Pulsed Proton Linacs and Separated Beams

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Ultra-rare decay (kaon) experiments want separated beams

- Previous techniques work but are *painful* (e.g. P996, CKM)
- How can we do better?
- A CW pulsed Linac makes a kaon beam with:
  - high duty factor
  - Excellent TOF resolution
  - Makes separation easier.

FNAL P996 son of BNL E787/949

- Separated K+ beam using Electrostatic separators (**E-P**/mx**B** velocity filters)
- 50kV/cm - 600kV across 12 cm: (2m of 5MV/m E field)
- Total beam line length 13.2m - only 4% of the 550 MeV/c Kaons survive

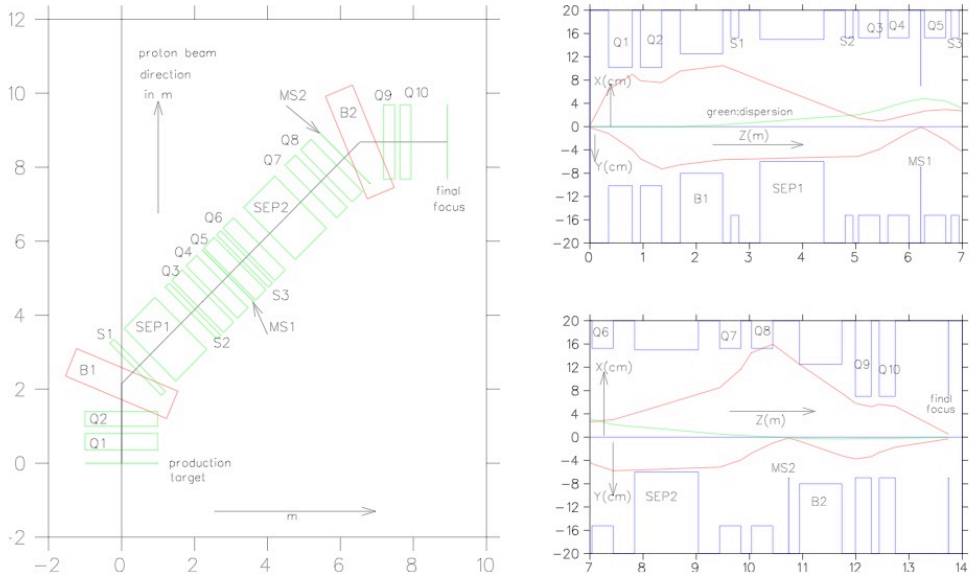
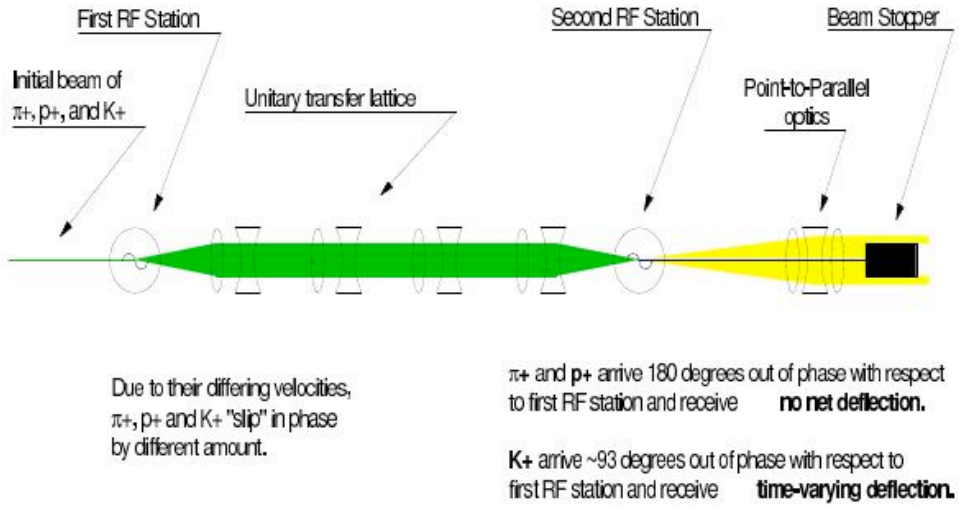


Figure 6.1: Left: The beamline layout. Right: The beam envelopes.

FNAL CKM (E921)

- CKM was designed with an SCRF Separated K+ beam using two 3.9GHzTransverse mode RF stations.
- Separator was a two station polarizer/analyser design. 70m long @ 22 GeV/c
- Designing and fabricating these would have been a big job.



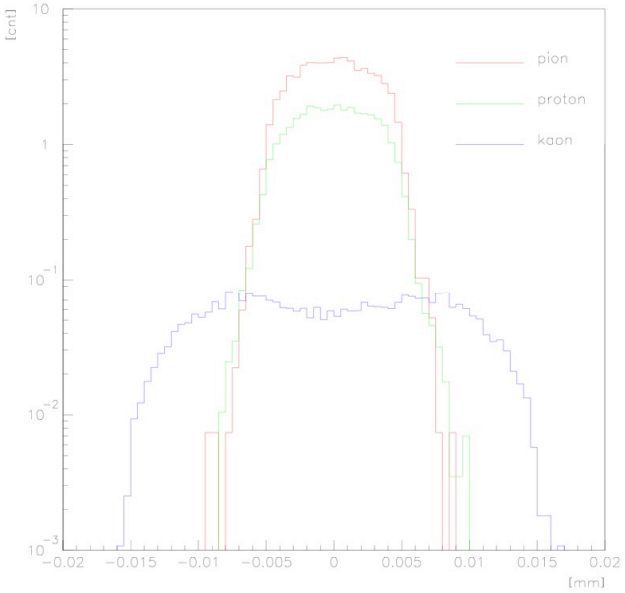


Figure 20: Layout of the beam line.

With ICD2 2.1 GeV CW Linac

- ~10 psec wide T= 2.1 GeV proton pulses at 300 MHz
- 550 MeV/c +/- 10% secondary beam at 1.4 m has infinite TOF separation
- Run beam sideways thru a 300 MHz accelerating cavity with transverse E field phased to kick pion and protons but not kaons. [~20MV/m *0.5m]
- Probably can build a beam line of half the P996 length. [Sqrt(0.04)=0.16]
- Separation isn't the only consideration - a real beam line design is required

I learned this trick from Gordon Thompson of Rutgers and the CPT experiment.