

International Research Training Group

Deutsche  
Forschungsgemeinschaft



# Development and Applications of intelligent Detectors

Autumn School

# FRONTIERS OF PARTICLE IDENTIFICATION

4<sup>th</sup> to 7<sup>th</sup> October 2006  
Physikalisches Institut

Oct.4<sup>th</sup>: Grosser Hörsaal, PI  
Oct.5<sup>th</sup>: SR, Philosophenweg 19  
Oct.6<sup>th</sup>: SR, Philosophenweg 19 Hörsaal  
Oct.7<sup>th</sup>: Kleiner Hörsaal, PI

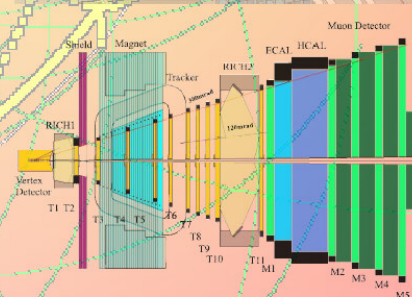
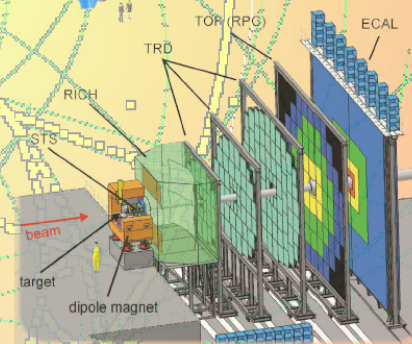
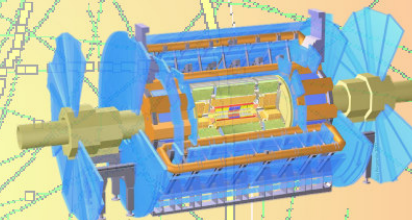
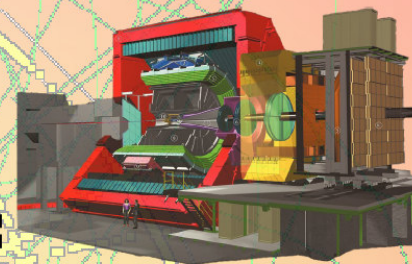
## Lectures

- Gas Detectors
- Calorimeters
- Silicon Detectors
- Time-Of-Flight Detectors

## Speakers

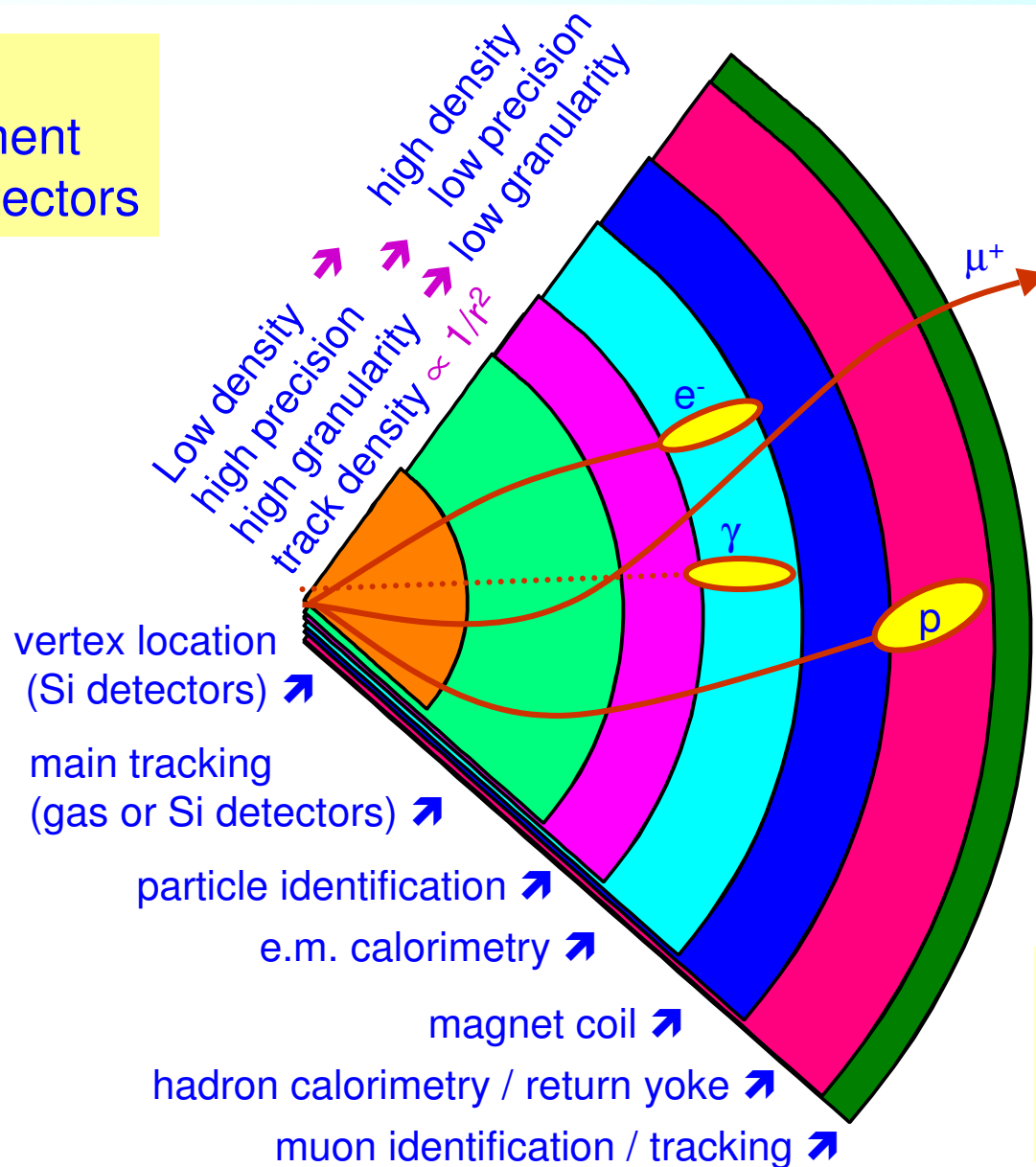
- N. Herrmann, Heidelberg
- U. Uwer, Heidelberg
- A. Schüttauf, GSI
- P. Fischer, Mannheim
- B. Svenson, Oslo
- ...

web: <http://irtg.physi.uni-heidelberg.de/news.php>



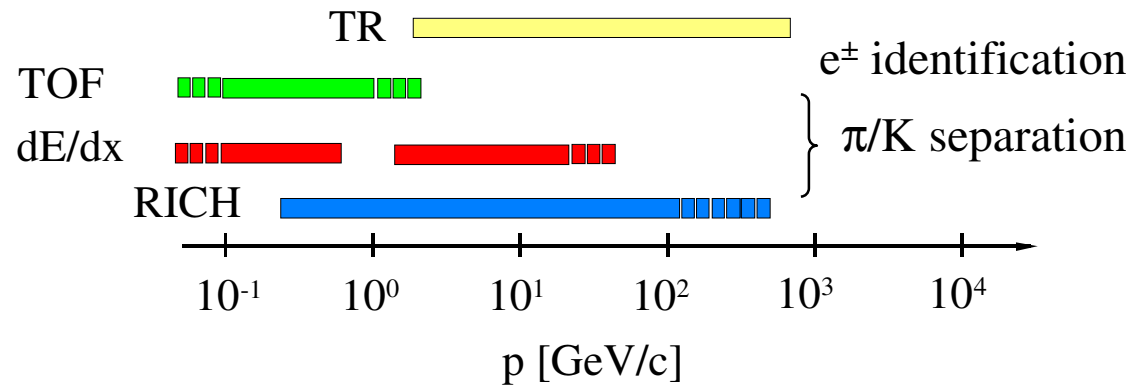
# Generic Detector Layout

Typical arrangement of subdetectors



**Detector developments:**  
Larger luminosities  
Better resolution  
Lower cost

# Particle Identification



**Momentum measurement  
by 'tracking'**

**Si counter (pixel, strip, drift)  
Gas: MWPC, straws, jet chamber, TPC, MSGC, ...**

**Transition Radiation (TR):**

**Converter + gas absorber**

**Time-of-Flight (TOF):**

**Plastic, RPC**

**dE/dx**

**Plastic,  
Si  
Gas: ionisation chamber, TPC**

**RICH**

**Radiator + Photon detector (Photomultiplier, CsI, TMAE)**

**Energy-measurement**

**calorimeter**  
     **electromagnetic**      **Nal, BaF<sub>2</sub>,...**  
     **hadronic**                **Pb/Scintillator,...**



# Lectures

			gHS	SR, Phil. 19	SR, Phil. 19	KHS		
		Tuesday 3. October	Wednesday 4. October	Thursday 5. October	Friday 6. October	Saturday 7. October	Sunday 8. October	
<b>Morning</b>	9 <sup>00</sup> - 9 <sup>30</sup>	<b>Arrival</b>	<b>Introduction</b> Herrmann	<b>Silicon Det. I</b> Svensson	<b>Silicon Det. II</b> Fischer	<b>Calorim. I</b> Poeschl	<b>Excursion</b>	
	9 <sup>30</sup> - 10 <sup>30/45</sup>		<b>Silicon Overview</b> Stugu					
<i>Coffee Break</i>				<i>Coffee Break</i>	<i>Coffee Break</i>	<i>Coffee Break</i>		
	11 <sup>00</sup> - 12 <sup>30</sup>		<b>Gas Det. I</b> Uwer	<b>TOF Det.</b> Schüttauf	<b>Gas Det. II</b> Andronic	<b>Calorim. II</b> Reiter		
<i>Lunch</i>				<i>Lunch</i>	<i>Lunch</i>	<i>Lunch</i>		
<b>Afternoon</b>	14 <sup>00</sup> - 16 <sup>00</sup>		Practical Exercises	Practical Exercises	Practical Exercises	Reporting of Results		
	16 <sup>00</sup> - 18 <sup>00</sup>		Practical Exercises	Practical Exercises	Practical Exercises			
<b>Evening</b>	19 <sup>30</sup> - ???	<i>Coordination Meeting</i>		<i>Dinner</i>				

Coordination meeting: PI, "Türmchen" (3<sup>rd</sup> floor), Oct.4<sup>th</sup>, 18:00

# Afternoons: practical exercises

## Objectives:

Gain hands-on experience with detectors

Understand production process

Measure detector key parameters

Noise

Signal shape

Rate capability

Efficiency

...

- Silicon – strip counter (LHCb)
- Straw tubes (LHCb)
- Resistive Plate Counters (FOPI, CBM)

Teamwork

Group - presentation on Saturday afternoon

# Silicon strips

Contact: Rachik Soualah

Location: Room 210

Single sided strip detector (LHCb)  
readout by 'BEETLE' chip  
(electronics from Ch. Bauer, MPI-KP)



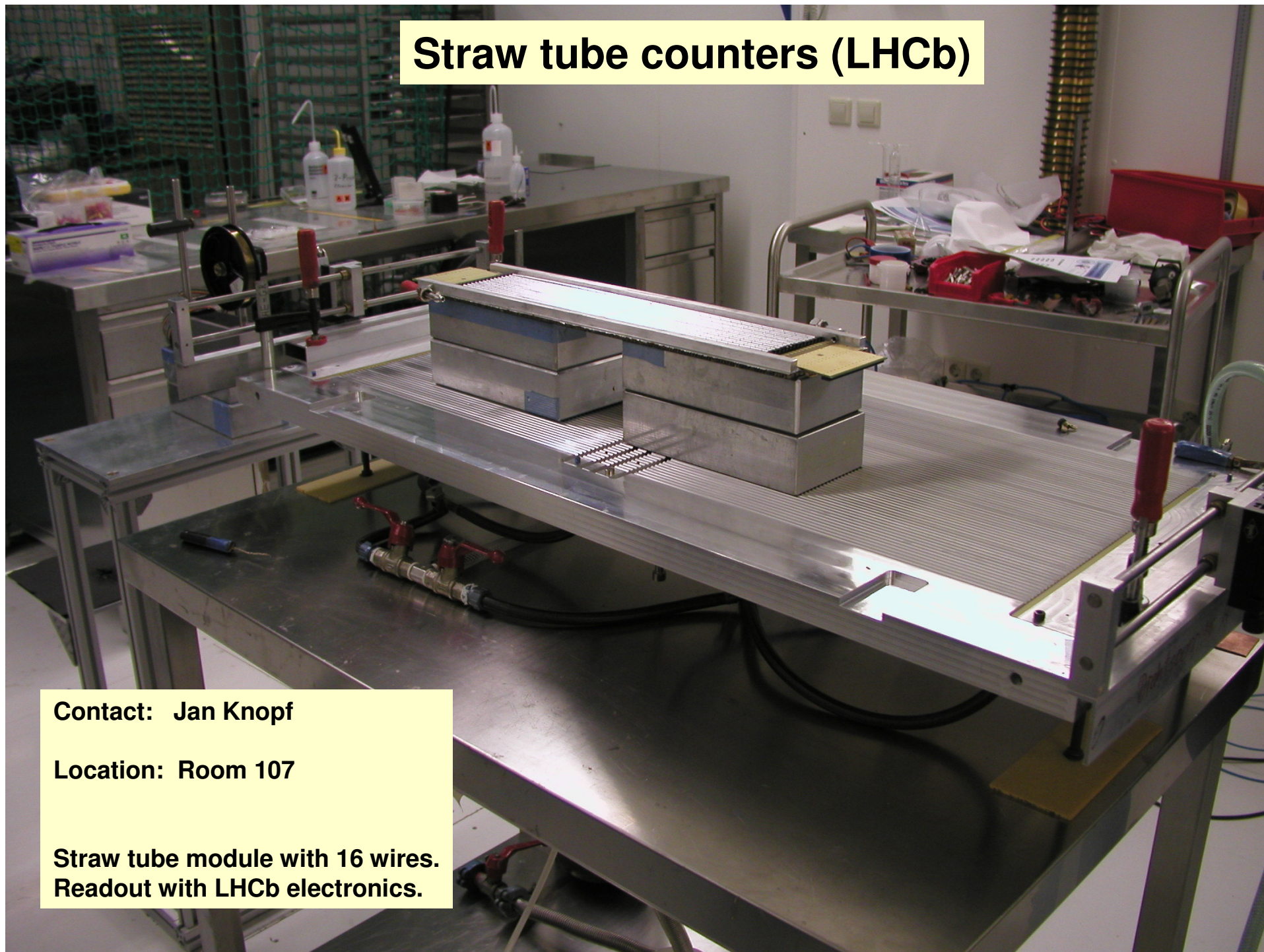


## Straw tube counters (LHCb)

**Contact: Jan Knopf**

**Location: Room 107**

**Straw tube module with 16 wires.  
Readout with LHCb electronics.**



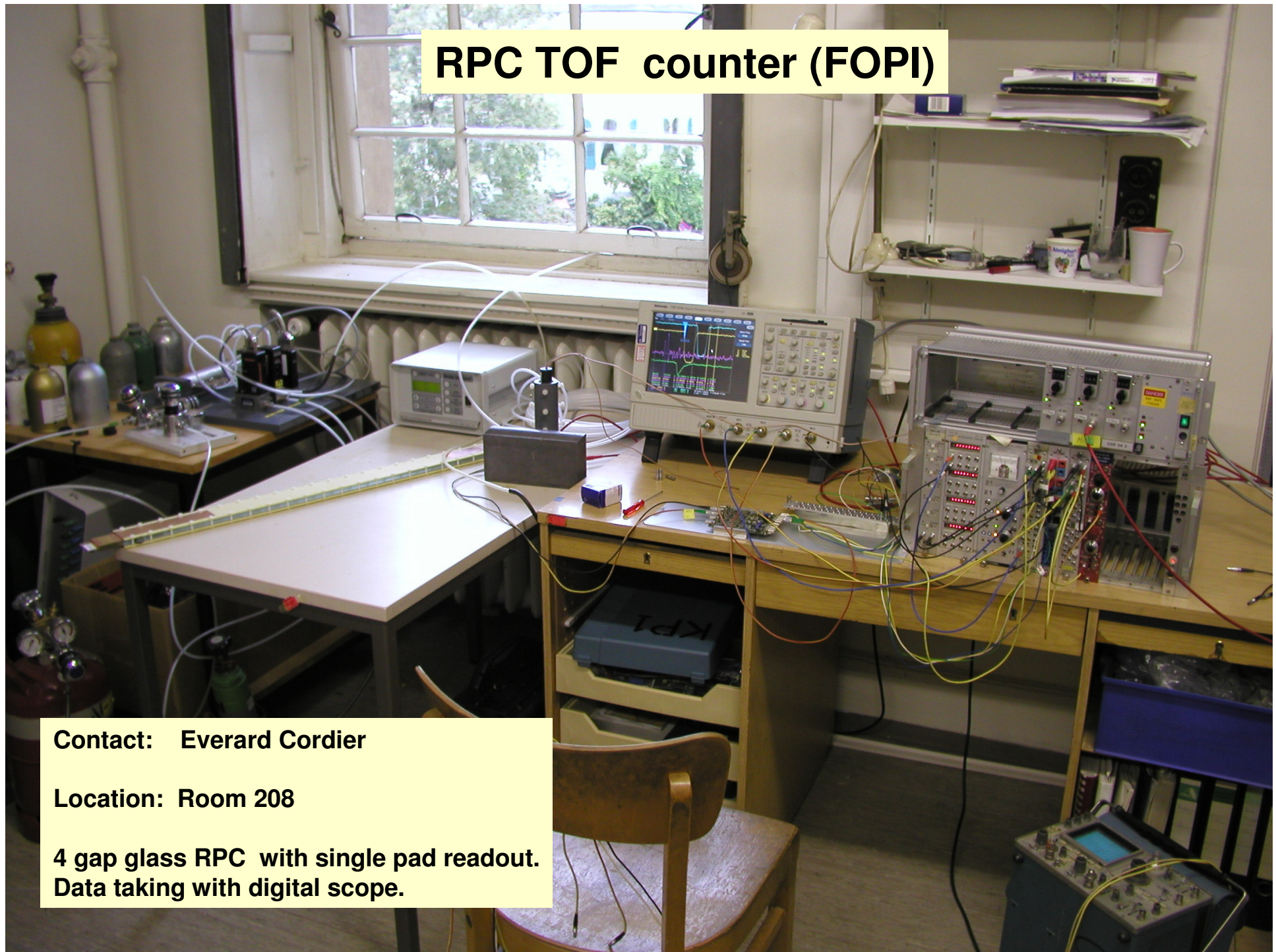


## RPC TOF counter (FOPI)

**Contact: Everard Cordier**

**Location: Room 208**

**4 gap glass RPC with single pad readout.  
Data taking with digital scope.**





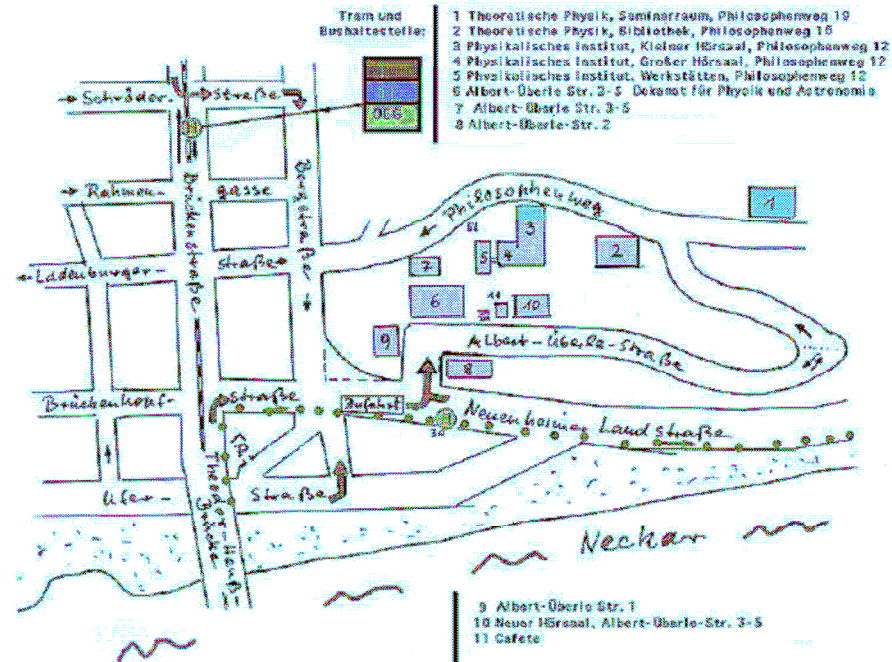
# Student presentations

- **Saturday: Oct. 7<sup>th</sup>, 14:00**  
**PI, kl. Hörsaal (2<sup>nd</sup> floor)**
- **Duration: 40 (+20) min**
- **Max 2 speakers per group**
  
- **Contents:**
  - **Description of mechanical construction**
  - **Description of FEE**
  - **Operating principle of detector**
  - **Main characteristics of counter**
  - **Own experiences / measurements / results**
    - » **Achievements**
    - » **Difficulties**
  - **Applications**
    - » **Running experiments**
    - » **Future experiments (R&D needs)**
  
- **Preparation has to start this afternoon!**

# Practical informations

Flyer by Markus Merschmeyer (Tel. 9244)

e.g.: Locations



**Lectures:**

- Wednesday large lecture Hall, 1<sup>st</sup> floor, Physics Institute (#4)
- Thursday Seminar Room, Theoretical Physics Bldg. (#1)
- Friday Seminar Room, Theoretical Physics Bldg. (#1)
- Saturday small lecture Hall, 2<sup>nd</sup> floor, Physics Institute (#3)

**Detector Courses:**

always at the Physics Institute