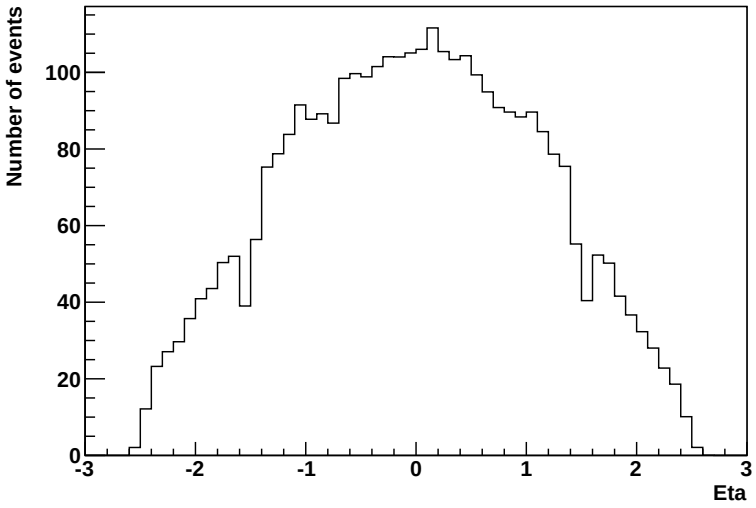
Outline

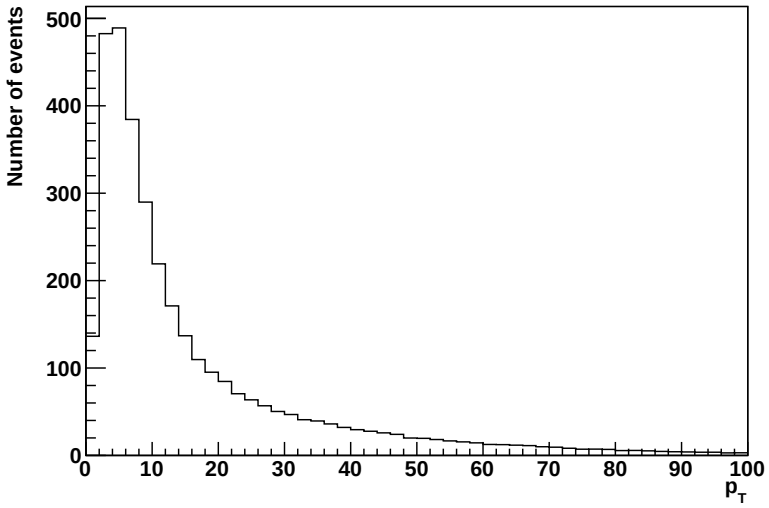
- MadGraph / MadEvent analysis (distributions)
- MadGraph / MadEvent event selection
- SHERPA generation of events
- SHERPA fast simulation
- Thesis (mainly CKKW / MLM matching algorithms)
- Next steps

MadGraph

$pp \to t\bar{t} + X$ jets, $X = (0, 1, 2, 3)$
100000 events, scaled to 20 pb^{-1}



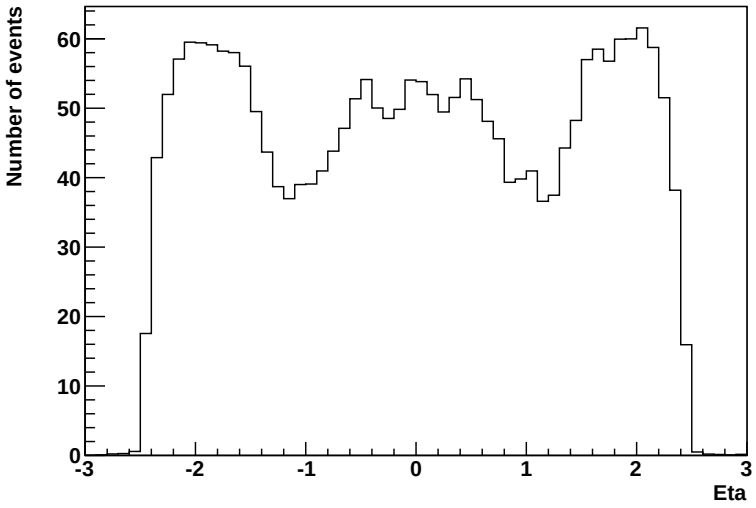
(a) Electron η



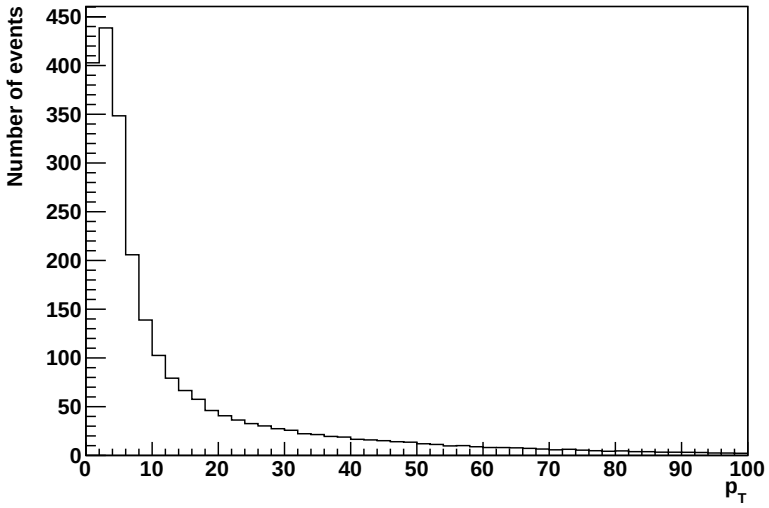
(b) Electron p_T

MadGraph

$pp \to t\bar{t} + X$ jets, $X = (0, 1, 2, 3)$
100000 events, scaled to 20 pb^{-1}



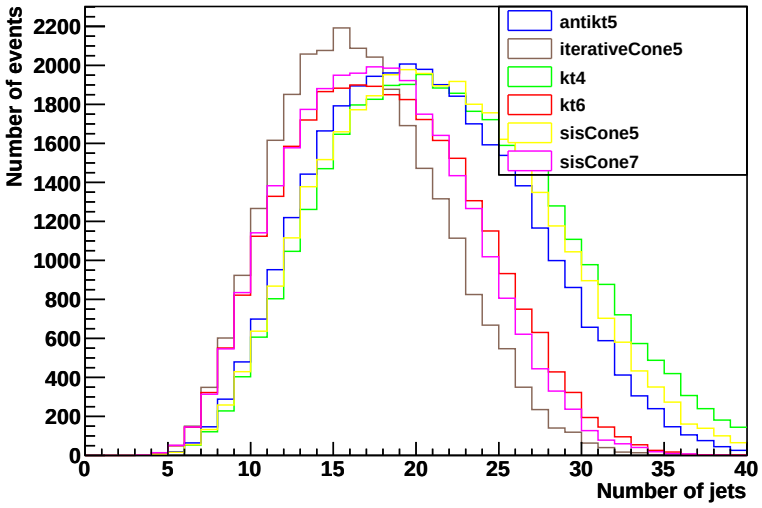
(c) Muon η



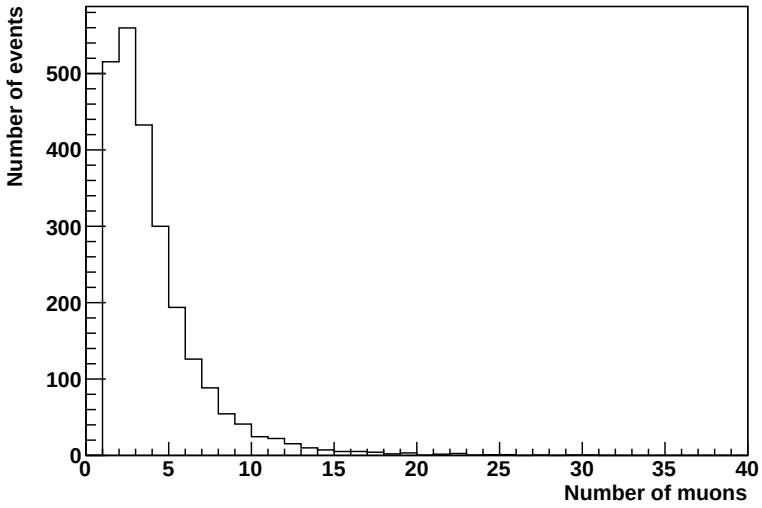
(d) Muon p_T

MadGraph

$pp \to t\bar{t} + X$ jets, $X = (0, 1, 2, 3)$
100000 events, scaled to 20 pb^{-1}



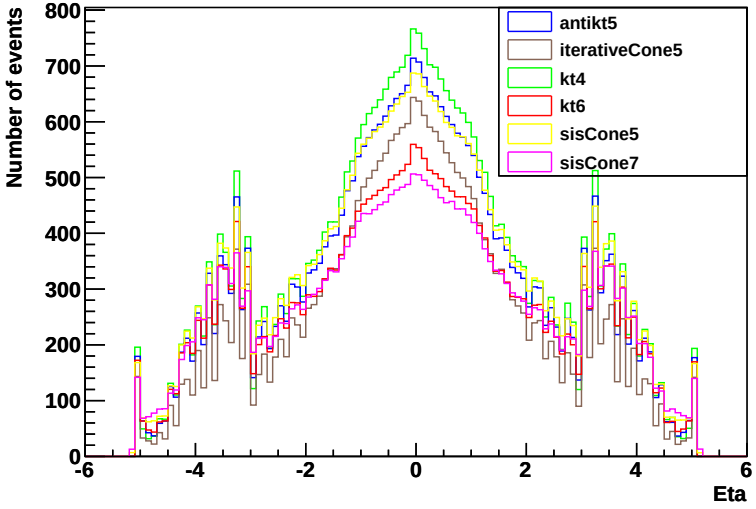
(e) Jet multiplicity



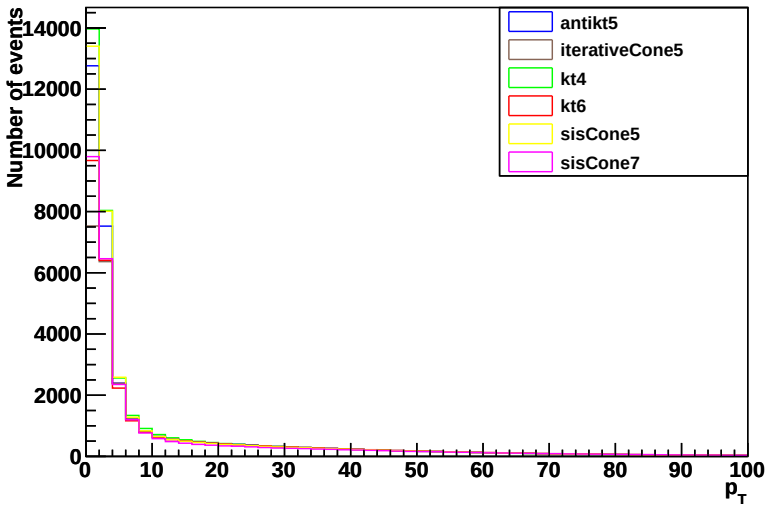
(f) Muon multiplicity

MadGraph

$pp \to t\bar{t} + X$ jets, $X = (0, 1, 2, 3)$
100000 events, scaled to 20 pb^{-1}



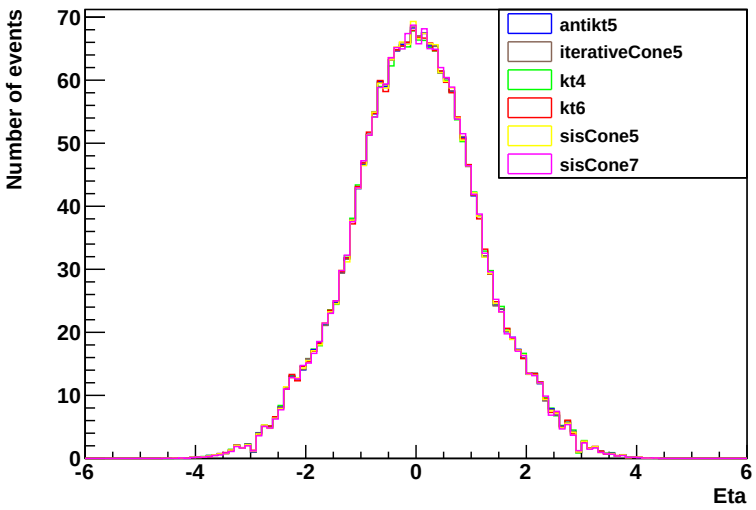
(g) Jet η



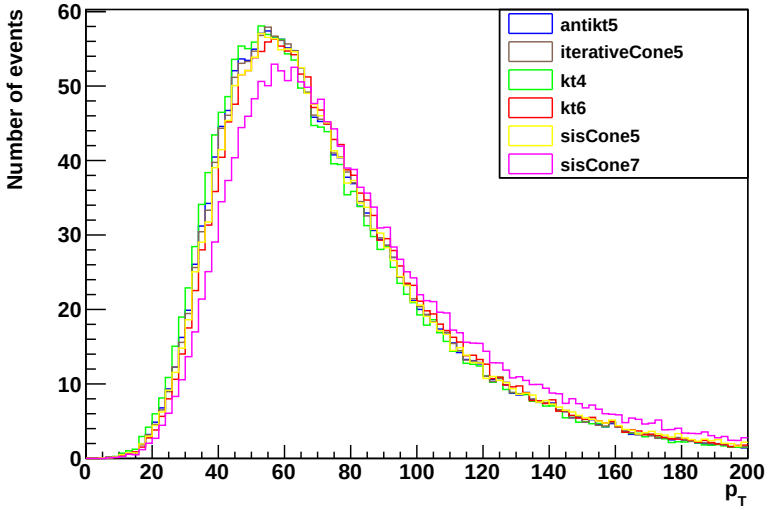
(h) Jet p_T

MadGraph

$pp \rightarrow t\bar{t} + X$ jets, $X = (0, 1, 2, 3)$
100000 events, scaled to 20 pb^{-1}



(i) Leading Jet η



(j) Leading Jet p_T

MadGraph

$pp \rightarrow t\bar{t} + X$ jets, $X = (0, 1, 2, 3)$
Event selection, like in CMS PAS TOP-09-003

Step	Cut	Events passed
0	-	100000
1 (μ)	Global, $\lvert\eta\rvert < 2.1, p_T > 20\ GeV$, RelIso < 0.05, $\frac{\chi^2}{\text{ndf}} < 10$	13690
2(Jet)	$\geq 4, p_T > 30\ GeV, \lvert\eta\rvert < 2.4$	18766
3(e)	no electron with $p_T > 30\ GeV$, $\lvert\eta\rvert < 2.5$, RelIso < 0.2	51714
4 (MET)	$p_T > 40\ GeV$	28549
Σ		295

Tabelle: Event Selection

SHERPA

Event generation

Event	Decay Channel	Result
$t\bar{t}$ + up to 3 jets	any	$t > 1000\ d$, errors
$t\bar{t}$ + 3 jets	any	$t > 100\ d$
$t\bar{t}$ + up to 2 jets	leptonic	errors
$t\bar{t}$ + up to 2 jets	semileptonic	$t \approx 4\ d$, internal error
$t\bar{t}$ + up to 2 jets	hadronic	$t \approx 12\ d$, internal error

Matrix element generators used: Comix and Amegic
We are still trying to find a working configuration
$t\bar{t}$ with up to 1 additional jet could work.

Fastsimulation

- new version is running on Zeuthen and NAF batch
- output is stored at dCache
- 5000 events $\approx$ 4Gb
- BUT: we need old version to compare with madgraph
- output of new SHERPA version is not compatible with old version of fastsim

Thesis

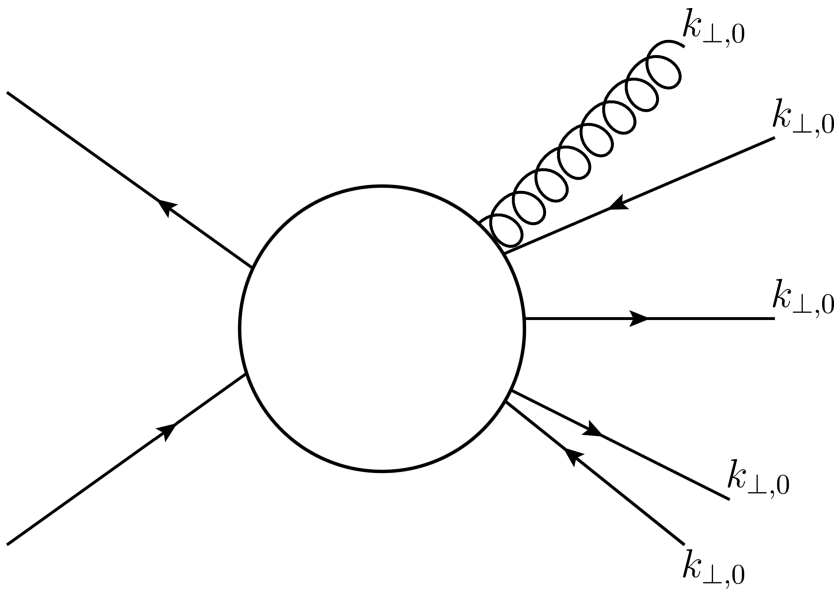
written:

- Basic structure (List of Figures, Tables, Symbols, . . .)
- Introduction (Standard Model, LHC, CMS, Top Quark)
- Monte Carlo (MadGraph/SHERPA)
- Matching of matrix elements and parton showers (CKKW / MLM)

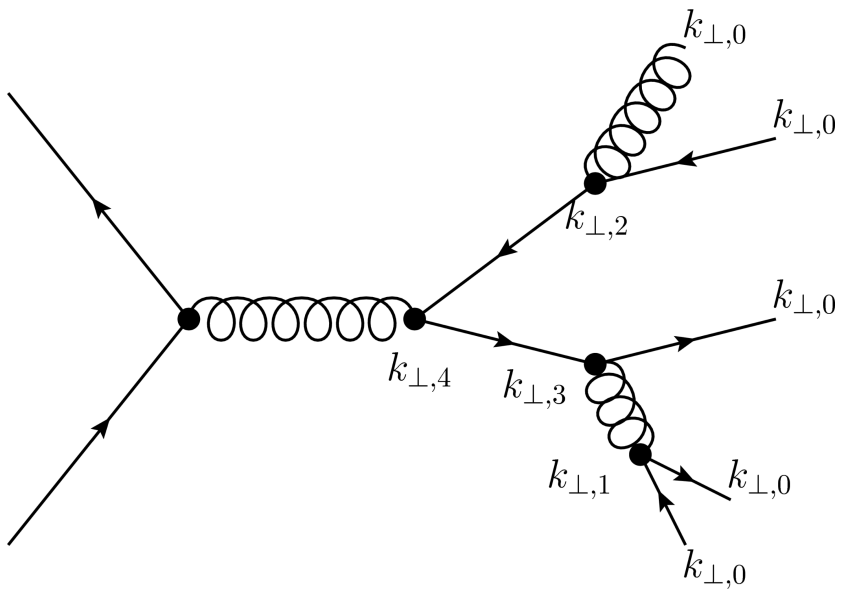
CKKW / MLM

CKKW
Cluster partons, back to $2 \to 2$

MLM
Cluster partons, back to $2 \to 2$



(a) Before clustering



(b) After clustering

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$

MLM

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node

MLM

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight

MLM

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed

MLM

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed
- Perform parton showering

MLM

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed
- Perform parton showering

MLM

- Cluster partons, back to $2 \to 2$

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed
- Perform parton showering

MLM

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed
- Perform parton showering

MLM

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Perform parton showering

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed
- Perform parton showering

MLM

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Perform parton showering
- Apply jet finding algorithm ($k_\perp$)

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed
- Perform parton showering

MLM

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Perform parton showering
- Apply jet finding algorithm ($k_\perp$)
- Match jets to partons

CKKW / MLM

CKKW

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Reweight each line between nodes with Sudakov weight
- Final states, which are more likely from PS are suppressed
- Perform parton showering

MLM

- Cluster partons, back to $2 \to 2$
- Calculate α_S-weight for each node
- Perform parton showering
- Apply jet finding algorithm ($k_\perp$)
- Match jets to partons
- Reject not matching events

Conclusion / Next Steps

- If SHERPA runs everything will be fine.
- If there is no way to run SHERPA with the MG/ME settings, we could run SHERPA with up to 1 jet and apply the settings to MG/ME.
- OR: We could try to use the old version of SHERPA.
- OR: We can run SHERPA without showering and hadronization and do these steps later with CMSSW