ROOT CI with GitHub Actions

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ROOT Team Meeting · November 13, 2023

Ingredients

- Runners

  - Images

- Workflows

- GitHub Interface
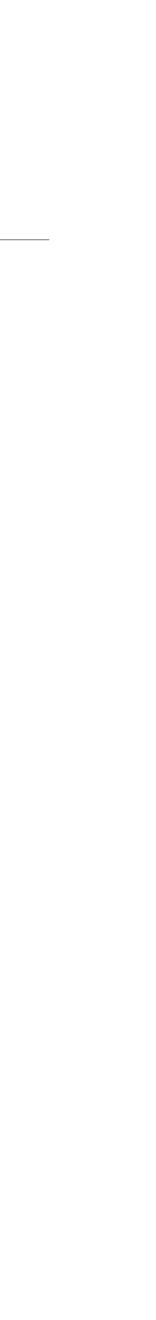
- What's Missing

Runners

Runners

- "Self-hosted Runners": depends on platform

  - Windows: beefy CERN IT VMs managed by Bertrand

  - macOS: Mac minis maintained by Olivier

  - Linux: Puppet-managed OpenStack VMs running docker images

Defining Docker Images

- https://github.com/root-project/root-ci-images

- One directory per platform with `packages.txt` and `Dockerfile`, e.g. Fedora 39

- New distro version: copy previous version as a PR and adjust until it works

Building Docker Images

- [Workflow](#) builds all images daily

- Pushes them to S3

```yaml
jobs:
  build:
    strategy:
      matrix:
        image:
          - debug
          - debian10
          - fedora37
          - fedora37-test
          - fedora38
          - fedora39
          - alma8
          - alma9
          - ubuntu2310
          - ubuntu2304
          - ubuntu22
          - ubuntu20
          - ubuntu18
      fail-fast: false
```
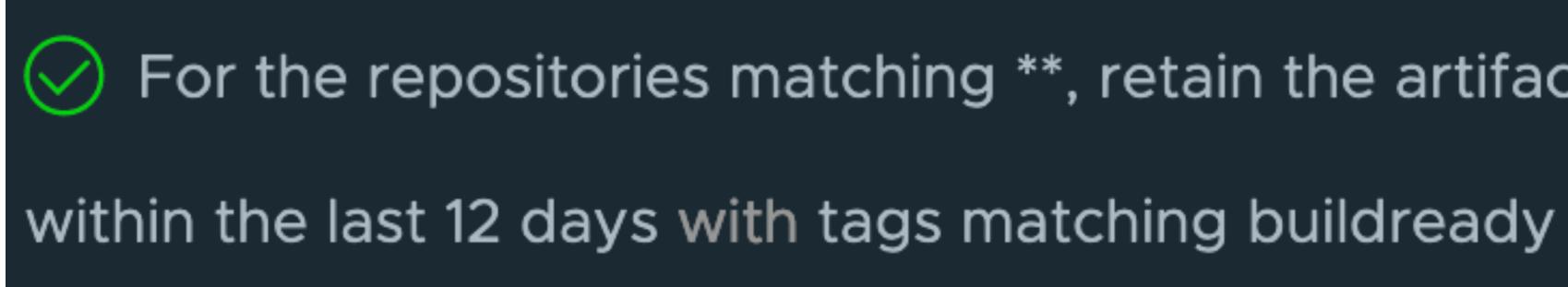
```yaml
- name: Build and push
  uses: docker/build-push-action@v4
  with:
    context: ./${{ matrix.image }}/
    push: ${{ github.event_name != 'pull_request' }}
    tags: registry.cern.ch/root-ci/${{ matrix.image }}:buildready
    labels: org.opencontainers.image.source=https://github.com/${{ github.repository }}
    no-cache: ${{ github.event_name != 'push' && github.event_name != 'pull_request' }}
    cache-from: type=gha,scope=${{ matrix.image }}
    cache-to: type=gha,mode=max,scope=${{ matrix.image }}
```
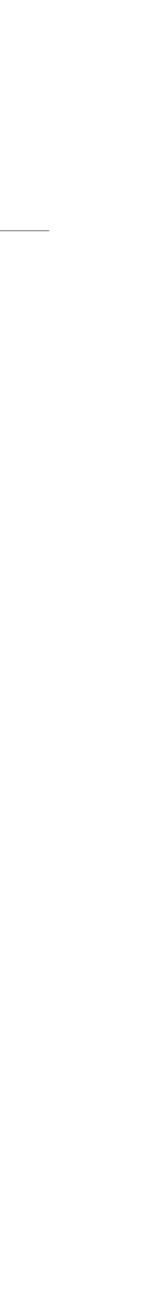
Storing Docker Images

- Stored in https://registry.cern.ch project root-ci

- One dir per platform image

For the repositories matching **, retain the artifacts pushed within the last 12 days with tags matching buildready

Workflows

Part of root.git repository

- .github/workflows/root-ci.yml defines CI

- PR to branch X checks this branch's file for "on pull_request"

  - Nightly *only* checks master!

- Calls script root-ci-config/build_root.py to rebase, build, package, test ROOT and upload build artifacts as source for incremental PR builds

Build Artifacts

- Complete builds (on merge and nightly) push source and build dir to S3 at OpenStack project `PH PH-ROOT-PROJECT` / object store container named ROOT-build-artifacts; currently 1TB

- One directory per platform, one subdir per branch, one subdir per CMake build type, one subdir per CMake invocation hash

CMake Configuration

- Stored as delta to buildconfig/global.txt per platform, e.g. ubuntu22.txt:

```
1    builtin_vdt=ON
2    pythia8=OFF
```

- NOTE: this MUST be the same for release binaries and PR builds

- Add "config phase space coverage" by adding overrides in build configuration

```
- image: fedora39
  overrides: ["LLVM_ENABLE_ASSERTIONS=On", "CMAKE_CXX_STANDARD=20"]
- image: fedora38
  overrides: ["LLVM_ENABLE_ASSERTIONS=On", "CMAKE_CXX_STANDARD=20",
- image: fedora37
  overrides: ["LLVM_ENABLE_ASSERTIONS=On"]
```

```
- name: Apply option overrides from matrix for this job for non-release builds
  if: ${{ github.event_name != 'schedule' && matrix.overrides != NaN }}
```

The Build Script 1/2

```python
if args.incremental:
    try:
        download_artifacts(obj_prefix)
    except Exception as err:
        build_utils.print_warning(f'Failed to download: {err}')
        args.incremental = False


git_pull(args.repository, args.base_ref)

if pull_request:
    rebase(args.base_ref, args.head_ref)

build(options, args.buildtype)
```

The Build Script 2/2

```python
# Build artifacts should only be uploaded for full builds, and only for
# "official" branches (master, v?-??-??-patches), i.e. not for pull_request
# We also want to upload any successful build, even if it fails testing
# later on.
if not pull_request and args.incremental and not args.coverage:
    archive_and_upload(yyyy_mm_dd, obj_prefix)

if args.binaries:
    create_binaries(args.buildtype)

if testing:
    ctest_returncode = run_ctest(extra_ctest_flags)

if args.coverage:
    create_coverage_xml()

if testing and ctest_returncode != 0:
    handle_test_failure(ctest_returncode)

print_trace()
```

GitHub Interface

What This Looks Like in GitHub: CI

- [Example PR](#)

github-actions (bot) commented 2 weeks ago

Test Results

10 files	10 suites	1d 14h 59m 2s ⏱
2 479 tests	2 477 ✔ 0 💤	2 ❌
23 763 runs	23 761 ✔ 0 💤	2 ❌

For more details on these failures, see [this check](#).

Results for commit `2c08082` .

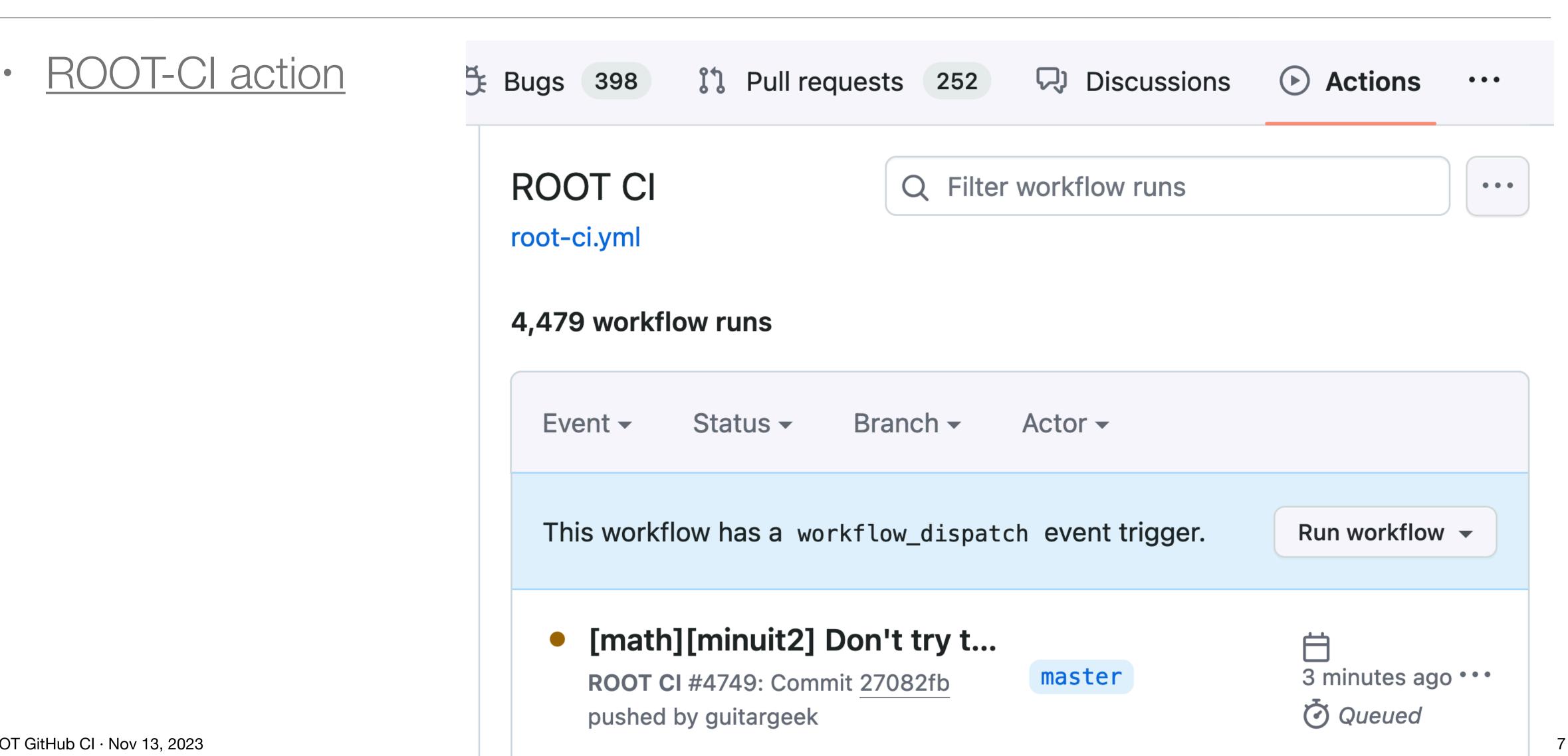# What This Looks Like in GitHub: CI

- [Example PR](#)

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Results for commit 2c08082 .

What This Looks Like in GitHub: Actions

- ROOT-CI action

ROOT-CI: on push, PR, Nightly

❌ **Changed filters used by RBatchGenera...**
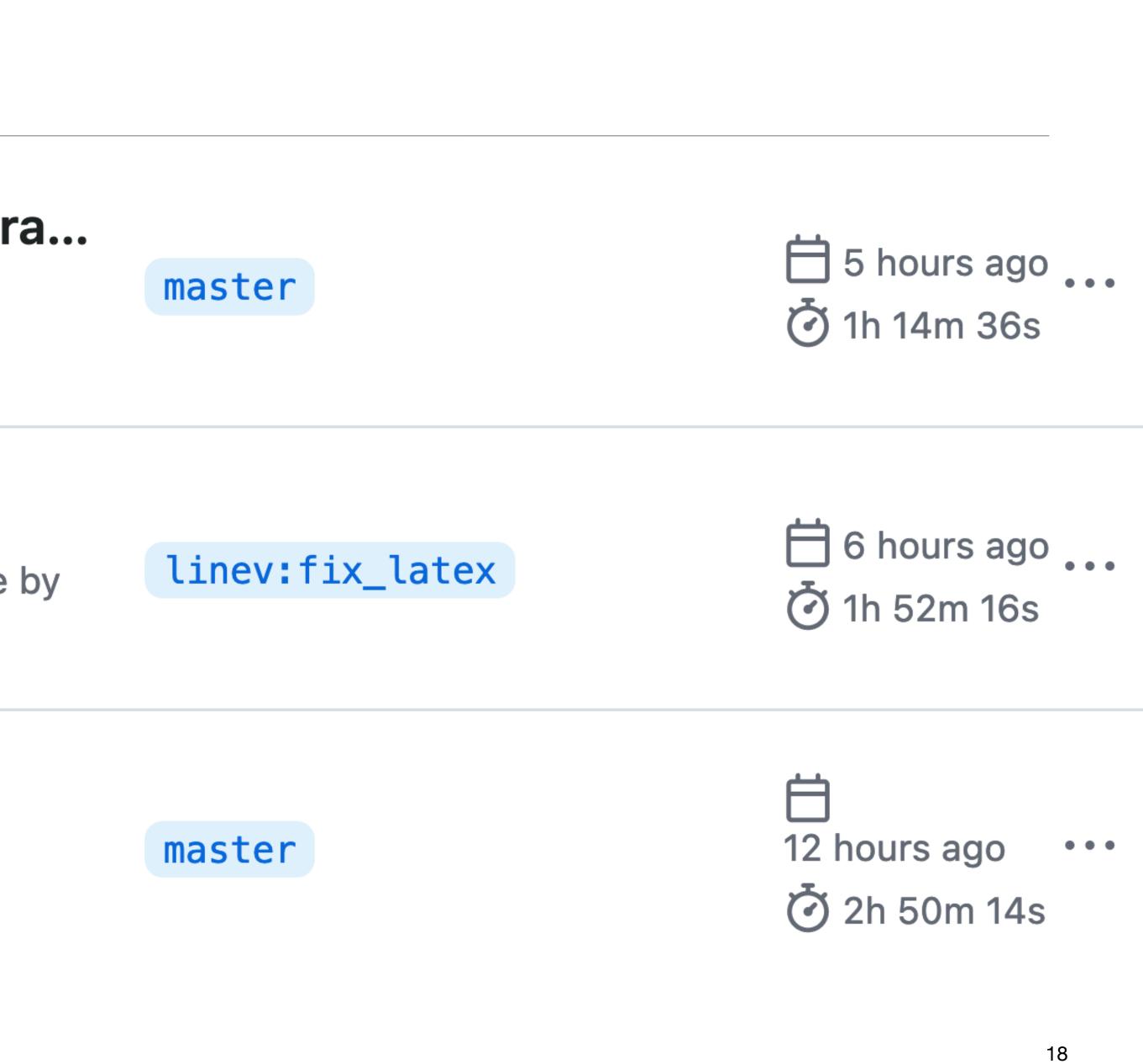
ROOT CI #4729: Commit eeb564e pushed by guitargeek

`master`

📅 5 hours ago ···
⏱ 1h 14m 36s

❌ **Improve latex drawing for** `#hat{f}`

ROOT CI #4728: Pull request #14042 synchronize by linev

`linev:fix_latex`

📅 6 hours ago ···
⏱ 1h 52m 16s

❌ **ROOT CI**

ROOT CI #4727: Scheduled

`master`

📅 12 hours ago ···
⏱ 2h 50m 14s

What's Missing

Shopping List

- Implement roottest CI

- Finish porting releases, updating docs

- 32bit and GPU runners

- Doxygen, rootbench, ASAN, etc builds

- "Runner is offline" job; "nightly release all branches" job

- Refactor: set up reusable workflows, calling "build ROOT", "test ROOT", etc

Big Thanks!!!

- To Ole for inventing this

- To Shahzad for directing us there

- To Bertrand, Olivier, JonasH, ... for complaints, sanity checks, and discussions!