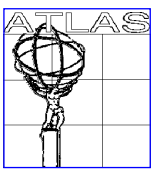
ATLAS
Muon Spectrometer Software:
Overview & DICE Integration

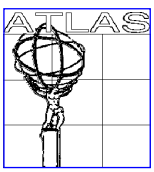
Outline:

- History
- Muon software in standard ATLAS packages
- Other muon software
- MC production plans
- Organization
- Spectrometer description in DICE
- Summary & Outlook



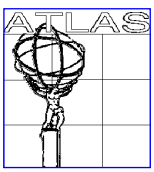
Historical remarks

- Most applications started as stand-alone developments
- Good progress with integration into 'ATLAS Software Framework' (LHCC milestone 12/97)
- Most software (still) developed in Fortran 77 (+AGE ...) but notable exceptions:
  - Level-1 barrel trigger simulation in C, conversion to C++ envisaged (A. dell'Acqua)
  - OO pattern recognition for DATCHA in C++ (P. Hendriks)



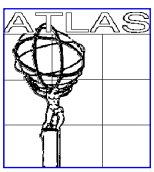
Muon Software in standard ATLAS packages (I)

- Implementation of spectrometer in DICE (☞RV)
- Trigger simulation in ATRIG:
  - Separate LVL-1 packages reflect different detector technologies in barrel/end-cap, integration with ATRIG underway (A. dell'Acqua/Y. Hasegawa)
  - Common LVL-2 package developed in ATRIG framework, expected to be ready in early '98 (Boston/Lecce/Rome)



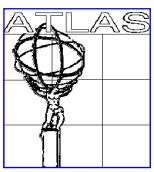
Muon Software in standard ATLAS packages (II)

- Momentum resolution code (Saclay group) (☞LC)
  - complete but fast analytic approach to momentum resolution, used for TDR performance figures
  - now integrated in ATLFAST(++)
- Pattern recognition, track and momentum reconstruction in ATRECON
  - MUONBOX (Saclay group): Integration nearly completed (☞LC)
  - MUONBMC (Boston group): standalone at present, plans for integration in ATRECON and ATRIG



Muon Software in standard ATLAS packages (III)

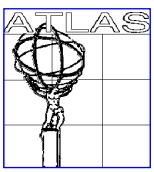
- Backtracking through calorimeters, track matching & combined reconstruction with Inner Detector
  - MUONFIT: complete solution for combined fit incl. covariance matrix, developed by Nijmegen group (F. Crijns), ready only later in '98
  - 'Fast' approach developed by G. Stavropoulos/CERN



Other Muon Software

- Muon database (AMDB_SIMREC): Dimensions & positions of all muon detectors (Saclay group) (☞LC)
- Magnetic field map (BMAGATLAS) (Saclay group) (☞LC)
- 3-D visualisation of muon spectrometer (PERSINT):
  - integrated with AMDB_SIMREC
  - allows to detect overlapping volumes (layout clashes)
  - can display reconstructed hits + tracks in 3-D

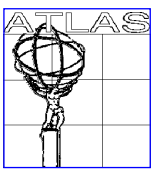
  (Saclay group)
- OO pattern recognition (DATCHA) in ARVE framework (☞PH)



MC production plans

Muon community plans to participate in 'massive' MC production effort:

- **Priority channels:**
  - **single muon 'scans' (performance studies)**
  - **$H \rightarrow ZZ^* \rightarrow 4\mu$**
  - **$H \rightarrow t\bar{t}$**
  - **$W' \rightarrow \mu\nu$**
- **Candidate institutes (t.b.c.):**
  - **CERN**
  - **BNL**
  - **Boston**
  - **Rome**
  - **Munich (MPI)**
  - **.....?**
- **Layout M in DICE on critical path**

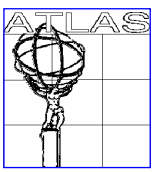


Organization

- Principal centers of S/W development:
  - Boston
  - CERN
  - Nijmegen
  - Rome, Lecce, Pavia, ...
  - Saclay

  More manpower badly needed!

- Coordination:
  - Physics: F. Paige (BNL)
  - Performance simulation: A. Nisati (Rome) (also coordinates muon trigger code in ATRIG)
  - S/W tools, ACOS representation: R. Voss (CERN)



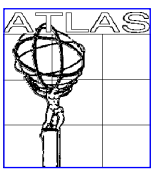
Muon spectrometer description in DICE

(A. Dell'Acqua/S. Baranov)

- Status: implementation of geometry and materials ('Volumes') of toroid magnet structures and of
  - RPC
  - TGC
  - MDT

  chamber sub-systems completed.

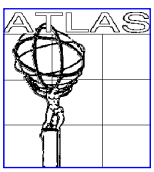
  For CSCs, digitisation code is ready but geometry will be implemented with chamber layout M only.



To do:

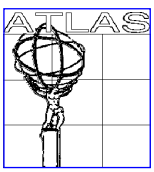
- Resolve incompatibility between volume numbering schemes of AMDB_SIMREC and AGE.

  Patch is available but needs consolidation and more testing.
- Implementation of stochastic (resolution, efficiencies, misalignements etc.) and systematic (Lorentz angles, propagation time of signals along the wires, r-t calibration, etc.) effects in the DICE/ GEANT digitisation.
- Implement latest version of chamber geometry and layout (AMDB_SIMREC version M)
- Superimpose background hits (FLUKA)



Summary & Outlook

- Muon spectrometer software developed by (too) small but dedicated community, covers most basic needs
- Integration of muon software in general ATLAS packages has made good progress and is largely completed

  (LHCC milestone)
- Plan to participate in MC production, implementation of recent layout on critical path

  (fall-back solution available)
- Set up PBS-type 'master plan' for muon software development