Getting Started with GEM

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- What is GEM?
- Before you start
- Downloading
- Compilation
- Running the simulation
- Output & Analysis

What is GEM?

- Detector simulation for the MEG experiment
  - XECAL : Liquid Xe calorimeter (final detector)
    - MC for the Large Prototype is called "TBEAM"
  - DCH : Drift chamber
  - TICP : Timing counter for Phi direction
  - TICZ : Timing counter for Z direction
  - MAG : Cobra magnet
  - TAR : muon stopping target
  - ...
- Based on FORTRAN77 + GEANT3
- The history of its naming has been lost

Before You Start ... (1) Requirements

- Knowledge of UNIX
- Knowledge of ROOT or/and PAW
- Standard UNIX-like environment
  - e.g. Redhat 9, Scientific Linux, CERN linux, PSI linux, etc.
  - GEM is developed and tested under linux
- AFS account in PSI
  - Required for CVS access
- CERNLIB

Before you Start ... (2)
Install CERNLIB

- Download CERNLIB
  - See following URL for the proper version
    http://cernlib.web.cern.ch/cernlib/version.html
- Install CERNLIB
  - Ungzip and Untar following files to proper directory e.g. /cern
    cernbin.tar.gz cernglib.tar.gz cernlib.tar.gz
    geant321.tar.gz mclibs.tar.gz
- RH9/RH10/FC1 users can copy from
  - pc4465.psi.ch:/cern/2003 or pc4466.psi.ch:/cern/2003

Before you Start ... (3a)
Set environment variables - bash/zsh

- bash/zsh users: add following variables to your .bashrc/.zshrc

```
export CERN=/cern
export CERN_LEVEL=2003

export CVSROOT=:ext:yamada@midas.psi.ch:/usr/local/cvsroot
export CVS_RSH=ssh

export MEG_DIR=~/meg
export RULESSRC=${MEG_DIR}/Rules
export PROJRULES=${MEG_DIR}/MegRules
export GEANT=geant321
```

This have to be same as the CERNLIB version you installed

Replace with your AFS account in PSI

Before you Start ... (3b)
Set environment variables - tcsh/csh

- tcsh/csh users: add following variables to your .tcshrc/.cshrc

```
setenv CERN /cern
setenv CERN_LEVEL 2003

setenv CVSROOT :ext:yamada@midas.psi.ch:/usr/local/cvsroot
setenv CVS_RSH ssh

setenv MEG_DIR ~/meg
setenv RULESSRC ${MEG_DIR}/Rules
setenv PROJRULES ${MEG_DIR}/MegRules
setenv GEANT geant321
```

This have to be same as the CERNLIB version you installed

Replace with your AFS account in PSI

Download the Source Code

- Source tree of GEM is available from the CVS repository
- Go to your home directory

```
% cd ~
```

- Check out the repository

```
% cvs co meg
```

- Directory named "meg" will appear in your home directory
- To update your working meg in sync with repository

```
% cd ~/meg
% cvs update
```

Compilation

- Build the program in your ${MEG_DIR};

```
% cd ~/meg
% make
```

- All the libraries and executables will be compiled

Running the Simulation

- The executable program is
  ~/meg/gem/gem/gem.sub
- Parameters for GEM are given by CARD provided by CERNLIB, i.e. FFGO.
  - Each sub-detector component have its own CARD files
  - See appendix or
    ~/meg/gem/gem/gem.sub
    for the list of CARD files.
  - Description and synopsis of parameters are described in each CARD file.

Outputs of the Simulation

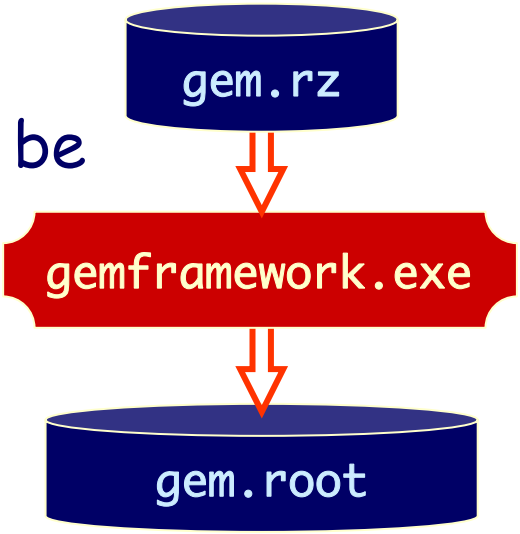
- 3 output files are created in

  ~meg/gem/gem/output

  - Log file : gem.ascii
  - Histograms: gem.hbk
    - Histograms for basic statistics
  - ZEBRA output : gem.rz
    - Run headers : geometry configuration, LXe parameters, etc.
    - Event by event : True track, Energy deposit, etc.

Analysis Tool (1)
gemframework

- Based on ROME
- Converts ZEBRA to ROOT
- Temporary software until MegRoot available -or- for personal computer analysis
- Just a framework :
  calculations & reconstructions need to be implemented



Analysis Tool (2)
Install ROOT

- Download ROOT
  - See http://root.cern.ch/
- Install ROOT
  - Unzip and Untar following file to proper directory
    e.g. /cern/root
    root_v4 .04 .02.Linux.slc3.gcc3.2.3.tar.gz
- Set environmental variables
  - bash/zsh :
    export ROOTSYS=/cern/root
    PATH=$ROOTSYS/bin:$PATH
  - tcsh/csh
    setenv ROOTSYS /cern/root
    set path=($ROOTSYS/bin $path)

Download suitable to your operating system & compiler

This have to be same as where you installed ROOT

Analysis Tool (3)
Install ROME

- Download ROME
  - Go to your home directory
    ```
    % cd ~
    ```
  - Check out the repository
    ```
    % cvs co rome
    ```
  - Directory named "rome" will appear in your home directory
- Set environmental variables
  - bash/zsh :
    ```
    export ROMESYS=~/rome
    ```
  - tcsh/csh
    ```
    setenv ROMESYS ~/rome
    ```
- Compile ROME
    ```
    % cd rome
    % make
    ```
- See http://midas.psi.ch/rome/ for details

Analysis Tool (4)
Install gemframework

- Install gsl (Gnu Scientific Library)
  - See http://www.gnu.org/software/gsl/
- Download gemframework
  - Go to your home directory

    ```
    % cd ~
    ```

  - Check out the repository

Replace with your AFS account in PSI

```
% cvs -d :ext:yamada@pc4 4 66.psi.ch:/usr/local/cvsroot co gemframework
```

  - Directory named "gemframework" will appear in your home directory
- Compile gemframework

```
% cd gemframework
% $ROMESYS/bin/romebuilder.exe GEMframework.xml
```

Analysis Tool (4)
running gemframework

- First, run gemframework.exe in order to generate the default configuration file:

  ```
  %  gemframework.exe
  ```

- Edit the configuration file : romeConfig.xml.

  ```
  + <DAQSystem>zebra</DAQSystem>
  + <OutputFilePath>./</OutputFilePath>
      Directory where you like to write data.
  + Configure other parameters as you like.
  ```

- Run gemframework

  ```
  % ./gemframework.exe -r 1 -f ~/meg/gem/gem/output/gem.rz
  ```

  At the present, a DUMMY run # is required

  Path to your ZEBRA output from GEM

  - A Root file is created : gem.root

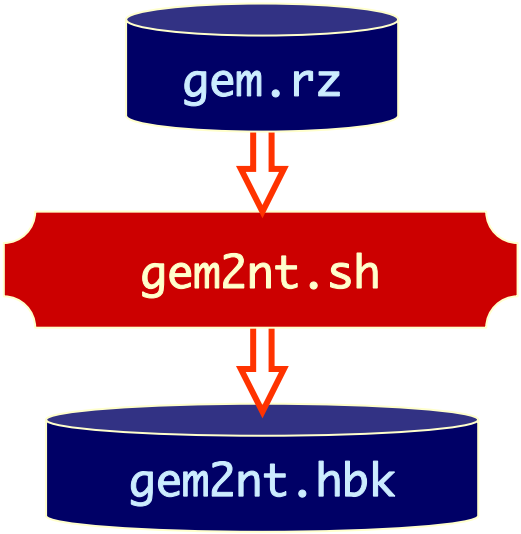
- See file://~/gemframework/GEMframework.html for details.

Enjoy your MC life !!

End of Slides

Appendix
Yet another analysis tool : RZ2NT

- Convert ZEBRA to NTUPLE:
  ~/meg/rz2nt/gem2nt/gem2nt.sh
  - Process RAW MC data
    - To have a look on statistics
      - # of hits
      - Energy deposit distribution
      - Etc…
    - Reconstructions are not yet implemented
  - Card file : ~/meg/rz2nt/gem2nt/cards/gem2nt.cards
  - Output : ~/meg/rz2nt/gem2nt/output/gem2nt.hbk



Appendix
List of card files

- For controlling the entire simulation:
  meg/gem/gem/cards/gem.cards, meg/gem/gem/cards/rem.cards,
  meg/gem/gem/cards/io.cards
- For the event generator:
  meg/megeve/cards/megeve.cards
- For DCH:
  meg/gem/dch/cards/dch.cards, meg/gem/dch/cards/dchdc.cards,
  meg/gem/dch/cards/dchring.cards, meg/gem/dch/cards/dchcd.cards,
  meg/gem/dch/cards/dchhebg.cards, meg/gem/dch/cards/dchrt.cards
- For TICP/TICZ:
  meg/gem/ticz/cards/ticz.cards, meg/gem/ticz/cards/ticzbar.cards,
  meg/gem/ticz/cards/ticzsect.cards, meg/gem/ticz/cards/ticzpmt.cards,
  meg/gem/ticp/cards/ticp.cards, meg/gem/ticp/cards/ticpbar.cards,
  meg/gem/ticp/cards/ticpsect.cards, meg/gem/ticp/cards/ticppmt.cards
- For XECAL:
  meg/gem/xecal/cards/xecal.cards
- For Target & Magnet
  meg/magnet/cards/magnet.cards, meg/target/cards/target.cards,
  meg/bfield/cards/bfield.cards
- For drawing:
  meg/draw/cards/draw.cards

Appendix
CVS

- To learn more about CVS see following WEB sites:
  in Japanese:
  http://radiofly.to/nishi/cvs/
  http://www.sodan.org/%7Epenny/vc/cvs-ja.html
  in English:
  http://wwwasd.web.cern.ch/wwwasd/cvs/tutorial/cvs_tutorial_toc.html
  http://cvsbook.red-bean.com/