Question

The requirements on the ODBMS are truly frightening. BaBar is finding problems with ODBMS/Operating system compatibility. What steps will you take/how confident are you that you will have a product which will cope with your requirements?

- ➢ What is the favoured Storage Model?
- ➢ How does this satisfy our technical requirements?
- ➢ Have we understood the risks?
- ➢ What is the outlook?

Favoured Storage Model

- We need a storage model for managing data at all stages of production from data acquisition to analysis
- Data are assumed to be in the form of (collections of) objects
- Following 3 years of R&D (RD45) the preferred solution is based on 2 commercial packages (Objectivity/DB and HPSS) and a small library of HEP-specific code (HepODBMS)
- Production services are being setup at CERN for specific applications (ATLAS/CMS test beams, NA45, COMPASS..)
- Important R&D still to be done based on "use cases" from the LHC collaborations to provide input for final decisions

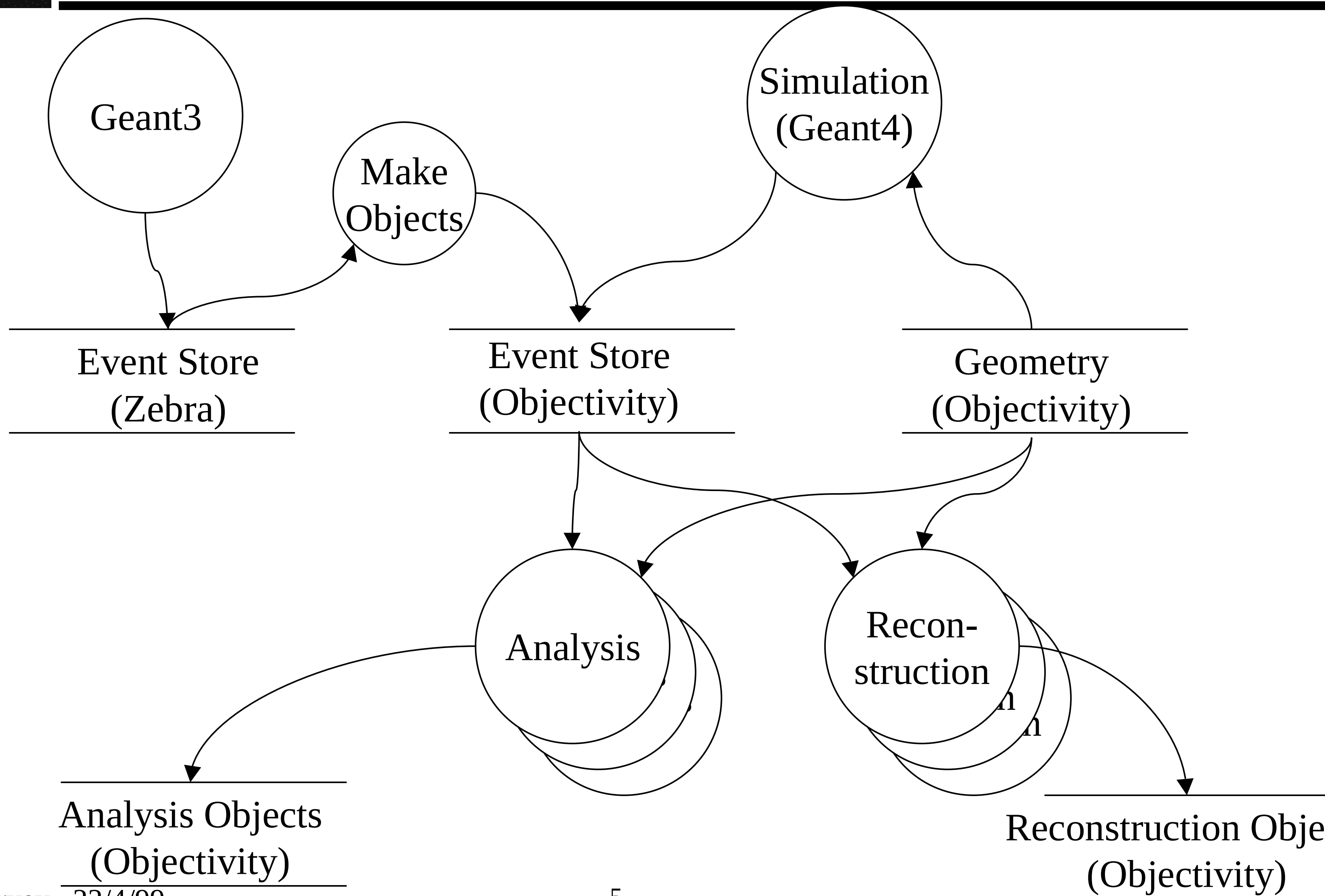
LHCb Technical Requirements

- Data recording at ~10 MB/s would require 10 parallel streams into a single Objectivity/DB federated database at 1 MB/s
  - 32 such streams already demonstrated by NA45
  - NB CMS/ATLAS -100 MB/s, ALICE 1 GB/s
- Scalability to large database sizes of ~1 PB
  - a single Objectivity/DB federation can contain 2^{16} databases
  - size of each database limited by file-system (unlimited if 64-bit)
  - 0.5 TB federated database demonstrated (limited by disk capacity)
  - integration with mass storage still to be studied
- Many other issues still to be studied
  - Database usage over a wide area network
  - Clustering and re-clustering strategies
  - Multi-user and multi-federation issues

LHCb Projects

- Storage model of LHCb detector description (structure, geometry etc) and LHCb Event Structure using Objectivity/DB
- Build frameworks for simulation (GEANT4 based), Analysis and Reconstruction
- Study multi-user environment and related issues e.g. schema management.
- Study access patterns and performance issues - input to computing model

LHCb Projects



Why Risks?

- ODBMS is a new technology
  - First ODMG standard produced in '93 and is still evolving
  - Market still small (breakthrough in telecoms and scientific applications)
  - None of the vendors is 100% ODMG compliant (and HEP enhancements)
  - Substantial effort to migrate to another product (Versant studied)
- Objectivity/DB is a commercial tool
  - must synchronise and test updates with new versions of other commercial software e.g. OS
    - aCC compiler bug prevents Objectivity/DB being compiled on HP/UX as found by BaBar
  - if market big enough this problem can be small (e.g. ORACLE/DB at Lep)
  - Control of future features driven by market needs (e.g. Linux unavailability)

Outlook

- Our approach has been to join the efforts of other experiments seeking a common solution
- COMPASS will begin full data-taking in 2000 with event samples of 300 TB per year.
- LCB project studying high-speed mass storage with milestone of 100 MB/s by 2000 (driven by ALICE)
- Continue our own R&D studies over next 2 years to gain experience
- Postpone final technical decisions until end 2000 when state of the market and risks will be better understood