Proton Impact for New Dump Retriggering Time

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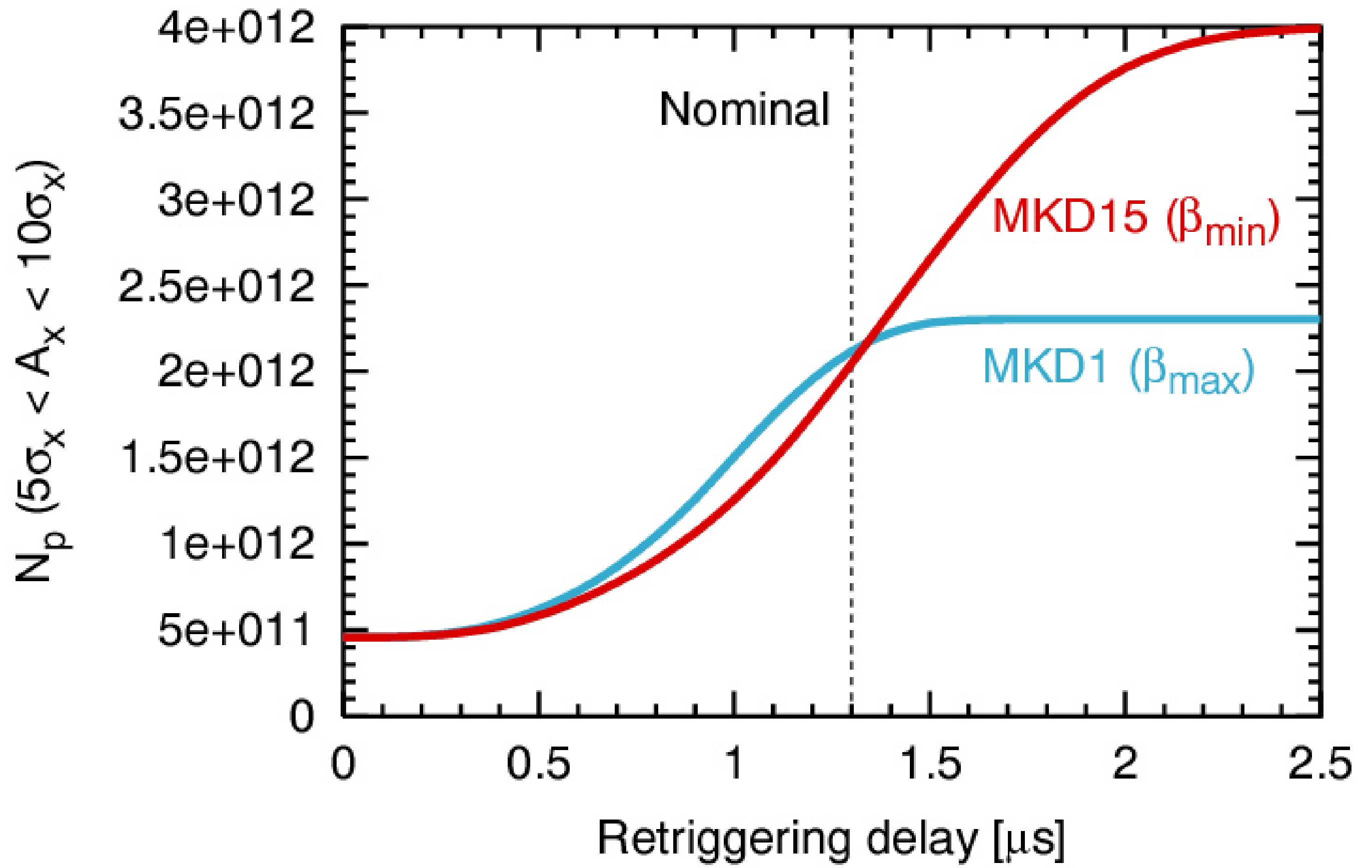
Use new re-trigger time: 0.7 μs

All modules re-trigger at exactly the same time (idealization?!).

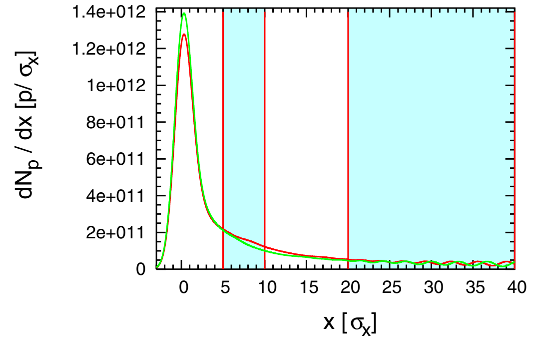
Expect significant gain from original publication (5/02):

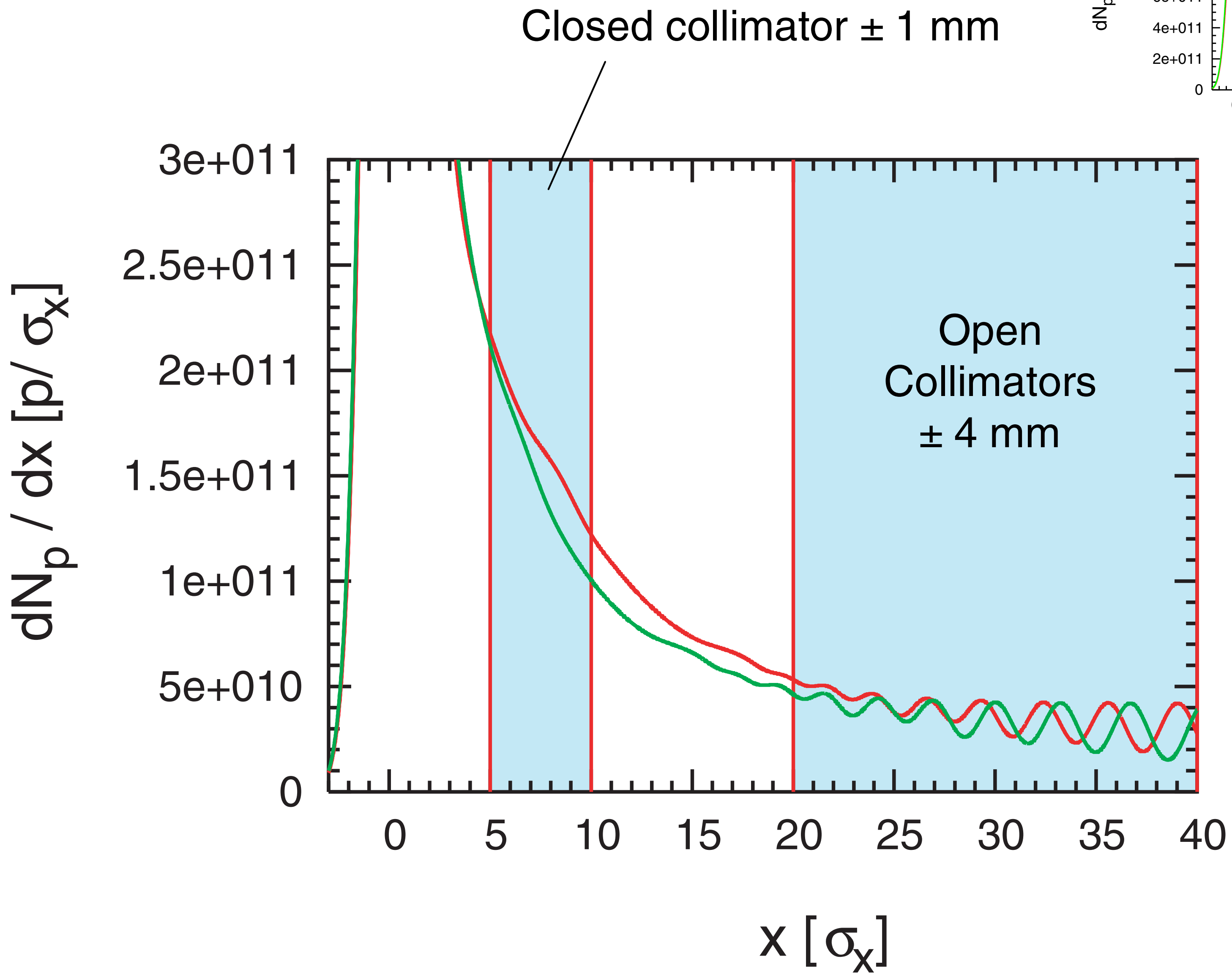


Old estimate:

Origin	450 GeV		7 TeV	
	ΔT [ns]	T_{sum} [ns]	ΔT [ns]	T_{sum} [ns]
Erratic switch No. 1	0	0	0	0
Re-triggering pick-up 10 V signal	400	400	200	200
Cable delay	180	580	180	380
Trigger unit delay	120	700	120	500
Cable delay + transformer delay	100	800	100	600
Turn delay GTO stack	400	1200	400	1000
Operational margin	300	1500	300	1300

New re-trigger delay:





Files available if needed…

As predicted in 2002:

Closed collimators go down by factor 2.5: 7-8 bunches over 1 mm

Open collimators at end of ramp: 7-8 bunches over 4 mm

Real dimensions depend on actual location (here used beam size 200 μm)!

Additional remarks

TIS document on Beryllium:

http://edms.cern.ch/file/335747/LAST_RELEASED/IS25_F.pdf

“Le béryllium est le métal le plus toxique utilisé dans l'industrie. **Son emploi devrait être évité chaque fois que cela est possible**.”

Gives rules for use of Beryllium!

"The document specifies a **BLM system** that should very well protect the machine against quenches. However, as discussed with Jean-Pierre Koutchouk, Jean-Bernard Jeanneret and Ruediger Schmidt, the specification should be extended to allow the usage of the BLM system for:

1) **Set-up of the LHC collimation system with the BLMC**. This should be performed with low beam intensity and decent beam lifetimes (non-destructive tuning). This requires an extension of the lower limit of dynamic range.

2) **Running at the best cleaning efficiency with nominal (and ultimate?) intensity**. This requires an extension of the higher limit of dynamic range.

3) **Minimization of injection losses**, e.g. allowing for a 2% loss an of injected batch in the warm regions. Presently the BLMS's would be saturated for a 1 turn loss of 1e-5 of a nominal injected batch.

It was agreed to approve the specification with the understanding that it will be modified to include the above mentioned requirements. This is important as it was stated that this specification should cover all requirements of beam loss observation, not just quench protection."

1) We have to define the detailed requirements for **collimation tuning**. Here some preliminary thoughts:

- The collimation system will be designed to withstand beam losses of up to several **0.1%** of the nominal intensity.

- Ideally collimator tuning at 7 TeV (moving jaws against the beam) would be done with about **5 10e11** protons (no risk for collimators, but risk for machine).

- Assume a lifetime of **30h** during collimator tuning. Then we get a loss rate of 4.6e6 p/s; this is about **130 times lower** than the lower limit for BLMC's in Table 11 (7 TeV, 10 s observation time).

- For injection tuning we could put one full batch without risk (maybe only half) for collimators. This means **3e13 p**.

- Assume a lifetime of **5 h**. The loss rate is 1.7e9 p/s, less than a **factor of three** below the lower limit for BLMC's in Table 11 (450 GeV, 10 s observation time). Maybe we should allow for a longer lifetime at injection and tuning also with lower intensities at injection?

- We have to think whether all loss rate will really impact on one collimator jaw and the corresponding BLM?!

2) **The maximum loss rate at the BLMC's would mean saturation at a lifetime of 0.23 h for nominal intensity.**

Note that the collimation system is designed such that we allow running at 0.2 h without quenching a magnet or damaging the collimator. In other words the design cleaning efficiency is better than used in the specifications for the BLMC's.

If we succeed with the collimation we probably would have to dump the beam at 0.5-1.0 h lifetime because the BLMC's go into saturation, while from the rest of the machine it would be possible to keep running. This might be an upgrade issue for the BLMC system?

3) **The BLMS's go into saturation for a 1e-5 1-turn loss of an injected batch.**

Now it can be imagined (just guessing) that we have quenches in the downstream arc for 3e-4 losses (off-momentum particles) that originate from a 1% loss in the TDI region!?

In this case it would be quite bad that all BLMS's are in saturation. We could not use them for minimizing beam loss at injection, which would be required for avoiding the downstream quench.

The BLMS's should allow operation to minimize realistic beam losses during the first turn.