Gaudi Introspection:
a possible starting point for the LCG-Data-Dictionary

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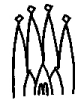
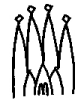
Content

- *General information*
- *Atlas & LHCb*
- *MetaModel*
- *Some examples*
- *Additional information*

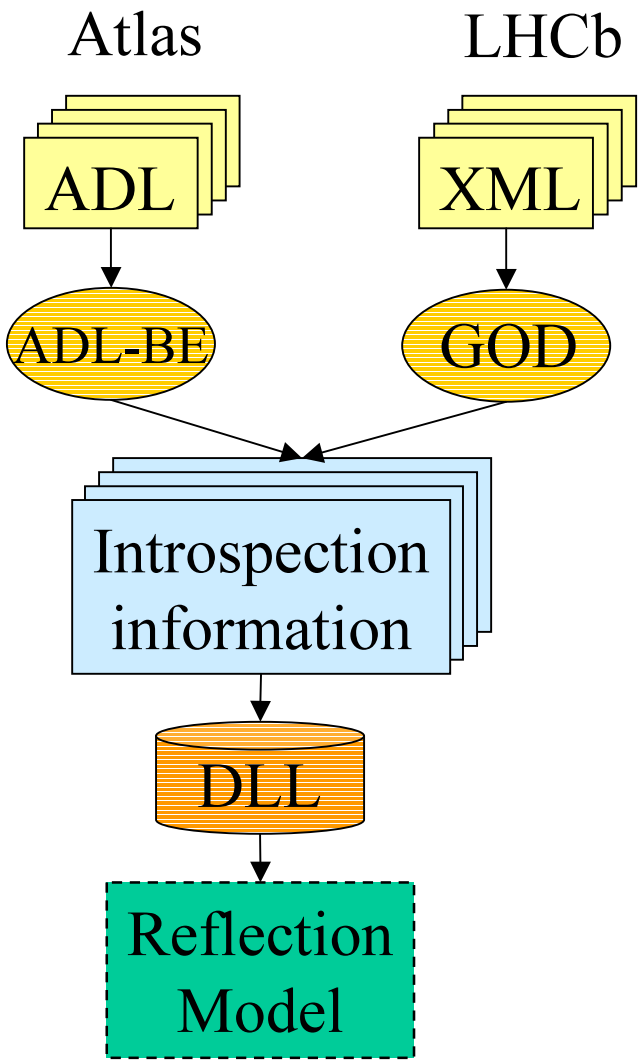


General

- *Almost independent from Gaudi-framework*
  - *framework only needed for loading of libraries*
  - *self-contained model*
- *borrowed from Java-Reflection-API*
  - *robust and complete model*
  - *easy to handle and intuitive*
  - *well documented*



Atlas & LHCb

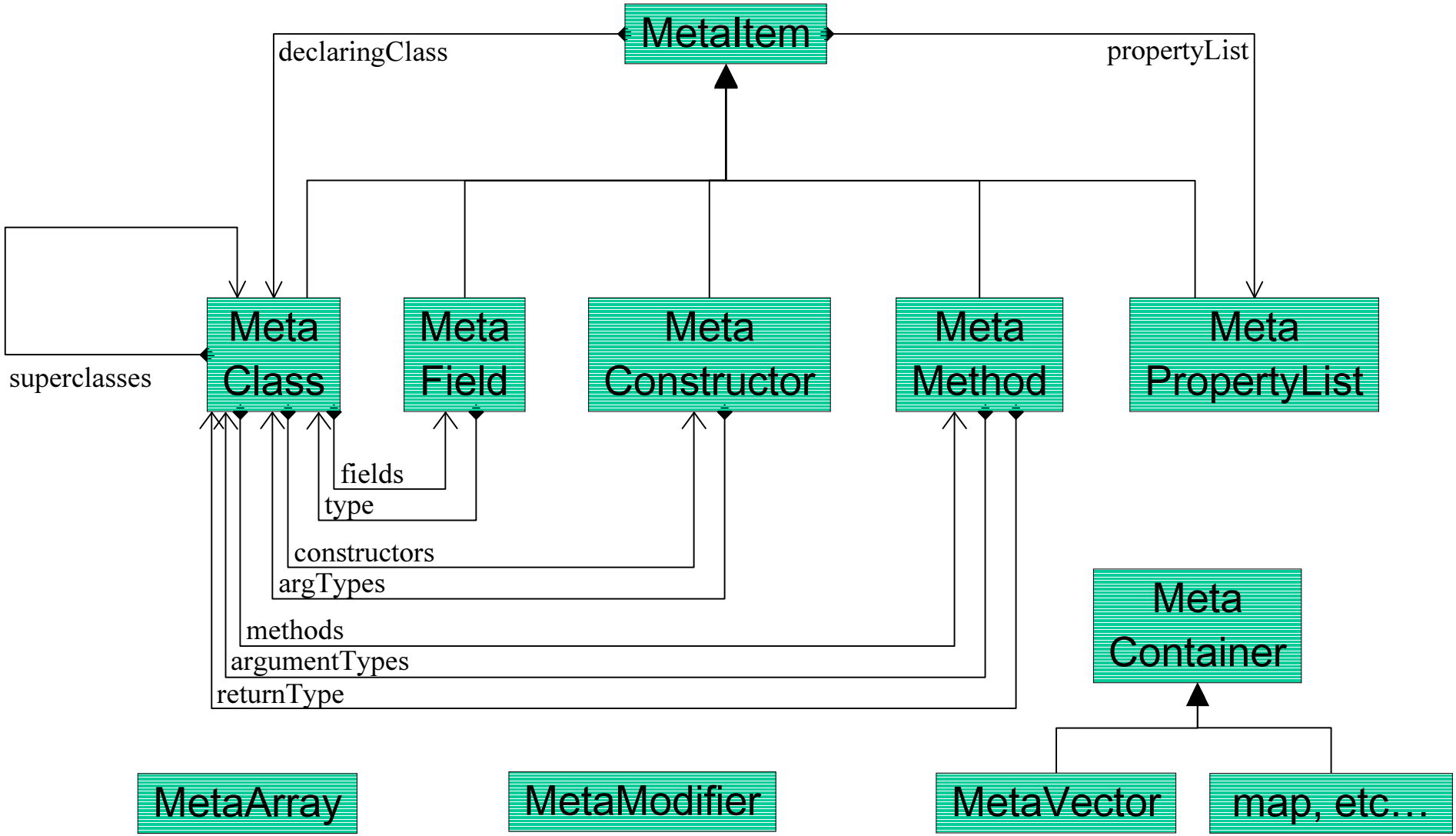


- *Common effort*
- *Automatic production of dictionary-information*
  - *by hand also possible*
- *Different additional info*
  - *classID, author*
  - *ADL-information*
- *Points to discuss*
  - *access to private data-members*

C++ concepts supported

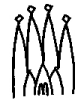
- *Classes*
- *Inheritance*
  - *walk tree*
- *Constructors*
  - *create instances*
- *Methods*
  - *invocation*
- *Members*
  - *get/set values*
- *Pointers*
- *Limited template functionality*

The Model


MetaItem
declaringClass
propertyList
superclasses
Meta Class
Meta Field
Meta Constructor
Meta Method
Meta PropertyList
fields
type
constructors
argTypes
methods
argumentTypes
returnType
Meta Container
MetaArray
MetaModifier
MetaVector
map, etc…

Meta-Classes

Name	Description	Functions
MetaItem	holds information common to all classes	name, description, declaringClass, propertyList
MetaClass	basic entity, distinguish pub/priv	fields, methods, constructors, forName, superClass
MetaField	info about members set and get values	get, set, type, offset
MetaMethod	info about methods invoke methods	invoke, returnType, argumentTypes,



Meta-Classes cont'd

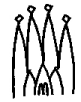
Name	Description	Functions
MetaConstructor	create new instances	argumentTypes, instantiate
MetaModifier	static functions, check modifiers	isPrivate, isConst, isProtected, etc…
MetaArray	get, set values	get, set
MetaContainer	MetaVector, MetaList, etc…	size, set, get, …
MetaPropertyList	additional info, that doesn't fit in model	getProperty, getProperties

How to fill the model

```
class MCParticle_dict {
public: MCParticle_dict(); }
```

```
static MCParticle_dict instance;
```

```
MCParticle_dict::MCParticle() {
MetaClass* metaC = new MetaClass("MCParticle",
   "The Monte Carlo particle kinematics information",
   0);
metaC->addField("helicity",
   "double",
   "Helicity",
   &((MCParticle)0)->m_helicity,
   MetaModifier::setPrivate());
}
```

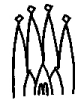
How to use the model

```
void* baseOfClass = new MCParticle;
MetaClass* mc = MetaClass::forName("MCParticle");
```

```
std::vector<MetaField*> mf = mc->fields();
std::cout << mf[0]->name()                  //  'helicity'
  << mf[0]->type()->name()                  //  'double'
  << mf[0]->declaringClass()->name()        //  'MCParticle'
  << mf[0]->get(baseOfClass,double());      //   some value
```

```
std::vector<MetaMethod*> mm = mc->methods();
std::cout  << mm[0]->name()                 //  'helicity'
  << mm[0]->returnType()->name()            //  'double'
  << mm->invoke(baseOfClass, double());     //   some value
```

```
MetaPropertyList* mp = mc->propertyList();
std::cout << mp->getProperty("ClassID"); //  '210'
```

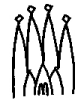



Use cases

- *Serialization of objects*
- *Data object description*
  - *produce dictionary-information with reflection-info*
- *Event data store browser*
  - *browse transient event store*
- *Interactive python-interface*

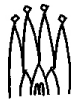
Improvements

- *access to private data members for foreign classes*
  - *for the time being '#define public private'*
- *namespace*
  - *should be easy to implement*
- *templates*
- *split into read/write interface*



Additional information

- *Data Dictionaries web pages*
  - *http://cern.ch/lhcb-comp/Frameworks/DataDictionary*
  - *http://atlas.web.cern.ch/Atlas/GROUPS/SOFTWARE/OO /architecture/DataDictionary*
- *afs-area*
  - *GaudiIntrospection*
    - */afs/cern.ch/sw/Gaudi/releases/GaudiIntrospection*
  - *Examples (Event-packages)*
    - */afs/cern.ch/lhcb/software/NEW/Event*



Summary

- *The model*
  - *is well designed*
  - *is self-contained*
  - *is complete*
    (except templates and namespaces)
  - *is intuitive*
  - *is easy to feed*
  - *is familiar to people knowing the Java Refletion API*
- *Dictionary is more than persistency*
  - *e.g. event data store browser*
- *Common effort of Atlas and LHCb*
  - *agreement on this model*