



PIXE PAN

JINA International Advisory Committee

March 2nd, 2007

Notre Dame, IN

Ed Stech

University of Notre Dame

Outline



- I. What is PIXE PAN
- II. Who Participated
- III. Participant Reaction
- IV. Plans for 2007

PIXE PAN 2006 Overview



- 2 Week Program
- 1st Week Teachers Only
- 2nd Week Teachers work with Students
- Three different experimental stations all using photon detectors.
- Student presentations can be found on JINA's website

2006 Schedule



PIXE-PAN Schedule 2006

TEACHERS (June 12 - 16):

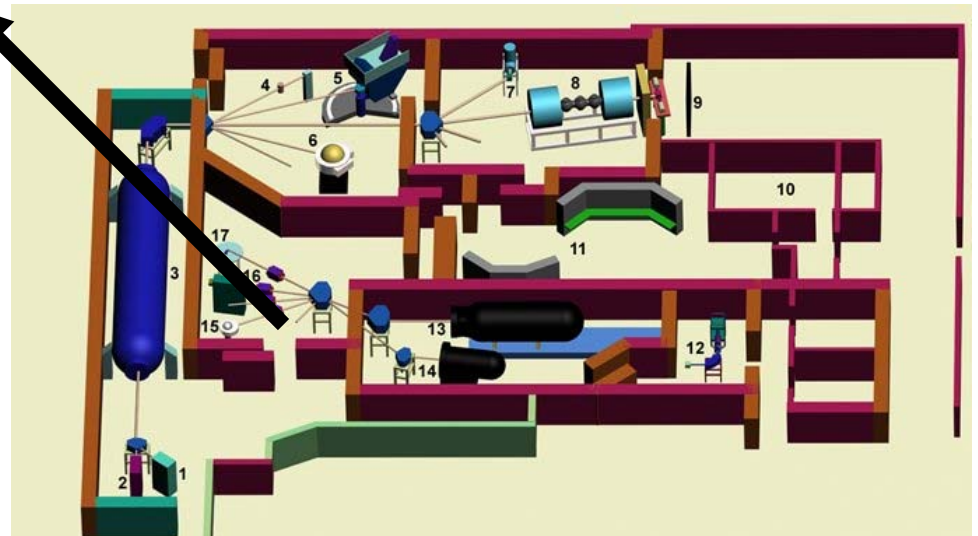
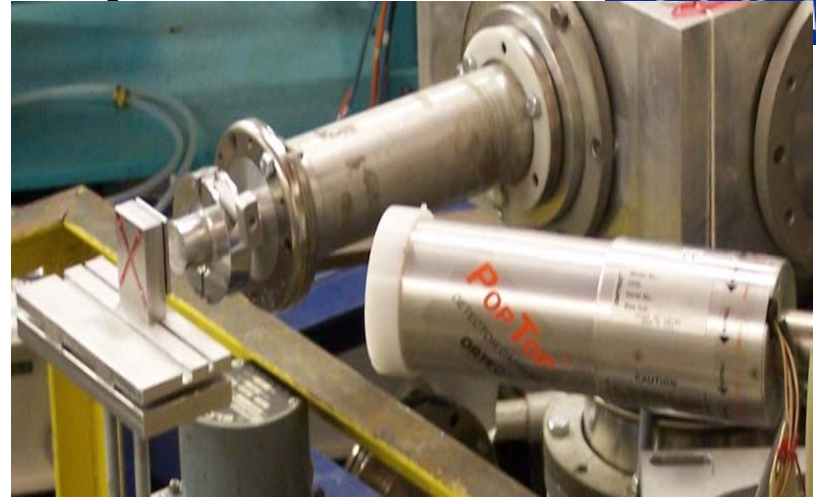
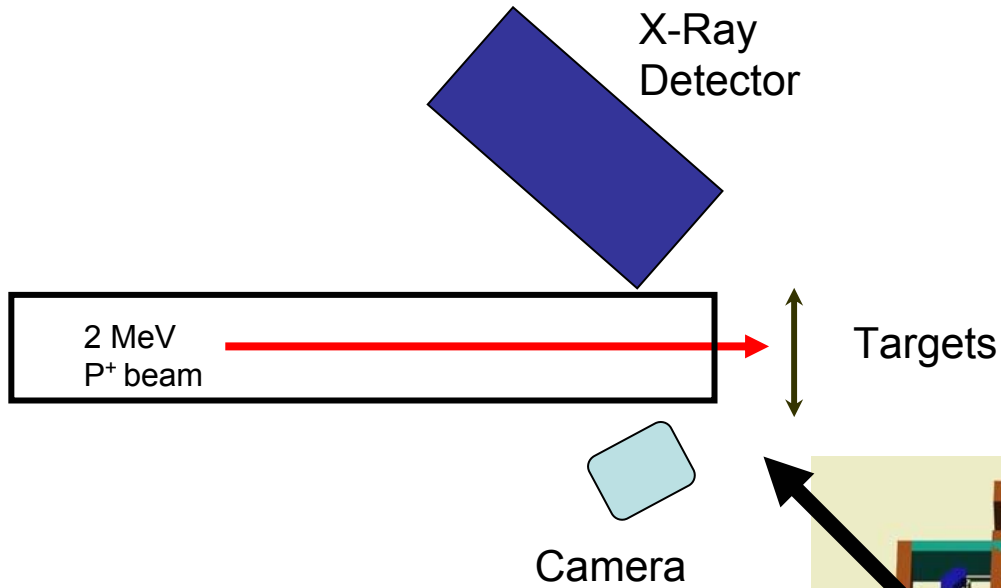
	Monday	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
time					
9:00	welcome/check in	daily orientation	daily orientation	daily orientation	daily orientation
9:15	introductions	Lecture (Tony Hyder)	Lecture (Phil Sakimoto)	Lecture (Ani Aprahamian)	Lecture (Larry Lamm)
9:30	Lecture Larry Lamm "Intro to PIXE"	Intro to Nuclear Science	Astronomy	JINA/Nuclear Astrophysics	PIXE Applications
10	Q&A & break	Q&A	Q&A	Q&A	Q&A
10:30	NSL Tour (Ed/Larry)	break	break	break	break
11:00		technical talk making beam	technical talk detector physics	technical talk statistics & analysis	teacher group proposals
11:30					
noon	LUNCH Provided SDH in group	lunch break	lunch break	lunch break	LUNCH Provided (JJ in conf room)
12:30					
1:00	Rad Safety	PIXE Experiment	Decay Lab 1	Decay Lab 2	Analysis
1:30					
2:00	Experimental Set-Ups				
2:30		break (when needed)	break (when needed)	break (when needed)	break (when needed)
3:00		PIXE cont'd	Decay lab 1 - cont'd	decay lab 2 cont'd	Analysis cont'd
3:30					
4:00					
4:30	re-cap today/plan tomorrow	re-cap today/plan tomorrow	re-cap today/plan tomorrow	re-cap today/plan tomorrow	re-cap today/plan tomorrow
5:00					

TEACHERS & STUDENTS (June 19 - 23):

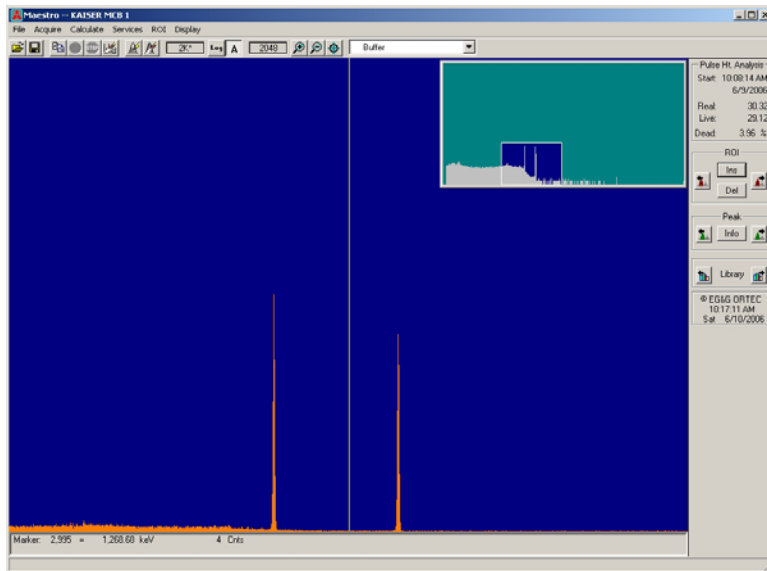
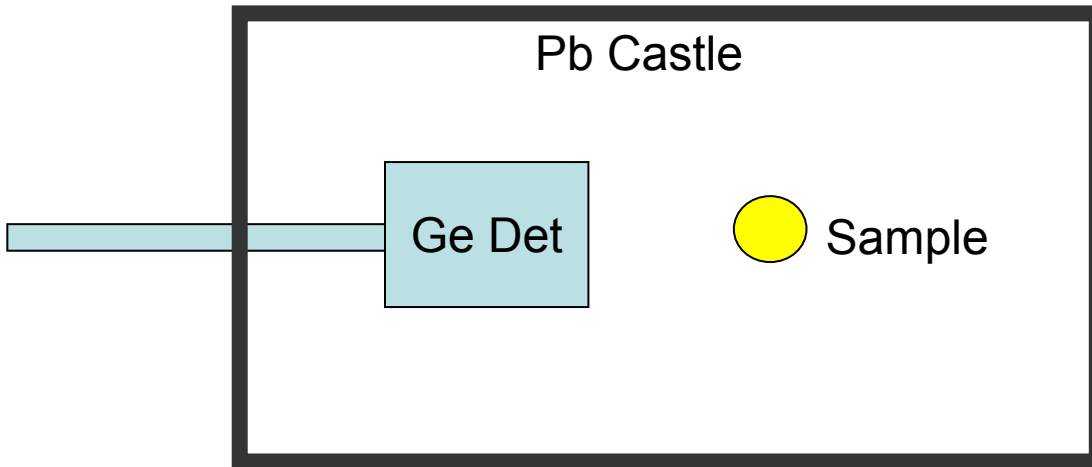
	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
time					
9:00	welcome/check in	daily orientation	daily orientation	daily orientation	daily orientation
9:15	introductions	Lecture (Philippe Collon)	Lecture (Peggy Norris, LBNL)	Lecture (Phil Sakimoto)	Lecture (Larry Lamm)
9:30	Lecture Larry Lamm "Intro to PIXE"	AMS	Intro to Nuclear Sciences	Astronomy	PIXE Applications
10	Q&A & break	Q&A	Q&A	Q&A	Q&A
10:30	NSL Tour (Ed/Larry)	break	break	break	break
11:00		technical talk making beam	technical talk detector physics	technical talk statistics & analysis	presentation preparations
11:30					
noon	LUNCH Provided SDH in group	lunch break	lunch break	lunch break	LUNCH Provided (JJ in conf room)
12:30					
1:00	Rad Safety	Experimental Stations (rotate through 3)	Experimental Stations (rotate through 3)	Analysis	presentation preparations cont'd
1:30					
2:00	Experimental Set-Ups	in groups	in groups		Presentations (184 NSH)
2:30		break (when needed)	break (when needed)	break (when needed)	
3:00		Experiments cont'd	Experiments cont'd	Analysis cont'd	Thank you's
3:30				presentation prep	GEO-Wall activity/talk
4:00					Grant Mathews
4:30	re-cap today/plan tomorrow	re-cap today/plan tomorrow	re-cap today/plan tomorrow	re-cap today/plan tomorrow	



PIXE Setup



Decay I Setup



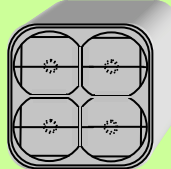
Decay Lab II Setup

Analyzing magnet

$E_p = 2.64 \text{ MeV}$

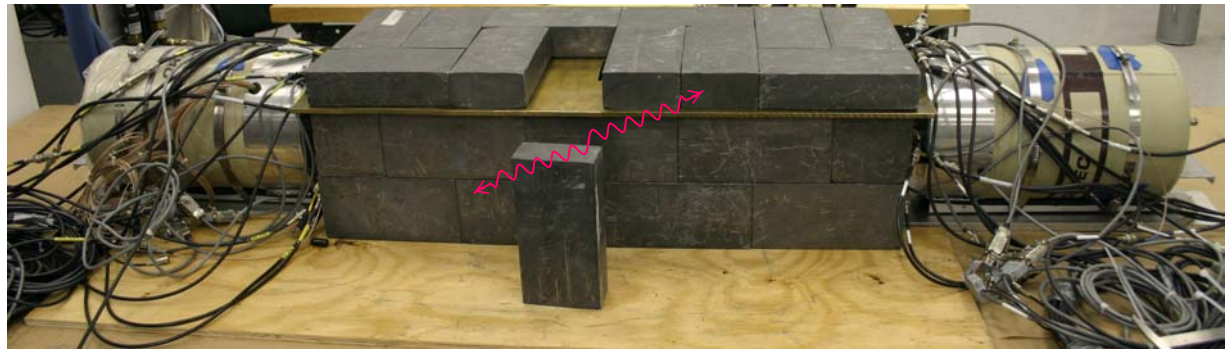
LN-cooled cold trap

Water-cooled target holder



Ge-Clover detectors

- *4 crystals subdivided electronically into two
- *130% total efficiency
- *shielded by 5cm Pb
- *faced each other in 5mm and filled in with Pb



KN accelerator

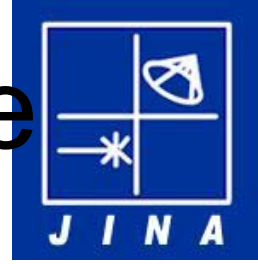
Activated target to be decayed by β^+ and annihilation:
2 Clover detectors count 2-511keV γ -rays.

2006 Participants



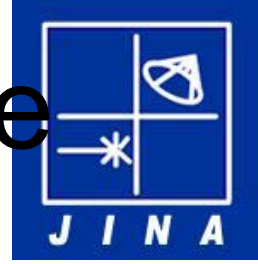
- 6 Teachers from 3 different States and 5 schools.
- 10 Students from 3 different States and 6 different schools.
 - 4 Female, 6 Males
- 3 Groups each with 2 teachers and 3 or 4 students.

PIXE-PAN Summer Science Program



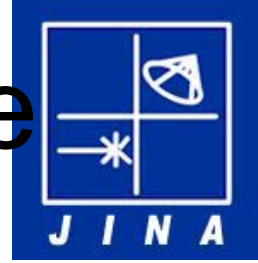
ND Technician
Brad Mulder
showing the
PIXE-PAN
teachers the
JN accelerator.

PIXE-PAN Summer Science Program



ND Graduate Student Elizabeth Strandberg leading a lab on nuclear decay.

PIXE-PAN Summer Science Program



New Haven High School student Emily Kruckeberg adjusting the beamline on the KN accelerator in the NSL.

Exit Survey Results



- Teachers:
100% of respondents said they would “definitely” recommend the program to their colleagues.
- Students: 100% of respondents said the program increased their interest in science. 80% of respondents said they would “definitely” recommend the program to other students.



Plan for 2007

- More emphasis on PIXE measurements and analysis.
- More detailed analysis of PIXE data with an emphasis on quantitative results.
- More freedom to design their own experiments.
- PIXE setup will use FN accelerator with a new setup.
- New Samples including some meteorites.



PIXE-PAN@ND 2007 Summer Science Program

Joint Institute for Nuclear Astrophysics
Nuclear Structure Laboratory @ University of Notre Dame

High School Science Teachers: June 18 - 30

High School Students: June 25 - 30

Apply on line at: www.JINAweb.org/outreach/PIXE
Application deadline: April 1st



Use accelerator based X-RAY analysis of materials from art to archaeological artifacts



Spend time working with particle accelerators in the Nuclear Structure Lab

PIXE: Proton Induced X-ray Emissions – an accelerator based technique to ascertain elemental abundances in the analysis of objects;
PAN: Physics of the Atomic Nuclei program, a successful educational outreach program for teachers and students @ MSU now in its 13th year
PIXE-PAN: a replication of the MSU program at ND, with a PIXE focus.

TEAM PIXE-PAN @ ND 2006



Team Leader: Kevin Johnston, Teacher
Jimtown High School

Chief Lieutenants: Larry Lamm, Research Professor of Physics
Technical Director, Nuclear Structure Laboratory, University of Notre Dame

Ed Stech, JINA Faculty, University of Notre Dame

Team Faculty: Tony Hyder, Professor of Physics, University of Notre Dame
Phil Sakimoto, Professional Faculty, Department of Physics, University of Notre Dame
Ani Aprahamian, Professor of Physics, University of Notre Dame
Philippe Collon, Assistant Professor of Physics, University of Notre Dame
Peggy McMahan Norris, Research Professor of Physics, Lawrence Berkeley Laboratory
Peter Garnavich, Professor of Physics, University of Notre Dame
Grant Mathews, Professor of Physics, University of Notre Dame

Domestiques: Manoel Couder, JINA PostDoc
Heide Costantini, JINA PostDoc
Hye-Young Lee, ND Graduate Student
Annalia Palumbo, ND Graduate Student
Dan Robertson, ND Graduate Student
Elizabeth Strandberg, ND Graduate Student
James Miller Marquez, REU/ND Undergraduate Student
Brad Tucker, REU/ND Undergraduate Student
Adam Lamm, Penn High School, photographer

Director Sportif: Suzanne Coshow, JINA Faculty, JINA Outreach

In the Team Car: Joachim Görres, Research Professor of Physics, University of Notre Dame

Sponsor CEO: Michael Wiescher, Freiman Professor of Physics, University of Notre Dame
Director, Joint Institute for Nuclear Astrophysics