Plans for ECAL-HCAL Upgrade Task Force "Phase II"

Global Charge

- Work with sub-detector teams in HCAL and ECAL to:
- Ensure studies required for CMS to take decisions on its ultimate detector design are pursued including:

  Simulation studies
  Candidate technology studies
  Physics implications

- Use the results of these studies to analyze the impact of candidate designs on CMS level requirements and to understand the tensioning between alternative implementations
- Report on progress to the Upgrade MB

Charge: Working Group on Forward Calorimetry for Phase II

- Establish the requirements for calorimetry in the forward direction (eta > 1.5) for Phase II operation of CMS
  - a) Considering the likely physics opportunities for phase II and their requirements for forward calorimetry performance.
  - b) Estimating the radiation environment likely to be encountered during phase II, and its effect on the current calorimeter systems
- Consider potential replacement technologies for calorimetry in the forward direction
  - a) Determine what detector components would require replacement in order to meet the performance requirements
  - b) Explore potential replacement technologies
    1. Estimate cost/performance
    2. Consider required R/D
    3. Establish timeline for studies/decisions
  - c) Determine what detector components could be used during phase II Establish what modifications might be required for re-use, and what R/D is necessary

First ECAL-HCAL Task Force Meeting

This is a **get-acquainted** meeting with no pretension of complete descriptions of any proposal or initiative.

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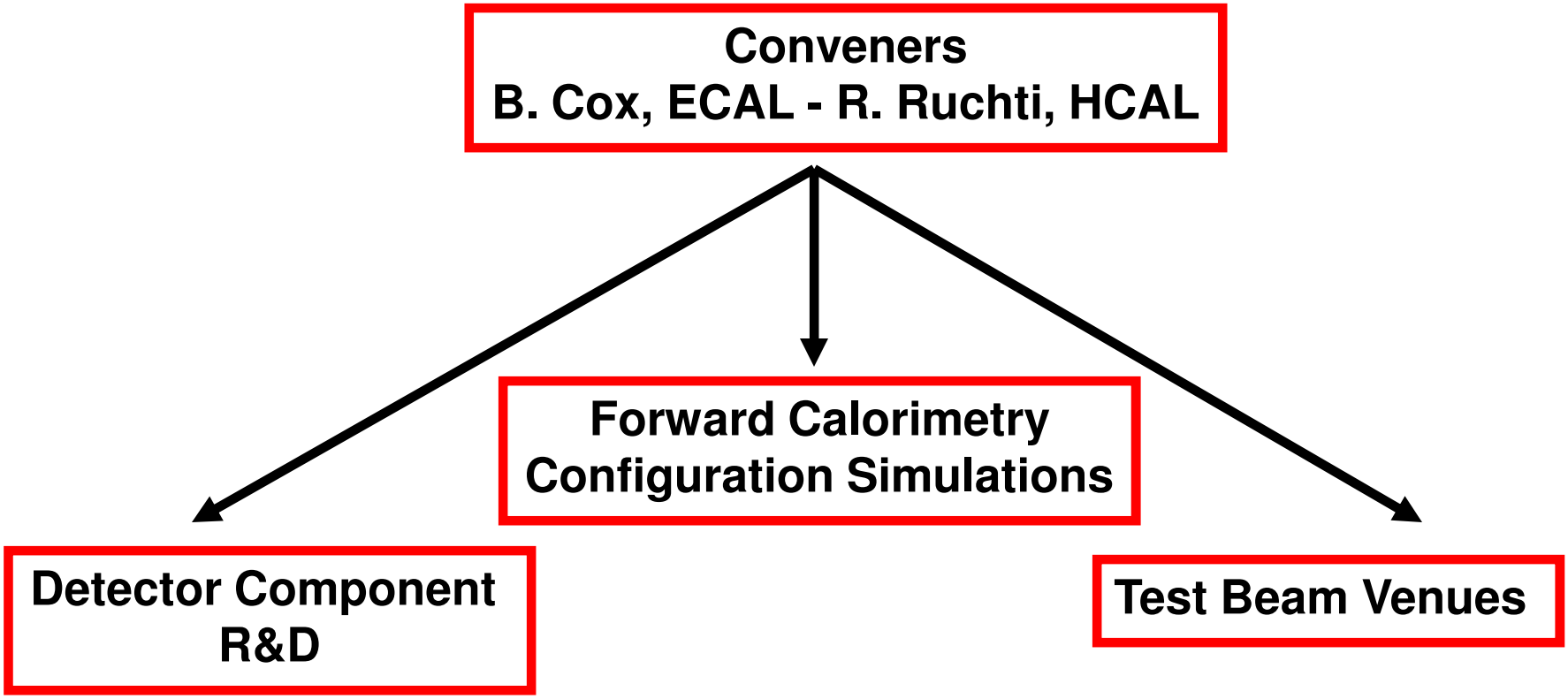
There will be future meetings that focus on specific agenda items.

General Idea for the Joint ECAL-HCALTask Force Organization



We will need dedicated people in all three boxes

Initial Proposal for Proceeding

- **Initially, no viable detector R&D that could be used in a feasible forward detector configuration should be precluded (to the level funding allows).**
- **The performance of any suggested forward detector configurations must be evaluated both from the standpoint of any data accumulated at a given point in time and against realistic simulation incorporating both radiation damage and expected pileup against a set of standard SM and beyond the SM modes and compared to the present CMS forward calorimetry configuration. When data is available, any configurations under consideration should be checked using this data.**
- **We must find suitable test beam venues for hadronic and electromagnetic radiation testing of detector options and attendant electronics**

Important Point

No winners/losers in the competition
for the chosen ECAL-HCAL configuration

Everyone will have a role in the construction
of the final chosen forward calorimeter configuration

Everyone will be needed
This is a big job

Our Problems
(known unknowns)

We do not know the actual performance of CMS detector at the moment

We do not know what the actual data will show and therefore we do not know how much data we actually need to determine what physics is present.

We do not know when the endcap replacement will be needed (2018???)

Therefore, we do not know when we will need to make the decision about what configuration to build.

Since we do not know what to build, we do not have a good idea of how long it will take.

etc.

Fluences at the front of EE

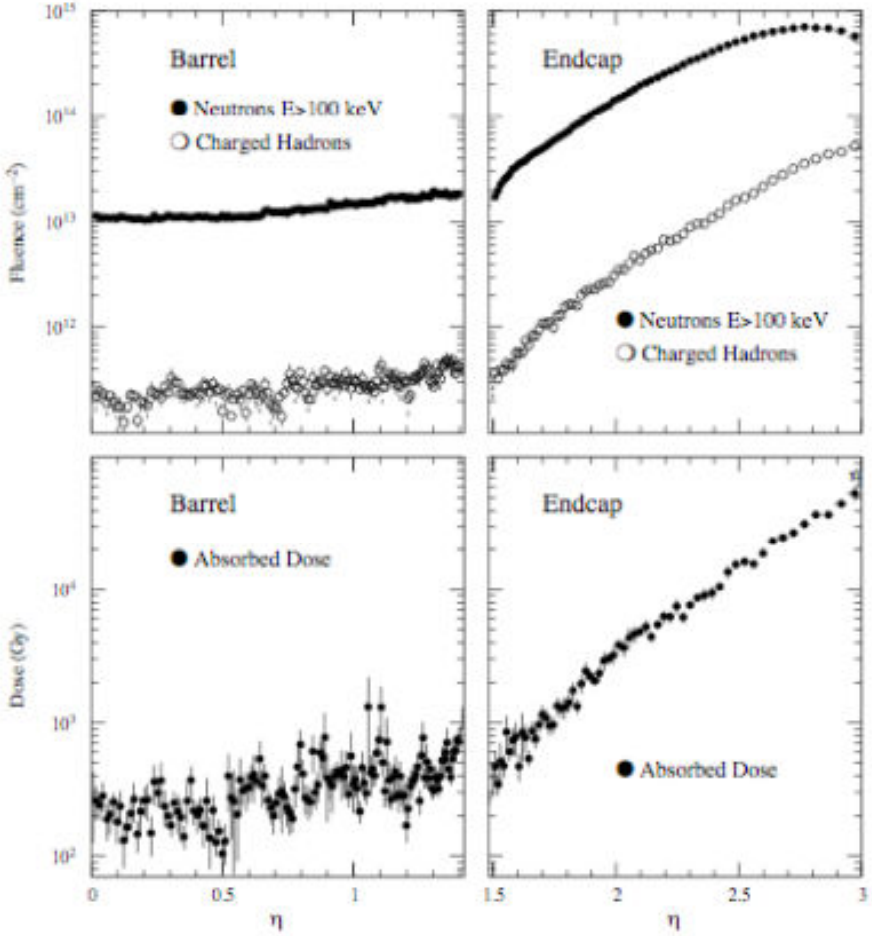


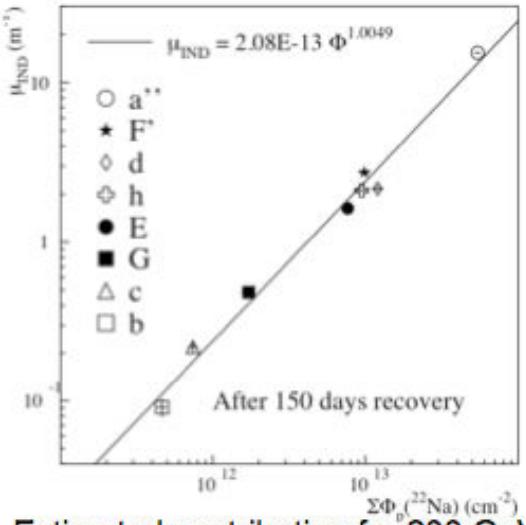
Fig. A.7: *Neutron (E > 100 keV) and charged hadron fluence and absorbed dose immediately behind the crystals as a function of pseudorapidity. The values are obtained in an aluminium–air mixture. Values correspond to an integrated luminosity of* 5×10^5 *pb*$^{-1}$.

10^{34} cm^{-2}s^{-1}

Shower max conditions are truly challenging

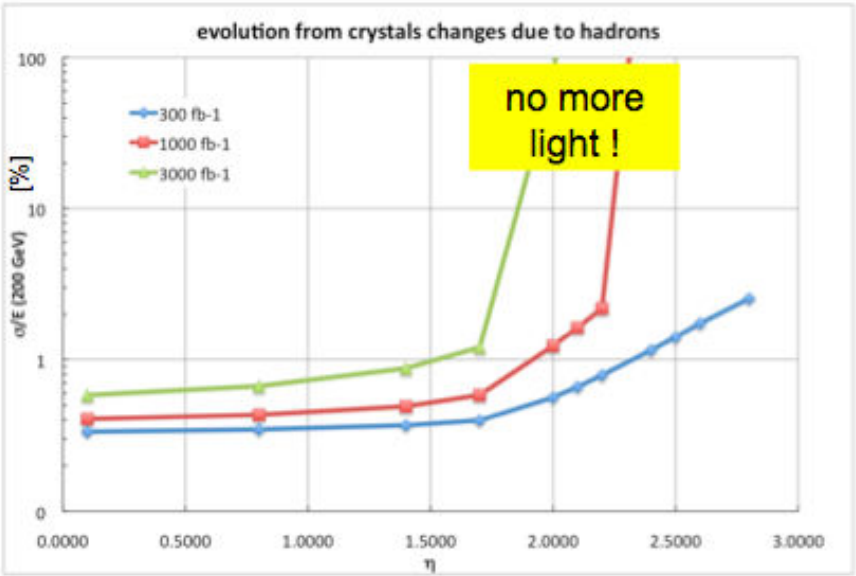
An example of a known problem (Francesco Nessi)

Estimated σ/E contribution from hadron damage



F. Nessi, Y. Kubota

Measurements on hadron damage to $PbWO_4$ indicate that it is cumulative and permanent, but affecting only light transmission, not scintillation → monitorable



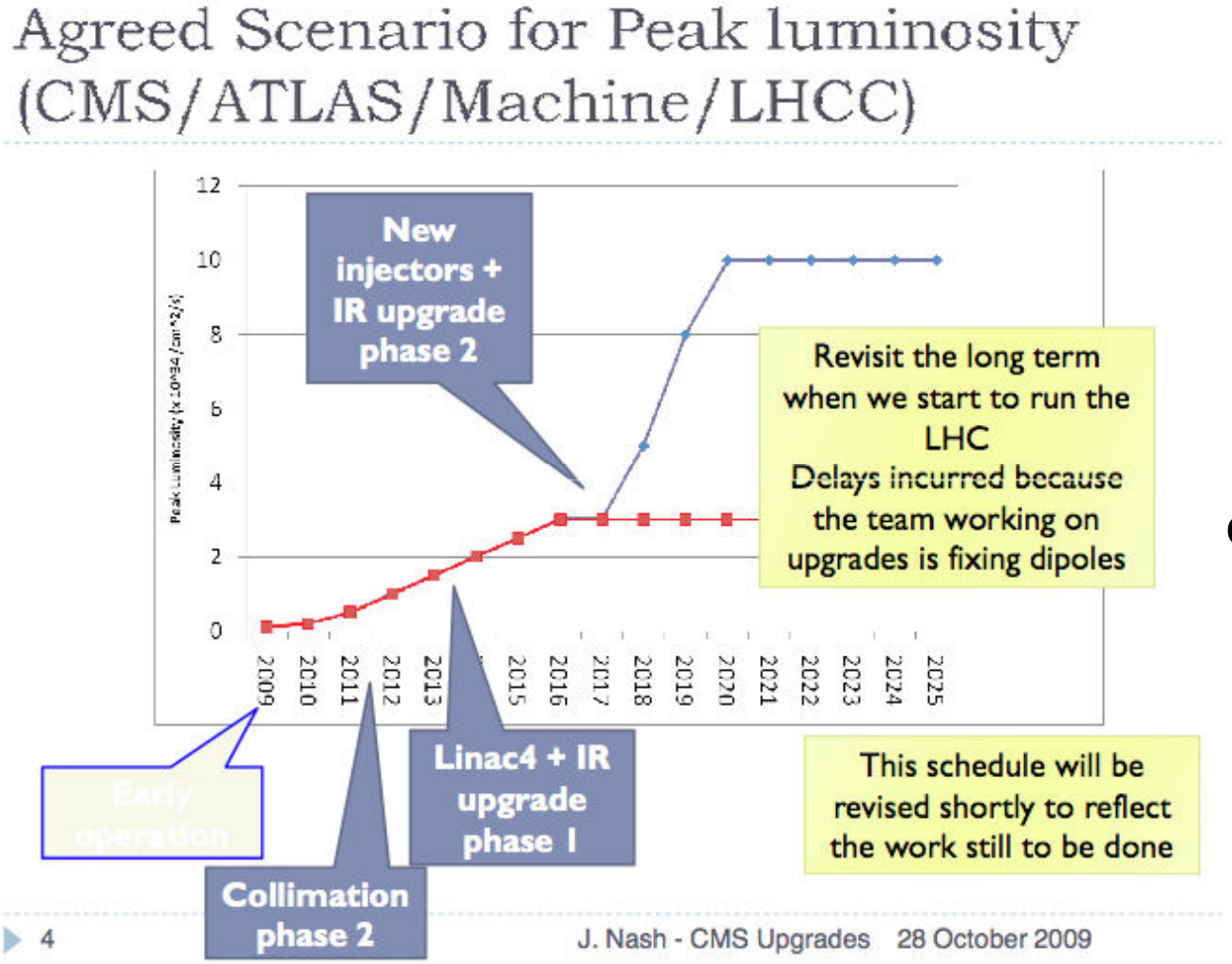
Estimated contribution for 200 GeV:
Assume stochastic term 4.5%
Neglect further contributions from

- losses from γ-damage
- VPT losses
- noise from VPT current induced by activated crystals
- Preshower
- Constant term from other sources

→ to be folded into a parametrization, to be used for simulations

Only light attenuation in $PbWO_4$

This plan will change; How? We don't know.



@700 pb^{-1} seriously degraded forward calorimetry

(Without any luminosity Increase!)

What should come out of today's session (and a meeting duringDecember CMS week)

- Decide on meeting dates for 2010
- Decide on objectives for 2010
- Establish a plan for the 2010 with well defined milestones for accomplishing these objectives
- Start consideration of a long range plan that quantizes the minimum time necessary for construction of the new forward calorimetry
- Begin to identify people who will participate in the forward calorimetry upgrade

Strawman Schedule
For Necessary Components

Potential 2010 ECAL-HCAL Task Force Meetings

Upgrade Weeks

26 - 30 April

25 - 29 October

Upgrade Days

21 Jan
18 Feb
24 June
15 July
30 Sep
18 Nov

We will next meet during Dec. CMS Week

Possible Task Force Meetings

During Upgrade Weeks

28 April*, 27 October*

During CMS Weeks

Dec 6*, March 15*, June 14*, Dec 6*

In coordination with Upgrade Days

20 Jan
19 Feb*
23 June
14 July
29 Sep*
17 Nov

* Suggested meeting dates