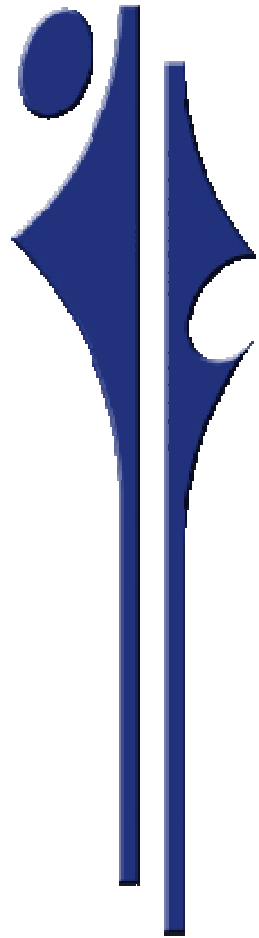


# ATLAS @ Institute of Physics Belgrade

[www.atlas.ipb.ac.rs](http://www.atlas.ipb.ac.rs)



## Overview of Belgrade ATLAS group activity

CERN Delegation visit  
8 June 2010



# Outline

- Short history
- Hardware contribution
- Group members
- Activities
- Publications
- Plans



# Short History

**Institute of Physics Belgrade (IPB) joined the ATLAS in February 2003.**

- **Before that IPB had contacts with ATLAS for a long time, interrupted only during the time of war in the Balkan region.**
- **Some members of the team participated and contributed to ATLAS over these years via JINR Dubna.**
- **In June 2001 CERN signed a general cooperation agreement with Serbia.**
- **In January 2003 a Protocol for the ATLAS hardware contribution was signed by CERN, ATLAS and the Serbian MSTD.**
- **The IPB contributions are the JD shielding disks and A frame forward shielding supports. These parts have a core value of 300 kCHF.**
- **In February 2003 IPB team led by Dragan Popovic had 6 PhD physicists and 3 PhD students. At that time some team members were already active in ATLAS physics studies.**



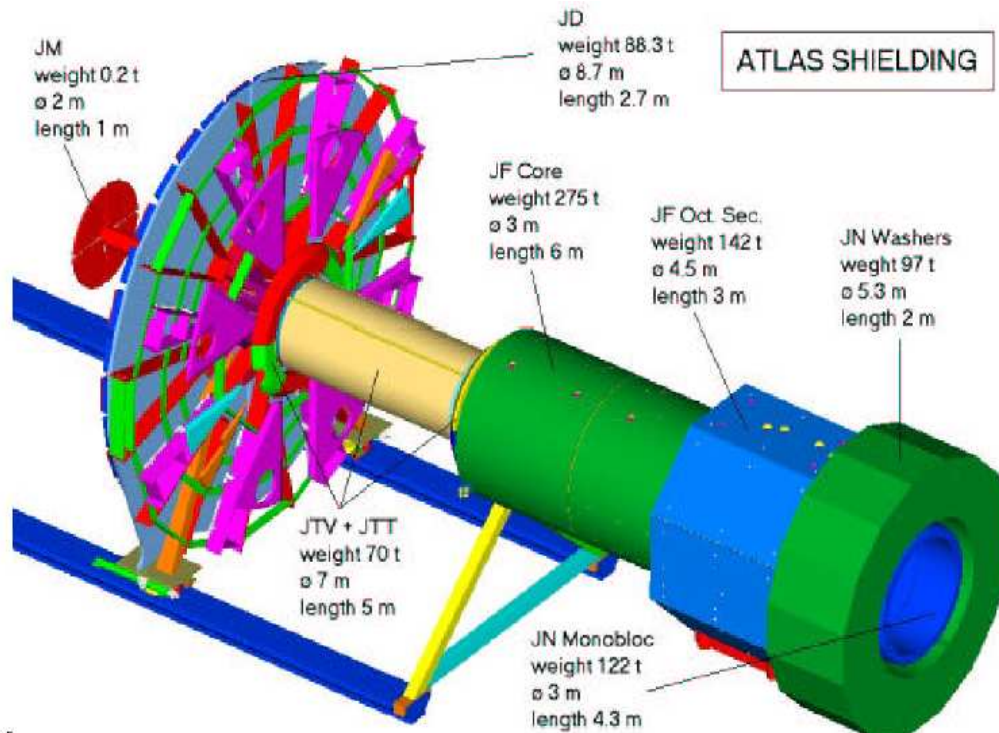
# Short History

Belgrade Cluster (since July 2008)

**In the past, ATLAS has offered and encouraged formation of clusters, which allow smaller group to join already existing ATLAS group, represented with one vote in the Collaboration Board (CB).**

**In July 2008, 2 PhD physicists,  
Ivanka Bozovic and Mihajlo Mudrinic,  
from the Vinca Institute of Nuclear Physics and Atlas group  
from Institute of Physics Belgrade formed Belgrade Cluster  
with Dragan Popovic as representative at CB.**

# Hardware contribution- ATLAS Shielding



IP Belgrade contribution to the ATLAS **Shielding** project is 2 JD shielding disks and **A-frame supports** for the forward shielding (JF).

JD shielding disks were produced in Serbia under IPB responsibility

**The ATLAS shielding project is divided in six subprojects**

**Seven participants in the project:**

CERN, Yerevan Physics Institute, Institute of Physics, Belgrade, Institute of Experimental and Applied Physics, Czech Technical University in Prague, Institute of Particle and Nuclear Physics, Charles University in Prague, Department of Experimental High-Energy Physics, Lund University Department of Physics, University of Arizona





# The assembly of the disk shielding in Serbia

Two stainless steel shielding disks, 88.3 t each, produced by **Lola Corporation** Železnik, Serbia and *A-frame* supports, produced by **Kryooprema**, Belgrade, were transported to CERN in **December 2004**.



**Loading test of the JF A-frames, March 2005**

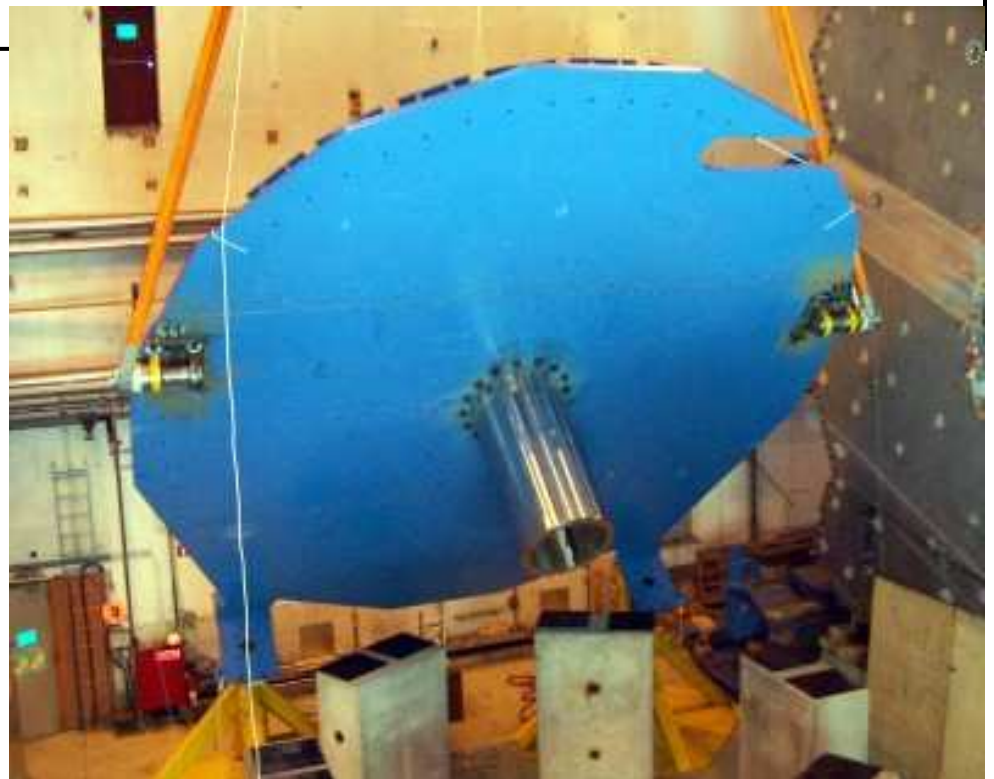
# The assembly of the disk shielding in CERN

*ATLAS e-news 2007/05*

*“At the end of March, final rotation of the disk shielding was carried out without incident. The two 80-ton heavy shielding assemblies were built in a horizontal position and they had to be first turned upside-down and then rotated to a vertical position during the assembly. The relatively thin disk plate with a diameter of 9 meters, made this operation quite delicate and a lot of calculation work and strengthening of the shielding was carried out before the rotations could take place”.*

## The Disk Shielding purpose:

- supports the muon chambers in the first forward muon station (the Small Wheel),
- shields these chambers from radiation
- returns the magnetic field from the solenoid magnet in a well defined way.





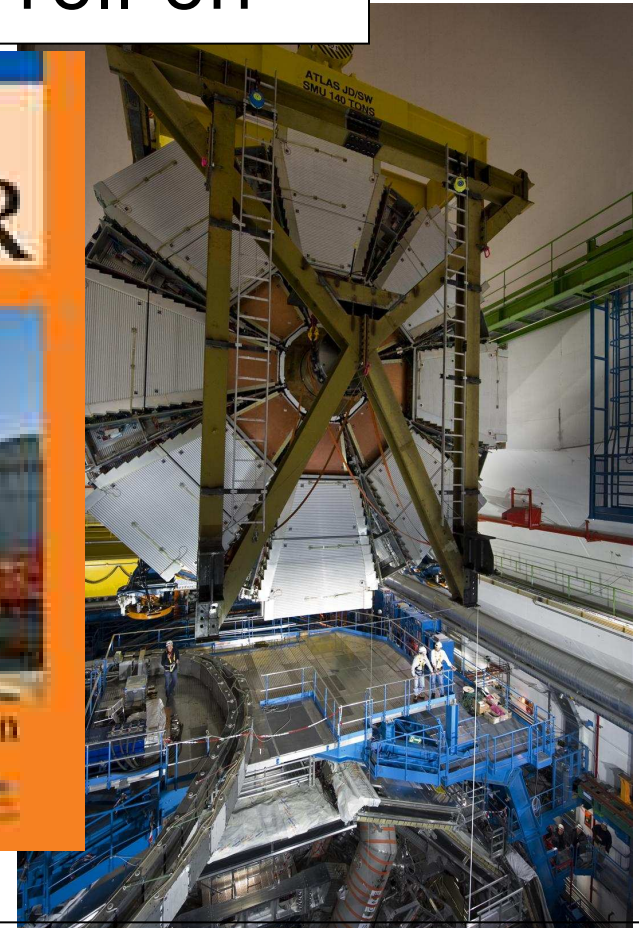
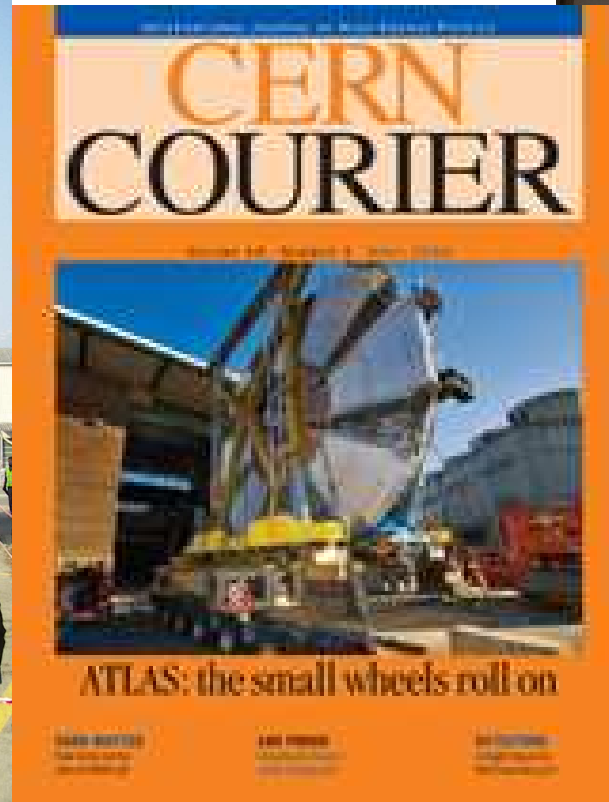


# ATLAS muon spectrometer with the shielding elements

The small wheels roll on



**Transport of the small wheel to the ATLAS surface building  
February 2008.**



**Lowering of the final large piece of the detector: small wheel**





# Institute of Physics Belgrade ATLAS group

**9 physicists** (4 Research Professors, 3 PhD, and 2 PhD students)

## Research staff:

- **Dragan Popovic**, research professor (team leader)
- Djordje Sijacki, (member of Serbian Academy of Sciences and Arts)
- Ljiljana Simic, research professor
- Jelena Krstic, research professor
- Iris Borjanovic PhD (post doc at INFN Lecce)
- Marija Vranjes Milosavljevic PhD, (MSc degree award, now at CERN)
- Predrag Krstonosic PhD, (PhD at University of Hamburg)

## PhD students:

- Nenad Vranjes, MSc (now at CERN)
- Gordana Milutinovic BSc

**Undergraduate students:** typically 1 per year

## Former members:

- Dusan Vudragovic, Dusan Reljic



## Recent Ph.D. graduates

- Iris Borjanovic (2009)  
also at the INFN/University Lecce 2005-2010
- Marija Vranjes Milosavljevic (2009)  
now at CERN
- Predrag Krstonosic (2008)  
also at University of Hamburg 2004-2008
- Nenad Vranjes (PhD in progress)  
now at CERN

### Close collaboration with:

- INFN Lecce/University of Salento,
- University of Athens,
- JINR Dubna



# Activities of the IP Belgrade ATLAS group

## **ATLAS operation tasks:**

Tier0 shifts, Muon combined performance DQ shifts, DAQ/HLT shifts and SW validation shifts.

## **Detector combined performance:**

Jet/Etmis, Muon combined

## **Physics analysis:**

SM physics

- Diboson physics study and triple gauge-boson couplings measurement
- Measurement of the top quark mass (all hadronic channel)

BSM physics

- Search for the Supersymmetry within the mSUGRA
- Search for the new heavy charged gauge boson,  $W'$
- Search for the neutral pseudoscalar Higgs boson within the MSSM



## Activities of the IP Belgrade ATLAS group (II)

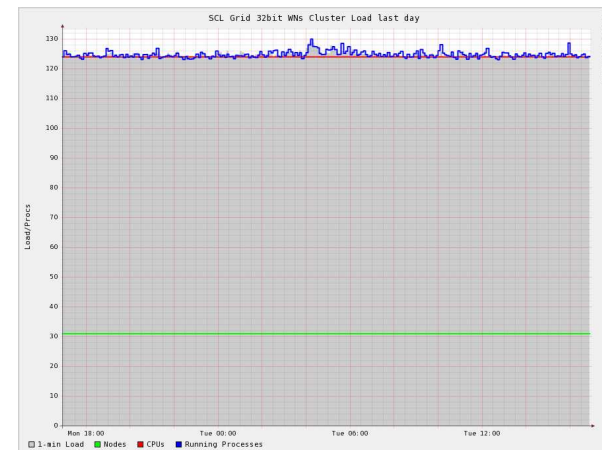
**Computing/Grid** (more details in talk of A. Balaz):

**IPB SCL maintain second-largest Serbian Grid site, AEGIS07-IPB-ATLAS.**

**It is based on 128 Intel Xeon processors with 32-bit architecture and the total of 96 GB of RAM.**

**The site supports several virtual organizations (VO), but is mainly dedicated to the ATLAS VO community.**

- In addition, IPB ATLAS group uses local Linux cluster (~10 cpu, 2.4 TB disk ) for ATLAS data analysis and Monte Carlo production



**Daily usage of AEGIS07-ATLAS**



# Education and Outreach

- **IP Belgrade is a subcontractor of the project Learning With ATLAS @ CERN (LA @ CERN)**

(Related Publication: The ATLAS Student Event Challenge, ATL-OREACH-PUB-2007-001)

- **Translated sites in Serbian:**

Particle Adventure <http://www.particleadventure.ipb.ac.rs>

The Universe Adventure <http://www.kosmologija.ipb.ac.rs>

- **Numerous interviews with IP ATLAS members,**
- **Articles on the LHC including quotes from team leader D.Popovic.**

Тут у средиште  
материје

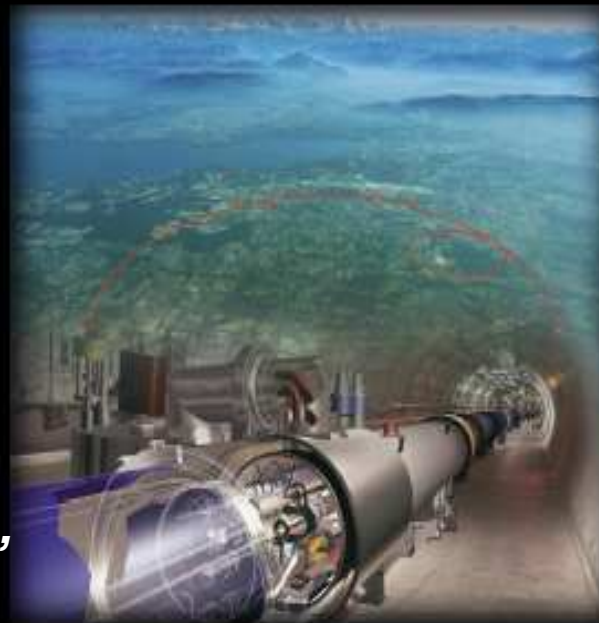
Откривање та  
раног свеми

LHC

# ВЕЛИКИ ХАДРОНСКИ СУДАРАЧ



*LHC Exhibition organized by  
Serbian Academy of Sciences,  
Institute of Physics  
and Vinca Institute*



16. април 2008. 15. мај 2008.



# Belgrade ATLAS group main recent publications

## 2010

- **Charged-particle multiplicities in pp interactions at 900 GeV measured with ATLAS**  
Phys.Letters B 688, 21,2010 ) ATLAS Collaboration.
- **DIS 2010 conference, talk, Search for SUSY at ATLAS (Borjanovic for ATLAS Coll.)**

**2009** Expected performance of the ATLAS Experiment Detector, Trigger and Physics, CERN-OPEN-2008-020:

- **Prospects for Supersymmetry Discovery Based on Inclusive Searches**  
ATL-PHYS-PUB-2009-066,2009 (...Borjanovic, Krstic,Milosavljevic...)
- **Measurements from Supersymmetric events**  
ATL-PHYS-PUB-2009-067,2009 (...Krstic,Milosavljevic...)
- **Search for the neutral MSSM Higgs Bosons in the decay Channel**  
A/H/h-> mumu  
ATL-PHYS-PUB-2009-060,2009 (...Milosavljevic...)
- **Lepton plus missing transverse energy signals at high mass**  
ATL-PHYS-PUB-2009-071,2009 (...Vranjes...)
- **Diboson Physics studies**  
ATL-PHYS-PUB-2009-038,2009 (...Popovic,Simic, Vranjes...)



# Belgrade ATLAS group main recent publications

## 2008

- Prospects for stop searches at ATLAS and CMS  
Nuovo Cim. B123, 1219 ,2008 (Blekman, Milosavljevic for ATLAS and CMS)
- Prospects for early SUSY search at LHC  
Nuovo Cim. C 2008 (Borjanovic for ATLAS and CMS)
- SUSY search with b jets  
Proceedings of Science (2008LHC) 110, 2008 (Milosavljevic for ATLAS Coll.)
- Search for W-prime in lepton+missing final state with early data at ATLAS  
Proceedings of Science (2008LHC) 121, 2008 (Vranjes for ATLAS Coll.)
- Diboson physics study with ATLAS  
Proceedings of Science (2008LHC) 112, 2008 (Simic for ATLAS Coll.)

(Con. Proceedings: Physics at LHC-2008, Top2006, IFAE2007)





## Belgrade ATLAS group main recent publications

### 2007-2006 (Physics at LHC-2006 conf proc. and ATLAS notes)

- Studies of a low mass SUSY model at ATLAS with full simulation  
Acta Phys.Polon. B38:627-634, 2007 (Krstic,Milosavljevic,Popovic)
- W W production and triple gauge boson couplings at ATLAS  
Acta Phys.Polon. B38:525-530, 2007 (Simic,Vranjse,Popovic)
- Studies of a low mass SUSY model at ATLAS with full simulation  
ATL-PHYS-PUB-2006-028, 2006 (Krstic,Milosavljevic, Popovic)
- Prospects for measuring triple gauge boson couplings in WW  
production at the LHC  
ATL-PHYS-PUB-2006-011,2006 (Simic,Vranjse,Popovic)
- Discovery potential for the MSSM H/A- $\rightarrow$ mumu- decays from direct  
and associated H/A production,  
ATL-PHYS-2006-030,2006 (Kourkoumelis, Fassouliotis,  
Milosavljevic)

# **Belgrade ATLAS group main recent publications**

## **2005-2000**

- SUSY studies with Snowmass Point 5 mSUGRA parameters  
Czech.J.Phys.55:B793-B799,2005 (Borjanovic,Krstic,Popovic)
- Impact of the alignment of the EC muon spectrometer to SM  $H \rightarrow 4l$  and MSSM H/A reconstruction and detection  
ATL-PHYS-PUB-2005-002, 2005 (Fassouliotis,Kourkumelis,Milosavljevic)
- Investigation of top mass measurements with the ATLAS detector at LHC  
Eur. Phys. J. C 39 (2005) s63-s90, SN-ATLAS-2004-040 (Borjanovic, ... Simic,Popovic...)
- All hadronic decay of top-antitop pairs at LHC,  
ATL-PHYS-2002-009 (Simic, Skoro, Popovovic)
- Top Quark Physics Proceedings of the Workshop on Standard Model Physics (and more) at the LHC  
CERN Yellow Report, CERN 2000/004, 2000, 111p (...Simic,Skoro, Popovic...)

**In summary, IP Belgrade ATLAS group contributed:  
1 ATLAS Scientific Note also pub. in Eur. Phys. J. C  
10 ATLAS PUB Notes and 14 publications in various  
conference proceedings.**



# Looking ahead



- **Group expansion, special attention to recruitment of graduate students**
- **Further activities in ATLAS operation and participation in physics working groups**
- **Setting ATLAS Tier3 site**
- **Participation in ATLAS upgrade for super LHC**