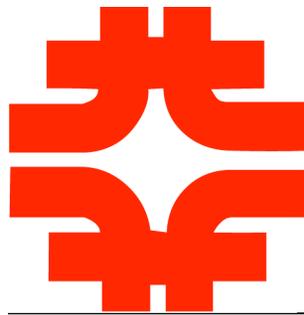


Collaboration

Organization, Work Accomplished,
Goals, and Funding

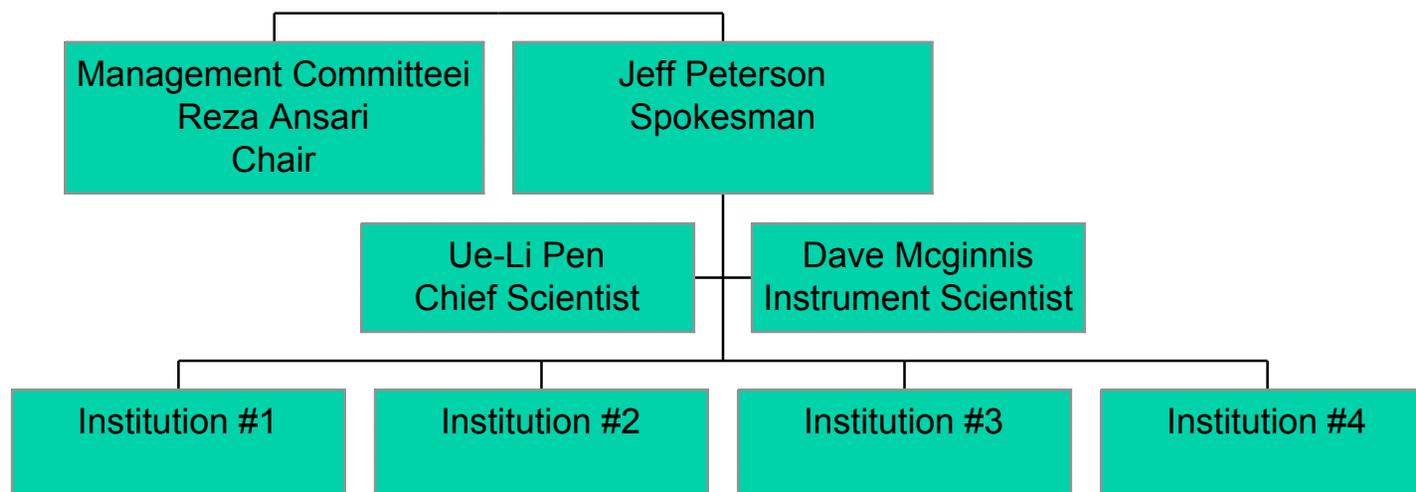
John Marriner

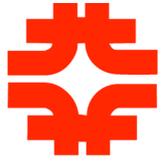
Fermilab





21 cm BAO Organization Chart





21 cm BAO Collaboration



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H. Darhmaoui



University British Columbia
K. Sigurdson



Carnegie-Mellon University
J. Peterson, k. Bandura



CEA (Saclay)
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A. Stebbins, A. Vallinotto



IN2P3 (Orsay)
R. Ansari, M. Moniez,
J.E. Campagne



University of Toronto
U. Pen



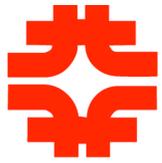
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Goal of the Collaboration

- To create a comprehensive, well thought-out pre-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
 - Orsay (2007)
 - 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	David McGinnis	Meeting Minutes	31 Mar 2009
474-v1	Comments on the Performance of a Adjacent Fee	David McGinnis	Technical Notes	02 Mar 2009
469-v2	Integration Time for 21cm Parabolic Cylinder Rad	John Marriner	Technical Notes	24 Feb 2009
471-v1	Phased Array Antenna	John Marriner et al.	Technical Notes	24 Feb 2009
467-v1	Status of Aperture Feed Simulations for the 21cm	David McGinnis	Technical Notes	02 Feb 2009
444-v4	Putting Documents into the 21 cm DocDb	David McGinnis	Technical Notes	02 Feb 2009
450-v1	The Cylinder Radio Telescope	David McGinnis	Technical Notes	26 Jan 2009
449-v1	21 cm Telescope Simulation	David McGinnis	Meeting Minutes	22 Dec 2008
366-v2	Spherical Coordinates for a Parabolic Cylinder Ant	David McGinnis	Technical Notes	22 Dec 2008
432-v7	Fermilab Morocco Site Visit Summary	John Marriner et al.	Meeting Minutes	22 Oct 2008
444-v4	Putting Documents into the 21 cm DocDb	David McGinnis	Technical Notes	01 Oct 2008
450-v1	The Cylinder Radio Telescope	David McGinnis	Technical Notes	01 Oct 2008
449-v1	21 cm Telescope Simulation	David McGinnis	Technical Notes	22 Sep 2008
366-v2	Spherical Coordinates for a Parabolic Cylinder Ant	David McGinnis	Technical Notes	30 Jun 2008
432-v7	Fermilab Morocco Site Visit Summary	-----	Technical Notes	30 Jun 2008
444-v4	Putting Documents into the 21 cm Simulation	David McGinnis	Technical Notes	02 Jun 2008
450-v1	The Cylinder Radio Telescope	David McGinnis	Technical Notes	02 Jun 2008
449-v1	21 cm Telescope Simulation	David McGinnis	Technical Notes	05 May 2008
373-v2	21cm Meeting at University of Chicago	David McGinnis	Technical Notes	05 May 2008
372-v1	21cm Cylinder Cartoon Pictures	John Marriner et al.	Meeting Minutes	05 May 2008
367-v1	Ray Tracing for an Offset Focus Parabolic Cylinder Antenna	David McGinnis	Technical Notes	22 Sep 2008
320-v1	HSHS Power Spectra	David McGinnis	Technical Notes	02 Jun 2008
311-v2	Initial Measurements of Radio Frequency Interference at 1 GHz at Fermilab	-----	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

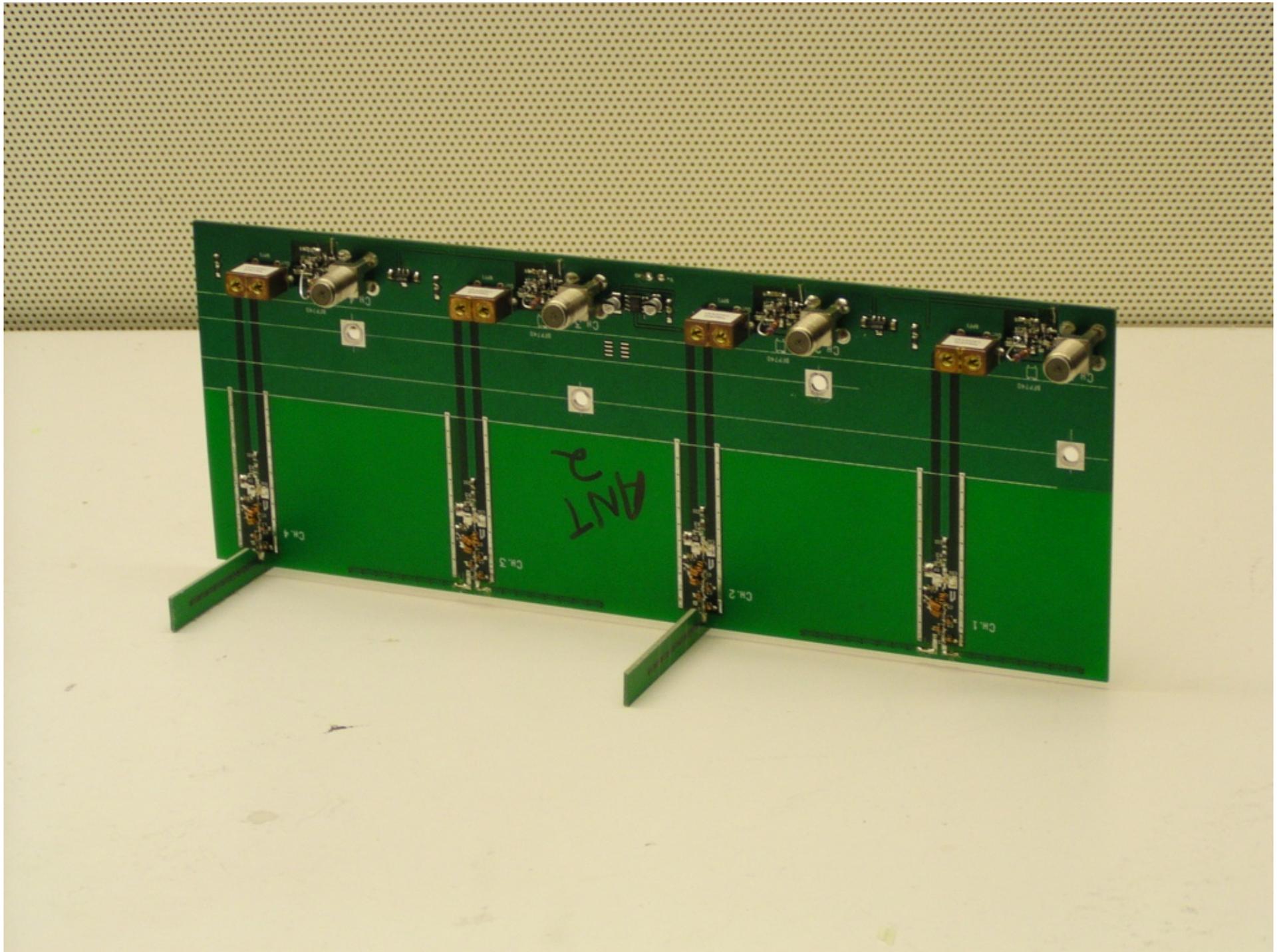
- R. Ansari, et al., “Reconstruction of HI power spectra with radio-interferometers to study dark energy,” arXiv: 0807.3967 (July 2008)
- Tegmark & Zaldarriaga, “The Fast Fourier Transform Telescope,” arXiv:0805.4414v1 [astro-ph] (May 2008)
- Chang, Pen, Peterson, & McDonald, “Baryon Acoustic Oscillation 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

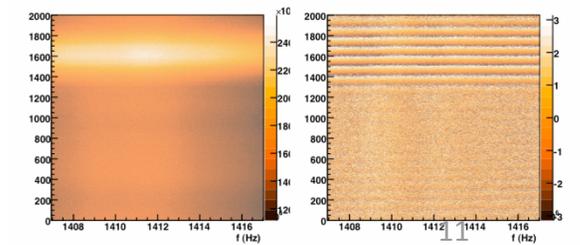
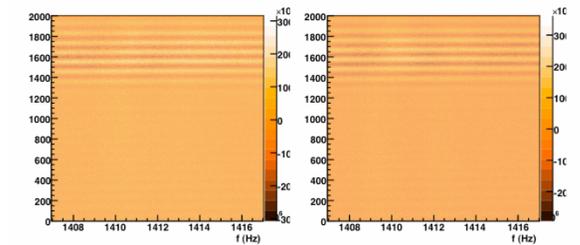
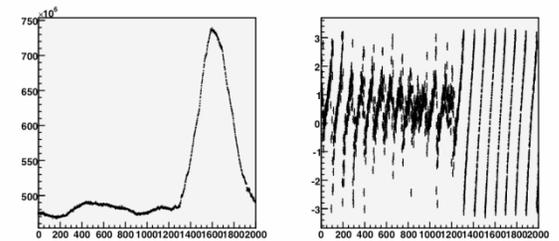
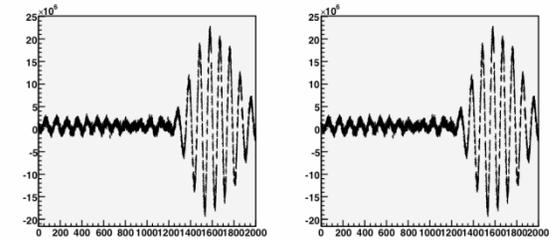
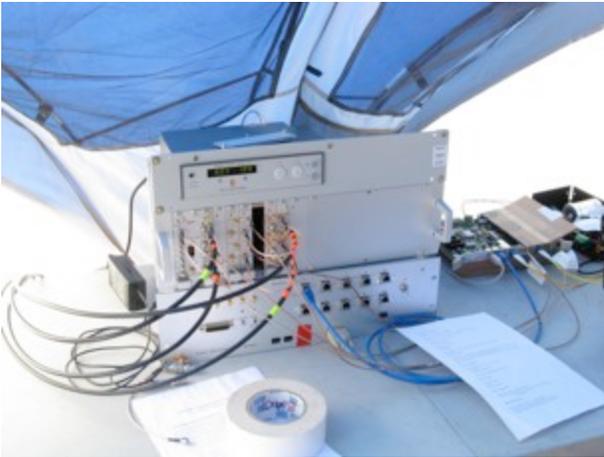


6/3/09

21 cm BAO

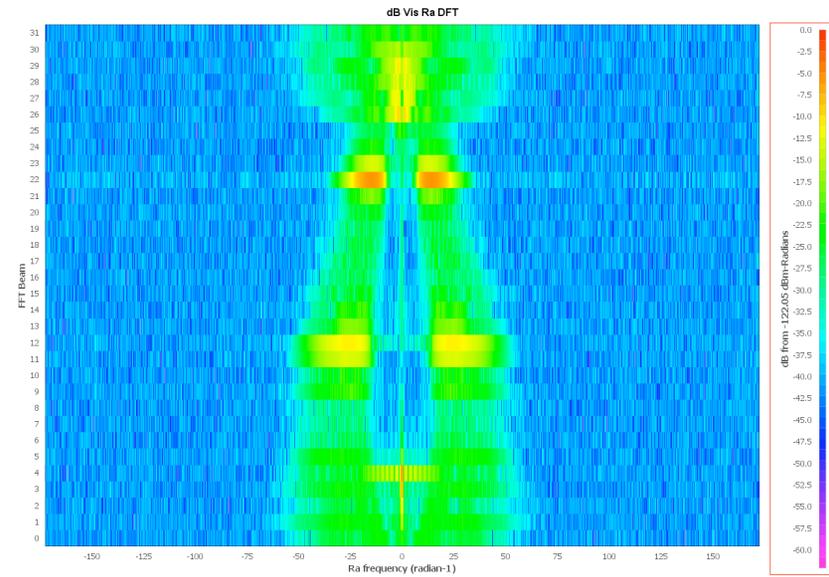
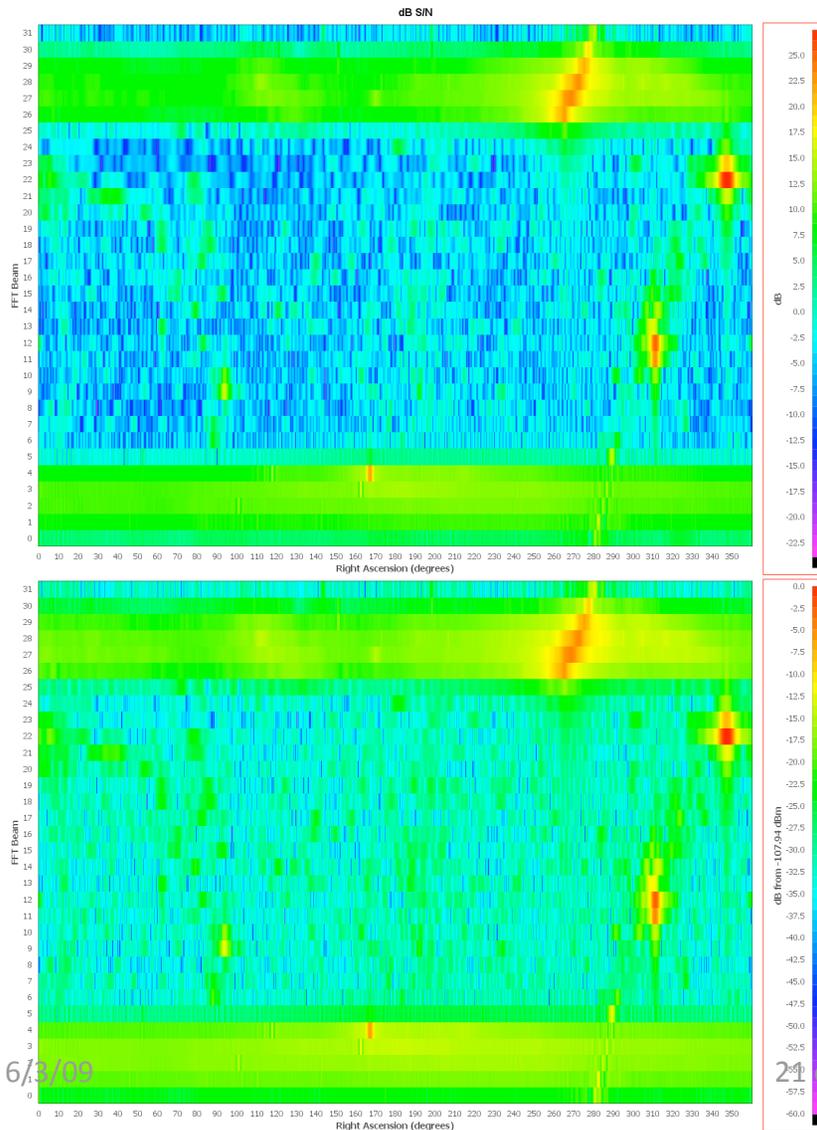


French Electronic Tests at Pittsburgh



21 cm BAO

Complete Sky and Instrument Simulations of the Pittsburgh Prototype



6/3/09

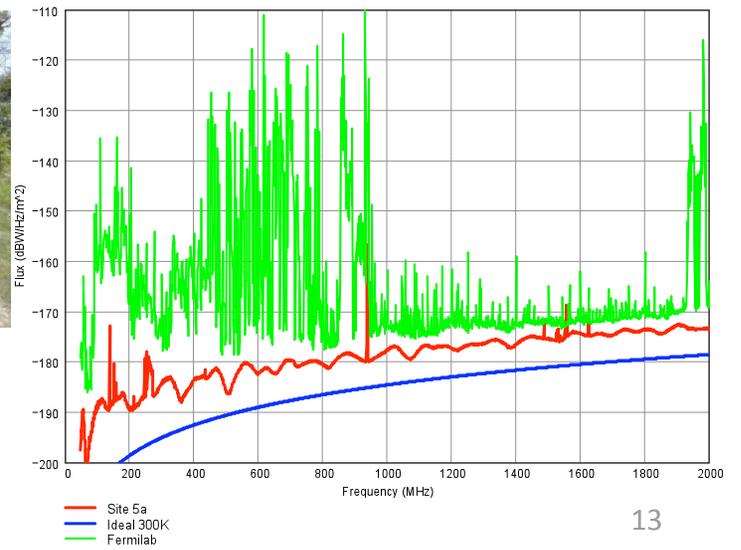
21 cm BAO

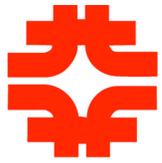
Site Tests

Qatar
 Kalahari
 Morocco
 Chihuahua
 Penticton
 Green Bank
 Wisconsin
 Inner Mongolia



6/3/09





Charge element 2b

- Is a rigorous site selection process underway? Are there technical, cost/schedule, and collaboration factors that make a Morocco site better than other possibilities?
 - ❑ A formal site selection process is *not* underway.
 - ❑ We will not choose a site before we have a viable funding plan because the decisions may be intertwined.
 - ❑ Morocco is potentially an excellent site but lacks infrastructure.
 - ❑ We have informal offers to use existing sites on a cost-neutral basis.



Charge Element 2c

- 2c) What role will FNAL play in the technical design and prototyping process. In particular, will FNAL have a significant role in antenna design or electronics? Does FNAL have people with sufficient expertise to do this work and, if so, are such people available? If the hardware design is mostly done by other institutions, do they have the technical resources and expertise to carry it out?
 - ❑ 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 including antenna design or electronics.
 - ❑ The French labs (Saclay and Orsay) are both rich in resources and the University collaborators have demonstrated abilities to build hardware.



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 3a

- Has a coherent collaboration emerged, capable of moving this concept towards an experiment? Are there well-defined institutional roles during the design and R&D phase? What are the institutional commitments? Does the collaboration have the credibility and expertise to carry this project to completion?
 - ❑ 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.



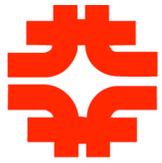
Charge element 3b

- Is there a realistic schedule and budget for completing R&D and moving forward with a project? Is there a realistic plan to obtain funding for R&D?
 - The plan needs to be developed.
 - The budget and schedule need to be developed.



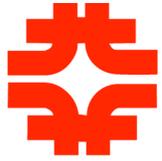
2010 Work Plan

- Finish pre-conceptual design report
 - ❑ Good progress on simulations
 - ❑ Outline and chapter assignments exist
 - ❑ Many unresolved issues!
 - ❑ A prerequisite for future work
- Exploit existing test facility at Pittsburgh
 - ❑ Develop alignment and calibration techniques
 - ❑ Test processing electronics
 - ❑ Make sky maps
 - ❑ Test foreground subtraction technique(s)



2010 Work Plan (con't)

- Establish a funding model (Requires some consultation with FNAL management)
- Realistic cost estimate (Requires some FNAL engineering support)
- Create an R&D plan for a “10%” prototype based on the pre-conceptual design
 - Test prototype hardware and software
 - Address foreground subtraction and calibration issues
 - Make a “detection” of LSS/BAO



2010 Work Plan (con't)

- Give more talks on 21 cm project
 - Build support for the concept
 - Recruit additional collaborators



Issues

- At the moment, there is no official support for the R&D effort at FNAL.
- We are seeking an endorsement for this effort ...
 - Support for scientific effort including salaries and travel.
 - Engineering support for system evaluation and development of realistic budget and schedule.