

Ciclo de Seminários PESc

Fabio Porto

Laboratório Nacional de Computação Científica
Comitê Olímpico Brasileiro



Agenda



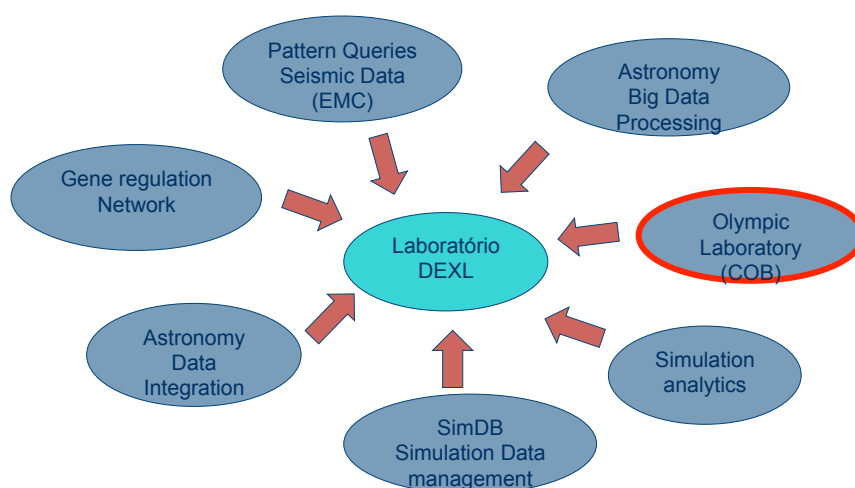
- DEXL - LNCC
- The Olympic Lab Project
- Interdisciplinary Data Science
- SAHA – Sistema de Apoio Holístico a Atletas
- Final Remarks

Laboratório LNCC-MCTI DEXL (dexl.lncc.br)



- Fundado em 2009
- Objetivo:
 - Desenvolver técnicas, métodos, algoritmos para apoio à Gerência e Análise de Dados Científicos
- Atuação:
 - Orientações de Mestrado e Doutorado
 - 3 Doutores e 2 Mestres formados
 - 6 Doutorandos e 2 mestrandos
 - 2 I.C.
 - Desenvolvimento
 - 6 programadores
 - Parcerias
 - O.N., COB, EMC Research, INCT MACC
 - INRIA – Montpellier – Team Associé

DEXL – Pesquisas em Andamento



The Olympic Lab Project



- Olympic Lab Project
 - Funded by FINEP – R\$ 13M
 - Coordinated by: COPPE – Crie Lab
 - Executed by: COB
 - Institutions: COPPE, UFRJ, COB, UERJ, INTO, LNCC, UNIRIO
 - Begin: January, 2010;
 - Operation Start: December 2015

Facility

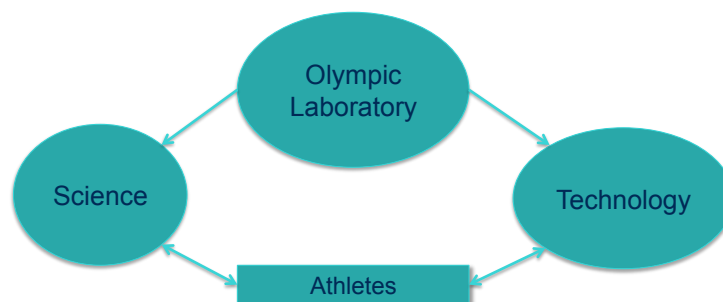


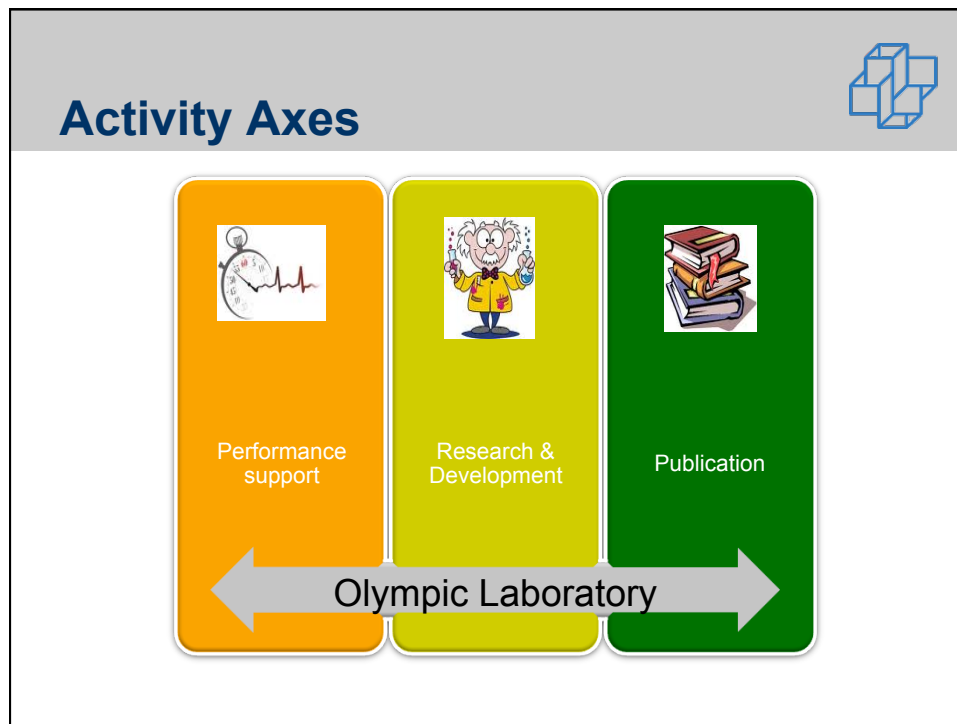
Main drives



- Objective
 - To improve Brazilian position in world high-performance sports ranking
- Approach
 - To improve athletes results through scientific analysis over specific metabolic-behavioral-physiological-mechanical-nutritional condition
- Means
 - To build the first Latin America Research Center for High-Performance Athletes

Principles





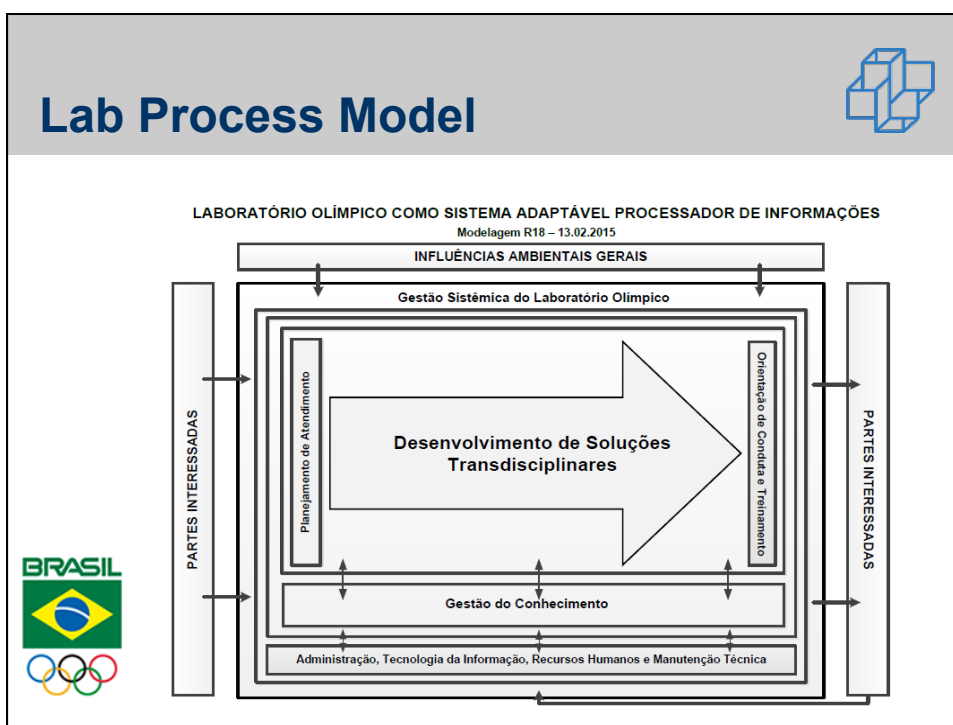
Inter-disciplinarity

Disciplines

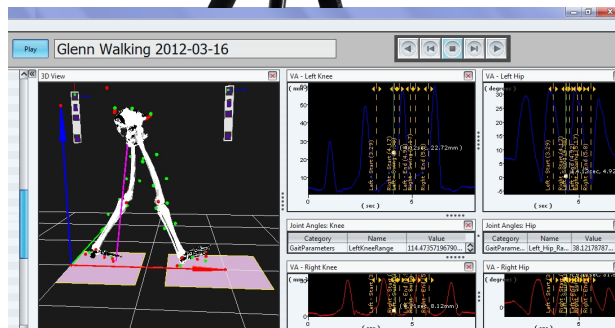
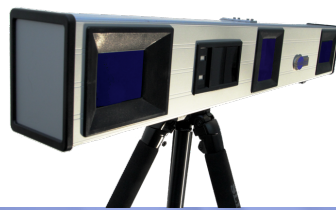


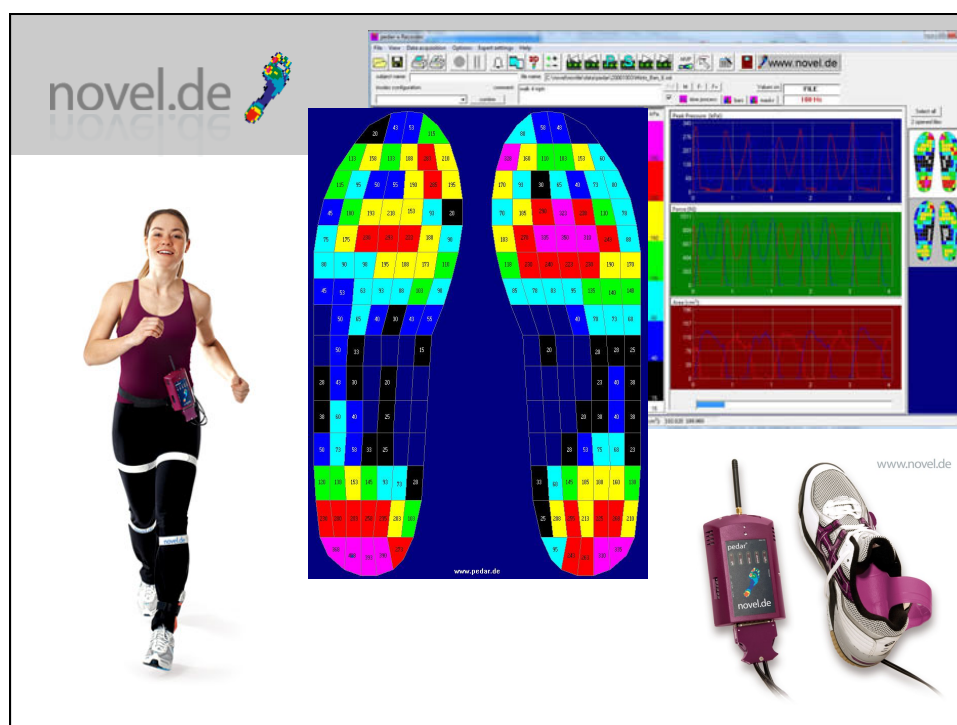
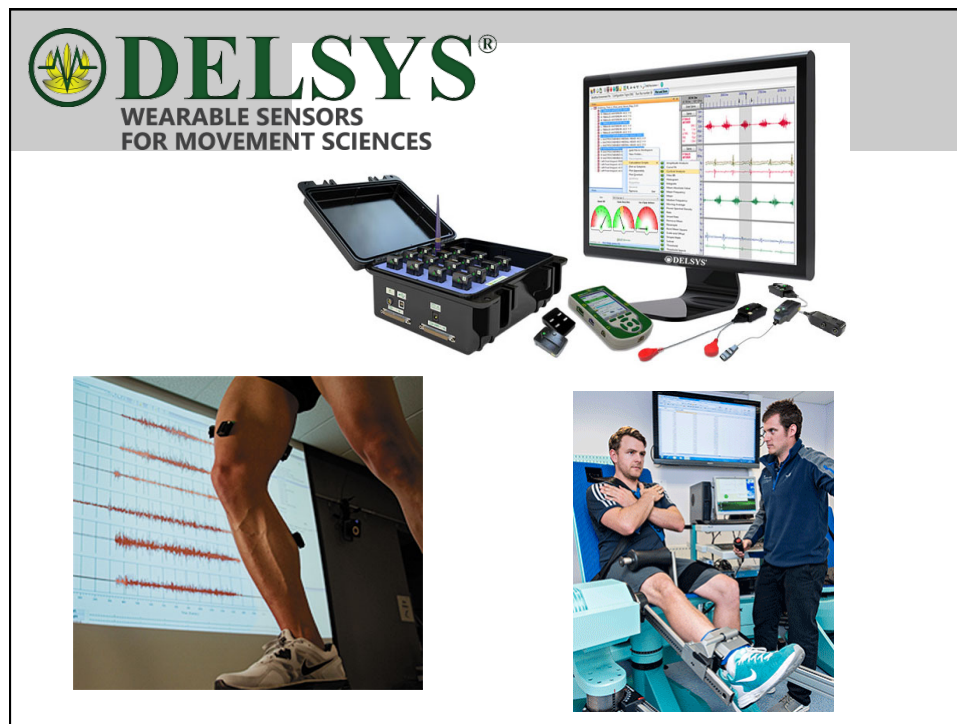
- Medicine
- Physiotherapy
- Behavior
- Biomechanics
- Physiology
- Biochemistry
- Nutrition
- Training
- Computational Modeling

Lab Process Model

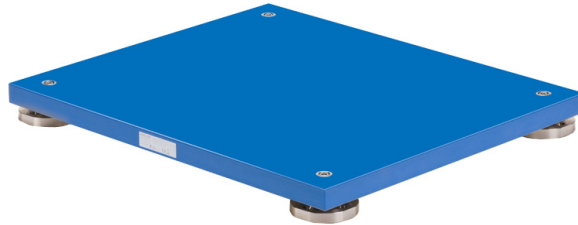


INSTRUMENTS IN BIOMECHANICS





KISTLER
measure. analyze. innovate.



DATA CAPTURING AND ANALYSIS IN BIOCHEMISTRY



BLOOD EXTRACTION



MASS ESCTOMETRY



[XEVO G2-S TQF]
Identify, quantify, and confirm the broadest range of compounds in the most complex and challenging samples.

StepWave

- Patented T-wave ion transfer that maintains sensitivity while extending routine maintenance.
- Revolutionary lift-act design for high method robustness with complex sample matrices.

Universal Ion Source

- The most extensive range of ion sources for the broadest range of analytes.
- Tool-free design enables ease of use and simplifies routine maintenance.
- Source options are quickly interchangeable and ready for use within minutes.

T-Wave Collision Cell

- Enables efficient transfer of ions to the full mass analyzer.
- Allows rapid MS/MS data acquisition with maximum sensitivity.

QuantTof

- Simultaneously delivers UPLC-compatible mass resolution and near-to-tolerant dynamic range, so that the narrowest chromatographic peaks from the most complex sample matrices can be identified and quantified with no compromise in performance.

Dual Stage Reflector
Improves focusing of ions for high resolution spectra.

High Field Pusher
Increases duty cycle and instrument sensitivity.

ADC Detector
Provides a linear response over 9 orders of dynamic range.

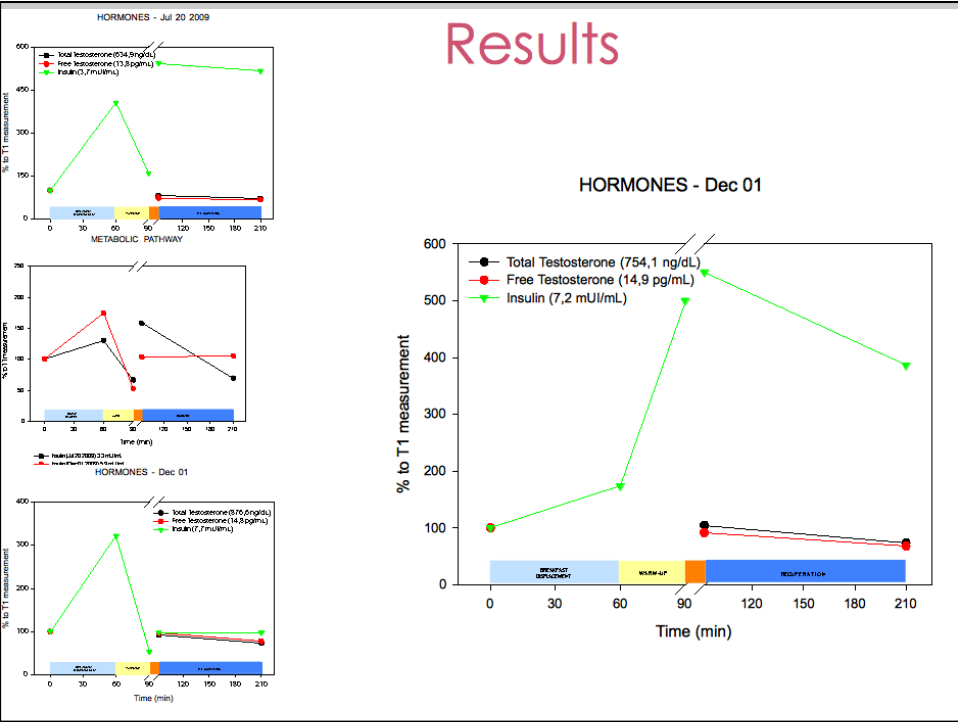
Waters
THE SCIENCE OF WHAT'S POSSIBLE.™

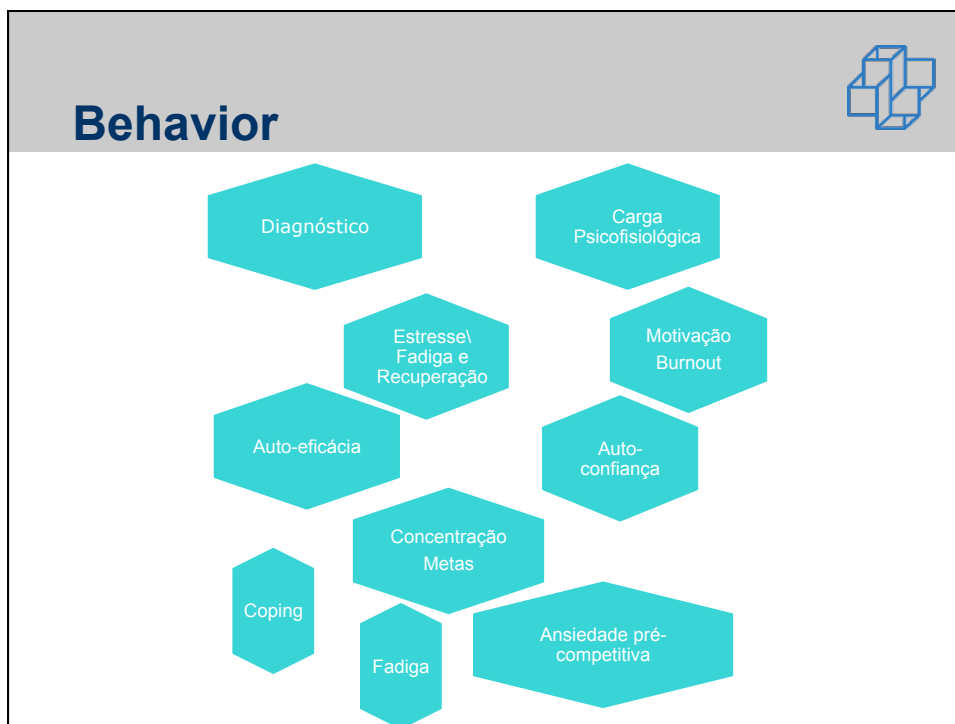
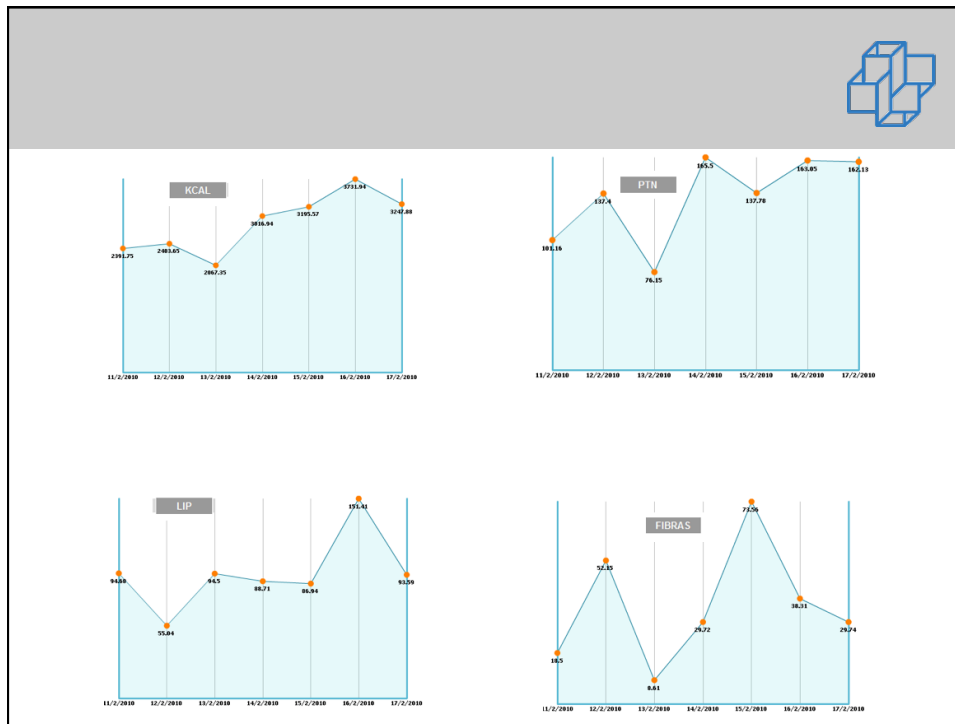
Biochemistry data - Football



	POSICÃO	TIME	NOME	Metlyte 8									
				Unidade de medida									
				Análise									
				T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
N da bioquímica				mmol/L		mmol/L		mmol/L		mmol/L		mmol/L	
				T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
6	Volante	Laranja	Wilson Martins	6.5	5.8	6.6	9.3	8	4.4	4.5	5.3	5.8	6
16	Goleiro	Laranja	Bruno Rocha	5.4	6	4.4	7.8	7.3	5.5	4.7	4.3	5.3	5.1
29	Zagueiro	Laranja	Wendel Lemos da Cruz	5.3	5.6	5	8.2	5.5	4	3.3	3.5	4.3	4.5
6	Meia	Laranja	Jose Ricardo	6	7	4.5	6.9	6.1	4.9	4.4	4.9	5.8	5.9
8	Atacante	Laranja	Vitor Matheus	5.7	5.2	7	10	7.1	7	8.3	11.5	8.3	11.1
19	Lateral Esquerdo	Laranja	Jefferson Santos	5.1	5.3	4.8	12	11.3	8.4	5.5	6.9	6.5	7.1
7	Volante	Laranja	João Alexandre Marques Junior (Ramires)			3.9	9.8	6.8			4.2	4.7	5.2
20	Meia	Laranja	David Cordero Miranda Fomaz			5.9	7	6			3.9	4.2	4.8
27	Atacante	Laranja	Daniel Marito			5.4	6	6.6			5.3	5.7	7.3
25	Lateral	Laranja	Thiago Ennes			4.2	5.8	5.8			4.3	4.7	5.1
26	Zagueiro	Laranja	Joelson Eduardo dos Santos	5	5.8	6.5	7.2	6.5	5.1	4.4	4.2	5	5.6
Orange Time				5.57	5.81	5.29	8.16	6.98	5.33	5.01	5.30	5.48	6.15
SD				0.53	0.60	1.07	1.89	1.60	1.07	1.59	2.25	1.17	1.86
28	Atacante	Grena	Carlos Alberto (Jaco)	5	5.4	4.7	7.9	6.3	5	4	3.8	4.4	4.8
1	Meia	Grena	Robson Rodrigo Costa	5.8	5.9	4.6	7	7.3	4.9	4.1	4.1	5.1	5.4
11	Atacante	Grena	Jefferson Gibano	5.9	5.6	5.8	8	7	6.3	5	4.5	5	5.3
1	Goleiro	Grena	Lucas Henrique Genardi		5.5	5.8	6.2	6.1	4.5	4.1	4.7	4.7	4.8
24	Atacante	Grena	Alvaro Santos	4.9	6.9	9.5	5	7.2	4.8	4.4	4.7	4.4	4.7
3	Zagueiro	Grena	Matheus Junior do Nascimento	5.4	5.5	4.9	7.8	7.5	6.7	6.5	5.2	6.4	6.1
17	Zagueiro	Grena	Renato Barbosa Vachi	6.4	6.1	6.4	7.7	7.5	5.2	4	4.7	5.9	6.3
12	Meia	Grena	Luiz Borges Machado	4.9	5.8	4.8	7.2		4.6	4.1	3.8	4.1	
12	Volante	Grena	Walter Oliveira Vieira	5.3	5.4	4.8	6.8	6.3	4.9	4.7	4.7	5	5.5
23	Meia	Grena	Yuri			5.6	8.2				4.4	4.7	
8	Lateral	Grena	Eduardo M. C. de Queiroz (Dudu)			4.7	6	5.7			4.2	5.2	5.6
14	Volante	Grena	Mauro Moreno dos Santos			5.7	7.8				5.8	6	
22	Lateral	Grena	Sidnei B. da Fonseca Junior			7.2	6.1	6.1			4.7	4.9	5.1

Results



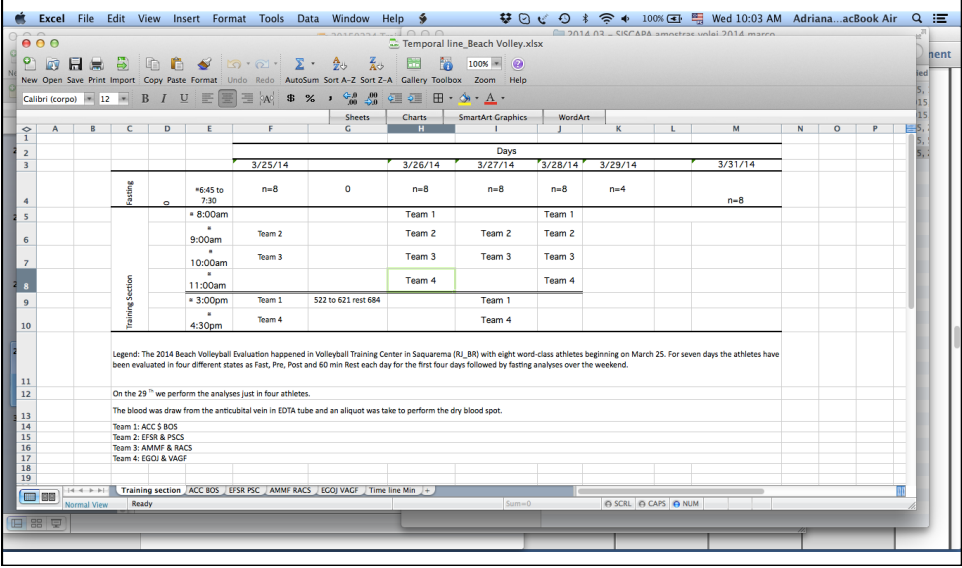


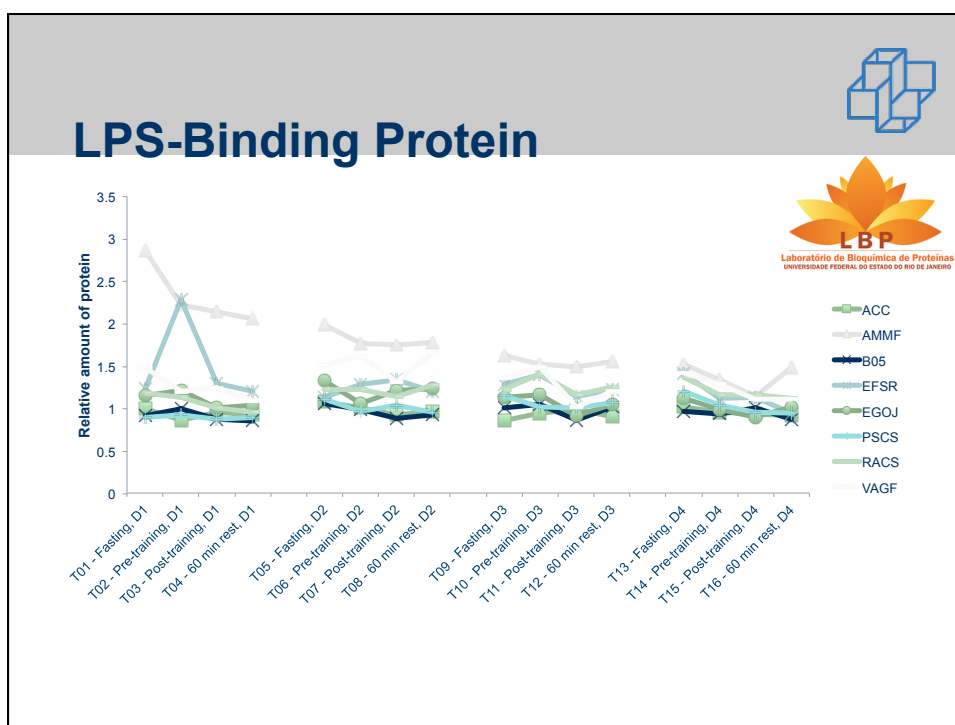
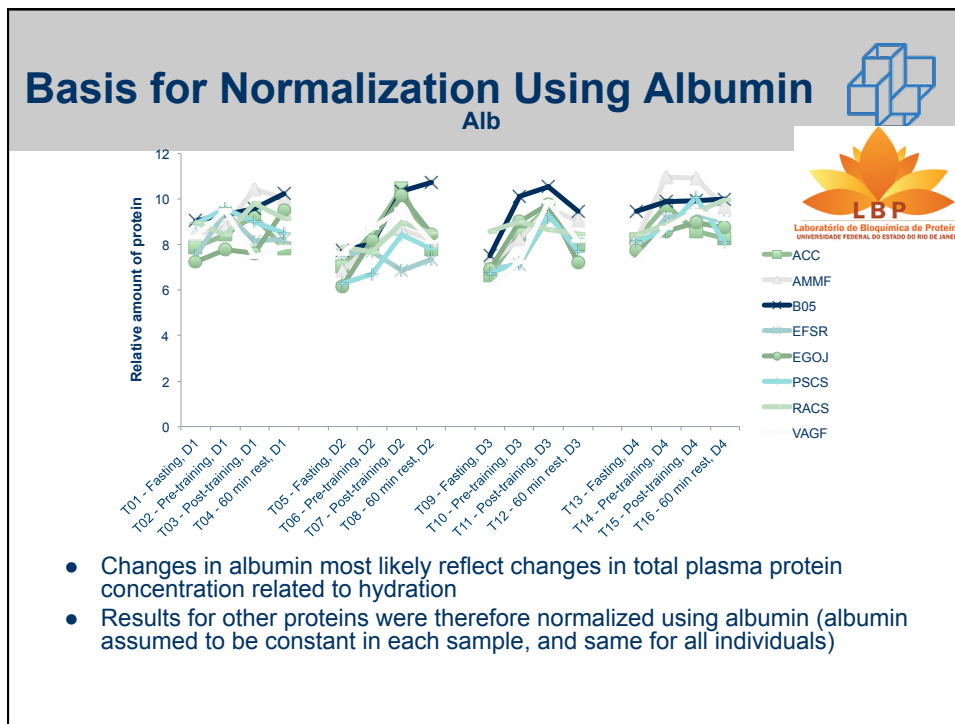


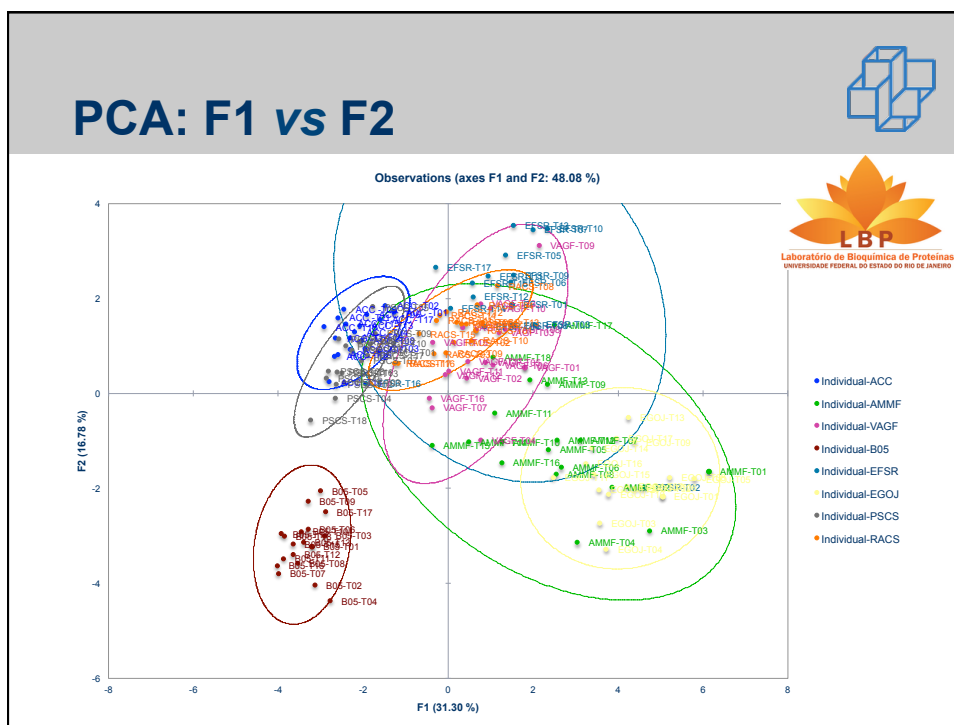
A science based on data



Data Collection Protocol







Big Data in e-Sports

- Reflects the data deluge observed as a result of athletes scientific follow-up
- Input from different disciplines: sportomics (ref. L. Cameron, LBP)
- Instruments capturing/generating data

In Science and Beyond



- “Scientists are spending most of their time manipulating, organizing, finding and moving data, instead of researching. And it’s going to get worse”
 - Office Science of Data Management challenge - DoE



Topic of the decade

USP-IAG

e-Science



- “In the future, e-Science will refer to the *large scale science* that will increasingly be carried out through *distributed global collaborations* enabled by the Internet. Typically, a feature of such collaborative scientific enterprises is that they will require *access to very large data collections*, *very large scale computing resources* and *high performance visualization* back to the individual user scientists. It is a scientific process that uses global networks of computing infrastructures (often referred to as the “*cyberinfrastructure*”), *data-gathering instruments*, *analytic software*, and of course, *scientists themselves*.”
- *National eScience Centre, Uk*

COB - LNCC 2013

SAHA – Cockpit for e-Sports



**SAHA – SISTEMA DE APOIO
HOLISTICO AO ATLETA**



Objetivo Projeto SAHA



- Desenvolver um programa de pesquisa em Modelagem Computacional centrado no método científico em apoio à melhoria de desempenho dos atletas.
 - Meta
 - Desenvolver métodos, modelos e técnicas com foco na gerência e análise de dados produzidos pela pesquisa centrada no atleta

Desafios



- Uniformizar os tipos de dados de acompanhamento
- Integrar dados
- Analisar os dados
- Disponibilizar os dados

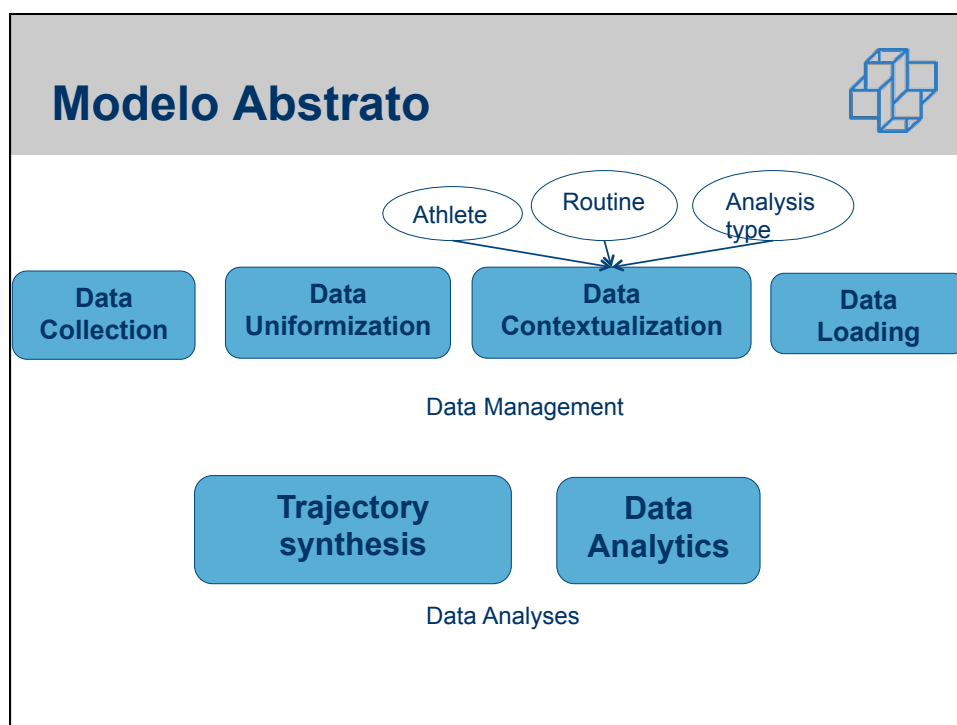
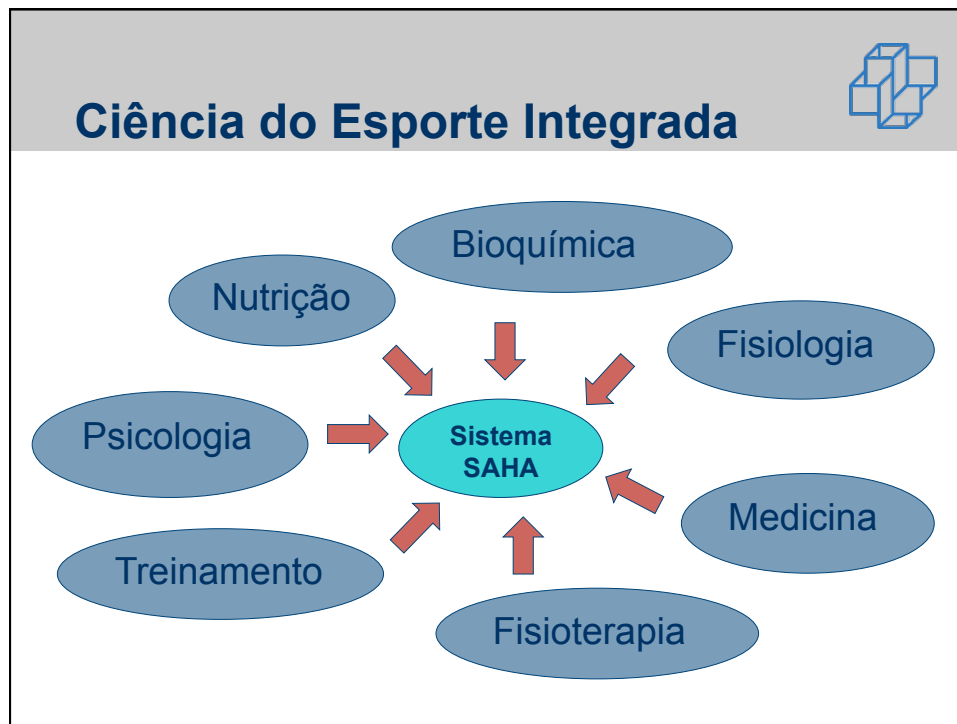
Do atleta

Ao e-Atleta

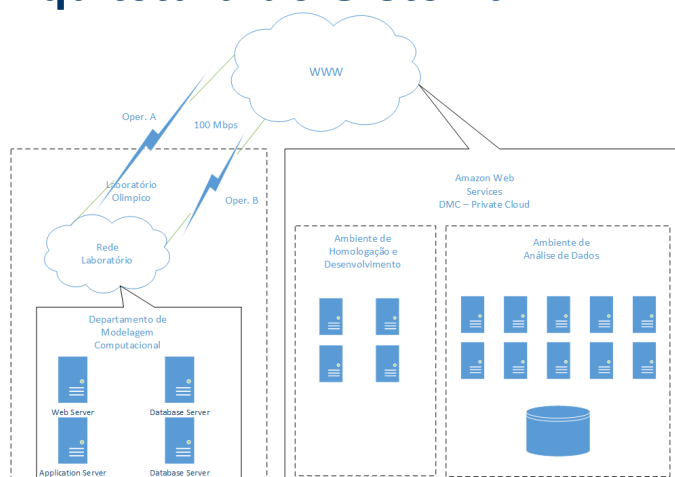
Trajetória básica de: 01/09/2010 à 27/09/2013

Data	Frequência (Hz)
01/09/2010	25
02/09/2010	25
03/09/2010	12
04/09/2010	15
05/09/2010	12
06/09/2010	75
07/09/2010	11
08/09/2010	15
09/09/2010	10
10/09/2010	20
11/09/2010	9

Hemolab



Arquitetura do Sistema



DEXL LAB
EXTREME DATA LAB



**Laboratório
Nacional de
Computação
Científica**

Abordagem

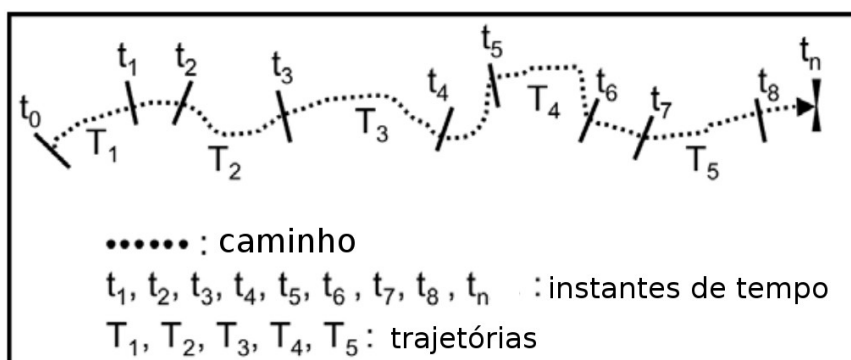
- **Atleta e seus *elementos observáveis***
 - Variáveis de observação
- **Variação dos elementos observáveis**
 - Tempo
 - Estado do treinamento
- **Observações pseudo-contínuas**
 - Coleta de material em diversos momentos da vida do atleta
 - Interpolação provê uma simulação de variação contínua no tempo
- **Observações discretas**
 - Registros pontuais do estado do atleta
 - Medicação
 - Lesão
 - ...

Trajectoria



- Modelar o processo de acompanhamento do atleta como a trajetória um elemento virtual no espaço de valores válidos
- Análise topológica de trajetórias
- Elemento de uniformidade entre as disciplinas
- Trajetória:
 - Atleta
 - Rotina (sequencia de estados)
 - Elemento Observável

Modelo de Trajetória

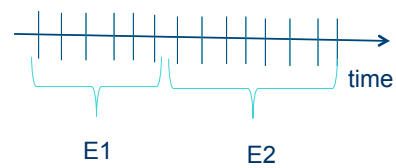


Um caminho espaço-temporal de um objeto em movimento. (Spaccapietra *et al.*, 2008)

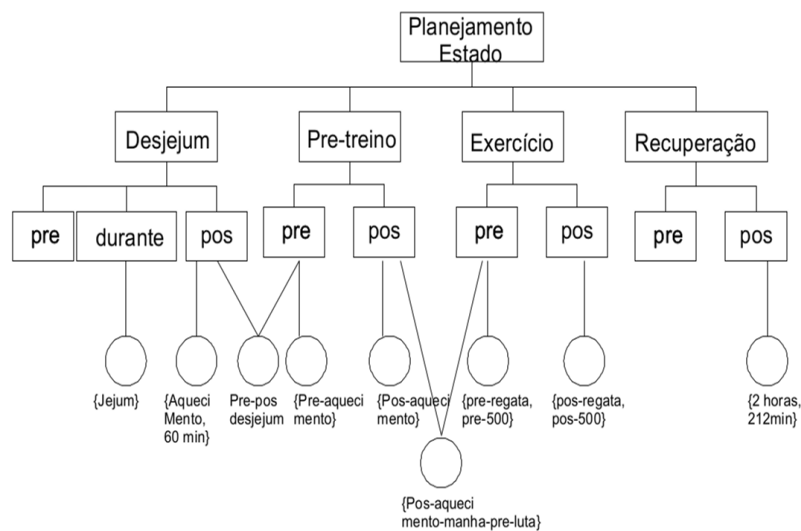
Estados

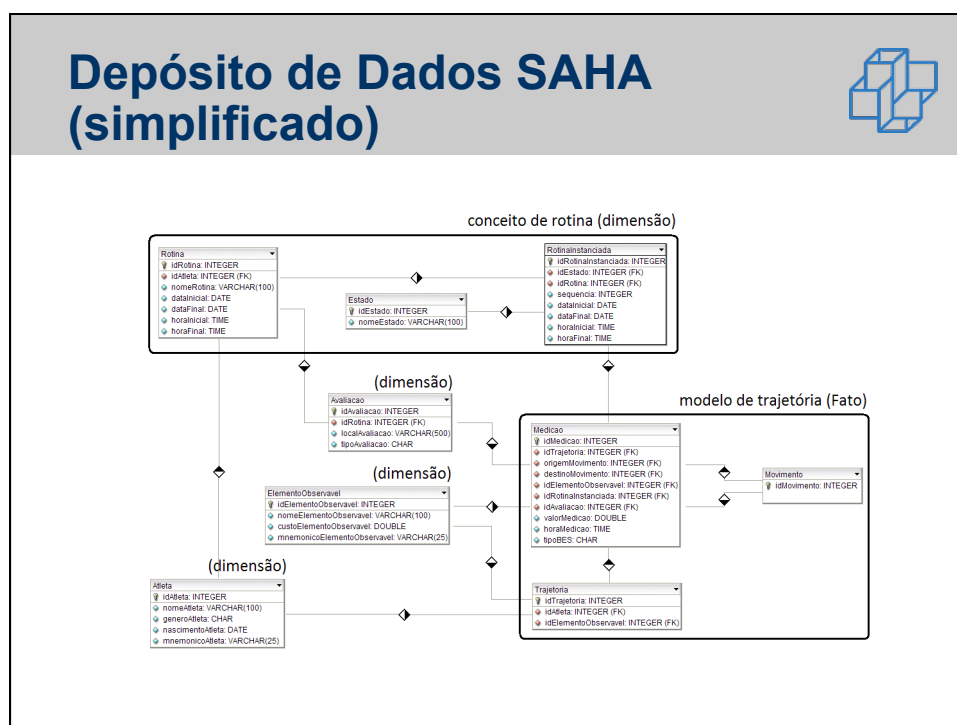
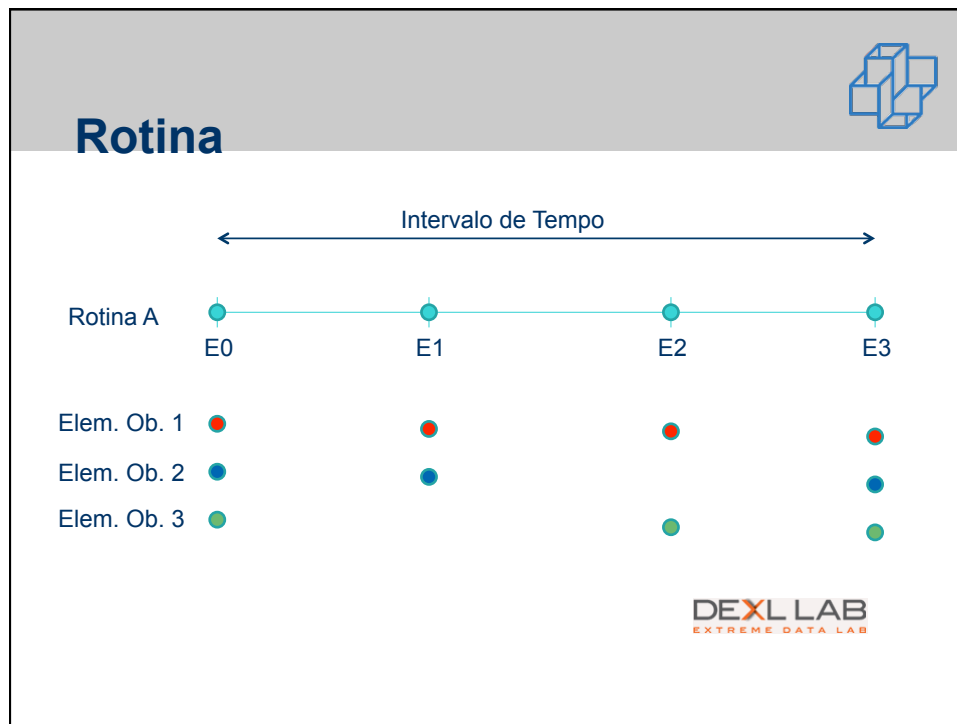


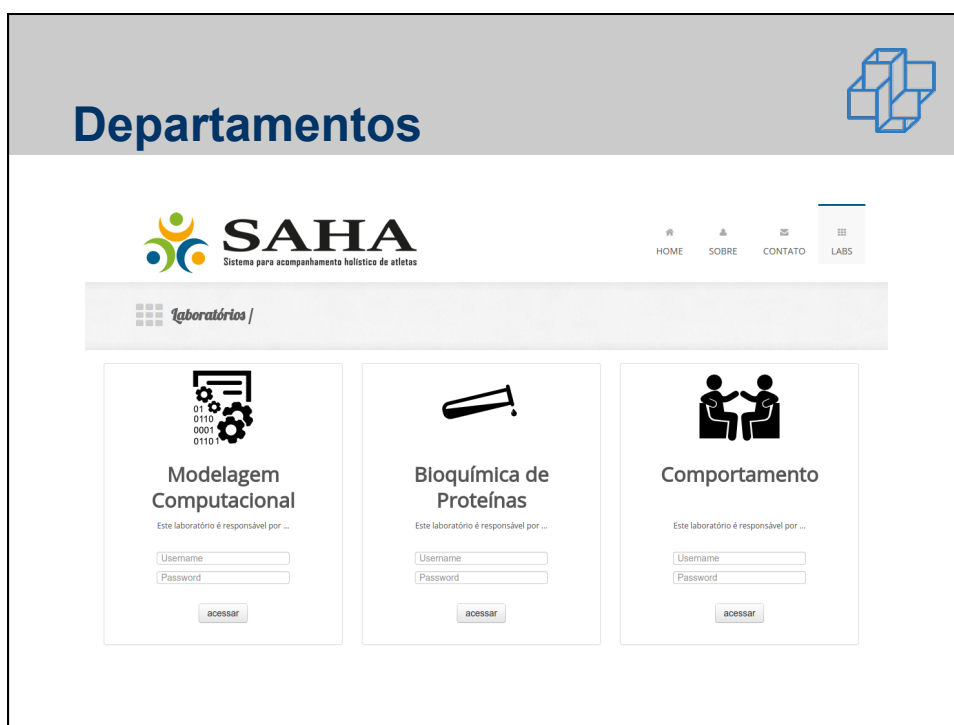
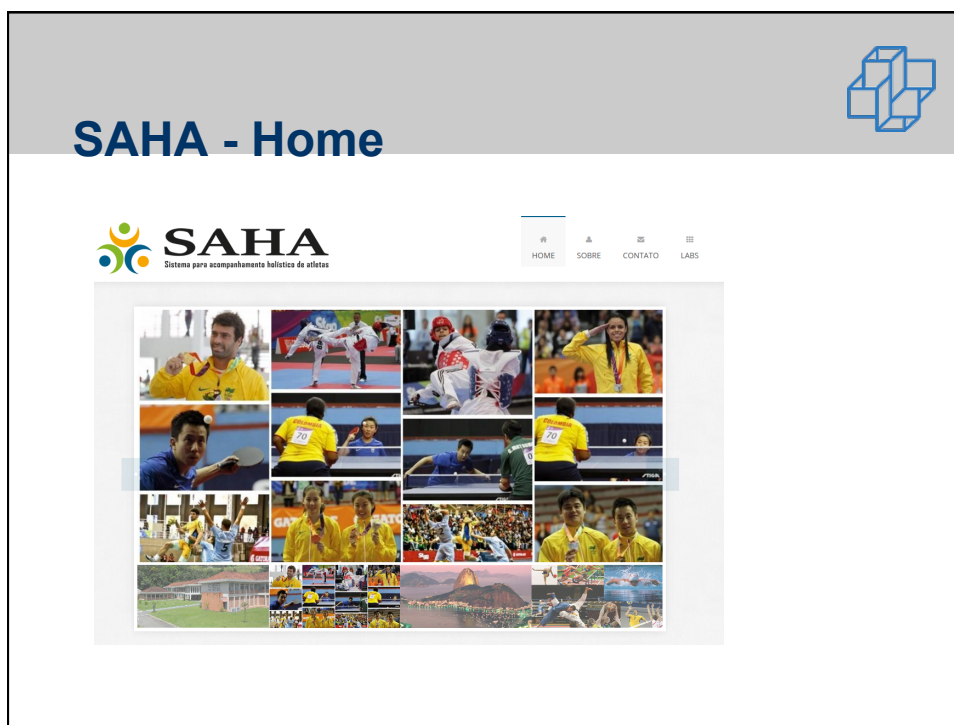
- Divisão do tempo segundo semântica do treinamento



Estados de Treinamento









Departamentos



Fisiologia do Esporte

Este laboratório é responsável por ...

Username

Password

[acessar](#)



Biomecânica

Este laboratório é responsável por ...

Username

Password

[acessar](#)



Base de Conhecimento

Este laboratório é responsável por ...

Username

Password

[acessar](#)



Coordenação INOVE

Este laboratório é responsável por ...

Username

Password



Gerência do Sistema

Este laboratório é responsável por ...

Username

Password



Atleta

SAHA
admin

Início
Atleta/Equipe
Atleta
Cadastro
Lista
Equipe
Modalidade
Esporte
Elementos observáveis
Métricas
Rotina
Coleta de dados
Gráficos

Atleta / Cadastro

Nome:

Mnemônico:

Gênero:

Data de nascimento:

Modalidade do esporte:

[Salvar](#) [Lista de Atletas](#)



Rotina Executada

SAHA

admin

- Início
- Atleta/Equipe
- Elementos observáveis
- Métricas
- Rotina
 - Estados
 - Tipo de projeto
 - Dados do projeto
 - Tipo de avaliação
 - Planejamento da rotina
 - Cadastro
 - Lista
- Coleta de dados
- Gráficos

Planejamento do treino / Editar

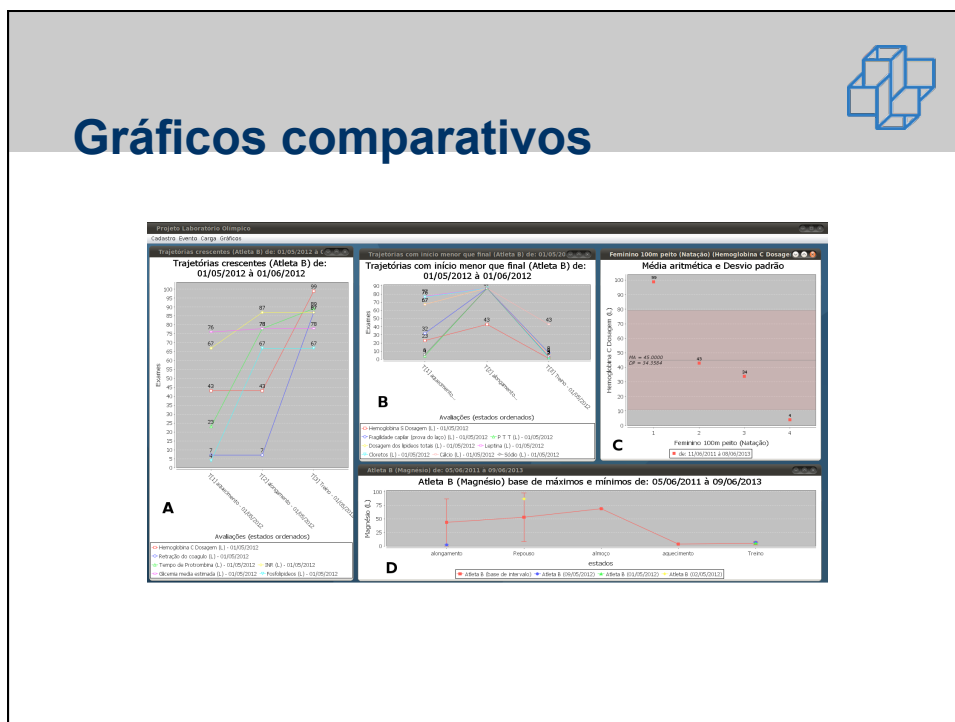
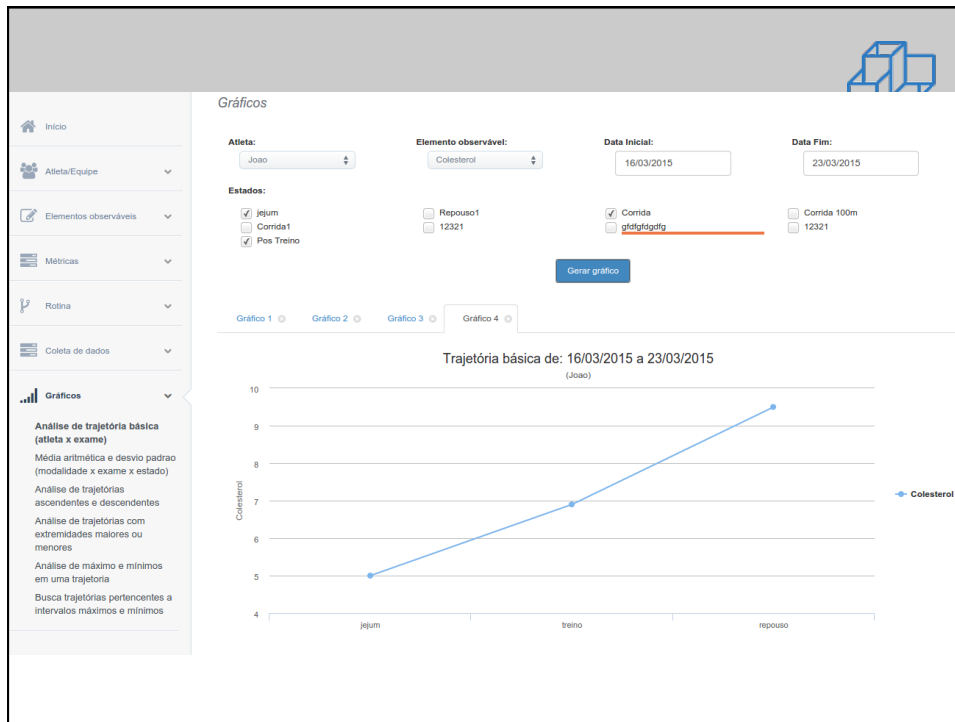
Nome do treino:

Estados e tempos / Ordenação

ESTADO	TEMPO	
jejum	01:00:00	
Corrida	01:00:00	
Pos Treino	01:00:00	

Salvar

Lista de planejamentos





CONCURRENCY AND COMPUTATION: PRACTICE AND EXPERIENCE
Concurrency Computat.: Pract. Exper. 2012; **24**:1497–1512
 Published online 9 November 2011 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/cpe.1869

SPECIAL ISSUE PAPER

A metaphoric trajectory data warehouse for Olympic athlete follow-up

Fabio Porto^{1,*}, Ana Maria de C. Moura¹, Frederico C. da Silva¹, Adriana Bassini³,
 Daniele C. Palazzi¹, Maira Poltosi¹, Luis Eduardo Viveiros de Castro^{2,3} and
 L. C. Cameron³

¹*Extreme Data Lab (DEXL Lab), National Laboratory of Scientific Computing (LNCC), Petrópolis, RJ, Brazil*

²*Brazilian Olympic Committee (BOC), Rio de Janeiro, RJ, Brazil*

³*Laboratory of Biochemistry of Proteins, Federal University of the State of Rio de Janeiro (UNIRIO), Rio de Janeiro, RJ, Brazil*

Int'l Association of Computer Science in Sport (<http://www.iacss.org/>)



Prof. Martin Lames
 Technische Univ. Munchen



IACSS | IACSS | Services
 You are here: IACSS

IACSS

- ☐ Objectives
- ☒ History
- ☐ IACSS-Board
- ☐ IACSS-Registration
- ☐ National associations
- ☐ Contact

International Association of Computer Science in Sport (IACSS)

The International Association of Computer Science in Sport (IACSS), and the predecessor (the WorkingGroup COSIP), have been founded to improve the international cooperation in the field of Computer Science in Sport. Obviously, the internationalization of this discipline is of great importance for the exchange of views, the discussion and presentation of current research results as well as the realization of joint research projects. This has also been become apparent by nine successful international symposiums "Computer Science in Sport" in Cologne (1997), Vienna (1999), Cardiff (2001), Barcelona (2003), Hvar (2005), Calgary (2007), Canberra (2009), Shanghai (2011) and Istanbul (2013).

Cooperations

International Council of Sport Science and Physical Education (ICSSPE)
 International Sports Engineering Association (ISEA)
 European College of Sport Science (ECSS)

17.6.2015 : 2:23 : +0200

Imprint

Latest News

10th International Symposium on Computer Science in Sport (IACSS 2015), September 09–11, 2015, Loughborough, UK
 Our British colleagues from BACSSE organize the biannual conference 2015. It will be held in Loughborough from 9th–11th September, 2015. Due to many requests the submission deadline has been extended until 10th June, 2015. For further information visit the conference website <http://gradients.lboro.ac.uk/iacss2015>.

PACSS established in Portugal
 The Portuguese Association of Computer Science in Sport (PACSS) was officially founded at a meeting of 15 foundation members and board members.



Comentários Finais

- Sportomics é uma nova abordagem de melhoria no esporte através da investigação científica interdisciplinar
- A ciência da computação tem um papel fundamental no desenvolvimento da sportomics com:
 - técnicas, modelos, metodologias
- Sportomics é uma fundamentalmente uma ciência de dados



Comentários

- Sportomics é centrada no ser humano
 - Tratamento de informações qualitativas
 - Medições de homens/mulheres normais não refletem as de atletas
- Análise integrada é um grande desafio
 - Correlações desconhecidas
 - Métodos de investigação
- Mecanismos de coleta de informações com menor impacto no atleta e em sua atividade

Colaboradores



- **Membros do Laboratório DEXL**
 - Prof. Ana Maria de C. Moura
 - MSc Frederico Corrêa da Silva
 - Bolsista Debora Cerqueira
 - Bolsista Dionisio Porto
 - Bolsista Enver Choque
 - Bolsista Adolfo Simões
- **UNIRIO**
 - Prof. L. C. Cameron
 - Dr. Adriana Bassini
- **COB**
 - Dr. Sidney Cavalcante,
 - Julio Noronha
- **UFJF**
 - Prof. Mauricio Bara
- **INTO**
 - Dr. José Inacio Salles
- **COPPE- Crie**
 - Prof. Marcos Cavalcante
 - Gilberto Sanpaio

Equipe SAHA



Esp. Dionisio Porto



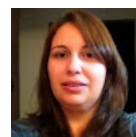
Esp. Adolfo Simões



MSc Frederico Corrêa da Silva



Esp. Enver Choque



Esp. Debora Cerqueira



Obrigado !😊

Fabio Porto (fporto@lncc.br)



DEXL LAB
EXTREME DATA LAB



Ministério da
Ciência, Tecnologia
e Inovação

