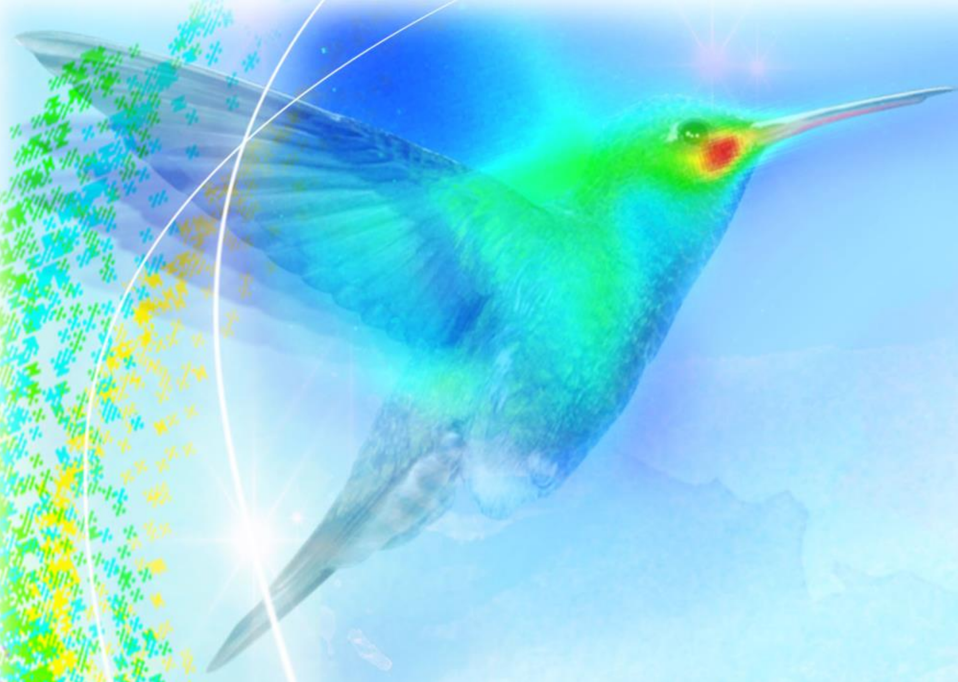


BIW 2012

Highlights & History

Hosted by
Jefferson Lab
Kevin Jordan, Program Chair

Where was it?

- Central East Coast, USA
- Newport News, Virginia
  - Hosted by Jefferson Lab
- Venue
  - Marriott City Center
- Banquet
  - Virginia Living Museum

Thanks to You!

- 134 attendees from 27 countries
  - 2 Tutorials
  - 11 Invited talks
  - 19 Contributed talks
  - 69 posters
- 50 institutions represented from 14 countries
- 17 vendors + 3 sponsors
- Proceeding published on JACoW
  - Preliminary proceedings available at: http://www.jlab.org/conferences/biw12/

Origins of BIW

BIW12

The Beam Instrumentation Workshop (BIW) was started to provide a forum for in depth discussions of techniques for measuring charged particle beams produced in high energy accelerators. The large US and European Particle Accelerator Conferences dedicated a few sessions to instrumentation, making it difficult to have significant interaction among those in the field. It became apparent to Dick Witkover at BNL that a conference or workshop dedicated to instrumentation was needed.

After meetings with representatives from the other National Labs across the US the first Accelerator Instrumentation Workshop was held at Brookhaven National Laboratory in 1989.

Total of 15 BIW Meetings

- 1989 BNL; Co-Chairs Gerry Bennett, Richard Witkover, Ed Beadle
- 1990 FNAL; Elliot McCrory
- 1991 CEBAF (JLab); Walter Barry
- 1992 LBNL; Co-chairs Jim Hinkson, Greg Stover
- 1993 LANL; Co-chairs Robert Shafer, Mike Plum
- 1994 TRIUMF; Co-chairs George Mackenzie, Bill Rawnsley
- 1996 APS-ANL; Alex Lumpkin
- 1998 SSRL/SLAC; Co-chairs Robert Hettel, Steve Smith
- 2000 MIT-Bates; Co-chairs Ken Jacobs, Coles Sibley
- 2002 BNL; Co-chairs Gary A. Smith, Thomas Russo
- 2004 ORNL/SNS; Co-chairs Tom Shea, Coles Sibley
- 2006 FNAL; Co-chairs Jim Zagel, Robert Webber
- 2008 LBNL; Co-chairs Fernando Sannibale, Walter Barry
- 2010 LANCE/LANL; J. Doug Gilpatrick
- 2012 Jefferson Lab; Kevin Jordan

There was food…

And Drink…


Leinenkugel's
1888 BOCK
Heineken
BREWED IN HOLLAND
PREMIUM QUALITY
Corona
Extra
LA CERVEZA MAS FINA
12 FL.OZ.
BUD LIGHT
Miller
Lite

Enthusiastic Vendors

Please thanks our vendors they are part of our community
& their support is greatly appreciated!

BIW12

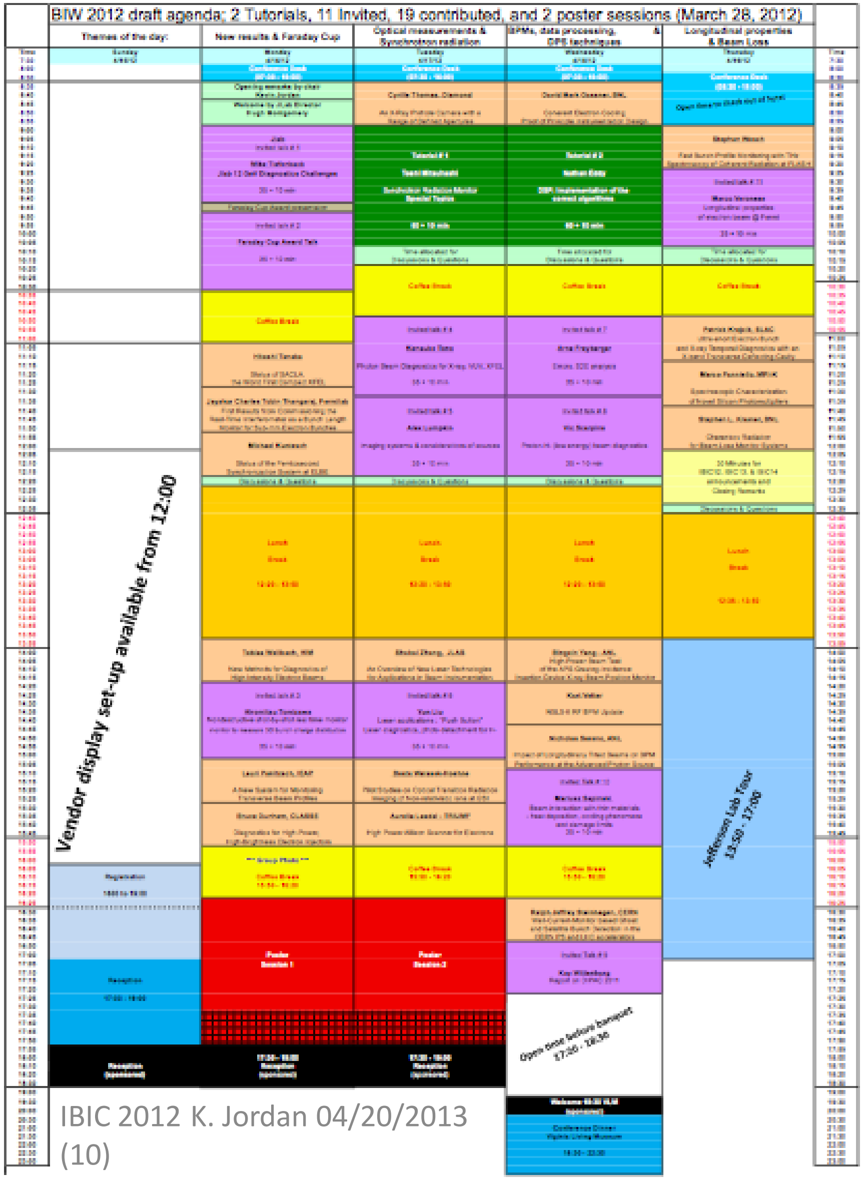
Plenty of Time for Good Interactions!

Jefferson Lab

Posters Were Up Entire Conference

BIW12

- Venue large enough to have posters, vendors & breaks in common area
  - No need for 'Poster Police'
- 'Refreshments' & food followed poster sessions promoting extended discussions into the evening
- Generous vendor support enabled this!



Jefferson Lab

Student Fellowships

BIW 2012 was able to support 5 student fellowships

Renuka Krishnakumar
Technische Universität Darmstadt

Martin Espig & Christian Eckardt (unable to attend)
Technische Universität Darmstadt

Auralee Morin
Colorado State University

Ling-Ying Lin
Michigan State University

Tutorials

These are a key part of the IBIC series
Perhaps combine all on BIGnet?

- Synchrotron Radiation Monitor; Special Topics
  – Toshi Mitsuhashi

- FPGA Based Digital Signal Processing – Applications & Techniques
  – Nathan Eddy

2012 Faraday Cup Award Winner
Marek Gasior (CERN)

Direct Diode Detection (3D);
High sensitivity tune measurements

AN INSTRUMENT NOT JUST A MEASUREMENT!

Next Faraday Cup Award is 2014
www.faraday-cup.com

Please review his talk at:

http://mgasior.web.cern.ch/mgasior/pro/BBQ/index.html

High Sensitivity Tune Measurement using Direct Diode Detection

2012 Faraday Cup Talk

Marek Gasior

Beam Instrumentation Group, CERN

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Outline:

- Basics of tune measurement
- Challenges of the LHC tune measurement
- History of the development
- Principles of the direct diode detection (3D)
- Measurement examples
- Other development triggered by the diode detection project

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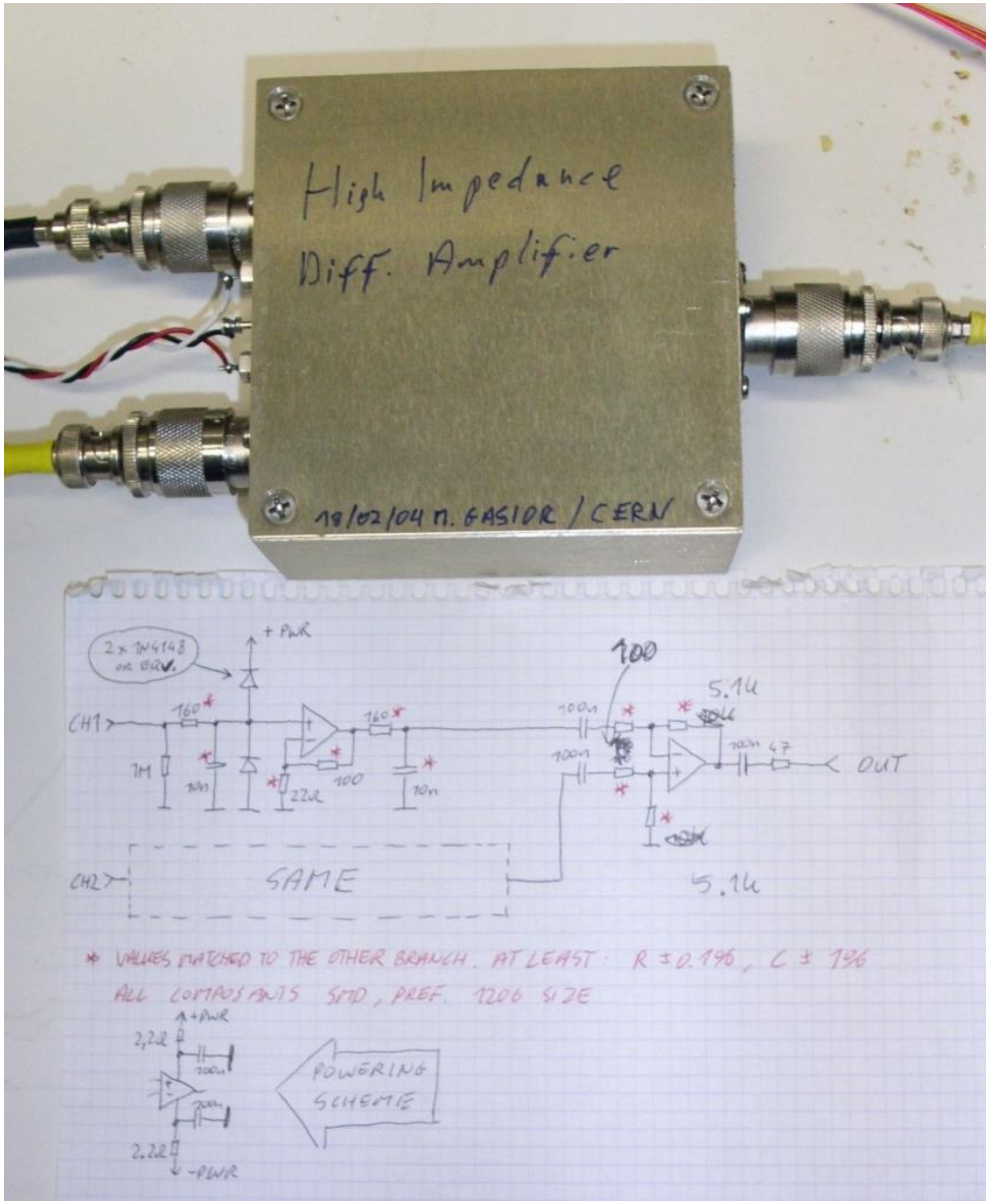
Once back home – the story of a protection diode ...



- On the input of the RHIC high impedance amplifier there were protecting diodes, connecting the input to the power supplies.
- On the schematic one diode was connected to ground. Such a configuration would make a diode detector. However, the diode in the built amplifier was in the standard protection configuration (seen on a photo of the amplifier).

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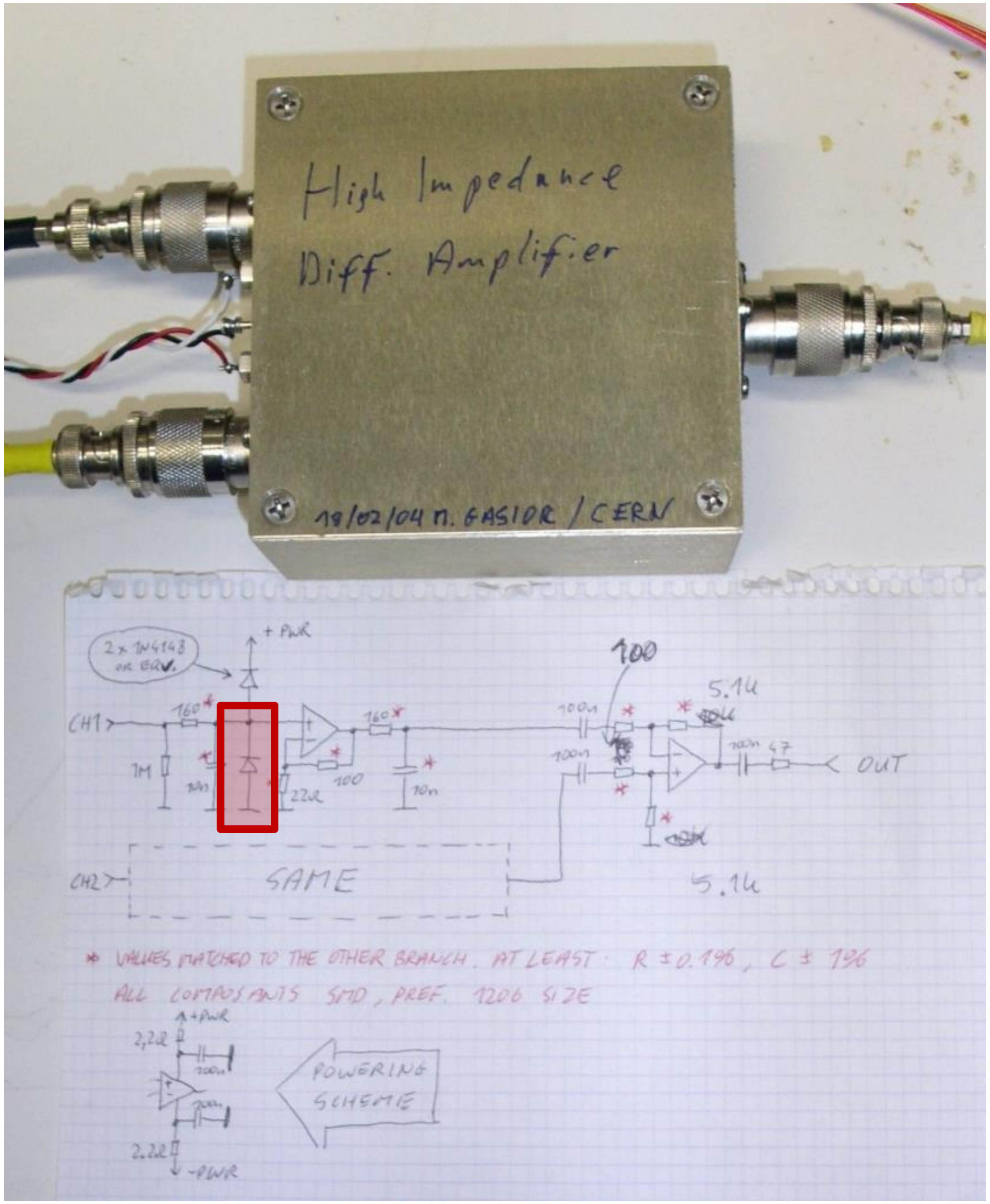

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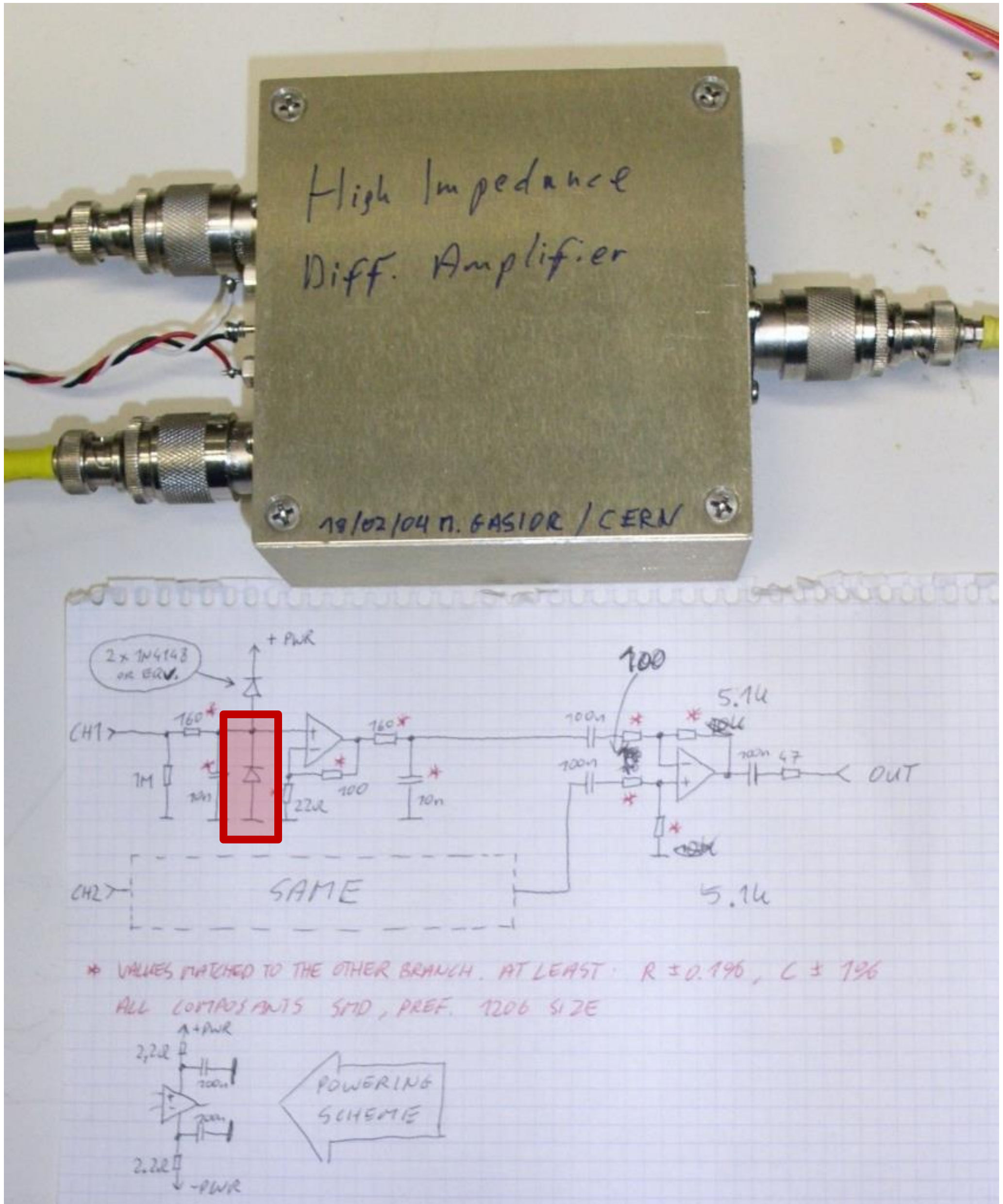

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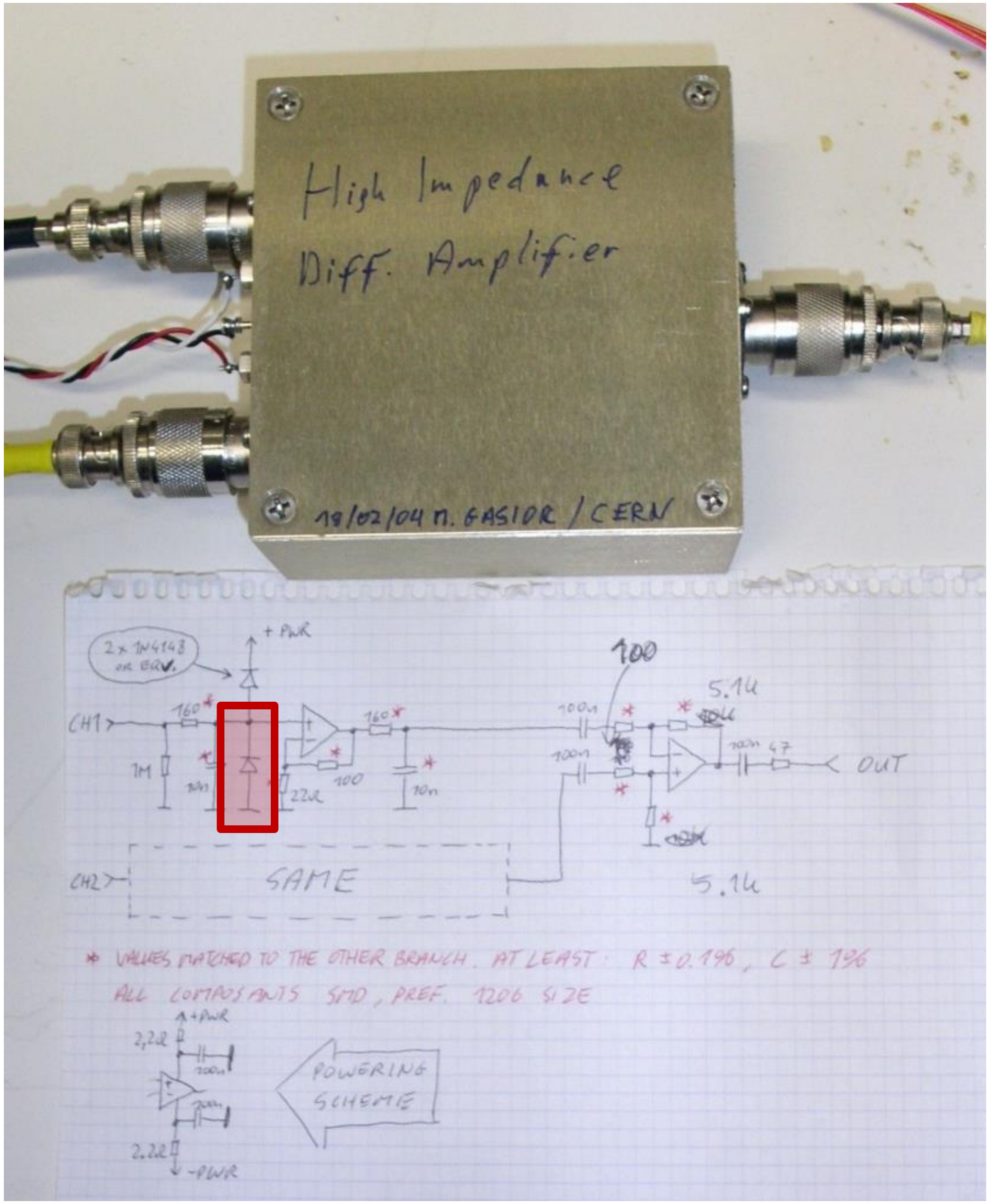

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- Reactions of the colleagues for the idea of measuring the tunes using diode detectors fitted generally between this two extreme ones:
  - “Great idea, should work !”
  - “Come on, too simple... If it worked, it would have been used before”.

Diode detectors – old good stuff, but …

SLAC-PUB-1452
June 1974

BEAM DYNAMICS EXPERIMENTS AT SPEAR*

The SPEAR Group†
Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305

Introduction

The single-particle properties of beams in storage rings are well understood, but high density single and colliding beams suffer from a variety of instabilities due to self-forces and interactions with their surroundings. The chief experimental problems in the study of stored beams arise from the difficulty of devising beam-diagnostic probes which do not affect the stored beams or disturb the phenomena being studied, and which give unambiguous results when different phenomena act on the probes simultaneously.

In the SPEAR electron-positron storage ring, we have apparatus and methods for measuring center-of-mass motions of our beams on all three axes, as well as motions with higher moments. The shapes of the beam bunches can also be accurately measured. We will describe the techniques we have used to study instabilities and measure operating characteristics.

Center-Of-Mass Motions

There are directional antennas (striplines) inside the vacuum envelope[1] which detect the electromagnetic field of the whole bunch. When the beam executes betatron oscillations, there is a small amplitude modulation of the signals from the striplines. We detect and measure this modulation to give us information on betatron wave numbers, line strengths and widths.

The wave analyzer has an oscillator which automatically tracks the center of the receiver pass band. By connecting this oscillator to the beam excitation system and sweeping the receiver and exciter simultaneously, we observe directly resonant responses of the beam with freedom from harmonic or intermodulation responses. (Fig. 1). A similar technique has been used at the Bevatron,[2] to measure the phase response of the beam.

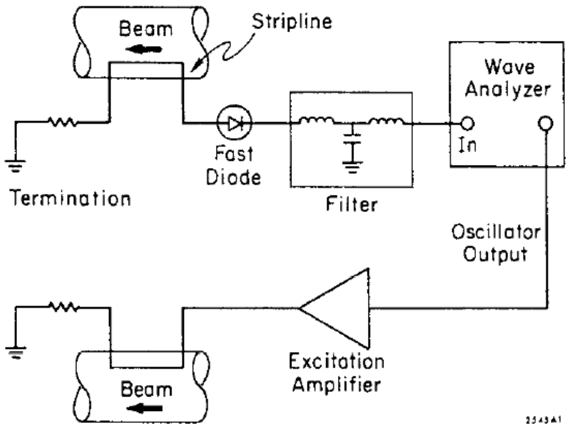

FIG. 1--The system for betatron and synchrotron-frequency response measurement. The oscillator is not used when observing self-excited lines.

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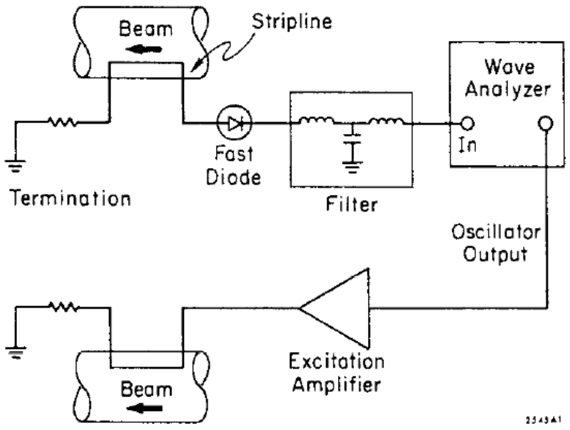

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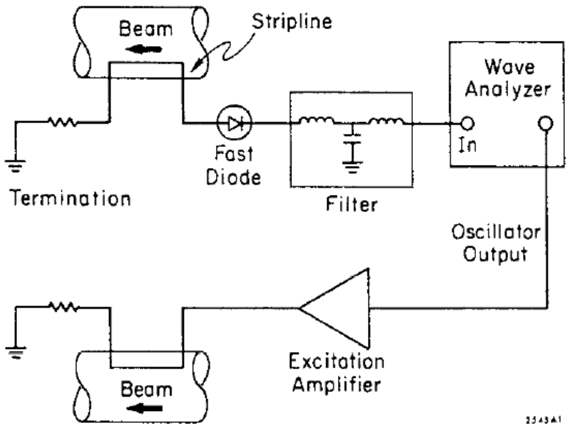


FIG. 1--The system for betatron and synchrotron-frequency response measurement. The oscillator is not used when observing self-excited lines.

- Diode detectors were used in the past, but with relatively low load.
- For a single 1 ns LHC bunch repeating every 89 μs (duty cycle ≈10^{-5}) low impedance load would spoil the idea.
- Load in the order of 10 MΩ was required. The question was how such a detector would behave in the presence of losses.

A short diversion…

Create account Log in

Article Talk Read Edit View history Search

WIKIPEDIA
The Free Encyclopedia

Main page
Contents
Featured content
Current events
Random article
Donate to Wikipedia

Interaction
Help
About Wikipedia
Community portal
Recent changes
Contact Wikipedia

Toolbox

Print/export

Languages
Česky
Dansk
Deutsch
Español
Français
Nederlands

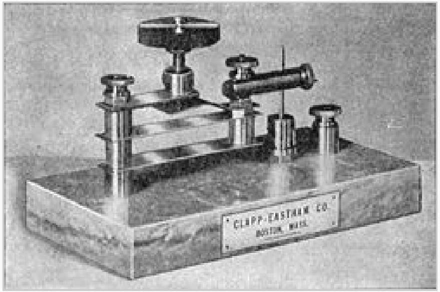
Cat's-whisker detector

From Wikipedia, the free encyclopedia

A **cat's whisker detector** (sometimes called a **crystal detector**) is an antique electronic component consisting of a thin wire that lightly touches a crystal of semiconducting mineral (usually galena) to make a crude point-contact rectifier. Developed by early radio researchers Jagadish Chandra Bose, G. W. Pickard and others, this device was used as the detector in early crystal radios, from about 1906 through the Second World War. It gave this type of radio receiver its name. It was the first type of semiconductor diode, and in fact the first semiconductor electronic device. The term cat's whisker was also sometimes used to describe the crystal receiver itself. Cat's whisker detectors are obsolete and are now only used in antique or antique-reproduction radios.

Galena cat's whisker detector

Contents [hide]



Precision cat's whisker detector using iron pyrite crystal, early 1900s. The crystal is inside the metal capsule under the vertical needle "whisker" *(right)*. The leaf springs and thumscrew

Description [edit]

The tip of the wire contacting the surface of the crystal formed a crude and unstable point-contact metal–semiconductor junction, forming a Schottky barrier diode. This junction conducts electric current in only one direction and resists current flowing in the other direction. In a

When was it done?

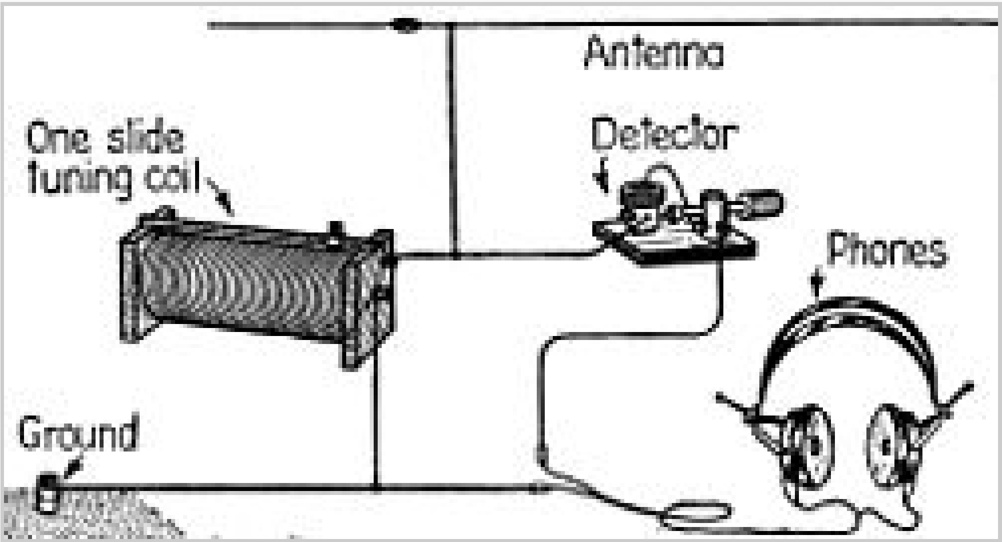
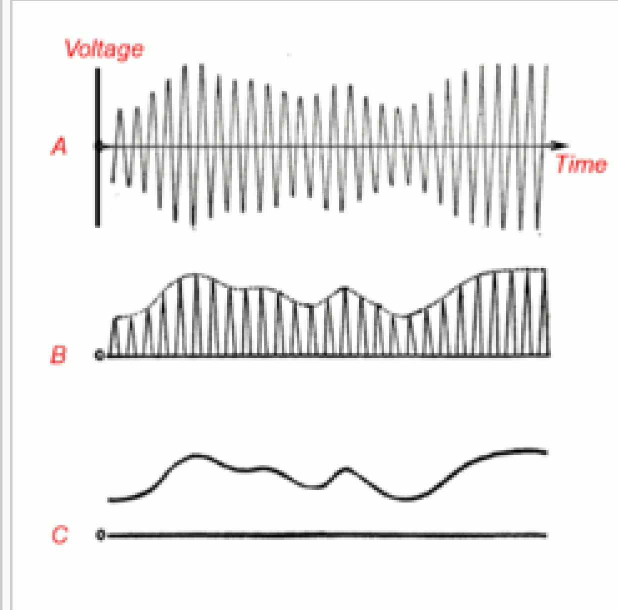


Diagram of a crystal radio from 1922 using a cat's-whisker detector.

http://en.wikipedia.org/wiki/Cat%27s-whisker_detector



How a crystal detector works in a radio receiver.[5][6] (A) The amplitude modulated radio signal from the receiver's tuning section. The rapid oscillations are the radio frequency carrier wave. The audio signal (the sound) is contained in the slow variations (modulation) of the size of the waves. This signal cannot be converted to sound by the earphone, because the audio excursions are the same on both sides of the axis, averaging out to zero, resulting in no net motion of the earphone's diaphragm. (B) The crystal conducts current in only one direction, stripping off the oscillations on one side of the signal, leaving a pulsing direct current whose amplitude does not average zero but varies with the audio signal. (C) A bypass capacitor across the earphone smoothes the waveform, removing the radio frequency carrier pulses, leaving the audio signal.

MIT Radiation Laboratory Series available on line

Microwaves pre-dated Hewlett-Packard!

CHAPTER 1

INTRODUCTION

By E. M. Purcell

1·1. Microwaves.—The microwave region of the electromagnetic spectrum is commonly taken to include frequencies of 10^9 cycles per second and higher. The upper frequency limit exists only as an active frontier lying, at the time of writing, not far below 10^{11} cycles per second. It is not necessary here to attempt to fix the boundaries more precisely. Instead, it may be asked why it is profitable and proper to single out for special treatment this section of the r-f spectrum. The answer to this

Edward Mills Purcell
(August 30, 1912 – March 7, 1997) was an American physicist who shared the 1952 Nobel Prize for Physics for his independent discovery (published 1946) of nuclear magnetic resonance in liquids and in solids.[2] Nuclear magnetic resonance (NMR) has become widely used to study the molecular structure of pure materials and the composition of mixtures.

Like Marek said – learn from the old guys! Please flip through these *resources* and get an Insight on how the *experts* did it with hardly a Cathode Ray Tube…

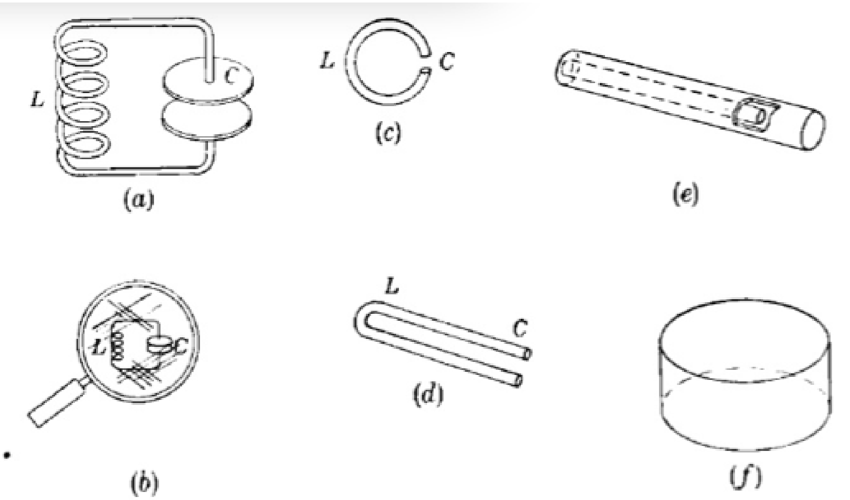
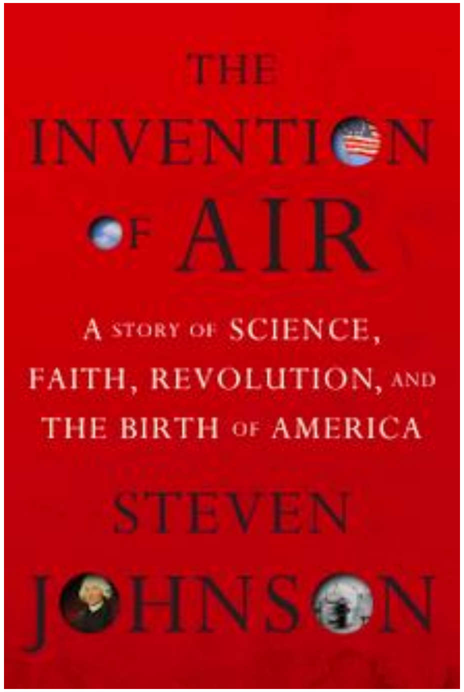


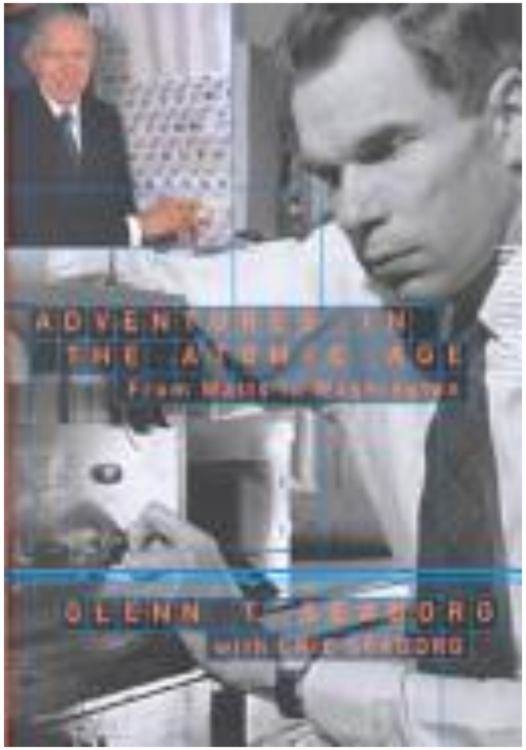
Fig. 1·1.—Resonant circuits at low frequencies and at microwave frequencies.

BIW12

2 of my favorite books



It is the story of Joseph Priestley—scientist and theologian, protégé of Benjamin Franklin, friend of Thomas Jefferson—an eighteenth-century radical thinker who played pivotal roles in the invention of ecosystem science, the discovery of oxygen…



Adventures in the Atomic Age
From Watts to Washington

Dr. Glenn Theodore Seaborg was co-recipient of the 1951 Nobel Prize in Chemistry for his transuranium element research. He was a co-discoverer of plutonium and heavier elements through element 102.

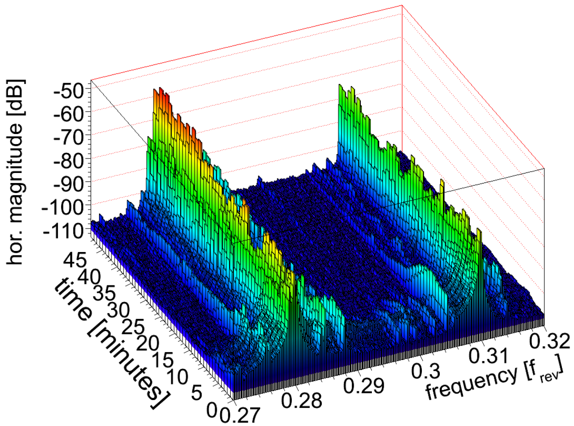
Jefferson Lab

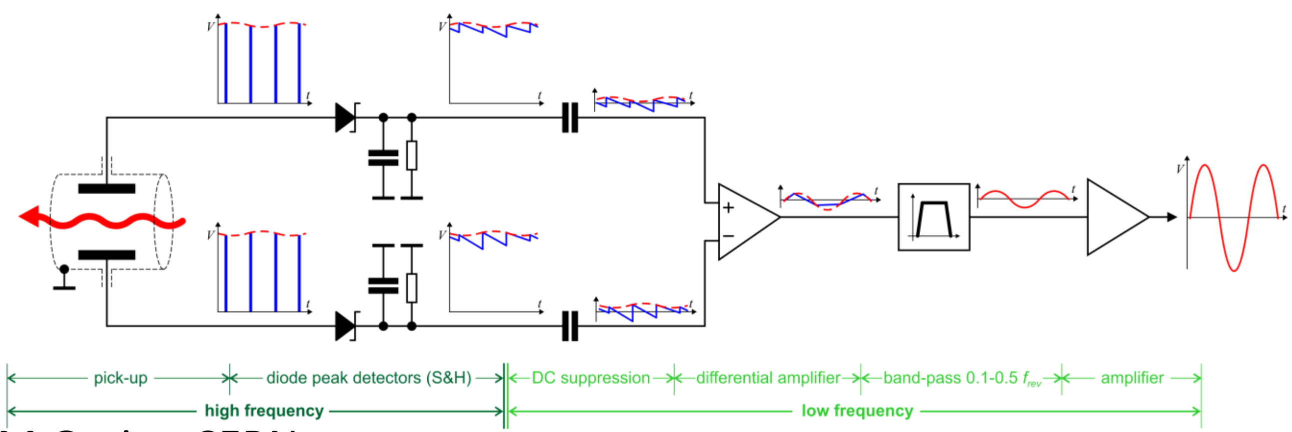
Where was I going…

Conclusions

- Cold weather may stimulate fruitful discussions, which in turn can set the direction of a development.
- An error on a hand made schematic can make a breakthrough in a development.
- The key people who made the diode detection project successful and with whom I had/have so much pleasure to work with: Rhodri Jones, Peter Cameron (BNL), Andrea Boccardi, Ralph Steinhagen.
- Good old ideas should be reviewed to make sure that they cannot be further improved with the recent technology advancement.
- Even with the excellent ADCs that we have today good analogue processing may pay off.
- Diode-based tune measurement works well already on quite a few machines.
- Diode detectors most likely can be used for other applications.
- Marek got a reputation to do everything with diodes:
  „When Marek wants to open a bottle the first tool he thinks about is a diode."
- For the "serious equation part" and references please look into the corresponding paper.

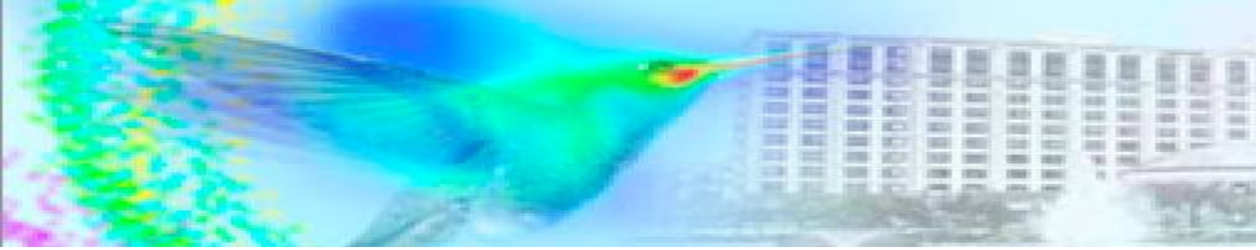
- A few pieces of beam sound can be found at: www.cern.ch/gasior/pro/BBQ/index.html



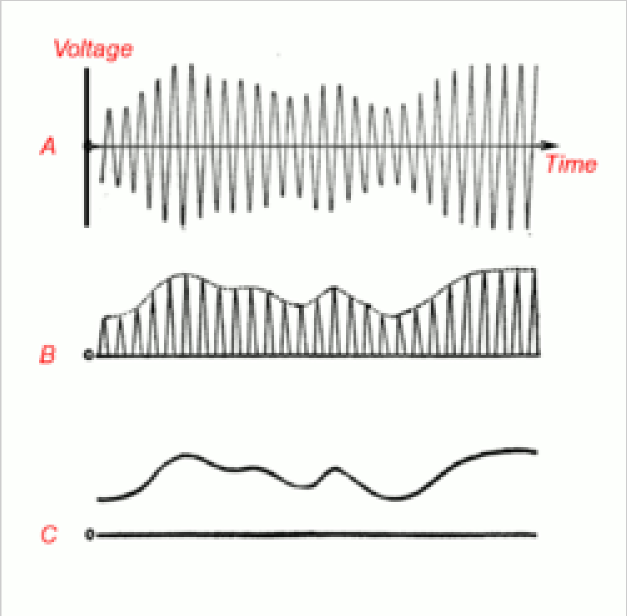


Diode tune systems

Machine	Lab	max f_{rev} [kHz]
LHC	CERN	11
SPS	CERN	43
PS	CERN	477
PSB	CERN	1800
LEIR	CERN	1440
RHIC	BNL	78
Tevatron	Fermilab	48
SIS18	GSI	1400
CNAO	CNAO	2800
CesrTA	Cornell	390



Look familiar?



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Jefferson Lab

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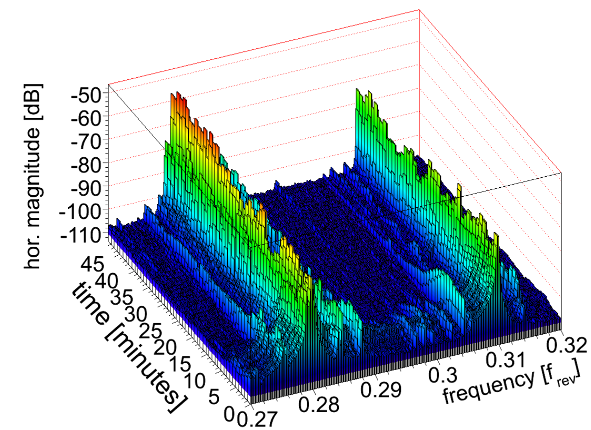

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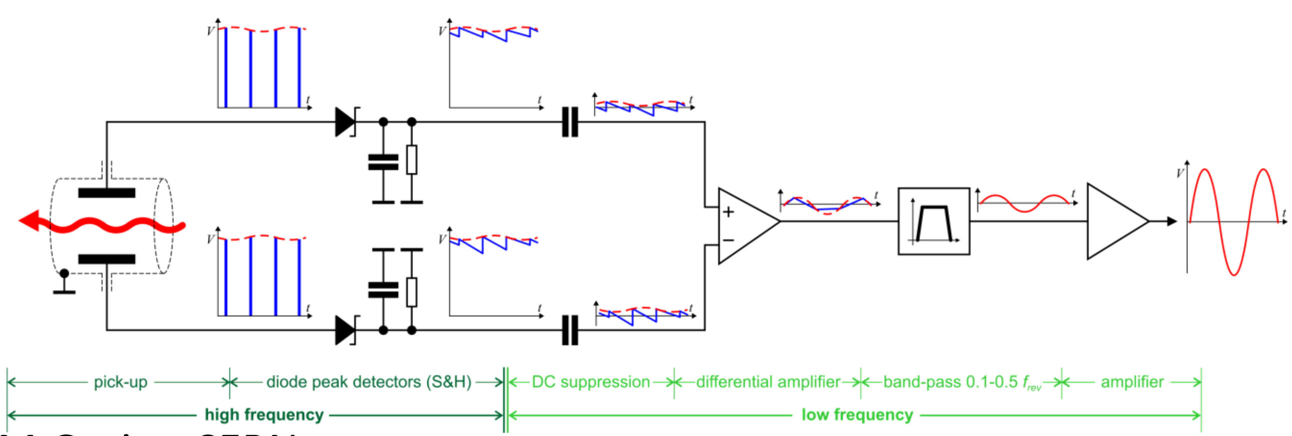
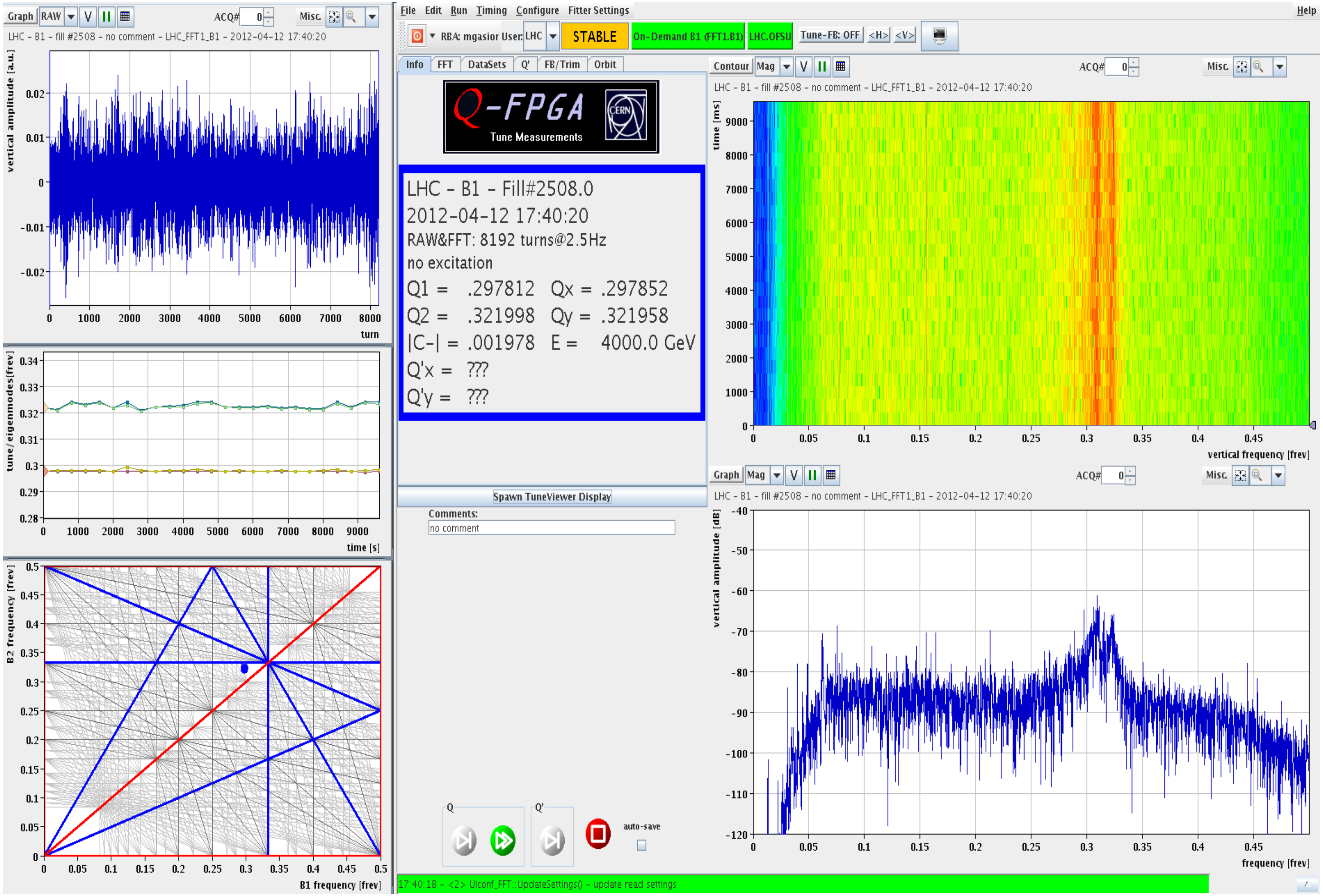


The tune measurement system seen from the control room



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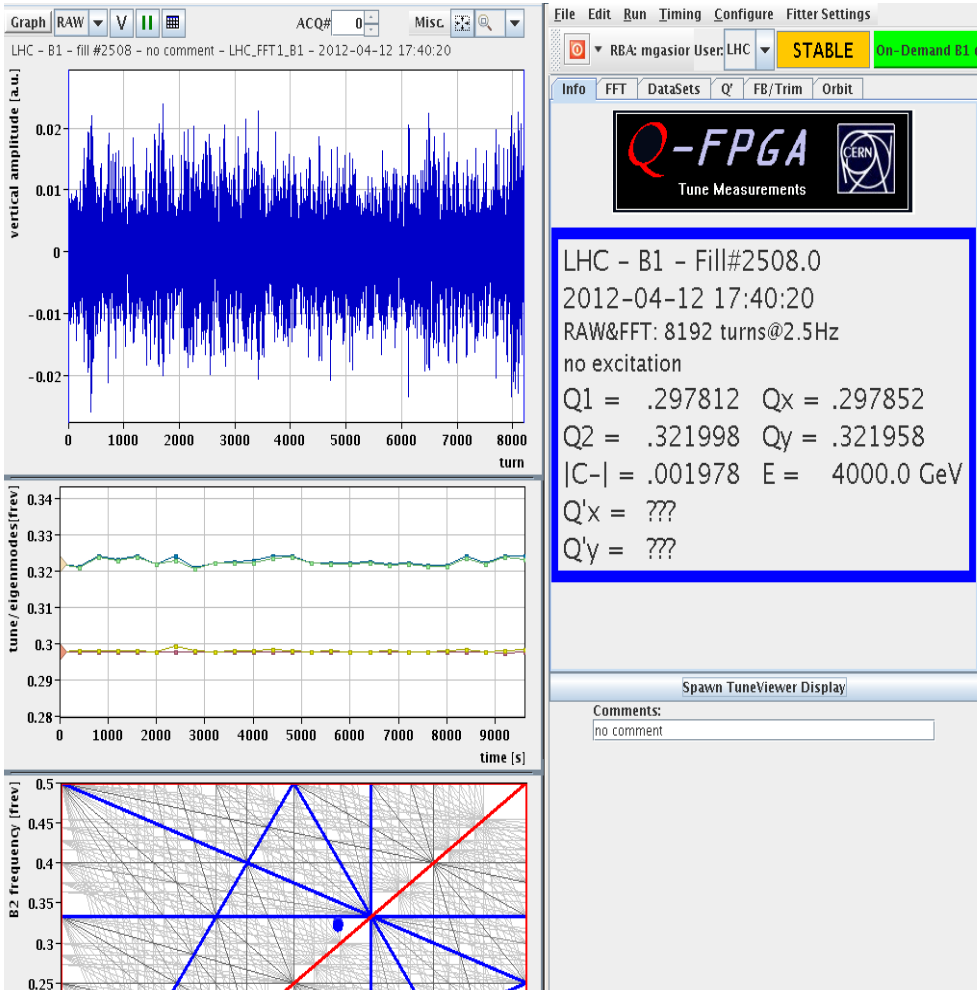
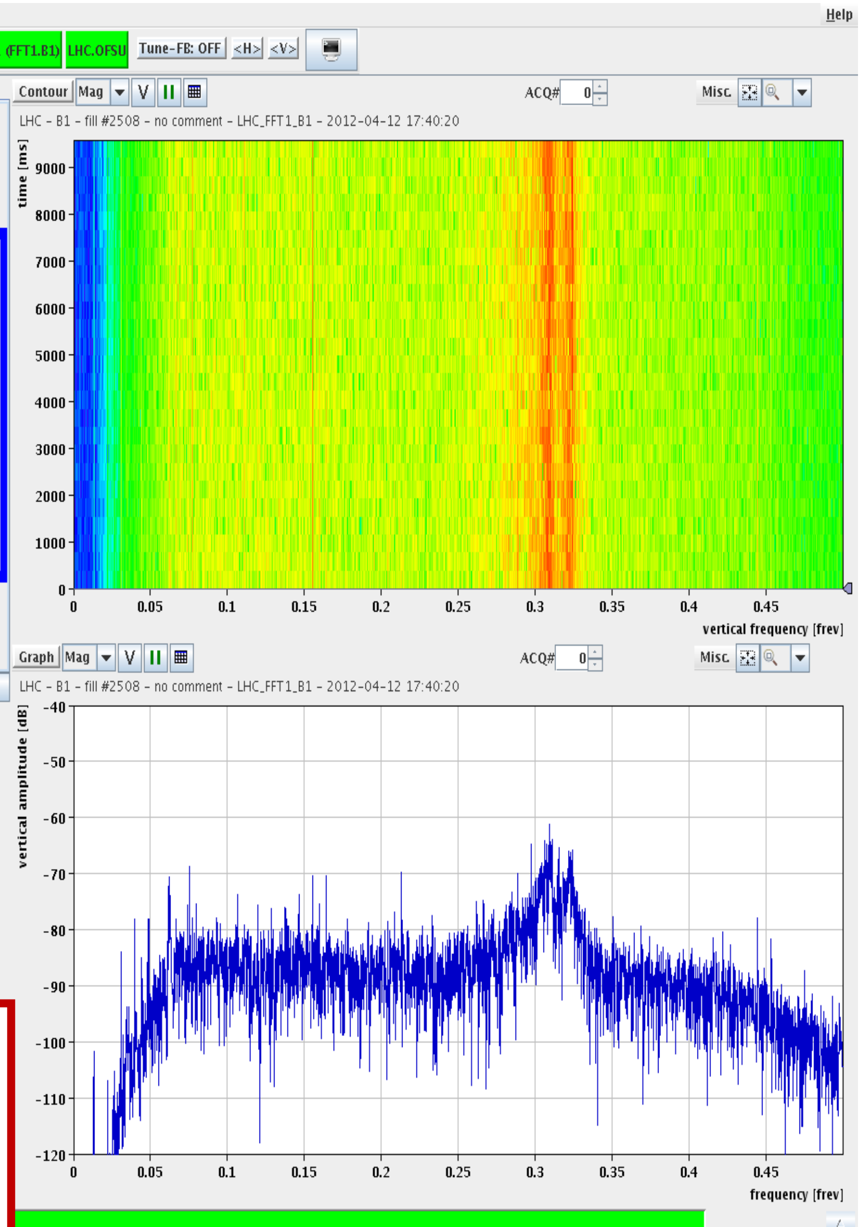




- A beam instrument is always seen from the control room through a software window.
- “The chain is as strong as its weakest element”.
- 4th key person: **Ralph Steinhagen.**

Banquet was at
Virginia Living Museum

…more time to interact
with colleagues
&
New Orleans Jazz Band

BIW12


BIW12


otect What's Precious
General Admission
New Membership Sales
Museum & Planetarium
Adults
Children ages 3-12
Family Membership $85
BIW12
Thomas
Shea
Rok
Ursic


BIW12


Stephen
Smith

BIW12

Good Bye BIW!

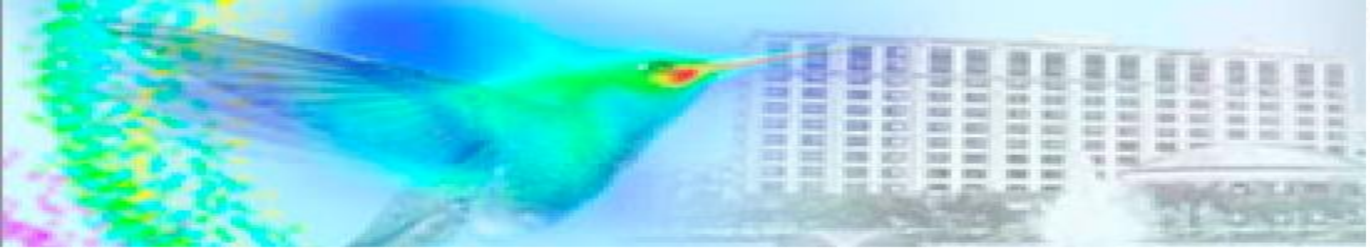
International Beam Instrumentation Conference

IBIC 2014
San Francisco

Fall 2014

SLAC
NATIONAL ACCELERATOR LABORATORY

Hello IBIC!



An early portable cat's-whisker radio set with aerial

Bowl of Corn-Cob Pipe Holds Radio Set

THE most compact radio receiving set that has made its appearance is built on the bowl of a corn-cob pipe. It is the work of F. E. Wi'son, of Detroit, who can fill his pipe at the close of day and settle back for a smoke while he tunes in the radio stations that are "in the air."

For an aerial, Mr. Wilson uses a small loop attached to the headband of his 2000-ohm phone. The tuning coil is made of 100 turns of enameled wire—No. 26—wound around the bowl of the pipe. A piece of galena is balanced on the pipe stem, while the catwhisker is arranged to pivot on the stem. This small set has been remarkably successful in picking up concerts within 10 miles of the broadcasting stations.

Thanks for your attention!