IL RUN DEL 2007 A 900 GeV

References:

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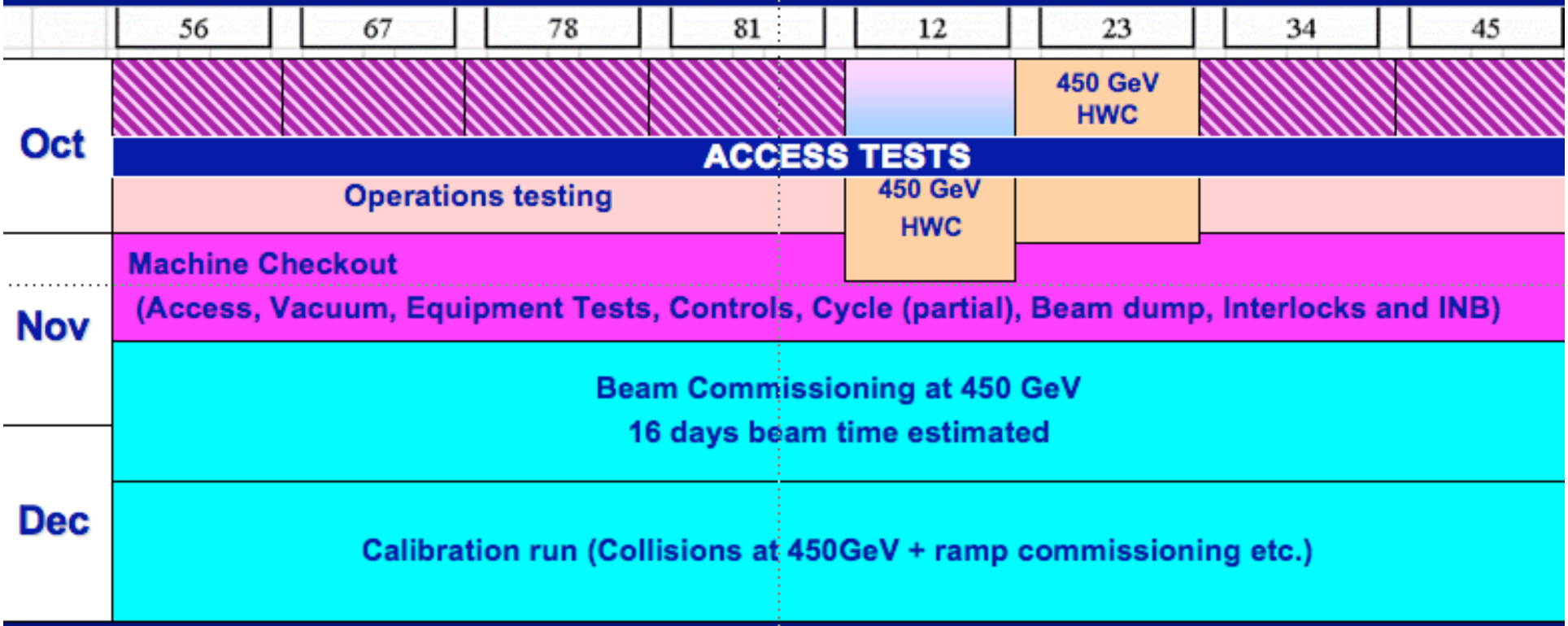
W.Scandale CSN1 Trieste
http://www.infn.it/csn1/riunioni/agenda/2006/18-09-2006/

D.Green Fermilab-CERN Hadron Colliders Physics SS 2006
http://vmsstreamer1.fnal.gov/VMS_Site_03/Lectures/HCPSS/index.html

I.Hinchliffe LBN
http://www-conf.slac.stanford.edu/ssi/2006/lec_notes/Hinchliffe072806.pdf

End 2007


56
67
78
81
12
23
34
45
Oct
450 GeV
HWC
ACCESS TESTS
Operations testing
450 GeV
HWC
Machine Checkout
(Access, Vacuum, Equipment Tests, Controls, Cycle (partial), Beam dump, Interlocks and INB)
Nov
Beam Commissioning at 450 GeV
16 days beam time estimated
Dec
Calibration run (Collisions at 450GeV + ramp commissioning etc.)

Time

	Phase	Beam time [days]	Beam
1	First turn	4	1 x Pilot
2	Establish circulating beam	3	1 x Pilot
3	450 GeV – initial	3	1 x Pilot++
4a	450 GeV - consolidation	1-2	1 x Pilot++
4b	450 GeV – system commissioning	2-3	1 x Pilot++
5a	2 beam operations	1	2 x Pilot++
5b	Collisions	1-2	2 x 1 x 10^{11} →
		16 days	

Given an operational efficiency of 60%, this gives an elapsed time of about 26 days. ***CAVAET: MACHINE AVAILABILITY***

Some opportunities for parallel development and parasitic studies…

Calibration Run 2007

- 6 weeks beam time
- 3 weeks beam commissioning
  - Essentially single beam, low intensity for the most part
- 3 weeks collisions
  - Single bunch initially, with staged increase to $156 \times 4 \times 10^{10}$ (+)
  - Luminosities: $1.3\ 10^{28}$ to $2.6\ 10^{29}$ $cm^{-2}s^{-1}$ (+)
  - Interleafed with low intensity single beam MD
    - Initial ramping tests to 1.1 TeV etc.

450 GeV pilot physics

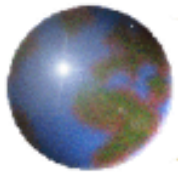
Sub-phase	Bunches	Bun. Int.	beta*	Luminosity	Time	Int lumi
first Collisions	1 x 1	2×10^{10}	18 m	4×10^{27}	12 hours	0.15 nb^{-1}
repeat ramp - same conditions	-	-	-	-	2 days @ 50%	0.3 nb^{-1}
multi-bunch at injection & through ramp - collimation	-	-	-	-	2 days	-
physics	12 x 12	3×10^{10}	18 m	1×10^{29}	2 days @ 50%	8 nb^{-1}
physics	43 x 43	3×10^{10}	18 m	3.8×10^{29}	2 days @ 50%	30 nb^{-1}
commission squeeze - single beam then two beams, IR1, IR5	-	-	-	-	2 days	-
measurements squeezed	-	-	-	-	2 day	-
physics	43 x 43	3×10^{10}	10 m	7×10^{29}	3 days - 6 hr t.a. - 70% eff.	75 nb^{-1}
commission squeeze to 2m collimation etc.	-	-	-	-	3 days	-
physics	43 x 43	3×10^{10}	2 m	3.4×10^{30}	3 days - 6 hr t.a. - 70% eff.	0.36 pb^{-1}
commission 156 x 156	-	-	-	-	1 day	
physics	156 x 156	2×10^{10}	2 m	5.5×10^{30}	2 days - 6 hr t.a. - 70% eff.	0.39 pb^{-1}
physics	156 x 156	3×10^{10}	2 m	1.2×10^{31}	5 days - 5 hr t.a. - 70% eff.	2.3 pb^{-1}
					29 days total	

450 GeV - Performance

			Reasonable	Maximum
k_b	43	43	156	156
i_b (10^{10})	2	4	4	10
β^* (m)	11	11	11	11
intensity per beam	$8.6\ 10^{11}$	$1.7\ 10^{12}$	$6.2\ 10^{12}$	$1.6\ 10^{13}$
beam energy (MJ)	.06	.12	.45	1.1
Luminosity ($cm^{-2}s^{-1}$)	$2\ 10^{28}$	$7.2\ 10^{28}$	$2.6\ 10^{29}$	$1.6\ 10^{30}$
event rate [1](kHz)	0.4	2.8	10.3	64
W rate [2] (per 24h)	0.5	3	11	70
Z rate [3] (per 24h)	0.05	0.3	1.1	7

Several days

1. Assuming 450GeV inelastic cross section 40 mb
2. Assuming 450GeV cross section $W \rightarrow l\nu$ 1 nb
3. Assuming 450GeV cross section $Z \rightarrow ll$ 100 pb

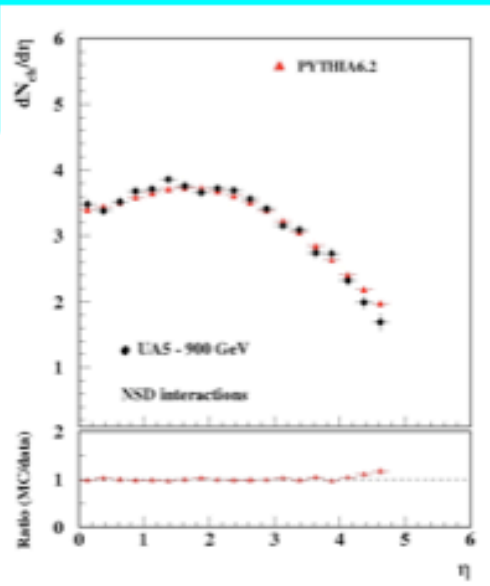


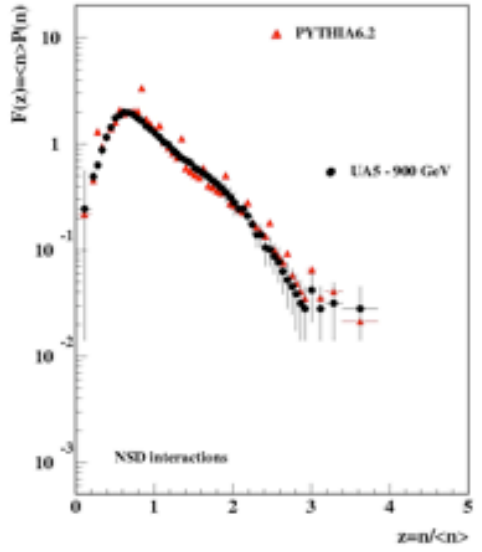
From 10^{23} to 10^{27} /(cm^2sec)

L for 1 month run (10^6 sec)	Integrated L	Trigger	Process	Comments
10^{23}	100 mb^{-1}	None σ_I~ 50 mb	Inelastic non-diff	Input to tweak Pythia
10^{24}	1 μb^{-1}	Setup Jet	Inelastic non-diff	Calib in azimuth
10^{25}	10 μb^{-1}	Jet $\sigma(gg) \sim 90\ \mu b$ $\sigma(ggg) \sim 6\ \mu b$	g+g -> g+g g+g -> g+g+g	Establish JJ cross section
10^{26}	100 μb^{-1}	Jet	g+g -> g+g g+g -> g+g+g	Dijet balance for polar angle – Establish MET
10^{27}	1 nb^{-1}	Jet Setup Photon $\sigma(q\gamma) \sim 20$ nb	g+g -> g+g g+g -> g+g+g q+g -> q+γ	Dijet masses > 2 TeV, start discovery search. J+γ calib

Minbias at 900 GeV

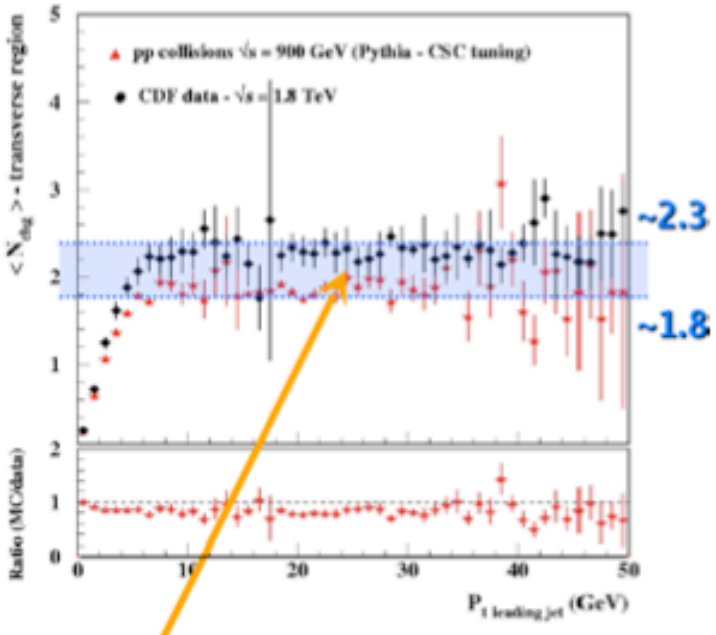
- This is new physics as there are only ppbar results at this energy
- Measure pt and rapidity
- **Debug tracking**





Underlying event at 900 GeV

- Jet underlying event
- Least understood parts of Monte Carlo



Bottom and Charm

	14 TeV	900 GeV
Total LHC bb cross section	500 μb	25 μb
Total LHC inelastic σ	70 mb	40 mb
bb → μ6(5) X	4000 nb	60 nb
bb → μ6(5) μ3 X	200 nb	2 nb
bb → J/ψ (μ6(5) μ3) X	7 nb	0.1 nb
pp → J/ψ (μ6(5) μ3) X	28 nb	1 nb
pp → ϒ (μ6(5) μ3)	9 nb	1.7 nb

***) pT cuts for 14TeV are μ6 μ3 and for 900 GeV μ5μ3**

For both muons $|\eta|<2.5$

Spunti per la discussione

- Fisica dei “minimum bias”
  - $gg \rightarrow gg(g)$ p_T spectra & jet algorithms
  - $qg \rightarrow q\gamma$ calibrazioni sui jet e calorimetria
  - $gg \rightarrow QQ$ con Q=c,b (vertici, b-tag)
  - $gg \rightarrow J/\psi, \Upsilon, \ldots$

1. Qual e` lo stato dell’arte dei MC per la fisica pp a 900 GeV
   I codici attuali (PYTHIA?) sono sufficientemente accurati per comprendere i rivelatori? Sappiamo gia` ora quali sono i punti deboli (ad es. produzione di HF, spettri in pT di tracce/jet/γ)

- C’e` della fisica non scontata che si puo` fare con 3 pb^{-1} a 900 GeV?