

# $\bar{P}$ ANDA

## Proton-ANTiproton annihilation DArmstadt

Strong interaction studies with antiprotons (1-15 GeV/c)  
stored and cooled with the storage ring HESR

A collaboration of 46 institutions (~350 physicists) from:

- EU
- Russia
- China
- USA

Poland represented by:

- JU – Cracow
- SU – Katowice
- SINS – Warsaw
- WUT – Warsaw

# PHYSICS CASE (main issues)

- Charmonium ( $c\bar{c}$ ) spectroscopy: precision measurements of mass, width, decay branches of all charmonium states  $\rightarrow$  extracting information on the quark-confining potential
- Firm establishment of the QCD-predicted gluonic excitations (charmed hybrids, glueballs)
- Search for modifications of meson properties in the nuclear medium (extension to heavy quarks)
- Precision  $\gamma$ -ray spectroscopy of single and double hypernuclei
- Extraction of generalized parton distributions from  $p\bar{p}$  annihilation
- D and  $D_s$  meson spectroscopy
- Search for CP violation in the charm and strangeness sector (D meson decay,  $\Lambda\bar{\Lambda}$  system)

# $\bar{P}$ ANDA Detector

Requirements: A nearly full coverage of the solid angle together with good particle identification and high energy and angular resolution for charged particles and photons

Solution: Subdivision into the target spectrometer (TS) [22-140°] consisting of a solenoid around interaction region and a forward spectrometer (FS) [0-22°] based on a dipole

Targets: Cluster-Jet target, Pellet Target, Nuclear targets  
– fibers or wires

TS Tracking detectors

Micro Vertex Detector (MVD) Detection of secondary vertices. Based on radiation hard silicon pixel detectors (ATLAS solution)

Straw Tube Tracker 11 double layers of straws

TS Particle Identification Detector of Internally Reflected Cherenkov Light (DIRC) – 1.7 cm thick quartz slabs ( $n=1.544$ ) surrounding the beam line

Electromagnetic Calorimeter ~1200  $\text{PbWO}_4$  crystals  
2.0x2.0x20 cm readout with avalanche photodiodes (APDs). Cooling down to  $-25^\circ$  will enhance light output and lower APD reverse current

## Forward Spectrometer (FS)

### Tracking detector

A set of 3 drift chamber (MDC), 1 placed before, 1 inside and 1 behind the dipole magnet

### Particle Identification

#### Time-of-flight Detector

### Ring Imaging Cherenkov Counter (RICH)

A ring of fused silica (12 mm thickness), 2160 mm in diameter Light detection with 20.000 avalanche photodiodes

### Electromagnetic Calorimeter alternatives

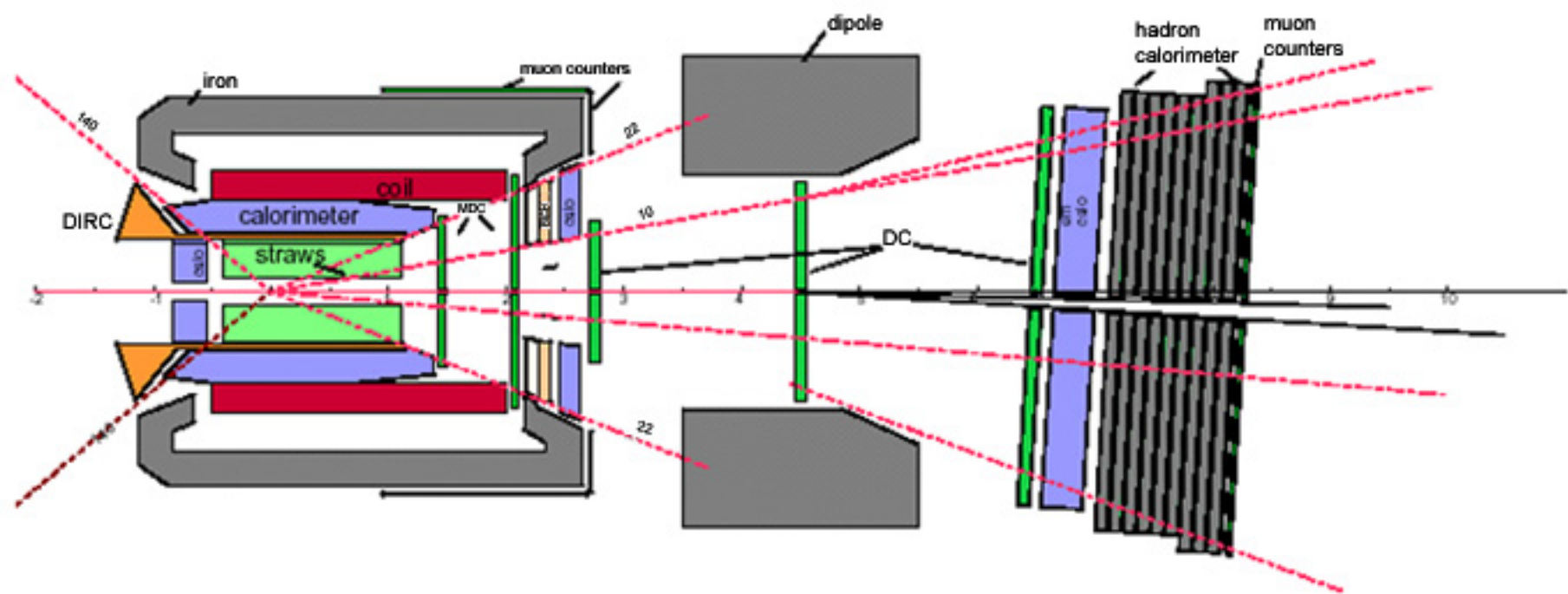
MIRAC lead plates-scintillator

lead-glass as LEDA in WA98

Shashlyk type as in KOPIO at BNL

### Hadron Calorimeter

MIRAC iron plates-scintillator



- PANDA is conceived to be built with a participation of 25% of the total estimated cost of 28.6 M€ coming from outside of the German federal budget
- What share could be brought in by Poland?
- Where to look for these funds?
- As an example let me quote those who have already declared their contribution:

Sweden	2.5-3 M€
UK	3 M€
Italy	3 M€
Germany (Universities)	8 M€
Germany (HGF)	
Russia (superconducting solenoid)	5.5 M€
France	1 M€
Finland	0.5 M€
Austria	(?)
Switzerland	(?)
Holland	(?)
China	(?)
Poland	(?)