2
Getting Started

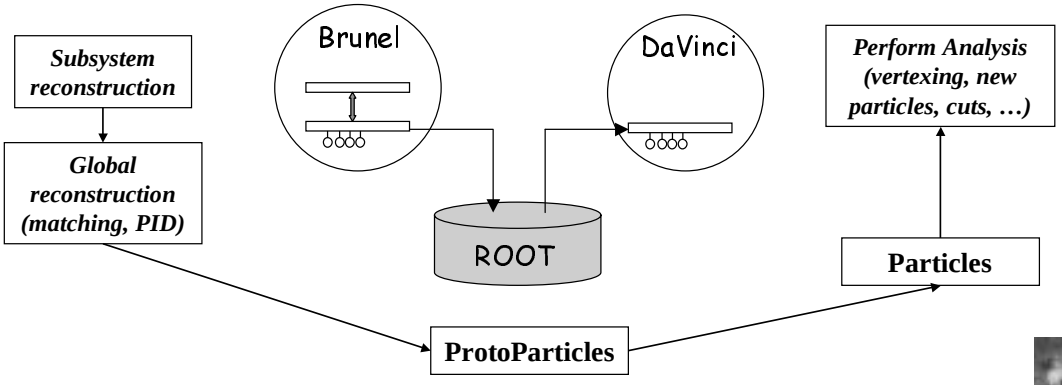
DaVinci Packge

- **DaVinci is a “shell” of Gaudi like, for example, Brunel.**
  - **All package and directory structure is familiar.**
  - **The “end-user” just programs Algorithms and Tools.**
  - **All “familiar” services are available**
    - **Job options.**
    - **Histograming.**
    - **Messaging.**
    - **……**
- **DaVinci takes care of data reading and package initializations that are of common use.**
- **DaVinci contains a library of tools that are of common need**
    - **See next talks….**

Interface with Brunel

- **Brunel writes a OO-DST (currently a ROOT file).**
- **DaVinci reads the OOT-DST.**
  - **It is programmed fully in C++**
  - **It is based on the new Physics Event Model**
  - **Generic tools (vertexer, Kinematic Filter, etc…) are in C++**

    ⇒ "Everybody" should learn C++ (or at least a little)



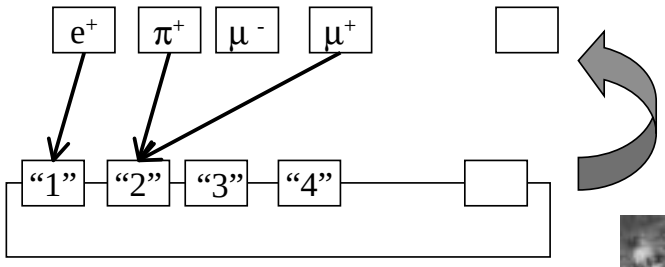
ProtoParticles

- **ProtoParticles are the starting point of the Physics Analysis**
- **ProtoParticles are the end product of the reconstruction**
  - **They cannot be changed by the physics analysis**
- **ProtoParticles have all the links to the reconstruction information used to produce them**
  - **They are LHCb specific and via this link can know about all detector related information**
  - **They are heavy and most likely a moving class**
- **ProtoParticles have a list of valid particleID hypothesis with their probability.**
  - **No particle ID is chosen at this point**
  - **different analysis will want to do it differently**
- **ProtoParticles have charge and measured kinematic information**
  - **A specific particleID is necessary to have all the four momentum components.**

Particles and ProtoParticles

- **A physics analysis does not interact "directly" with a ProtoParticle but with a Particle**
  - **It is possible to navigate back to the originating ProtoParticle**
- **A Particle has ONE chosen particle ID**
- **A physics analysis starting from DST files have a pre-processing stage to make Particles from ProtoParticles according to some "picking" criteria.**
  - **Different particles can originate from the same ProtoParticle**

For ex: all pions with CL > 40% and all muons where muonID has the highest CL



Particles

- **Particles originate either from ProtoParticles or from other Particles**
  - **They contain detector independent information only**

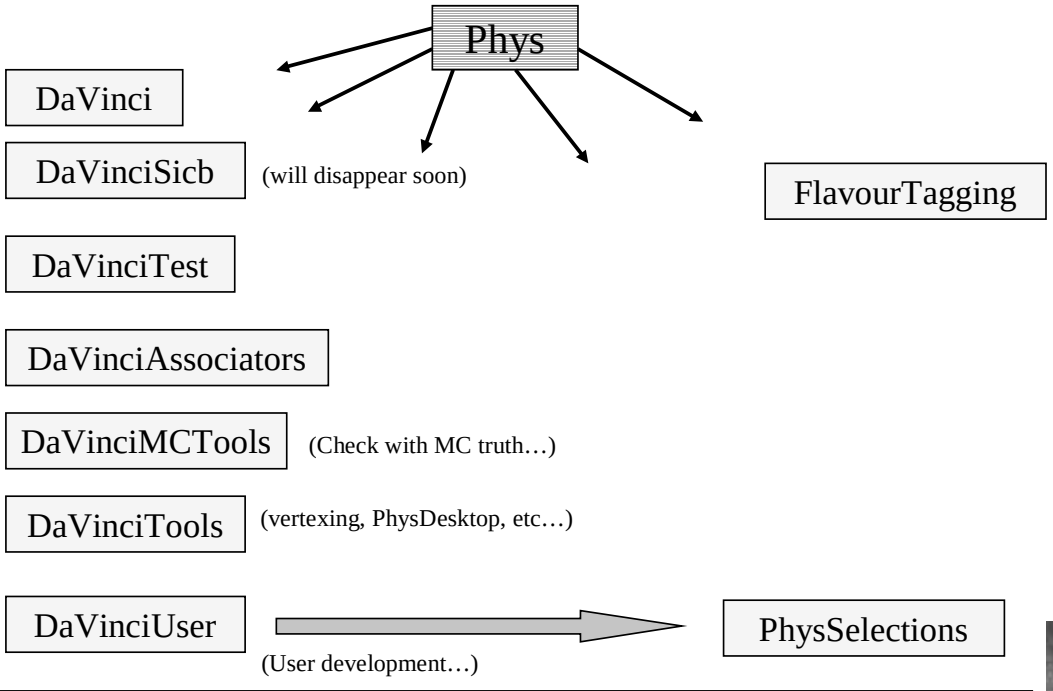
ParticleID	particleID	according to PDG convention
double	charge	
HepLorentzVector	momentum	
HepSymMatrix	covariance	
HepPoint3D	pointOnTrack	at which the momentum is given

- **GenParticles and MCParticles are uncorrelated classes.**
  - **In order to use Particle Tools, an interface will be provided to populate Particle classes with GenParticles or MCParticles**

Tools Needed

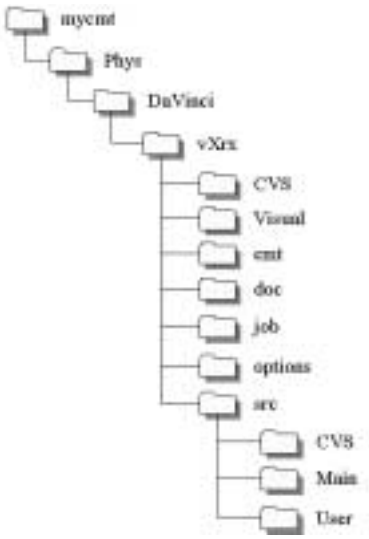
- **A creator of Particles from ProtoParticles: PhysDesktop**
- **A Particle Filter Interface and several implemntations:**
  - **PIDFilter**
  - **KinematicalFilter**
  - **…..**
- **Vertexing algorithms, included constrained and unconstrained fit and the possibility to use the daughters in the vertexing.**
- **Tools to compute Geometrical variables**
  - **Impact parameter**
  - **Distance between vertexes and particles.**
  - **….**
- **Particle transporter: Transports a particle to a given z**
- **Particle stuffer: create "consistent" particles from daughters**
- **Decay finders and Channel Selection Algorithms.**
- **MCDecay finder**
- **Debugging tool**
- **Associators**
- **Tagging**

Phys packages



First Try

- **Get the Gaudi Package**
  `getpack Phys/DaVinci v4r2`
- **Go to the cmt directory**



- **Execute**
  `source setup.csh`
- **Execute**
  `gmake`
- **Go to the job directory**
- **Execute (xxx the dbs verstion to use)**
  `DaVinci.job vxxx`

(the current version will run the J/Psi K0s selection algorithm)

Options File

- **Important lines in DaVinci**
  - `EventSelector.Input= ...`, which selects the input file
  - `NTupleSvc.Output= ...`, which selects the output ntuple file
  - `HistogramPersistencySvc.OutputFile= ...`, which select the output hitogram file
  - `ApplicationMgr.TopAlg+= ...` lines, which configure the algorithms to run.
- **Selection cuts and other variables are steered in the corresponding algorithms**

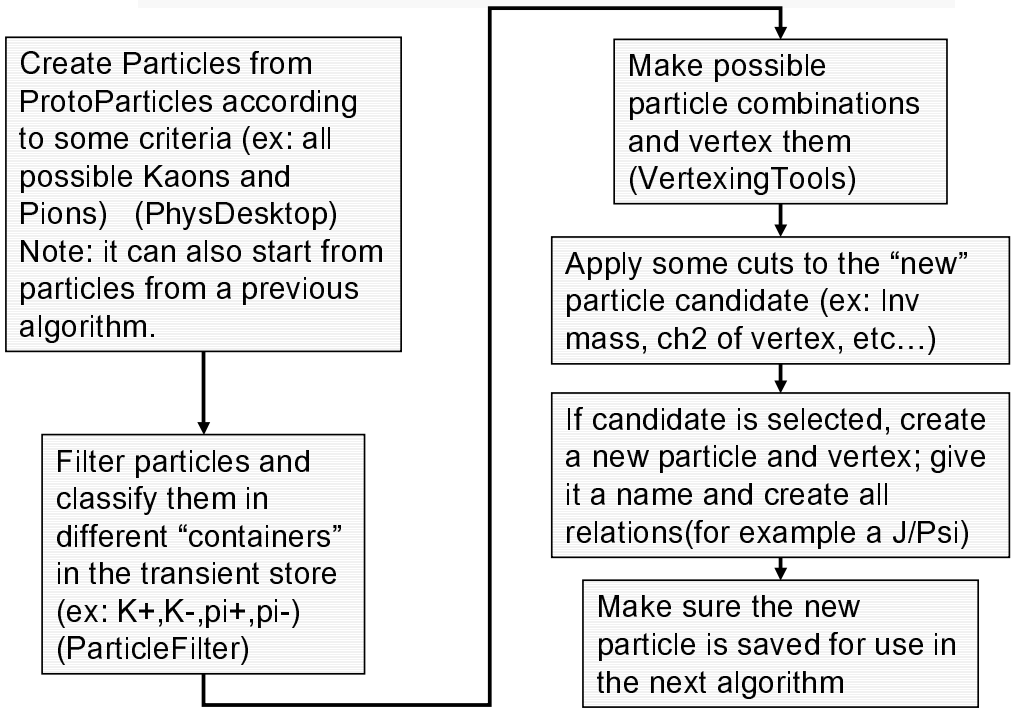
Developing an Algorithm

- **An "end user" will usually develop algorithms that will user DaVinci Tools**

```
Algorithm::Algorithm{
  declareProperty{"CutName",cutVariable=defaultvalue);
}
Algorithm::initialize{
  Initialize all needed tools and services;
  Histograms;
}
Algorithm::execute{
  Next slide
}
Algorithm::finalize{
  Final statistics
}
```

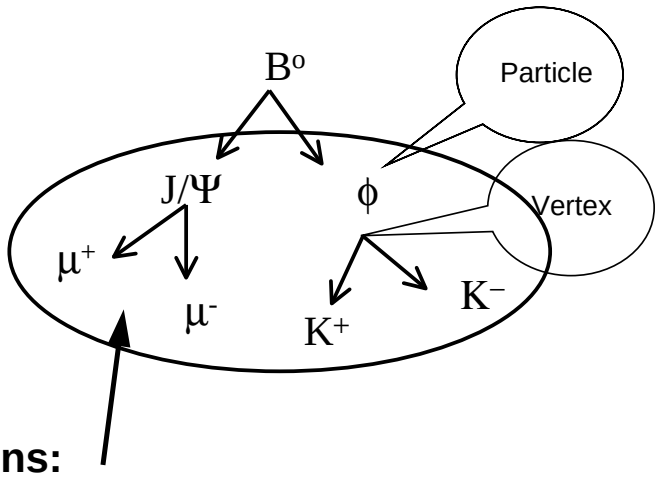
Recommended to make all analysis variable cuts available in job options.

The Execute Member Function



A "Possible" Example

Make a 4 particle vertex with some constraints??

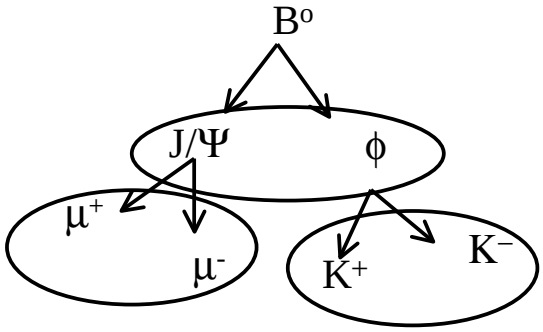


- **Two options:**
  - **A selection algorithm that makes vertexes of 4 particles with some cuts in the invariant mass of the lepton and Kaon Pairs**
- **Three algorithms called in sequence**

A "Possible" Example (cont'd)

All are particle pairs with "roughly" the same algorithmic sequence

- Select two particles with some PiD
- Make a vertex
- Cut in some mass window and some "Geometrical variables
- Use a swich for additional cuts in "decaying vertex point distance of daughters"
- Use the daughters for the B vertex



Can program a Select2ParticleDecay algorithm with carefully selected option

The Options Files

- **In DaVinci.opts file**

```
ApplicationMgr.TopAlg+={Slect2ParticleDecay/SelectJPsi};
ApplicationMgr.TopAlg+={Slect2ParticleDecay/SelectPhi};
ApplicationMgr.TopAlg+={Slect2ParticleDecay/SelectB0JPsiPhi};
```

- **SelectJPsi.opts, SelectPhi.opts and SelectB0JPsiPhi.opts**

```
SelectXXXXX.MassWindowLoose = zzz;
SelectXXXXX.DaughterCandidates= {“Part1”,”Part2”};
SelecXXXXX.ZWindow = zzz;
SelectXXXXX.Chi2UncFitCut = zzz;
SelectXXXXX.ImpParamMother = zzz;
……
SelectXXXXX.MotherPArticleName= {“Mother”};
```

⟹ The same algorithm could be configured for $B \longrightarrow \pi^+\pi^-$...

Status and “Homework”

- **DaVinci version v4r2 is available**
  - **Try it and “learn”**
- **Plan that next version of DaVinci does not support Sicb anymore**
  - **Nevertheless, the software you have written will not change**
    - **Only the ProtoParticles will change. From then on everything remains the same**
- **As soon as different Physics Selection become “official”, they will be included in the PhysSelection package**