Upgrading CMS - Plans after Chamonix

LHC planning
Upgrade Phase I
Upgrade Phase II
Next Step : Technical Proposal

LHC planning

- Current status
- LHC upgrade plans
- Overall schedule & shutdowns

LHC Operations in the next two months

a) In the next two months the priority for LHC will be to give a sizeable amount of data to the experiments in time for the major summer conferences.

b) Most of the time will be devoted to stable beams for physics. Periods of MD will be organized to implement the steps in protection needed to cope with the increase of power in the machine.

c) Goals:

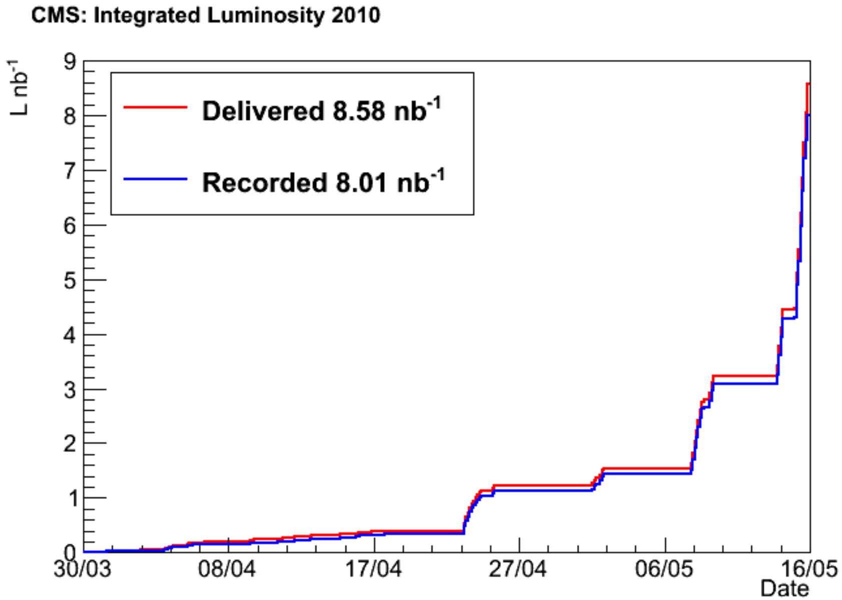
   a) **Mid May (next week-end): 10nb^{-1}**
   b) **End of May 10nb^{-1}**
   c) **End of June 300nb^{-1}**

   d) **The program will continue in the first two-three weeks of July.**

Longer term, for the bunch trains operations, it has been officially stated that bunches will be separated by 150ns.

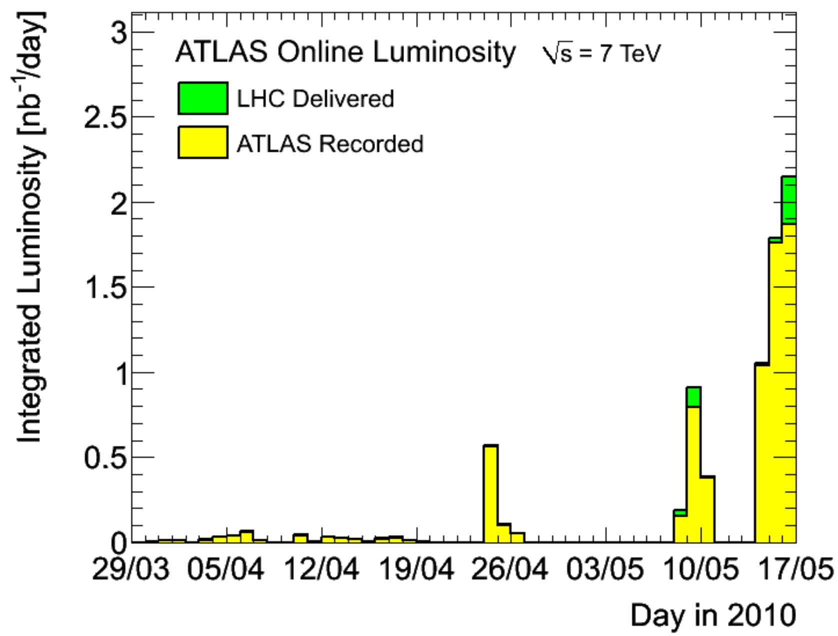
G. Tonelli
WGM17, May 12th

Current LHC running



until May 16th

8.58 nb^{-1} delivered
8.01 nb^{-1} recorded



Last weekend
LHC delivered L_{int} > 2nb^{-1} per day

300 nb^{-1} by end of June needs ~10nb^{-1}/day

LHC Operations

Several discussions within the machine+ formal meeting yesterday of the 4SPs + Rolf Heuer, Steve Myers, Serigo Bertolucci and M. Ferro-luzzi

After the measurements done on 900 GeV **high intensity bunches (>1x10^{11}p/b NOMINAL LHC BUNCH INTENSITY) the strategy to achieve higher luminosity has been defined better.**

a) LHC will move soon towards the nominal single bunch intensity 1x10^{11}p/b and 3.5 TeV per beam (a factor x100 gainin single bunch instantaneous luminosity)

b) A concern on the safety of tertiary collimators in these conditions and with β^*=2m has been raised

c) To avoid risks the machine will be running with beams squeezed only to β^*=5m (a factor 2.5 lost)

d) To compensate for this an increased number of bunches is foreseen up to 16 (corresponding to a total power of about 1MJ in the machine).

The timescale for this will be from now up to end of June

G. Tonelli
WGM17, May 12th

LHC planning

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Machine Plans for Upgrades
"SLHC"type luminosities - issues and solutions

Frank Zimmermann
CMS Upgrade Week
29 April 2010

Input from 2001 LHC Upgrade Feasibility Study and from numerous CARE-HHH and EuCARD-AccNet workshops, LMC's, Chamonix2010, CERN MAC, etc.

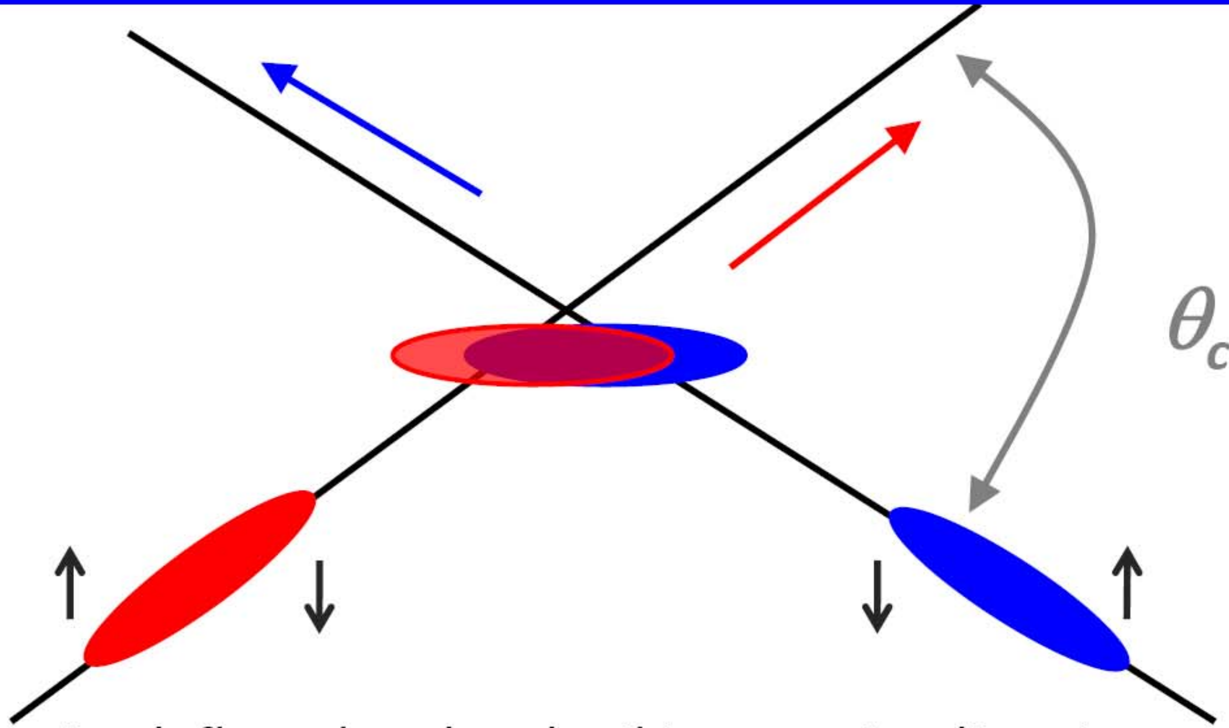
Special thanks to R. Bailey, C. Bhat, O. Brüning, R. Calaga, H. Damerau, O. Dominguez, L. Evans, S. Fartoukh, R. Garoby, J.-P. Koutchouk, H. Maury Cuna, S. Myers, R. Ostojic, L. Rossi, F. Ruggiero, W. Scandale, G. Sterbini, L. Tavian, T. Taylor, E. Todesco, R. Tomas,...

parameters

- β^* - IP beta function
- β_x^*/β_y^* - ratio of IP beta functions
- θ_c – (full) crossing angle
- ε_N – normalized transverse emittance
- N_b – bunch intensity
- n_b – number of bunches ($\rightarrow s_b$ - bunch spacing)
- longitudinal bunch profile (“flat” vs “Gaussian”)
- number of collision points (IP’s)
- T_{ta} – turn-around time

F. Zimmermann
CMS UgW, Apr 29th

crab crossing

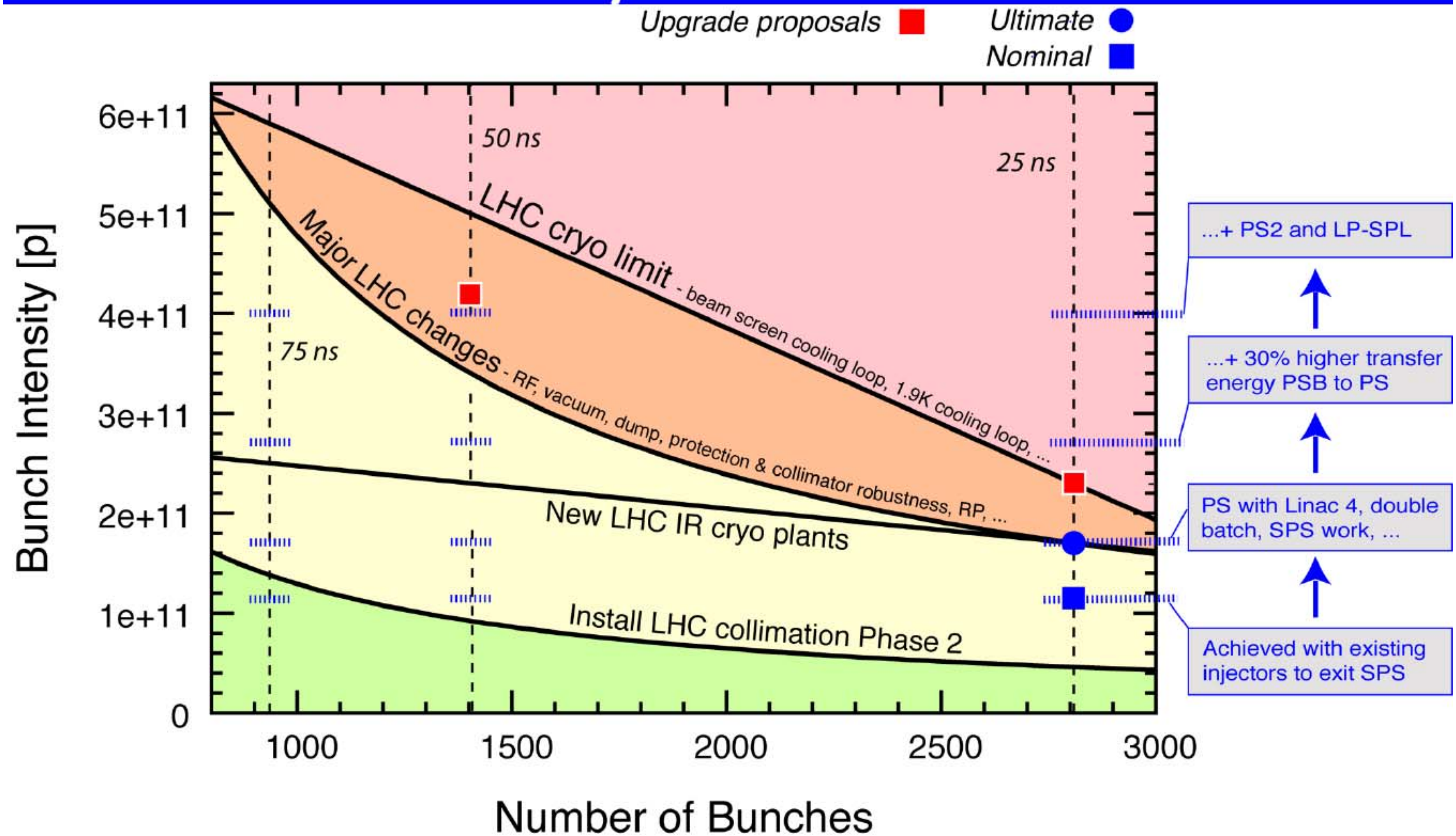


- RF crab cavity deflects head and tail in opposite direction so that collision is effectively "head on" for luminosity and tune shift
- bunch centroids still cross at an angle (easy separation)
- 1st proposed in 1988, in operation at KEKB since 2007

<u>advantages:</u> higher geometric luminosity, easy leveling, potentially higher beam-beam tune shift

F. Zimmermann
CMS UgW, Apr 29th

LHC intensity limits - schematic

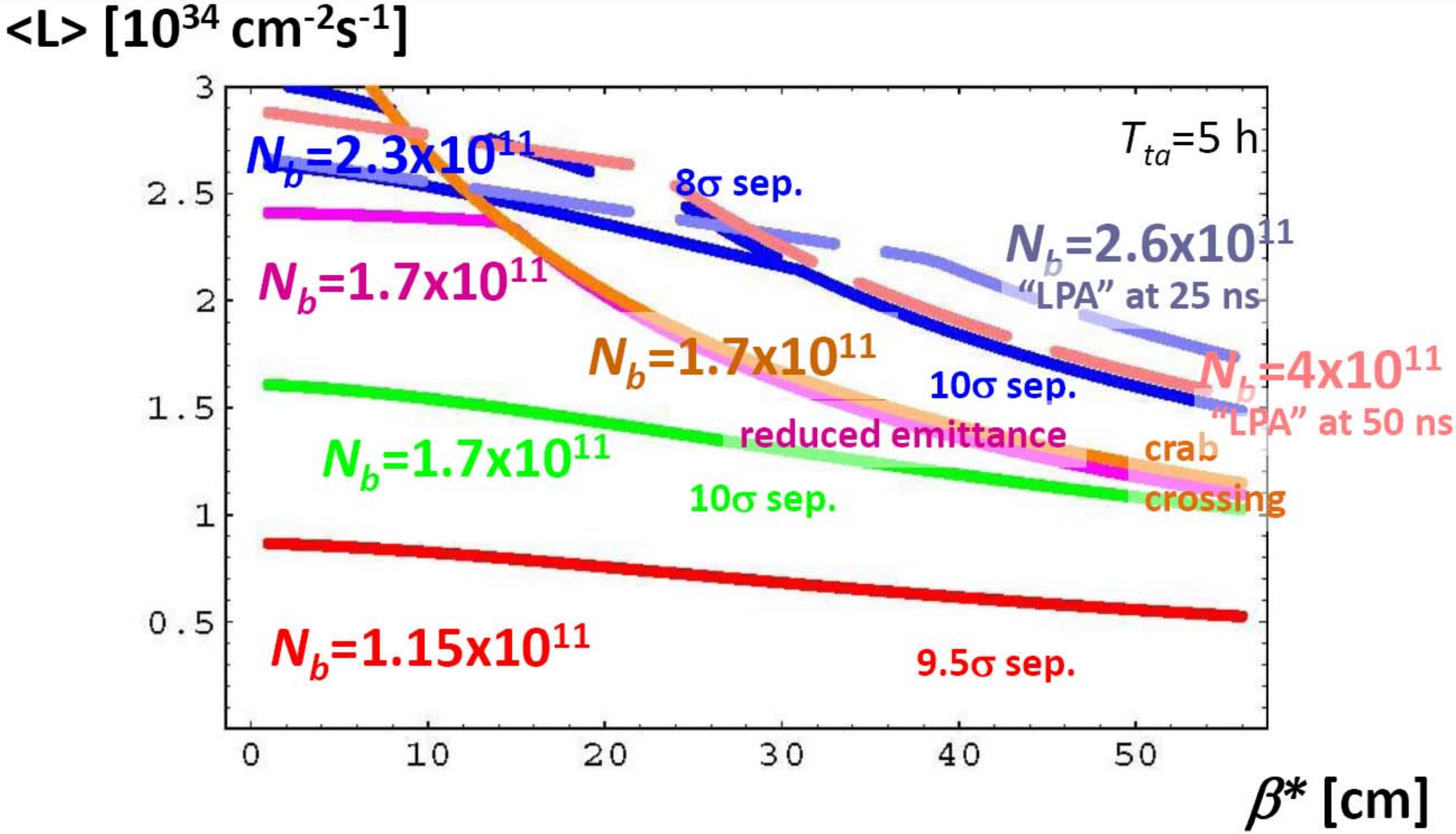


R. Assmann, LMC, 03.02.2010

Note: Some assumptions and conditions apply...

F. Zimmermann
CMS UgW, Apr 29th

<L> vs. β* - the KEY PLOT



beam intensity is much more important than β*, reducing β* only helps in the presence of crab cavities

F. Zimmermann
CMS UgW, Apr 29th

conclusions

- upgrade scenarios with 25 & 50 ns spacing
- maximum N_b ~2.3x10^{11} at 25 ns, ~5.0x10^{11} at 50 ns
- T_{ta} - 10→2 h: 2x higher <*L*>
- β* : factor 2 reduction → 10-20% higher <*L*>
- **N_b: factor 2 increase → 3 times higher <*L*>!**
- crab crossing: 20-100% higher <*L*>
- luminosity optimization assumes two IPs;
  needs/policy for ALICE & LHCb?
- θ_c leveling can increase run time by factor 1.5-3,
  & reduce pile up, at ~ constant <*L*>
- annual luminosities of 150-300 fb^{-1}
- put emphasis on N_b (!!), T_{ta} (!) and crab crossing

F. Zimmermann
CMS UgW, Apr 29th

LHC planning

- Current status
- LHC upgrade plans towards sLHC
- Overall schedule & shutdowns

upgrade time lines

- **collimation** upgrade 2013-2015

- parallel R&D on Nb-Ti and Nb_3Sn **IR quadrupoles**
  technology choice by 2014
- parallel R&D on compact and global **crab cavities**
  choice by 2014

- **LINAC4** connection 2014-15
- **injector** upgrades & consolidation (PSB, PS, SPS)
  completed by ~2015
- production & installation of **new IRs** ~2018-22
- production & installation of **crab cavities** ~2018-22

F. Zimmermann
CMS UgW, Apr 29th

LHC Long Term Plan

Meeting with CERN Directorate+ 4 Spokespersons and Technical Coordinators+ all LHC Directors. Tuesday May 11.

Scope: collect the needs for the various components of the machine (Linac, Booster, SPS, PS, etc) and of the experiment to build a coherent schedule for LHC running/major shutdown in the next 10+ years.
Goal: produce a common document to be presented/approved at the next Council in June.
Very important to us for launching the Upgrade Project.

Preliminary conclusions:

1-st major shutdown: 2012 (14-15 months): to get to 13-14TeV
3-rd major shutdown: 2020 (>1year): Ni-Sn triplets to get to >200fb-1/year

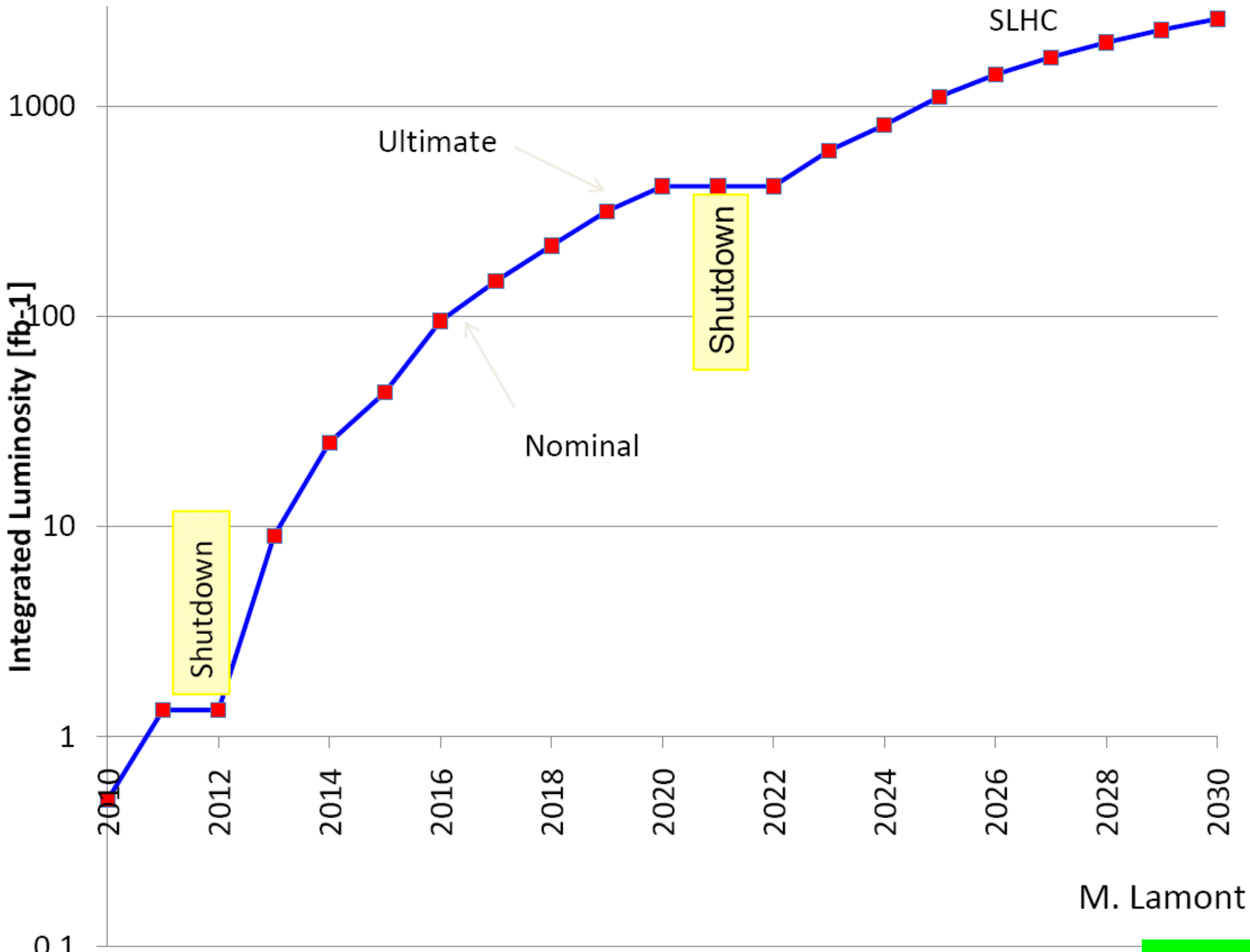
2-nd major shutdown (to get to >70 fb-1/year) to be better defined:

Linac 4 would like to have it in 2015 (and CMS will be happy)
Atlas is strongly pushing to have it not before mid 2016.

A common solution will be found in the next couple of weeks.

G. Tonelli
WGM17, May 12th

possible luminosity evolution → 2030



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CMS UgW, Apr 29th

Phase I

(L $\leq 2x10^{34}$, until ~ 2020)

- Definition & time line
- 1^{st} shutdown (~2012)
- 2^{nd} shutdown (? 2015/2016)

Phase I
Definition and Timeline

What is Phase 1 of the Upgrade?

All upgrades until the big shutdown (~2020) which will increase the LHC luminosity beyond 100 fb-1/year.

"Their motivation may be based on required performance for higher luminosity, better physics performance, better reliability of operation" (J. Nash, CMS upgrades, Apr 26th)

Detectors should be able to operate at $L_{peak} = 2x10^{34}$ and up to a $L_{int} \sim 700fb^{-1}$

2 mayor shutdowns :

~ 2012, (14-15 months duration)

? 2015/2016 (still to be defined)

Agreed at the May 2008 Upgrades Workshop
http://indico.cern.ch/conferenceDisplay.py?confId=28746

Upgrade Scope

Year	System	Phase 1	Phase 2
2015	Pixel	New Pixel Detector (1 or 2 iterations?)	
	Tracker	FEDs?	New Tracking System (incl Pixel)
2012, 2015	HCAL	Electronics + PD replacement	HF/HE?
	ECAL	TP (Off Detector Electronics) ?	EE?
2012	Muons	ME4/2, ME1/1 ,RPC endcap, Minicrate spares, some CSC Electronics	Electronics replacement
2015	Trigger	HCAL/RCT/GCT to μTCA	Complete replacement

J. Nash
CMS UgW, Apr 26th

Upgrades in 1st shutdown (2012)

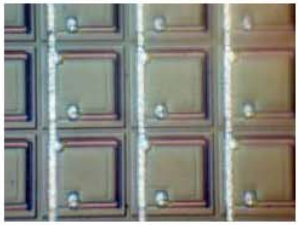
Beampipe
- may install new central beam pipe (25mm radius)
- if at all install before new pixel (bake-out issues)

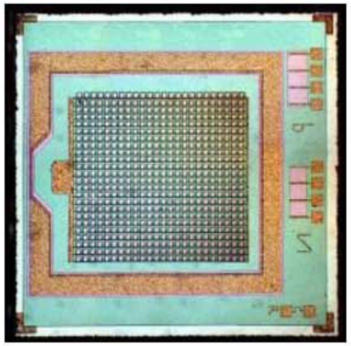
HCAL
- HO ring 1&2 : replace HPDs with SiPM
- new photomultipliers for HF
- new BE electronics test (µTCA in parallel to VME)

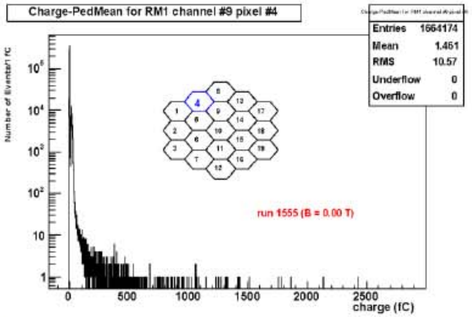
MUON
- ME4/2 new RPCs & maybe CSCs (likely 2nd shutdown)
- Test of new ME1/1 front end electronics ?

New Photodetectors for Hadronic Calorimeter- SiPMs

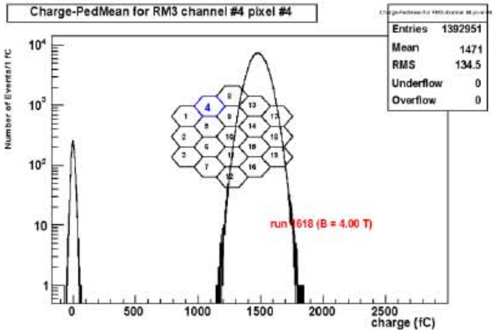
- Array of avalanche photo diodes ("digital" photon detection)
  - Array can be 0.5x0.5 up to 5.0x5.0 mm^2
  - Pixel size can be 10 up to 100μ
- All APDs connect to a single output
  - Signal = sum of all cells
- Advantages over HPDs:
  - 28% QE (x2 higher) and 10^6 gain (x500 higher)
  - More light (40 pe/GeV), less photostatistics broadening
  - Very high gain can be used to give timing shaping/filtering







HPD



SiPM

For 2012 :
SiPM in
HO ring 1 & 2

J. Nash
CMS UgW, Apr 26th

Upgrades in 2nd shutdown (2015/2016?)

HCAL

- SiPM for HB/HE, new FE and BE electronics (no VME)

MUON

- ME4/2 compete with CSC (if not done before)
- ME1/1 new CSC front end electronics

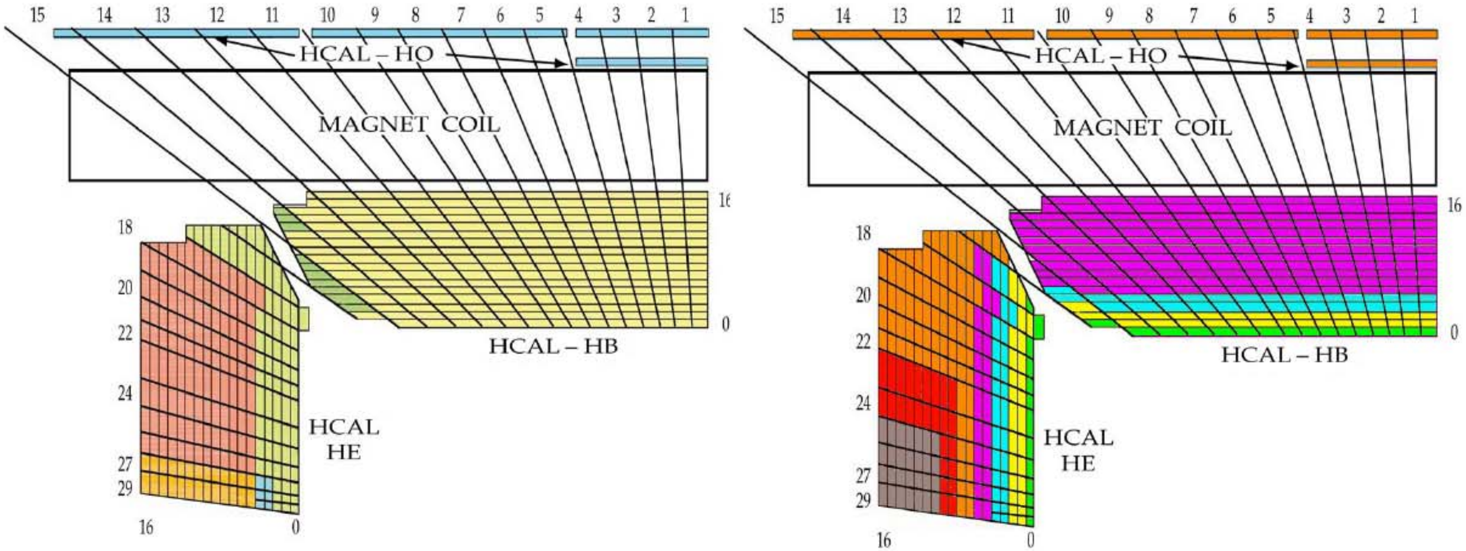
Trigger

- new technology (μTCA?)

Pixel

- 4-layer BPIX, 3 disk FPIX, less material, less dead time

New Photodetectors allow finer segmentation of readout in depth



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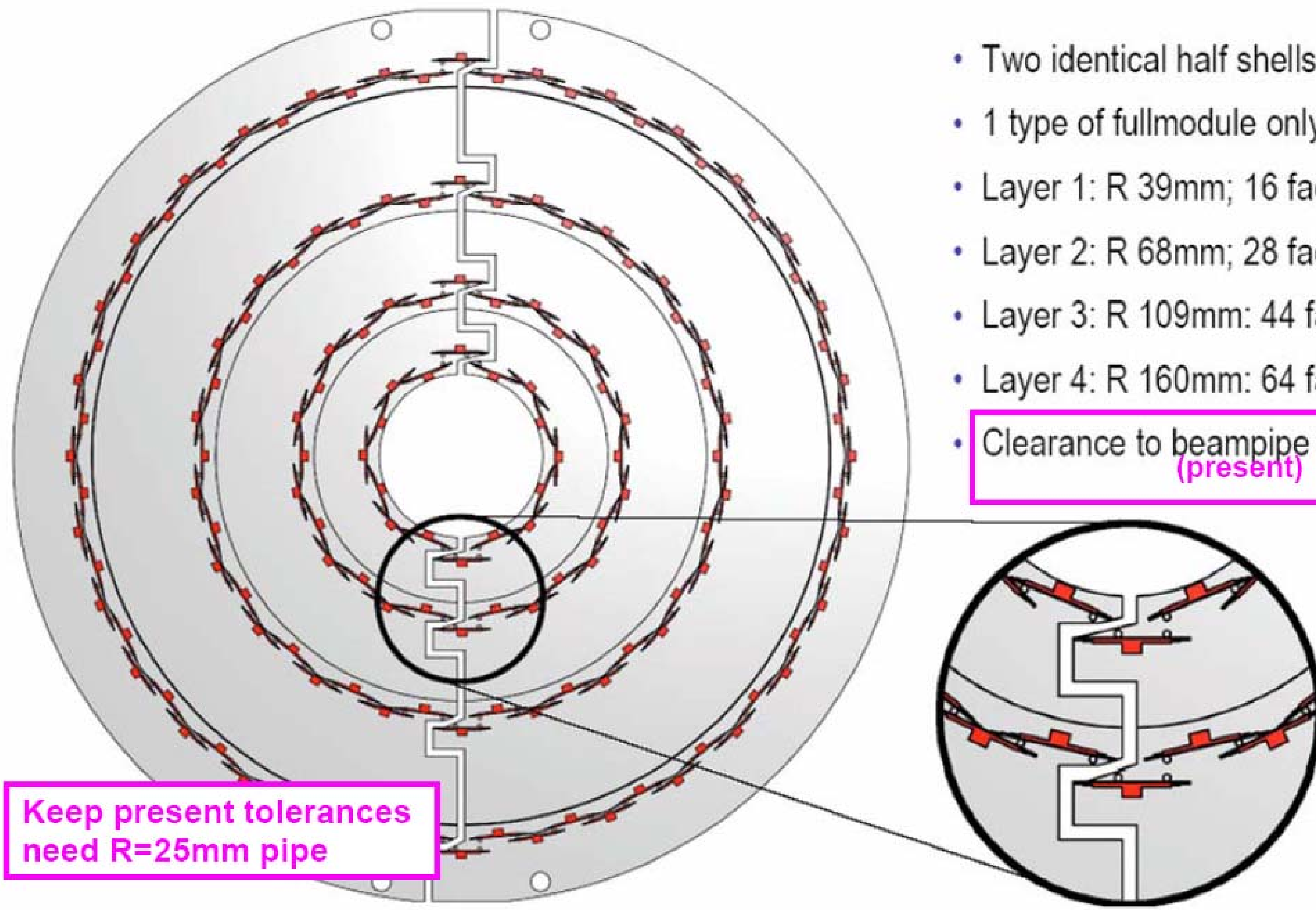
BPIX Upgrade Baseline (2015)

→ **1216 modules**
(1.6 x present BPIX)



- Two identical half shells
- 1 type of fullmodule only
- Layer 1: R 39mm; 16 faces
- Layer 2: R 68mm; 28 faces
- Layer 3: R 109mm: 44 faces
- Layer 4: R 160mm: 64 faces
- Clearance to beampipe 4mm **(present)**

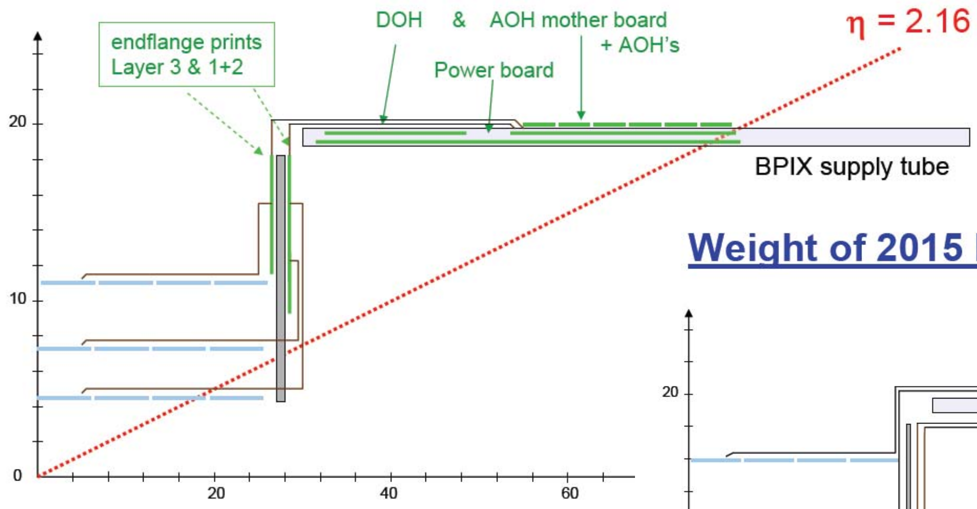
Keep present tolerances need R=25mm pipe

R. Horisberger
CMS UgW, Apr 29th

BPIX upgrade - material

Weight of 2008 Pixel System with Supply Tube

current vs phase I

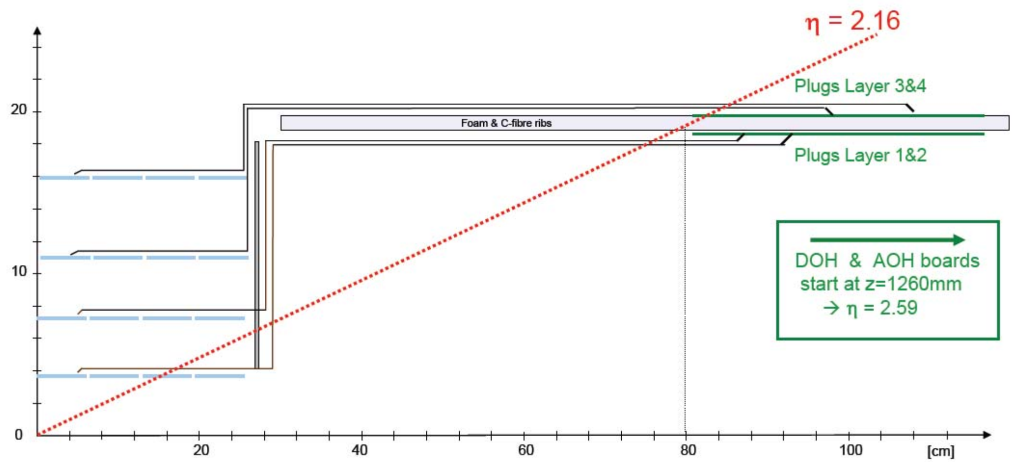


Total weight of 2008 BPIX within η<2.16 : 1(

2 Barrels & 4 Supply Tube Sections & Fluid & Cables

16.9 kg -> 6.5 kg

Weight of 2015 Phase 1 Pixel System (4 layers)



Total weight of 2014 4 Layer BPIX within η<2.16 : 6454 g ~ 6.5 Kg

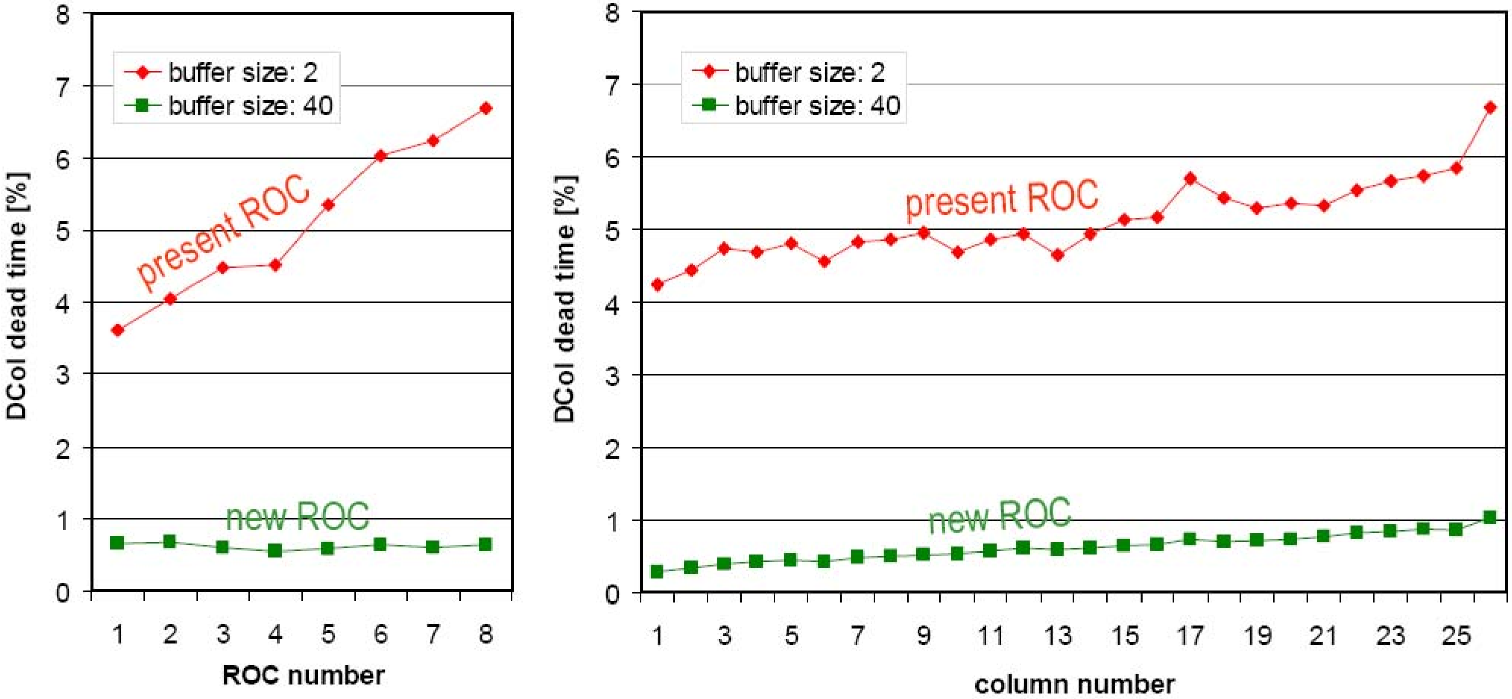
2 Barrels & 4 Supply Tube Sections & CO_2 & Cables

Ratio (3 Layers 2008 / 4 layers 2015) ~ 2.62

Weight of TIB/TID ~ 430 Kg

R. Horisberger
CMS UgW, Apr 29th

DCol Data Buffer Waiting Time



- Data verified by trigger and ready for readout
- DCol data acquisition blocked
- Waiting for readout
- Trigger latency not included (no dead time)
- No direct translation to inefficiency values

Clock cycles 500'000
Readout buffer size: 2 & 40
L1 trigger rate: 100 kHz
Luminosity: $2 \cdot 10^{34}$ $cm^{-2}s^{-1}$

R. Horisberger
CMS UgW, Apr 29th

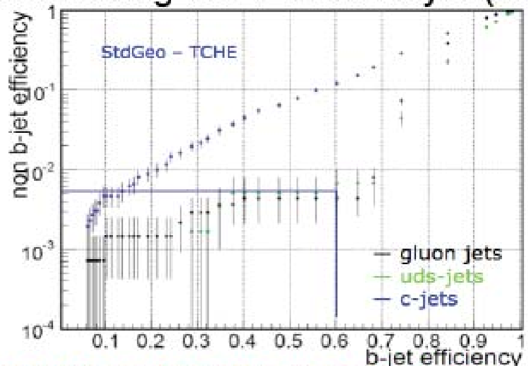
From Feb 11 Status Report:

b-tagging Performance

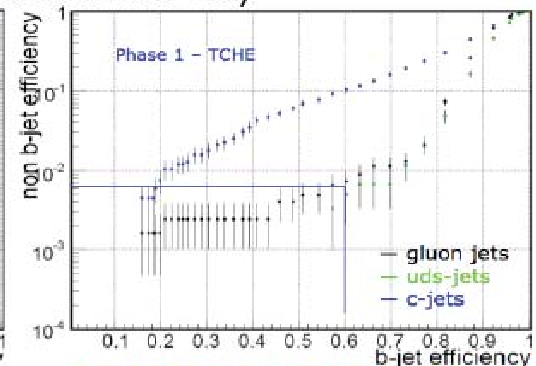
- Using Phase1 geometry using realistic Phase1 disks with problems in negative eta and the quick approach for adding the 4th barrel layer (version from Oct)

- Using 50 –120 GeV jets
- Fastsim using CMSSW_2_2_6
- Track Counting High Efficiency algorithm

Pile-up 0,
restricted to |eta| < 1.4

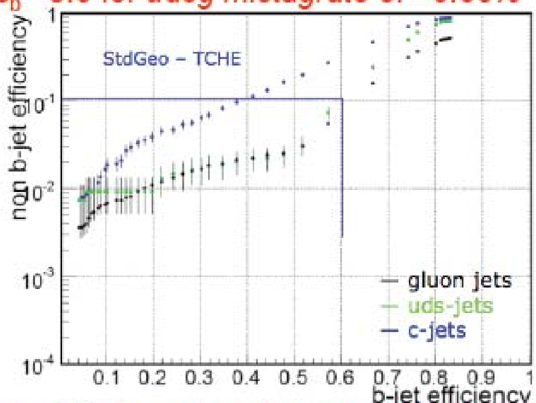


ε_b= 0.6 for *udsg mistagrate of ~0.55%*

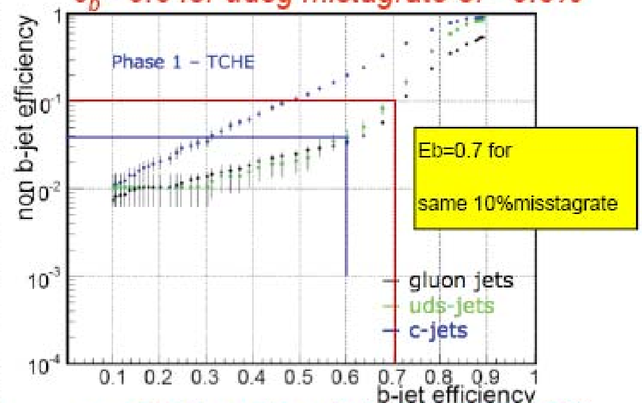


ε_b= 0.6 for *udsg mistagrate of ~0.6%*

Pile-up 100,
restricted to |eta| < 1.4



ε_b= 0.6 for *udsg mistagrate of ~10.0%*



ε_b= 0.6 for *udsg mistagrate of ~4.0%*

John Ellison &
Ferdinando
Giordano

R. Horisberger
CMS UgW, Apr 29th

A lot more activities for Phase I

<u>Pixel Upgrade Phase I</u> - 32-1-A24 (14:00-18:00)

- Conveners: Horisberger, Roland

time	title	presenter
14:00	Introduction & News	HORISBERGER, Roland
14:15	Observed Pixel Rates from 7TeV Data and Implications for the Pixel Upgrade	KOTLINSKI, Danek
14:30	Design Status of Readout Buffered Digital Pixel ROC (PSI46dig)	MEIER, Beat
15:00	Design & Construction of a Ultra Low Mass Supplytube for the 4 Layer BPIX Upgrade	STREULI, Silvan Bjoern
15:20	Power & Cooling: Design Status for BPIX	BERTL, Wilhelm
15:40	Coffee Break	
15:55	Status of mechanical design	KWAN, Simon
16:15	FPIX cooling system studies	HOWELL, Joseph
16:35	Design Modifications for the TBM with Digital Readout	BARTZ, Edward
16:55	FPIX Read Out System	LOS, Sergey
17:15	Simulation of the 4 Layer Pixel Upgrade System	CHEUNG, Harry
17:35	Pixel CO2 Cooling R at CERN	MARQUES PINHO NOITE, Joao

Phase II
Definition and time lines

all upgrades during/after the big shutdown (~2020)

detectors should be able to operate at $L_{peak} = 5x10^{34}$ and up to a L_{int} ~ $3000fb^{-1}$ (~$300fb^{-1}$ per year)

or easy to be replaced

Agreed at the May 2008 Upgrades Workshop
http://indico.cern.ch/conferenceDisplay.py?confId=28746

Upgrade Scope

	System	Phase I	Phase 2
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J. Nash
CMS UgW, Apr 26th

Two comments: schedule and pile-up

- The new time frame for a full tracker Upgrade is 2020÷2022. What are the consequences?
  - The project now looks feasible
    - For the present Tracker in 2000 we had:
      - ASICS developed
      - Links developed
      - Electronics architecture fully defined
      - Started design of hybrids, interconnection electronics, finalize mechanics, etc…
    - Installed the tracker in 2007
    - We will not go much faster (If anything, will need even more strict quality control and longer commissioning)
  - We have a 1÷2 years to keep exploring technologies, then define the system
  - Aim at having basic blocks in hand by 2013÷2015 (at latest)
- A possible ultimate scenario mentioned in Chamonix was 5×10^{34} @ 40 MHz (with luminosity leveling) corresponding to 100 mb / BX
  - 5×10^{34} is a “success-oriented” figure, but the 20 MHz option is not dead!
  - Keep 100 mb/BX as reference (and add some safety margin)

D. Abbaneo
CMS UgW, Apr 29^{th}

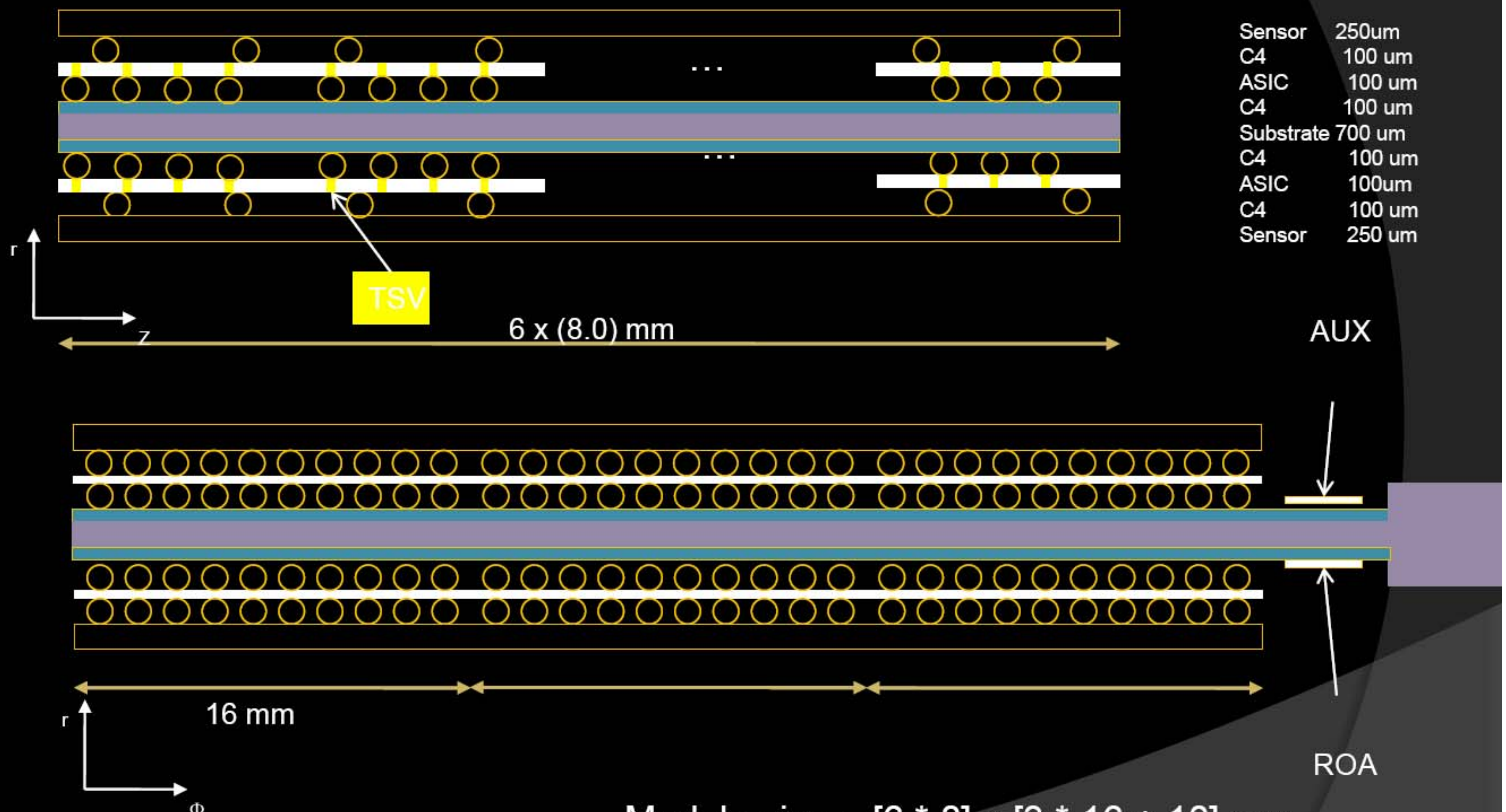
Schedule of the session

Overview of sensors R&D	Frank HARTMANN
Status of the LePix project	Walter SNOEYS
CBC status and perspectives	Mark RAYMOND
Plan for development of a pixellated Pt module	Alessandro MARCHIORO
Development of a strip Pt module	Alberto MESSINEO
Development of 3d electronics	Ronald LIPTON
GBT and optical link	Jan TROSKA
Modelling of Outer Layers	Hans POSTEMA
Overview of layout studies	Duccio ABBANEO

D. Abbaneo
CMS UgW, Apr 29^{th}

Option 2: TSV & BB

(pixellated pt module)

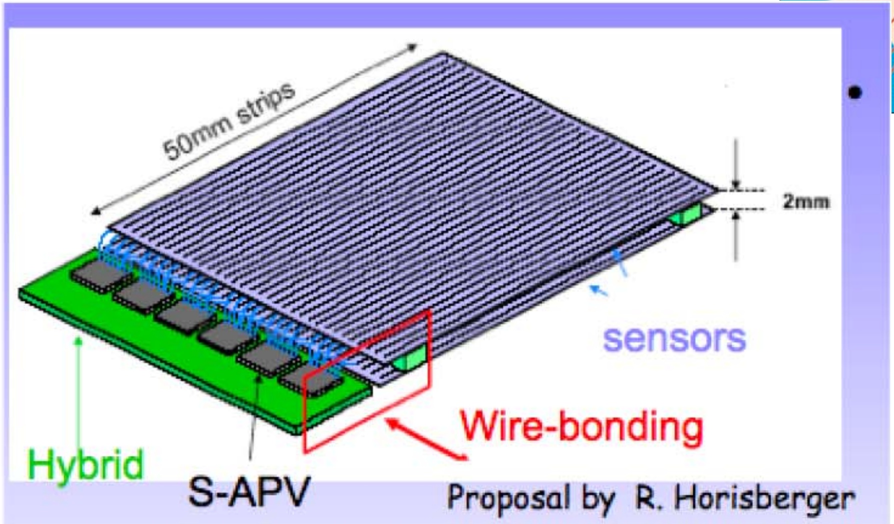


Module size = [6 * 8] x [3 * 16 + 10] mm

A. Marchioro

D. Abbaneo
CMS UgW, Apr 29th

Development of a strip Pt module



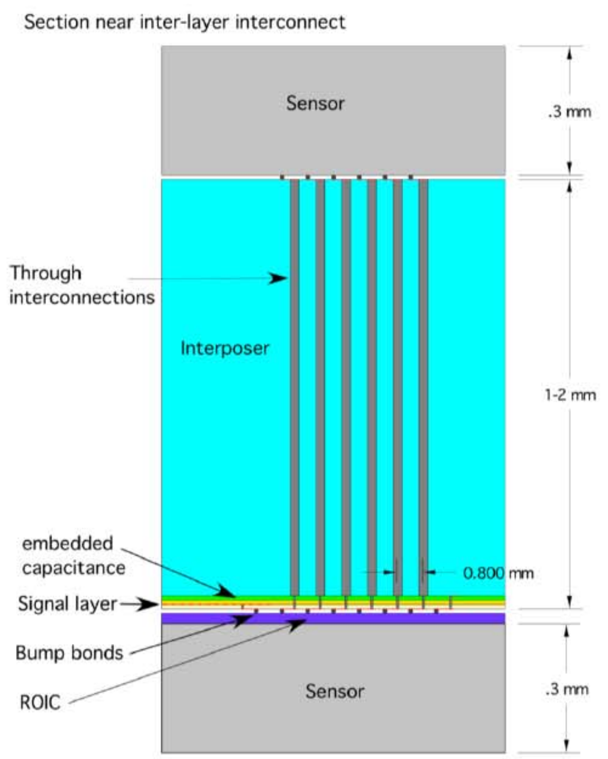
- Performance measured on data from TOB stereo modules
  - Using tracking info to account for stereo angle
- Prototypes built using rejected TIB sensors (two versions)
- Measured on telescope
- First validation of the concept on real data!

A. Messineo

D. Abbaneo
CMS UgW, Apr 29th

3D Trigger module R&D status

- Development of trigger module based on emerging 3D technology
- Electronics only on one side with analogue paths through interposer

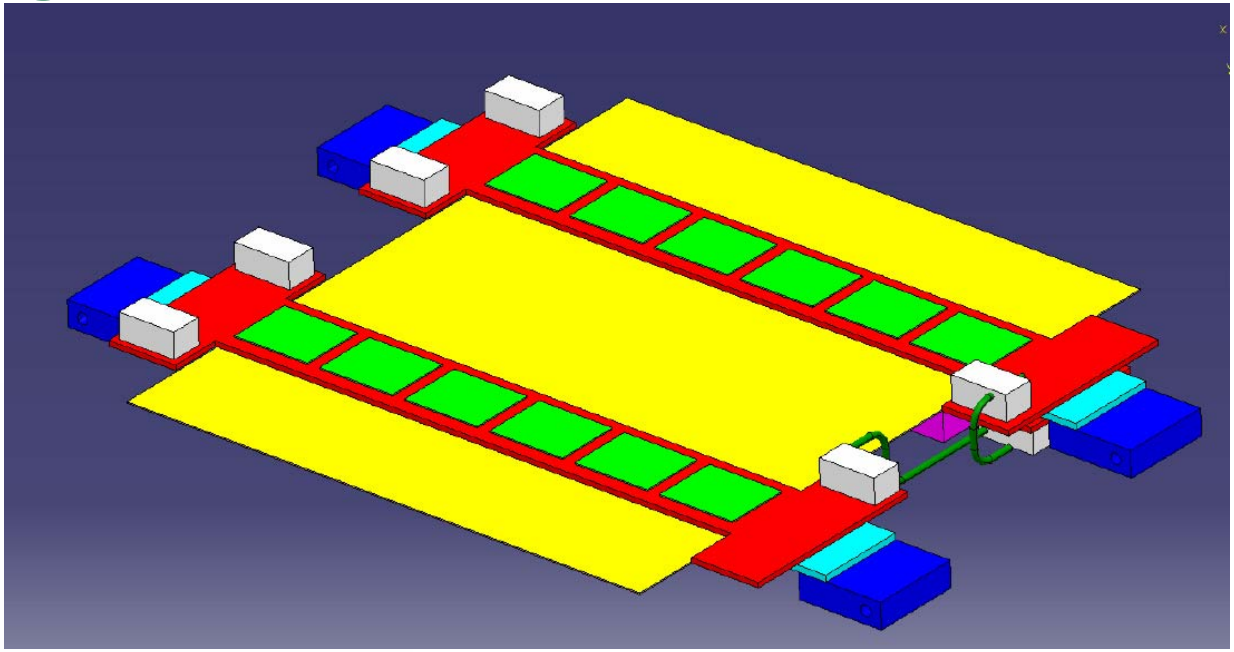


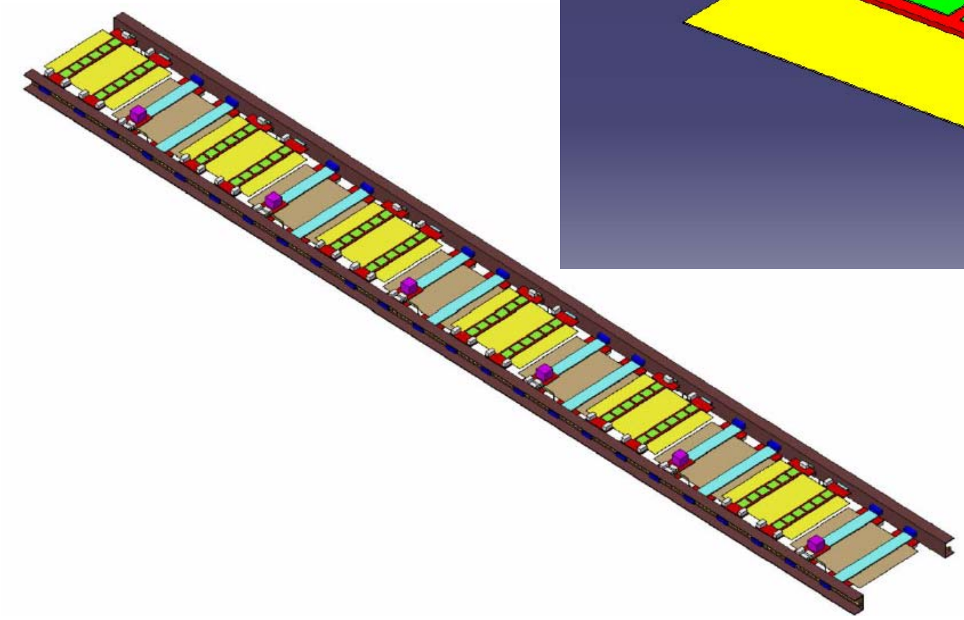
- Demonstration of 3D chip
- Sensor integration
- Development of interposer
- Demonstration of bump-bonding
- Reliable/affordable production of large area devices
- Functionality, data volume and power consumption

R. Lipton

D. Abbaneo
CMS UgW, Apr 29th

3D modeling of outer tracker





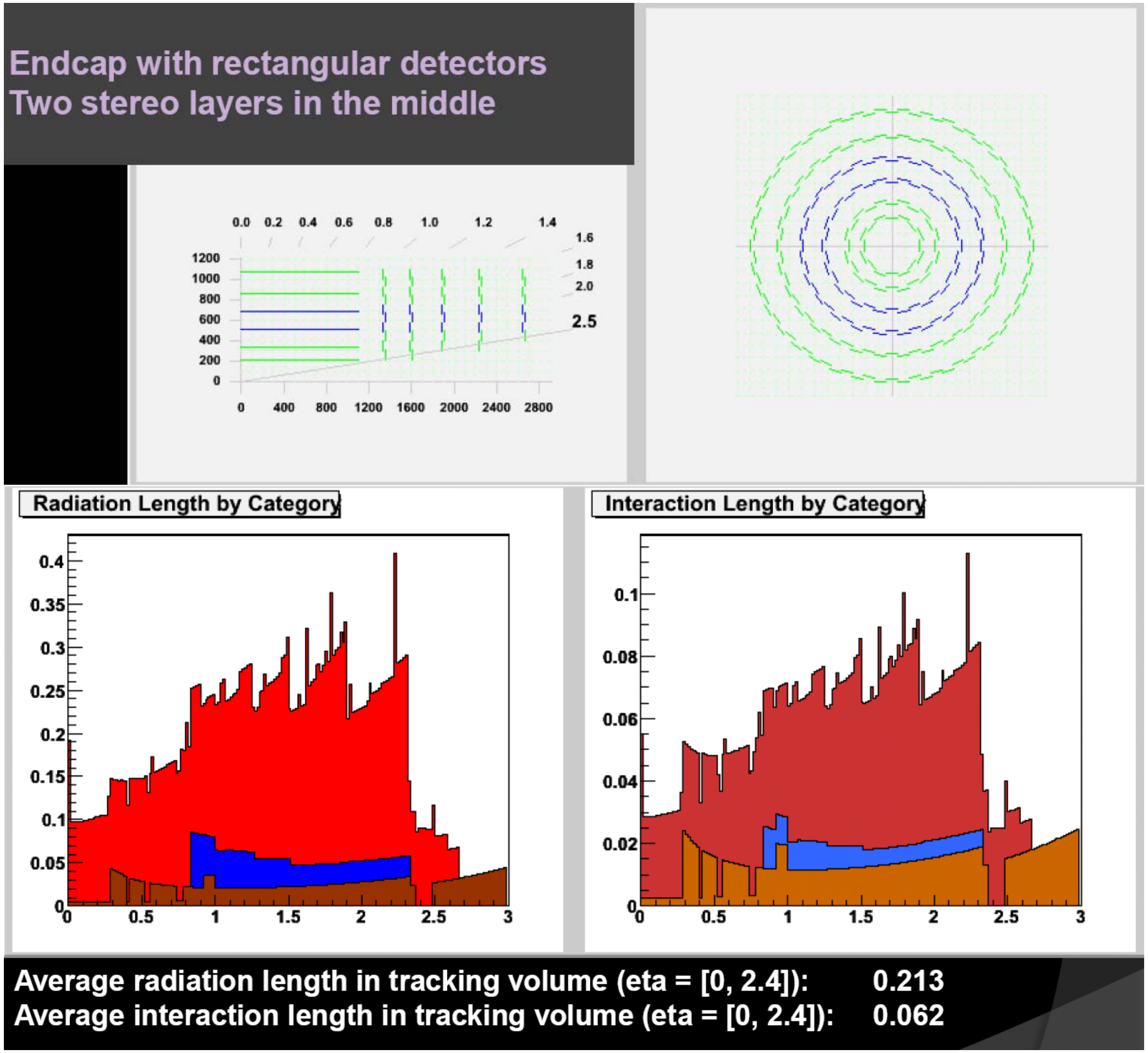
Short strip module
view of hybrid side

and 3D view of rod

more on modules and thermal studies
in next session : A. Mussgiller, J. Olzem

H. Postema
CMS UgW, Apr 29th

The layout tool – model a full tracker



D. Abbaneo
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Next Step : Technical Proposal

Schedule and Scope

- After discussion, Guido would like to have a draft document at the end of June with a final document at the end of the summer (September)
- Scope should be all improvements and upgrades required to maintain/increase the physics potential of the experiment"
  - This includes efforts to
    - cope with aging and luminosity increases
    - Improve efficiency where possible based on operational experience
    - Make the experiment more robust, more efficient, more reliable and easier to maintain
- **We may "project" more than one document out of the parent document**

J. Butler
CMS UgW, Apr 29th

Technical Proposal Scope

- Phase I is the main thrust of this document
- Some mention of the parameters of Phase II
- Main sections
  - Upgrade scenarios overview
  - A Physics performance section
    - How we improve the physics reach of CMS during phase I with each of the upgrades
  - Detector Sections
    - Pixel
    - HCAL
    - Muons
    - Trigger

J. Nash
CMS UgW, Apr 26th

Summary

- Technical Proposal
  - Main focus are phase I upgrades
  - But need to give/check input on parameters for phase II
- Phase II : Tracker R&D
  - 1-2 years for exploring technologies
  - Define basic blocks by ~2014
- Need to crosscheck CEC activities accordingly
  - Today : modules, service, simulations, test beam
  - Tomorrow : Sensors

Thank You !

Questions ?

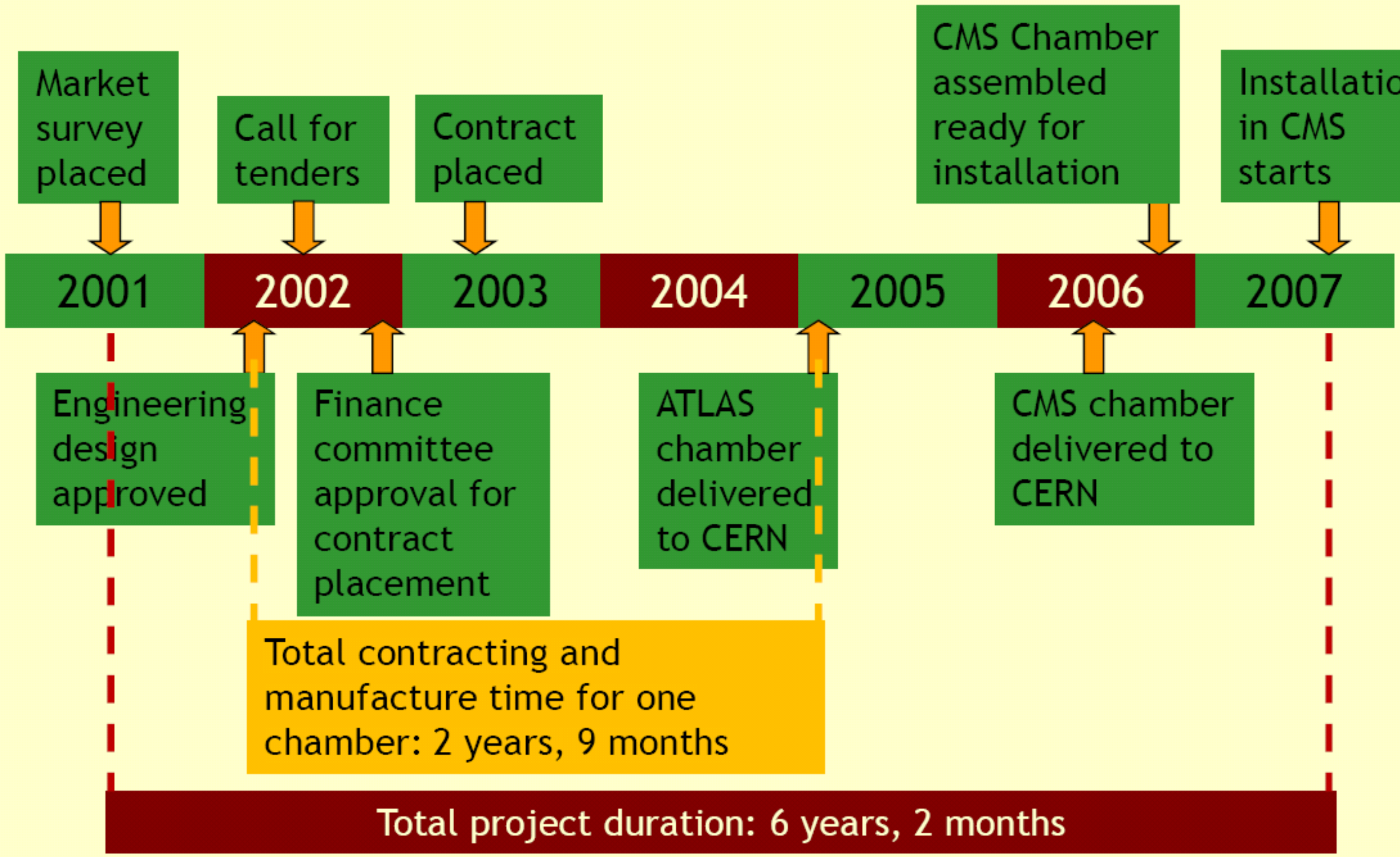
Backup

constraints

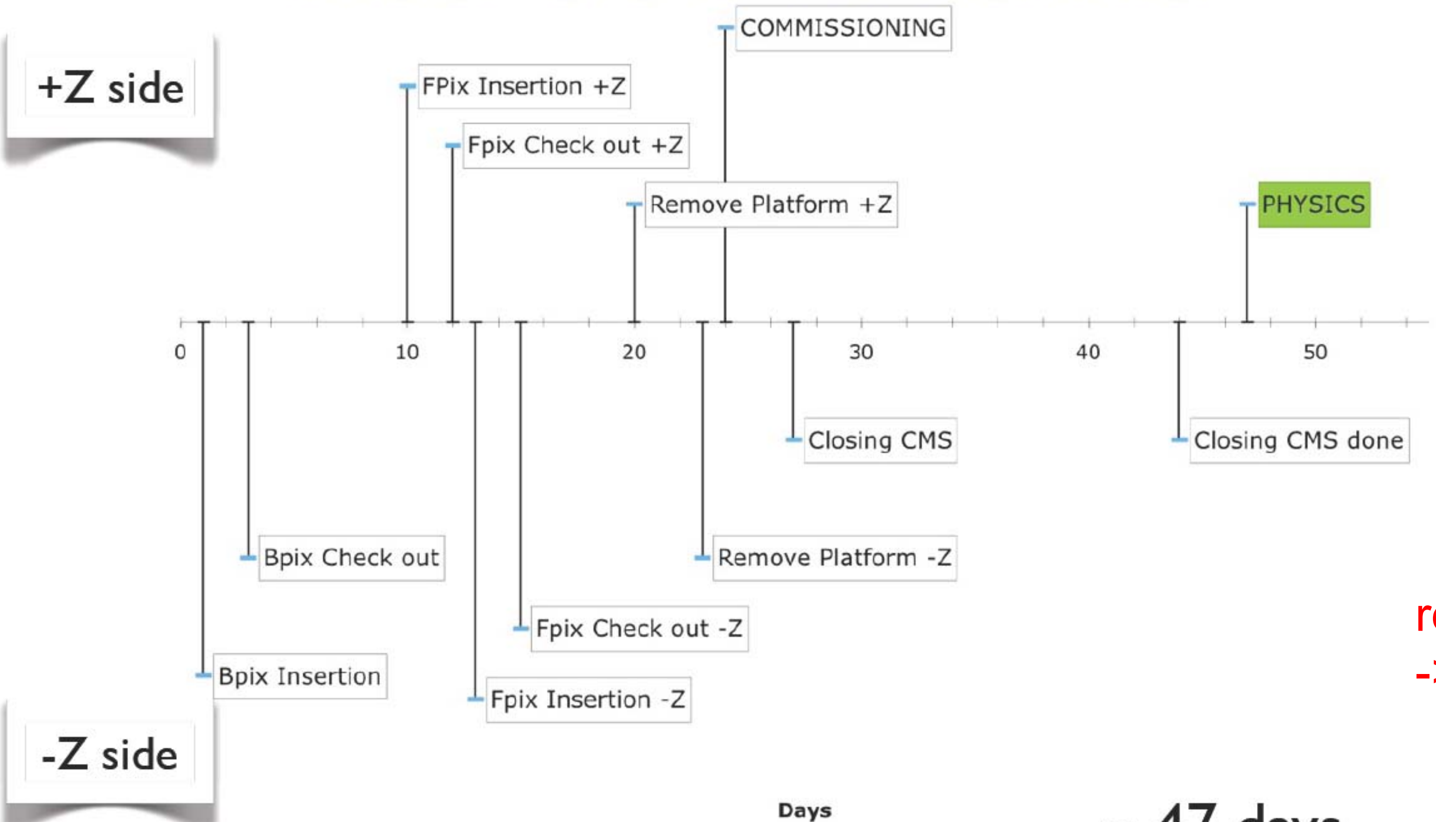
- **total beam-beam tune shift ≤0.01**
  - SPS p-pbar experience
- long-range beam-beam → **crossing angle ≥9σ**
- **arc cooling capacity**
  - global & local limitations, cooling shares with IR
  - heat load from SR, image currents, & e-cloud
- IR layout & optics → β*
- **event pile up** in the detectors (≤300, ≤200?)
- **luminosity lifetime** (≥ 2h? ≥ 5h?))

F. Zimmermann
CMS UgW, Apr 29th

Contract timeline for Installed beryllium pipes



Insertion Timeline



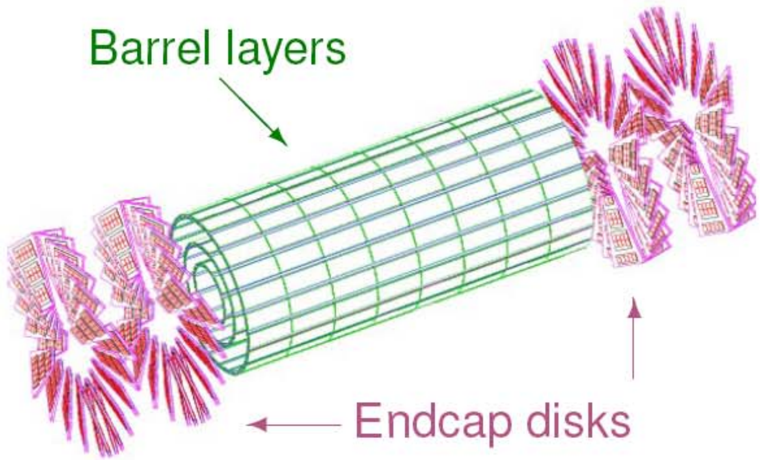
~ 47 days

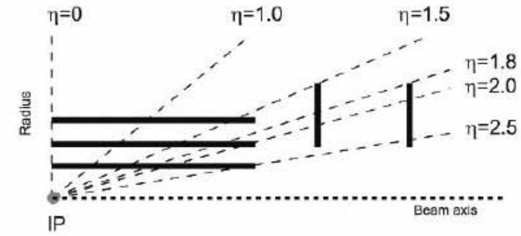
replacing pixel
-> 3-4 months

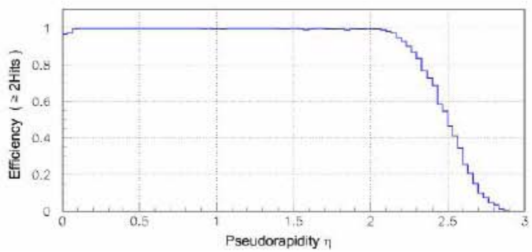
15

CMS Pixel Detector

current pixel



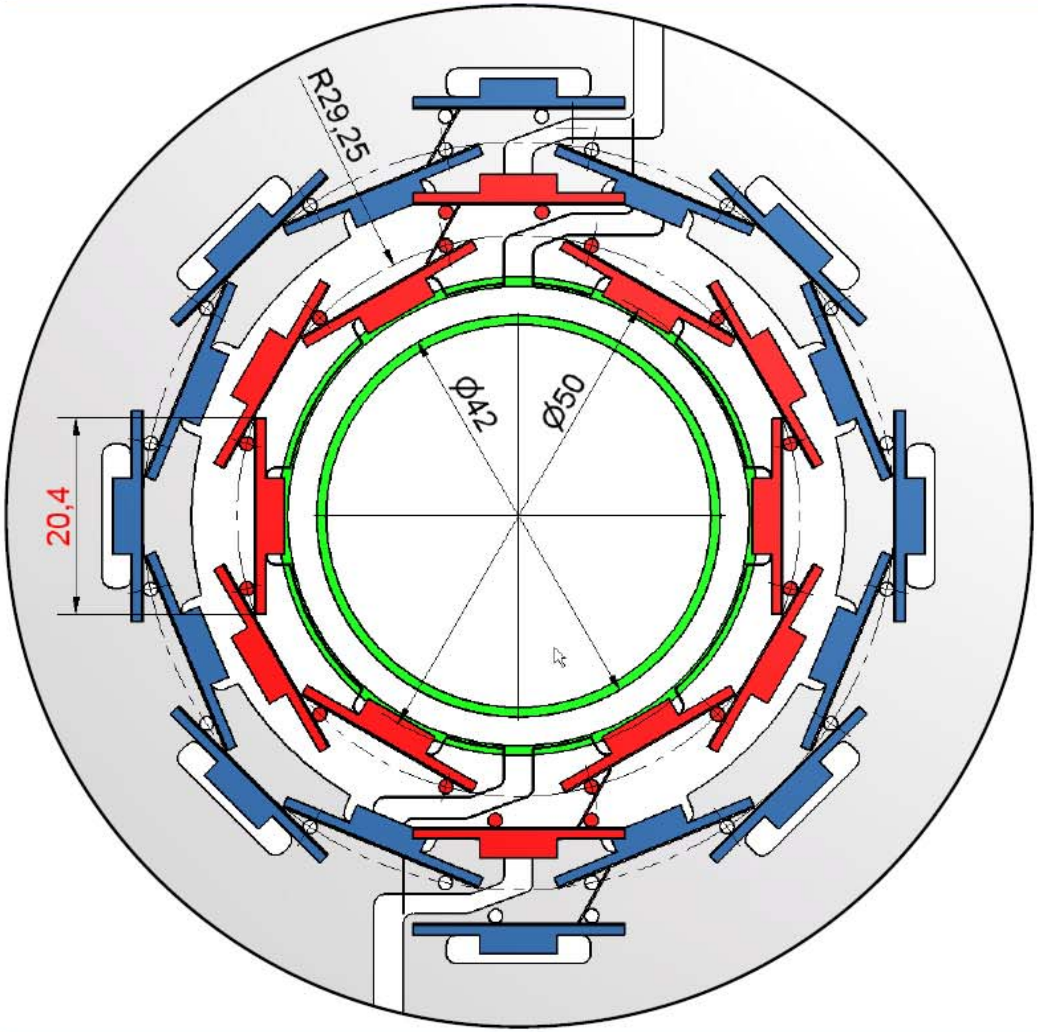




CMS Pixel Detector consists of:

- BPix: $l = 53.3\,cm$, $R = 4.4,\ 7.3,\ 10.2\,cm$, 768 modules, 11520 ROCs, 48 Mpixels
- FPix: $z = \pm 35.5, \pm 48.5\,cm$, $R = 6 \div 15\,cm$, 192 panels, 4320 ROCs, 18Mpixels

5 layer sytem / layer #1 closer to beam pipe ?



5 layer system ?

- To little space between layer #0 (R=29mm; 12 faces) and layer #1 (R=39; 16 faces)
- Not enough optical fibers
- Beam pipe max. D=42mm
- Max. module width can be a problem

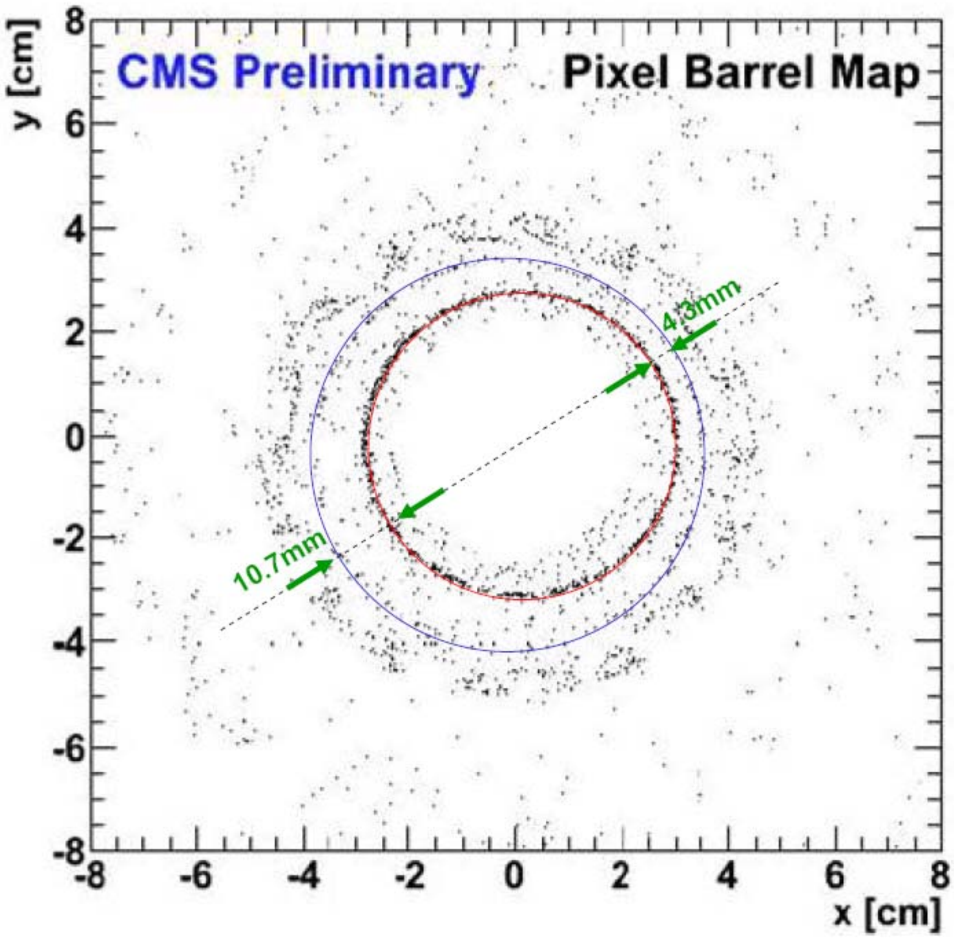
4 layer system ?

- Layer #1 reducing to 12 faces with R=29mm - possible when beam pipe max. D=42mm
- Max. module width can be a problem

S Streuli
TK Upgrade Meeting , Feb 11th

Current BPIX tolerances

Material Tomography by Hadronic Interactions **(Gouzevitch)**



Beam pipe
r_{outer} = 29.8mm

Inner shield
r_{inner} = 37.3mm

Displacement
(observed)

Shield to beam pipe

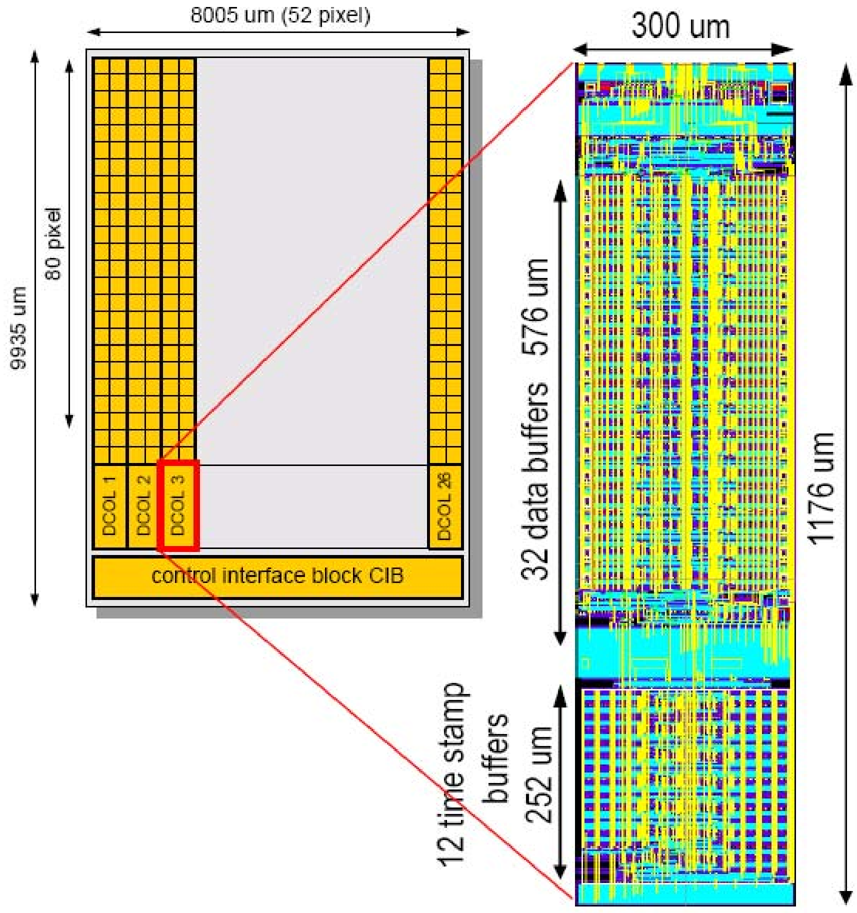
Horizontal: 2.7 mm
Vertical : 1.7 mm

Beam displaced ~2mm asymmetric to pipe!

Why ? We have no idea !

R. Horisberger
CMS UgW, Apr 29th

Enlarge L1 latency Buffers in DCol



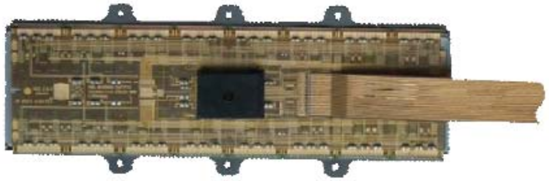
- **Dominant data loss mechanism → larger buffer size**
- Data loss simulations performed
  - Data buffer from 32 to 80 cells
  - Timestamp buffer from 12 to 24 cells
- Simple scaling not possible → ROC to long; not enough space in layer 1 → need more compact buffer layout

R. Horisberger
CMS UgW, Apr 29th

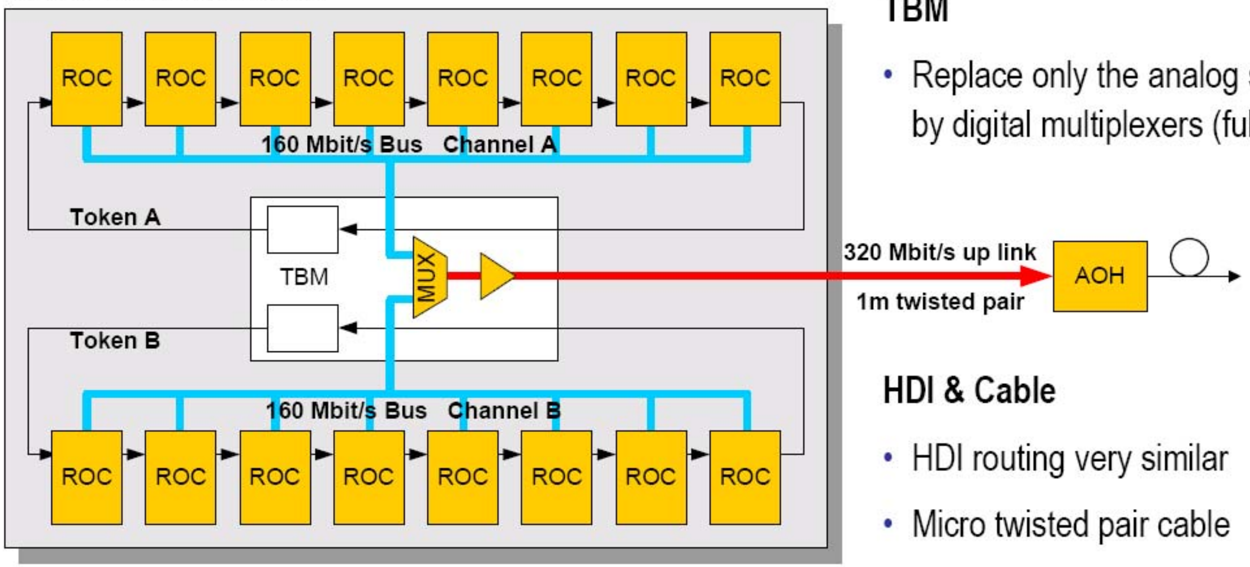
ASIC Modifications Overview

PAUL SCHERRER INSTITUT PSI

1 of 1216 modules (BPIX)



New Readout Scheme



ROC

- Digital readout interface
- increase size of data buffers
- Additional Readout Buffer

TBM

- Replace only the analog switches by digital multiplexers (full digital)

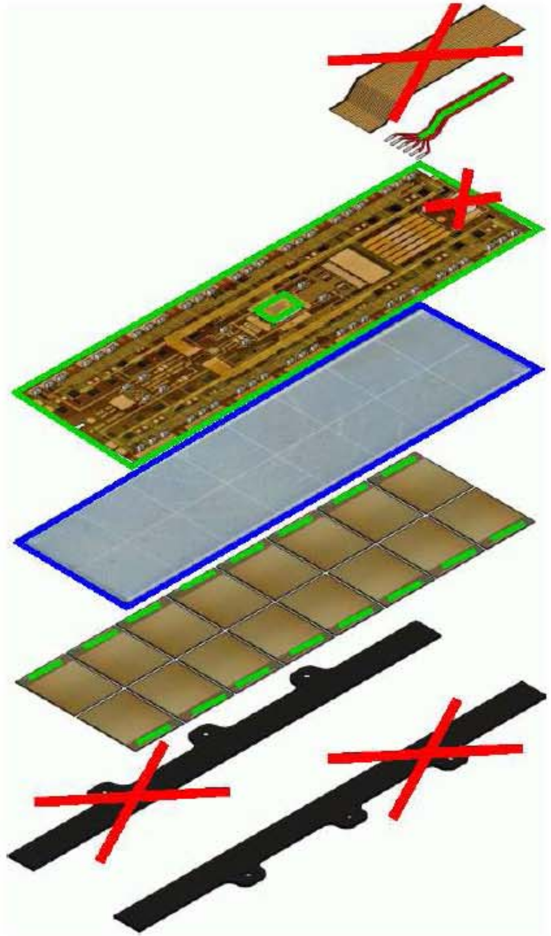
HDI & Cable

- HDI routing very similar
- Micro twisted pair cable

B Meier
TK Upgrade Meeting , Feb 11th

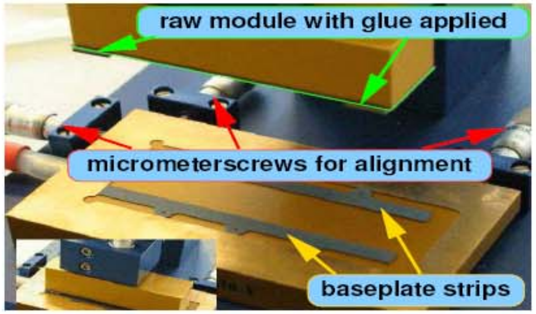
Upgrade BPix module

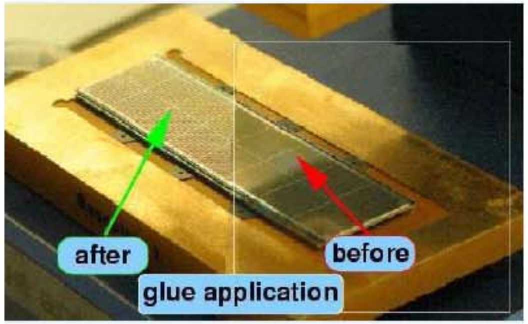
- Single module design: 2x8 ROCs
  - no basestrips (0.47 *g*), instead inter-module strip (0.02 *g*)
  - ROC is thinner: 175 μm goes to 75 μm
  - HDI: smaller components, less connectors (see next)
- Module cable modifications
  - $\sim$ 1 *m* micro twisted pairs cable: low voltages, bias voltage, clock, trigger, I2C, data
  - work is going on in PSI with help of PIRE students
- Material budget reduction
  - upgrade module is $\sim$46% of current one
  - new cable is $\sim$56% of currently used
  - no plugs/port-cards in active area

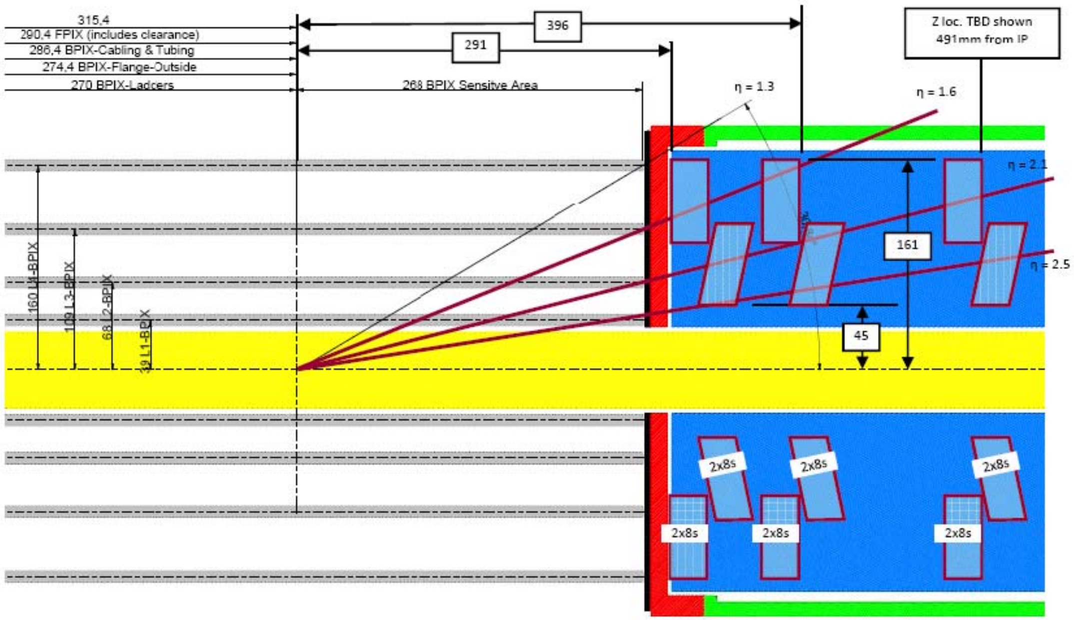


Assembly line (PSI)

- Production rate:
  - 4 full + 2 half modules / day
  - or 6 full modules / day
- Three gluing steps:
  - glue basestrips to raw module
  - underfill sensor with glue
  - glue HDI to complete assembly
- Important: custom-made tools







Based on Morris Swartz's study, it's possible to optimize the layout to obtain excellent resolution in both the azimuthal and radial directions throughout the FPix acceptance angle since we have separate inner and outer blade assemblies.

Inverted cone array combined with the 20 deg Rotated Vanes for the inner blade assembly is thus decided.

Material Budget Estimate

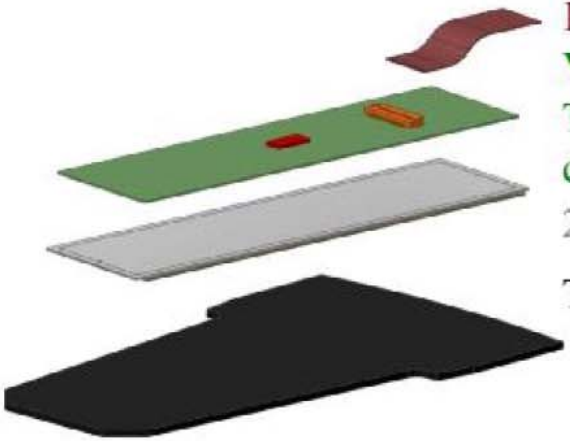
Item	Current (%RL)	Upgrade (%RL)
Sensors+ ROCs	0.50	0.50
VHDI+substrate+ components	0.93	0
HDI+substrate+ components	0.80	0.70
Cooling channel + coolant	1.25	0.04
Outer & inner ring	0.68	0.48
Total per blade	**4.16**	**1.72**

The goal of reducing the material by 50% is feasible, primarily by removing the VHDI and by using CO2 cooling for a x10 reduction in the mass of the cooling channels and coolant.

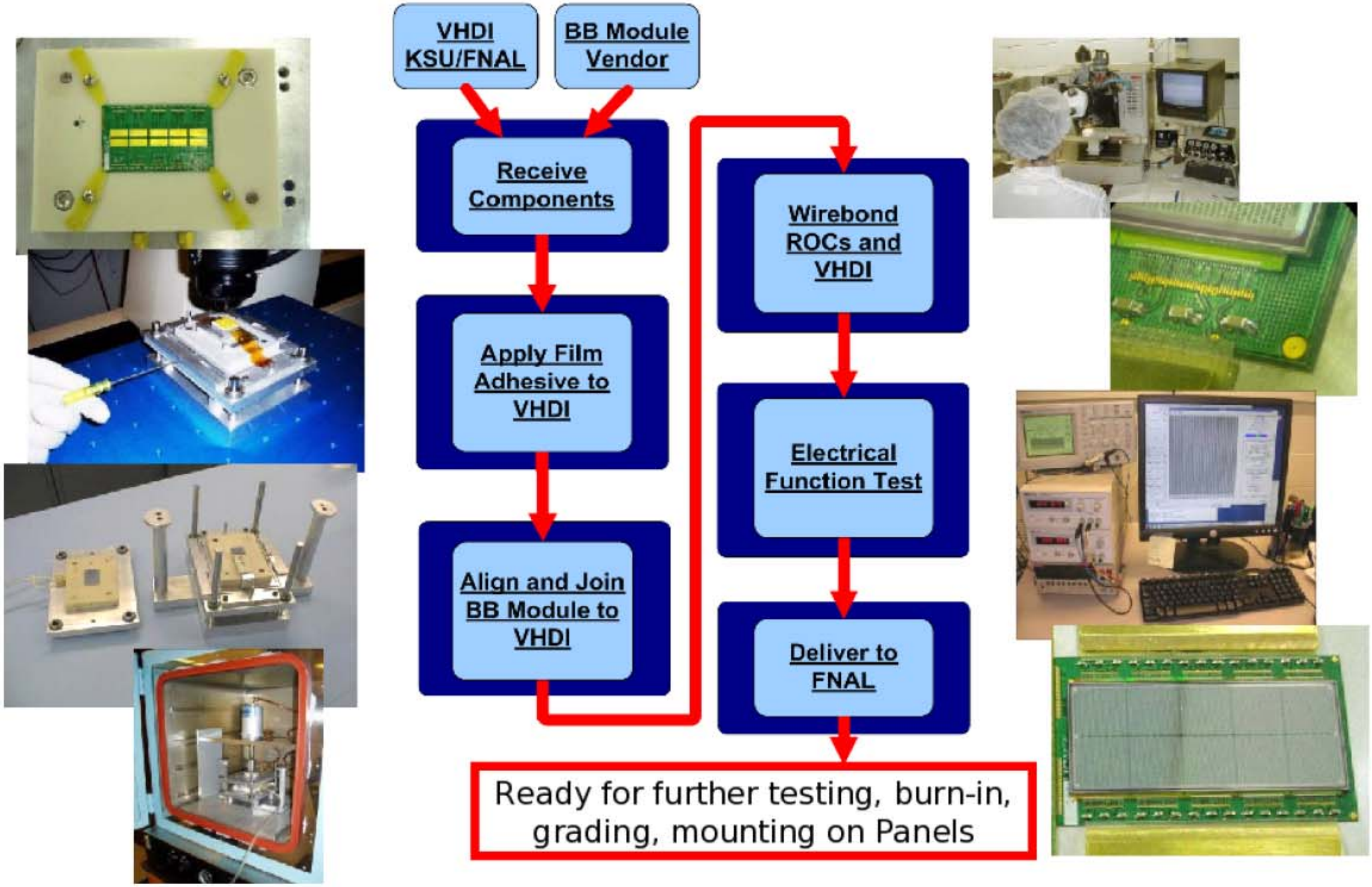
Upgrade FPix module

- Single module design: 2x8 ROCs
  - BBM mounted directly on TPG (high heat transfer substrate) for cooling
  - VHDI and TBM chip are placed on top of the module
  - reduced number of module thermal (adhesive) interfaces: less material and thermal impedance, fewer assembly steps
  - Easier to assemble and test

- 2010 Goals
  - Commissioning of new flip-chip alignment/placement machine (in support of upgrade pixel sensor development)
  - Assemble Phase 1 module prototypes to evaluate adhesives, interconnects, and develop module assembly tooling and procedures

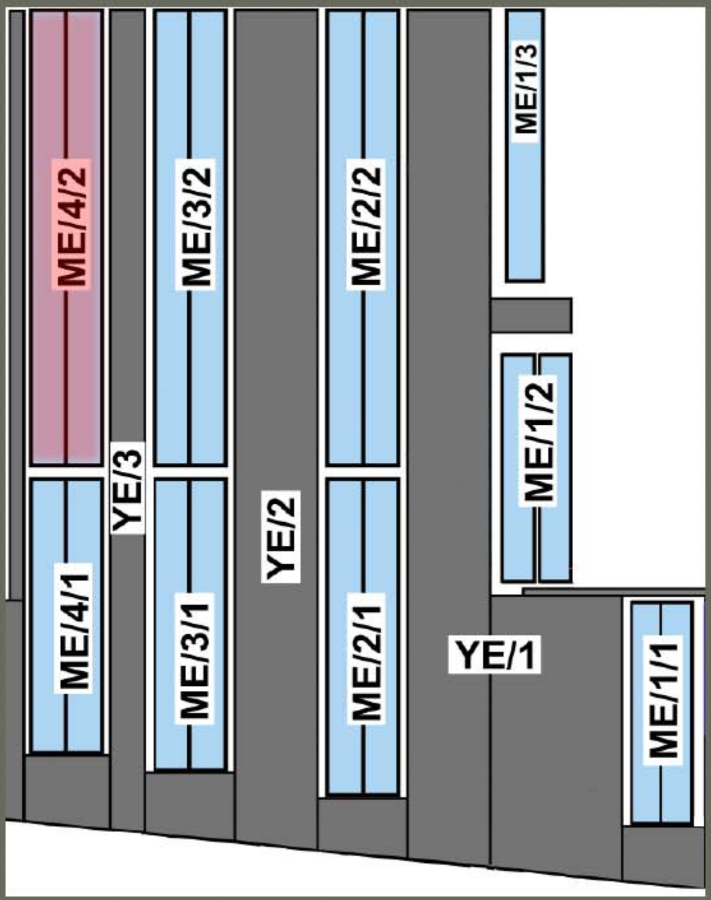


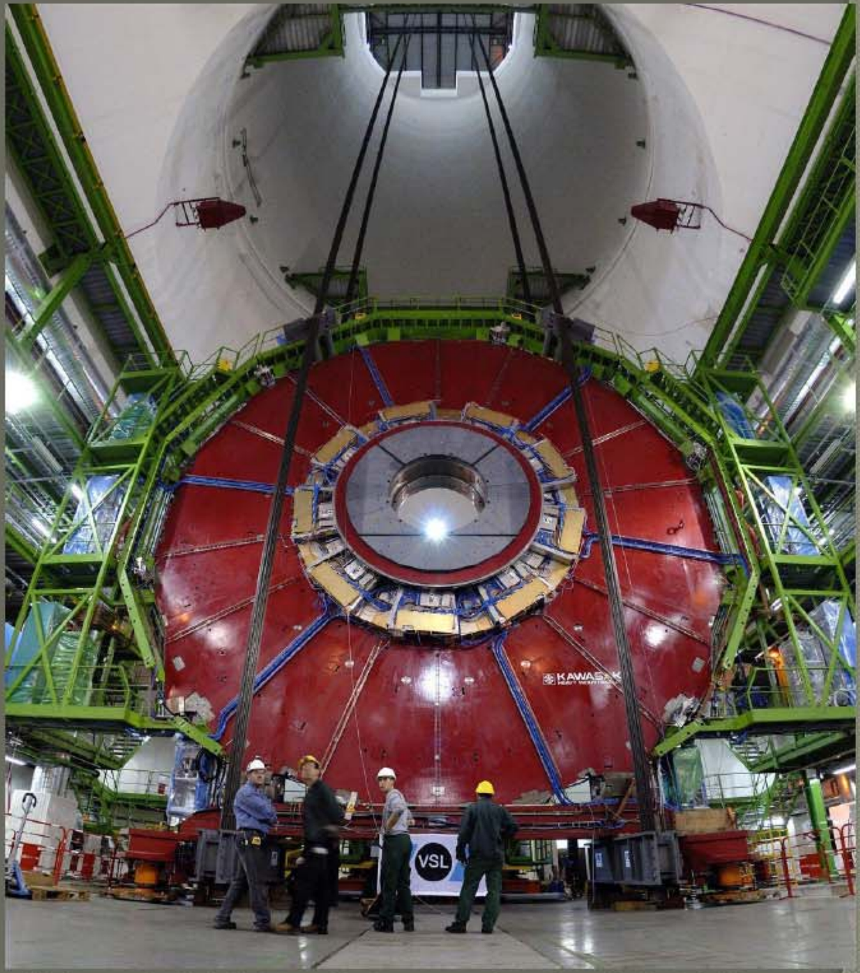
Plaquette assembly line (Purdue)



ME4/2 upgrade

R-Z cross-section



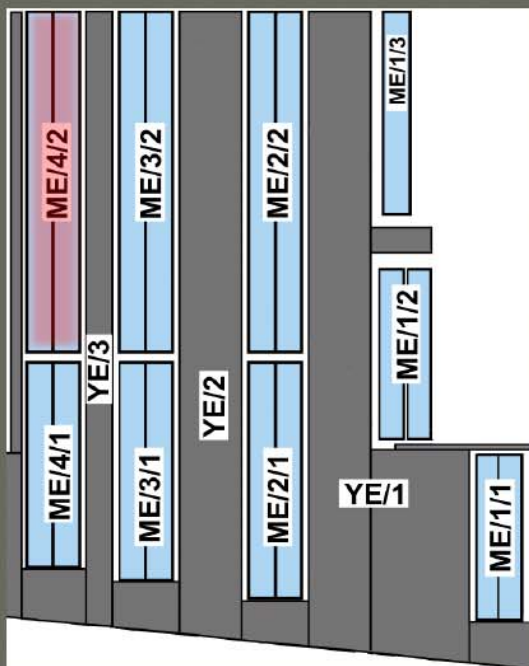


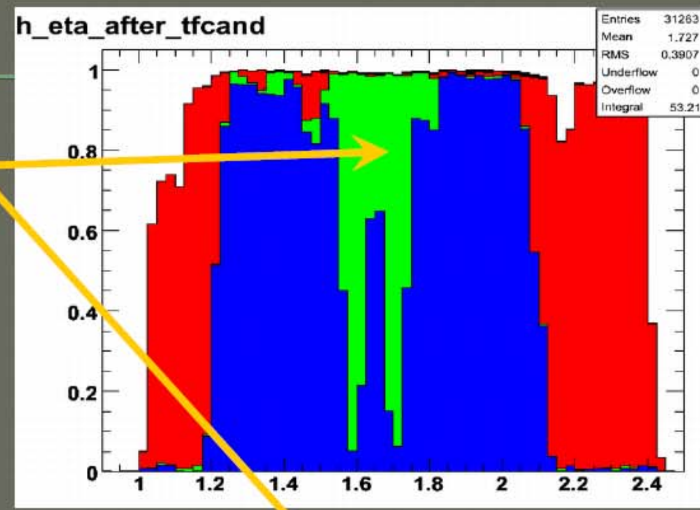
“Empty” YE3 disk ready for ME4/2

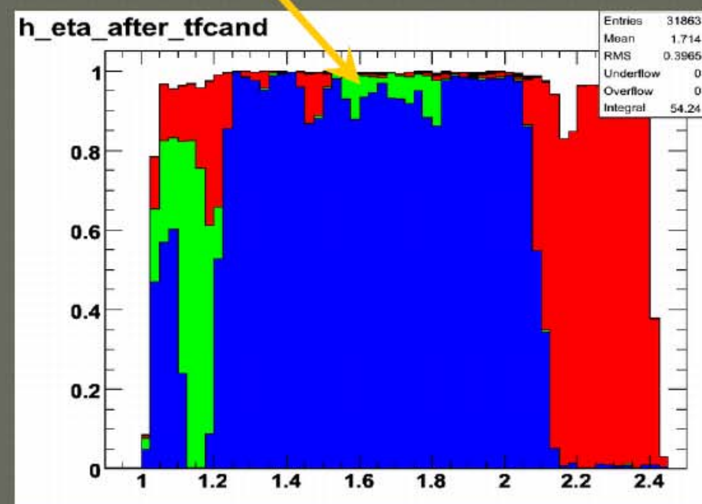
A. Safonov
CMS UgW, Apr 29th

ME4/2 Upgrade

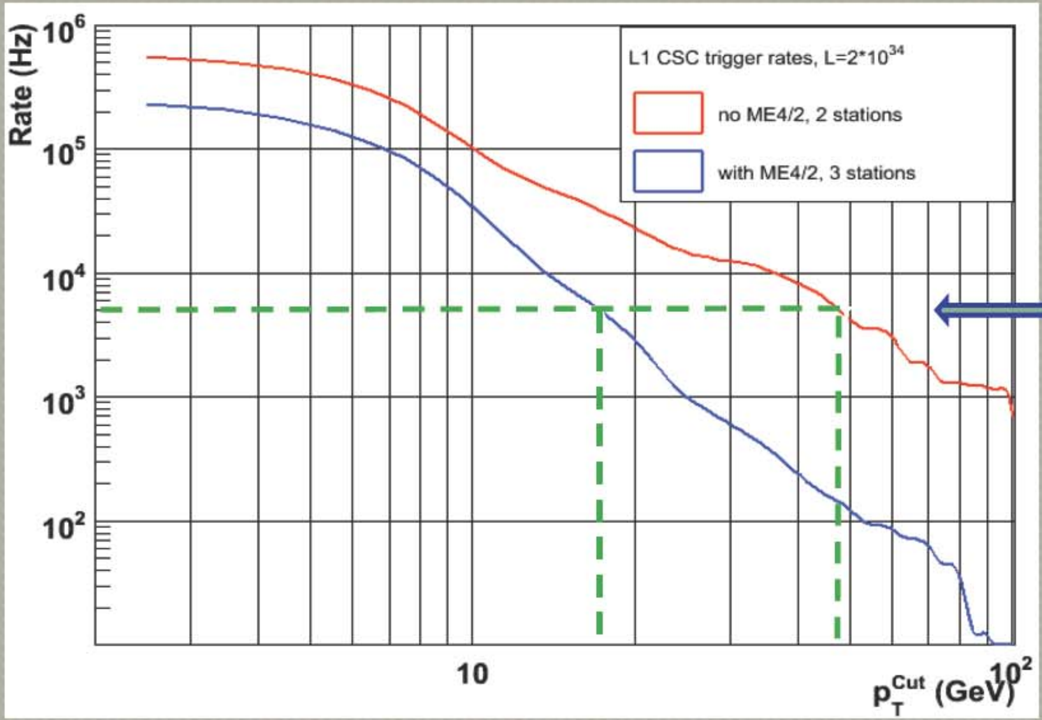
- Efficiency gaps for good quality CSC TF tracks disappear with addition of ME4/2







- Improvement on single muon threshold with ME4/2
  - Level 1 trigger threshold is reduced from 48 → 18 GeV/c



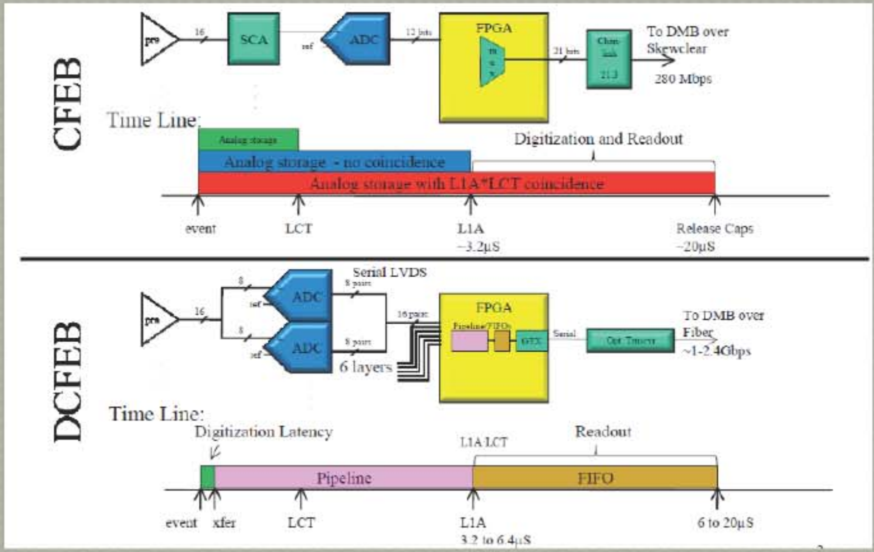
Target Rate
5 kHz

Ingo Bloch, Norbert Neumeister, Rick Wilkinson

P. Zotto
CMS UgW, Apr 29th

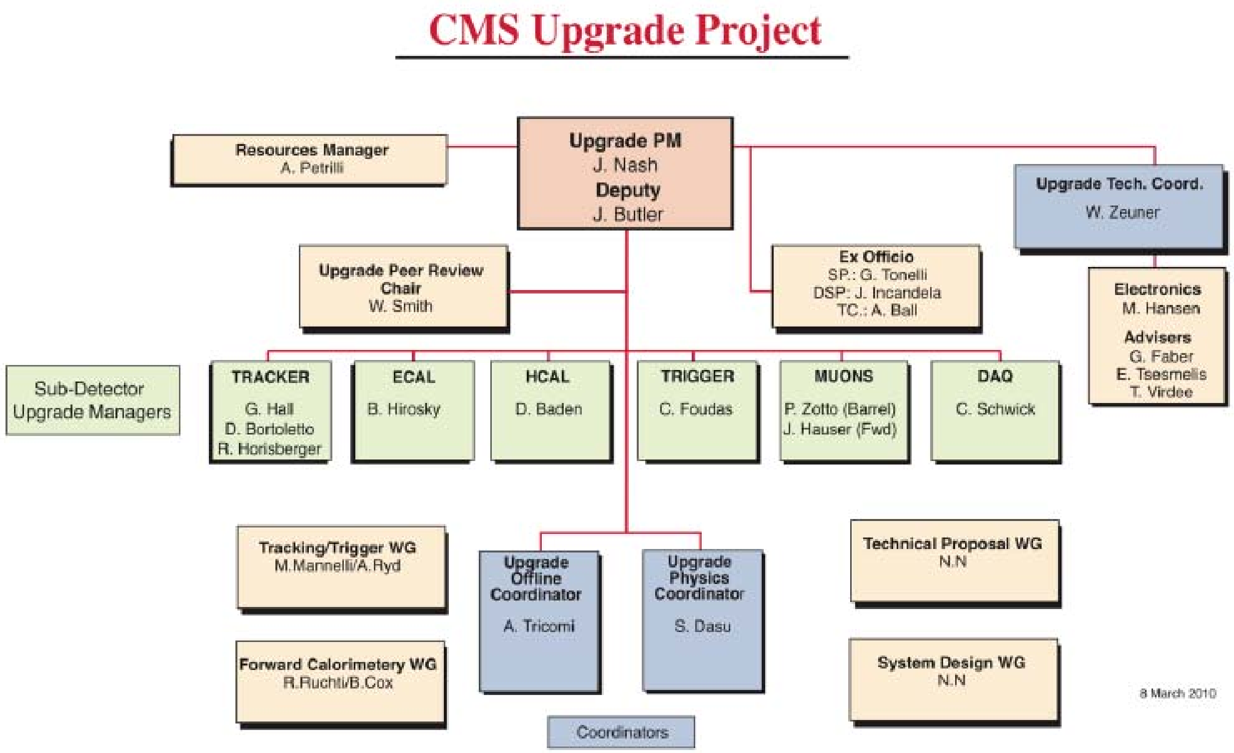
ME-1/1: New Digital (D)CFEB

1. Replace Conventional ADC and SCA storage with Flash ADC and Digital Storage
   - Deadtimeless, no rate worries
   - Similar cost to old system
   - Fairly radical design, i.e. couldn't build 8 years ago



- Complex board: analog and digital in one (noise!)
- Output: skewclear (CFEB) → fiber (DCFEB)
- DCFEB upgrade forces upgrade of TMB and DMB

Upgrade project organization



J. Nash
CMS UgW, Apr 26th