Detectors' Efficiency During Production:
Aiming for the correction to the cross section.

1. Trigger Efficiency

During production, the main trigger are T3 (single L-HRS) and T5 (coincidence of L- and R-HRS).

The auxiliary trigger for electron is T4.
The trigger efficiency then determined by the ratio of the number of primary triggers to the the total possible triggers.

The efficiency for the electron
need to have the electron PID cut

$$\epsilon_e = (T3+T5)/(T3+T4+T5).$$

This is true in the case where T5 trump T3, i.e. when the trigger form T5, the record show T5 not T3.

But if we use the eventypebits &(1<<3) where we can extract T3 event out from T5 event, the efficiency become simpler

$$\epsilon_e = (T3\_bit)/(T3\_bit+T4\_bit).$$

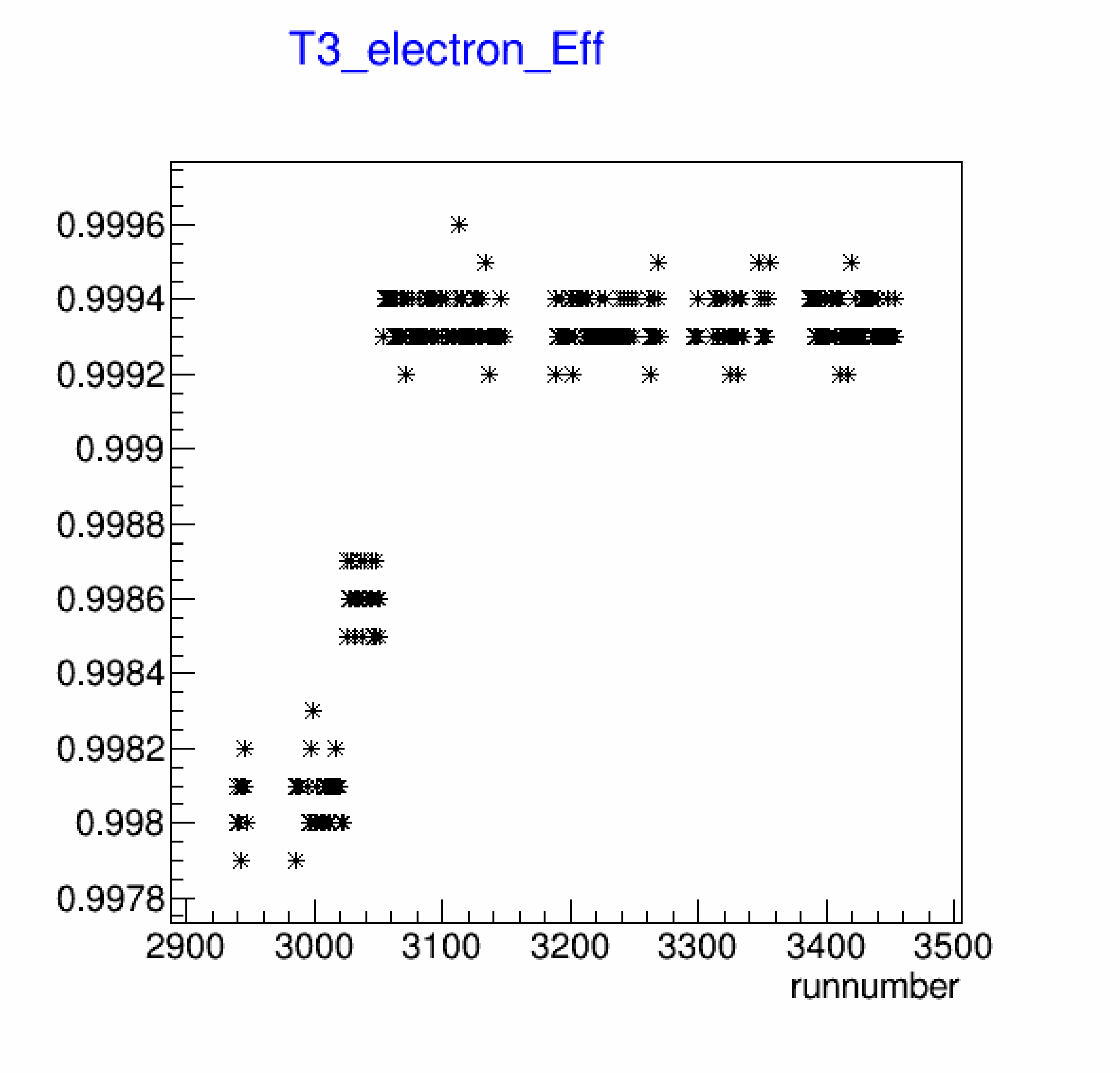
The prescale for T3, T4, and T5 are set to 1 which simplify the need to include the prescale factor.

Note: we do not have the BigBite include in forming the Trigger.

cut: electron PID: (prl1.e+prl2.e)/L.p>0.6 && no edtm
T3_bit = DBB.evtypebits&(1<<3)
T4_bit = DBB.evtypebits&(1<<4)

The T3 electron efficiency is 0.998 with +/- 0.23% per production run.
Examples:

Run number	T3_bit entries	T4_bit entries	Eff=T3_bit/(T3_bit+T4_bi	Eff_err (%)
2939	384541	761	0.9980	0.23
2940	329463	629	0.9981	0.25
2941	76611	155	0.9980	0.51
2942	345578	668	0.9981	0.24
2943	156466	325	0.9979	0.36
2944	386487	721	0.9981	0.23
2945	224104	420	0.9981	0.30
2946	56948	102	0.9982	0.59
2947	131990	269	0.9980	0.39
2985	360422	745	0.9979	0.24
2986	363384	694	0.9981	0.23
2987	359088	688	0.9981	0.24
2988	358480	693	0.9981	0.24
2989	342035	652	0.9981	0.24
2994	358944	686	0.9981	0.24
2995	364474	695	0.9981	0.23
2996	363749	735	0.9980	0.23
2997	360264	654	0.9982	0.24
2998	358909	735	0.9980	0.24
2999	141062	244	0.9983	0.38
3000	331109	650	0.9980	0.25
3001	356831	713	0.9980	0.24
3002	359090	687	0.9981	0.24
3004	359267	711	0.9980	0.24
3005	364910	722	0.9980	0.23
3006	365921	734	0.9980	0.23
3007	375749	765	0.9980	0.23
3008	304735	577	0.9981	0.26
3009	361787	697	0.9981	0.24



Trigger T3 electron Efficiency vs run numbers.

2. Tracking Efficiency

2.1 Tracking Efficiency for L-HRS

This tracking efficiency has two components: The possible of VDC to record data the charge particle left during its passage, and the tracking software to reconstruct the track from VDC information.

Consider the data for the best fit from tracking software, we can determine the efficiency of the tracking efficiency as a single efficiency number.

The sample of data must not include any information from the VDC.

Sample data:

2.1.1 electron PID cuts from Pion-rejector and if possible the Cherenkov.

~~2.1.2???? The coincidence time cut or the raw TDC.~~

2.1.3 The cut on the trigger planes accepting area such that the data in the accepting area has the possibility to create track in the VDC.

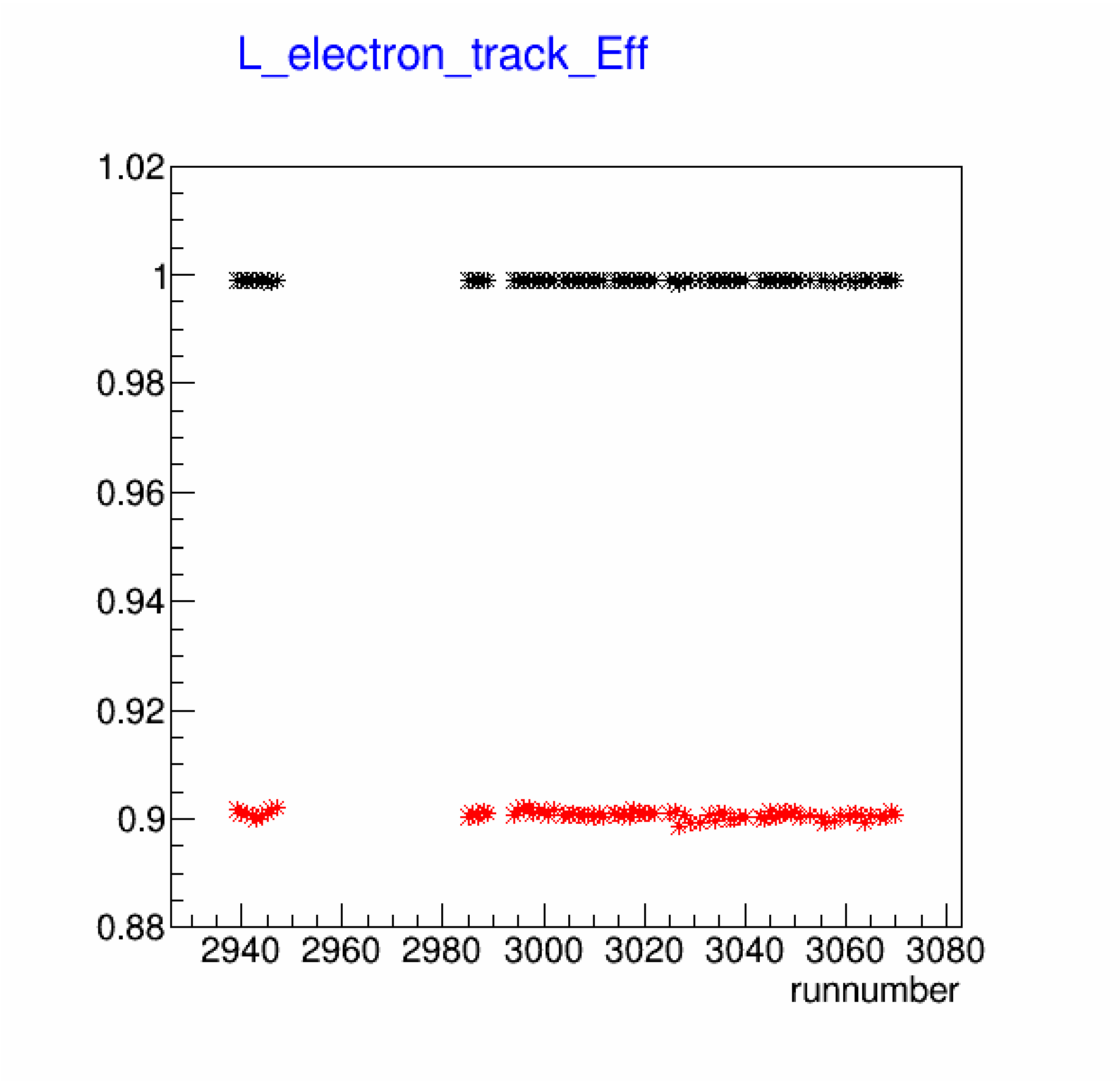
~~2.1.4????? Acceptance cuts on the opposing spectrometer (BigBite) (theta_tg,phi_tg,and delta_tg).~~

Cut data include the sample data and:

2.1.5 cut on electron acceptance theta_e,phi_e, and delta_e.

The variation in theta_e,phi_e,and delta_e will give the tracking efficiency dependence.

Sample data:
T3 and no edtm
electron PID (modified) : (prl1.e+prl2.e)>0.6*electron_momentum_center(3.60 GeV/c)
Cut data:
option 0: able to create track (L.tr.n>0) : 99.8%
option 1: Largest acceptance cut: |theta_e|<=0.060, |phi_e|<=0.030 and |dp|<=4.5%
: 90.0%



2.2 Tracking Efficiency for BigBite

Sample data:

2.2.1 The coincidence time cut

2.2.2 The fullhit Proton PID which have both dE and E data && the parthit high momentum data which only have the E plane data.

2.2.3 The cut on the LHRS acceptance. : need to try both with and without

2.2.4 The cut on the area of the trigger plane.

Cut data include the sample data and:

2.1.5 cut on proton acceptance theta_p, and phi_p and positive polarity.

3. Particle Identification Efficiency.

3.1 electron Identification efficiency
In general we can use both pion-rejector and the cherenkov detector to form the electron ID. In our case we do have overflow in the cherenkov detector which I decide not to use.

Sample data:
3.1.1 LHRS acceptance cuts, theta_e,phi_e,delta_e.
3.1.2 coincidence time cut.
3.1.3 The cherenkov ADC sum cut. With the overflow we can select data in some range below the overflow.

Cut data include the sample data and:
3.1.4 The electron identification cut from the pion-rejector ADC sum.

3.2 proton identification efficiency
There are three combination of dE+E, E+p, and dE+p to make the proton PID. The one that I use is the E+p so:

sample data:
3.2.1 BigBite acceptance cuts, theta_p,phi_p,positive polarity
3.2.2 coincidence time cut.
3.2.3 for fullhit data, require the dE+E cut,
for the parthit-dE data, require dE>100?,
and for the parthit-E data, require E>500.

Cut data include the sample data and:
3.2.4 for fullhit and parthit-E, make E+p cut.
For parthit-dE data, make dE+p cut

17-18 ns

*** need to check dE efficiency vs E efficiency since I need to combine data from each set.

4. Data Acquisition Deadtime

the dead-time
$\epsilon_{DT}^i = 1-P_i*N_i/S_i$
P_i = prescale
N_i = number of events recorded.
S_i = the scalers count. ****