Argonne NATIONAL LABORATORY

... for a brighter future

Presentations at Proton Accelerator Review

Overview & Introduction	*---H.Weerts*
CDF at Argonne	*---A.B. Wicklund*
ATLAS: Hardware, Computing, Operations & Analysis	*---J.Proudfoot*
ANL ATLAS Analysis Support Center	*---R.Yoshida*
Neutrino Program at ANL	*---M.Goodman*

June 11, 2009, Bethesda, MD

U.S. Department of Energy

UChicago ▶ Argonne LLC

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Overview and Introduction

H.Weerts

HEP Division

Argonne National Lab

Main theme for ANL HEP

One word mission and goal for ANL HEP:

ENABLE

Actions and activities are driven by "enabling" future of HEP

This means:

- Strong contributions to experiments: CDF, MINOS….ZEUS
- Enabling national participation in ATLAS/LHC
- Developing new "technologies" for accelerators & detectors to enable experiments
- Interact with & use material science, computing, nano scale, accelerator expertise at Argonne to do this (interact with other sciences)
- Also transfer HEP expertise to other fields (detector expertise for example)
- Direction for future of field (theory)
- Connections & collaboration with universities (examples later)

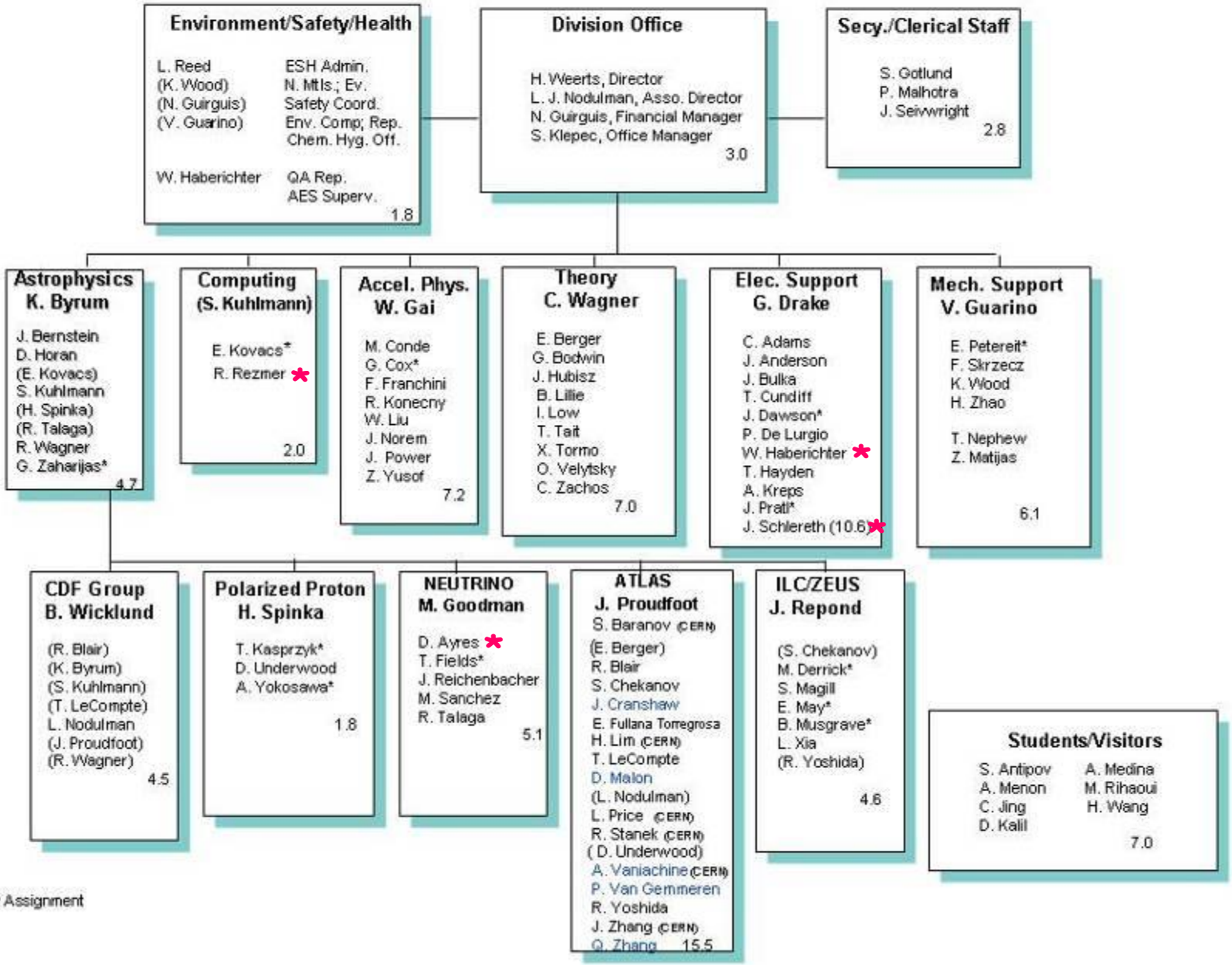
Nova

ANL HEP DIVISION ORGANIZATION CHART

Version: February 2008

Total Staff: 92 Total Full-time Staff: 76

* Voluntary layoff FY08



*Part time

( ) Secondary Assignment

ANL HEP DIVISION ORGANIZATION CHART

VERSION: JUNE 2009 TOTAL STAFF: 93

Environment/ Safety/ Health

L. Reed	ESH Admin.
(K. Wood)	366 Bldg. Manager
(N. Guirguis)	Safety Coord.
(V. Guarino)	Env. Comp. Rep.
	Chem. Hyg. Off.
N. Guirguis	QA Rep.

Division Office

H. Weerts	Director
L. J. Nodulman	Assoc. Director
N. Guirguis	Assist. Div. Director
J. Seivwright	Office Manager

Finance & Admin.

N. Guirguis
- S. Gotlund
- N. La Rue
- P. Malhotra
- J Seivwright
- L. Stech

Astrophysics

K. Byrum
- J. Bernstein
- (E. Kovacs)
- S. Kuhlmann
- A. Smith
- (H. Spinka)
- (R. Talaga)
- (D. Underwood)
- R. Wagner

Computing

(S. Chekanov)
- J. Hinthorn
- E. Kovacs*

Accel. Physics

W. Gai
- S. Antipov
- M. Conde
- R. Konency
- W. Liu
- J. Norem
- J. Power
- T. Prolier
- Z. Yusof

Theory

C. Wagner
- E. Berger
- G. Bodwin
- Q. Cao
- C. Jackson
- I. Low
- E. N. Mann
- G. Shaughnessy
- D. Sinclair
- T. Tait
- X. Tormo
- C. Zachos

Electric Support

G. Drake
- C. Adams
- J. Anderson
- J. Bulka
- T. Cundiff
- P. De Lurgio
- W. Haberichter
- T. Hayden
- A. Kreps
- J. Pratl*

Mech. Support

V. Guarino
- F. Skrzecz
- K. Wood
- H. Zhao
- T. Nephew
- Z. Matijas
- S. Doran
- J. Zmuda
- M. Lien

CDF Group

B. Wicklund
- (R. Blair)
- (K. Byrum)
- (T. LeCompte)
- L. Nodulman
- (J. Proudfoot)
- (R. Wagner)

Polarized Proton

H. Spinka
- A. Bridgeman
- T. Kaspyzyk*
- K. Krueger
- D. Underwood

Neutrino

M. Goodman
- T. Fields*
- X. Huang
- M. Sanchez
- R. Talaga
- S. Budd

ATLAS

J. Proudfoot
- (E. Berger)
- R. Blair
- G. Blazey
- S. Chekanov
- J. Cranshaw
- E. Fullana Torregrosa
- T. LeCompte (CERN)
- D. Malon
- (L. Nodulman)
- L. Price
- M. Salvachua Ferrando
- R. Stanek
- (D. Underwood)
- A. Vaniachine (CERN)
- P. Van Gemmeren
- R. Yoshida
- J. Zhang (CERN)
- Q. Zhang

Detector R&D

J. Repond
- M. Derrick*
- H. Frisch
- S. Magill
- E. May*
- B. Musgrave*
- D. Onoprienko
- J. Smith
- (D. Underwood)
- M. Wetstein
- L. Xia

Students/Visitor

C. Awad
J. Boomsma
I. Crane
J. Cunningham
R. Essick
F. Gao
N. Gardner
T. Hufford
A. Kanaseykin
W. Keung
K. Kumar
H. Lipkin
B. Loseth
Z. Lu
A. Lumpkin
A. McBowun
S. Milton
T. Mui
T. Nussbaum
P. Piot
K. Ramirez
M. Ramirez Palacious
G. Ramsey
M. Rihaoui
P. Schoessow
S. Shalgar
D. Sinclair
Z. Sullivan
A. Taborgo
D. Turner
J. Uretsky
M. Virgo
R. Vega- Morales
E. Yustev
J. Xue
Qingmin Zhang

*Part Time

( ) Secondary Assignment

Lots of visitors for summer

Argonne HEP science program overview

Science pillars

Collider physics (Terascale)
ZEUS, CDF phasing in

ATLAS past & future (analysis center & upgrade); computing

ILC longer term (PFA, R&D & SiD)

Neutrino physics

MINOS analysis

Nova very active

Reactor based: DC

Long Baseline

Theory Pheno.

BSM & QCD ⇔ Collider program

Need theory & exp. for physics

Joint NU

Reviewed

Advanced Acc. R&D

AWA facility (dielec. wakefield, two beam)

Accel. Physics

Muon Collider (breakdown)

.....

SCRF new directions

Astro physics

VERITAS DES

Lab wide initiative; LDRD funded

Define future…

Detector R&D

DHCAL (digital gas HCAL)

New photo detectors /pico sec timing

Support groups critical

ILC R&D (AAI)

SCRF, positron source, controls system

Detector R&D: PFA & HCAL

Strong support groups:

- Electronics group, serves several divisions; design & build
- Mechanical support group; design & build
- Scientific Software & Computing

(this review)

Argonne HEP science program overview

Science pillars & funding sources

Collider physics
(Terascale)

ZEUS, CDF phasing in

ATLAS past & future (analysis center & upgrade); computing

Proton acc.

ILC longer term (PFA, R&D & SiD)

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Theory

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AWA facility (dielec. wakefield, two beam)

Accel. Physics

Acceler, Science

Muon Collider (breakdown)

.....

SCRF new directions

NIU acc.

Astro physics

VERITAS DES

Non-Acceler.

Lab wide initiative; LDRD funded

Define future...

Other

Detector R&D

DHCAL (digital gas HCAL)

Techn. R&D

New photo detectors

+ several others, smaller

Support groups critical

ILC R&D (AAI)

SCRF, positron source, controls system

Detector R&D: PFA & HCAL

Strong support groups:

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- Scientific Software & Computing

Collider Physics I

CDF — EW convener; chair of reading group, B physics, hardware responsibilities (on call).

ATLAS — Leading role in design, construction and commissioning:
Tile Cal; TDAQ and Computing

Leading roles in ATLAS in all three -- @CERN

Upgrade efforts in future:
Tile cal electronics --- with Chicago
Trigger & DAQ --- with MSU
Computing .....

Collider physics (Terascale)
ZEUS, CDF phasing out

ATLAS past & future (analysis center & upgrade); computing
Proton acc.
ILC longer term (PFA, R&D & SiD)

ATLAS transition to analysis/physics

ATLAS physics Coordinator from Argonne
Director's Fellow joined (turned down CERN offer)
Strong analysis support and expertise ➔ "ENABLE"

ANL Analysis Support Center (ANL ASC)

There will be need for this
Enable National HEP
Enable LHC physics in US
Support universities

More ➔

Collider Physics II

ATLAS

ANL ASC

Argonne ATLAS group not work alone
Support national program in ATLAS

Not necessarily agreed upon model

Reasons:

"ENABLE" LHC physics

- Have centers of ATLAS physics/activities in US
- In a few years "only" activity in US
- LHC program needs visibility in US (large investment)
- At **all** national labs provide place to work on LHC
- Not everybody can go to CERN (less in future)
- Theory at Argonne support physics
- Computing expertise (data access) valuable to experimenters
- Argonne Tier 3 configuration proposal; use at Argonne and home institution
- Expertise at Argonne to do this (ZEUS group ➔ ATLAS)
- Proximity to LPC at Fermilab
- Keep physics centers in US for national program (not everybody at CERN)
- Labs support university programs, build relationships
- Place for Fermilab to join ATLAS

Collider physics (Terascale)
ZEUS, CDF phasing out

ATLAS past & future (analysis center & upgrade); computing

Proton acc.
ILC longer term (PFA, R&D & SiD)

It is not that complicated to do; space, infrastructure exists

ANL is taking this serious; started in this direction and try to provide this.... more in later talk

Neutrino Physics

Diverse program at accelerator and non-accelerate.
Very active senior person retired last year (voluntary layoff) not replaced
Group active in US program; publish neutrino newsletter

Neutrino physics

MINOS analysis

Nova very active

Reactor based: DC
Non-Acceler

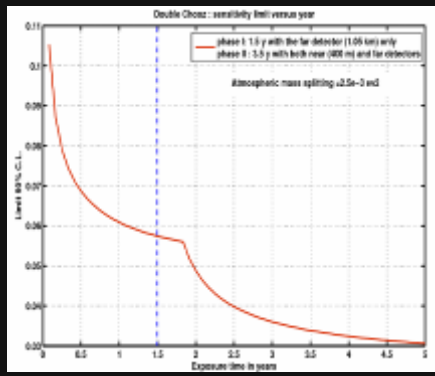
Long Baseline

MINOS
Actively involved in analyses
Leading ν_e appearance

Nova*
Develop Assembly (vacuum lift, glue application)
Assemble prototype & optimize (CD 3b review)
Assemble IPND for physics
First physics with IPND in beam ~2010 & continue

Use unique buildings & engineering at Argonne

Double Chooz
Calibration system design and construction (with Drexel Univ)
First indication of θ_{13} through 2011, 2012
Long time involvement



Long baseline
Some involvement in target/horn/beam layout
Engaged in collaboration (water Cerenkov)
R&D on large area photo detectors (later detector R&D)

For size and facilities: 56’ x 56’ Nova prototype module

(not this review) Argonne HEP science program overview

Science pillars & funding sources

Collider physics	Neutrino physics	Theory Pheno.	Advanced Acc. R&D	Astro physics	Detector R&D	ILC R&D (AAI)
(Terascale) ZEUS, CDF phasing in	MINOS analysis	BSM & QCD ⇔ Collider program	AWA facility (dielec. wakefield, two beam)	VERITAS DES	DHCAL (digital gas HCAL)	SCRF, positron source, controls system
ATLAS past & future (analysis center & upgrade); computing	Nova very active	Need theory & exp. for physics	Accel. Physics	Non-Acceler. Lab wide initiative; LDRD funded	Techn. R&D New photo detectors	Detector R&D: PFA & HCAL
Proton acc. ILC longer term (PFA, R&D & SiD)	Reactor based: DC	Joint NU	Acceler, Science Muon Collider (breakdown)	Define future…	+ several others, smaller	
	Non-Acceler. Long Baseline	Reviewed Theory	SCRF new directions	Other	Support groups critical	
			NIU acc.			

Strong support groups:

- Electronics; serves several divisions; design & build
- Mechanical; design & build
- Scientific Software & Computing

Support groups

Serves several divisions;

In FY08: ~40% work for HEP

Distribution varies by year

From R&D: 20-30%/year

Mix of "staff" & projects

Electronics:

- Group Resources :
  - 10 people in total

Mechanical:

- Group Resources:
  - 9 people in total

Typically work on project oriented R&D or construction. Small amount from R&D

Both groups are in the HEP division

(both groups need other funding sources to exist)

Unique capabilities & facilities

Theory

Strength in QCD and BSM model building well positioned for LHC results.

This is needed to extract physics from LHC.
Active participation in ATLAS jamborees and workshops.

Theory
Pheno.

BSM & QCD ⇔ Collider program

Need theory & exp. for physics

Joint NU

Reviewed

Joint workshop day two weeks ago

Theory is WEB that ties it all together

Theory group is a mix of experienced senior and junior people with expertise to make an impact.

Accelerator R&D

Emphasis on Argonne Wakefield Accelerator

- Dielectric high gradient acceleration structures (> 100MV/m)
- Two beam acceleration; short pulses
- High current; short pulse; high quality drive beam; photo cathode development
- Accelerator science

Advanced Acc. R&D

On path towards reconfiguring beams; install new drive beam; klystron commissioned

AWA facility (dielec. wakefield, two beam)

Muon collider: (one person)

- Breakdown mechanisms
- ALD treatment of SRF Nb cavities --- LDRD support

Accel. Physics

Muon Collider (breakdown)

NIU

- Setting up ~5MeV diagnostic machine in same building (slow), ONR funded

SCRF new directions

NIU acc.

Astrophysics

Part of LDRD initiative: 2008- ~2010

Astro physics

VERITAS

DES

VERITAS
DES

Lab wide initiative; LDRD funded

Define future…

VERITAS

Participating in analysis; leading DM search
Effort towards future & upgrades
Both AEGIS & CTA
Collaboration with Chicago, UCLA and SLAC (also competition)

Camera development
Telescope
Trigger with Iowa
(details Detector R&D)

DES

Joined through LDRD "buy-in"
Strong mechanical engineering contribution –switch to project
Very active in science: other surveys
Responsible for producing run "plan" or "map" for DES

Initiative partially Argonne funded in FY08 → FY10

Detector R&D

DHCAL (digital gas HCAL)

New photo detectors /pico sec timing

Support groups critical

Name	Description	Collaboration
DHCAL	RPC based digital hadron calorimeter; driven by PFA & LC physics	CALICE & SiD. In US: Boston, Iowa, FNAL, UTA
PFA	Algorithm development; directed at SiD	SiD concept (LOI preparation)
New, photo detectors	Large area new, cheap photo detectors (Use ALD @ANL)	Chicago (ADR) + many others(incl. SLAC, FNAL, LBNL SSL)
Trigger	Topological trigger for VERITAS or future	Iowa State (ADR), sabbatical
SiPM	Characterization, PET, national security, AEGIS	Chicago (Med), MPI(?)
CCD test	Testing & characterize DES; setup teststand	ANL & DES
PreCam	Design vacuum vessel	ANL & DES
Future DAQ	ATCA based systems	ANL
Wireless	Wireless & fiberless data	ANL
Telescope	New telescope design; Schwarzschild -Couder ++	UCLA, AGIS/'CTA'
TES	Threshold edge sensors for CMB polarization	MSD & Chicago

Exciting & important program

ILC accel R&D

ILC accel R&D

- Argonne wide participation, coordinated through Argonne Accelerator Institute (AAI)
- Cavity processing facility (joint ANL-FNAL) for EP,

- Control System development (EPICS)
- Physics/Science of positron source simulation (HEP)

ILC R&D (AAI)

SCRF, positron source, controls system

Detector R&D: PFA & HCAL

Have processing facility for cavity processing for ILC and Project X

In very close collaboration with Fermilab

Establish process cycle/schedule for next few years → 2012

Funding & future

- Funding

Table I (all numbers in k$)

FY08 (actual)	FY09	FY10	FY11	FY12
4,540k$	5,221k$	5,459k$	5,470k$	5,735k$

Details in spreadsheets

Why did I drag you through whole ANL HEP program ?

- Strong feelings about having strong national program
- Program can not simply be "only" at CERN
- Next 10-15 years, strong emphasis on LHC– deal with it
- Have strong LHC analysis/physics capabilities & presence in US

Summary

Vision:

- Establish LHC analysis support centers at all HEP labs (already infrastructure)
- Have LHC people interact with/participate in programs (make them interesting!!) at labs: neutrinos, astrophysics, detector & acc. R&D, new technologies, new computing, new tools…..
- Labs have major responsibility here to make an interesting program and have university participation/enable universities & others

We are attempting this at Argonne.

We look forward to your feedback.

More and details in the next presentations…….