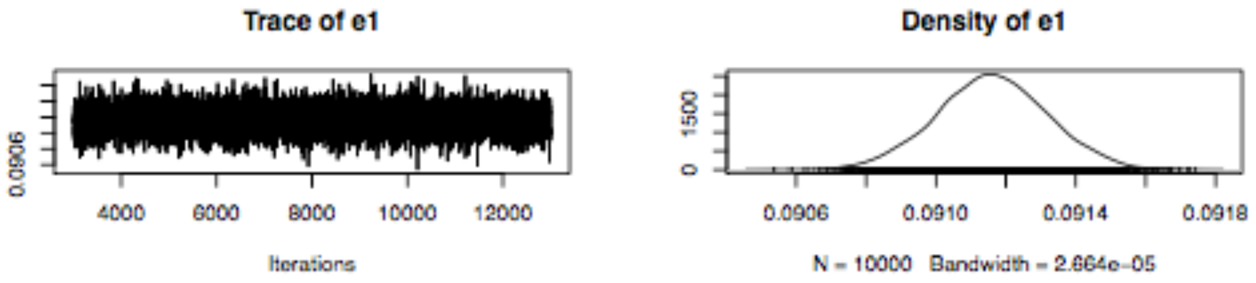
what if we get rid of the intrinsic scatter?

```
## broad priors:
#  e1 <- 0.0912
  e1 ~ dunif(0.01, 1.0)
  ex <- 0.0912
  gi <- 2.93
  gf <- 0.0794
#  gi ~ dunif(0.01, 100)
#  gf ~ dunif(0.01, 100)
  ri <- 6.0
  rf <- 5.0
  ue <- 0.0
```

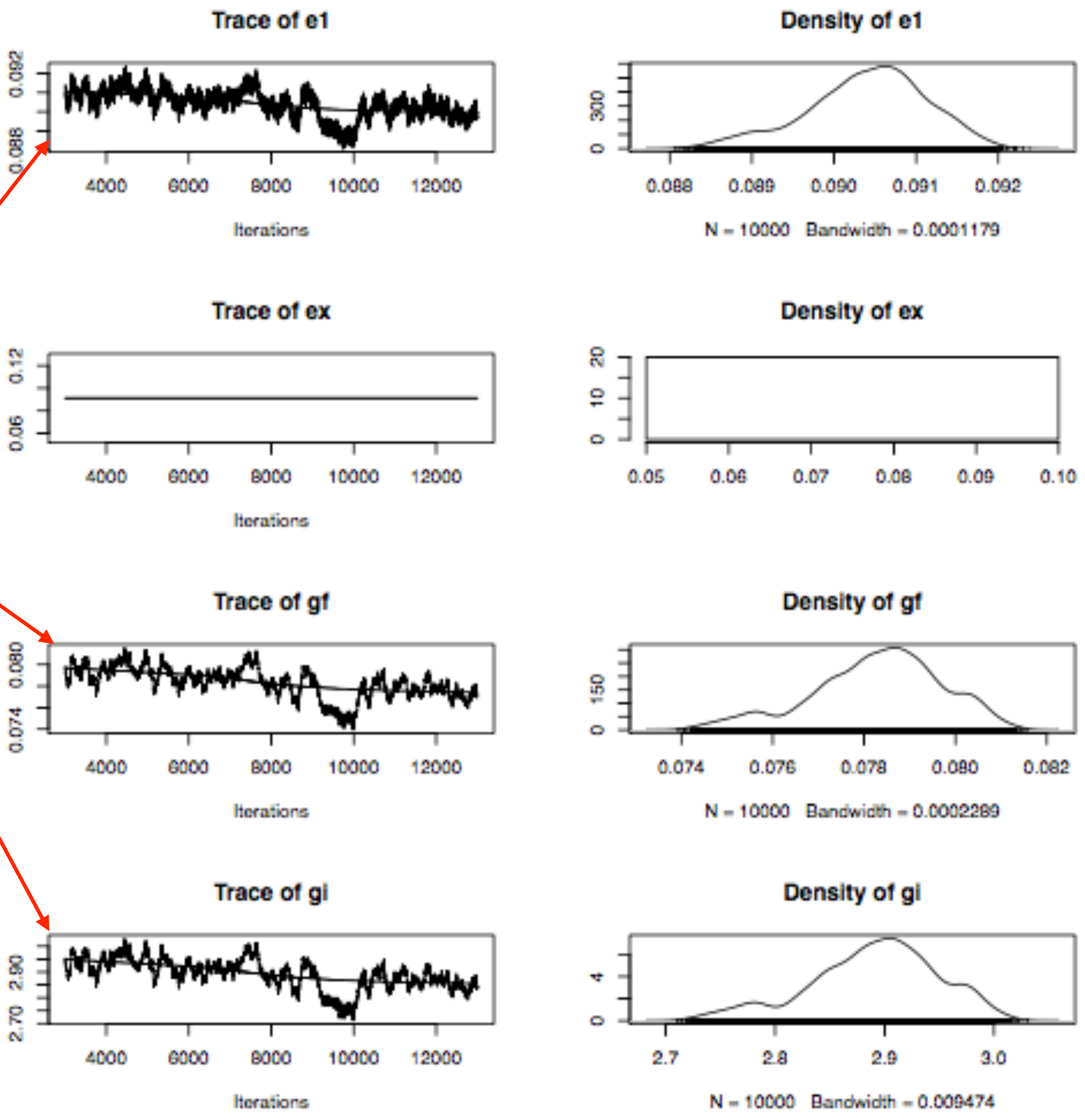
sample only energy

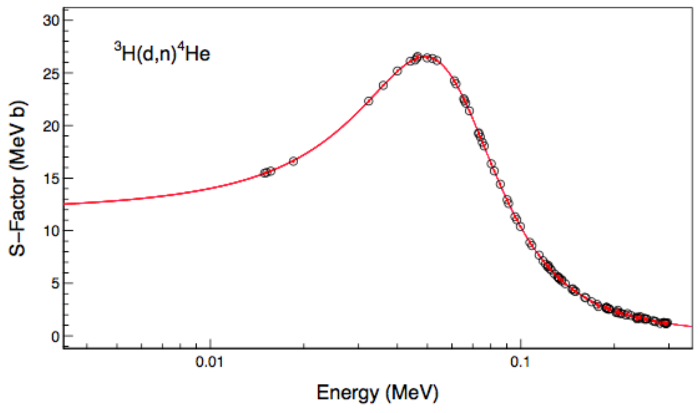


```
## broad priors:
#  e1 <- 0.0912
   e1 ~ dunif(0.01, 0.2)
   ex <- 0.0912
#  gi <- 2.93
#  gf <- 0.0794
   gi ~ dunif(0.0, 10)
   gf ~ dunif(0.0, 10)
   ri <- 6.0
   rf <- 5.0
   ue <- 0.0
```

why strong correlation??

sample energy and reduced widths





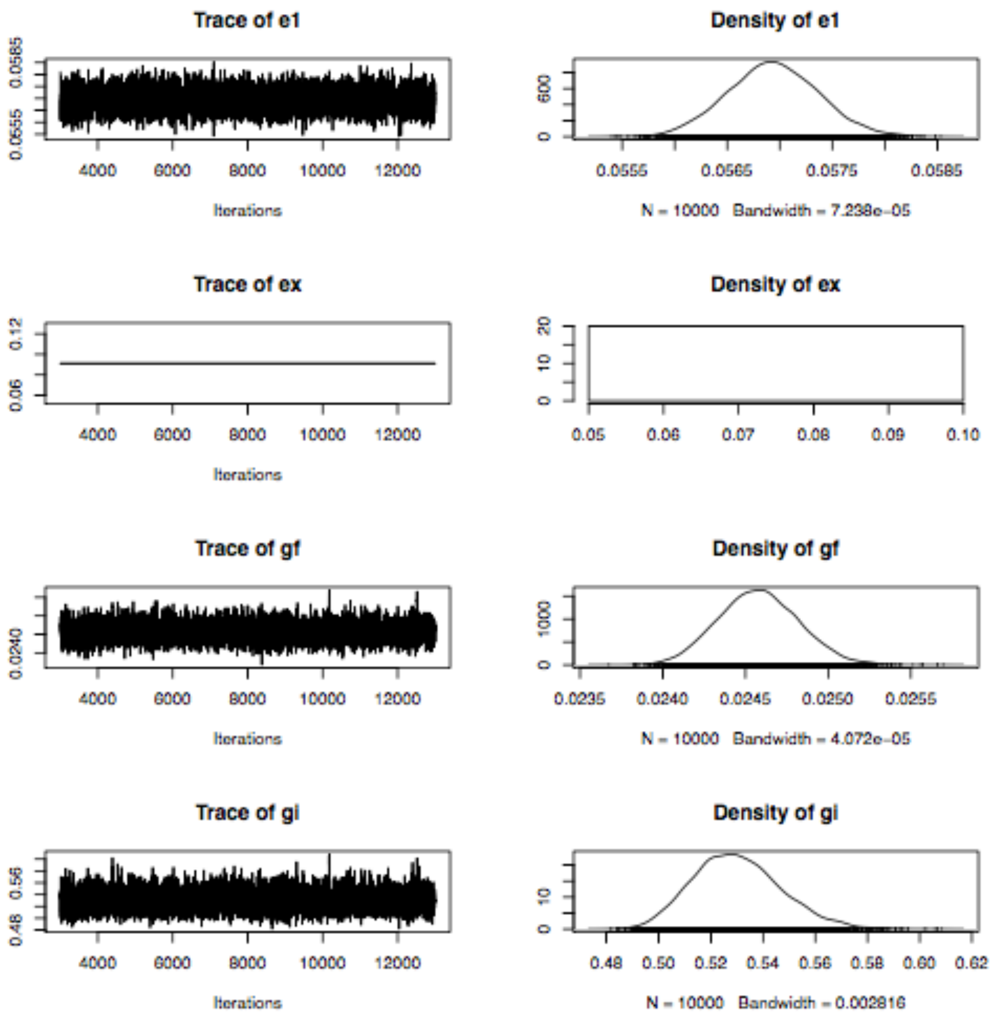
question:

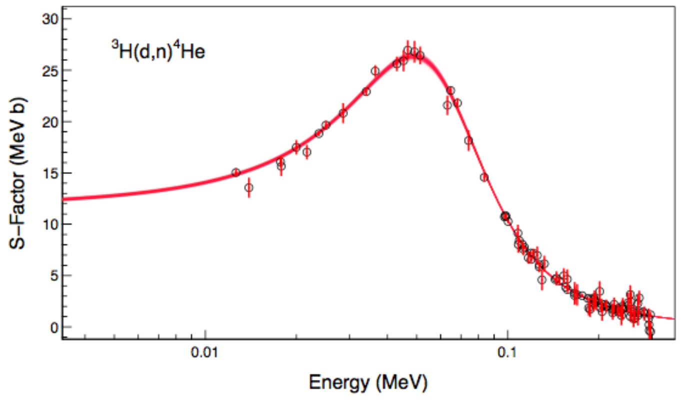
how does the chain look like for a PREDICTED S-factor at a given energy?

```
## broad priors:
#  e1 <- 0.0912
   e1 ~ dunif(0.01, 1.0)
   ex <- 0.0912
#  gi <- 2.93
#  gf <- 0.0794
   gi ~ dunif(0.0, 100)
   gf ~ dunif(0.0, 100)
   ri <- 6.0
   rf <- 5.0
   ue <- 0.0
```

```
bar[1] <- 0.0912   # eigenenergy
bar[2] <- 0.0912   # Er for Bc=Sc(Er)
bar[3] <- 2.93     # reduced width incoming
bar[4] <- 0.0794   # reduced width outgoing
bar[5] <- 6.0
bar[6] <- 5.0
bar[7] <- 0.0
```

mixing looks good, but the artificial data have been generated with vastly different parameter values

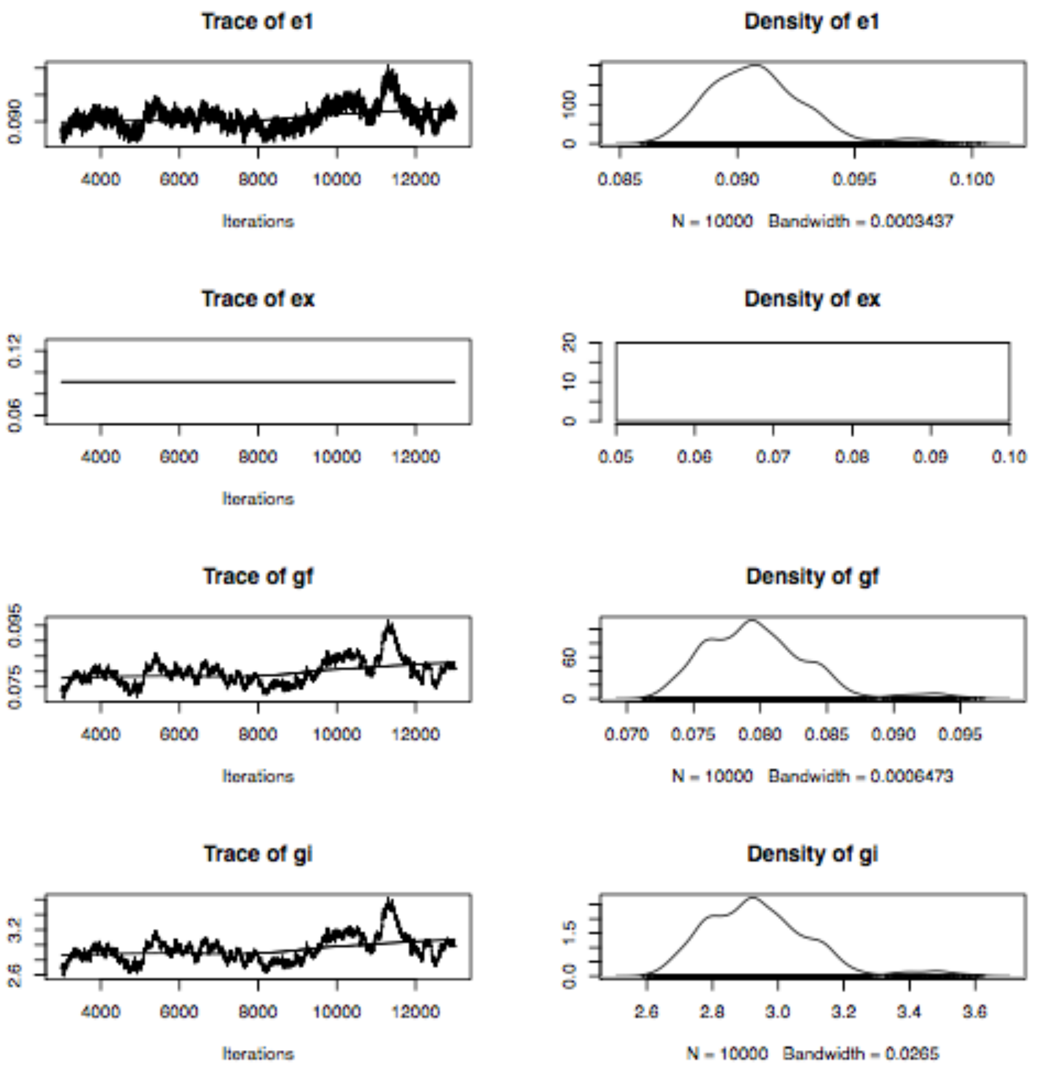


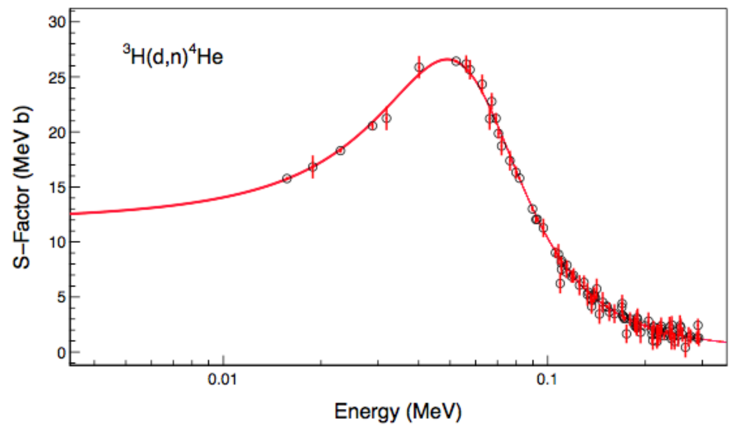


```
## broad priors:
#  e1 <- 0.0912
  e1 ~ dunif(0.01, 1.0)
  ex <- 0.0912
#  gi <- 2.93
#  gf <- 0.0794
  gi ~ dunif(0.0, 100)
  gf ~ dunif(0.0, 100)
  ri <- 6.0
  rf <- 5.0
  ue <- 0.0
```

```
inits = list(e1 = 0.091, gi = 2.9, gf = 0.079),
```

with initial starting values...



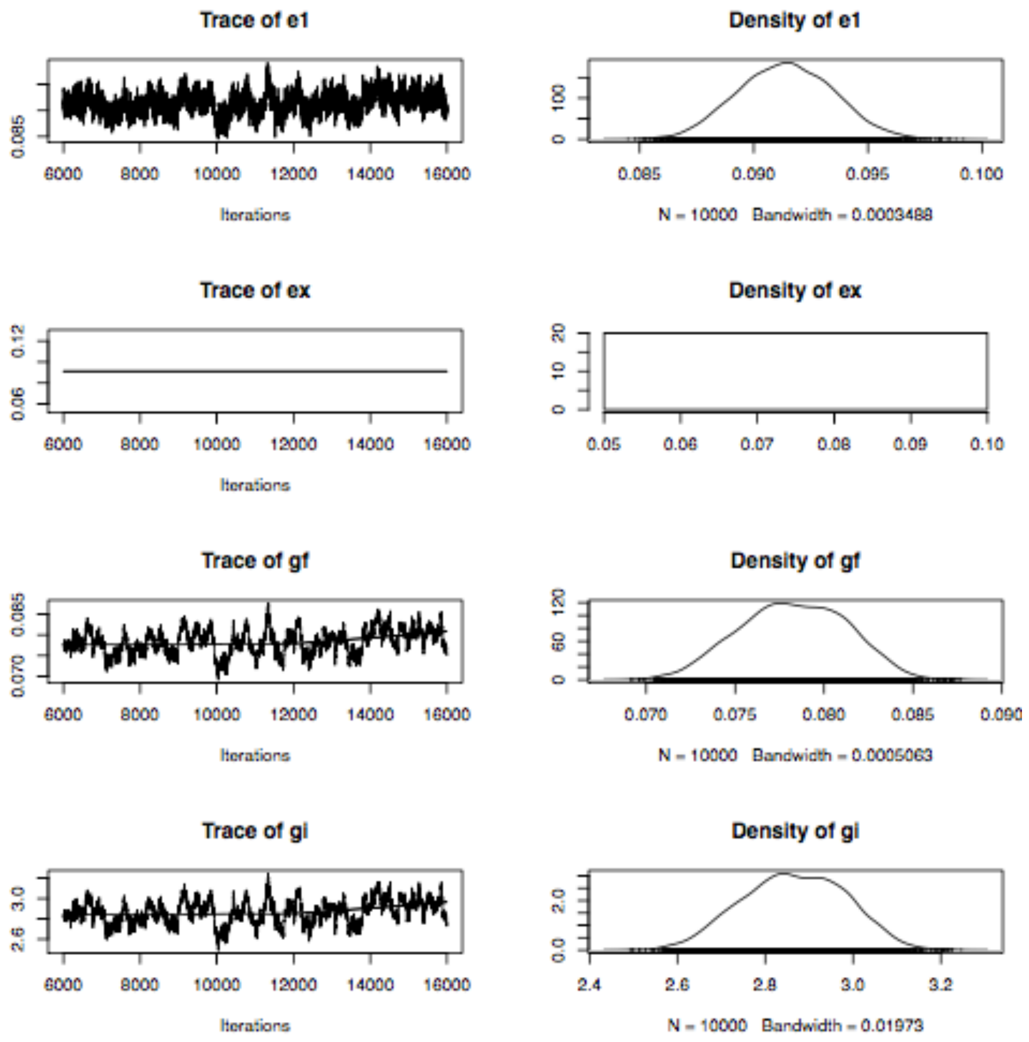


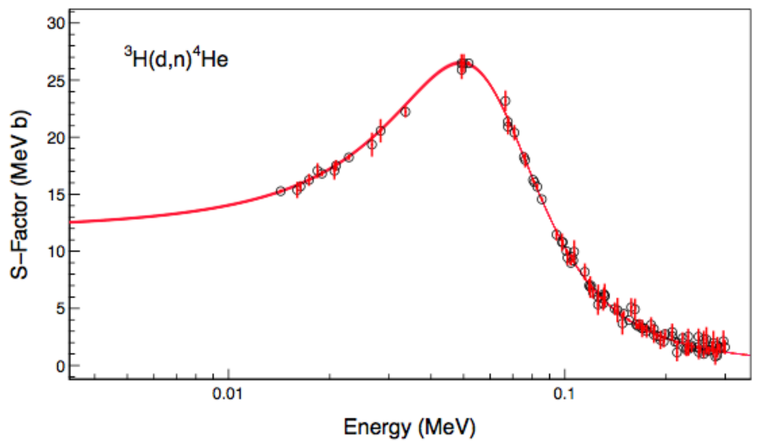
```
## broad priors:
#  e1 <- 0.0912
  e1 ~ dunif(0.01, 1.0)
  ex <- 0.0912
#  gi <- 2.93
#  gf <- 0.0794
  gi ~ dunif(0.0, 100)
  gf ~ dunif(0.0, 100)
  ri <- 6.0
  rf <- 5.0
  ue <- 0.0
```

```
n.adapt  <- 1000
#n.burnin <- 5000
n.update <- 5000
n.iter   <- 10000
n.chains <- 1
n.thin   <- 1
```

results are not stable; repeated runs yield garbage

no starting values, but used longer burnin

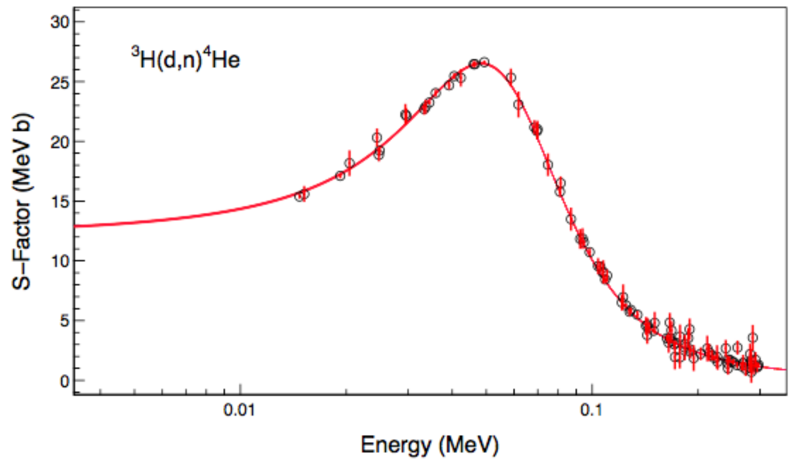


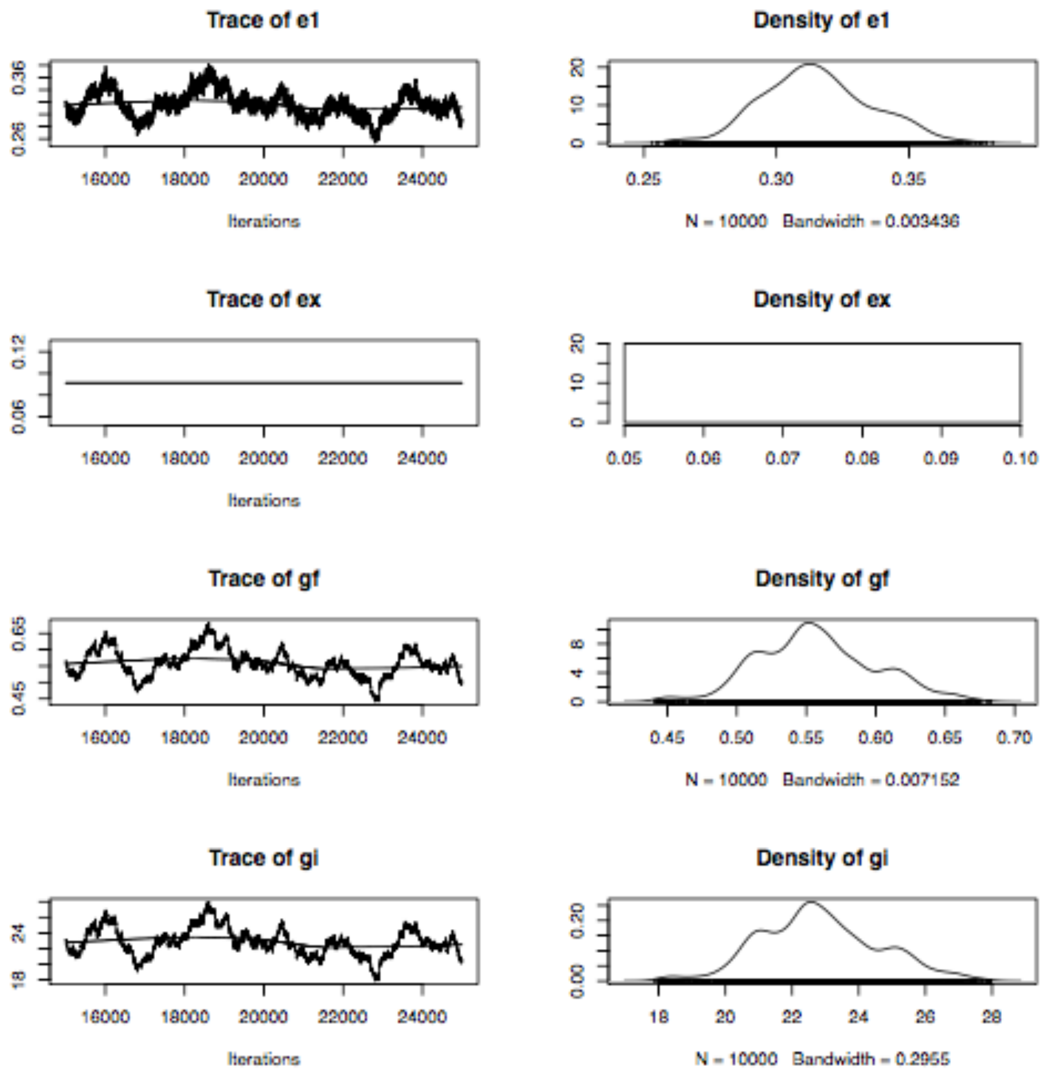


```
## broad priors:
#  e1 <- 0.0912
   e1 ~ dunif(0.01, 1.0)
   ex <- 0.0912
#  gi <- 2.93
#  gf <- 0.0794
   gi ~ dunif(0.0, 100)
   gf ~ dunif(0.0, 100)
   ri <- 6.0
   rf <- 5.0
   ue <- 0.0
```

```
n.adapt  <- 5000
#n.burnin <- 5000
n.update <- 10000
n.iter   <- 10000
n.chains <- 1
n.thin   <- 1
```

parameters are way off,
but fit looks good...





results so far:

we get essentially identical fits with vastly different sets of parameters, with most of these solutions vastly different compared to the set used to generate the artificial data

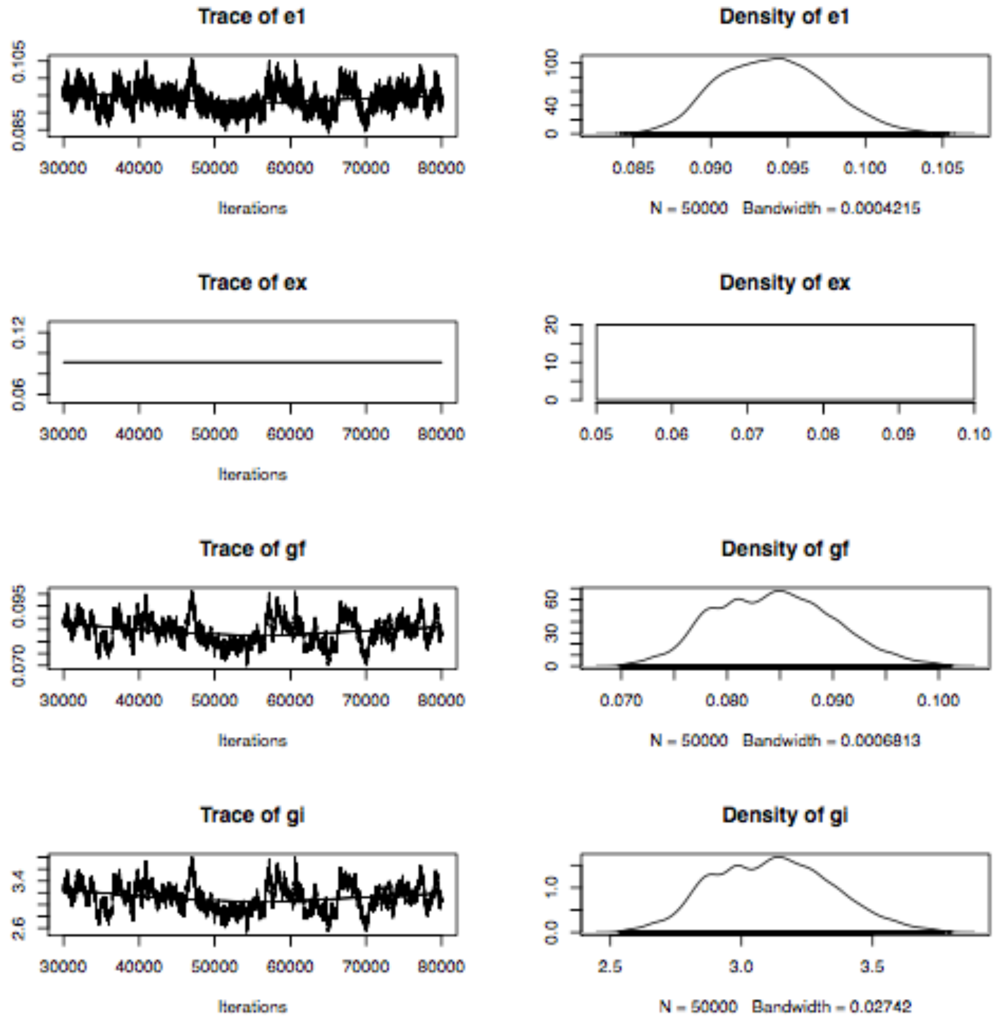
(1) I cannot see how any sampler in the world could pull out the original parameter set

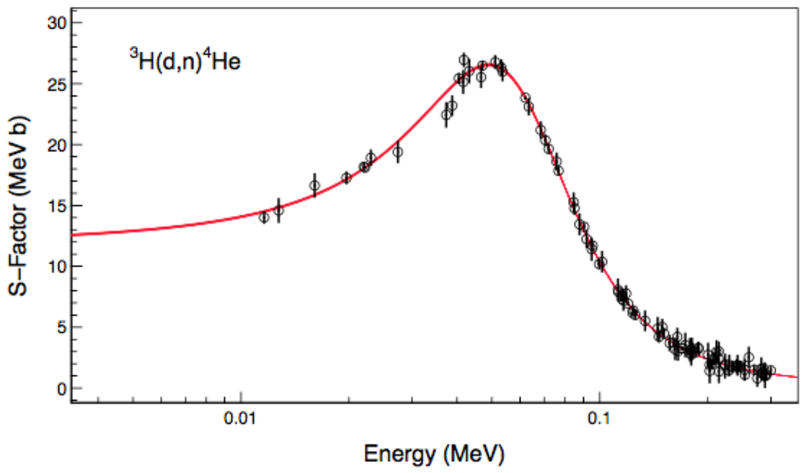
(2) I do not understand how previous chi-square fitting [Argo et al.; Jarmie et al.] could find any solutions for the resonance parameters

(3) use different sampler [Stan] to see if the fits can be improved

```
## broad priors:
#  e1 <- 0.0912
  e1 ~ dunif(0.01, 1.0)
  ex <- 0.0912
#  gi <- 2.93
#  gf <- 0.0794
  gi ~ dunif(0.0, 100)
  gf ~ dunif(0.0, 100)
  ri <- 6.0
  rf <- 5.0
  ue <- 0.0
```

```
n.adapt  <- 10000
#n.burnin <- 5000
n.update <- 20000
n.iter   <- 50000
n.chains <- 1
n.thin   <- 1
```


Trace of e1
Density of e1
Iterations
N = 50000 Bandwidth = 0.0004215
Trace of ex
Density of ex
Iterations
Trace of gf
Density of gf
Iterations
N = 50000 Bandwidth = 0.0006813
Trace of gi
Density of gi
Iterations
N = 50000 Bandwidth = 0.02742


^{3}H(d,n)^{4}He
S–Factor (MeV b)
Energy (MeV)