

# **Poland & CERN**

**Prof. dr hab. Tadeusz Lesiak**

**The scientific delegate of Poland to the CERN Council**

# At the beginning there were three professors...



1954 -1957

Marian Miesowicz (Kraków), Marian Danysz and Andrzej Sołtan (Warszawa)  
made the first individual contacts with CERN researchers

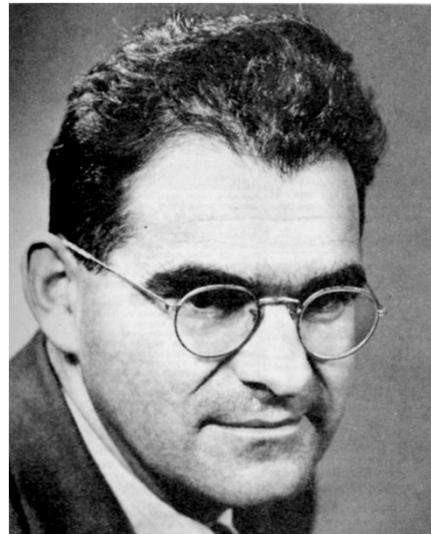


a few fellowships for young Poles at CERN



A snowball effect:  
individual contacts → intense collaboration on everyday basis

# Getting an observer status...



1963

The initiative of prof. Marian Danysz and the CERN DG Victor Weisskopf

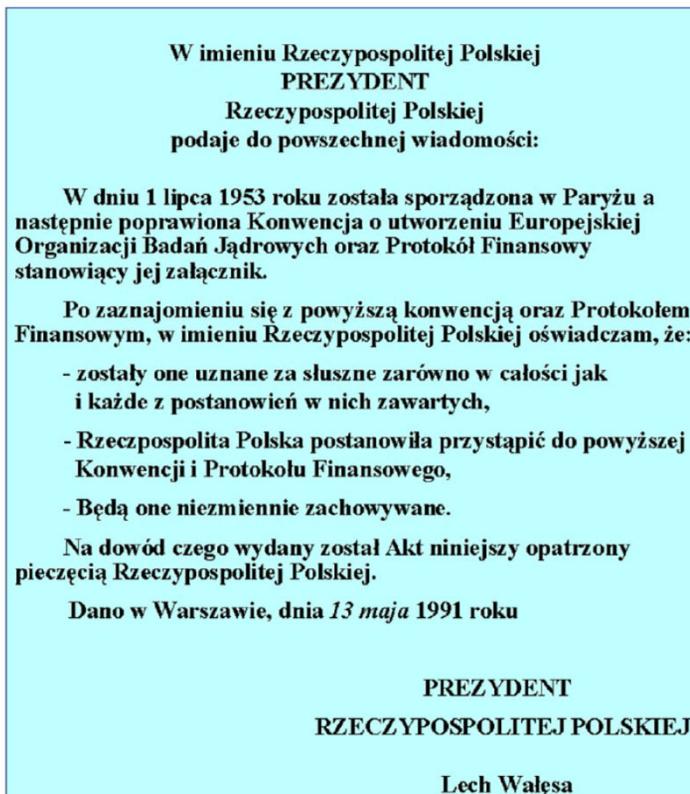


Poland, as the unique country behind the iron curtain, was granted an observer status in the CERN Council (no right to vote)

Attempts of getting the full membership ...  
encountered strong opposition from the side of the USSR



# And finally a membership...



**1991**

Poland becomes CERN member state  
(again as the first country of the Eastern block)



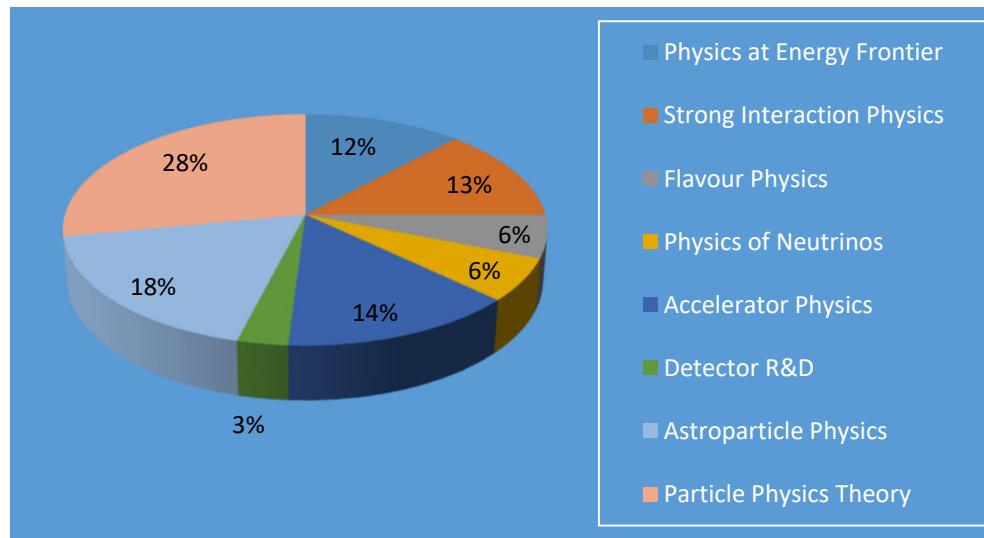
The legal basis – the agreement between Polish government and CERN, ratified by the parliament and signed by the president Lech Wałęsa

# Current status of Poland @ CERN



- ✓ CERN membership since July 1991, observer since 1963
- ✓ Contribution to CERN budget: **2.96% (34.8 MCHF/year)**
- ✓ Number of users: **298** (31.12.2021)

Nationality	Experiment/Programme											Total
	ATLAS	CMS	ALICE	LHCb	SPS	PS	AD	ISOLDE	RE	NEUTRINO	OTHER	
PL	64	36	41	38	58	3	14	22	8	5	9	298



# Particle Physics in Poland

## Warszawa:

- University of Warsaw (UW)
- Warsaw University of Technology (PW)
- National Centre for Nuclear Research (NCBJ)
- N. Copernicus Astronomical Centre (CAMK)
- Space Research Center (CBK)
- Institute of Mathematics PAS (IM PAN)

## Kraków:

- AGH Univ. of Science and Technology (AGH)
- Jagiellonian University (UJ)
- Cracow University of Technology (PK)
- Institute of Nuclear Physics PAS (IFJ PAN)

## Katowice:

- University of Silesia (UŚ)

## Wrocław:

- University of Wrocław (UWr)
- Wrocław University of Technology (PWrr)

## Kielce:

- Jan Kochanowski University (UJK)

## Szczecin:

- University od Szczecin (Usz)



## Łódź:

- University of Łódź (UŁ)
- National Centre for Nuclear Research (NCBJ)

## Toruń:

- N. Copernicus University (UMK)

## Białystok:

- University of Białystok

## Zielona Góra:

- University of Zielona Góra (UZG)

## Lublin:

- Maria Curie Skłodowska University (UMCS)

# A few selected highlights...

- ✓ LEP times – very active participation in the DELPHI experiment
- ✓ LHC time – presence in all four big experiments
- ✓ Beyond colliders – polish expertise in deep inelastic scattering experiments (EMC,NMC SMC,COMPASS)
- ✓ NA61/SHINE – Polish researchers comprise 1/3 of collaborators
  - the spokesperson Marek Gaździcki
- ✓ Rapidly growing field of local accelerator physics in close collaboration with CERN and national industry
- ✓ Enormous effort to vulgarize CERN science to young Poles (visits to the lab paid by 550 teachers)
- ✓ Distinguished positions at CERN: Agnieszka Zalewska elected as the chair of the CERN Council 2013-2015

# 1993 European School of High-Energy Physics

Zakopane, Polana Zgorzelisko



# **BACKUP**

# Physics at Energy Frontier

## (A): ATLAS - Kraków

- AGH Univ. of Science and Technology (AGH)
- Jagiellonian University (UJ)
- Institute of Nuclear Physics PAS (IFJ PAN)

## (C): CMS – Warszawa & Kraków

- University of Warsaw (UW)
- National Centre for Nuclear Research (NCBJ)
- Warsaw University of Technology (PW)
- AGH Univ. of Science and Technology (AGH)

## (F): FCC-ee - Kraków & Katowice

- Institute of Nuclear Physics PAS (IFJ PAN)
- University of Silesia (UŚ)
- Wrocław University of Technology (PWr)

## (L): Linear Colliders (ILC & CLIC) - Kraków & Warszawa

- AGH Univ. of Science and Technology (AGH)
- Institute of Nuclear Physics PAS (IFJ PAN)
- University of Warsaw (UW)



# Fixed Target and Heavy Ions Physics

## Warsaw:

- University of Warsaw (**UW**)
- Warsaw University of Technology (**PW**)
- National Centre for Nuclear Research (**NCBJ**)

## Płock:

- Warsaw University of Technology, Branch in Płock (**PWP**)

## Kielce:

- Jan Kochanowski University in Kielce (**UJK**)

## Cracow:

- Jagiellonian University (**UJ**)
- AGH University of Science and Technology (**AGH**)
- Cracow University of Technology (**PK**)
- Institute of Nuclear Physics, Polish Academy of Sciences (**IFJ PAN**)

## Katowice:

- University of Silesia (**UŚ**)

## Wrocław:

- University of Wrocław (**UWr**)

## Heavy ions projects:

- **ALICE**
- **STAR**
- **MPD (NICA,JINR)**
- **EIC – Electron-Ion Collider (BNL)**



## Fixed target projects:

- **BM@N** (Baryonic Matter at Nuclotron), Nuclotron, JINR (data taking since 2016/18)
- **FOPI** (Four  $\pi$ ), SIS-18, GSI (data taking 1991-2011)
- **HADES** (High Acceptance Di-Electron Spectrometer), SIS-18, GSI (data taking since 2003)
- **CBM** (Compressed Baryonic Matter), FAIR SIS-100, GSI (data taking > 2025)
- **PANDA** (AntiProton ANihilations at DArmstadt), FAIR HESR, GSI (data taking > 2025)
- **NA61/SHINE** (SPS Heavy Ion and Neutrino Experiment), SPS, CERN (data taking since 2007)
- **COMPASS** (Common Muon and Proton Apparatus for Structure and Spectroscopy), SPS, CERN (data taking since 2003); expansion into new collab. AMBER (data taking > 2021)
- **MUonE**, SPS, CERN (data taking > 2021)
- **AFTER@LHC** (A Fixed-Target ExperRiment at LHC) and its implementation **FT@ALICE** (data taking > 2025)
- **FT@STAR**, RHIC, BNL (test run in 2015), part of BES II (data taking 2019-2021)



# Flavor Physics

## (L): LHCb - Kraków & Warszawa

- AGH Univ. of Science and Technology (AGH)
- Institute of Nuclear Physics PAS (IFJ PAN)
- National Centre for Nuclear Research (NCBJ)

## (B): Belle II – Kraków

- Institute of Nuclear Physics PAS (IFJ PAN)



# Neutrino Physics

## (T): T2K – Kraków, Warszawa, Wrocław, Katowice

- Institute of Nuclear Physics PAS (IFJ PAN)
- University of Warsaw (UW)
- National Centre for Nuclear Research (NCBJ)
- Warsaw University of Technology (PW)
- University of Wrocław (UWr)
- University of Silesia, Katowice (UŚ)

## (H): Hyper-K – Warszawa, Kraków, Katowice, Wrocław

- National Centre for Nuclear Research (NCBJ)
- Warsaw University of Technology (PW)
- University of Warsaw (UW)
- AGH Univ. of Science and Technology (AGH)
- Institute of Nuclear Physics PAS (IFJ PAN)
- Jagiellonian University, Kraków (UJ)
- University of Silesia (UŚ)
- University of Wrocław (UWr)

## (Bo): BOREXINO, GERDA/LEGEND, Darkside - Kraków

- Jagiellonian University (UJ)



## (M): MINOS/MINOS+ – Warszawa

- University of Warsaw (UW)

## (K): KM3NeT - Warszawa

- National Centre for Nuclear Research (NCBJ)

## (Ba): BAIKAL-GVD – Kraków

- Institute of Nuclear Physics PAS (IFJ PAN)

# Astroparticle Physics (APP)

## Institutions

- University of Warsaw (UW)
- Jagiellonian University (UJ)
- Nicolaus Copernicus University , Toruń (UMK)
- University of Lodz (UŁ)
- University of Bialystok (UwB)
- University of Zielona Góra (UZG)
- N. Copernicus Astronomical Center PAS (CAMK PAN), Warszawa
- Institute of Nuclear Physics PAS (IFJ), Kraków
- Institute of Mathematics PAS (IM ), Warszawa
- Cosmic Research Center PAS (CBK), Warszawa
- National Center for Nuclear Research (NCBJ), Warszawa
- Center for Theoretical Physics PAS (CFT), Warszawa
- Warsaw University of Technology (PW)
- University of Silesia (US)
- AGH, University of Science and Technology (AGH), Kraków
- University of Wroclaw(UWr)

## Projects:

- LSST
- ATHENA
- HESS
- CTA
- HAWC
- CREDO
- Auger
- Virgo/LIGO
- ET

See the report, attached to the APP talk



	LSST	Athena	HESS	CTA	HAWC	CREDO	Auger	Virgo	ET	KM3NET
UW	X		X	X				X	X	
UJ	X		X	X					X	
UMK	X		X	X						
UŁ				X			X			
UwB				X				X	X	
UZG				X				X	X	
CAMK	X	X	X	X				X	X	
IFJ			X	X	X	X	X			
IM									X	X
CBK		X		X						
NCBJ	X			X		X				X
CFT	X									
PW					X					
US										
AGH					X		X			
UWr										

# Theory

**Katowice, Kielce, Kraków, Lublin, Łódź, Szczecin, Toruń, Warszawa, Wrocław, Zielona Góra**

- University of Warsaw (UW)
- University of Silesia (UŚ)
- Jan Kochanowski University in Kielce (UJK)
- AGH Univ. of Science and Technology (AGH)
- Jagiellonian University (UJ)
- Cracow University of Technology (PK)
- Institute of Nuclear Physics PAS (IFJ PAN). Kraków
- National Centre for Nuclear Research (NCBJ), Warszawa
- University of Łódź (UŁ)
- Warsaw University of Technology (PW)
- University of Wrocław (UWr)
- University of Szczecin (Usz)
- University of Zielona Góra (UZG)
- Maria Curie Skłodowska University in Lublin (UMCS)
- N. Copernicus University (UMK). Toruń

## Main topics of research:

- QCD and EW physics at higher orders
- BSM models
- baryogenesis, scale invariant models
- Monte Carlo generators for HEP
- Phenomenology of strong interactions
- Quark-gluon plasma properties



- Flavor and neutrino physics
- Partonic distributions
- (Generalized) partonic distributions
- Cosmology, dark matter, gravitational waves
- Inflationary cosmology
- General QFT, quantum gravity
- Extensions of Einstein gravity, extra dimensions, string phenomenology
- Strings, AdS/CFT correspondence
- Random matrix theory & lattice QCD
- ...

# Accelerator Activities

## Kraków, Łódź, Warszawa, Wrocław

- AGH Univ. of Science and Technology (AGH)
- Jagiellonian University (UJ)
- Cracow University of Technology (PK)
- Institute of Nuclear Physics PAS (IFJ PAN)
- University of Łódź (UŁ)
- Warsaw University of Technology (PW)
- National Centre for Nuclear Research (NCBJ)
- Wrocław University of Technology (PWr)

Participation in the construction of big infrastructures: LHC, W7-X, E-XFEL, ITER, ESS ...



## Expertise:

X - E-XFEL  
E - ESS  
G - GDE/LCC  
A - ATF2  
C - CLIC  
O - others

	SCRF	HLRF	Sources	Damping Rings	Instrumentation	Beam Dynamics	Beam Delivery System	Cryogenics
CERN			O	G,C,O	C,G A,G X	C,G G G	C,G C,G	O
France	X,E,G		G	G				
Germany	X,G	X	G	G				X,O
Italy	X,E,G			G				
Poland	X,E		O		E,O			X,E,O
Russia	X		G		A			
Spain	X,E							
Sweden	E				X,C A,C,G		C,G G	
Switzerland								
UK	E		G	G		C,G,A	C,G,A	

# Detector R&D

## Warszawa

- University of Warsaw (UW)
- National Centre for Nuclear Research (NCBJ)
- Warsaw University of Technology (PW)

## Kraków

- AGH Univ. of Science and Technology (AGH)
- Jagiellonian University (UJ)
- Institute of Nuclear Physics PAS (IFJ PAN)
- Cracow University of Technology (PK)

## Wrocław

- University of Wroclaw (UWr)

## Kielce

- Jan Kochanowski University (UJK)

