

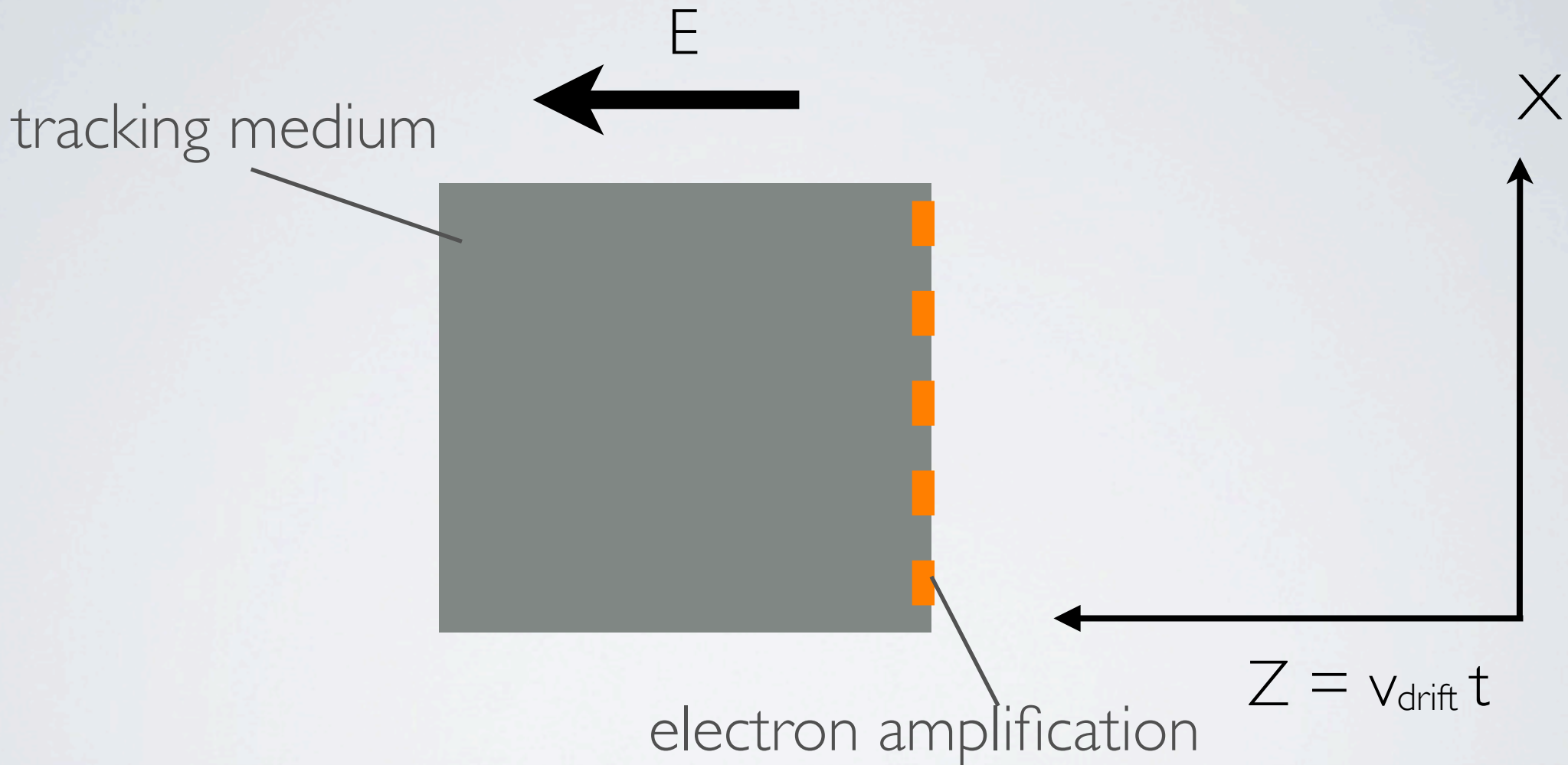
ACTIVE TARGET-TIME PROJECTION CHAMBER

ATTPC

Saul Beceiro-Novo

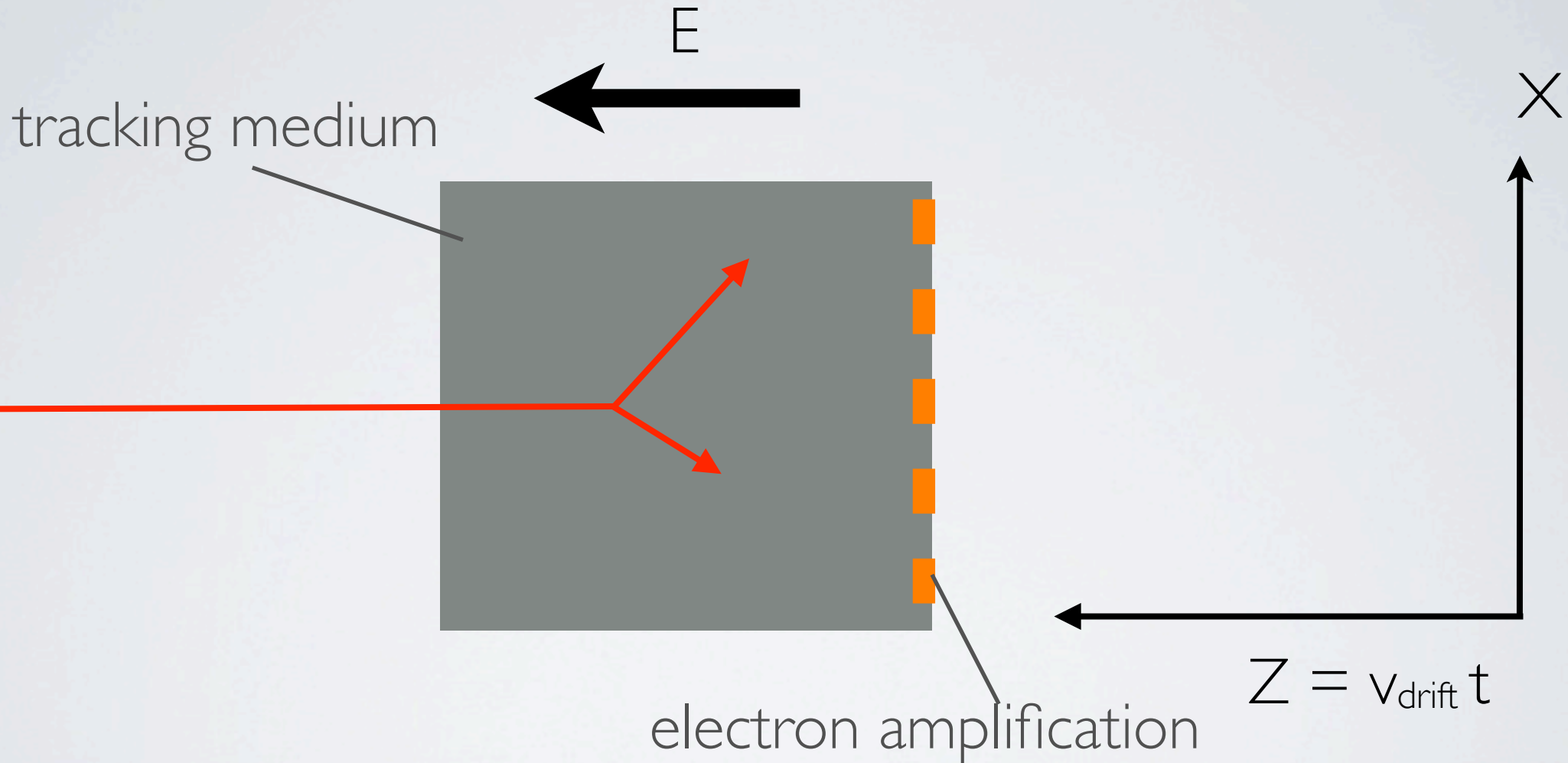
National Superconducting Cyclotron Laboratory, MSU

AT-TPC CONCEPT



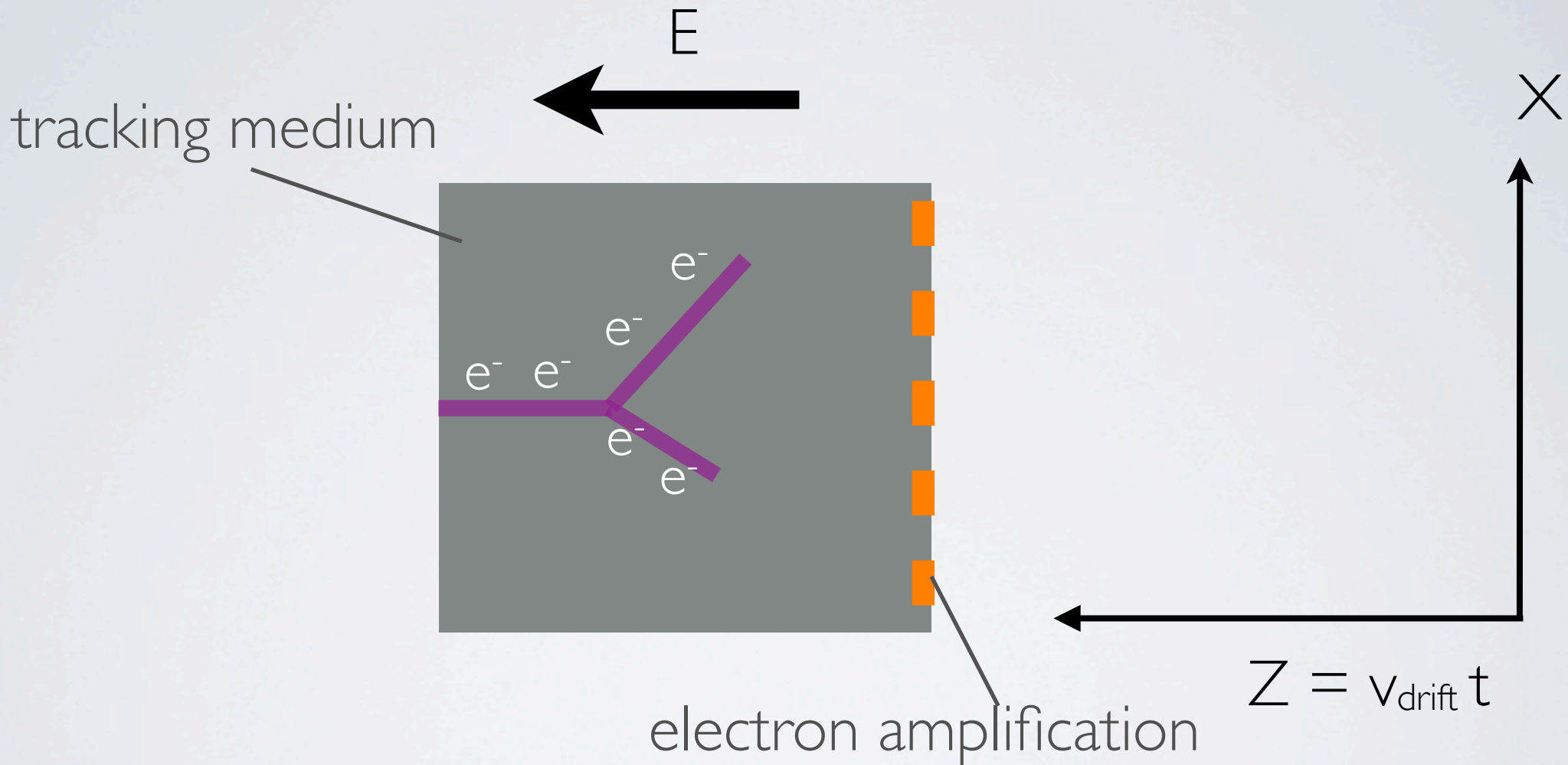
- Active-Target Time-Projection Chamber

AT-TPC CONCEPT



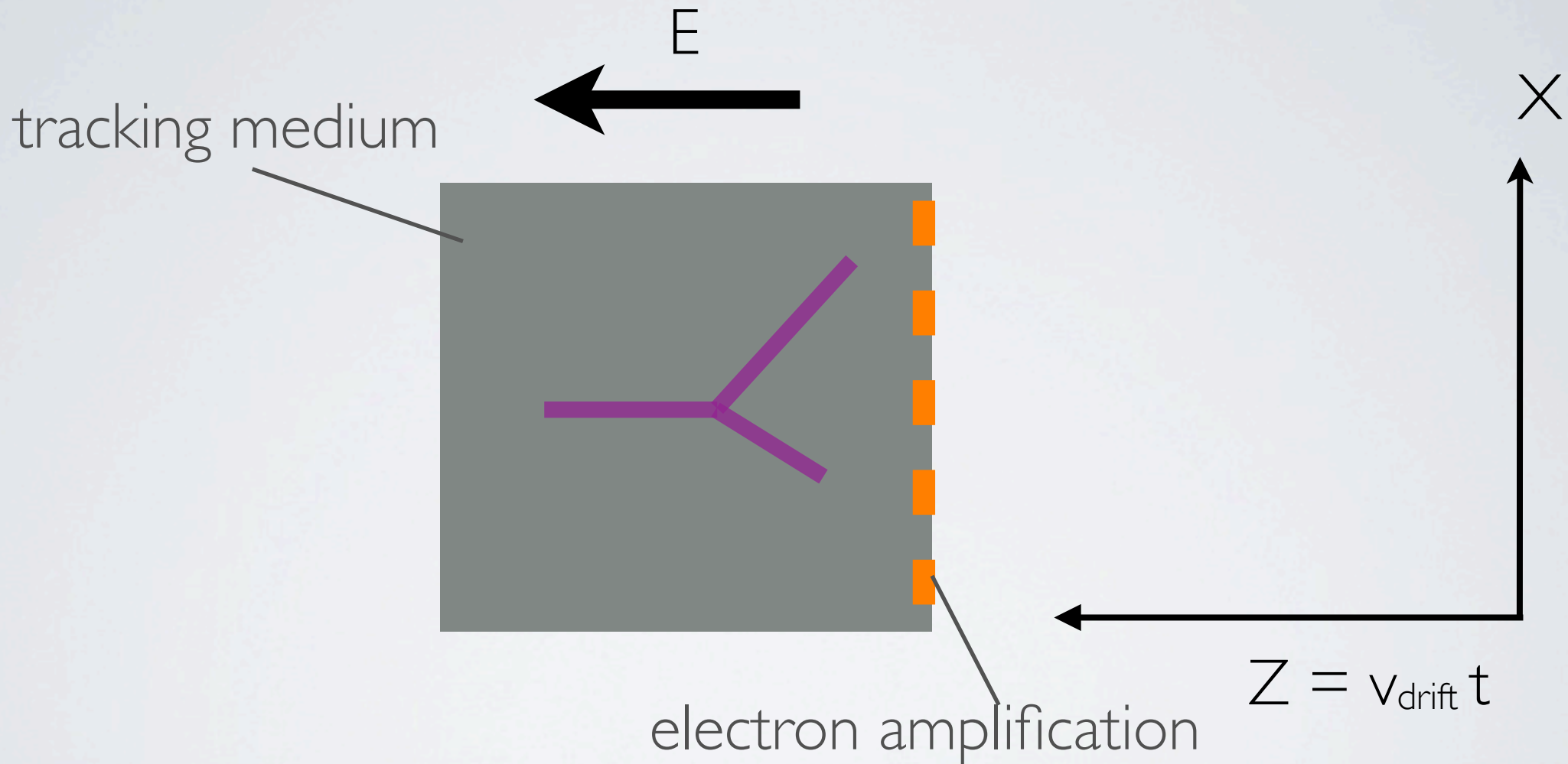
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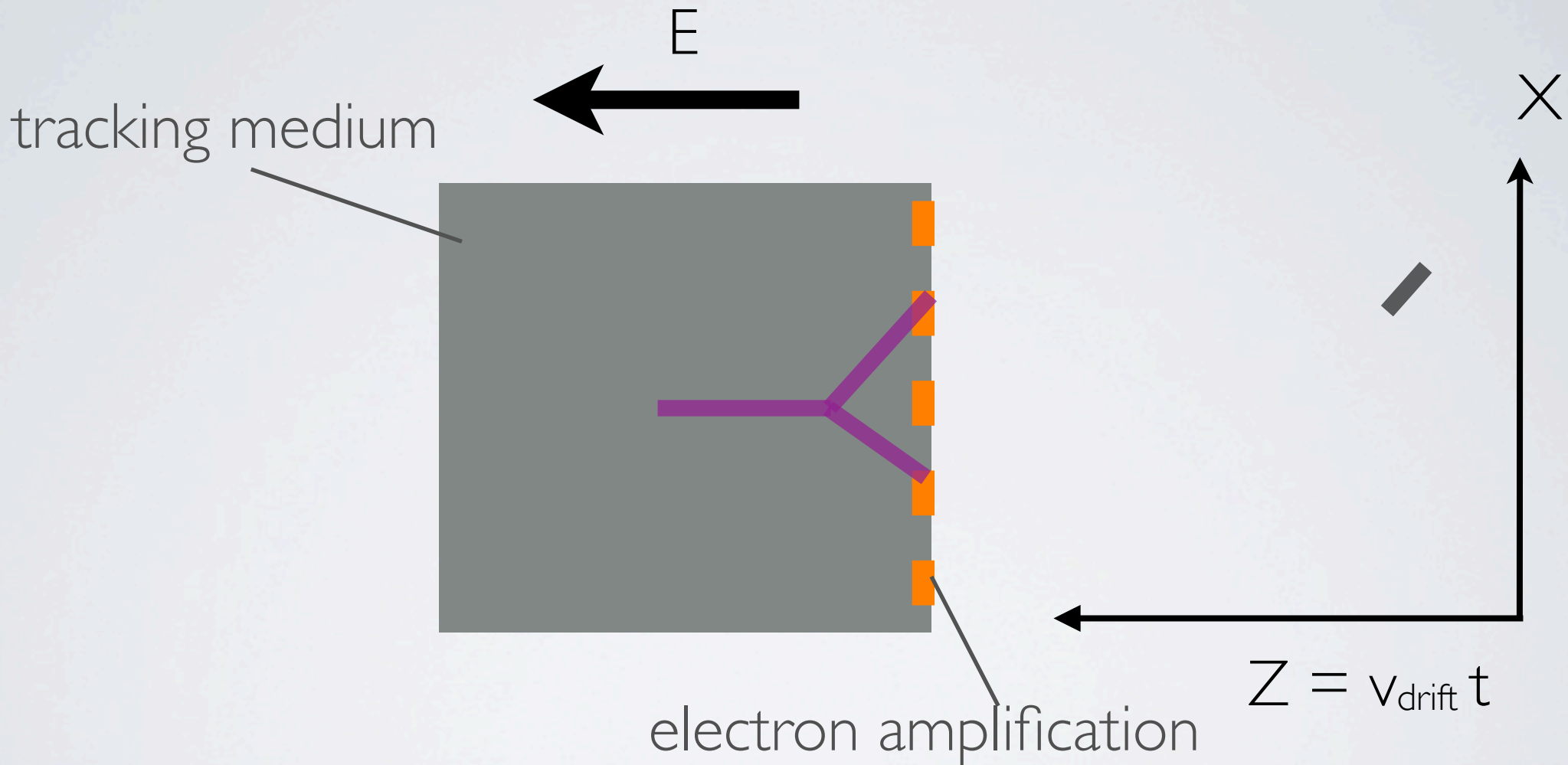
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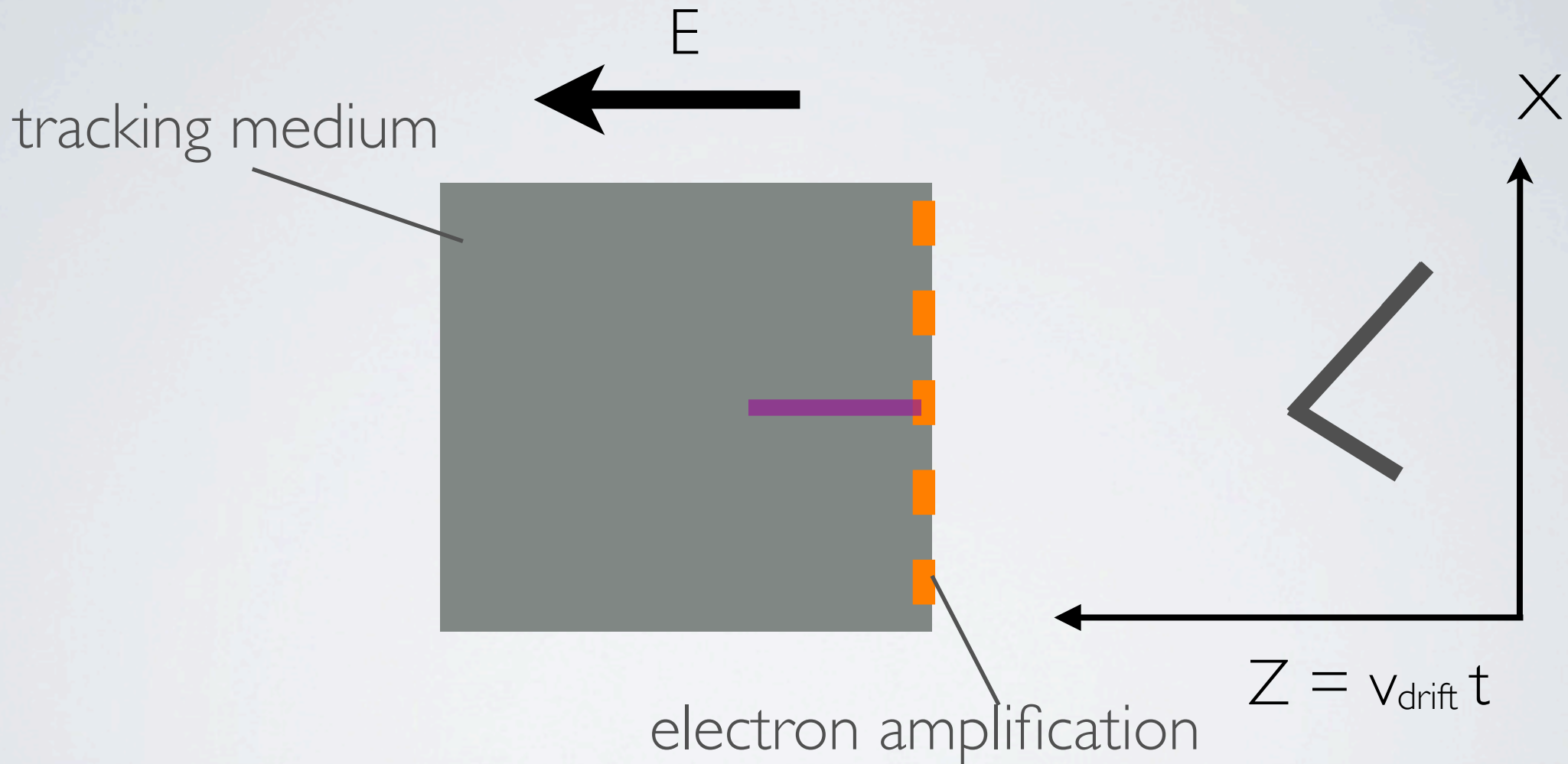
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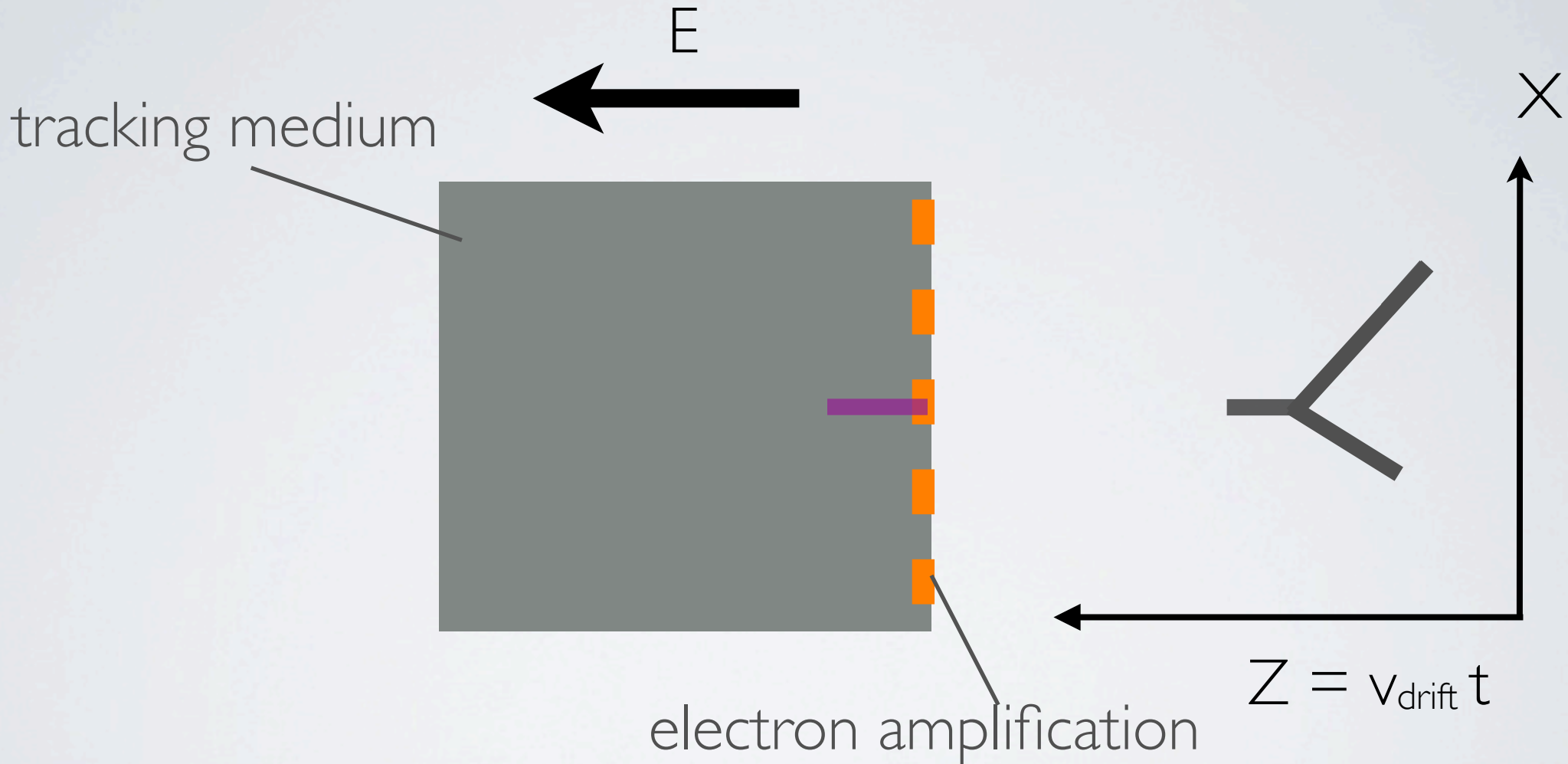
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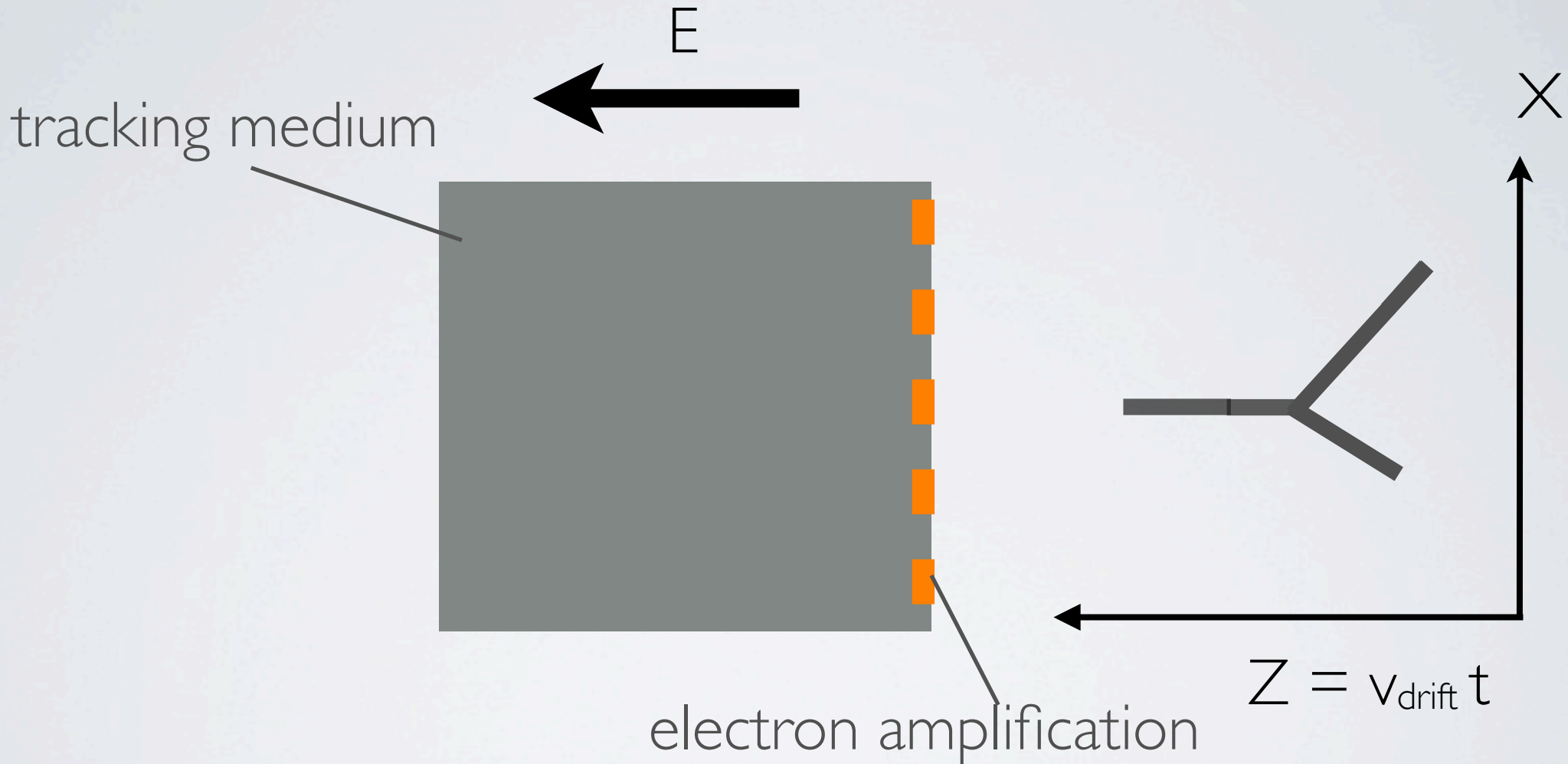
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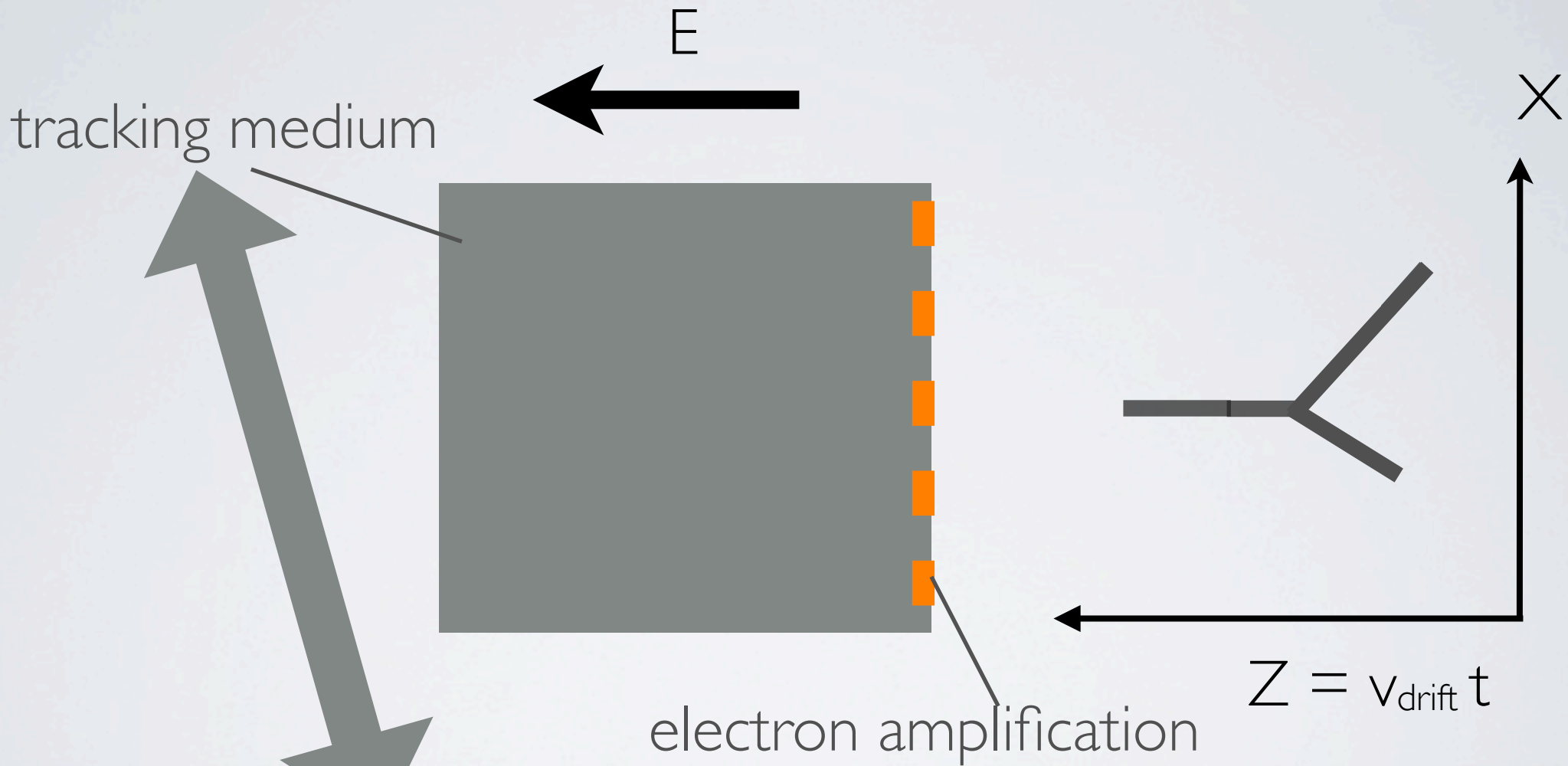
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AT-TPC CONCEPT



- Active-Target Time-Projection Chamber

AT-TPC CONCEPT

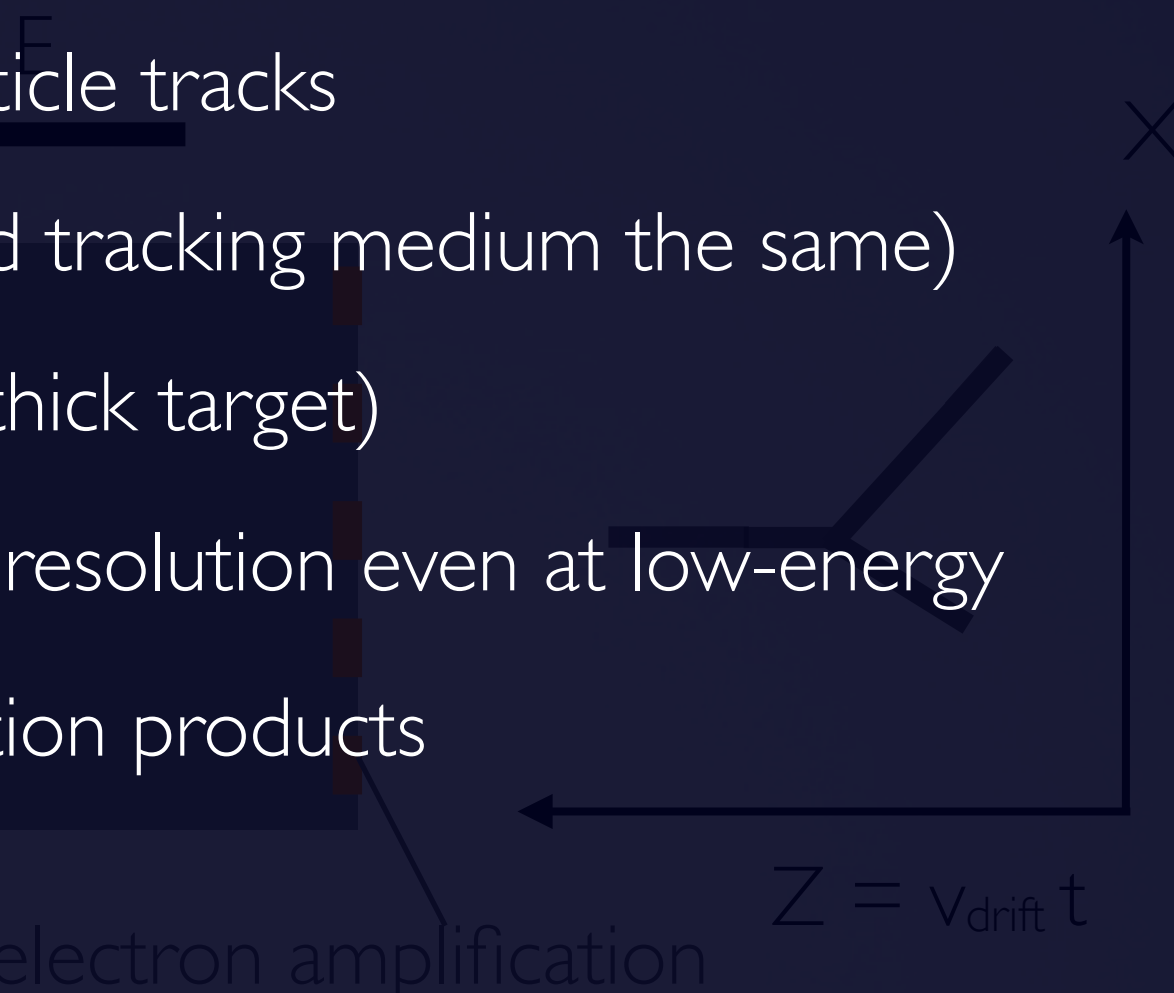


- Active-Target Time-Projection Chamber

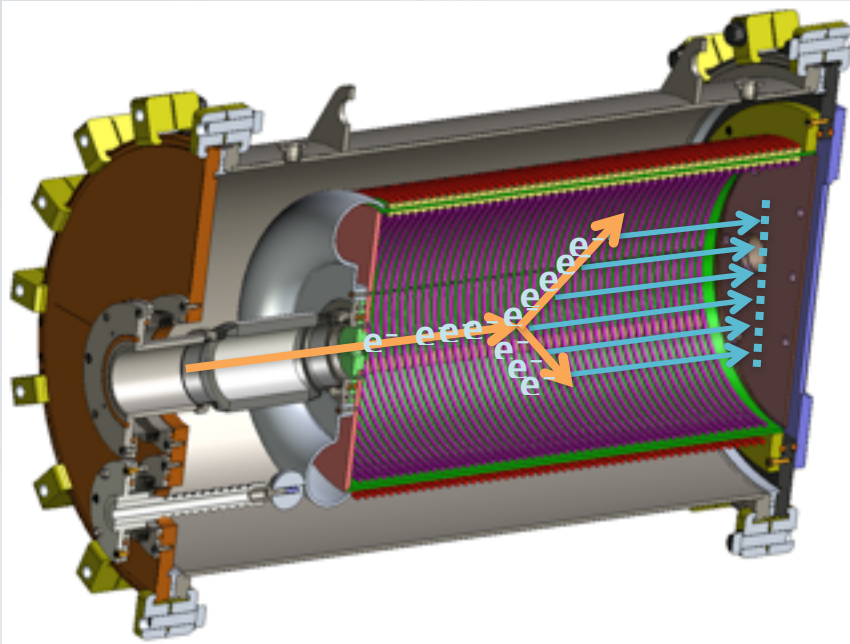
AT-TPC CONCEPT

- imaging of charged particle tracks
- active-target (target and tracking medium the same)
- increase in luminosity (thick target)
- good energy and angle resolution even at low-energy
- 4π acceptance of reaction products
- low-intensity RIB's
- scan energy range

• Active-Target Time-Projection Chamber

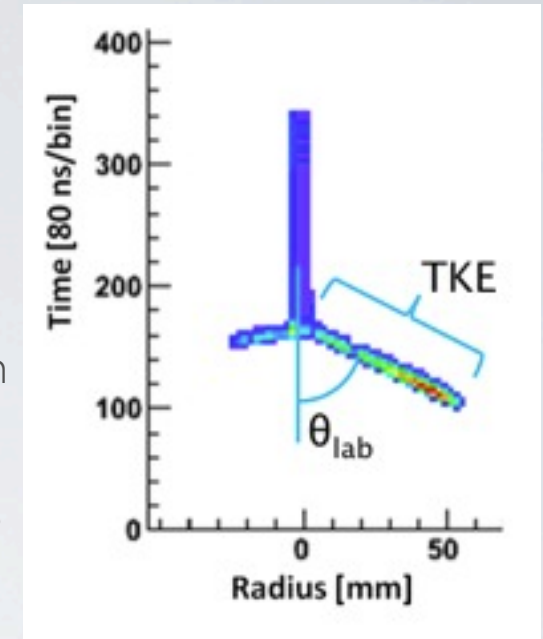


AT-TPC

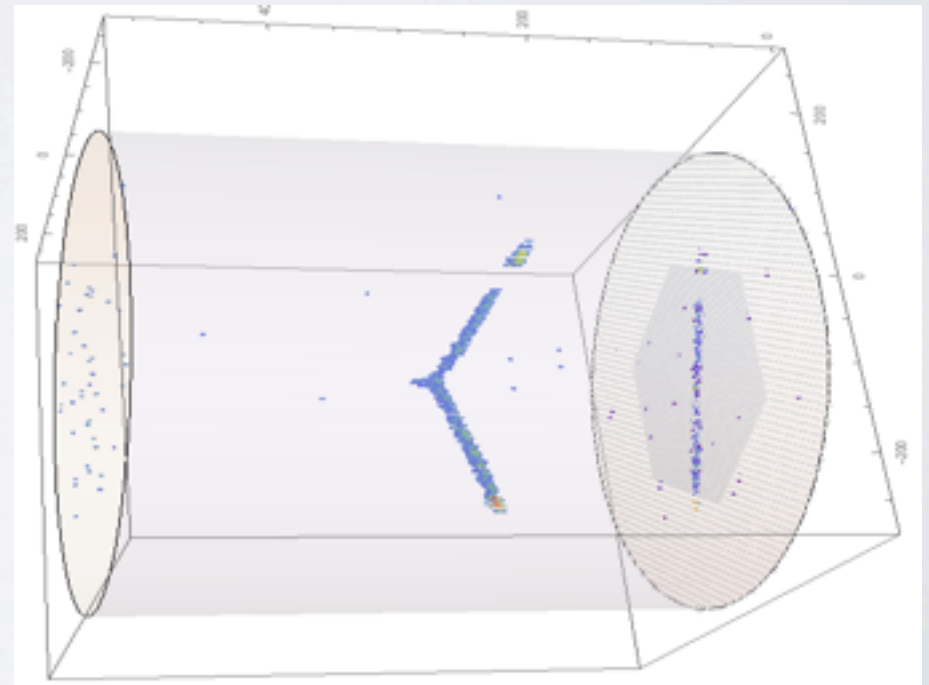


We can measure:

- Angle
 - Tracking
- Energy, momentum
 - Bragg curve
 - B-rho analysis
- Cross Sections

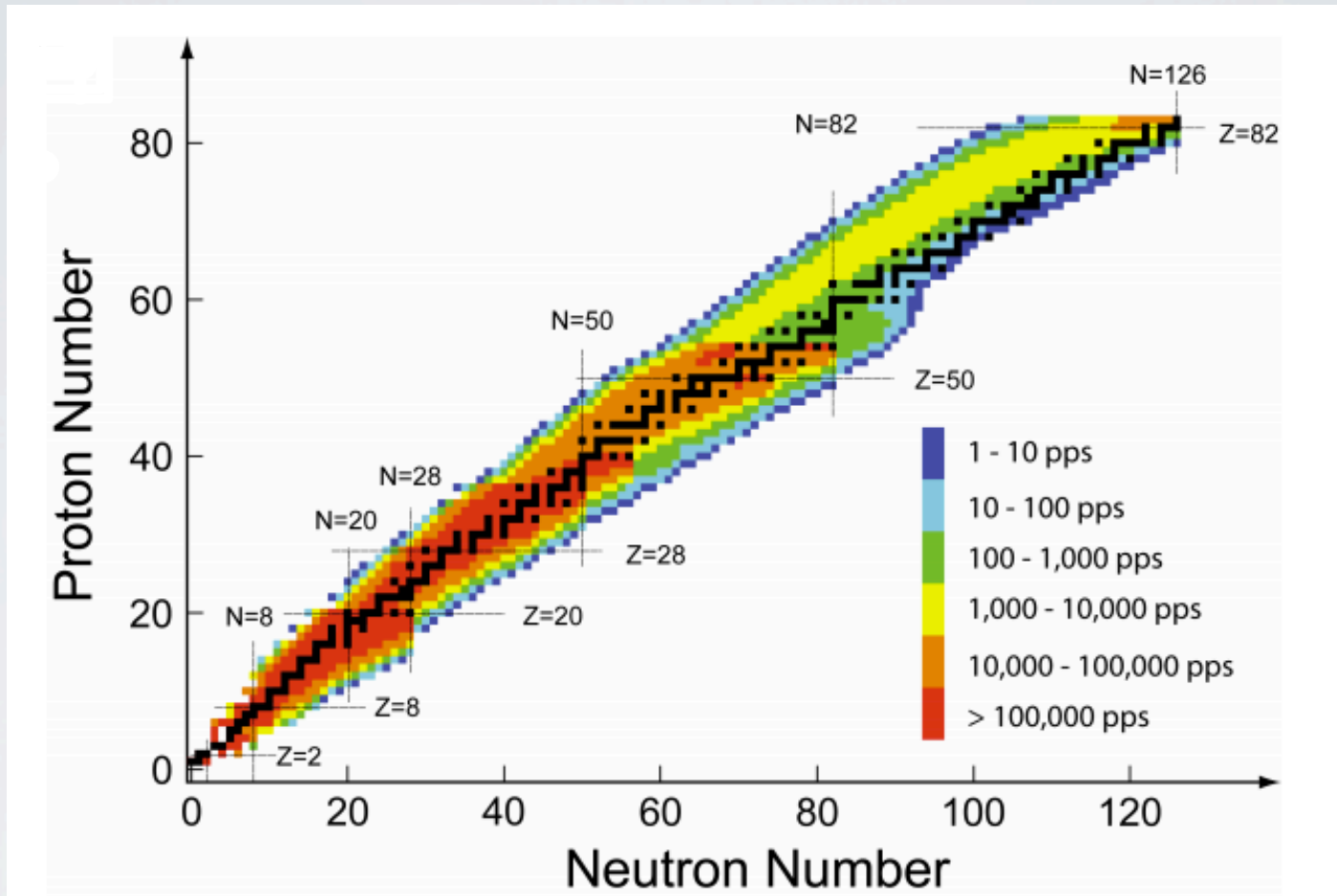


- 1 m length, 50 cm diameter
- Electrons amplified using a Micromegas with 10,240 triangular pads
- Embedded in a 2T magnetic field for B-rho analysis
- Detector already commissioned with a ^4He beam in ReA3.



Event recorded during commissioning.

REA3/12



- Reaccelerated rare isotopes
- Lower energies, up to 3 MeV/n, 12 MeV/n
- Rates from 1 - 10^3 pps for more exotic beams

AT-TPC PROGRAM

Table 1: Overview of the AT-TPC scientific program.

Measurement	Physics	Beam Examples	Beam Energy (A MeV)	Min Beam (pps)	Scientific Leader
Transfer & Resonant Reactions	Nuclear Structure	$^{32}\text{Mg}(d,p)^{33}\text{Mg}$ $^{26}\text{Ne}(p,p)^{26}\text{Ne}$ $^{66,\dots,70}\text{Ni}(p,p)$	3	100	Kanungo
Astrophysical Reactions	Nucleosynthesis	$^{25}\text{Al}(^3\text{He},d)^{26}\text{Si}$	3	100	Famiano, Montes
Fusion and Breakup	Nuclear Structure	$^8\text{B}+^{40}\text{Ar}$	3	1000	Kolata
Transfer	Pairing	$^{56}\text{Ni}+^3\text{He}$	5-19	1000	Macchiavelli
Fission Barriers	Nuclear Structure	$^{199}\text{Tl}, ^{192}\text{Pt}$	20 - 60	10,000	Phair
Giant Resonances	Nuclear EOS, Nuclear Astro.	$^{54}\text{Ni}-^{70}\text{Ni},$ $^{106}\text{Sn}-^{127}\text{Sn}$	50 - 200	50,000	Garg
Heavy Ion Reactions	Nuclear EOS	$^{106}\text{Sn} - ^{126}\text{Sn},$ $^{37}\text{Ca} - ^{49}\text{Ca}$	50 - 200	50,000	Lynch

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- *GET Collaboration*: CEA-Saclay, Bordeaux, GANIL, MSU
- *AT-TPC Collaboration*: Umesh Garg, Jim Kolata (Notre Dame), Daisuke Suzuki (IPN Orsay), I-Yang Lee, Larry Phair (LBNL), Mike Heffner (LLNL), Rituparna Kanungo (St. Mary's), Michael Famiano (Western Michigan)

PUBLICATIONS

- *Test of a micromegas detector with helium-based gas mixtures for active target time projection chambers utilizing radioactive isotope beams.* D. Suzuki et al., Nucl. Instrum. Meth. A 660 (2011) 64.
- *Prototype AT-TPC: Toward a new generation active target time projection chamber for radioactive beam experiments,* D. Suzuki et al., Nucl. Instrum. Meth. A 691 (2012) 39–54
- *Resonant scattering of ^6He : Limits of clustering in ^{10}Be .* D.Suzuki et al., Phys. Rev. C. 87, 054301 (2013)

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