Chapman's Master Thesis

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER GNE/PH/74-1	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER AD 777841
4. TITLE *(and Subtitle)* A COMPUTER CODE FOR HIGH ALTITUDE EMP		5. TYPE OF REPORT & PERIOD COVERED THESIS 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Terry C. Chapman, Captain, USAF		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS AFIT/ENP Wright-Patterson AFB, OH 45433		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS AFIT/ENP Wright-Patterson AFB, OH 45433		12. REPORT DATE January 1974 13. NUMBER OF PAGES 82
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)* Air Force Weapons Laboratory/EL Kirtland AFB, New Mexico 87117		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

Roadmap

- Goals
  - Identify missing pieces
  - Recreate output in thesis
  - Create baseline
- Process
- Status
  - Compiles will gfortran in Linux environment
  - Runs on guessed input file
  - Produces output and does not crash

Goals

- Identify missing pieces
- Recreate output in thesis
- Create baseline

The output from a typical run is shown in Fig. 4. The $E(\tau)$ calculated during the run is shown in Fig. 5. The input data for this run was:

X	= 0 meters	(65a)
Y	= 0 meters	(65b)
Z	= 0 meters	(65c)
HOB	= 100 km	(65d)
Y_γ	= .001 kt	(65e)
B_0	= $2(10)^{-5}$ wb/m^2	(65f)
Dip Angle	= 20°	(65g)
NDELR	= 50	(65h)
TMAX	= 20 shakes	(65i)

The CDC 6600 Computer required 191 sec and 33000_8 words of central memory to execute this run.

The peak value of E, 6400 V/m, obtained in this run compares favorably with Karzas-Latter's order of magnitude estimate of 10^4 V/m (Ref 2) from similar input data.

```
THE BURST WITH GAMMA YIELD OF 1.000E-03 KILOTONS
IS AT AN ALTITUDE OF 1.000E+02 KILOMETERS.

THE TARGET IS AT COORDINATES      0.              0.              0.
WHICH IS 1.000E+05 METERS FROM THE BURST



DIRECT WAVE IS BEING CALCULATED



ITERATION TERMINATED AFTER 20.0 SHAKES .



PEAK OCCURRED AT  2.1 SHAKES



* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
* PEAK EFIELD AT TARGET IS  6.448E+03 VOLTS/METER *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

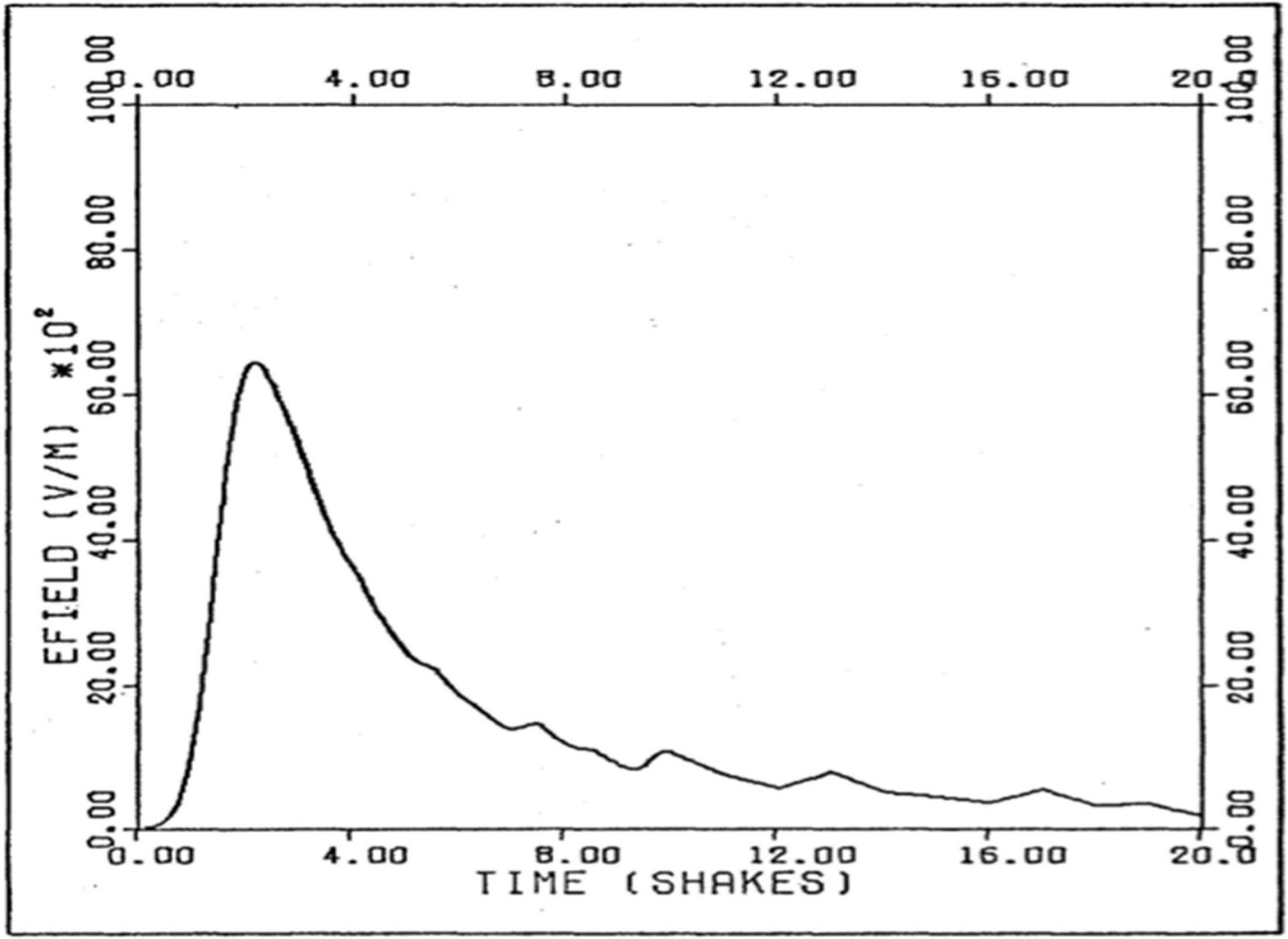


Fig. 5. Plot of E(τ) at target from a typical run

Process

- OCR FORTRAN program in thesis
- Change code from gfortran compiler
- Correct OCR errors
- Exclude Plotting code
- Compile program
- Identify needed inputs
- Run program
- Compare output with known output

OCR

- Extract individual code pages from thesis
- Use Free Online OCR Service
  - https://onlineocr.net

FORTRAN dialect differences

- OUT changed to OUX
- TIME changed to TIMX
- DATA
  - DATA (C=3.0E8),(RMLC=12.56637E-7)
  - DATA C/3.0E8/,RMLC/12.56637E-7/
- Multi statement line
  - DO 21 1=1,190 $ T=1+(1.E-9)*DT $ TIME(I)=1·(1.E8)

Pomranning

$$f(\tau) = (1/N) \frac{(\alpha+\beta)\ \exp\ (\tau-\tau_0)}{\beta + \alpha\ \exp\ [(\alpha+\beta)(\tau-\tau_0)]} \qquad (61)$$

where N is chosen such that

$$\int_0^\infty f(\tau)d\tau = 1 \qquad (62)$$

and $\alpha > \beta$.

This function rises like $e^{\alpha\tau}$ for small τ, falls like $e^{-\beta\tau}$ for large τ, and has a single maximum at τ_0.

from Chapman Thesis page 20

$$f(t) = \frac{(a + \beta)\ \exp\ a\ (t - t_o)}{\beta + a\ \exp\ [(a + \beta)(t - t_o)]} \qquad (47)$$

from Seller Thesis page 15

Correct in FOFT(T)

```
      FUNCTION FOFT(T)                                                  FOFT1010
C                                                                       FOFT1020
C         F(T) IS THE POMRANNING MODEL FOR TIME DEPENDENCE              FOFT1030
C         OF NUCLEAR WEAPON YIELD IN RETARDED TIME                      FOFT1040
          INTEGER OUX                                                   FOFT1050
          COMMON OUX,AP,BP,RNP,TOP                                      FOFT1060
          TSHAKE=1.E8*T                                                 FOFT1070
          DENOM=(BP+AP*EXP((AP+BP)*(TSHAKE-TOP)))*RNP                   FOFT1080
          FOFT=(AP+BP)*EXP(AP*(TSHAKE-TOP))/DENOM                       FOFT1090
          RETURN                                                        FOFT1100
          END                                                           FOFT1101
```

wolframcloud.com

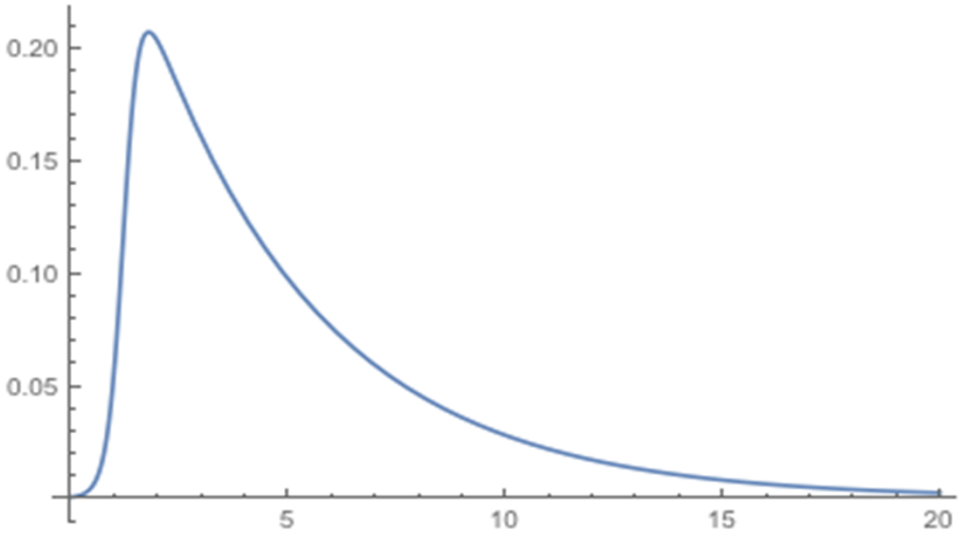
WOLFRAM | ONE

(unnamed) File

```
In[3]:= f47[a_, b_, t_, t0_, N_] := (1 / N) * ( ((a + b) * Exp[a * (t - t0)]) / (b + (a * Exp[(a + b) * (t - t0)])) )

In[14]:= Plot[f47[5.2, 0.25, t, 1.8, 4.83489], {t, 0, 20}]
```

Out[14]=



axes | image size | add fill | background | rasterize

```
In[13]:= N[Integrate[f47[5.2, 0.25, t, 1.8, 4.83489], {t, 0, 20000}]]

Out[13]= 1.
```

wolframcloud.com

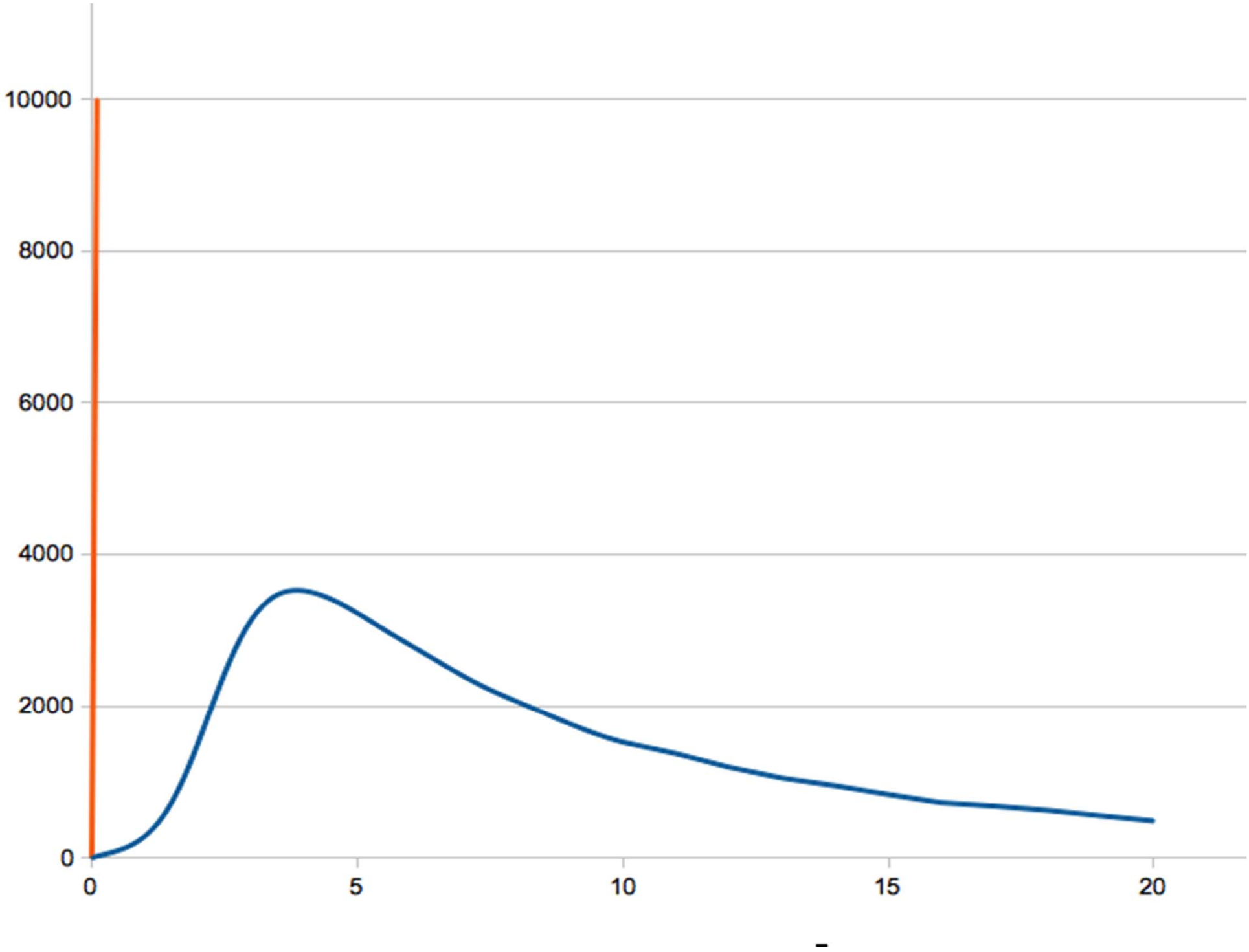
```
f47[a_,b_,t_,t0_,N_] :=
   (1/N) * ( ((a+b)*Exp[a*(t-t0)]) / (b+(a*Exp[(a+b)*(t-t0)])) )

Plot[f47[5,0.25,t,2.24,1],{t,0,20}]

N[Integrate[f47[5,0.25,t,2.24,4.86205],{t,0,20}]]
```

Status

- Compiles will gfortran in Linux environment
- Runs on guessed input file
- Produces output and does not crash
- Have NOT duplicated PEAK and graph from IN


10000
8000
6000
4000
2000
0
0
5
10
15
20

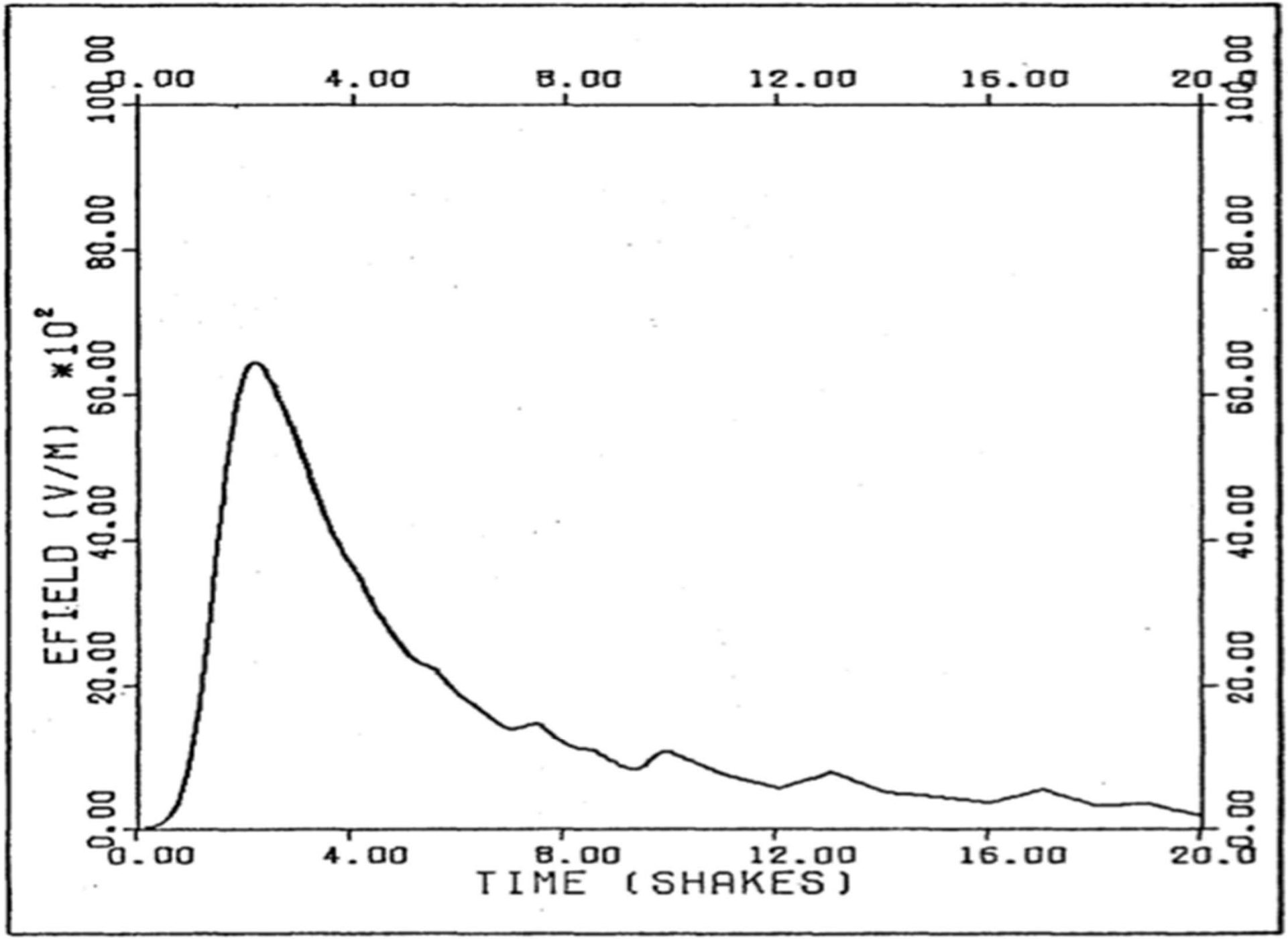


Fig. 5. Plot of E(τ) at target from a typical run