



CERN-RRB-2002-070

Status of the LHCb Experiment

LHCb RRB meeting

24 April 2002

on behalf of the LHCb Collaboration

Tatsuya Nakada

CERN and Univ. Lausanne

The *LHCb* Collaboration, 45+3 institutes (No change since September 2001)

France:FR Annecy, Clermont-Ferrand, CPPM Marseille, LAL Orsay

Germany:DE Tech. Univ. Dresden, Phys. Inst. Univ. Heidelberg, KIP Univ. Heidelberg, MPI Heidelberg,

Italy:IT Bologna, Cagliari, Ferrara, Firenze, Frascati, Genoa, Milan, Univ. Rome I (La Sapienza), Univ. Rome II(Tor Vergata)

Netherlands:NL NIKHEF

Poland:PL Cracow Inst. Nucl. Phys. & Tech. Univ. of Mining and Metallurgy, Warsaw Soltan Inst.

Spain:ES Univ. Barcelona, Univ. Santiago de Compostela

Switzerland:CH Univ. Lausanne, Univ. Zürich

UK:GB Univ. Bristol, Univ. Cambridge, Univ. Edinburgh, Univ. Glasgow, IC London, Univ. Liverpool, Univ. Oxford, RAL

CERN

Brazil:BR UFRJ, CPBF

China:CN IHEP(Beijing), Tsinghua Univ.

Russia:RU BINP, INR, ITEP, IHEP, PNPI

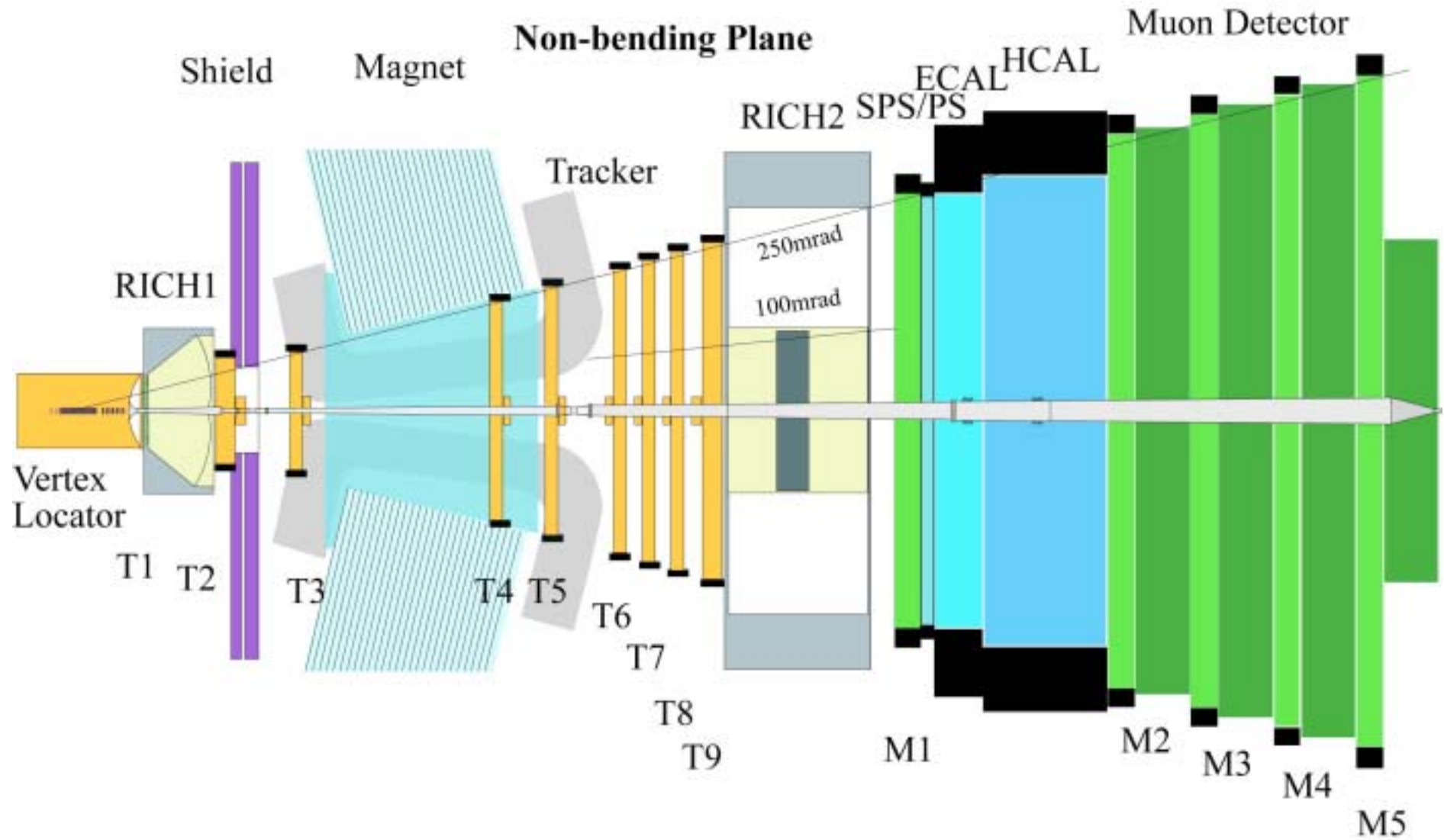
Romania:RO IFIN-HH (Bucharest)

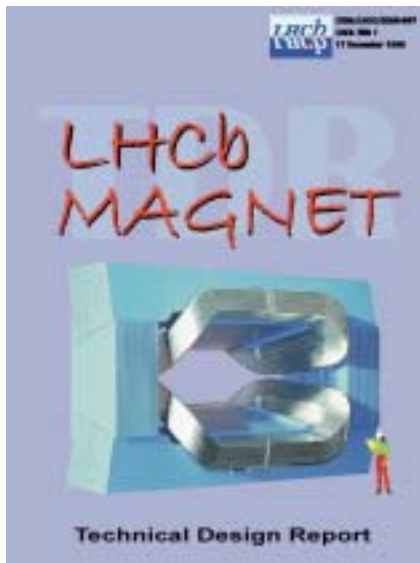
Ukraine:UA Inst. Phys. Tech. (Kharkov), Inst. Nucl. Research (Kiev)

MoU missing signatures: BMBF(Germany), Poland, Brazil, China

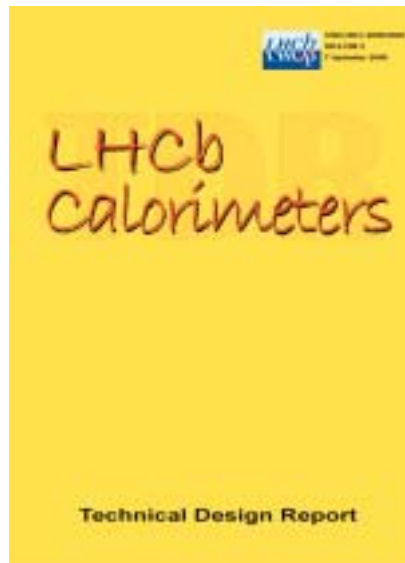
Technical Associates: Espoo-Vantaa Inst. Tech. (Finland), Geneva Engineering School (Switzerland) CEFET-RJ (Brazil)

LHCb “Classic” detector, side view





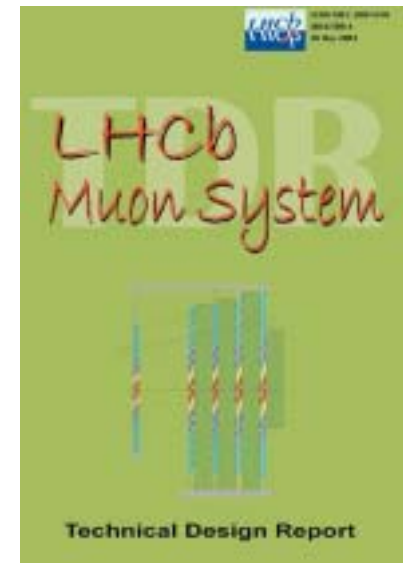
Approved in
April 2000



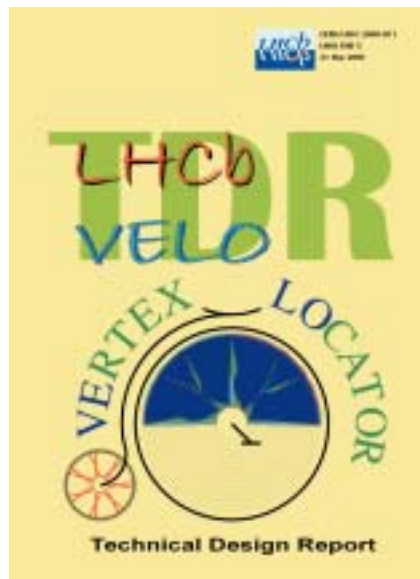
Approved in
Feb 2001



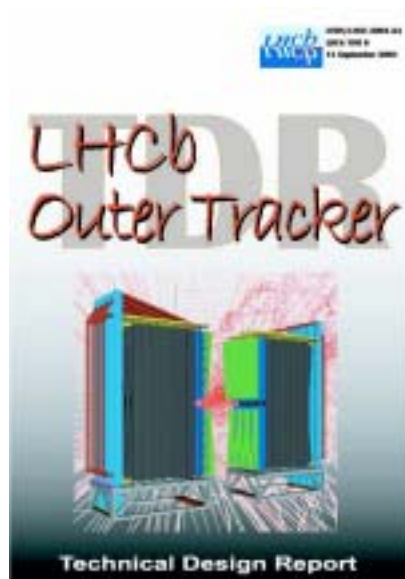
Approved in
Feb 2001



Approved in
Nov 2001



Approved in
Nov 2001



Approved in
Feb 2002



Approved in
April 2002

Still to come
Inner Tracker
Trigger
Computing
TDR's



General remarks

Magnet: most of money committed.
manufacturing tests.

Ecal&Hcal: most of the money for raw material committed.
module assembly started.

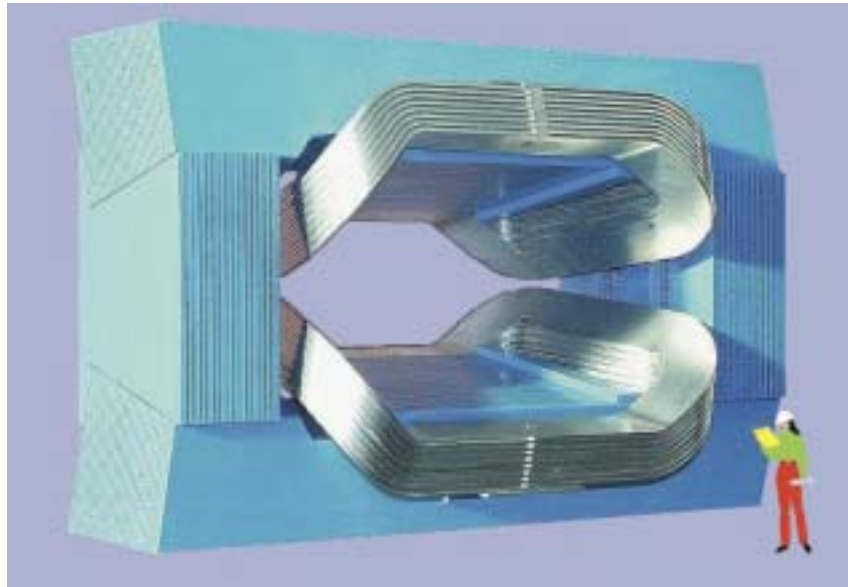
Adaptation work of the experimental area in progress.

LHCb-light optimization (reducing material budget) affects:

VELO	minor design change
RICH-1	major design change (B field)
Tracking(OT/IT)	fewer stations but each with better performance

Adjusting the construction plan to the new LHC schedule

Magnet



funding responsibility: CF

Well into the production

Al-conductor (manufacturer: Holton GB)

Coils (manufacturer: SigmaPhi FR)

Yoke (manufacturer: Jebens DE)

Power converter -common with ALICE-

Thyristor (manufacturer: Schneider Electric FR)

Transformer (manufacturer: Trasfor CH)

Bending of the Al conductor



Calorimeters

funding responsibility: ES, FR, RO, RU, UA, CERN, CF

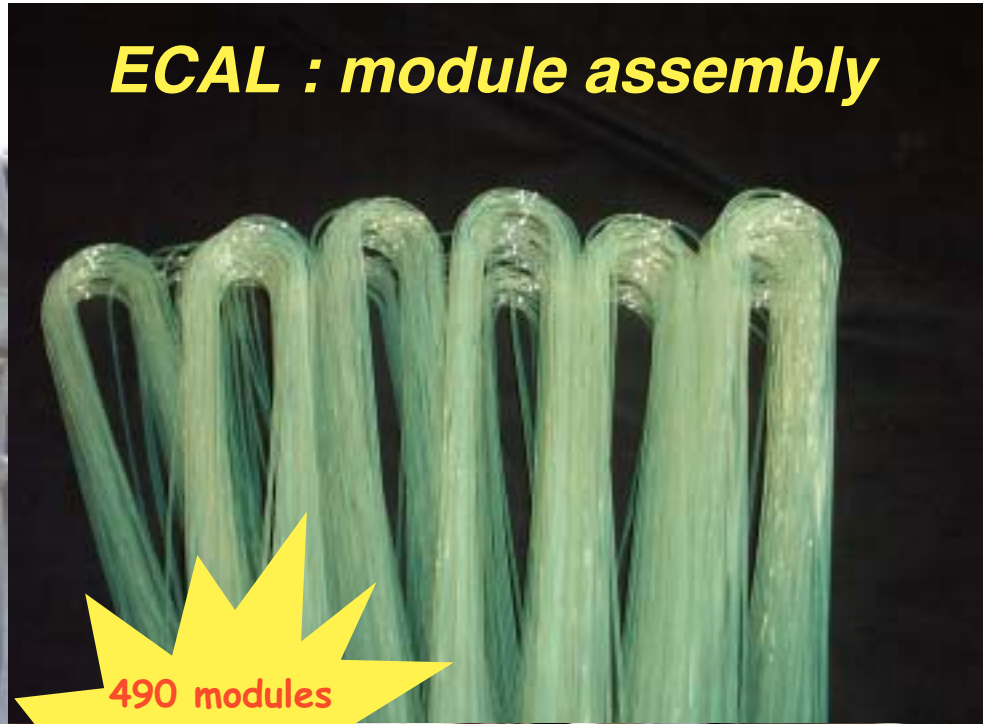
Detectors

E-cal, H-cal: procurement of material, module assembly
on schedule, within budget

SPD-Preshower: EDR completed

Electronics

E/H-cal and Preshower front-end ASIC chips
PRR completed, ready for production



ECAL : module assembly

490 modules
were produced
Assembly rate
~10 modules/day

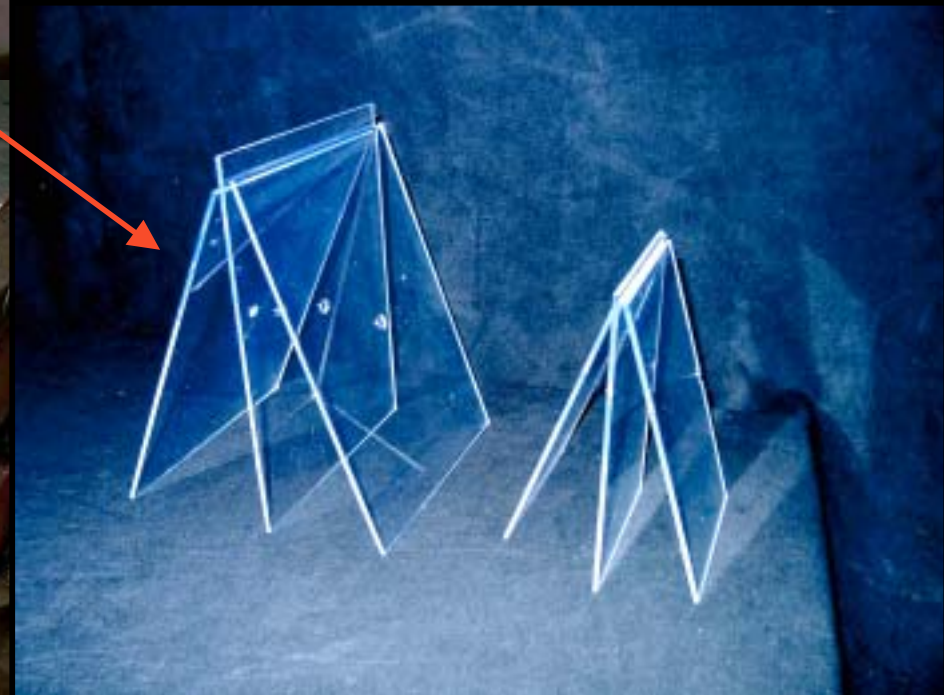
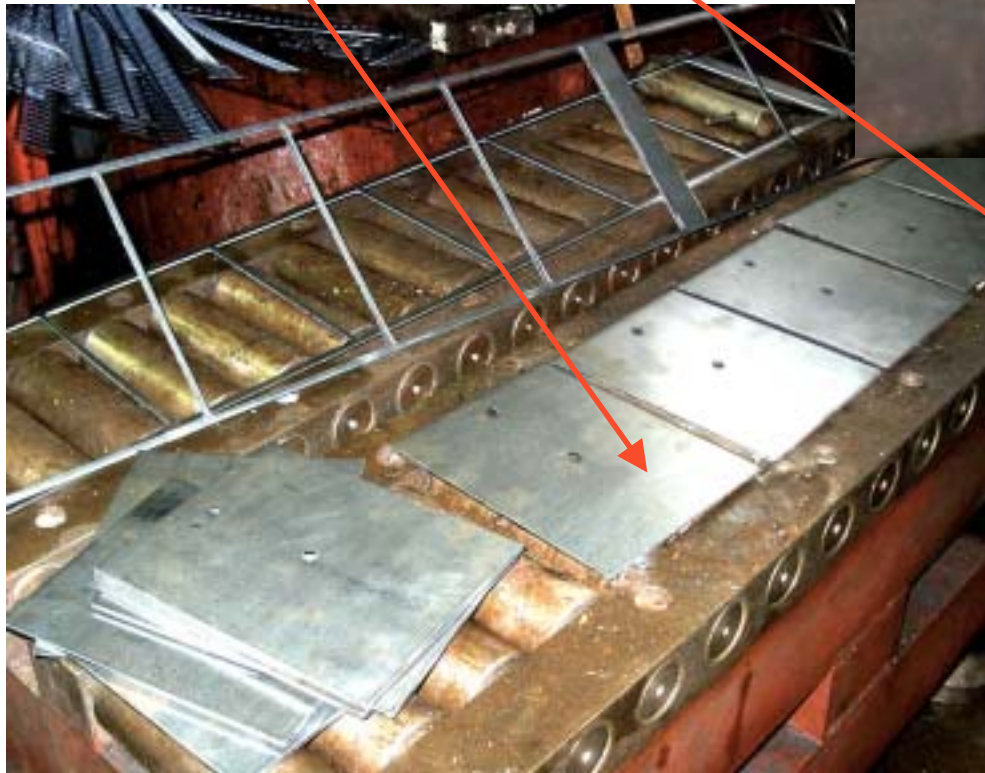
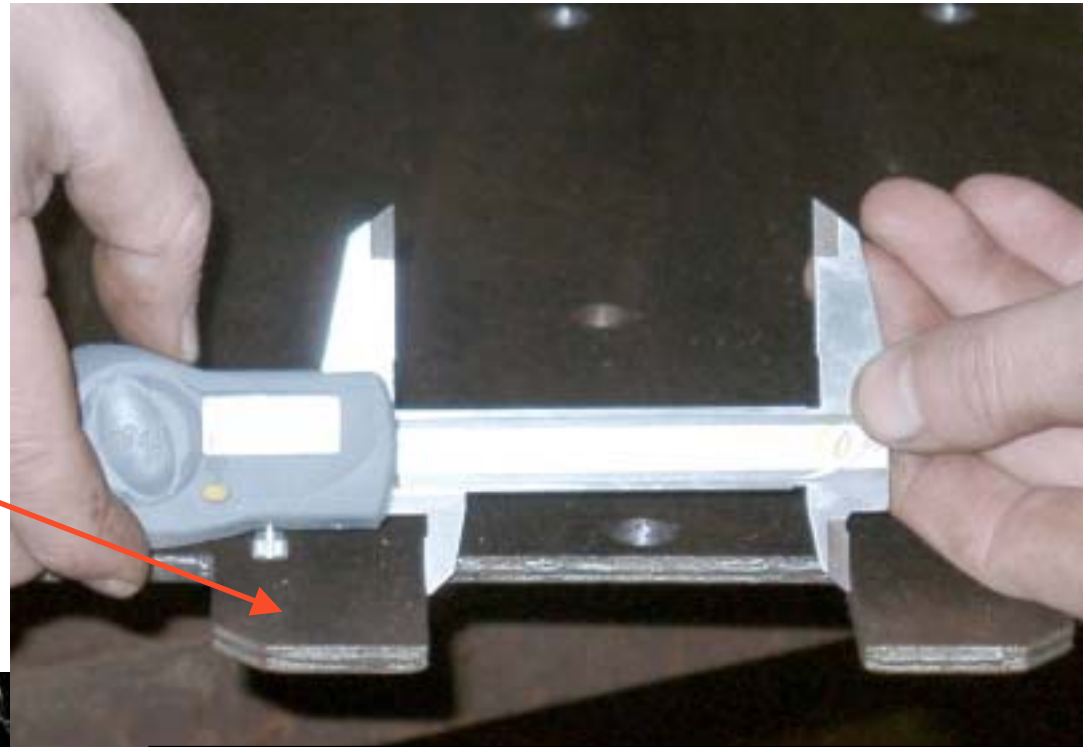


*HCAL : Production of steel
converter and Scintillator*

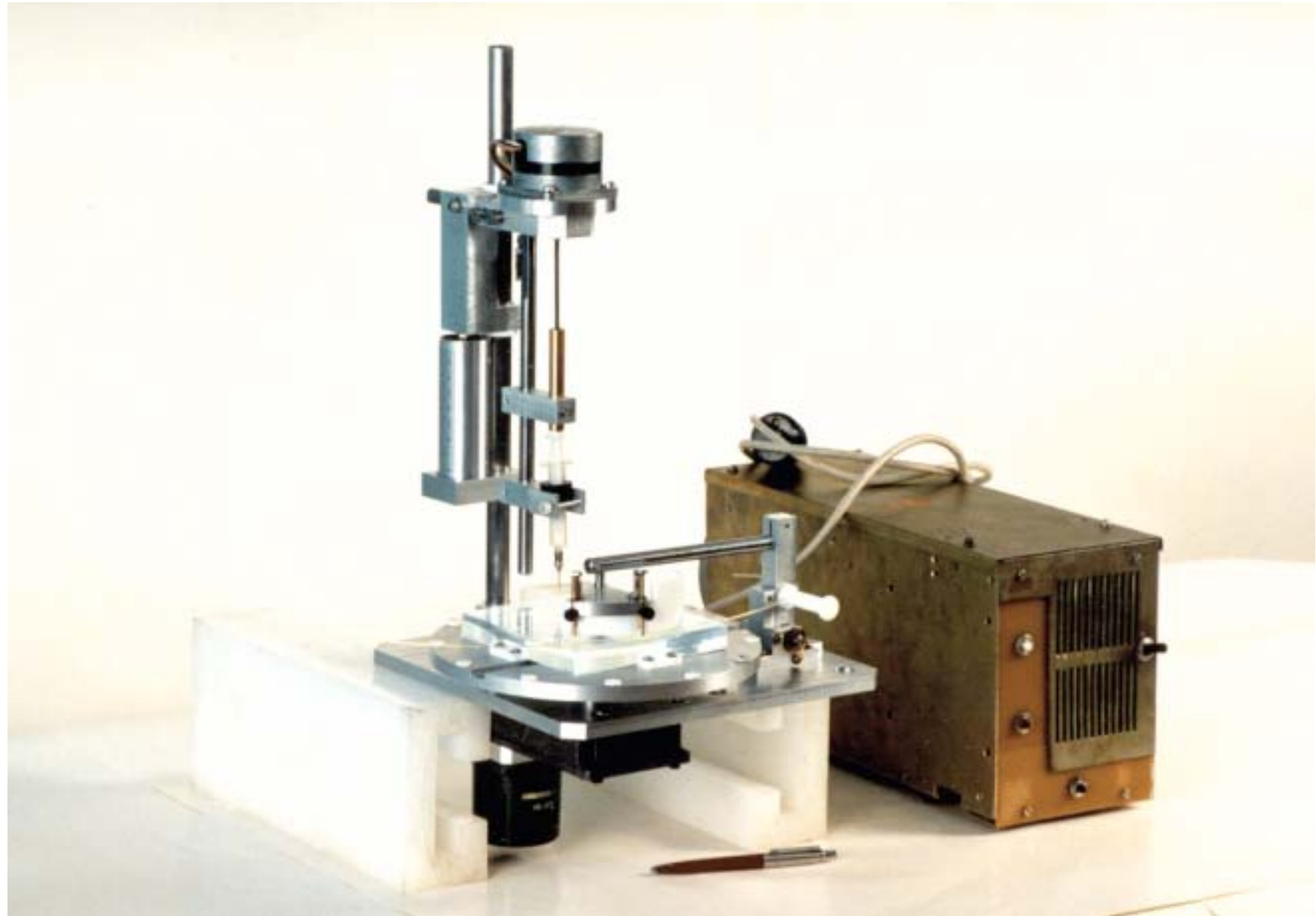
Master plates

Spacer plates

Scintillator tiles



Preshower : Fiber Gluing Machine



Re-optimisation

Current baseline:

Beam pipe: Be-Al alloy
(possibly the first 25 mrad cone with Be)

Detector designs to reduce material budget:

VELO: reduced number of stations (21 vs 25 in TDR)

RICH-1: composite mirror and light mirror support

Tracking: reduced number of stations (4 vs 9 in TDR)

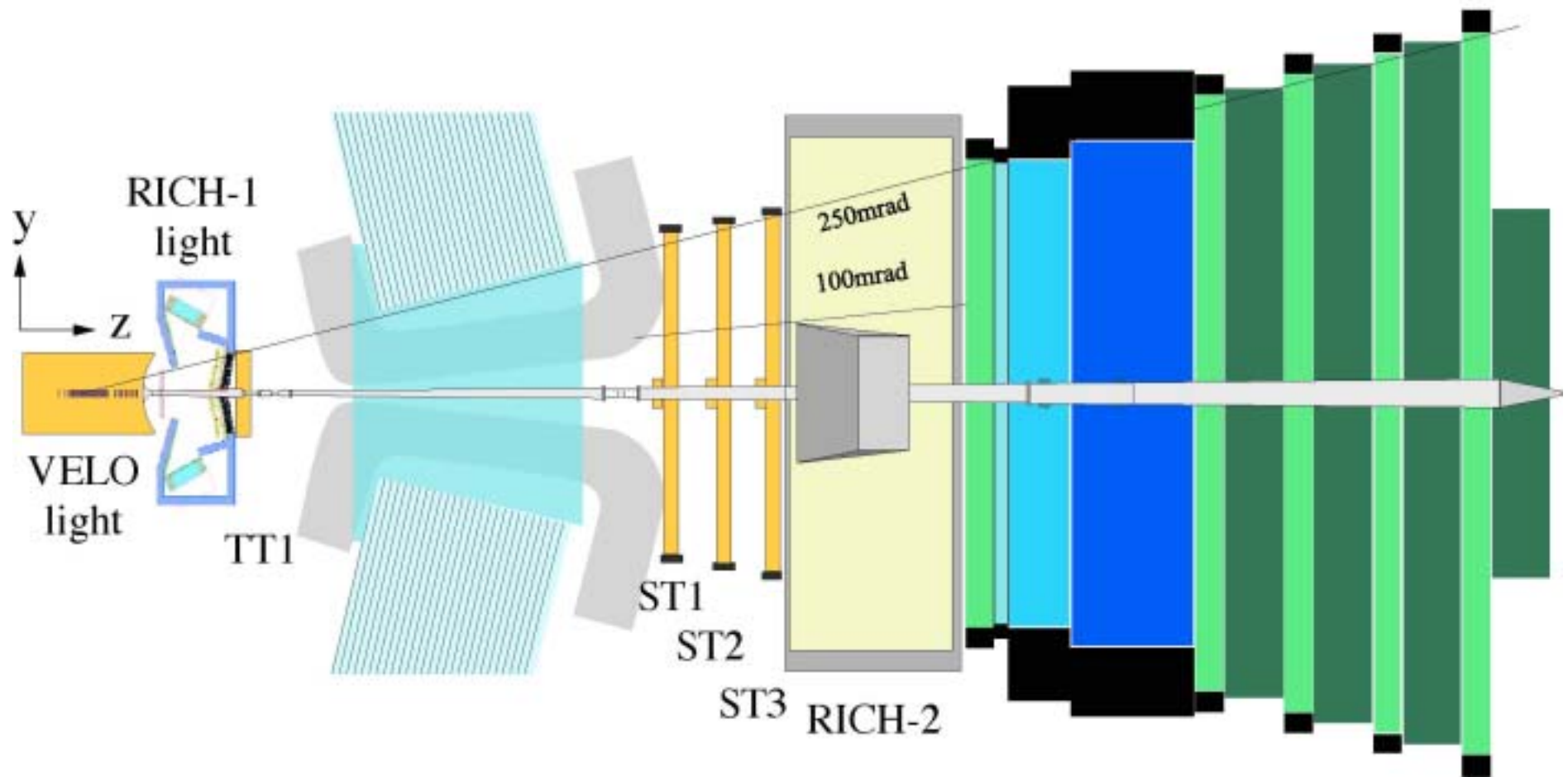
TT1(before the magnet), ST1-ST3(after the magnet)

but possibly with larger IT(Si) coverage

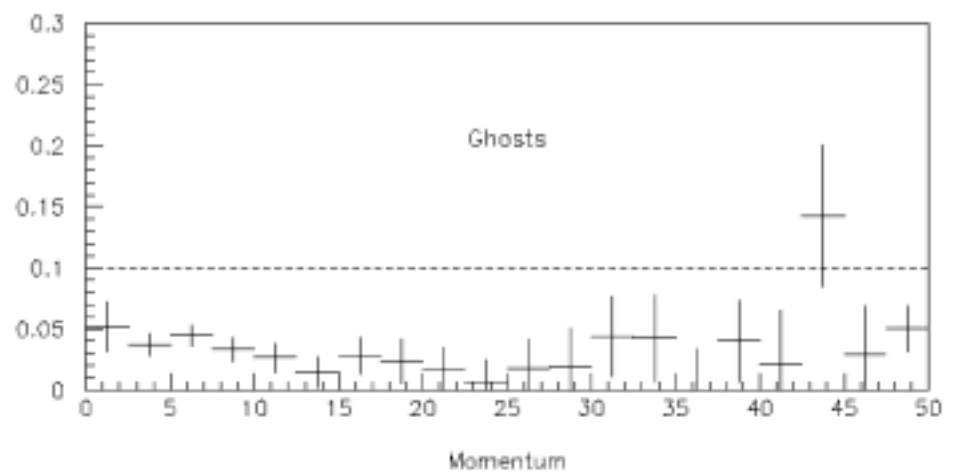
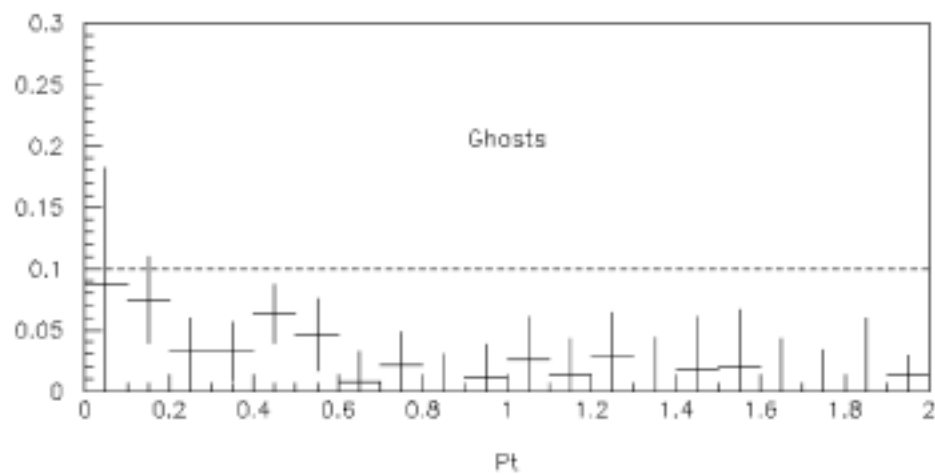
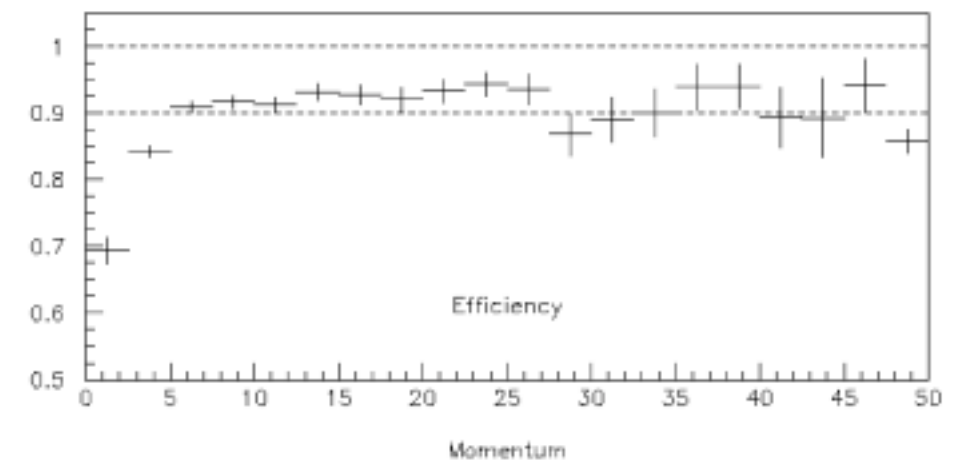
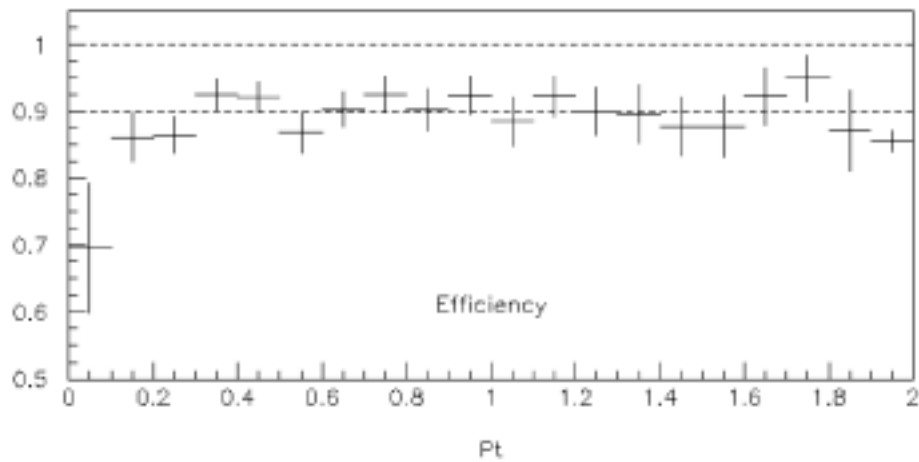
Small B field @ RICH-1, by removal of shielding plate

- Tracking strategy being adapted to this configuration
- Testing robustness, optimizing TT1

LHCb-light layout, side view



B track efficiencies and ghost rates as functions of p_T and p



Submission of “LHCb-light TDR”

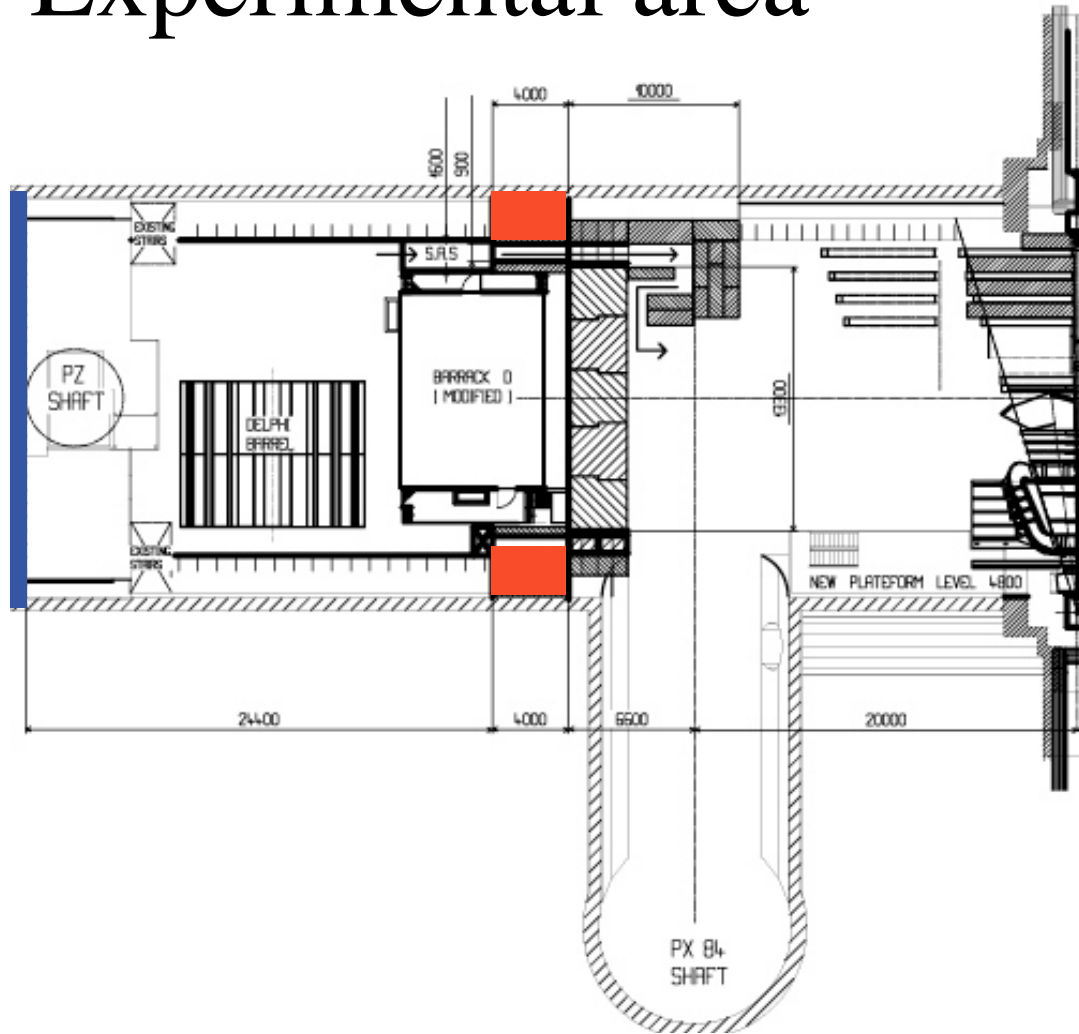
toward the end of this year.

- **re-optimized LHCb detector design:**
 - configuration of the tracking stations,
 - VELO modifications
 - RICH-1 design
- **performance bench marks:**
 - tracking efficiencies and physics event yields.

GENERAL LAYOUT OF LHCb IN UX 85 AREA

TOP VIEW 27/09/2001

Experimental area



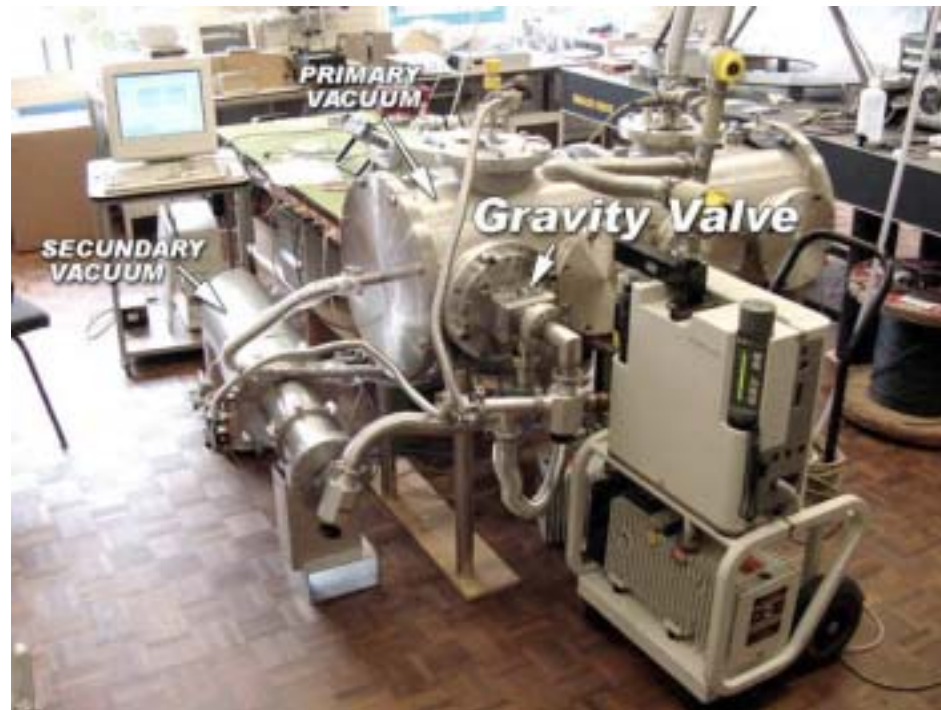
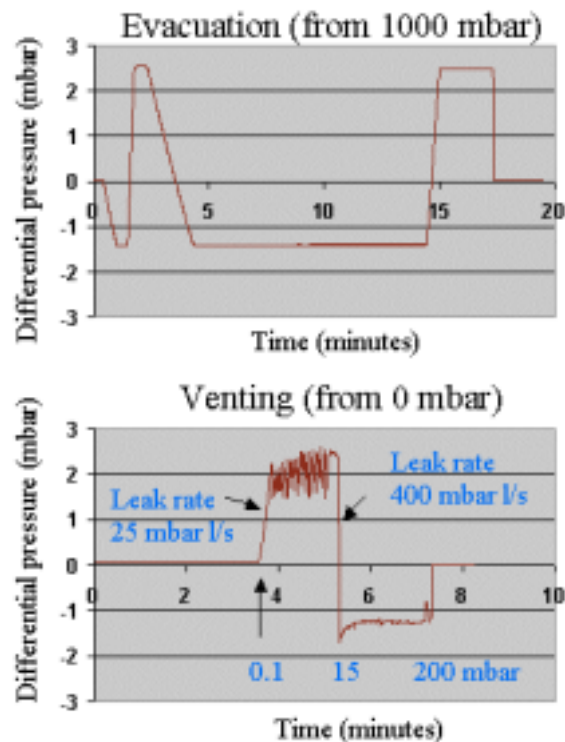
DELPHI dismantling completed.
Necessary modification work started.

VELO

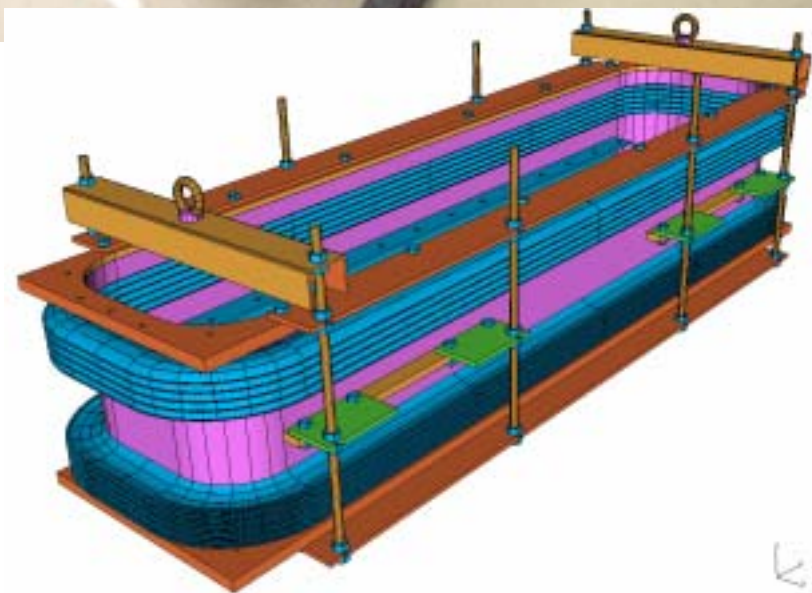
funding responsibility: CH, DE, GB, NL

Vacuum tank and mechanics:

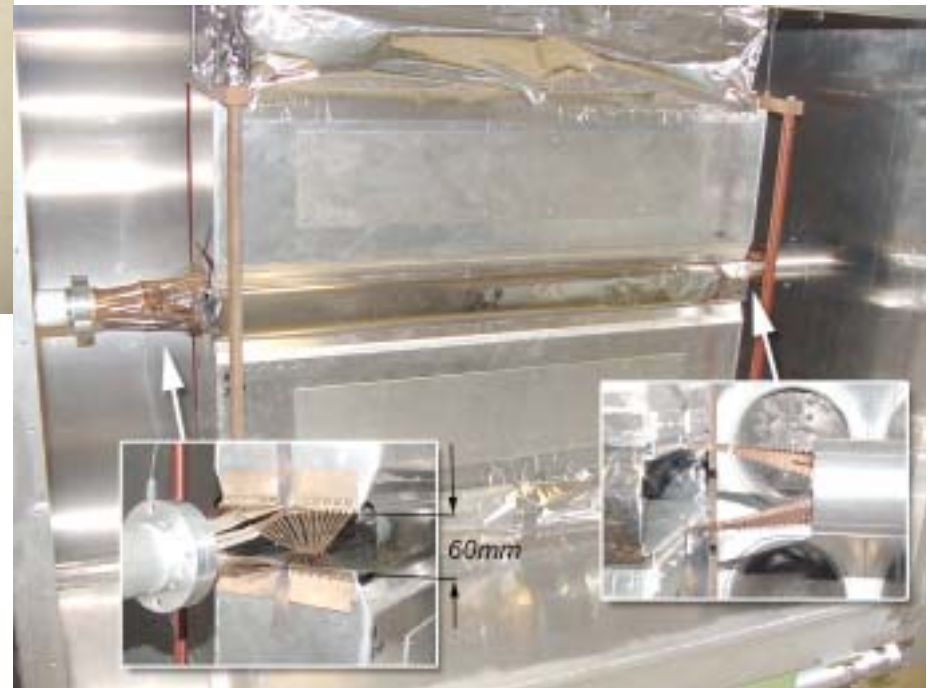
- last design review by the machine groups in April 2001
- next review in autumn 2002
- many progresses have been made to validate the design -
test of the vacuum system

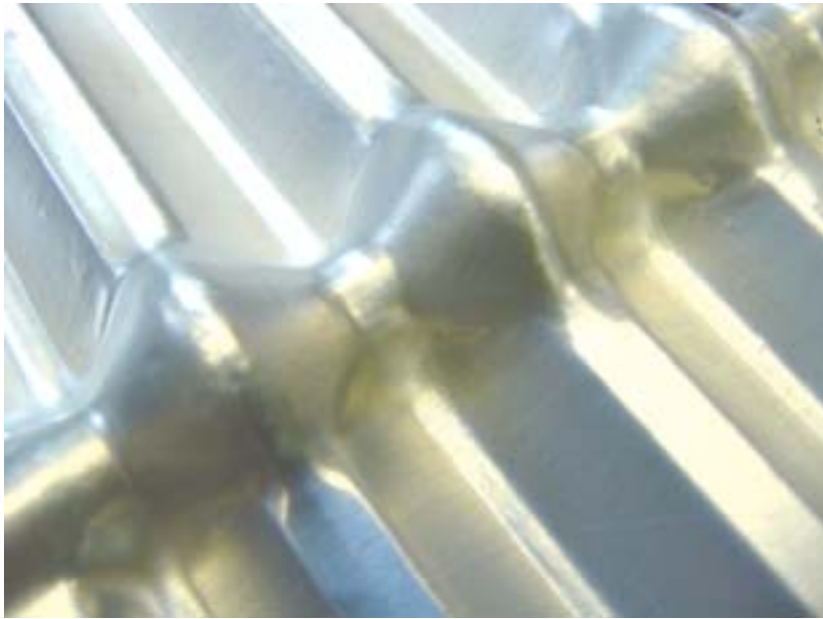


rectangular bellow prototype



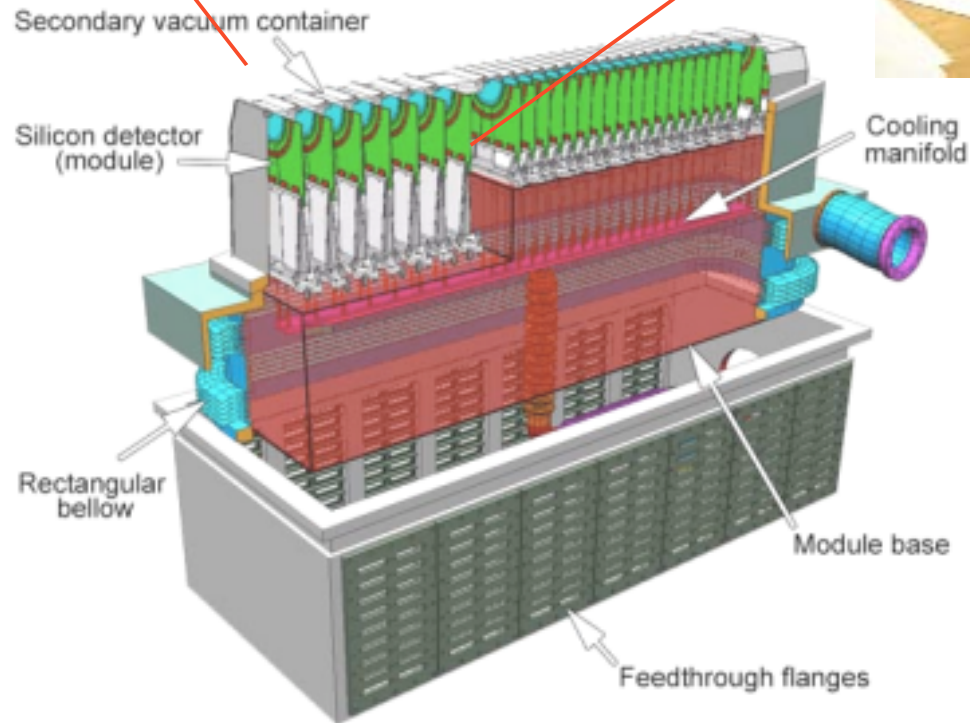
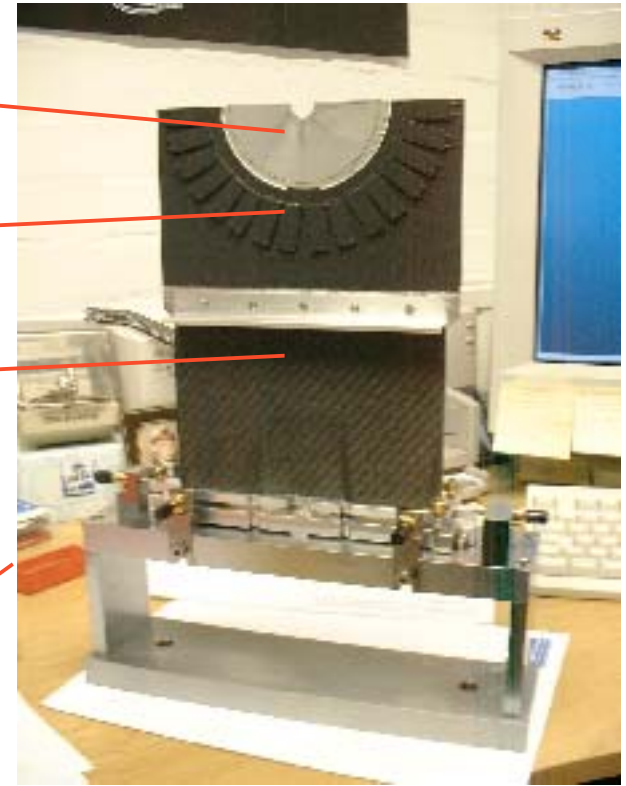
wakefield suppressor test





RF foil

Si
Hybrid
Support



Two radiation hard FE chip prototypes

Beetle 1.1
0.25 μm CMOS

SCTA-VELO
DMILL



NB: Beetle is the choice for IT and Pile-up.

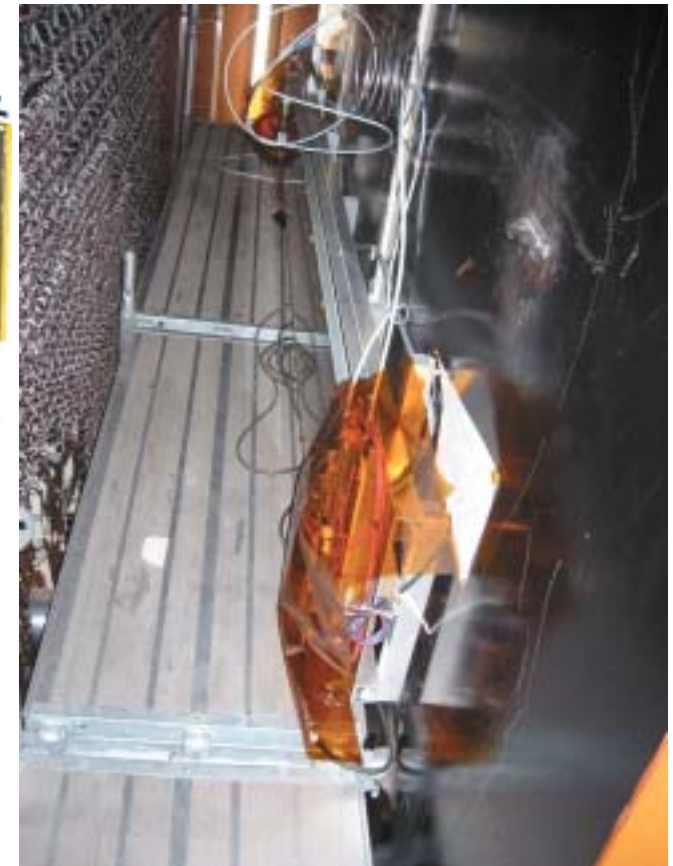
VELO choice will be made in Autumn.

Outer tracker

funding responsibility

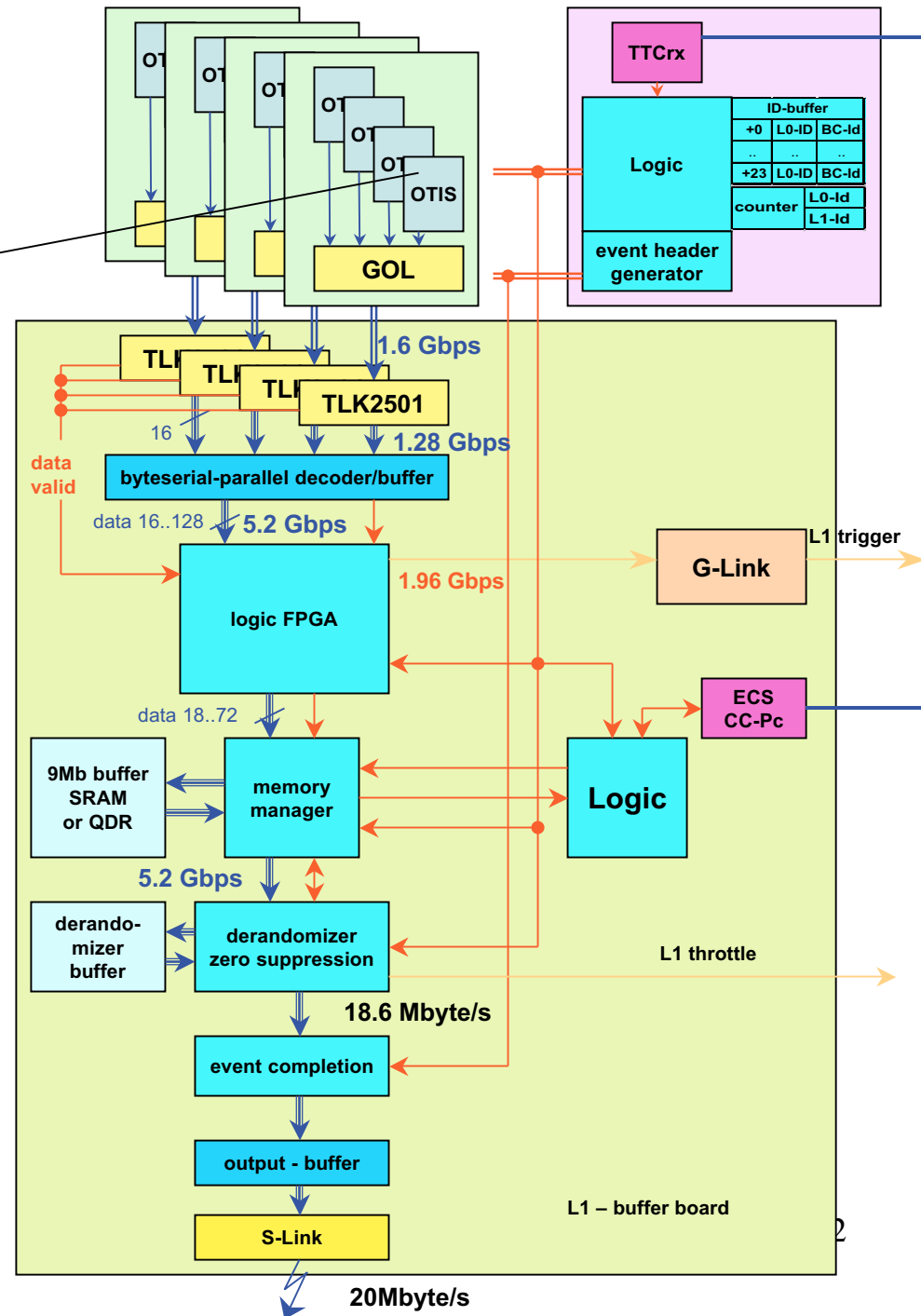
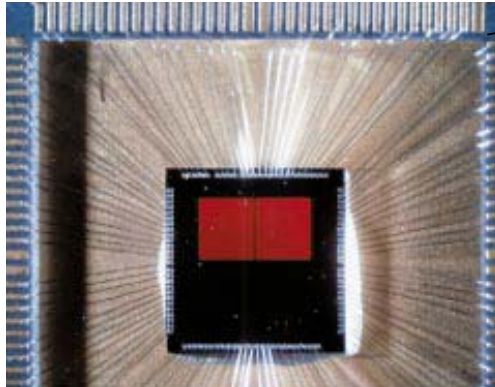
CN, DE, NL, PL, CERN, CF

Construction of a long (3m)
prototype module in Heidelberg
Installed in HERA-B



ST1-ST3 in LHCb-light are
identical to T7-T9 in OT-TDR

OT electronics



DLL: Resolution < 400 ps.
Lock Time < 2 μ s reached.

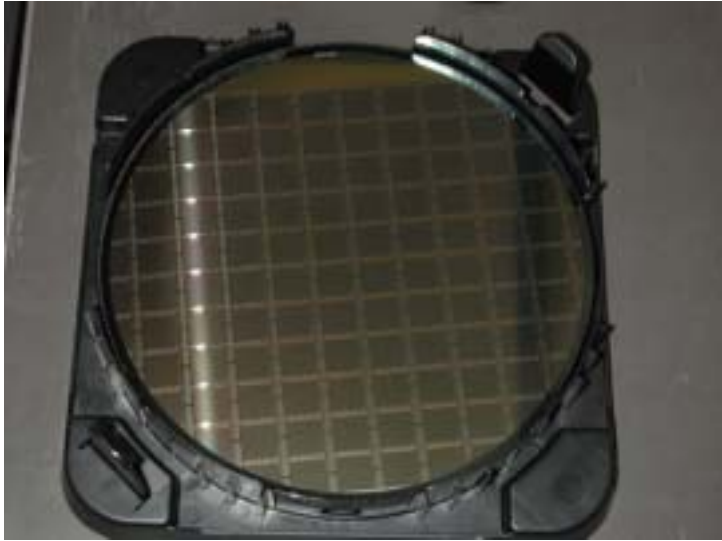
MEMORY: Tested, fully functional

OTIS 1.0 available in July/August

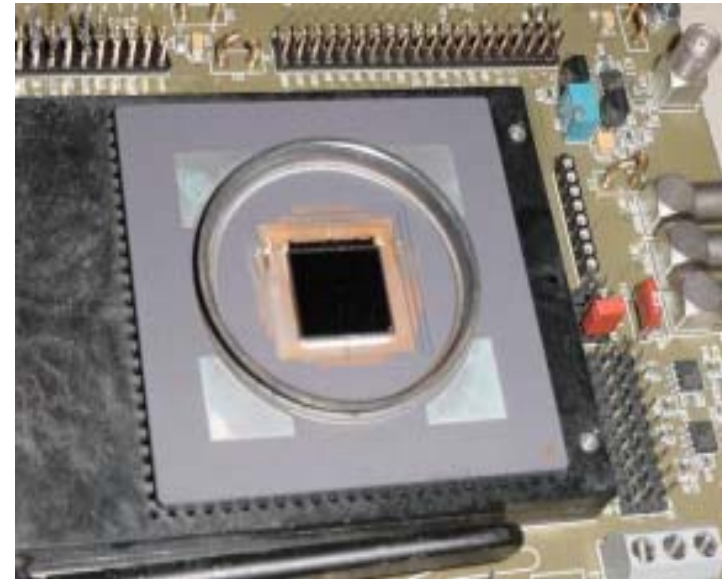
RICH

funding responsibility: GB, IT, CERN

Chips on wafer

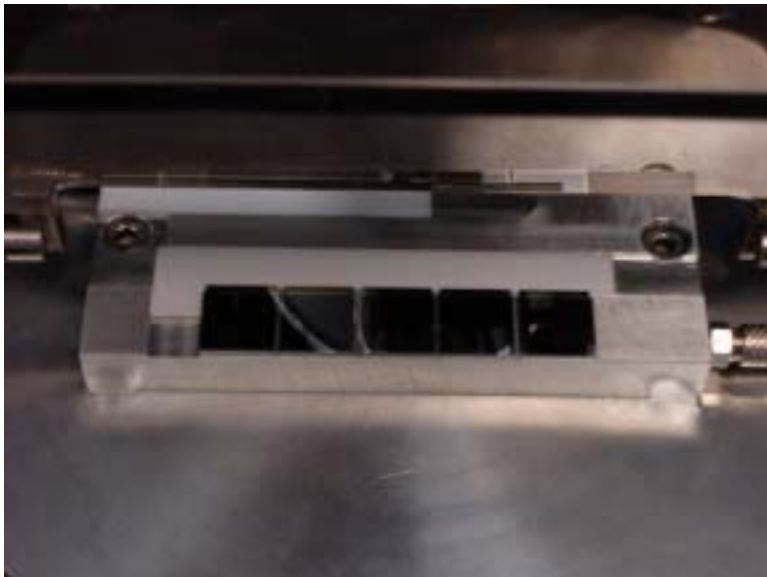


Assemblies on carrier



HPD
R&D
Review
in June

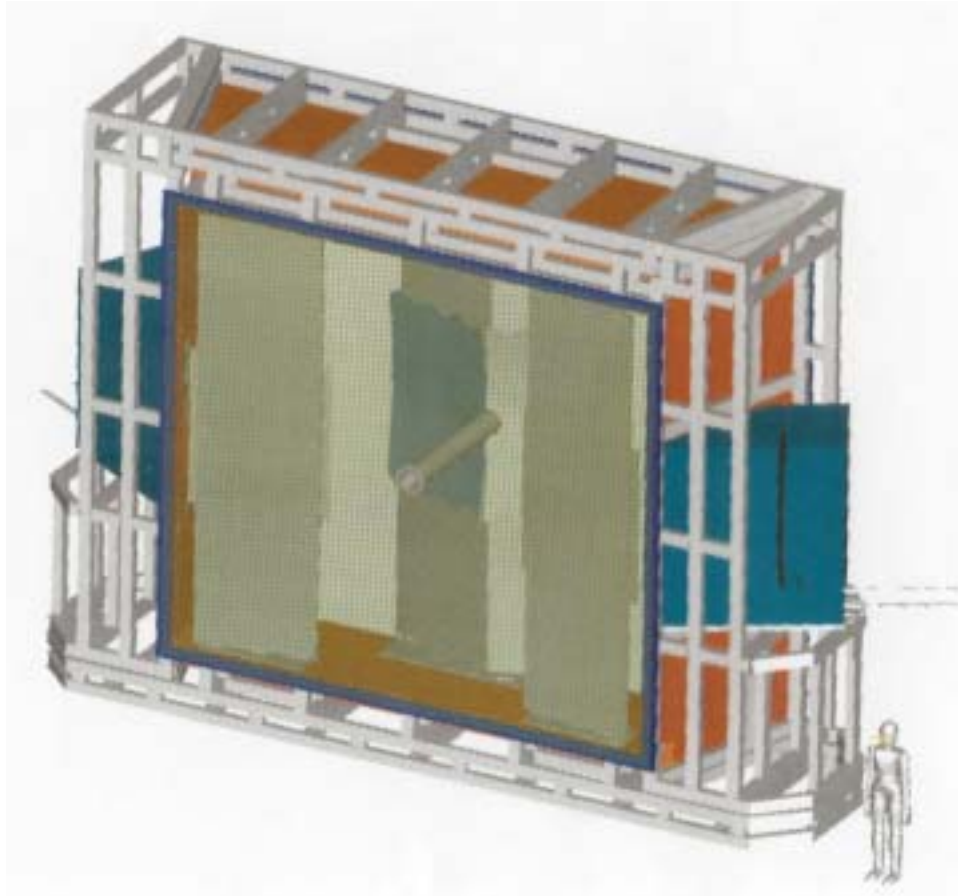
Bump-bonded assemblies



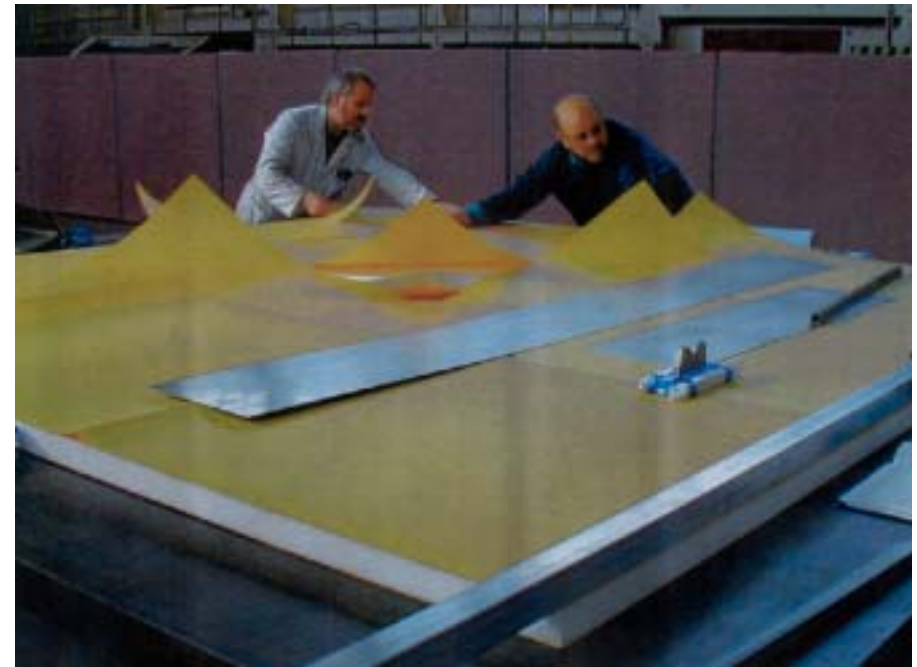
HPDs



RICH-2 EDR in progress



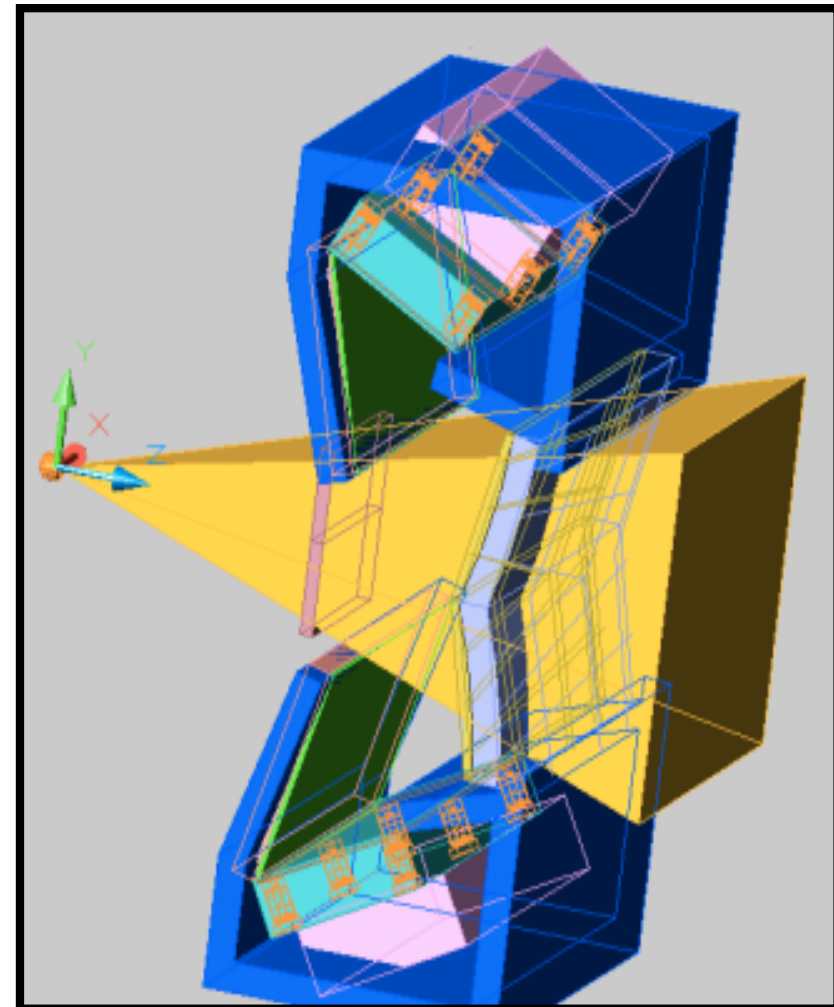
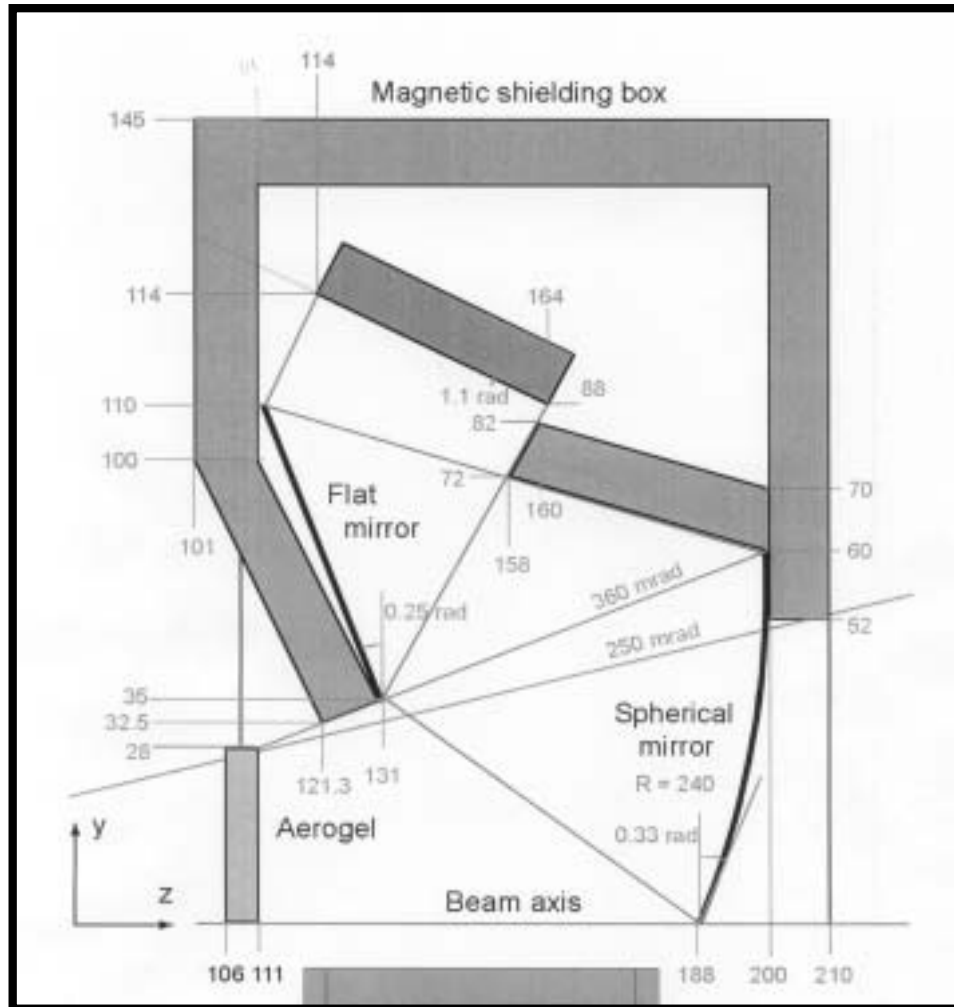
3d CAD model



Assembling
the prototype windows

LHCb-light

→ Some redesigning work needed for RICH-1



engineering design: LHCb-light TDR

Muon

funding responsibility: BR, IT, RU, CERN

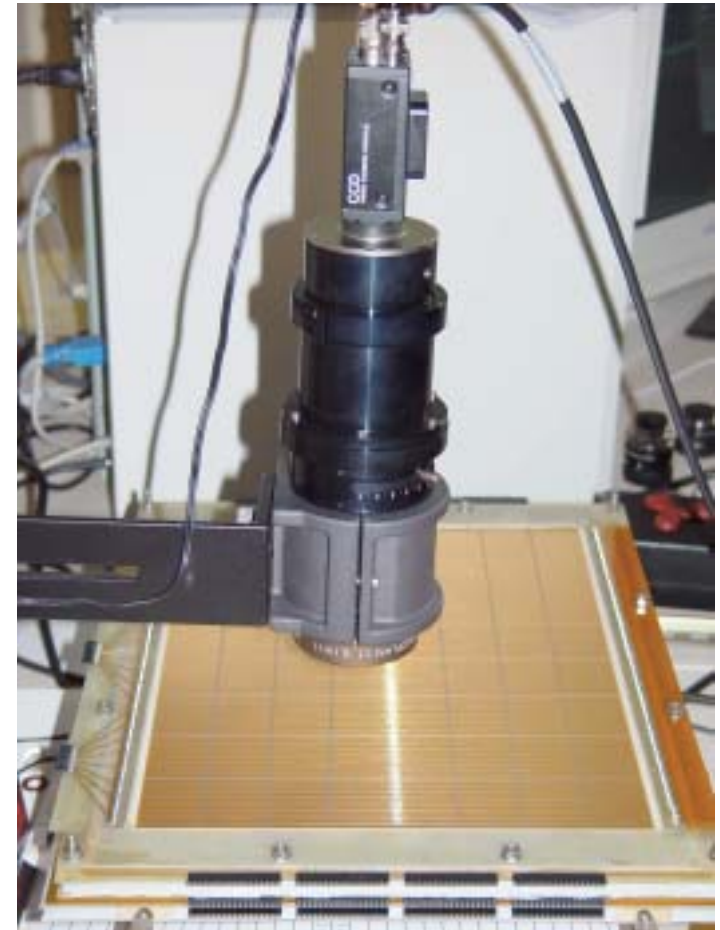


wiring
machine

production
tools being
prepared



soldering
machine

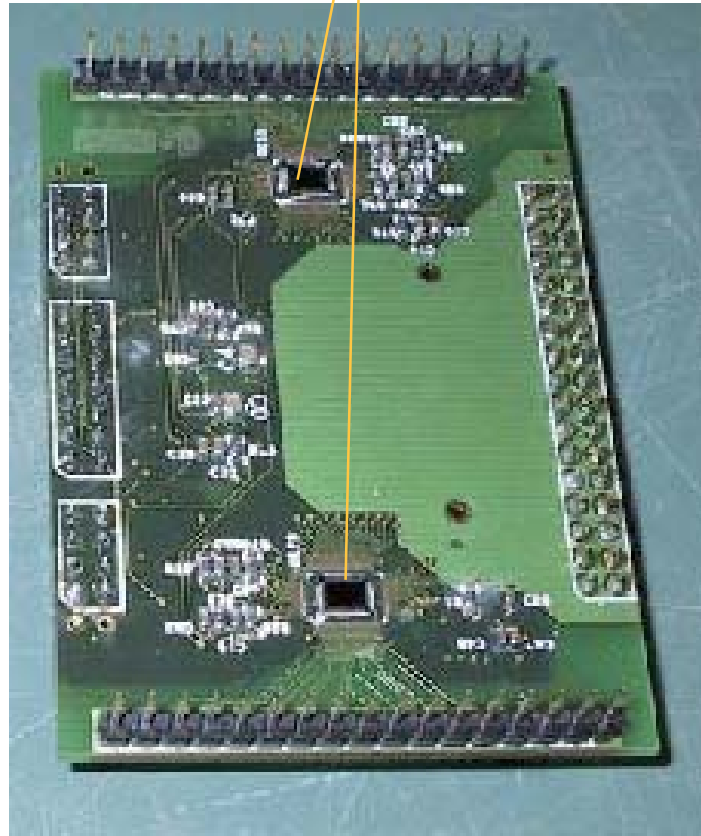


wire pitch
measurement machine

Recuperation of iron blocks
from the CERN neutrino beam line
for the muon shield



front-end board
with CARIOCA chip



Inner Tracker funding responsibility CH, DE, ES, UA

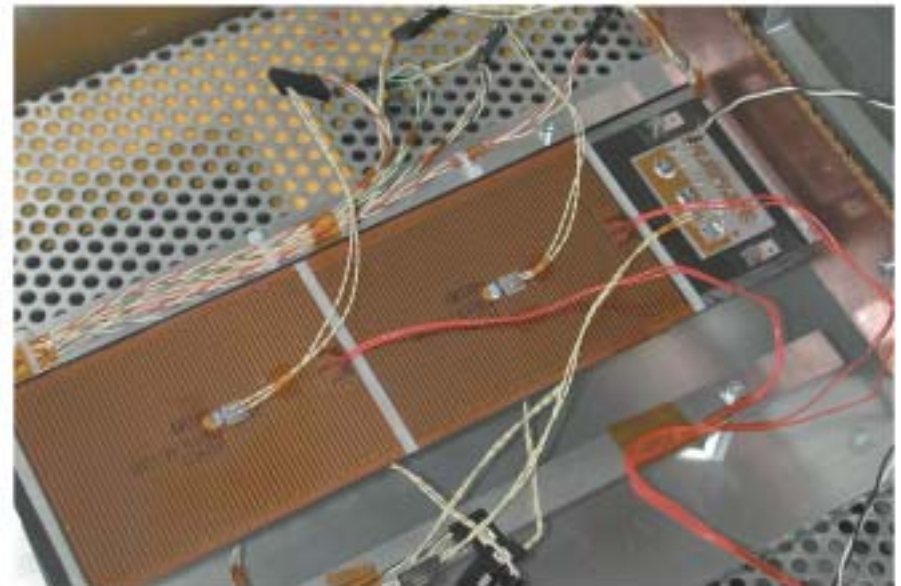
TDR to be submitted autumn of 2002

Si test, detector design and electronics development work
in progress and on schedule.

Si beam test with Beetle chip



Si ladder thermal test



Trigger

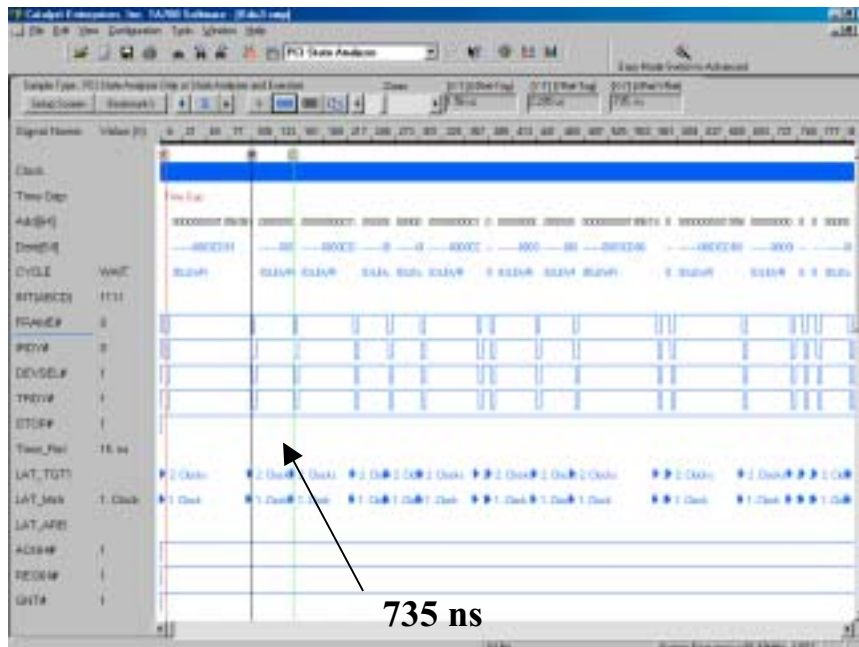
funding responsibility:

Level-0: FR(Calo, μ), IT(Calo), NL(Pile-up)

Level-1: CH, DE

Higher levels: CF (online filter farm)

TDR to be submitted beginning of 2003
design and prototype construction and testing work
in progress and on schedule



Level-1
SCI network prototype
data transfer test result

Computing

funding responsibility: CF

Online: DAQ and ECS

TDR approved (MoU cost)

main responsibility = CERN

however missing manpower

→ help needed from the collaboration

Offline: Software and Computing infrastructure

mid 2004: to be confirmed in alignment with other
LHC experiments and LHC-Grid project

Performance study for the remaining TDRs:

with OO based software

and events generated in FR, IT, GB, NL and CERN.

Computing agreement

Core task for the Online and Offline

CERN: institutional commitment

+ manpower contribution from the collaboration

→ Commitment expressed in a form of “agreement”

First signed agreement

Event visualization with LAL

In preparation

GRID related activities (UK)

Analysis framework (Brazil)

GEANT4 (Russia)

SPECS (LAL)

etc.

Summary

- Majority of the TDRs submitted and approved.
- Construction of Magnet and E/H-Cal modules proceeding in time and within the budget.
- Adjustment of the construction plan to the new LHC schedule in progress.
- Re-optimization of the detector proceeding as planned.

No cost over-run.

Full detector should be ready for the 2007 physics run.