(Solutions - day 2)

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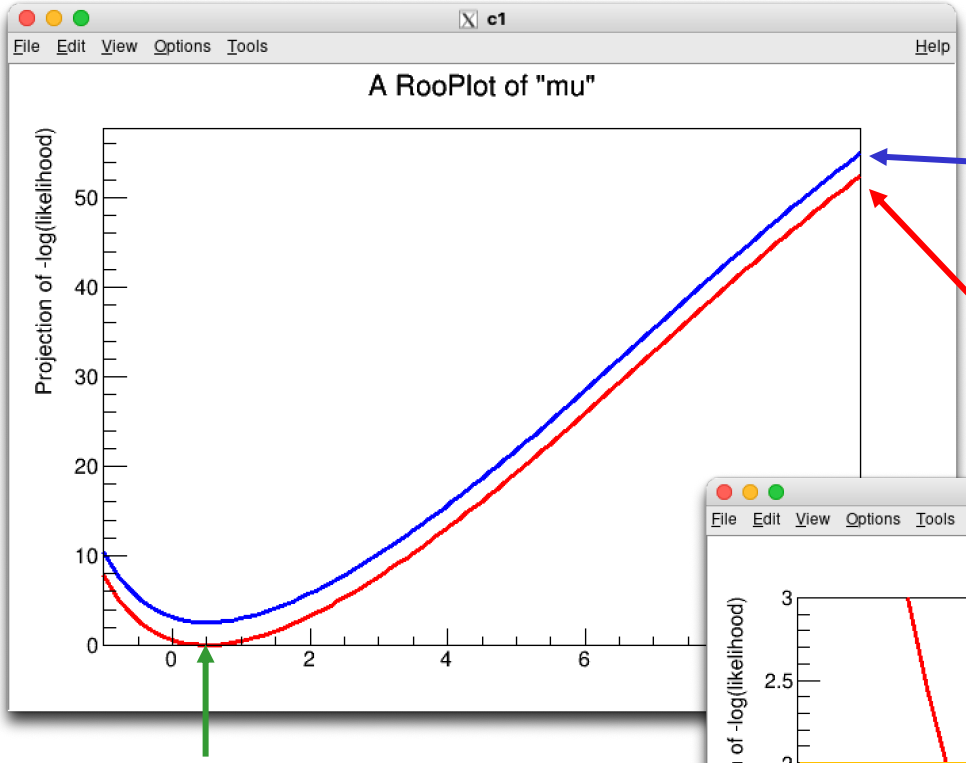
Solution – Exercise 9

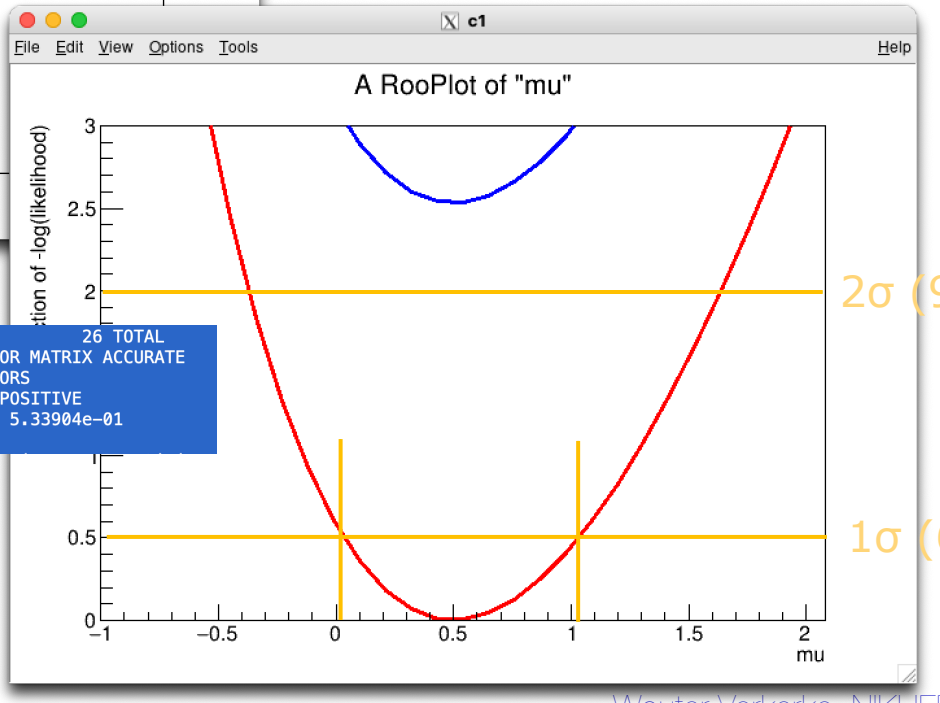


$P(N|\mu) = \text{Poisson}(N|\mu S+B)$
$= \text{Poisson}(N|\mu 10+20)$

$L(25|\ \mu)=\text{Poisson}(25|\ \mu 10+20)$

$\hat{\mu}=0.5$

$\lambda(\mu) = L(25|\mu)/L(25|0.5)$



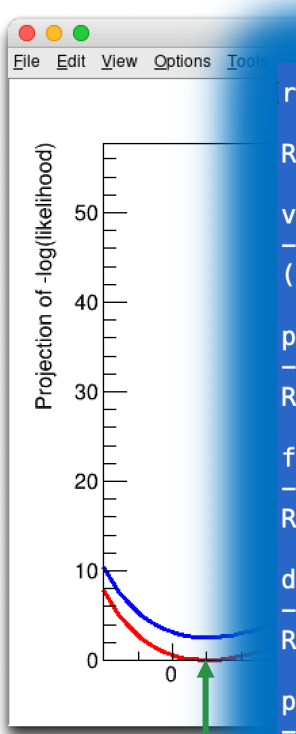

```
FCN=2.53171 FROM MINOS     STATUS=SUCCESSFUL      5 CALLS          26 TOTAL
                     EDM=3.72415e-09    STRATEGY= 1      ERROR MATRIX ACCURATE
  EXT PARAMETER                   PARABOLIC         MINOS ERRORS
  NO.   NAME      VALUE            ERROR       NEGATIVE       POSITIVE
   1  mu           5.00031e-01   4.98543e-01  -4.67268e-01   5.33904e-01
                               ERR DEF= 0.5
```

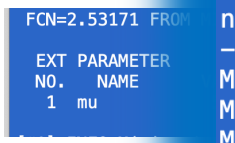
2σ (95%)

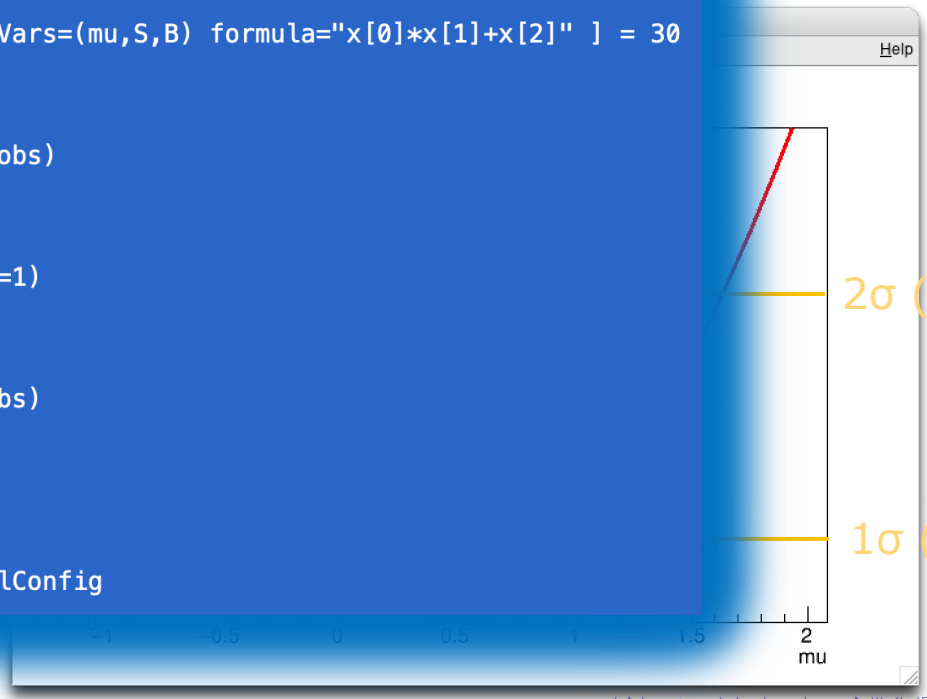
1σ (68%)

Solution – Exercise 9

```
root [3] w->Print("v")

RooWorkspace(w) w contents

variables
---------
(B,Nobs,S,mu)

p.d.f.s
-------
RooPoisson::model[ x=Nobs mean=Nexp ] = 0.0511153

functions
--------
RooFormulaVar::Nexp[ actualVars=(mu,S,B) formula="x[0]*x[1]+x[2]" ] = 30

datasets
--------
RooDataSet::observed_data(Nobs)

parameter snapshots
-------------------
ModelConfig__snapshot = (mu=1)

named sets
----------
ModelConfig_Observables:(Nobs)
ModelConfig_POI:(mu)
ModelConfig__snapshot:(mu)

generic objects
---------------
RooStats::ModelConfig::ModelConfig
```







P(N|μ) = Poisson(N|μS+B)

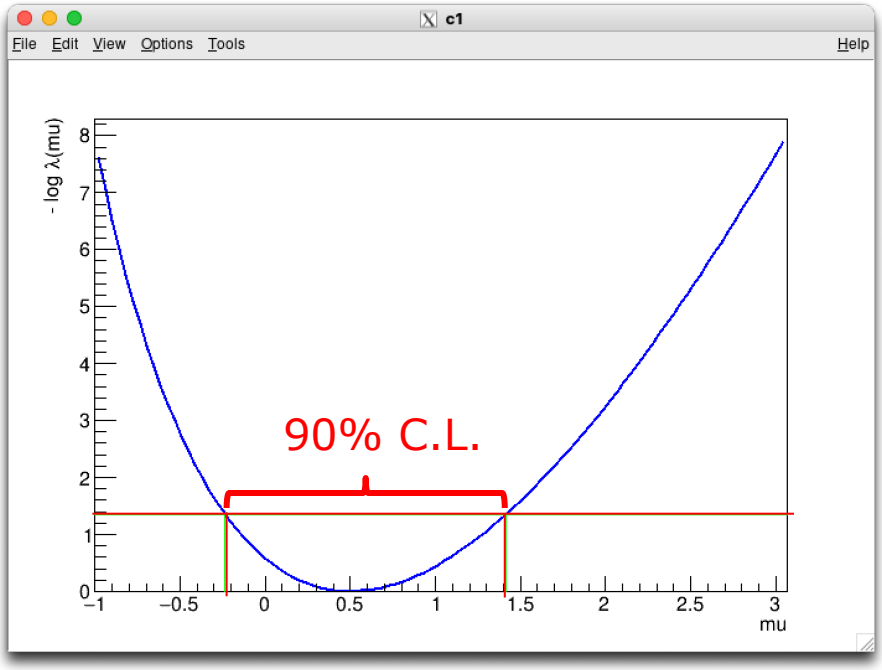
(N|μ10+20)

25| μ10+20)

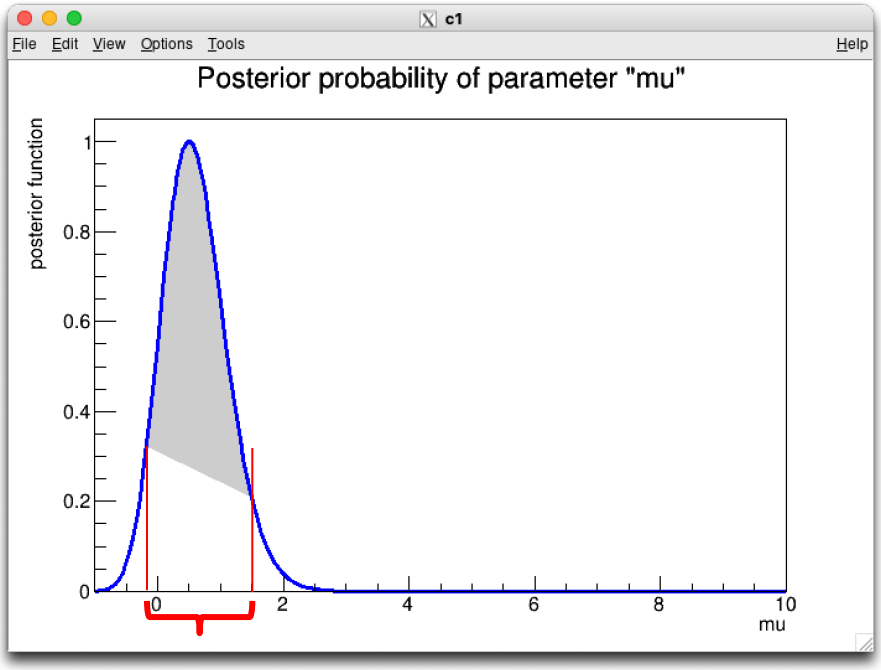
25|0.5)

Solution – Exercise 10

PLR interval



Bayesian interval



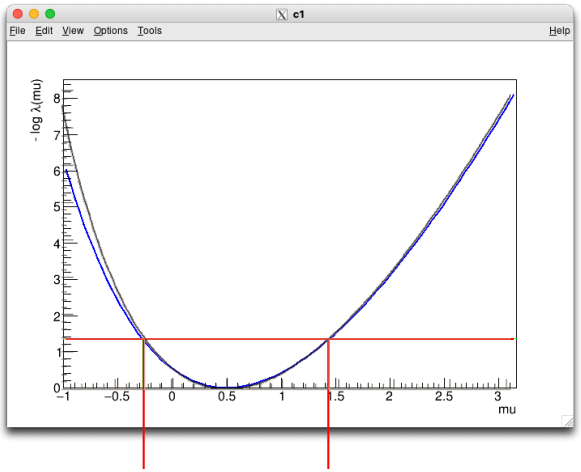
90% C.L.

```
RESULT: 90% interval is : [-0.234825, 1.41498]
```

```
INFO:Eval -- BayesianCalculator::GetInterval -
found a valid interval : [-0.178229 , 1.49173 ]
```

Solution – Exercise 11

ex11/ex09



$P(N_{SR},N_{CR}|\mu) = \text{Poisson}(N_{SR}|\mu S+B)\text{Poisson}(N_{CR}|\tau B)$

```
root [1] w->Print("t")

RooWorkspace(w) w contents

variables
---------
(B,Nobs_CR,Nobs_SR,S,mu,tau)

p.d.f.s
-------
RooProdPdf::model[ model_SR * model_CR ] = 0.00144134
  RooPoisson::model_SR[ x=Nobs_SR mean=Nexp_SR ] = 0.0511153
    RooFormulaVar::Nexp_SR[ actualVars=(mu,S,B) formula="x[0]*x[1]+x[2]" ] = 30
  RooPoisson::model_CR[ x=Nobs_CR mean=Nexp_CR ] = 0.0281977
    RooFormulaVar::Nexp_CR[ actualVars=(tau,B) formula="x[0]*x[1]" ] = 200

datasets
```

with $N_{SR}=25$, $N_{CR}=200$, $\tau=10 \rightarrow B=20$, $\mu=0.5$

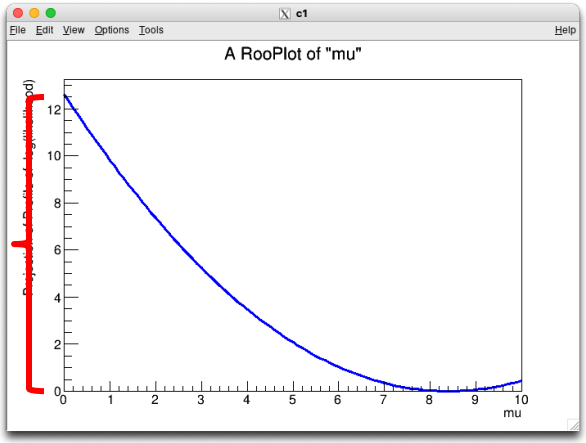
$L_{ex11}(25,200|\mu,B) = \text{Poisson}(25|\mu 10+B)\text{Poisson}(200|10B)$

similar to ex09

$$L_{ex09}(25|\ \mu) = \text{Poisson}(25|\ \mu 10+20)$$

however in ex11, bkg is *not* presumed exactly known
slight broadening of interval

Solution – Exercise 11



$P(N_{SR},N_{CR}|\mu) = \text{Poisson}(N_{SR}|\mu S+B)\text{Poisson}(N_{CR}|\tau B)$

```
root [1] w->Print("t")

RooWorkspace(w) w contents

variables
---------
(B,Nobs_CR,Nobs_SR,S,mu,tau)

p.d.f.s
-------
RooProdPdf::model[ model_SR * model_CR ] = 0.00144134
  RooPoisson::model_SR[ x=Nobs_SR mean=Nexp_SR ] = 0.0511153
    RooFormulaVar::Nexp_SR[ actualVars=(mu,S,B) formula="x[0]*x[1]+x[2]" ] = 30
  RooPoisson::model_CR[ x=Nobs_CR mean=Nexp_CR ] = 0.0281977
    RooFormulaVar::Nexp_CR[ actualVars=(tau,B) formula="x[0]*x[1]" ] = 200

datasets
```

with $N_{SR}=184$, $N_{CR}=100$, $\tau=1 \rightarrow B=100$, $\mu=8.4$

$t^{\mu}(0) = 0.5Z^2$

$5\sigma \rightarrow t^{\mu}(0) = 12.5$

$L_{ex11}(184,100|\mu,B) = \text{Poisson}(184|\mu 10+B)\text{Poisson}(100|B)$