

Statistical Methods in Particle Physics / WS 13

Lecture VII

Minimization

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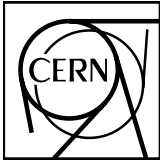
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Part VII:

Minimization

7.4. The MINUIT program



CERN Program Library Long Writup D506

MINUIT

Function Minimization and Error Analysis

Reference Manual

Version 94.1

F. James

Computing and Networks Division

CERN Geneva, Switzerland

The HEP standard for function minimization

- Written by Fred James at CERN 1975-80 in FORTRAN
- Translated to C++ several times SEALMinuit, Minuit2, TMinuit ...
- They all still feel a bit FORTRANy - which is not necessarily a bad thing
- Extremely well debugged by use
- Consisting of several subprograms
- If you are stuck, read the manual; very likely, they already knew about your fitting problem in the 70ies...

Minuit programs

- **MIGRAD**: Gradient descent minimization with variable metric
- **SIMPLEX**: Simplex search
- **SCAN**: Just scan one variable
- **HESSE**: Numerical calculation of Hessian matrix; usually for error estimation
- **MINOS**: Error estimation by varying one variable and minimizing for all others
- **CONTOUR**: MINOS in 2D

You provide:

- An **objective function** to be minimized called FCN
- A **list of parameters** with starting values
- **Commands** for which MINUIT program to run
- If you fit a root histogram, most is taken care of - somehow...

MINUIT issues

If things do not go as expected...

- your starting value is bad
- your objective function might have a bug
- your problem is under-determined
- your objective function is not well behaved/you have numerical problems
- your precision and the MINUIT precision do not match

- you have too many free parameters; depending on the implementation, there is a hard-coded limit (usually commented out by those in the know)

- Everything is very slow because calculating one function value is very expensive:
Give FUMILI a try...