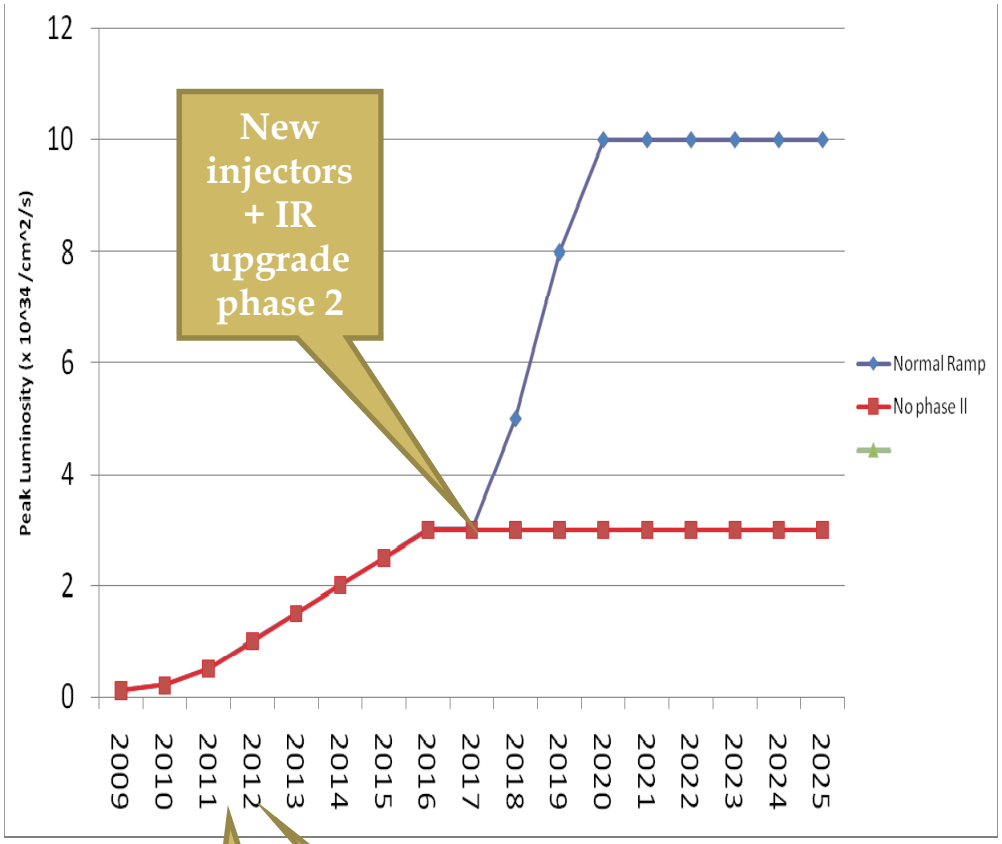
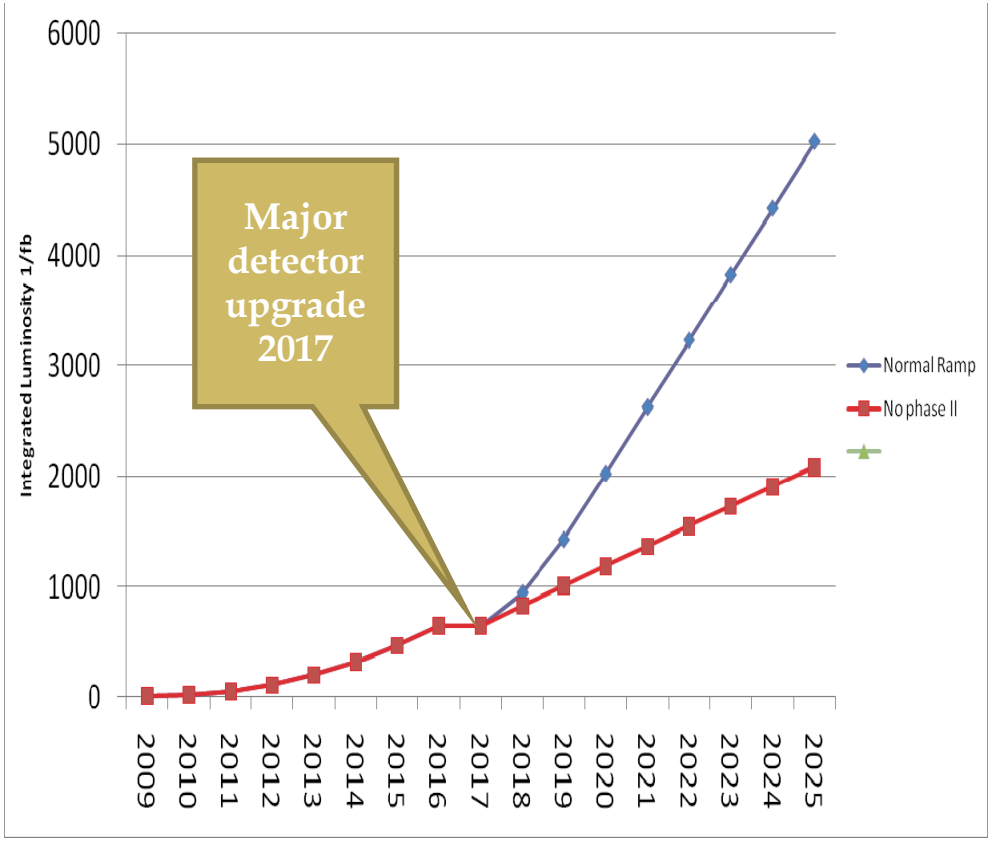
The Experiments' (ATLAS) View on LHC Crab Cavities

CARE-HHH mini WS, CERN, 21-8-08

From the last LHCC session .....





Goal for ATLAS Upgrade:

3000 fb^{-1} recorded

cope with ~400 pile-up events each BC

Detector upgrade

If just phase 1

- ✓ New inner detector (this is the major activity !!!)
- ✓ Upgraded trigger and data acquisition

If phase 2 in addition

- ✓ New Forward Calorimeter
- ✓ New overall Detector Shielding
- ✓ New Calorimeter Electronics
- ✓ New high rate Muon Chambers in the forward region

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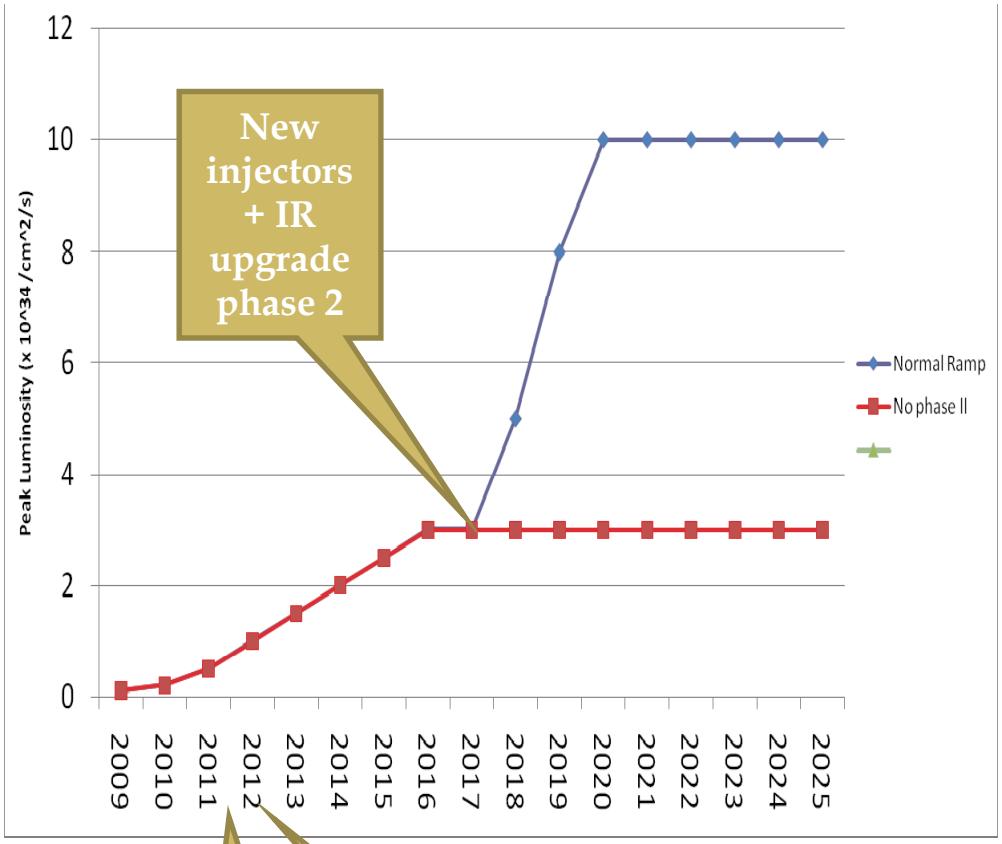

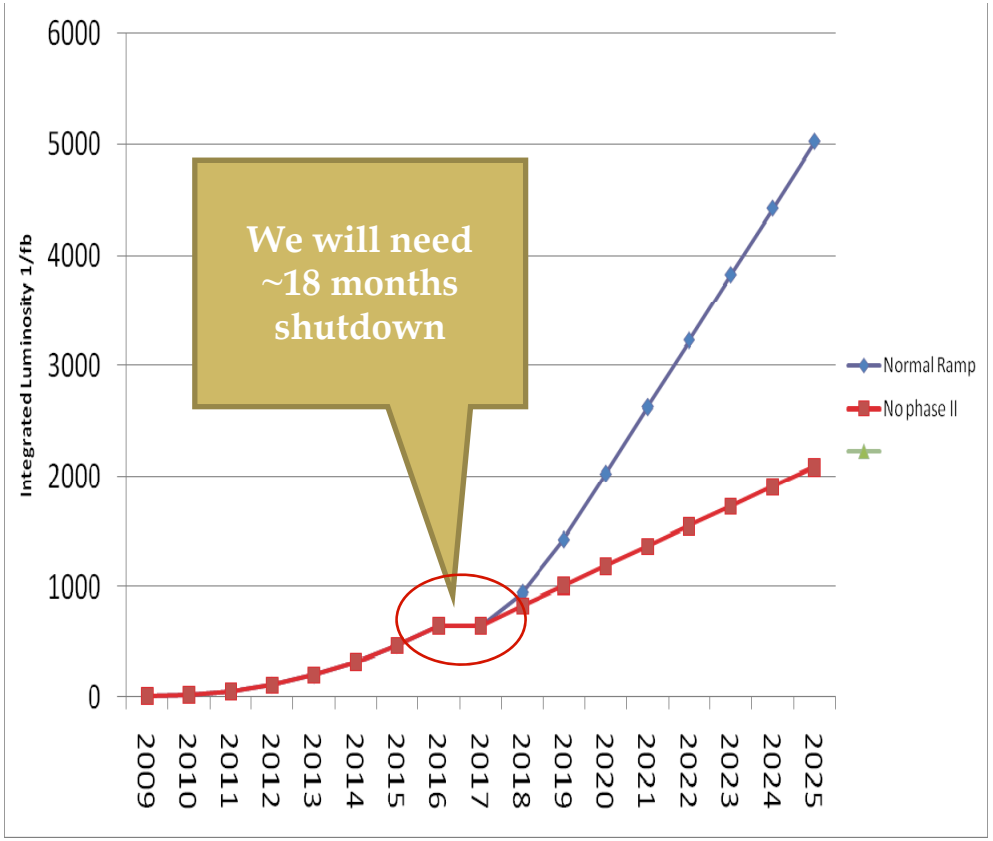

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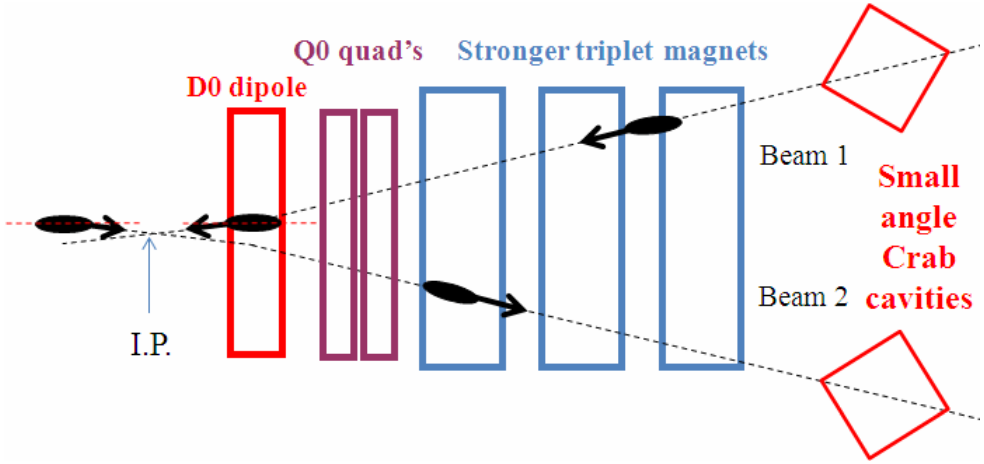
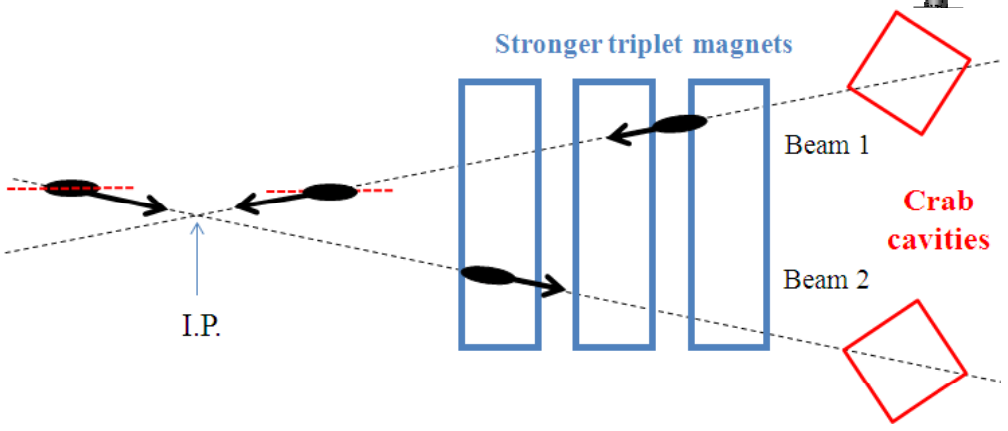
PHASE II scenarii



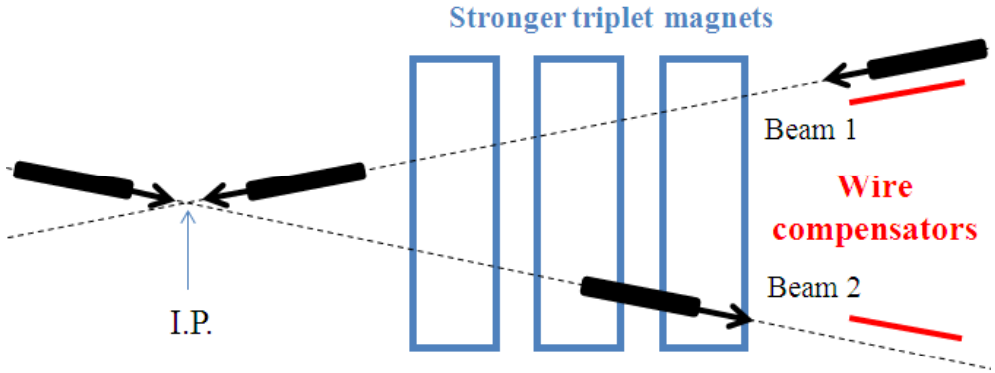
- **ultimate beam (1.7x10^{11} protons/bunch, 25 spacing), β* ~10 cm**
- **early-separation dipoles in side detectors , crab cavities**
  → hardware inside ATLAS & CMS detectors

We have been looking further in the early separation ….. Looking at the detector implications:

https://edms.cern.ch/document/932316/1

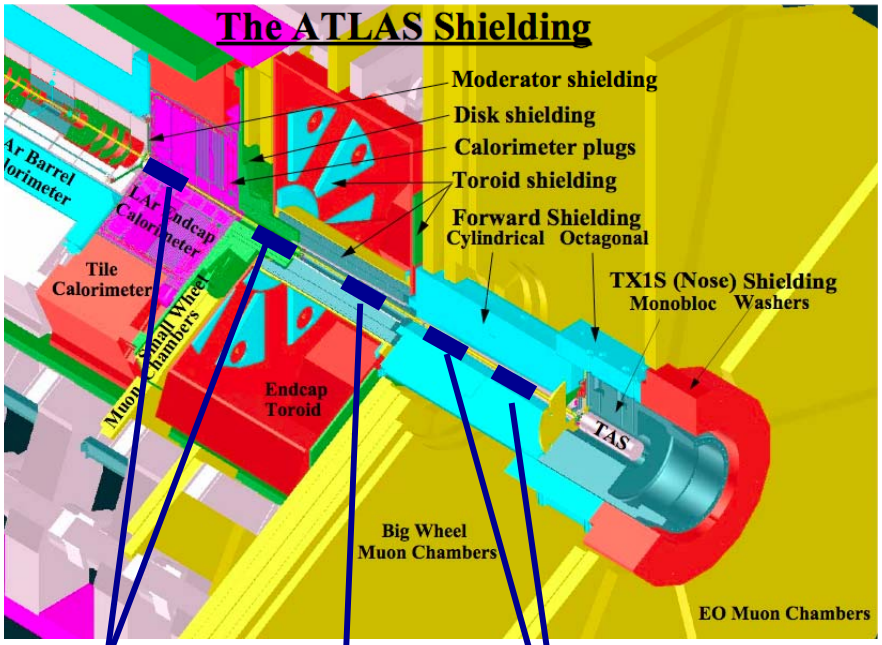


- **ultimate LHC beam (1.7x10^{11} protons/bunch, 25 spacing), β* ~10 cm**
- **crab cavities with 60% higher voltage**



- **50 ns spacing, longer & more intense bunches (5x10^{11} protons/bunch)**
- **β*~25 cm, no elements inside detectors**
- **long-range beam-beam wire compensation**

Beam Magnets inside ATLAS



We have simulated the effect of various individual magnets and collimators inside the ATLAS detector, as it was discussed in the last 18 months.

Typically the backgrounds get worse by factors 2-3 in the ATLAS active detectors independently of the particles type. Closer you are to the IP, more difficult it is.

D0s and TAS are clearly difficult for the experiment, Q0s in the very forward region can be better tolerated

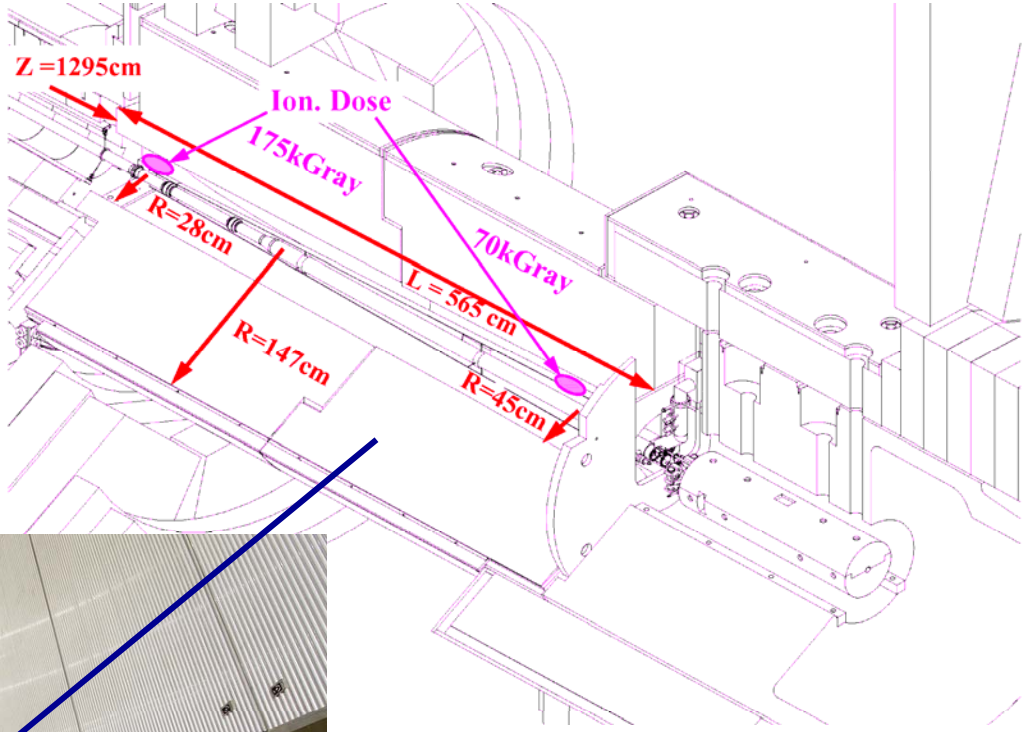
All services to such devices will be very problematic and might be the real show stoppers. Supports and stability an engineering challenge

If a new TAS, then the only place is inside the JF (forward shielding). Q0 or triplets must go downstream of it

All devices are not stable, but will move with the various detector opening scenarii

Only place which make sense

Forward Shielding Region (JF) …. which need to be redesigned for SLHC in any case



Some remarks

- ✓ Crab cavities (or wire compensation), which do not interfere with the detector are preferred
- ✓ They seem to allow 25 ns (lower pile-up) schemes, with luminosity levelling (by turning the crab on gradually) .... A winning argument

- ✓ We will request always to maximize the integrated luminosity and minimize the pileup ..... Luminosity levelling is a great idea
- ✓ A good goal for luminosity levelling would be to come up with a "Naive scaling": at LHC we expect 23 ev/bc at nominal luminosity. For sLHC, advertised as 10xnominal, we would hope for 230. If we get close, we will be happy

- ✓ The upgraded detector will need 18months shutdown time after the 2016 run to be installed, the plan of the SLHC should take this into account. No way for us to do it in steps.

- ✓ If you think you will need dedicated learning time to arrive to a final operating machine, lets put it in the schedule, we might use this time also to plan our finishing of the detector installation and commissioning.