Proposal for a High Energy Nuclear Database

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Ramona Vogt

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10 Feb 2005

Outline

- Role of the community
- Background and applications
- Evaluation Case Study: *HBT radii at RHIC*
- What it would look like/Enabling technologies
- Timeline/Resource requirements
- Making it happen

What types of data we want to store

- Top Priority: Measured data
  - Cross sections, particle yields, single spectra
  - Multi-particle spectra, flow, correlations
  - Whatever data is needed to characterize a high-energy (heavy-ion) reaction
- Secondary: Evaluated data
  - Product of topical reviews
  - Crucial for applications
- Data must be cross-linked with experimental descriptions, theoretical calculation

Role of the community

- Obvious point #1, Stocking database:
  - Making measurements
- Obvious point #2, Using database:
  - Validating theories, phenomenology
  - Evaluating data
  - Writing reviews
- The Not-so Obvious point:
  - For database to serve community, community must have say in design

Background and Impact

- Large amount of data begs for organization
  - AGS to CERN-LHC data on proton-proton to lead-lead collisions (and other systems as needed)
  - 109+ RHIC experimental publications with tables
- Would simplify cross-experiment comparisons, better theory benchmarking
- Centralization eases the development of systematics
  - First step in characterizing the plasma
  - Cost (in time & $$) to assemble data limits researchers

Cost to community if no database

Data can be lost

- Can't rely on experiments to save data:
  - Many RHIC experiments post data on web (e.g. PHENIX)
  - Competing formats
  - What happens when experiment ends?
- Need community input, but can't rely on community to save data:
  - Manpower and $$ limited

Growing list of applications

Application	Relation to heavy ion data
Proton radiography	*p+A* data are needed to understand backgrounds caused by particle production in proton radiographs.
Heavy-ion driven inertial confinement fusion	*p* or *A* beams on gold hohlraums drive compression and eventual fusion reactions.
ν and μ source development	*p+A* spallation reactions create particles for secondary beams for use in the Main Injector Neutrino Oscillation (MINOS) experiment and the Next Linear Collider (NLC).
Cosmic ray dose rates	Nuclei form a large component of cosmic radiation. NASA seeks to understand dosages on humans and equipment for long term space missions.

None currently have resources available to RHIC experimental programs

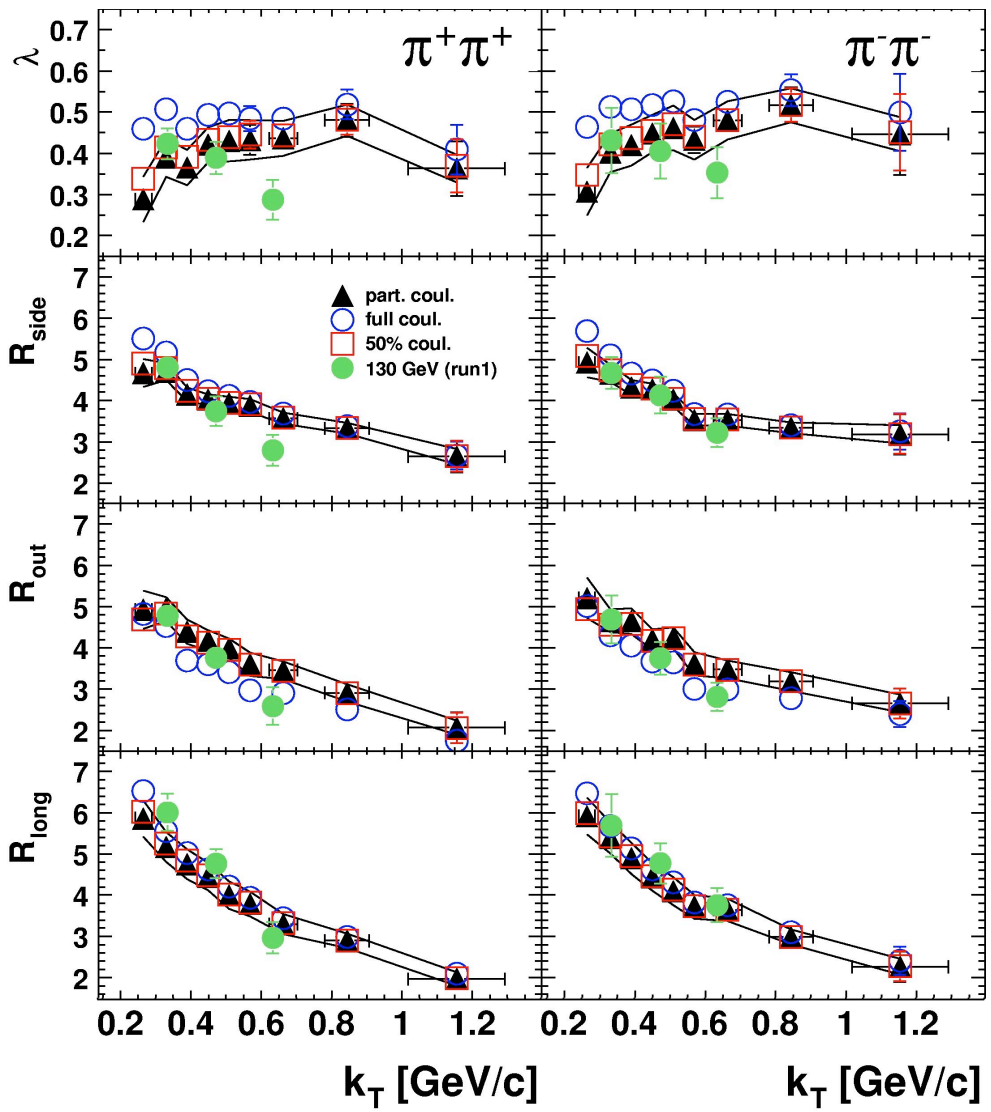
Topical Reviews

- Collecting data is useful, but must understand data
- Applications need evaluated data

- What we mean by evaluation:
  - Review of all experimental data and comparison to current theory
  - Peer reviewed

Topical review articles can fulfill these needs

Case Study: *HBT Radii at RHIC*



Au+Au at 200 GeV/A

- $R_{side} \sim R_{out} \Rightarrow \Delta\tau = 0$ fm/c
- Radii sensitive to Coulomb correction
- Coulomb correction has changed every other year for last 10 years
- Need raw, uncorrected data to redo correction "right way"

Model user interface (NNDC)

Experimental Nuclear Reaction Data (EXFOR / CSISRS) - Mozilla

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://www.nndc.bnl.gov/exfor/index.html Search Print

Home Bookmarks LITE MyLLNL NNDC NADS Physics Slashdot Python Fedora Google News

Experimental Nuclear Reaction Data (EXFOR / CSISRS)

IAEA-NDS

NNDC

Database Version of July 20, 2004

The EXFOR library contains an extensive compilation of experimental nuclear reaction data. Neutron reactions have been compiled systematically since the discovery of the neutron, while charged particle and photon reactions have been covered less extensively. The library contains data from more than 14,000 experiments.

Standard Request (example); Requests: Extended Advanced

Submit Reset

Target
Reaction
Product
Quantity
Energy from to eV
Author(s)
Publication year
Last modified
Accession #

Submit Reset

Options

- [x] Exclude superseded data
- [x] No reaction combinations (ratios, etc.)

Sort by:

- (•) Reaction
- ( ) Accession#

Note:

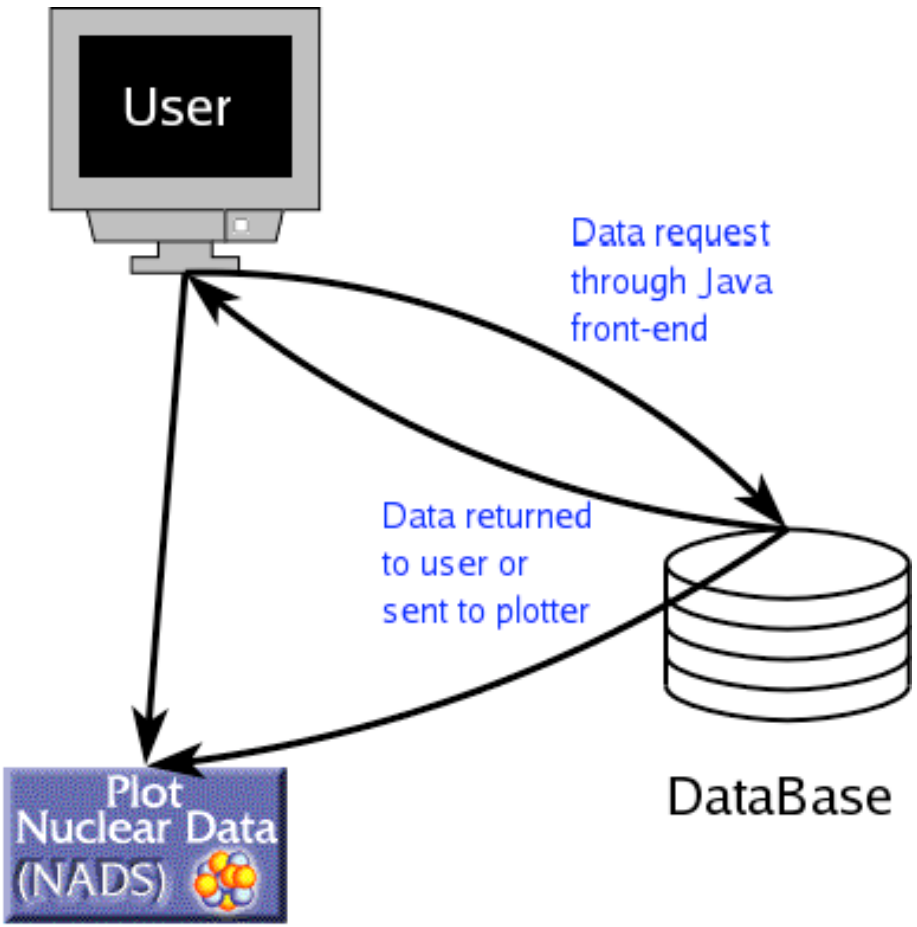
- all criteria are optional (selected by cheching ☑)
- selected criteria are combined for search with logical AND
- criteria separated in a field by ";" are combined with logical OR
- wildcards and intervals are available

Database Manager: Victoria McLane, NNDC, Brookhaven National Laboratory (vmclane@bnl.gov)
Web and Database Programming: Viktor Zerkin, NDS, International Atomic Energy Agency (V.Zerkin@iaea.org)

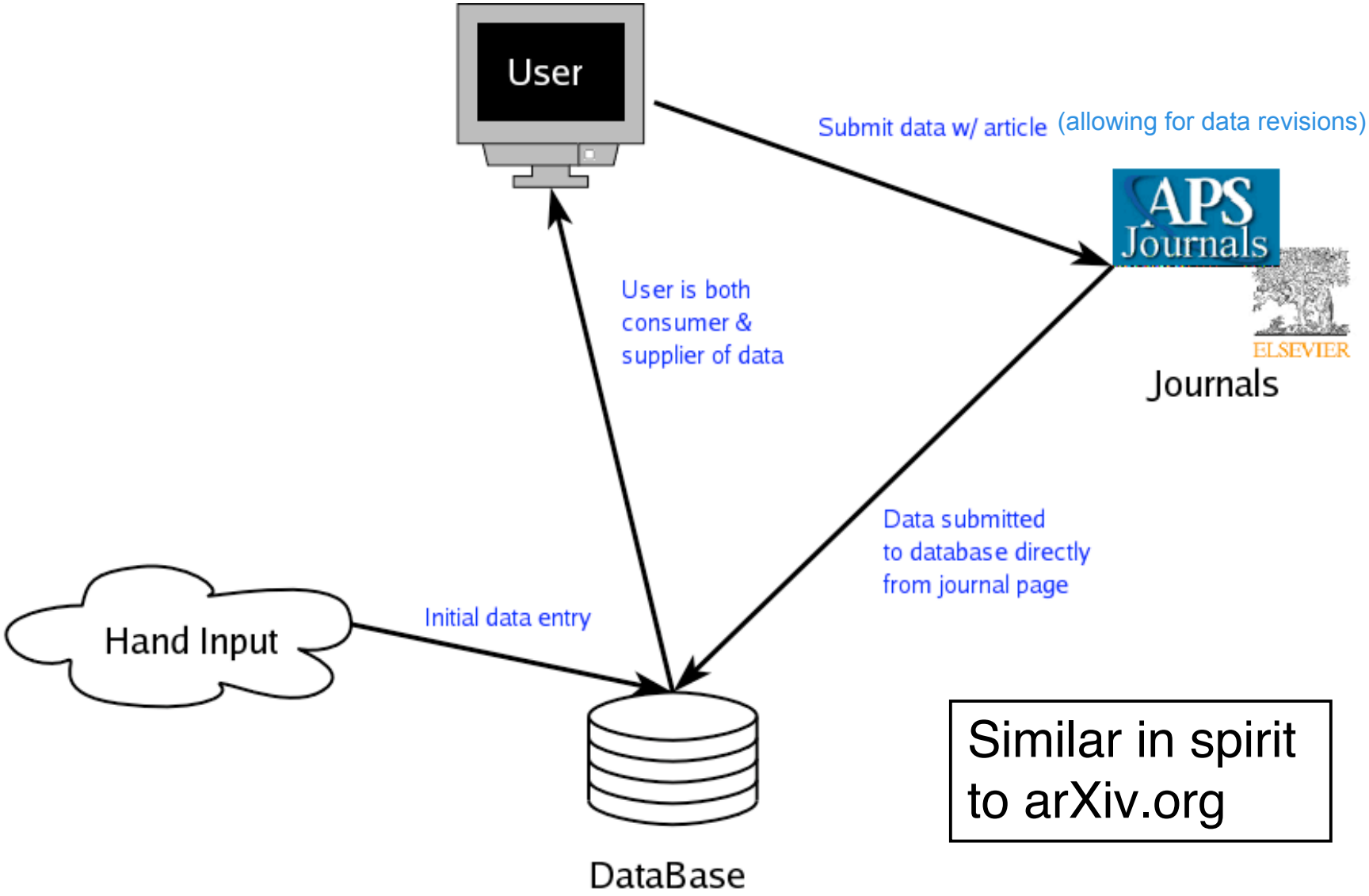
Done

Interface and Backend Technologies

- Java server page or PHP interface
- Similar to NNDC's EXFOR and ENDF/B retrievals
- Data returned as dynamic webpage or to NADS
- Separate data server allows for batch retrievals



Submitting Data



Similar in spirit to arXiv.org

Data stored in XML format

- **Key Features:**
  - Self describing
  - Open standard, license-free, platform-neutral
  - Transformable (see next page)
  - Unicode support
  - Human readable
  - Hierarchical structure
- **Lots of Freeware:**
  - Editors
  - Checkers
  - Converters
  - Storing
  - Publishing
  - Parsing (C/C++, Java, Python)

XML Feature: Stylesheets

Address D:\My Documents\EndML\endl94\za000001\elastic\integrated.xml

Data

Mass: 1.00867 amu

Date: May 29, 1976

Interpolation: Linear/Linear

Half-Life: 660 s

Temperature: 2.58600E-8 keV

Energy (Q-Value): 0

x	y
1.0000000E-10	6.59564E+02
1.2596100E-10	5.87874E+02
1.5866170E-10	5.24021E+02
1.9985190E-10	4.67155E+02
2.5173550E-10	4.16516E+02
3.1708850E-10	3.71431E+02
3.9940790E-10	3.31297E+02
5.0309810E-10	2.95580E+02
6.3370740E-10	2.63803E+02
7.9822420E-10	2.35543E+02
1.0054512E-09	2.10422E+02
1.2664764E-09	1.88105E+02
1.5952663E-09	1.68295E+02
2.0094134E-09	1.50726E+02
2.5310772E-09	1.35164E+02
3.1881702E-09	1.21400E+02
4.0158511E-09	1.09248E+02
5.0584062E-09	9.85437E+01
7.1986870E-09	8.46517E+01
1.0109321E-08	7.37390E+01
1.4386713E-08	6.45819E+01
2.0203671E-08	5.75683E+01
2.8752121E-08	5.18693E+01
4.0377423E-08	4.76719E+01
6.4063520E-08	4.35926E+01
1.0164429E-07	4.09229E+01
2.0313806E-07	3.86200E+01
5.1137053E-07	3.72275E+01
3.6612382E-06	3.64373E+01

integrated.xml (D:\My Documents\EndML\endl94\za000001\elastic) - GVIM

File Edit Tools Syntax Buffers Window Help

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        <HalfLife>660 s</HalfLife>
        <Temperature>2.58600E-8 keV</Temperature>
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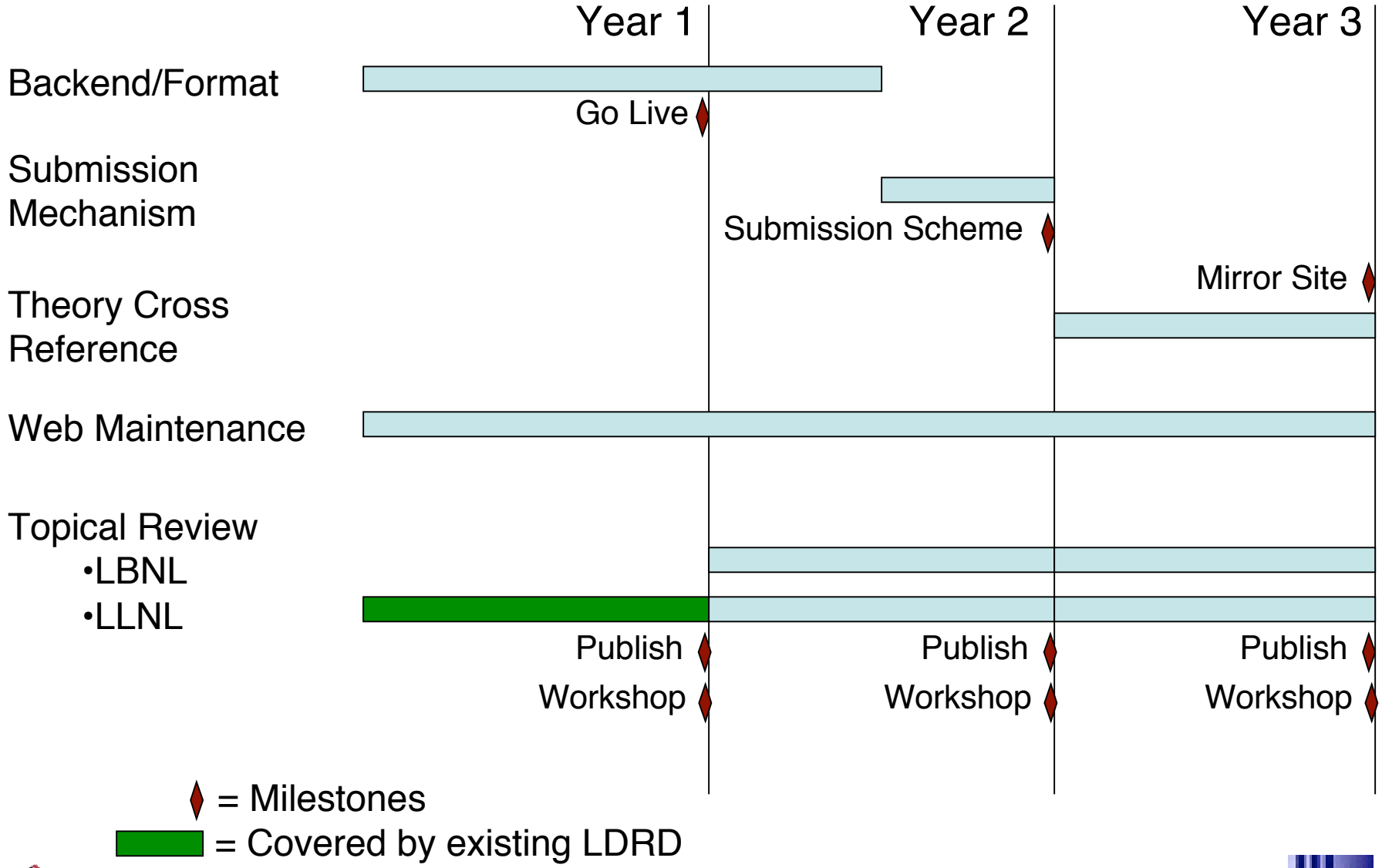
                                                    1,1          Top
```

Project Timeline

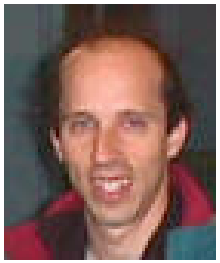


LBNL and LLNL Strengths

Co-PI
Hard probe expert
Widely known in field

Co-PI
Two particle correlation expert
Transport theory
Nuclear data evaluator

HBT Expert
LLNL's PHENIX Grp. leader
Convenor Hadronic Physics Working Grp.



Soft hadron expert
LBNL's Soft hadron Grp. leader
Serves on several STAR committees

XML, Java
NADS Developer

High energy nuclear astrophysics
XML, Java
ENDL Maintainer

LLNL's "Hidden Agenda"

- Get new XENDL format in use on outside
  - Experimental data
  - Evaluated data
- Web infrastructure test-bed

- Venue for NADS/LLNLPlot

- 2-fer for Main Injector Particle Production -- LLNL LDRD already pays for:
  - Collecting experiment results
  - Inserting in application code

Making it happen: who we must sell to

- LLNL/CNP group
  - worker bees
- Funding agency == $$
- Big Experiments
  - What they say, funding agencies do
  - They do the measurements
- High Energy Nuclear Physics Community
  - Main users
  - Topical reviews
  - Non-RHIC measurements
- Nuclear Data Community
  - This is a test-bed for information technology

Current Status

- Submitted whitepaper to Gulshan Rai (DOE/OS Heavy-Ions)
- Ready to add whole proposal to LLNL & LBNL Field Work Proposals
- Copies circulating among RHIC collaborations
- Lobbying in full swing (that's what this talk is!)
- XML nuclear data format (XENDL) in development

EXTRA SLIDES

Proposal for High Energy Nuclear Database

Joint LBNL/LLNL Proposal

November 30, 2004

Principal Investigators:	David Brown (LLNL)
	Ramona Vogt (LBNL)
Co-Investigators:	Nu Xu (LBNL)
	Ron Soltz (LLNL)
	Jason Pruet (LLNL)
	Scott McKinley (LLNL)

Resource Requirements

	Year 1	Year 2	Year 3	Out Years
Backend Technology Development	0.5 FTE (LLNL)	0.25 FTE (LLNL)		
Data Collection	0.25 FTE (LBNL)	0.5 FTE (LLNL/LBNL)	0.5 FTE (LLNL/LBNL)	As needed
Theory Cross Reference Scheme			0.5 FTE (LLNL/LBNL)	Continuing
Topical Review		1.5 FTE (LLNL/LBNL)	1.5 FTE (LLNL/LBNL)	1.5 FTE (LLNL/LBNL)
Workshop	$5K	$5K	$5K	$5K
Website Maintenance	0.1 FTE	0.1 FTE	0.1 FTE	0.1 FTE

Related Funding (Year 1):

– LBNL *D* Meson LDRD pays 100% of an FTE for R. Vogt

– LLNL MIPP LDRD pays 50% of an FTE for D. Brown

Politicking

- Gulshan Rai and Sid Coon
- RHIC experiments
  - Spokesmen
    - Ramona calling
    - Ron/Nu lobbying
  - Plebe
    - Mailing lists
- Community
  - Journal editors
  - Workshops & meetings:
    - 21st Winter Workshop on Nuclear Dynamics
    - CSEWG
    - QM2005

Planning for 21st WWND

- Need webpage mock-up
  - with database backend
  - submission page mock-up
- Need data mock-up
  - use HE data from BNL
  - convert to XML, subset of EXFOR
- Need to drive NADS from mock-up
- What else??

Helps to see it working