

FairRoot & FairSoft

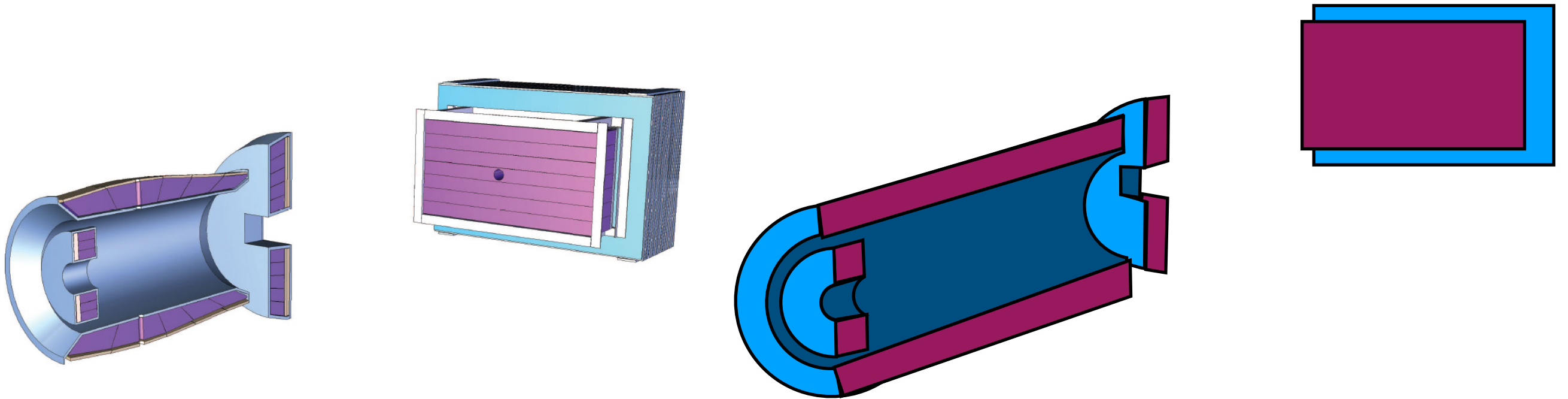
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Recent developments in:

- FairRoot
- FairSoft
- spack
- CVMFS

FairRoot FastSim

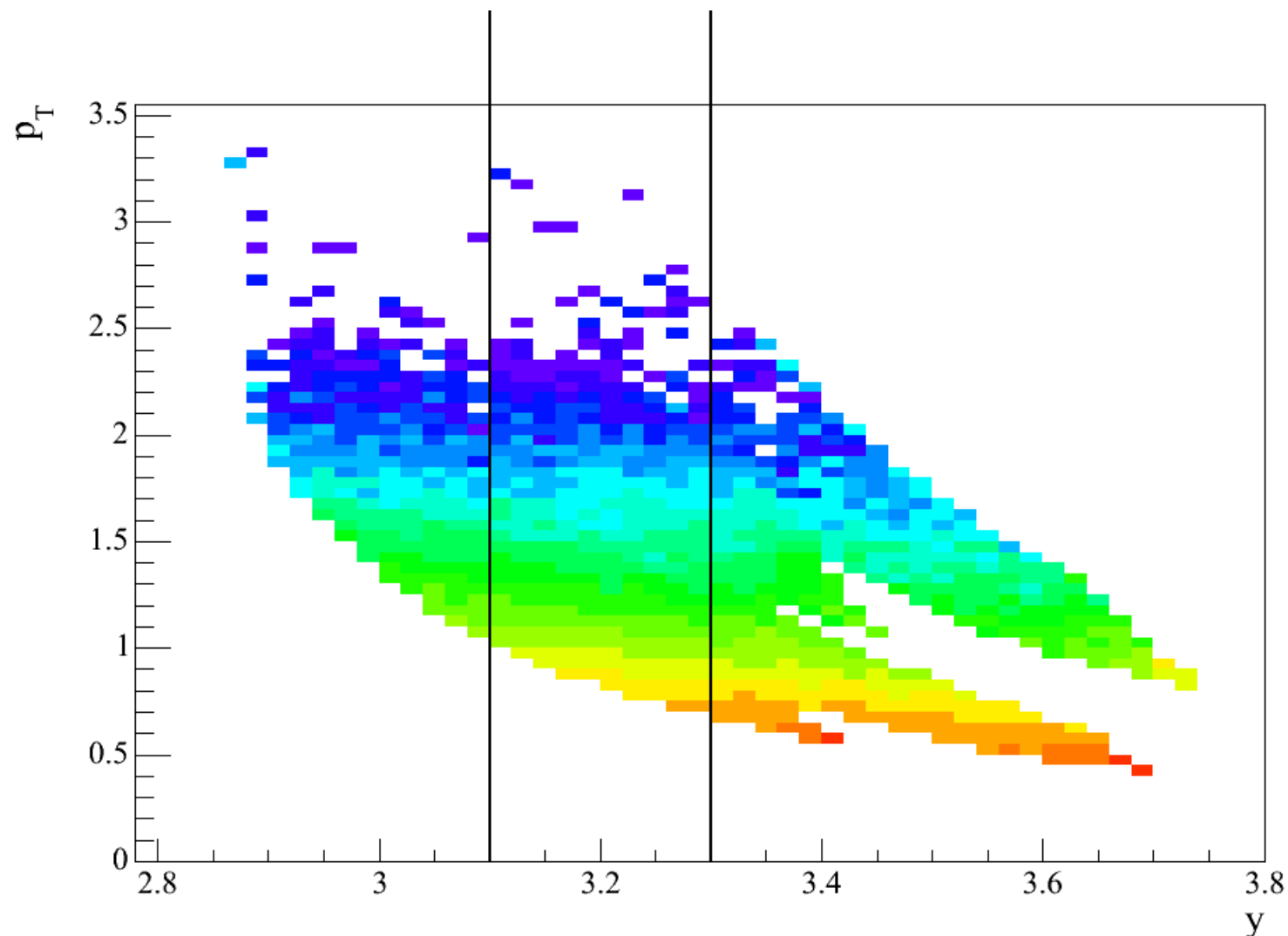
- Replace complex detector description (time or memory consuming) with simple volume of same dimensions.



- Developer has to implement the transport of the particle in the volume (i.e. what is the output position/momentum of the particle) and may implement detector response/secondary creation.
- **Accessible in Geant3 and Geant4 transports.**

FairRoot y-pt Generator

- Generates particles by using 2D histogram with distribution of Y (x-axis) and p_T (y-axis).



gconfig macros -> .yaml

```
void Config()
{
    FairRunSim* fRun = FairRunSim::Instance();
    TString* gModel = fRun->GetGeoModel();
    TGeant3* geant3 = NULL;
    if (strncmp(gModel->Data(), "TGeo", 4) == 0) {
        geant3 = new TGeant3TGeo("C++ Interface to Geant3");
        // cout << "-I- G3Config: Geant3 with TGeo has been created."
        //      << endl;
    } else {
        geant3 = new TGeant3("C++ Interface to Geant3");
        // cout << "-I- G3Config: Geant3 native has been created."
        //      << endl;
    }
    // create Fair Specific Stack
    FairStack* st = new FairStack();
    st->SetMinPoints(0);
    st->StoreSecondaries(kTRUE);
    geant3->SetStack(st);

    // ***** Geant3 specific configuration for simulated Runs *
    geant3->SetTRIG(1); // Number of events to be processed
    geant3->SetSWIT(4, 100);
    geant3->SetDEBU(0, 0, 1);

    geant3->SetRAYL(1);
    geant3->SetSTRA(1);
    geant3->SetAUTO(0);
    geant3->SetABAN(0);
    geant3->SetOPTI(2);
    geant3->SetERAN(5.e-7);
    geant3->SetCKOV(1);
}
```

```
G3_TRIG:      1
G3_SWIT:      [4, 100]
G3_DEBU:      [0, 0, 1]
G3_RAYL:      1
G3_STRA:      1
G3_AUTO:      0
G3_ABAN:      0
G3_OPTI:      2
G3_ERAN:      5.e-7
G3_CKOV:      1

MonteCarlo_Process:
  PAIR:        1
  COMP:        1
  PHOT:        1
  PFIS:        0
  DRAY:        1
  ANNI:        1
  BREM:        1
  HADR:        1
  MUNU:        1
  DCAY:        1
  LOSS:        1
  MULS:        1

MonteCarlo_Cut:
  CUTGAM:      1.0E-3
  CUTELE:      1.0E-3
  CUTNEU:      1.0E-3
  CUTHAD:      1.0E-3
  CUTMUO:      1.0E-3
  BCUTE:       1.0E-3
  BCUTM:       1.0E-3
  DCUTE:       1.0E-3
  DCUTM:       1.0E-3
  PPCUTM:      1.0E-3
  TOFMAX:      1.E10

FairStack_StoreSecondaries: true
FairStack_MinPoints:      0
```

FairSoft development

- Pythia6 428 (same as jun19)
- Pythia8 8301 (jun19: 8240)
- HepMC 2.06.09 (same as jun19)
- Geant3 3-0 (jun19: 2.7)
- Geant4 10.05.p01 (same as jun19)
- Geant4_vmc@5-0-p1 (same as jun19)
- **ROOT 6.18.04 (jun19: 6.16.00)**
- **VMC 1-0-p1 (now separated from ROOT)**
- VGM 4-7 (jun19: 4.5)

FairSoft spack

- Until now the FairSoft (collection of various HEP programs: Pythia, Geant, ROOT, etc) was installed using set of home-developed scripts.
- Decision to replace it with modern package management tool was taken few years ago.
- **spack** - developed at LLNL, tool designed to support multiple versions of software on a wide variety of platforms and environments.

spack package

- **Package installation is based on pure Python recipes:**
 - ▶ where to download the package from,
 - ▶ list of the package versions,
 - ▶ the package/version dependencies,
 - ▶ patches if needed,
 - ▶ compiler requirements,
 - ▶ how to setup the build environment.
- Package recipes are easy to create.

spack FairRoot

- FairRoot is also a package:

```
class Fairroot(CMakePackage):
    """C++ simulation, reconstruction and analysis framework for particle physics experiments """

    homepage = "http://fairroot.gsi.de"
    url       = "https://github.com/FairRootGroup/FairRoot/archive/v18.0.6.tar.gz"
    git       = "https://github.com/FairRootGroup/FairRoot.git"

    # Development versions
    version('develop', branch='dev')

    version('18.4.0', branch='RC_v18.4.0')
    version('18.2.1', '06a5b3b2c5445f7342464061cccbe7bc')
    version('18.0.6', '822902c2fc879eab82fca47eccb14259')

    variant('cxxstd',
            default='11',
            values=('11', '14', '17'),
            multi=False,
            description='Use the specified C++ standard when building.')

    variant('sim', default=True, description='Enable simulation engines and event generators')
    variant('examples', default=False, description='Install examples')

    # Dependencies which are same for all versions
    depends_on('cmake@3.13.4: +ownlibs', type='build')
    depends_on('googletest@1.8.1:')

    depends_on('pythia6', when='+sim')
    depends_on('pythia8', when='+sim')

    # mesa and libxml2 are dependencies of root which have to be build extra due to the
    # extra build options
    depends_on('libxml2~python')

    # Dependencies for dev version
    depends_on('boost@1.68.0: cxxstd=11 +container')

    depends_on('vnc', when='@18.4: ^root@6.18:')
```

spack test PandaRoot

- PandaRoot is also a package:

```
# Copyright 2013-2020 Lawrence Livermore National Security, LLC and other
# Spack Project Developers. See the top-level COPYRIGHT file for details.
# Copyright 2020 GSI Helmholtz Centre for Heavy Ion Research GmbH,
# Darmstadt, Germany
#
# SPDX-License-Identifier: (Apache-2.0 OR MIT)

from spack import *

class Pandakara(CMakePackage):
    git = 'https://git.panda.gsi.de/karabowi/PandaRoot'
    homepage = 'https://git.panda.gsi.de/karabowi/PandaRoot'

    version('develop', branch='install_evt')

    depends_on('fairroot')

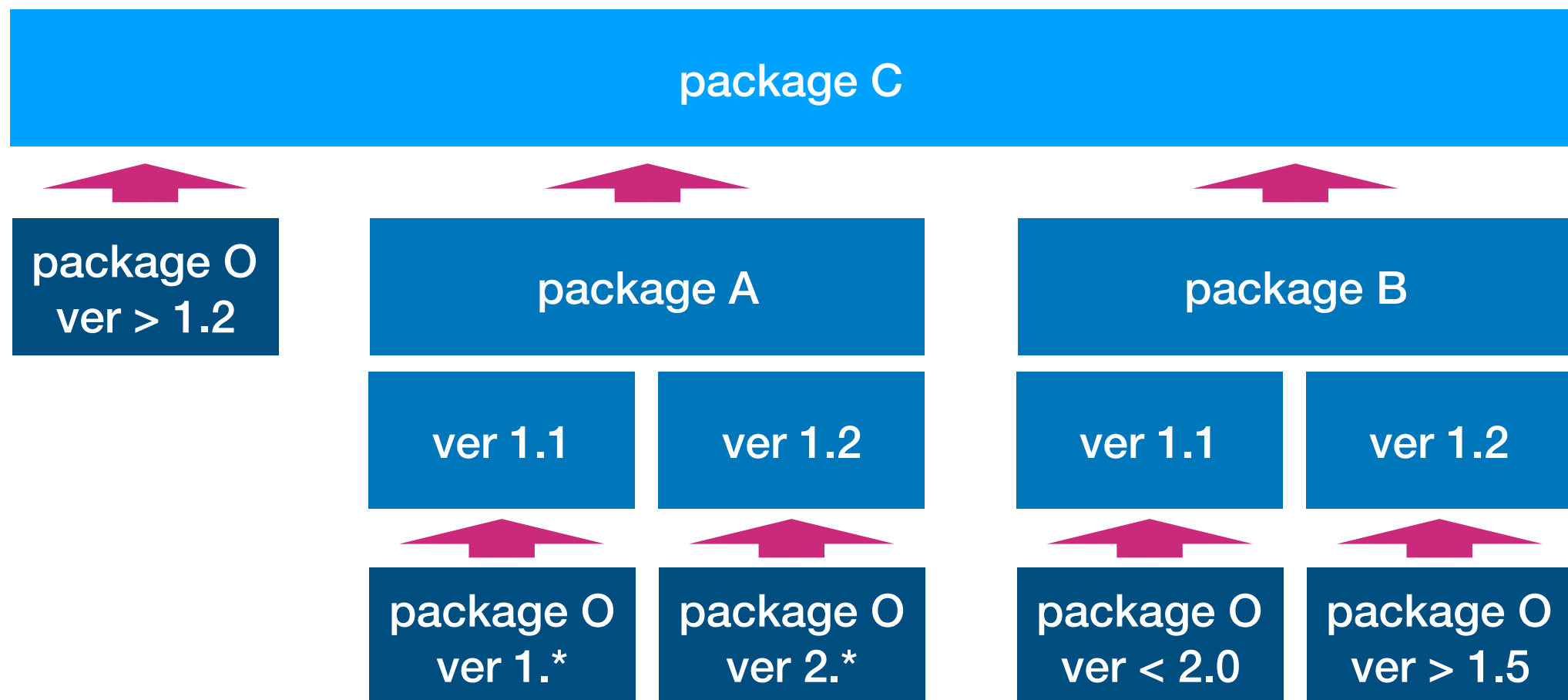
    depends_on('fairlogger')
    depends_on('geant3')
    depends_on('geant4~threads')
    depends_on('geant4_vmc')
    depends_on('pythia6')
    depends_on('pythia8')

    def cmake_args(self):
        args = ['-DCMAKE_CXX_STANDARD=11']
        return args

    def setup_build_environment(self, env):
        env.set("FAIRROOTPATH", self.spec['fairroot'].prefix)
        env.set("SIMPATH", self.spec["fairroot"].prefix)
        env.append_path('CPATH', self.spec['fairlogger'].prefix.include)
```

spack environment

- Environment helps avoiding possible conflicts stemming from multiple packages cross dependencies:



- **Environment specs: lists the correct package versions.**

spack jun19 / FairRoot

```
spack:
  definitions:
    - when: platform == 'linux'
      root: [root@6.16.00+fortran+gdm1+memstat+pythia6+pythia8+vc~vdt+python+tmva+xrootd ^mesa~llvm]
    - when: platform == 'darwin'
      root: [root@6.16.00+fortran+gdm1+memstat+pythia6+pythia8+vc~vdt+python+tmva+xrootd+aqua]
  specs:
    - pcre+jit
    - python@2.7.16
    - py-numpy@1.16.5
    - googletest@1.8.1
    - boost@1.68.0
    - fairlogger@1.4.0
    - dds@2.4
    - fairmq@1.4.3
    - pythia6@428-alice1
    - hepmc@2.06.09 length=CM momentum=GEV
    - pythia8@8240
    - geant4@10.05.p01~qt~vecgeom~opengl~x11~motif~data~clhep+threads
    - $root
    - geant3@2-7_fairsoft
    - vgm@4-5
    - geant4_vmc@4-0-p1
    - fairroot@18.2.1+sim+examples
  concretization: together
  view: false
```

FairRoot installation

```
spack env create jun19 env/jun19/sim_threads.yaml
```

```
spack env activate jun19
```

```
spack install
```



```
[karabowi@witmac004:~/spack/FairSoft$ spack env list
=> 2 environments
    dev_nt  jun19nt
[karabowi@witmac004:~/spack/FairSoft$ spack env create jun19 env/jun19/sim_threads.yaml
=> Created environment 'jun19' in /Users/karabowi/spack/FairSoft/spack/var/spack/environments/jun19
[karabowi@witmac004:~/spack/FairSoft$ spack env activate -p jun19
[jun19] karabowi@witmac004:~/spack/FairSoft$ spack find
=> In environment jun19
=> Root specs
boost@1.68.0                                hepmc@2.06.09  length=CM momentum=GEV
dds@2.4                                       pcre +jit
fairlogger@1.4.0                             py-numpy@1.16.5
fairmq@1.4.3                                pythia6@428-alice1
fairroot@18.2.1 +examples+sim                pythia8@8240
geant3@2-7_fairsoft                          python@2.7.16
geant4@10.05.p01 ~clhep~data~motif~opengl~qt+threads~vecgeom~x11 root@6.16.00 +aqua+fortran+gdm1+memstat+pythia6+pythia8+python+tmva+vc~vdt+xrootd
geant4_vmc@4-0-p1                           vgm@4-5
googletest@1.8.1

=> 0 installed packages
[jun19] karabowi@witmac004:~/spack/FairSoft$ spack -C ./config install
=> Warning: clang@10.0.1-apple cannot build optimized binaries for "skylake". Using best target possible: "x86_64"
=> Concretized pcre+jit
[+] 3xya2nl  pcre@8.42%clang@10.0.1-apple+jit+multibyte+utf arch=darwin-mojave-x86_64

=> Concretized python@2.7.16
```

- **Same package versions (with dependencies) are automatically reused by spack in different environments.**

spack issues

- Fresh user perspective:
 - new workflow and change of habits creates uneasiness,
 - spack, an automated tool, makes some things automatically: f.e. reusing preexisting packages.
- Read carefully the FairSoft installation manual on the github for the dev branch.
- Read the issues on the FairSoft github issue webpage.
- Contact our team - write a new issue in case of any problems.

GSI CVMFS

- New FairSoft/FairRoot will be installed using spack.
- There will be a change in the path to SIMPATH/
FAIRROOTPATH:

`/cvmfs/fairsoft.gsi.de/OSname/compiler/packageName`

- **The user on the new GSI computing cluster (VIRGO) will have a choice of the OS distribution (debian jessie, compatible with the KRONOS, CENT OS 7).**
- **The GSI CVMFS (part of) will be made accessible from outside.**

Summary

- FairRoot 18.4.0 released.
- FairSoft dev moved to **spack**, the package management tool.
- FairSoft now includes FairRoot, and may include experiment software.
- FairSoft and FairRoot on the CVMFS will be installed with spack.
- The GSI CVMFS will be open to outside.