

The JEDI Polarimetry Concept

Target & Detector System

May 21, 2015 | Irakli Keshelashvili – IKP-2 |

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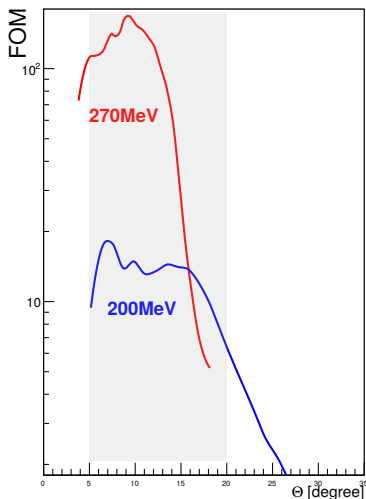
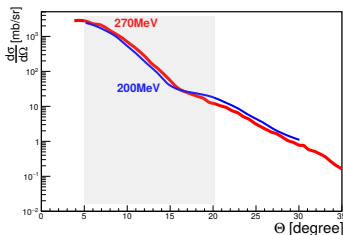
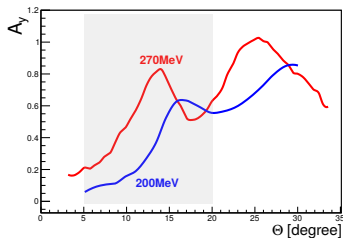
- Introduction
- Target
- Detector
- Readout
- Summary

EDM – Precision Experiment !!!

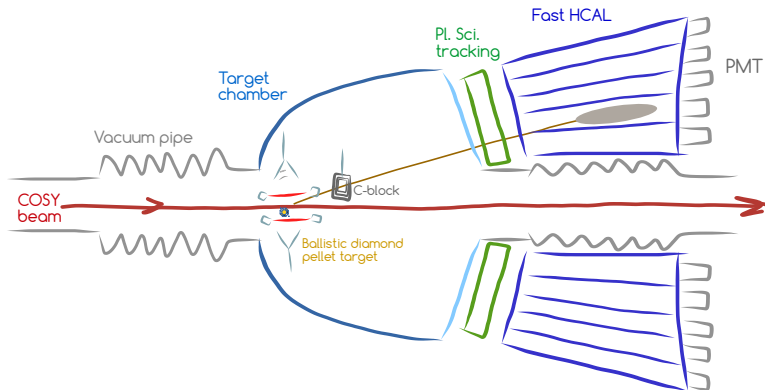
- “Effective” Target !!! { C – Carbon }
- 100% DAQ Efficiency !!!
- Full ϕ Acceptance in Reasonable FOM region !!!
- No Magnetic / Electric Field !!!
- Stability – Long / Short Term !!!
- Best Reaction $dC \rightarrow dC$ Identification !!!

$dC \rightarrow dC$ Elastic Scattering @ 270 MeV

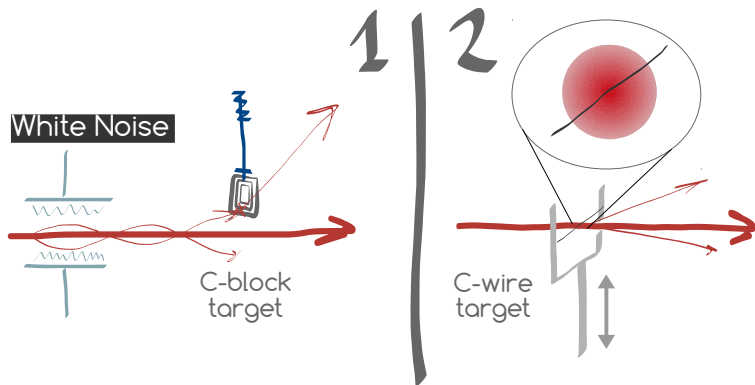
Y. Satou et al., Phys. Lett. B 549, 307 (2002).



Towards JEDI Polarimetry

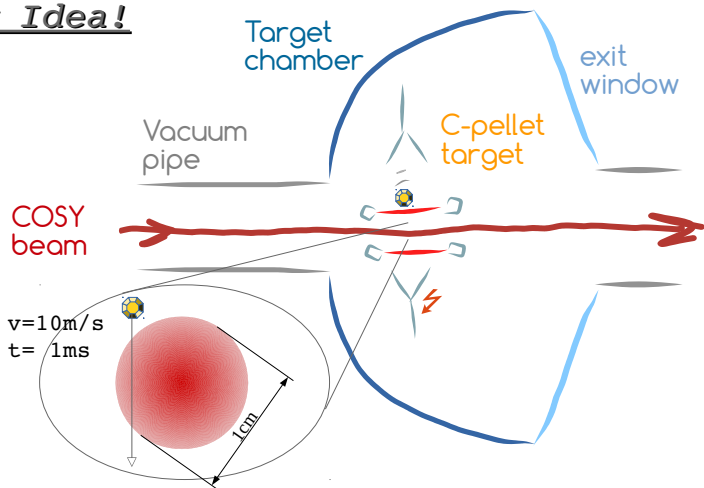


Targets used @ EDDA



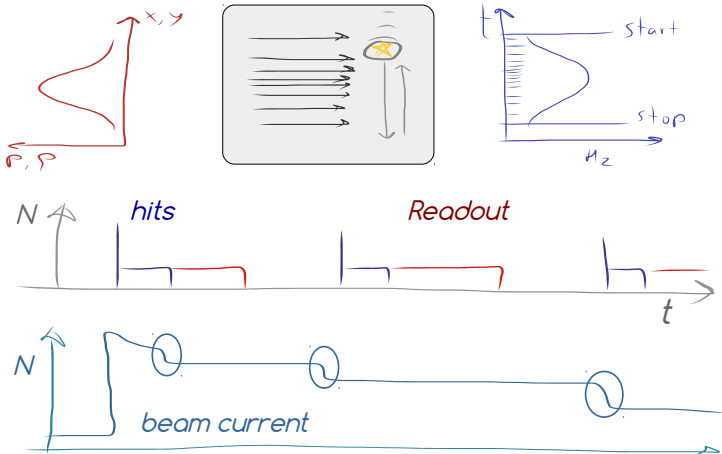
JüDiT – Jülich "Ballistic" Diamond Pellet Target

New Idea!



JüDiT – Jülich "Ballistic" Diamond Pellet Target

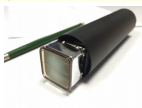
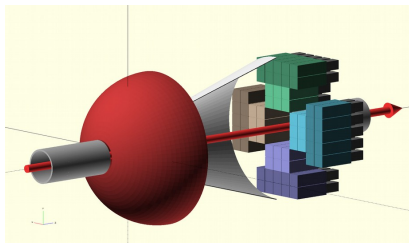
dedicated simulations ongoing (Master Thesis)



Proposed Detector Concept: Layout

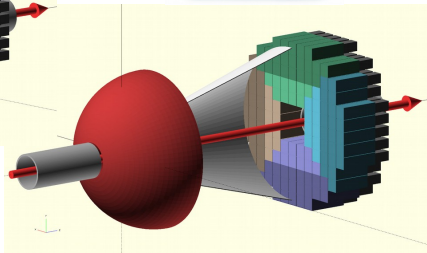
First Version

4x6=24 LYSO
4x10=40 BGO



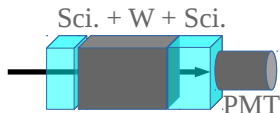
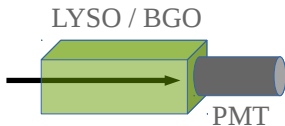
Final Version

LYSO & BGO



Detector Concept: Matter of Simulation

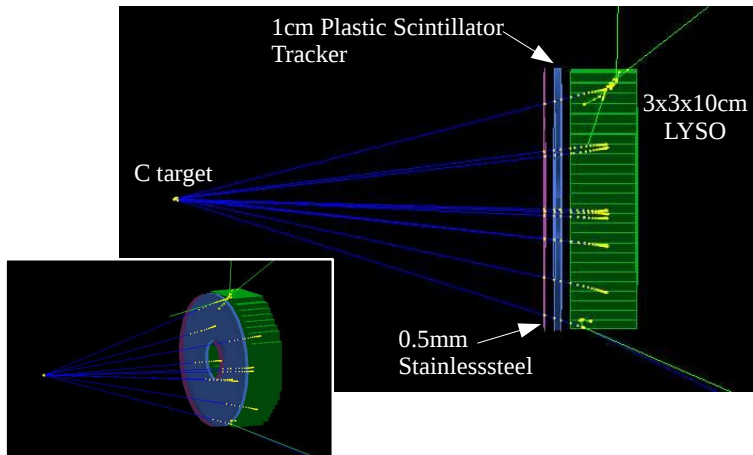
Scintillation Materials



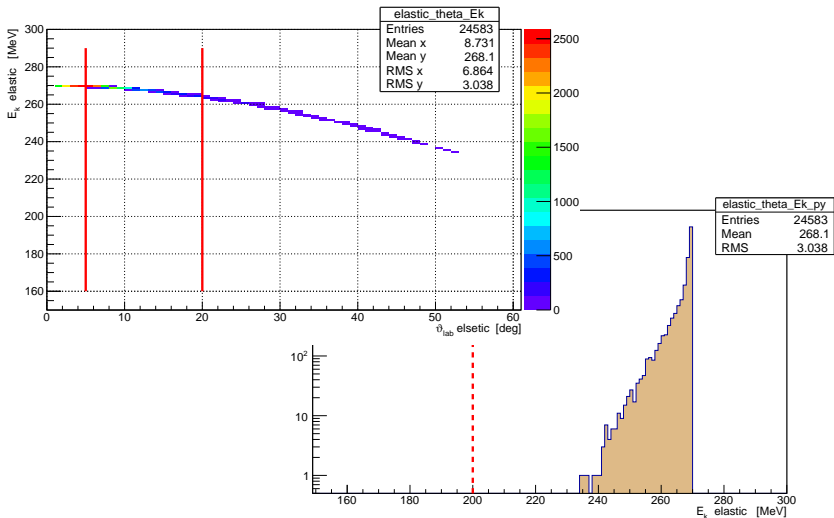
	LYSO	BGO	Plastic
[g/cm ³]	<u>7.1</u>	7.1	1.05
Devay [ns]	<u>40</u>	300	<u>2.4</u>
L. Y. % NaI(Tl)	<u>75</u>	25	25
S. Peak [nm]	<u>420</u>	480	420
n-index	<u>1.82</u>	2.15	1.58
Melt. °C	<u>2050</u>	1050	75
Hygros.	No	No	No
Radioact.	Yes	<u>No</u>	No

MC Simulation (GEANT4)

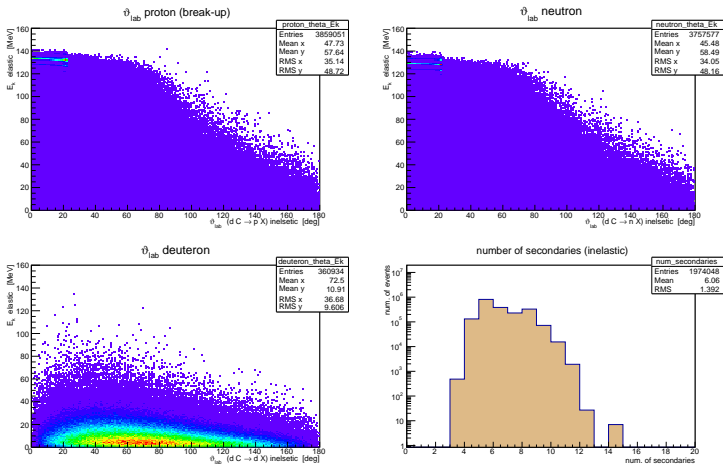
G. Macharashvili & P. Maanen



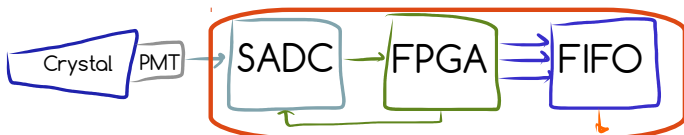
G4: Elastic $dC \rightarrow dC$ Energy Distribution



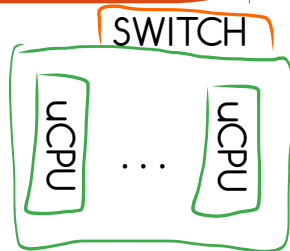
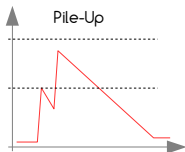
G4: Inelastic $dC \rightarrow X$ Energy Distribution



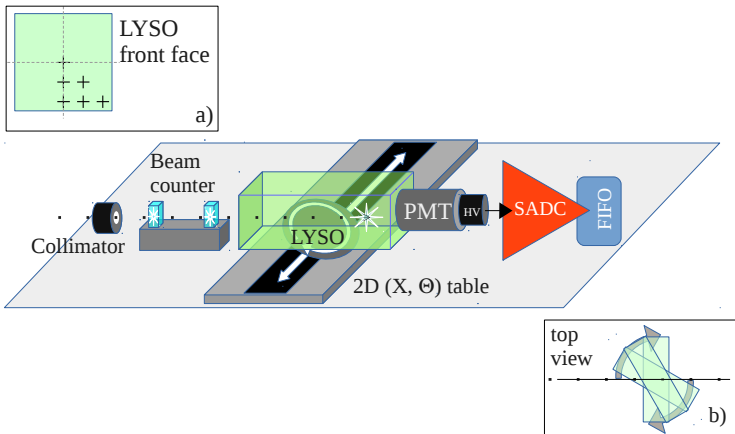
DAQ



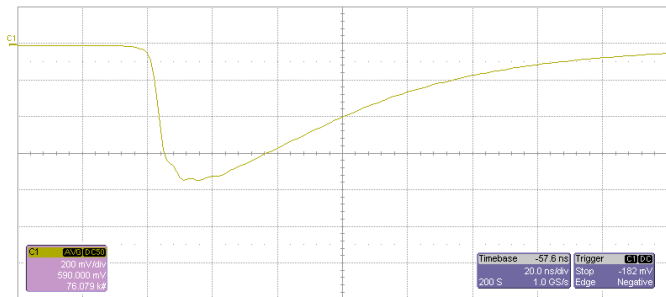
Struck SIS 3316
 16 channel – 64MS/ch
 250MS/s – 4ns per S.



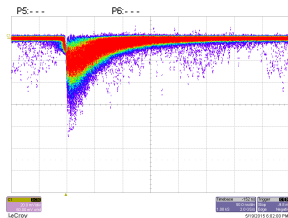
Prototype Test



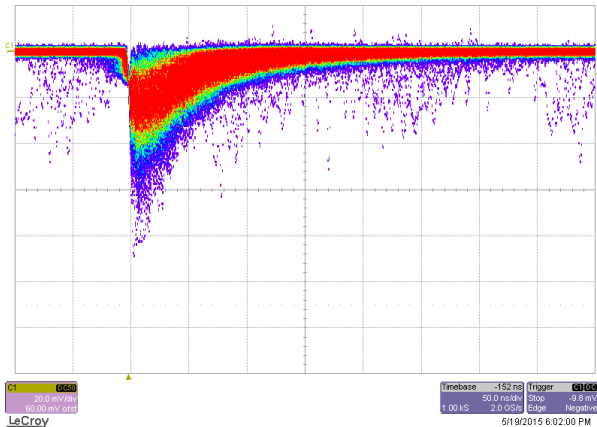
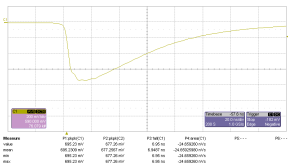
Cosmic Signal vs Intrinsic Radiation



Measure	P1:plpk(C1)	P2:plpk(C2)	P3:fall(C1)	P4:area(C1)
value	695.23 mV	677.26 mV	6.95 ns	-24.659260 nVs
mean	695.2309 mV	677.2567 mV	6.9487 ns	-24.65925980 nVs
min	695.23 mV	677.26 mV	6.95 ns	-24.659260 nVs
max	695.23 mV	677.26 mV	6.95 ns	-24.659260 nVs



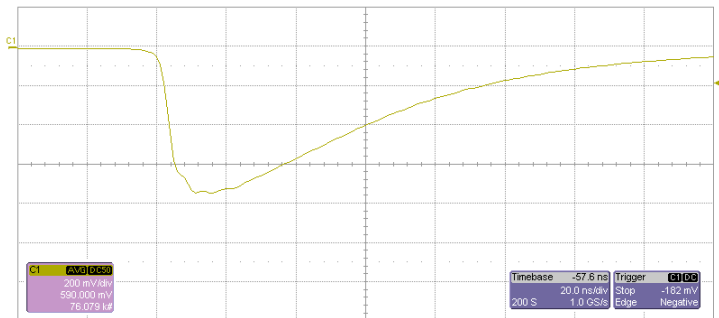
Cosmic Signal vs Intrinsic Radiation



Summary

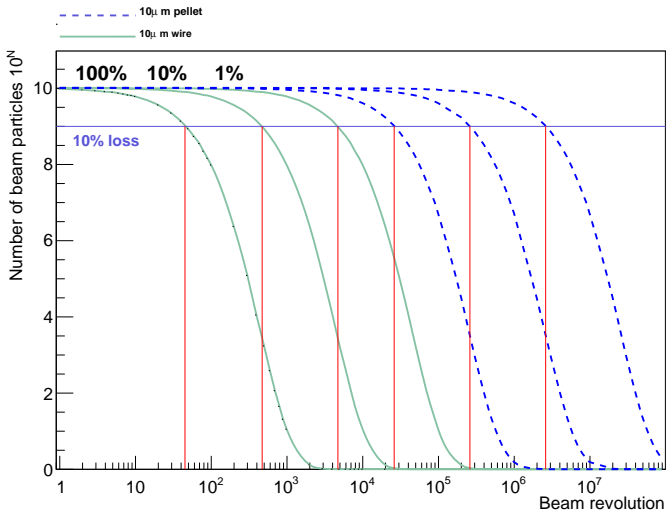
- Proposed HCAL is under intensive MC simulation
- Hardware development: LYSO, PMT, SiPM/MPPC, HV-Divider
- Realistic mini data acquisition is under construction (ZEA-2)
- Mechanical engineers are ready to support (ZEA-1)
- By the end of 2015, first prototype test is expected (dedicated beam request submitted)

Cosmic Signal

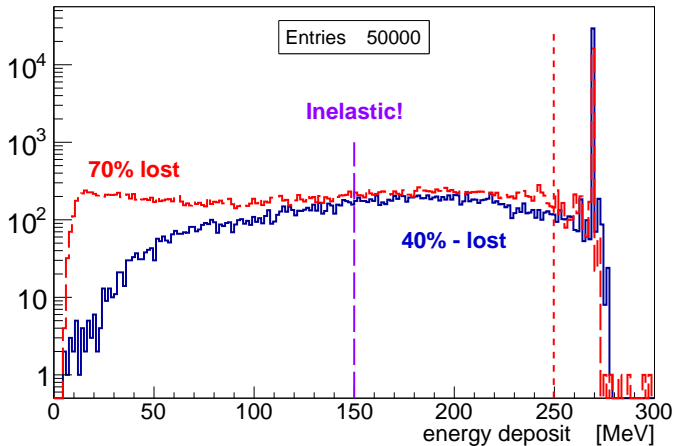


Measure	P1:pkpk(C1)	P2:pkpk(C2)	P3:fall(C1)	P4:area(C1)	P5:---	P6:---
value	695.23 mV	677.26 mV	6.95 ns	-24.659260 nVs		
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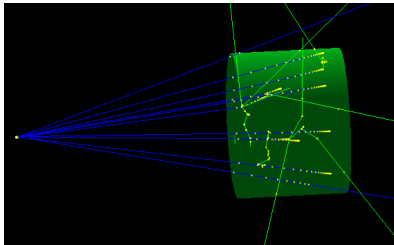
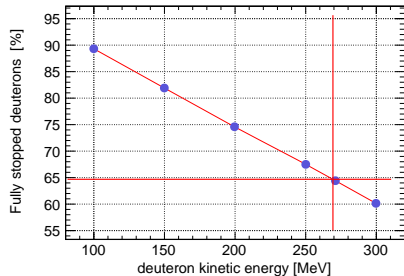
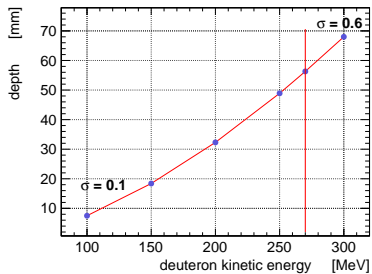
Pellet Vs. Wire



LYSO 10cm Vs. PI.Sci. 30cm

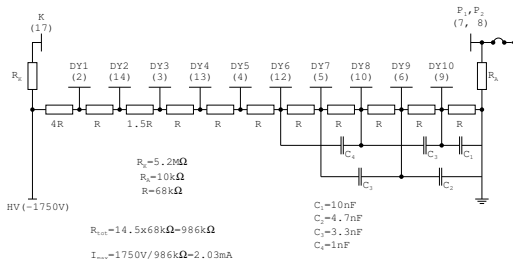
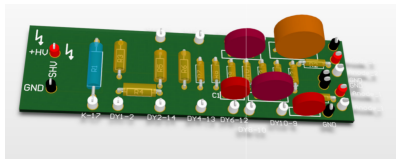


deuteron path length in LYSO

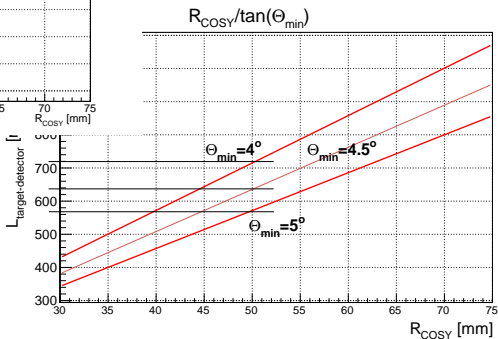
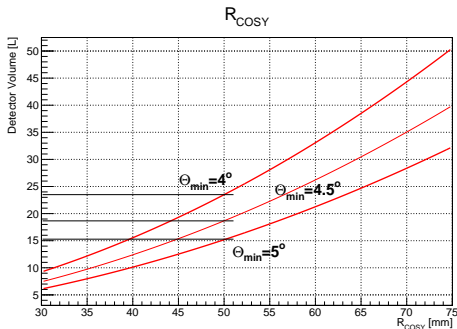


Hardware Progress

P. Wüstner, Tanja Hahnraaths-von der Gracht & T. Sezfick



Detector Cost Understanding ($\Theta_{max} = 20^\circ$)



LYSO Prototype

