Detector development for ILC
(international linear collider)

Joint effort of Lund HEP division

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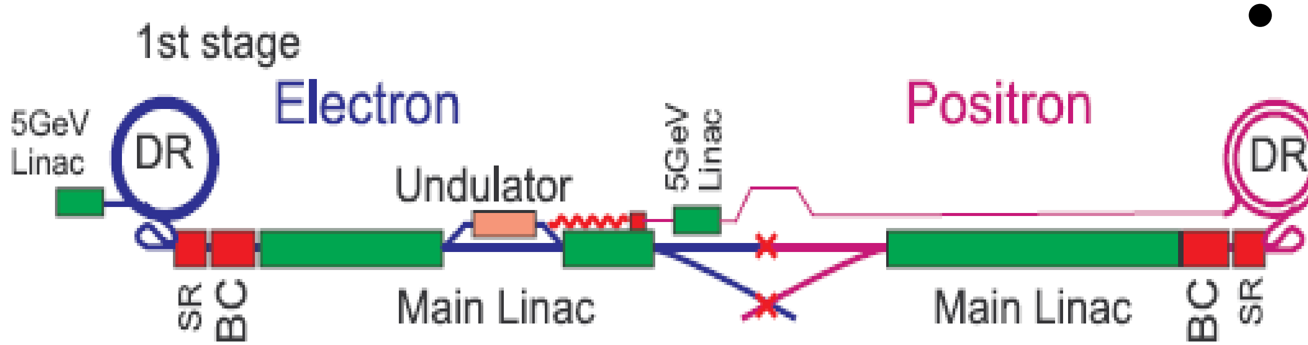
EUDET, FP6 III project to position Europé in detector for ILC
+ VR counterfinancing

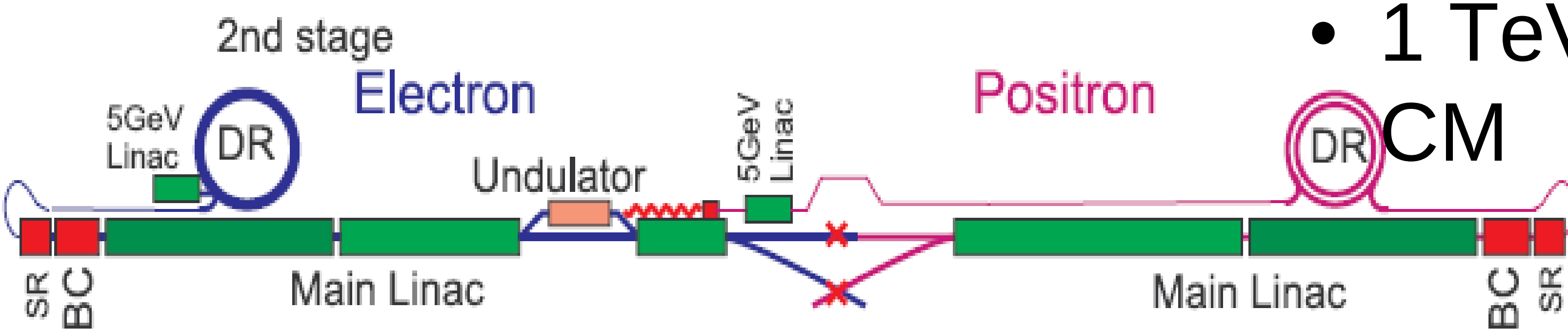
EUDET partners: CERN, DESY, NIKHEF, CEA, CNRS,CSIC,MPI,INFN
+ universities

EUDET:
test beamline at DESY
high resolution tracking
High resolution calorimetry

Baseline Configuration - Schematic



- 500 GeV CM



- 1 TeV CM

~30km, 31.5MV/m

2820 bunches, spaced 300ns 5 times per second

Luminosity 2 10^{34}

The physics agenda for the ILC

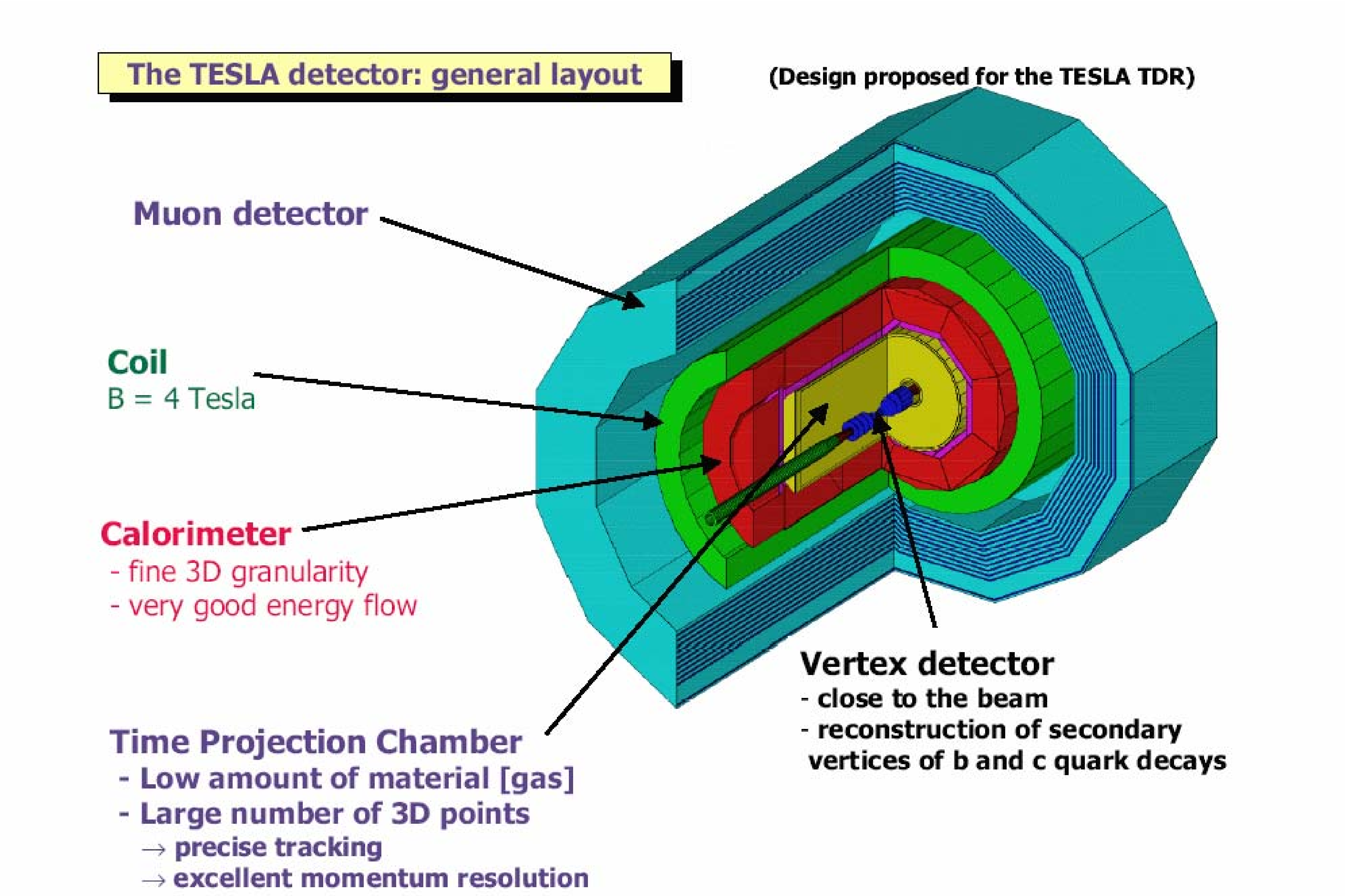
- Higgs
  - The Standard Model Higgs
  - SUSY Higgs
- Non-SUSY extensions of SM
- SUSY
  - Minimal Supersymmetric Standard Model (MSSM)
  - The Minimal Supergravity model (mSUGRA)
  - Gauge-Mediated SUSY Breaking (GSMB)
  - Anomaly-Mediated SUSY Breaking (AMSB)
- Alternative theories
  - Extra Dimensions
  - Strong electroweak symmetry breaking
  - Compositness
- Precision measurements
  - Electroweak Gauge bosons
  - Extended Gauge theories
  - Top quark physics
  - Quantum Chromodynamics

- J.A. Aguilar-Saavedra et al., hep-ph/0106315
- T. Abe et al., hep-ex/0106055
- K. Abe et al., hep-ph/0109166
- G. Weiglein et al., hep-ph/0410364

Very much the same as LHC
Why ILC?

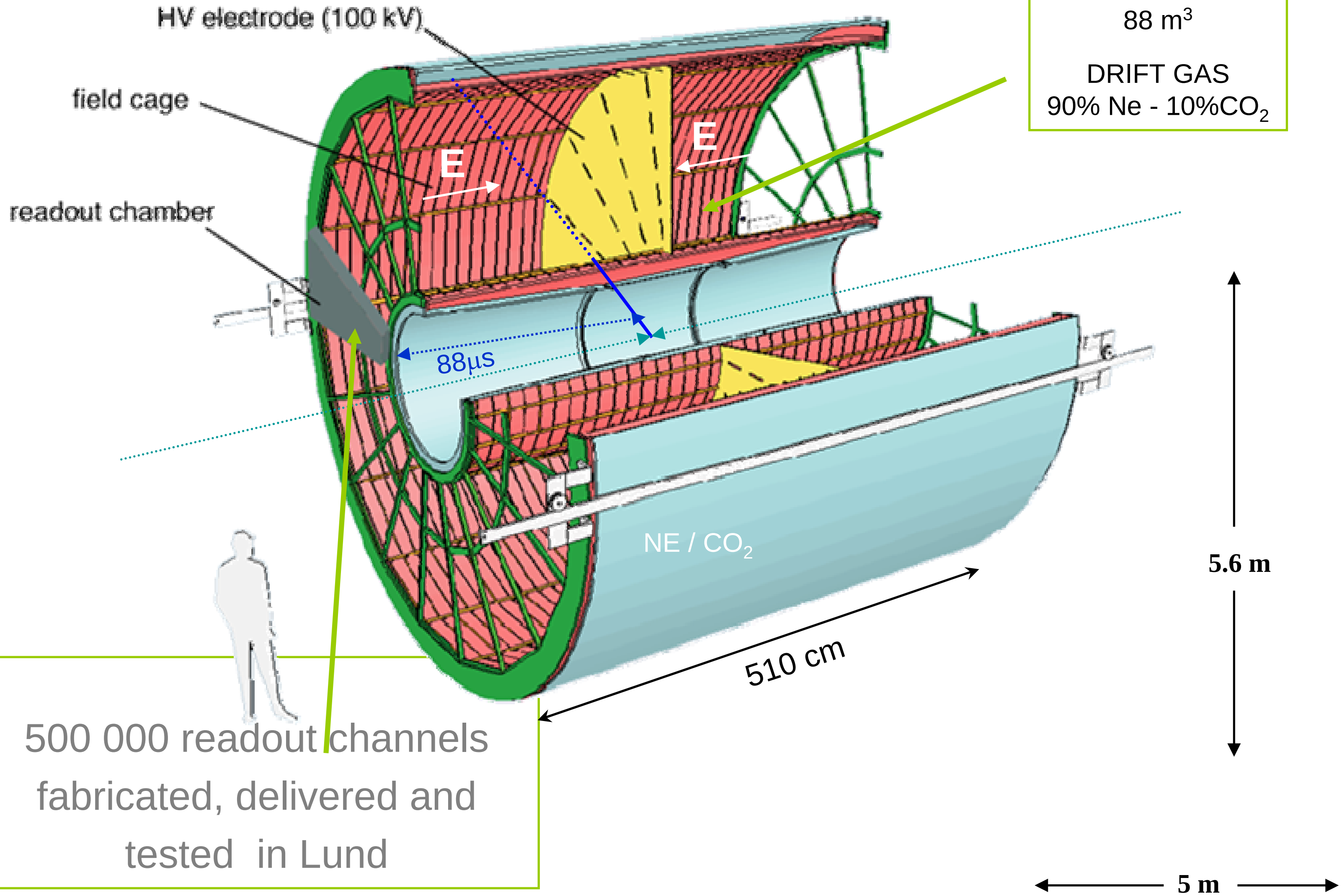
- **Complementarity to LHC**
- **Clean entrance channel**
- **Matched by precision measurements**

The detector. Order of magnitude better resolution.

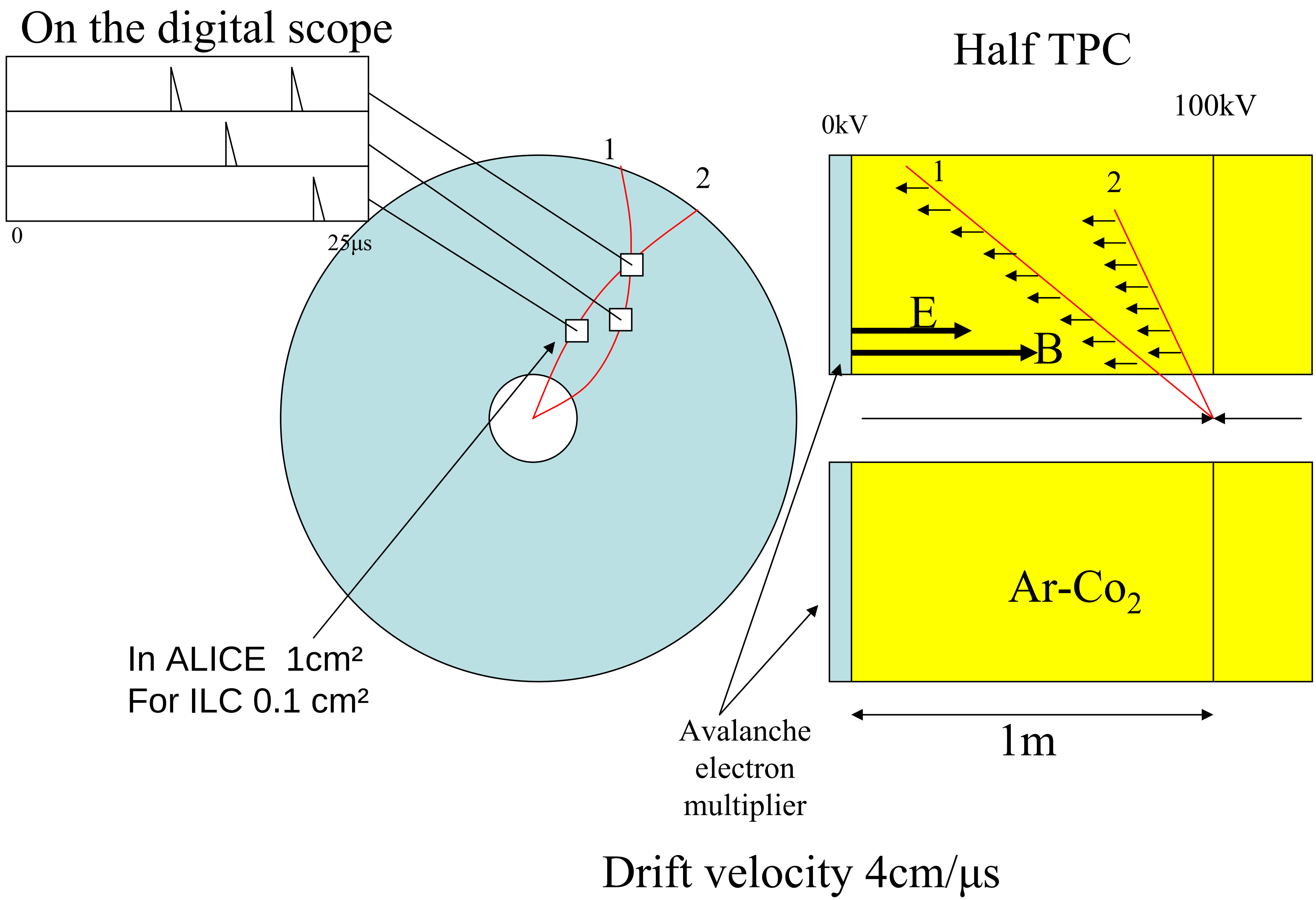


GAS VOLUME
88 m^3

DRIFT GAS
90% Ne - 10%CO_2



500 000 readout channels fabricated, delivered and tested in Lund

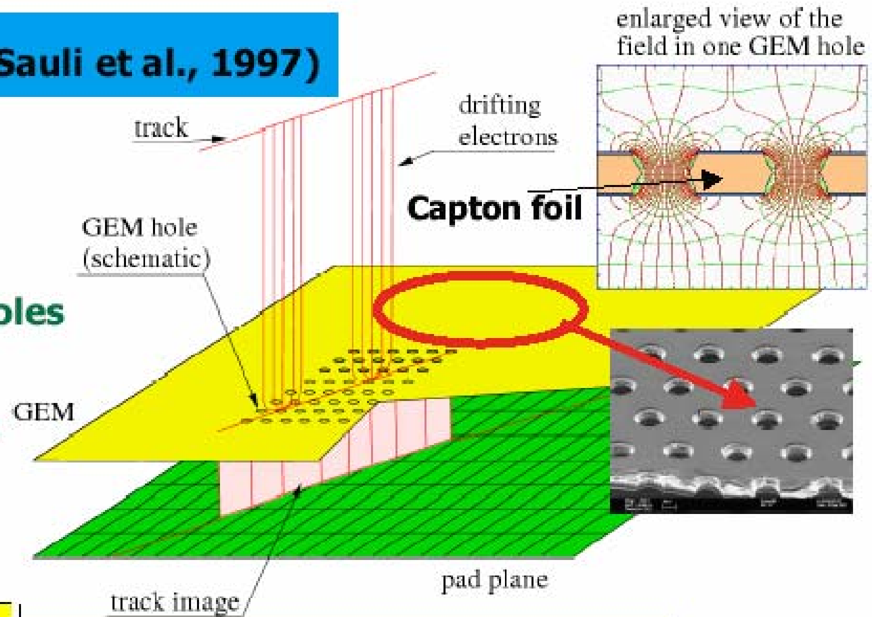


On the digital scope
0
25μs
1
2
In ALICE 1cm²
For ILC 0.1 cm²
Half TPC
0kV
100kV
1
2
E
B
Ar-Co2
Avalanche
electron
multiplier
1m
Drift velocity 4cm/μs

TPC as the central tracker at TESLA: Gas amplification: GEM

Gas Electron Multiplier (F. Sauli et al., 1997)

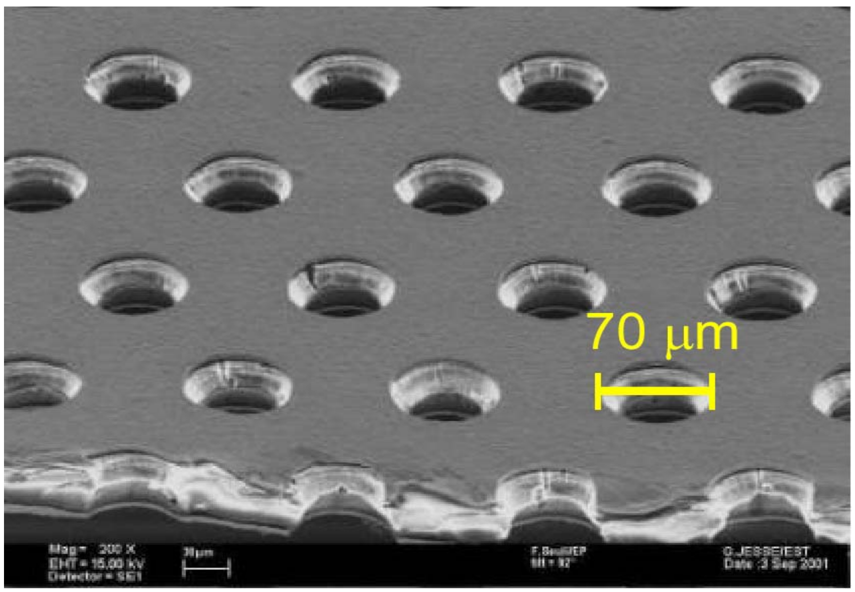
- thin polymer base (~50 μm)
- coated on each side by ~ 5 μm copper.
- perforated by a high density of small holes
  - 70 μm holes, 100 μm pitch
- Strong field (~ 80 kV/cm) between the two conductive sides.

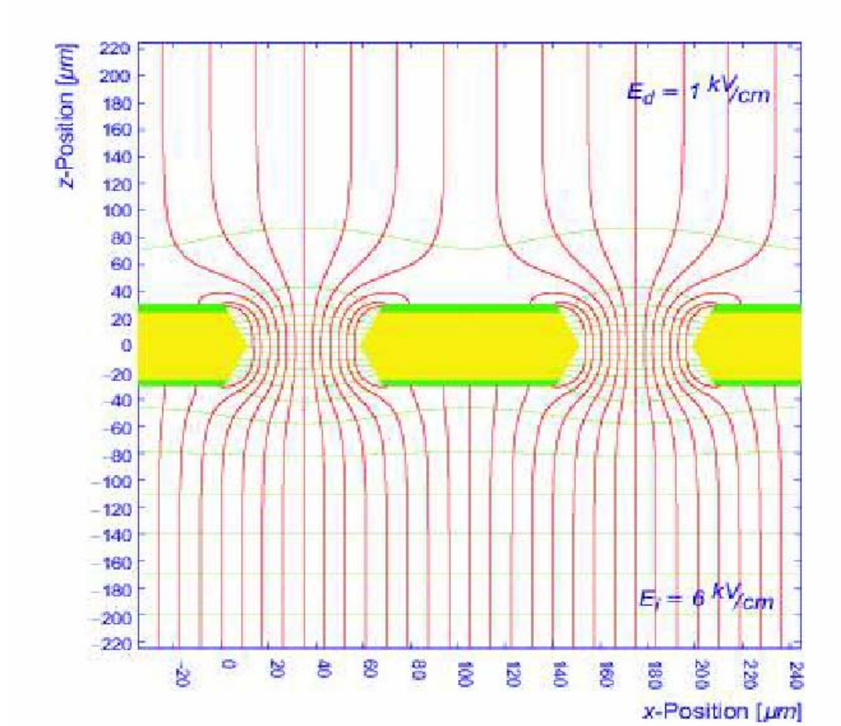


Advantages of GEM:

- almost no E x B effects (~ 50 μm)
- natural suppression of ion feedback
- low material budget
- 2-D symmetry
- high gain and possibility to use multi GEM structure
- fast signal collection
- simple design (no mechanical tension)

A GEM, Gas Electron Multiplier

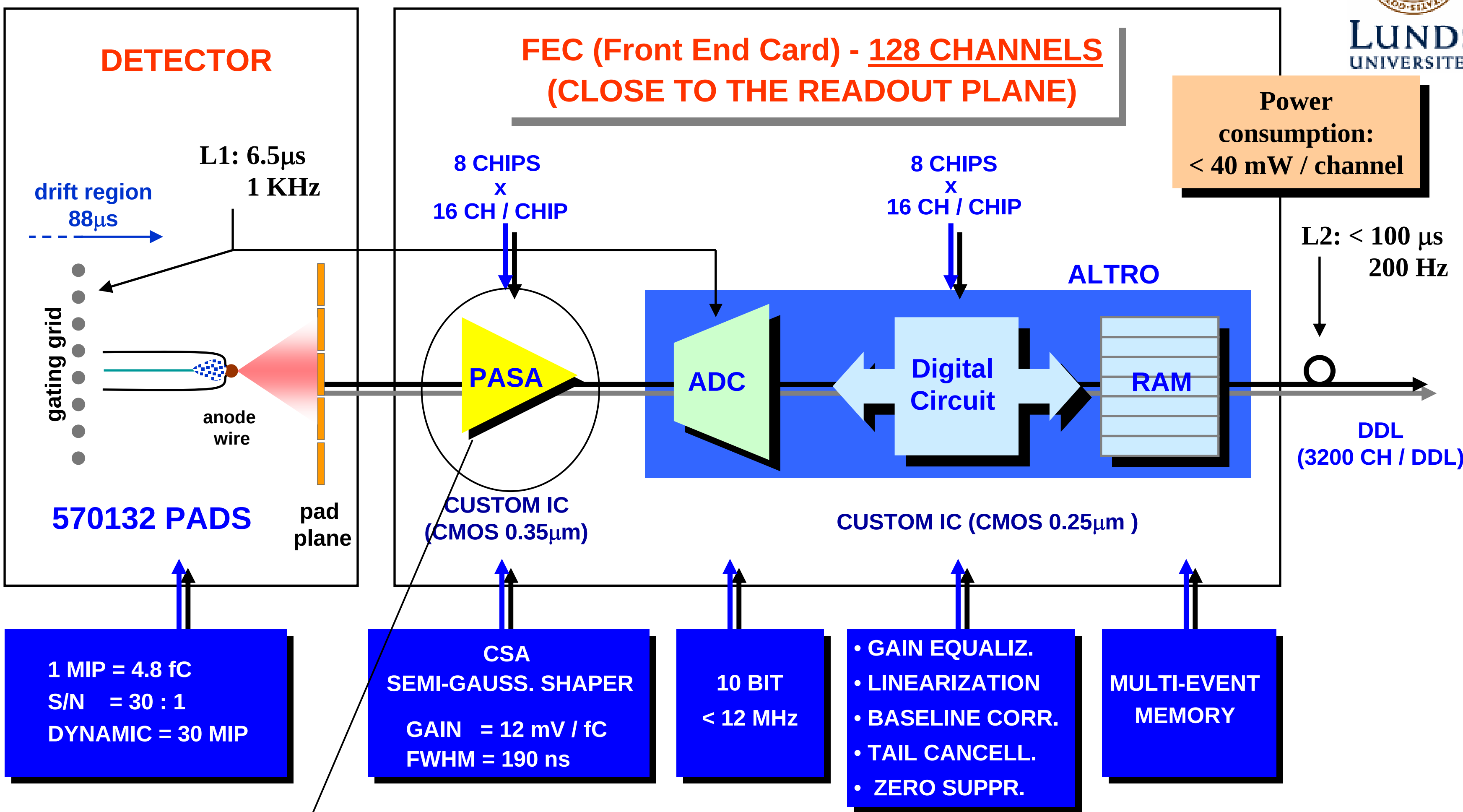




Typical gain 10^3 per GEM plane
Will use 2 or 3 planes
Single electron efficiency, can be used as large area UV-photon detector

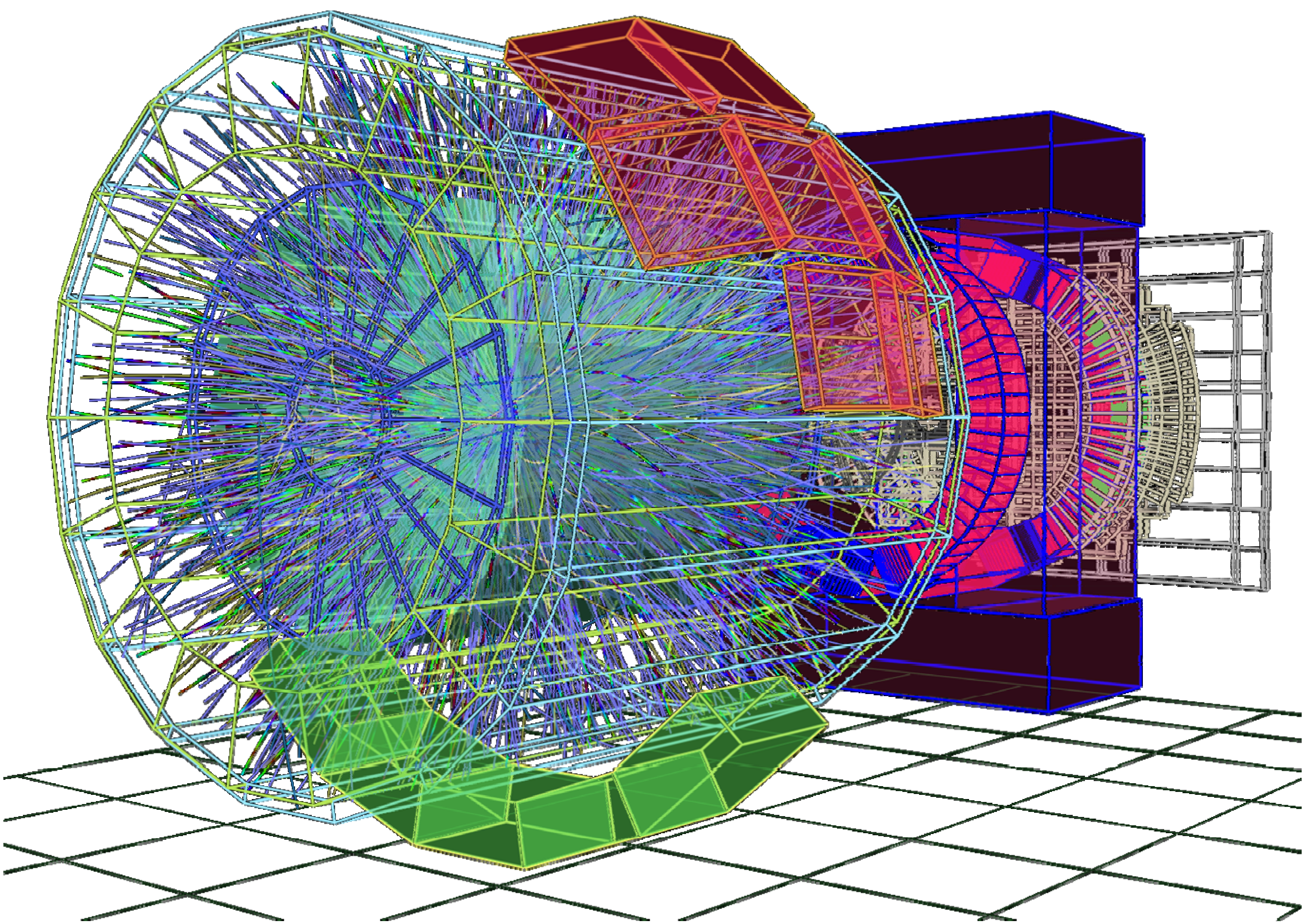
ALICE front end card in reality, 128 channel digital scope
Lund Hardware contribution to ALICE

ALICE front end card



Need new preamp-shaper chip,
Programmable pol. Gain, shaping time
190nm process

Different problems, same solution - GEMs with small readout pads
ALICE upgrade: resolve nearby tracks better
ILC-TPC: measure each track extremely accurately



Diploma projects
ex-jobb

Analyze test results from ALICE TPC
-Test and develop algoritms for tracking and Particle ID
-Develop and test monitoring software

First tests of small TPC with GEM readout (ILC type).
-Put small TPC in operation. Hardware in Lund.
-Test with cosmics, sources. Analyse performance
-Possibly test some medical imaging application