Shared resources, simulated sample, and FastSim update

International MUON Collider Collaboration

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for

Physics and Detector Group

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Local Resources for Physics & Detector activities:

INFN-University Padova
INFN-Trieste
INFN-Bari
Berkeley
NERSC/Cori
FermiLab
IHEP
DESY

Mainly access by local people, with some exception

Shared Resources for Physics & Detector activities:

INFN Tier-1

- CPU resources access not possible outside INFN currently due to software configuration, possible in the future with new software framework or wrapper if that takes too long
- Disk storage access possible via GRID tools provide you are in the VO muoncoll.infn.it

CERN

Access via subscription to the e-groups:
muoncollider-batch (batch queue)
muoncollider-readers (read from disk)
muoncollider-writers (write to disk) → Granted to developers for the moment

Granted to everybody of the Muon Collider collaboration

Full simulation/reconstruction comments

Tutorial

- Overview
  - Monte Carlo samples
    - Signal samples
    - Beam-induced background sample
  - Simulation and reconstruction code
  - Steering files and ROOT macros
- Tutorial setup
- 1 - Running the simulation and reconstruction
  - Simulation step
  - Digitization/reconstruction step
  - Some useful tools
  - Event display
- 2 - A look at the beam-induced background (BIB)
- 3 - Overlaying the BIB to signals
- Advanced topics
  - Modifying an existing processor
  - Creating a new processor

Same type of events, full BIB overlaid:

- Conformal tracking, Double Layer requirement ~ 32 hours per event, often crashes, ~40GB of memory needed
- ACTS: 10 minutes ~ 8 GB memory

Simulated and reconstructed sample available to everybody
https://confluence.infn.it/display/muoncollider/Monte+Carlo+Simulated+Samples

Monte Carlo Simulated Samples

The table summarizes the simulated samples currently available.

ID	CoM Energy (TeV)	Process name	BIB	Events	Software	Generator (card)	Simulation	Reconstruction	Location	Authors	Date	Notes
001	1.5	Beam crossing	100%	1000	mars15 v02-05-MC/ v02-07-MC MuCollv1	detector-simulation/utils/	001-Base	001-trimm	mars15/mumi-1e3x500-26m-lowth-excl_25ns_nEkin150MeV/mumi-1e3x500-26m-lowth-excl.txt mars15/mupl-1e3x500-26m-lowth-excl_25ns_nEkin150MeV/mupl-1e3x500-26m-lowth-excl.txt MuCollv1_25ns_nEkin150MeV_QGSPBERT	bartosik, gianelle	12/2020 06/2021 07/2022	#ID001
002	1.5	mumu2bdijet	100%	10k x 6	Pythia8 v02-06-MC MuCollv1	TBC	001-Base	002-djets 005-Acts	pythia8/mumu2bdijet /bdijet_*_10kevt.stdhep mumu2dijetStudies/mumu2bdijet /CT & /ACTs	sestini, gianelle	03/2021 02/2022	#ID002 #ID005
003	1.5	mumu2cdijet	100%	10k x 6	Pythia8 v02-06-MC MuCollv1	TBC	001-Base	002-djets 005-Acts	pythia8/mumu2cdijet /cdijet_*_10kevt.stdhep mumu2dijetStudies/mumu2cdijet /CT & /ACTs	sestini, gianelle	03/2021 02/2022	#ID002 #ID005

… and much more

Beam-induced background events, will be copied at CERN. Example on how to use them need to be published to avoid mis-usage.

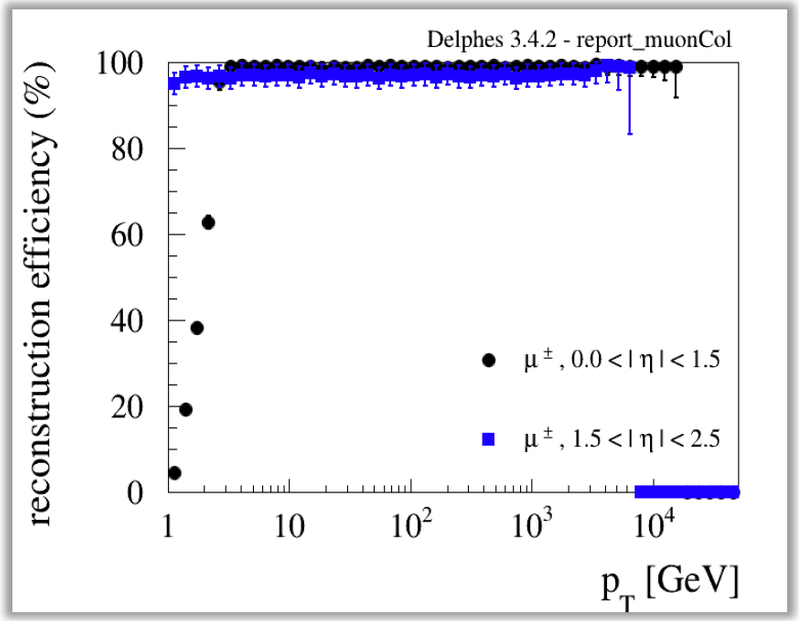
Among the information:

- `Id`: represents an unique number associated to the sample;
- `CoM Energy (TeV)` centre of mass energy of the hard-scattering process;
- `Process name` is a short description of the physics process (e.g. HH_bbbb, ...);
- `BIB` specifies if beam-induced background is fully included (1), partially included (e.g. `0.1` for 10% of expected BIB rate), or not included `0`; if a different configuration (e.g. CoM energy) is used for BIB and hard-scattering, please specify it in the `Notes` column.
- `Events` number of events generated;
- `Software` is the list of the software/detector versions, as tagged in the repository and described in the software releases; if a custom version is used, please add "_custom" to the starting software version, add in the `Notes` what is special and add a link to the relevant code commit, if possible;
- `Generator (card)` is a short name of the folder in the repository containing the configuration for the generator/process used (the link should preferably be to a specific commit/version of the card);
- `Simulation` is a short name of the folder in the repository containing the simulation settings and a link to it (the link should preferably be to a specific commit/version of the card);
- `Reconstruction` is a short name of the folder in the repository containing the reconstruction settings and a link to it (the link should preferably be to a specific commit/version of the card);
- Location: list of the directories on the SE (*srm://storm-fe-archive.cr.cnaf.infn.it:8444/muoncoll/)* where data have stored (the path follows the convention: <√S in GeV>/<Signal or BIB or Mixed>/<Generator Process>/<Dataset name>)
- Authors: one or more authors/responsible of the samples
- Date: month/year of sample's production
- `Notes` contains any special remark that is deemed useful to know.

FastSim Status aka delphes card
and
Comparison with FullSim

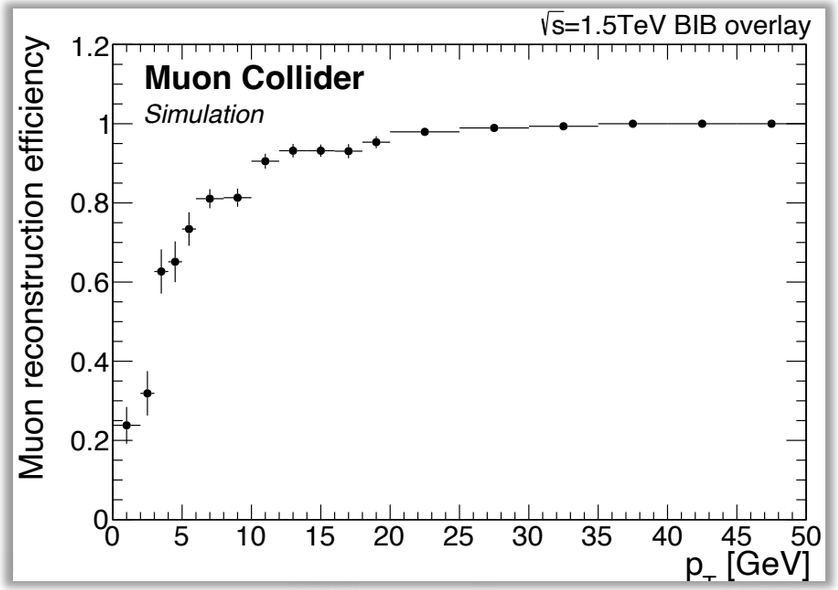
Muon Efficiency

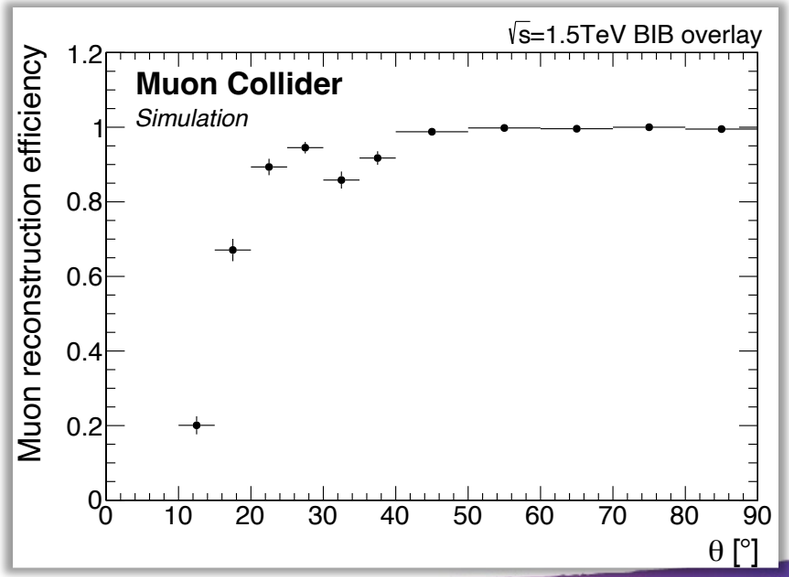
Delphes card



Michele Selvaggi
Muon collider card performance

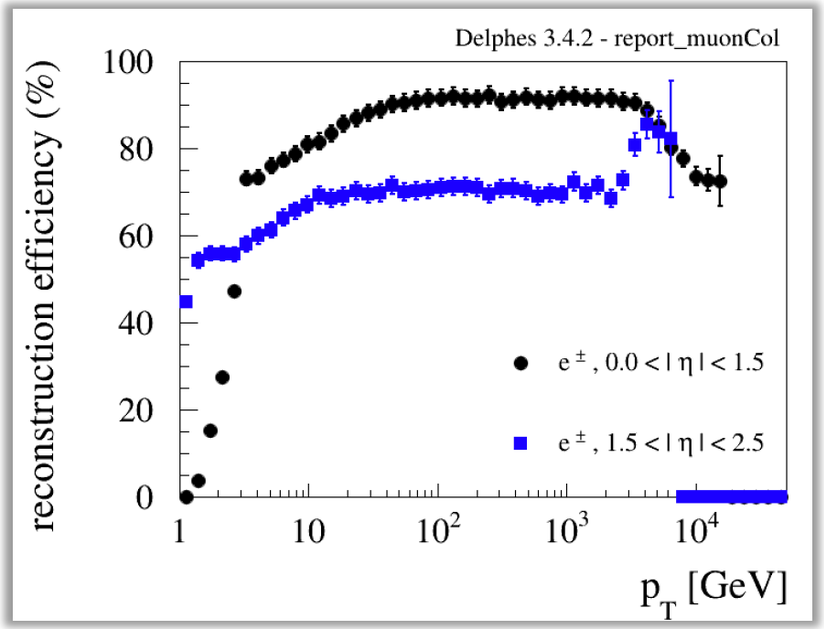
FullSim





Electron Efficiency

Delphes card



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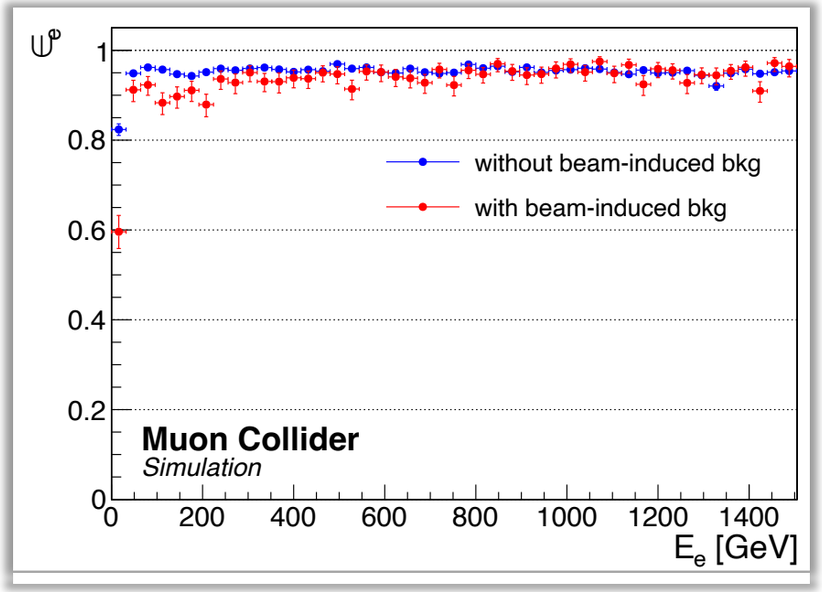
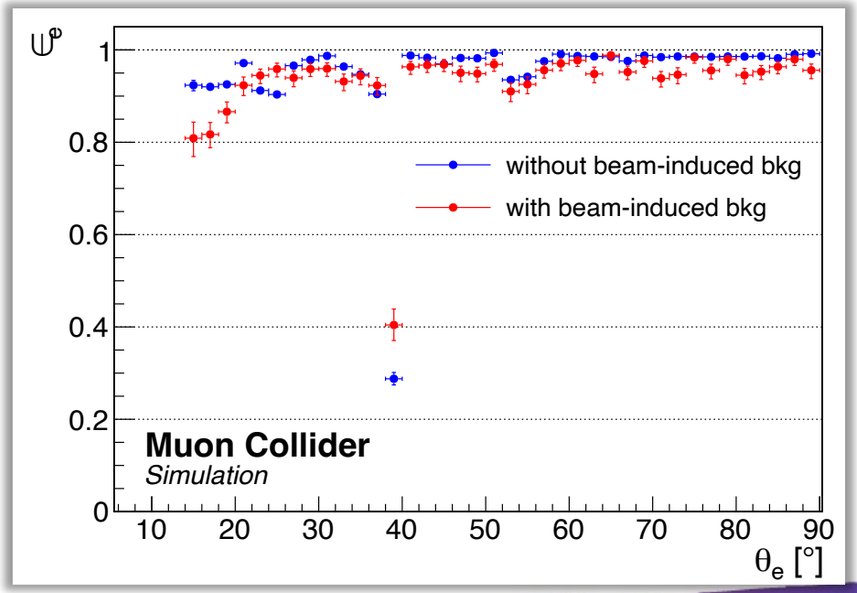
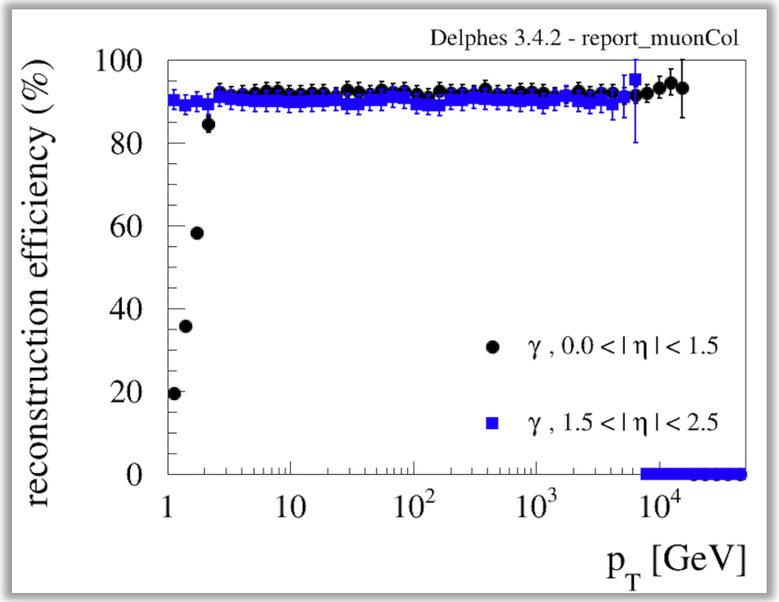
FullSim





Photon Efficiency

Delphes card



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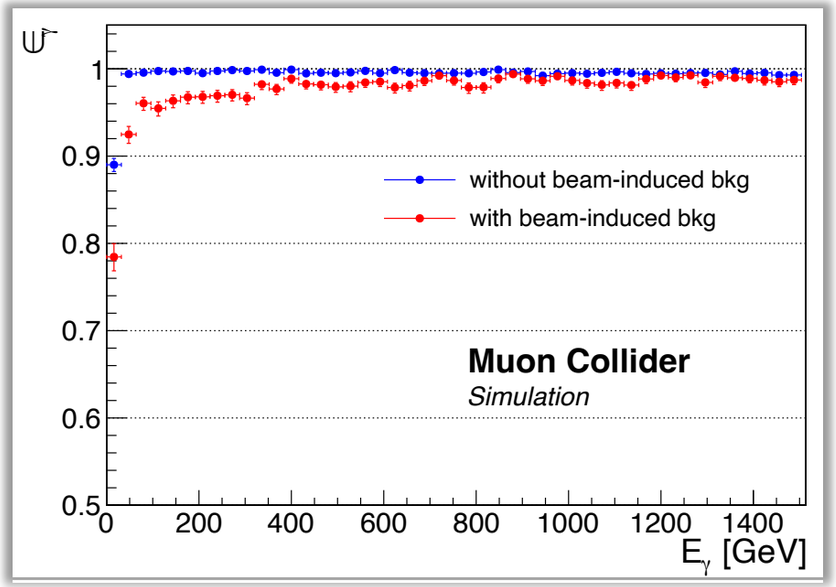
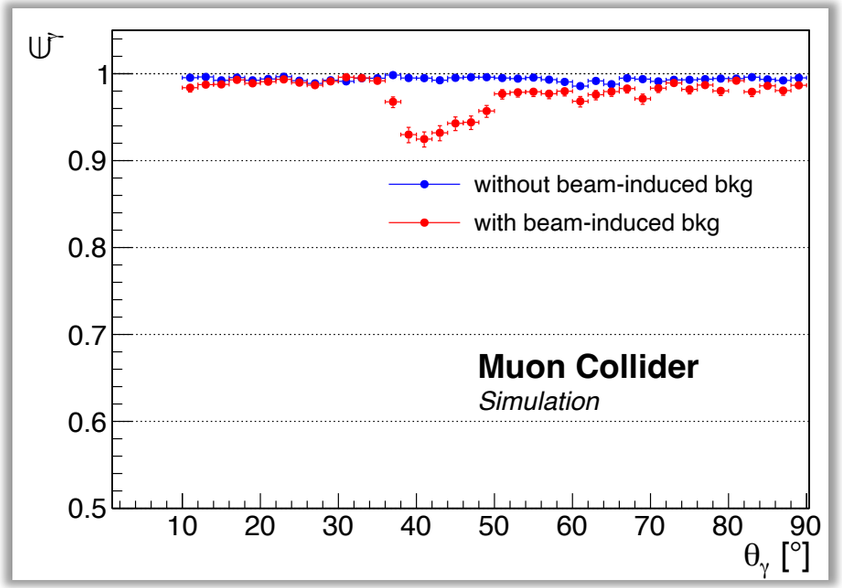
Muon collider card performance

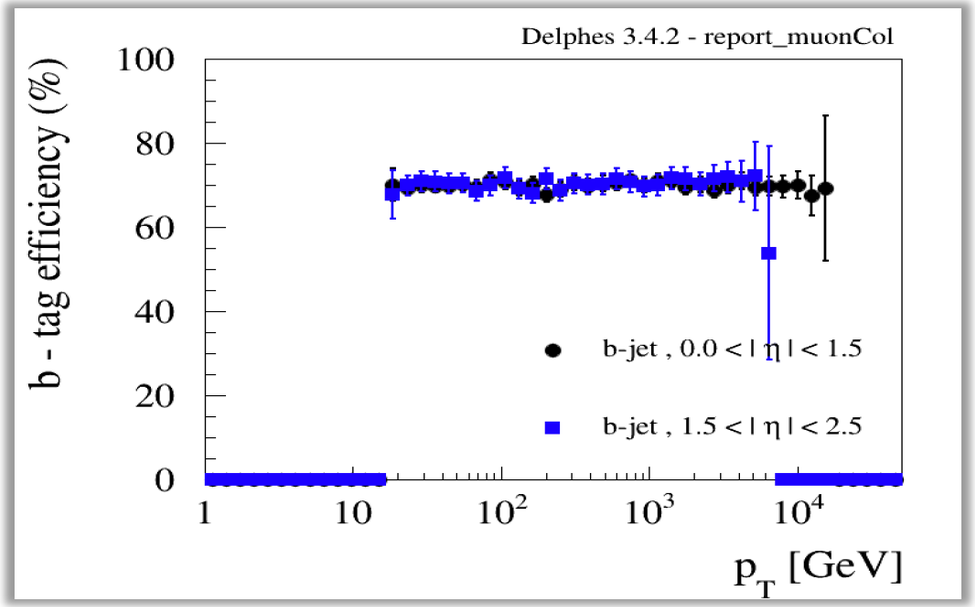
FullSim





b-tag Efficiency

Delphes card



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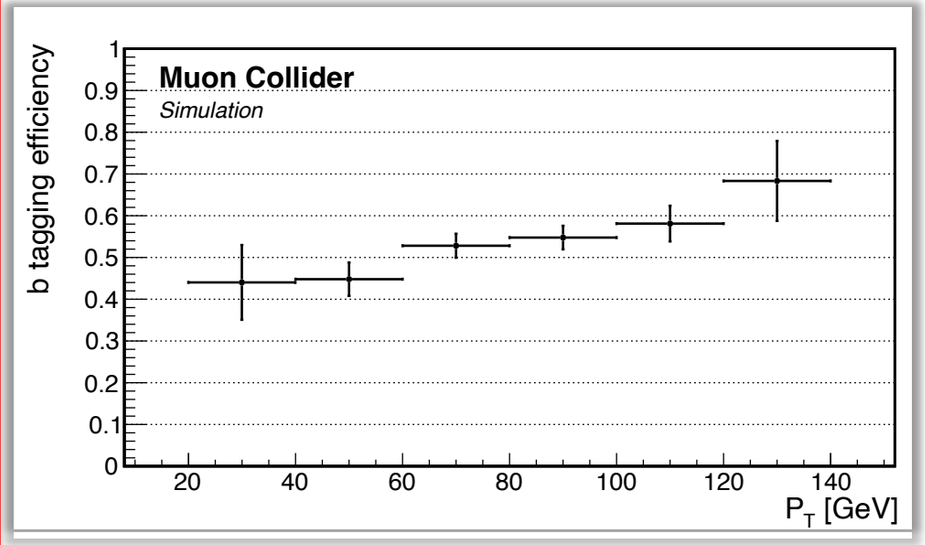
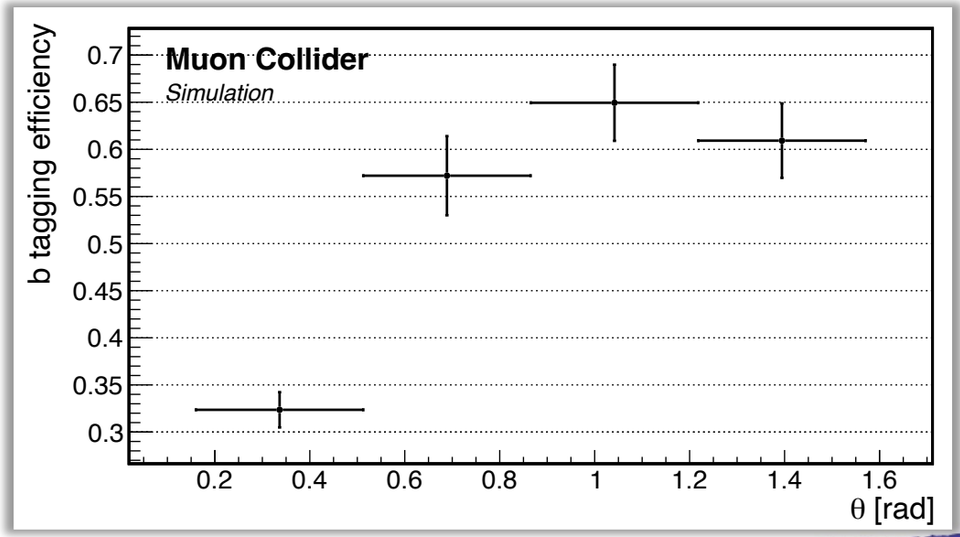
Muon collider card performance

FullSim





Mistag

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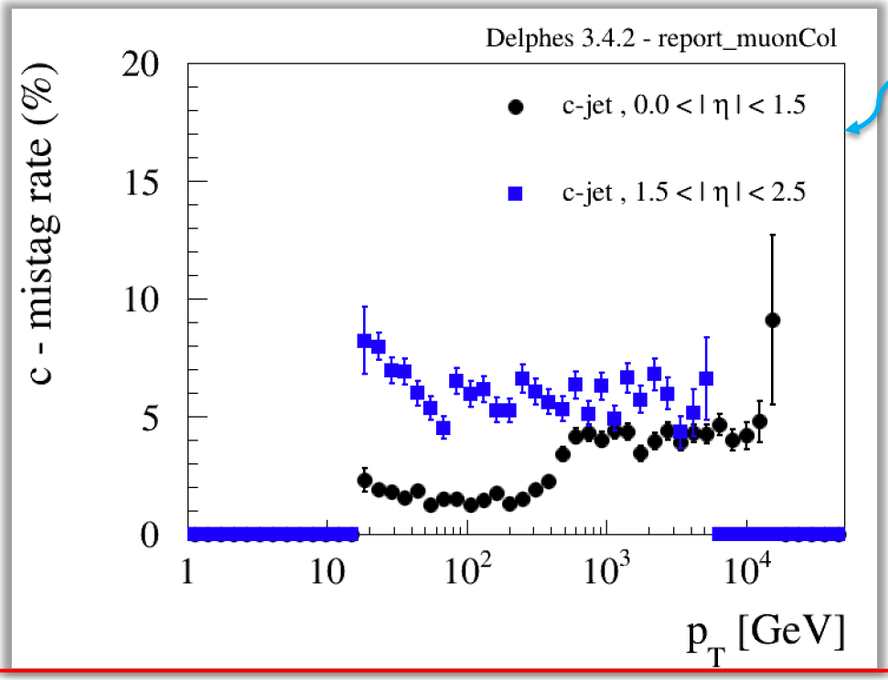

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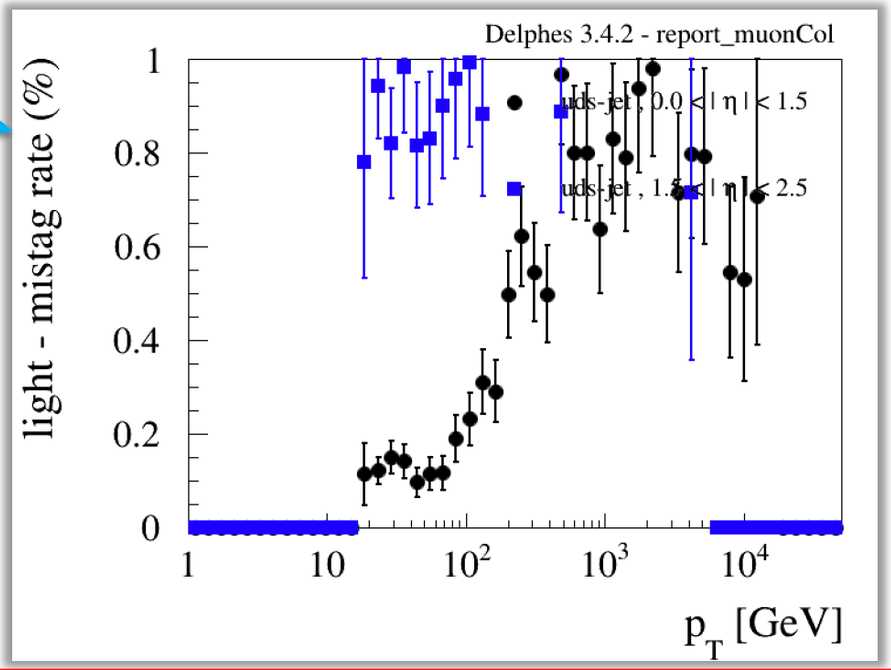
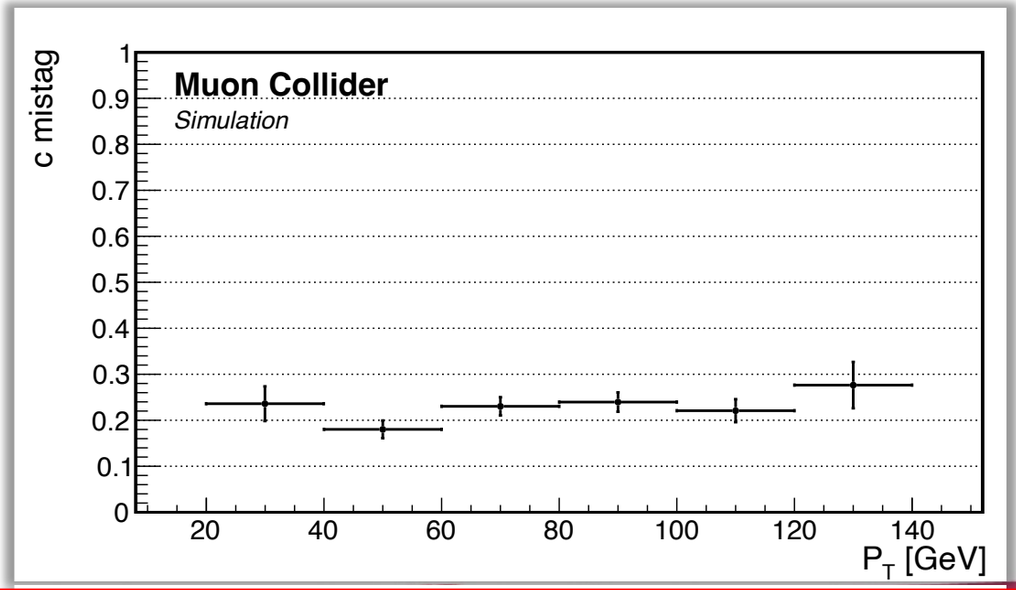
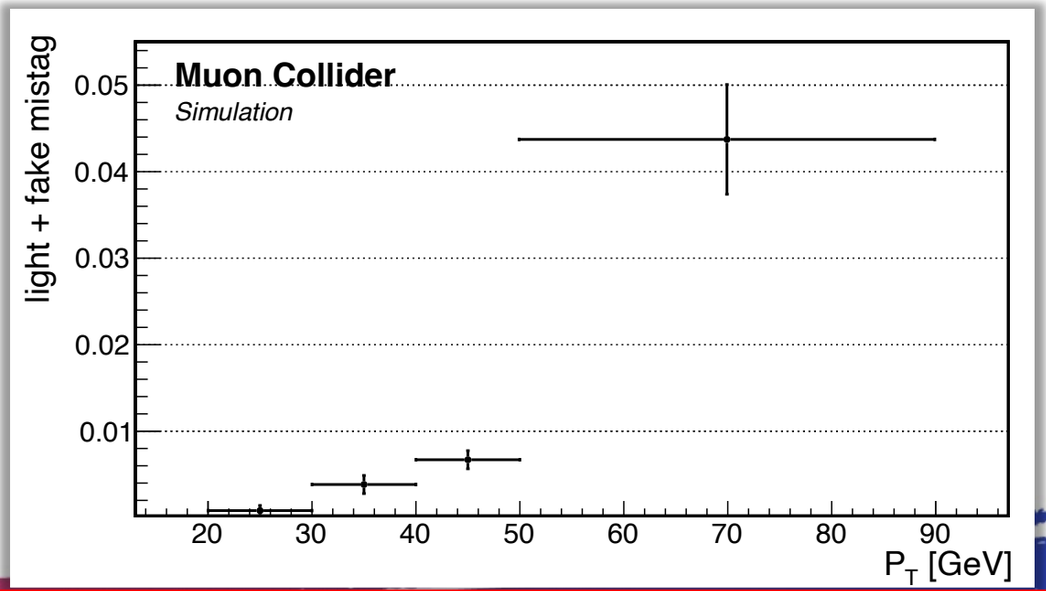


FullSim





Summary and next steps

- A working package, beam-induced background sample at 1.5 TeV, and simulated/reconstructed data are available.
- Resources are available in several places and common shared resources start to be available

Future steps

- Move to a common framework that all the resources may/can (?) be used from every collaborator everywhere
- Define rules, procedure and resources to make beam-induced background events available to the collaboration and publish instructions to use them
- Update the delphes card:
  - keep a target efficiencies and resolutions at 3 TeV for pheno studies
  - have 3 TeV “realistic” version for student’s thesis
  - Different proposal?