

# Material for discussion

## Towards Geant4 10.0 : action items

- JIRA with issues (please use) related to MT:  
<http://jira-geant.kek.jp>
  - Select “Dashboards” -> “Multi Threading”
- Report issues and feature requests selecting as “Component” -> “Multi-threaded”
- Currently: 49 total issues related to MT, 21 open in progress (none critical)
- Marked current limitations with ☂
- Marked current issue with ☹

## What we need to do (1/3): general aspects

- **☂ Visualization:** during the event-loop visualizations is not yet fully functional (begin worked on). Can visualize geometry or keep events and replay during event loop
  - In Version 10.0 we will have visualization in MT fully functional, however CPU penalty is expected when VIS is on
  - Parallel Session 3B discusses the details
- **☹ Windows platform:** MT not working yet. Need manpower to port few spots on the code and test the applications. Volunteer? Backup solution: postpone MT for Windows to Version 10.1
- Further cleanup and improvement of public API. When we freeze them? I propose end of October
- **More examples and tests should be migrated**

## What we need to do (2/3): collaboration wide efforts

- **Memory reduction:** identify physics processes that require most memory, reduce the per-thread overhead sharing read-only parts
- **Reduce use of G4ThreadLocal keyword:** mainly in Hadronics, underway, but more effort is needed
- Note: Goal of December release is functionality, performances can be continued in 2014

## What we need to do (3/3): specific actions

- ☂ **/run/beamOn** command currently explicitly required to work in MT, limitation to be removed
- **Clean up** geometry and physics initializations in worker initialization phase
- **Finalize documentation** for version 10.0: both application and developers guides (convert twiki to docbook)
- **“Externals”**: tpmalloc, checkpointing, MPI (not critical, shown in examples, can be delayed)
  - Use of G4EnhancedAllocator
- ☹ **Ion handling** is undergoing important redesign for MT, we need to further test it
- ☂ **TBB based example**: show how to use TBB instead of PTHREADS (re-write example done for prototypes)

## Major efforts, large new developments required

- **Workspaces:** re-use memory pools for threads, needed by CMS –See Parallel Session 4B, talk from J. Apostolakis for details
- **pRNG:** evaluate random number generators for parallel applications. Specific high performing (parallel) RNG exists.
  - Need to better understand what is available and how to use them
  - Understand if they can solve of theoretical overlap of number sequences

# MT enables examples/tests (updated: September 16<sup>th</sup>)

- All four **basics**
- Extended: **electromagnetic/emTest4, runAndEvent/R03&05, analysis/AnaEx01, optical/LXe optical/wls**
- Advanced: **dnphysics, microbeam, nanobeam**
  
- **Tests:** 11, 12, 13, 16, 18, 24, 25, 27, 28, 60, 61, 64, 67, 68, 69
  
- In addition two full applications used for profiling testing: **FullCMS, SimplifiedCalorimeter**
  
- **Priority should go to extended examples:** demonstrate all functionalities work as expected in MT. At least one example per directory.
- Missing directories: biasing, errorpropagation, eventgenerator (but covered in RE05), exoticphysics, field (but covered in full applications), g3tog4 (skip!), geometry (not needed), **hadronic, medical, parametrisations, persistency** (!), polarisation, **radioactivedecay**, visualization (probably not needed)

# Time-line

- November 6<sup>th</sup>: Kernel tags deadlines
- **December 6<sup>th</sup>: Release**
- Warning: due to its nature MT bugs are difficult to debug and usually takes longer for fixes
  - **We cannot accept last minute tags related to MT.** Example: sharing of a table in physics process
  - Deliverable to experiment: working code, 2014 is the occasion to further increase performances
- **On critical path:**
  - Workspace, requires early tags for testing, at latest mid of October
  - TBB example: needed for developing by some experiments, in the worst case can be provided as a separate tar-ball
  - Windows: complete migration, testing (!)
- **Hadronics and MT:** we will probably need some re-coding of some framework classes (no public API involved), my opinion is we should move these developments to 2014, unless very clearly understood



## Metrics and testing

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- Performance and Physics Validation
  - See Soon and Alberto presentation here, how to consolidate current effort? automatize?
  - Extension of test suite with a second application (already agreed last year for sequential, no progress unfortunately)