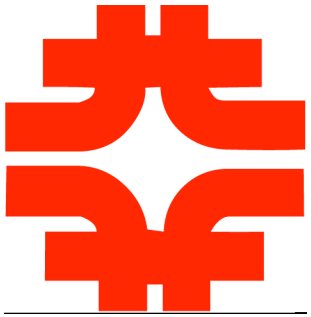
Collaboration

Organization, Work Accomplished, Goals, and Funding

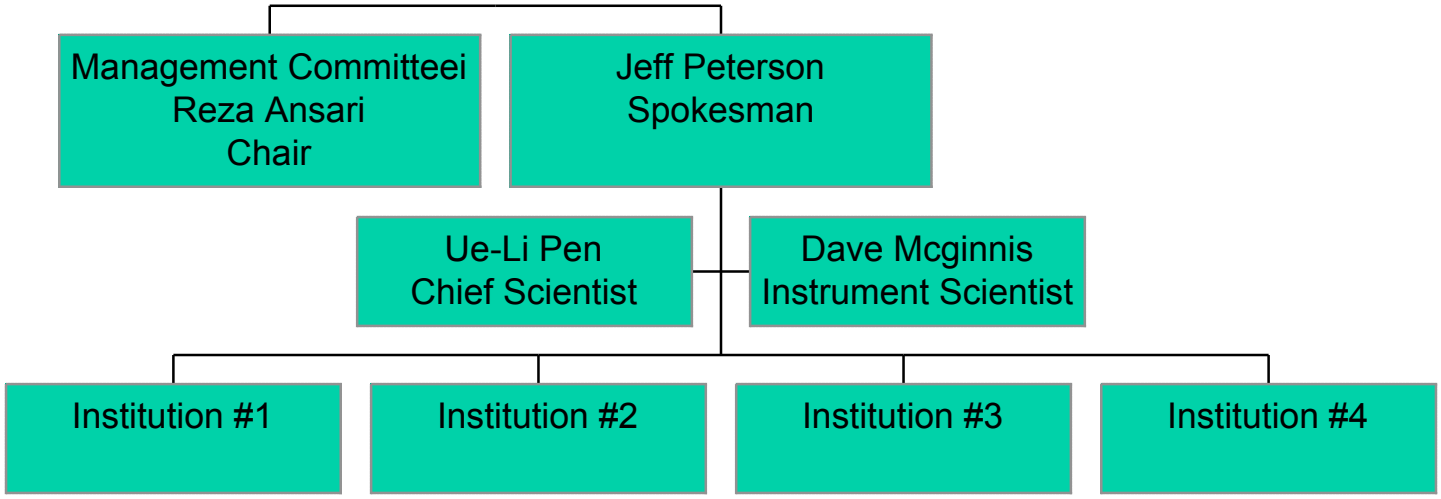
John Marriner

April 26, 2010

21 cm Internal Review



21 cm BAO Organization Chart



21 cm BAO Collaboration

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Goal of the Collaboration

- To create a comprehensive, well thought-out conceptual design report.
- To pursue opportunities for funding
  - Private sources
  - Foreign sources
  - Traditional government sources
    - NSF
    - DOE
    - French national & European sources

Meetings

- Scheduled monthly video conferences (2nd Thursday of each month)
- Irregularly scheduled meetings on specific topics (irregular but ~bi-weekly)
- Annual collaboration meetings
  - Fermilab (2008)
  - Al Akawayn (2009)
- Workshop on radio telescopes (FNAL 2009)

Fermilab 21cm Document Database

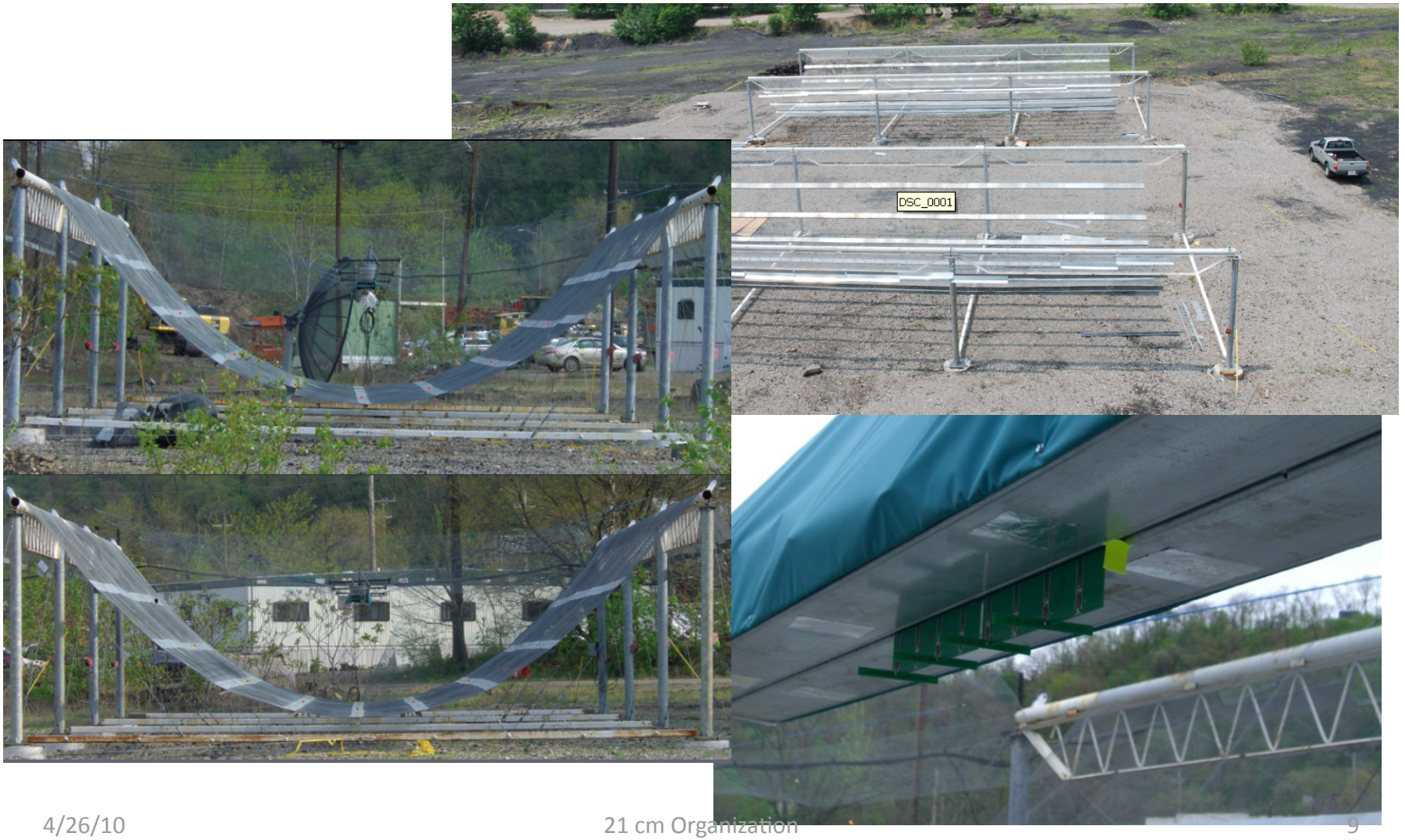
Projects-doc-#	Title	Author(s)	Topic(s)	Last Updated
784-v3	Initial Pittsburgh Cylinder Simulations results	David McGinnis	21CM	02 Dec 2009
778-v1	Formulation Cylinder Visibilities	David McGinnis	21CM	05 Nov 2009
473-v4	General Requirement Formulae for the 21cm Cylindrical Radio Telescope	David McGinnis	Technical Notes	20 Oct 2009
653-v2	Signal to Noise for an FFT Antenna array	David McGinnis	Technical Notes	12 Oct 2009
713-v1	Fermilab Presentations at the Spet 9, 2009 21cm collaboration meeting	John Marriner *et al.*	21CM	10 Sep 2009
670-v1	Pine Bluff Observatory RFI Measurements	David McGinnis	21CM	10 Aug 2009
656-v1	21cm Calibration by Ue-Li Pen	----- -----	21CM	23 Jul 2009
626-v1	Morocco Site Testing for the Cylinder Radio Telescope	----- -----	21CM	09 Jul 2009
566-v1	Positioning and orienting a static radio-reflector	----- -----	21CM	30 Jun 2009
562-v1	21cm Collaboration Meeting June 2009 in Ifrane Morocco	----- -----	21CM	26 Jun 2009
284-v1	Rates and Resolutions	Chris Stoughton	Technical Notes	22 Jun 2009
476-v3	Martin Leung Thesis: A Wideband Feed For a Cylindrical Radio Telescope	----- -----	Technical Notes	27 May 2009
543-v1	Dave's 21cm Five Magic Numbers	David McGinnis	21CM	08 May 2009
542-v1	Measuring BAO with the 21cm line of Hydrogen	John Marriner	21CM	08 May 2009
475-v1	April 9 2009 21cm CRT Collaboration Meeting			
474-v1	Comments on the Performance of a Adjacent Fee			
469-v2	Integration Time for 21cm Parabolic Cylinder Rad			
471-v1	Phased Array Antenna			
467-v1	Status of Aperture Feed Simulations for the 21cm			
444-v4	Putting Documents into the 21 cm DocDb			
450-v1	The Cylinder Radio Telescope			
449-v1	21 cm Telescope Simulation			
366-v2	Spherical Coordinates for a Parabolic Cylinder Ant			
432-v7	Fermilab Morocco Site Visit Summary			
435-v1	Antenna Factor for the 21 cm Simulation			
407-v1	Fermilab 21cm Morocco Site Evaluation Status			

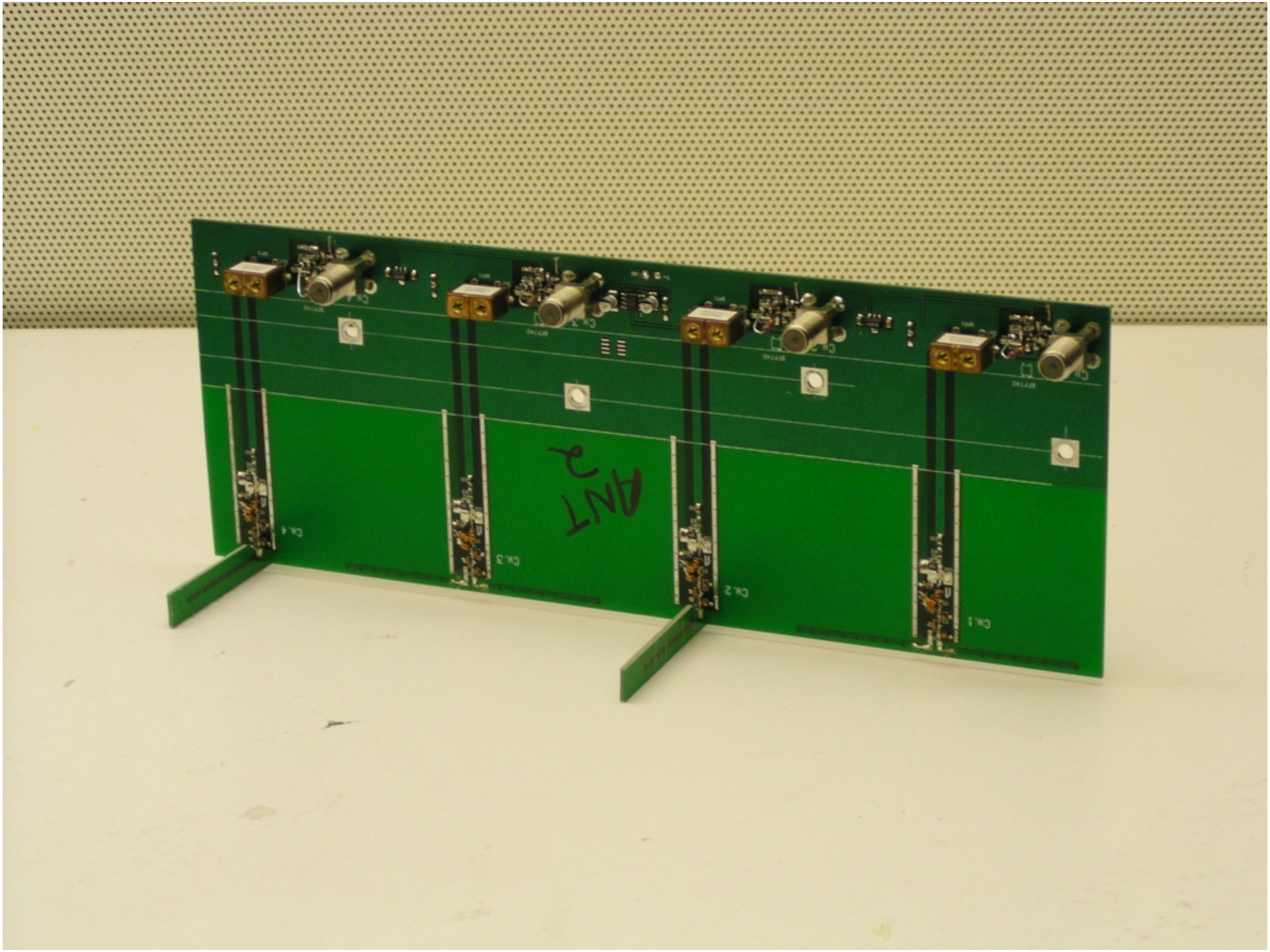
467-v1	Status of Aperture Feed Simulations for the 21cm CRT	David McGinnis	Meeting Minutes	31 Mar 2009
444-v4	Putting Documents into the 21 cm DocDb	David McGinnis	Technical Notes	02 Mar 2009
450-v1	The Cylinder Radio Telescope	John Marriner	Technical Notes	24 Feb 2009
449-v1	21 cm Telescope Simulation	John Marriner *et al.*	Technical Notes	24 Feb 2009
366-v2	Spherical Coordinates for a Parabolic Cylinder Antenna	David McGinnis	Technical Notes	02 Feb 2009
432-v7	Fermilab Morocco Site Visit Summary	David McGinnis	Technical Notes	02 Feb 2009
435-v1	Antenna Factor for the 21 cm Simulation	David McGinnis	Technical Notes	26 Jan 2009
407-v1	Fermilab 21cm Morocco Site Evaluation Status	David McGinnis	Meeting Minutes Technical Notes	22 Dec 2008
373-v2	21cm Meeting at University of Chicago	John Marriner *et al.*	Meeting Minutes	22 Oct 2008
372-v1	21cm Cylinder Cartoon Pictures	David McGinnis	Technical Notes	01 Oct 2008
367-v1	Ray Tracing for an Offset Focus Parabolic Cylinder Antenna	David McGinnis	Technical Notes	22 Sep 2008
320-v1	HSHS Power Spectra	----- -----	Technical Notes	30 Jun 2008
311-v2	Initial Measurements of Radio Frequency Interference at 1 GHz at Fermilab	David McGinnis	Technical Notes	02 Jun 2008
310-v1	Average Noise Power for a Low Noise Amplifier	David McGinnis	Technical Notes	02 Jun 2008
282-v1	Directivity of a Parabolic Cylinder Antenna	David McGinnis	Technical Notes	05 May 2008
290-v5	Integration Length for 21cm	David McGinnis	Technical Notes	05 May 2008
303-v1	Integration Time for a Parabolic Dish Radio Telescope	David McGinnis	Technical Notes	05 May 2008
297-v1	Radiometer Equation	John Marriner	Technical Notes	01 Apr 2008
292-v1	3-D Intensity Mapper Project Description	----- -----	Technical Notes	11 Mar 2008
291-v1	NSF ATI Proposal (2007)	----- -----	Technical Notes	10 Mar 2008
286-v1	21 CENTIMETER FLUCTUATIONS FROM COSMIC GAS AT HIGH REDSHIFTS	----- -----	Publications	03 Mar 2008
285-v1	THE HUBBLE SPHERE HYDROGEN SURVEY	----- -----	Publications	03 Mar 2008
283-v1	Digitized response function of a phased array of Antennae	John Marriner	Technical Notes	03 Mar 2008
281-v1	21-cm Baryon Acoustic Oscillation Survey	Scott Dodelson	Technical Notes	03 Mar 2008
280-v1	3-D Intensity Mapper Project Description	----- -----	Technical Notes	03 Mar 2008

References

- R. Ansari, et al., "Reconstruction of HI power spectra with radio-interferometers to study dark energy," arXiv: 0807.3967 (July 2008)
- Tegmark & Zaldarriaga, "The Fast Fourier Transform Telescope," arXiv:0805.4414v1 [astro-ph] (May 2008)
- Chang, Pen, Peterson, & McDonald, "Baryon Acoustic Oscillation Intensity Mapping as a Test of Dark Energy," arXiv:0709.3672v2 [astro-ph] (Jan 2008)
- Peterson & Bandura, "The Hubble Sphere Hydrogen Survey," arXiv:astro-ph/0606104v1 (June 2006)

Pittsburgh Prototype

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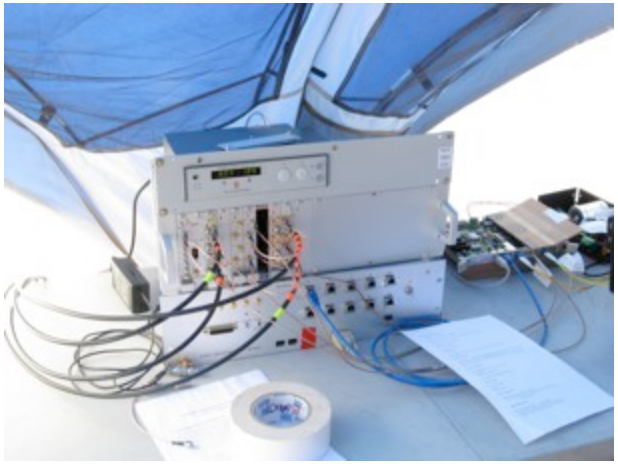
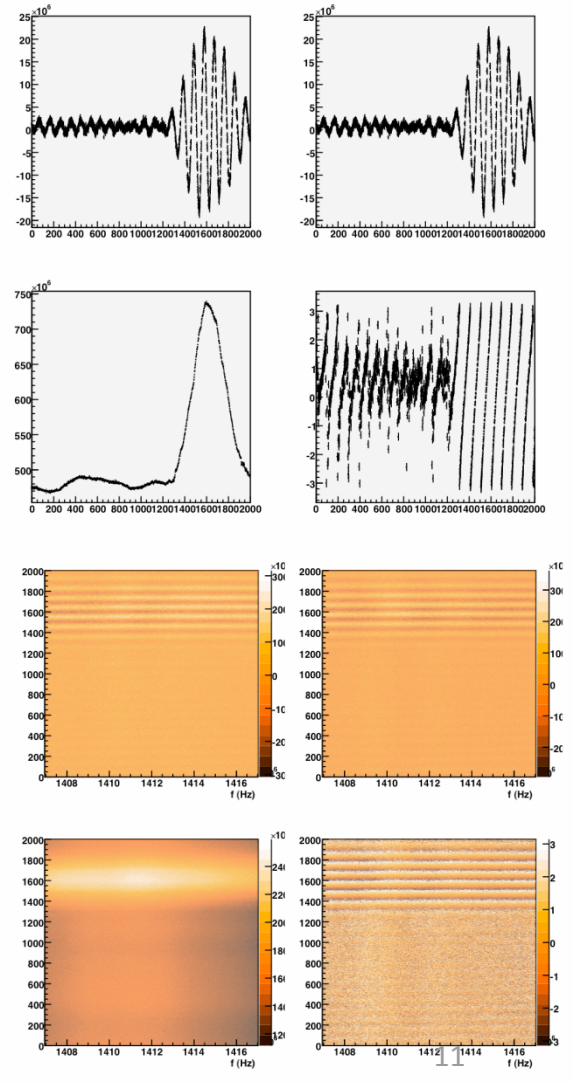
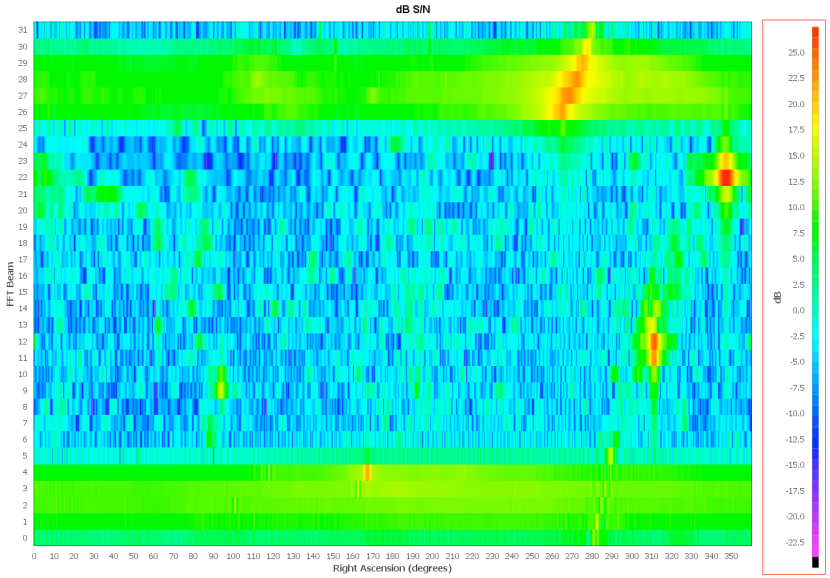
CH.4
CH.3
CH.2
CH.1

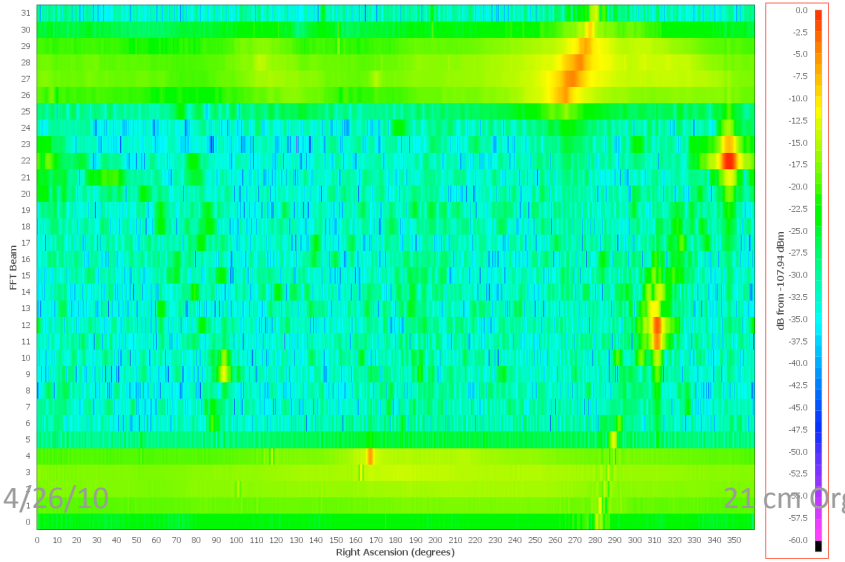
French Electronic Tests at Pittsburgh

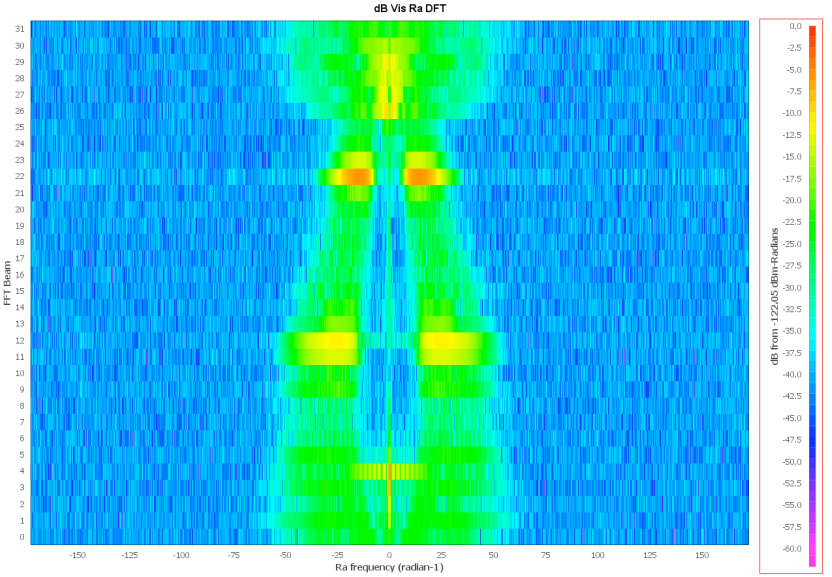




Complete Sky and Instrument Simulations of the Pittsburgh Prototype



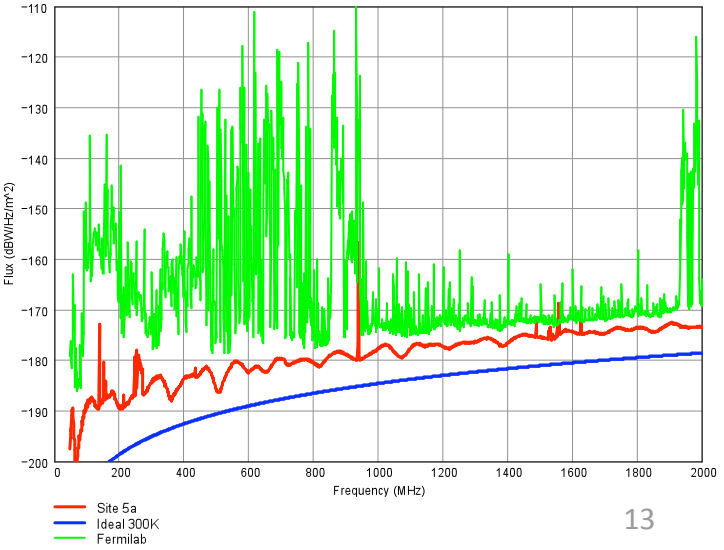




Site Tests


DSC04411.JPG


DSC05181.JPG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-130
-140
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200
400
600
800
1000
1200
1400
1600
1800
2000
Frequency (MHz)
Site 5a
Ideal 300K
Fermilab

Technical Capabilities at FNAL

- RF analog signal processing (accelerator applications).
- RF digital signal processing (accelerator applications).
- High speed parallel data processing (particle experiments)
- High speed data transport (particle experiments)
- Complex simulations
- Large astronomical data sets (SDSS)
- Project management & cost & schedule discipline

☞ We are currently concentrating on simulations since those are most critical for the conceptual design report, but feel well-qualified to contribute in any or all of these areas.

Charge element 2c

- 2c) Assess the technical progress made to date. What resources were used and is the current technical status promising?
  - Prototype work at Carnegie-Mellon and CEA/IN2P3
  - Advanced simulations at FNAL
  - Site characterization measurements
  - Received travel and support for site characterization in FY09.
  - Main goal for FY10 is a conceptual design report. An R&D plan should emerge from the design study.

Charge Element 2d

- 2d) What is the expected technical role at FNAL? Does the lab have the required facilities and personnel to fulfill this role, or would we have to import radio astronomy expertise?
  - The technical role at FNAL is so far limited to contributing to the conceptual design report.
  - The lab has abundant resources to contribute to any aspect of this experiment.
  - An experienced radio astronomer would be a valuable asset for FNAL, but not a necessary one if there is sufficient expertise in the collaboration as a whole.

Charge element 3a

- 3a) Has a strong collaboration emerged, capable of mounting an experiment? What is the role of FNAL in this collaboration? Is there a project-oriented management structure being formed?
  - There is a significant collaboration capable of producing a conceptual design report.
  - The collaboration needs to grow in order to mount an experiment.
  - A project management structure is in place and is sufficient for current needs.

Issues

- At the moment, there is no official support for the R&D effort.
- We are seeking an endorsement for this effort …
  - Personnel charging time
  - We need some support for travel
  - Prototype work to advance on the conceptual design work

Backup Slides

Management Committee

- The management committee consists of one representative from each institution.
- Each member has three responsibilities
  - To oversee and approve the activities of the chief scientist and instrument scientist
  - To accept responsibility for tasks and provide line management for the activities at their respective institutions.
  - To approve funding strategies and submission of proposals.

Management Committee Chair

- The role of the chair of the management committee is to run the committee: preparing the agenda, running the minutes, circulating minutes, etc.
- The committee will act by consensus amongst the various institutions. The role of the chair is to facilitate the building of this consensus.

Spokesman

- Primary contact for the project.
- Coordinates the activities of the chief scientist and instrument scientist.
- Calls meetings as necessary to coordinate efforts.

Chief Scientist

- Coordinates development of clear science goals.
- Coordinates outreach activities.
- Calls meetings as necessary to coordinate efforts.

Instrument Scientist

- Coordinates creation of a conceptual design document including
  - Technical design
  - Budget
  - Management issues
- Coordinates preparation of proposals.
- Coordinates instrument R&D that is determined to be necessary to the success of future proposals.
- Call meetings as necessary to coordinate efforts.

FY2010 Work Plan

- Organize project management structure
- Recruit collaborators
- Write conceptual design report (CDR)
- Define funding plan
- External review of the CDR and funding plan
- Pursue funding

Conceptual Design Report

- As noted previously, a large amount of design and prototyping work has taken place.
- It is possible to write a design report of the instrument at this point.
  - We will begin writing the instrument chapters once the project work plan has been developed.
  - These chapters will be written during March-May 2010.
- The most difficult part of the project will be foreground subtraction.
  - We have concepts on how to due the foreground subtraction and instrument calibration.
  - These concepts are not validated at this point.
  - We will finish simulations on these concepts by May 2010.
  - We will write the chapters on instrument calibration foreground subtraction in June 2010
- The conceptual design report should be completed by June 2010.

Funding Sources

- While writing the CDR and searching for external collaborators, the collaboration will identify an number of possible funding plans
- For example, one scenario could be:
  - 25% DOE
  - 25% NSF
  - 25% in-kind contributions from foreign collaborators
  - 25% from the host country that would cover infrastructure costs.
  - Fermilab would likely be a major player in this scenario
- Another scenario could be
  - 25% from an outside contributor (i.e. The Dubai Institute)
  - 20% NSF
  - 25% in-kind contributions from foreign collaborators
  - 25% from the host country that would cover infrastructure costs.
  - 5% from DOE
  - Fermilab would be a minor player in this scenario
- The amount that DOE contributes would be proportional to how large a roll Fermilab plays in the overall project.
- The funding plan will be presented to the Fermilab Physics Advisory Committee (PAC).

Timeline

- Organize Management Structure – January 2010
- Agree on project and institution work plans - February 2010
- Collaboration support building February-June 2010
- Write engineering portions of the CDR – February-May 2010
- Complete foreground algorithms – May 2010
- Finish CDR - June 2010
- Internal review of the CDR – May - July 2010
- External review of the CDR – May - September 2010
- Presentation to the Fermilab PAC - Fall 2010
- Pursue funding Fall-Winter 2010