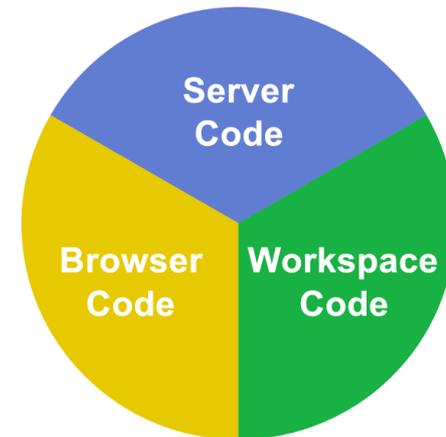


# The VISPA Internet Platform for Outreach, Education and Scientific Research in Various Experiments



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RWTH Aachen University

GEFÖRDERT VOM

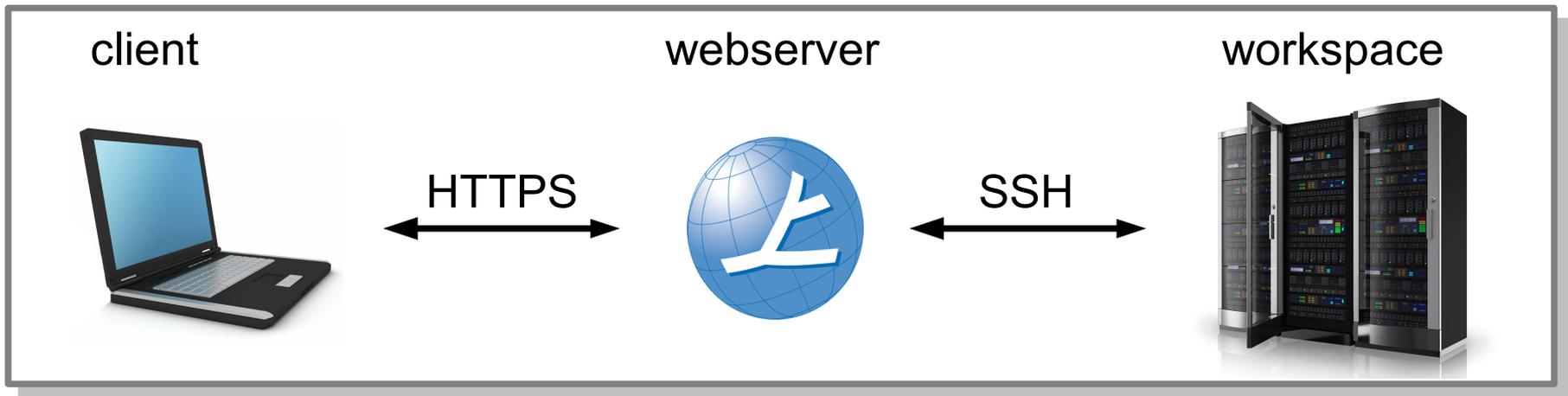


Bundesministerium  
für Bildung  
und Forschung

**DFG**

**RWTHAACHEN**  
UNIVERSITY

# Motivation

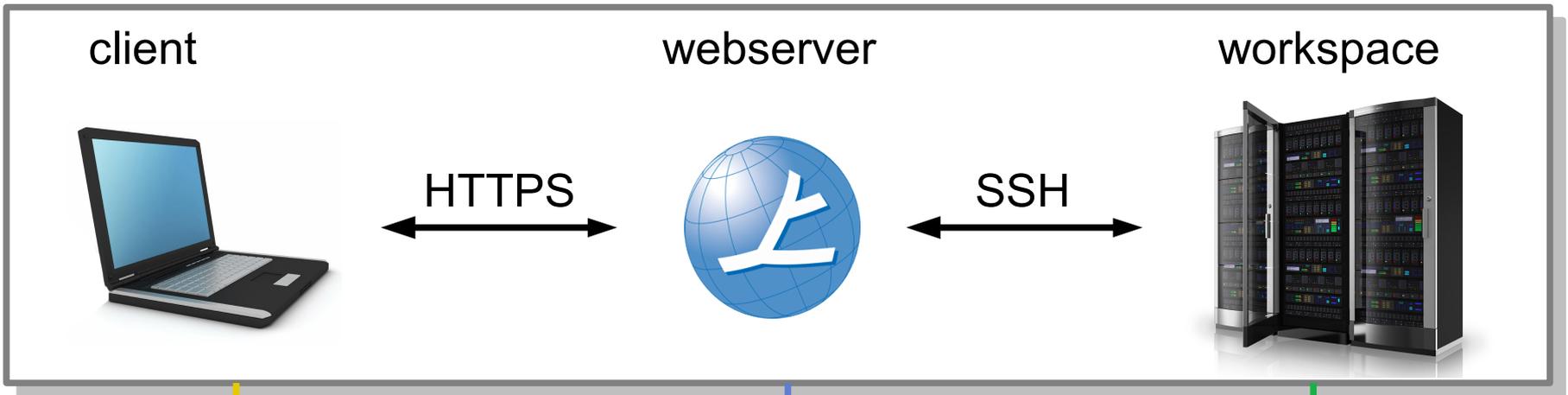


- Web based platform providing a graphical front-end to infrastructures
- Deployment (once for all)
- Scalability (workspaces exchangeable)
- Access from everywhere and with many devices



**More physics and less computing**

# Concept



static content, scripts and GUI



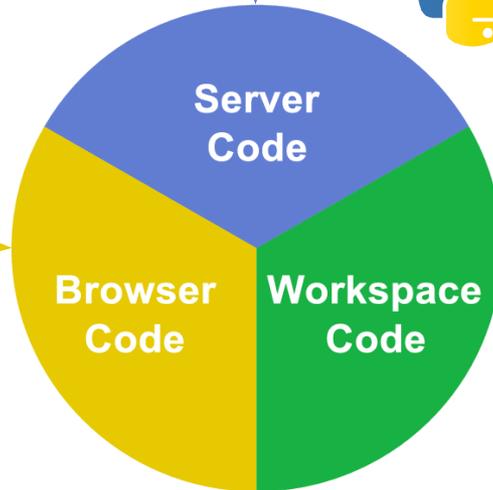
controller functions dispatch requests



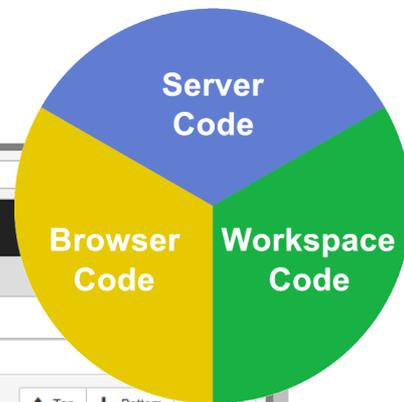
workspace code, process requests



+ local resources



# Code Editor: Edit – Run – Verify



```
17 import os
18 from ROOT import TCanvas, TH1F
19 from pyl.core import toEvent, PluginManager
20 from pyl.modules import Analysis, PythonModule
21 from pyl.hep import Particle
22
23
24 THISFILE = os.path.abspath(__file__)
25 THISDIR = os.path.dirname(THISFILE)
26 DATADIR = "/home/public/CERN/examples/data"
27
28
29 class LeptonSelectionModule(PythonModule):
30     """ This class implements the selection of leptons.
31
32     Supported criteria are:
33     * particle name
34     * kinematic properties: transverse momentum, pseudo-rapidity
35     * total number of leptons
36     """
37
38     def __init__(self):
39         PythonModule.__init__(self)
40
41     def initialize(self, module):
42         """ Initialize module sinks, sources and options """
43         self._module = module
44
45         # physics events "enter" the selection via a sink (input)
46         module.addSink("in", "Input port")
47
48         # physics events are passed on to subsequent modules via sources (output)
49         module.addSource("passed", "All events passing selection criteria will be passed to this ou
50         module.addSource("veto", "All events failing the selection criteria end up in this output p
51
52         # module.addOption(option name, description, default value)
53         module.addOption("leptonName", "Particles with this name are lepton candidates", "Lepton")
54         module.addOption("minLeptonPt", "Minimal transverse momentum (in GeV) a lepton candidate has
55         module.addOption("maxLeptonEta", "Maximum pseudo-rapidity a lepton candidate has to have to
56         module.addOption("minNLeptons", "Minimal number of leptons in the event for the event to be
57         module.addOption("maxNLeptons", "Maximal number of leptons in the event for the event to be
58
59     def beginJob(self, args):
60
```

Execute python %file

5.3.2015 15:29:57:  
executing "python z\_mass.py"

OUTPUT:

2015-03-05 15:29:56 [[0;33mWARNING[m pyl::PluginManager Exception in loadPlugin: PluginMana  
2015-03-05 15:29:56 [[0;33mWARNING[m pyl::PluginManager Exception in loadPlugin: PluginMana  
Lepton selection criteria:  
\* particle name: Lepton  
\* minimal transverse momentum: 30 GeV  
\* maximum pseudo rapidity: 2.1  
\* minimal number of leptons: 2  
\* maximal number of leptons: 2

Info in <TCanvas::Print>: png file /home/asseldonk/z\_mass/Z\_mass.png has been created

runtime: 1.22 s

/home/asseldonk/z\_mass

Z\_mass.png

- Editing, output and preview of results in one view
- C/C++ and Python Scripts can directly be executed
- Verify output figures

# Extensions

- Custom applications to serve individual requirements
  - Installed on top of the platform
- Basic extensions provided in standard setup
  - Codeeditor, Filebrowser, Terminal
- Working conditions comparable to personal computer

The screenshot displays a web-based development environment with three main components:

- Terminal (Left):** Shows a shell prompt with the following commands and output:

```
(python)cglaser@w16:~/$ cd CERN/  
(python)cglaser@w16:~/CERN$ ls  
hello_lepton.py Parsed_Z_ll_out.pxlio Parsed_Z_ll.pxlio Z_mass.png Z_mass.py  
(python)cglaser@w16:~/CERN$ ls -la  
insgesamt 108  
drwxr-xr-x 2 cglaser vispa 4096 Aug 25 13:31  
drwx----- 24 cglaser vispa 4096 Aug 25 13:28  
-rw-r--r-- 1 cglaser vispa 2337 Aug 25 12:54 hello_lepton.py  
-rw-r--r-- 1 cglaser vispa 17884 Sep 8 14:53 Pa  
-rw-r--r-- 1 cglaser vispa 37695 Aug 25 11:47 Pa  
-rw----- 1 cglaser vispa 25428 Sep 8 14:53 Z  
-rw-r--r-- 1 cglaser vispa 6764 Aug 25 13:31 Z  
(python)cglaser@w16:~/CERN$ head Z_mass.py  
# -*- coding: utf-8 -*-  
  
import os  
from ROOT import TCanvas, TH1F  
from pxl.core import toEvent, PluginManager  
from pxl.modules import Analysis, PythonModule  
from pxl.hep import Particle  
  
THISFILE = os.path.abspath(__file__)  
(python)cglaser@w16:~/CERN$
```
- Code Editor (Top Right):** Displays a Python script named `Z_mass.py` with the following code:

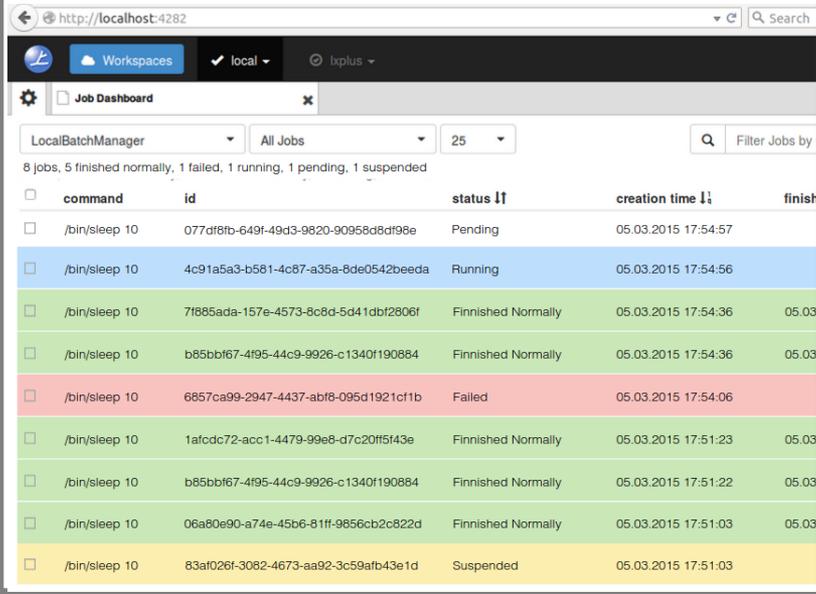
```
17 import os  
18 from ROOT import TCanvas, TH1F  
19 from pxl.core import toEvent, PluginManager  
20 from pxl.modules import Analysis, PythonModule  
21 from pxl.hep import Particle  
22  
23  
24 THISFILE = os.path.abspath(__file__)  
25 THISDIR = os.path.dirname(THISFILE)  
26 DATADIR = "/home/public/CERN/examples/data"  
27  
28  
29 class LeptonSelectionModule(PythonModule):  
30     """ This class implements the selection of leptons.  
31  
32     Supported criteria are:  
33     * particle name  
34
```
- File Browser (Bottom):** Shows a directory listing for the path `/afs/cern.ch/user/d/dvanasse/flow/CMSSW_6_1_2/src/FastSimulation/Configuration/test`. The table below summarizes the contents:

Name	Size	Modified
CVS		Fri Aug 16 2013 09:02
AODIntegrationTestWithHLT.root	1.97 MB	Mon Dec 16 2013 17:41
Example_cfg.py	3.84 kB	Mon Apr 16 2012 17:32
ExampleWithHLT_GRun_cfg.py	5.52 kB	Tue Aug 21 2012 19:03
IntegrationTest_cfg.py	3.56 kB	Sun Nov 04 2012 21:54
IntegrationTestFake_cfg.py	3.60 kB	Mon Apr 16 2012 17:32

# Special Extensions

## Jobmanagement:

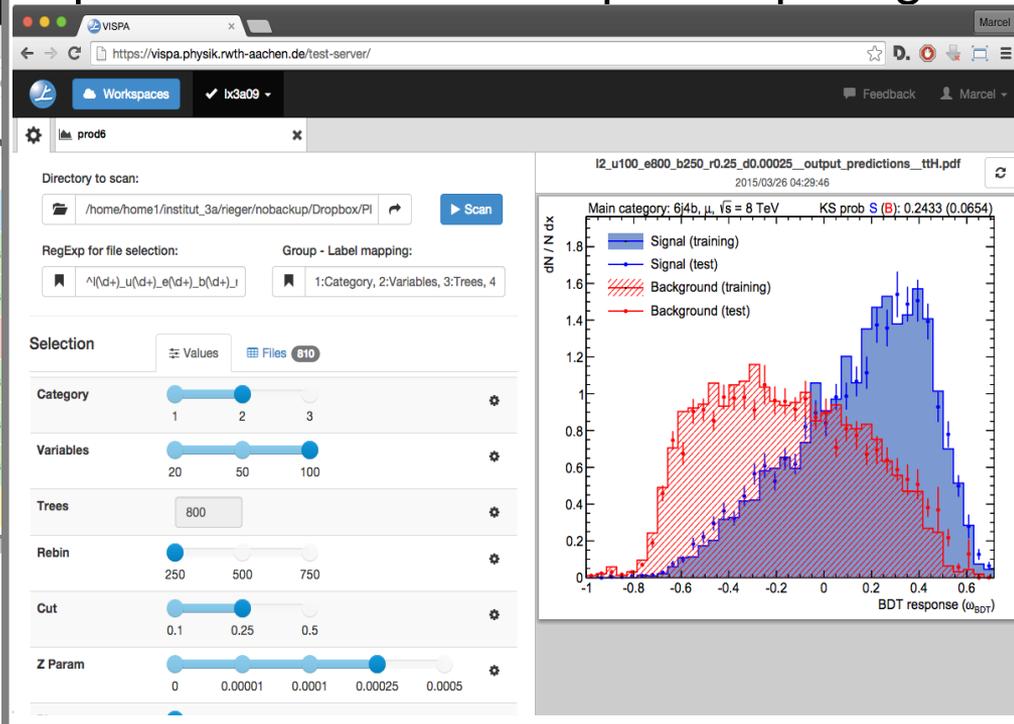
- designer: integrate parameter scans
- submission: submission to a batch system e.g. HTC Condor, WLCG
- dashboard: overview of jobs e.g. status, runtime



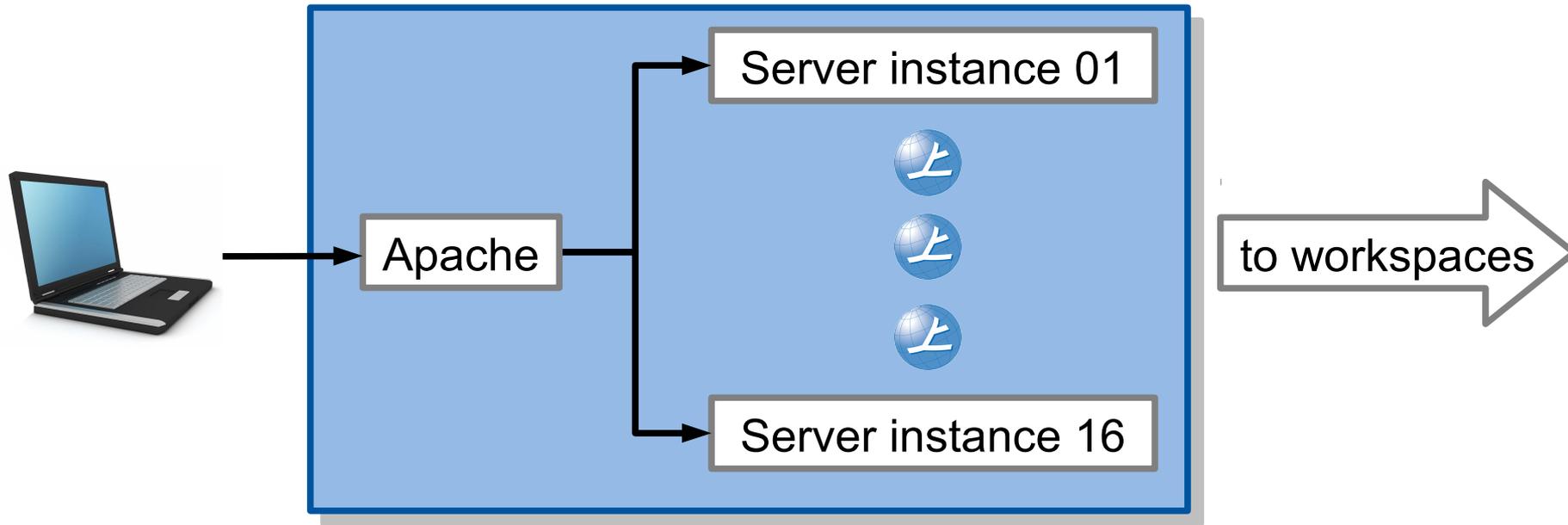
checkbox	command	id	status	creation time	finish
<input type="checkbox"/>	/bin/sleep 10	077df8fb-649f-49d3-9820-90958d8df98e	Pending	05.03.2015 17:54:57	
<input type="checkbox"/>	/bin/sleep 10	4c91a5a3-b581-4c87-a35a-8de0542beeda	Running	05.03.2015 17:54:56	
<input type="checkbox"/>	/bin/sleep 10	71885ada-157e-4573-8c8d-5d41dbf2806f	Finnished Normally	05.03.2015 17:54:36	05.03
<input type="checkbox"/>	/bin/sleep 10	b85bbf67-4f95-44c9-9926-c1340f190884	Finnished Normally	05.03.2015 17:54:36	05.03
<input type="checkbox"/>	/bin/sleep 10	6857ca99-2947-4437-abf8-095d1921cf1b	Failed	05.03.2015 17:54:06	
<input type="checkbox"/>	/bin/sleep 10	1afcdc72-acc1-4479-99e8-d7c20ff5f43e	Finnished Normally	05.03.2015 17:51:23	05.03
<input type="checkbox"/>	/bin/sleep 10	b85bbf67-4f95-44c9-9926-c1340f190884	Finnished Normally	05.03.2015 17:51:22	05.03
<input type="checkbox"/>	/bin/sleep 10	06a80e90-a74e-45b6-811f-9856cb2c822d	Finnished Normally	05.03.2015 17:51:03	05.03
<input type="checkbox"/>	/bin/sleep 10	83af026f-3062-4673-aa92-3c59afb43e1d	Suspended	05.03.2015 17:51:03	

## Parameter Scan

- overview over all plots produced in a parameter scan → helps comparing

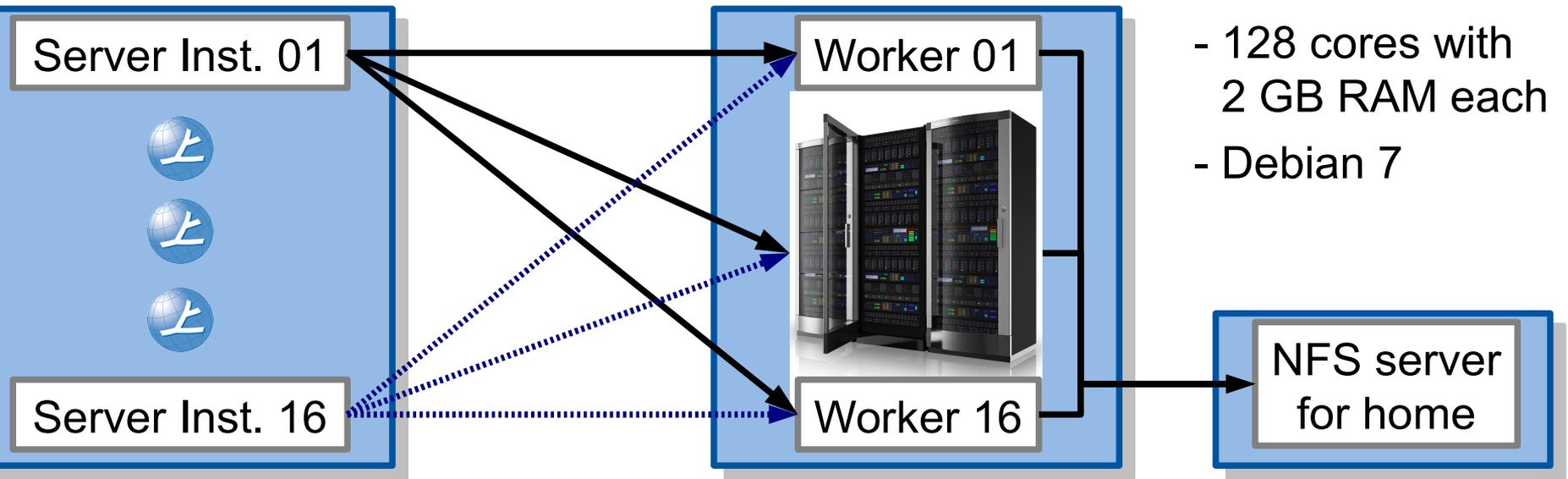


# Server Setup at RWTH Aachen



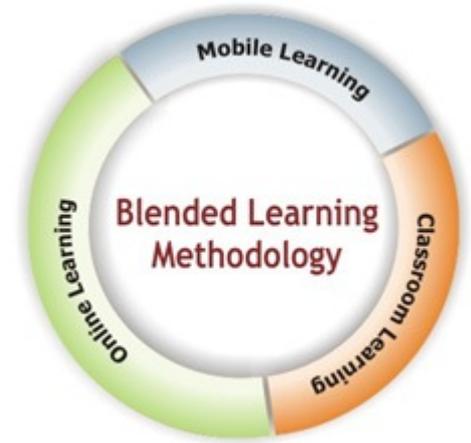
- Load balancing allows simultaneous access of many users
  - Without balancer limited by CherryPy threads (sticky sessions)
- Apache cache for static content
  - speed up loading
- Next step: starting server instances on demand

# Workspace setup at RWTH Aachen



- User authentication via common MySQL database of server instances
  - Only one database and no synchronization
  - No additional registration for workspace needed
- Home directories on external NFS
  - Highest stability, speed not depending on load of workers
  - Easy to extend
- Distributed file system (gluster) for scratch

# VISPA in Education



- Blended Learning
- VISPA successfully used in lectures:
  - Bachelor and Master
    - » Homework assignments + analyzing experiments demonstrated in lecture hall
  - Feedback helped to improve the platform
- Publication: Eur. J. Phys. 35 (2014) 035018



# VISPA in Outreach

## Pierre Auger Public Data

The screenshot shows the website <https://www.auger.org/index.php/edu-outreach/vispa>. The header features a navigation menu with items: Home, News, Cosmic Rays, Observatory, About Us, Science, and Edu & Outreach. The main content area is titled "Online Analysis of Pierre Auger Data with VISPA". It contains a text block describing the platform's capabilities, a central image showing four data plots (a histogram, a scatter plot, a sky map, and a simulation), and a footer note stating that VISPA is developed at RWTH Aachen University.

- Perform physics analyses with public data of the Pierre Auger Observatory

Poster Session B  
Contrib. ID: 249

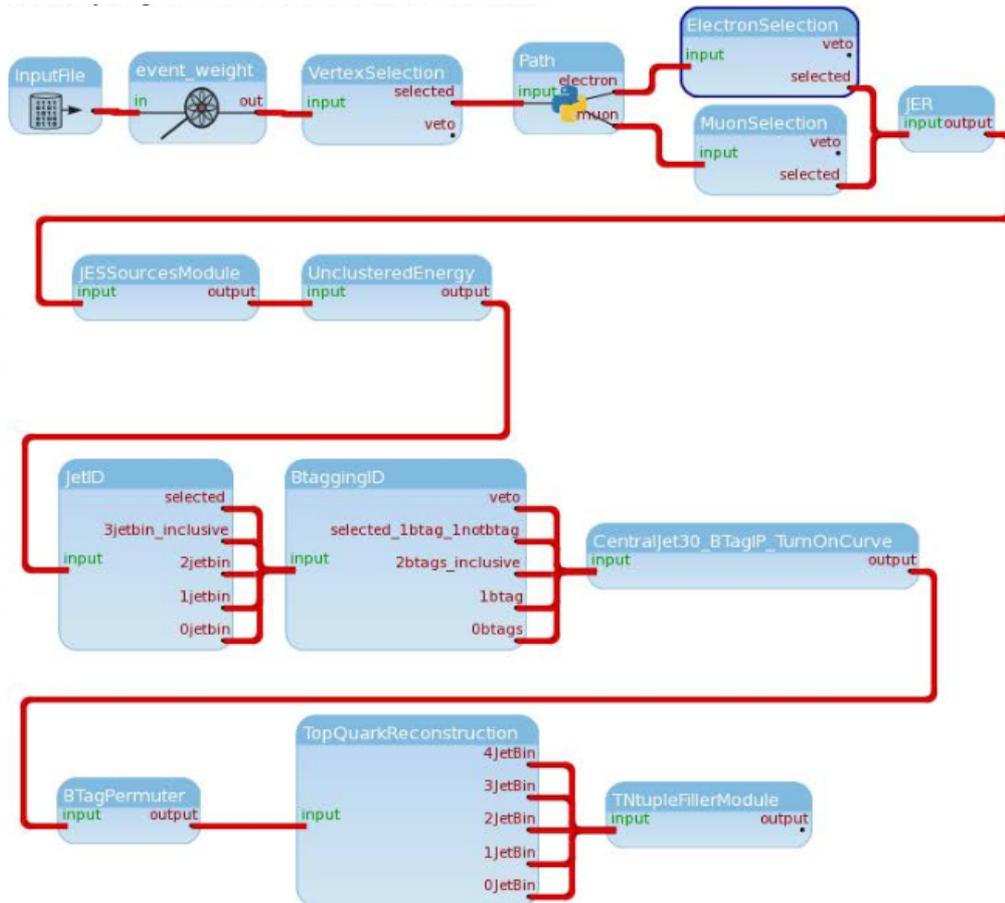
## CERN Open Data Portal:

The screenshot shows the CERN Open Data Portal at [opendata.cern.ch](https://opendata.cern.ch). The page features a navigation bar with "ABOUT", "SEARCH", "EDUCATION", and "RESEARCH". The main content area is divided into two sections: "Education" and "Research". The "Education" section includes the text "Visualise events, check reconstructed data, run tools or build your own!" and a "Start learning" button. The "Research" section includes the text "Get the genuine working environments, virtual machines and datasets to start your research" and a "Start analysing" button. A central hub-and-spoke diagram connects these sections to various particle physics symbols:  $\mu$ ,  $\gamma$ ,  $\tau$ ,  $e$ , and  $q$ .

- One click access to CMS public data
- "Discover" e.g. the Z-Boson without installing any software
- Use examples as start for analysis
- ~ 300 Users since start

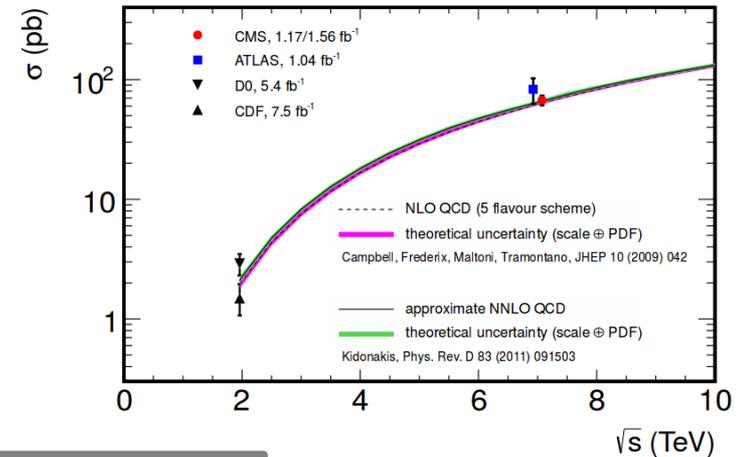
# VISPA in Scientific Research

**CMS Collaboration:** Measurement of the single-top-quark t-channel cross section in pp collisions at  $\sqrt{7}$  TeV (JHEP12 (2012) 035)



## Used modules:

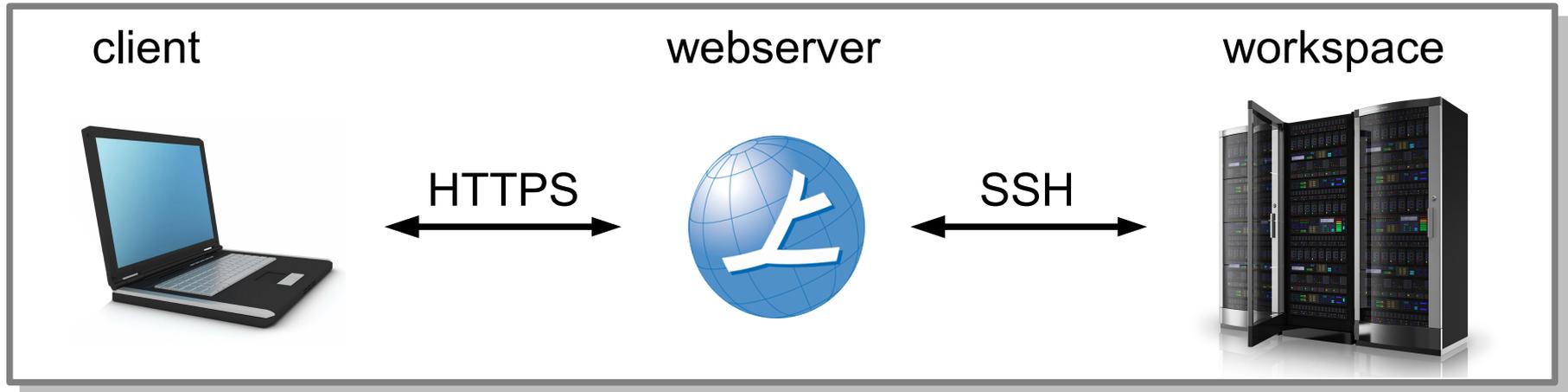
- electron selection
- jet energy resolution
- b-tagging
- top reconstruction
- ...



Currently transferring analysis designer from desktop to web version

# Summary

- VISPA delivers a web GUI to infrastructures



- Used for scientific research, teaching and outreach

- Continuously improved system

- Try it (guest login available):  
[www.vispa.physik.rwth-aachen.de](http://www.vispa.physik.rwth-aachen.de)

- Repository:  
<https://forge.physik.rwth-aachen.de/projects/vispa-web>

