Top Triggers
RunIIa experience and extrapolations

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DØ Trigger Upgrade Workshop
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Introduction

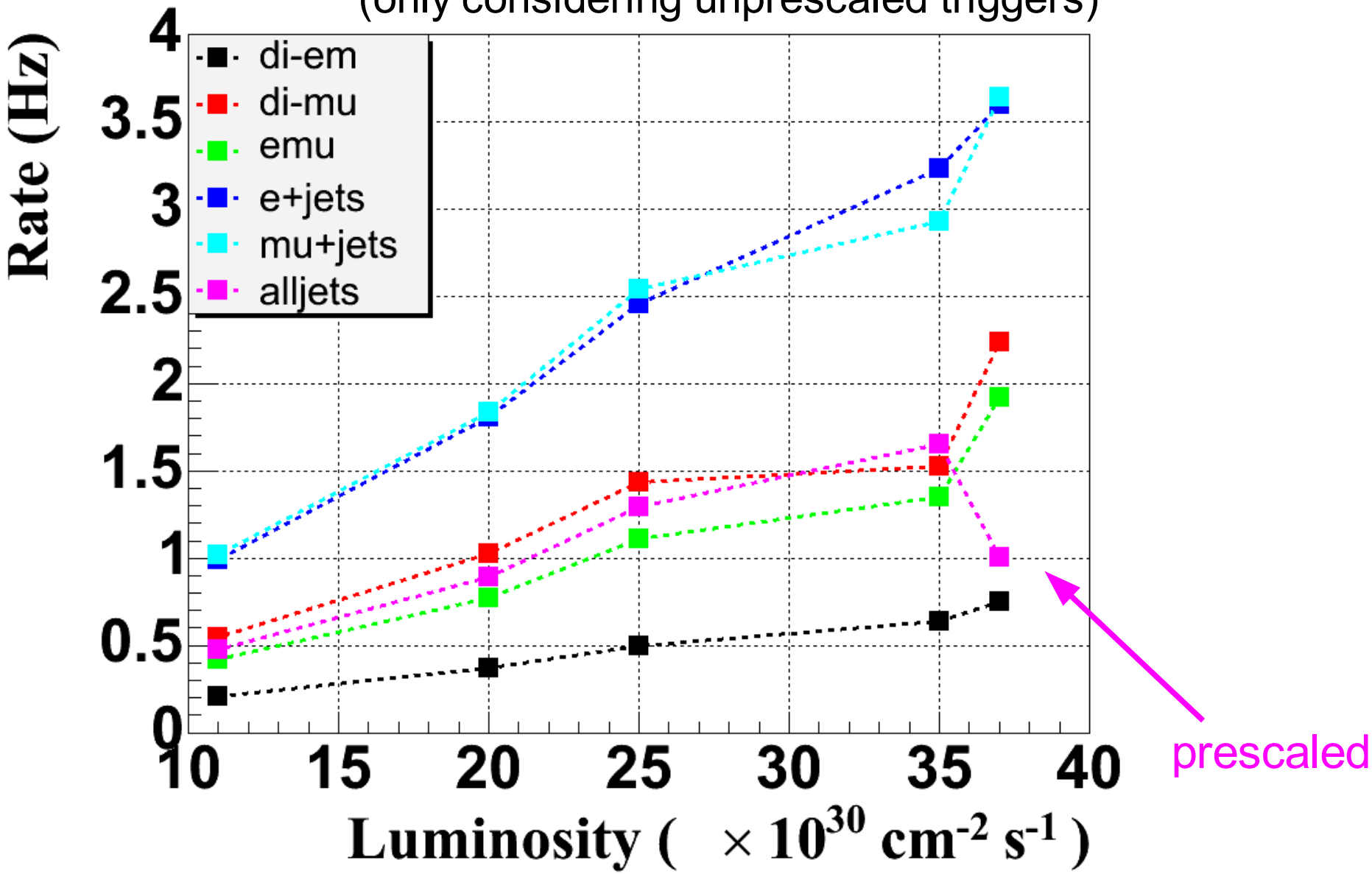
- Up to shutdown, ran trigger list version 12
  - Breaks down at lumi > 45E30
    (L3 rate too high)
- Aiming for new trigger list v13 for beginning 2004
  - Should run for lumi ~ 80E30

Top Physics Triggers in v12

Channel	Trigger Name	L1	L2	L3
ee	Ex_2L20	EM_OR	------	ELE(2,20)
	Ex_2L15_SH15	EM_OR	------	ELE(2,15)_ELE_SH(1,15)
μμ	2MU_A_L2M0_TRK5	mu2ptxatxx	MUON(1,med)	TRK(1,5,10 hits)
	2MU_A_L2M0_L3L6	mu2ptxatxx	MUON(1,med)	MUON(1,6,loose)
eμ	MATX_EM6_L12	mu1ptxatxx_CEM(1,6)	------	ELE(1,12)
	MATX_2EM3_L12	mu1ptxatxx_CEM(2,3)	------	ELE(1,12)
	(MWLXT10_EM6_L12)	mu1pt4wlxx_CEM(1,6)	------	ELE(1,12)
	(MWLXT10_2EM3_L12)	mu1pt4wlxx_CEM(2,3)	------	ELE(1,12)
e + jets	Ex_SHT15_2J20	EM_OR	------	ELE_SHT(1,15)_JET(2,20.,3.)
	Ex_SH15_2J20_M10	EM_OR	------	ELE_SH(1,15)_JET(2,20.,3.) _ME
	EX_SHT15_TK13	EM_OR	------	ELE_SHT(1,15)_TRK(1,13.,8 hits
μ+jets	MU_JT25_L2M0	mu1ptxatxx_CJT(1,3)	MUON(1,med)_JET(1,10.)	JET(1,25.,3.)
	MU_JT20_L2M0_MET10	mu1ptxatxx_CJT(1,3)	MUON(1,med)_JET(1,10.)	JET(1,20.,3.)_MET(10.)
	(MU_JT20_L2M0)	mu1ptxatxx_CJT(1,3)	MUON(1,med)_JET(1,10.)	JET(1,20.,3.)
	(MU_JT15_L2M0)	mu1ptxatxx_CJT(1,3)	MUON(1,med)_JET(1,10.)	JET(1,15.,3.)
	(MT10_JT20_L2M0)	mu1pt4wlxx_CJT(1,3)	MUON(1,med)_JET(1,10.)	JET(1,20.,3.)
	(3CJT5_JT20_L2M0)	CJT(3,5)	MUON(1,med)_JET(1,10.)	JET(1,20;,3.)
all-jets	4JT12	CJT(3,5)	JET(3,8.)_HT(50.)	JET(4,12..,1.) _JET(3,15.,1.) _JE

Top Trigger Rate vs Luminosity

(only considering unprescaled triggers)



Top Trigger Total vs Unique Rates

Average luminosity ~ 35E30

Trigger Type	Total Rate (Hz)	Uniqe Rate (Hz)
di-EM	0.6	0.2
di-muon	1.5	0.5
emu	1.4	0.7
e+jets	3.2	0.7
mu+jets	2.9	1.6
all-jets	1.7	0.3

Top Trigger Rates using trigger list v12

Trigger Type	Rate at 35E30 (Hz)	Rate at 1E32 (Hz)
di-EM	0.6	1.7
di-muon	1.5	4.3
emu	1.4	4.0
e+jets	3.2	9.1
mu+jets	2.9	8.3
all-jets	1.7	4.9

(linear extrapolation)

(only considering unprescaled triggers)

Challenges for Lumi > 1E32

GOAL: Unprescaled top triggers at high luminosity

di-EM: Should be ok (single electron triggers problematic!)

- L1 : Increase threshold
  Reduce eta range
  Take advantage of new L1CAL/L1CTT
- L2 : Use EMfraction, track+PS matching, isolation

di-muon: Should be ok

- L1 : take advantage of track+mu matching with improved L1CTT

e+mu: Should be ok (not relying on single electron trigger)

e + jets: High rate

- To avoid single electron trigger rate problems maybe have a dedicated e+jets trigger
- For example, CEM(1,10)CJT(2,5)
- Need improvements in L3 jets

mu + jets: L3 rate too high

- improvements in L3 jets (NADA, improved cone algorithm, T42, ignore CH seeds)
- muon + track match at L3

All-jets: Rate too high, low threshold at L1 due to slow turn-on

- Huge gain with new L1CAL (sharper turn-on!)

SUMMARY

- Will benefit from Trigger upgrade, in particular for the all-jets trigger.

- Major struggle right now is to keep L3 rate under control
  - Still have “head-room” at L1/L2
  - Lots of work needed to improve L3 jets

- With upgrade, should be able to have unprescaled top triggers at the highest foreseen luminosity