# EvtGen inside the PandaRoot Framework

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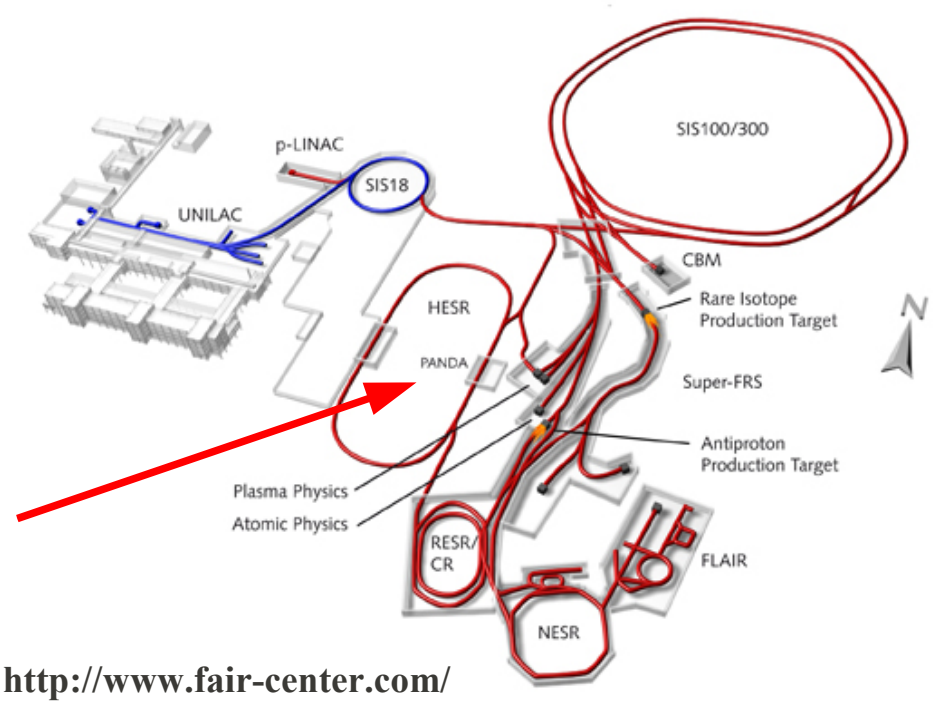
## Outline

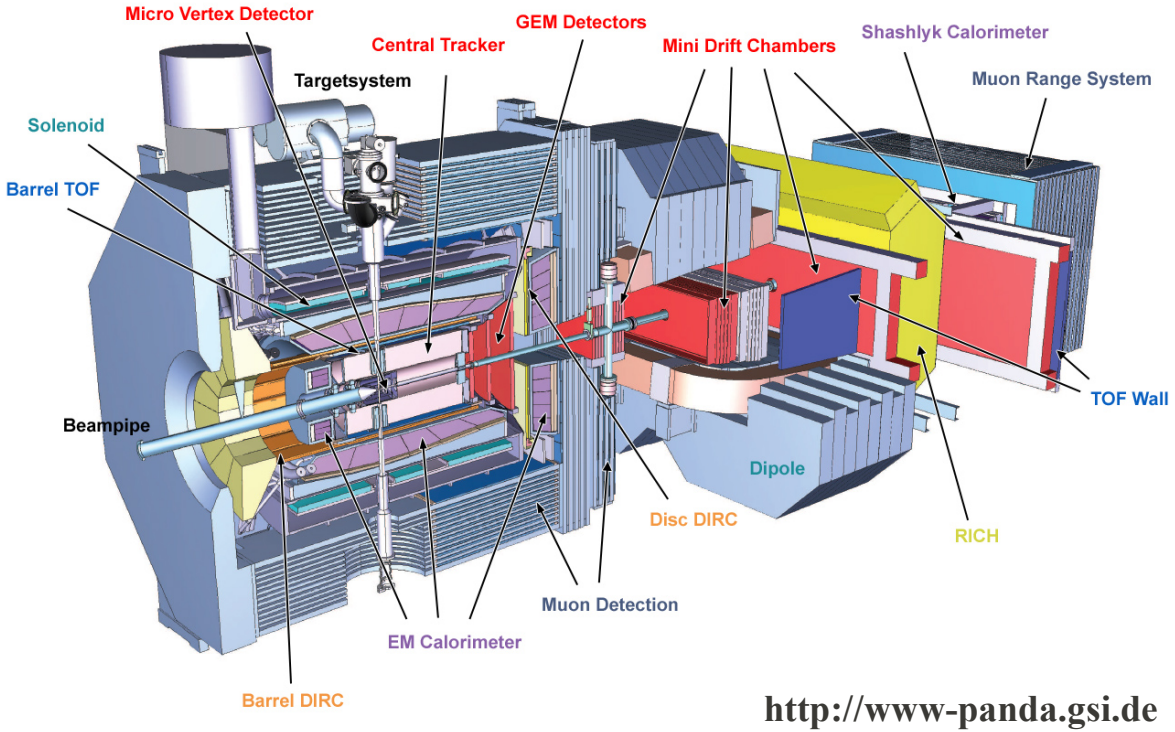
- PANDA and PandaRoot
- EvtGen inside PandaRoot
- PANDA Requirements

# The PANDA Experiment – Very Short Introduction

- Proton anti-proton fixed target experiment
- FAIR facility in Darmstadt Germany (host lab GSI)
- Energy sqrt(s)<5.5GeV => charmonium region
- Anti-proton cooled in HESR storage ring
  - Resonance scans




http://www.fair-center.com/




http://www-panda.gsi.de

# PandaRoot

- Developed since 2006
- Detector simulation, reconstruction and analysis framework
- root based (5.26)
- Shares common code and packages with other FAIR experiments, “FairSoft”
  - utilities, root, geant, pythia
  - base classes
- > 100.000 lines of code
- 400.000 geometry volumes
  - in root, G4 format
- based upon VMC
  - easy switch between G3 and G4
- Source code distribution!
- Buildsystem: cmake
- running on >20 platforms
  - Suse, Debian (Ubuntu), SLC4, SLC5, OSX
  - 32 bit, 64 bit
- GRID (alien middleware)

**http://panda-wiki.gsi.de/cgi-bin/view/Computing/PandaRoot**

# Status up to last year (before modifications)

- EvtGen code shipped within PandaRoot svn
- But: User has to compile it himself!
- Result:
  - standalone binary, f.e. simpleEvtGen
  - text output, read in later by a PandaRoot task
- Problems:
  - Depend on cernlib
    - to be installed by the user
    - versions, 32/64, compiler
  - Mix of C and Fortran code
    - g77/gfortran problem (better: libgfortran, libg2c)
    - g77 not (officially) supported anymore since gcc 4.0

# Main Goal

- Get it compiled automatically on all systems
  - with different compilers and platforms, 32/64, g77/gfortran
  - compile it together with PandaRoot
    - Cmake make system
    - Shared Lib
- Have a PandaRoot Task
  - usable inside macros
  - keep standalone binary (optional)

# How to provide Cernlib?

- Automatically install (correct) precompiled Cernlib?
  - many versions, depending on compiler and system
  - future support?
  - a lot of problems
- Automatically compiling Cernlib from source?
  - on “any” system?
  - even more complicated!
  - Again:
    - g77/gfortran problem (better: libgfortran, libg2c)
    - g77 not (officially) supported anymore since gcc 4.0
- Not a solution yet.

# The Solution (for PandaRoot)

- Get rid of (precompiled) Cernlib!!!
- What is EvtGen depending on?
  - Pythia
  - Photos
  - and a few more things...
- And:
  - Pythia is already in FairSoft as shared lib, why not use it?
  - Cernlib available as source code
    - use/copy only needed parts

# Making It Compile

- Use existing **libPythia** instead of Cernlib
- Photos not depending on other Cernlib modules
  - Add as source code and build shared **libPhotos**
- EvtGen contains “unused” code which depend on Cernlib
  - Testing and debugging code
  - Get rid of it (hbook...)
- Left over:
  - ddilog and ranf function missing
  - add als source code
- Works!!!

# Short Summary

- No dependence on precompiled Cernlib anymore!!!
- Ships and compiles with PandaRoot
  - using Cmake
  - on all tested system
  - gcc 3&4, g77/gfortran/ifort
  - 32/64 bit, SLC4&5, Ubuntu 9&10, Suse ...
- What you get:
  - Shared library
  - Standalone binary (simpleEvtGen and others)
  - PandaRoot task (taking the same parameters as simpleEvtGen)

# Things done for the PandaRoot version

- For Cernlib free version:
  - (nearly) no change on EvtGen package code
  - “old” way of compiling/linking against cernlib still works
  - all changes are by defines in CMakeFile.txt
- Code cleanup
  - deprecated include files etc
  - warnings
  - hidden variables
- Interface to output to a root tree (TParticle based)
- Interface to use simulated data directly in VMC
- Using TRandom from root (still open issue)

# Requirements and Wishes for the Future

- Technical:
  - No dependence on any precompiled libraries (cernlib)!
  - Source code distribution, compiling on huge variety of systems
- Suggestion:
  - subversion repository
  - different branches for developers/experiments
  - sharing of “private” models
- Wishes:
  - Support/Models for particles with spin>1 (initial state is not a photon in PANDA!)
  - Support for (external) Random engines.

# Backup and further notes

# Remarks and Tests of EvtGen in PandaRoot

# Checks done sor far

- old way simpleEvtGen with CernLib against new SimpleEvtGen ... compare output.evt
- Simple decay J/psi->ee,mumu including photos, 1000Evts
  - SLC 4.7 (32), “old” cernlib 2005?
  - SLC 5.4 (64), Ubuntu 9.10(64), cernlib2006
  - no difference between old and new!
  - one rounding(?) error difference between the SLC4 and other systems
- Pythia decays not done
  - same error on all systems... decay file problem?
  - either “pythia cannot decay this particle” or “no requested process has non-vanishing cross-section.”

# More Checks done...

- using runtime checks: -fstack-protector  -fbounds-check -fcheck-array-temporaries -frange-check -fcheck-data-deps
  - (-fcheck=all not supported?)
- **No** error detected on running without Photos
  - Psi(3770) all decays from DECAY.DEC
- But with Photos: (**solved!**)
  - At line 64 of file /home/bjoern/pandaroot/trunk/pgenerators/EvtGen/photos/photos_make.F
  - Fortran runtime error: Array reference out of bounds for array 'jmohep', lower bound of dimension 2 exceeded (0 < 1)
  - IF (JDAHEP(1,I).NE.0.AND.JMOHEP(1,JDAHEP(1,I)).EQ.I) THEN
  - for me the code looks o.k. if and is done left before right nad righ only if left succeeded (like in C code).
    - But this is fortran!
  - Error is gone if code is splitted into two lines
    - IF (JDAHEP(1,I).NE.0) THEN
    - IF (JMOHEP(1,JDAHEP(1,I)).EQ.I) THEN
- check in old precompiled version not possible...
  - however the interface can be compiler with flags, they do not show an error!
- Other fortran compilers might have more thorough checks.
  - ifort ... works

# Code structure

- /trunk/pgenerators/
  - EvtGen/
    - photos/ contains code for **libPhotos**, but could be put anywhere
    - EvtGenBase/ -> **libEvtGen**
    - EvtGenModels/ -> **libEvtGen**
    - Cernlib/ (only two files) -> **libEvtGen**
  - EvtGenDirect/
    - PndEvtGenDirect.cxx/h -> **libEvtGen**
- Note:
  - The whole EvtGen Directory can be put to any location, e.g. fairroot

# Example:

- Using example code from tutorials/charmonium/
  - run_sim_tpccombi.C
  - Before simulation (same in both cases):
    - Prepare your user.dec, DECAY.DEC and evt.pdl file (optional)
    - See EvtGen Manual / Wiki / Torino Tutorial
    - esp the one for simpleEvtGen

```
Old Way:
run simpleEvtGen particle userdecayfile #nrevts [mom] [seed]
(the file output.evt is created)
in the macro, use:
FairEvtGenGenerator* evtGen = new FairEvtGenGenerator("output.evt");

New Way:
in the macro, use:
PndEvtGenDirect* evtGen = new PndEvtGenDirect("particle","userdecayfile"[,mom,seed]);
```

# Try out and check

- If you want to try:
  - Add to rootlogon.C (to be done in svn)
    - if(isLibrary("libPhotos"))gSystem->Load("libPhotos");
    - if(isLibrary("libEvtGen"))gSystem->Load("libEvtGen");
    - if(isLibrary("libEvtGenDirect"))gSystem->Load("libEvtGenDirect");
  - ... and change the generator line in your macro.

- Check it!!!
  - old way simpleEvtGen with CernLib against new SimpleEvtGen
  - can be done on text output basis without analysis

# INTELs FORTRAN compiler ifort

- add library path, compiler name and path to CMakeLists
- w/o additional parameters -> compiler and runs
- with “-fltconsitency -zero – auto” -> compiles and run
- with “-check all” -> Problem, but why???
  - compiles but does not run
  - Error: Symbol #include is not defined in current scope
-

# Known Problems

- Due to global fortran variables, only **one** EvtGen can be run at the time! (but why would you like to run two at the same time?)
- There is no real error msg in that case, but maybe one can set a flag to prevent this?