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Centrally Produced Simulation samples for Upgrade studies

A set of reference samples are centrally produced for studies of the upgrade detectors. They comprise smallish samples for specific detectors, tracking and particleID evaluation and later on a few reference key physics channels to study the impact of the technology choices across the range of the LHCb physics programme.

Reference physics channels

At this early stage, a subset of the physics channels has been identified to be used to test the production chain and develop the reconstruction algorithms. These are the following channels:

- Bs0
- B0 K*0μμ
- D*+ D0(KS +) +
- Bs0 .

Beam conditions

Upgrade simulations are made for collisions of 7+7 TeV protons, with 25 ns spaced bunches and 2808 filled bunches.

The crossing angle is assumed to be $\mp 135 \mu rad$ horizontal (beam1/beam2) due to the LHCb magnet (field pointing down) and related MBXW compensator and MBXWS correctors. The sign on the angle is flipped in the case of field pointing up. An external vertical crossing angle of $+120 \mu rad$ is assumed to ensure no parasitic collisions occurs in the Long Straight Section (LSS8).

Initially only one of the polarity of the magnet will be simulated, magnet down. Only for very special studies the other polarity will also be produced.

β^* and ε_n are not yet known and are related to the virtual Luminosity needed at the start of fill and to the procedure that will be used for the luminosity leveling during the fills. Since β^* may vary between 3 and 15 m, in order to simulate the most difficult conditions to reconstruct a $\beta^* = 3m$ is chosen since it will give a narrower primary vertex transverse distributions. A normalized emittance of $\epsilon_n = 2 \mu m$ is chosen as it may be possible to reach after LS2 and also makes for a smaller beam size.

The number of total/visible collisions per bunch crossing, ν / μ will depend of the chosen constant Luminosity it will be decided to run the Upgrade detector. In order to cover both the initial and what is at the moment considered the ultimate luminosity a few central samples will be produced for both $\nu = 3.8$ and 7.6 corresponding to a Luminosity of 1 and $2 \times 10^{33} cm^{-2} s^{-1}$ with 2400 colliding bunches (2808 filled bunches - 408 not colliding in IP8), 25 ns bunch spacing, $f_{rev} = 11.245 kHz$) and a total cross section from Pythia of $102 mbarn$. The latest official nominal scheme is summarised in the table below.

An explanation of ν, μ and their relations is available at this page.

Parameter	Value
beam energy	7TeV
# bunches colliding in IP8	2400
bunch Z RMS	90mm
half angle horizontal	135 urad
half angle vertical	120 urad

luminosity	2e33 Hz/cm2
bunch charge	1.2e11 protons

Derived parameter	Value
nu	7.596 (for sigma_total 102.5 mb)
bunch X,Y RMS	37.70 um

Detectors configurations

A few different detectors configuration are produced and can be found in the book-keeping via part of the name of the `*Simulation Conditions*`. A full explanation is given in the description of the simulation conditions itself.

The following possible options and their combinations are currently available of which the subset to be simulated is extracted:

- Current Velo, Velo Pixels (VP), Velo Light Strips (VL)
- RICH1 without Aerogel and with PMTs
- Current TT, Upstream Tracker (UT)
- Magnetic field as in current detector
- Beam pipe as in current detector, or with lighter SF2 and SF3 supports
- IT and OT as in current detector, Fiber Tracker covering whole T stations (FT)
- RICH2 with PMTs
- Calorimeters as in current detectors, or in Gauss it is also possible to switch off SPD and PRS
- Muon System as in current detector
- Upstream region (BLS+BCM, RB84) and Downstream region (RB86) as in current detector (not normally simulated)
- Infrastructure as in current detector (not normally simulated)

Processing steps

Initially only `sim` files (i.e. the output of Gauss) will be produced. As soon as Boole will be ready also `xdigi` files can be made. Eventually once A first version of Brunel will be ready `dst` (or `xdst`) files for physics channels to be processed by the physics analysis will be produced.

An explanation of the various files types is available in this page

List of samples to be or being produced.

The following samples will be produced to evaluate and compare the performance of different detector technologies.

EventType	Channel (DecFiles)	Detector configuration	Beam Conditions	No. of events	Output type	Purpose	Statu
30000000	minimum bias	VP + UT + FT (no preference for rich)	tbd	1M (10M would be even better)	xdst	trigger timing and retention	on ho until tracking algorith are mor advance
13104013	Bs_phiphi=CDFAmp,DecProdCut,hpt400			10k	sim		

		VP + UT + large IT + OT + without aerogel	nu=3.8 with spillover			once geometry is ready	geometr not yet availabl
13102201	Bs_phigamma=DecProdCut	baseline	nu=7.6, spillover	100k	xdst	Calo PID	
27163221	Dsst_Dsgamma,KKpi=DecProdCut	baseline	nu=7.6, spillover	100k	xdst	Calo reco	
11124003	Bd_Kstee=phsp,DecProdCut	baseline	nu=7.6, spillover	100k	xdst	Calo PID	
22262001	D0_Kpipi0=DecProdCut	baseline	nu=7.6, spillover	100k	xdst	Calo PID	

Done Samples

Unless otherwise indicated, all samples now use the Upgrade Baseline geometry:

- VP1 (new geometry)
- UT (new geometry)
- FT (Monolayer)
- Calo with no Spd/Prs
- Muon with no M1

FT Spillover Samples

Pythia 6

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia6/Sim08c/Digi13/Reco14U4/13104011/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-25ns-Pythia6/Sim08c/Digi13/Reco14U4/13104011/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu11.4-25ns-Pythia6/Sim08c/Digi13/Reco14U4/13104011/XDST

Pythia 8

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13104011/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13104011/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu11.4-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13104011/XDST

UPT/Upgrade Velo TDR Samples

Old UT, nu=3.8, Pythia 6, No Spillover

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-Pythia6/Sim08c-UTv0/Digi13/Reco14U4/11114001/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-Pythia6/Sim08c-UTv0/Digi13/Reco14U4/30000000/XDST

Old UT, nu=7.6, Pythia 6, No Spillover

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-Pythia6/Sim08c-UTv0/Digi13/Reco14U4/11114001/XDST

nu=3.8, Pythia 6, Spillover

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia6/Sim08c/Digi13/Reco14U4/11114001/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia6/Sim08c/Digi13/Reco14U4/30000000/XDST

nu=3.8, Pythia 6, No Spillover

bkPath	Even
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-Pythia6/Sim08c/Digi13/Reco14U4/11114001/XDST	10524
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-Pythia6/Sim08c/Digi13/Reco14U4/30000000/XDST	10300

nu=3.8, Pythia 8, Spillover

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13102201/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13104013/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13104015/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-25ns-Pythia8/Sim08c/Digi13/Reco14U4/27165175/XDST

nu=3.8, Pythia 8, No Spillover

bkPath	Even
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-Pythia8/Sim08c/Digi13/Reco14U4/13102201/XDST	10974
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-Pythia8/Sim08c/Digi13/Reco14U4/13104013/XDST	61250
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu3.8-Pythia8/Sim08c/Digi13/Reco14U4/30000000/XDST	12024

nu=7.6, Pythia 6, Spillover

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-25ns-Pythia6/Sim08c/Digi13/Reco14U4/11114001/XDST

nu=7.6, Pythia 6, No Spillover

bkPath	Even
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-Pythia6/Sim08c/Digi13/Reco14U4/11114001/XDST	10849
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-Pythia6/Sim08c/Digi13/Reco14U4/30000000/XDST	10874

nu=7.6, Pythia 8, Spillover

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13102201/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13104013/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-25ns-Pythia8/Sim08c/Digi13/Reco14U4/13104015/XDST
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-25ns-Pythia8/Sim08c/Digi13/Reco14U4/27165175/XDST

nu=7.6, Pythia 8, No Spillover

bkPath	Even
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-Pythia8/Sim08c/Digi13/Reco14U4/13102201/XDST	10075
/MC/Upgrade/Beam7000GeV-Upgrade-MagDown-Nu7.6-Pythia8/Sim08c/Digi13/Reco14U4/30000000/XDST	10350

Upgrade Calo Samples

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade.VP1.UT.FT.noPRSnoSPD-MagDown-Nu11.4-Pythia6/Sim08a/Digi13/Reco14
/MC/Upgrade/Beam7000GeV-Upgrade.VP1.UT.FT.noPRSnoSPD-MagDown-Nu3.8-Pythia6/Sim08a/Digi13/Reco14U
/MC/Upgrade/Beam7000GeV-Upgrade.VP1.UT.FT.noPRSnoSPD-MagDown-Nu7.6-Pythia6/Sim08a/Digi13/Reco14U

Velo TDR Samples:

bkPath
/MC/Upgrade/Beam7000GeV-Upgrade.Velo.TT.ITOT.RICHMinimal.M1.SPD-MagDown-Nu3.8-Pythia6/Sim08c/Dig
/MC/Upgrade/Beam7000GeV-Upgrade.Velo.TT.ITOT.RICHMinimal.M1.SPD-MagDown-Nu3.8-Pythia6/Sim08c/Dig
/MC/Upgrade/Beam7000GeV-Upgrade.Velo.TT.ITOT.RICHMinimal.M1.SPD-MagDown-Nu7.6-Pythia6/Sim08c/Dig
/MC/Upgrade/Beam7000GeV-Upgrade.Velo.TT.ITOT.RICHMinimal.M1.SPD-MagDown-Nu7.6-Pythia6/Sim08c/Dig

The previous Velo request information is archived here.

The previous sim-only request information is archived here. The previous xdigi request info is archived here.

-- *Last updated*: PaulSzczypka - 11-Apr-2013

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