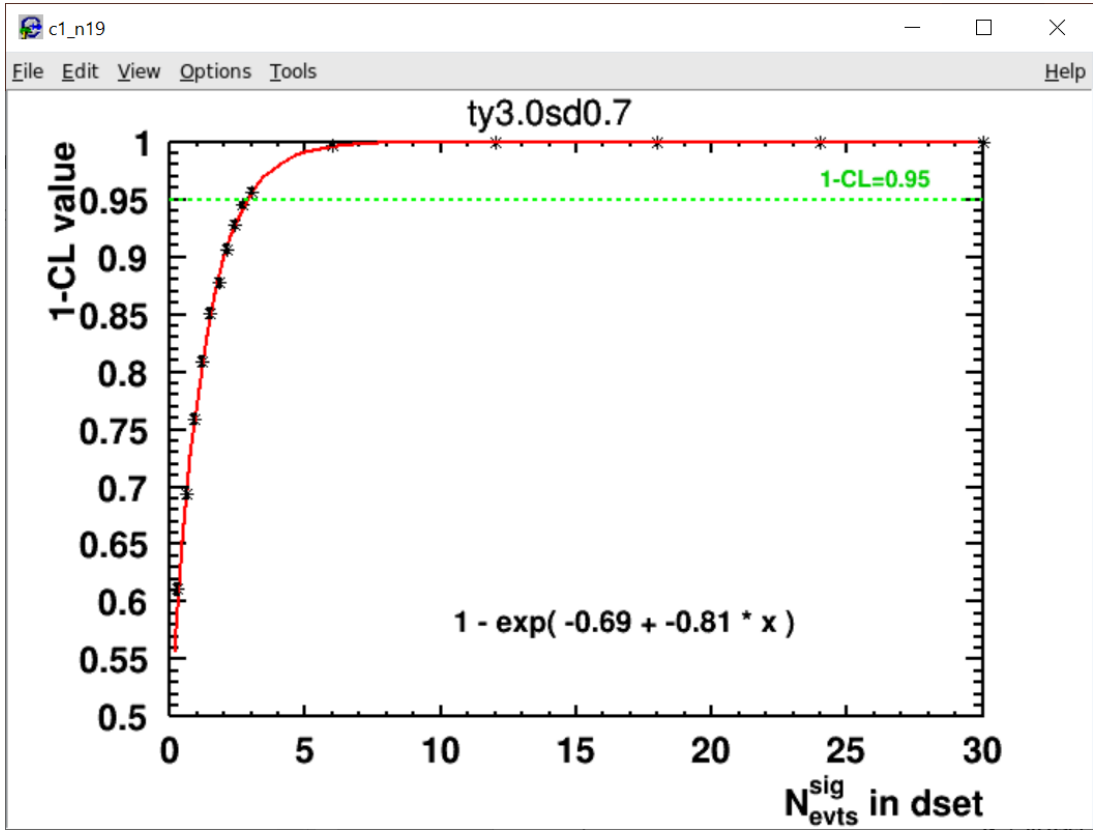

c1
File Edit View Options Tools Help
ty1.0sd-0.9
1-CL value
1-CL=0.9
1 - exp(-0.67 + -0.85 * x)
N^{sig}_{evts} in dset

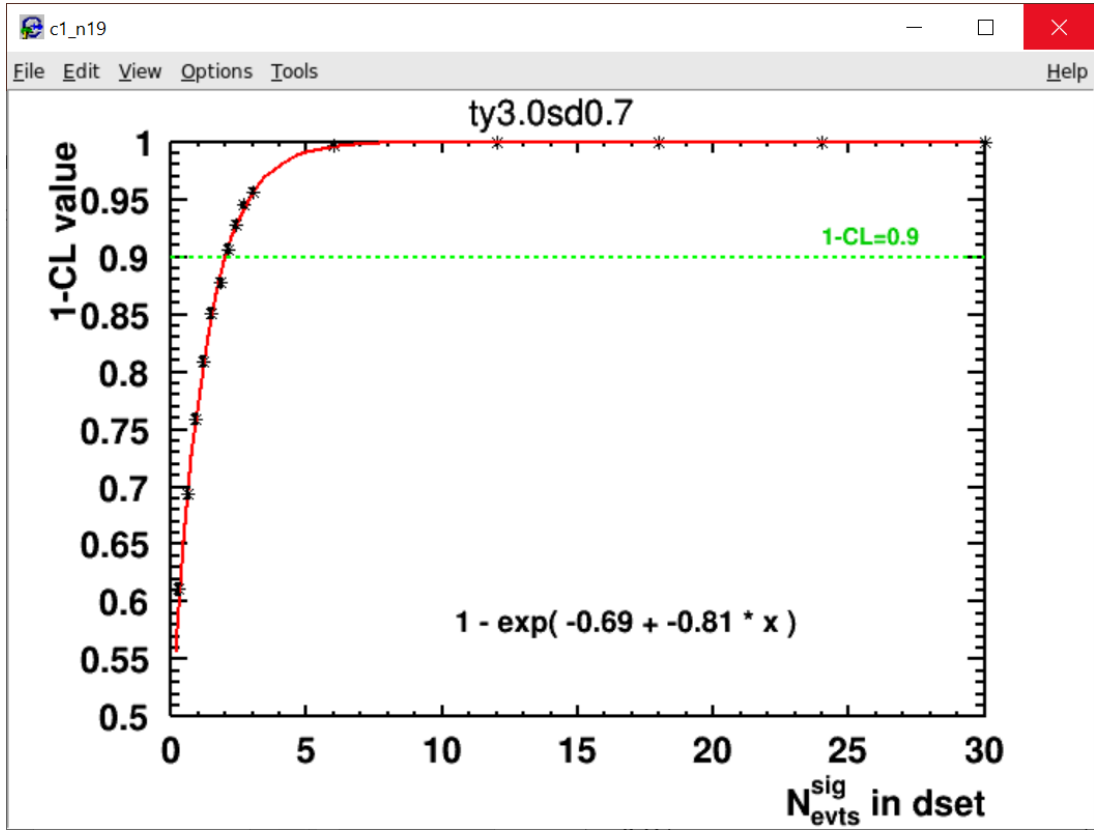
3yr


c1_n20
File Edit View Options Tools Help
ty3.0sd0.9
1-CL value
1-CL=0.95
1 - exp(-0.72 + -0.92 * x)
N^{sig}_{evts} in dset

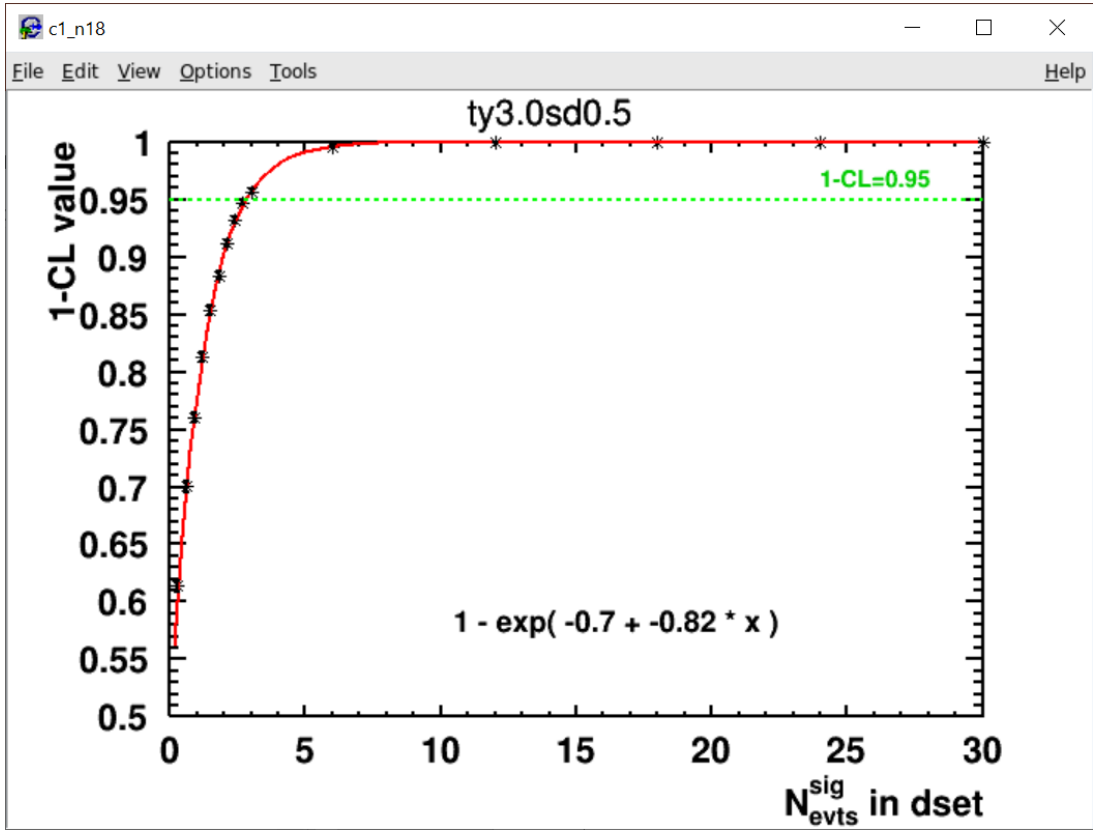

c1_n20
File Edit View Options Tools Help
ty3.0sd0.9
1-CL value
1-CL=0.9
1 - exp(-0.72 + -0.92 * x)
N^{sig}_{evts} in dset

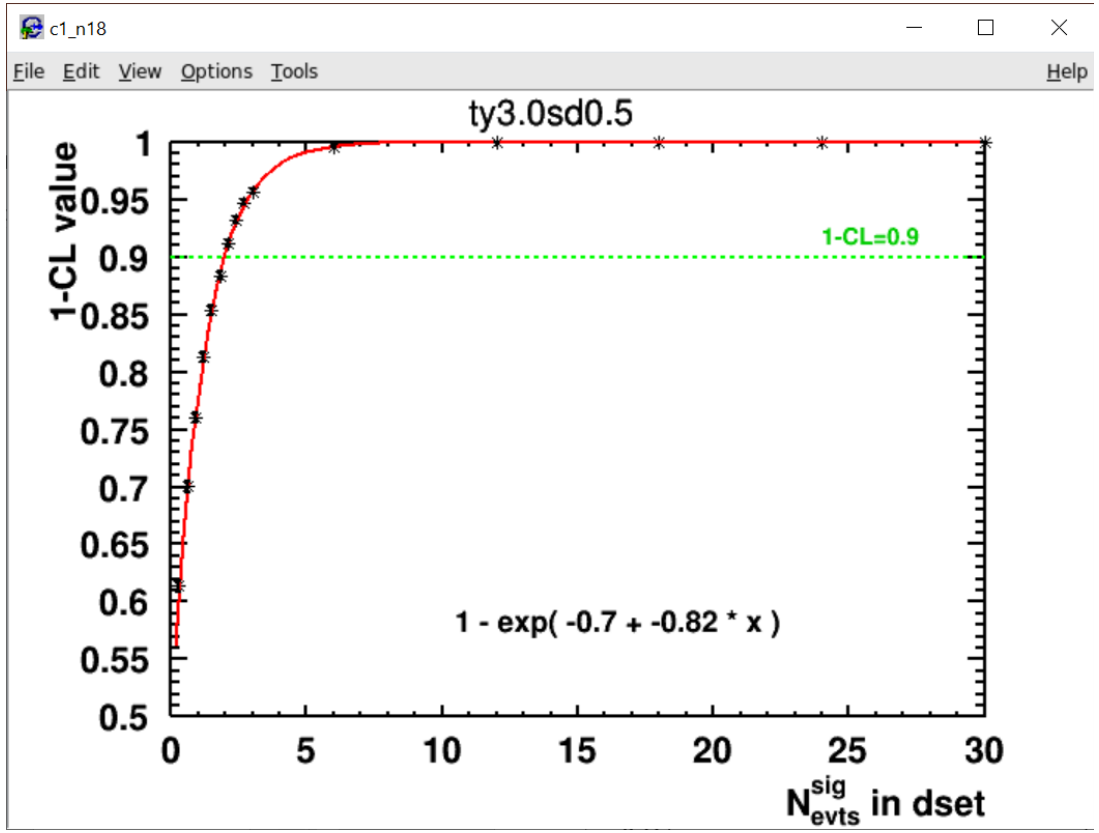
3yr


c1_n19
File Edit View Options Tools Help
ty3.0sd0.7
1-CL value
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
1-CL=0.95
1 - exp(-0.69 + -0.81 * x)
0
5
10
15
20
25
30
N^sig_evts in dset

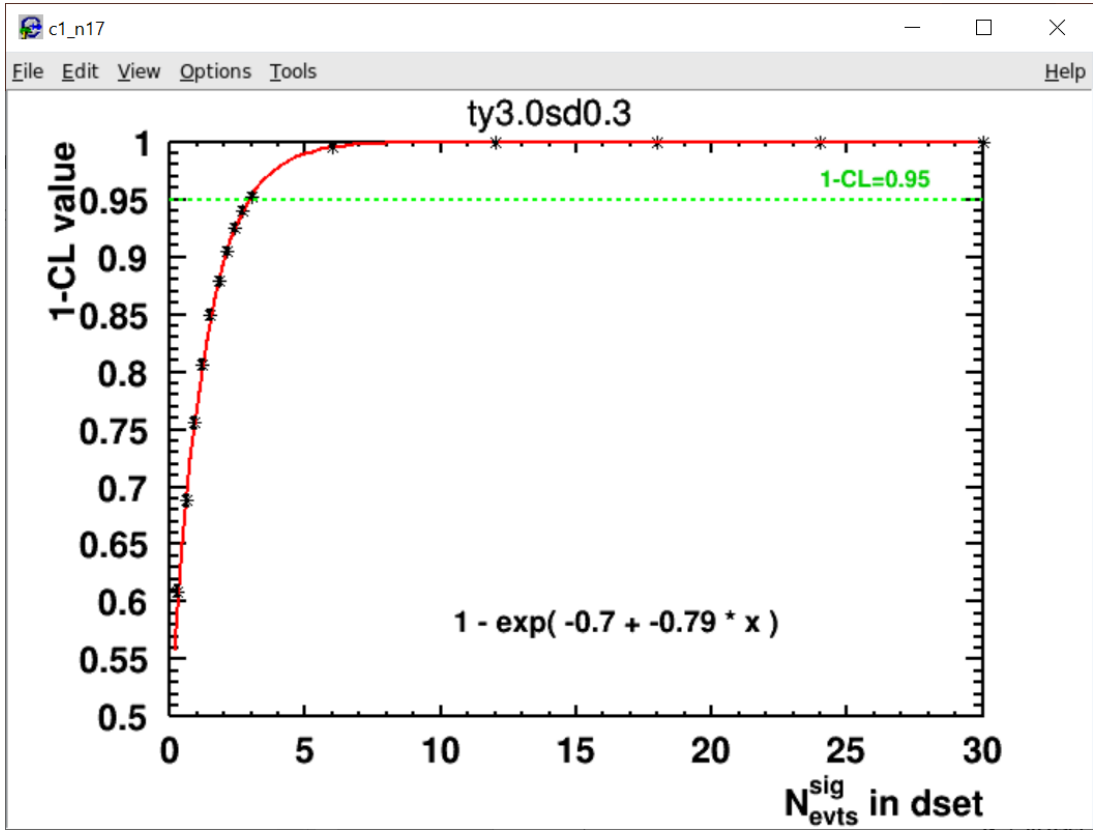

c1_n19
File Edit View Options Tools Help
ty3.0sd0.7
1-CL value
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
1-CL=0.9
1 - exp(-0.69 + -0.81 * x)
0
5
10
15
20
25
30
N^sig_evts in dset

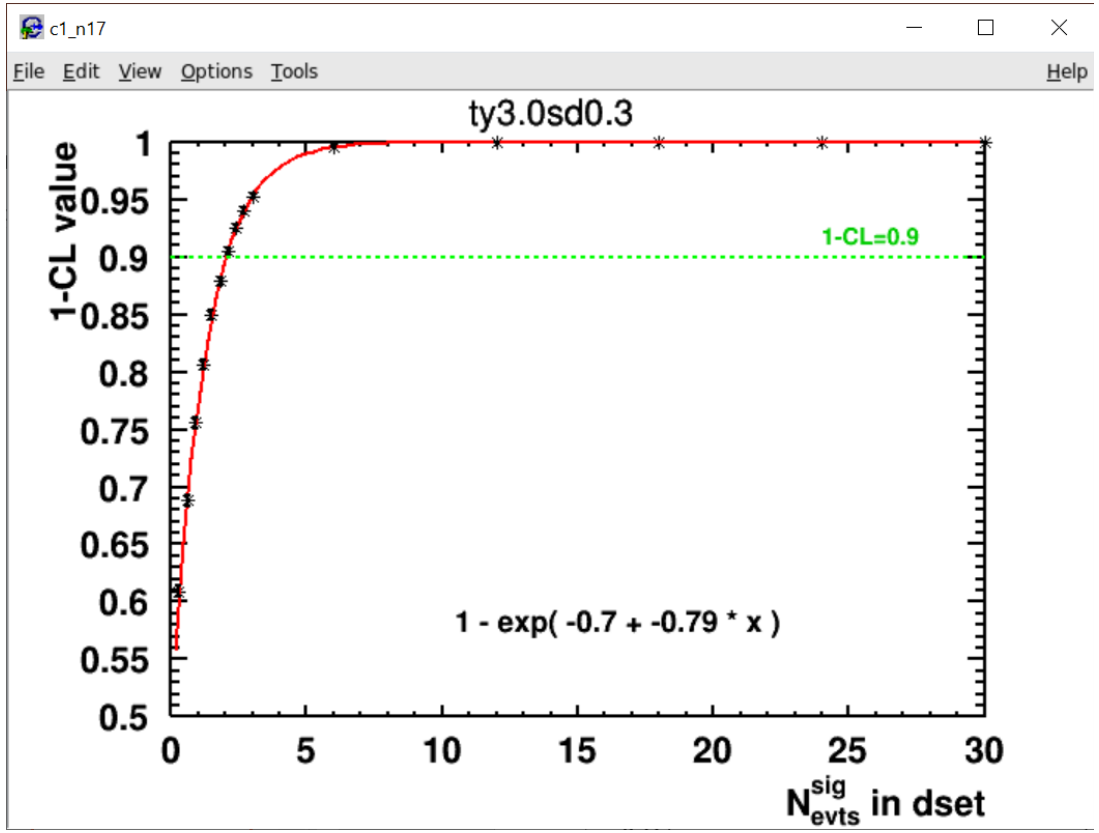
3yr


c1_n18
File Edit View Options Tools Help
ty3.0sd0.5
1-CL value
1-CL=0.95
1 - exp(-0.7 + -0.82 * x)
N^{sig}_{evts} in dset

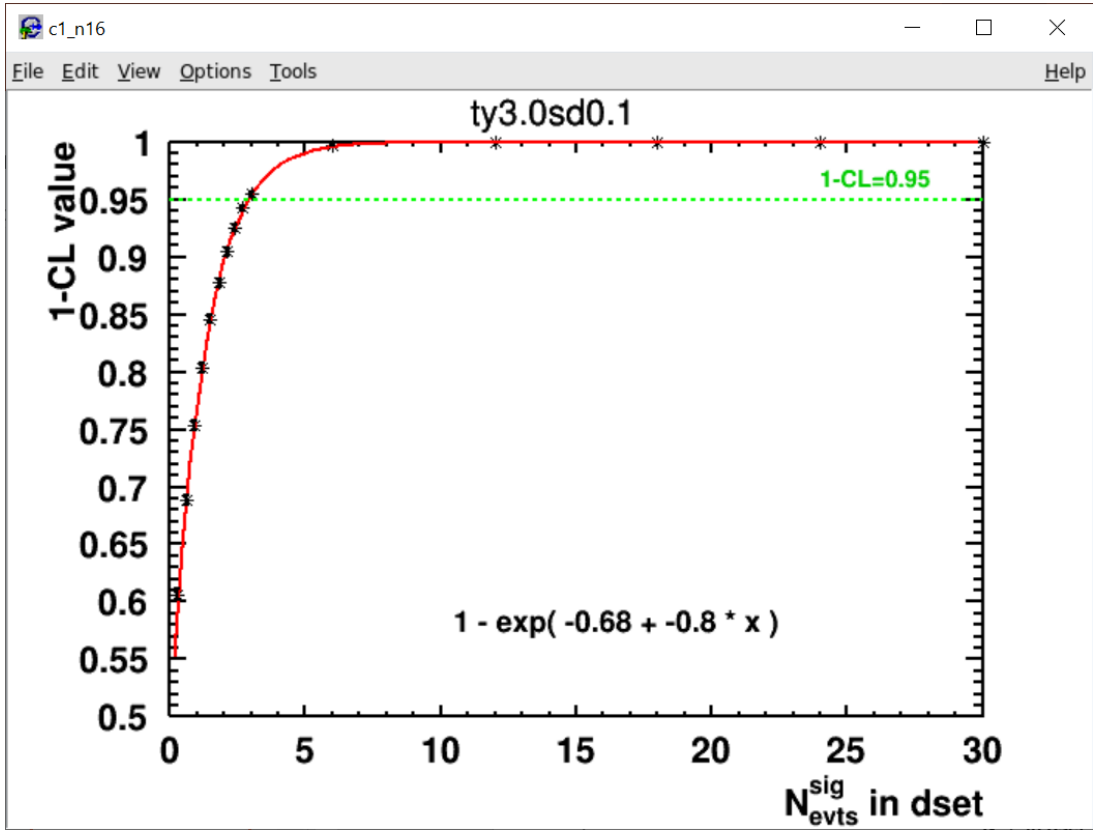

c1_n18
File Edit View Options Tools Help
ty3.0sd0.5
1-CL value
1-CL=0.9
1 - exp(-0.7 + -0.82 * x)
N^{sig}_{evts} in dset

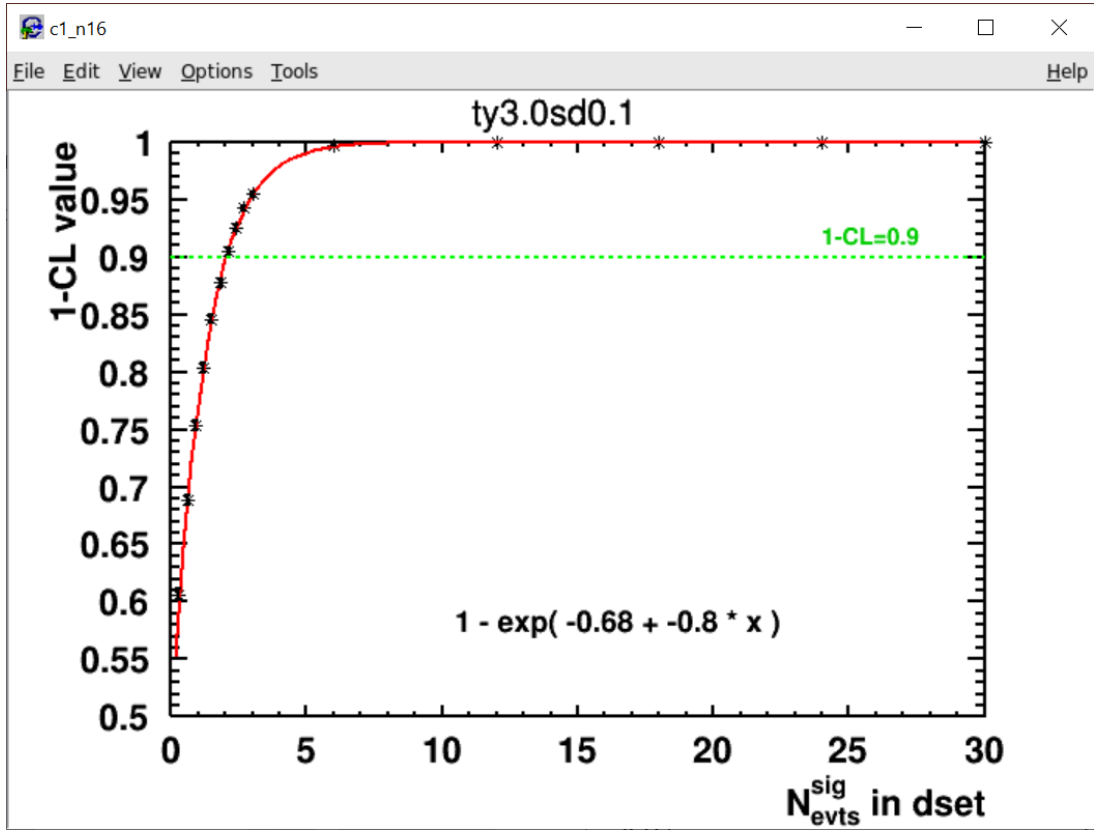
3yr


c1_n17
File Edit View Options Tools Help
ty3.0sd0.3
1-CL value
1-CL=0.95
1 - exp(-0.7 + -0.79 * x)
N^{sig}_{evts} in dset

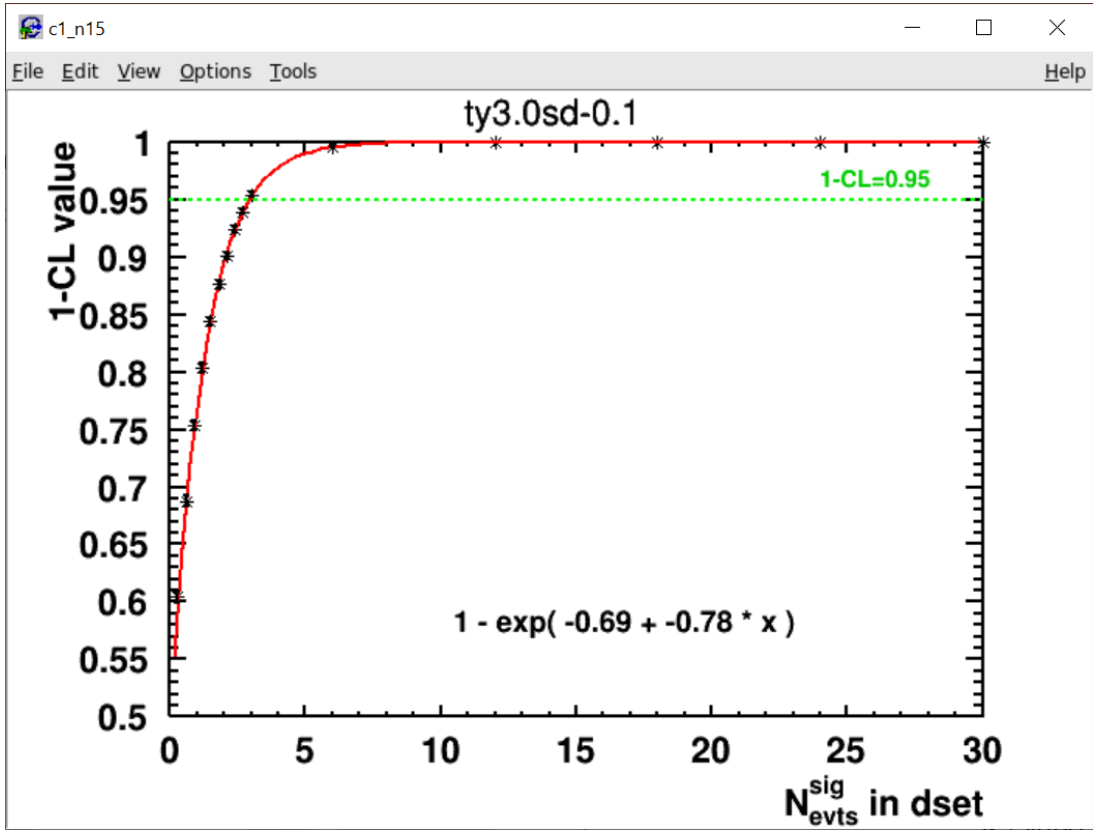

c1_n17
File Edit View Options Tools Help
ty3.0sd0.3
1-CL value
1-CL=0.9
1 - exp(-0.7 + -0.79 * x)
N^{sig}_{evts} in dset

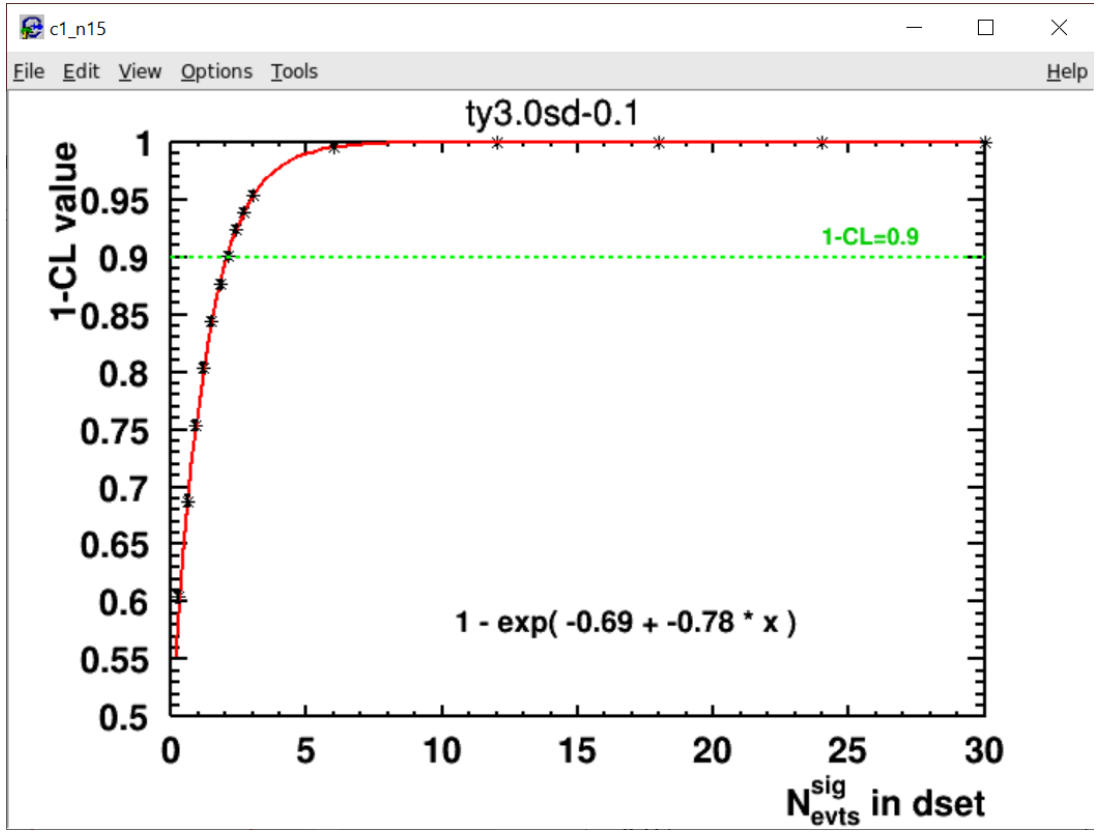
3yr


c1_n16
File Edit View Options Tools Help
ty3.0sd0.1
1-CL value
1-CL=0.95
1 - exp(-0.68 + -0.8 * x)
N^{sig}_{evts} in dset

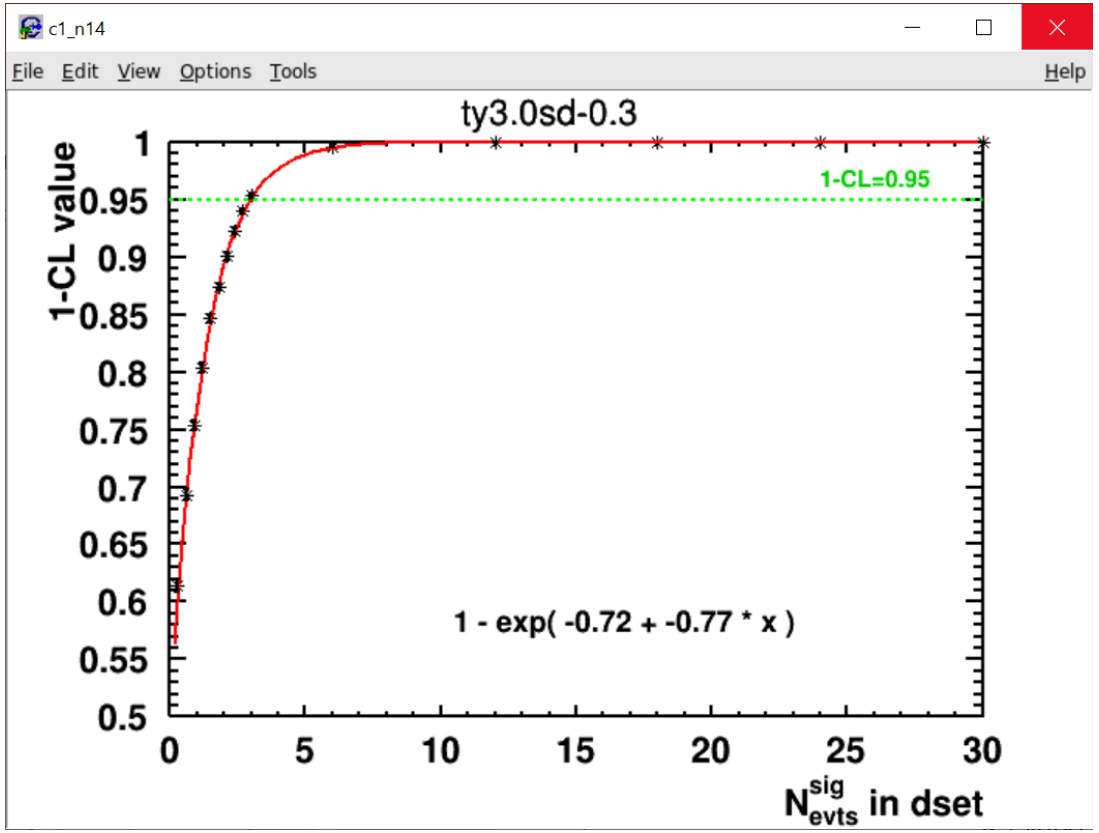

c1_n16
File Edit View Options Tools Help
ty3.0sd0.1
1-CL value
1-CL=0.9
1 - exp(-0.68 + -0.8 * x)
N^{sig}_{evts} in dset

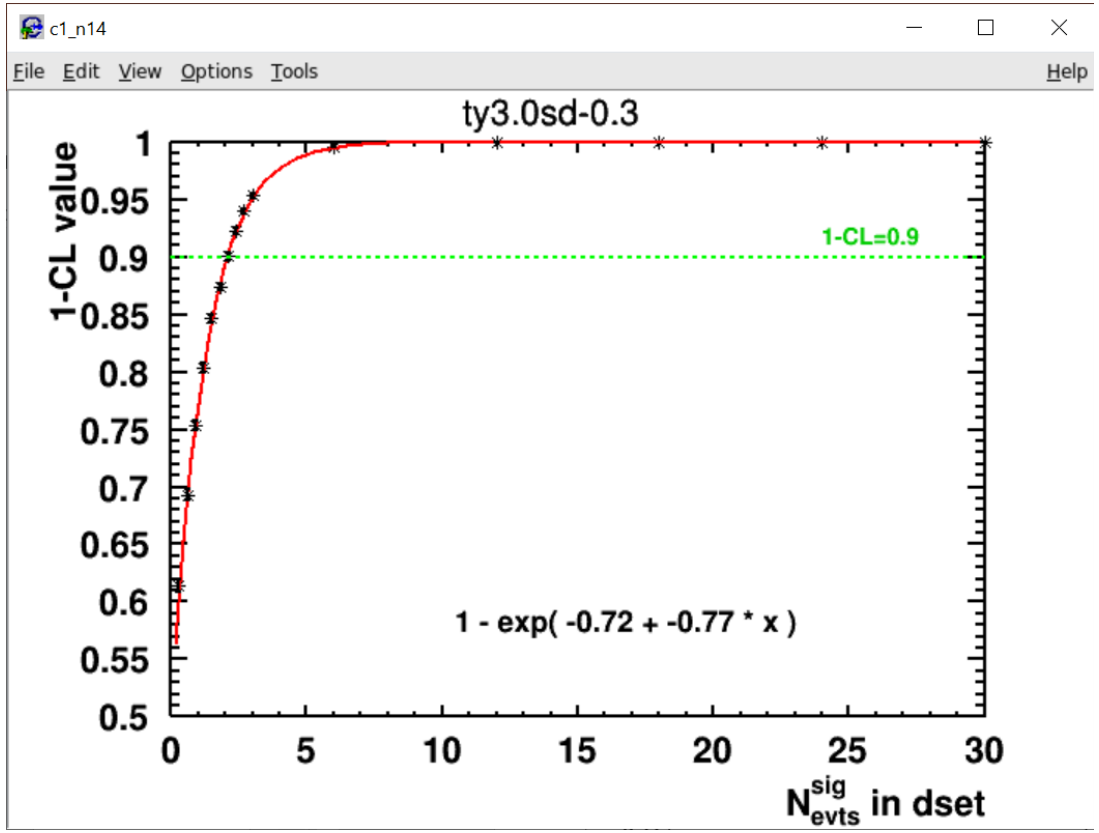
3yr


c1_n15
File Edit View Options Tools Help
ty3.0sd-0.1
1-CL value
1-CL=0.95
1 - exp(-0.69 + -0.78 * x)
N^{sig}_{evts} in dset

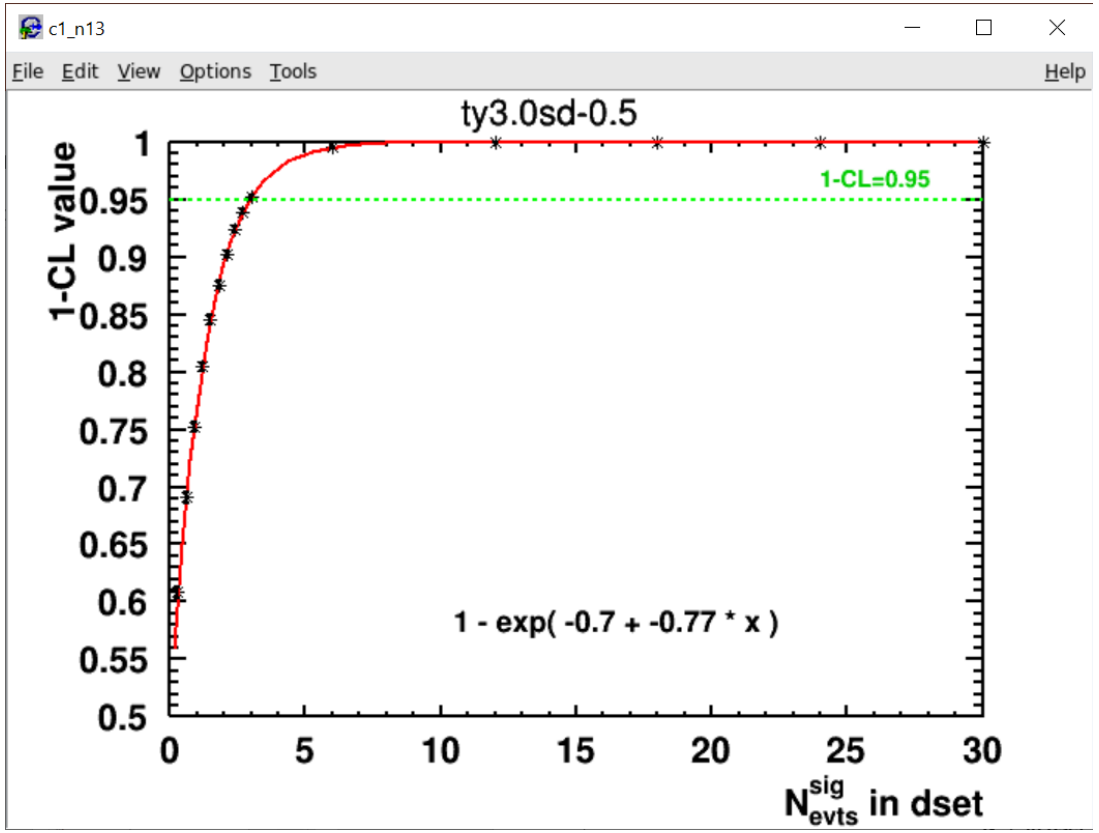

c1_n15
File Edit View Options Tools Help
ty3.0sd-0.1
1-CL value
1-CL=0.9
1 - exp(-0.69 + -0.78 * x)
N^{sig}_{evts} in dset

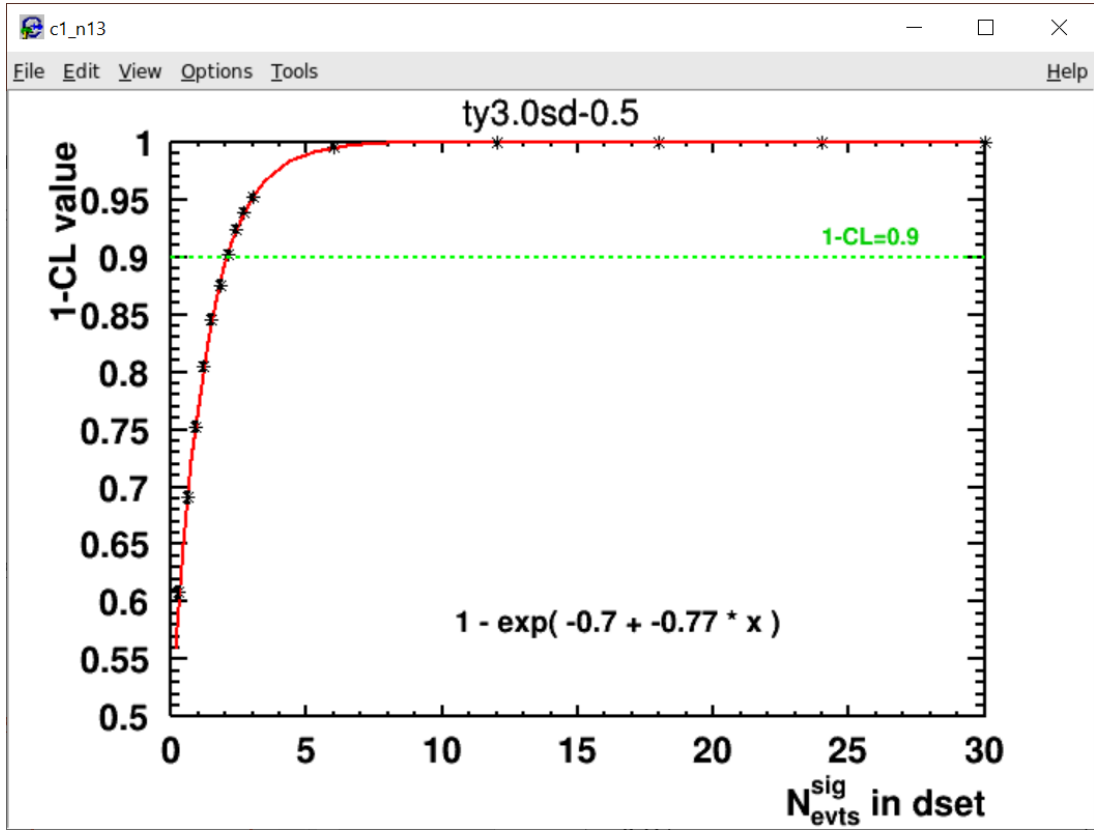
3yr


c1_n14
File Edit View Options Tools Help
ty3.0sd-0.3
1-CL value
1-CL=0.95
1 - exp(-0.72 + -0.77 * x)
N^{sig}_{evts} in dset

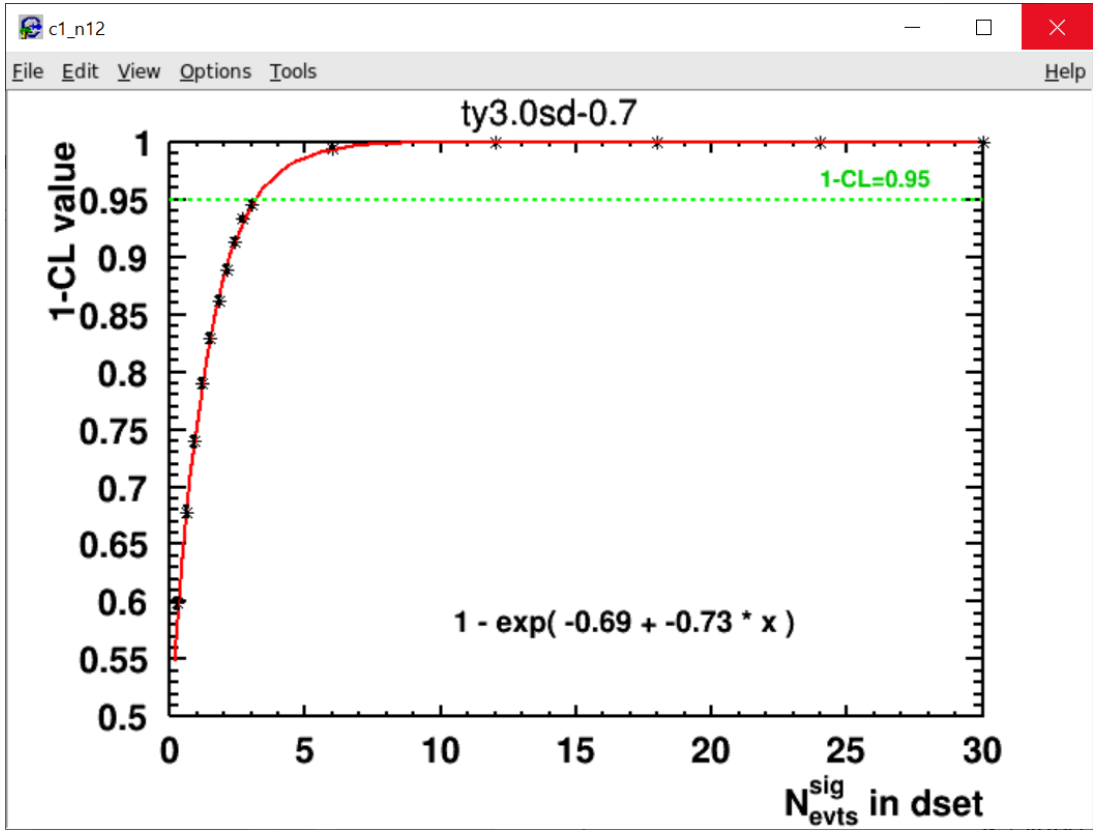

c1_n14
File Edit View Options Tools Help
ty3.0sd-0.3
1-CL value
1-CL=0.9
1 - exp(-0.72 + -0.77 * x)
N^{sig}_{evts} in dset

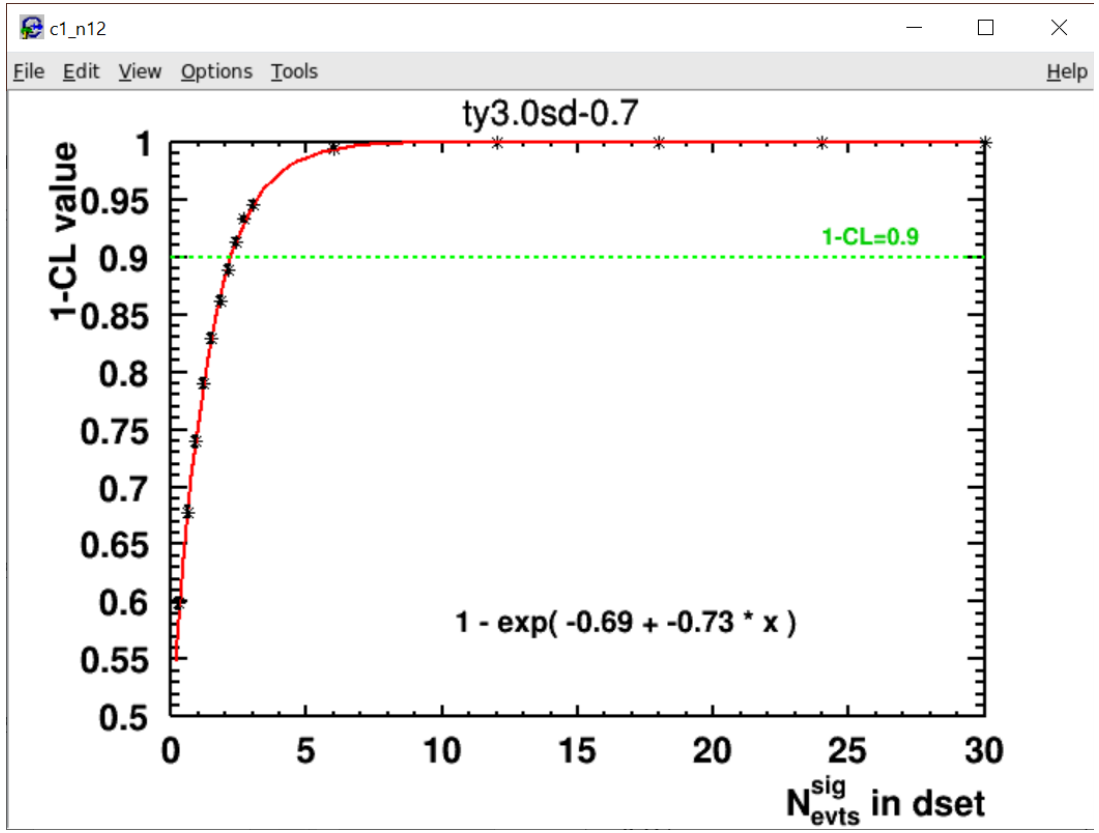
3yr


c1_n13
File Edit View Options Tools Help
ty3.0sd-0.5
1-CL value
1-CL=0.95
1 - exp(-0.7 + -0.77 * x)
N^{sig}_{evts} in dset

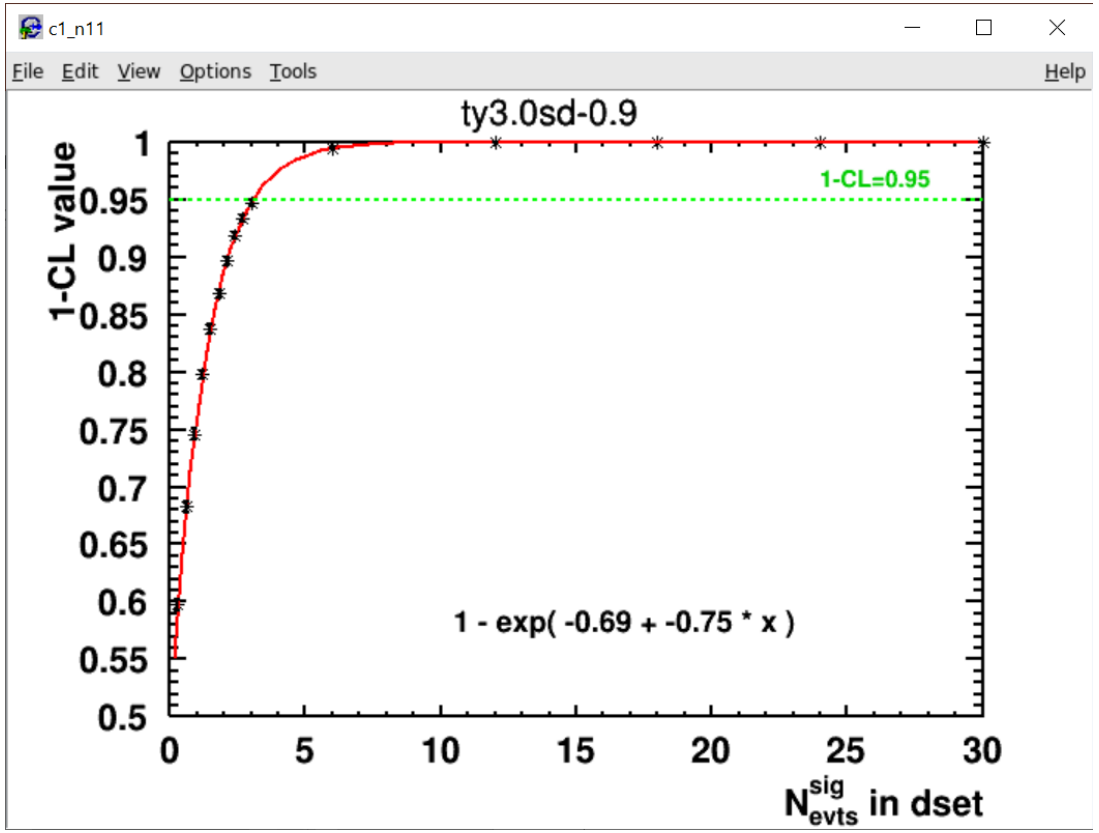

c1_n13
File Edit View Options Tools Help
ty3.0sd-0.5
1-CL value
1-CL=0.9
1 - exp(-0.7 + -0.77 * x)
N^{sig}_{evts} in dset

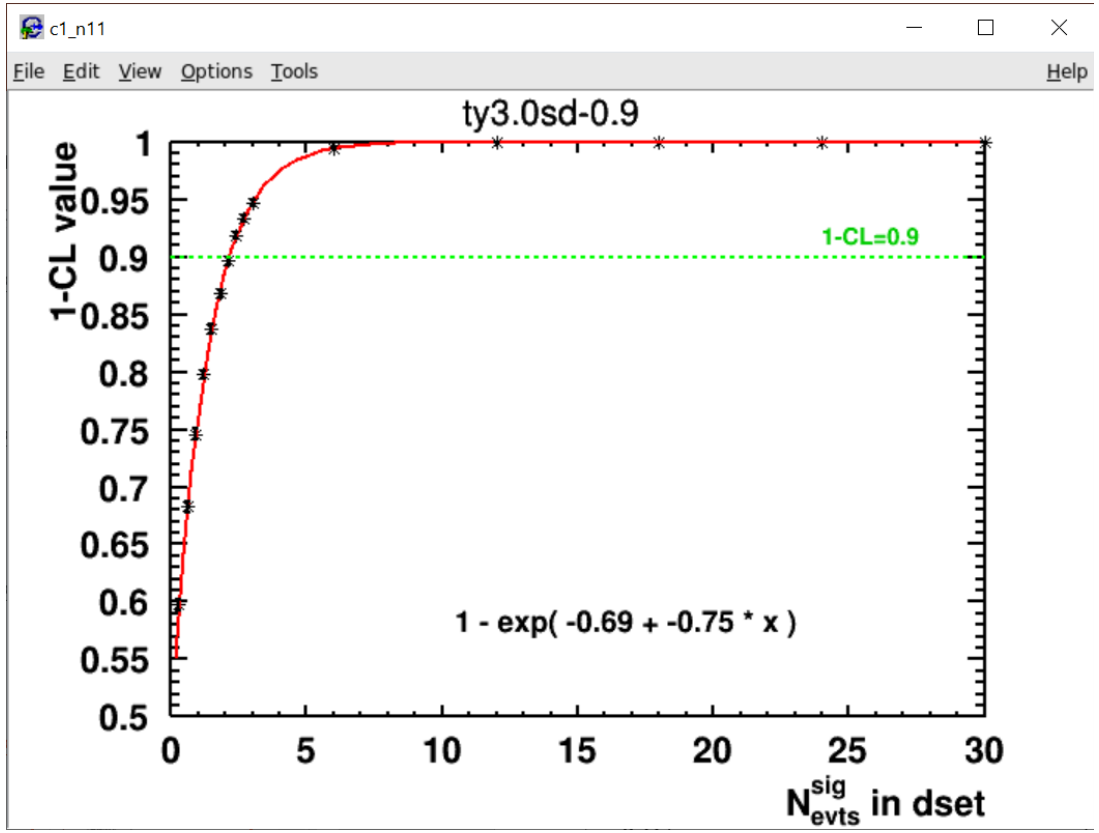
3yr


c1_n12
File Edit View Options Tools Help
ty3.0sd-0.7
1-CL value
1-CL=0.95
1 - exp(-0.69 + -0.73 * x)
N^{sig}_{evts} in dset

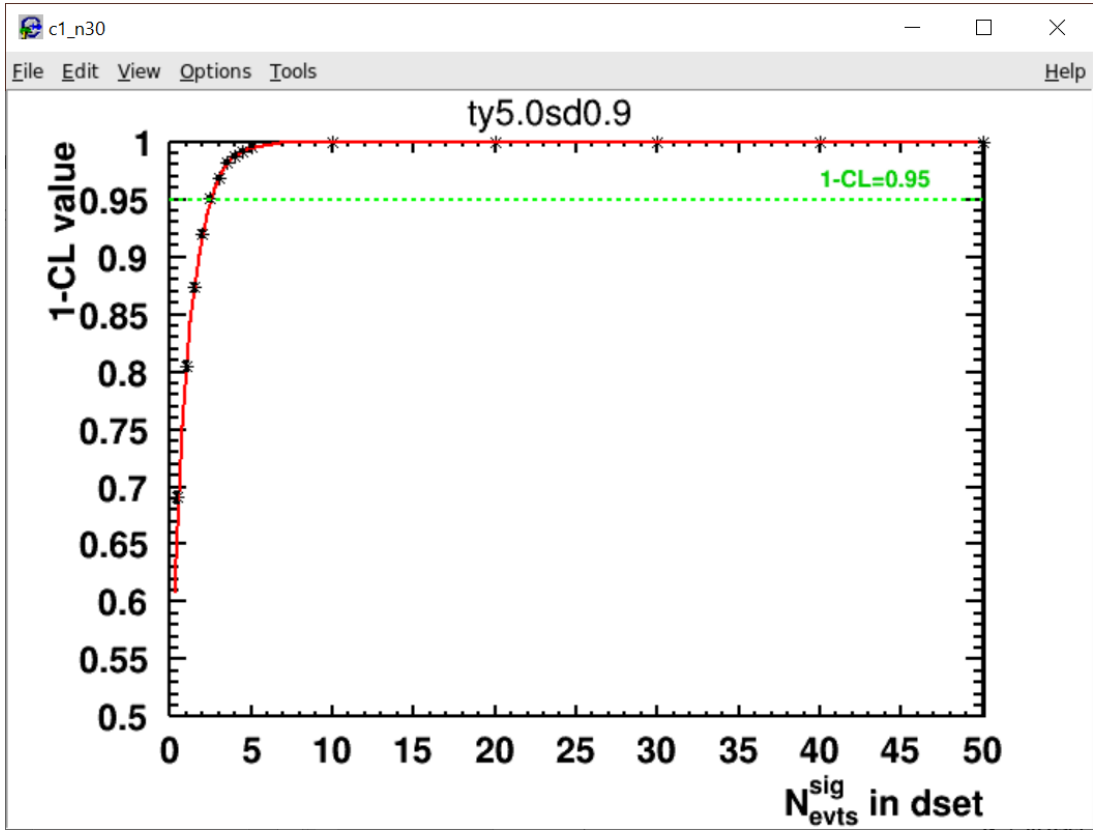

c1_n12
File Edit View Options Tools Help
ty3.0sd-0.7
1-CL value
1-CL=0.9
1 - exp(-0.69 + -0.73 * x)
N^{sig}_{evts} in dset

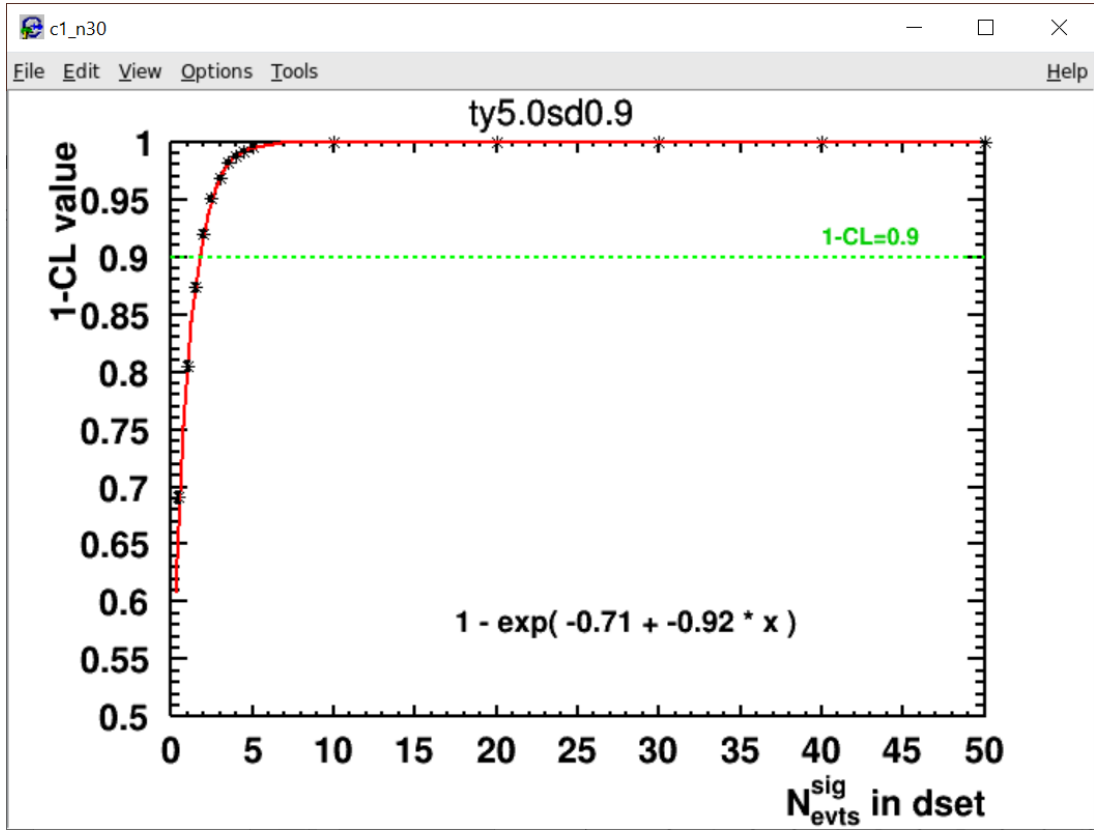
3yr


c1_n11
File Edit View Options Tools Help
ty3.0sd-0.9
1-CL value
1-CL=0.95
1 - exp(-0.69 + -0.75 * x)
N^{sig}_{evts} in dset

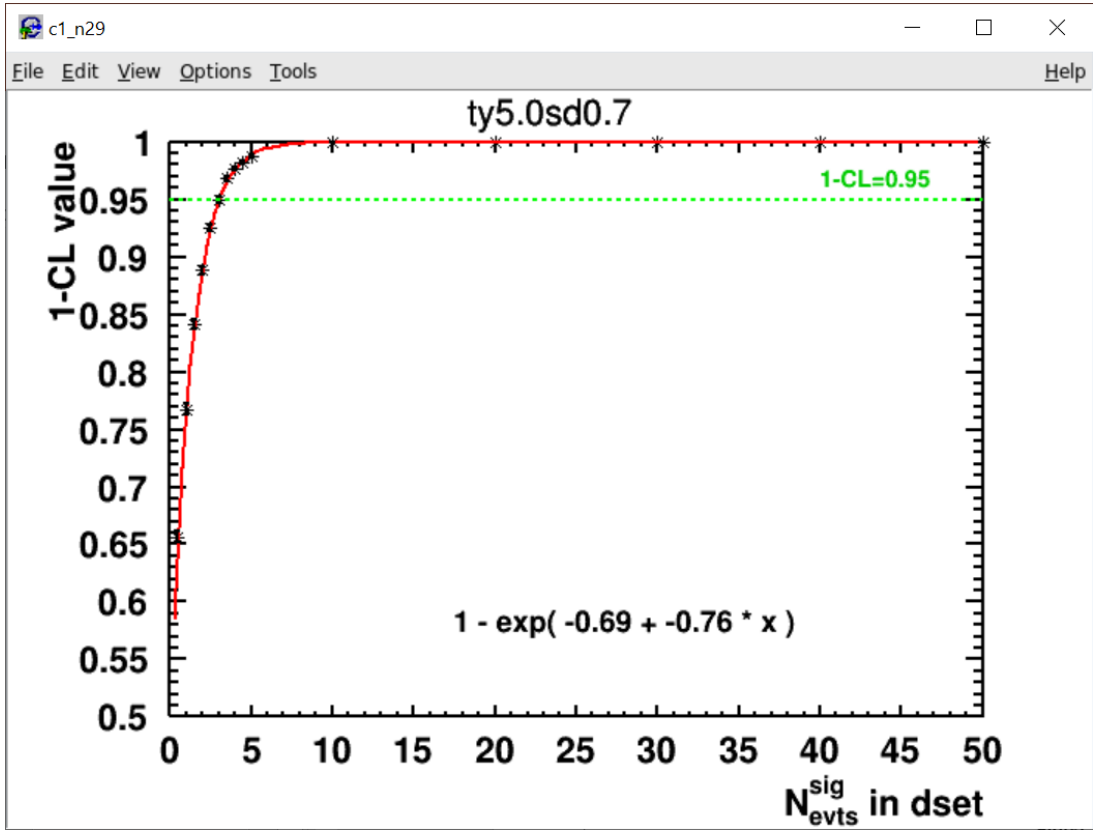

c1_n11
File Edit View Options Tools Help
ty3.0sd-0.9
1-CL value
1-CL=0.9
1 - exp(-0.69 + -0.75 * x)
N^{sig}_{evts} in dset

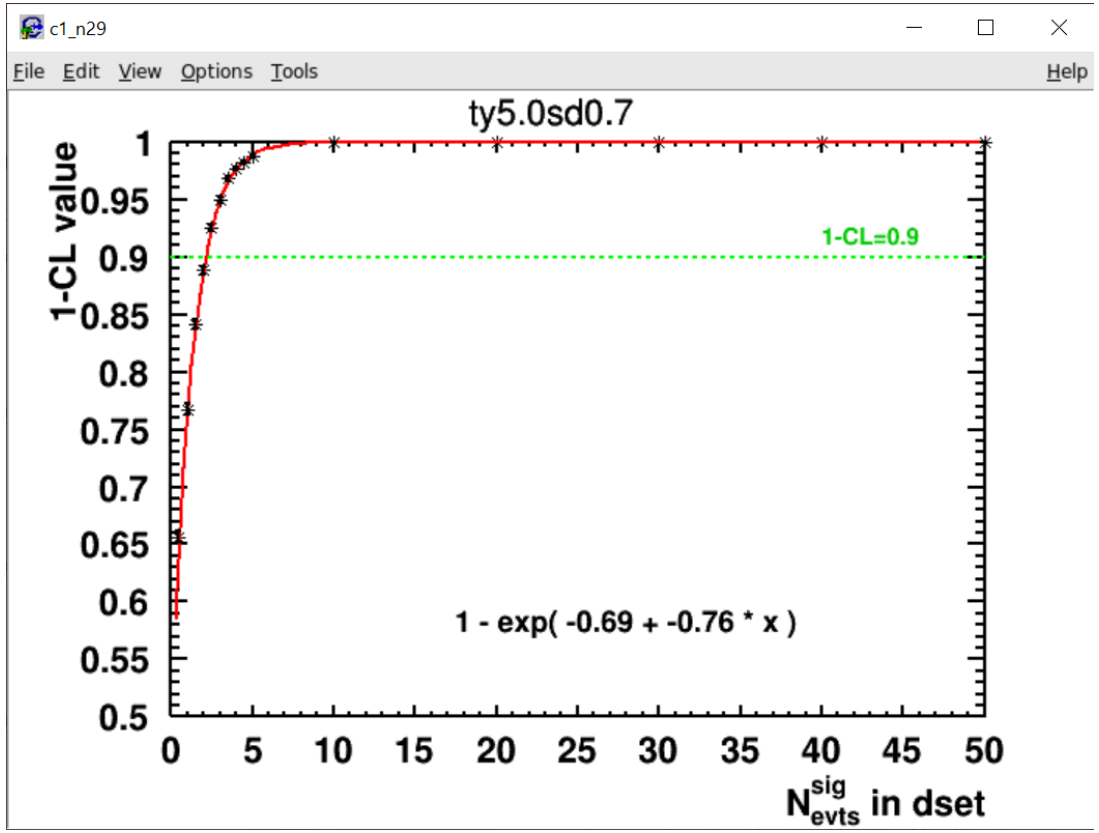
5yr


c1_n30
File Edit View Options Tools Help
ty5.0sd0.9
1-CL value
1-CL=0.95
N^{sig}_{evts} in dset

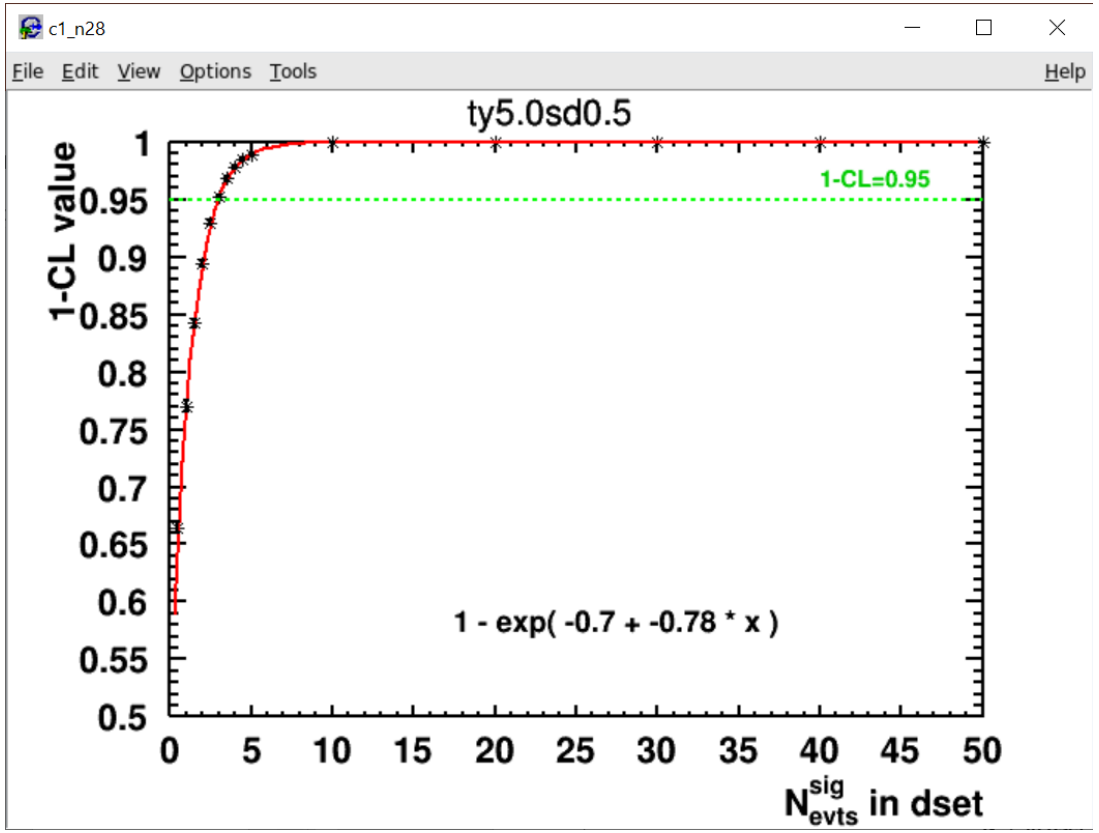

c1_n30
File Edit View Options Tools Help
ty5.0sd0.9
1-CL value
1-CL=0.9
1 - exp(-0.71 + -0.92 * x)
N^{sig}_{evts} in dset

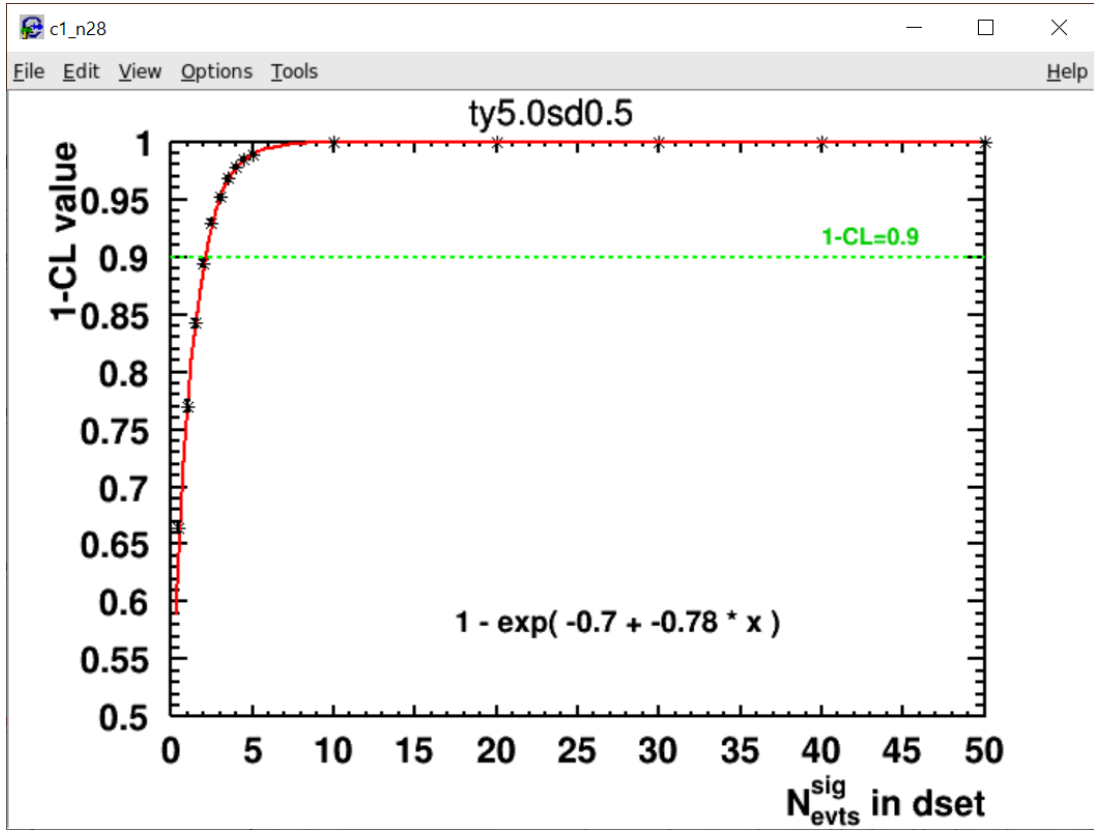
5yr


c1_n29
File Edit View Options Tools Help
ty5.0sd0.7
1-CL value
1-CL=0.95
1 - exp(-0.69 + -0.76 * x)
N^{sig}_{evts} in dset

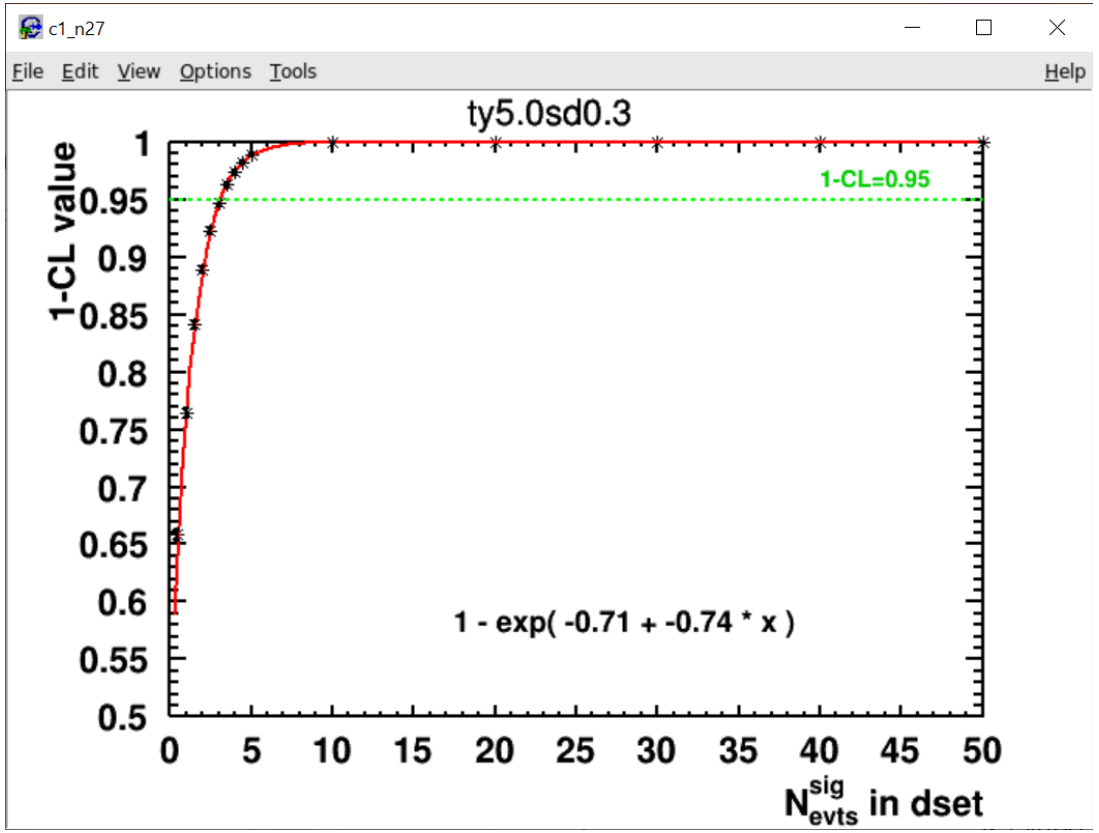

c1_n29
File Edit View Options Tools Help
ty5.0sd0.7
1-CL value
1-CL=0.9
1 - exp(-0.69 + -0.76 * x)
N^{sig}_{evts} in dset

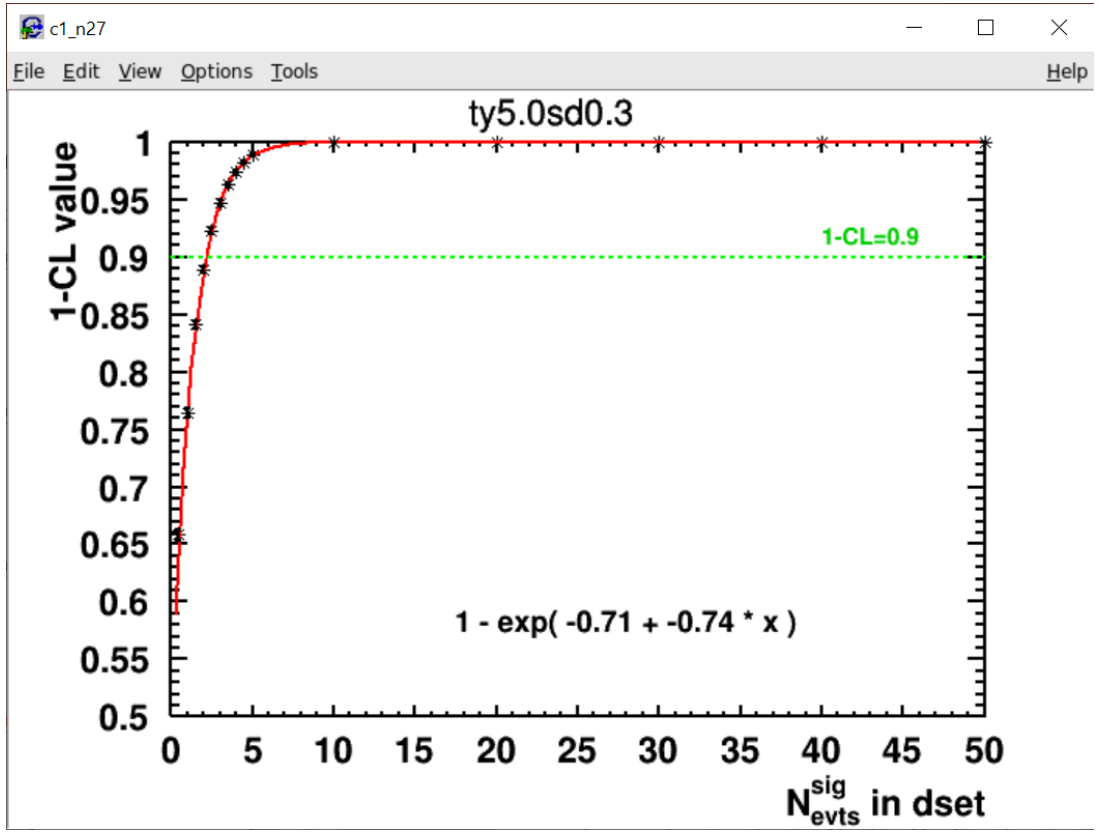
5yr


c1_n28
File Edit View Options Tools Help
ty5.0sd0.5
1-CL value
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
1-CL=0.95
1 - exp(-0.7 + -0.78 * x)
0 5 10 15 20 25 30 35 40 45 50
N sig evts in dset

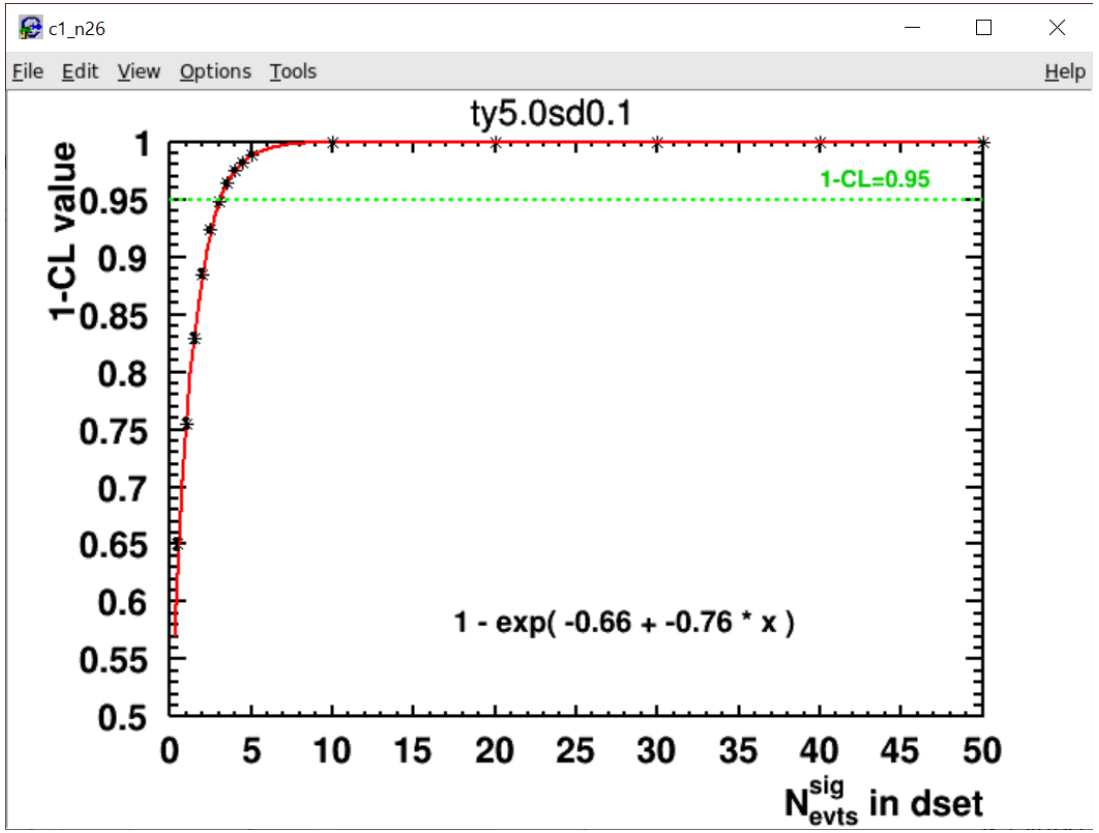

c1_n28
File Edit View Options Tools Help
ty5.0sd0.5
1-CL value
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
1-CL=0.9
1 - exp(-0.7 + -0.78 * x)
0 5 10 15 20 25 30 35 40 45 50
N sig evts in dset

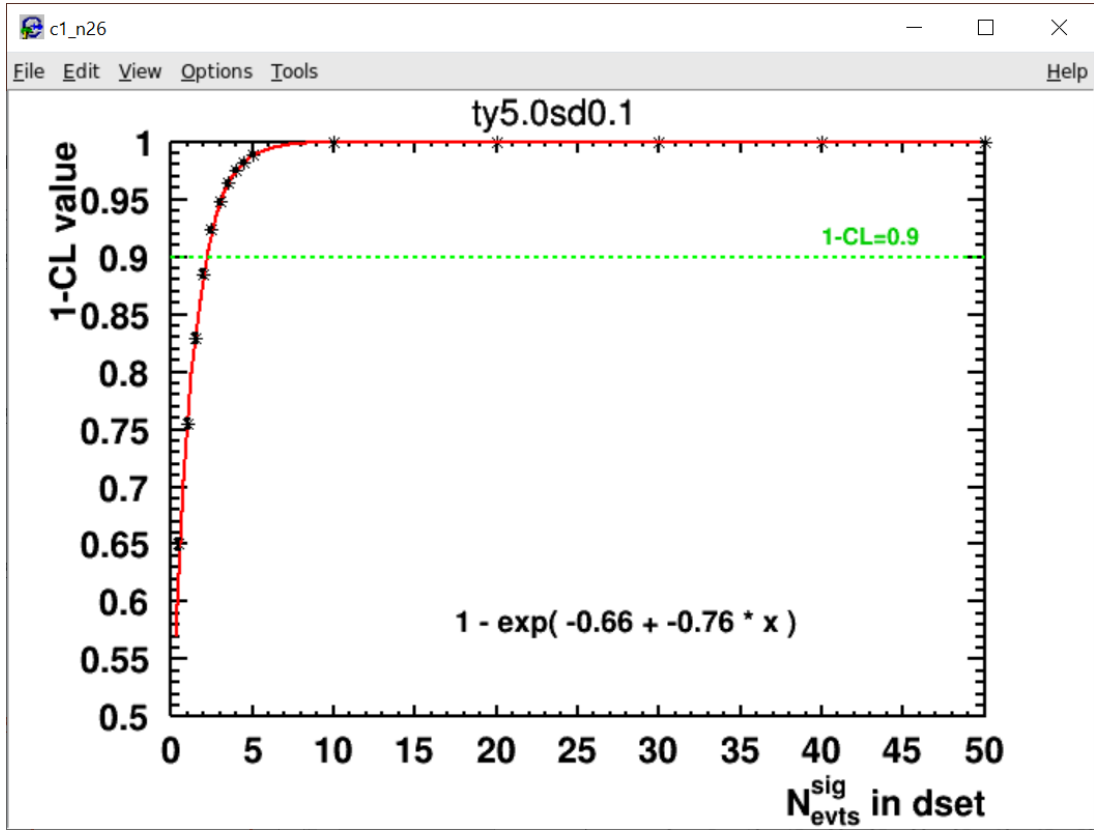
5yr


c1_n27
File Edit View Options Tools Help
ty5.0sd0.3
1-CL value
1-CL=0.95
1 - exp(-0.71 + -0.74 * x)
N^{sig}_{evts} in dset

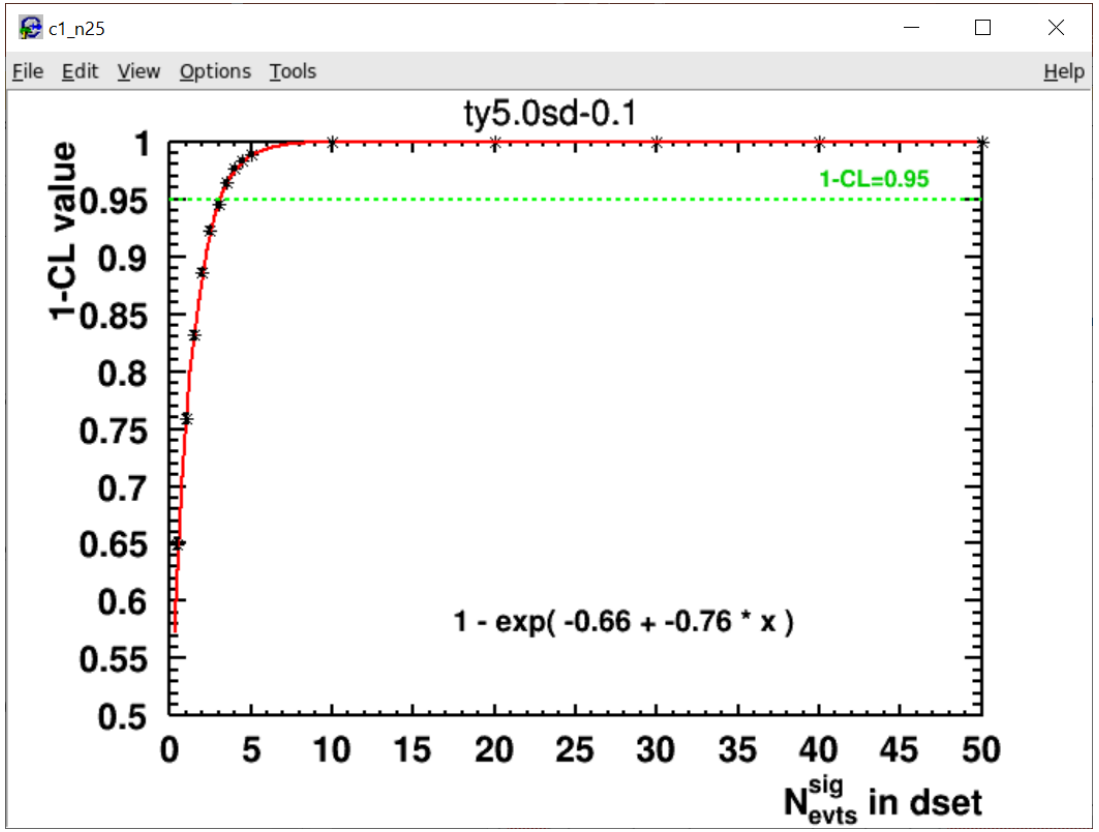

c1_n27
File Edit View Options Tools Help
ty5.0sd0.3
1-CL value
1-CL=0.9
1 - exp(-0.71 + -0.74 * x)
N^{sig}_{evts} in dset

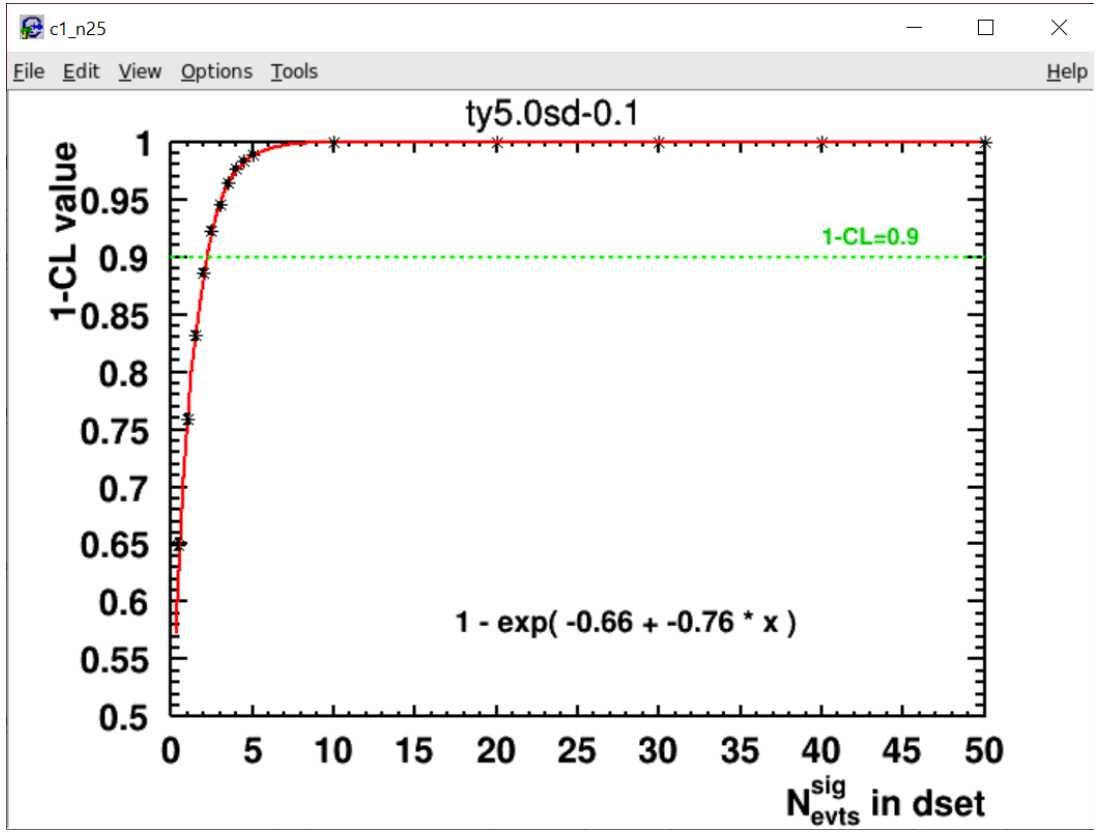
5yr


c1_n26
File Edit View Options Tools Help
ty5.0sd0.1
1-CL value
1-CL=0.95
1 - exp(-0.66 + -0.76 * x)
N^{sig}_{evts} in dset

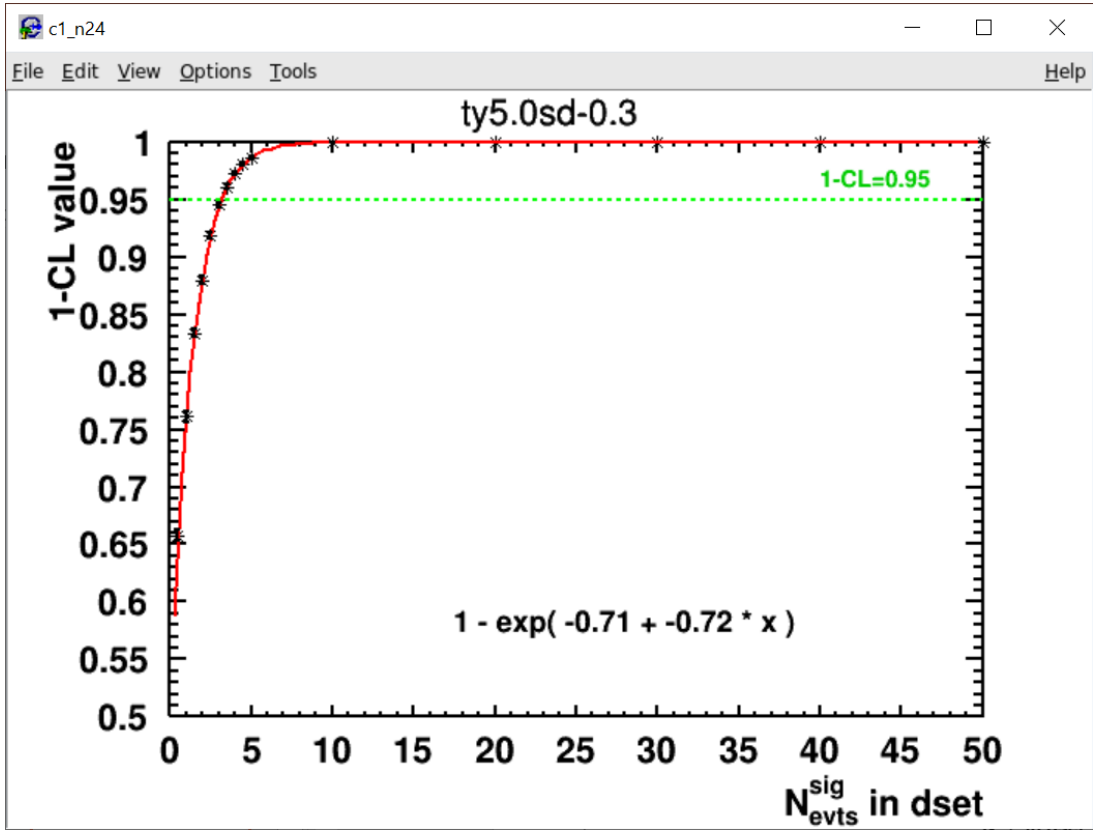

c1_n26
File Edit View Options Tools Help
ty5.0sd0.1
1-CL value
1-CL=0.9
1 - exp(-0.66 + -0.76 * x)
N^{sig}_{evts} in dset

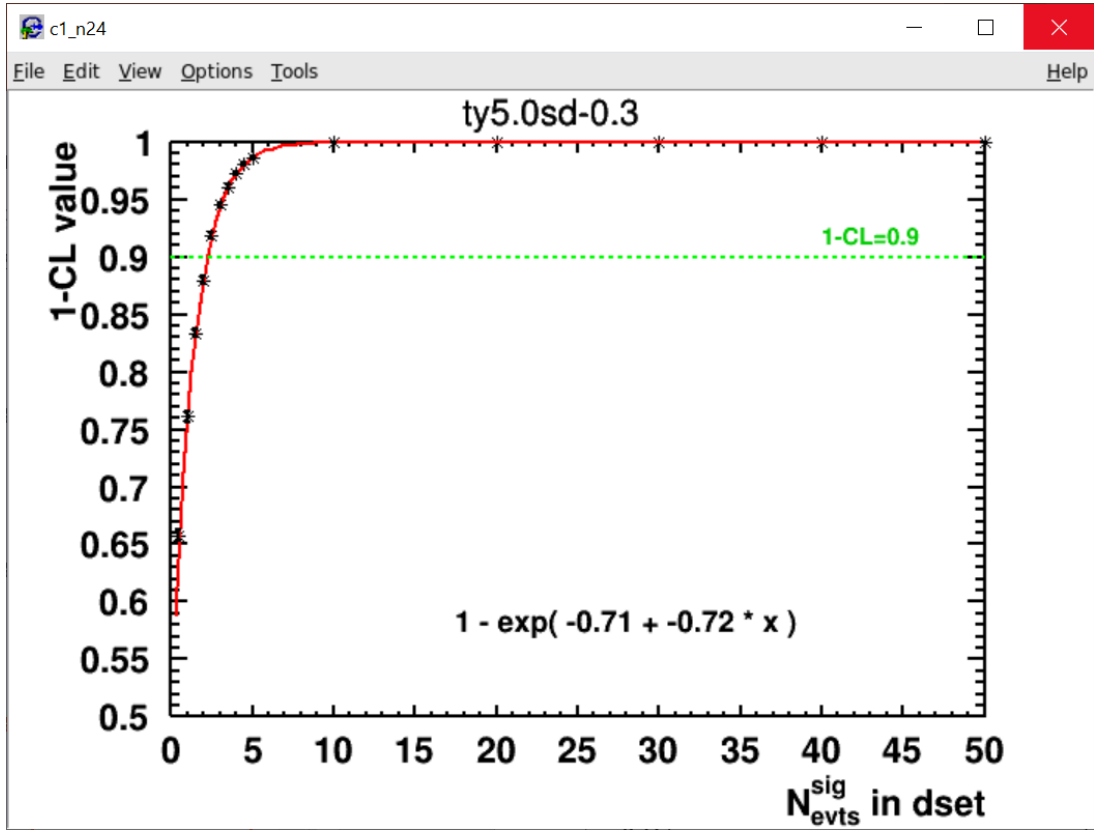
5yr


c1_n25
File Edit View Options Tools Help
ty5.0sd-0.1
1-CL value
1-CL=0.95
1 - exp(-0.66 + -0.76 * x)
N^{sig}_{evts} in dset

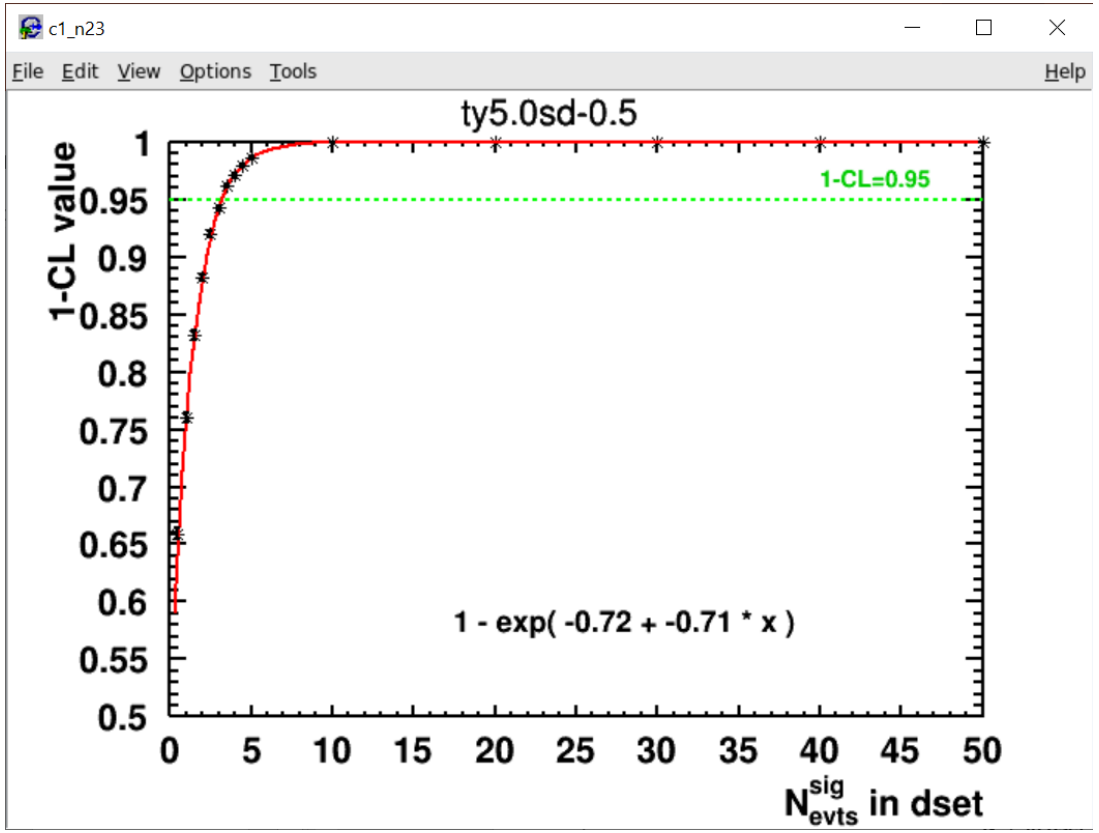

c1_n25
File Edit View Options Tools Help
ty5.0sd-0.1
1-CL value
1-CL=0.9
1 - exp(-0.66 + -0.76 * x)
N^{sig}_{evts} in dset

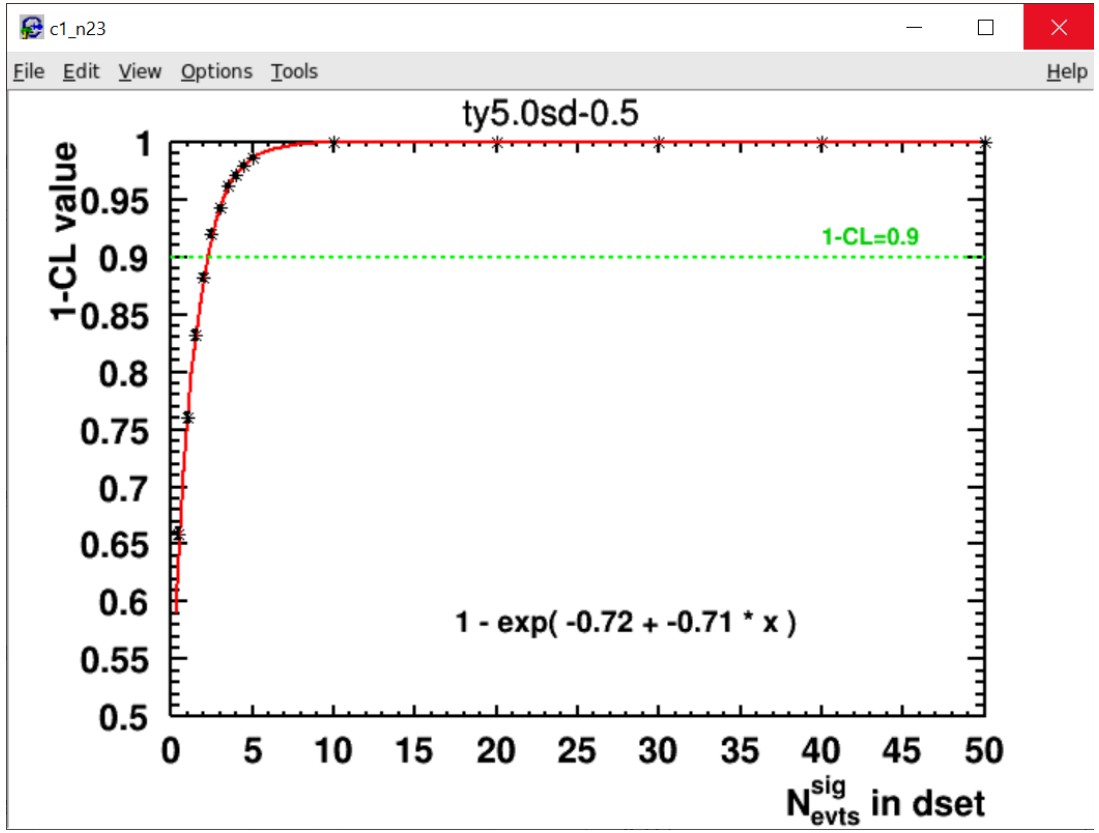
5yr


c1_n24
File Edit View Options Tools Help
ty5.0sd-0.3
1-CL value
1-CL=0.95
1 - exp(-0.71 + -0.72 * x)
N^{sig}_{evts} in dset

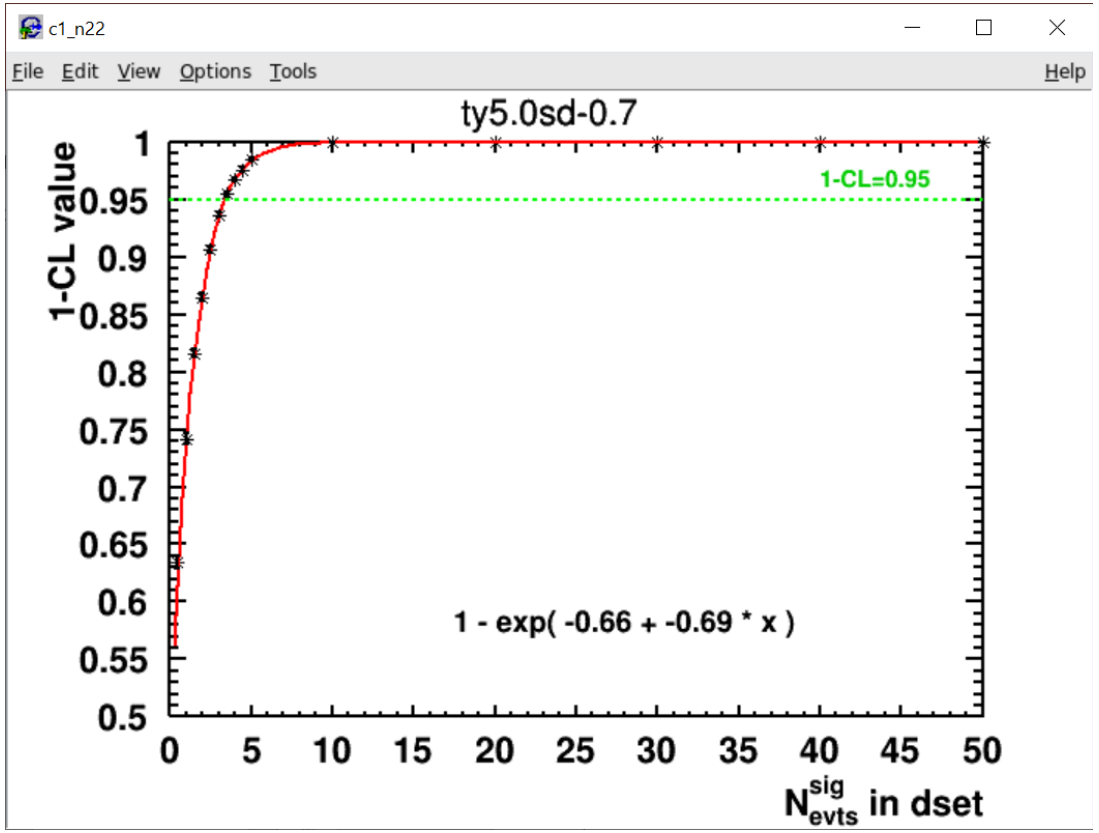

c1_n24
File Edit View Options Tools Help
ty5.0sd-0.3
1-CL value
1-CL=0.9
1 - exp(-0.71 + -0.72 * x)
N^{sig}_{evts} in dset

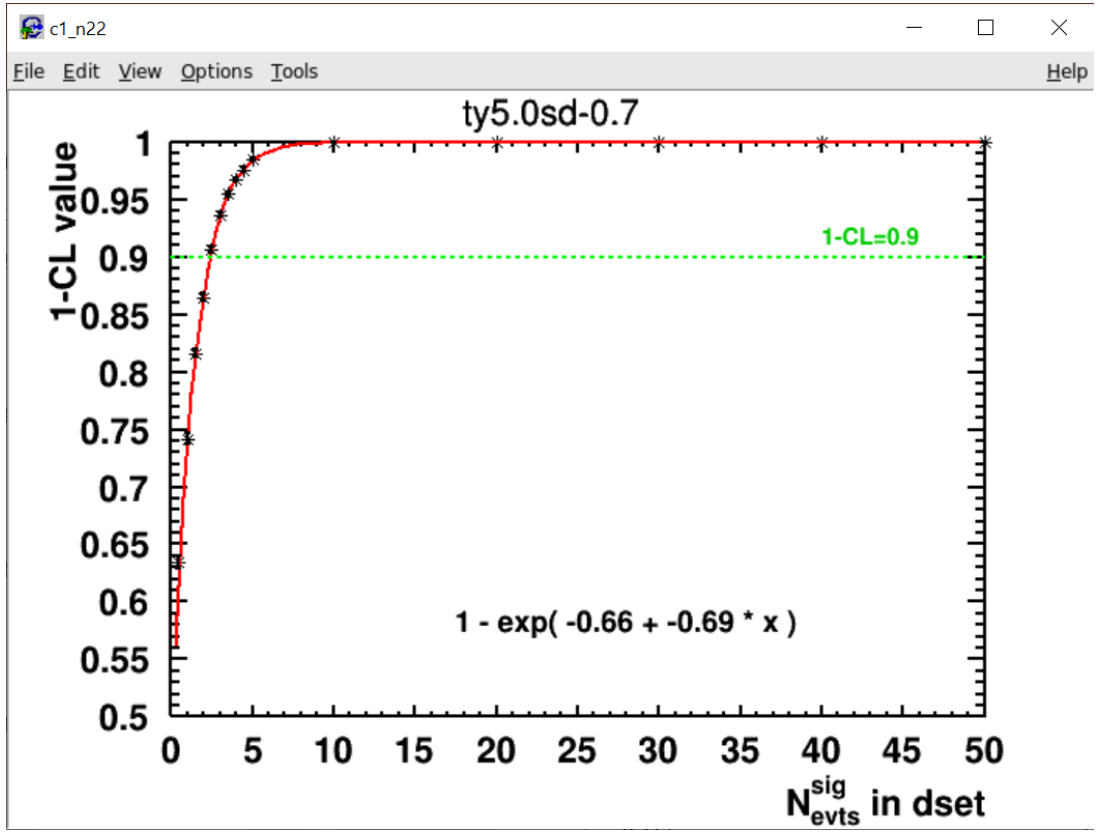
5yr


c1_n23
File Edit View Options Tools Help
ty5.0sd-0.5
1-CL value
1-CL=0.95
1 - exp(-0.72 + -0.71 * x)
N^{sig}_{evts} in dset

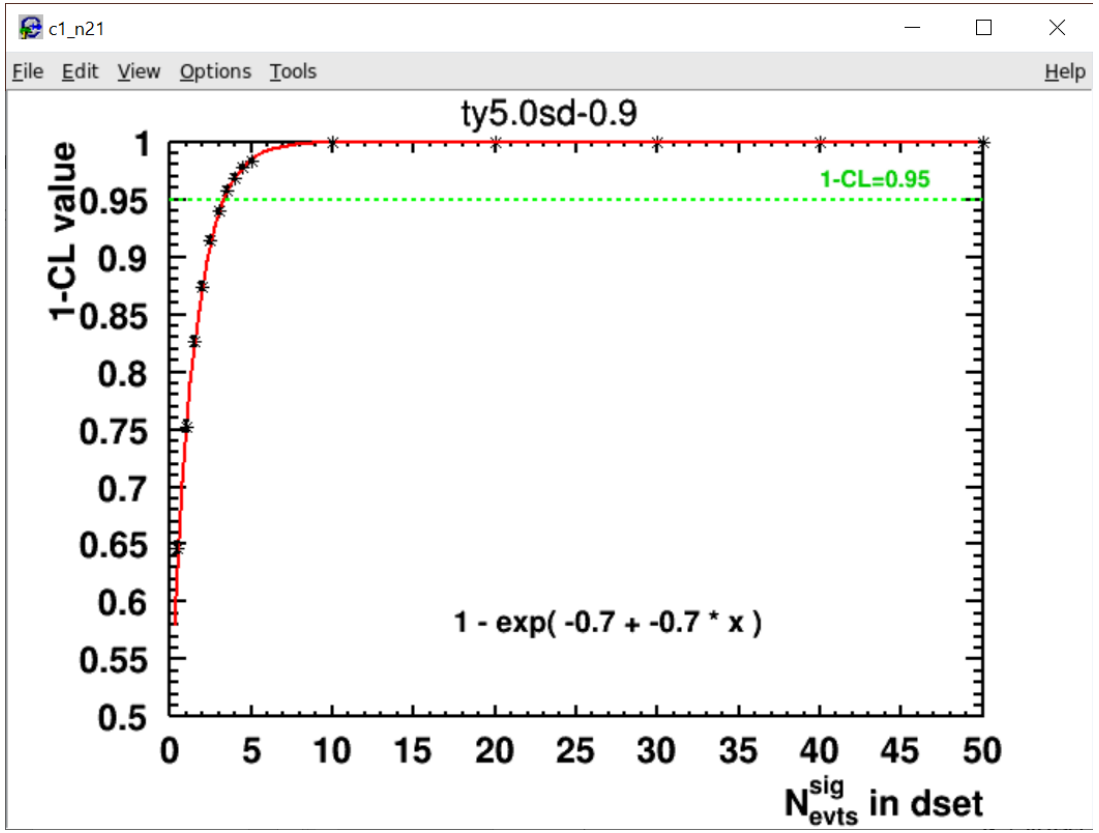

c1_n23
File Edit View Options Tools Help
ty5.0sd-0.5
1-CL value
1-CL=0.9
1 - exp(-0.72 + -0.71 * x)
N^{sig}_{evts} in dset

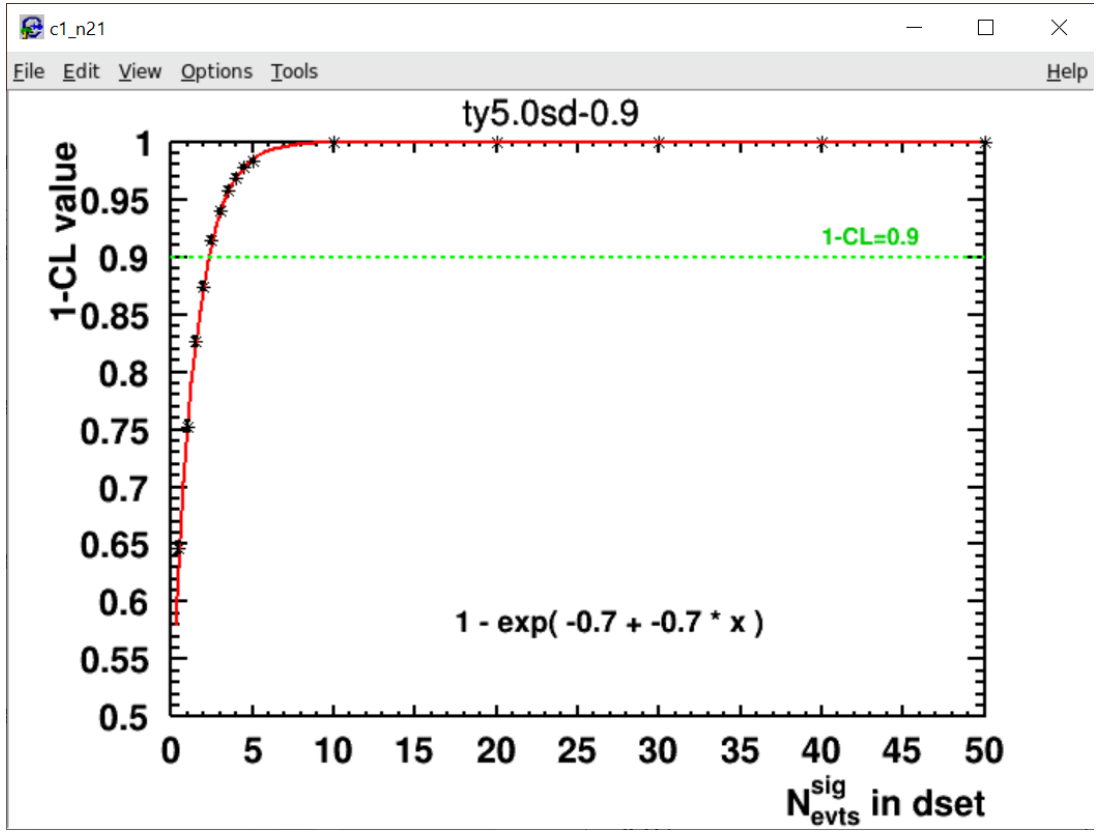
5yr


c1_n22
File Edit View Options Tools Help
ty5.0sd-0.7
1-CL value
1-CL=0.95
1 - exp(-0.66 + -0.69 * x)
N^{sig}_{evts} in dset


c1_n22
File Edit View Options Tools Help
ty5.0sd-0.7
1-CL value
1-CL=0.9
1 - exp(-0.66 + -0.69 * x)
N^{sig}_{evts} in dset

5yr


c1_n21
File Edit View Options Tools Help
ty5.0sd-0.9
1-CL value
1-CL=0.95
1 - exp(-0.7 + -0.7 * x)
N^{sig}_{evts} in dset


c1_n21
File Edit View Options Tools Help
ty5.0sd-0.9
1-CL value
1-CL=0.9
1 - exp(-0.7 + -0.7 * x)
N^{sig}_{evts} in dset

(Investigate flux)

```
>>> for i in [-0.9, -0.7, -0.5, -0.3, -0.1, 0.1, 0.3, 0.5, 0.7, 0.9]:
...     point_E2    = ROOT.PointSourceComponent("point", detres, 2, 1, asin(i))
...     PF_E2       = point_E2.getflux()
...     N0 = detres.Aeff.GetRateDecl( i, PF_E2 )
...     print("for decl:", i, "sin(dec) = ", sin(i), " fluxrate = ", detres.Aeff.GetRateDecl( i, PF_E2 ))
...

for decl: -0.9 sin(dec) =  -0.7833269096274834  fluxrate =  1099.8644065152307

for decl: -0.7 sin(dec) =  -0.644217687237691  fluxrate =  888.6982021350441

for decl: -0.5 sin(dec) =  -0.479425538604203  fluxrate =  755.1866784614216

for decl: -0.3 sin(dec) =  -0.29552020666133955  fluxrate =  685.0116266141235

for decl: -0.1 sin(dec) =  -0.09983341664682815  fluxrate =  647.5611606376762

for decl: 0.1 sin(dec) =  0.09983341664682815  fluxrate =  618.5713999471976

for decl: 0.3 sin(dec) =  0.29552020666133955  fluxrate =  603.4983374369579

for decl: 0.5 sin(dec) =  0.479425538604203  fluxrate =  573.7645251312225

for decl: 0.7 sin(dec) =  0.644217687237691  fluxrate =  547.0003303943539

for decl: 0.9 sin(dec) =  0.7833269096274834  fluxrate =  493.5854943787892
>>>
```