Status of WW analysis at 1 TeV

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DESY

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Introduction

- Asses the accuracy of the beam polarization measurement using annihilation data, at E_{CM} = 1 TeV.

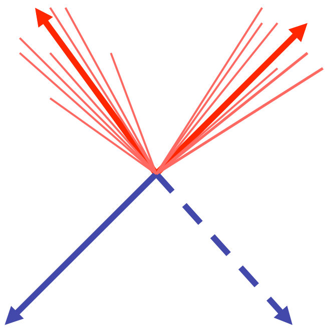
- Use the process: $e^+e^- \to W^+W^- \to qql\nu$, $l = e,\mu$
  - High cross section, highly dependent on polarization

- Samples used were produced with ilcsoft v01-15-p00 (no background overlay) and v01-15-p01 (background overlay).

- Process ID: 200067 (contains the signal and dominant background)

Selection of Semileptonic Final State

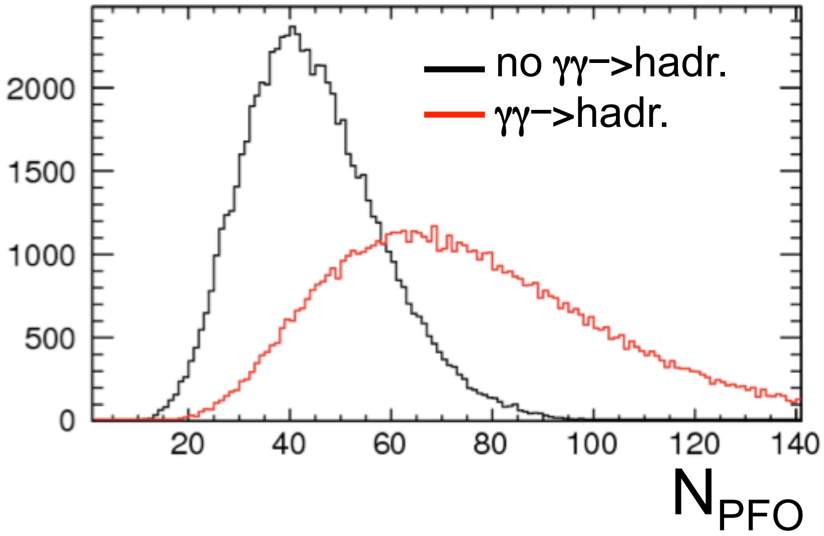
- Event topology

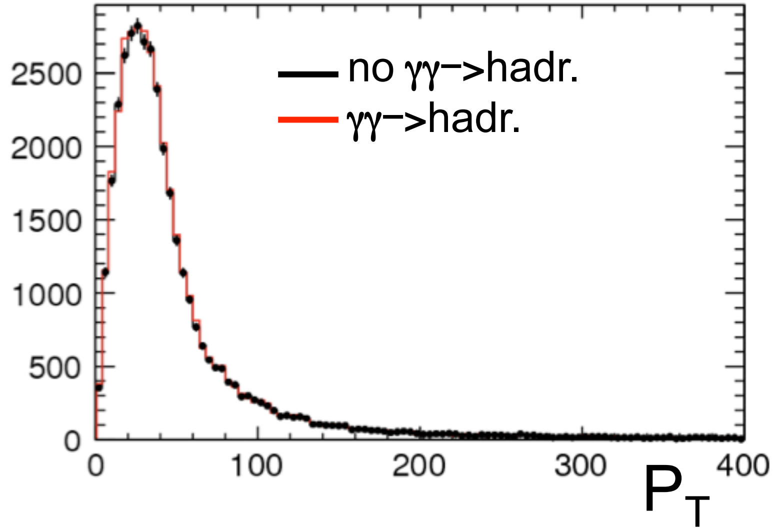


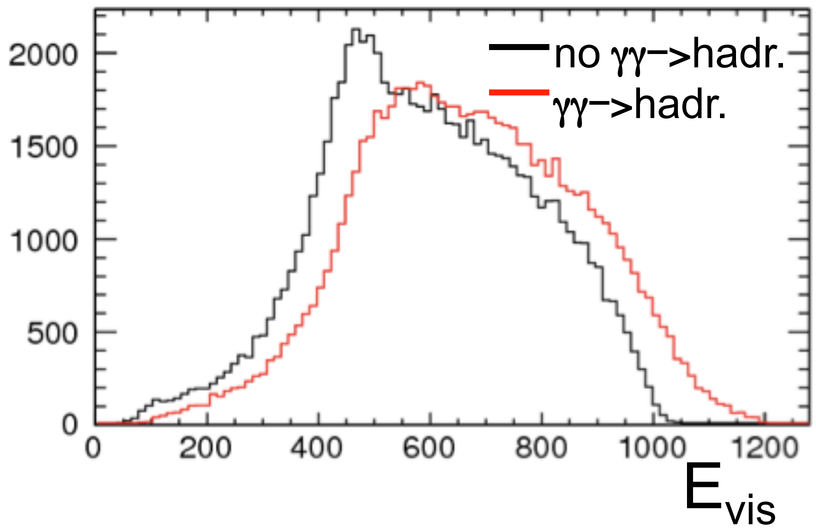
  - 2 jets
  - 1 charged lepton
  - 1 neutrino
- Straightforward reconstruction
- Low background

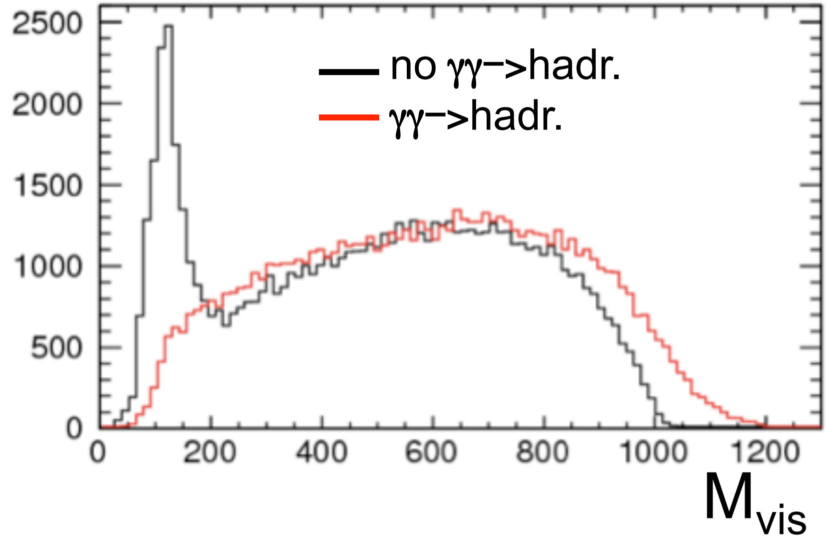
- Standard Selection at 500 GeV
  - Cut based selection
  - Preselection
  - Durham algorithm to force the event in three jets
  - Selection of lepton jet + Isolation cuts
  - Anti-tau discriminant variable
  - Cut on the reconstructed W mass
  - Cut on the W production angle
- New at 1 TeV:
  - Dedicated lepton ID
  - Force event in two jets
  - Kinematic fit with 2C
  - Background overlay

Preselection







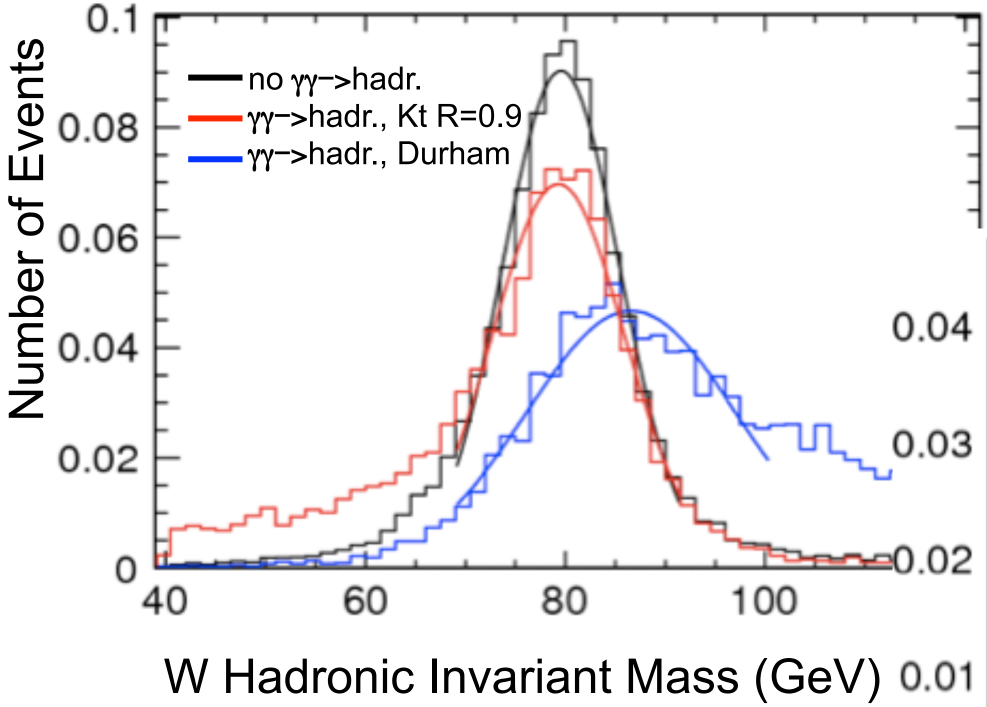


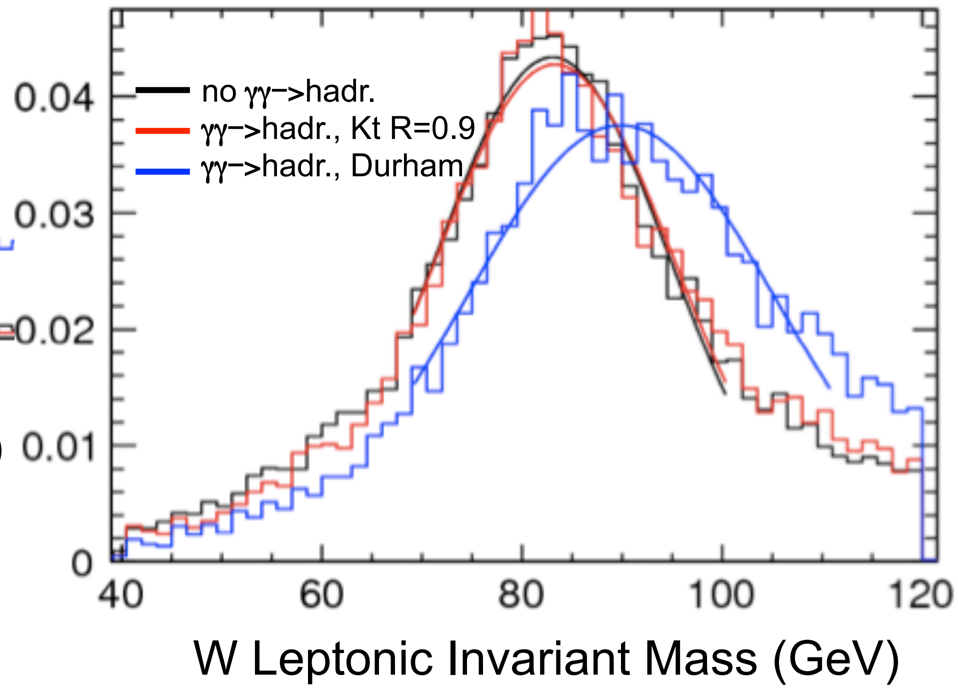
Selection of the Lepton with Jet Algorithm

- Force event in 3 jets (Durham), two jets for the hadronic decay and the jet with less multiplicity is taken as the lepton.
- Requirements on the lepton jet:
  - Only one track with p_T>10GeV
    - For electron (E/p -> 1): allow 3 tracks for FSR converting into e^+e^- pair. Two tracks must have invariant mass -> 0.
    - For muon (E/p -> 0): allow only one track.
  - Lepton track must be charged.
  - Isolation

Reconstructed Masses

Compare different jet algorithms: K_t algorithm vs Durham



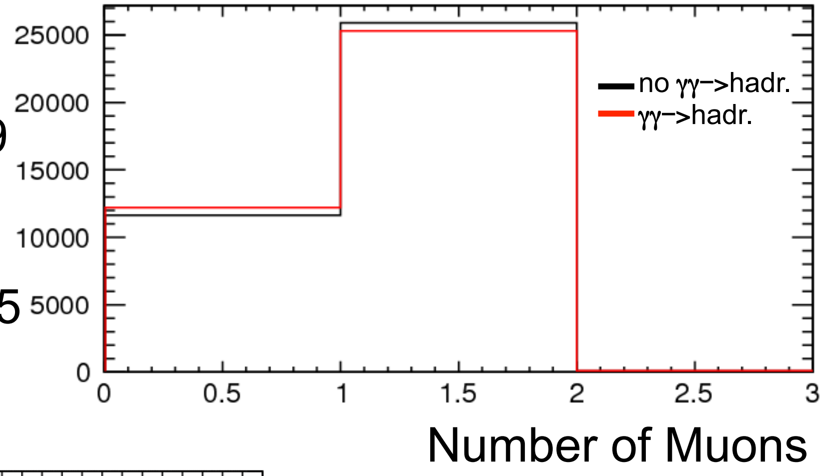


Lepton Identification

- Lepton ID

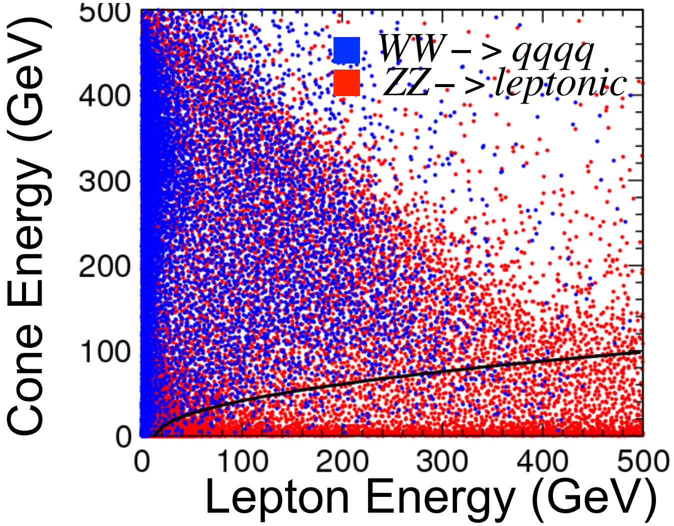
For e+/e- : $(En_{ECAL}+En_{HCAL})/P > 0.8$
$En_{ECAL}/(En_{ECAL}+En_{HCAL})>0.9$
Charge not-zero

For μ+/μ-: $(En_{ECAL}+En_{HCAL})/P < 0.4$
$En_{ECAL}/(En_{ECAL}+En_{HCAL})<0.5$
Charge not-zero



- Isolation

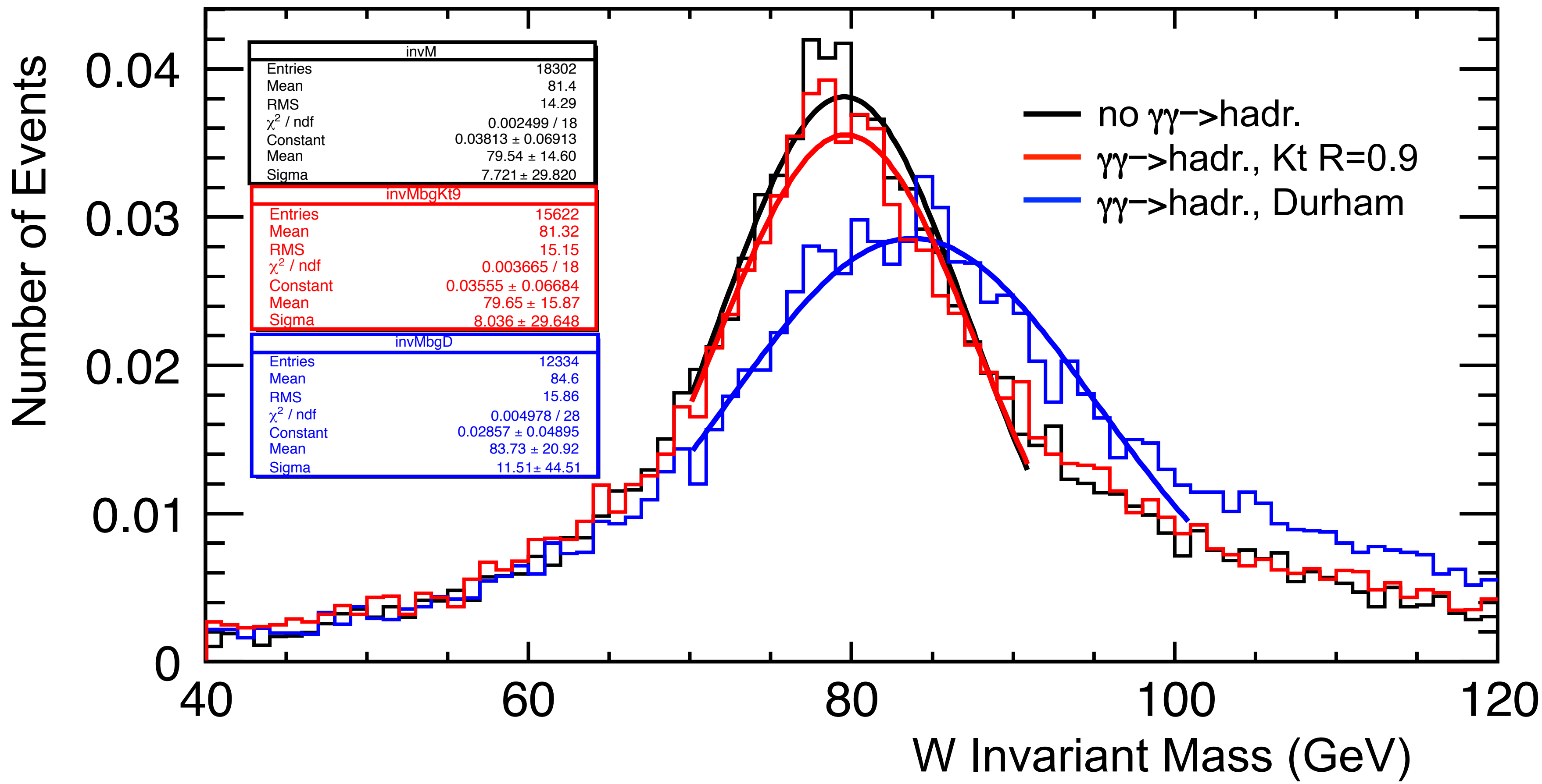
$$E_{cone} < \sqrt{20E_{\ell} - 300}$$



Efficiency: 93%

W Reconstructed Mass from Fit

- Compare different jet algorithms: K_t algorithm vs Durham



Data Reduction

Selection	No Bkg. Durham WW->qqμν	No Bkg. Durham WW->qqτν	Bkg. K_t, R=0.9 WW->qqμν	Bkg. K_t, R=0.9 WW->qqτν	Bkg. Durham WW->qqμν	Bkg. Durham WW->qqτν
Preselection	37049	37192	34532	36863	34532	36863
Lepton ID +Isolation	25723	8197	22625	7568	22625	7568
$M_{lep}=M_{had}=M_{fit}$	18302	3930	15622	3748	12334	2885
Efficiency	50%	11%	42%	10%	33%	7%
Lepton jet	20480	18752	17830	16833	15883	15905
Isolation + anti-tau	19196	6844	15823	5506	13450	7440
M_{lep}	16568	5334	13465	4158	10365	5817
M_{had}	15550	5014	12185	3684	6846	3181
Efficiency	41%	13%	33%	10%	18%	9%

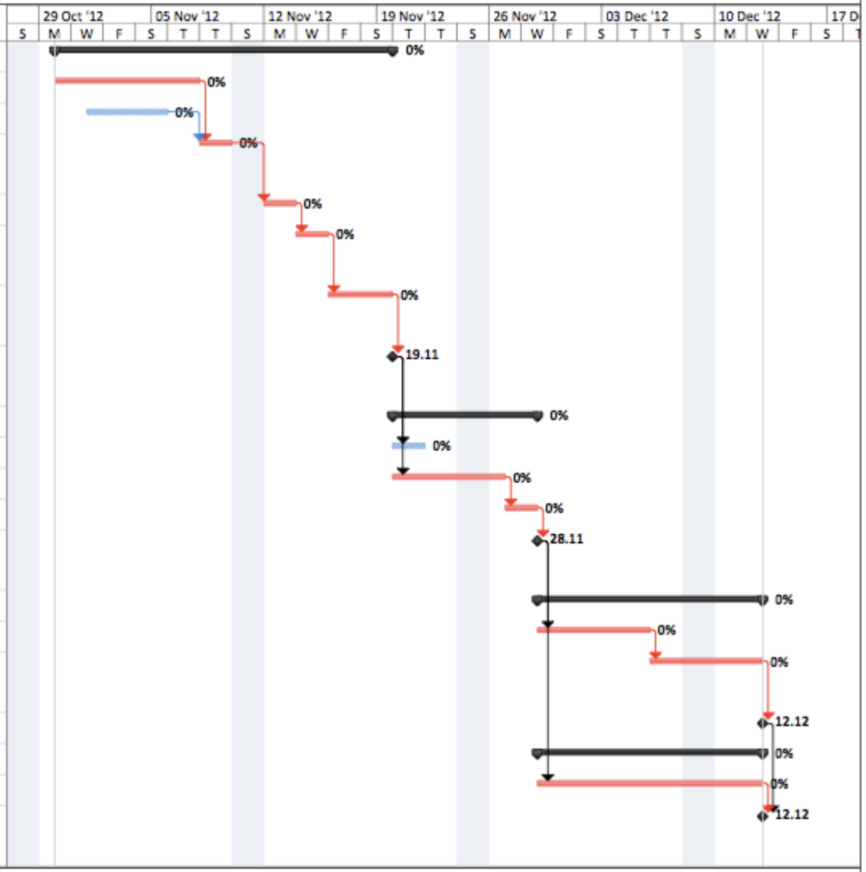
Summary

- Lepton ID seems to work better than lepton reconstruction with a jet algorithm.
- Lepton ID seems robust against $\gamma\gamma$-> hadrons background.
- K_t jet algorithm seems to be a better choice over Durham algorithm to reduce effect of background overlay.
- Kinematic fit improves efficiency.
- However, numbers not yet final, all selection cuts need optimization.

Time Schedule

Project1.mpp

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Selection**	**15 days**	**Tue 30.10.12**	**Mon 19.11.12**	
2		Refine current analysis	7 days	Tue 30.10.12	Wed 07.11.12	
3		Finalize analysis code	3 days	Thu 01.11.12	Mon 05.11.12	
4		Finalize scripts to produce ntuples	2 days	Thu 08.11.12	Fri 09.11.12	3;2
5		Production ntuples	2 days	Mon 12.11.12	Tue 13.11.12	4
6		Production stage 2 (analysis)	2 days	Wed 14.11.12	Thu 15.11.12	5
7		Combine plots, obtain efficiency	2 days	Fri 16.11.12	Mon 19.11.12	6
8		Milestone 1 - Selection ready	0 days	Mon 19.11.12	Mon 19.11.12	7
9		**Analysis**	**7 days**	**Tue 20.11.12**	**Wed 28.11.12**	
10		Blondel results	2 days	Tue 20.11.12	Wed 21.11.12	8
11		Prepare templates	5 days	Tue 20.11.12	Mon 26.11.12	8
12		Run fit polarization	2 days	Tue 27.11.12	Wed 28.11.12	11
13		Milestone 2 - Analysis ready	0 days	Wed 28.11.12	Wed 28.11.12	12
14		**TGC**	**10 days**	**Thu 29.11.12**	**Wed 12.12.12**	
15		Prepare code TGC	5 days	Thu 29.11.12	Wed 05.12.12	13
16		Run fit polarization + TGC	5 days	Thu 06.12.12	Wed 12.12.12	15
17		Milestone 3 - TGC	0 days	Wed 12.12.12	Wed 12.12.12	16
18		**Systematics**	**10 days**	**Thu 29.11.12**	**Wed 12.12.12**	
19		Systematics	10 days	Thu 29.11.12	Wed 12.12.12	13
20		Milestone 4 - Final result	0 days	Wed 12.12.12	Wed 12.12.12	17;19



Critical, Critical Split, Critical Progress, Task, Split, Task Progress, Manual Task, Start-only, Finish-only, Duration-only, Baseline, Baseline Split, Baseline Milestone, Milestone, Summary Progress, Summary, Manual Summary, Project Summary, External Tasks, External Milestone, Inactive Task, Inactive Milestone, Inactive Summary, Deadline

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