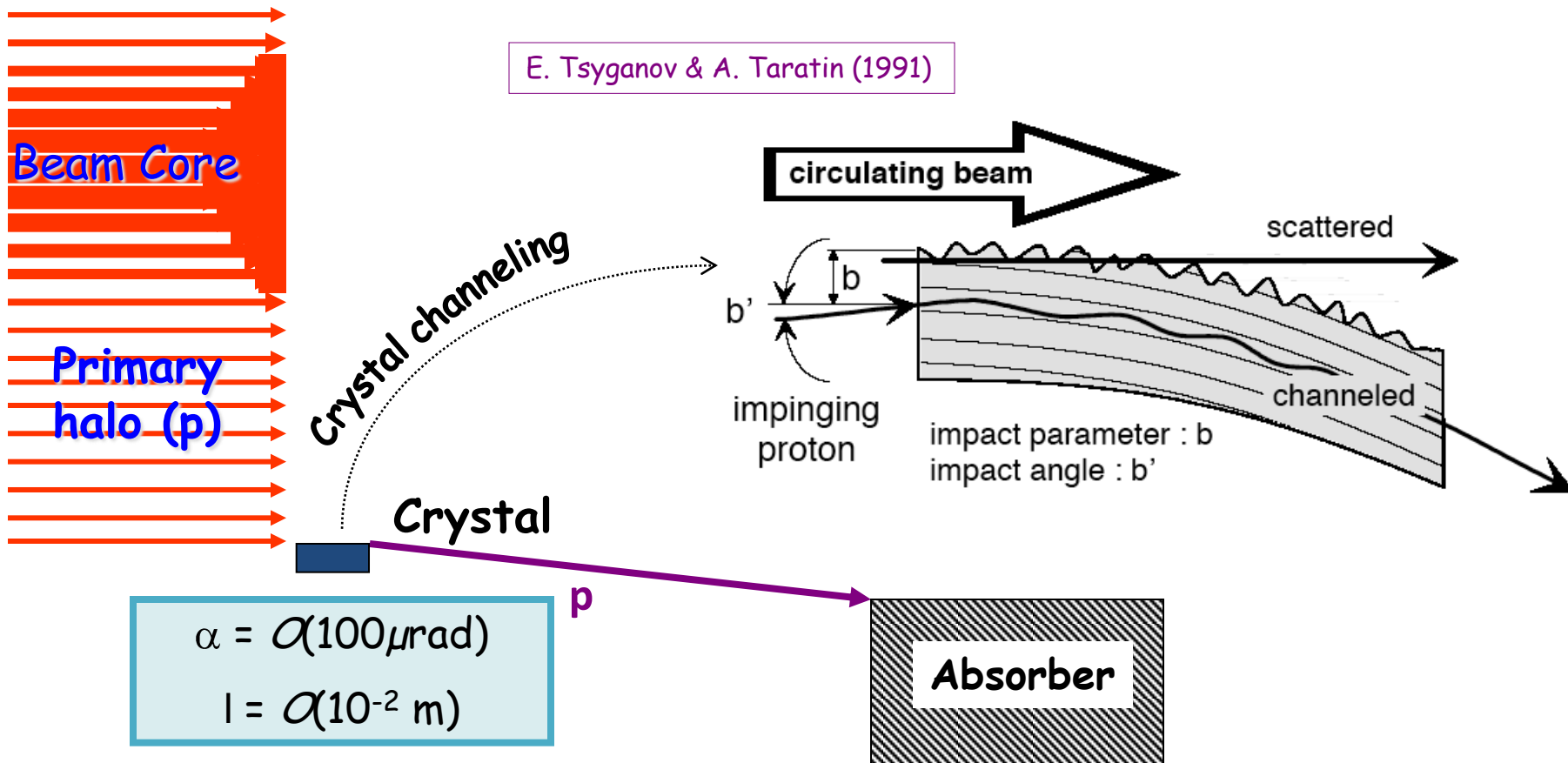


Goals of the workshop

Walter Scandale

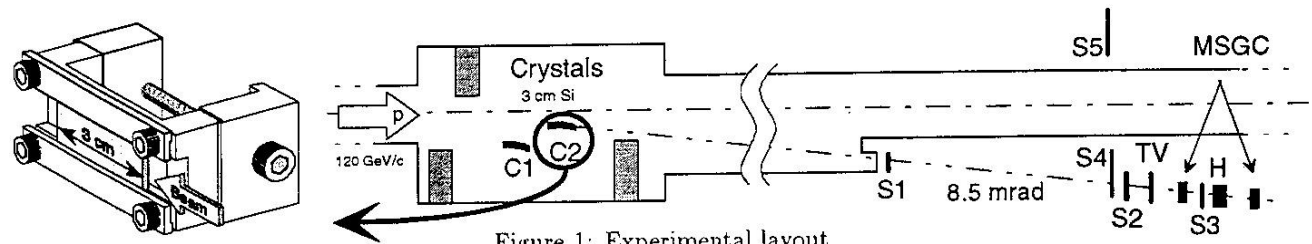
Crystal collimation

E. Tsyganov & A. Taratin (1991)

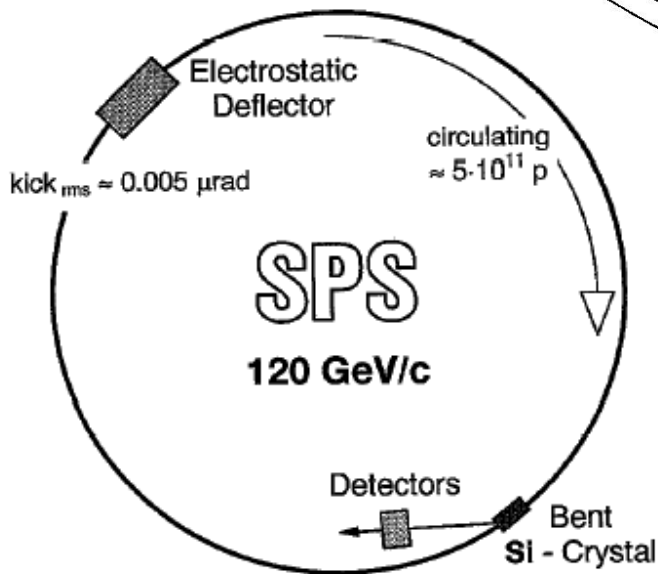


- ◆ Coherent deviation of the primary halo
- ◆ Very small probability of inelastic interaction in the crystal
- ◆ Larger collimation efficiency
- ◆ Less impedance
- ◆ Reduced tertiary halo

RD 22: extraction of 120 GeV protons (SPS: 1990-95)



	Crystal 1	Crystal 2
beam intensity (protons)	$(7.0 \pm 0.1) \cdot 10^{11}$	$(3.7 \pm 0.1) \cdot 10^{11}$
beam lifetime (hrs)	20 ± 2	12 ± 1
protons lost per second	$(6.7 \pm 0.6) \cdot 10^6$	$(8.9 \pm 0.7) \cdot 10^6$
protons detected per second	$5.6 \cdot 10^5$	$6.6 \cdot 10^5$
background (%)	5	2
detection efficiency (%)	78 ± 12	78 ± 12
extraction efficiency (%)	10.2 ± 1.7	9.3 ± 1.6



The RD22 Collaboration, CERN DRDC 94-11

- ◆ Large channeling efficiency measured for the first time
- ◆ Consistent with simulation expectation extended to high energy beams
- ◆ Experimental proof of multi-turn effect (channeling after multi-traversals)
- ◆ Definition of a reliable procedure to measure the channeling efficiency

Crystal collimation at RHIC

- ◆ Indirect experiment (measure particles disappearance) with Au and p runs
- ◆ Si crystal 5×1 mm with $\theta_B=465$ mrad located in interaction region matching section
- ◆ Positioning not optimal (large beam divergence and $\alpha \neq 0$)
- ◆ Crystal bends in the same plane where it scrapes \Rightarrow sensitivity to horiz. halo

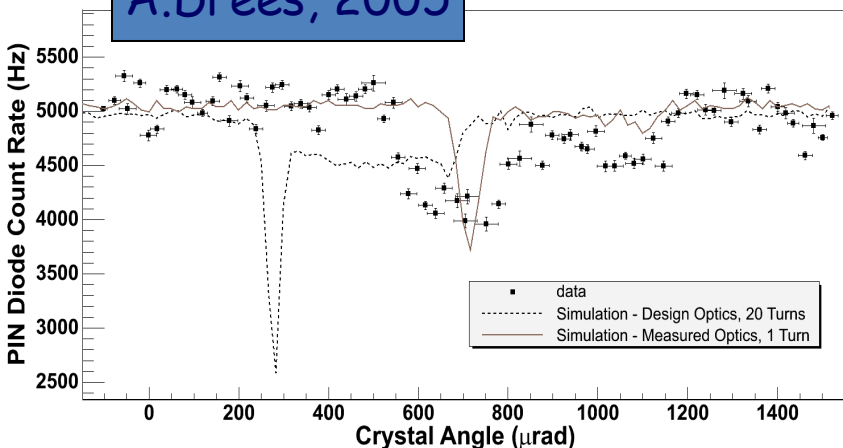
No clear interpretation of the results!

- ◆ Measured ch. efficiency ($\sim 25\%$) doesn't match theoretical predictions (56% with nominal machine optics). Better agreement and consistency when using measured beam divergence \square need accurate knowledge of lattice functions.
- ◆ Multipass physics and halo distribution models too simplistic?
- ◆ Low channelling efficiency \Rightarrow collimation not successful & increased backgrounds !!

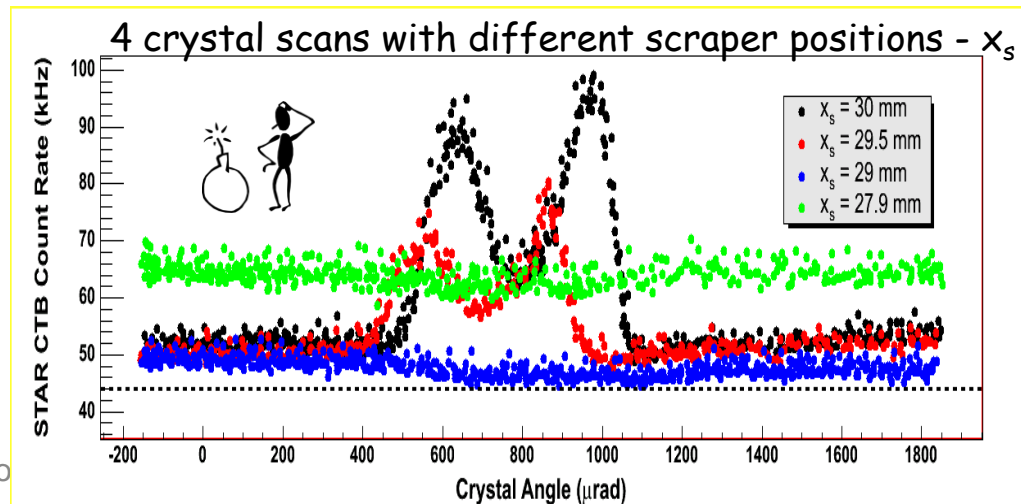
R.Fliller III,
A.Drees, 2005

STAR Background during crystal collimation

Not conclusive &
abandoned !

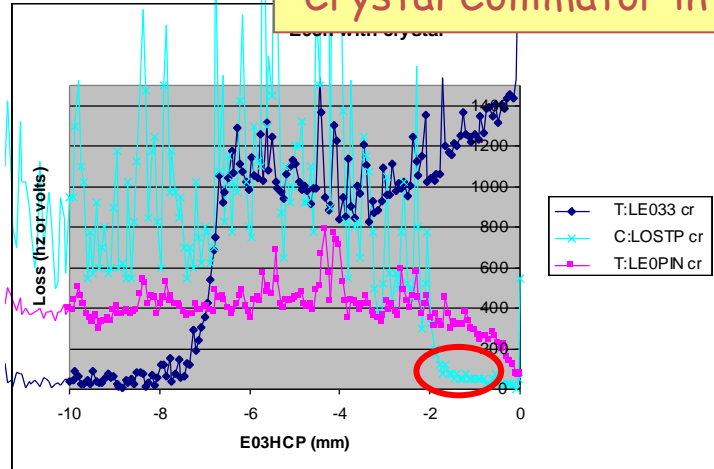


tio

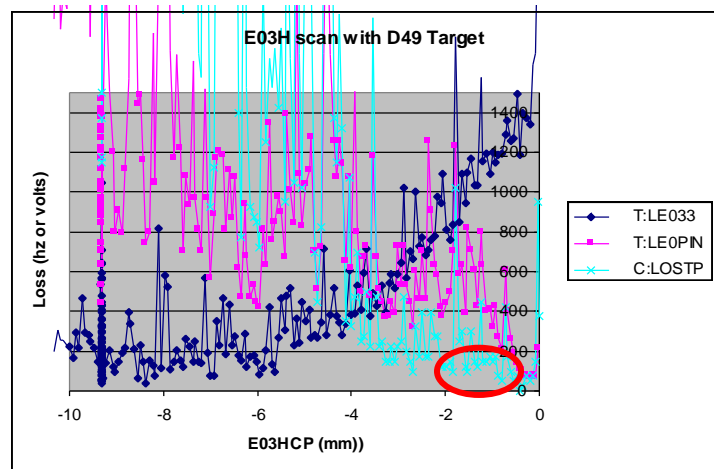


Crystal collimation at FNAL - T890 experiment

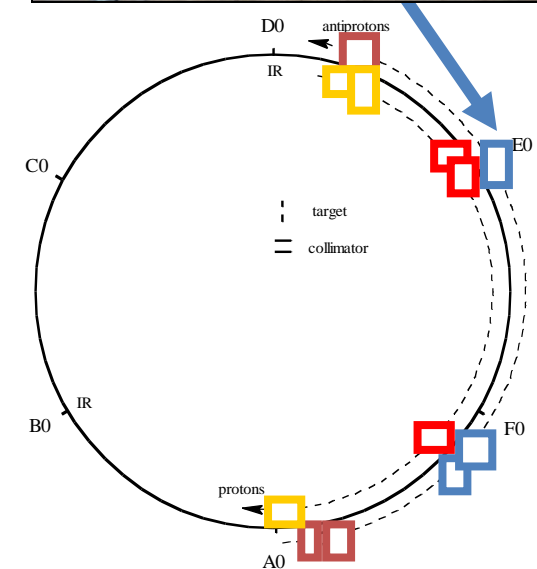
Crystal Collimator in E0 replacing a Tungsten Target (2005)



Crystal



Tungsten scatterer



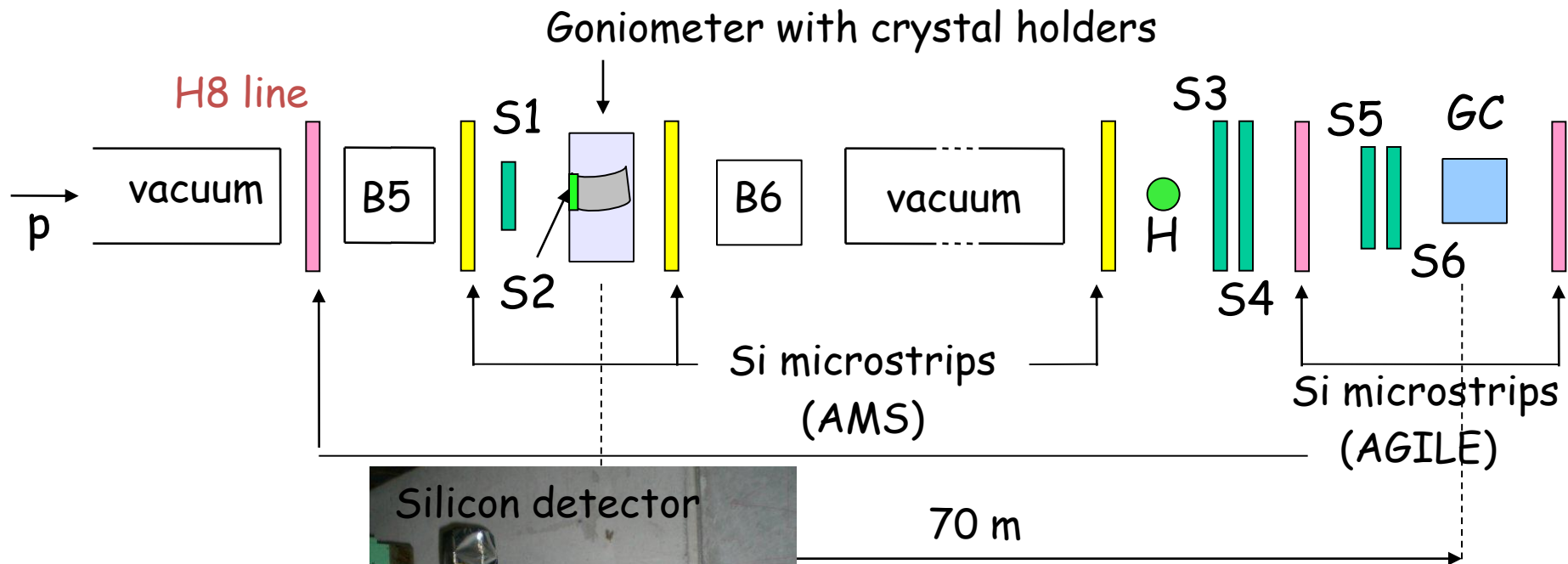
Using the crystal, the secondary collimator E03 can remain further (-1 mm or so) from the beam and achieve almost a factor of 2 better result!

What about CERN ?

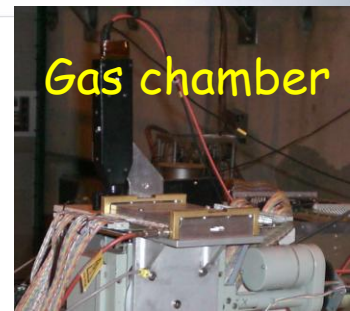
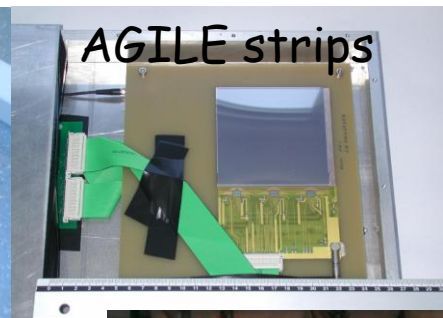
Intense theoretical and technological activity (1996-2006)

- The European Community-Research Infrastructure Activity under the FP6 "Structuring the European Research Area" program (CARE, contract number RII3-CT-2003-506395),
- Three INTAS programs
- The MIUR 2006028442 project,
- The Russian Foundation for Basic Research grant 06-02-16912,
- The Council of the President of the Russian Federation grant NSh-3057.2006.2,
- The Program "Physics of Elementary Particles and Fundamental Nuclear Physics" of Russian Academy of Sciences.
- INFN: NTA programme

H8-RD22 experiment (2006-'09)

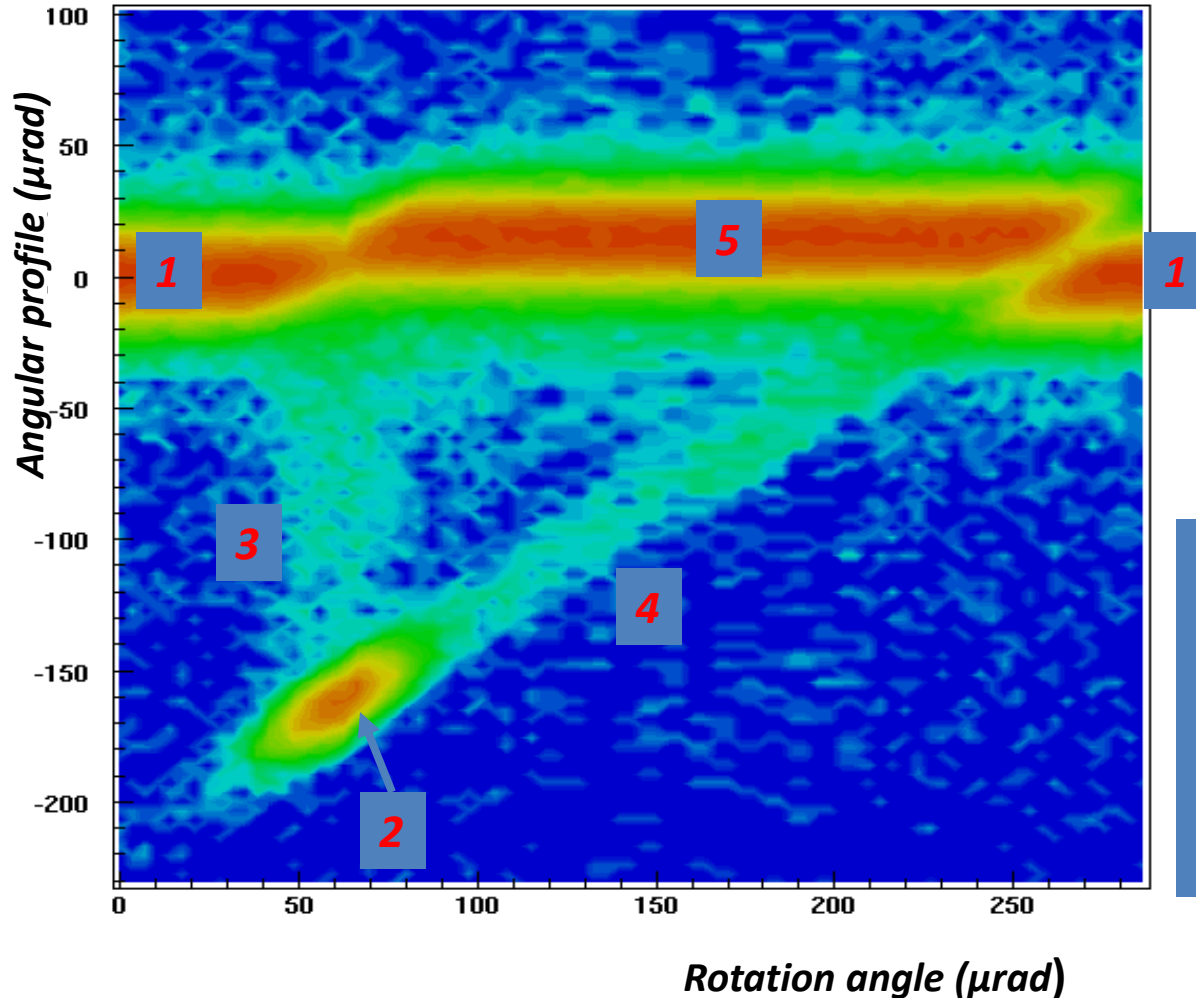


Granite Block



Angular beam profile as a function of the crystal orientation

9mm long Si-crystal deflecting 400GeV protons



The **angular profile** is the change of beam direction induced by the crystal

The **rotation angle** is angle of the crystal respect to beam direction

The **particle density** decreases from red to blue

- 1 - "amorphous" orientation
- 2 - channeling (50 %)
- 3 - de-channeling (1 %)
- 4 - volume capture (2 %)
- 5 - volume reflection (98 %)

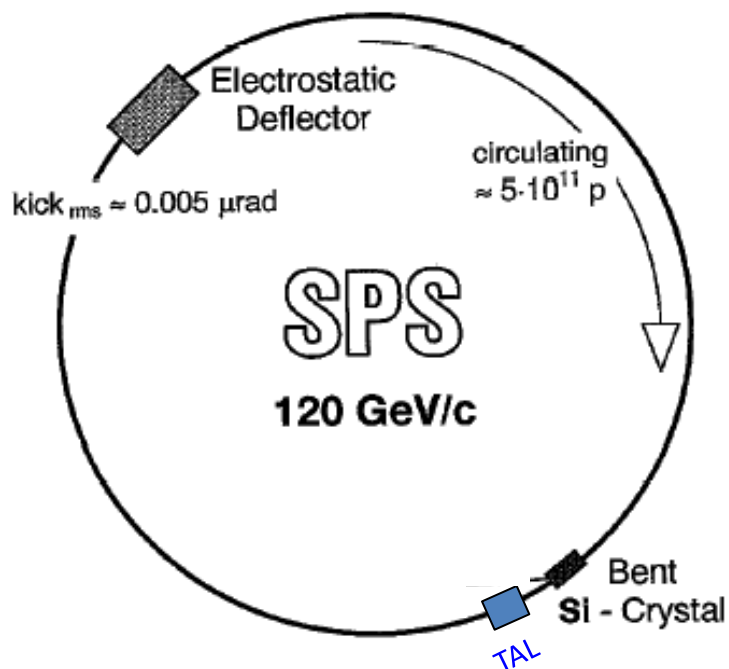
UA9

The underground experiment in the SPS

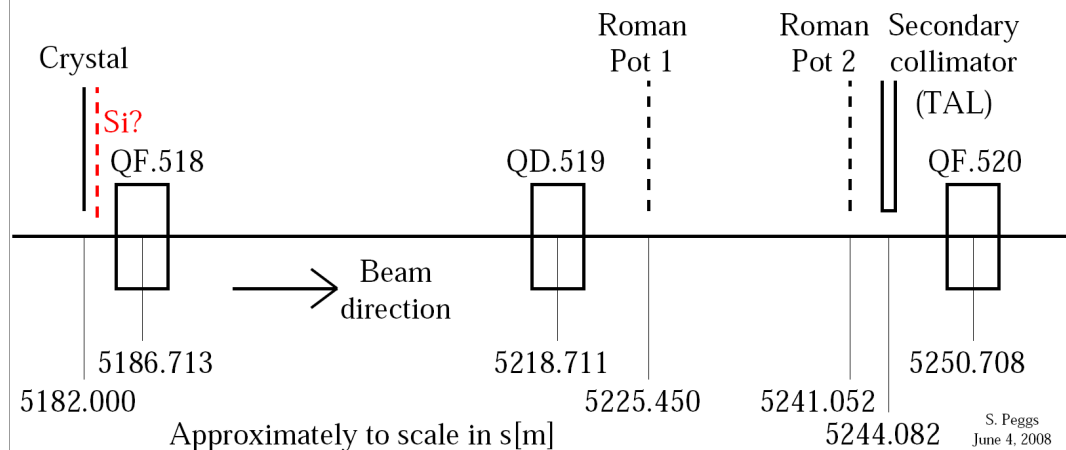
Approved by the CERN Research Board of the 3 Sept 2008

Goals:

- ◆ Demonstrate high efficiency collimation assisted by bent crystals (loss localization)
- ◆ Follow single particle dynamics in crystal-collimation system



CRYSTAL experiment layout



Workshop details

Session 1: The H8 experiment (-> add 10' talk by De Salvador on crystal characterization)

Session 2: The SPS experiment

(Oct 26 from 1100 to 1230: the three talks of Galluccio, Chesnokov and Cavoto and the discussion afterwards are intended as an extension of Session 2 in view of proposing advanced devices for UA9)

Session 3: Proposal of a crystal experiment in LHC (the talk of Previtali is cancelled)

Session 4: Crystals for LHC (or for advanced test in the SPS)

Session 5: Other applications and facilities

Session 6: UA9 collaboration meeting

- Working lunches and coffee breaks will be served in the Restaurant 2
- They will be offered to all participants and charged to the workshop.

In practice:

- Please collect your coupons and use them at the cashier of the Restaurant 2
- You can have a coffee and a pastry of your choice at each coffee break.
- You can have the lunch of your choice. Its cost will be written on your coupon and charged to us.