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Status report on Muon code in ORCA 7

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Summary:

- A list of items for future Muon development,
- starting from work in progress (to be released soon),
- short, medium and longer term work and plan,

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Long summary:

Work in progress,

- Transition to DDD,
- DT hits as RecHits,
- Neutron background,
- Transition to gcc 3.2,

Short term TODO;

⋆ Fortran code residual,

⋆ Det vs DetUnit misuse,

⋆ Dets, DetUnit and SimHit access,

⋆ Radial strip topology in End-Cap,

Medium term TODO;

⇝ DT digitization,

⇝ Muon alignment,

Longer term TODO;

⇝ New propagator implementation,

⇝ Passive and Magnetic material description,

⇝ Navigation with passive material;

Transition to DDD:

- Lot of work done by M.Case, A. Straessner on DDD/xml side,
- xml still based on the semi–automatic tz translator by Pedro: synchronization with cmsim guaranteed
- Sub detector status:

  - $\rightsquigarrow$ CSC status: almost ready; (MC, PTC)
  - $\rightsquigarrow$ working with ORCA6, some technical problem with ORCA7 (probably BuildFile related),

  - RPC status: ready (?); (MC, AK)

  - $\star$ DT status: on the way...; (MC, SL)

Transition to DDD (2) DT status:

- ⋆ Work in strict contact with Mike:
- ⋆ Manage to build all DT chamber from DDD, check correct position, rotation and orientation,
- ⋆ Build (yesterday night!) also MuBarLayer (as Det), to be checked for position,
- ⋆ Some problem for SuperLayer: they are not present in the Tz/Xml modeling: should build them out of 4 layers, technical problem,
- ⋆ Some problem (not so trivial) about left-handiness of reference frame of Chamber in geant3 (so in tz, so in xml). Tricks applied to fix it.

Timescale: 1.5 week

DT hits as DetHits (SL):

- ⇝ This summer lot of work spent in improving DT hits reconstruction,
- ⇝ Now only the DT segments are RecHits, the hits are not, so it's not easy to access them, and not possible to eventually use them in muon reconstruction,
- ⇝ To do it, MuBarRecHit, and MuBarRecHitPair introduced since this summer: MuBarRecHit are RecHits. Not used so far for technical problem.
- ⇝ To have DT hits as RecHits we need MuBarLayer to be Det: not easy in the current (G3 based) geometry building,
- ⇝ Take the opportunity given by DDD use to redo MuBar geometry in order to build layer as Det,
- ⇝ Rest of the work in principle already done, to be tested within reconstruction

Timescale: 1 week after DDD completed

Neutron background:

- Work by Rick W. Presented at 3 December PRS-mu meeting inside CMS-week
- Status: committed in CVS.
  - ⋆ Neutron Hit DB ready for CSC,
  - ⋆ now off by default,
  - ⋆ DT and RPC should populate their DBs of neutron hits to use this functionality.

Transition to gcc 3.2 (and icc): (SL, PTC, AK, NN, ...)

⋆ No major problem foreseen, Norbert already started to fix most common problem

Fortran code residual:

- Major source of FORTRAN residuals is now in the G3 geometry interface,
- Once DDD transition completed, .F code still in: **MXHitFormatter, MEDigitizer** and MuonTrackFinder,
- In MXHitFormatter used to access and decode G3 SimHit, will survive until OSCAR (when HitFormatter will not be used anymore),
- MEDigitizer: FORTRAN used to simulate the gas ionization.
- Geant3 routines accessed to get material parameters! Not just a matter of Fortran$\longrightarrow$C++ translation.

Fortran code residual (2):

- 2 possible solution:
  - Store material info somewhere (ASCII, xml, ...) and port the code to C++,
  - access Geant4 for material,
- Russian CSC people are working on a new digitization, so the problem could be not present in this new code: Tim waiting news
- MuonTrackFinder FORTRAN present just to reduce the printout of geane.
- Until we use geane we will use FORTRAN code anyway (even if "hidden" in CommonReco) – see after

Det vs DetUnit misuse: (PTC)

- Det are object used by reconstruction,
- DetUnit are Det with access to SimHits and ROU (digi);
- Misuse of DetUnit in endcap: either layer and chamber are DetUnit,
- Tim is working to have only layer as DetUnit, and chamber just as Det.
- Apparently our navigation require to use DetUnit and not Det (as it should)
- Work in progress to fix the problem,
- Work related with DDD geometry building.

Dets, DetUnit and SimHit access:

- Now the access to Dets, DetUnit and SimHits is different for the three sub-systems (DT, CSC, RPC), and also different to the Tracker one,
- Easy access is a very common use case, a clearer interface is important,
- Functionality to be provided: user–friendly access to all detector, either as Det and as concrete chamber (`MuBarChamber, MuBarLayer, ...`),
- also access to SimHit (and digi) or via DetUnit or directly,
- A common interface is under discussion (within RPROM) and will be implemented soon.

Radial strip topology in EndCap (PTC):

- Actual implementation of measurement geometry is orthogonal, corresponding to the local coordinate frame, but doesn't match the real CSC layout, where the strips are radial
- The detector does not measure directly the local x and y, but phi and y
- This gives some problem in computing the hits errors due to correlation of the two coordinates;
- with Radial strip topology a correct measurement frame is introduced (along wires and strips), in addition to the usual two, local and global, with proper transformation between the 3 for positions and covariance matrices,
- Status: almost ready,

DT digitization:

- Work in progress by J.Puerta, M.C.Fouz, P.García & P.Ronchese,
- Al the December CMS week presented:,
- progress on GARFIELD simulation of the new (4.2 cm wide) cell
- SimHit treatment for special cases
- Timescale: spring (?).

Muon (mis)-alignment:

- Work done and presented by Francisco Matorras (December CMS week),
- Should go in ORCA official release.

Farewell to GEANE:

- Lot of (hard) discussion about GEANE replacement during last CMS week.
- two proposal:
- Geant4 replacement (aka “geant4e”)
- and Tracker extrapolation software (aka “Teddy software”)
- Conclusion: (from a mail by Paris)

It is best that the new tracker extrapolation software be used by all – including the muon software.

we would to have “GEAN4E” as a **backup** *and cross check, provided it will be developed by GEANT4 team*

Farewell to GEANE (2):

- But Teddy software is not for free!
- We should provide passive material (iron Yoke) description and C++ modeling, as well as dedicated and optimized navigation.
- Similar work is needed for the new magnetic field description and it's strictly related to future propagator optimization
- Valery Andreev is working to provide a magnetic material description in ORCA
- Preliminary work by Norbert (see last PRS/μ) showed that the model (at least in the barrel) should not be too difficult
- looking for manpower, both for barrel and endcap,
- Nicola A. shows interest in the navigation business

Longer timescale: $\approx$ this summer