

PARTICLE TO MC ASSOCIATION

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OVERVIEW

- Overview of recent changes See slides by Juan in same agenda slot
- Using the “Smart” associator
- Specific issues
 - Background Category and MicroDST files
 - Differences between the Track Associators and the Ghost Classification tool

USING THE “SMART” ASSOCIATOR

WHAT IS THE SMART ASSOCIATOR?

What the user really wants to do is say

**“Here is my Particle, associate it
and return me the match”**

Unfortunately associating charged “stables”, neutrals, and composites requires different associators

- The Smart Associator knows which associator to use for each type of final state particle
- Uses protoparticle association for stables, and BackCat for composites

BACKCAT AND COMPOSITE ASSOCIATION

The BackCat association logic for composites will return an associated MCP as long as the following criterion is met:

- Each reconstructed final state track coming from the composite candidate has an associated MCP, and all of these associated MCPs have the same final mother
- This final mother is then the associated MCP of the composite particle in question

Note: this does not mean that you reconstructed your **signal** decay!

- You could have partially or fully reconstructed a different decay as well - only checking the BackCat category will tell you which.

USE CASE 1: GETTING THE BEST MATCH

- Get the tool in your initialize method

```
SA = tool<IParticle2MCWeightedAssociator>("DaVinciSmartAssociator", this)
```

- Get the best match

```
MCParticle* mcp = SA->relatedMCP(Particle* mypart)
```

- The “correct” associator will be used:
 - NeutralPP2MC for neutrals (via P2MCPFromProtoP)
 - ChargedPP2MC for charged (via P2MCPFromProtoP)
 - BackCat for composites (uses P2MCPFromProtoP)

USE CASE 2: GETTING EVERY MATCH

- Get the tool in your initialize method

```
SA = tool<IParticle2MCWeightedAssociator>("DaVinciSmartAssociator", this)
```

- Get a vector with all the matches

```
Particle2MCParticle::ToVector mcps = SA->relatedMCPs(Particle* mypart)
```

- Each entry in the vector contains the methods
 - `to()` - returns a given match
 - `weight()` - returns the weight of that match
- For composites, if any association is found, the weight is always 1, since multiple associated composite MCPs have no meaning in the framework.

UNDERSTANDING WEIGHTS

- The meaning of association weights has been standardized between neutral and charged association
- The weight returned now corresponds to the Bayesian probability that a given MCP is the correct match, given that a match was found
 - So if two charged MCPs are both associated to a given particle, and they each match the same number of hits, their weights are 50% each
 - This weight does **not** mean that they only matched 50% of the hits!!

SPECIFIC ISSUES

BACKCAT AND MICRODST FILES

- As Juan pointed out on the mailing list some time ago, BackCat requires the “whole” MC event in order to make its decisions
 - In fact it only needs the MCPs associated to each final state daughter of the reconstructed candidate **and** their full MC history
 - This is because the full MC hierarchy is needed to decide if the MCPs associated to final state tracks came from the primary vertex, or from a D/B/whatever
- Probably best to just do the BackCat classification when making the MicroDST as suggested by Juan

TRACK ASSOCIATORS

- For associating charged tracks, the DaVinci associators use the result of the TrackAssociators run at the Brunel stage
- The criterion (for long tracks) is:
 - $\geq 70\%$ reconstructed Velo hits match to an MCP
 - $\geq 70\%$ reconstructed IT/OT hits match to an MCP
 - The two track components match to the same MCP or they match to different MCPs but one is the parent of the other (in which case both MCPs are associated with the same weight)
- The track associator does not care how many other MCPs might have contributed to the track as long as one MCP contributes $\geq 70\%$

GHOST CLASSIFICATION TOOL

- The ghost classification tool has one significant difference with the track associators
 - The associated MCP has to contribute $\geq 70\%$ of the total MC hits associated to the reconstructed hits on a track
- Introduce the concept of a “polluted” track, which has an associated MCP by the track associator rule, but not by the ghost classification rule.
 - In MC09, about 7-8% of reconstructed charged tracks fall into this category
 - Is it something to worry about? Unclear if “polluted” tracks have worse track parameters...