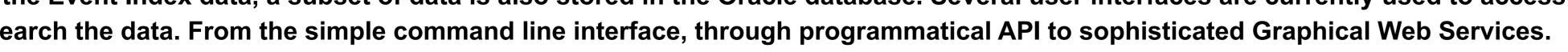


Data-centric Graphical User Interface of the ATLAS Event Index Service

Julius Hrivnac(1), Evgeny Alexandrov(2), Igor Alexandrov(2), Zbigniew Baranowski(3), Dario Barberis(4), Gancho Dimitrov(3), Alvaro Fernandez Casani(5), Elizabeth Gallas(6), Carlos García Montoro(5), Santiago Gonzalez De La Hoz(5), Andrei Kazymov(2), Mikhail Mineev(2), Fedor Prokoshin(2), Grigori Rybkin(1), Javier Sanchez(5), Jose Salt(5), Miguel Villaplana(7) on behalf of the ATLAS Collaboration

(1) Laboratoire de l'Accelerateur Lineaire Orsay, (2) Joint Institute for Nuclear Research Dubna, (3) CERN, (4) Università e INFN Genova, (5) Instituto de Fisica Corpuscular Valencia, (6) University of Oxford, (7) Department of Physics, University of Alberta, Edmonton

ATLAS Event Index Service keeps references to all real and simulated ATLAS events. Hadoop Map files and HBase tables are used to store the Event Index data, a subset of data is also stored in the Oracle database. Several user interfaces are currently used to access and search the data. From the simple command line interface, through programmatical API to sophisticated Graphical Web Services.



9

Availabl

00263962 00

0266503 0

00267639 002

<u>00271048</u> 002

EI17.1/0033

EI15





osmicCalo.merge.AOD.f933 m196

oject:data18_13Te\

amitag:f933 m196

project:data18_900Ge

data18 900GeV.00349769.p

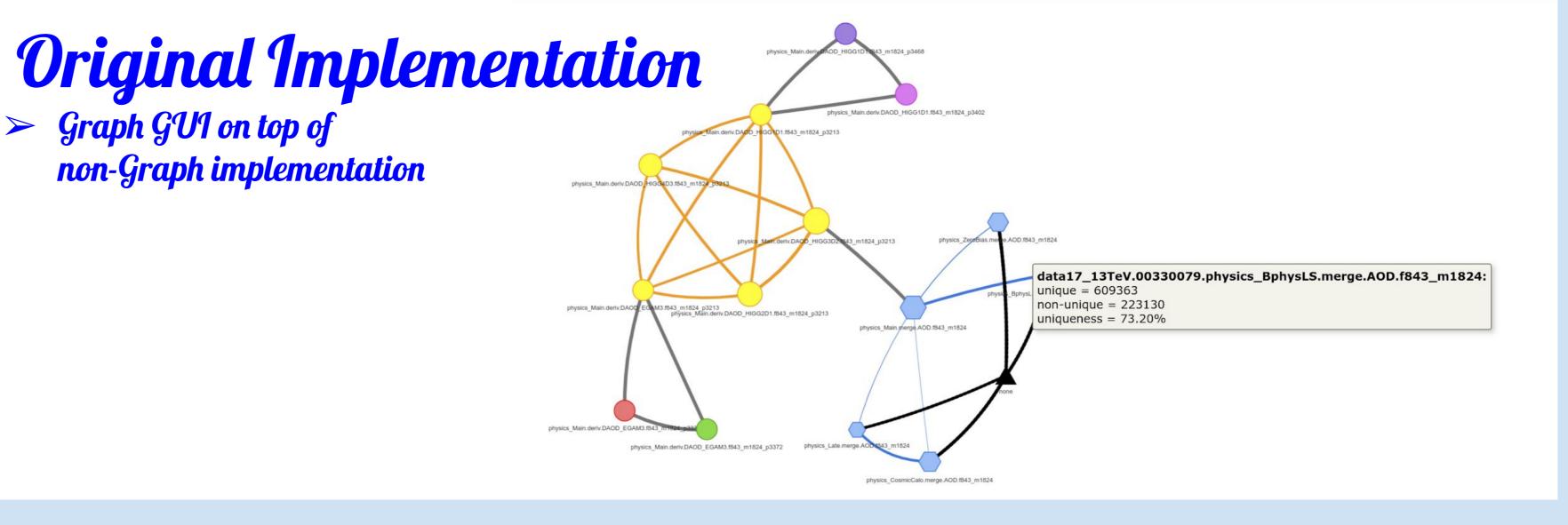
(stream:physics CosmicCale

- The original implementation was organized by service type (event lookup, \succ dataset overlaps, trigger statistics,...)
 - Each service gives access to all relevant data
- Following user requests, the User Interface has evolved into a system organized by data entity (events, datasets, collections, runs,...)
 - Each entity gives access to all available services
 - While the underlying implementation was still organized by service type
- \succ New implementation (under development for Run 3) is organized by data entity
 - Two prototypes were implemented, the *Prototype 2* has been selected for the final implementation

	PNG <u>histogram</u>	PNG <u>histogram</u>		PNG <u>histogram</u>	
Event Index	data17_13TeV.00330079.physics_CosmicCalo.merge.AOD.	f843_m1824 evt=199452.0	data17_13TeV.00330079.physics_CosmicCalo.merge.AOD.f843_m1824	evt=199452.0	
	L1_EM3_EMPTY	144315 (72.36%)	HLT_larcalib_L1EM3_EMPTY	144315 (72.36%)	
Problems or Questions ? - Ask service manager !	L1_EM7_EMPTY	34159 (17.13%)	HLT_noalg_cosmiccalo_L1EM3_EMPTY	140610 (70.50%)	
Detailed Help	L1_TAU8_EMPTY	34068 (17.08%)	HLT_noalg_cosmiccalo_L1EM7_EMPTY	22109 (11.08%)	
	L1_J12_EMPTY	23673 (11.87%)	HLT_larcalib_L1EM7_EMPTY	15205 (7.62%)	
le wung	L1_RD1_EMPTY	12652 (6.34%)	HLT_larps_L1EM7_EMPTY	13070 (6.55%)	
le runs	L1_J30_EMPTY	5940 (2.98%)	HLT_larcalib_L1J12_EMPTY	13050 (6.54%)	
	L1_TAU30_EMPTY	5292 (2.65%)	HLT_noalg_cosmiccalo_L1RD1_EMPTY	12652 (6.34%)	
0263964 00263965 00264034 00265532 00265545 00265573 (00266211 L1_J12_ABORTGAPNOTCALIB	2284 (1.15%)	HLT_larcalib_L1TAU8_EMPTY	11751 (5.89%)	
0266534 00266904 00266919 00267073 00267148 00267152 (1228 (0.62%)	HLT_noalg_cosmiccalo_L1J12_EMPTY	9480 (4.75%)	
0267358 00267359 00267360 00267367 00267385 00267599 0		1052 (0.53%)	HLT_larps_L1TAU8_EMPTY	7542 (3.78%)	
<u>0270441</u> 00270448 00270588 00270806 00270816 00270949 0	00270953 L1_J12_BGRP12	448 (0.22%)	HLT_larps_L1J12_EMPTY	7429 (3.72%)	
<u>0271298 00271370 00271388 00271421 00271516 00271595 0</u>	00271649 . L1_J50_UNPAIRED_ISO	243 (0.12%)	HLT_larps_L1EM3_EMPTY	6828 (3.42%)	
30079: Vive Help	data17_13TeV.00330079.physics_BphysLS.merge.AOD).f843_m1824			

ag level: 99 target: nul may be slow

og - Dataset Overlaps - Trigger Statistics - Trigger Overlaps(*) - TagFile Sample - TagFile Info(*) - Journal(run)(tag)(*) - AM neric: Catalog - Event Index For experts: EI - EL - TI - Inspect - Journal - Full Service-oriented Portal

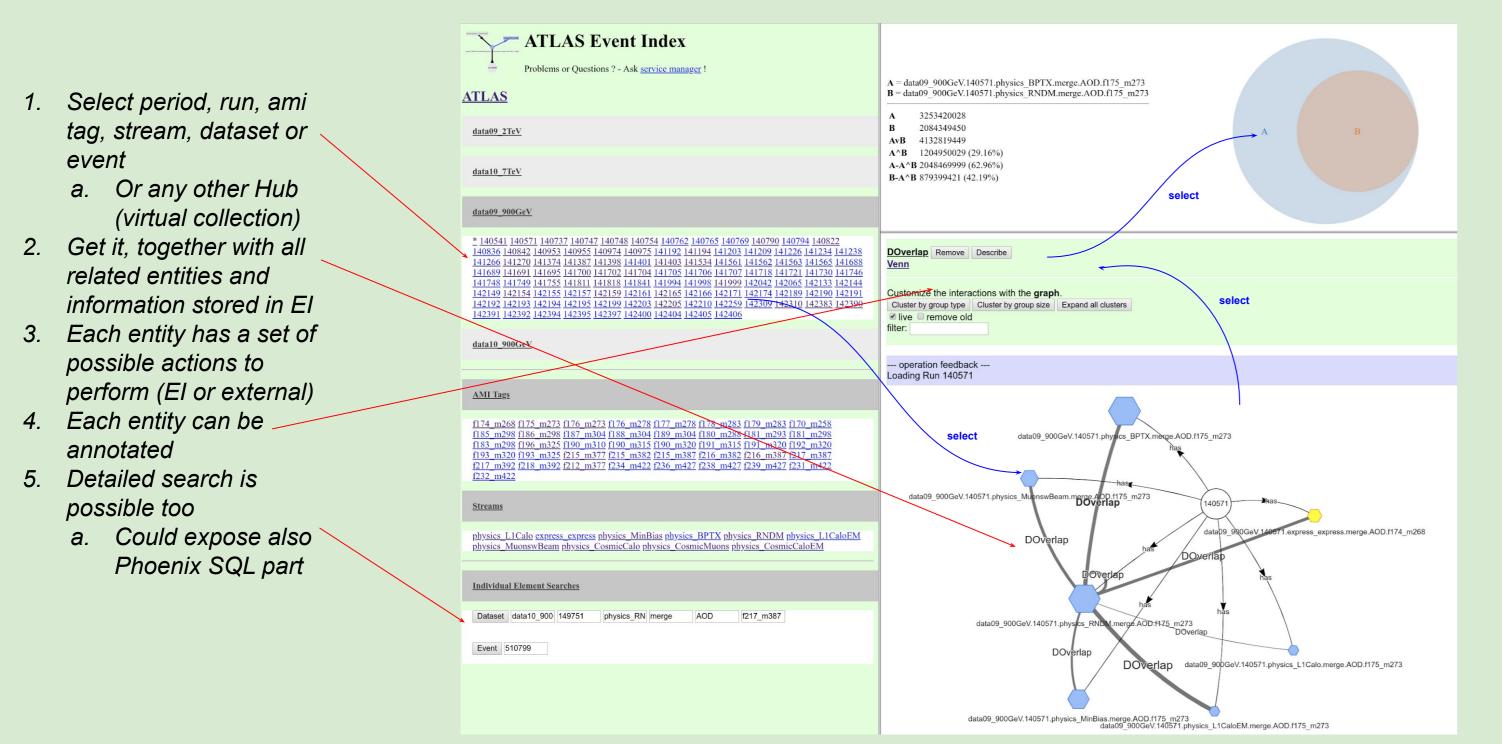


- Navigation is provided via dynamic hierarchical graph-like overview of all available data and data collections
- \succ Data are shown together with their relations, ownership, containment or overlaps
- Some actions are provided directly by the Event Index system, others are interfaces to various external ATLAS services
- > In many cases, specialised views are offered for detailed data inspection
 - Trigger histograms
 - Dataset overlaps
 - Trigger overlaps Ο
 - 0 ...

CHEP

2019

Prototype 2 > selected for 'Run 3' Event Index implementation

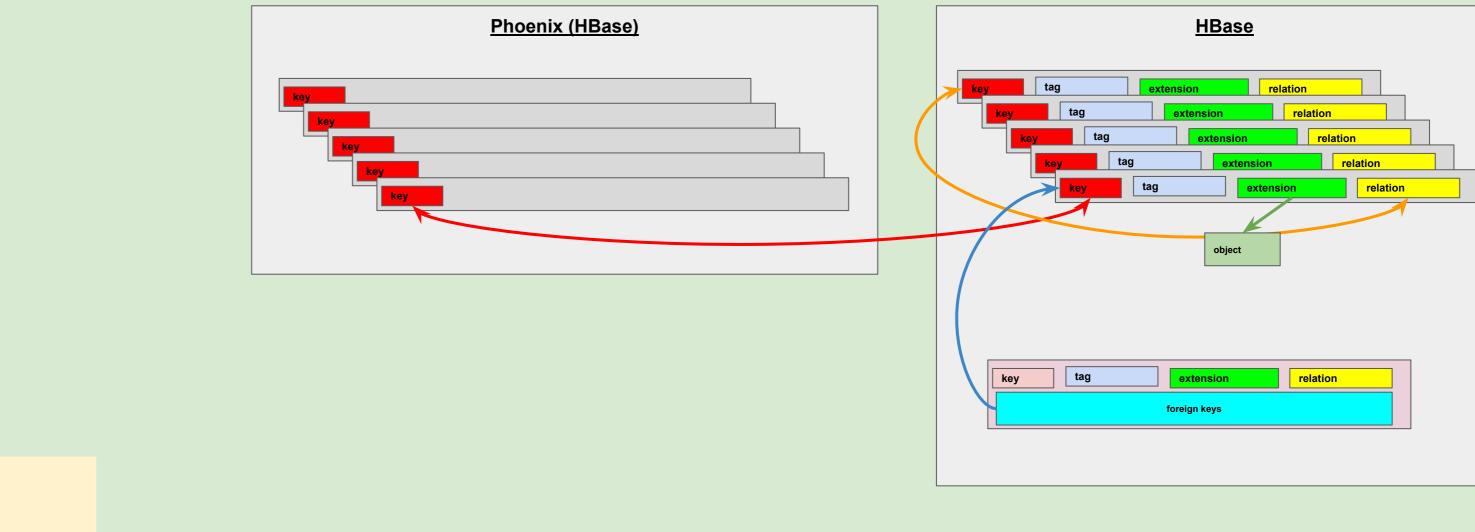


Prototype 1

- Directly storing data in JanusGraph database (on top of HBase)
- Accessing them via standard Gremlin interface of the TinkerPop framework

Prototype 2 - selected for Run 3

- Storing data in HBase tables with Phoenix SQL API
 - To allow interoperability with other SQL-based ATLAS services
- With additional HBase tables adding (lazy) graph structure on top
- Very generic Dynamical Web Service GUI
 - In principle re-usable for any Graph-like data
 - Customizable via stylesheets



- Create a prototype of the Element you want to search
- 2. Fill in known values
 - a. You can use SQL for Phoenix part
 - b. You may choose which backend (Phoenix, HBase or both) is used for searching and data filling
- Send it to the ElementFactory
- Get a set of satisfying Elements, with all values 4. filled (from both Phoenix and HBase)
- 5. Add Tags, Relations of Extensions to Elements
- a. DOverlap is_a Relation
- b. TStat is_a Extention
- 6. Update via ElementFactory
 - a. HBase will be updated

ElementFactory ef = ...;

Dataset dprototype1 = new Dataset(); dprototype1.set("runnumber", 140571). .set("project", "data09_900GeV").

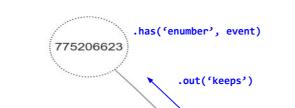
· · · **;** Dataset dataset1 = (Dataset)ef.search(dprototype1).get(0);

Dataset dataset2 = (Dataset)ef.search(dprototype2).get(0); dataset2.add(new DOverlap(10, 30, 50, 40, dataset1)); dataset2.add(new Tag("mytag", "myvalue")); dataset2.add(new TStat(....)); ef.update(dataset2);

- \succ Both database share the same keys
- \succ User sees one interface to both
 - All data of one key is represented by one Element
- HBase db is much smaller (only subset of data)
- Phoenix db is read-only \succ
- HBase db is modifiable, it can contain
- Simple Tags
 - They can be also used in search filter
- Extensions with any object
- E.g. Trigger statistics and overlap, duplicated events list,...
- **Relations** to other elements (Graph DB emulation)
 - E.g. overlaps between datasets
- > HBase can also contain Elements without Phoenix partner: **Hubs**
 - They represent pre-defined virtual collections of Elements
 - E.g. Amitag, Stream, Run, Project,...
 - They can be extended and searched in the same way as other Elements
- > Ad-hoc virtual collections can be build also using Tags

See also Presentation Using Graph Databases in HEP (Track 4, Th, 15:15)

- \succ The global dynamical interactive view of all ATLAS data
 - With relations between data entities



EI16.1/00298690:	✓ live Help			
Cluster by AMI Tag	Cluster by group siz	ze Expand all clusters		
overlap thresholds:	2	20%	80%	Context-sens
tag level: 99 target:	null	filter: null	Recreate	

ustomize the interactions with the graph. Cluster by group type Cluster by group size Expand all clusters I live III expand children III expand parents III remove old

