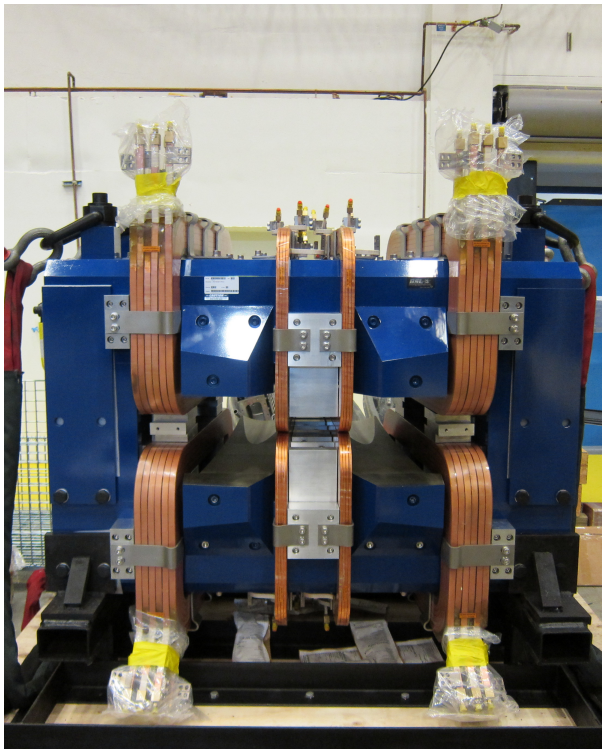
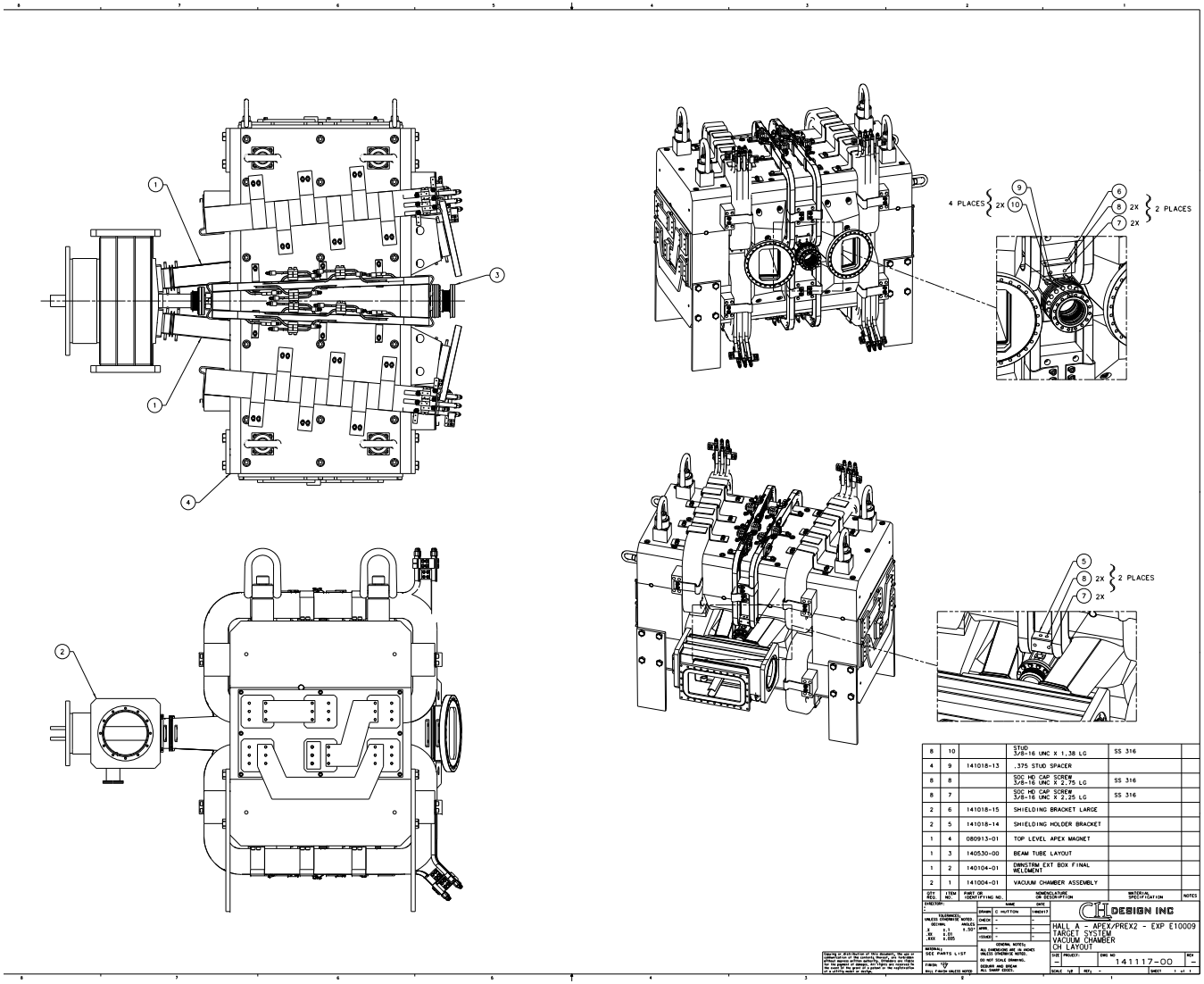
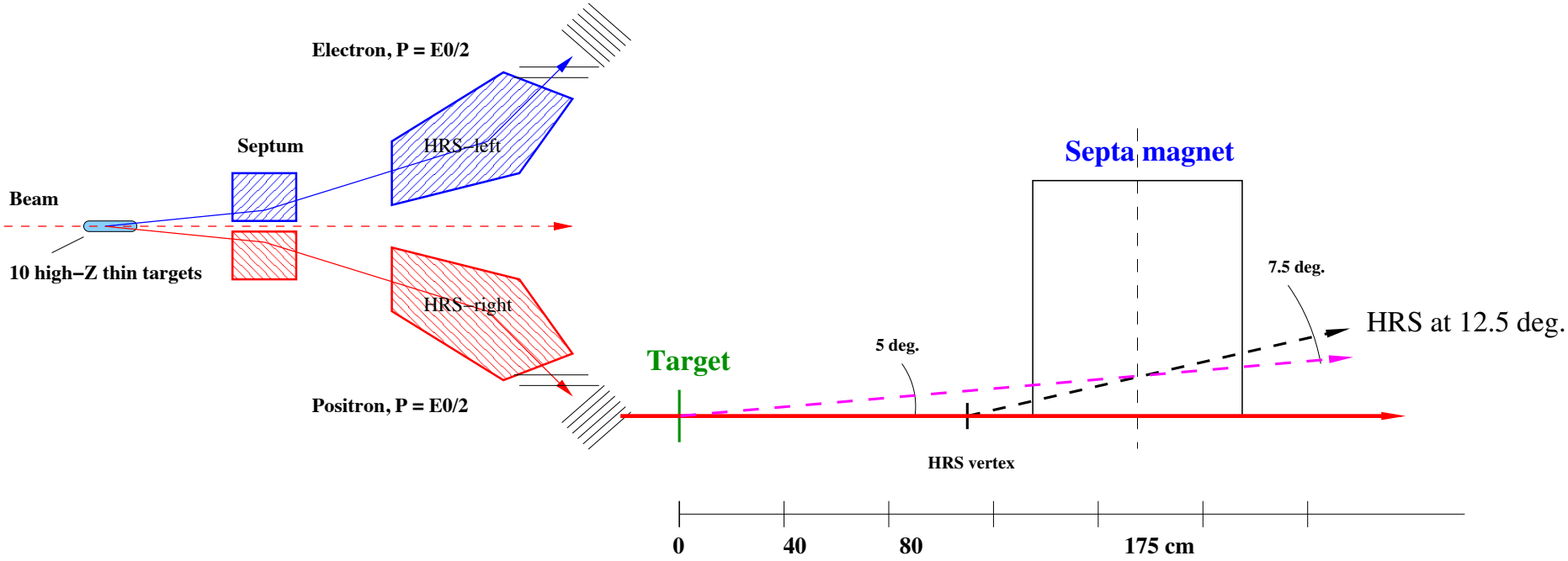
Specialized APEX hardware update

Bogdan Wojtsekhowski





Specialized APEX hardware: Septa magnet



Septa works well for $\Delta p/p << 1$. In HRS $\Delta p/p$ is of 0.09
Required field integral is 0.44 Tesla-m per 1 GeV/c
APEX is approved to run with 1.1, 2.2, 3.3, and 4.4 GeV beam energies,
which requires 0.55, 1.1, 1.65, and 2.2 GeV in HRS

The concept was used in two previous septa magnets and well understood

Specialized APEX hardware: Septa magnet

External shield

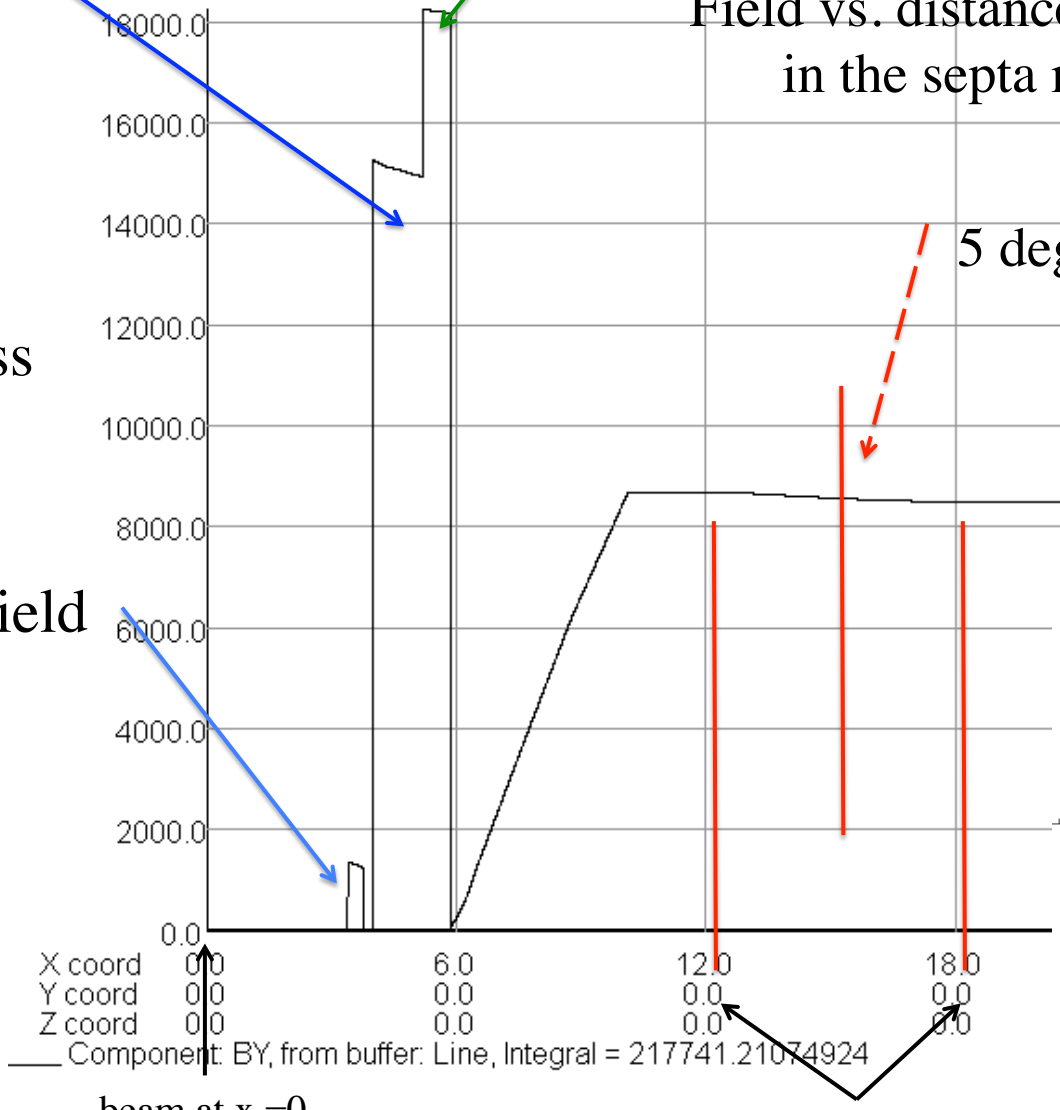
Permendur

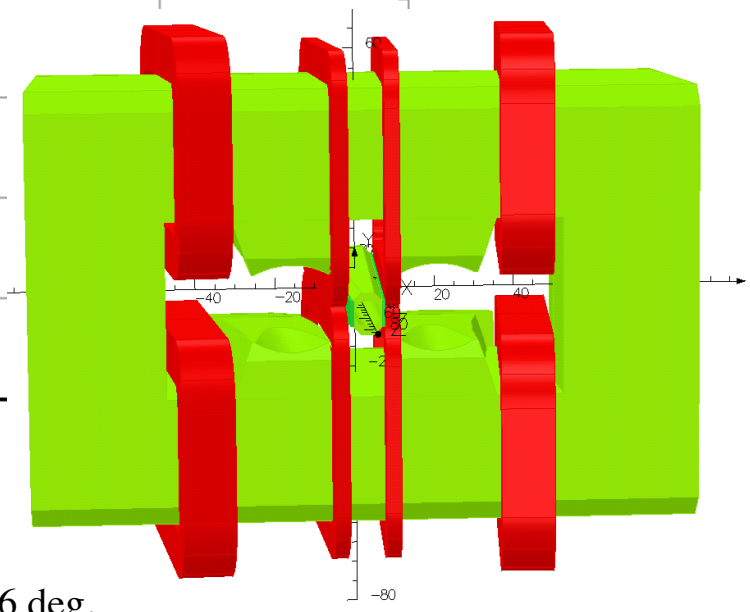
Field vs. distance from the beam,
in the septa middle plane

5 deg. trajectory passes here

B_y, Gauss

Inner shield

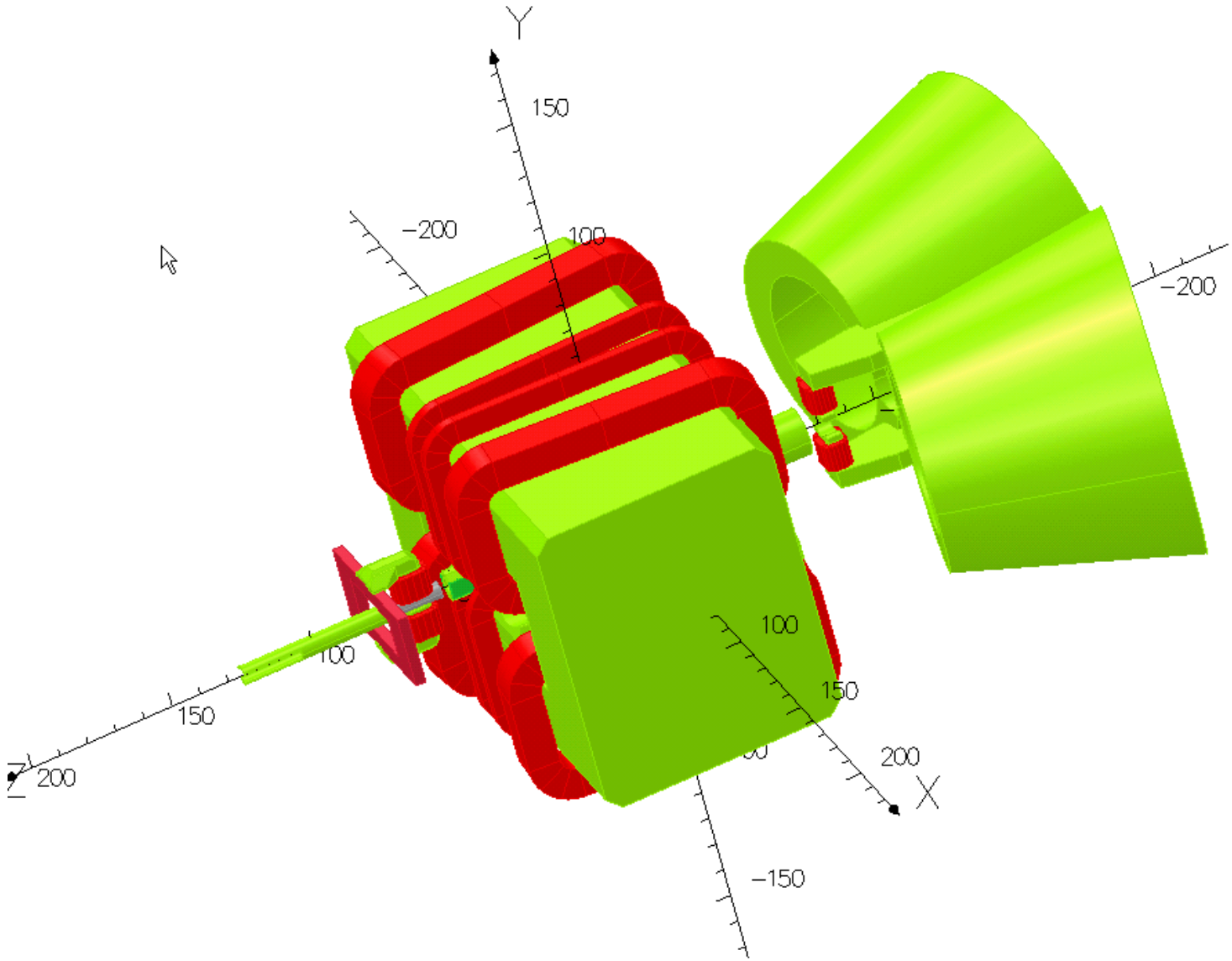




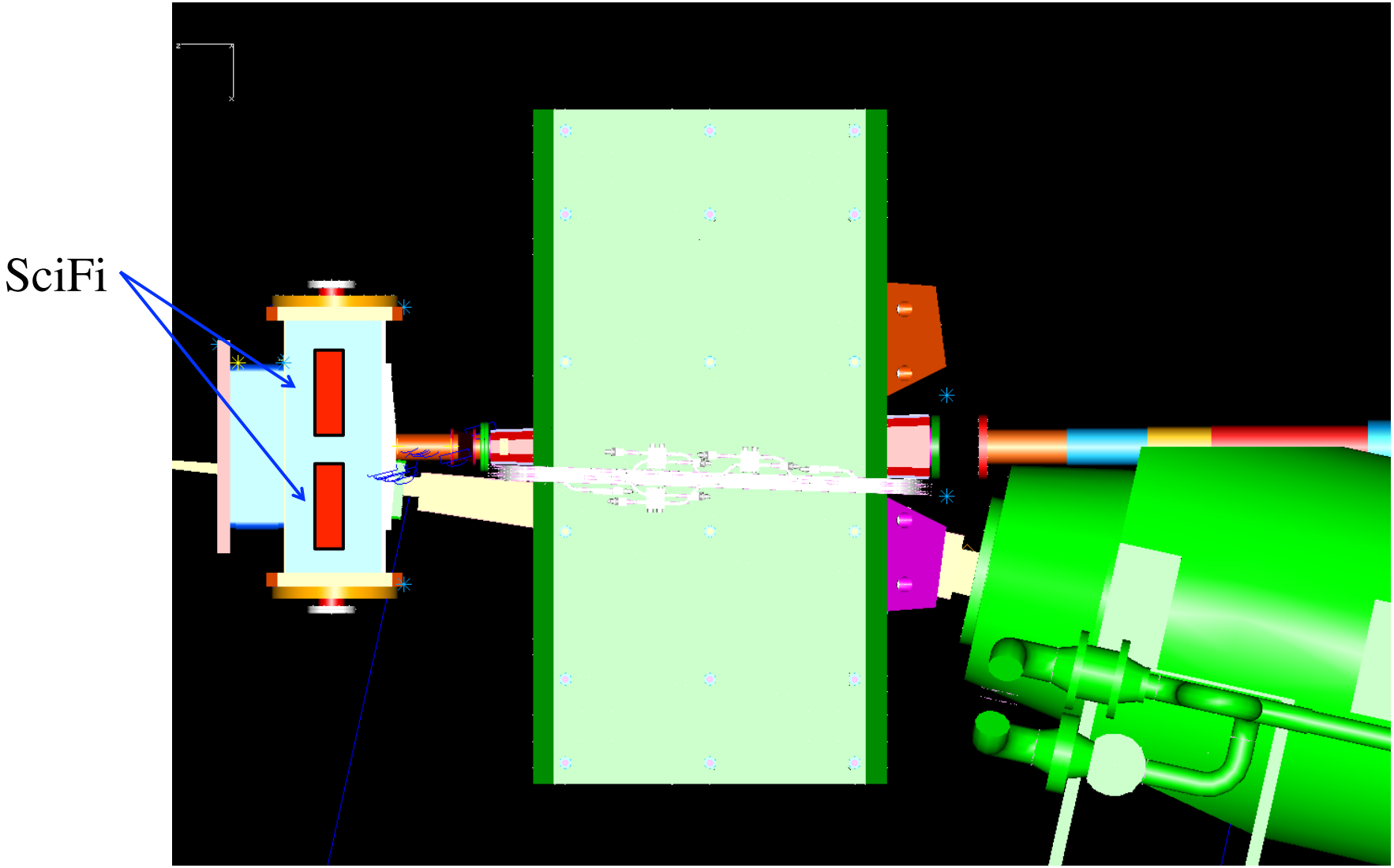
beam at x =0

trajectories to HRS from 4 to 6 deg.

Magnet view and correctors

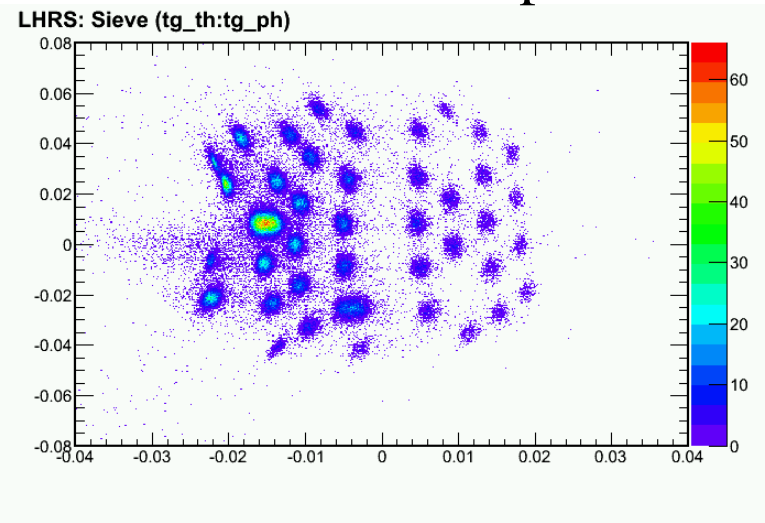


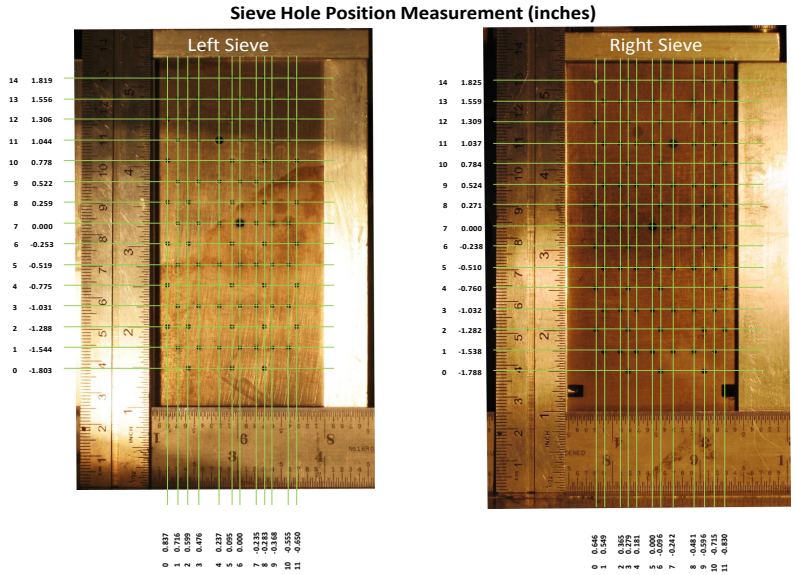
Magnet top view and vacuum connections



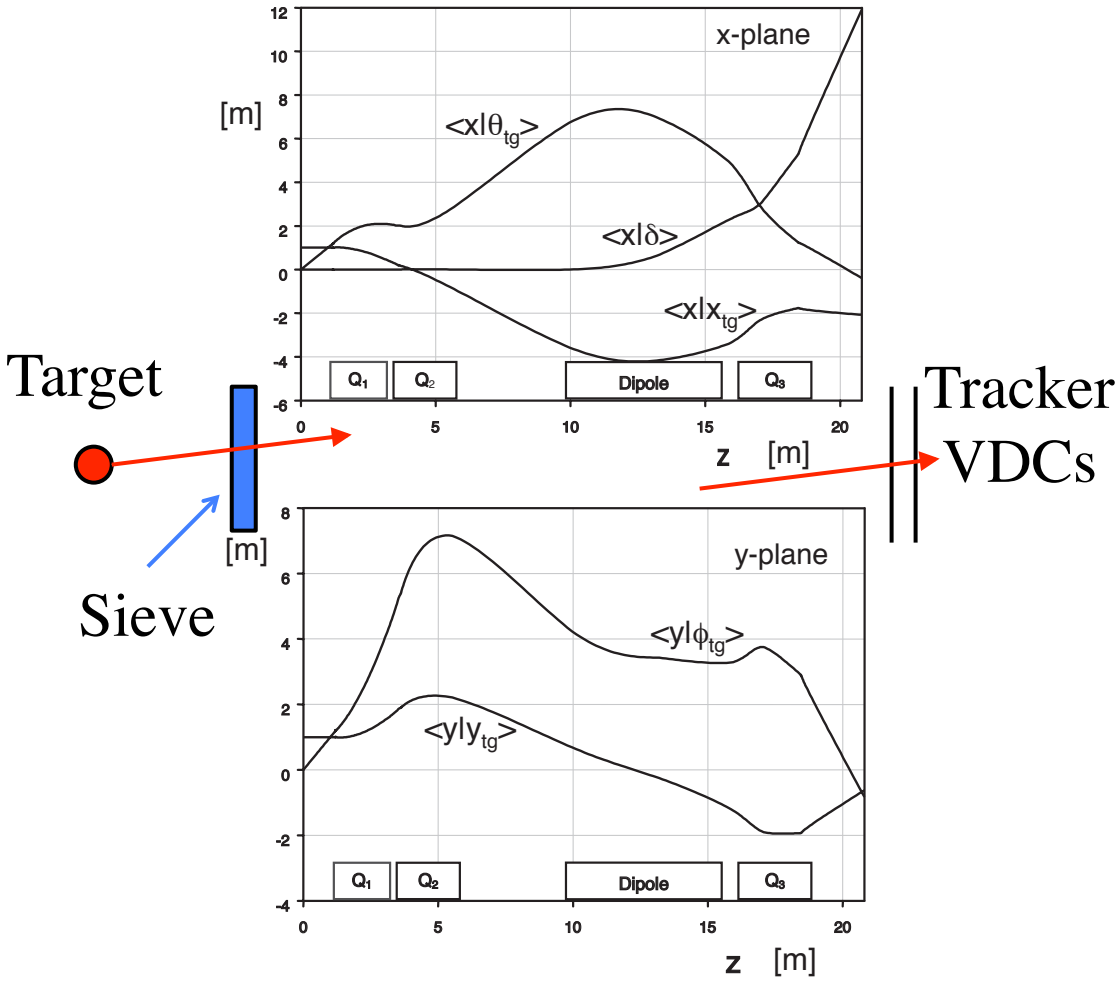
Specialized APEX detector: SciFi detector

Traditional sieve pattern





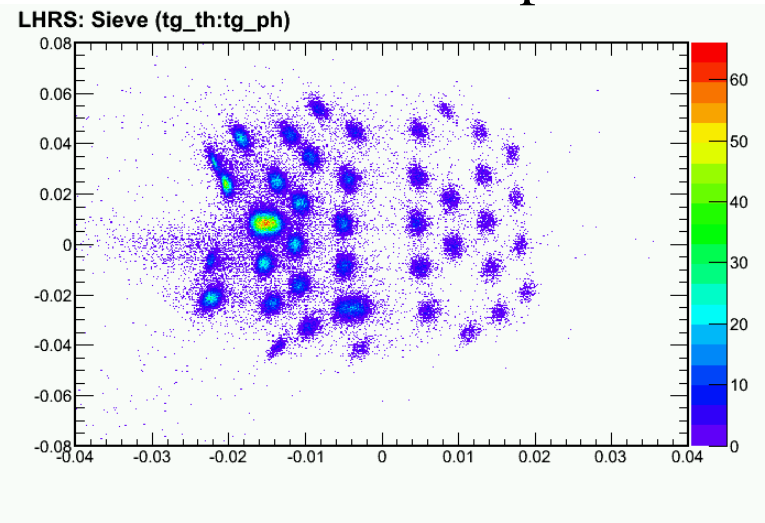
Spectrometer optics



Calibrated optics is good to 0.1 mrad!

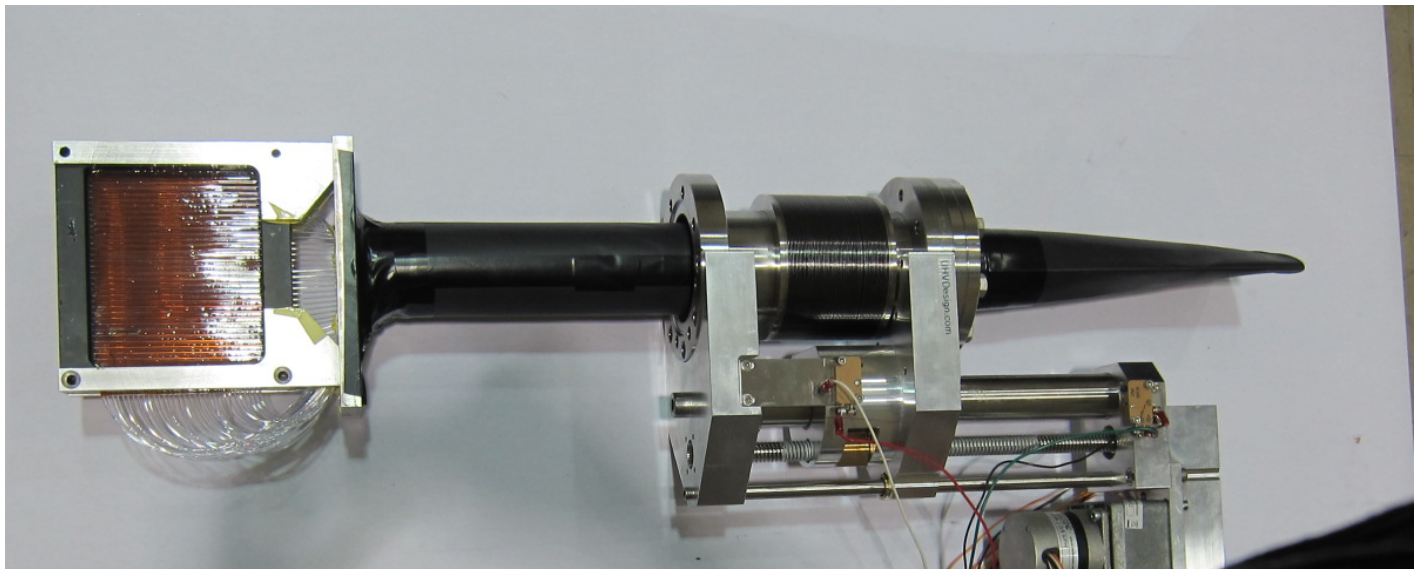
Specialized APEX detector: SciFi detector

Traditional sieve pattern



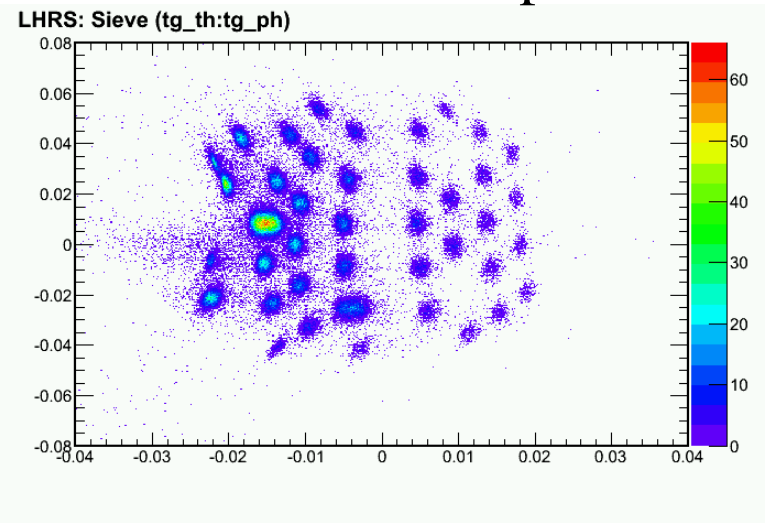
Active "sieve slit": a Sci Fiber detector with 1 mm fibers with 1/4" pitch connected via a bundle of 1.5 mm clear fibers to a 64-channel PMT.
Readout via 1877S TDC; 1-3 MHz rate per fiber; off-line time window of < 5 ns

Positively charged particle optics needs the SciFi



Specialized APEX detector: SciFi detector

Traditional sieve pattern



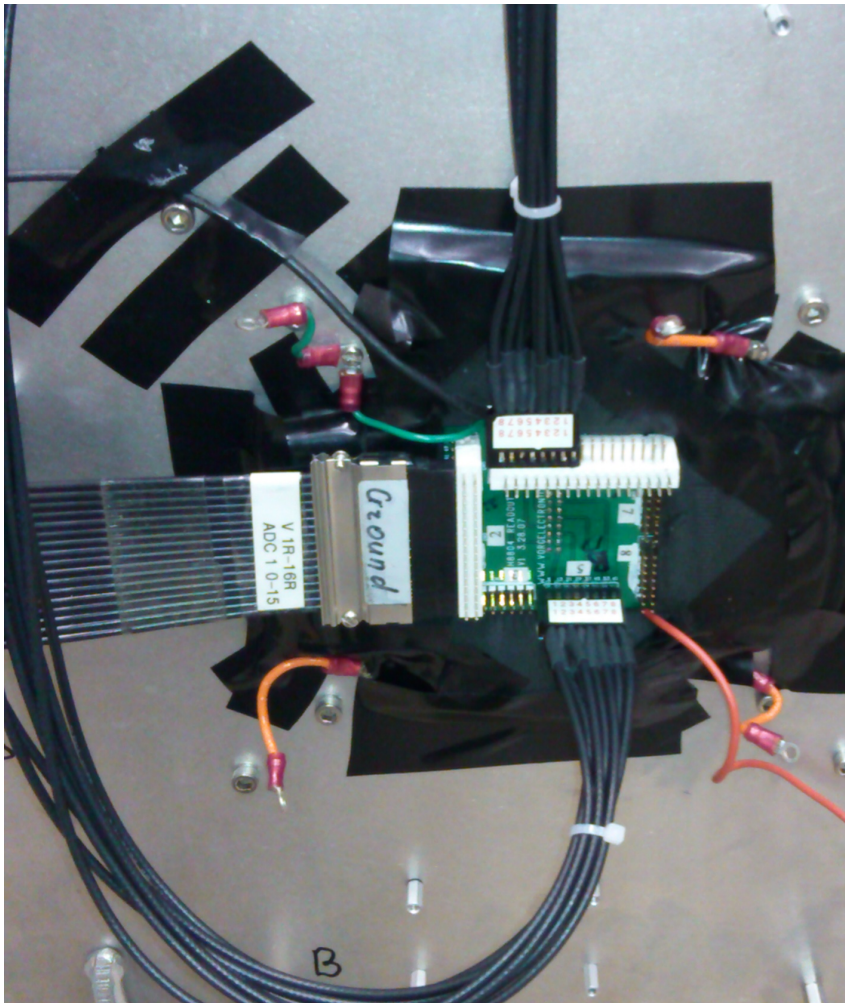
Active "sieve slit": a Sci Fiber detector with 1 mm fibers with 1/4" pitch connected via a bundle of 1.5 mm clear fibers to a 64-channel PMT.

Readout via 1877S TDC; 1-3 MHz rate per fiber; off-line time window of < 5 ns

The front-end is made with the low threshold A/D card from MWDC.

Tested in September – a significant rate of hits in the DAQ is due to crosstalk signals: capacitive coupling between adjacent electronic channels. It limits the range of PMT HV and efficiency.

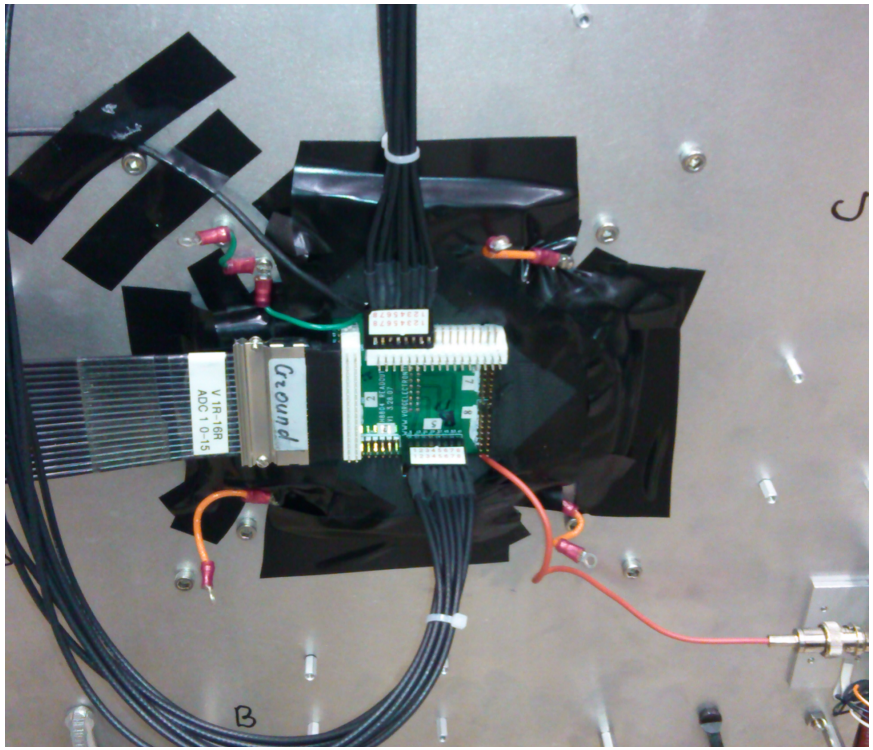
Specialized APEX detector: SciFi detector

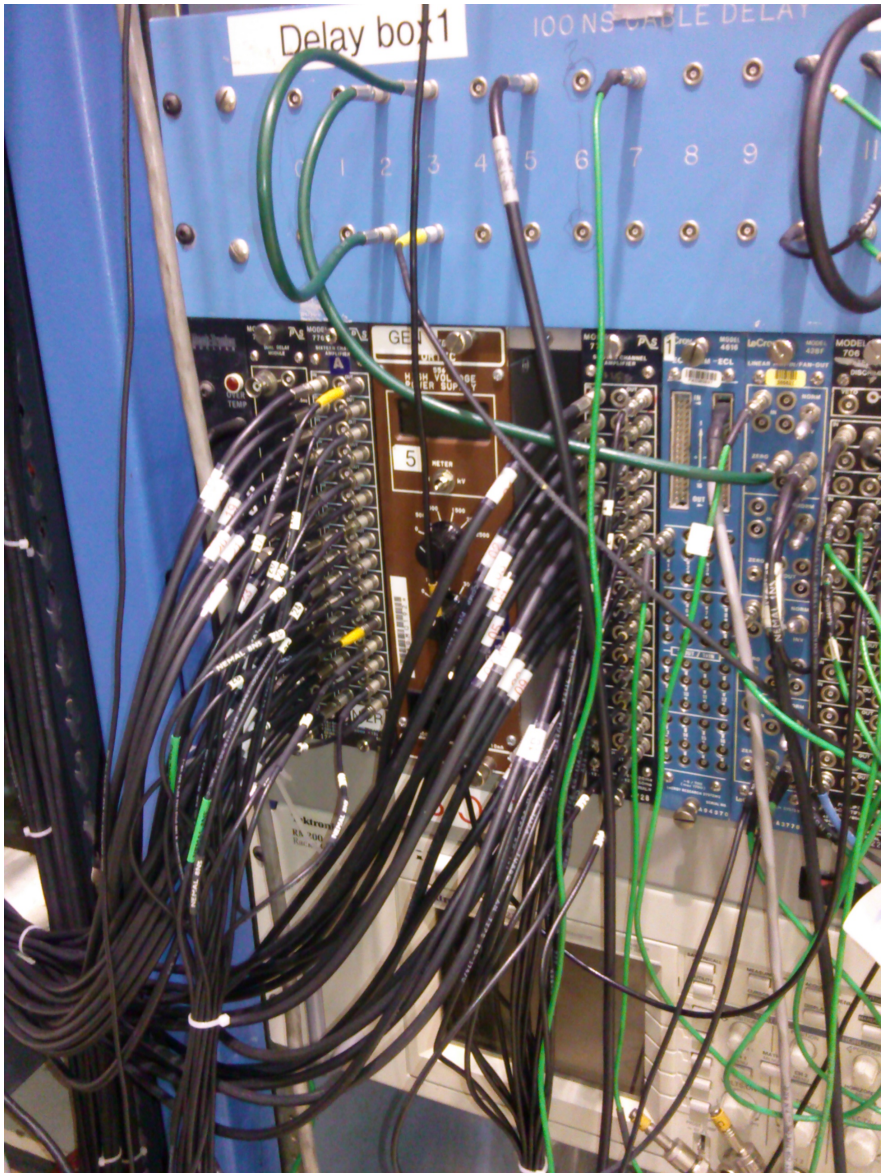


Active “sieve slit”: a Sci Fiber detector with 1 mm fibers with 1/4” pitch connected via a bundle of 1.5 mm clear fibers to a 64-channel PMT.

Readout via costly VME fADC250: 4 ns ticks; allow up to 20 MHz rate per fiber; off-line time window of ~ 5 ns, integration window just 12 ns

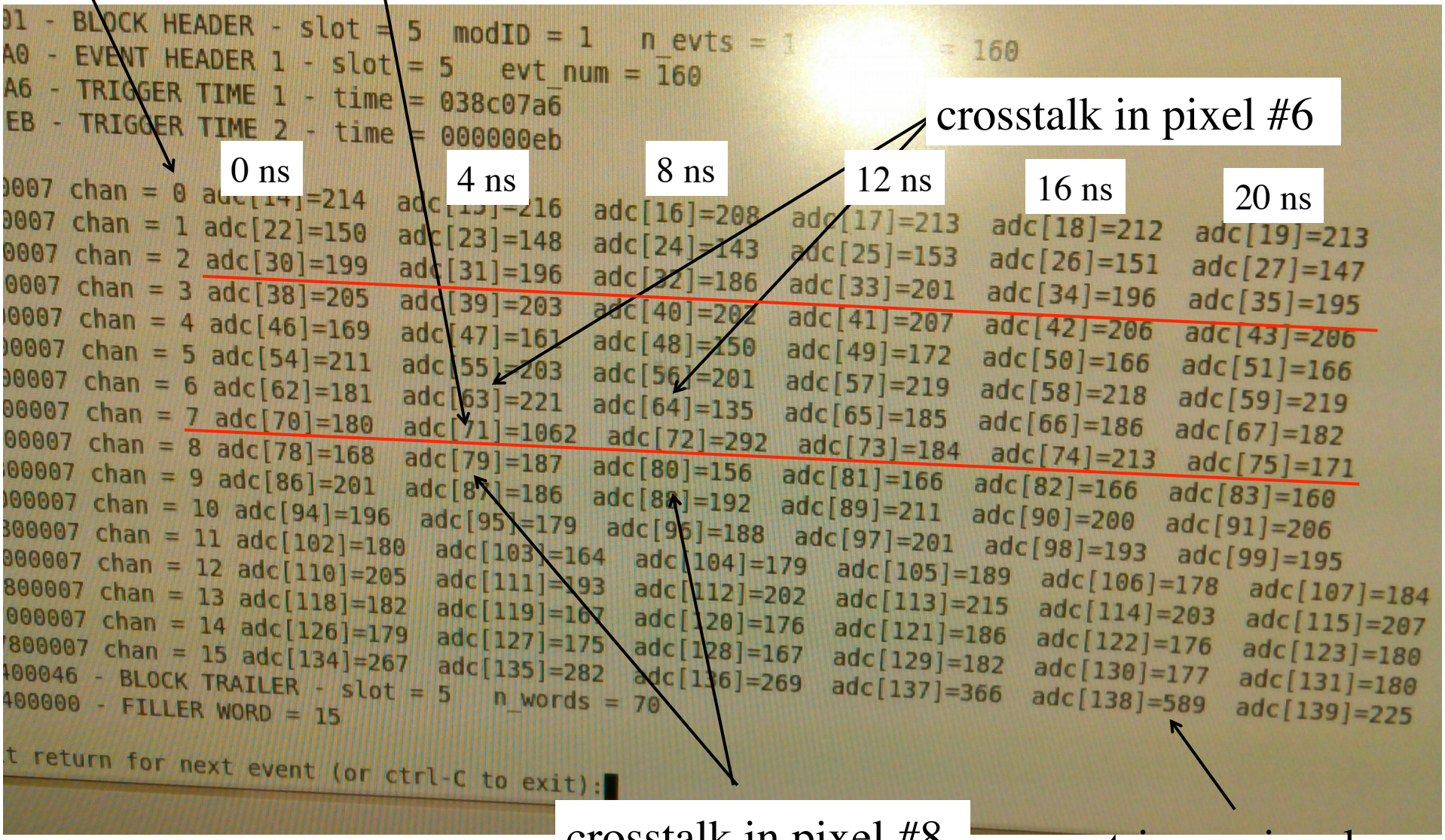
Specialized APEX detector: SciFi detector





The front-end is a fast NIM amplifier.

Preliminary tested in November – works!
Require more studies with additional analysis scripts.


pixel #
the main pulse in pixel #7
crosstalk in pixel #6
0 ns
4 ns
8 ns
12 ns
16 ns
20 ns
crosstalk in pixel #8
trigger signal
the dinode
01 - BLOCK HEADER - slot = 5 modID = 1 n_evts = 1 = 160
A0 - EVENT HEADER 1 - slot = 5 evt_num = 160
A6 - TRIGGER TIME 1 - time = 038c07a6
EB - TRIGGER TIME 2 - time = 000000eb
0007 chan = 0 adc[14]=214 adc[15]=216 adc[16]=208 adc[17]=213 adc[18]=212 adc[19]=213
0007 chan = 1 adc[22]=150 adc[23]=148 adc[24]=143 adc[25]=153 adc[26]=151 adc[27]=147
0007 chan = 2 adc[30]=199 adc[31]=196 adc[32]=186 adc[33]=201 adc[34]=196 adc[35]=195
0007 chan = 3 adc[38]=205 adc[39]=203 adc[40]=202 adc[41]=207 adc[42]=206 adc[43]=206
0007 chan = 4 adc[46]=169 adc[47]=161 adc[48]=150 adc[49]=172 adc[50]=166 adc[51]=166
0007 chan = 5 adc[54]=211 adc[55]=203 adc[56]=201 adc[57]=219 adc[58]=218 adc[59]=219
0007 chan = 6 adc[62]=181 adc[63]=221 adc[64]=135 adc[65]=185 adc[66]=186 adc[67]=182
0007 chan = 7 adc[70]=180 adc[71]=1062 adc[72]=292 adc[73]=184 adc[74]=213 adc[75]=171
0007 chan = 8 adc[78]=168 adc[79]=187 adc[80]=156 adc[81]=166 adc[82]=166 adc[83]=160
0007 chan = 9 adc[86]=201 adc[87]=186 adc[88]=192 adc[89]=211 adc[90]=200 adc[91]=206
0007 chan = 10 adc[94]=196 adc[95]=179 adc[96]=188 adc[97]=201 adc[98]=193 adc[99]=195
0007 chan = 11 adc[102]=180 adc[103]=164 adc[104]=179 adc[105]=189 adc[106]=178 adc[107]=184
0007 chan = 12 adc[110]=205 adc[111]=193 adc[112]=202 adc[113]=215 adc[114]=203 adc[115]=207
0007 chan = 13 adc[118]=182 adc[119]=167 adc[120]=176 adc[121]=186 adc[122]=176 adc[123]=180
0007 chan = 14 adc[126]=179 adc[127]=175 adc[128]=167 adc[129]=182 adc[130]=177 adc[131]=180
0007 chan = 15 adc[134]=267 adc[135]=282 adc[136]=269 adc[137]=366 adc[138]=589 adc[139]=225
0046 - BLOCK TRAILER - slot = 5 n_words = 70
0000 - FILLER WORD = 15
t return for next event (or ctrl-C to exit):