HEP Division Strategic Plan

- **Charge to Planning Group**
- **Process: presentations on projects + support tasks (Dec. 03)**
- **Final Divisional review (Feb 10, 2004)**
- **Draft Report (May 2004) includes:**

  executive summary

  interactions with HEP community

  define national laboratory role

  ongoing projects

  -effort transitions from CDF,ZEUS to ATLAS, MINOS

  -advanced accelerator, theory

  new projects shorter term: neutrino, astrophysics

  new projects longer term: Linear Collider (detector R+D, future role)

  -we considered one LC scenario (technology/siting not seen as critical)

  detailed individual project goals

  recommendations

- **Choices => plan based on constant FTE 2004-2010**

Charge

- Organize the development of a long-range plan for high energy physics at Argonne National Laboratory. ***The plan should be moderately detailed for a five year period,*** based on a model of costs and FTE levels for each project, starting from the present budget and effort levels in the program. ***Appropriate sizes of technical support groups should be explicitly addressed***. It should provide a broader picture of the evolution of the program over the next 10 years.
- The following assumptions should be taken as the starting point for the plan:
  - 1. ***Base budgets should be taken as flat (constant level of effort) at the level of the FY 2004 AFP;***
  - 2. When initiatives rely on additional funding, that should be indicated explicitly and the scenarios for and likelihood of obtaining such funding should be discussed briefly;
  - 3. ***The national HEP program should be assumed to be that given in the roadmap from the HEPAP Subpanel on Long Range Planning***, as maintained by P5. If ANL plans require modification of the roadmap by P5, this should be noted explicitly;
  - 4. For definiteness in making a timeline, ***assume that the LHC will start data taking during FY 2007 and that construction will start on the Linear Collider during FY 2010***

Argonne HEP Role (from draft report)

- *2.0 National Lab Role: A central issue in the development of the Division strategic plan is to insure that the projects and allocation of Division resources match national goals and interests. A set of criteria were established in order to evaluate all projects in terms of the contributions expected from groups at a National Laboratory to the US High Energy Physics program. These criteria are summarized below.*

- ***Experimental Groups:*** Contribute unique scientific and technical expertise; Provide dedicated scientific leadership and management; Contribute strong support of overall operations (not only for systems built at ANL); Provide strong technical and infrastructure support of university groups and other national laboratories; Provide strong leadership in exploring scientific and technical options for the future of the national experimental program; Provide capabilities beyond that of the Division itself by leveraging laboratory resources (such as technical groups, accelerator technology, computing, and supplemental funding such as LDRD funds) ***We perceive the technical skills of our support groups to be a central capability of our Division and in evaluating the technical content of future programs we endeavored to identify those with the potential to maintain and enhance these skills***.

- ***Theory Group:*** Carry out basic research in a broad range of topics both directly and not directly connected with the present Laboratory experimental program. Expose experimenters to both current ideas as well as alternative ideas that could form the seeds of future projects. Support the experimental groups, keeping them up to date with the latest theoretical developments in their respective fields. Organize Workshops and Visitor programs, bringing into the laboratory experts in a variety of fields and increasing the visibility of the work of the HEP staff while exposing local scientists to the latest ideas in HEP. Contribute to national HEP program and further education of phenomenologists through dedicated mentoring of postdocs. Intellectual leadership in proposing new experimental tests to extract maximum benefit from DOE facility investments.

Argonne HEP Role (synopsis)

- **Leadership and management of experimental projects, including basic accelerator R+D**
- **Work with university/lab groups.**
- **Contribute mechanical/ electronic engineering resources**
- **Utilize strength of multidisciplinary laboratory-examples:**
  - **Lab-wide accelerator science**
    - **HEP (AWA), Physics (SC RF), APS (undulators, FEL, damping rings)**
  - **Lab-wide computing (applied to ATLAS)**
    - **MCS Div. (Grid/Globus Toolkit), DIS Div. (D. Malon), LCRC (JAZZ)**
  - **Theory institute**
  - **Laboratory support for new initiatives**
    - **LDRD support for LC detector,**
    - **Startup support for particle astrophysics and reactor Θ_{13}**
    - **Collaboration with UC (fostered by lab management)**

ANL-HEP Experimental Projects (History)

HEP Division projects historically have covered all aspects

- **Design => construction => QA =>testbeam =>commission => M+O =>physics**
- **physicist + mechanical and electronics engineering + computing**
  - **HRS (calorimeter/magnet)**
  - **CDF (calorimeter/front end electronics/ trigger)**
  - **ZEUS (calorimeter/front end electronics/trigger/management)**
  - **Soudan (calorimeter/electronics/management)**
  - **SDC at SSC (calorimeter)**
  - **ATLAS (calorimeter/trigger/ computing)**
  - **MINOS (calorimeter/front end electronics/trigger/beamline/management)**
  - **Linear Collider (calorimeter prototype/front end electronics)**
  - **Reactor/Off-axis (calorimeter/front end electronics)**
  - **RHIC/STAR (shower max-calorimeter)**
  - **VERITAS/Auger (prototype/front end electronics/trigger?)**
- **History: large apparatus/ engineering/ electronics**
  - **(Argonne tradition- we build nuclear reactors)**
  - **Strong participation in physics program begin to end**

Main Ingredients in Long Range Plan

- **Details in breakout sessions**

- **"Existing projects"= CDF, ZEUS, MINOS, ATLAS, AWA, theory**

  CDF/ZEUS efforts phase into ATLAS/MINOS

- **"New Projects"=neutrino, particle astrophysics, LC:**

- Neutrinos (aiming at leptogenesis)

(neutrinos at ANL go back to ZGS E1,12 ft. BC, Soudan, Minos..)

Reactor experiments (Θ_{13})

Off-axis (eg., NOvA) large detector, monochromatic, Θ_{13}, CP

- Astroparticle ("Precision Astrophysics")

(long term interest dating back to Soudan: Spinka, Talaga, Goodman)

VERITAS (gamma spectrum based at Whipple, complement GLAST)

AUGER (highest energy cosmic rays)

- Linear Collider

Detector R+D aimed at energy flow algorithm test

Process

- **Planning Group formed a Steering Committee**
  - *J. Proudfoot(Chair), W. Gai, S. Kuhlmann, C. Wagner, A.B. Wicklund, L. Price (ex officio)*
- **Steering Group developed and implemented the planning process**:
  - Involved all Division scientific staff
  - Held presentations on current and future projects
- **Investigated specific opportunities:**
  - Operations at LHC (ATLAS) and LHC upgrades
  - Reactor and off-axis neutrino experiments
  - BTeV
  - Auger, OMNIS, VERITAS astrophysics projects
  - Linear Collider detector development
  - Plus CDF, ZEUS, MINOS, Accelerator (AWA), theory

- **Held extensive discussions within Steering Committee, the Planning Group and on an individual basis with Division staff**

Divisional Presentations for Strategic Plan

Gary Drake (Electronics Support)(Dec. 2, 2003)
Vic Guarino (Mechanical Eng. Support)(Dec. 2, 2003)
Carlos Wagner (Theory) (Dec. 2, 2003)
Maury Goodman (Strictly MINOS) (Dec. 5, 2003)
Maury Goodman (Off axis et al) (Dec. 5, 2003)
Karen Byrum (VERITAS) (Dec. 9, 2003)
Hal Spinka (Auger) (Dec. 9, 2003)
Richard Talaga (OMNIS) (Dec. 9, 2003)
Jose Repond (LC) (Dec. 9, 2003)
Barry Wicklund (CDF) (Dec. 12, 2003)
Jose Repond (ZEUS) (Dec. 12, 2003)
Tom LeCompte (BTeV) (Dec. 12, 2003)
Wei Gai (Accelerator R+D) (Dec. 12, 2003)
Bob Blair (ATLAS) (Dec. 15, 2003)
Jim Proudfoot (ATLAS) (Dec. 15, 2003)
Tom LeCompte (ATLAS Physics) (Dec. 15, 2003)
Tom LeCompte (ATLAS Computing) (Dec. 15, 2003)

Consultation/Interaction with HEP community

- **Neutrinos:**
  -Participate/hosted meetings at ANL for APS study (report 2004)
  - Helped found/hosted meetings/white paper on Reactor Θ_{13} WG.
  -Participate in planning/hosted meetings for NOvA (off-axis)
  (note collaboration with LC detector electronics)
- **Linear Collider:**
  -Participate in US LC collaboration and Desy/European CALICE.
  - established collaboration on RPC's
- **Auger**
  - ANL Symposium (Jan. 2004)
  - Attended collaboration meeting/ southern site.
- **VERITAS**
  - UC/ANL funding for laboratory tests, extensive discussions on electronics
  - Attended Whipple collaboration meeting
- **OMNIS- hosted meetings, developed new detector design**
- **ATLAS/LHC- mature role established as in CDF, ZEUS, MINOS**

Outcome

- **All material presented is available on the Planning Group web page**
- **The DRAFT report includes:**
  - **A summary of project opportunities and some succinct recommendations**
  - **A (nearly) flat effort profile as requested in the charge**
  - **A summary of Division Goals for each project**

Example of Project Goals Sheet (ATLAS)

ATLAS Goals

These goals are to set the perspective of where we would like to be in 5 years and 10 years.

Trigger DAQ

- Complete installation of Supervisor / RoI Builder (~8/2005)
- Complete cosmic ray run at CERN successfully supporting trigger supervisor
- Integrate RoI Builder in Atlas 2nd Level trigger and assist in other software development areas in level 2 (~12/2006)

Detector System Construction and Installation, Maintenance and Operations

- Provide leadership and technical staff for the completion of tile calorimeter installation (est. complete in 2 years)
- Provide leadership and technical staff in support of Atlas-wide maintenance and detector operations, consistent with the overall level of US participation (ongoing responsibility)
- Maintain Supervisor / RoI Builder (~8/2005 - until ATLAS as we know it ends or the system is replaced)
- Provide leadership and technical staff for the design and implementation of ATLAS databases

Technical Coordination

- Complete our assigned tasks associated with movement systems in cavern and had over operational responsibility to Atlas (est. complete in 2 years)

Physics

- Establish presence in at least one early physics analysis (~5/2007).). Identify this analysis in ~1 year and consolidate simulation and analysis skills to allow this initial work to be carried out by physicist predominantly at Argonne. These tasks will include strong participation in the combined testbeam and calorimeter calibration, in the development of software tools and in the development of simulation and analysis codes.
- Contribute significant physicist participation at CERN to early years of physics running (~2007-2011)
- Take lead in target analysis and publish when appropriate data is taken (~2008). Ideally this will be one of the first physics papers produced by Atlas.
- Establish strong presence in at least one additional fundamental analysis such as searches for high mass Higgs, or signatures of Supersymmetry. This analysis is expected to produce important results soon after the LHC achieves design luminosity (2009-2010) and will continue thereafter with increased statistical sensitivity.
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Summary Recommendations (1)

- **Theory**
  - New appointments should strengthen the work of the theory group in areas related to phenomenology and experimental HEP
- **CDF**
  - It would be undesirable for Argonne and for the national program to reduce our participation in the CDF physics program much before the end of operations in FY2009, but it will drop naturally after the first LHC physics paper. If LHC is significantly delayed, CDF manpower doing physics analysis will last somewhat longer.
- **ZEUS**
  - ZEUS effort will decrease naturally as data taking ends in FY2007 and other projects such as Linear Collider grow.

Summary Recommendations (2)

- **ATLAS**
  - It is essential that Atlas have new hires in the Division experimental program in 2005 and 2006 (at post-doc level) to establish a strong physicist involvement in the commissioning and early physics analysis of Atlas
- **BTeV**
  - **(..) Therefore we choose to not pursue this project at the present time**
- **Linear Collider**
  - Find a way to insure that the beam test goes ahead and achieves its objectives. Continue (strengthen) electronics design effort on the longer term issue of increasing readout density and reducing cost. If possible, provide assembly effort and M&S from Division base if sufficient external funds are not forthcoming. Of the new initiatives under consideration in our plan, LC R+D is our highest priority.

Summary Recommendations (3)

- **Neutrino Program**
  - A choice should be made between the NO ν A and Reactor experiments based on the expected timing and the roles that Argonne is playing. For NO ν A we should seek to build a big piece of the detector, with appropriate leadership responsibilities; for Reactor, our goal should be a continued major leadership role.
- **Advanced Accelerator R&D**
  - Focus effort on the AWA getting to 100 MeV/m and understanding the physics issues. If possible bring Division resources to bear on this to allow effort to go faster.
  - Concentrate other efforts on Fermilab issues (such as the ongoing LDRD work on electron cooling.)

Summary Recommendations (4)

- **Particle Astrophysics (VERITAS, Auger, OMNIS)**
  - All three proposals have significant scientific merit. However, as a Division it is not realistic to maintain efforts in all three areas.
  - Due to the lower physicist interest in OMNIS we recommend that further work on OMNIS should cease and that the OMNIS effort be redirected towards Auger.
  - Work on both VERITAS and Auger will emphasize R+D in the near term. Near the end of 2005, a decision must be made between VERITAS and Auger. **The two efforts should merge at that point to form one strong group.**

Reaching Consensus on Fixed Baseline (from Report)

- ***The goal of this planning process is to develop a strategic plan for the allocation of resources assuming a fixed level of effort (near 33 FTE from base funding.) The combined effort "request" for all projects in which Division staff proposes to participate .. shows a peak at 45 FTE in FY08. Therefore difficult choices were needed to meet the requirement of realizing a flat level of effort. We considered many issues in reaching this plan:***
  - The scientific loss associated with not participating in a specific project
  - The level of scientific interest in each future project
  - The minimum level of effort required to take each future project from its present status to one in which the Division would have a significant level of participation
  - In our plan, there is never more than 5 FTE available for all the proposed new projects combined, including both neutrinos and particle astrophysics. This number was used to set the scale for the number of concurrent future projects as well as the number in which we could participate in the long term
  - Although we assumed that the Linear Collider construction will begin in FY10, with significant R+D money starting in FY05, we also considered the implications of a delay in this schedule.
  - The present ZEUS spokesman is from the ANL HEP group. Given this fact, it is unrealistic to consider a significant reduction in the ZEUS effort before 2005/6
  - We made educated guesses about involvement in MINOS and ATLAS upgrades
  - We considered the impact of technical work on enhancing the skills in the technical support groups in the Division
  - We considered opportunities for enhancement of the technical skill of the scientific staff (e.g. in RPC's and APD's)

Choices Leading to Flat Plan (Synopsis)

- **Strategic plan goal was fixed effort (~33 physicist FTE) FY05-10**
- **Combined requests by project added to ~46 FTE's**
- **Difficult choices:**

  -Premature phase out of CDF to ramp up ATLAS effort

  -Neutrino's: choose reactor or Nova,

  minimal physics analysis on MINOS

  -Astrophysics: choose (small group) VERITAS or Auger

  -LC: unavoidable delays in calorimeter completion

  -AWA: important technical opportunities neglected.
- **Effort spreadsheets (following) reflect these compromises.**

Areas to strengthen with increased funding

- **Timely addition of postdocs to ATLAS for operations and physics**
  -while retaining adequate effort on CDF(=>2009) and ZEUS(=>2007)

- **Strengthening overall neutrino program with postdocs**
  -excellent opportunities for leading reactor experiment and/or planning for NOvA while meeting commitments to MINOS

- **Advanced accelerator- study technologies related to current work**
  - cf. beam-driven plasma wakefields, other advanced structures

- **Linear Collider: accelerate work leading to beam tests**
  - this depends on external support for overall US LC program

	A	B	C	D	E	F	G	H	I	J	K
2	**Fiscal Year**	**2004-"Non-DOEHEP"**	**2004-FinPlan**		**Assumed Non-DOEHEP**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
3											
4	**CDF**										
5	**Physicists**		**6.2**			**5.1**	**4.8**	**4.0**	**2.1**	**1.0**	**0.5**
6	**Other (Mech.)**		**0.9**			**0**	**0**	**0.0**	**0.0**		
7	**Other (Elec.)**		**0.3**			**0.2**	**0.2**	**0.2**	**0.2**		
8	**Secretary**		**0.1**			**0.1**	**0.1**	**0.1**	**0.1**		
9	**ZEUS**										
10	**Physicists**	**0.4**	**2.8**			**2.35**	**1.6**	**0.85**	**0.5**	**0**	**0**
11	**Other (Mech.)**	**0.5**	**0.5**			**0.5**	**0.5**	**0.5**	**0.0**		
12	**Other (Elec.)**		**0.1**			**0.1**	**0.1**	**0.1**	**0.0**		
13	**Students**		**2.0**			**2.0**	**2.0**	**2.0**	**1.0**	**0.0**	
14	**Secretary**		**0.1**			**0.1**	**0.1**	**0.1**	**0.1**		
15	**ATLAS**										
16	**Physicists**		**3.2**			**4.2**	**5.0**	**6.0**	**7.0**	**7.0**	**7.0**
17	**Computing**	**2.0**	**3.0**			**3.0**	**4.0**	**4.0**	**3.0**	**2.5**	**2.5**
18	**Other (Mech.)**		**2.6**			**1.9**	**1.1**	**1.1**	**0.5**	**0.5**	**0.5**
19	**Other (Elec.)**		**1.6**			**1.6**	**0.7**	**1.5**	**1.2**	**1.7**	**1.6**
20	**Secretary**		**0.3**			**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**
21	**MINOS**										
22	**Physicists**		**3.7**			**3.5**	**3.0**	**3.0**	**3.0**	**3.5**	**3.5**
23	**Other (Mech.)**		**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
24	**Other (Elec.)**		**1.0**			**0.1**	**0.1**	**0.1**	**0.4**	**0.6**	**1.1**
25	**Secretary**		**0.4**			**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**
26	**Off-Axis**										
27	**Physicists**		**0.5**								
28	**Other (Mech.)**		**1.6**								
29	**Other (Elec.)**		**0.8**								
30	**Reactor**										
31	**Physicists**		**0.7**								
32	**Other (Mech.)**		**0.0**								
33	**Other (Elec.)**		**0.0**								
34											
35	**Reactor OR Off-Axis**										
36	**Physicists**					**1.0**	**1.2**	**1.2**	**2.5**	**2.5**	**3**
37	**Other (Mech.)**					**1.0**	**1**	**1**	**1.5**	**1.5**	**1.5**
38	**Other (Elec.)**					**1.0**	**1**	**1**	**1**	**0.5**	**0.5**

	A	B	C	D	E	F	G	H	I	J	K
40	**Fiscal Year**	**2004-"Non-DOEHEP"**	**2004-FinPlan**		**Non-DOEHEP**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
41	**Neutrinos (Sub-Totals)**										
42	Physicists		4.9			4.5	4.2	4.2	5.5	6.0	6.5
43	Other (Mech.)		1.6			1.0	1.0	1.0	1.5	1.5	1.5
44	Other (Elec.)		1.8			1.1	1.1	1.1	1.4	1.1	1.6
45											
46	**Theory**										
47	Physicists	0.6	9.3			8	8	8	8	8	8
48	Other										
49	Secretary		0.7			0.7	0.7	0.7	0.7	0.7	0.7
50	**Accelerator + MuColl**										
51	Physicists	1.4	3.6			4.6	4.6	4.6	4.6	4.6	4.6
52	Other (Scientist)	0.5	2.2			2.2	2.2	2.2	2.2	2.2	2.2
53	Other (Mech. Tech)		1.9			2.0	2.0	2.0	2.0	2.0	2.0
54	Secretary		0.3			0.3	0.3	0.3	0.3	0.3	0.3
55	**Linear Collider**										
56	Physicists	1	1.5			2	2.5	2.5	3	4	4
57	Other (Mech.)	0	0.1			1.6	0.7	0.7	1.1	1.5	2
58	Other (Elec.)	0.3	0.1		*1.7*	0.8	0.8			1.0	1.0
59											
60	**New Projects**										
61	Veritas										
62	Physicists		0.7			1.2					
63	Other (Mech.)		0.0			0.0					
64	Other (Elec.)	0.8	0.0		1.5	0					
65	Auger										
66	Physicists		0.0			1.3					
67	Other (Mech.)		0.0			0.6					
68	Other (Elec.)		0.0			0.1					
69	Veritas OR Auger										
70	Physicists						2.5	3.0	3.0	3.1	3.1
71	Other (Mech.)						1.3	1.3	2.0	1.5	1.0
72	Other (Elec.)						1.0	1.0	1.0	1.0	1
73	OMNIS										
74	**New Projects (sub-totals)**										
75	Physicists		0.7			2.5	2.5	3.0	3.0	3.1	3.1
76	Other (Mech.)		0.0			0.6	1.3	1.3	2.0	1.5	1.0
77	Other (Elec.)		0.0			0.1	1.0	1.0	1.0	1.0	1.0

	A	B	C	D	E	F	G	H	I	J	K
89	**Fiscal Year**	**2004-"Non-DOEHEP"**	**2004-FinPlan**		**Non-DOEHEP**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
90											
91	**Support Groups**										
92	**Electronics**		**0.4**			**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**
93	**Mechanics**		**0.7**			**0.7**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**
94	**Computing**		**1.9**			**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**
95	**Administration**		**4.0**			**4.0**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
96	**Totals**										
97	**Physicists**	**6.0**	**32.6**		**6.0**	**33.6**	**33.6**	**33.6**	**34.1**	**34.1**	**34.1**
98	**Other (total)**	**4.2**	**23.3**		**4.2**	**23.3**	**23.3**	**23.3**	**22.8**	**23.0**	**23.0**
99	**Other (Computing)**	**2.0**	**4.9**			**4.9**	**5.9**	**5.9**	**4.9**	**4.4**	**4.4**
100	**Other (Mech)**	**1.4**	**8.3**			**8.3**	**7.3**	**7.3**	**7.8**	**7.7**	**7.7**
101	**Other (Elec.)**	**0.8**	**4.2**			**4.2**	**4.2**	**4.2**	**4.2**	**5.2**	**5.2**
102	**Administration + Secretaries**	**0.3**	**5.9**		**0.3**	**5.9**	**5.9**	**5.9**	**5.9**	**5.7**	**5.7**
103	**Students**		**2.0**			**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
104		**10.5**	**57.9**		**10.5**	**58.9**	**58.9**	**58.9**	**58.9**	**59.1**	**59.1**