

A Vision for Argonne HEP

A preview /try out of my DOE review intro talk

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Feedback is appreciated.....

Purpose of this talk

Practice talk for DOE review and other occasions

← March 30 & 31, 2006

Goal

Establish a vision /image/program for Argonne HEP

Want to set the tone for review in intro talk i.e. the main direction for division

Other talks provide the scientific/technical/implementation of this vision for Argonne

Collaboration with other divisions, managing institutions & Fermilab is one component

Would like to keep this information within division for now.

Draft Vision for HEP

Division program:

- Work on national priority programs
- Programs with high visibility
- Use strength of division
- (New) programs need strong physics case

Keep division alive can be in back of our mind, but can not be the driving force

Vision for division:

- Opportunities in physics are manifold
- Make choices based on our strength
- Limit our involvement to funding capabilities (slightly overextend)
- Pursue directions with goal to be the best and visible
- Support those programs from base
- Pursue innovative new ideas → accelerator & detector R&D program
- Increase # postdocs & students

Sharpen this up;
need your input/help
& support

Let's see whether we project this.....

FY06- current year

Started year with a very difficult financial situation
About \$1M shortfall

Additional funding

ATLAS M&O funds are specific and are not simply base
LDRD funds realized

Support from DESY for S.Chekanov

NOVA R&D support: total \$0.5M, instead of \$0.25M

General supplement: \$0.2M (not very public)*

Possible other sources(not realized yet)

Fermilab, Accelerator R&D, ATLAS support center

Reactor neutrino R&D (total national: \$3M)

Not out of the woods yet

**Not all information is to be widely broadcast*

Division Funding FY07

Background info

FY07- request; still needs congressational approval

Overall base budget is up by 8%

Additional funding

Generic detector R&D goes from \$800K → \$400K

ILC R&D funding (for ALL of Argonne) comes through HEP division. Includes accelerator & detector.

ILC amount unknown; placeholder \$932K

ATLAS M&O funds, identify use

Neutrino R&D, not determined yet

Not out of the woods yet

Need to keep making case for funding with strong, innovative and interesting programs and then execute them well and be clearly seen as drivers for them.

Current efforts of Argonne HEP

- CDF at Tevatron with a long history
 - ZEUS at HERA, similar with long history
 - ATLAS has been the large investment
 - Neutrino physics is other main effort
 - MINOS running
 - Strong involvement in defining future US program
 - Nova (Eva) strong role this year
 - Theory continues important role in phenomenology
 - Advanced Accelerator R&D unique role
 - Role in ILC defined in accelerator & detector R&D
 - Other detector R&D efforts continue, which resulted in involvements in Veritas and Auger
-
- Astro physics initiative, Lab wide, started

Tevatron ending this decade
 HERA stop mid 2007

Future of Argonne HEP

Driven by where we want to be in 5 years.....

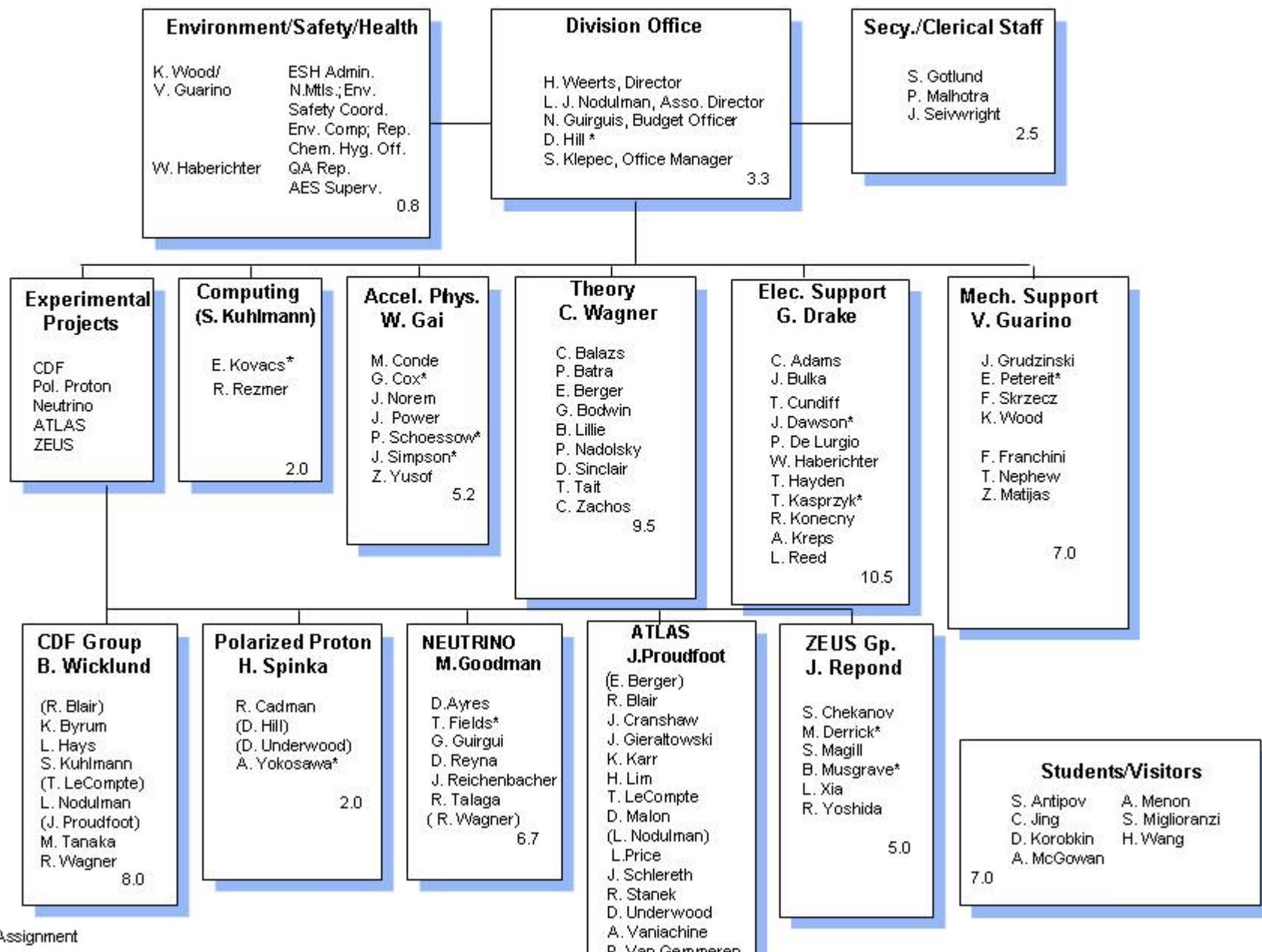
Lets see where we are now in programs and see
where we will be in 5 years

Important ingredient:

Collaboration with: Other Argonne divisions, Fermilab & UC,NU, UI

ANL HEP DIVISION ORGANIZATION CHART

Version: February 2006 Total Staff: 92 (FTE: 80.3)



*Part time
 () Secondary Assignment

Collider physics

ZEUS, CDF phasing out

ATLAS critical for future; computing

ILC long term possible

Neutrino physics

MINOS ongoing

Waiting for NUSAG
Nova going

Strong role

Beam and Reactor based

Advanced Acc. R&D

AWA facility

Accel. Physics program

Work on ILC, with other divisions

Theory Pheno.

Critical for Collider program

Need theory & exp. for physics

Detector R&D

Several efforts

Some in non-accel based efforts

Support groups critical

Astro physics

Try Lab wide initiative

Working on this

Multi divisional

Strong support groups:

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

ANL HEP -- Collider

Collider physics

ZEUS,
CDF
phasing
out

ATLAS
critical
for
future;
computi
ng

ILC long
term
possible

*LHC obviously critical for
future of HEP in world*

ZEUS will stop running mid 2007
CDF time frame is longer-- 2009

A ATLAS is critical for HEP, not just ANL HEP
T Necessary to ramp up activity
L May require faster ramp down of ZEUS/CDF
A
S Installation now, then commissioning

Future:

- Analysis center at ANL, which would serve and be center for "Midwest" ATLAS groups and more. Defining role (have had input from universities).
- Theory & ATLAS Computing group important ingredients in this

With
physics
goal shared
with
others.

CMS center at FNAL and ATLAS center at ANL can provide unique LHC physics opportunity for Illinois

ATLAS computing group -- should evolve; remain part of division

Long term future: ILC detector R&D & concept study

ν physics

MINOS: taking data & analysis

MINOS
ongoing

ANL played critical role in defining program, in studies over last few years

Waiting for
NUSAG

Have started participation in Nova, anticipating NUSAG priority and importance for FNAL program. R&D funding flow sets direction.

Nova
going

Future:

Continue MINOS

Strong
role

Be part of a reactor neutrino experiment. Preference and most work has been done on Double Chooz.

Braidwood and Daya Bay may be alternatives (reactor exp. together with PHY division)

Beam and
Reactor
based

Waiting for NUSAG..... taking rather long.

ANL ν group involved in both accelerator and non-accelerated based ν physics. **We should be a center.**

May be over committed here, given manpower

Opportunity for collaboration

Advanced
Acc. R&D

AWA
facility

Accel.
Physics
program

Work on
ILC, with
other
divisions

Advanced Wakefield Accelerator (AWA)

Research on advanced accelerator R&D: understand the underlying physics of high density beams and dielectric wakefield acceleration.

Unique in U.S.

Goal: understand physics, not build accelerator

Example: build our own photocathode for source

AWA user facility

AIRFLY - calibration
(unique contribution)

Other users (APS, NIU)

Built this up ???

(not funded this way now)

Argonne Accelerator Institute

Currently struggling, but
Work with other divisions

AWA critical part of this (R&D
component)

Test facility

Define role in ILC

Use expertise, to model the positron source for ILC.
Leading this work currently worldwide.

R&D Goal : establish large gradient wakefield acceleration $\sim 100\text{MV/m}$

Theory
Pheno.

Critical
for
Collider
program

Need
theory
& exp.
for
physics

Theory group has seen a concentration on phenomenology mostly related to hadron collider physics. Based on the Standard Model and recently with more and more emphasis on "Beyond the Standard Model" physics. In addition contributions to Quarkonium final states/ lattice QCD and more formal treatments.

Group will play/has to play a critical role in extraction of physics from LHC/ATLAS and is a necessary ingredient in an ATLAS analysis center at ANL.

Propose renewed effort in "PDF" effort within CTEQ, locate at Argonne. Use as base to be center for Standard Model LHC predictions (critical for new physics)

Would also like to explore more efforts in neutrino physics as well as "astro" physics and cosmology.

Detector R&D

Several efforts

Some in non-accel based efforts

Support groups critical

Calorimetry R&D and construction:

- There has been a long history of R&D and construction of calorimeters: CDF, ZEUS (major) and ATLAS hadron tile calorimeter
- **Based in this there is substantial program in ILC hadron calorimetry: develop PFA algorithms and develop digital hadron calorimeter, based on RPC's.**

We are interested in a "Midwest" approach to this with ANL, FNAL, NIU, UTA, UoC plus others. Started...where will it go?

Argonne playing a leading role in world in developments of PFA algorithms(measure jet energy at ILC) and development of RPC based digital hadron calorimetry for ILC.

Detector R&D

Several efforts

Some in non-accel based efforts

Support groups critical

Areas under investigation (with some funding):

- The use of MAPMT's for an upgrade of VERITAS. Test telescope at ANL to test rates (TRICE).
- Developing design of a 1GHz ASIC to read out TRICE
- Fast timing with resolution of few picoseconds (with Frisch & Sanders at Chicago)
- Calibration of fluorescence based energy measurement in air showers (Auger) using AWA, APS and van der Graaff @ ANL
- Build scintillators for Auger and transfer technology to Argentina
- Development of fast trigger processor for Veritas.
- New interest in use of SiPM as small, high gain photon collection devices

ANL HEP -- Astro physics

Astro physics

Currently based on interest of developing new techniques/transferring detector technology from HEP to astrophysics. Has resulted in ANL participation in Veritas and Auger

Try Lab wide initiative

Working on this

Three divisions (HEP, MSD, PHY) put together a 9 member committee to investigate/draft/define an ANL lab wide astrophysics initiative. If successful make this initiative part of the ANL strategic plan.

Multi divisional

→ Qualify for LDRD funds

A key requirement: it should be fundable and bring in new funding.

Named postdoc, Deirdre Hogan, arrives in September; fellowship funded by ANL, not HEP

First report due in February

Interested in collaboration with other institutions, especially close by

Quite a few potential projects

???????

Could this be more physics specific ?

"Dark matter" direction

Support groups

Existence of this infrastructure was one of reasons for me to join ANL. Physics can not be done without theory, but can also not be done without being able to build hardware and read it out.

Mechanical (V.Guarino)

- Project Management
- Structural analysis
- Finite Element modeling
- 3D solid modeling and 2D drafting
- Mechanical construction
 - ◆ Fabrication
 - ◆ Fixturing

- Machine design
- Fiber optics
- Material testing
 - ◆ Creep testing
 - ◆ Bolt strength testing
- Automatic control systems
- Safety Analysis
- Hydraulics
- Ultra-High Vacuum

Nova
taking over

Electronics (G.Drake)

This group is within HEP division, but supports other divisions, based on annual financial agreements.

- Front end electronics, specification, design and fabrication (analog and digital, including specs. for ASICs);
- high speed data processors;
- trigger systems;

- detector design for related fields (X-ray, astronomy, nuclear, neutron scattering)
- managing of projects
- take responsibility for lifetime of system

ANL special: funding & students

Special opportunities at ANL:

In addition to our base funding, which is intended for participation in "physics research", which is coupled to national priorities, there are also Lab. Director R&D funds (LDRD).

I

Unique competitive R&D funding opportunity for new directions. Collaborations with "management universities" encouraged.

In HEP this year:
~0.6M

Several R&D activities within division. Nearly all R&D activities partially supported by this funding source.

II

Special UoC funds for ANL-UoC collaborations. HEP is using them. Other opportunities with NU, UI and now LDRD funds at Fermilab

Unique opportunities for students to do research in all areas.
Currently: neutrinos, ZEUS and accelerator R&D

Driven by where we want to be in 5 years.....

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- ATLAS is the BIG one with strong connection to theory
- Neutrino physics is other main effort. Unique program with involvement in accelerator(MINOS, NOvA) and reactor (Double Chooz, plus other ?) based experiments; depends on national priority.
- Theory continues role in phenomenology & improve (colliders & neutrino?)
- Advanced Accelerator R&D continues unique program (additional component Argonne Accelerator Institute)
- ILC is more real, with real Argonne involvement or
- Detector R&D efforts continue, which emphasis on improving detector techniques

- Lab wide Astro physics initiative, will be thriving or will move in other direction

Needs physics goal; not just "astro-physics". May be "Dark Matter Institute"

Collaboration with: Other Argonne divisions, Fermilab & UC,NU, UI

See/find connections between different efforts in division.

Examples:

Dark matter searches in Veritas, CDF, ATLAS and ILC (theory links)

Phenomenology: theory & experiment

ILC R&D on accelerators & detectors

Neutrinos: in reactors and in beams; with PHY ?

Detector R&D from HEP to other areas (APS, astro, ????)

Electronics expertise to new experiments

Mechanical expertise, participate early in new projects, "outside detectors"

See/find connections with other divisions, managing universities & Fermilab

Summary

We have a strong physics (= theory and experiment) program now and an even stronger base physics program in future.
Two main, complementary directions, playing a leading role:
LHC and Neutrinos

Playing significant role in accelerator science and R&D.

Positioned to play significant role in ILC: accelerator & detector

Continue detector R&D efforts, applied and pushing forefront

Exploring new lab wide effort in "Astro-physics" lab wide
(look towards universe for clues why we are only 4% of it)

Support groups in place to support this program

Universities: Chicago, Illinois and Northwestern play special role,
because involved in managements structure of ANL
Fermilab is joined "at hip" through Chicago

Looking forward to more interaction, leading to collaboration in projects, creating
opportunities for all of us in Northern Illinois

Current numbers:

11 postdocs and 2+a+b students

This is a summary of the ANL people spreadsheet

		staff	postdocs	sta's
p-pp	21	21		
p-pp-sta	4			4
p-pp-post	7		7	
p-th	6	6		
p-th-post	4		4	
p-th-sta	0			0
p-ac	5	5		
p-ac-post	0		0	
p-ac-sta	2			2
p-comp	4	4		
p-comp-sta	1			1
mech	7	7		
mech-sta	0			0
ee	10	10		
ee-soft	1	1		
ee-sta	0			0
admin	5	5		
admin-sta	1			1
comp	1	1		
comp-sta	1			1
	80	60	11	9

Criticism....observations

Do we have sufficient resources/staff to execute all this ?

Are we willing to make choices based on funding and national priorities? Example: we have advocated choice A, but B is chosen to go forward and funding. Are we willing to join B and play critical role ?

Are we willing and able to cut our losses ? Investments in effort do not pan out, effort is not funded or is not progressing, are we willing to cut it off ?

Our efforts can not be seen as a "laundry list" of unconnected topics. There has to be a physics motivation driving them and if possible connecting them.

Others ?