Cross-Linking with the Particle Data Group

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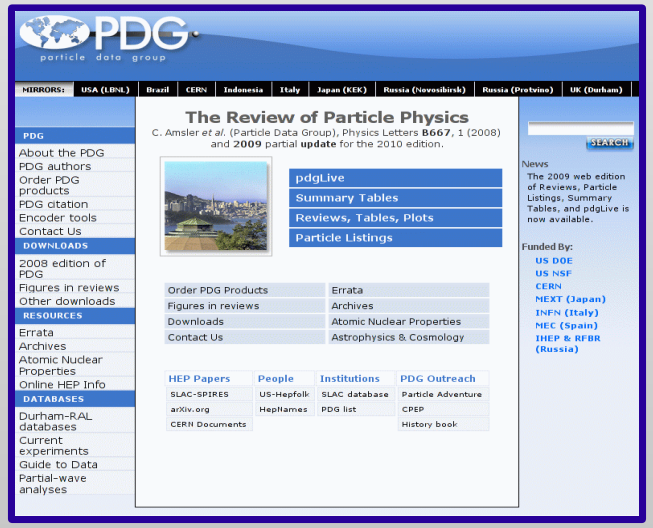


Outline:

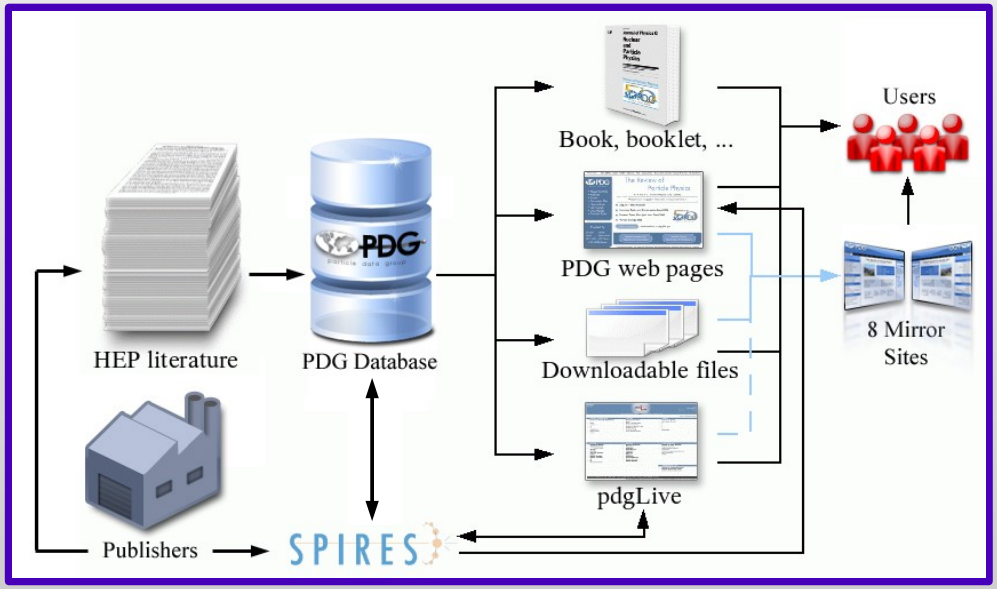
- Introduction
- Interaction with SPIRES
- Cross-linking with PDG Identifiers
- Status of computing upgrade

Particle Data Group (PDG)

- **PDG is an international collaboration charged with summarizing Particle Physics, as well as related areas of Cosmology and Astrophysics**
  - **170 authors** from 20 countries and 108 institutions
  - Plus 700 consultants in the particle physics community

Data Evaluation

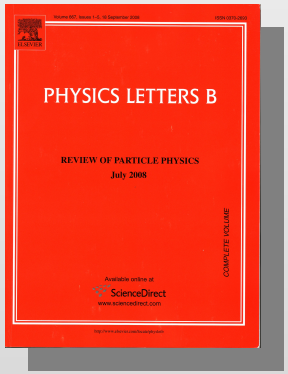
- **Primary goal is to evaluate and review available published data in order to give authoritative answers endorsed by the experts in the field**
  - We rely on publishers and libraries (in particular through SPIRES) for access to published data



- **As part of doing its work, PDG naturally catalogs published results, but this is not our primary goal**

Review of Particle Physics

- **Our main product "Review of Particle Physics"**
  - 2008 edition: 1344 pages, over 2,500 citations (SPIRES)
  - Available in print and online as http://pdgLive.lbl.gov



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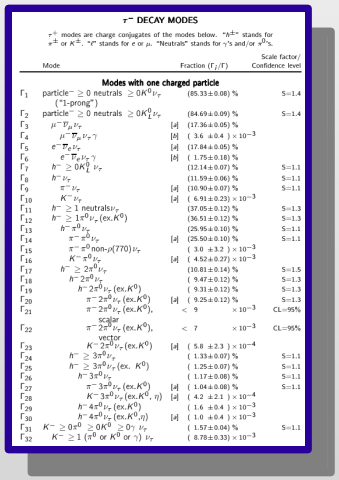

Listings with Summary Tables

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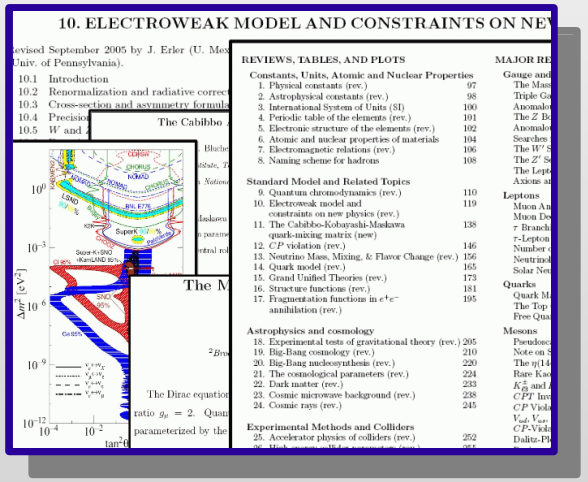


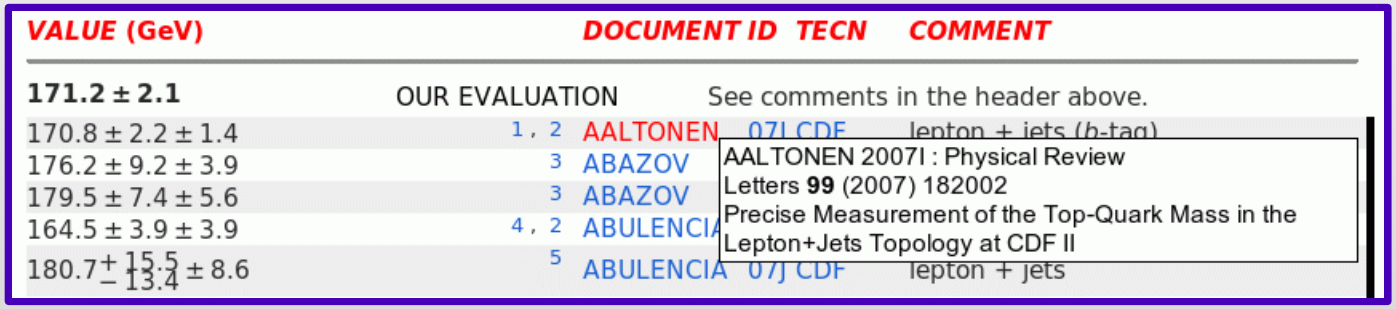
108 Review Articles

- **A large amount of data that one might want to reference online from different systems**

Interaction with SPIRES

So far have interacted with SPIRES in two ways:

- **Harvesting of information based on paper reference**
  - Authors and titles
  - Used e.g. to display paper titles in popup windows in pdgLive



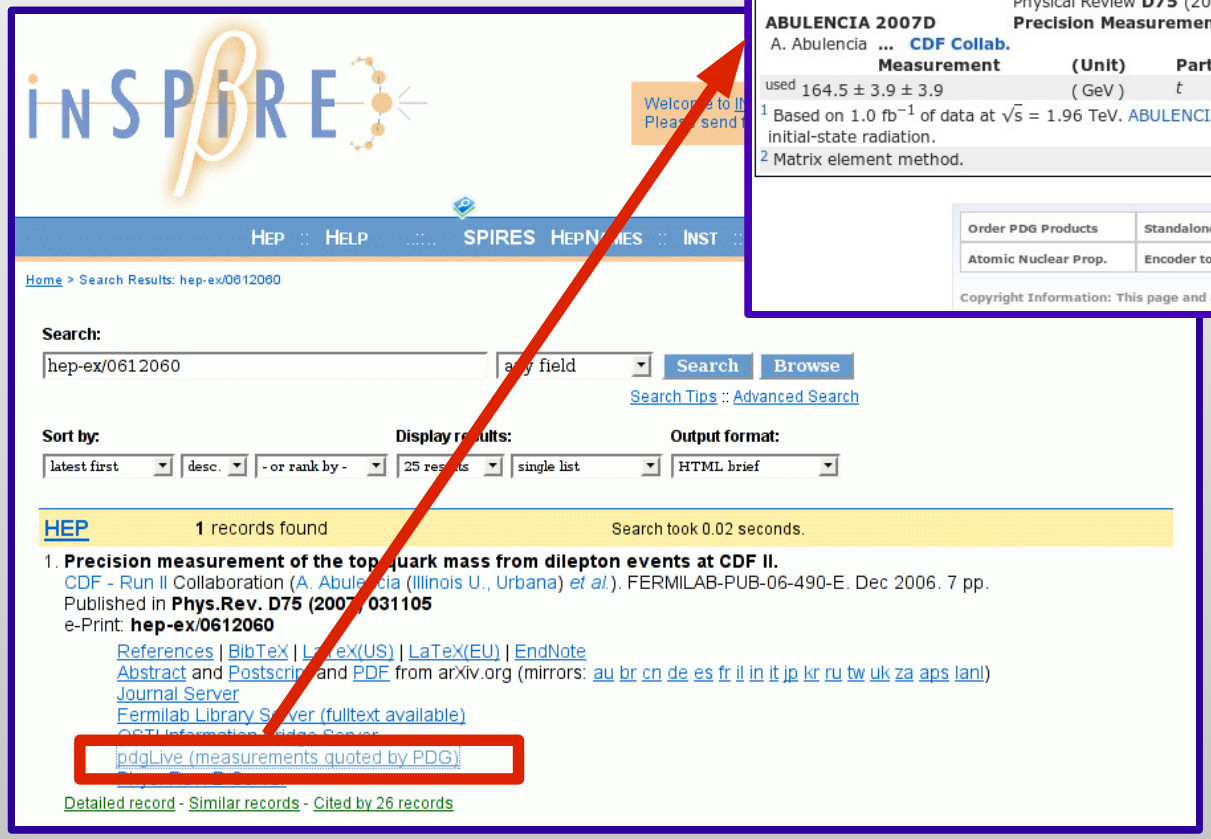
- **Cross-referencing between SPIRES/INSPIRE and PDG**
  - From pdgLive to SPIRES, and from SPIRES/INSPIRE to pdgLive
  - From internal PDG pages for encoders to SPIRES (as a convenient way to point encoders to relevant papers)
  - Based on "CODEN,Volume,Page" where possible, on SLAC IRN otherwise (how should this be done with INSPIRE?)

Interaction with SPIRES

- From pdgLive to SPIRES

Interaction with INSPIRE

- **From INSPIRE to pdgLive**
  - Only if paper is included in Listings



Can We Do More?

- **Current one-to-one linking between SPIRES/INSPIRES and PDG very useful but limited**
- **Wish list:**
  - A user looking at an entry in INSPIRE:
    "What data does PDG have about this?"
    - Entries in the Listings for related particles or particle properties
    - PDG review articles on related topics
  - A user looking at an entry in PDG:
    "What are the latest preprints / publications on this topic?"
  - *…*
- **Discussions started at 3rd HEP Information Resource Summit on how to do this**
  - Since then worked together with Annette Holtkamp, Kirsten Sachs and others on this topic

PDG Classification

Behind the scene, the PDG Listings define a well-established classification scheme for particle physics data:

LIGHT UNFLAVORED MESONS
($S = C = B = 0$)

For $I = 1$ (π, b, ρ, a): $u\overline{d}$, $(u\overline{u}-d\overline{d})/\sqrt{2}$, $d\overline{u}$;
for $I = 0$ (η, η', h, h', ω, ϕ, f, f'): $c_1(u\overline{u} + d\overline{d}) + c_2(s\overline{s})$

$\pi^\pm$ $I^G(J^P) = 1^-(0^-)$

Mass $m = 139.57018 \pm 0.00035$ MeV (S = 1.2)
Mean life $\tau = (2.6033 \pm 0.0005) \times 10^{-8}$ s (S = 1.2)
$c\tau = 7.8045$ m

$\pi^\pm \to \ell^\pm \nu\gamma$ form factors [a]

$F_V = 0.017 \pm 0.008$
$F_A = 0.0115 \pm 0.0005$ (S = 1.2)
$R = 0.059^{+0.009}_{-0.008}$

π^- modes are charge conjugates of the modes below.

For decay limits to particles which are not established, see the appropriate Search sections (Massive Neutrino Peak Search Test, A^0 (axion), and Other Light Boson (X^0) Searches, etc.).

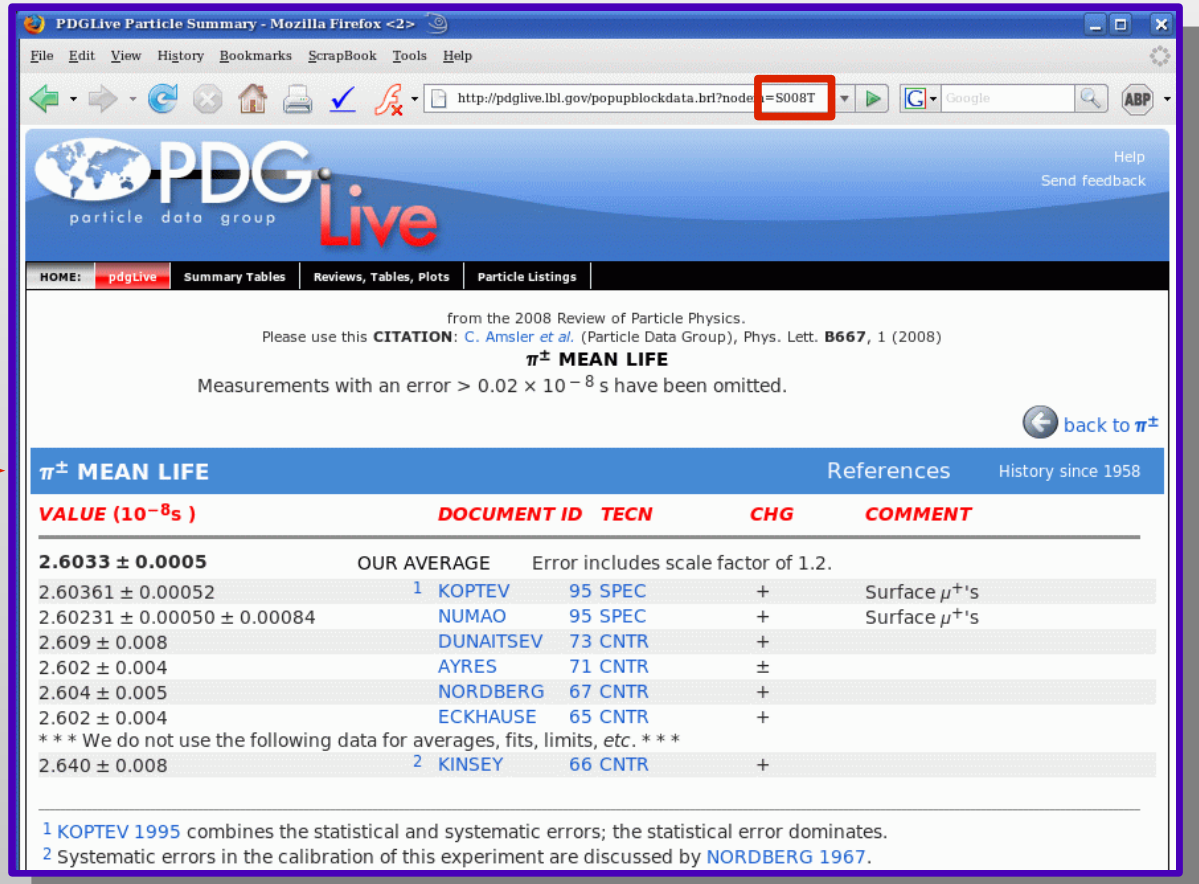
π^+ DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	p (MeV/c)
$\mu^+\nu_\mu$	[b]	(99.98770±0.00004) %		30
$\mu^+\nu_\mu\gamma$	[c]	(2.00 ±0.25) × 10^{-4}		30
$e^+\nu_e$	[b]	(1.230 ±0.004) × 10^{-4}		70

Code	Description
S008	$\pi^\pm$ (particle code)
S008M	$\pi^\pm$ mass
S008T	$\pi^\pm$ life time
S008CTA	$\pi^\pm$ cτ
S008FV	$\pi^\pm$ form factor F_V
S008, 1	$\pi^\pm$ decay mode: $\mu^+\upsilon_\mu$
S008, 2	$\pi^\pm$ decay mode: $e^+\upsilon_e$

From Node to Full Data Block

- **The classification code is a unique string that leads directly to the corresponding PDG data**
  - Similarly for PDG reviews

S008T →



PDG Identifiers

- **Formalized this classification into externally usable PDG Identifiers**
  - Strings w/o spaces of the form

    `[DATABASE::]NODE[:ATTRIBUTE=VALUE[,ATTRIBUTE=VALUE...]]`

    where
    - DATABASE: PDG database/RPP edition (optional)
    - **NODE: a PDG node (e.g. S008)**
    - ATTRIBUTE, VALUE: additional qualifiers (e.g. decay modes)
- **Examples:**
  - `S008` pi+-
  - `S008M` pi+- mass (MeV)
  - `S008T` pi+- mean life time (10**-8 s)
  - `S008:Desig=1` pi+ --> mu+ nu_mu

Comments

- **PDG will provide up-to-date authoritative list**
  - Once defined, meaning of an identifier will not change
  - Preliminary list contains ~8,000 identifiers
- **Can be used to link to PDG information (e.g. in pdgLive)**
- **New version of pdgLive will allow lookup of PDG Identifiers and using PDG Identifiers as references**
- **NB: There are PDG Identifiers for decay modes like**

$\eta \to 2\gamma$ `S014:Desig=1`

$\eta \to \pi^0 2\gamma$ `S014:Desig=7`

but not for branching ratios like

$$\frac{\Gamma(\eta \to \pi^0 2\gamma)}{\Gamma(\eta \to 2\gamma)}$$

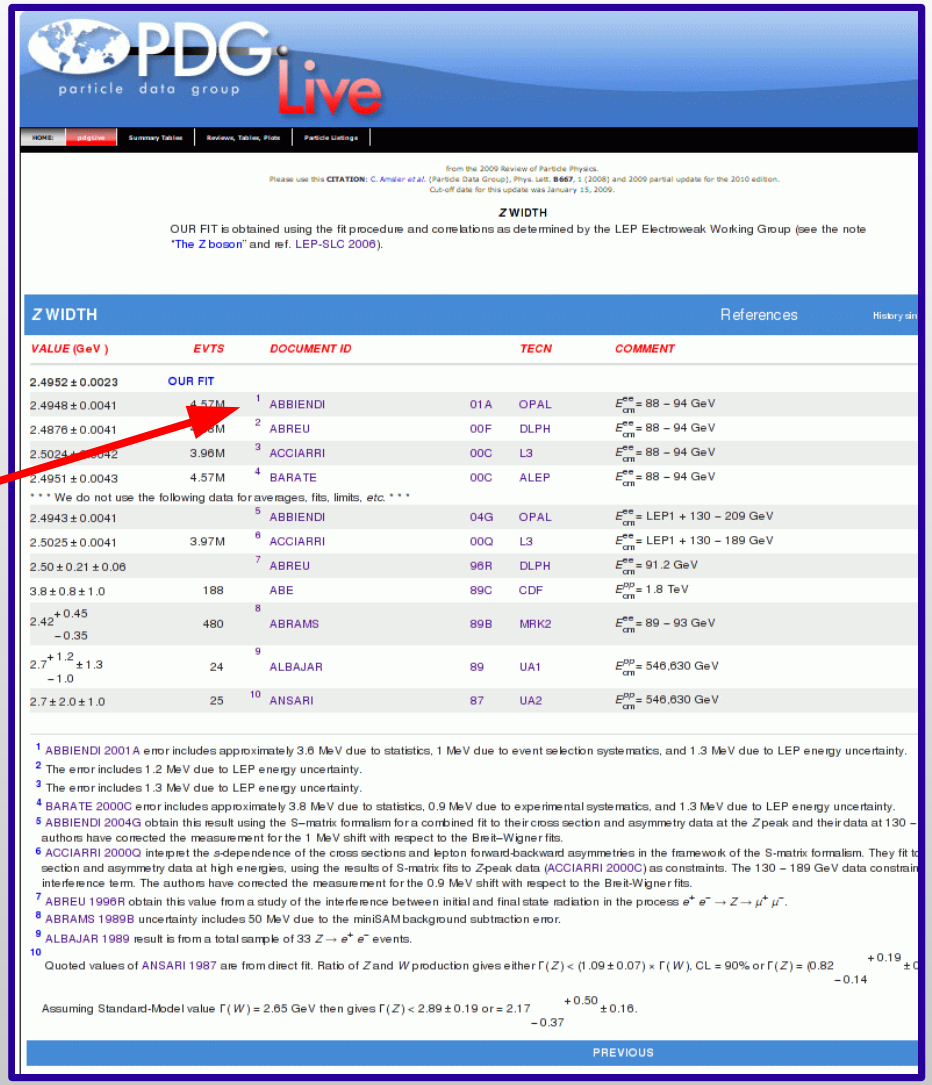
Query Table

- **Work on a translation table between PDG Identifiers and HEP Taxonomy (Annette Holtkamp et al)**
  - Further discussions during this summit ...

- **Examples:**

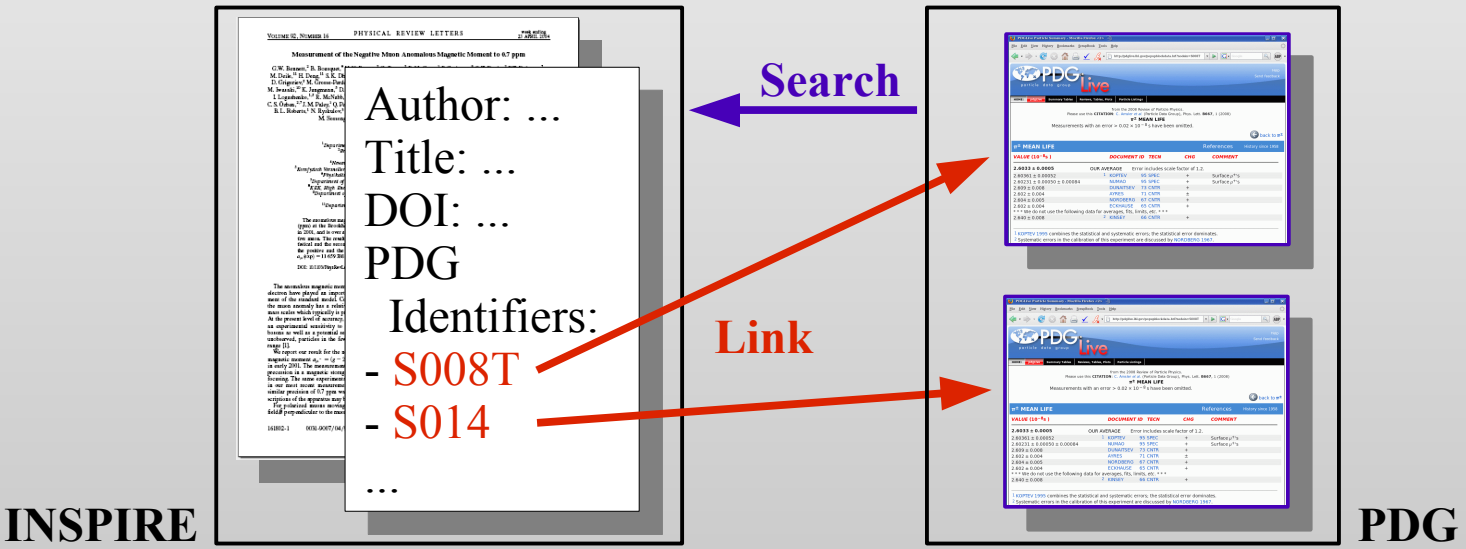
```
[PDGitem]
PDGcode = S044W
Description = Z WIDTH (GeV)
Query = "Z0: width"

[PDGitem]
PDGcode = S044:Desig=1
Description = Z --> e+ e-
Query = "Z0 --> positron electron"

[PDGitem]
PDGcode = S044Z0T
Description = A**(0,tau)(FB) CHARGE ASYMMETRY IN e+ e- --> tau+ tau-
Query = "electron positron: annihilation"  and "tau: pair production"
or "electron positron --> tau+ tau-" and
("charge: asymmetry" or "angular distribution: asymmetry")
```

INSPIRE Queries vs pdgLive



PDG Identifiers as Tags

- **Include PDG Identifiers as tags into article metadata?**
  - Lets INSPIRE point directly to relevant sections of PDG
  - Can generate initial set of tags from PDG database
  - Could allow authors to tag their articles using a convenient GUI (similar to pdgLive) to find the relevant identifier



Side Remark

- **How do you enter or search for example for**

$$B^+ \rightarrow \overline{D}^*(2007)^0 \ell^+ \nu_\ell$$

- **Same problem for web-based tools where PDG collaborators will enter data into PDG database**
  - Cannot expect occasional user to know correct PDG internal representation: #d{ B+ --> Dbar^*(2007)0 lepton+ nu_lepton }
- **Tried different approaches – current solution:**
  - User assembles desired expression by dragging into place the desired items from (hierarchical) lists of possible items
  - Example: → *demo of prototype tool to define new branching ratios to be included into Review of Particle Physics*
- **Perhaps something similar might work well for searches for decay modes in INSPIRE?**

Summary and Outlook

- **Aim at a much more comprehensive cross-linking of PDG and INSPIRE (and any others interested)**
- **The PDG Computing Upgrade that is in progress will include support for this from the PDG side**
  - Expect (internal) deployment of the backbone of the new system this summer (updated database schema, Java and Python APIs, test application of major data entry tool)
  - Within about a year a new pdgLive with cross-linking support should be available
- **Continue collaboration started long ago with SLAC with INSPIRE on cross-linking and information interchange**

Additional Slides

2008 Edition of the Review

2,778 new measurements from 645 new papers

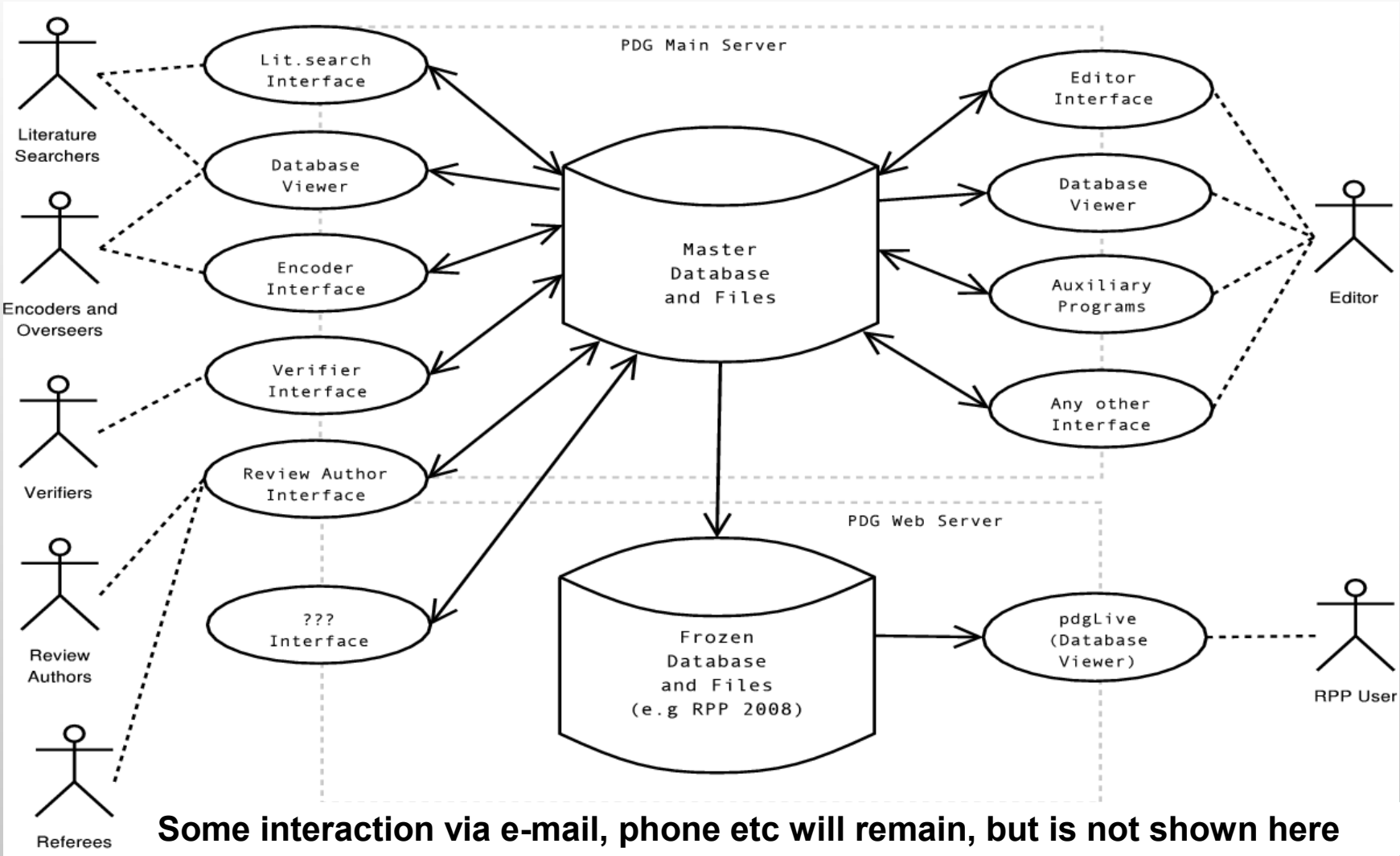
(in addition to 24,559 measurements from 7,104 papers that first appeared in previous editions)

108 reviews written by experts

RPP: 1344 pages

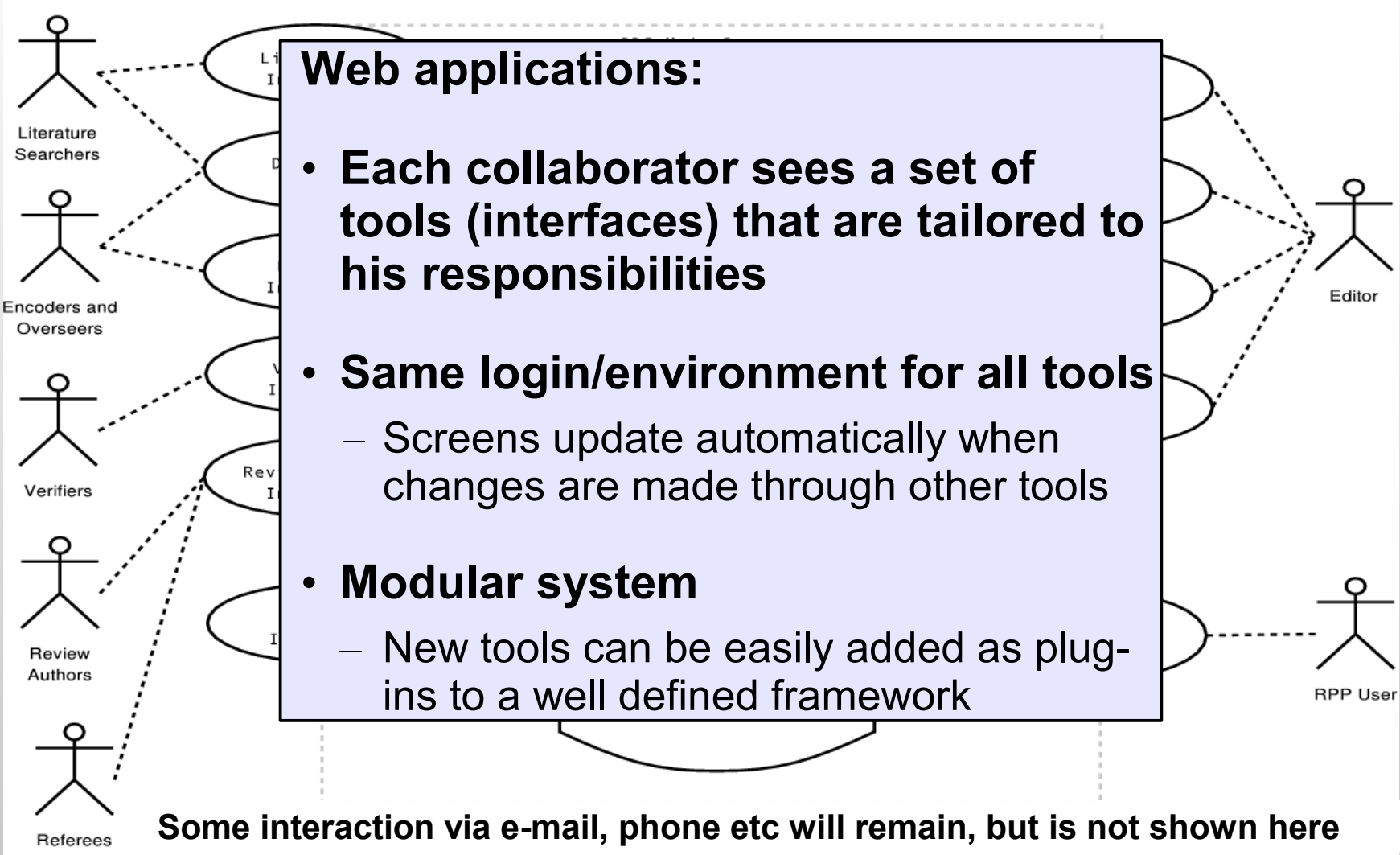
Booklet: 294 pages

Architecture



Some interaction via e-mail, phone etc will remain, but is not shown here

Architecture

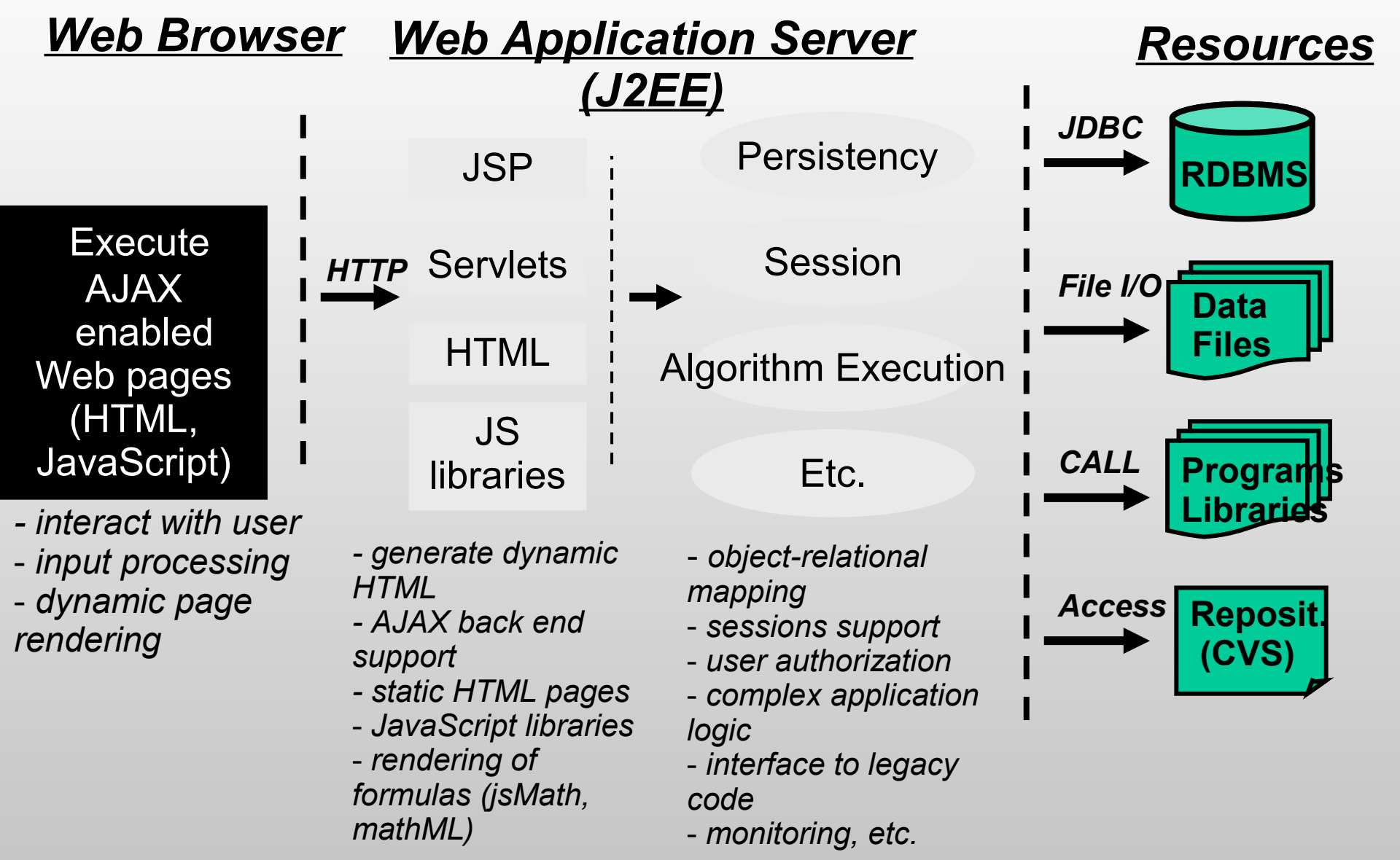


Web applications:

- **Each collaborator sees a set of tools (interfaces) that are tailored to his responsibilities**
- **Same login/environment for all tools**
  - Screens update automatically when changes are made through other tools
- **Modular system**
  - New tools can be easily added as plug-ins to a well defined framework

Some interaction via e-mail, phone etc will remain, but is not shown here

Three-Tier Web Application



Technologies

- **J2EE-based web application framework**
  - Commonly used industry standard for building scalable, distributed web applications
- **AJAX-enabled web pages**
  - User-friendly and highly interactive GUI behavior
- **Relational database (PostgreSQL)**
  - O(100) database tables
- **Programming languages**
  - Java and JSP for web application framework backend
  - JavaScript for client-side HTML (AJAX)
  - Python API for programmatic access to database
  - Legacy Fortran applications restructured as libraries