Hadronic Calibration Workshop 2009
26 June 2009

DPD and Trigger Session

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Outline

Overview of online trigger selections and data analysis flow

Overview of Performance DPDs and event selections

Contributions to the new skimming proposal

Discussions

Bunch filling schemes LHC startup:
LHC-OP-ES-0011 rev 2 + Chamonix discussions

now 50 ns

Beam characteristics and performance levels in points 1 and 5 are summarised for the various stages in the following table.

Machine parameters		Stage A		Stage B		Stage C			Stage D
		Target	Limit	Target	Limit	Target	Limit		Nominal
spacing	ns	2021	566	75	75	25	25	Installation of phase II collimators and full beam dump	25
bunch length	m	0.0755	0.0755	0.0755	0.0755	0.0755	0.0755		0.0755
crossing angle	urad	0	0	250	250	285	285		285
bunch intensity		4.00E+10	9.00E+10	4.00E+10	9.00E+10	5.00E+10	5.00E+10		1.15E+11
bunches		43	156	936	936	2808	2808		2808
energy	eV	7.00E+12	7.00E+12	7.00E+12	7.00E+12	7.00E+12	7.00E+12		7.00E+12
F		1	1	0.96	0.92	0.9	0.84		0.84
normalised emittance	cm	3.75E-04	3.75E-04	3.75E-04	3.75E-04	3.75E-04	3.75E-04		3.75E-04
beta*	cm	200	200	200	100	100	55		55
luminosity	/cm^{2}s	6.12E+30	1.12E+32	1.28E+32	1.24E+33	1.13E+33	1.91E+33		1.01E+34
total inel cross section	cm^2	6.00E-26	6.00E-26	6.00E-26	6.00E-26	6.00E-26	6.00E-26		6.00E-26
event rate per cross		0.76	3.85	0.73	7.09	2.14	3.63		19.18
protons per beam		1.72E+12	1.40E+13	3.74E+13	8.42E+13	1.40E+14	1.40E+14		3.23E+14
current per beam	mA	3.09E+00	2.53E+01	6.74E+01	1.52E+02	2.53E+02	2.53E+02		5.81E+02
energy per beam	Joules	1.93E+06	1.57E+07	4.19E+07	9.43E+07	1.57E+08	1.57E+08		3.62E+08
beam size	um	31.7	31.7	31.7	22.4	22.4	16.6		16.6

A quick aside ...

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Installation of phase II collimators and full beam dump

A quick aside ...

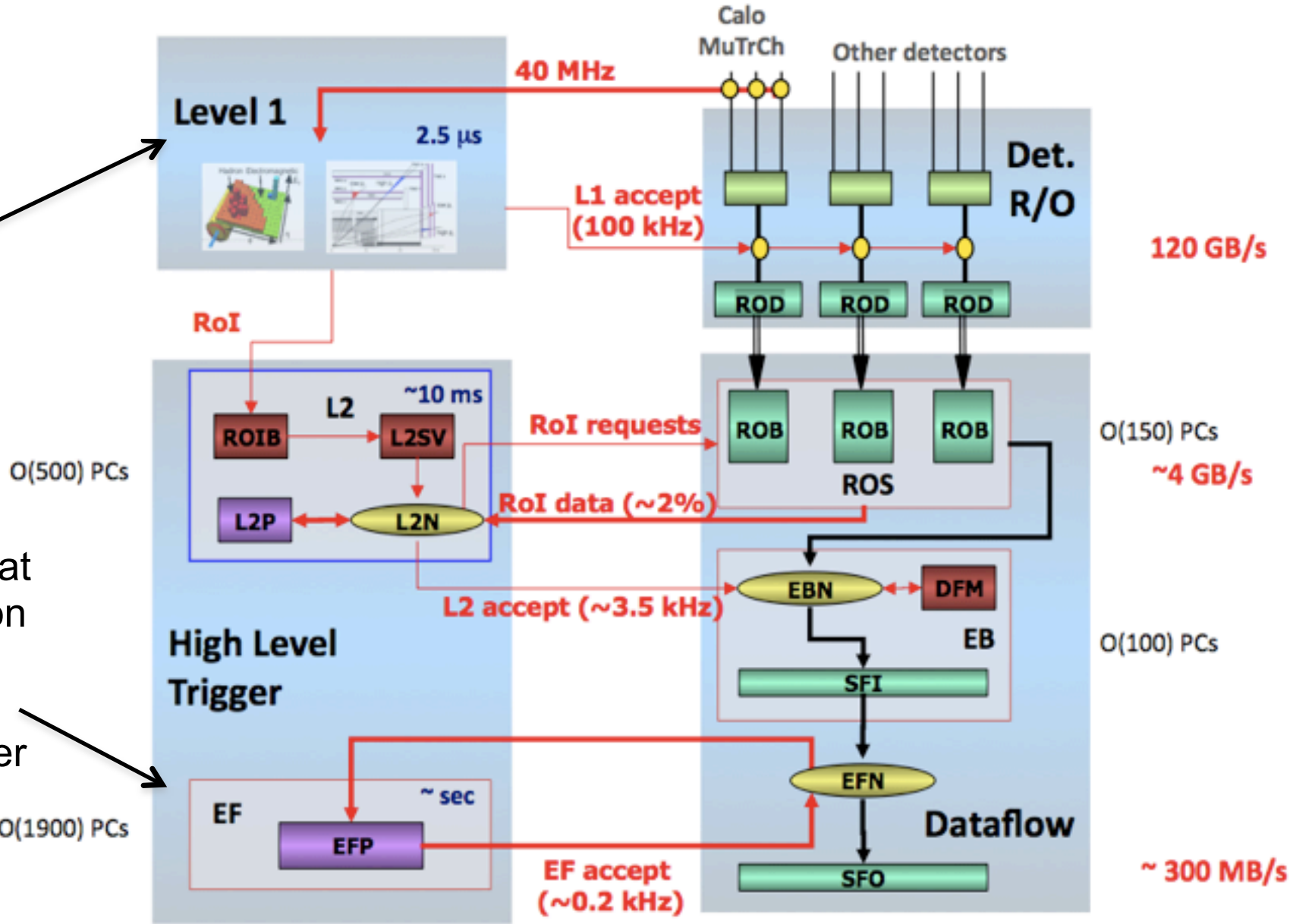
What will you get from the Online event selection?

Trigger and DAQ

Streaming

↓

Trigger type based on L1 items passed



Stream tag set at the EF, based on trigger chain (if HLT chains active) or Trigger Type

At startup streams [→PerfDPDs] are likely based on L1 items only

Streams to Tier-0

Menus at startup

Initial beam menu: https://twiki.cern.ch/twiki/bin/view/Atlas/InitialBeam_v1

HLT

It is important to stress the fact that the HLT will **not** be deployed to select events to begin with. Unseeded streaming chains will be streaming events according to their L1 trigger type according to a scheme that still needs to be defined. After a while parts of the HLT may be deployed in pass-through while keeping the streaming to the L1 based paradigm.

The HLT menu **will** be continuously tested offline, though, as a precursor for deploying the HLT online in pass through in preparation for enabling selection.

L1Calo thresholds

- EM: EM3, EM4, EM7, EM7I, EM10, EM13, EM13I, EM18
- Tau: HA5, HA6, HA9, HA9I, HA16, HA16I, HA25, HA40 **(Notice, this is different from 2008.)**
- Jets: J5, J10, J10_win6, J18, J23, J35, J42, J70

The "J10_win6" threshold is a 6x6 window 10 GeV threshold. The standard threshold uses an 8x8 window.

- Forward jets: JB3, JF3, JF18, JB18 ("Forward" and "backward" thresholds are separate)
- Sum Scalar Et: TE150, TE650
- Sum Scalar Jet Et: JE120, JE340
- Missing Et: XE20, XE30, XE50, XE80

Beam items – L1Calo

EM

L1_EM3	L1_EM10	L1_2EM3
L1_EM4	L1_EM13	L1_2EM4
L1_EM7	L1_EM13I	L1_2EM7
L1_EM7I	L1_EM18	L1_2EM7I
		L1_2EM10

TAU

L1_TAU5	L1_TAU16	L1_2TAU5
L1_TAU6	L1_TAU16I	L1_2TAU9
L1_TAU9	L1_TAU40	L1_2TAU9I
L1_TAU9I		

MET

L1_XE20	L1_JE120
L1_XE30	L1_JE340
L1_XE50	L1_TE150
L1_XE60	L1_TE650

JET

L1_J5	L1_J42	L1_2J18
L1_J10	L1_J70	L1_2J10_win6
L1_J10_win6	L1_FJ18	L1_2FJ3
L1_J18	L1_FJ3	L1_2FJ18
L1_J23	L1_2J5	L1_3J10
L1_J35	L1_2J10	

Diffractive

L1_J18_LV	L1_J18_MV	L1_J18_NL

L1_<item> = <threshold> & BGRP0 & BPTX

Beam items - the rest

MBTS

L1_MBTS_1	L1_MBTS_A	L1_MBTSA0-15
L1_MBTS_1_1	L1_MBTS_C	L1_MBTSC0-15
L1_MBTS_2		

LUCID

L1_LUCID	L1_LUCID_A_C
L1_LUCID_A	L1_LUCID_C

BCM

L1_BCM_AtoC	L1_BCM_MUL_2	L1_BCM_MUL_5
L1_BCM_CtoA	L1_BCM_MUL_3	L1_BCM_MUL_6
L1_BCM_HT	L1_BCM_MUL_4	L1_BCM_Wide
L1_BCM_MUL_1		

ZDC

L1_ZDC

Muons

L1_MU0	L1_MU0_TGC_HALO	L1_MU20
L1_MU0_HIGH_RPC	L1_MU10	L1_MU6

Note: No “spare” items anymore

L1_<item> = <threshold> & BGRP0 & BPTX

Streaming

8 bit trigger type definition used for initial streaming

A suggestion to a streaming paradigm is to use the following definition of the L1 trigger type

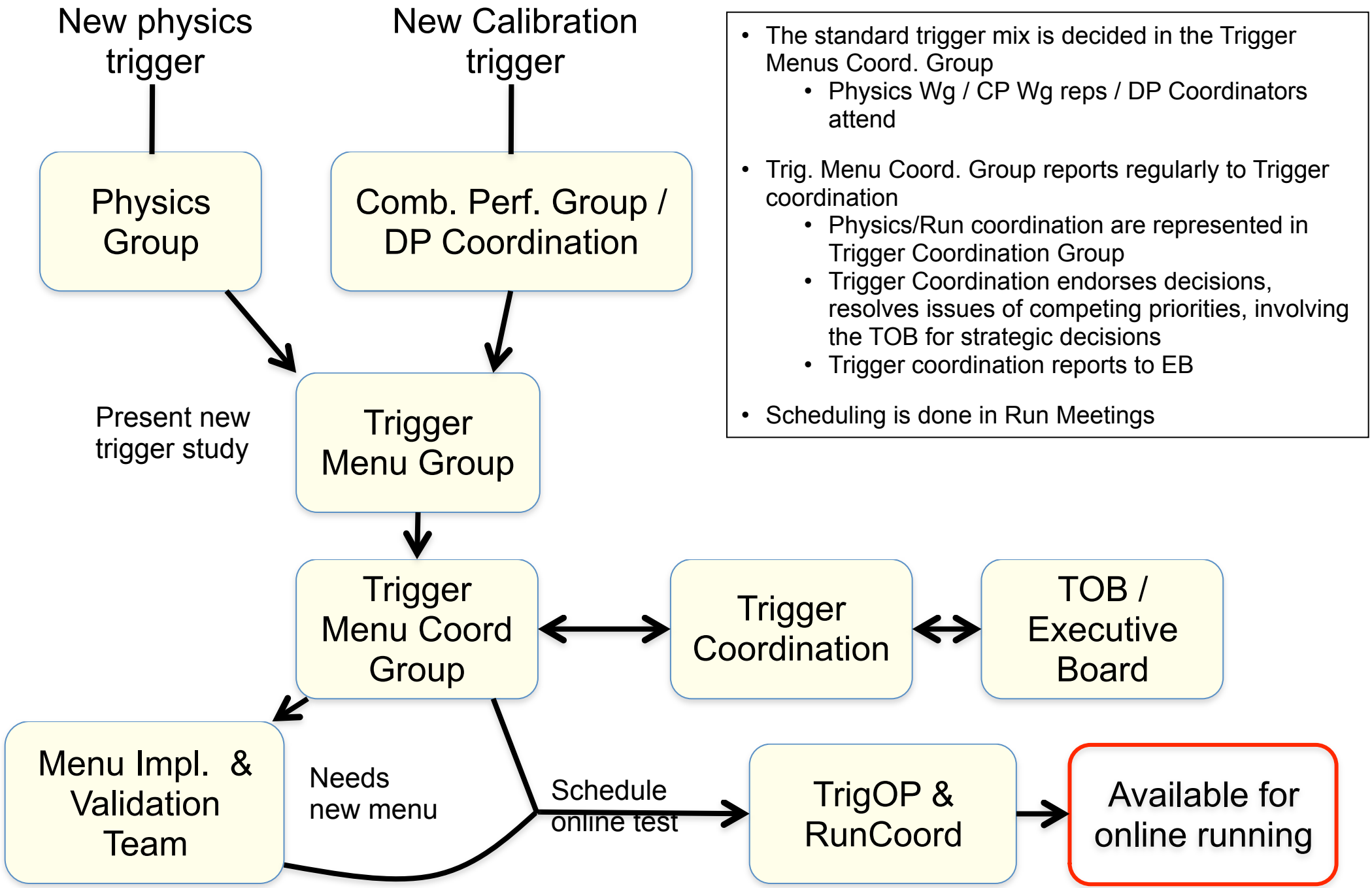
Bit	Name	Comment
0	RNDM	Random + bunch group items
1	BPTX	Set for BPTX items
2	L1Calo	Set for L1Calo items
3	Mu_physics	1 means muon physics item, 0 means RPC/TGC test item
4	Beam	Yes = 1, no = 0
5	MBTS_BCM_LUCID	MBTS/BCM/LUCID
6	Muon	Set for any muon item
7	physics	True for everything but calibration requests

- Only 8 bits → less selective
- Express stream is likely just a random x% selection

[might also stream on 256 bit CTP accept pattern if needed – is it needed?]

Not happy? Need a change?

1. New/changed trigger for physics/calibration



- The standard trigger mix is decided in the Trigger Menus Coord. Group
  - Physics Wg / CP Wg reps / DP Coordinators attend
- Trig. Menu Coord. Group reports regularly to Trigger coordination
  - Physics/Run coordination are represented in Trigger Coordination Group
  - Trigger Coordination endorses decisions, resolves issues of competing priorities, involving the TOB for strategic decisions
  - Trigger coordination reports to EB
- Scheduling is done in Run Meetings

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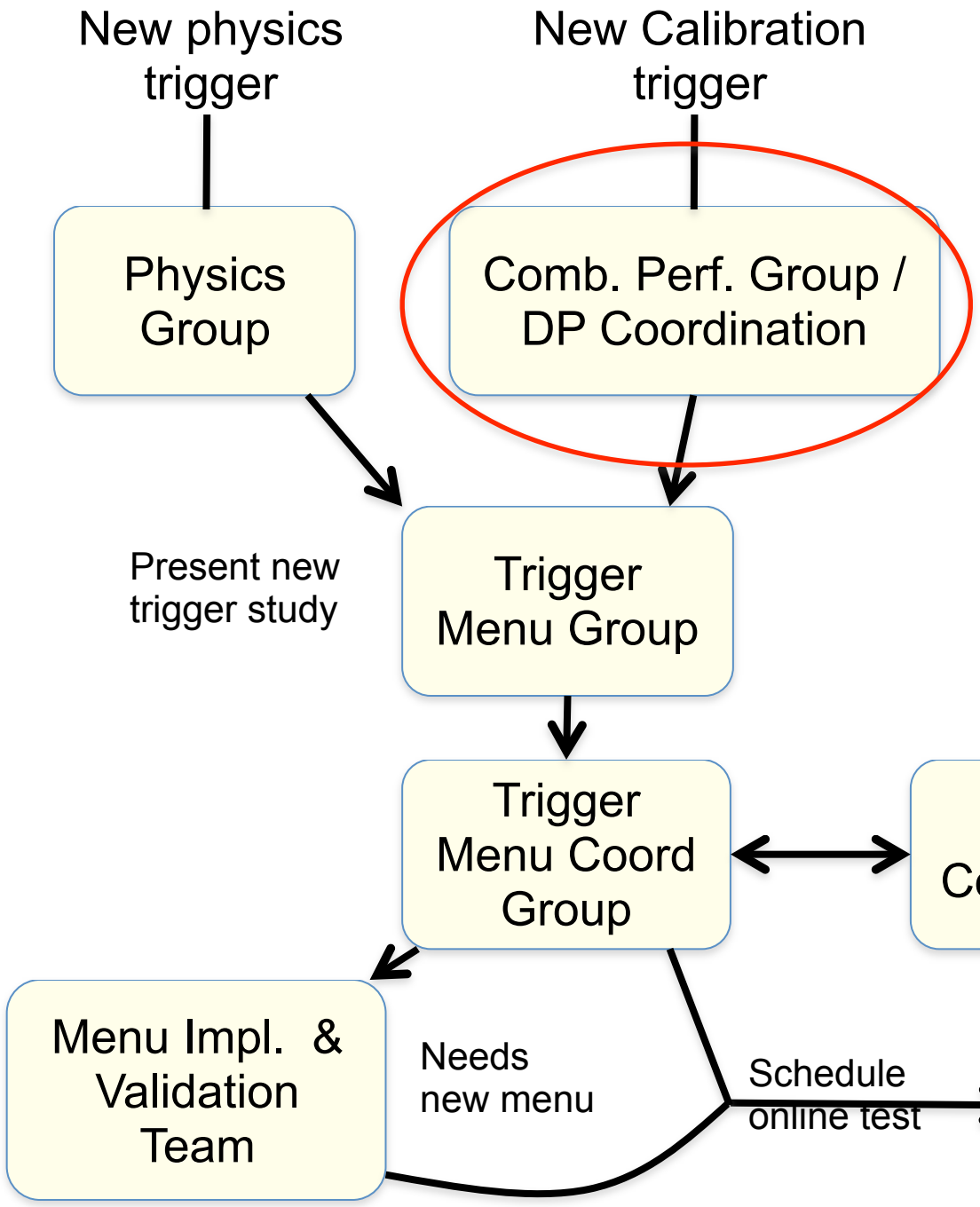

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Calibration used online

Level 1

Gain settings in L1Calo
Discussions under way what to use for initial calibration

Start very simple ?
- EM scale
- No eta/phi dep.

A bit more complex?
- Apply e/pi ratio
- Some eta/phi dependence

Big implications on effective trigger threshold

Level 2

Use offline tools
Sampling method

No time to read geometry info needed for cell based calibration
- Use just two samples (EM, HAD)
- L2 object is EM+HAD
- Need RAW data to study clustering offline

EF

Use offline calibration

Performance DPD

Primary Performance DPD (= D1PD)

- DPDs centrally produced from ESD
- Tier-2 disk budget requires DPD from each stream to be ~10% of AOD size = 1~2% of ESD size

9 primary Performance DPDs will be produced

Trigger Stream	DPDs
EGamma	EGAMMA, SINGLEEL, PHOTONJET
Muon	MUON, SINGLEMU
JetTauEtMiss	CALOJET, TRACKING, LARGEMET
MinBias	MINBIAS

Performance DPDs

DPD Name	Event Selection (ESD→DPD)	Event Content
DPD_CALOJET	▸ ≥1 jet within $\|\eta\|<2.5$ ▸ Tiered prescale on jet E_T at EM scale	Full ESD (PrepRawData removed)
DPD_PHOTONJET	***Z→ee*** ▸ 2 medium electrons : $E_T>15$ GeV, $\|\eta\|<2.5$ ▸ $60 < M_{ee} < 120$ GeV ***γ+Jets*** ▸ ≥1 good (tight) photon with $E_T>20$ GeV ▸ Prescale by 5(2) if the photon E_T is $20<E_T<40$ GeV ($40<E_T<60$ GeV) ▸ No prescale if the photon $E_T>60$ GeV	Full ESD

Performance DPDs

DPD Name	Stream	Event Selection (ESD→DPD)	Event Content
DPD_MINBIAS	MinBias	▸ Unbiased prescale (by 50) ▸ Isolated track filter : p_T >3 GeV	Full ESD
DPD_SINGLEEL	EGamma	▸ ≥1 medium IsEM electron with E_T>15 GeV and author=1 (egamma)	Full ESD
DPD_SINGLEMU	Muon	▸ ≥1 Staco or Muid muon with p_T>15 GeV ▸ Calo Isolation: $E_{0.05<R<0.5}$ <10 GeV ▸ Track Isolation: $\Sigma_{0.05<R<0.5}$ p_T <8 GeV	Full ESD

DPD Discussions on March 24, 2009

Develop analysis strategies in terms of trigger and DPD

Questions to be answered includes:

- Event selection strategies: What events are needed in the DPD ?
- How many useful events for understanding calorimeter performance are in DPD ?
- Content of the DPD
- What is needed to understand E_TMiss performance ?
  - Single inclusive jet trigger enough ?
  - Electron/Muon DPDs good enough to assess E_TMiss performance using W/Z bosons ?
- How do we react to changing trigger menu ?
  - Infrastructure ready? Is the strategy to select certain trigger immune to that ?
- Local hadron calibration on the DPDs
- Feasibility to do forward jet analysis on DPD
- e/p-studies: minimum bias DPD ? Tau-DPD ? Jet-DPD ?
- Top quark ($W \rightarrow$jet+jet, b-tagging) analysis and performance DPD
- Studies to switch jet algorithm on HLT
- Can trigger efficiency be derived from Jet/E_TMiss DPD ?
- Trigger biases on jet performance studies
- Trigger calibration strategy and effect on understanding performance

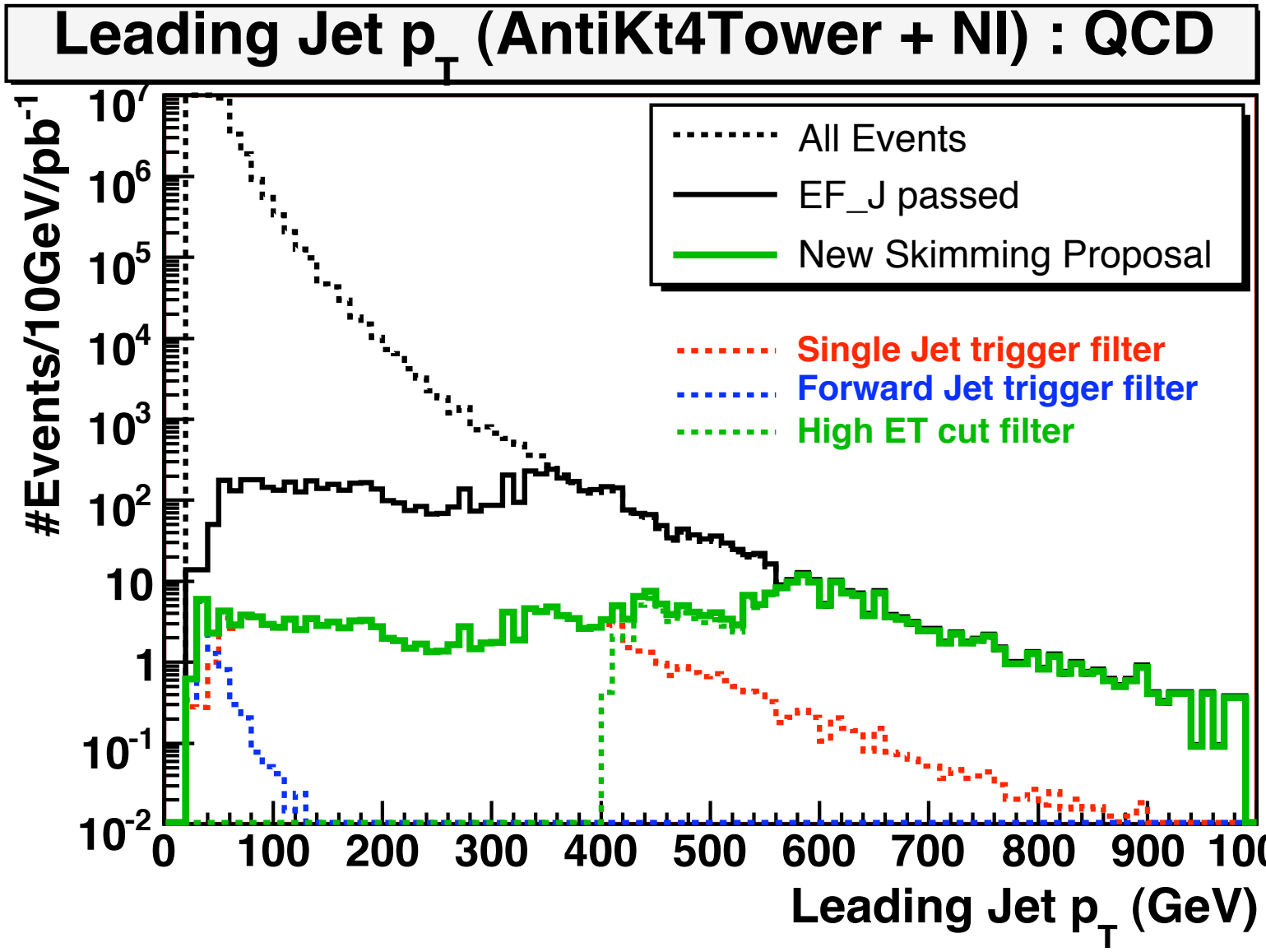
DPD_CALOJET : Skimming Proposal

Event Selection (based on 10^{31} tigger menu)	**Prescale**
OR of the following filters	
Single Jet trigger filter ▸ EF_J50, EF_J80, EF_J115, EF_J140, EF_J180, EF_J265 EF_J350	50 (for each)
Forward Jet trigger filter ▸ EF_FJ18 + ≥1 jet in barrel/endcap	200
High ET cut filter ▸ 350 < Jet1 E_T^{EM} < 450 GeV ▸ Jet1 E_T^{EM} > 450 GeV	10 1

Does this selection meet your needs?

Does your jet calibration method work with this?

DPD_CALOJET : Skimming Proposal (II)



QCD dijets

no pile-up

e344_s479_r635

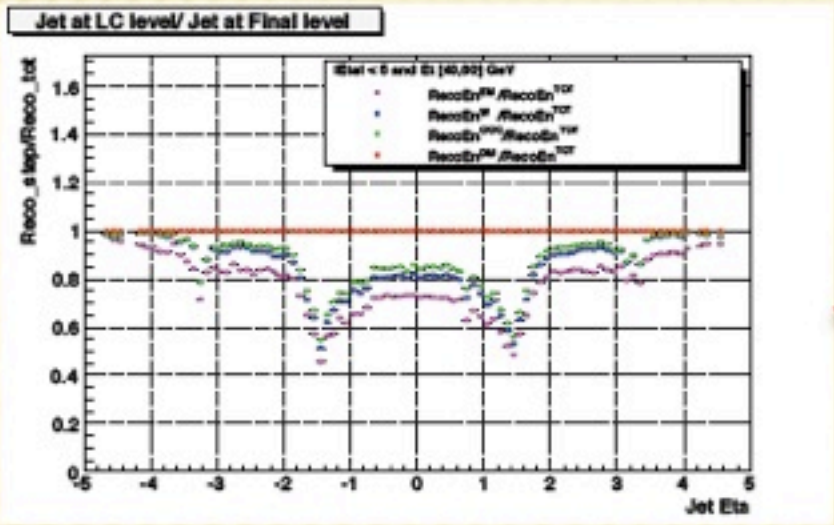
10^{31} trigger menu

➔ *Plots for individual components are in backup*

CONCLUSIONS

Few comments:

- the relative importance of ooc and dm corrections decreases with energy
- but still DM represents the largest correction...



plot jet energy_step/jet energy tot

DM accounts for ~ 20 % of the jet energy

✓Local Hadron Calibration plots are feasible on Performance DPDs with standard jet trigger

✓but it is difficult to have "good" jets at low pt, by construction
➔ maybe lower energy trigger thresholds (EFJ10 EFJ20) could be included?

✓trigger thresholds at LV1 are changing drastically ➔ to be tested !!!

DPD_PHOTONJET : Skimming Proposal

Event Selection (based on 10^{31} tigger menu)	**Prescale**
OR of the following filters	
Z→ee filter ▸ 2 medium electrons with E_T>15 GeV, $\|\eta\|$<2.5 ▸ 60 < M_{ee} < 120 GeV	1
Photon+Jet filter ▸ EF_g20 trigger ▸ Photon cut *≥1 tight photon : E_T>20 GeV, $\|\eta\|$<2.5* ▸ *Jet cut* *≥1 jet : E_T^{EM} >20 GeV, $\|\eta\|$<2.5 (non photon-overlap within ΔR<1.0)* *$\Delta\phi$(photon, jet1) > π − 0.3* *Second jet-veto as option (Jet2 E_T^{EM} < X GeV)*	1

What we learned : DPD_PHOTONJET (I)

The size was checked with FDR data

Filter	Criteria	Prescale	Efficiency (FDR 52280)
$Z \rightarrow ee$	2 medium electrons : E_T>15 GeV, $\lvert\eta\rvert$ <2.5, 60 < M_{ee} < 120 GeV	1	0.58%
Low E_T photon	≥1 tight photon : E_T>20 GeV, $\lvert\eta\rvert$<2.5	5	6.4%
Medium E_T photon	≥1 tight photon : E_T>40 GeV, $\lvert\eta\rvert$<2.5	2	5.3%
High E_T photon	≥1 tight photon : E_T>60 GeV, $\lvert\eta\rvert$<2.5	1	4.0%

➔ Too large in size...
Increase prescale or apply tighter cuts??

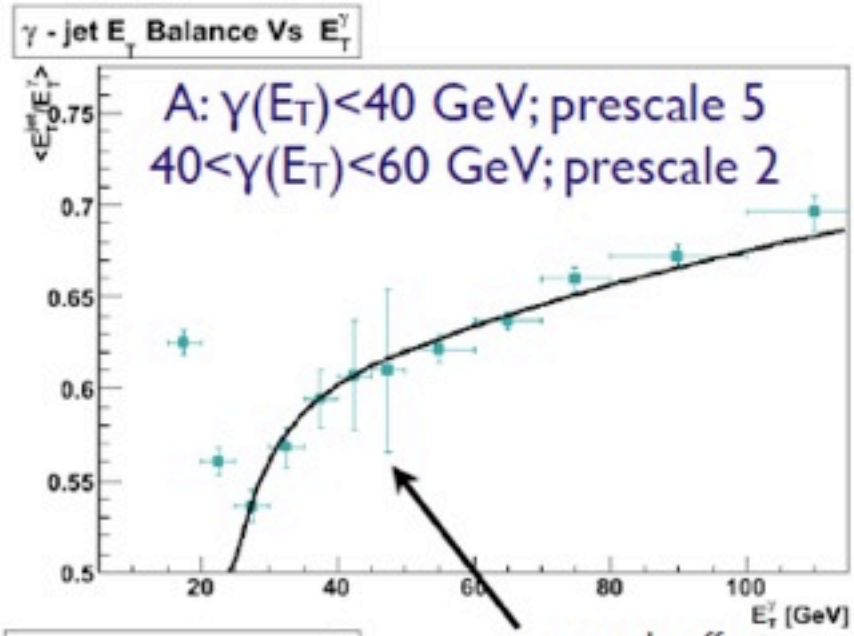
What we learned : DPD_PHOTONJET (II)

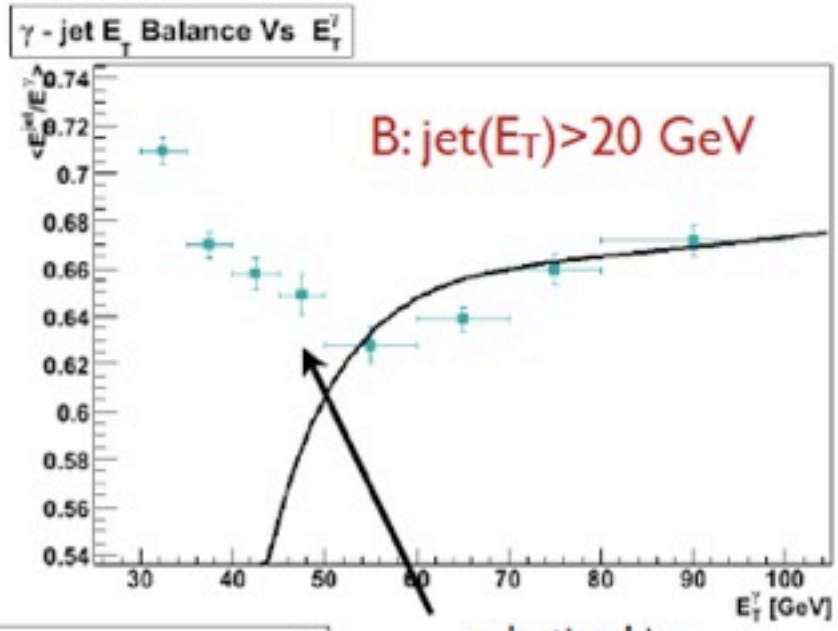
Attempt to replace photon cuts with inclusive photon triggers

Filter	Criteria	Prescale	Efficiency (FDR 52280)
$Z \rightarrow ee$	2 medium electrons with E_T>15 GeV, $\|\eta\|$<2.5, 60 < M_{ee} < 120 GeV	1	0.58%
g25_L32	EF_g25_L32 trigger	3	13.7%
g25i_L32	EF_g25i_L32 trigger	3	12.8%

➔ Still too large in size...
Event topology cuts? (e.g, photon-jet $\Delta\phi$)

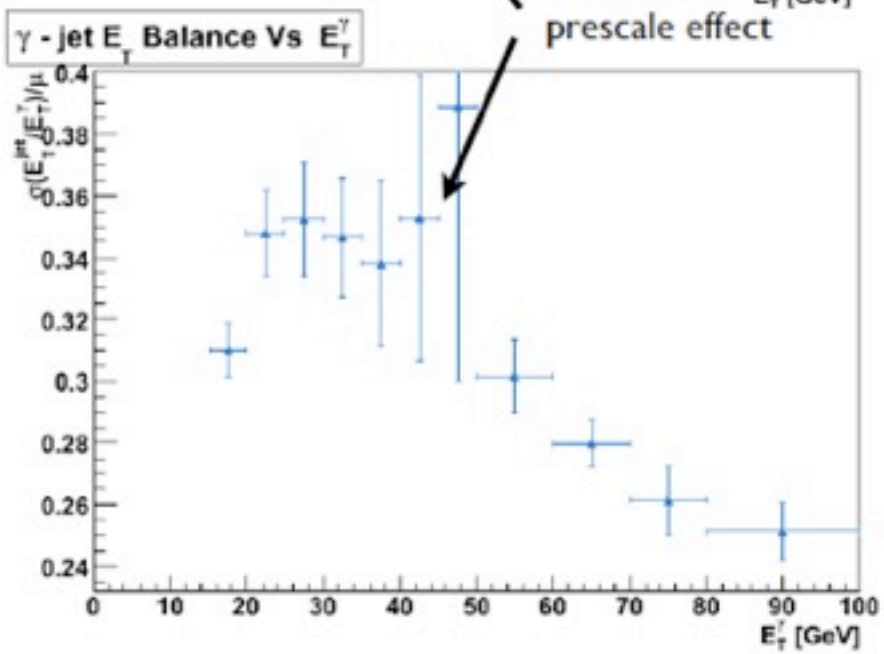
DPD skim strategy

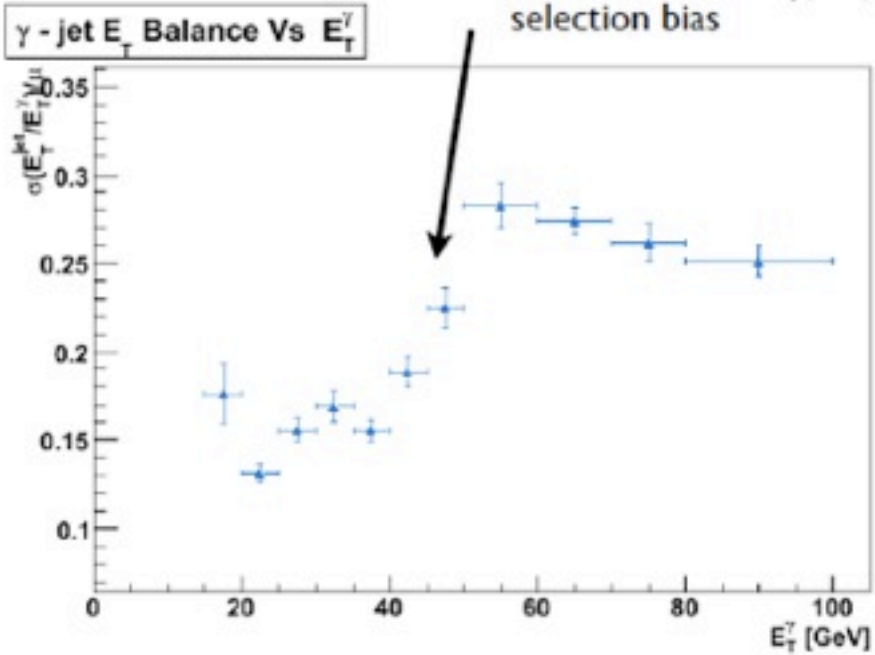




prescale effect

selection bias





How/who to go about studying trigger effects?

How to best integrate trigger studies with the jet trigger slice group?

What event selections do you want to make DPDs?

Performance DPDs on non-collision data (cosmics, single beam)?

How flexible are we for changing trigger/DPD selections?

Backup

Reminder

- Suggestion made for menu evolution:
  1) Cosmic2009_v1 (2008 style)
  2) Cosmic2009_v2 (Muon changes)
  3) Initial beam menu
  4) Bunch groups commissioned
  5) MBTS single inputs removed
  6) Physics_lumi1E31

Running at P1…

Need development

Cosmic L1 items

L1Calo

L1_EM3_EMPTY	L1_J10_EMPTY	L1_TAU6_EMPTY
L1_EM4_EMPTY	L1_J5_EMPTY	L1_TAU9I_EMPTY
L1_EM7_EMPTY	L1_J70_EMPTY	L1_TE150_EMPTY
L1_FJ18_EMPTY	L1_JE120_EMPTY	L1_XE20_EMPTY
L1_FJ3_EMPTY	L1_TAU5_EMPTY	

LUCID

L1_LUCID_A_C_EMPTY	L1_LUCID_C_EMPTY
L1_LUCID_A_EMPTY	L1_LUCID_EMPTY

ZDC

L1_ZDC_EMPTY

BCM

L1_BCM_AtoC_EMPTY	L1_BCM_MUL_1_EMPTY	L1_BCM_MUL_4_EMPTY
L1_BCM_CtoA_EMPTY	L1_BCM_MUL_2_EMPTY	L1_BCM_MUL_5_EMPTY
L1_BCM_HT_EMPTY	L1_BCM_MUL_3_EMPTY	L1_BCM_MUL_6_EMPTY
L1_BCM_Wide_EMPTY		

MBTS

L1_MBTS_1_1_EMPTY	L1_MBTS_A_EMPTY
L1_MBTS_1_EMPTY	L1_MBTS_C_EMPTY
L1_MBTS_2_EMPTY	

Muons

L1_MU0_EMPTY	L1_MU0_TGC_HALO_EMPTY	L1_MU20_EMPTY
L1_MU0_HIGH_RPC_EMPTY	L1_MU10_EMPTY	L1_MU6_EMPTY

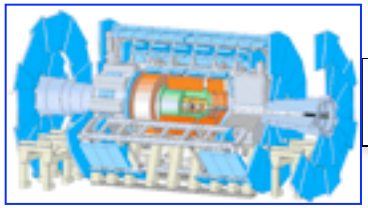
Special

L1_Tile	L1_TRT

L1_<item> = <threshold> & BGRP0

Where do you analyse your performance data?

Format Flow



FE — ROD — ROS — … — SFO

from here everything is stream-wise

RAW data samples

sub-system resources

Tier-0

RAW

Comm. NT

- Trigger/MinBias (from ESD)
- Muon Comm. (from RAW)
- Tracking Comm. (from RAW)

ESD

AOD

Perf DPD

AOD

x9

AOD

TAG

~10%

~10%

CAF

merge Commissioning and Performance DPDs

Tier-1

on disk

on disk

on disk as long as possible

D¹PD

on disk

one copy of RAW across all Tier-1s

two copies of ESD across all Tier-1s

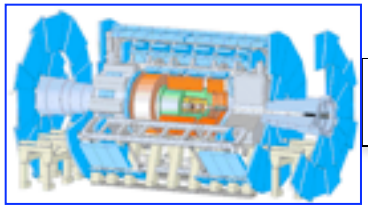
Tier-2 x N

One copy of all active AOD/ PerfDPD/D1PD sets across all Tier-2s of one cloud

ESD/RAW data sets retrieved on request

user/group data sets (i.e. D2PDs), MC produced on Tier-2, copied to Tier-1s

Format Flow



FE — ROD — ROS — … — SFO

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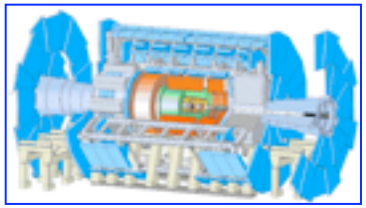


© RH

Conditions data flow

detectors
DAQ
PVSS

Online

pvss2 cool

ATONR 100 GB/y

dbproxy

HLT

POOL files

pt1transfer

Tier-0

ATLR 100 GB/y

Tier-0
CAF
users

POOL files <500 GB/y

DBRelease:MC ~ 300MB

SQLite/POOL

DDM

DDM

CDRelease: data- 1GB slice?

Calibration processes

Tier-1

Tier-1 DB 100 GB/y

POOL files

DDM

Tier-1 prod

Tier-1 analysis

Tier-2 MCprod

DDM

POOL files?

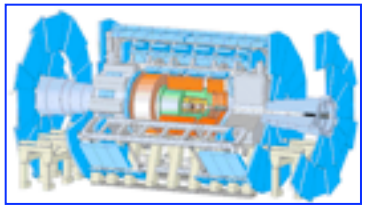
Frontier?

Squid cache?

Tier-2/3

Tier-2/3 analysis?

Squid cache?



© RH

Conditions data flow

detectors
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Tier-1 DB 100 GB/y

POOL files

DDM

Tier-1 prod

Tier-1 analysis

Tier-2 MCprod

DDM

POOL files?

Frontier?

Squid cache?

Tier-2/3

Tier-2/3 analysis?

Squid cache?

We need to try out the full computing model we will want to use for studies as data comes in NOW

There are still enough bits that have not been tried in anger to slow us down significantly if they fail later.

Detector requests for trigger menu

[considering Tile/LAr here]

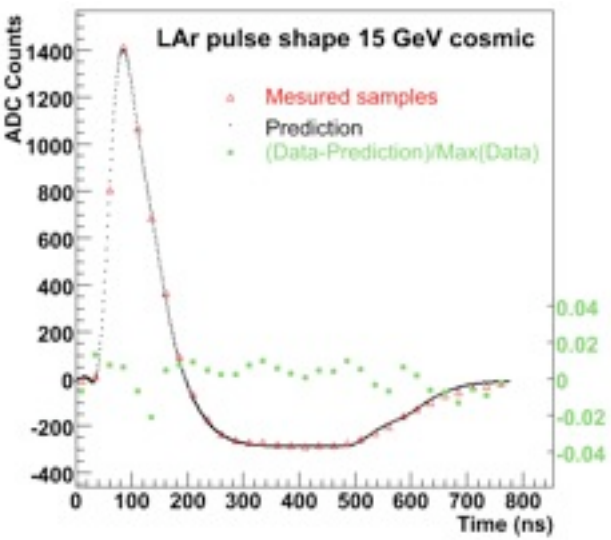
Recently menu group has queried detector systems to learn about any menu related requests for hardware commissioning

http://indico.cern.ch/conferenceDisplay.py?confId=44750

Comments from LAr

- Special streaming requirements?
  - L1Calo_EM: We would like to have this stream as a small subset of L1Calo.
    - Makes analysis much easier (smaller data volume to loop through).
  - Calibration stream: EF triggered electrons, O(10Hz), higher energy better
- Triggers needing partial event building?
  - Calibration stream: Event size <10% of total event size (only LAr region of interest and ID)
- Dedicated runs for LAr?
  - Electronic calibration runs (LAr standalone and LAr+L1Calo) during LHC inter-fill time
  - 1 day of collisions data in 32 samples (and 15+1 for L1Calo) read-out (EF electrons, higher energy better)
    - To be seen, when there is the best moment, can be in the shadow of other sub-detector needs
    - Limits rate to O(20Hz)

Number of LAr Samples Read Out



- LAr has several modes to write out data
  - Transparent mode: The signal is sampled every 25ns, all the samples are written on disk
    - Choice of reading out from 5 samples up to 32 samples (full signal, makes signal studies possible)
      - Rate limitation (e.g. 32 samples O(20Hz) only)
    - For asynchronous data taking (Cosmics and first beam (before being timed in properly)) an iteration is performed to find the best suited set of optimal filtering coefficients (if not error in the energy measurement O(10%) is induced, but can be worse if timing off by >25ns)
    - Has consequences for HLT running on LAr data (no energy calculated in the DSP)

  Physics mode: The signal is sampled every 25ns (5 samples, 7 being implemented), the DSP (back end electronics) the energy is calculated, only samples for energies above a certain threshold are written to disk
    - No iteration in the DSP → for asynchronous running error in the energy measurement O(10%) is induced, but can be worse if timing off by >25ns
    - If |E|-thresholds for writing out all the samples are 0, then all the samples get written out (on top of DSP calculated energy)
      - Limited to 30kHz LVL1 rate
      - Iteration for asynchronous running can be done resulting in a correct energy reconstruction, however, if timing off by >25ns (by any trigger source) then big error in the energy reconstruction.
    - → with non-zero |E|-thresholds and asynchronous data taking LAr data of very limited use for ATLAS

- LAr view on how to run taking into account these above mentioned points:
  - Fair amount of time in 10 or 32 samples for cosmics
    - We are conscious that this conflicts with other needs of sub-systems and HLT → to be discussed and compromise to be found in run coordination meetings (But we have good reasons to ask for that!!)
  - Beam splash events: 32 samples transparent mode
  - First collisions: Physics mode but |E|-thresholds 0 until we are sure about our timing

Executive Summary of Tile's Trigger Needs

- Cosmics (pre-beam):
  1. Single muon triggers for EM scale verification and calibration of digitizer timings
  2. Calibration triggers for monitoring hardware stability
- Initial Beam:
  1. Isolated muons triggers for EM scale calibration
  2. MBTS triggers for verification of calorimeter uniformity and cell intercalibration
  3. Single track triggers for single hadron selections for hadronic scale verification
  4. Calibration triggers for monitoring hardware stability

M. Dunford, I. Vichou, G. Usai

Initial Beam Menus Needs

- Special runs:
  - Splash events: Request 50 (20 at the lower limit)
  - Scraping muons: 1-2 day run with scraping events (muon chambers on)
  - trk9i_id no prescale: 1-2 days with no prescale on this trigger. This would be 45Hz at the EF
  - D-Cell calibration: To be done during the 10^{31} menu. 1 day with normal 10^{31} menu but with the HV settings in Tile's D-cells set to 1.0 (compared to the current 1.20 settings)
    - Needed for tests of any bias in L1Calo

8

Othe Questions for Discussion

- When can we move from the L1 bit streaming to physics streaming?
  - Tile relied heavily on the L1 bit streaming last year because we can use the Tier0 monitoring plots for quick overnight evaluation
  - We do NOT want to change to the physics streaming until the trigger timing between all the triggers in a given physics stream are in-time

M. Dunford, I. Vichou, G. Usai

PLOTS....

jet energy after had weighting / jet energy at em level
jet energy after w and ooc / jet energy at em level
jet energy after w and ooc and dm / jet energy at em level

in 4 Et bins :
I. 15 GeV ± 20%
II. 30 GeV ± 20%
III. 50 GeV ± 20%
IV. 100 GeV ± 20%

VERSUS η

- ✓ electron-jet overlap removal applied
  - electron author : ElectronAuthor
  - electron isem : ElectronMedium
  - jet overlap with electron in deltaR of 0.2
  - et of the electron is > ½ of the et of the jet
- ✓ 4 most energetic jets in the event are considered
- ✓ presample cells are subtracted from em, w and ooc level → considered as DM

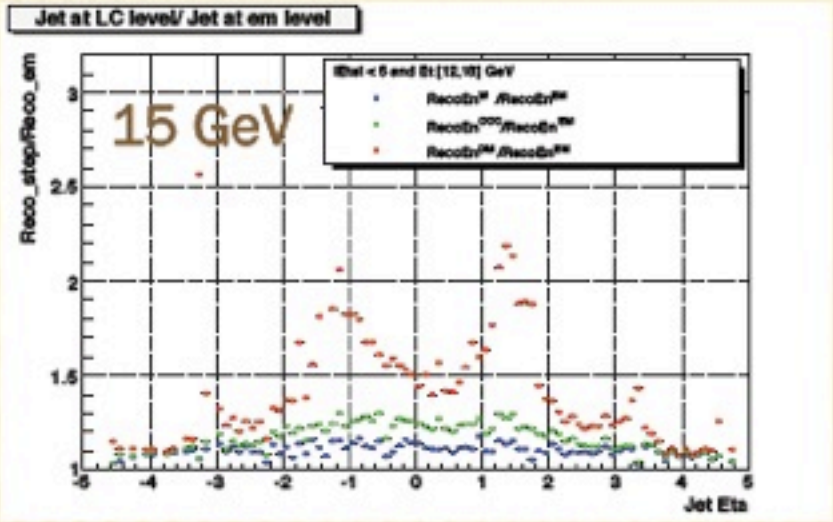
SKIMMING FILTERS APPLIED ::

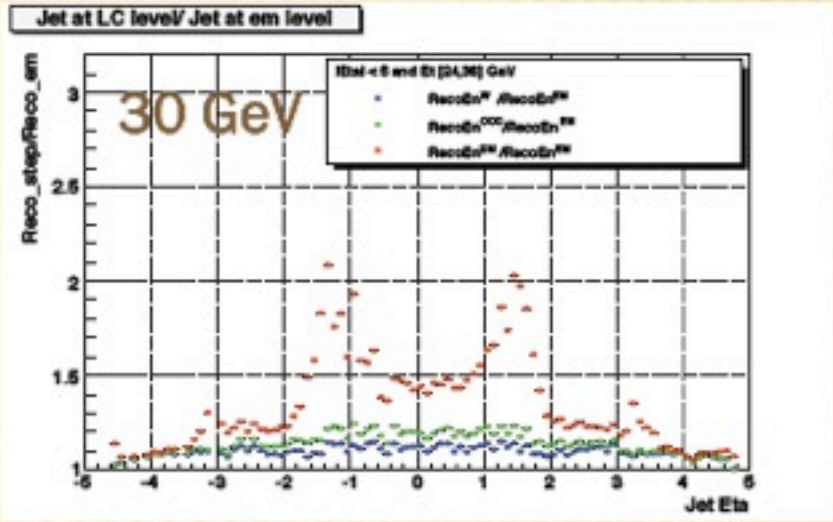
- Single jet trigger filter : EF_J50, EF_J80, EF_J115, EF_J140, EF_J180, EF_J265, EF_J350 (prescale 50 each)
- Forward jet filter : EF_FJ18 + at least one jet with ET > 20 GeV and |eta| < 2.5 (prescale 200)
- High ET cut filter : 350 < Jet1 ET < 450 GeV (prescale 10), Jet1 ET > 450 GeV (no prescale)

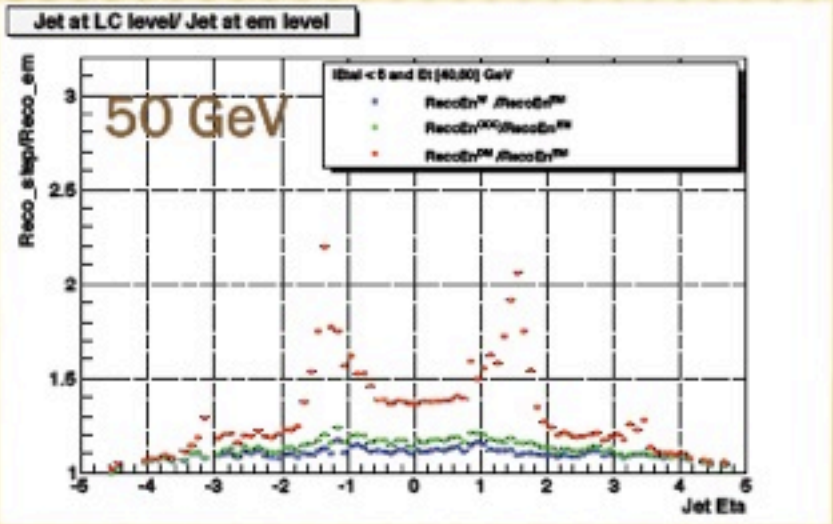
expected problems at lower energies the leading jet is never in the range considered

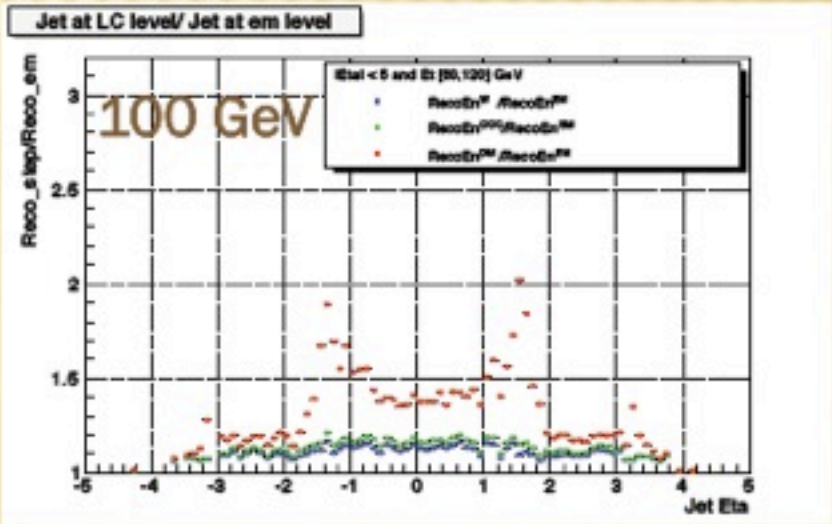
PLOTS....

AntiKt4







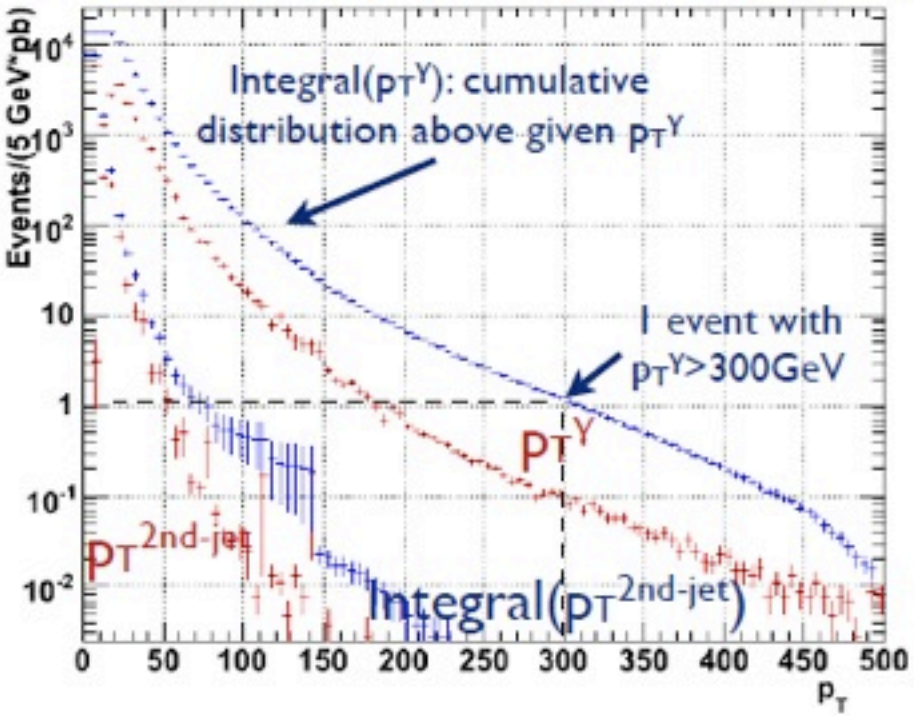


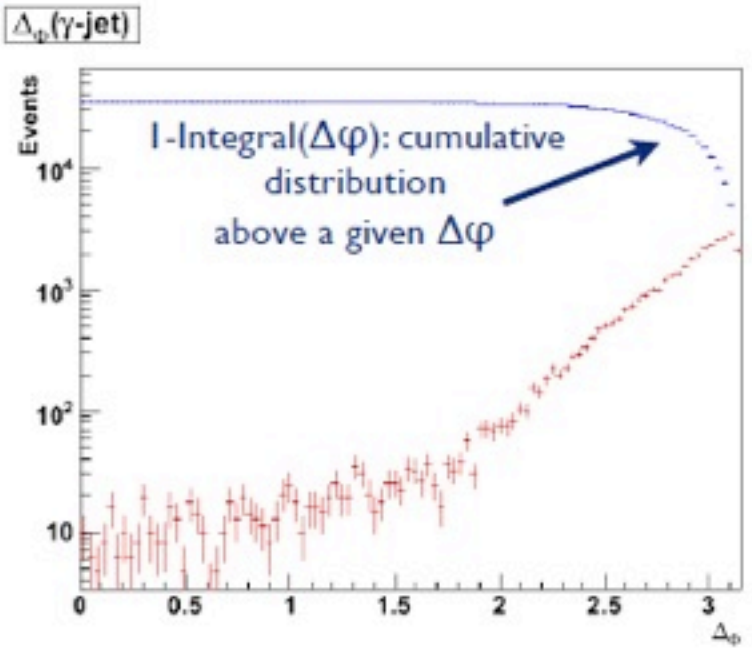
introduction

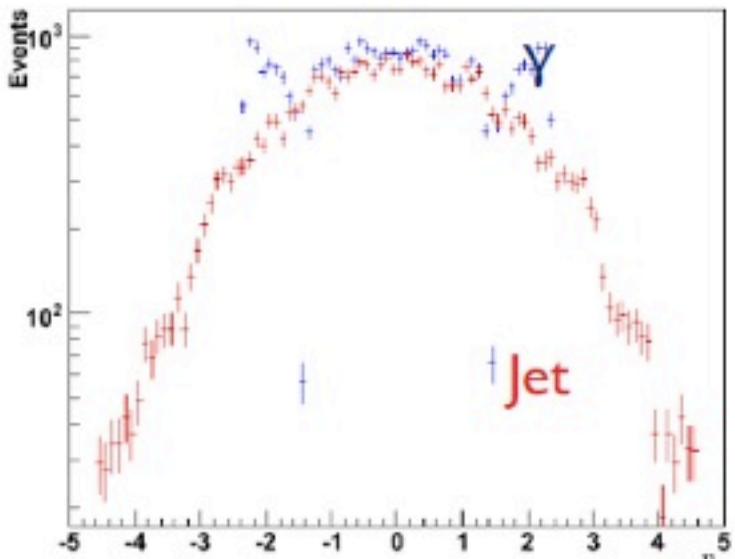
- study the impact of different skimming strategy for the photon-jet performance D2PDs on the photon-jet balance procedure
- I started from the non-skimmed D2PD samples, I applied on the skimming selection before calculating the photon-jet balancing. I then checked for possible biases or important loss in statistical power.
- The relevant variable that could be used to to select events other than trigger requirements are: p_T^{jet}, p_T^{γ}, $p_T^{2nd\ jet}$, $\Delta\varphi_{\gamma\text{-jet}}$; their distribution together with the integral above threshold is shown in the next slide

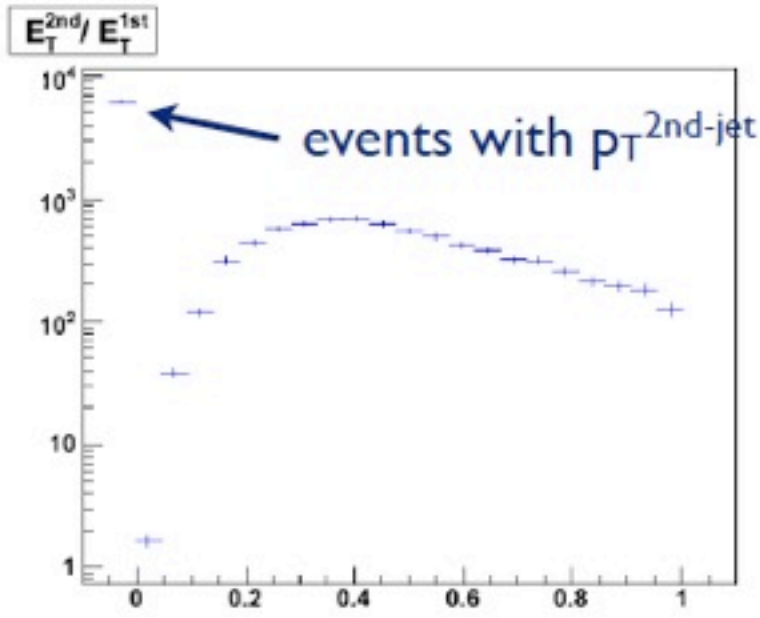
Event Sample

group08.PerfJets.mc08.10800x.PythiaPhotonJetX.recon.DPD_NOSKIM.e344_s456_r545_DPDMaker000157_p1 (X=1,4)









Conclusions

- it is preferable a D2PD skimming procedure based on prescales. Selecting on E_T jet is biasing the results. Selecting on variables used later to clean the sample could be dangerous. It is always best to have some sidebands to study the sample.

What we learned : DPD_CALOJET (I)

Jet E_T cuts and prescales were adjusted with FDR data

E_T^{Jet1} (EM scale)	Prescale
30-60 GeV	200
60-100 GeV	250
100-150 GeV	100
150-225 GeV	25
225-375 GeV	5
> 375 GeV	1

FDR-2c Run 52280	#events	size/event (kB)
ESD	297,785	781
AOD	297,785	136
DPD_CALOJET	5,924	562

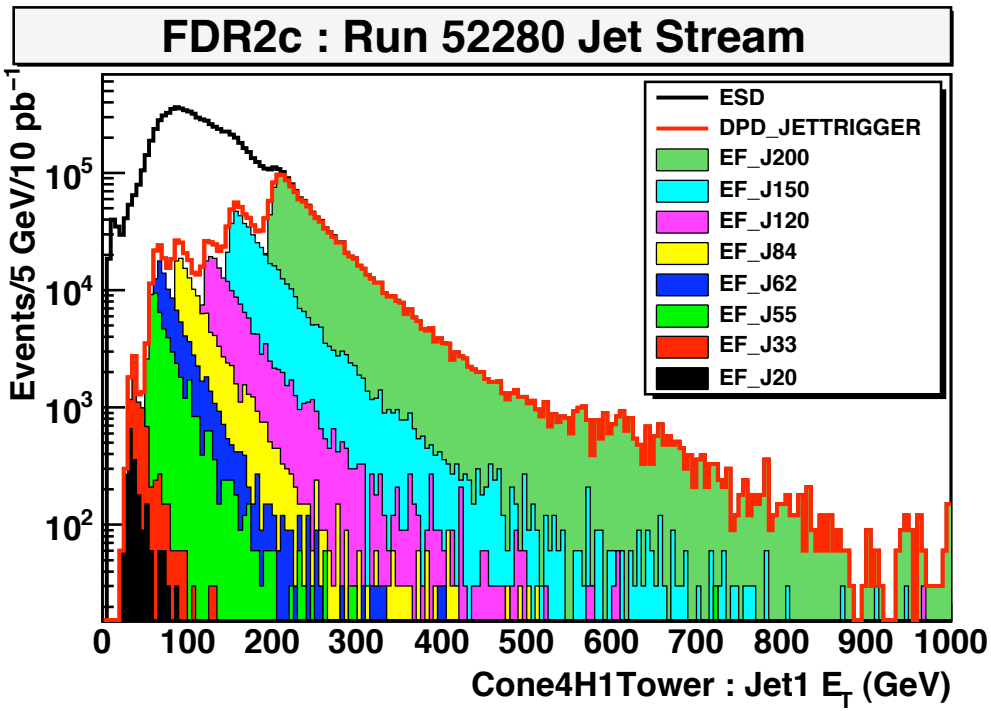
DPD_CALOJET = ~ 8% of AOD
~ 1.4% of ESD

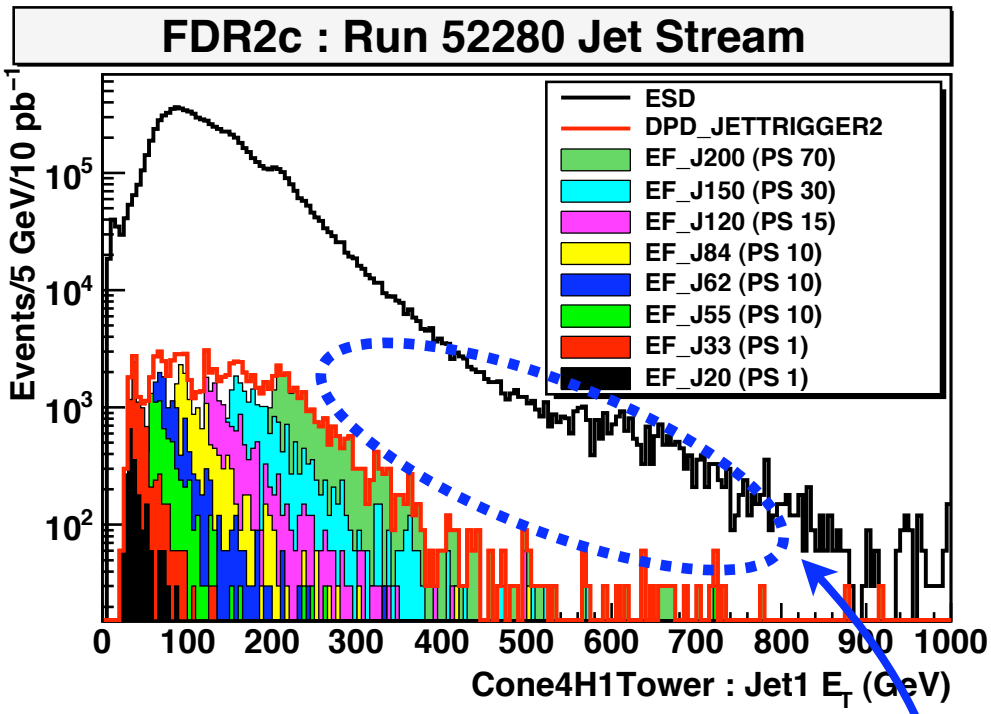
➔ OK in size

Caveat :
FDR trigger menu is old and quite different from current menu

What we learned : DPD_CALOJET (II)

Offline trigger selections instead of jet E_T cuts proposed as an alternative option of event selection





Single jet trigger selection
⇒ ~ 20% of ESD

Single jet trigger selection
+ additional prescales
⇒ ~ 1% of ESD

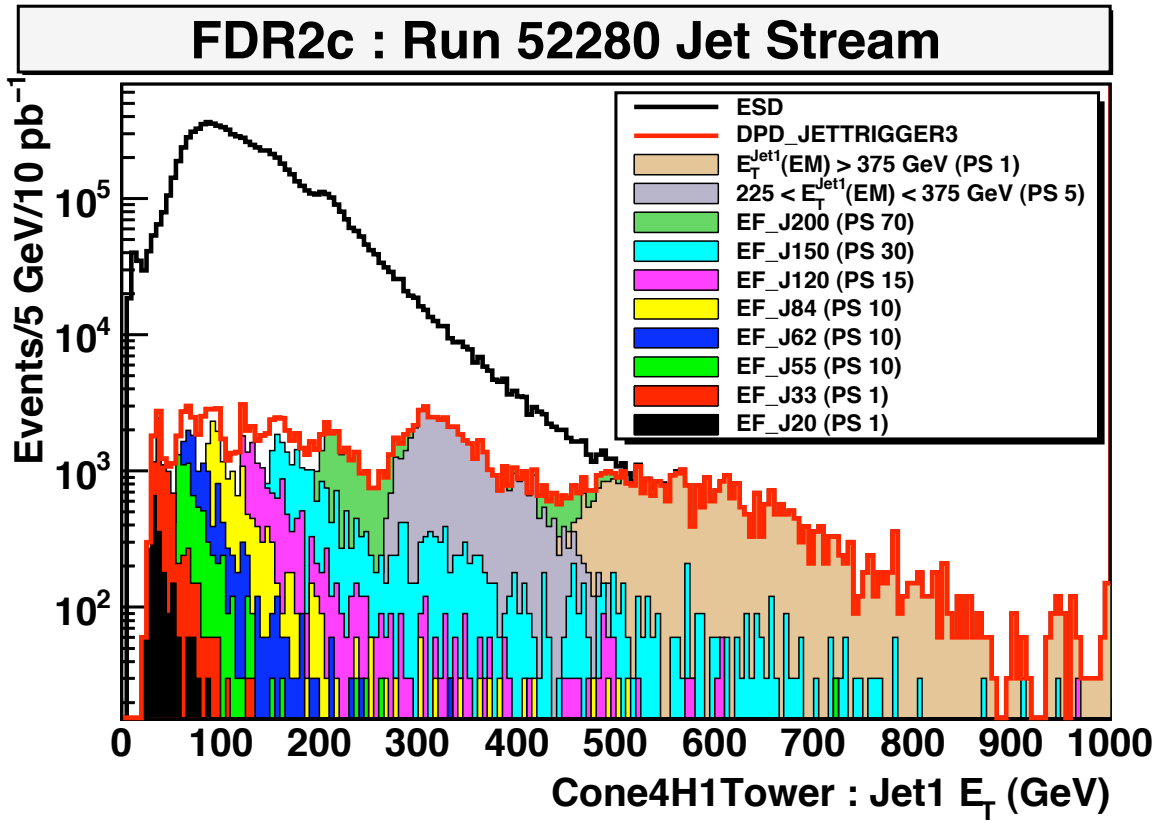
Huge loss at high p_T ...

What we learned : DPD_CALOJET (III)

Add 2 highest E_T jet cuts to fill the hole at high p_T

E_T^{Jet1} (EM scale)	Prescale
225-375 GeV	5
> 375 GeV	1

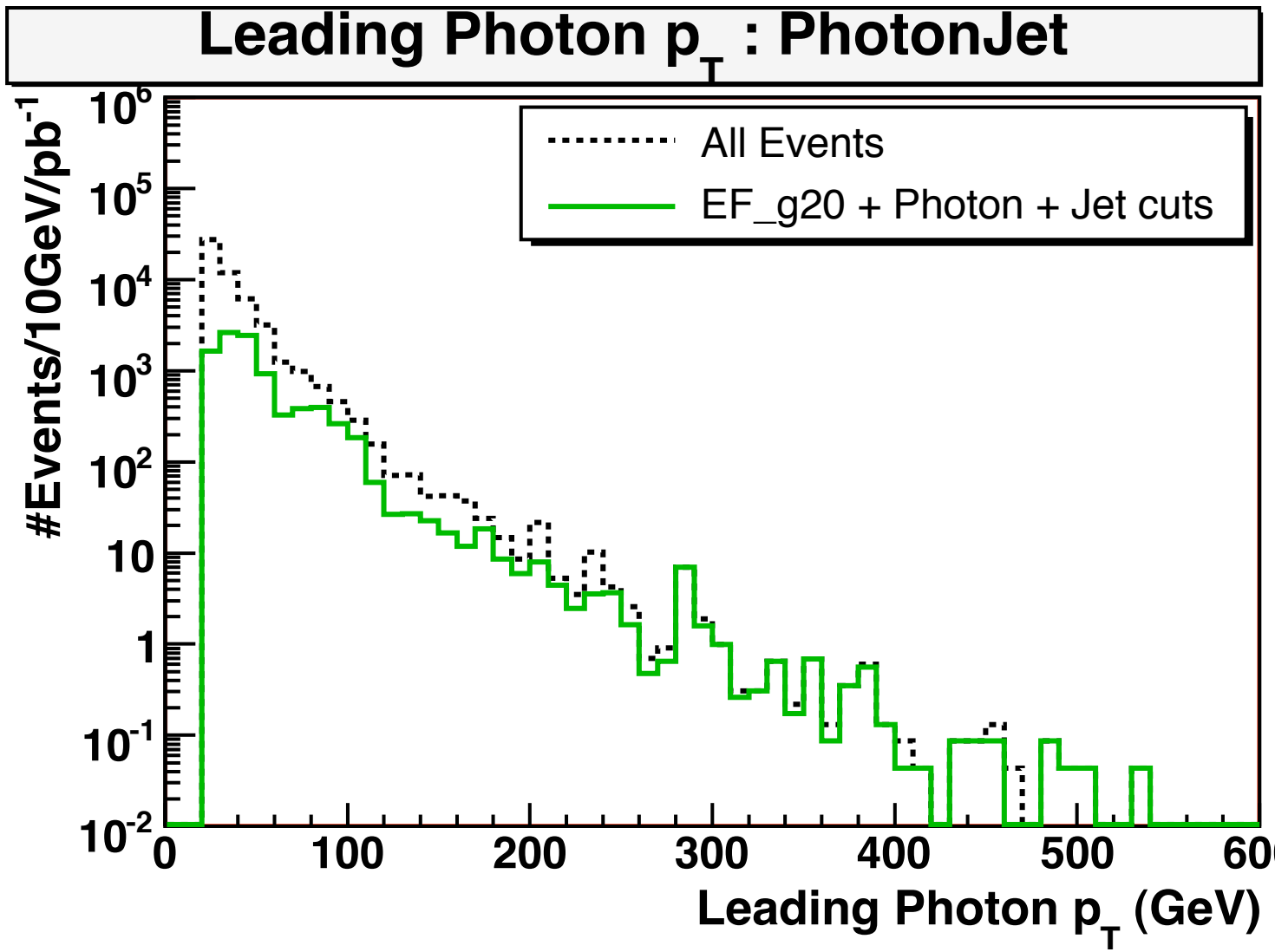
➔ Very similar to E_T cuts in statistics and size



FDR-2c Run 52280	#events	Relative size
ESD	297,785	1
E_T cut-based DPD	6,520	0.022
Trigger-based DPD	6,603	0.022

These are FDR data
➔ Better to evaluate with recent menu...

DPD_PHOTONJET : Skimming Proposal (II)



Photon+Jets

no pile-up

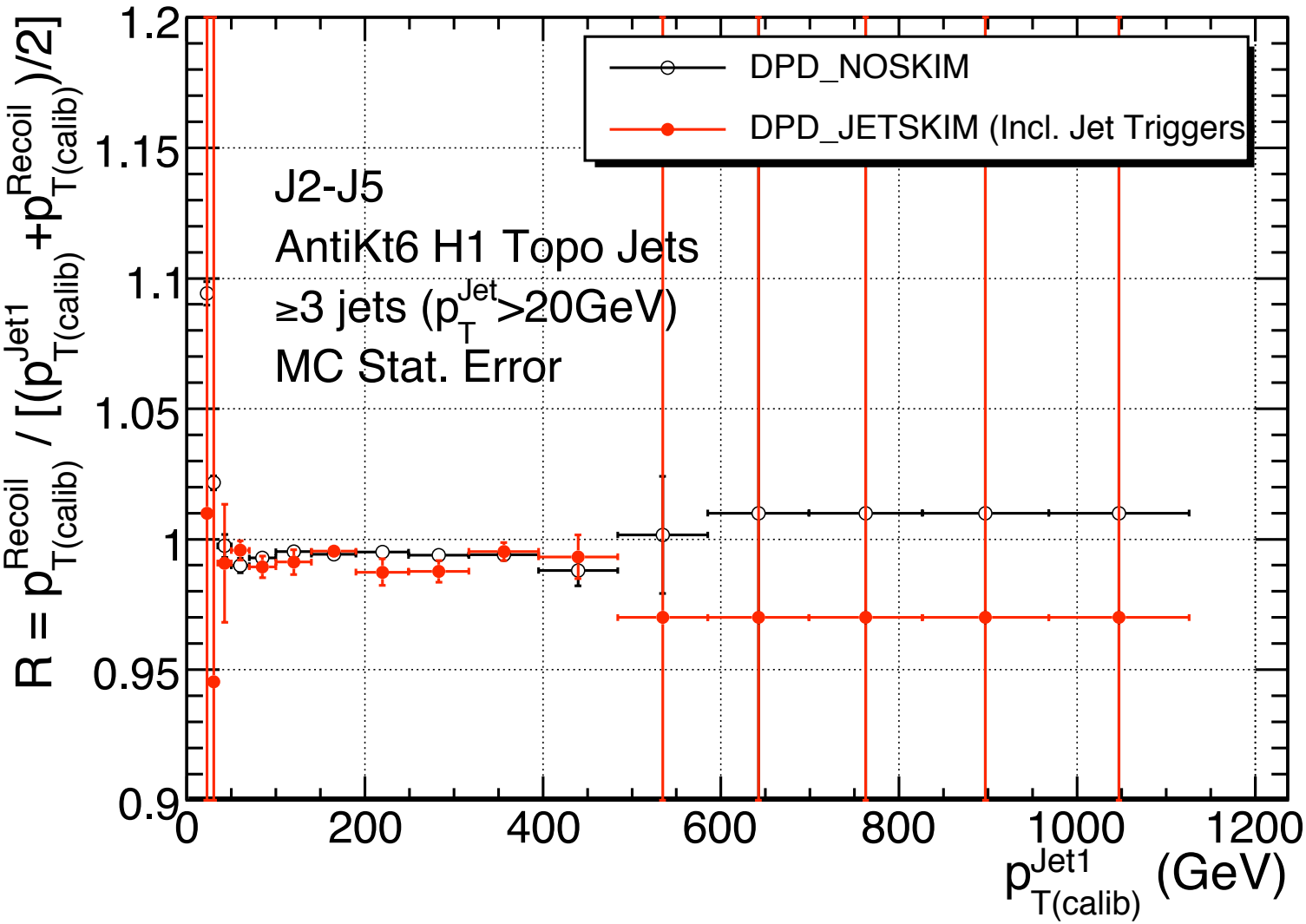
e344_s479_r635

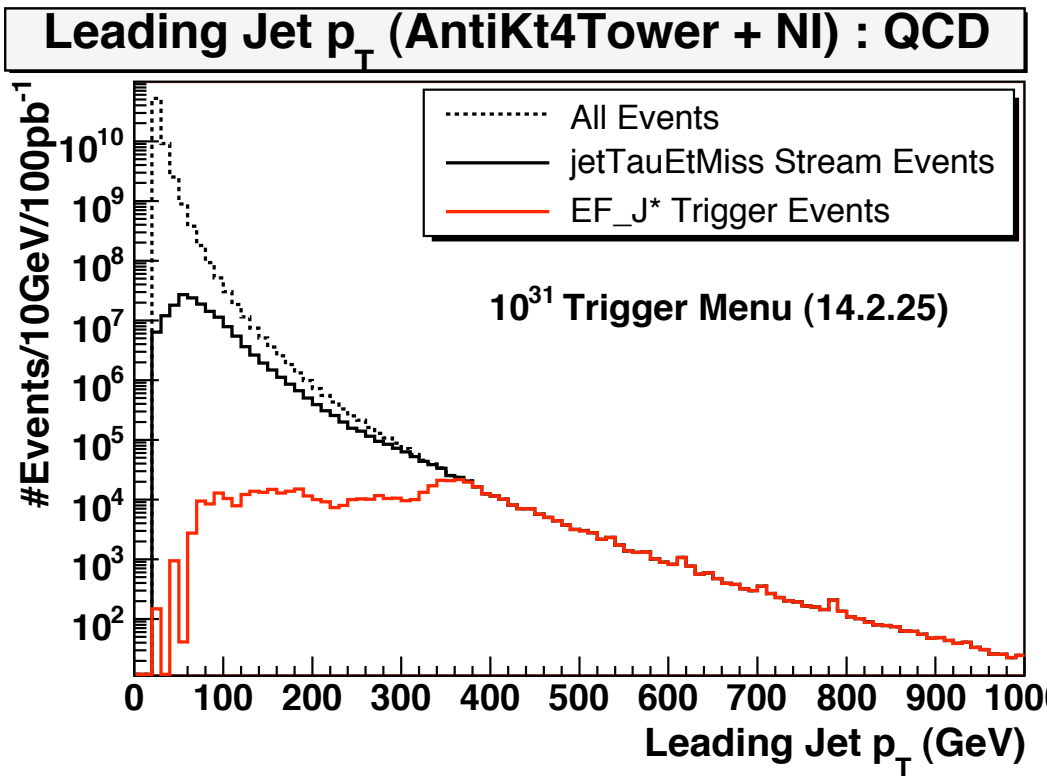
10^{31} trigger menu

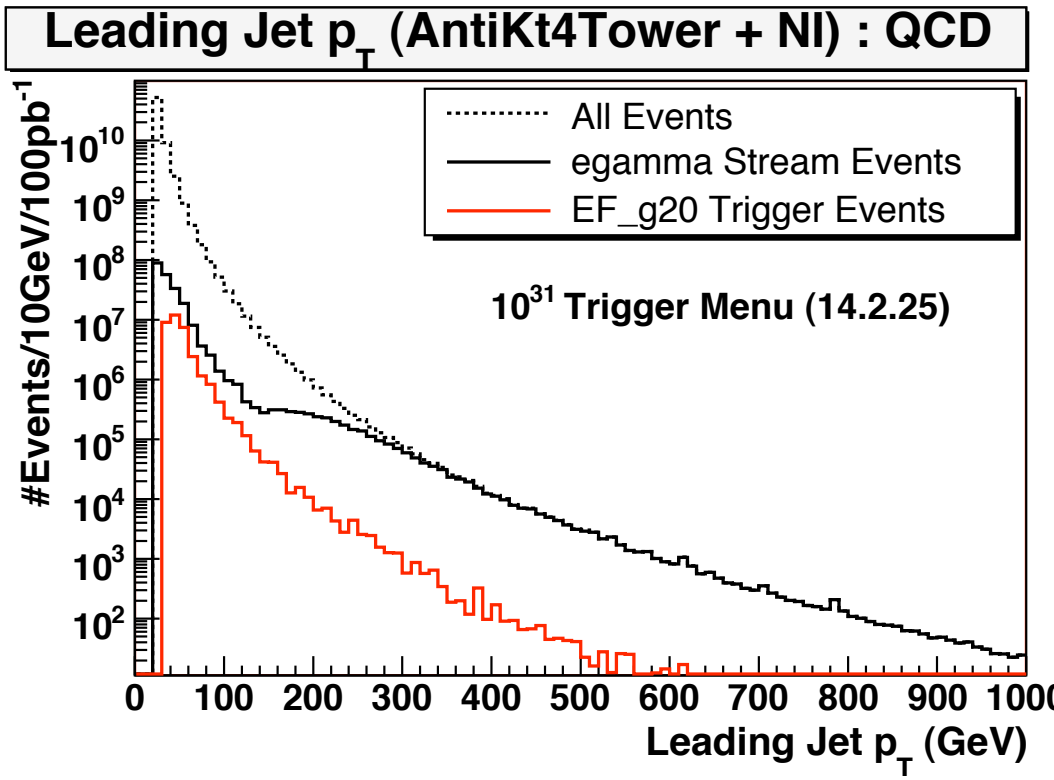
Efficiency	
PhotonJet1	6%
PhotonJet2	16%
PhotonJet3	40%
PhotonJet4	52%

→ *QCD rejection needs to be checked...*

Multi-jet Balancing with Skimmed DPDs



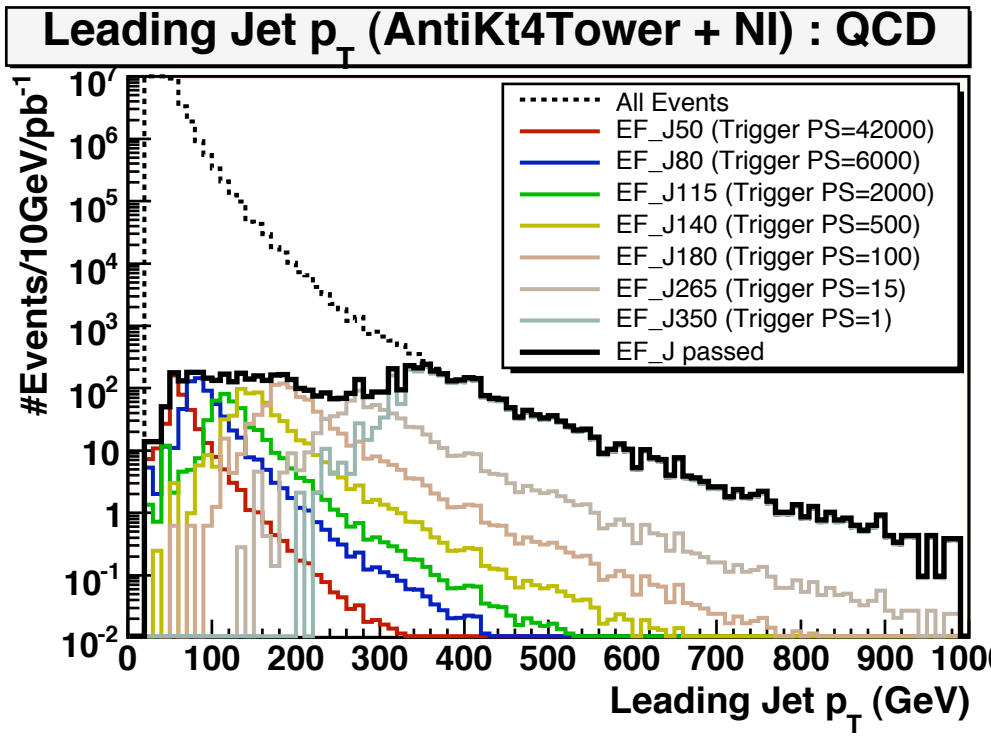

Leading Jet p_T (AntiKt4Tower + NI) : QCD
All Events
jetTauEtMiss Stream Events
EF_J* Trigger Events
10^31 Trigger Menu (14.2.25)
#Events/10GeV/100pb^-1
Leading Jet p_T (GeV)

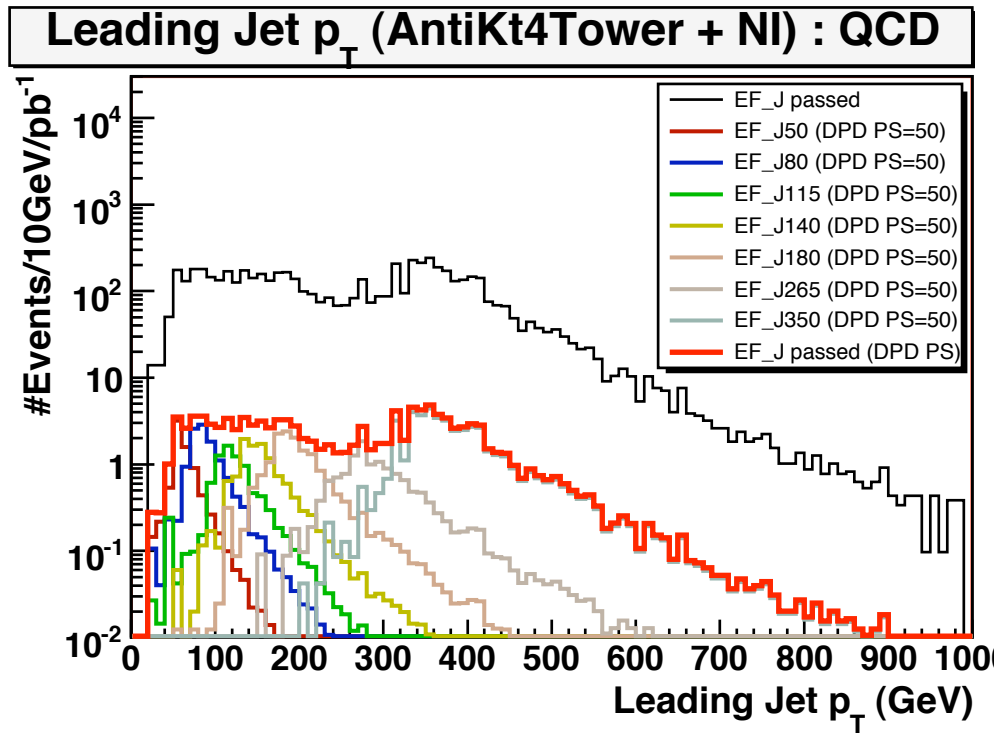

Leading Jet p_T (AntiKt4Tower + NI) : QCD
All Events
egamma Stream Events
EF_g20 Trigger Events
10^31 Trigger Menu (14.2.25)
#Events/10GeV/100pb^-1
Leading Jet p_T (GeV)

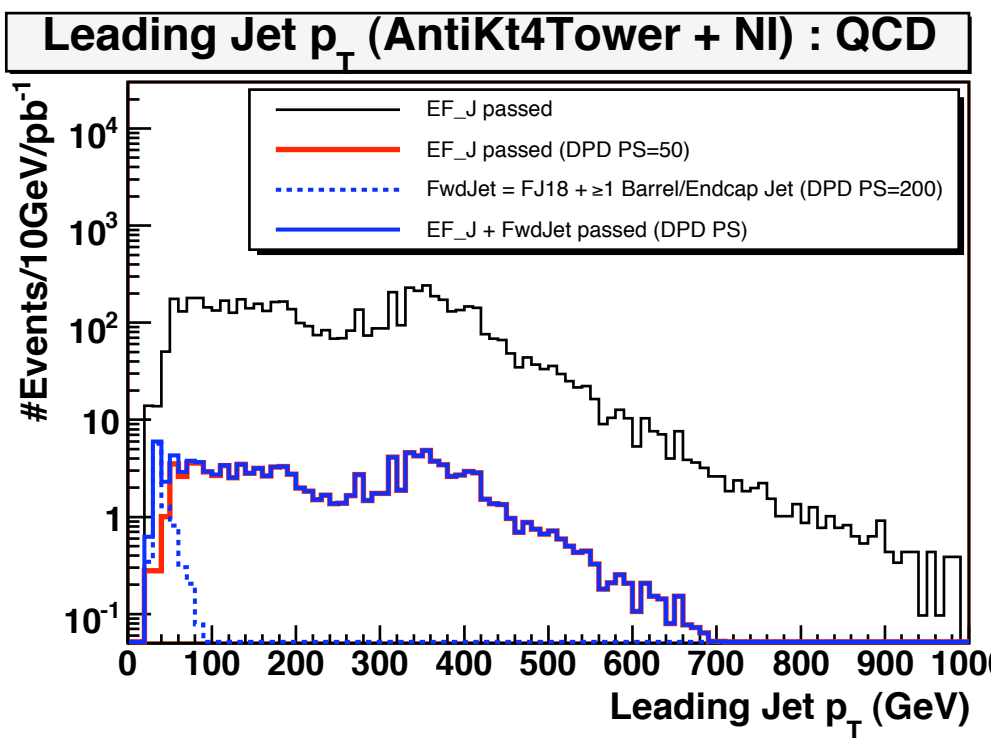
QCD Rejection with DPD_PHOTONJET Cuts

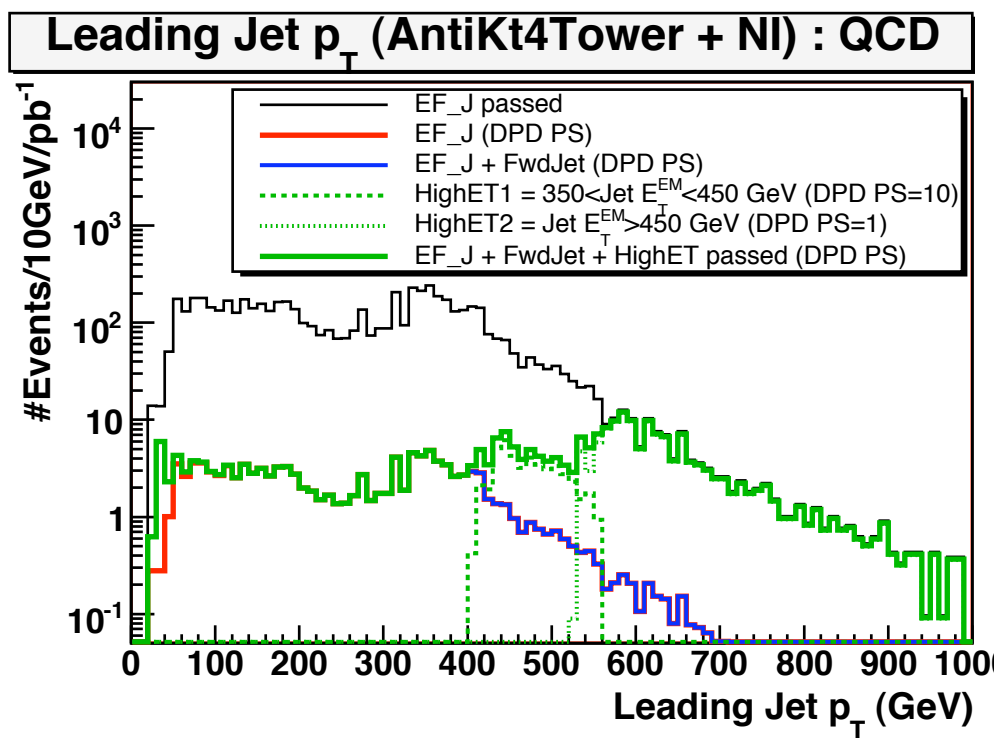
	All	A	B	C	D	E
J2	398618	870	293	223	124	106
J3	1307486	6632	1944	1931	921	790
J4	978035	6902	2123	2123	816	720
J5	1377997	14089	4922	4922	1749	1559

A : EF_g20
B : TightPhoton
C: TightPhoton + Jet1 E_T^{EM}>20 GeV
D: TightPhoton + Jet1 E_T^{EM}>20 GeV + DeltaPhi
E: EF_g20 + TightPhoton + Jet1 E_T^{EM}>20 GeV + DeltaPhi


Leading Jet p_T (AntiKt4Tower + NI) : QCD
All Events
EF_J50 (Trigger PS=42000)
EF_J80 (Trigger PS=6000)
EF_J115 (Trigger PS=2000)
EF_J140 (Trigger PS=500)
EF_J180 (Trigger PS=100)
EF_J265 (Trigger PS=15)
EF_J350 (Trigger PS=1)
EF_J passed
#Events/10GeV/pb^-1
Leading Jet p_T (GeV)


Leading Jet p_T (AntiKt4Tower + NI) : QCD
EF_J passed
EF_J50 (DPD PS=50)
EF_J80 (DPD PS=50)
EF_J115 (DPD PS=50)
EF_J140 (DPD PS=50)
EF_J180 (DPD PS=50)
EF_J265 (DPD PS=50)
EF_J350 (DPD PS=50)
EF_J passed (DPD PS)
#Events/10GeV/pb^-1
Leading Jet p_T (GeV)


Leading Jet p_T (AntiKt4Tower + NI) : QCD
EF_J passed
EF_J passed (DPD PS=50)
FwdJet = FJ18 + ≥1 Barrel/Endcap Jet (DPD PS=200)
EF_J + FwdJet passed (DPD PS)
#Events/10GeV/pb^-1
Leading Jet p_T (GeV)

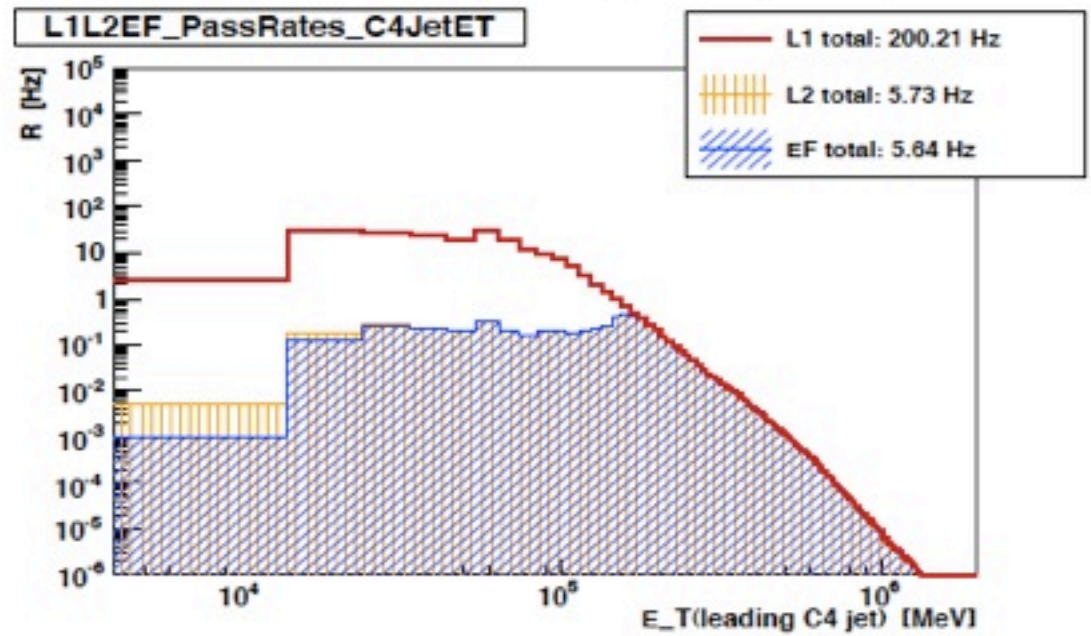

Leading Jet p_T (AntiKt4Tower + NI) : QCD
EF_J passed
EF_J (DPD PS)
EF_J + FwdJet (DPD PS)
HighET1 = 350<Jet E_T^EM<450 GeV (DPD PS=10)
HighET2 = Jet E_T^EM>450 GeV (DPD PS=1)
EF_J + FwdJet + HighET passed (DPD PS)
#Events/10GeV/pb^-1
Leading Jet p_T (GeV)

Thresholds & Prescales: 10^{31} 2(3)

- table: **Proposed** thresholds and prescales for L1, L2 and EF triggers (HLT in pass-through)

cumulative prescales	200k	100k	5k	300	50	10	1	1
L1 thresholds	5	10	20	40	70	100	130	150
L1 prescales	2k	1k	50	3	1	1	1	1
L2 thresholds	0	0	0	0	0	0	0	0
L2 prescales	100	100	100	100	50	10	1	1
EF thresholds	0	0	0	0	0	0	0	0
EF prescales	1	1	1	1	1	1	1	1

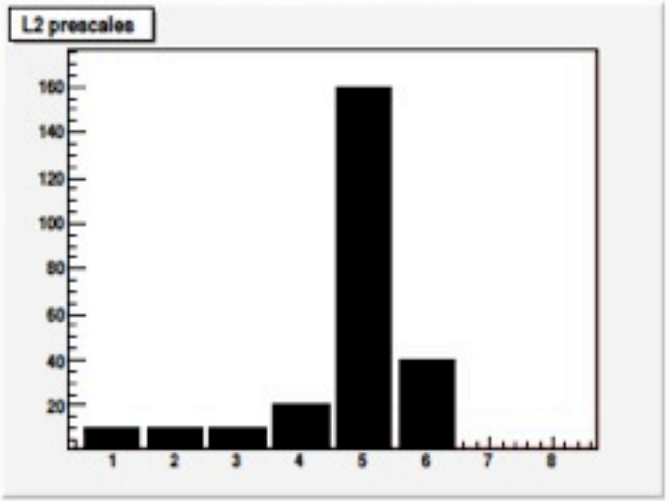
- two highest triggers unprescaled
- "pseudo prescales" for L2 which allows L1 events to be used by other signatures
- plot: rates for L1, L2 and EF → flat HLT rate up to ~ 150 GeV
- L2 "pseudo prescales" set such that total **L2 and EF pass rate** ~ 6 Hz. Existing threshold and prescale values would result in 11 Hz (see back-up slides).



Thresholds & Prescales: 10^{32} 2(3)

- table: **Proposed** thresholds (GeV) and prescales for L1, L2 and EF triggers (EF in pass-through)

L1 thresholds	5	10	20	40	70	100	130	150
L1 prescales	30k	12k	1k	50	1	1	1	1
L2 thresholds	10	20	50	80	120	160	200	250
L2 prescales	10	10	10	20	160	40	1	1
EF thresholds	0	0	0	0	0	0	0	0
EF prescales	1	1	1	1	1	1	1	1



- top plot: L2 prescales set such that total EF pass rate $\mathcal{O}(10\ \mathrm{Hz})$ (hence the "bump")
- two highest triggers unprescaled
- bottom plot: rates for L1, L2 and EF $\rightarrow$ flat HLT rate up to $\sim 200\ \mathrm{GeV}$
- prescales set such that **L2 and EF pass rate** $\sim 13\ \mathrm{Hz}$. Existing threshold and prescale values would result in $16\ \mathrm{Hz}$ (see back-up slides).