Monitoring of T0 and Dead Layer

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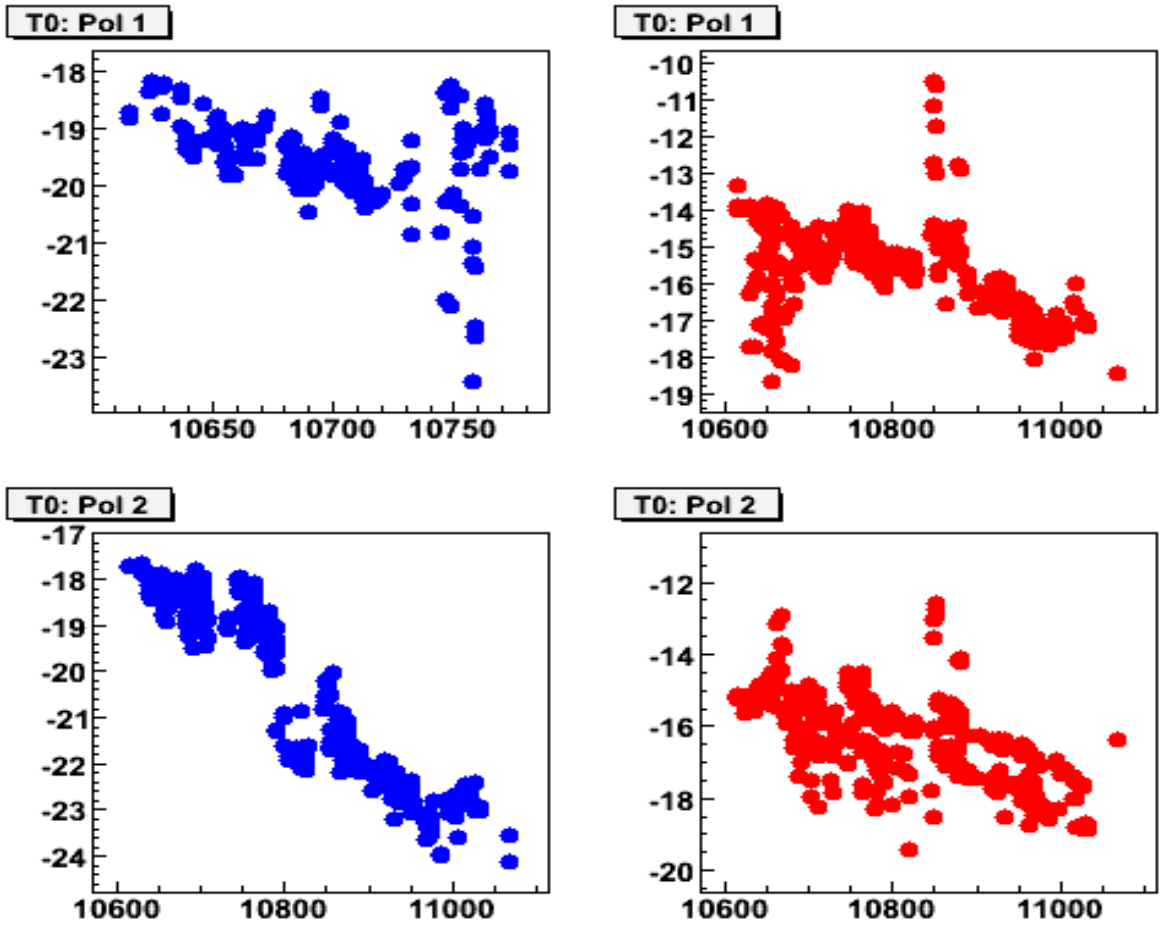
BNL, January 6, 2011

From Sasha's report : *"RHIC pC Polarimeters in Run9: Performance and Issues"*



ToF offset drifts by ~3-6 ns!

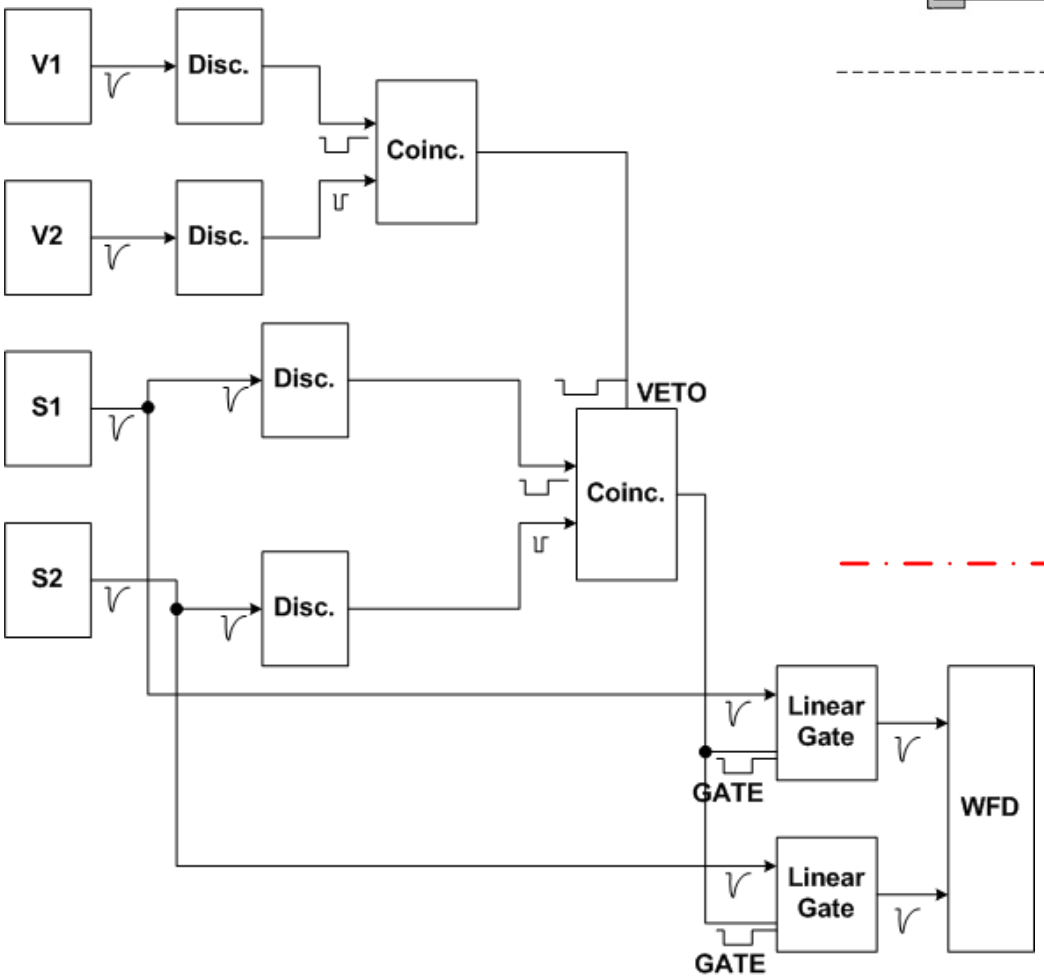
1 ns change is equivalent to "Dead Layer"~5 μg/cm^2

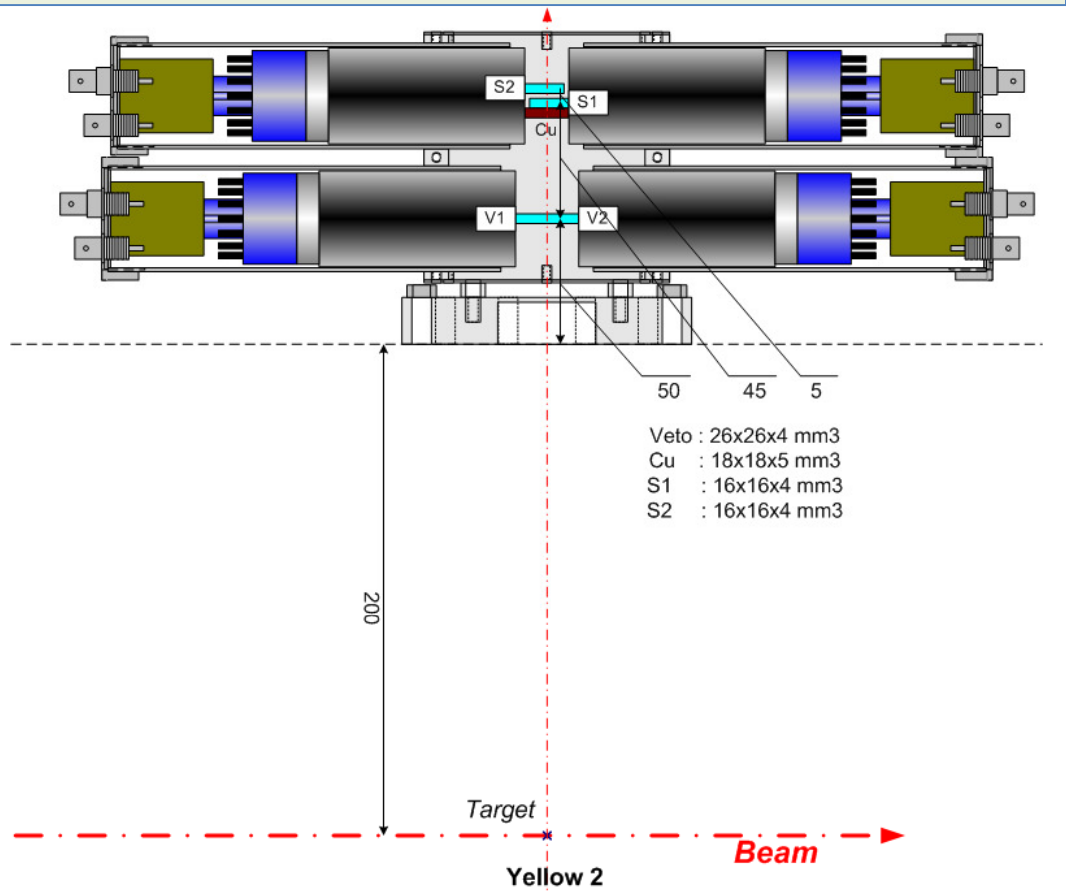
Is it just a fit problem (correlation between "DL" and T0)?

If ~20% change in reconstructed C-mass corresponded to shift in energy scale it would mean ~20% change in asymmetry, which is not confirmed by the comparison with Hjet ⇒ T0 <u>as measured by the system</u> does drift!

Need to monitor T0

PMT setup what we have right now

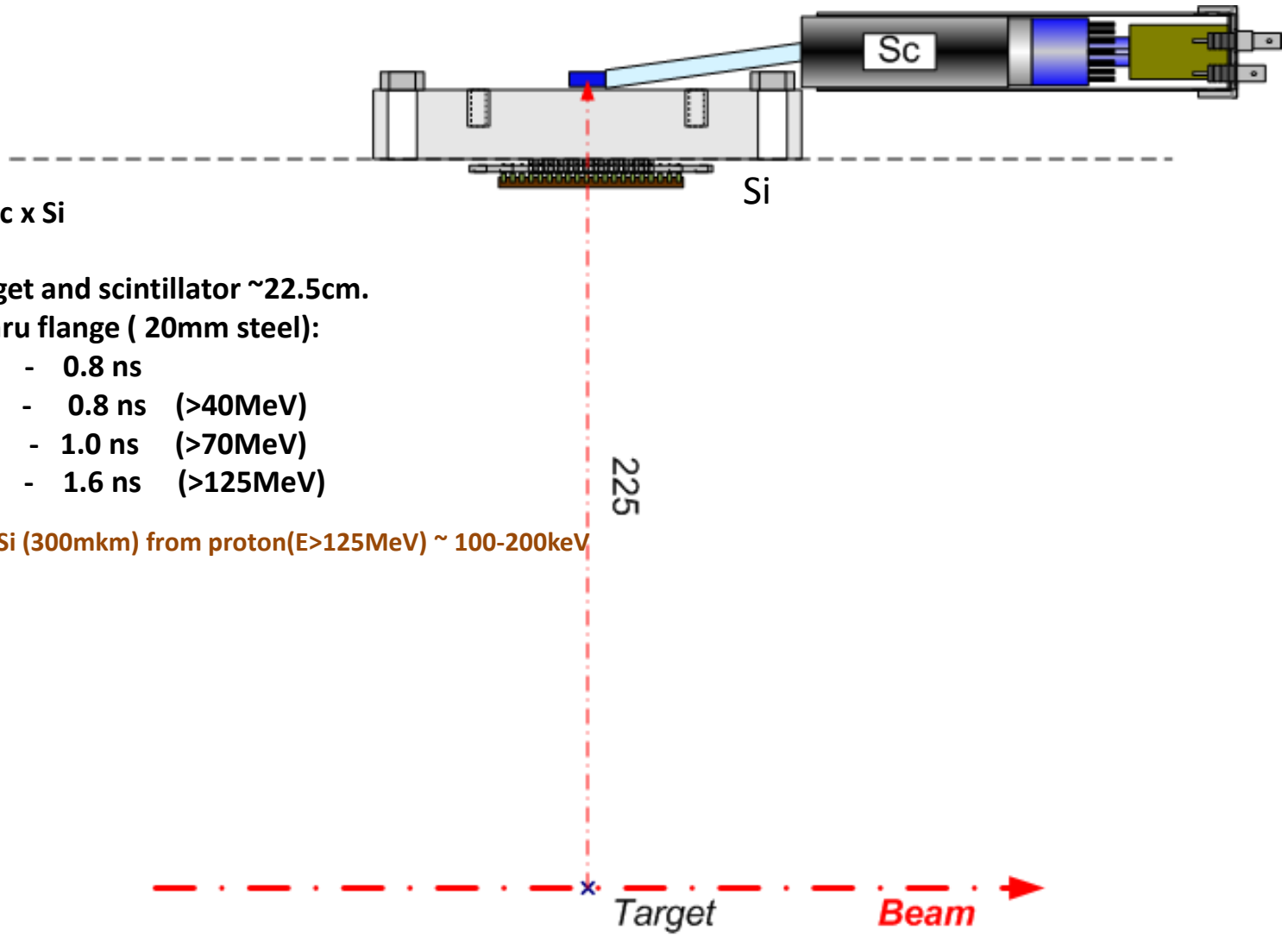




Distance between target and scintillator ~30cm.
ToF for particles go thru flange (~10mm glass + 6mm Cu):

- **gamma - 1.0 ns**
- **electron - 1.0 ns (>10MeV)**
- **pion - 2.0 ns (>20MeV)**
- **proton - 2.7 ns (>70MeV)**

Dima's offer of monitoring T0



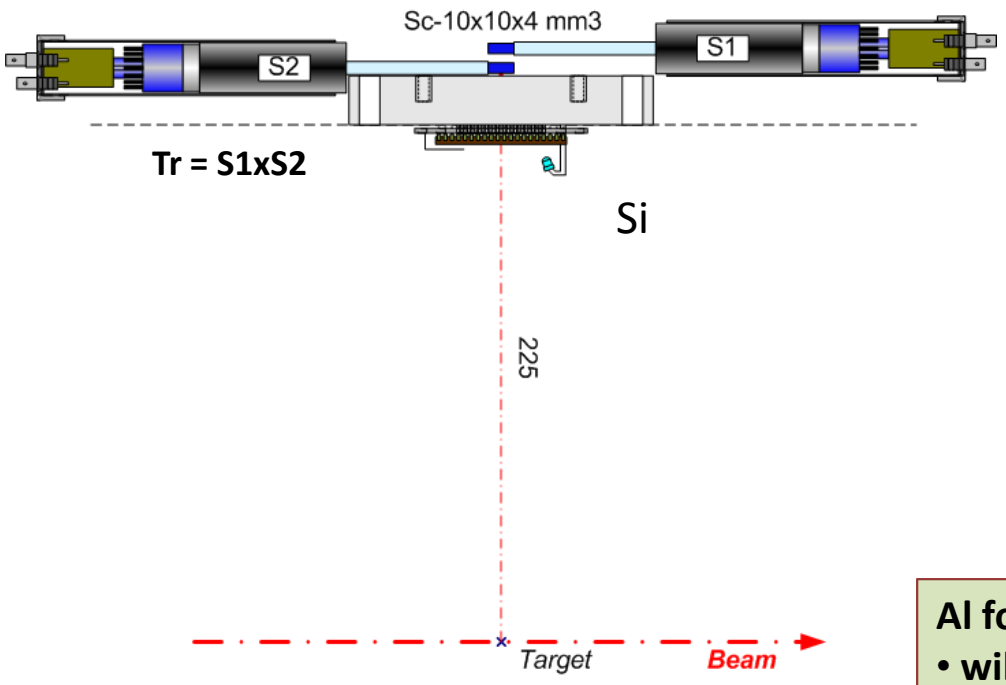
Tr = Sc x Si

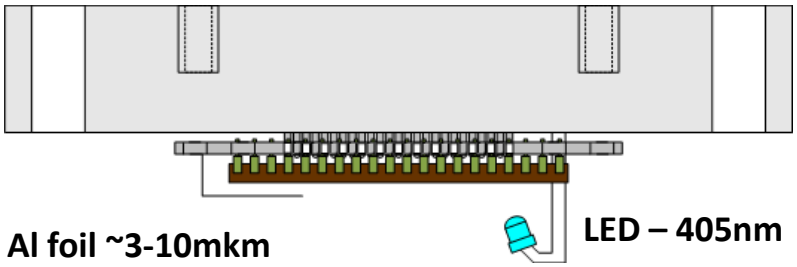
Distance between target and scintillator ~22.5cm.
ToF for particles go thru flange (20mm steel):

- **gamma - 0.8 ns**
- **electron - 0.8 ns (>40MeV)**
- **pion - 1.0 ns (>70MeV)**
- **proton - 1.6 ns (>125MeV)**

Deposited energy on the Si (300mkm) from proton(E>125MeV) ~ 100-200keV

New offer of monitoring T0 and Dead Layer





Al foil ~3-10mkm

LED – 405nm

LED will shine on the detectors and PMTs simultaneously

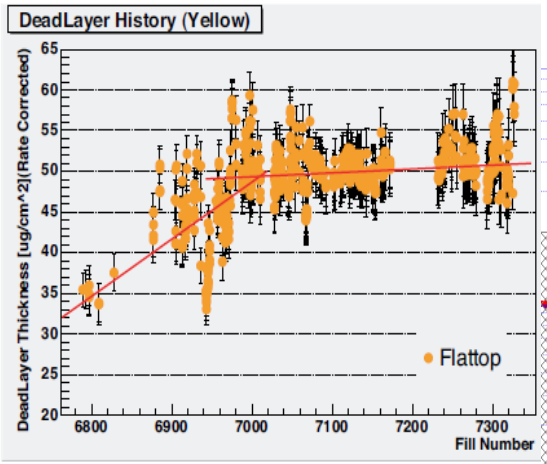
Distance between a target and scintillator ~22.5cm.
ToF for particles go thru flange (20mm steel):

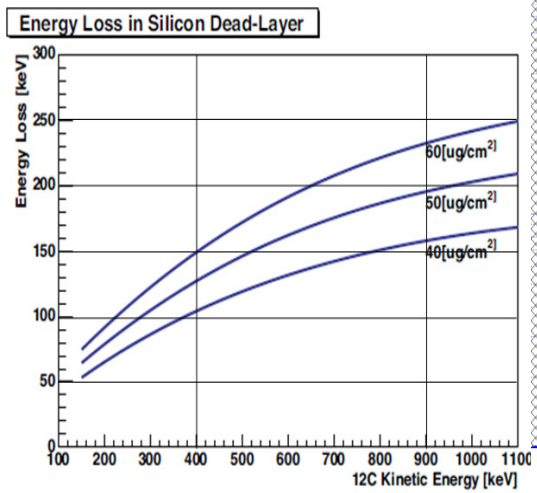
- gamma - 0.8 ns
- electron - 0.8 ns (>40MeV)
- pion - 1.0 ns (>70MeV)
- proton - 1.6 ns (>125MeV)

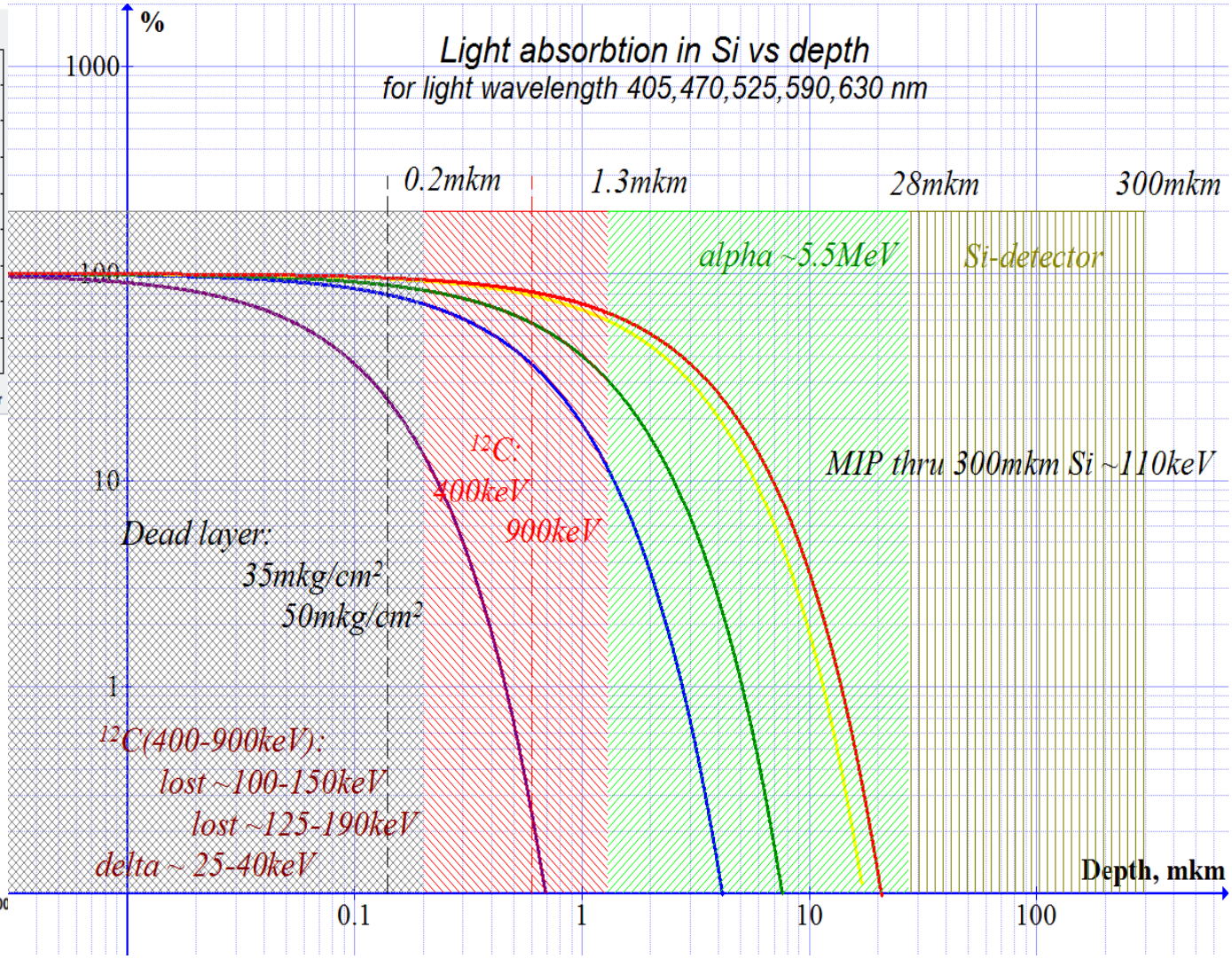
Al foil:
- will absorb heavy (carbon …) particles for an estimation of a background (prompt + induce)

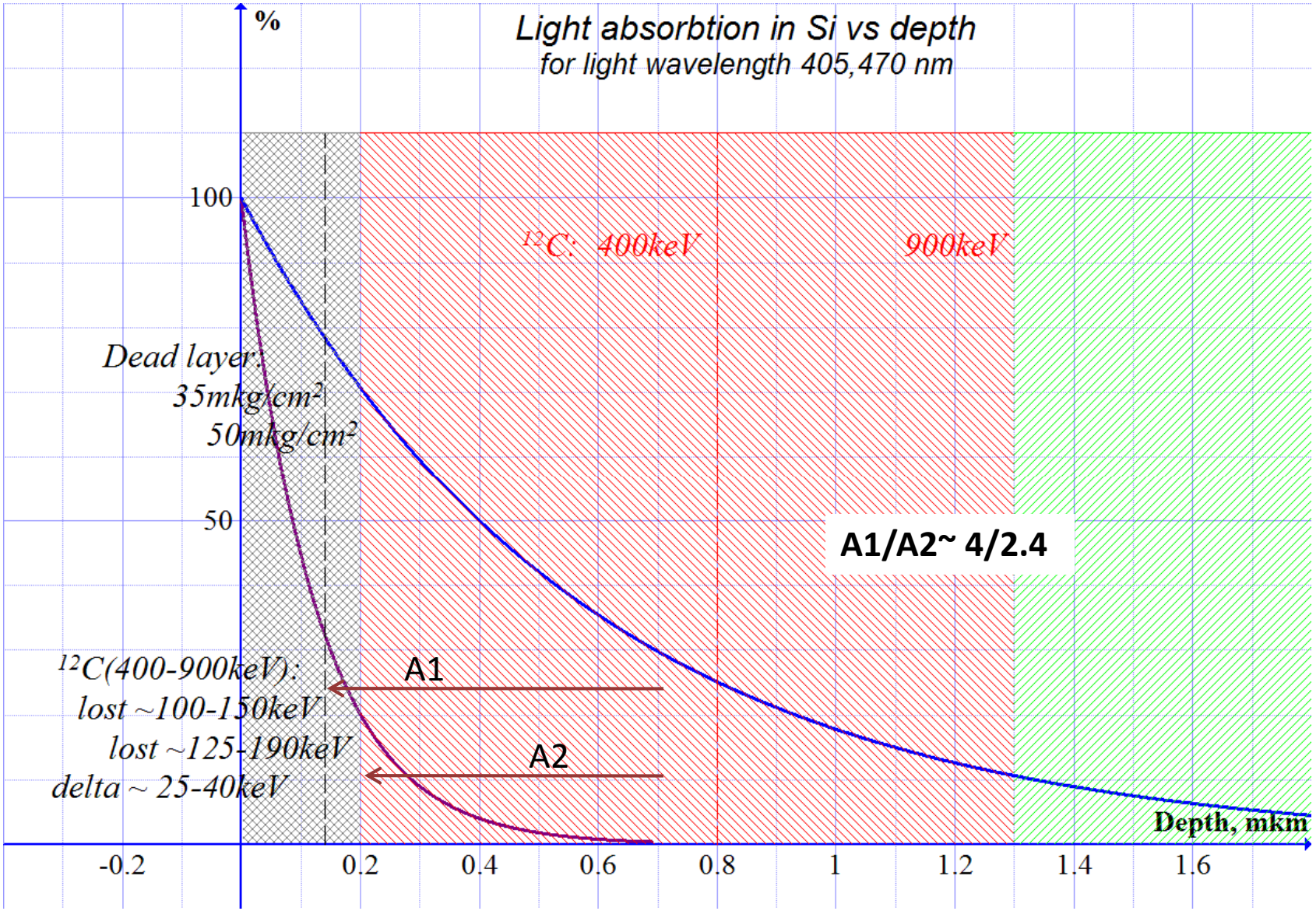
LED:
- for alignment a delays of the detectors among themselves and with PMTs;
- for monitoring Dead Layer ???

PMT:
- for monitoring a T0;
- for monitoring a rate.


DeadLayer History (Yellow)
DeadLayer Thickness [ug/cm^2](Rate Corrected)
Flattop
Fill Number


Energy Loss in Silicon Dead-Layer
Energy Loss [keV]
60[ug/cm2]
50[ug/cm2]
40[ug/cm2]
12C Kinetic Energy [keV]


%
Light absorbtion in Si vs depth
for light wavelength 405,470,525,590,630 nm
0.2mkm
1.3mkm
28mkm
300mkm
alpha ~5.5MeV
Si-detector
MIP thru 300mkm Si ~110keV
12C:
400keV
900keV
Dead layer:
35mkg/cm2
50mkg/cm2
12C(400-900keV):
lost ~100-150keV
lost ~125-190keV
delta ~ 25-40keV
Depth, mkm

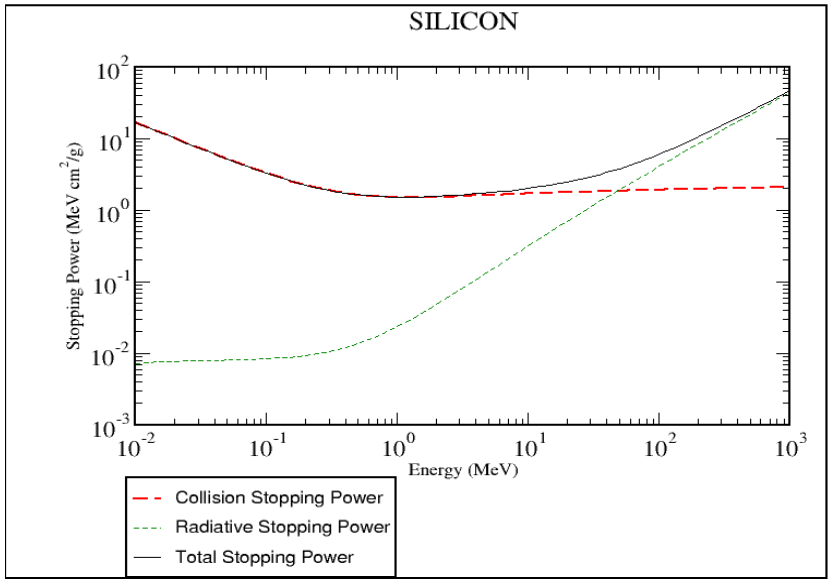

%
Light absorbtion in Si vs depth
for light wavelength 405,470 nm
100
50
^{12}C: 400keV
900keV
Dead layer:
35mkg/cm²
50mkg/cm²
A1/A2~ 4/2.4
^{12}C(400-900keV):
lost ~100-150keV
lost ~125-190keV
delta ~ 25-40keV
A1
A2
Depth, mkm
-0.2
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

Backups

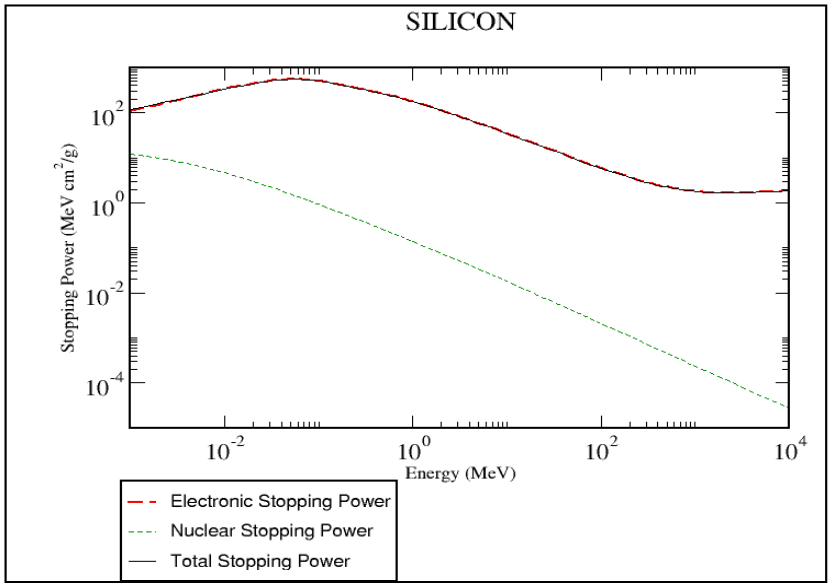
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

http://www.nist.gov/pml/data/star/index.cfm

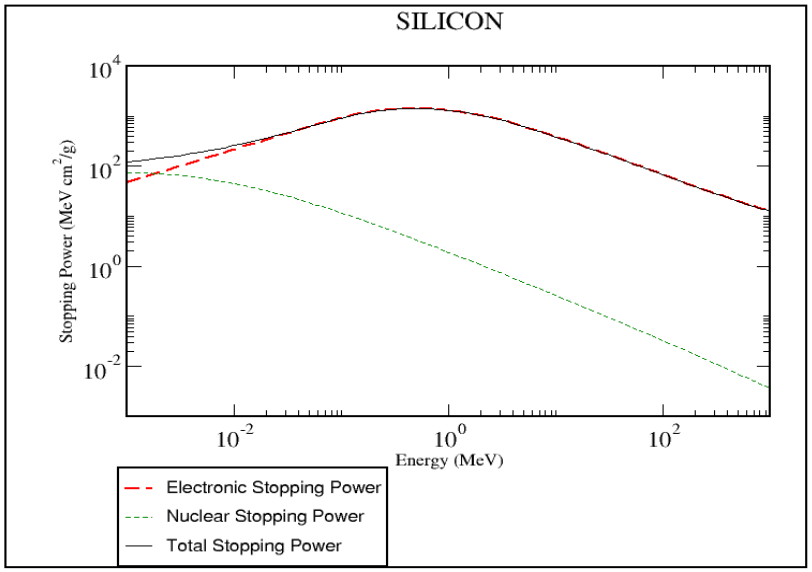
ESTAR : Stopping Power for Electrons



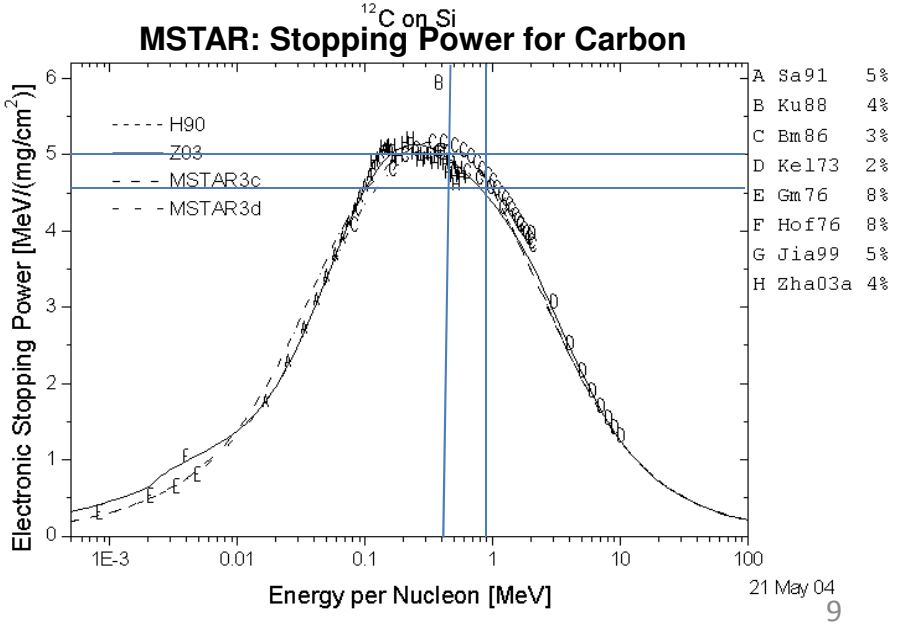
PSTAR : Stopping Power for Protons



ASTAR : Stopping Power for Alpha Particles



MSTAR: Stopping Power for Carbon



The absorption depth vs. wavelength

http://www.pveducation.org/pvcdrom