

USING BCM1F IN 2011 IMPROVEMENTS FOR 2012 LESSONS FOR 2014

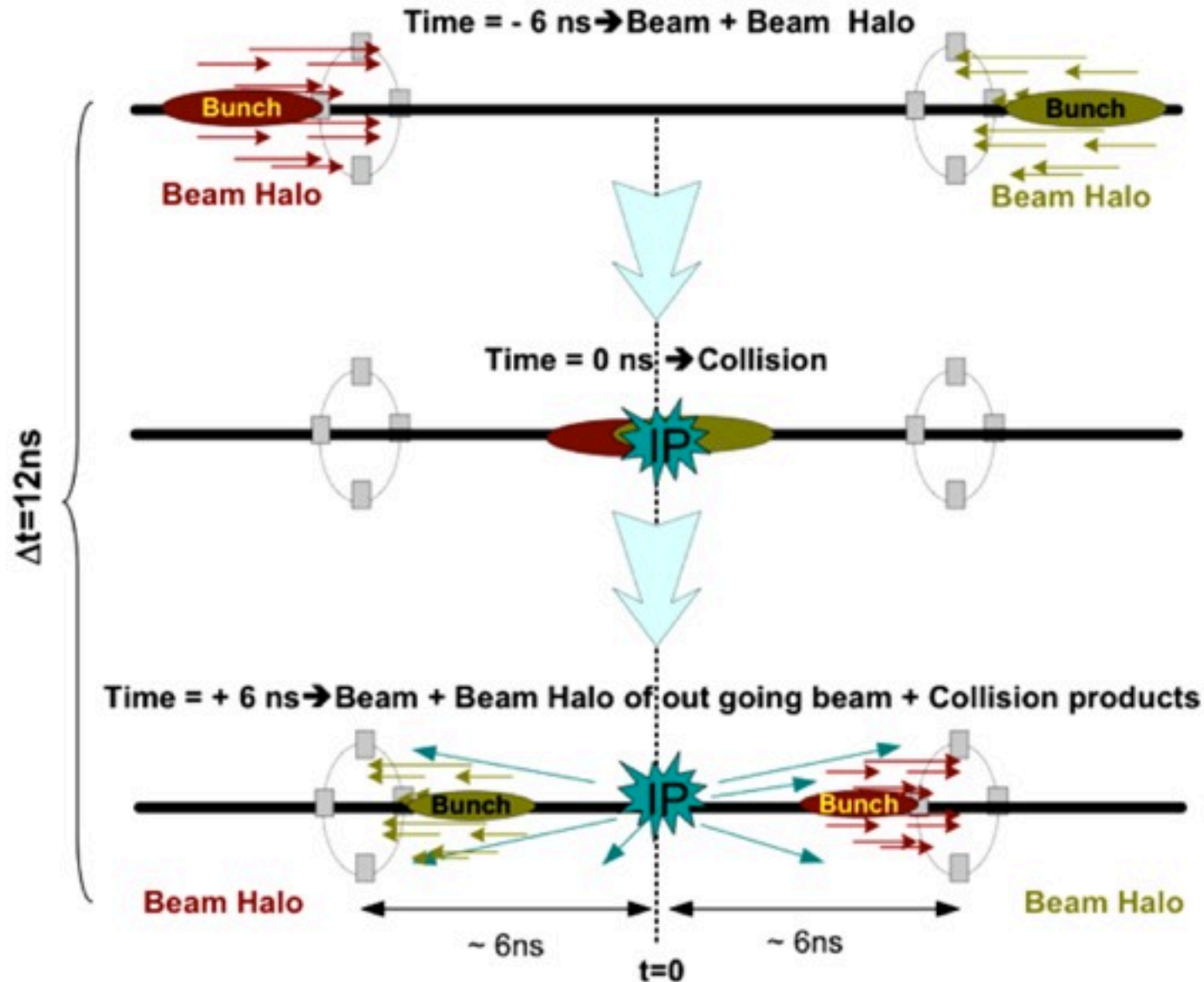
(SORRY, CHANGE OF TITLE!)

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2/2/12**

HOW DID WE USE BCM1F IN 2011, HOW WOULD WE LIKE TO USE IT IN 2012? WHAT ARE THE LESSONS FOR THE FUTURE?

- BCM1F FORMED THE CORE OF OUR BACKGROUND MONITORING.
 - WE ALSO STARTED TO USE IT FOR LUMINOSITY MONITORING (SEE NATE TALK)
- BKGD1 COMPARES BCM1F RATE TO THAT EXPECTED GIVEN THE LUMINOSITY
- BKGD2 MONITORS BEAM-GAS (ESSENTIALLY INCOMING RATES AS OPPOSED TO OUTGOING RATES)
- BKGD3 IS ABORT LEVEL FROM BCM1L AND BCM2

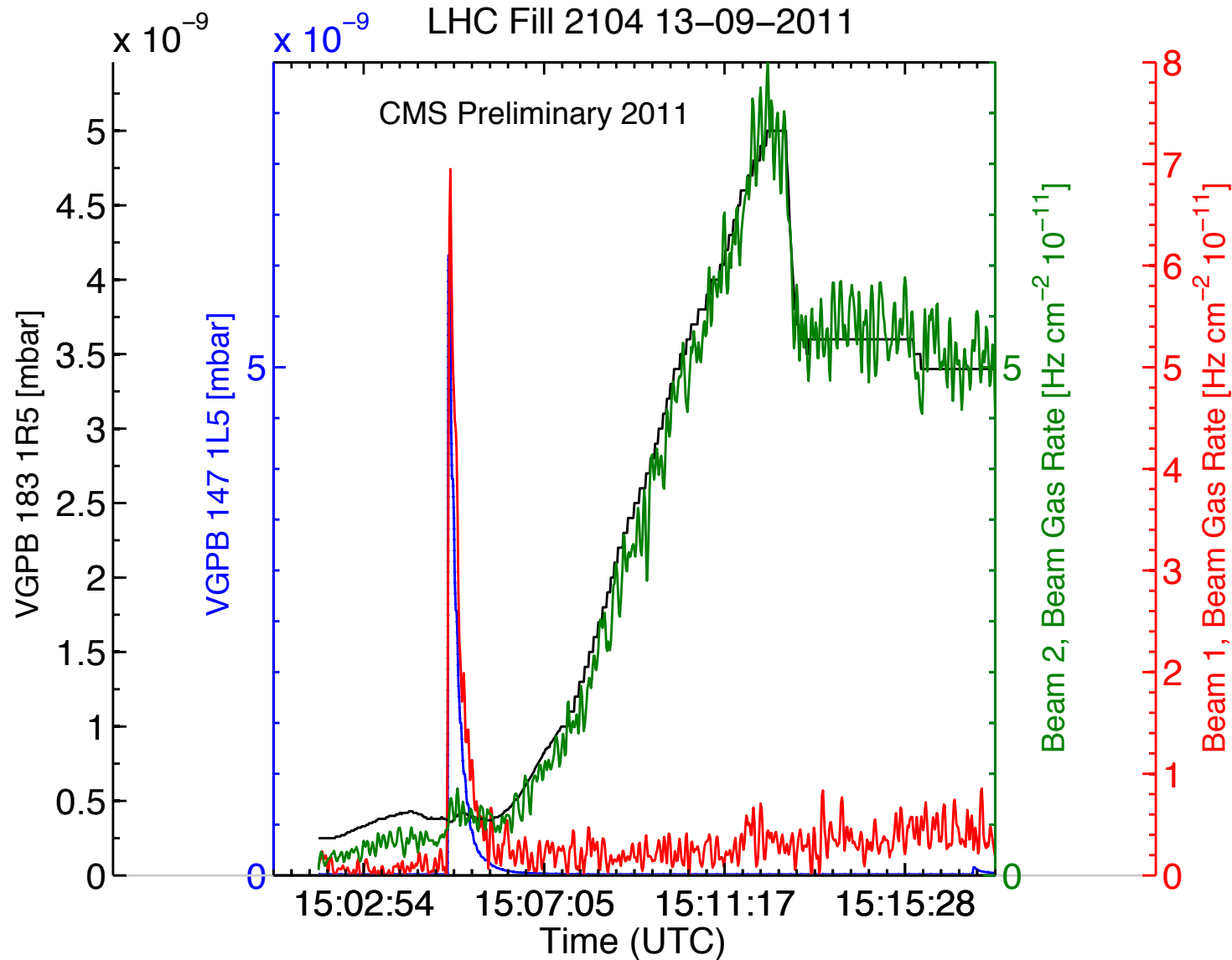
ROBERVAL PICTOGRAM



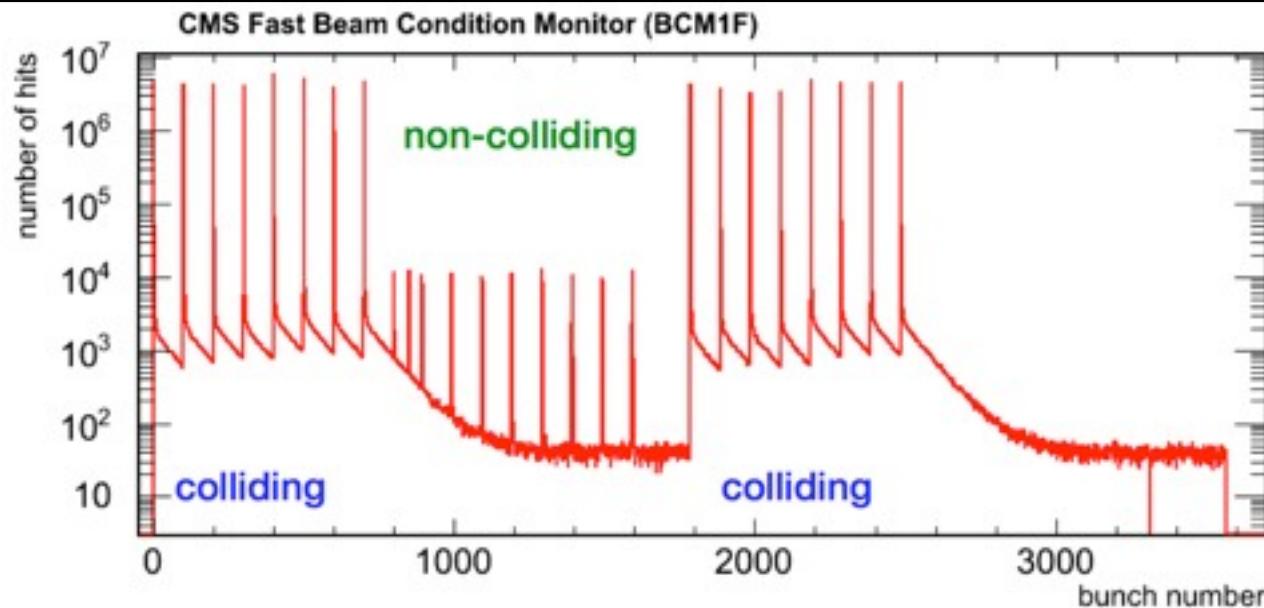
BKGD2

- ONLY HAD AVAILABLE -Z AND +Z OR SIGNALS
 - JUST BECAUSE OF SHORTAGE CABLE DELAYS ETC, NOTHING FUNDAMENTAL
- USING BPTX WE GENERATE GATES IN TIME WITH COLLISIONS AND IN TIME WITH INCOMING BEAM
 - BUT INCOMING RATES ARE DOMINATED BY ALBEDO HITS IN THE BUNCH TRAINS
 - SO WE RESTRICTED SAMPLE TO NON-COLLIDING BUNCHES LONG AFTER THE PREVIOUS COLLISION
 - TYPICAL RATES ARE $\sim 1 \text{ Hz/cm}^2/1 \text{ E}11$

FAST VACUUM SPIKE ON BEAM1 INCOMING SIDE AND PROBLEMATIC VACCUM RISE DURING RAMP ON BEAM2 SIDE



ALBEDO



- ALBEDO HITS ARE PRESENT THROUGHOUT THE ORBIT, THEY FALL OFF STEEPLY AFTER COLLISIONS, BUT ARE STILL $\sim 1\%$ OF COLLISION RATES.
- IN HIGH INTENSITY PP RUNNING WE SEE UP TO 100/ HITS/ORBIT/CM² (1MHZ) IN A COLLISION WINDOW(5NS)
- THAT IS 1KHZ OF ALBEDO IN AN INCOMING BEAM GATE, APPROXIMATELY EQUAL TO THE RATE FROM BEAMGAS...

REDUCING ALBEDO

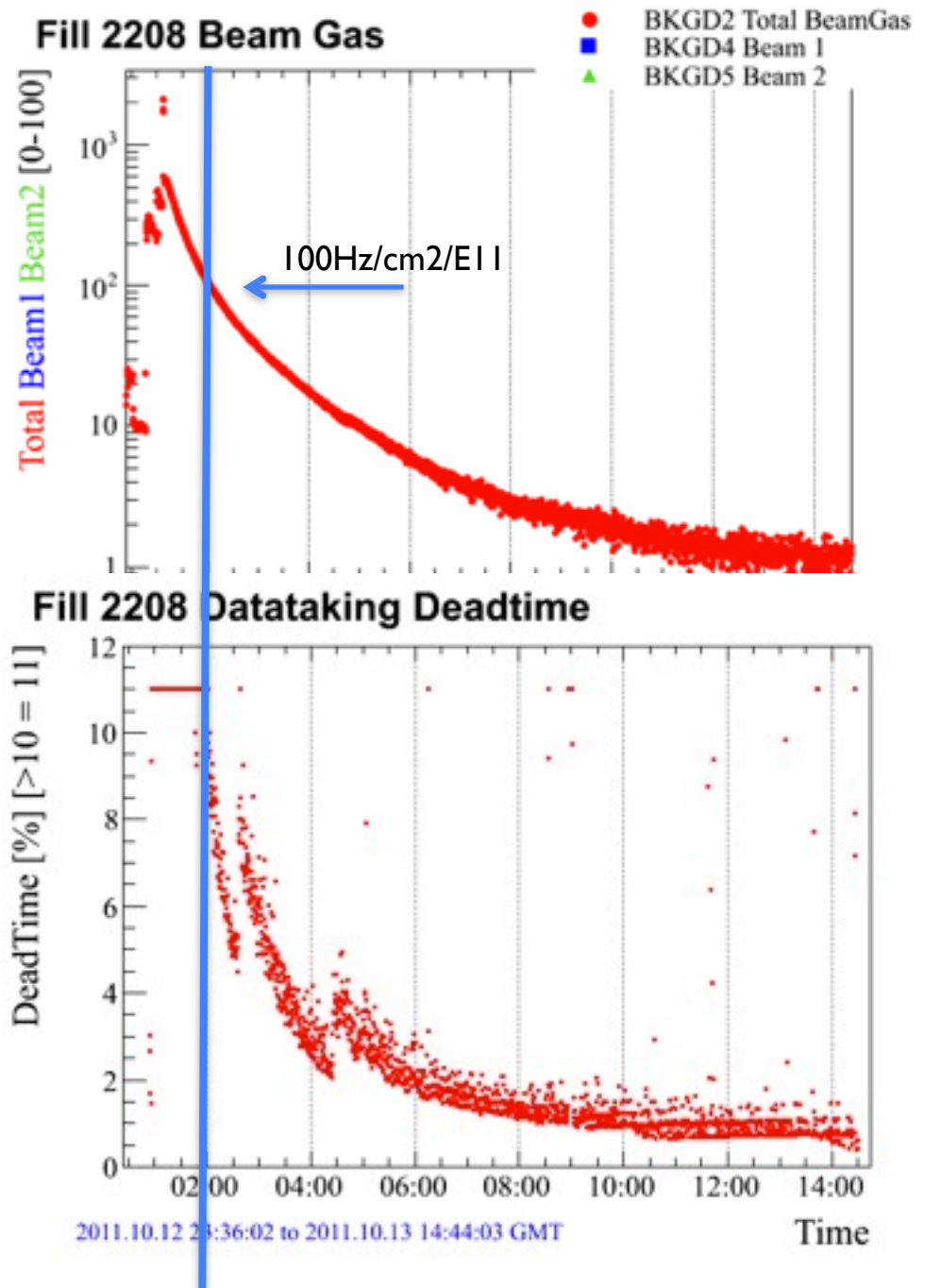
- **USE ONLY THE SUBSET OF BUNCHES LONG AFTER A COLLISION (LEADING NC BUNCHES)**
 - **CALCULATE AND SUBTRACT ALBEDO FOR THESE BUNCHES (LOOK 100NS BEFORE THE INCOMING BEAM)**
- **MEASURE AND SUBTRACT ALBEDO DURING COLLISIONS - NOT GOOD IF RATES OF ALBEDO AND BEAMGAS ARE SIMILAR**
- **GATE MORE SHARPLY IN TIME (BUT GOING BELOW 5NS SEEMS TO KILL EFFICIENCY ALSO)**
- **REQUIRE MULTIPLE DIAMOND HITS IN THE SAME GATE**

CHANGES FOR 2012

- HANS PREPARES AN FPGA SOLUTION AVOIDING ALL NIM, CABLE DELAYS ETC!.
 - MAY NEED EXTENSION AS WE UNDERSTAND MORE USE-CASES
- BACKUP NIM SOLUTION EXTENDED AND RATIONALIZED...
 - VERY USEFUL FOR UNDERSTANDING/DEBUGGING/ DEVELOPING NEW ALGORITHMS
- CREATE GATED OUTPUTS FOR EACH DIAMOND:
 - COLLISION GATE
 - INCOMING GATE
 - ALBEDO GATE (25NS-ADJUSTABLE BEFORE INCOMING GATE)
 - RECREATE EQUIVALENT BKGD SIGNALS AS USED IN 2011
 - OR'S AND MULTIPLICITY OUTPUTS FOR COLLISIONS AND INCOMING BEAM
- AIM TO USE FADC/TDC/HISTOGRAM SOLUTIONS (OTHER TALKS) TO STUDY BUNCH BY BUNCH CONDITIONS

CAN BRM TAG POTENTIAL PIXEL PROBLEM-READOUT EVENTS WITH THE BCM1F?

- BCM1F GENERATES BKGD2 SIGNALS, WITH DEMONSTRATED SENSITIVITY TO BEAM GAS
- COINCIDENCES WITH INCOMING BEAM TIMING. BKGD2 UNITS Hz/CM2/E11
- IN 2012 WE WILL COMMISSION FPGA BASED LOGIC TO GENERATE 4 INDEPENDENT INCOMING BEAM GAS SIGNALS PER SIDE.
- REQUIRE MULTIPLE HITS. TODAY WE CANNOT ANSWER THE EFFICIENCY/FAKE QUESTIONS, WE NEED MORE DATA.
- REDUCIBLE BACKGROUND FROM ALBEDO IRREDUCIBLE BACKGROUNDS FROM “HALO”
- WE SUSPECT THAT BAD EVENTS FOR PIXEL CORRESPOND TO HIGH FLUXES OF SECONDARIES FROM BEAMGAS COLLISION PRODUCTS. POSSIBLY SCRAPING?
- PROPOSAL IS TO SEND 8 TECHNICAL TRIGGER BITS (4-Z, 4+Z) TO PERMIT ANALYSIS WITH A VIEW TO GENERATING AN EVENTUAL “VETO” IF JUSTIFIED AND



BCM1F IN DATA STREAM

- UNTIL NOW BCM DATA IS TOTALLY ASYNCHRONOUS FROM CMS TRIGGERS, OUTPUT STATES ARE NOT LOGGED WITH DATA
- TO IMPLEMENT THE “VACUUM ANTIDOTE” THE BCM1F SIGNALS MUST BE AVAILABLE TO STUDY AND EVENTUALLY VETO EXTREME BEAMGAS EVENTS
- SEND THE 8 DIAMOND BEAMGAS COINCIDENCES TO TECHNICAL TRIGGER.
 - PERHAPS IMPORTANT ALSO FOR EVENTUAL PHYSICS ANALYSES - IF YOUR EXOTIC EVENT HAS A LOT OF INCOMING BEAM GAS ACTIVITY PERHAPS YOU SHOULD THINK TWICE BEFORE ANNOUNCING YOUR DISCOVERY...
 - BCM1F INCOMING GATED SIGNALS ARE UNIQUE IN CMS (?) AS THEY ARE COMPLETELY UNBIASED BY COLLISIONS (ASSUMING CAUSALITY!)
 - (IF SPECIFIC “ANTIDOTE” SOLUTIONS ARE UNDERSTOOD WE CAN DO THIS LOGIC AND SEND SINGLE BITS TO THE TT ALSO)

THANK YOU ZEUTHEN

- WHEN BCM1F WAS PROPOSED, BUILT AND INSTALLED, I DONT THINK ANYONE REALISTICALLY FORESAW JUST HOW POWERFUL IT WOULD BE
- THE PROJECT HAS BEEN 99% CARRIED BY THE ZEUTHEN GROUP WHO TURNED THIS INTO A POWERFUL SYSTEM FOR CMS
- THE OTHER 10% (SIC) OF THE DEVELOPMENTS HAVE BEEN DUE TO BRAINSTORMING SESSIONS WITH NICOLA, ANNE, MYSELF AND THE ZEUTHEN GROUP, WHO HAVE ALWAYS RESPONDED POSITIVELY AS WE PROPOSED WILD IDEAS THAT UNDERMINED THEIR “BEST LAID PLANS”..
THANK YOU