

ACTIVITIES AT THE UNIVERSITY OF SANTIAGO DE COMPOSTELA

RECFA 29-03-2003

B. Adeva / USC

USC group members :

Bernardo Adeva Andany	Catedrático
Máximo Pló Casasús	Catedrático
J. Angel Hernando Morata	Prof. Titular
Juan J. Saborido Silva	Prof. Ayudante
Pablo Vázquez Regueiro	Postdoc
Manuel Sánchez García	Postdoc
Xosé Manuel González	Ph.D. student
Otón Vázquez Doce	Ph.D. student
Cristina Lois Vázquez	Ph.D. student
Antonio Romero González	Ph.D. student
Daniel Esperante Pereira	Ph.D. student*
Antonio Pazos Alvarez	Electronics Technician

Commitment of USC group : LHCb Silicon Tracker (ST)

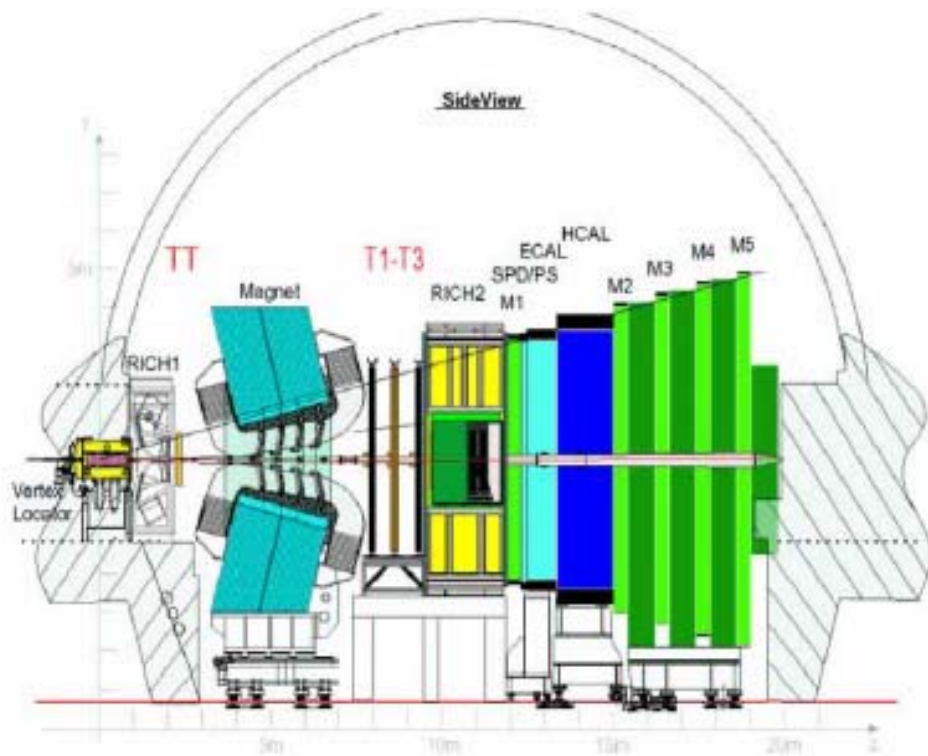
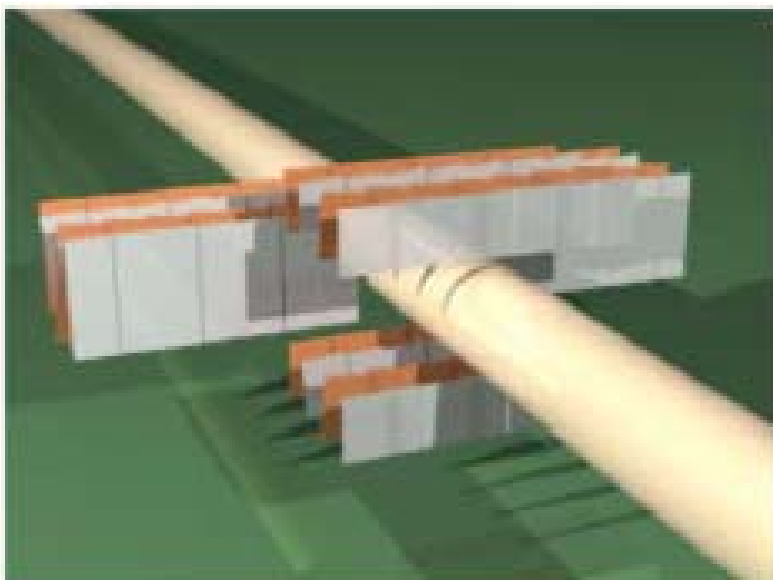
TDR : CERN LHCC 2002-029, TDR-8

Responsibility: Production site for ST1-2-3 stations with IPHE-Lausanne

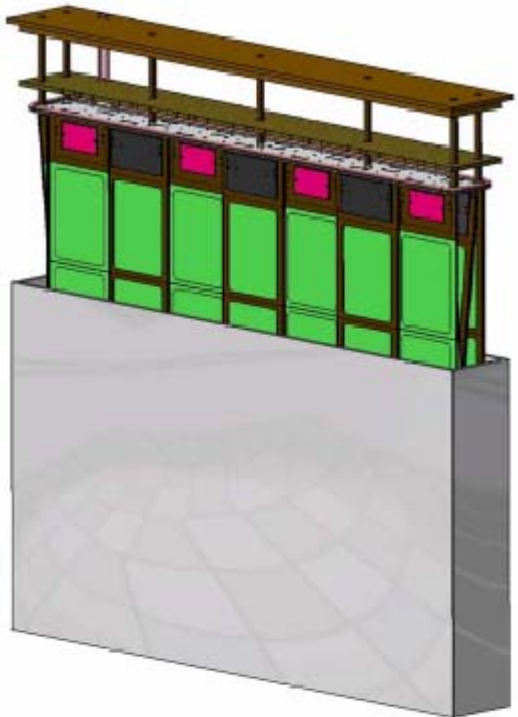
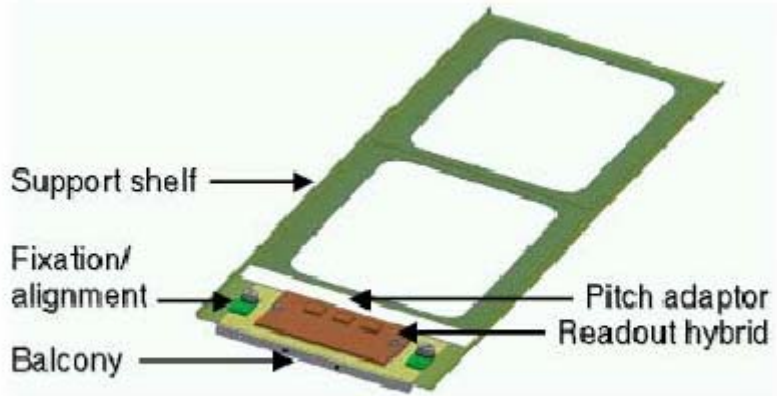
Production schedule : Start assembly Sept. 2004 until Sept. 2005

Collaborators LHCb ST :

Heidelberg, Lausanne, Kiev, Santiago, Zurich

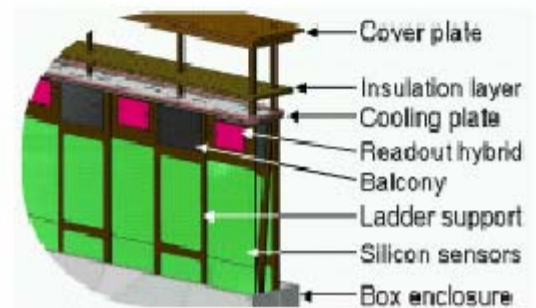


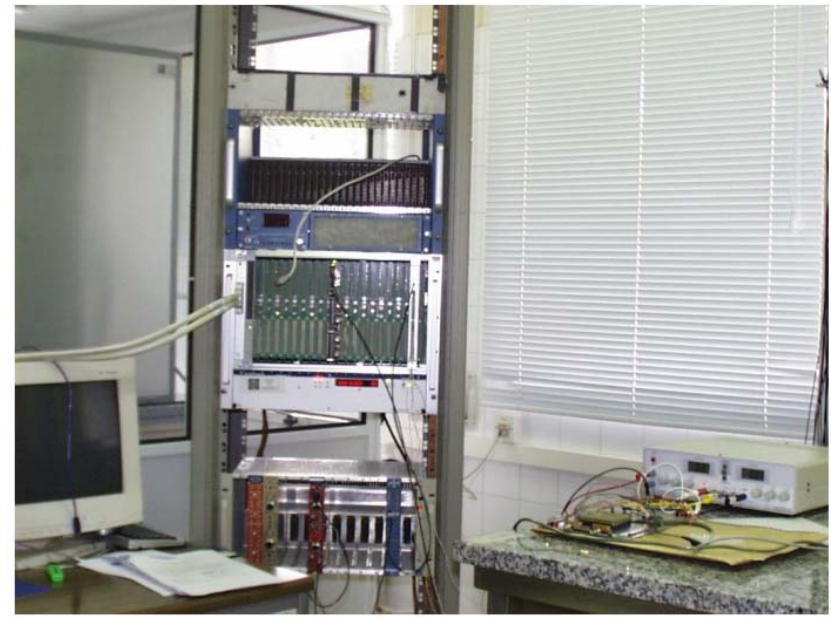
LHCb Silicon Tracker



LHCb Silicon Tracker

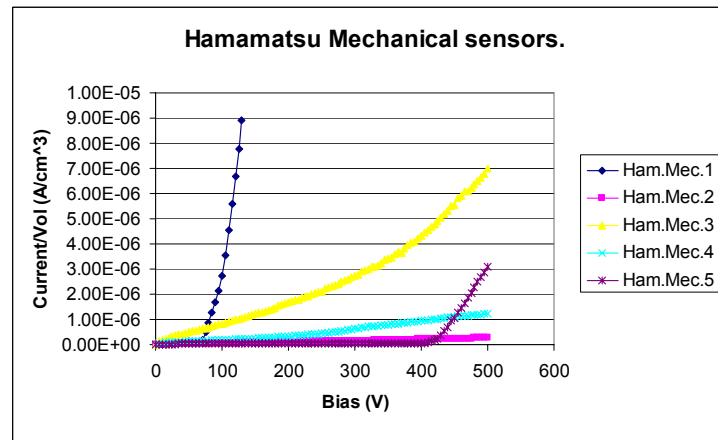
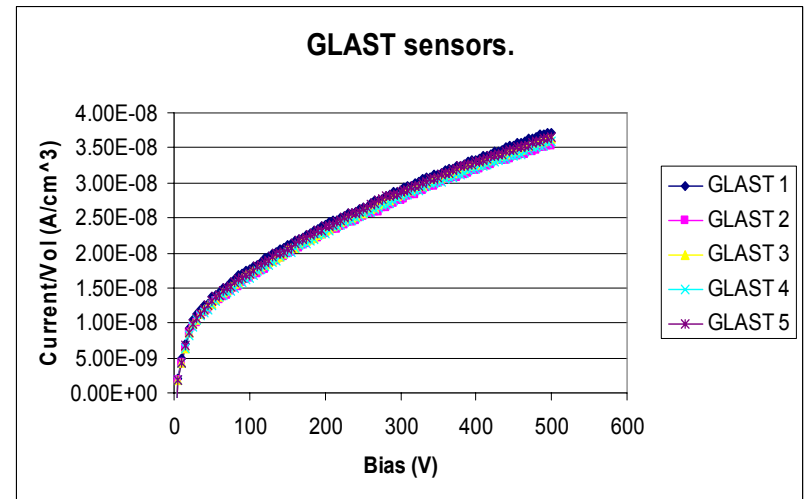
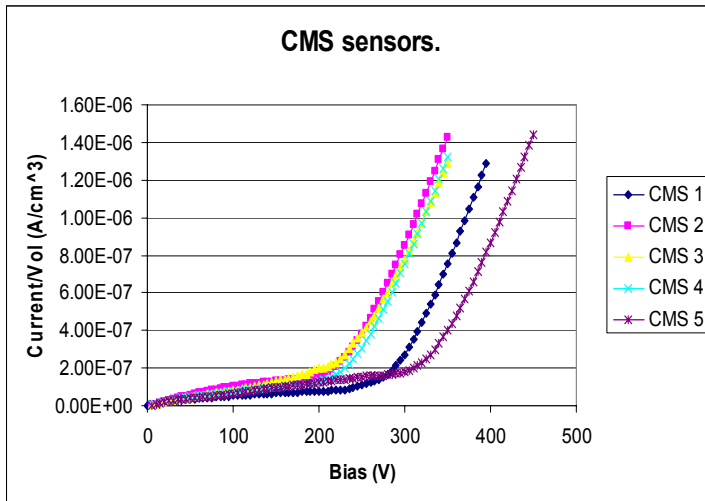
Ladder/Box assembly



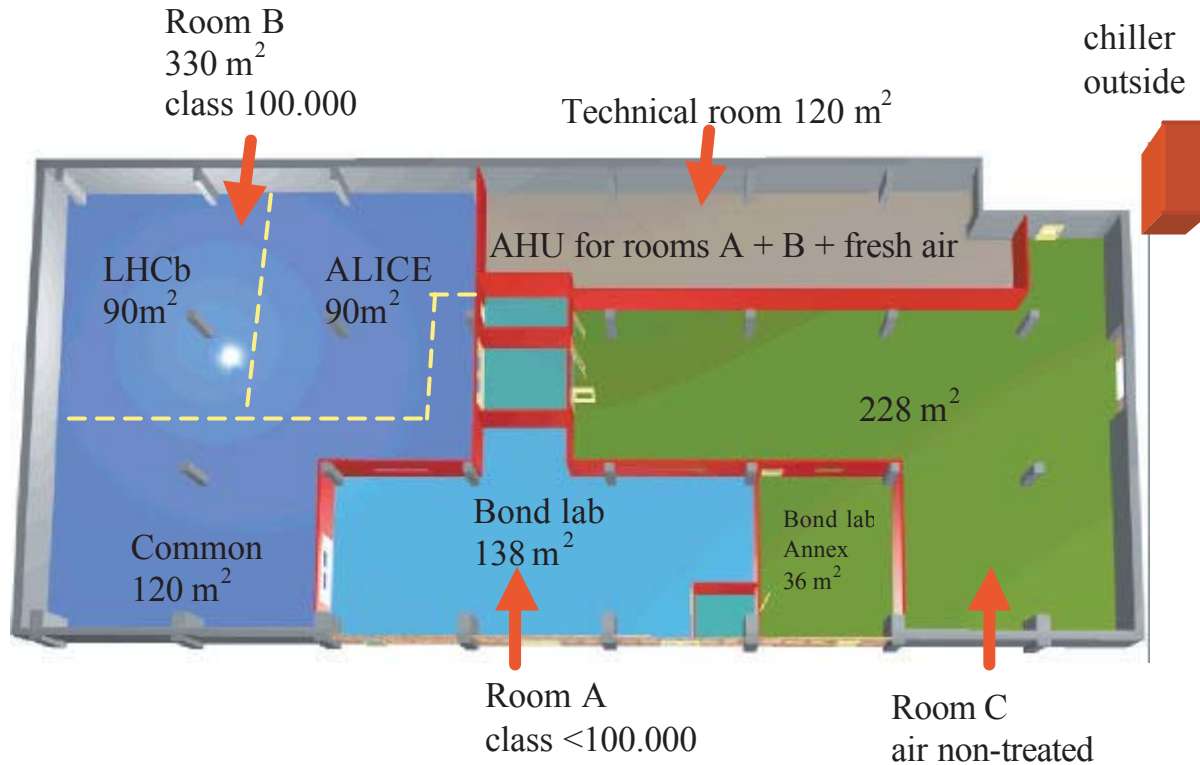


USC
Laboratory
Equipment

Measurements on Silicon sensors



ST production site at CERN (B186)



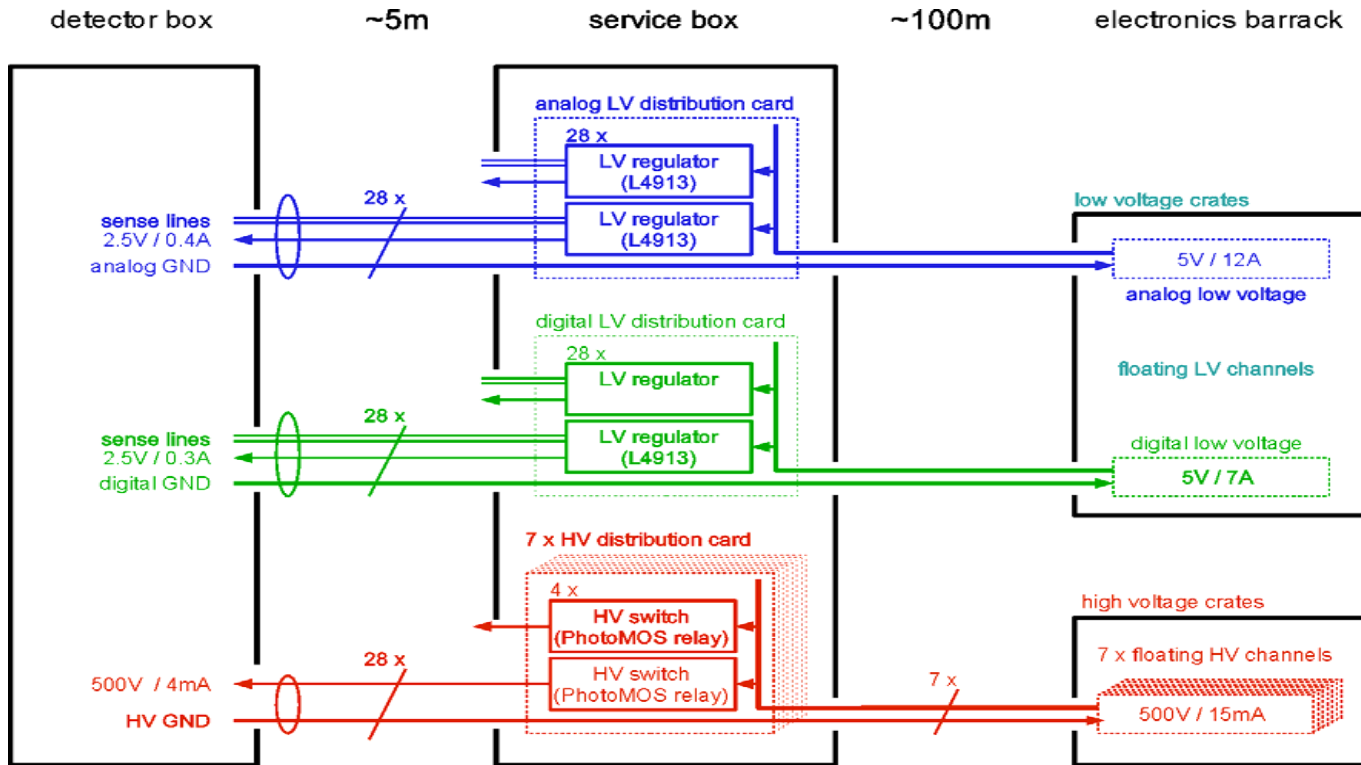
Planning for production site

Santiago/Lausanne groups

- Ladder & Box Assembly
 - Gluing
 - Planarity measurements
 - Micro-probing
 - Storage
- Bonding
 - Bonding machine: Kulike & Sofa 8060
 - Pull test
- Testing
 - VME and Labview based data acquisition
 - SEQSI
 - ODE



Power supply and monitoring



DIRAC EXPERIMENT (CERN PS212)

Production of Pionium ($\pi^+\pi^-$) Atoms and Lifetime Measurement

$a_0(\pi\pi)$ 5% precision at threshold, test of Chiral Perturbation Theory and vacuum structure of QCD

- Experiment started 1999, physics runs 2000-01-02
- New data run 2003 (4 month)

Collaborating institutions:

Prague, Ioannina, Frascati, Trieste, Kyoto-Sangyou, KEK, JINR, Bucharest, Moscow, Santiago, Basel, Bern, CERN

USC responsibility in DIRAC

- TOF detector
- GEM/MSGC tracking detector
- Level 3 Trigger

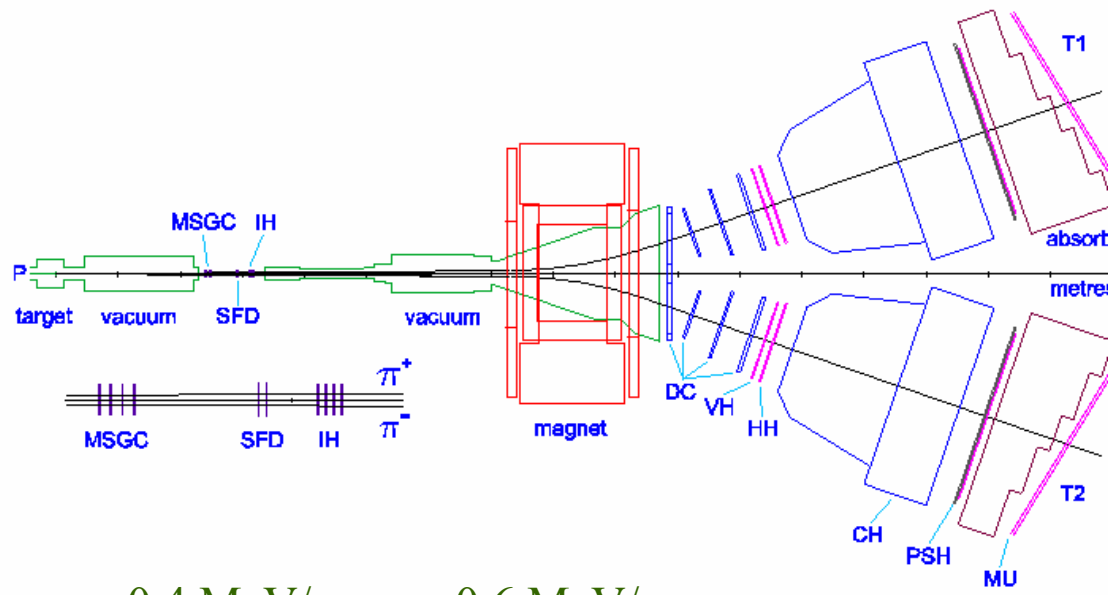
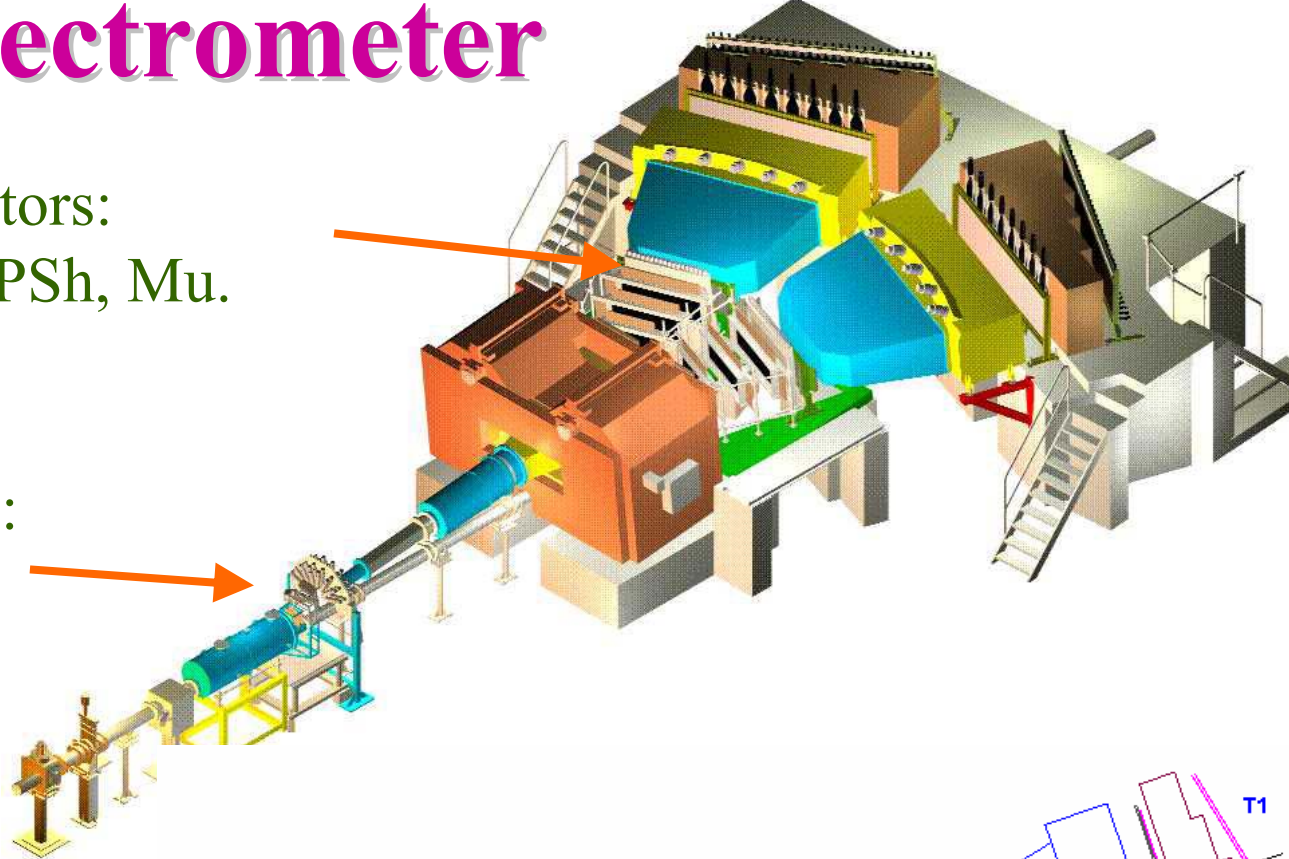
Total investment by USC ~ 1.2 MCHF

(20% of experiment)

DIRAC Spectrometer

Downstream detectors:
DCs, VH, HH, C, PSh, Mu.

Upstream detectors:
MSGCs, SciFi, IH.



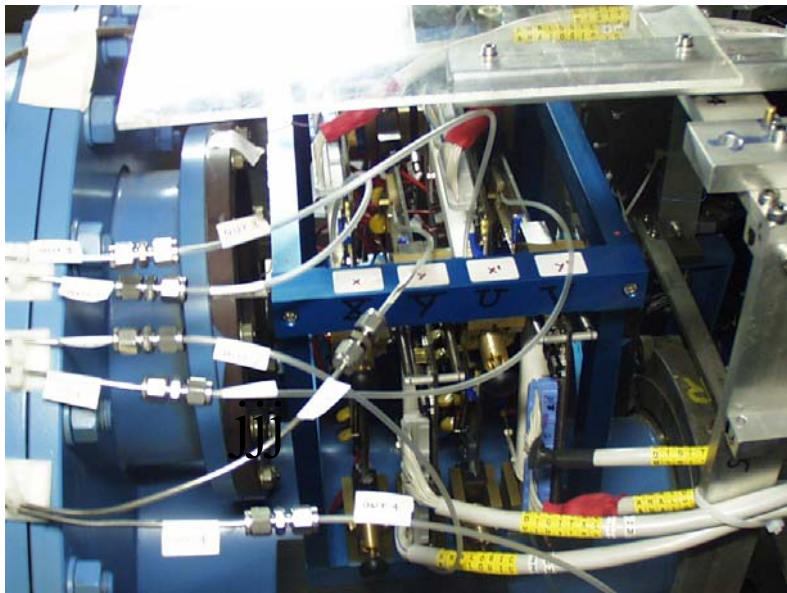
Setup features:

- magnet to proton beam $\Theta=5.7^\circ$
- channel aperture $\Omega=1.2 \cdot 10^{-3}$ sr
- magnet 1.85 T·m
- momentum range $1.2 \leq p_\pi \leq 7$ GeV/c
- resolution on relative momentum $\sigma_{p/p} = 0.4$ MeV/c $\sigma_{p/p} = 0.6$ MeV/c



TOF detector

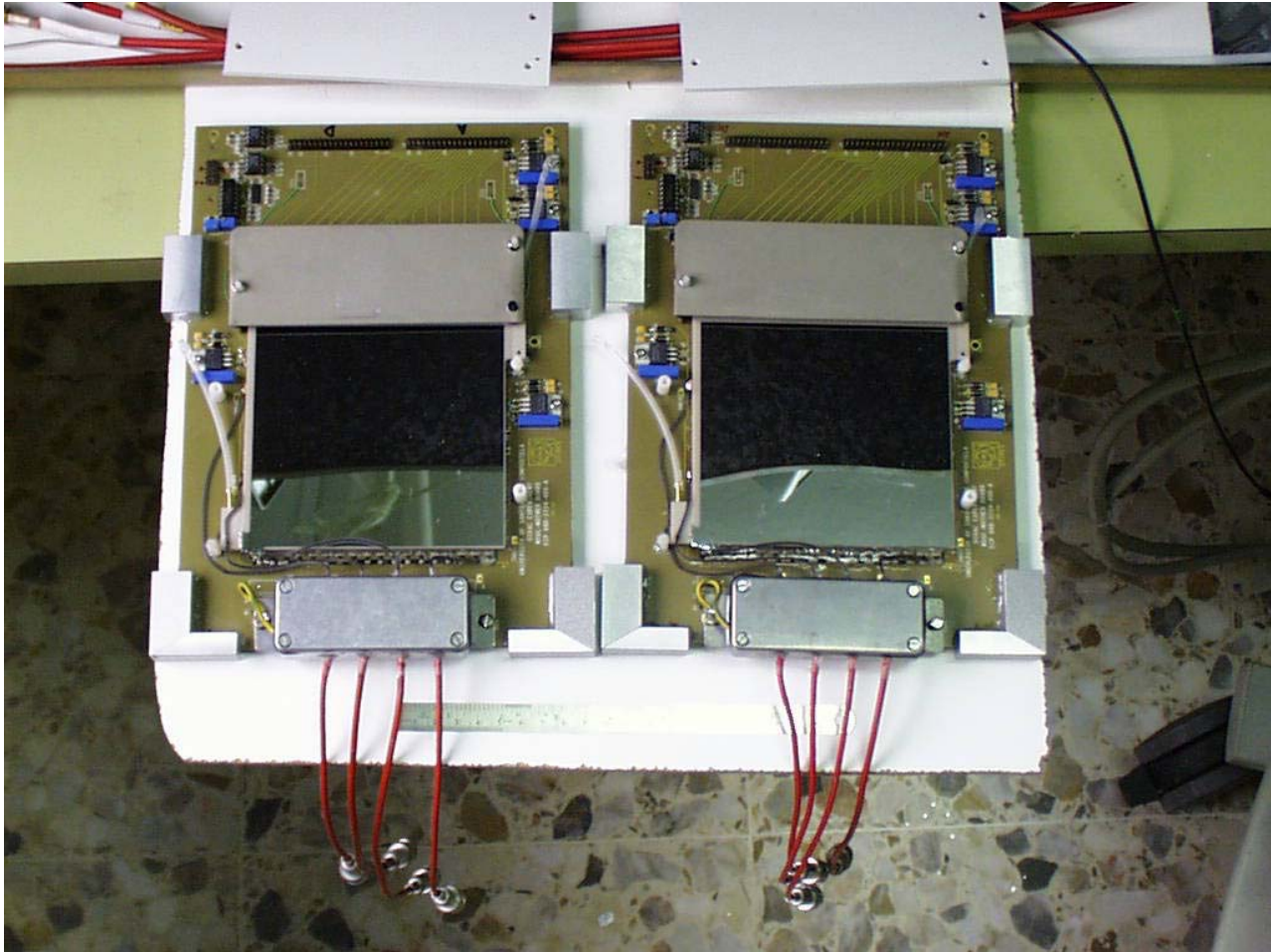
110 ps resolution



GEM/MSGC detector


10^5 pions $\text{cm}^{-2} \text{s}^{-1}$

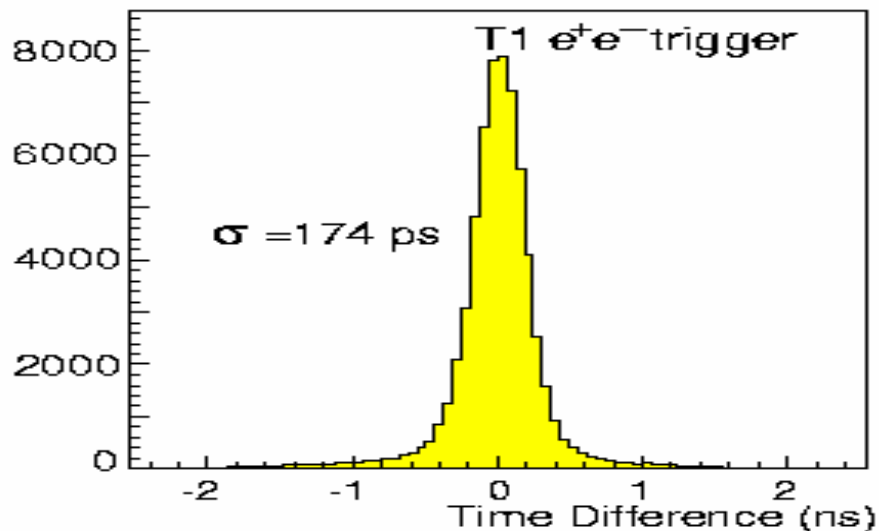
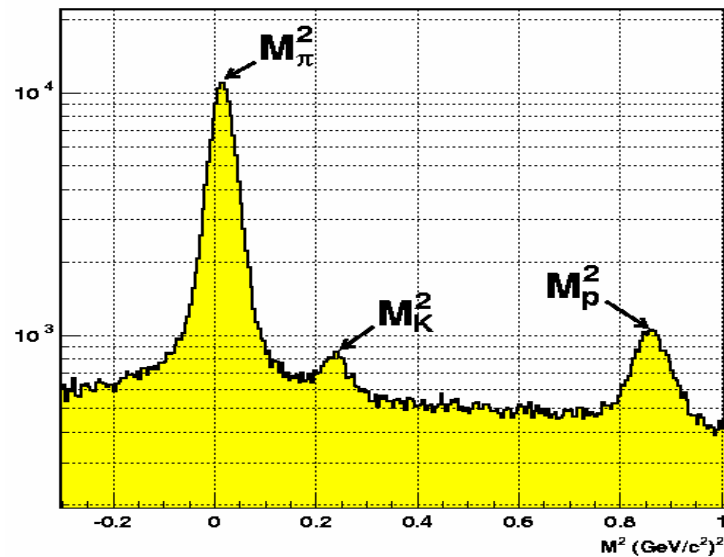
2K channels



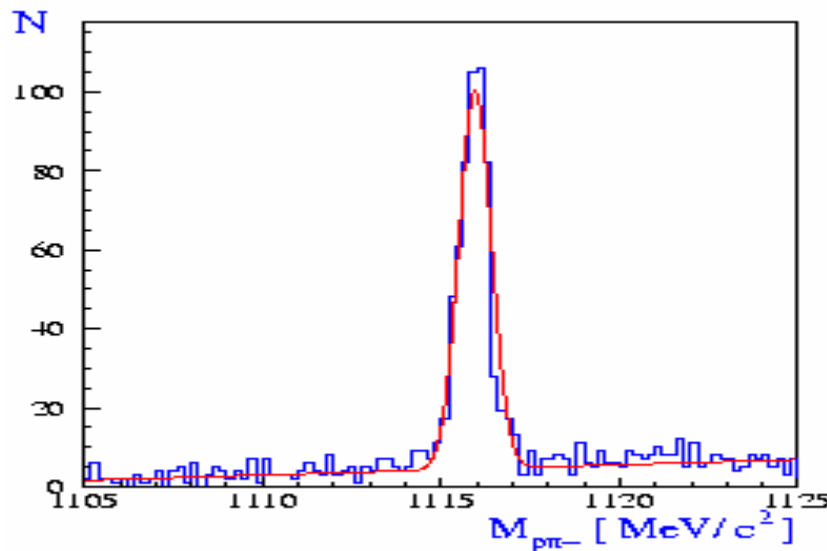
2 new GEM detectors installed in 2002

Calibration DIRAC spectrometer

Positive arm mass spectrum, obtained by time difference at TOF, under π^- hypothesis in the negative arm. 

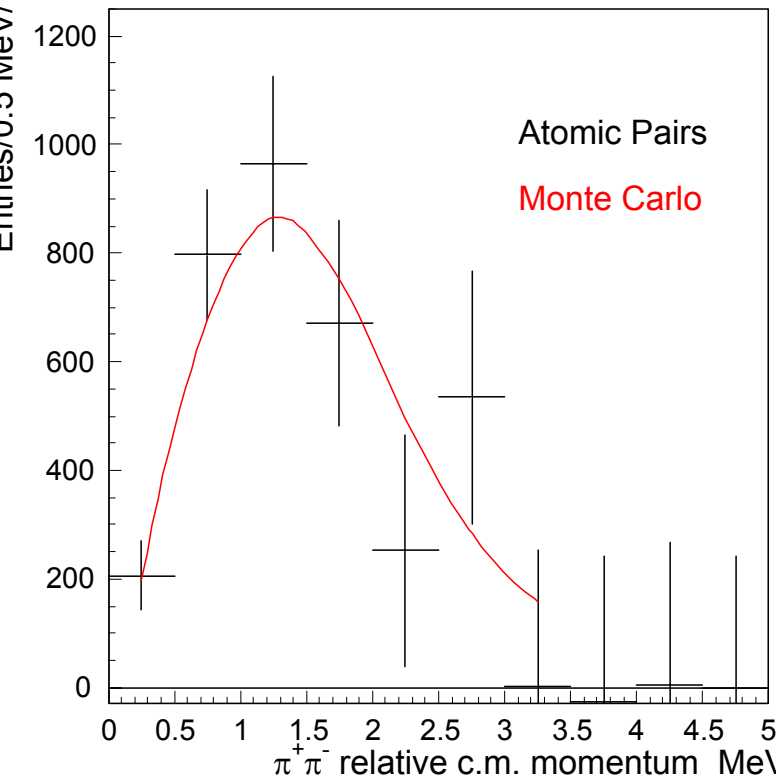


Time difference spectrum at TOF with e^+e^- T1 trigger.



Mass distribution of $p\pi^-$ pairs from Λ decay. $\sigma_{\Lambda} = 0.43 \text{ MeV}/c^2$ $< 0.49 \text{ MeV}/c^2$ (Hartouni et al.).

Pionium atom pairs



Sample	Triggers 10^6	n_a at $Q < 2 \text{ MeV}/c$	n_a at $Q < 3 \text{ MeV}/c$
Pt 1999	55.7	130 ± 43 (3.0σ)	207 ± 77 (2.7σ)
Ni 2000	896	920 ± 170 (5.4σ)	1335 ± 300 (4σ)
Ti 2000+01	910	1170 ± 190 (6.2σ)	1495 ± 340 (4.4σ)
Ni 2001	647	2686 ± 310 (8.7σ)	3500 ± 510 (6.9σ)
Ni 2002 (15 day)	77	400 ± 100 (4σ)	545 ± 170 (3.2σ)

Silicon Tracker LHCb Milestones

Project	
- Decision on production site	June 03
- Design review	Dec. 03
- Production site ready	June 04
- Ladder production	Sept 04
Silicon sensors	
- Final order	Mar 04
- Start delivery	Sept 04
Mechanics	
- First ladder support delivered	Aug 04
- First detector box delivered	Nov. 04

Sensor characteristics

Sensor		Size (mm ²)	Thickness (μm)	Volume (cm ³)	Pitch (μm)	w/p
Ham. Mech.	A	110×78	320±20	2.75	198	0.252
	B				198	0.303
	C				198	0.354
	D				237.5	0.295
	E				237.5	0.358
GLAST		89.5×89.5	410±15	3.28	228	0.246
CMS		94.4×96.4	500±20	4.55	183	0.251